Appendix O

Preliminary Hydrology Report

For the Property Located in

Section 5, Township 7 South, Range 8 East, S.B.M.

Riverside County, California

Tentative Tract Map 38578 (Schedule A)

Prepared by

MSA Consulting, Inc.

September 20, 2024

PRELIMINARY HYDROLOGY REPORT

For Property Located
in Section 5,
Township 7 South, Range 8 East, S.B.M.
Riverside County, California

Tentative Tract Map 38578 (Schedule A)

September 20, 2024

Prepared for:

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PROJECT DESCRIPTION & LOCATION

The project is proposed to consist of residential homes, a mixed-use resort/commercial complex, equestrian facilities, and workforce RV and manufactured homesites. The project site comprises approximately 620 acres in the County of Riverside, bounded by Avenue 62 and the Avenue 64 alignment on the north and south, and by Harrison Street and Tyler Street on the west and east. The project occupies Sections 5, Township 7 South, Range 8 East, SBM. A vicinity map obtained from the Riverside TLMA website is included as Appendix A.

EXISTING SITE CONDITIONS

Flood Rate Map

The proposed area is covered by FIRM Panel Number 06065C2910H, Revision number 2.3.3.2 per LOMR dated 6/25/2018, which indicates the subject property lies within Zone X, defined *as "Areas determined to be outside the 0.2% annual chance floodplain."* , Zone X (Shaded), defined as "Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood. Insurance purchase is not required in these zones.", and Zone X (Diagonal Shading) "Areas with reduced flood risk due to levee." Refer to the attached NFIP Flood Insurance Rate Map in Appendix B.

Existing Topography

The property currently is being used for agriculture with CVWD irrigation mains and drain lines. Various desert and agriculture vegetation is found throughout the site. Site drainage appears to sheet flow generally from northwest to southeast, except where interrupted by slightly raised farm-use roads, with surface infiltration collected in existing CVWD subsurface drain tile systems.

PROPOSED FLOOD CONTROL REQUIREMENTS

The purpose of this report is to provide preliminary drainage and retention basin analyses for the subject property. The drainage requirements for this project fall under the jurisdiction of the County of Riverside. Storm flows will be conveyed through the site via street flow to localized low points, to on-site retention basins. All proposed pad elevations are set a minimum of 1-foot above the high-side street elevation.

HYDROLOGY ANALYSIS DESIGN CRITERIA

Storm runoff volumes for the 100-year event were obtained utilizing the Synthetic Unit Hydrograph as described in the *RCFC&WCD Hydrology Manual*. The hydrologic data used for the calculations are as follows:

Hydrologic Soil Group

The existing soil is categorized as hydrologic soil group B and C for the subject property as shown per the attached National Cooperative Soil Survey exhibits in Appendix C.

Soil Group B is defined by RCFCD as – "Soils having moderate infiltration rates when thoroughly wetted and consisting chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission".

Soil Group C is defined by RCFCD as – "Soils having slow infiltration rates when thoroughly wetted and consisting chiefly of soils with a layer that impedes downward movement of water, or soils with moderately fine to fine textured. These soils have a slow rate of water transmission".

Antecedent Moisture Condition

AMC II – Moderate runoff potential, an intermediate condition. Per RCFC & WCD Hydrology Manual (Dated: April 1978): "For the purposes of design hydrology using District methods, AMC II should normally be assumed for both the 10-year and 100-year frequency storm".

Land Use Classifications and Runoff Index Numbers

Runoff Index Numbers, Infiltration Rates and Impervious Cover Percentages were obtained from RCFCD Plates E-6.1, E-6.2 and E-6.3, respectively, and are summarized below:

Land Use	RI No.	Infiltration Rate	% Impervious
Equestrian Center (Soil Group B)	69	0.39 in/hr	50
Single Family Residence- 1 Acre (Soil Group B)	56	0.51 in/hr	20
Single Family Residence- ¼ Acre (Soil Group B)	56	0.51 in/hr	50
RV & Workforce Housing (Soil Group B)	56	0.51 in/hr	75
RV & Workforce Housing (Soil Group C)	69	0.39 in/hr	75
Resort/Commercial (Soil Group B)	56	0.51 in/hr	65
Resort/Commercial (Soil Group C)	69	0.39 in/hr	65
Offsite Streets (Soil Group B)	56	0.51 in/hr	90
Offsite Streets (Soil Group C)	69	0.39 in/hr	90

Low Loss Rates: 85%

Precipitation Frequency Estimates

Precipitation depths were obtained from NOAA Atlas 14:

100 Year – 1 Hour Precipitation:	1.22	inches
100 Year – 3 Hour Precipitation:	2.00	inches
100 Year - 6 Hour Precipitation	2.66	inches
100 Year – 24 Hour Precipitation	4.21	inches

See Appendix D for the NOAA Atlas 14 Point Precipitation Frequency Estimates and respective RCFCD Plates.

Site Infiltration

Given the large area of the project and the very large areas of the primary retention basins, adherence to typical requirements of percolation test density of coverage would have yielded far too many test locations to be practicable. Sufficiently representative test locations were therefore determined by hydrologic engineers and geologists at Petra Geosciences, Inc., and approved for use by the County. The findings of the resultant percolation tests are shown in Appendix H. Within the Synthetic Unit Hydrograph analyses, the calculations of retention basin capacities and stormwater routing utilized the percolation rates determined at the nearest respective test location after reducing the rate by a safety factor of ⅓.

SUMMARY of SYNTHETIC UNIT (SHORTCUT METHOD) ANALYSES

The proposed retention basins for the associated drainage areas were sized to retain the 100-year controlling storm event flood volumes and were analyzed utilizing the RCFCD Synthetic Unit (Shortcut Method). Per the RCFCD *Hydrology Manual*, for areas of less than 100 – 200 acres, and lag times less than 7 – 8 minutes, the shortcut method is applicable. This method assumes that in a small watershed, response time to effective rainfall is very short. Therefore, runoff rates for a given period of time can be assumed to be directly proportional to effective rain. This method yields only approximate results (on the conservative side) and should be used only for watersheds meeting the criteria noted above.

The synthetic unit worksheets are included in Appendix E and are summarized on the hydrology exhibit in Appendix I.

Drainage Area 1 (DA-1A, DA-1B)

Drainage Area 1, occupying the central portion of the project area, comprises the area devoted to equestrian uses (pastures, polo fields, corrals, barns and associated parking), along with a portion of the single family residential area with ¼-acre lots, all of which drain to two large retention basins at the east edge of the

equestrian area. The retention basins are sized to store the maximum runoff volume that can be dewatered in 48 hours via percolation and drain tiles (see Percolation Test Results Exhibit and CVWD Farm Drain Tile Discharge Table in Appendix H). Any runoff exceeding this volume in Basin 1A will overflow via gravity pipeline to Basin 1B, and any excess from Basin 1B will overflow via gravity pipeline to Basin 4.

Drainage Area 2 (DA-2A, DA-2B)

Drainage Area 2 covers the single-family residential area with 1-acre lots, along with the half-street frontages of Avenue 62 and the portion of Tyler Street north of the east entry point. Storm runoff in this drainage area is directed to long, narrow retention basins dispersed throughout the drainage area. Any runoff exceeding the 48-hour dewatering volume in Basin 2A will overflow via gravity pipeline to Basin 2B, and any excess from Basin 2B will overflow via gravity pipeline to Basin 4.

Drainage Area 3 (DA-3A, DA-3B, DA-3C)

Drainage Area 3 consists of the eastern portion of the ¼-acre single family residential area, along with the half-street frontage of Tyler Street. All Strom runoff in this drainage area (3A, 3B and 3B) will flow via gravity pipeline along with overflows from Basin 2B to Basin 4.

Drainage Area 4 (DA-4)

Drainage Area 4 comprises the bulk of the workforce housing and RV area in the center of the project's southern frontage. Also included are a southwesterly portion of the ¼-acre single family residential area and a portion of the equestrian-use area, which includes a large, shallow retention basin that receives all storm runoff from the drainage area, plus all overflow from Basin 1B, 2B and storm runoff flows from drainage area 3 (3A, 3B and 3C). Retention Basin 4 is sufficiently sized to allow full drawdown in 48 hours via percolation and drain tiles. Storm flows exceeding the capacity of Basin 4 will overflow along the south side of the basin, in a sheet flow manner similar to pre-development flows.

Drainage Area 5 (DA-5)

Drainage Area 5 is located along the western portion of the project, the bulk of which is the area designated for resort and commercial uses, lying west of the internal spine road that enters from Harrison Street. Also included are small portions of the RV area and the equestrian-use area, as well as the half-street frontage of Harrison Street. All storm runoff from this drainage area is collected in a large retention area near the southwest corner of the project. Although the design of the resort/commercial is still under development, it is anticipated that stormwater retention will occur as added depth on top of a lake amenity which also is used for irrigation water storage. The retention storage will nominally remain within the lake footprint and will be reduced through normal irrigation usage, so the 48-hour dewatering requirement is not applicable.

Drainage Areas DA-2Q and DA-3Q

In order to ensure the proposed residential streets have sufficient capacity to carry 100-year peak flow rates, and to establish preliminary peak flow rates for catch basins, the largest tributary drainage areas in each residential development area (1-acre SFR and ¼-acre SFR) were analyzed using 3-hour Synthetic Unit Hydrographs (Shortcut Method), since the peak flows from those 3-hour hydrographs "should normally compare well with Rational [Method] peaks" (RCFC *Hydrology Manual*, p. E-12). The peak flow rates from these hydrographs, representing the highest 100-year peak flow for each residential development area, were then compared with hydraulic analyses of the respective street cross-sections (see Street Capacity Calculations in Appendix G). Drainage Area DA-2Q is a sub-area of DA-2B, while DA-3Q is a sub-area of DA-1A (the "3Q" nomenclature reflects the fact that most of the ¼-acre SFR area is within Drainage Area 3, to distinguish it from the primarily equestrian use of Drainage Area 1).

Catch basin peak flow estimates in the residential areas were generated on a pro rata basis by area, as compared to the two hydrographs described above. For the non-residential areas, the respective overall drainage area hydrographs were used for comparison.

PRELIMINARY WQMP ANALYSES

Preliminary design volume and flow for BMP measures were based on Worksheets 1 and 2 from the Riverside County – Whitewater River Region Water Quality Management Plan. Impervious areas for the drainage sub-areas are derived from the preliminary land use worksheets. A summary of the BMP results is presented on the Hydrology Exhibit in Appendix I with the worksheets included in Appendix F.

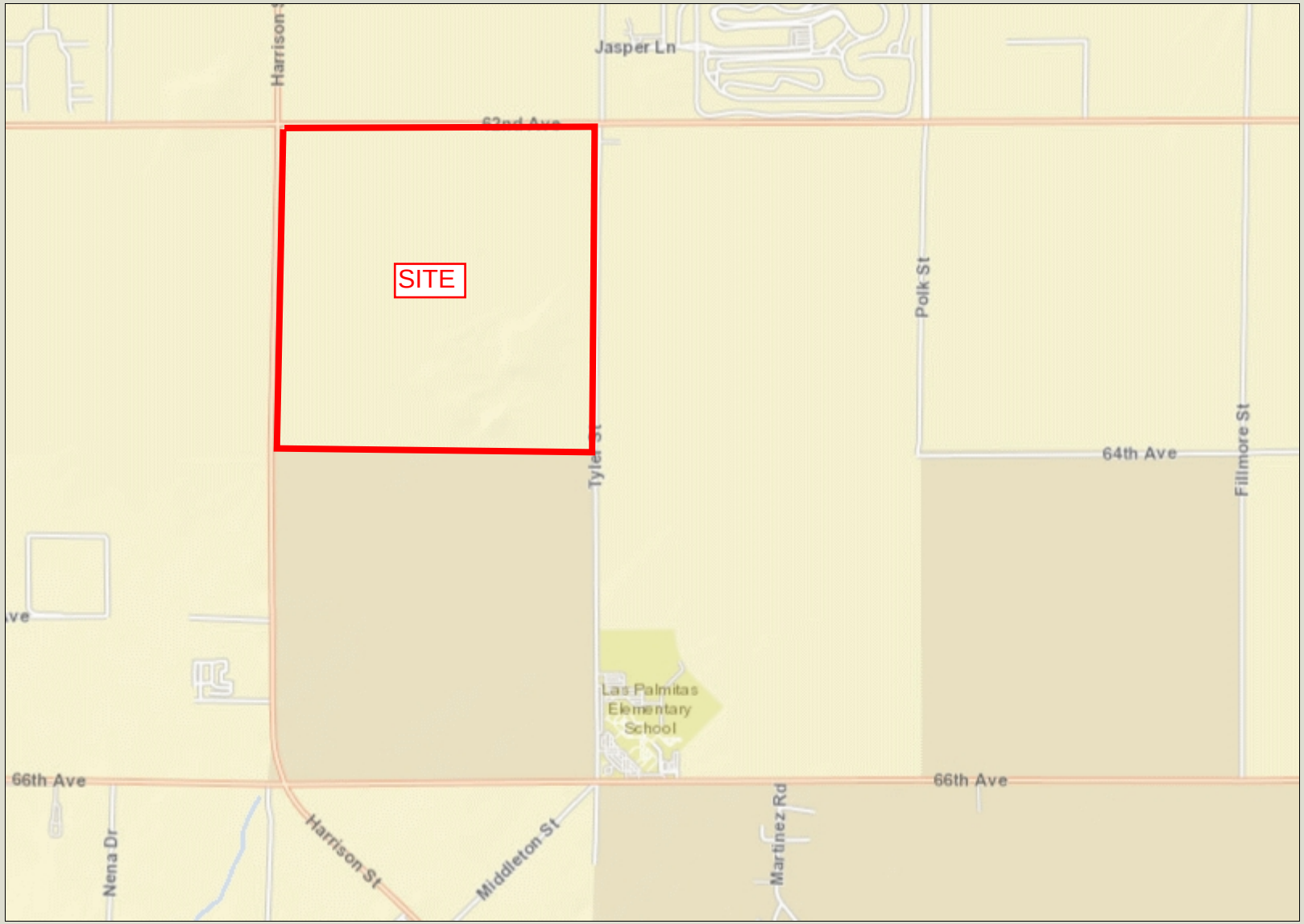
RESULTS AND CONCLUSIONS

As the above narrative and the data in the appendices confirm, the proposed streets have sufficient capacity to convey 100-year storm runoff to catch basins for further conveyance to the proposed retention basins, and the proposed retention basins are sufficiently sized to provide sufficient storage to mitigate the 100-year stormwater runoff volume for the entire property through percolation and drain tile dewatering, as assisted by overflow basin routing. As such, the proposed design exceeds the hydrologic requirements established by the County of Riverside.

Appendix A

Riverside County TLMA Vicinity Map

VICINITY MAP



Legend

- Blueline Streams
- City Areas
- World Street Map

0 3,009 6,019 Feet

IMPORTANT Maps and data are to be used for reference purposes only. Map features are approximate, and are not necessarily accurate to surveying or engineering standards. The County of Riverside makes no warranty or guarantee as to the content (the source is often third party), accuracy, timeliness, or completeness of any of the data provided, and assumes no legal responsibility for the information contained on this map. Any use of this product with respect to accuracy and precision shall be the sole responsibility of the user.

REPORT PRINTED ON... 12/6/2022 11:15:55 AM

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Notes

Appendix B

NFIP Flood Insurance Rate Map

See attached LOMAR revision to FEMA Map 06065C2910H, Case No.: 18-09-0328P, Effective Date: June 25, 2018.

DEFINITIONS OF FEMA FLOOD ZONE DESIGNATIONS

Moderate to Low Risk Areas

In communities that participate in the NFIP, flood insurance is available to all property owners and renters in these zones:

ZONE	DESCRIPTION
X (Shaded)	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood. Insurance purchase is not required in these zones.
X	Areas determined to be outside the 0.2% annual chance floodplain.

High Risk Areas

In communities that participate in the NFIP, mandatory flood insurance purchase requirements apply to all of these zones:

ZONE	DESCRIPTION
A	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones.
AE	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. In most instances, base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
AH	Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
AO	River or stream flood hazard areas, and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones. For areas of alluvial fan flooding, velocities are also determined.
AR	Areas with a temporarily increased flood risk due to the building or restoration of a flood control system (such as a levee or a dam). Mandatory flood insurance purchase requirements will apply, but rates will not exceed the rates for unnumbered A zones if the structure is built or restored in compliance with Zone AR floodplain management regulations.
A99	Areas with a 1% annual chance of flooding that will be protected by a Federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones.

High Risk – Coastal Areas

In communities that participate in the NFIP, mandatory flood insurance purchase requirements apply to all of these zones:

ZONE	DESCRIPTION
V	Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. No base flood elevations are shown within these zones.
VE	Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.

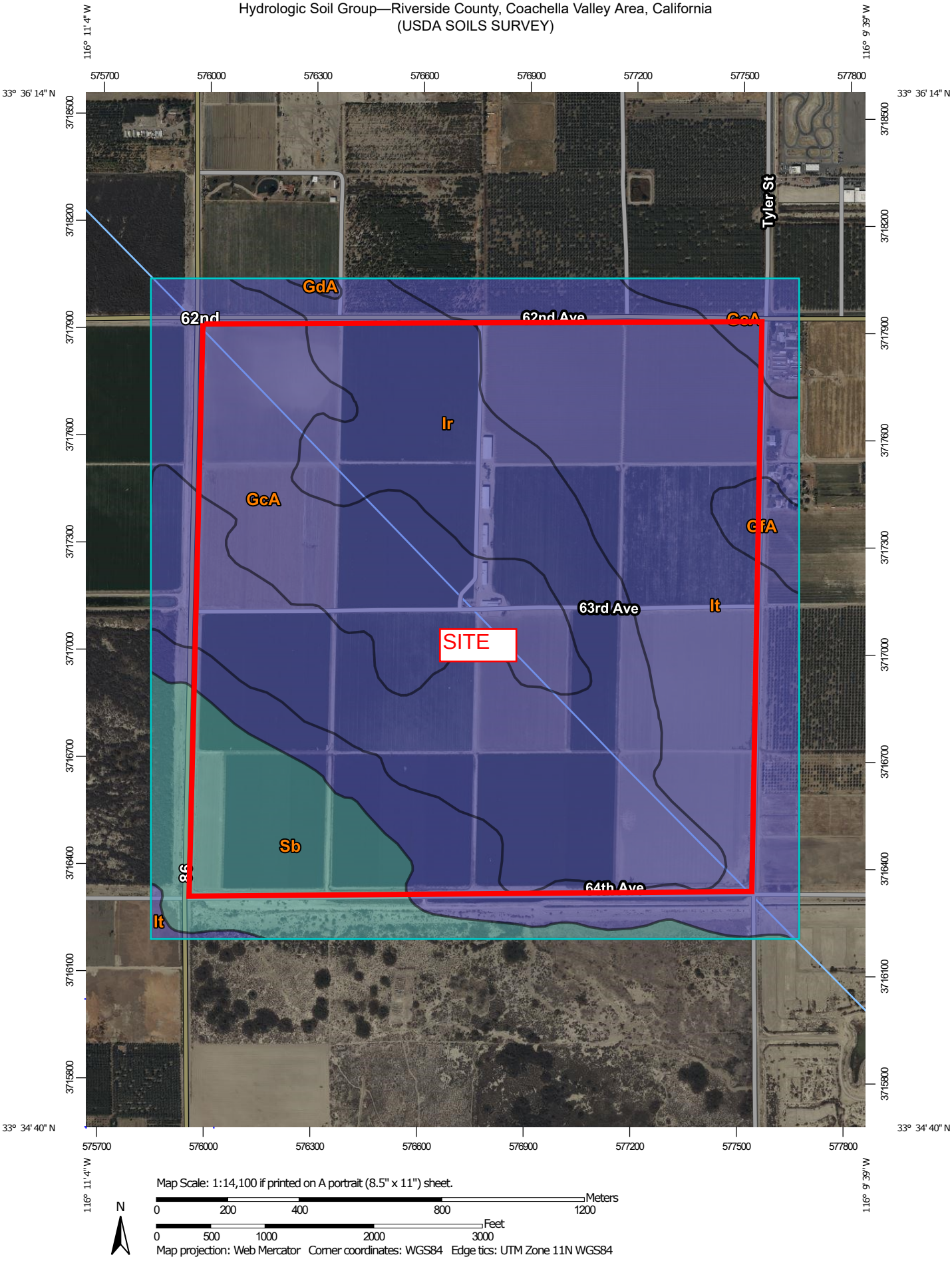
Undetermined Risk Areas

ZONE	DESCRIPTION
D	Areas with possible but undetermined flood hazards. No flood hazard analysis has been conducted. Flood insurance rates are commensurate with the uncertainty of the flood risk.

Appendix C

USDA NCSS Hydrologic Soils Map

Hydrologic Soil Group—Riverside County, Coachella Valley Area, California
(USDA SOILS SURVEY)



Map Scale: 1:14,100 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 200 400 800 1200

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

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.

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: Riverside County, Coachella Valley Area, California
Survey Area Data: Version 14, Sep 1, 2022

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

Date(s) aerial images were photographed: Mar 15, 2022—May 28, 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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
GcA	Gilman fine sandy loam, wet, 0 to 2 percent slopes	B	165.7	19.8%
GdA	Gilman fine sandy loam, moderately fine substratum, 0 to 2 percent slopes	B	1.2	0.1%
GfA	Gilman silt loam, wet, 0 to 2 percent slopes	B	12.3	1.5%
Ir	Indio fine sandy loam, wet	B	272.1	32.5%
It	Indio very fine sandy loam, wet	B	283.9	33.9%
Sb	Salton silty clay loam	C	101.1	12.1%
Totals for Area of Interest			**836.3**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Appendix D

NOAA Atlas 14

RCFCD Reference Plates

NOAA Atlas 14, Volume 6, Version 2
Location name: Thermal, California, USA*
Latitude: 33.5912°, Longitude: -116.1729°
Elevation: -138.43 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.061 (0.051-0.074)	0.097 (0.081-0.117)	0.147 (0.122-0.178)	0.190 (0.157-0.232)	0.253 (0.202-0.320)	0.305 (0.238-0.394)	0.361 (0.275-0.479)	0.422 (0.312-0.577)	0.512 (0.363-0.730)	0.588 (0.402-0.869)
10-min	0.088 (0.073-0.106)	0.139 (0.116-0.168)	0.210 (0.175-0.255)	0.272 (0.225-0.333)	0.362 (0.289-0.459)	0.437 (0.341-0.565)	0.517 (0.394-0.686)	0.605 (0.448-0.827)	0.734 (0.520-1.05)	0.843 (0.577-1.25)
15-min	0.106 (0.089-0.128)	0.168 (0.140-0.203)	0.254 (0.212-0.308)	0.329 (0.272-0.402)	0.438 (0.349-0.555)	0.528 (0.412-0.683)	0.625 (0.476-0.830)	0.732 (0.541-1.00)	0.888 (0.629-1.27)	1.02 (0.697-1.51)
30-min	0.148 (0.124-0.179)	0.234 (0.195-0.283)	0.354 (0.295-0.430)	0.459 (0.379-0.561)	0.611 (0.487-0.774)	0.736 (0.575-0.953)	0.872 (0.664-1.16)	1.02 (0.755-1.39)	1.24 (0.878-1.77)	1.42 (0.973-2.10)
60-min	0.207 (0.173-0.251)	0.328 (0.274-0.397)	0.497 (0.414-0.603)	0.643 (0.531-0.787)	0.856 (0.683-1.08)	1.03 (0.806-1.34)	1.22 (0.930-1.62)	1.43 (1.06-1.96)	1.74 (1.23-2.48)	1.99 (1.36-2.94)
2-hr	0.287 (0.240-0.347)	0.429 (0.358-0.519)	0.638 (0.531-0.774)	0.827 (0.683-1.01)	1.12 (0.891-1.41)	1.37 (1.07-1.77)	1.65 (1.25-2.19)	1.97 (1.45-2.69)	2.45 (1.74-3.50)	2.88 (1.97-4.25)
3-hr	0.349 (0.292-0.421)	0.510 (0.426-0.618)	0.754 (0.628-0.915)	0.979 (0.808-1.20)	1.33 (1.06-1.69)	1.64 (1.28-2.12)	2.00 (1.52-2.65)	2.41 (1.78-3.29)	3.04 (2.16-4.34)	3.61 (2.47-5.34)
6-hr	0.462 (0.386-0.558)	0.667 (0.557-0.807)	0.982 (0.818-1.19)	1.28 (1.06-1.56)	1.75 (1.39-2.21)	2.17 (1.69-2.81)	2.66 (2.02-3.53)	3.23 (2.39-4.41)	4.14 (2.93-5.90)	4.96 (3.39-7.33)
12-hr	0.545 (0.456-0.658)	0.805 (0.672-0.974)	1.20 (0.999-1.46)	1.57 (1.29-1.92)	2.14 (1.71-2.71)	2.66 (2.07-3.44)	3.25 (2.47-4.31)	3.93 (2.91-5.37)	5.01 (3.55-7.14)	5.98 (4.09-8.83)
24-hr	0.690 (0.610-0.796)	1.05 (0.928-1.21)	1.58 (1.40-1.83)	2.07 (1.81-2.42)	2.82 (2.39-3.40)	3.47 (2.88-4.26)	4.21 (3.41-5.29)	5.05 (3.99-6.52)	6.33 (4.81-8.51)	7.46 (5.48-10.4)
2-day	0.783 (0.693-0.903)	1.21 (1.07-1.40)	1.83 (1.61-2.12)	2.38 (2.09-2.78)	3.21 (2.72-3.87)	3.92 (3.25-4.81)	4.70 (3.81-5.91)	5.57 (4.40-7.19)	6.87 (5.21-9.23)	7.98 (5.86-11.1)
3-day	0.843 (0.745-0.972)	1.31 (1.16-1.51)	1.98 (1.74-2.29)	2.57 (2.25-3.00)	3.45 (2.92-4.15)	4.18 (3.47-5.14)	4.99 (4.05-6.27)	5.88 (4.64-7.60)	7.20 (5.47-9.68)	8.32 (6.11-11.6)
4-day	0.894 (0.791-1.03)	1.39 (1.23-1.60)	2.10 (1.85-2.43)	2.72 (2.38-3.17)	3.63 (3.08-4.37)	4.39 (3.65-5.40)	5.23 (4.24-6.58)	6.15 (4.86-7.95)	7.51 (5.70-10.1)	8.65 (6.35-12.0)
7-day	0.954 (0.844-1.10)	1.47 (1.30-1.70)	2.21 (1.94-2.55)	2.85 (2.49-3.32)	3.79 (3.21-4.57)	4.58 (3.80-5.62)	5.43 (4.40-6.83)	6.37 (5.03-8.22)	7.74 (5.87-10.4)	8.89 (6.53-12.3)
10-day	0.982 (0.869-1.13)	1.51 (1.34-1.75)	2.26 (1.99-2.62)	2.92 (2.55-3.40)	3.88 (3.29-4.67)	4.67 (3.88-5.74)	5.53 (4.49-6.96)	6.48 (5.12-8.37)	7.86 (5.97-10.6)	9.02 (6.62-12.5)
20-day	1.05 (0.930-1.21)	1.63 (1.44-1.88)	2.45 (2.16-2.83)	3.16 (2.76-3.68)	4.20 (3.55-5.05)	5.05 (4.19-6.21)	5.97 (4.85-7.51)	6.98 (5.51-9.01)	8.43 (6.40-11.3)	9.64 (7.08-13.4)
30-day	1.12 (0.990-1.29)	1.75 (1.55-2.03)	2.65 (2.34-3.07)	3.43 (3.00-4.00)	4.56 (3.87-5.50)	5.50 (4.56-6.75)	6.49 (5.27-8.17)	7.58 (5.99-9.79)	9.15 (6.94-12.3)	10.4 (7.67-14.5)
45-day	1.22 (1.08-1.41)	1.95 (1.72-2.25)	2.96 (2.61-3.43)	3.85 (3.36-4.49)	5.13 (4.35-6.18)	6.18 (5.14-7.60)	7.31 (5.93-9.20)	8.53 (6.74-11.0)	10.3 (7.81-13.8)	11.7 (8.61-16.3)
60-day	1.28 (1.14-1.48)	2.07 (1.83-2.39)	3.18 (2.81-3.69)	4.15 (3.63-4.84)	5.54 (4.70-6.68)	6.69 (5.55-8.22)	7.91 (6.42-9.95)	9.23 (7.29-11.9)	11.1 (8.44-14.9)	12.7 (9.30-17.6)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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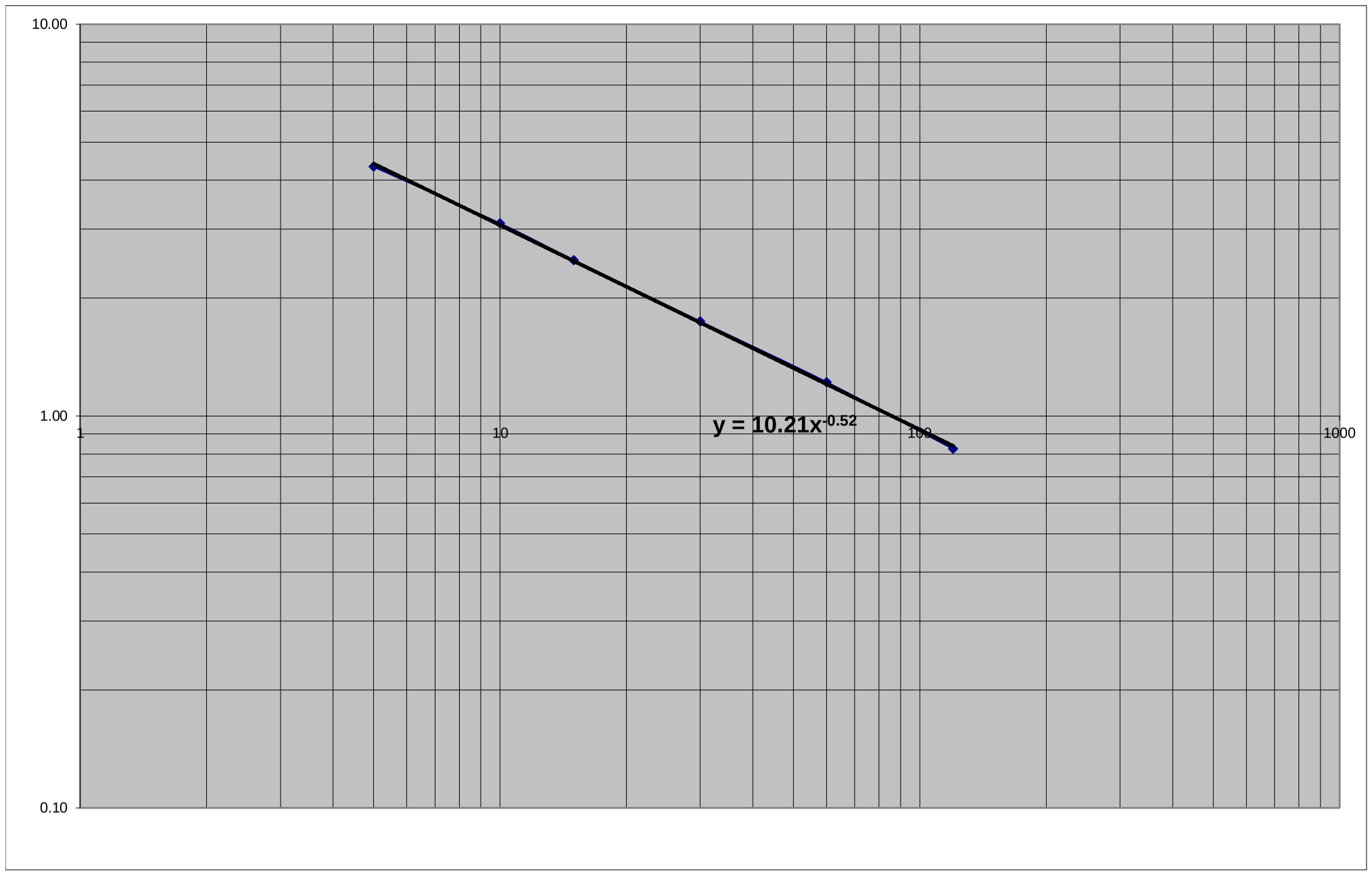
PF graphical

NOAA ATLAS 14 INTENSITY - DURATION WORKSHEET

PROJECT NAME	DESERT EQUESTRIAN CENTER
PROJECT NUMBER	2735
STORM EVENT	100 yr
DATE:	February 16, 2023

DATA FROM NOAA ATLAS 14

MINUTES	RAINFALL INTENSITY (in/hr)	RAINFALL DEPTH (in)
5	4.33	0.36
10	3.10	0.52
15	2.50	0.63
30	1.74	0.87
60	1.22	1.22
120	0.83	1.65



INTENSITY VALUES FROM GRAPH

CONSTANT FROM GRAPH	10.21
EXPONENT FROM GRAPH	-0.52

MINUTES	RAINFALL INTENSITY (in/hr)	RAINFALL DEPTH (in)
5	4.42	0.37
10	3.08	0.51
15	2.50	0.62
20	2.15	0.72
25	1.91	0.80
30	1.74	0.87
35	1.61	0.94
40	1.50	1.00
45	1.41	1.06
50	1.34	1.11
55	1.27	1.16
60	1.21	1.21
65	1.16	1.26
70	1.12	1.31
75	1.08	1.35
80	1.05	1.39
85	1.01	1.44
90	0.98	1.48
95	0.96	1.51
100	0.93	1.55
105	0.91	1.59
110	0.89	1.62
115	0.87	1.66
120	0.85	1.69

RUNOFF INDEX NUMBERS OF HYDROLOGIC SOIL-COVER COMPLEXES FOR PERVIOUS AREAS-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
NATURAL COVERS -					
Barren (Rockland, eroded and graded land)		78	86	91	93
Chaparrel, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparrel, Narrowleaf (Chamise and redshank)	Poor	71	82	88	91
	Fair	55	72	81	86
Grass, Annual or Perennial	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Meadows or Cienegas (Areas with seasonally high water table, principal vegetation is sod forming grass)	Poor	63	77	85	88
	Fair	51	70	80	84
	Good	30	58	72	78
Open Brush (Soft wood shrubs - buckwheat, sage, etc.)	Poor	62	76	84	88
	Fair	46	66	77	83
	Good	41	63	75	81
Woodland (Coniferous or broadleaf trees predominate. Canopy density is at least 50 percent)	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	28	55	70	77
Woodland, Grass (Coniferous or broadleaf trees with canopy density from 20 to 50 percent)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
URBAN COVERS -					
Residential or Commercial Landscaping (Lawn, shrubs, etc.) (SF 1-acre, SF ¼-acre, Commercial/Resort, Workforce Housing, Offsite Streets)	Good	32	56	69	75
Turf (Irrigated and mowed grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
AGRICULTURAL COVERS -					
Fallow (Land plowed but not tilled or seeded)		76	85	90	92

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HYDROLOGY MANUAL

RUNOFF INDEX NUMBERS FOR PERVIOUS AREAS

RUNOFF INDEX NUMBERS OF HYDROLOGIC SOIL-COVER COMPLEXES FOR PERVIOUS AREAS-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
AGRICULTURAL COVERS (cont.) -					
Legumes, Close Seeded (Alfalfa, sweetclover, timothy, etc.)	Poor	66	77	85	89
	Good	58	72	81	85
Orchards, Deciduous (Apples, apricots, pears, walnuts, etc.)		See Note 4			
Orchards, Evergreen (Citrus, avocados, etc.)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
Pasture, Dryland (Annual grasses) (Equestrian Center)	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Pasture, Irrigated (Legumes and perennial grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
Row Crops (Field crops - tomatoes, sugar beets, etc.)	Poor	72	81	88	91
	Good	67	78	85	89
Small Grain (Wheat, oats, barley, etc.)	Poor	65	76	84	88
	Good	63	75	83	87
Vineyard		See Note 4			

Notes:

1. All runoff index (RI) numbers are for Antecedent Moisture Condition (AMC) II.

2. Quality of cover definitions:
   Poor-Heavily grazed or regularly burned areas. Less than 50 percent of the ground surface is protected by plant cover or brush and tree canopy.
   Fair-Moderate cover with 50 percent to 75 percent of the ground surface protected.
   Good-Heavy or dense cover with more than 75 percent of the ground surface protected.

3. See Plate C-2 for a detailed description of cover types.

4. Use runoff index numbers based on ground cover type. See discussion under "Cover Type Descriptions" on Plate C-2.

5. Reference Bibliography item 17.

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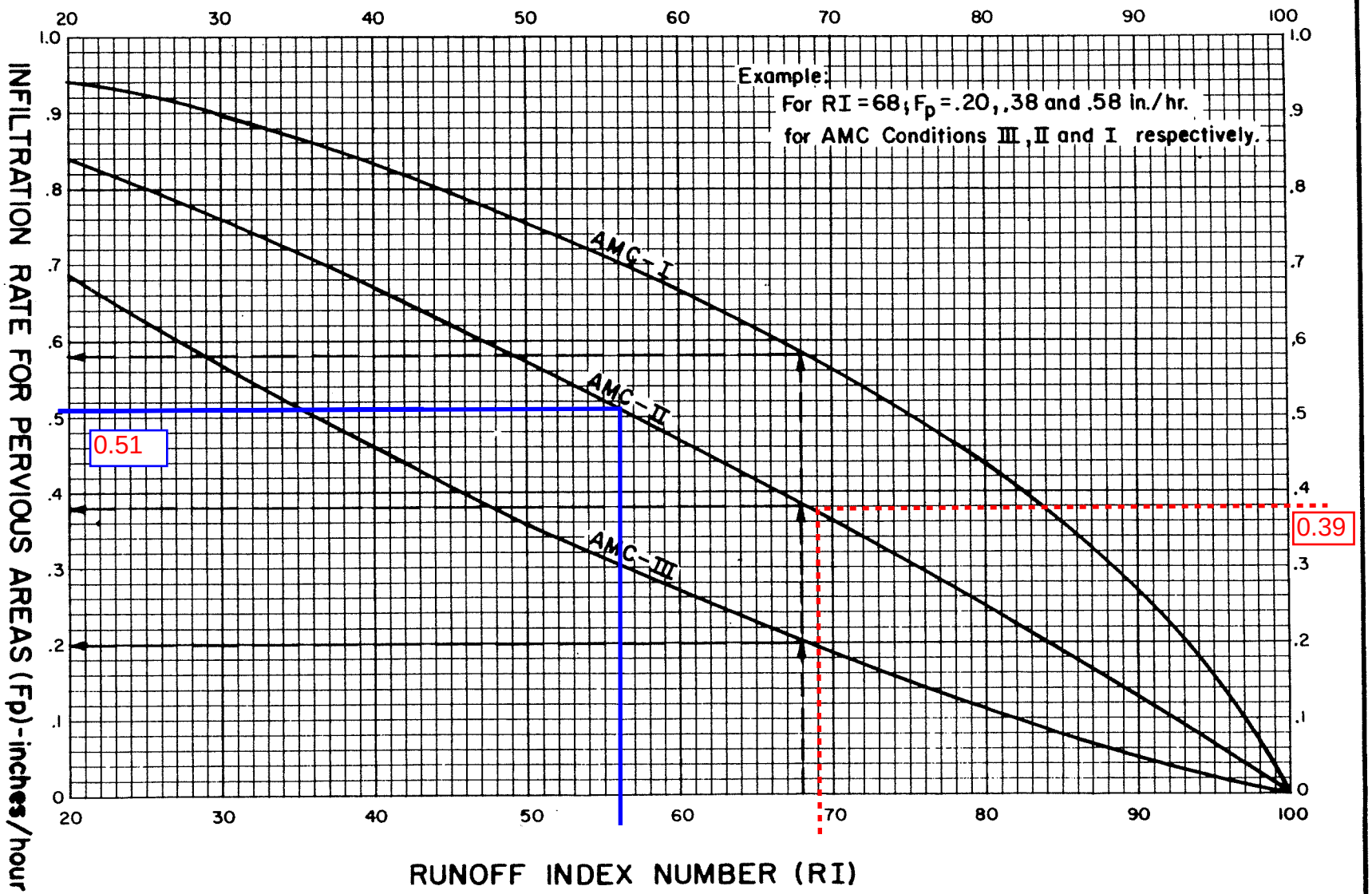
HYDROLOGY MANUAL

RUNOFF INDEX NUMBERS FOR PERVIOUS AREAS

NOTES:

1. R.I. Number-Infiltration relationships are derived from rainfall-runoff relationships in Bibliography item No. 36.



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HYDROLOGY MANUAL

INFILTRATION RATE FOR PERVIOUS AREAS VERSUS RUNOFF INDEX NUMBERS

ACTUAL IMPERVIOUS COVER

Land Use (1)	Range-Percent	Recommended Value For Average Conditions-Percent (2)
Natural or Agriculture	0 - 10	0
Single Family Residential: (3)		
40,000 S. F. (1 Acre) Lots	10 - 25	20
20,000 S. F. (½ Acre) Lots	30 - 45	40
7,200 - 10,000 S. F. Lots (SF ¼-acre)	45 - 55	50
(Equestrian Center assumed 50% Impervious)		
Multiple Family Residential:		
Condominiums (Resort/Commercial)	45 - 70	65
Apartments	65 - 90	80
Mobile Home Park (Workforce Housing)	60 - 85	75
Commercial, Downtown Business or Industrial (Offsite Streets)	80 -100	90

Notes:

1. Land use should be based on ultimate development of the watershed. Long range master plans for the County and incorporated cities should be reviewed to insure reasonable land use assumptions.

2. Recommended values are based on average conditions which may not apply to a particular study area. The percentage impervious may vary greatly even on comparable sized lots due to differences in dwelling size, improvements, etc. Landscape practices should also be considered as it is common in some areas to use ornamental gravels underlain by impervious plastic materials in place of lawns and shrubs. A field investigation of a study area should always be made, and a review of aerial photos, where available may assist in estimating the percentage of impervious cover in developed areas.

3. For typical horse ranch subdivisions increase impervious area 5 percent over the values recommended in the table above.

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HYDROLOGY MANUAL

IMPERVIOUS COVER FOR DEVELOPED AREAS

Appendix E

RCFCD Synthetic Unit Hydrograph Worksheets

RCFCD SYNTHETIC UNIT HYDROGRAPH - SHORTCUT METHOD

DATA INPUT SHEET

DATE	March 8, 2024
WORKSHEET PREPARED BY:	RRR
PROJECT NAME	Thermal Ranch TTM 38578
PROJECT NUMBER	2735
CONCENTRATION POINT DESIGNATION	Retention Basin 1A
AREA DESIGNATION	DA-1A
AMC NUMBER	2

Low Loss Conditions: X=Existing; D=Developed; BS=Retention

AREA DESIG	SOIL GROUP	TRIBUTARY AREAS	ACRES	LOW LOSS CONDITION	RI NUMBER	AMC II INFILTRATION RATE	IMPERVIOUS PERCENT
18	B	EQUESTRIAN CENTER	85.1	X	69	0.39	0.50
5	B	SF - 1/4 ACRE	23.9	D	56	0.51	0.50

LENGTH OF WATERCOURSE (L)	3,252 ft
LENGTH TO POINT OPPOSITE CENTROID (Lca)	852 ft
ELEVATION OF HEADWATER	367.7 ft
ELEVATION OF CONCENTRATION POINT	356.2 ft
AVERAGE MANNINGS 'N' VALUE	0.020
STORM FREQUENCY (YEAR)	100
LOW LOSS RATE (Storm Events > 10 Years)	**85%**
POINT RAIN FROM NOAA ATLAS	**14**
1-HOUR	1.22 in
3-HOUR	2.00 in
6-HOUR	2.66 in
24-HOUR	4.21 in

BASIN CHARACTERISTICS:

ELEVATION	AREA
351.5 ft	238,510 sf
352.5 ft	301,737 sf

PERCOLATION RATE (in/hr)	0.24 in/hr
DRYWELL DATA	
NUMBER USED	0
PERCOLATION RATE	
LOWEST FLOWLINE ELEVATION	353.60
LOWEST PAD ELEVATION	357.1

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD BASIC DATA CALCULATION FORM	PROJECT: Thermal Ranch TTM 38578 Job No.: 2735 BY: RRR DATE: 3/8/24

PHYSICAL DATA

[1] CONCENTRATION POINT	Retention Basin 1A
[2] AREA DESIGNATION	DA-1A
[3] AREA - ACRES	109.000
[4] L-FEET	3252
[5] L-MILES	0.616
[6] La-FEET	852.00
[7] La-MILES	0.161
[8] ELEVATION OF HEADWATER	367.7
[9] ELEVATION OF CONCENTRATION POINT	356.22
[10] H-FEET	11.48
[11] S-FEET/MILE	18.6
[12] S^0.5	4.32
[13] L*LCA/S^0.5	0.023
[14] AVERAGE MANNINGS 'N'	0.02
[15] LAG TIME-HOURS	0.11
[16] LAG TIME-MINUTES	6.9
[17] 100% OF LAG-MINUTES	6.9
[18] 200% OF LAG-MINUTES	13.7

RAINFALL DATA

[1] AMC	II
[2] FREQUENCY-YEARS	100
FROM NOAA ATLAS	**14**
[3] STORM DURATION:	Point Rain
1-HOUR	1.22 in
3-HOUR	2.00 in
6-HOUR	2.66 in
24-HOUR	4.21 in

STORM EVENT SUMMARY

STORM DURATION		1-HOUR	3-HOUR	6-HOUR	24-HOUR
RAINFALL VOLUME	(cu ft)	482,719	791,343	1,052,486	**1,665,777**
SOIL LOSSES	(cu ft)	90,598	268,279	508,170	**1,099,189**
EFFECTIVE RAIN	(in)	0.99	1.32	1.38	1.43
FLOOD VOLUME	(cu ft)	392,122	523,064	544,317	**566,589**
	(acre-ft)	9.00	12.01	12.50	**13.01**
PEAK FLOW	(cfs)	n/a	191.13	171.30	41.26
STORAGE PROVIDED	(cu ft)	269,505			
	(acre-ft)	6.19			
PERCOLATION RATE	(in/hr)	0.24			
PERCOLATION VOLUME	(cu ft)	230,920	241,403	255,788	319,984
	(acre-ft)	5.30	5.54	5.87	7.35
DRAIN TILE LOSS VOLUME	(cu ft)	84,039	87,963	93,819	112,230
	(acre-ft)	1.93	2.02	2.15	2.58
OVERFLOW VOLUME	(cu ft)	77,163	193,699	194,710	134,374
	(acre-ft)	1.77	4.45	4.47	3.08
TOTAL VOLUME LOSSES	(cu ft)	392,122	523,064	544,317	566,589
	(acre-ft)	9.00	12.01	12.50	**13.01**
BASIN DEWATERING TIME	(hours)	41.9	41.9	41.8	37.3
MAXIMUM VOLUME IN BASIN	(cu ft)	307,797	307,797	307,797	307,797
	(acre-ft)	7.07	7.07	7.07	7.07
MAXIMUM WSEL	(ft)	352.21	352.39	352.44	**352.49**
DEPTH	(ft)	0.71	0.89	0.94	**0.99**
LOWEST FLOWLINE ELEVATION		353.60			
DIFFERENCE	(ft)	1.39	1.21	1.16	1.11
LOWEST PAD ELEVATION		357.1			
DIFFERENCE	(ft)	4.89	4.71	4.66	4.61

NOTE: PEAK FLOW FOR THE 1-HOUR STORM IS NOT REPRESENTATIVE. PER RCFCD PEAK DISCHARGES FROM THE 3-HOUR STORM SHOULD NORMALLY COMPARE WELL WITH RATIONAL PEAKS.

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD BASIC DATA CALCULATION FORM AMC II	PROJECT: Thermal Ranch TTM 38578 Job No.: 2735 Area ID: DA-1A By: RRR Date: 3/8/24

AVERAGE ADJUSTED LOSS RATE

SOIL GROUP [Plate C-1]	LAND USE	RI NUMBER [Plate E-6.1]	PERVIOUS AREA INFILTRATION RATE (in/hr) [Plate E-6.2]	DECIMAL PERCENT OF AREA IMPERVIOUS [Plate E-6.3]	ADJUSTED INFILTRATION RATE (in/hr)	AREA	AREA WEIGHTED AVERAGE	MAX AVERAGE ADJUSTED INFILTRATION RATE (in/hr)	LOW LOSS CONDITION	LOW LOSS RATE PER RCFC/2322	MIN AVERAGE ADJUSTED INFILTRATION RATE
B	EQUESTRIAN CENTER	69	0.39	50%	0.21	85.100	0.781	0.1675	UNDEVELOPED	0.9000	0.7027
B	SF - 1/4 ACRE	56	0.51	50%	0.28	23.900	0.219	0.0615	DEVELOPED	0.5000	0.1096
					SUM	109.000	SUM	0.2290			0.8123

VARIABLE LOSS RATE CURVE (24-HOUR STORM ONLY)

Fm= 0.11448578

C= 0.00212

F_t=C(24-(T/60))^1.55+F_m = 0.00212 (24-(T/60))^1.55 + 0.11 in/hr

CONSTANT LOSS RATE (3 & 6 HOUR STORMS) = **0.2290**

LOW LOSS RATE = **0.8500**

Where:

T=Time in minutes. To get an average value for each unit time period, Use T=1/2 the unit time for the first time period, T=1 1/2 unit time for the second period, etc.

NOTE: Low loss rates established per RCFC/2322 (Dated: May-30-95)
For 10 Year Storms or Less
Undeveloped Condition: Low Loss = 90%
Developed Condition: Low Loss = 0.9 - (0.8 * %impervious)
Basin Site: Low Loss = 10%
For 100 Year Storm - Low Loss should be between 80% & 90% of the Rainfall Rate

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

1-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-1A
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	109.00
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	6.87
UNIT TIME-PERCENT OF LAG	72.8
TOTAL ADJUSTED STORM RAIN-INCHES	1.22
CONSTANT LOSS RATE-in/hr	0.23
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	0.24 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu ft	Basin Volume cu ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu ft	Basin Losses Percolation Out cu ft	Basin Losses Drain Tile Out cu ft	Basin Losses Overflow Out cu ft	Total In Basin cu ft	Total In Basin ac-ft	Basin WSEL ft
1	5	0.08	3.6	0.53	0.23	0.45	0.30	32.76	9,828	9,828	240,816	401	401	164	0	9,263	0.21	351.53
2	10	0.17	4.2	0.61	0.23	0.52	0.39	42.41	12,724	21,988	243,668	406	406	164	0	21,418	0.49	351.58
3	15	0.25	4.4	0.64	0.23	0.55	0.42	45.63	13,690	35,108	246,746	411	411	164	0	34,533	0.79	351.63
4	20	0.33	4.6	0.67	0.23	0.57	0.44	48.85	14,655	49,188	250,050	417	417	164	0	48,608	1.12	351.68
5	25	0.42	5.0	0.73	0.23	0.62	0.50	55.29	16,586	65,194	253,805	423	423	164	0	64,608	1.48	351.74
6	30	0.50	5.6	0.82	0.23	0.70	0.59	64.94	19,482	84,090	258,238	430	430	164	0	83,496	1.92	351.81
7	35	0.58	6.4	0.94	0.23	0.80	0.71	77.81	23,344	106,841	263,575	439	439	164	0	106,238	2.44	351.89
8	40	0.67	8.1	1.19	0.23	1.01	0.96	105.17	31,550	137,788	270,836	451	451	164	0	137,173	3.15	352.01
9	45	0.75	13.1	1.92	0.23	1.63	1.69	185.62	55,686	192,860	283,756	473	473	164	0	192,223	4.41	**352.21**
10	50	0.83	34.5	5.05	0.23	4.29	4.82	**529.96**	**158,988**	351,212	269,505	449	449	164	42,803	**307,797**	**7.07**	
11	55	0.92	6.7	0.98	0.23	0.83	0.75	82.64	24,792	332,589	269,505	449	449	164	24,180	**307,797**	**7.07**	
12	60	1.00	3.8	0.56	0.23	0.47	0.33	35.98	10,794	318,590	269,505	449	449	164	10,181	**307,797**	**7.07**	

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL	1.22 in
RAINFALL VOLUME	482,719 cu ft
SOIL LOSSES	90,598 cu ft
EFFECTIVE RAIN	0.99 in
FLOOD VOLUME	9.00 ac-ft
FLOOD VOLUME	392,122 cu ft
REQUIRED STORAGE	7.07 ac-ft
REQUIRED STORAGE	307,797 cu ft
MAX WSEL	352.21 ft
PEAK FLOW RATE	529.96 cfs
TOTAL BASIN LOSSES	314,959 cu ft
TOTAL OVERFLOW OUT	77,163 cu ft

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

3-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-1A
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	109.00
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	6.87
UNIT TIME-PERCENT OF LAG	72.8
TOTAL ADJUSTED STORM RAIN (in)	2.00
CONSTANT LOSS RATE (in/hr)	0.23
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	0.24 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu ft	Basin Volume cu ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu ft	Basin Losses Percolation Out cu ft	Basin Losses Drain Tile Out cu ft	Basin Losses Overflow Out cu ft	Total In Basin cu ft	Total In Basin ac-ft	Basin WSEL ft
1	5	0.08	1.3	0.31	0.23	0.27	0.08	9.13	2,738	2,738	239,152	399	399	164	0	2,176	0.05	351.51
2	10	0.17	1.3	0.31	0.23	0.27	0.08	9.13	2,738	4,913	239,663	399	399	164	0	4,350	0.10	351.52
3	15	0.25	1.1	0.26	0.23	0.22	0.04	3.85	1,155	5,505	239,802	400	400	164	0	4,942	0.11	351.52
4	20	0.33	1.5	0.36	0.23	0.31	0.13	14.40	4,320	9,262	240,683	401	401	164	0	8,698	0.20	351.53
5	25	0.42	1.5	0.36	0.23	0.31	0.13	14.40	4,320	13,018	241,564	403	403	164	0	12,452	0.29	351.55
6	30	0.50	1.8	0.43	0.23	0.37	0.20	22.31	6,694	19,146	243,002	405	405	164	0	18,578	0.43	351.57
7	35	0.58	1.5	0.36	0.23	0.31	0.13	14.40	4,320	22,898	243,882	406	406	164	0	22,328	0.51	351.58
8	40	0.67	1.8	0.43	0.23	0.37	0.20	22.31	6,694	29,023	245,319	409	409	164	0	28,450	0.65	351.61
9	45	0.75	1.8	0.43	0.23	0.37	0.20	22.31	6,694	35,145	246,755	411	411	164	0	34,570	0.79	351.63
10	50	0.83	1.5	0.36	0.23	0.31	0.13	14.40	4,320	38,890	247,634	413	413	164	0	38,314	0.88	351.64
11	55	0.92	1.6	0.38	0.23	0.33	0.16	17.04	5,112	43,426	248,698	414	414	164	0	42,848	0.98	351.66
12	60	1.00	1.8	0.43	0.23	0.37	0.20	22.31	6,694	49,542	250,133	417	417	164	0	48,962	1.12	351.68
13	65	1.08	2.2	0.53	0.23	0.45	0.30	32.87	9,860	58,822	252,310	421	421	164	0	58,238	1.34	351.72
14	70	1.17	2.2	0.53	0.23	0.45	0.30	32.87	9,860	68,097	254,486	424	424	164	0	67,510	1.55	351.75
15	75	1.25	2.2	0.53	0.23	0.45	0.30	32.87	9,860	77,369	256,661	428	428	164	0	76,778	1.76	351.78
16	80	1.33	2.0	0.48	0.23	0.41	0.25	27.59	8,277	85,055	258,464	431	431	164	0	84,461	1.94	351.81
17	85	1.42	2.6	0.62	0.23	0.53	0.40	43.42	13,025	97,486	261,381	436	436	164	0	96,887	2.22	351.86
18	90	1.50	2.7	0.65	0.23	0.55	0.42	46.05	13,816	110,703	264,482	441	441	164	0	110,099	2.53	351.91
19	95	1.58	2.4	0.58	0.23	0.49	0.35	38.14	11,442	121,542	267,024	445	445	164	0	120,933	2.78	351.95
20	100	1.67	2.7	0.65	0.23	0.55	0.42	46.05	13,816	134,749	270,123	450	450	164	0	134,136	3.08	352.00
21	105	1.75	3.3	0.79	0.23	0.67	0.56	61.88	18,565	152,700	274,334	457	457	164	0	152,080	3.49	352.06
22	110	1.83	3.1	0.74	0.23	0.63	0.52	56.61	16,982	169,061	278,173	464	464	164	0	168,434	3.87	352.12
23	115	1.92	2.9	0.70	0.23	0.59	0.47	51.33	15,399	183,833	281,638	469	469	164	0	183,201	4.21	352.18
24	120	2.00	3.0	0.72	0.23	0.61	0.49	53.97	16,190	199,391	285,288	475	475	164	0	198,752	4.56	352.24
25	125	2.08	3.1	0.74	0.23	0.63	0.52	56.61	16,982	215,734	289,122	482	482	164	0	215,089	4.94	352.30
26	130	2.17	4.2	1.01	0.23	0.86	0.78	85.62	25,687	240,775	294,997	492	492	164	0	240,120	5.51	**352.39**
27	135	2.25	5.0	1.20	0.23	1.02	0.97	106.72	32,017	272,137	269,505	449	449	164	0	271,525	6.23	
28	140	2.33	3.5	0.84	0.23	0.71	0.61	67.16	20,147	291,672	269,505	449	449	164	0	291,059	6.68	
29	145	2.42	6.8	1.63	0.23	1.39	1.40	154.21	46,262	337,321	269,505	449	449	164	28,912	**307,797**	**7.07**	
30	150	2.50	7.3	1.75	0.23	1.49	1.52	167.39	50,218	358,015	269,505	449	449	164	49,606	**307,797**	**7.07**	
31	155	2.58	8.2	1.97	0.23	1.67	1.74	**191.13**	**57,340**	365,137	269,505	449	449	164	56,728	**307,797**	**7.07**	
32	160	2.67	5.9	1.42	0.23	1.20	1.19	130.46	39,139	346,936	269,505	449	449	164	38,527	**307,797**	**7.07**	
33	165	2.75	2.0	0.48	0.23	0.41	0.25	27.59	8,277	316,074	269,505	449	449	164	7,664	**307,797**	**7.07**	
34	170	2.83	1.8	0.43	0.23	0.37	0.20	22.31	6,694	314,491	269,505	449	449	164	6,082	**307,797**	**7.07**	
35	175	2.92	1.8	0.43	0.23	0.37	0.20	22.31	6,694	314,491	269,505	449	449	164	6,082	**307,797**	**7.07**	
36	180	3.00	0.6	0.14	0.23	0.12	0.02	2.37	712	308,509	269,505	449	449	164	100	**307,797**	**7.07**	

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL	2.00 in
RAINFALL VOLUME	791,343 cu ft
SOIL LOSSES	268,279 cu ft
EFFECTIVE RAIN	1.32 in
FLOOD VOLUME	12.01 ac-ft
FLOOD VOLUME	523,064 cu ft
REQUIRED STORAGE	7.07 ac-ft
REQUIRED STORAGE	307,797 cu ft
MAX WSEL	352.39 ft
PEAK FLOW RATE	191.13 cfs
TOTAL BASIN LOSSES	329,366 cu ft
TOTAL OVERFLOW OUT	193,699 cu ft

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

6-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-1A
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	109.00
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	6.87
UNIT TIME-PERCENT OF LAG	72.8
TOTAL ADJUSTED STORM RAIN (in)	2.66
CONSTANT LOSS RATE (in/hr)	0.23
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	0.24 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu ft	Basin Volume cu ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu ft	Basin Losses Percolation Out cu ft	Basin Losses Drain Tile Out cu ft	Basin Losses Overflow Out cu ft	Total In Basin cu ft	Total In Basin ac-ft	Basin WSEL ft
1	5	0.08	0.5	0.16	0.23	0.14	0.02	2.63	789	789	238,695	398	398	164	0	228	0.01	351.50
2	10	0.17	0.6	0.19	0.23	0.16	0.03	3.16	947	1,175	238,786	398	398	164	0	614	0.01	351.50
3	15	0.25	0.6	0.19	0.23	0.16	0.03	3.16	947	1,561	238,876	398	398	164	0	999	0.02	351.50
4	20	0.33	0.6	0.19	0.23	0.16	0.03	3.16	947	1,947	238,967	398	398	164	0	1,385	0.03	351.51
5	25	0.42	0.6	0.19	0.23	0.16	0.03	3.16	947	2,332	239,057	398	398	164	0	1,770	0.04	351.51
6	30	0.50	0.7	0.22	0.23	0.19	0.03	3.68	1,105	2,875	239,185	399	399	164	0	2,313	0.05	351.51
7	35	0.58	0.7	0.22	0.23	0.19	0.03	3.68	1,105	3,418	239,312	399	399	164	0	2,856	0.07	351.51
8	40	0.67	0.7	0.22	0.23	0.19	0.03	3.68	1,105	3,961	239,439	399	399	164	0	3,398	0.08	351.51
9	45	0.75	0.7	0.22	0.23	0.19	0.03	3.68	1,105	4,504	239,567	399	399	164	0	3,941	0.09	351.51
10	50	0.83	0.7	0.22	0.23	0.19	0.03	3.68	1,105	5,046	239,694	399	399	164	0	4,483	0.10	351.52
11	55	0.92	0.7	0.22	0.23	0.19	0.03	3.68	1,105	5,588	239,821	400	400	164	0	5,025	0.12	351.52
12	60	1.00	0.8	0.26	0.23	0.22	0.03	2.90	870	5,895	239,893	400	400	164	0	5,332	0.12	351.52
13	65	1.08	0.8	0.26	0.23	0.22	0.03	2.90	870	6,202	239,965	400	400	164	0	5,638	0.13	351.52
14	70	1.17	0.8	0.26	0.23	0.22	0.03	2.90	870	6,508	240,037	400	400	164	0	5,945	0.14	351.52
15	75	1.25	0.8	0.26	0.23	0.22	0.03	2.90	870	6,815	240,109	400	400	164	0	6,251	0.14	351.52
16	80	1.33	0.8	0.26	0.23	0.22	0.03	2.90	870	7,121	240,181	400	400	164	0	6,557	0.15	351.52
17	85	1.42	0.8	0.26	0.23	0.22	0.03	2.90	870	7,428	240,253	400	400	164	0	6,864	0.16	351.53
18	90	1.50	0.8	0.26	0.23	0.22	0.03	2.90	870	7,734	240,324	401	401	164	0	7,170	0.16	351.53
19	95	1.58	0.8	0.26	0.23	0.22	0.03	2.90	870	8,040	240,396	401	401	164	0	7,476	0.17	351.53
20	100	1.67	0.8	0.26	0.23	0.22	0.03	2.90	870	8,346	240,468	401	401	164	0	7,781	0.18	351.53
21	105	1.75	0.8	0.26	0.23	0.22	0.03	2.90	870	8,652	240,540	401	401	164	0	8,087	0.19	351.53
22	110	1.83	0.8	0.26	0.23	0.22	0.03	2.90	870	8,957	240,611	401	401	164	0	8,393	0.19	351.53
23	115	1.92	0.8	0.26	0.23	0.22	0.03	2.90	870	9,263	240,683	401	401	164	0	8,698	0.20	351.53
24	120	2.00	0.9	0.29	0.23	0.24	0.06	6.41	1,923	10,621	241,002	402	402	164	0	10,056	0.23	351.54
25	125	2.08	0.8	0.26	0.23	0.22	0.03	2.90	870	10,926	241,073	402	402	164	0	10,360	0.24	351.54
26	130	2.17	0.9	0.29	0.23	0.24	0.06	6.41	1,923	12,283	241,392	402	402	164	0	11,717	0.27	351.54
27	135	2.25	0.9	0.29	0.23	0.24	0.06	6.41	1,923	13,640	241,710	403	403	164	0	13,073	0.30	351.55
28	140	2.33	0.9	0.29	0.23	0.24	0.06	6.41	1,923	14,996	242,028	403	403	164	0	14,429	0.33	351.55
29	145	2.42	0.9	0.29	0.23	0.24	0.06	6.41	1,923	16,352	242,346	404	404	164	0	15,784	0.36	351.56
30	150	2.50	0.9	0.29	0.23	0.24	0.06	6.41	1,923	17,707	242,664	404	404	164	0	17,139	0.39	351.56
31	155	2.58	0.9	0.29	0.23	0.24	0.06	6.41	1,923	19,062	242,982	405	405	164	0	18,493	0.42	351.57
32	160	2.67	0.9	0.29	0.23	0.24	0.06	6.41	1,923	20,416	243,300	405	405	164	0	19,847	0.46	351.57
33	165	2.75	1.0	0.32	0.23	0.27	0.09	9.92	2,975	22,822	243,864	406	406	164	0	22,252	0.51	351.58
34	170	2.83	1.0	0.32	0.23	0.27	0.09	9.92	2,975	25,227	244,428	407	407	164	0	24,656	0.57	351.59
35	175	2.92	1.0	0.32	0.23	0.27	0.09	9.92	2,975	27,631	244,992	408	408	164	0	27,059	0.62	351.60
36	180	3.00	1.0	0.32	0.23	0.27	0.09	9.92	2,975	30,034	245,556	409	409	164	0	29,462	0.68	351.61
37	185	3.08	1.0	0.32	0.23	0.27	0.09	9.92	2,975	32,437	246,120	410	410	164	0	31,863	0.73	351.62
38	190	3.17	1.1	0.35	0.23	0.30	0.12	13.43	4,028	35,890	246,930	412	412	164	0	35,315	0.81	351.63
39	195	3.25	1.1	0.35	0.23	0.30	0.12	13.43	4,028	39,343	247,740	413	413	164	0	38,767	0.89	351.64
40	200	3.33	1.1	0.35	0.23	0.30	0.12	13.43	4,028	42,794	248,550	414	414	164	0	42,216	0.97	351.66
41	205	3.42	1.2	0.38	0.23	0.33	0.15	16.93	5,080	47,296	249,606	416	416	164	0	46,717	1.07	351.67
42	210	3.50	1.3	0.41	0.23	0.35	0.19	20.44	6,133	52,849	250,909	418	418	164	0	52,268	1.20	351.69
43	215	3.58	1.4	0.45	0.23	0.38	0.22	23.95	7,185	59,453	252,458	421	421	164	0	58,868	1.35	351.72
44	220	3.67	1.4	0.45	0.23	0.38	0.22	23.95	7,185	66,053	254,006	423	423	164	0	65,467	1.50	351.74
45	225	3.75	1.5	0.48	0.23	0.41	0.25	27.46	8,238	73,704	255,801	426	426	164	0	73,114	1.68	351.77
46	230	3.83	1.5	0.48	0.23	0.41	0.25	27.46	8,238	81,352	257,595	429	429	164	0	80,759	1.85	351.80
47	235	3.92	1.6	0.51	0.23	0.43	0.28	30.97	9,290	90,049	259,636	433	433	164	0	89,453	2.05	351.83
48	240	4.00	1.6	0.51	0.23	0.43	0.28	30.97	9,290	98,743	261,675	436	436	164	0	98,143	2.25	351.86
49	245	4.08	1.7	0.54	0.23	0.46	0.31	34.47	10,342	108,486	263,961	440	440	164	0	107,882	2.48	351.90
50	250	4.17	1.8	0.57	0.23	0.49	0.35	37.98	11,395	119,277	266,493	444	444	164	0	118,669	2.72	351.94
51	255	4.25	1.9	0.61	0.23	0.52	0.38	41.49	12,447	131,117	269,271	449	449	164	0	130,505	3.00	351.98
52	260	4.33	2.0	0.64	0.23	0.54	0.41	45.00	13,500	144,005	272,294	454	454	164	0	143,387	3.29	352.03
53	265	4.42	2.1	0.67	0.23	0.57	0.44	48.51	14,552	157,940	275,563	459	459	164	0	157,317	3.61	352.08

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

6-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-1A
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	109.00
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	6.87
UNIT TIME-PERCENT OF LAG	72.8
TOTAL ADJUSTED STORM RAIN (in)	2.66
CONSTANT LOSS RATE (in/hr)	0.23
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	0.24 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu ft	Basin Volume cu ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu ft	Basin Losses Percolation Out cu ft	Basin Losses Drain Tile Out cu ft	Basin Losses Overflow Out cu ft	Total In Basin cu ft	Total In Basin ac-ft	Basin WSEL ft
54	270	4.50	2.1	0.67	0.23	0.57	0.44	48.51	14,552	171,869	278,831	465	465	164	0	171,241	3.93	352.14
55	275	4.58	2.2	0.70	0.23	0.60	0.47	52.02	15,605	186,846	282,345	471	471	164	0	186,212	4.27	352.19
56	280	4.67	2.3	0.73	0.23	0.62	0.51	55.52	16,657	202,869	286,104	477	477	164	0	202,229	4.64	352.25
57	285	4.75	2.4	0.77	0.23	0.65	0.54	59.03	17,710	219,939	290,109	484	484	164	0	219,292	5.03	352.31
58	290	4.83	2.4	0.77	0.23	0.65	0.54	59.03	17,710	237,002	294,112	490	490	164	0	236,348	5.43	352.38
59	295	4.92	2.5	0.80	0.23	0.68	0.57	62.54	18,762	255,110	298,360	497	497	164	0	254,450	5.84	**352.44**
60	300	5.00	2.6	0.83	0.23	0.71	0.60	66.05	19,815	274,264	269,505	449	449	164	0	273,652	6.28	
61	305	5.08	3.1	0.99	0.23	0.84	0.76	83.59	25,077	298,729	269,505	449	449	164	0	298,116	6.84	
62	310	5.17	3.6	1.15	0.23	0.98	0.92	101.13	30,340	328,456	269,505	449	449	164	20,047	**307,797**	**7.07**	
63	315	5.25	3.9	1.24	0.23	1.06	1.02	111.66	33,497	341,294	269,505	449	449	164	32,884	**307,797**	**7.07**	
64	320	5.33	4.2	1.34	0.23	1.14	1.11	122.18	36,655	344,451	269,505	449	449	164	36,042	**307,797**	**7.07**	
65	325	5.42	4.7	1.50	0.23	1.28	1.27	139.72	41,917	349,714	269,505	449	449	164	41,304	**307,797**	**7.07**	
66	330	5.50	5.6	1.79	0.23	1.52	1.56	**171.30**	**51,389**	359,186	269,505	449	449	164	50,777	**307,797**	**7.07**	
67	335	5.58	1.9	0.61	0.23	0.52	0.38	41.49	12,447	320,244	269,505	449	449	164	11,835	**307,797**	**7.07**	
68	340	5.67	0.9	0.29	0.23	0.24	0.06	6.41	1,923	309,719	269,505	449	449	164	1,310	**307,797**	**7.07**	
69	345	5.75	0.6	0.19	0.23	0.16	0.03	3.16	947	308,744	269,505	449	449	164	335	**307,797**	**7.07**	
70	350	5.83	0.5	0.16	0.23	0.14	0.02	2.63	789	308,586	269,505	449	449	164	177	**307,797**	**7.07**	
71	355	5.92	0.3	0.10	0.23	0.08	0.01	1.58	474	308,270	269,505	449	449	164	0	307,657	7.06	
72	360	6.00	0.2	0.06	0.23	0.05	0.01	1.05	316	307,973	269,505	449	449	164	0	307,361	7.06	

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL	2.66 in
RAINFALL VOLUME	1,052,486 cu ft
SOIL LOSSES	508,170 cu ft
EFFECTIVE RAIN	1.38 in
FLOOD VOLUME	12.50 ac-ft
FLOOD VOLUME	544,317 cu ft
REQUIRED STORAGE	7.07 ac-ft
REQUIRED STORAGE	307,797 cu ft
MAX WSEL	352.44 ft
PEAK FLOW RATE	171.30 cfs
TOTAL BASIN LOSSES	30,474 cu ft
TOTAL OVERFLOW OUT	194,710 cu ft

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

24-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-1A
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	109.00
UNIT TIME-MINUTES	15
LAG TIME - MINUTES	6.87
UNIT TIME-PERCENT OF LAG	218%
TOTAL ADJUSTED STORM RAIN (in)	4.21

VARIABLE LOSS RATE (AVG) IN/HR	
Fm = Minimum value on loss curve (in/hr)	0.11
C	0.00212
Low Loss Rate (percent)	85.00%

Basin Percolation Rate	0.24 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu ft	Basin Volume cu ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu ft	Basin Losses Percolation Out cu ft	Basin Losses Drain Tile Out cu ft	Basin Losses Overflow Out cu ft	Total In Basin cu ft	Total In Basin ac-ft	Basin WSEL ft
1	15	0.25	0.2	0.034	0.404	0.029	0.01	0.56	500	500	238,627	1,193	500	0	0	0	0.00	351.50
2	30	0.50	0.3	0.051	0.400	0.043	0.01	0.83	750	750	238,686	1,193	750	0	0	0	0.00	351.50
3	45	0.75	0.3	0.051	0.395	0.043	0.01	0.83	750	750	238,686	1,193	750	0	0	0	0.00	351.50
4	60	1.00	0.4	0.067	0.390	0.057	0.01	1.11	999	999	238,744	1,194	999	0	0	0	0.00	351.50
5	75	1.25	0.3	0.051	0.386	0.043	0.01	0.83	750	750	238,686	1,193	750	0	0	0	0.00	351.50
6	90	1.50	0.3	0.051	0.381	0.043	0.01	0.83	750	750	238,686	1,193	750	0	0	0	0.00	351.50
7	105	1.75	0.3	0.051	0.377	0.043	0.01	0.83	750	750	238,686	1,193	750	0	0	0	0.00	351.50
8	120	2.00	0.4	0.067	0.372	0.057	0.01	1.11	999	999	238,744	1,194	999	0	0	0	0.00	351.50
9	135	2.25	0.4	0.067	0.368	0.057	0.01	1.11	999	999	238,744	1,194	999	0	0	0	0.00	351.50
10	150	2.50	0.4	0.067	0.363	0.057	0.01	1.11	999	999	238,744	1,194	999	0	0	0	0.00	351.50
11	165	2.75	0.5	0.084	0.359	0.072	0.01	1.39	1,249	1,249	238,803	1,194	1,194	55	0	0	0.00	351.50
12	180	3.00	0.5	0.084	0.354	0.072	0.01	1.39	1,249	1,249	238,803	1,194	1,194	55	0	0	0.00	351.50
13	195	3.25	0.5	0.084	0.350	0.072	0.01	1.39	1,249	1,249	238,803	1,194	1,194	55	0	0	0.00	351.50
14	210	3.50	0.5	0.084	0.346	0.072	0.01	1.39	1,249	1,249	238,803	1,194	1,194	55	0	0	0.00	351.50
15	225	3.75	0.5	0.084	0.341	0.072	0.01	1.39	1,249	1,249	238,803	1,194	1,194	55	0	0	0.00	351.50
16	240	4.00	0.6	0.101	0.337	0.086	0.02	1.67	1,499	1,499	238,862	1,194	1,194	305	0	0	0.00	351.50
17	255	4.25	0.6	0.101	0.333	0.086	0.02	1.67	1,499	1,499	238,862	1,194	1,194	305	0	0	0.00	351.50
18	270	4.50	0.7	0.118	0.328	0.100	0.02	1.94	1,749	1,749	238,920	1,195	1,195	491	0	64	0.00	351.50
19	285	4.75	0.7	0.118	0.324	0.100	0.02	1.94	1,749	1,813	238,935	1,195	1,195	491	0	128	0.00	351.50
20	300	5.00	0.8	0.135	0.320	0.115	0.02	2.22	1,999	2,127	239,009	1,195	1,195	491	0	441	0.01	351.50
21	315	5.25	0.6	0.101	0.316	0.086	0.02	1.67	1,499	1,940	238,965	1,195	1,195	491	0	255	0.01	351.50
22	330	5.50	0.7	0.118	0.312	0.100	0.02	1.94	1,749	2,004	238,980	1,195	1,195	491	0	319	0.01	351.50
23	345	5.75	0.8	0.135	0.308	0.115	0.02	2.22	1,999	2,318	239,054	1,195	1,195	491	0	632	0.01	351.50
24	360	6.00	0.8	0.135	0.304	0.115	0.02	2.22	1,999	2,631	239,127	1,196	1,196	491	0	945	0.02	351.50
25	375	6.25	0.9	0.152	0.300	0.129	0.02	2.50	2,249	3,194	239,259	1,196	1,196	491	0	1,507	0.03	351.51
26	390	6.50	0.9	0.152	0.296	0.129	0.02	2.50	2,249	3,756	239,391	1,197	1,197	491	0	2,068	0.05	351.51
27	405	6.75	1.0	0.168	0.292	0.143	0.03	2.78	2,499	4,567	239,581	1,198	1,198	491	0	2,878	0.07	351.51
28	420	7.00	1.0	0.168	0.288	0.143	0.03	2.78	2,499	5,377	239,771	1,199	1,199	491	0	3,688	0.08	351.51
29	435	7.25	1.0	0.168	0.284	0.143	0.03	2.78	2,499	6,186	239,961	1,200	1,200	491	0	4,496	0.10	351.52
30	450	7.50	1.1	0.185	0.280	0.157	0.03	3.05	2,749	7,245	240,210	1,201	1,201	491	0	5,553	0.13	351.52
31	465	7.75	1.2	0.202	0.276	0.172	0.03	3.33	2,998	8,551	240,516	1,203	1,203	491	0	6,858	0.16	351.53
32	480	8.00	1.3	0.219	0.272	0.186	0.03	3.61	3,248	10,107	240,881	1,204	1,204	491	0	8,412	0.19	351.53
33	495	8.25	1.5	0.253	0.268	0.215	0.04	4.16	3,748	12,160	241,363	1,207	1,207	491	0	10,462	0.24	351.54
34	510	8.50	1.5	0.253	0.265	0.215	0.04	4.16	3,748	14,210	241,844	1,209	1,209	491	0	12,511	0.29	351.55
35	525	8.75	1.6	0.269	0.261	0.229	0.01	0.93	833	13,344	241,641	1,208	1,208	491	0	11,645	0.27	351.54
36	540	9.00	1.7	0.286	0.257	0.243	0.03	3.18	2,863	14,508	241,914	1,210	1,210	491	0	12,808	0.29	351.55
37	555	9.25	1.9	0.320	0.254	0.272	0.07	7.28	6,555	19,363	243,053	1,215	1,215	491	0	17,657	0.41	351.57
38	570	9.50	2.0	0.337	0.250	0.286	0.09	9.53	8,578	26,235	244,665	1,223	1,223	491	0	24,521	0.56	351.59
39	585	9.75	2.1	0.354	0.247	0.301	0.11	11.77	10,597	35,118	246,749	1,234	1,234	491	0	33,394	0.77	351.62
40	600	10.00	2.2	0.370	0.243	0.315	0.13	14.01	12,613	46,007	249,304	1,247	1,247	491	0	44,270	1.02	351.66
41	615	10.25	1.5	0.253	0.239	0.215	0.01	1.44	1,300	45,570	249,201	1,246	1,246	491	0	43,834	1.01	351.66
42	630	10.50	1.5	0.253	0.236	0.215	0.02	1.83	1,643	45,477	249,179	1,246	1,246	491	0	43,741	1.00	351.66
43	645	10.75	2.0	0.337	0.233	0.286	0.10	11.46	10,312	54,053	251,191	1,256	1,256	491	0	52,307	1.20	351.69
44	660	11.00	2.0	0.337	0.229	0.286	0.11	11.83	10,649	62,956	253,280	1,266	1,266	491	0	61,199	1.40	351.73
45	675	11.25	1.9	0.320	0.226	0.272	0.09	10.35	9,316	70,515	255,053	1,275	1,275	491	0	68,749	1.58	351.76
46	690	11.50	1.9	0.320	0.222	0.272	0.10	10.72	9,646	78,395	256,902	1,285	1,285	491	0	76,620	1.76	351.78
47	705	11.75	1.7	0.286	0.219	0.243	0.07	7.38	6,640	83,260	258,043	1,290	1,290	491	0	81,479	1.87	351.80
48	720	12.00	1.8	0.303	0.216	0.258	0.09	9.59	8,628	90,108	259,650	1,298	1,298	491	0	88,319	2.03	351.83
49	735	12.25	2.5	0.421	0.213	0.358	0.21	22.90	20,608	108,927	264,065	1,320	1,320	491	0	107,116	2.46	351.90
50	750	12.50	2.6	0.438	0.209	0.372	0.23	25.10	22,588	129,704	268,939	1,345	1,345	491	0	127,869	2.94	351.97
51	765	12.75	2.8	0.472	0.206	0.401	0.27	29.15	26,231	154,101	274,663	1,373	1,373	491	0	152,237	3.49	352.06
52	780	13.00	2.9	0.488	0.203	0.415	0.29	31.34	28,205	180,442	280,842	1,404	1,404	491	0	178,547	4.10	352.16
53	795	13.25	3.4	0.573	0.200	0.487	0.37	40.93	36,838	215,384	289,040	1,445	1,445	491	0	213,449	4.90	352.29
54	810	13.50	3.4	0.573	0.197	0.487	0.38	**41.26**	**37,138**	250,586	297,299	1,486	1,486	491	0	248,609	5.71	352.42
55	825	13.75	2.3	0.387	0.194	0.329	0.19	21.23	19,110	267,720	301,318	1,507	1,507	491	0	265,722	6.10	**352.49**
56	840	14.00	2.3	0.387	0.191	0.329	0.20	21.56	19,402	285,125	269,505	1,348	1,348	491	0	283,287	6.50	

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HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

24-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-1A
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	109.00
UNIT TIME-MINUTES	15
LAG TIME - MINUTES	6.87
UNIT TIME-PERCENT OF LAG	218%
TOTAL ADJUSTED STORM RAIN (in)	4.21

VARIABLE LOSS RATE (AVG) IN/HR	
Fm = Minimum value on loss curve (in/hr)	0.11
C	0.00212
Low Loss Rate (percent)	85.00%

Basin Percolation Rate	0.24 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu ft	Basin Volume cu ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu ft	Basin Losses Percolation Out cu ft	Basin Losses Drain Tile Out cu ft	Basin Losses Overflow Out cu ft	Total In Basin cu ft	Total In Basin ac-ft	Basin WSEL ft
57	855	14.25	2.7	0.455	0.188	0.386	0.27	29.28	26,354	309,641	269,505	1,348	1,348	491	6	**307,797**	**7.07**	
58	870	14.50	2.6	0.438	0.185	0.372	0.25	27.75	24,973	332,769	269,505	1,348	1,348	491	23,134	**307,797**	**7.07**	
59	885	14.75	2.6	0.438	0.183	0.372	0.26	28.06	25,253	333,049	269,505	1,348	1,348	491	23,415	**307,797**	**7.07**	
60	900	15.00	2.5	0.421	0.180	0.358	0.24	26.51	23,863	331,660	269,505	1,348	1,348	491	22,025	**307,797**	**7.07**	
61	915	15.25	2.4	0.404	0.177	0.344	0.23	24.97	22,470	330,266	269,505	1,348	1,348	491	20,632	**307,797**	**7.07**	
62	930	15.50	2.3	0.387	0.174	0.329	0.21	23.41	21,072	328,868	269,505	1,348	1,348	491	19,234	**307,797**	**7.07**	
63	945	15.75	1.9	0.320	0.172	0.272	0.15	16.30	14,672	322,469	269,505	1,348	1,348	491	12,834	**307,797**	**7.07**	
64	960	16.00	1.9	0.320	0.169	0.272	0.15	16.59	14,932	322,728	269,505	1,348	1,348	491	13,094	**307,797**	**7.07**	
65	975	16.25	0.4	0.067	0.166	0.057	0.01	1.11	999	308,796	269,505	1,348	1,348	491	0	306,958	7.05	
66	990	16.50	0.4	0.067	0.164	0.057	0.01	1.11	999	307,957	269,505	1,348	1,348	491	0	306,119	7.03	
67	1005	16.75	0.3	0.051	0.161	0.043	0.01	0.83	750	306,869	269,505	1,348	1,348	491	0	305,031	7.00	
68	1020	17.00	0.3	0.051	0.159	0.043	0.01	0.83	750	305,781	269,505	1,348	1,348	491	0	303,943	6.98	
69	1035	17.25	0.5	0.084	0.157	0.072	0.01	1.39	1,249	305,192	269,505	1,348	1,348	491	0	303,354	6.96	
70	1050	17.50	0.5	0.084	0.154	0.072	0.01	1.39	1,249	304,603	269,505	1,348	1,348	491	0	302,765	6.95	
71	1065	17.75	0.5	0.084	0.152	0.072	0.01	1.39	1,249	304,014	269,505	1,348	1,348	491	0	302,176	6.94	
72	1080	18.00	0.4	0.067	0.150	0.057	0.01	1.11	999	303,176	269,505	1,348	1,348	491	0	301,338	6.92	
73	1095	18.25	0.4	0.067	0.147	0.057	0.01	1.11	999	302,337	269,505	1,348	1,348	491	0	300,499	6.90	
74	1110	18.50	0.4	0.067	0.145	0.057	0.01	1.11	999	301,499	269,505	1,348	1,348	491	0	299,661	6.88	
75	1125	18.75	0.3	0.051	0.143	0.043	0.01	0.83	750	300,410	269,505	1,348	1,348	491	0	298,572	6.85	
76	1140	19.00	0.2	0.034	0.141	0.029	0.01	0.56	500	299,072	269,505	1,348	1,348	491	0	297,234	6.82	
77	1155	19.25	0.3	0.051	0.139	0.043	0.01	0.83	750	297,984	269,505	1,348	1,348	491	0	296,146	6.80	
78	1170	19.50	0.4	0.067	0.137	0.057	0.01	1.11	999	297,145	269,505	1,348	1,348	491	0	295,307	6.78	
79	1185	19.75	0.3	0.051	0.135	0.043	0.01	0.83	750	296,057	269,505	1,348	1,348	491	0	294,219	6.75	
80	1200	20.00	0.2	0.034	0.134	0.029	0.01	0.56	500	294,718	269,505	1,348	1,348	491	0	292,880	6.72	
81	1215	20.25	0.3	0.051	0.132	0.043	0.01	0.83	750	293,630	269,505	1,348	1,348	491	0	291,792	6.70	
82	1230	20.50	0.3	0.051	0.130	0.043	0.01	0.83	750	292,542	269,505	1,348	1,348	491	0	290,704	6.67	
83	1245	20.75	0.3	0.051	0.128	0.043	0.01	0.83	750	291,453	269,505	1,348	1,348	491	0	289,615	6.65	
84	1260	21.00	0.2	0.034	0.127	0.029	0.01	0.56	500	290,115	269,505	1,348	1,348	491	0	288,277	6.62	
85	1275	21.25	0.3	0.051	0.125	0.043	0.01	0.83	750	289,026	269,505	1,348	1,348	491	0	287,188	6.59	
86	1290	21.50	0.2	0.034	0.124	0.029	0.01	0.56	500	287,688	269,505	1,348	1,348	491	0	285,850	6.56	
87	1305	21.75	0.3	0.051	0.123	0.043	0.01	0.83	750	286,600	269,505	1,348	1,348	491	0	284,762	6.54	
88	1320	22.00	0.2	0.034	0.121	0.029	0.01	0.56	500	285,261	269,505	1,348	1,348	491	0	283,423	6.51	
89	1335	22.25	0.3	0.051	0.120	0.043	0.01	0.83	750	284,173	269,505	1,348	1,348	491	0	282,335	6.48	
90	1350	22.50	0.2	0.034	0.119	0.029	0.01	0.56	500	282,835	269,505	1,348	1,348	491	0	280,997	6.45	
91	1365	22.75	0.2	0.034	0.118	0.029	0.01	0.56	500	281,496	269,505	1,348	1,348	491	0	279,658	6.42	
92	1380	23.00	0.2	0.034	0.117	0.029	0.01	0.56	500	280,158	269,505	1,348	1,348	491	0	278,320	6.39	
93	1395	23.25	0.2	0.034	0.116	0.029	0.01	0.56	500	278,820	269,505	1,348	1,348	491	0	276,982	6.36	
94	1410	23.50	0.2	0.034	0.116	0.029	0.01	0.56	500	277,482	269,505	1,348	1,348	491	0	275,644	6.33	
95	1425	23.75	0.2	0.034	0.115	0.029	0.01	0.56	500	276,143	269,505	1,348	1,348	491	0	274,305	6.30	
96	1440	24.00	0.2	0.034	0.115	0.029	0.01	0.56	500	274,805	269,505	1,348	1,348	491	0	272,967	6.27	

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL	4.21 in
RAINFALL VOLUME	1,665,777 cu ft
SOIL LOSSES	1,099,189 cu ft
EFFECTIVE RAIN	1.43 in
FLOOD VOLUME	13.01 ac-ft
FLOOD VOLUME	566,589 cu ft
REQUIRED STORAGE	7.07 ac-ft
REQUIRED STORAGE	307,797 cu ft
MAX WSEL	352.49 ft
PEAK FLOW RATE	41.26 cfs
TOTAL BASIN LOSSES	340,933 cu ft
TOTAL OVERFLOW OUT	134,374 cu ft

BASIN VOLUME WORKSHEET

PROECT Thermal Ranch TTM 38578
JOB No. 2735
BASIN DESIGNATION: Retention Basin 1A

BASIN CHARACTERISTICS

CONTOUR ELEVATION	DEPTH		AREA		VOLUME		
	INCR (ft)	TOTAL (ft)	INCR (sf)	TOTAL (sf)	INCR (cuft)	TOTAL (cuft)	TOTAL (acre-ft)
351.5	0	0		238,510	0	0	0.00
352.5	1	1	63,227	301,737	269,505	269,505	6.19

WHERE: $$V = \frac{1}{3}(E_1 - E_2)\left(A_1 + A_2 + \sqrt{A_1 A_2}\right)$$

RCFCD SYNTHETIC UNIT HYDROGRAPH - SHORTCUT METHOD

DATA INPUT SHEET

DATE	March 8, 2024
WORKSHEET PREPARED BY:	RRR
PROJECT NAME	Thermal Ranch TTM 38578
PROJECT NUMBER	2735
CONCENTRATION POINT DESIGNATION	Retention Basin 1B
AREA DESIGNATION	DA-1B
AMC NUMBER	2

Low Loss Conditions: X=Existing; D=Developed; BS=Retention

AREA DESIG	SOIL GROUP	TRIBUTARY AREAS	ACRES	LOW LOSS CONDITION	RI NUMBER	AMC II INFILTRATION RATE	IMPERVIOUS PERCENT
18	B	EQUESTRIAN CENTER	92.7	X	69	0.39	0.50
5	B	SF - 1/4 ACRE	16.1	D	56	0.51	0.50

LENGTH OF WATERCOURSE (L)	2,680 ft
LENGTH TO POINT OPPOSITE CENTROID (Lca)	604 ft
ELEVATION OF HEADWATER	365.7 ft
ELEVATION OF CONCENTRATION POINT	354.3 ft
AVERAGE MANNINGS 'N' VALUE	0.020
STORM FREQUENCY (YEAR)	100
LOW LOSS RATE (Storm Events > 10 Years)	**85%**
POINT RAIN FROM NOAA ATLAS	**14**
1-HOUR	1.22 in
3-HOUR	2.00 in
6-HOUR	2.66 in
24-HOUR	4.21 in

BASIN CHARACTERISTICS:

ELEVATION	AREA
350.5 ft	222,055 sf
351.5 ft	277,637 sf

PERCOLATION RATE (in/hr)	0.13 in/hr
DRYWELL DATA	
NUMBER USED	0
PERCOLATION RATE	
LOWEST FLOWLINE ELEVATION	352.40
LOWEST PAD ELEVATION	355.7

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD BASIC DATA CALCULATION FORM	PROJECT: Thermal Ranch TTM 38578 Job No.: 2735 BY: RRR DATE: 3/8/24

PHYSICAL DATA

[1] CONCENTRATION POINT	Retention Basin 1B
[2] AREA DESIGNATION	DA-1B
[3] AREA - ACRES	108.800
[4] L-FEET	2680
[5] L-MILES	0.508
[6] La-FEET	604.00
[7] La-MILES	0.114
[8] ELEVATION OF HEADWATER	365.7
[9] ELEVATION OF CONCENTRATION POINT	354.3
[10] H-FEET	11.4
[11] S-FEET/MILE	22.5
[12] S^0.5	4.74
[13] L*LCA/S^0.5	0.012
[14] AVERAGE MANNINGS 'N'	0.02
[15] LAG TIME-HOURS	0.09
[16] LAG TIME-MINUTES	5.4
[17] 100% OF LAG-MINUTES	5.4
[18] 200% OF LAG-MINUTES	10.8

RAINFALL DATA

[1] AMC	II
[2] FREQUENCY-YEARS	100
FROM NOAA ATLAS	**14**
[3] STORM DURATION:	Point Rain
1-HOUR	1.22 in
3-HOUR	2.00 in
6-HOUR	2.66 in
24-HOUR	4.21 in

STORM EVENT SUMMARY

STORM DURATION		1-HOUR	3-HOUR	6-HOUR	24-HOUR
RAINFALL VOLUME	(cu ft)	481,834	789,891	1,050,555	**1,662,721**
SOIL LOSSES	(cu ft)	88,573	262,367	498,411	**1,084,239**
EFFECTIVE RAIN	(in)	1.00	1.34	1.40	1.46
FLOOD VOLUME	(cu ft)	393,260	527,525	552,144	**578,481**
	(acre-ft)	9.03	12.11	12.68	**13.28**
PEAK FLOW	(cfs)	n/a	191.30	171.50	41.63
OVERFLOW VOLUME RECEIVED	(cu ft)	42	166	283	669
	(acre-ft)	0.00	0.00	0.01	0.02
TOTAL VOLUME INTO BASIN	(cu ft)	393,302	527,690	552,427	579,151
	(acre-ft)	9.03	12.11	12.68	13.30
STORAGE PROVIDED	(cu ft)	249,329			
	(acre-ft)	5.72			
PERCOLATION RATE	(in/hr)	0.13			
PERCOLATION VOLUME	(cu ft)	113,356	118,785	126,337	166,340
	(acre-ft)	2.60	2.73	2.90	3.82
DRAIN TILE LOSS VOLUME	(cu ft)	84,190	88,107	93,915	120,798
	(acre-ft)	1.93	2.02	2.16	2.77
OVERFLOW VOLUME	(cu ft)	195,756	320,799	332,175	292,013
	(acre-ft)	4.49	7.36	7.63	6.70
TOTAL VOLUME LOSSES	(cu ft)	393,302	527,690	552,427	579,151
	(acre-ft)	9.03	12.11	12.68	13.30
BASIN DEWATERING TIME	(hours)	42.0	42.0	42.0	39.3
MAXIMUM VOLUME IN BASIN	(cu ft)	192,903	192,903	192,903	192,903
	(acre-ft)	4.43	4.43	4.43	4.43
MAXIMUM WSEL	(ft)	**351.27**	**351.27**	**351.27**	**351.27**
DEPTH	(ft)	**0.77**	**0.77**	**0.77**	**0.77**
LOWEST FLOWLINE ELEVATION		352.40			
DIFFERENCE	(ft)	1.13	1.13	1.13	1.13
LOWEST PAD ELEVATION		355.7			
DIFFERENCE	(ft)	4.43	4.43	4.43	4.43

NOTE: PEAK FLOW FOR THE 1-HOUR STORM IS NOT REPRESENTATIVE. PER RCFCD PEAK DISCHARGES FROM THE 3-HOUR STORM SHOULD NORMALLY COMPARE WELL WITH RATIONAL PEAKS.

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD BASIC DATA CALCULATION FORM AMC II	PROJECT: Thermal Ranch TTM 38578 Job No.: 2735 Area ID: DA-1B By: RRR Date: 3/8/24

AVERAGE ADJUSTED LOSS RATE

SOIL GROUP [Plate C-1]	LAND USE	RI NUMBER [Plate E-6.1]	PERVIOUS AREA INFILTRATION RATE (in/hr) [Plate E-6.2]	DECIMAL PERCENT OF AREA IMPERVIOUS [Plate E-6.3]	ADJUSTED INFILTRATION RATE (in/hr)	AREA	AREA WEIGHTED AVERAGE	MAX AVERAGE ADJUSTED INFILTRATION RATE (in/hr)	LOW LOSS CONDITION	LOW LOSS RATE PER RCFC/2322	MIN AVERAGE ADJUSTED INFILTRATION RATE
B	EQUESTRIAN CENTER	69	0.39	50%	0.21	92.700	0.852	0.1828	UNDEVELOPED	0.9000	0.7668
B	SF - 1/4 ACRE	56	0.51	50%	0.28	16.100	0.148	0.0415	DEVELOPED	0.5000	0.0740
					SUM	108.800	SUM	0.2243			0.8408

VARIABLE LOSS RATE CURVE (24-HOUR STORM ONLY)

Fm= 0.112133272

C= 0.00208

F_t=C(24-(T/60))^1.55+F_m = 0.00208 (24-(T/60))^1.55 + 0.11 in/hr

CONSTANT LOSS RATE (3 & 6 HOUR STORMS) = **0.2243**

LOW LOSS RATE = **0.8500**

Where:

T=Time in minutes. To get an average value for each unit time period, Use T=1/2 the unit time for the first time period, T=1 1/2 unit time for the second period, etc.

NOTE: Low loss rates established per RCFC/2322 (Dated: May-30-95)
For 10 Year Storms or Less
Undeveloped Condition: Low Loss = 90%
Developed Condition: Low Loss = 0.9 - (0.8 * %impervious)
Basin Site: Low Loss = 10%
For 100 Year Storm - Low Loss should be between 80% & 90% of the Rainfall Rate

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

1-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-1B
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	108.80
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	5.41
UNIT TIME-PERCENT OF LAG	92.5
TOTAL ADJUSTED STORM RAIN-INCHES	1.22
CONSTANT LOSS RATE-in/hr	0.22
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	0.13 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu ft	Overflow In cu ft	Basin Volume cu ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu ft	Basin Losses Percolation Out cu ft	Basin Losses Drain Tile Out cu ft	Basin Losses Overflow Out cu ft	Total In Basin cu ft	Total In Basin ac-ft	Basin WSEL ft
1	5	0.08	3.6	0.53	0.22	0.45	0.30	33.22	9,965	0	9,965	224,276	202	202	163	0	9,599	0.22	350.54
2	10	0.17	4.2	0.61	0.22	0.52	0.39	42.85	12,856	1	22,456	227,061	205	205	163	0	22,088	0.51	350.59
3	15	0.25	4.4	0.64	0.22	0.55	0.42	46.07	13,820	1	35,908	230,060	208	208	163	0	35,537	0.82	350.64
4	20	0.33	4.6	0.67	0.22	0.57	0.45	49.28	14,783	1	50,322	233,273	211	211	163	0	49,948	1.15	350.70
5	25	0.42	5.0	0.73	0.22	0.62	0.51	55.70	16,711	2	66,660	236,915	214	214	163	0	66,283	1.52	350.77
6	30	0.50	5.6	0.82	0.22	0.70	0.60	65.34	19,602	2	85,887	241,201	218	218	163	0	85,506	1.96	350.84
7	35	0.58	6.4	0.94	0.22	0.80	0.71	78.19	23,456	3	108,965	246,346	222	222	163	0	108,579	2.49	350.94
8	40	0.67	8.1	1.19	0.22	1.01	0.96	105.49	31,647	3	140,230	253,316	229	229	163	0	139,838	3.21	351.06
9	45	0.75	13.1	1.92	0.22	1.63	1.69	185.80	55,739	4	195,581	265,655	240	240	163	2,276	**192,903**	**4.43**	**351.27**
10	50	0.83	34.5	5.05	0.22	4.29	4.83	**529.50**	**158,851**	8	351,762	277,637	251	251	163	158,445	**192,903**	**4.43**	**351.27**
11	55	0.92	6.7	0.98	0.22	0.83	0.76	83.01	24,902	8	217,813	270,611	244	244	163	24,503	**192,903**	**4.43**	**351.27**
12	60	1.00	3.8	0.56	0.22	0.47	0.33	36.43	10,929	9	203,840	267,496	241	241	163	10,533	**192,903**	**4.43**	**351.27**

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL	1.22 in
RAINFALL VOLUME	481,834 cu ft
SOIL LOSSES	88,573 cu ft
EFFECTIVE RAIN	1.00 in
FLOOD VOLUME	9.03 ac-ft
FLOOD VOLUME	393,260 cu ft
REQUIRED STORAGE	4.43 ac-ft
REQUIRED STORAGE	192,903 cu ft
MAX WSEL	351.27 ft
PEAK FLOW RATE	529.50 cfs
TOTAL BASIN LOSSES	197,546 cu ft
TOTAL OVERFLOW OUT	195,756 cu ft

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

3-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-1B
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	108.80
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	5.41
UNIT TIME-PERCENT OF LAG	92.5
TOTAL ADJUSTED STORM RAIN (in)	2.00
CONSTANT LOSS RATE (in/hr)	0.22
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	0.13 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu ft	Overflow In cu ft	Basin Volume cu ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu ft	Basin Losses Percolation Out cu ft	Basin Losses Drain Tile Out cu ft	Basin Losses Overflow Out cu ft	Total In Basin cu ft	Total In Basin ac-ft	Basin WSEL ft
1	5	0.08	1.3	0.31	0.22	0.27	0.09	9.62	2,887	0	2,888	222,699	201	201	163	0	2,523	0.06	350.51
2	10	0.17	1.3	0.31	0.22	0.27	0.09	9.62	2,887	0	5,411	223,261	202	202	163	0	5,046	0.12	350.52
3	15	0.25	1.1	0.26	0.22	0.22	0.04	4.36	1,308	0	6,354	223,472	202	202	163	0	5,989	0.14	350.52
4	20	0.33	1.5	0.36	0.22	0.31	0.14	14.89	4,467	0	10,457	224,386	203	203	163	0	10,091	0.23	350.54
5	25	0.42	1.5	0.36	0.22	0.31	0.14	14.89	4,467	1	14,559	225,301	203	203	163	0	14,192	0.33	350.56
6	30	0.50	1.8	0.43	0.22	0.37	0.21	22.79	6,837	1	21,030	226,743	205	205	163	0	20,662	0.47	350.58
7	35	0.58	1.5	0.36	0.22	0.31	0.14	14.89	4,467	1	25,130	227,657	206	206	163	0	24,761	0.57	350.60
8	40	0.67	1.8	0.43	0.22	0.37	0.21	22.79	6,837	1	31,599	229,099	207	207	163	0	31,229	0.72	350.63
9	45	0.75	1.8	0.43	0.22	0.37	0.21	22.79	6,837	1	38,067	230,541	208	208	163	0	37,696	0.87	350.65
10	50	0.83	1.5	0.36	0.22	0.31	0.14	14.89	4,467	1	42,165	231,455	209	209	163	0	41,793	0.96	350.67
11	55	0.92	1.6	0.38	0.22	0.33	0.16	17.52	5,257	1	47,051	232,544	210	210	163	0	46,678	1.07	350.69
12	60	1.00	1.8	0.43	0.22	0.37	0.21	22.79	6,837	2	53,517	233,985	211	211	163	0	53,142	1.22	350.71
13	65	1.08	2.2	0.53	0.22	0.45	0.30	33.32	9,997	2	63,141	236,131	213	213	163	0	62,764	1.44	350.75
14	70	1.17	2.2	0.53	0.22	0.45	0.30	33.32	9,997	2	72,763	238,276	215	215	163	0	72,384	1.66	350.79
15	75	1.25	2.2	0.53	0.22	0.45	0.30	33.32	9,997	2	82,383	240,420	217	217	163	0	82,003	1.88	350.83
16	80	1.33	2.0	0.48	0.22	0.41	0.26	28.06	8,417	3	90,422	242,213	219	219	163	0	90,041	2.07	350.86
17	85	1.42	2.6	0.62	0.22	0.53	0.40	43.85	13,156	3	103,199	245,061	221	221	163	0	102,815	2.36	350.91
18	90	1.50	2.7	0.65	0.22	0.55	0.42	46.49	13,946	3	116,764	248,085	224	224	163	0	116,377	2.67	350.97
19	95	1.58	2.4	0.58	0.22	0.49	0.35	38.59	11,576	3	127,957	250,580	226	226	163	0	127,567	2.93	351.01
20	100	1.67	2.7	0.65	0.22	0.55	0.42	46.49	13,946	4	141,517	253,603	229	229	163	0	141,125	3.24	351.07
21	105	1.75	3.3	0.79	0.22	0.67	0.57	62.28	18,685	4	159,814	257,682	233	233	163	0	159,419	3.66	351.14
22	110	1.83	3.1	0.74	0.22	0.63	0.52	57.02	17,106	5	176,529	261,408	236	236	163	0	176,130	4.04	351.21
23	115	1.92	2.9	0.70	0.22	0.59	0.47	51.75	15,526	5	191,660	264,781	239	239	163	0	191,258	4.39	351.27
24	120	2.00	3.0	0.72	0.22	0.61	0.50	54.39	16,316	5	207,579	268,330	242	242	163	14,271	**192,903**	**4.43**	**351.27**
25	125	2.08	3.1	0.74	0.22	0.63	0.52	57.02	17,106	6	210,014	268,873	243	243	163	16,705	**192,903**	**4.43**	**351.27**
26	130	2.17	4.2	1.01	0.22	0.86	0.78	85.98	25,794	6	218,703	270,810	244	244	163	25,393	**192,903**	**4.43**	**351.27**
27	135	2.25	5.0	1.20	0.22	1.02	0.98	107.04	32,113	7	225,023	272,219	246	246	163	31,712	**192,903**	**4.43**	**351.27**
28	140	2.33	3.5	0.84	0.22	0.71	0.62	67.55	20,265	7	213,175	269,577	243	243	163	19,866	**192,903**	**4.43**	**351.27**
29	145	2.42	6.8	1.63	0.22	1.39	1.41	154.44	46,332	8	239,243	275,388	249	249	163	45,928	**192,903**	**4.43**	**351.27**
30	150	2.50	7.3	1.75	0.22	1.49	1.53	167.60	50,281	10	243,193	276,269	249	249	163	49,878	**192,903**	**4.43**	**351.27**
31	155	2.58	8.2	1.97	0.22	1.67	1.74	**191.30**	**57,390**	11	250,303	277,637	251	251	163	56,987	**192,903**	**4.43**	**351.27**
32	160	2.67	5.9	1.42	0.22	1.20	1.19	130.74	39,222	12	232,137	273,804	247	247	163	38,824	**192,903**	**4.43**	**351.27**
33	165	2.75	2.0	0.48	0.22	0.41	0.26	28.06	8,417	12	201,331	266,937	241	241	163	8,024	**192,903**	**4.43**	**351.27**
34	170	2.83	1.8	0.43	0.22	0.37	0.21	22.79	6,837	12	199,752	266,585	241	241	163	6,445	**192,903**	**4.43**	**351.27**
35	175	2.92	1.8	0.43	0.22	0.37	0.21	22.79	6,837	12	199,752	266,585	241	241	163	6,445	**192,903**	**4.43**	**351.27**
36	180	3.00	0.6	0.14	0.22	0.12	0.02	2.37	711	12	193,626	265,219	239	239	163	320	**192,903**	**4.43**	**351.27**

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL	2.00 in
RAINFALL VOLUME	789,891 cu ft
SOIL LOSSES	262,367 cu ft
EFFECTIVE RAIN	1.34 in
FLOOD VOLUME	12.11 ac-ft
FLOOD VOLUME	527,525 cu ft
REQUIRED STORAGE	4.43 ac-ft
REQUIRED STORAGE	192,903 cu ft
MAX WSEL	351.27 ft
PEAK FLOW RATE	191.30 cfs
TOTAL BASIN LOSSES	206,892 cu ft
TOTAL OVERFLOW OUT	320,799 cu ft

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

6-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-1B
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	108.80
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	5.41
UNIT TIME-PERCENT OF LAG	92.5
TOTAL ADJUSTED STORM RAIN (in)	2.66
CONSTANT LOSS RATE (in/hr)	0.22
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	0.13 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu ft	Overflow In cu ft	Basin Volume cu ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu ft	Basin Losses Percolation Out cu ft	Basin Losses Drain Tile Out cu ft	Basin Losses Overflow Out cu ft	Total In Basin cu ft	Total In Basin ac-ft	Basin WSEL ft
1	5	0.08	0.5	0.16	0.22	0.14	0.02	2.63	788	0	788	222,231	201	201	163	0	424	0.01	350.50
2	10	0.17	0.6	0.19	0.22	0.16	0.03	3.15	945	0	1,370	222,360	201	201	163	0	1,006	0.02	350.50
3	15	0.25	0.6	0.19	0.22	0.16	0.03	3.15	945	0	1,951	222,490	201	201	163	0	1,587	0.04	350.51
4	20	0.33	0.6	0.19	0.22	0.16	0.03	3.15	945	0	2,533	222,620	201	201	163	0	2,169	0.05	350.51
5	25	0.42	0.6	0.19	0.22	0.16	0.03	3.15	945	0	3,114	222,749	201	201	163	0	2,750	0.06	350.51
6	30	0.50	0.7	0.22	0.22	0.19	0.03	3.68	1,103	0	3,853	222,914	201	201	163	0	3,489	0.08	350.51
7	35	0.58	0.7	0.22	0.22	0.19	0.03	3.68	1,103	0	4,592	223,079	201	201	163	0	4,227	0.10	350.52
8	40	0.67	0.7	0.22	0.22	0.19	0.03	3.68	1,103	0	5,330	223,243	202	202	163	0	4,966	0.11	350.52
9	45	0.75	0.7	0.22	0.22	0.19	0.03	3.68	1,103	0	6,069	223,408	202	202	163	0	5,704	0.13	350.52
10	50	0.83	0.7	0.22	0.22	0.19	0.03	3.68	1,103	0	6,807	223,573	202	202	163	0	6,442	0.15	350.53
11	55	0.92	0.7	0.22	0.22	0.19	0.03	3.68	1,103	0	7,546	223,737	202	202	163	0	7,181	0.16	350.53
12	60	1.00	0.8	0.26	0.22	0.22	0.03	3.41	1,023	0	8,204	223,884	202	202	163	0	7,839	0.18	350.53
13	65	1.08	0.8	0.26	0.22	0.22	0.03	3.41	1,023	0	8,863	224,031	202	202	163	0	8,497	0.20	350.53
14	70	1.17	0.8	0.26	0.22	0.22	0.03	3.41	1,023	0	9,521	224,177	202	202	163	0	9,155	0.21	350.54
15	75	1.25	0.8	0.26	0.22	0.22	0.03	3.41	1,023	0	10,179	224,324	203	203	163	0	9,813	0.23	350.54
16	80	1.33	0.8	0.26	0.22	0.22	0.03	3.41	1,023	1	10,837	224,471	203	203	163	0	10,472	0.24	350.54
17	85	1.42	0.8	0.26	0.22	0.22	0.03	3.41	1,023	1	11,495	224,618	203	203	163	0	11,129	0.26	350.54
18	90	1.50	0.8	0.26	0.22	0.22	0.03	3.41	1,023	1	12,154	224,764	203	203	163	0	11,787	0.27	350.55
19	95	1.58	0.8	0.26	0.22	0.22	0.03	3.41	1,023	1	12,811	224,911	203	203	163	0	12,445	0.29	350.55
20	100	1.67	0.8	0.26	0.22	0.22	0.03	3.41	1,023	1	13,469	225,058	203	203	163	0	13,103	0.30	350.55
21	105	1.75	0.8	0.26	0.22	0.22	0.03	3.41	1,023	1	14,127	225,204	203	203	163	0	13,761	0.32	350.56
22	110	1.83	0.8	0.26	0.22	0.22	0.03	3.41	1,023	1	14,785	225,351	203	203	163	0	14,418	0.33	350.56
23	115	1.92	0.8	0.26	0.22	0.22	0.03	3.41	1,023	1	15,443	225,498	204	204	163	0	15,076	0.35	350.56
24	120	2.00	0.9	0.29	0.22	0.24	0.06	6.91	2,074	1	17,151	225,878	204	204	163	0	16,784	0.39	350.57
25	125	2.08	0.8	0.26	0.22	0.22	0.03	3.41	1,023	1	17,808	226,025	204	204	163	0	17,441	0.40	350.57
26	130	2.17	0.9	0.29	0.22	0.24	0.06	6.91	2,074	1	19,516	226,406	204	204	163	0	19,148	0.44	350.58
27	135	2.25	0.9	0.29	0.22	0.24	0.06	6.91	2,074	1	21,223	226,786	205	205	163	0	20,855	0.48	350.58
28	140	2.33	0.9	0.29	0.22	0.24	0.06	6.91	2,074	1	22,931	227,167	205	205	163	0	22,562	0.52	350.59
29	145	2.42	0.9	0.29	0.22	0.24	0.06	6.91	2,074	1	24,638	227,547	205	205	163	0	24,269	0.56	350.60
30	150	2.50	0.9	0.29	0.22	0.24	0.06	6.91	2,074	1	26,344	227,928	206	206	163	0	25,975	0.60	350.60
31	155	2.58	0.9	0.29	0.22	0.24	0.06	6.91	2,074	2	28,051	228,308	206	206	163	0	27,681	0.64	350.61
32	160	2.67	0.9	0.29	0.22	0.24	0.06	6.91	2,074	2	29,757	228,689	206	206	163	0	29,387	0.67	350.62
33	165	2.75	1.0	0.32	0.22	0.27	0.09	10.41	3,124	2	32,514	229,303	207	207	163	0	32,143	0.74	350.63
34	170	2.83	1.0	0.32	0.22	0.27	0.09	10.41	3,124	2	35,270	229,918	208	208	163	0	34,899	0.80	350.64
35	175	2.92	1.0	0.32	0.22	0.27	0.09	10.41	3,124	2	38,025	230,532	208	208	163	0	37,654	0.86	350.65
36	180	3.00	1.0	0.32	0.22	0.27	0.09	10.41	3,124	2	40,780	231,146	209	209	163	0	40,408	0.93	350.66
37	185	3.08	1.0	0.32	0.22	0.27	0.09	10.41	3,124	2	43,535	231,760	209	209	163	0	43,163	0.99	350.67
38	190	3.17	1.1	0.35	0.22	0.30	0.13	13.92	4,175	2	47,340	232,608	210	210	163	0	46,967	1.08	350.69
39	195	3.25	1.1	0.35	0.22	0.30	0.13	13.92	4,175	2	51,144	233,456	211	211	163	0	50,770	1.17	350.70
40	200	3.33	1.1	0.35	0.22	0.30	0.13	13.92	4,175	2	54,948	234,304	212	212	163	0	54,573	1.25	350.72
41	205	3.42	1.2	0.38	0.22	0.33	0.16	17.42	5,226	3	59,801	235,386	213	213	163	0	59,425	1.36	350.74
42	210	3.50	1.3	0.41	0.22	0.35	0.19	20.92	6,276	3	65,704	236,702	214	214	163	0	65,327	1.50	350.76
43	215	3.58	1.4	0.45	0.22	0.38	0.22	24.42	7,327	3	72,657	238,252	215	215	163	0	72,279	1.66	350.79
44	220	3.67	1.4	0.45	0.22	0.38	0.22	24.42	7,327	3	79,609	239,802	216	216	163	0	79,229	1.82	350.82
45	225	3.75	1.5	0.48	0.22	0.41	0.25	27.92	8,377	3	87,609	241,585	218	218	163	0	87,228	2.00	350.85
46	230	3.83	1.5	0.48	0.22	0.41	0.25	27.92	8,377	4	95,609	243,369	220	220	163	0	95,226	2.19	350.88
47	235	3.92	1.6	0.51	0.22	0.43	0.29	31.43	9,428	4	104,658	245,386	222	222	163	0	104,273	2.39	350.92
48	240	4.00	1.6	0.51	0.22	0.43	0.29	31.43	9,428	4	113,705	247,403	223	223	163	0	113,318	2.60	350.95
49	245	4.08	1.7	0.54	0.22	0.46	0.32	34.93	10,478	4	123,801	249,653	225	225	163	0	123,412	2.83	350.99
50	250	4.17	1.8	0.57	0.22	0.49	0.35	38.43	11,529	5	134,946	252,138	228	228	163	0	134,555	3.09	351.04
51	255	4.25	1.9	0.61	0.22	0.52	0.38	41.93	12,579	5	147,139	254,856	230	230	163	0	146,746	3.37	351.09
52	260	4.33	2.0	0.64	0.22	0.54	0.41	45.43	13,630	5	160,381	257,808	233	233	163	0	159,985	3.67	351.14
53	265	4.42	2.1	0.67	0.22	0.57	0.45	48.94	14,681	6	174,671	260,994	236	236	163	0	174,273	4.00	351.20

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

6-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-1B
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	108.80
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	5.41
UNIT TIME-PERCENT OF LAG	92.5
TOTAL ADJUSTED STORM RAIN (in)	2.66
CONSTANT LOSS RATE (in/hr)	0.22
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	0.13 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu ft	Overflow In cu ft	Basin Volume cu ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu ft	Basin Losses Percolation Out cu ft	Basin Losses Drain Tile Out cu ft	Basin Losses Overflow Out cu ft	Total In Basin cu ft	Total In Basin ac-ft	Basin WSEL ft
54	270	4.50	2.1	0.67	0.22	0.57	0.45	48.94	14,681	6	188,959	264,179	238	238	163	0	188,557	4.33	351.26
55	275	4.58	2.2	0.70	0.22	0.60	0.48	52.44	15,731	6	204,295	267,598	242	242	163	10,987	**192,903**	**4.43**	**351.27**
56	280	4.67	2.3	0.73	0.22	0.62	0.51	55.94	16,782	7	209,691	268,801	243	243	163	16,382	**192,903**	**4.43**	**351.27**
57	285	4.75	2.4	0.77	0.22	0.65	0.54	59.44	17,832	7	210,742	269,035	243	243	163	17,433	**192,903**	**4.43**	**351.27**
58	290	4.83	2.4	0.77	0.22	0.65	0.54	59.44	17,832	7	210,742	269,035	243	243	163	17,434	**192,903**	**4.43**	**351.27**
59	295	4.92	2.5	0.80	0.22	0.68	0.57	62.94	18,883	8	211,793	269,269	243	243	163	18,484	**192,903**	**4.43**	**351.27**
60	300	5.00	2.6	0.83	0.22	0.71	0.61	66.44	19,933	8	212,844	269,504	243	243	163	19,535	**192,903**	**4.43**	**351.27**
61	305	5.08	3.1	0.99	0.22	0.84	0.77	83.95	25,186	9	218,098	270,675	244	244	163	24,787	**192,903**	**4.43**	**351.27**
62	310	5.17	3.6	1.15	0.22	0.98	0.92	101.46	30,439	10	223,351	271,846	245	245	163	30,040	**192,903**	**4.43**	**351.27**
63	315	5.25	3.9	1.24	0.22	1.06	1.02	111.97	33,591	10	226,503	272,549	246	246	163	33,192	**192,903**	**4.43**	**351.27**
64	320	5.33	4.2	1.34	0.22	1.14	1.12	122.47	36,742	11	229,656	273,251	247	247	163	36,343	**192,903**	**4.43**	**351.27**
65	325	5.42	4.7	1.50	0.22	1.28	1.28	139.98	41,995	12	234,910	274,422	248	248	163	41,596	**192,903**	**4.43**	**351.27**
66	330	5.50	5.6	1.79	0.22	1.52	1.56	**171.50**	**51,450**	13	244,366	276,531	250	250	163	51,050	**192,903**	**4.43**	**351.27**
67	335	5.58	1.9	0.61	0.22	0.52	0.38	41.93	12,579	13	205,495	267,865	242	242	163	12,188	**192,903**	**4.43**	**351.27**
68	340	5.67	0.9	0.29	0.22	0.24	0.06	6.91	2,074	13	194,990	265,523	240	240	163	1,684	**192,903**	**4.43**	**351.27**
69	345	5.75	0.6	0.19	0.22	0.16	0.03	3.15	945	13	193,862	265,272	239	239	163	556	**192,903**	**4.43**	**351.27**
70	350	5.83	0.5	0.16	0.22	0.14	0.02	2.63	788	13	193,704	265,237	239	239	163	399	**192,903**	**4.43**	**351.27**
71	355	5.92	0.3	0.10	0.22	0.08	0.01	1.58	473	13	193,389	265,166	239	239	163	84	**192,903**	**4.43**	**351.27**
72	360	6.00	0.2	0.06	0.22	0.05	0.01	1.05	315	13	193,231	265,131	239	239	163	0	192,829	4.43	351.27

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL	2.66 in
RAINFALL VOLUME	1,050,555 cu ft
SOIL LOSSES	498,411 cu ft
EFFECTIVE RAIN	1.40 in
FLOOD VOLUME	12.68 ac-ft
FLOOD VOLUME	552,144 cu ft
REQUIRED STORAGE	4.43 ac-ft
REQUIRED STORAGE	192,903 cu ft
MAX WSEL	351.27 ft
PEAK FLOW RATE	171.50 cfs
TOTAL BASIN LOSSES	15,673 cu ft
TOTAL OVERFLOW OUT	44 cu ft

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

24-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-1B
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	108.80
UNIT TIME-MINUTES	15
LAG TIME - MINUTES	5.41
UNIT TIME-PERCENT OF LAG	277%
TOTAL ADJUSTED STORM RAIN (in)	4.21

VARIABLE LOSS RATE (AVG) IN/HR	
Fm = Minimum value on loss curve (in/hr)	0.11
C	0.00208
Low Loss Rate (percent)	85.00%

Basin Percolation Rate	0.13 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu ft	Overflow In cu ft	Basin Volume cu ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu ft	Basin Losses Percolation Out cu ft	Basin Losses Drain Tile Out cu ft	Basin Losses Overflow Out cu ft	Total In Basin cu ft	Total In Basin ac-ft	Basin WSEL ft
1	15	0.25	0.2	0.034	0.396	0.029	0.01	0.55	499	0	499	222,166	602	499	0	0	0	0.00	350.50
2	30	0.50	0.3	0.051	0.391	0.043	0.01	0.83	748	0	748	222,222	602	602	146	0	0	0.00	350.50
3	45	0.75	0.3	0.051	0.387	0.043	0.01	0.83	748	0	748	222,222	602	602	146	0	0	0.00	350.50
4	60	1.00	0.4	0.067	0.382	0.057	0.01	1.11	998	0	998	222,277	602	602	396	0	0	0.00	350.50
5	75	1.25	0.3	0.051	0.378	0.043	0.01	0.83	748	0	748	222,222	602	602	146	0	0	0.00	350.50
6	90	1.50	0.3	0.051	0.373	0.043	0.01	0.83	748	0	748	222,222	602	602	146	0	0	0.00	350.50
7	105	1.75	0.3	0.051	0.369	0.043	0.01	0.83	748	0	748	222,222	602	602	146	0	0	0.00	350.50
8	120	2.00	0.4	0.067	0.364	0.057	0.01	1.11	998	0	998	222,277	602	602	396	0	0	0.00	350.50
9	135	2.25	0.4	0.067	0.360	0.057	0.01	1.11	998	0	998	222,277	602	602	396	0	0	0.00	350.50
10	150	2.50	0.4	0.067	0.356	0.057	0.01	1.11	998	0	998	222,277	602	602	396	0	0	0.00	350.50
11	165	2.75	0.5	0.084	0.351	0.072	0.01	1.39	1,247	0	1,247	222,333	602	602	490	0	155	0.00	350.50
12	180	3.00	0.5	0.084	0.347	0.072	0.01	1.39	1,247	0	1,403	222,368	602	602	490	0	311	0.01	350.50
13	195	3.25	0.5	0.084	0.343	0.072	0.01	1.39	1,247	0	1,558	222,402	602	602	490	0	466	0.01	350.50
14	210	3.50	0.5	0.084	0.338	0.072	0.01	1.39	1,247	0	1,713	222,437	602	602	490	0	621	0.01	350.50
15	225	3.75	0.5	0.084	0.334	0.072	0.01	1.39	1,247	0	1,868	222,472	603	603	490	0	776	0.02	350.50
16	240	4.00	0.6	0.101	0.330	0.086	0.02	1.66	1,496	0	2,273	222,562	603	603	490	0	1,180	0.03	350.50
17	255	4.25	0.6	0.101	0.326	0.086	0.02	1.66	1,496	0	2,677	222,652	603	603	490	0	1,585	0.04	350.51
18	270	4.50	0.7	0.118	0.322	0.100	0.02	1.94	1,746	0	3,331	222,797	603	603	490	0	2,238	0.05	350.51
19	285	4.75	0.7	0.118	0.318	0.100	0.02	1.94	1,746	0	3,984	222,943	604	604	490	0	2,890	0.07	350.51
20	300	5.00	0.8	0.135	0.313	0.115	0.02	2.22	1,995	0	4,886	223,144	604	604	490	0	3,792	0.09	350.52
21	315	5.25	0.6	0.101	0.309	0.086	0.02	1.66	1,496	0	5,289	223,234	605	605	490	0	4,195	0.10	350.52
22	330	5.50	0.7	0.118	0.305	0.100	0.02	1.94	1,746	0	5,941	223,379	605	605	490	0	4,846	0.11	350.52
23	345	5.75	0.8	0.135	0.301	0.115	0.02	2.22	1,995	0	6,842	223,580	606	606	490	0	5,747	0.13	350.52
24	360	6.00	0.8	0.135	0.297	0.115	0.02	2.22	1,995	0	7,742	223,781	606	606	490	0	6,647	0.15	350.53
25	375	6.25	0.9	0.152	0.293	0.129	0.02	2.49	2,245	0	8,892	224,037	607	607	490	0	7,796	0.18	350.53
26	390	6.50	0.9	0.152	0.289	0.129	0.02	2.49	2,245	1	10,041	224,293	607	607	490	0	8,944	0.21	350.54
27	405	6.75	1.0	0.168	0.286	0.143	0.03	2.77	2,494	1	11,438	224,605	608	608	490	0	10,340	0.24	350.54
28	420	7.00	1.0	0.168	0.282	0.143	0.03	2.77	2,494	1	12,835	224,916	609	609	490	0	11,736	0.27	350.55
29	435	7.25	1.0	0.168	0.278	0.143	0.03	2.77	2,494	1	14,231	225,227	610	610	490	0	13,131	0.30	350.55
30	450	7.50	1.1	0.185	0.274	0.157	0.03	3.05	2,743	1	15,876	225,594	611	611	490	0	14,775	0.34	350.56
31	465	7.75	1.2	0.202	0.270	0.172	0.03	3.33	2,993	1	17,769	226,016	612	612	490	0	16,667	0.38	350.57
32	480	8.00	1.3	0.219	0.267	0.186	0.03	3.60	3,242	1	19,910	226,493	613	613	490	0	18,807	0.43	350.58
33	495	8.25	1.5	0.253	0.263	0.215	0.04	4.16	3,741	1	22,549	227,082	615	615	490	0	21,444	0.49	350.59
34	510	8.50	1.5	0.253	0.259	0.215	0.04	4.16	3,741	1	25,187	227,670	617	617	490	0	24,080	0.55	350.60
35	525	8.75	1.6	0.269	0.256	0.229	0.01	1.51	1,362	1	25,443	227,727	617	617	490	0	24,337	0.56	350.60
36	540	9.00	1.7	0.286	0.252	0.243	0.03	3.76	3,380	1	27,718	228,234	618	618	490	0	26,610	0.61	350.61
37	555	9.25	1.9	0.320	0.248	0.272	0.07	7.84	7,058	2	33,669	229,561	622	622	490	0	32,558	0.75	350.63
38	570	9.50	2.0	0.337	0.245	0.286	0.09	10.08	9,069	2	41,629	231,335	627	627	490	0	40,513	0.93	350.66
39	585	9.75	2.1	0.354	0.241	0.301	0.11	12.31	11,078	2	51,593	233,556	633	633	490	0	50,471	1.16	350.70
40	600	10.00	2.2	0.370	0.238	0.315	0.13	14.54	13,083	3	63,557	236,223	640	640	490	0	62,427	1.43	350.75
41	615	10.25	1.5	0.253	0.235	0.215	0.02	1.98	1,783	3	64,213	236,370	640	640	490	0	63,083	1.45	350.75
42	630	10.50	1.5	0.253	0.231	0.215	0.02	2.35	2,119	3	65,205	236,591	641	641	490	0	64,075	1.47	350.76
43	645	10.75	2.0	0.337	0.228	0.286	0.11	11.96	10,765	3	74,844	238,740	647	647	490	0	73,707	1.69	350.80
44	660	11.00	2.0	0.337	0.224	0.286	0.11	12.33	11,094	4	84,805	240,960	653	653	490	0	83,663	1.92	350.84
45	675	11.25	1.9	0.320	0.221	0.272	0.10	10.84	9,757	4	93,424	242,882	658	658	490	0	92,277	2.12	350.87
46	690	11.50	1.9	0.320	0.218	0.272	0.10	11.20	10,079	4	102,360	244,874	663	663	490	0	101,208	2.32	350.91
47	705	11.75	1.7	0.286	0.215	0.243	0.07	7.86	7,073	4	108,285	246,194	667	667	490	0	107,128	2.46	350.93
48	720	12.00	1.8	0.303	0.211	0.258	0.09	10.06	9,051	5	116,184	247,955	672	672	490	0	115,022	2.64	350.96
49	735	12.25	2.5	0.421	0.208	0.358	0.21	23.33	21,001	5	136,029	252,379	684	684	490	0	134,856	3.10	351.04
50	750	12.50	2.6	0.438	0.205	0.372	0.23	25.52	22,972	6	157,834	257,240	697	697	490	0	156,647	3.60	351.13
51	765	12.75	2.8	0.472	0.202	0.401	0.27	29.56	26,602	6	183,256	262,908	712	712	490	0	182,054	4.18	351.23
52	780	13.00	2.9	0.488	0.199	0.415	0.29	31.74	28,565	7	210,627	269,009	729	729	490	16,506	**192,903**	**4.43**	**351.27**
53	795	13.25	3.4	0.573	0.196	0.487	0.38	41.31	37,176	8	230,087	273,347	740	740	490	35,954	**192,903**	**4.43**	**351.27**
54	810	13.50	3.4	0.573	0.193	0.487	0.38	**41.63**	**37,469**	9	230,381	273,413	740	740	490	36,248	**192,903**	**4.43**	**351.27**
55	825	13.75	2.3	0.387	0.190	0.329	0.20	21.63	19,469	9	212,381	269,400	730	730	490	18,259	**192,903**	**4.43**	**351.27**
56	840	14.00	2.3	0.387	0.187	0.329	0.20	21.95	19,755	10	212,667	269,464	730	730	490	18,545	**192,903**	**4.43**	**351.27**

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

24-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578				
Job No.:	2735	Area ID:	DA-1B		
By:	RRR	Date:	3/8/24		

DRAINAGE AREA-ACRES	108.80	VARIABLE LOSS RATE (AVG) IN/HR	
UNIT TIME-MINUTES	15	Fm = Minimum value on loss curve (in/hr)	0.11
LAG TIME - MINUTES	5.41	C	0.00208
UNIT TIME-PERCENT OF LAG	277%	Low Loss Rate (percent)	85.00%
TOTAL ADJUSTED STORM RAIN (in)	4.21		

Basin Percolation Rate	0.13 in/hr		
Maxwell Drywells			
Number	0		
Drywell Percolation Rate	0.00 cfs	0.00 cfm	

Unit Time Period	Time Minutes	Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu ft	Overflow In cu ft	Basin Volume cu ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu ft	Basin Losses Percolation Out cu ft	Basin Losses Drain Tile Out cu ft	Basin Losses Overflow Out cu ft	Total In Basin cu ft	Total In Basin ac-ft	Basin WSEL ft
57	855	14.25	2.7	0.455	0.184	0.386	0.27	29.65	26,688	11	219,601	271,010	734	734	490	25,474	**192,903**	**4.43**	**351.27**
58	870	14.50	2.6	0.438	0.182	0.372	0.26	28.11	25,303	11	218,217	270,701	733	733	490	24,091	**192,903**	**4.43**	**351.27**
59	885	14.75	2.6	0.438	0.179	0.372	0.26	28.42	25,577	12	218,491	270,762	733	733	490	24,366	**192,903**	**4.43**	**351.27**
60	900	15.00	2.5	0.421	0.176	0.358	0.24	26.87	24,184	12	217,099	270,452	732	732	490	22,974	**192,903**	**4.43**	**351.27**
61	915	15.25	2.4	0.404	0.173	0.344	0.23	25.32	22,788	13	215,703	270,141	732	732	490	21,579	**192,903**	**4.43**	**351.27**
62	930	15.50	2.3	0.387	0.171	0.329	0.22	23.76	21,387	13	214,303	269,829	731	731	490	20,180	**192,903**	**4.43**	**351.27**
63	945	15.75	1.9	0.320	0.168	0.272	0.15	16.66	14,994	14	207,910	268,404	727	727	490	13,791	**192,903**	**4.43**	**351.27**
64	960	16.00	1.9	0.320	0.166	0.272	0.15	16.94	15,247	14	208,164	268,460	727	727	490	14,045	**192,903**	**4.43**	**351.27**
65	975	16.25	0.4	0.067	0.163	0.057	0.01	1.11	998	14	193,914	265,284	718	718	490	0	192,706	4.42	351.27
66	990	16.50	0.4	0.067	0.161	0.057	0.01	1.11	998	14	193,718	265,240	718	718	490	0	192,510	4.42	351.27
67	1005	16.75	0.3	0.051	0.158	0.043	0.01	0.83	748	14	193,273	265,141	718	718	490	0	192,065	4.41	351.27
68	1020	17.00	0.3	0.051	0.156	0.043	0.01	0.83	748	14	192,827	265,041	718	718	490	0	191,620	4.40	351.27
69	1035	17.25	0.5	0.084	0.153	0.072	0.01	1.39	1,247	14	192,881	265,053	718	718	490	0	191,674	4.40	351.27
70	1050	17.50	0.5	0.084	0.151	0.072	0.01	1.39	1,247	14	192,935	265,065	718	718	490	0	191,728	4.40	351.27
71	1065	17.75	0.5	0.084	0.149	0.072	0.01	1.39	1,247	14	192,989	265,077	718	718	490	0	191,781	4.40	351.27
72	1080	18.00	0.4	0.067	0.147	0.057	0.01	1.11	998	14	192,793	265,034	718	718	490	0	191,586	4.40	351.27
73	1095	18.25	0.4	0.067	0.144	0.057	0.01	1.11	998	14	192,598	264,990	718	718	490	0	191,390	4.39	351.27
74	1110	18.50	0.4	0.067	0.142	0.057	0.01	1.11	998	14	192,402	264,947	718	718	490	0	191,195	4.39	351.27
75	1125	18.75	0.3	0.051	0.140	0.043	0.01	0.83	748	14	191,958	264,847	717	717	490	0	190,751	4.38	351.27
76	1140	19.00	0.2	0.034	0.138	0.029	0.01	0.55	499	14	191,264	264,693	717	717	490	0	190,057	4.36	351.26
77	1155	19.25	0.3	0.051	0.136	0.043	0.01	0.83	748	14	190,820	264,594	717	717	490	0	189,614	4.35	351.26
78	1170	19.50	0.4	0.067	0.134	0.057	0.01	1.11	998	14	190,626	264,550	716	716	490	0	189,420	4.35	351.26
79	1185	19.75	0.3	0.051	0.133	0.043	0.01	0.83	748	14	190,182	264,452	716	716	490	0	188,976	4.34	351.26
80	1200	20.00	0.2	0.034	0.131	0.029	0.01	0.55	499	14	189,489	264,297	716	716	490	0	188,284	4.32	351.26
81	1215	20.25	0.3	0.051	0.129	0.043	0.01	0.83	748	14	189,047	264,198	716	716	490	0	187,841	4.31	351.25
82	1230	20.50	0.3	0.051	0.127	0.043	0.01	0.83	748	14	188,604	264,100	715	715	490	0	187,399	4.30	351.25
83	1245	20.75	0.3	0.051	0.126	0.043	0.01	0.83	748	14	188,162	264,001	715	715	490	0	186,957	4.29	351.25
84	1260	21.00	0.2	0.034	0.124	0.029	0.01	0.55	499	14	187,470	263,847	715	715	490	0	186,266	4.28	351.25
85	1275	21.25	0.3	0.051	0.123	0.043	0.01	0.83	748	14	187,029	263,749	714	714	490	0	185,825	4.27	351.25
86	1290	21.50	0.2	0.034	0.121	0.029	0.01	0.55	499	14	186,338	263,595	714	714	490	0	185,134	4.25	351.24
87	1305	21.75	0.3	0.051	0.120	0.043	0.01	0.83	748	14	185,897	263,496	714	714	490	0	184,694	4.24	351.24
88	1320	22.00	0.2	0.034	0.119	0.029	0.01	0.55	499	14	185,207	263,342	713	713	490	0	184,004	4.22	351.24
89	1335	22.25	0.3	0.051	0.118	0.043	0.01	0.83	748	14	184,767	263,244	713	713	490	0	183,564	4.21	351.24
90	1350	22.50	0.2	0.034	0.117	0.029	0.01	0.55	499	14	184,077	263,091	713	713	490	0	182,875	4.20	351.23
91	1365	22.75	0.2	0.034	0.116	0.029	0.01	0.55	499	14	183,388	262,937	712	712	490	0	182,187	4.18	351.23
92	1380	23.00	0.2	0.034	0.115	0.029	0.01	0.55	499	14	182,700	262,784	712	712	490	0	181,498	4.17	351.23
93	1395	23.25	0.2	0.034	0.114	0.029	0.01	0.55	499	14	182,012	262,630	711	711	490	0	180,811	4.15	351.23
94	1410	23.50	0.2	0.034	0.113	0.029	0.01	0.55	499	14	181,324	262,477	711	711	490	0	180,123	4.14	351.22
95	1425	23.75	0.2	0.034	0.113	0.029	0.01	0.55	499	14	180,637	262,324	710	710	490	0	179,437	4.12	351.22
96	1440	24.00	0.2	0.034	0.112	0.029	0.01	0.55	499	14	179,950	262,170	710	710	490	0	178,750	4.10	351.22

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL	4.21 in
RAINFALL VOLUME	1,662,721 cu ft
SOIL LOSSES	1,084,239 cu ft
EFFECTIVE RAIN	1.46 in
FLOOD VOLUME	13.28 ac-ft
FLOOD VOLUME	578,481 cu ft
REQUIRED STORAGE	4.43 ac-ft
REQUIRED STORAGE	192,903 cu ft
MAX WSEL	351.27 ft
PEAK FLOW RATE	41.63 cfs
TOTAL BASIN LOSSES	220,245 cu ft
TOTAL OVERFLOW OUT	292,013 cu ft

BASIN VOLUME WORKSHEET

PROECT Thermal Ranch TTM 38578
JOB No. 2735
BASIN DESIGNATION: Retention Basin 1B

BASIN CHARACTERISTICS

CONTOUR ELEVATION	DEPTH		AREA		VOLUME		
	INCR (ft)	TOTAL (ft)	INCR (sf)	TOTAL (sf)	INCR (cuft)	TOTAL (cuft)	TOTAL (acre-ft)
350.5	0	0		222,055	0	0	0.00
351.5	1	1	55,582	277,637	249,329	249,329	5.72

WHERE: $$V = \frac{1}{3}(E_1 - E_2)\left(A_1 + A_2 + \sqrt{A_1 A_2}\right)$$

RCFCD SYNTHETIC UNIT HYDROGRAPH - SHORTCUT METHOD

DATA INPUT SHEET

DATE	March 8, 2024
WORKSHEET PREPARED BY:	RRR
PROJECT NAME	Thermal Ranch TTM 38578
PROJECT NUMBER	2735
CONCENTRATION POINT DESIGNATION	Retention Basin 2A
AREA DESIGNATION	DA-2A
AMC NUMBER	2

Low Loss Conditions: X=Existing; D=Developed; BS=Retention

AREA DESIG	SOIL GROUP	TRIBUTARY AREAS	ACRES	LOW LOSS CONDITION	RI NUMBER	AMC II INFILTRATION RATE	IMPERVIOUS PERCENT
3	B	SF - 1 ACRE	93.7	D	56	0.51	0.20

LENGTH OF WATERCOURSE (L)	1,482 ft
LENGTH TO POINT OPPOSITE CENTROID (Lca)	836 ft
ELEVATION OF HEADWATER	372.0 ft
ELEVATION OF CONCENTRATION POINT	365.5 ft
AVERAGE MANNINGS 'N' VALUE	0.020
STORM FREQUENCY (YEAR)	100
LOW LOSS RATE (Storm Events > 10 Years)	**85%**
POINT RAIN FROM NOAA ATLAS	**14**
1-HOUR	1.22 in
3-HOUR	2.00 in
6-HOUR	2.66 in
24-HOUR	4.21 in

BASIN CHARACTERISTICS:

ELEVATION	AREA
362.4 ft	108,827 sf
363.6 ft	216,998 sf

PERCOLATION RATE (in/hr)	0.29 in/hr
DRYWELL DATA	
NUMBER USED	0
PERCOLATION RATE	
LOWEST FLOWLINE ELEVATION	364.64
LOWEST PAD ELEVATION	368.2

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD BASIC DATA CALCULATION FORM	PROJECT: Thermal Ranch TTM 38578 Job No.: 2735 BY: RRR DATE: 3/8/24

PHYSICAL DATA

[1] CONCENTRATION POINT	Retention Basin 2A
[2] AREA DESIGNATION	DA-2A
[3] AREA - ACRES	93.700
[4] L-FEET	1482
[5] L-MILES	0.281
[6] La-FEET	836.00
[7] La-MILES	0.158
[8] ELEVATION OF HEADWATER	372
[9] ELEVATION OF CONCENTRATION POINT	365.5
[10] H-FEET	6.5
[11] S-FEET/MILE	23.2
[12] S^0.5	4.81
[13] L*LCA/S^0.5	0.009
[14] AVERAGE MANNINGS 'N'	0.02
[15] LAG TIME-HOURS	0.08
[16] LAG TIME-MINUTES	4.9
[17] 100% OF LAG-MINUTES	4.9
[18] 200% OF LAG-MINUTES	9.7

RAINFALL DATA

[1] AMC	II
[2] FREQUENCY-YEARS	100
FROM NOAA ATLAS	**14**
[3] STORM DURATION:	Point Rain
1-HOUR	1.22 in
3-HOUR	2.00 in
6-HOUR	2.66 in
24-HOUR	4.21 in

STORM EVENT SUMMARY

STORM DURATION		1-HOUR	3-HOUR	6-HOUR	24-HOUR
RAINFALL VOLUME	(cu ft)	414,961	680,265	904,752	**1,431,957**
SOIL LOSSES	(cu ft)	142,243	388,856	588,575	**1,189,381**
EFFECTIVE RAIN	(in)	0.80	0.86	0.93	0.71
FLOOD VOLUME	(cu ft)	272,718	291,408	**316,177**	242,576
	(acre-ft)	6.26	6.69	**7.26**	5.57
PEAK FLOW	(cfs)	n/a	146.43	129.37	20.08
STORAGE PROVIDED	(cu ft)	191,799			
	(acre-ft)	4.40			
PERCOLATION RATE	(in/hr)	0.29			
PERCOLATION VOLUME	(cu ft)	170,466	177,154	186,508	166,251
	(acre-ft)	3.91	4.07	4.28	3.82
DRAIN TILE LOSS VOLUME	(cu ft)	72,478	75,756	80,816	76,325
	(acre-ft)	1.66	1.74	1.86	1.75
OVERFLOW VOLUME	(cu ft)	29,775	38,498	48,853	0
	(acre-ft)	0.68	0.88	1.12	0.00
TOTAL VOLUME LOSSES	(cu ft)	272,718	291,408	316,177	242,576
	(acre-ft)	6.26	6.69	7.26	5.57
BASIN DEWATERING TIME	(hours)	42.0	42.0	42.0	23.5
MAXIMUM VOLUME IN BASIN	(cu ft)	237,709	237,709	237,709	149,775
	(acre-ft)	5.46	5.46	5.46	3.44
MAXIMUM WSEL	(ft)	363.14	363.44	**363.57**	363.34
DEPTH	(ft)	0.74	1.04	**1.17**	0.94
LOWEST FLOWLINE ELEVATION		364.64			
DIFFERENCE	(ft)	1.50	1.20	1.07	1.30
LOWEST PAD ELEVATION		368.2			
DIFFERENCE	(ft)	5.06	4.76	4.63	4.86

NOTE: PEAK FLOW FOR THE 1-HOUR STORM IS NOT REPRESENTATIVE. PER RCFCD PEAK DISCHARGES FROM THE 3-HOUR STORM SHOULD NORMALLY COMPARE WELL WITH RATIONAL PEAKS.

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD BASIC DATA CALCULATION FORM AMC II	PROJECT: Thermal Ranch TTM 38578 Job No.: 2735 Area ID: DA-2A By: RRR Date: 3/8/24

AVERAGE ADJUSTED LOSS RATE

SOIL GROUP [Plate C-1]	LAND USE	RI NUMBER [Plate E-6.1]	PERVIOUS AREA INFILTRATION RATE (in/hr) [Plate E-6.2]	DECIMAL PERCENT OF AREA IMPERVIOUS [Plate E-6.3]	ADJUSTED INFILTRATION RATE (in/hr)	AREA	AREA WEIGHTED AVERAGE	MAX AVERAGE ADJUSTED INFILTRATION RATE (in/hr)	LOW LOSS CONDITION	LOW LOSS RATE PER RCFC/2322	MIN AVERAGE ADJUSTED INFILTRATION RATE
B	SF - 1 ACRE	56	0.51	20%	0.42	93.700	1.000	0.4182	DEVELOPED	0.7400	0.7400
					SUM	93.700	SUM	0.4182			0.7400

VARIABLE LOSS RATE CURVE (24-HOUR STORM ONLY)

Fm= 0.2091

C= 0.00387

F_t=C(24-(T/60))^1.55+F_m = 0.00387 (24-(T/60))^1.55 + 0.21 in/hr

CONSTANT LOSS RATE (3 & 6 HOUR STORMS) = **0.4182**

LOW LOSS RATE = **0.8500**

Where:

T=Time in minutes. To get an average value for each unit time period, Use T=1/2 the unit time for the first time period, T=1 1/2 unit time for the second period, etc.

NOTE: Low loss rates established per RCFC/2322 (Dated: May-30-95)
For 10 Year Storms or Less
Undeveloped Condition: Low Loss = 90%
Developed Condition: Low Loss = 0.9 - (0.8 * %impervious)
Basin Site: Low Loss = 10%
For 100 Year Storm - Low Loss should be between 80% & 90% of the Rainfall Rate

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

1-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-2A
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	93.70
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	4.86
UNIT TIME-PERCENT OF LAG	103.0
TOTAL ADJUSTED STORM RAIN-INCHES	1.22
CONSTANT LOSS RATE-in/hr	0.42
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	0.29 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu ft	Basin Volume cu ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu ft	Basin Losses Percolation Out cu ft	Basin Losses Drain Tile Out cu ft	Basin Losses Overflow Out cu ft	Total In Basin cu ft	Total In Basin ac-ft	Basin WSEL ft
1	5	0.08	3.6	0.53	0.42	0.45	0.11	10.28	3,085	3,085	110,567	223	223	141	0	2,722	0.06	362.42
2	10	0.17	4.2	0.61	0.42	0.52	0.20	18.58	5,575	8,297	113,506	229	229	141	0	7,927	0.18	362.45
3	15	0.25	4.4	0.64	0.42	0.55	0.23	21.35	6,405	14,332	116,910	235	235	141	0	13,956	0.32	362.49
4	20	0.33	4.6	0.67	0.42	0.57	0.26	24.12	7,235	21,191	120,778	243	243	141	0	20,807	0.48	362.53
5	25	0.42	5.0	0.73	0.42	0.62	0.31	29.65	8,894	29,701	125,578	253	253	141	0	29,308	0.67	362.58
6	30	0.50	5.6	0.82	0.42	0.70	0.40	37.95	11,384	40,692	131,777	265	265	141	0	40,286	0.92	362.65
7	35	0.58	6.4	0.94	0.42	0.80	0.52	49.01	14,704	54,990	139,840	282	282	141	0	54,568	1.25	362.74
8	40	0.67	8.1	1.19	0.42	1.01	0.77	72.53	21,758	76,326	151,874	306	306	141	0	75,880	1.74	362.87
9	45	0.75	13.1	1.92	0.42	1.63	1.50	141.69	42,506	118,386	175,595	354	354	141	0	117,892	2.71	**363.14**
10	50	0.83	34.5	5.05	0.42	4.29	4.63	**437.69**	**131,308**	249,200	191,799	386	386	141	10,964	**237,709**	**5.46**	
11	55	0.92	6.7	0.98	0.42	0.83	0.56	53.16	15,949	253,658	191,799	386	386	141	15,422	**237,709**	**5.46**	
12	60	1.00	3.8	0.56	0.42	0.47	0.14	13.05	3,915	241,624	191,799	386	386	141	3,388	**237,709**	**5.46**	

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL	1.22 in
RAINFALL VOLUME	414,961 cu ft
SOIL LOSSES	142,243 cu ft
EFFECTIVE RAIN	0.80 in
FLOOD VOLUME	6.26 ac-ft
FLOOD VOLUME	272,718 cu ft
REQUIRED STORAGE	5.46 ac-ft
REQUIRED STORAGE	237,709 cu ft
MAX WSEL	363.14 ft
PEAK FLOW RATE	437.69 cfs
TOTAL BASIN LOSSES	242,944 cu ft
TOTAL OVERFLOW OUT	29,775 cu ft

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

3-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-2A
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	93.70
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	4.86
UNIT TIME-PERCENT OF LAG	103.0
TOTAL ADJUSTED STORM RAIN (in)	2.00
CONSTANT LOSS RATE (in/hr)	0.42
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	0.29 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu ft	Basin Volume cu ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu ft	Basin Losses Percolation Out cu ft	Basin Losses Drain Tile Out cu ft	Basin Losses Overflow Out cu ft	Total In Basin cu ft	Total In Basin ac-ft	Basin WSEL ft
1	5	0.08	1.3	0.31	0.42	0.27	0.05	4.42	1,327	1,327	109,575	221	221	141	0	965	0.02	362.41
2	10	0.17	1.3	0.31	0.42	0.27	0.05	4.42	1,327	2,292	110,120	222	222	141	0	1,929	0.04	362.41
3	15	0.25	1.1	0.26	0.42	0.22	0.04	3.74	1,122	3,052	110,548	223	223	141	0	2,689	0.06	362.42
4	20	0.33	1.5	0.36	0.42	0.31	0.05	5.10	1,531	4,219	111,207	224	224	141	0	3,855	0.09	362.42
5	25	0.42	1.5	0.36	0.42	0.31	0.05	5.10	1,531	5,385	111,864	225	225	141	0	5,020	0.12	362.43
6	30	0.50	1.8	0.43	0.42	0.37	0.01	1.30	391	5,411	111,879	225	225	141	0	5,045	0.12	362.43
7	35	0.58	1.5	0.36	0.42	0.31	0.05	5.10	1,531	6,575	112,535	227	227	141	0	6,208	0.14	362.44
8	40	0.67	1.8	0.43	0.42	0.37	0.01	1.30	391	6,599	112,549	227	227	141	0	6,232	0.14	362.44
9	45	0.75	1.8	0.43	0.42	0.37	0.01	1.30	391	6,623	112,562	227	227	141	0	6,256	0.14	362.44
10	50	0.83	1.5	0.36	0.42	0.31	0.05	5.10	1,531	7,787	113,219	228	228	141	0	7,418	0.17	362.45
11	55	0.92	1.6	0.38	0.42	0.33	0.06	5.44	1,633	9,051	113,931	229	229	141	0	8,681	0.20	362.45
12	60	1.00	1.8	0.43	0.42	0.37	0.01	1.30	391	9,072	113,943	229	229	141	0	8,702	0.20	362.45
13	65	1.08	2.2	0.53	0.42	0.45	0.11	10.37	3,112	11,814	115,490	233	233	141	0	11,441	0.26	362.47
14	70	1.17	2.2	0.53	0.42	0.45	0.11	10.37	3,112	14,553	117,035	236	236	141	0	14,177	0.33	362.49
15	75	1.25	2.2	0.53	0.42	0.45	0.11	10.37	3,112	17,289	118,578	239	239	141	0	16,910	0.39	362.51
16	80	1.33	2.0	0.48	0.42	0.41	0.06	5.84	1,752	18,662	119,352	240	240	141	0	18,281	0.42	362.51
17	85	1.42	2.6	0.62	0.42	0.53	0.21	19.44	5,833	24,114	122,427	247	247	141	0	23,727	0.54	362.55
18	90	1.50	2.7	0.65	0.42	0.55	0.23	21.71	6,514	30,240	125,882	254	254	141	0	29,846	0.69	362.59
19	95	1.58	2.4	0.58	0.42	0.49	0.16	14.91	4,473	34,319	128,182	258	258	141	0	33,920	0.78	362.61
20	100	1.67	2.7	0.65	0.42	0.55	0.23	21.71	6,514	40,434	131,631	265	265	141	0	40,028	0.92	362.65
21	105	1.75	3.3	0.79	0.42	0.67	0.37	35.32	10,595	50,623	137,378	277	277	141	0	50,206	1.15	362.71
22	110	1.83	3.1	0.74	0.42	0.63	0.33	30.78	9,235	59,441	142,350	287	287	141	0	59,013	1.35	362.77
23	115	1.92	2.9	0.70	0.42	0.59	0.28	26.25	7,874	66,888	146,550	295	295	141	0	66,452	1.53	362.82
24	120	2.00	3.0	0.72	0.42	0.61	0.30	28.51	8,554	75,006	151,129	304	304	141	0	74,561	1.71	362.87
25	125	2.08	3.1	0.74	0.42	0.63	0.33	30.78	9,235	83,796	156,086	314	314	141	0	83,341	1.91	362.92
26	130	2.17	4.2	1.01	0.42	0.86	0.59	55.73	16,718	100,058	165,258	333	333	141	0	99,585	2.29	363.02
27	135	2.25	5.0	1.20	0.42	1.02	0.78	73.87	22,160	121,745	177,489	357	357	141	0	121,247	2.78	363.16
28	140	2.33	3.5	0.84	0.42	0.71	0.42	39.85	11,956	133,202	183,951	370	370	141	0	132,691	3.05	363.23
29	145	2.42	6.8	1.63	0.42	1.39	1.21	114.68	34,404	167,096	203,066	409	409	141	0	166,546	3.82	**363.44**
30	150	2.50	7.3	1.75	0.42	1.49	1.33	126.02	37,806	204,352	191,799	386	386	141	0	203,825	4.68	
31	155	2.58	8.2	1.97	0.42	1.67	1.55	**146.43**	**43,928**	247,753	191,799	386	386	141	9,518	**237,709**	**5.46**	
32	160	2.67	5.9	1.42	0.42	1.20	1.00	94.27	28,282	265,991	191,799	386	386	141	27,755	**237,709**	**5.46**	
33	165	2.75	2.0	0.48	0.42	0.41	0.06	5.84	1,752	239,460	191,799	386	386	141	1,225	**237,709**	**5.46**	
34	170	2.83	1.8	0.43	0.42	0.37	0.01	1.30	391	238,100	191,799	386	386	141	0	237,573	5.45	
35	175	2.92	1.8	0.43	0.42	0.37	0.01	1.30	391	237,964	191,799	386	386	141	0	237,437	5.45	
36	180	3.00	0.6	0.14	0.42	0.12	0.02	2.04	612	238,050	191,799	386	386	141	0	237,523	5.45	

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL	2.00 in
RAINFALL VOLUME	680,265 cu ft
SOIL LOSSES	388,856 cu ft
EFFECTIVE RAIN	0.86 in
FLOOD VOLUME	6.69 ac-ft
FLOOD VOLUME	291,408 cu ft
REQUIRED STORAGE	5.46 ac-ft
REQUIRED STORAGE	237,709 cu ft
MAX WSEL	363.44 ft
PEAK FLOW RATE	146.43 cfs
TOTAL BASIN LOSSES	252,911 cu ft
TOTAL OVERFLOW OUT	38,498 cu ft

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

6-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

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By:	RRR
Date:	3/8/24

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1	5	0.08	0.5	0.16	0.42	0.14	0.02	2.26	679	679	109,210	220	220	141	0	318	0.01	362.40
2	10	0.17	0.6	0.19	0.42	0.16	0.03	2.71	814	1,132	109,466	220	220	141	0	771	0.02	362.40
3	15	0.25	0.6	0.19	0.42	0.16	0.03	2.71	814	1,586	109,721	221	221	141	0	1,224	0.03	362.41
4	20	0.33	0.6	0.19	0.42	0.16	0.03	2.71	814	2,038	109,977	221	221	141	0	1,676	0.04	362.41
5	25	0.42	0.6	0.19	0.42	0.16	0.03	2.71	814	2,491	110,232	222	222	141	0	2,128	0.05	362.41
6	30	0.50	0.7	0.22	0.42	0.19	0.03	3.17	950	3,078	110,563	223	223	141	0	2,715	0.06	362.42
7	35	0.58	0.7	0.22	0.42	0.19	0.03	3.17	950	3,665	110,894	223	223	141	0	3,301	0.08	362.42
8	40	0.67	0.7	0.22	0.42	0.19	0.03	3.17	950	4,251	111,224	224	224	141	0	3,886	0.09	362.42
9	45	0.75	0.7	0.22	0.42	0.19	0.03	3.17	950	4,836	111,555	225	225	141	0	4,471	0.10	362.43
10	50	0.83	0.7	0.22	0.42	0.19	0.03	3.17	950	5,421	111,884	225	225	141	0	5,055	0.12	362.43
11	55	0.92	0.7	0.22	0.42	0.19	0.03	3.17	950	6,005	112,214	226	226	141	0	5,639	0.13	362.44
12	60	1.00	0.8	0.26	0.42	0.22	0.04	3.62	1,086	6,724	112,619	227	227	141	0	6,357	0.15	362.44
13	65	1.08	0.8	0.26	0.42	0.22	0.04	3.62	1,086	7,443	113,025	228	228	141	0	7,075	0.16	362.44
14	70	1.17	0.8	0.26	0.42	0.22	0.04	3.62	1,086	8,160	113,429	228	228	141	0	7,791	0.18	362.45
15	75	1.25	0.8	0.26	0.42	0.22	0.04	3.62	1,086	8,877	113,834	229	229	141	0	8,507	0.20	362.45
16	80	1.33	0.8	0.26	0.42	0.22	0.04	3.62	1,086	9,593	114,237	230	230	141	0	9,222	0.21	362.46
17	85	1.42	0.8	0.26	0.42	0.22	0.04	3.62	1,086	10,308	114,641	231	231	141	0	9,937	0.23	362.46
18	90	1.50	0.8	0.26	0.42	0.22	0.04	3.62	1,086	11,022	115,043	232	232	141	0	10,650	0.24	362.47
19	95	1.58	0.8	0.26	0.42	0.22	0.04	3.62	1,086	11,736	115,446	232	232	141	0	11,363	0.26	362.47
20	100	1.67	0.8	0.26	0.42	0.22	0.04	3.62	1,086	12,448	115,848	233	233	141	0	12,075	0.28	362.48
21	105	1.75	0.8	0.26	0.42	0.22	0.04	3.62	1,086	13,160	116,249	234	234	141	0	12,786	0.29	362.48
22	110	1.83	0.8	0.26	0.42	0.22	0.04	3.62	1,086	13,871	116,650	235	235	141	0	13,496	0.31	362.48
23	115	1.92	0.8	0.26	0.42	0.22	0.04	3.62	1,086	14,582	117,051	236	236	141	0	14,205	0.33	362.49
24	120	2.00	0.9	0.29	0.42	0.24	0.04	4.07	1,221	15,427	117,527	237	237	141	0	15,050	0.35	362.49
25	125	2.08	0.8	0.26	0.42	0.22	0.04	3.62	1,086	16,135	117,927	237	237	141	0	15,757	0.36	362.50
26	130	2.17	0.9	0.29	0.42	0.24	0.04	4.07	1,221	16,979	118,403	238	238	141	0	16,600	0.38	362.50
27	135	2.25	0.9	0.29	0.42	0.24	0.04	4.07	1,221	17,821	118,878	239	239	141	0	17,441	0.40	362.51
28	140	2.33	0.9	0.29	0.42	0.24	0.04	4.07	1,221	18,662	119,352	240	240	141	0	18,282	0.42	362.51
29	145	2.42	0.9	0.29	0.42	0.24	0.04	4.07	1,221	19,503	119,826	241	241	141	0	19,121	0.44	362.52
30	150	2.50	0.9	0.29	0.42	0.24	0.04	4.07	1,221	20,343	120,300	242	242	141	0	19,960	0.46	362.52
31	155	2.58	0.9	0.29	0.42	0.24	0.04	4.07	1,221	21,181	120,773	243	243	141	0	20,797	0.48	362.53
32	160	2.67	0.9	0.29	0.42	0.24	0.04	4.07	1,221	22,019	121,245	244	244	141	0	21,634	0.50	362.54
33	165	2.75	1.0	0.32	0.42	0.27	0.05	4.52	1,357	22,991	121,794	245	245	141	0	22,605	0.52	362.54
34	170	2.83	1.0	0.32	0.42	0.27	0.05	4.52	1,357	23,962	122,341	246	246	141	0	23,576	0.54	362.55
35	175	2.92	1.0	0.32	0.42	0.27	0.05	4.52	1,357	24,933	122,889	247	247	141	0	24,545	0.56	362.55
36	180	3.00	1.0	0.32	0.42	0.27	0.05	4.52	1,357	25,902	123,435	249	249	141	0	25,513	0.59	362.56
37	185	3.08	1.0	0.32	0.42	0.27	0.05	4.52	1,357	26,870	123,981	250	250	141	0	26,479	0.61	362.57
38	190	3.17	1.1	0.35	0.42	0.30	0.05	4.98	1,493	27,972	124,603	251	251	141	0	27,581	0.63	362.57
39	195	3.25	1.1	0.35	0.42	0.30	0.05	4.98	1,493	29,074	125,224	252	252	141	0	28,681	0.66	362.58
40	200	3.33	1.1	0.35	0.42	0.30	0.05	4.98	1,493	30,174	125,844	253	253	141	0	29,780	0.68	362.59
41	205	3.42	1.2	0.38	0.42	0.33	0.06	5.43	1,629	31,408	126,541	255	255	141	0	31,013	0.71	362.59
42	210	3.50	1.3	0.41	0.42	0.35	0.06	5.88	1,764	32,777	127,313	256	256	141	0	32,380	0.74	362.60
43	215	3.58	1.4	0.45	0.42	0.38	0.03	2.71	813	33,193	127,547	257	257	141	0	32,796	0.75	362.61
44	220	3.67	1.4	0.45	0.42	0.38	0.03	2.71	813	33,609	127,782	257	257	141	0	33,211	0.76	362.61
45	225	3.75	1.5	0.48	0.42	0.41	0.06	5.73	1,718	34,928	128,526	259	259	141	0	34,529	0.79	362.62
46	230	3.83	1.5	0.48	0.42	0.41	0.06	5.73	1,718	36,247	129,269	260	260	141	0	35,846	0.82	362.62
47	235	3.92	1.6	0.51	0.42	0.43	0.09	8.74	2,622	38,468	130,522	263	263	141	0	38,065	0.87	362.64
48	240	4.00	1.6	0.51	0.42	0.43	0.09	8.74	2,622	40,687	131,774	265	265	141	0	40,281	0.92	362.65
49	245	4.08	1.7	0.54	0.42	0.46	0.12	11.76	3,527	43,809	133,534	269	269	141	0	43,399	1.00	362.67
50	250	4.17	1.8	0.57	0.42	0.49	0.16	14.77	4,432	47,831	135,803	273	273	141	0	47,417	1.09	362.70
51	255	4.25	1.9	0.61	0.42	0.52	0.19	17.79	5,337	52,754	138,579	279	279	141	0	52,334	1.20	362.73
52	260	4.33	2.0	0.64	0.42	0.54	0.22	20.80	6,241	58,575	141,862	286	286	141	0	58,149	1.33	362.76
53	265	4.42	2.1	0.67	0.42	0.57	0.25	23.82	7,146	65,295	145,652	293	293	141	0	64,862	1.49	362.81

RCFC & WCD
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SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

6-HOUR STORM

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LAG TIME - MINUTES	4.86
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LOW LOSS RATE - PERCENT	85.00%

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Maxwell Drywells		
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Drywell Percolation Rate	0.00 cfs	0.00 cfm

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54	270	4.50	2.1	0.67	0.42	0.57	0.25	23.82	7,146	72,008	149,438	301	301	141	0	71,566	1.64	362.85
55	275	4.58	2.2	0.70	0.42	0.60	0.28	26.84	8,051	79,617	153,730	310	310	141	0	79,167	1.82	362.90
56	280	4.67	2.3	0.73	0.42	0.62	0.32	29.85	8,956	88,123	158,527	319	319	141	0	87,663	2.01	362.95
57	285	4.75	2.4	0.77	0.42	0.65	0.35	32.87	9,860	97,523	163,828	330	330	141	0	97,053	2.23	363.01
58	290	4.83	2.4	0.77	0.42	0.65	0.35	32.87	9,860	106,913	169,124	341	341	141	0	106,432	2.44	363.07
59	295	4.92	2.5	0.80	0.42	0.68	0.38	35.88	10,765	117,197	174,924	352	352	141	0	116,704	2.68	363.13
60	300	5.00	2.6	0.83	0.42	0.71	0.41	38.90	11,670	128,374	181,228	365	365	141	0	127,869	2.94	363.20
61	305	5.08	3.1	0.99	0.42	0.84	0.57	53.98	16,194	144,063	190,076	383	383	141	0	143,539	3.30	363.30
62	310	5.17	3.6	1.15	0.42	0.98	0.73	69.06	20,717	164,257	201,465	406	406	141	0	163,710	3.76	363.42
63	315	5.25	3.9	1.24	0.42	1.06	0.83	78.11	23,432	187,142	214,372	432	432	141	0	186,570	4.28	**363.57**
64	320	5.33	4.2	1.34	0.42	1.14	0.92	87.15	26,146	212,716	191,799	386	386	141	0	212,189	4.87	
65	325	5.42	4.7	1.50	0.42	1.28	1.08	102.23	30,670	242,859	191,799	386	386	141	4,623	**237,709**	**5.46**	
66	330	5.50	5.6	1.79	0.42	1.52	1.37	**129.37**	**38,812**	276,521	191,799	386	386	141	38,286	**237,709**	**5.46**	
67	335	5.58	1.9	0.61	0.42	0.52	0.19	17.79	5,337	243,045	191,799	386	386	141	4,810	**237,709**	**5.46**	
68	340	5.67	0.9	0.29	0.42	0.24	0.04	4.07	1,221	238,930	191,799	386	386	141	695	**237,709**	**5.46**	
69	345	5.75	0.6	0.19	0.42	0.16	0.03	2.71	814	238,523	191,799	386	386	141	287	**237,709**	**5.46**	
70	350	5.83	0.5	0.16	0.42	0.14	0.02	2.26	679	238,387	191,799	386	386	141	152	**237,709**	**5.46**	
71	355	5.92	0.3	0.10	0.42	0.08	0.01	1.36	407	238,116	191,799	386	386	141	0	237,589	5.45	
72	360	6.00	0.2	0.06	0.42	0.05	0.01	0.90	271	237,861	191,799	386	386	141	0	237,334	5.45	

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL	2.66 in
RAINFALL VOLUME	904,752 cu ft
SOIL LOSSES	588,575 cu ft
EFFECTIVE RAIN	0.93 in
FLOOD VOLUME	7.26 ac-ft
FLOOD VOLUME	316,177 cu ft
REQUIRED STORAGE	5.46 ac-ft
REQUIRED STORAGE	237,709 cu ft
MAX WSEL	363.57 ft
PEAK FLOW RATE	129.37 cfs
TOTAL BASIN LOSSES	19,871 cu ft
TOTAL OVERFLOW OUT	48,853 cu ft

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

24-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-2A
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	93.70
UNIT TIME-MINUTES	15
LAG TIME - MINUTES	4.86
UNIT TIME-PERCENT OF LAG	309%
TOTAL ADJUSTED STORM RAIN (in)	4.21

VARIABLE LOSS RATE (AVG) IN/HR	
Fm = Minimum value on loss curve (in/hr)	0.21
C	0.00387
Low Loss Rate (percent)	85.00%

Basin Percolation Rate	0.29 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu ft	Basin Volume cu ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu ft	Basin Losses Percolation Out cu ft	Basin Losses Drain Tile Out cu ft	Basin Losses Overflow Out cu ft	Total In Basin cu ft	Total In Basin ac-ft	Basin WSEL ft
1	15	0.25	0.2	0.034	0.738	0.029	0.01	0.48	430	430	109,069	659	430	0	0	0	0.00	362.40
2	30	0.50	0.3	0.051	0.730	0.043	0.01	0.72	644	644	109,190	660	644	0	0	0	0.00	362.40
3	45	0.75	0.3	0.051	0.721	0.043	0.01	0.72	644	644	109,190	660	644	0	0	0	0.00	362.40
4	60	1.00	0.4	0.067	0.713	0.057	0.01	0.95	859	859	109,312	660	660	199	0	0	0.00	362.40
5	75	1.25	0.3	0.051	0.705	0.043	0.01	0.72	644	644	109,190	660	644	0	0	0	0.00	362.40
6	90	1.50	0.3	0.051	0.696	0.043	0.01	0.72	644	644	109,190	660	644	0	0	0	0.00	362.40
7	105	1.75	0.3	0.051	0.688	0.043	0.01	0.72	644	644	109,190	660	644	0	0	0	0.00	362.40
8	120	2.00	0.4	0.067	0.680	0.057	0.01	0.95	859	859	109,312	660	660	199	0	0	0.00	362.40
9	135	2.25	0.4	0.067	0.671	0.057	0.01	0.95	859	859	109,312	660	660	199	0	0	0.00	362.40
10	150	2.50	0.4	0.067	0.663	0.057	0.01	0.95	859	859	109,312	660	660	199	0	0	0.00	362.40
11	165	2.75	0.5	0.084	0.655	0.072	0.01	1.19	1,074	1,074	109,433	661	661	413	0	0	0.00	362.40
12	180	3.00	0.5	0.084	0.647	0.072	0.01	1.19	1,074	1,074	109,433	661	661	413	0	0	0.00	362.40
13	195	3.25	0.5	0.084	0.639	0.072	0.01	1.19	1,074	1,074	109,433	661	661	413	0	0	0.00	362.40
14	210	3.50	0.5	0.084	0.631	0.072	0.01	1.19	1,074	1,074	109,433	661	661	413	0	0	0.00	362.40
15	225	3.75	0.5	0.084	0.623	0.072	0.01	1.19	1,074	1,074	109,433	661	661	413	0	0	0.00	362.40
16	240	4.00	0.6	0.101	0.615	0.086	0.02	1.43	1,289	1,289	109,554	662	662	422	0	205	0.00	362.40
17	255	4.25	0.6	0.101	0.608	0.086	0.02	1.43	1,289	1,494	109,670	663	663	422	0	410	0.01	362.40
18	270	4.50	0.7	0.118	0.600	0.100	0.02	1.67	1,504	1,913	109,906	664	664	422	0	828	0.02	362.41
19	285	4.75	0.7	0.118	0.592	0.100	0.02	1.67	1,504	2,331	110,142	665	665	422	0	1,244	0.03	362.41
20	300	5.00	0.8	0.135	0.584	0.115	0.02	1.91	1,718	2,962	110,498	668	668	422	0	1,873	0.04	362.41
21	315	5.25	0.6	0.101	0.577	0.086	0.02	1.43	1,289	3,162	110,610	668	668	422	0	2,072	0.05	362.41
22	330	5.50	0.7	0.118	0.569	0.100	0.02	1.67	1,504	3,576	110,844	670	670	422	0	2,484	0.06	362.42
23	345	5.75	0.8	0.135	0.562	0.115	0.02	1.91	1,718	4,203	111,197	672	672	422	0	3,109	0.07	362.42
24	360	6.00	0.8	0.135	0.554	0.115	0.02	1.91	1,718	4,828	111,550	674	674	422	0	3,732	0.09	362.42
25	375	6.25	0.9	0.152	0.547	0.129	0.02	2.15	1,933	5,665	112,022	677	677	422	0	4,567	0.10	362.43
26	390	6.50	0.9	0.152	0.540	0.129	0.02	2.15	1,933	6,500	112,493	680	680	422	0	5,398	0.12	362.43
27	405	6.75	1.0	0.168	0.533	0.143	0.03	2.39	2,148	7,546	113,083	683	683	422	0	6,442	0.15	362.44
28	420	7.00	1.0	0.168	0.525	0.143	0.03	2.39	2,148	8,589	113,671	687	687	422	0	7,481	0.17	362.45
29	435	7.25	1.0	0.168	0.518	0.143	0.03	2.39	2,148	9,629	114,258	690	690	422	0	8,517	0.20	362.45
30	450	7.50	1.1	0.185	0.511	0.157	0.03	2.63	2,363	10,880	114,963	695	695	422	0	9,764	0.22	362.46
31	465	7.75	1.2	0.202	0.504	0.172	0.03	2.86	2,578	12,341	115,787	700	700	422	0	11,220	0.26	362.47
32	480	8.00	1.3	0.219	0.497	0.186	0.03	3.10	2,792	14,012	116,730	705	705	422	0	12,885	0.30	362.48
33	495	8.25	1.5	0.253	0.490	0.215	0.04	3.58	3,222	16,107	117,911	712	712	422	0	14,973	0.34	362.49
34	510	8.50	1.5	0.253	0.483	0.215	0.04	3.58	3,222	18,195	119,089	719	719	422	0	17,054	0.39	362.51
35	525	8.75	1.6	0.269	0.477	0.229	0.04	3.82	3,437	20,491	120,383	727	727	422	0	19,342	0.44	362.52
36	540	9.00	1.7	0.286	0.470	0.243	0.04	4.06	3,651	22,993	121,795	736	736	422	0	21,836	0.50	362.54
37	555	9.25	1.9	0.320	0.463	0.272	0.05	4.53	4,081	25,917	123,444	746	746	422	0	24,749	0.57	362.55
38	570	9.50	2.0	0.337	0.457	0.286	0.05	4.77	4,296	29,045	125,208	756	756	422	0	27,867	0.64	362.57
39	585	9.75	2.1	0.354	0.450	0.301	0.05	5.01	4,511	32,378	127,087	768	768	422	0	31,188	0.72	362.60
40	600	10.00	2.2	0.370	0.444	0.315	0.06	5.25	4,725	35,914	129,082	780	780	422	0	34,712	0.80	362.62
41	615	10.25	1.5	0.253	0.437	0.215	0.04	3.58	3,222	37,934	130,221	787	787	422	0	36,726	0.84	362.63
42	630	10.50	1.5	0.253	0.431	0.215	0.04	3.58	3,222	39,948	131,357	794	794	422	0	38,732	0.89	362.64
43	645	10.75	2.0	0.337	0.425	0.286	0.05	4.77	4,296	43,028	133,094	804	804	422	0	41,802	0.96	362.66
44	660	11.00	2.0	0.337	0.419	0.286	0.05	4.77	4,296	46,098	134,826	815	815	422	0	44,862	1.03	362.68
45	675	11.25	1.9	0.320	0.412	0.272	0.05	4.53	4,081	48,943	136,430	824	824	422	0	47,697	1.09	362.70
46	690	11.50	1.9	0.320	0.406	0.272	0.05	4.53	4,081	51,778	138,029	834	834	422	0	50,523	1.16	362.72
47	705	11.75	1.7	0.286	0.400	0.243	0.04	4.06	3,651	54,174	139,380	842	842	422	0	52,910	1.21	362.73
48	720	12.00	1.8	0.303	0.394	0.258	0.05	4.30	3,866	56,777	140,848	851	851	422	0	55,504	1.27	362.75
49	735	12.25	2.5	0.421	0.388	0.358	0.03	3.08	2,770	58,274	141,692	856	856	422	0	56,996	1.31	362.76
50	750	12.50	2.6	0.438	0.383	0.372	0.06	5.22	4,697	61,693	143,621	868	868	422	0	60,404	1.39	362.78
51	765	12.75	2.8	0.472	0.377	0.401	0.09	8.94	8,049	68,453	147,433	891	891	422	0	67,141	1.54	362.82
52	780	13.00	2.9	0.488	0.371	0.415	0.12	11.07	9,964	77,105	152,313	920	920	422	0	75,763	1.74	362.87
53	795	13.25	3.4	0.573	0.366	0.487	0.21	19.56	17,601	93,364	161,483	976	976	422	0	91,967	2.11	362.98
54	810	13.50	3.4	0.573	0.360	0.487	0.21	**20.08**	**18,072**	110,039	170,887	1,032	1,032	422	0	108,585	2.49	363.08
55	825	13.75	2.3	0.387	0.355	0.329	0.03	3.10	2,786	111,371	171,638	1,037	1,037	422	0	109,912	2.52	363.09
56	840	14.00	2.3	0.387	0.349	0.329	0.04	3.61	3,245	113,157	172,645	1,043	1,043	422	0	111,692	2.56	363.10

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

24-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-2A
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	93.70
UNIT TIME-MINUTES	15
LAG TIME - MINUTES	4.86
UNIT TIME-PERCENT OF LAG	309%
TOTAL ADJUSTED STORM RAIN (in)	4.21

VARIABLE LOSS RATE (AVG) IN/HR	
Fm = Minimum value on loss curve (in/hr)	0.21
C	0.00387
Low Loss Rate (percent)	85.00%

Basin Percolation Rate	0.29 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu ft	Basin Volume cu ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu ft	Basin Losses Percolation Out cu ft	Basin Losses Drain Tile Out cu ft	Basin Losses Overflow Out cu ft	Total In Basin cu ft	Total In Basin ac-ft	Basin WSEL ft
57	855	14.25	2.7	0.455	0.344	0.386	0.11	10.47	9,425	121,117	177,135	1,070	1,070	422	0	119,625	2.75	363.15
58	870	14.50	2.6	0.438	0.339	0.372	0.10	9.38	8,440	128,065	181,053	1,094	1,094	422	0	126,549	2.91	363.19
59	885	14.75	2.6	0.438	0.333	0.372	0.10	9.87	8,880	135,429	185,207	1,119	1,119	422	0	133,889	3.07	363.24
60	900	15.00	2.5	0.421	0.328	0.358	0.09	8.76	7,882	141,770	188,783	1,141	1,141	422	0	140,208	3.22	363.28
61	915	15.25	2.4	0.404	0.323	0.344	0.08	7.64	6,877	147,085	191,780	1,159	1,159	422	0	145,504	3.34	363.31
62	930	15.50	2.3	0.387	0.318	0.329	0.07	6.52	5,865	151,370	194,197	1,173	1,173	422	0	**149,775**	**3.44**	**363.34**
63	945	15.75	1.9	0.320	0.313	0.272	0.01	0.61	552	150,327	193,608	1,170	1,170	422	0	148,735	3.41	363.33
64	960	16.00	1.9	0.320	0.309	0.272	0.01	1.07	959	149,694	193,252	1,168	1,168	422	0	148,105	3.40	363.33
65	975	16.25	0.4	0.067	0.304	0.057	0.01	0.95	859	148,964	192,840	1,165	1,165	422	0	147,377	3.38	363.32
66	990	16.50	0.4	0.067	0.299	0.057	0.01	0.95	859	148,237	192,430	1,163	1,163	422	0	146,652	3.37	363.32
67	1005	16.75	0.3	0.051	0.295	0.043	0.01	0.72	644	147,297	191,900	1,159	1,159	422	0	145,716	3.35	363.31
68	1020	17.00	0.3	0.051	0.290	0.043	0.01	0.72	644	146,360	191,371	1,156	1,156	422	0	144,782	3.32	363.31
69	1035	17.25	0.5	0.084	0.286	0.072	0.01	1.19	1,074	145,856	191,087	1,154	1,154	422	0	144,280	3.31	363.30
70	1050	17.50	0.5	0.084	0.282	0.072	0.01	1.19	1,074	145,354	190,804	1,153	1,153	422	0	143,780	3.30	363.30
71	1065	17.75	0.5	0.084	0.277	0.072	0.01	1.19	1,074	144,853	190,522	1,151	1,151	422	0	143,281	3.29	363.30
72	1080	18.00	0.4	0.067	0.273	0.057	0.01	0.95	859	144,140	190,119	1,149	1,149	422	0	142,570	3.27	363.29
73	1095	18.25	0.4	0.067	0.269	0.057	0.01	0.95	859	143,429	189,718	1,146	1,146	422	0	141,861	3.26	363.29
74	1110	18.50	0.4	0.067	0.265	0.057	0.01	0.95	859	142,720	189,318	1,144	1,144	422	0	141,155	3.24	363.28
75	1125	18.75	0.3	0.051	0.262	0.043	0.01	0.72	644	141,799	188,799	1,141	1,141	422	0	140,237	3.22	363.28
76	1140	19.00	0.2	0.034	0.258	0.029	0.01	0.48	430	140,666	188,160	1,137	1,137	422	0	139,108	3.19	363.27
77	1155	19.25	0.3	0.051	0.254	0.043	0.01	0.72	644	139,752	187,645	1,134	1,134	422	0	138,197	3.17	363.26
78	1170	19.50	0.4	0.067	0.251	0.057	0.01	0.95	859	139,056	187,252	1,131	1,131	422	0	137,503	3.16	363.26
79	1185	19.75	0.3	0.051	0.247	0.043	0.01	0.72	644	138,148	186,740	1,128	1,128	422	0	136,598	3.14	363.25
80	1200	20.00	0.2	0.034	0.244	0.029	0.01	0.48	430	137,027	186,108	1,124	1,124	422	0	135,481	3.11	363.25
81	1215	20.25	0.3	0.051	0.241	0.043	0.01	0.72	644	136,126	185,599	1,121	1,121	422	0	134,583	3.09	363.24
82	1230	20.50	0.3	0.051	0.238	0.043	0.01	0.72	644	135,227	185,092	1,118	1,118	422	0	133,687	3.07	363.24
83	1245	20.75	0.3	0.051	0.235	0.043	0.01	0.72	644	134,331	184,587	1,115	1,115	422	0	132,795	3.05	363.23
84	1260	21.00	0.2	0.034	0.232	0.029	0.01	0.48	430	133,224	183,963	1,111	1,111	422	0	131,691	3.02	363.22
85	1275	21.25	0.3	0.051	0.229	0.043	0.01	0.72	644	132,335	183,462	1,108	1,108	422	0	130,805	3.00	363.22
86	1290	21.50	0.2	0.034	0.226	0.029	0.01	0.48	430	131,235	182,841	1,105	1,105	422	0	129,709	2.98	363.21
87	1305	21.75	0.3	0.051	0.224	0.043	0.01	0.72	644	130,353	182,344	1,102	1,102	422	0	128,830	2.96	363.21
88	1320	22.00	0.2	0.034	0.222	0.029	0.01	0.48	430	129,259	181,727	1,098	1,098	422	0	127,740	2.93	363.20
89	1335	22.25	0.3	0.051	0.219	0.043	0.01	0.72	644	128,384	181,233	1,095	1,095	422	0	126,868	2.91	363.19
90	1350	22.50	0.2	0.034	0.217	0.029	0.01	0.48	430	127,297	180,620	1,091	1,091	422	0	125,784	2.89	363.19
91	1365	22.75	0.2	0.034	0.215	0.029	0.01	0.48	430	126,214	180,009	1,088	1,088	422	0	124,705	2.86	363.18
92	1380	23.00	0.2	0.034	0.214	0.029	0.01	0.48	430	125,134	179,400	1,084	1,084	422	0	123,629	2.84	363.17
93	1395	23.25	0.2	0.034	0.212	0.029	0.01	0.48	430	124,058	178,793	1,080	1,080	422	0	122,556	2.81	363.17
94	1410	23.50	0.2	0.034	0.211	0.029	0.01	0.48	430	122,986	178,189	1,077	1,077	422	0	121,488	2.79	363.16
95	1425	23.75	0.2	0.034	0.210	0.029	0.01	0.48	430	121,917	177,586	1,073	1,073	422	0	120,423	2.76	363.15
96	1440	24.00	0.2	0.034	0.209	0.029	0.01	0.48	430	120,852	176,985	1,069	1,069	422	0	119,361	2.74	363.15

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL	4.21 in
RAINFALL VOLUME	1,431,957 cu ft
SOIL LOSSES	1,189,381 cu ft
EFFECTIVE RAIN	0.71 in
FLOOD VOLUME	5.57 ac-ft
FLOOD VOLUME	242,576 cu ft
REQUIRED STORAGE	3.44 ac-ft
REQUIRED STORAGE	149,775 cu ft
MAX WSEL	363.34 ft
PEAK FLOW RATE	20.08 cfs
TOTAL BASIN LOSSES	242,576 cu ft
TOTAL OVERFLOW OUT	0 cu ft

BASIN VOLUME WORKSHEET

PROECT Thermal Ranch TTM 38578
JOB No. 2735
BASIN DESIGNATION: Retention Basin 2A

BASIN CHARACTERISTICS

CONTOUR ELEVATION	DEPTH		AREA		VOLUME		
	INCR (ft)	TOTAL (ft)	INCR (sf)	TOTAL (sf)	INCR (cuft)	TOTAL (cuft)	TOTAL (acre-ft)
362.4	0	0		108,827	0	0	0.00
363.6	1.2	1.2	108,171	216,998	191,799	191,799	4.40

WHERE: $$V = \frac{1}{3}(E_1 - E_2)\left(A_1 + A_2 + \sqrt{A_1 A_2}\right)$$

RCFCD SYNTHETIC UNIT HYDROGRAPH - SHORTCUT METHOD

DATA INPUT SHEET

DATE	March 8, 2024
WORKSHEET PREPARED BY:	RRR
PROJECT NAME	Thermal Ranch TTM 38578
PROJECT NUMBER	2735
CONCENTRATION POINT DESIGNATION	Retention Basin 2B
AREA DESIGNATION	DA-2B
AMC NUMBER	2

Low Loss Conditions: X=Existing; D=Developed; BS=Retention

AREA DESIG	SOIL GROUP	TRIBUTARY AREAS	ACRES	LOW LOSS CONDITION	RI NUMBER	AMC II INFILTRATION RATE	IMPERVIOUS PERCENT
3	B	SF - 1 ACRE	93.8	D	56	0.51	0.20
2	B	OFFSITE STREETS	13.7	D	56	0.51	0.90

LENGTH OF WATERCOURSE (L)	5,724 ft
LENGTH TO POINT OPPOSITE CENTROID (Lca)	3,090 ft
ELEVATION OF HEADWATER	372.4 ft
ELEVATION OF CONCENTRATION POINT	358.3 ft
AVERAGE MANNINGS 'N' VALUE	0.020
STORM FREQUENCY (YEAR)	100
LOW LOSS RATE (Storm Events > 10 Years)	**85%**
POINT RAIN FROM NOAA ATLAS	**14**
1-HOUR	1.22 in
3-HOUR	2.00 in
6-HOUR	2.66 in
24-HOUR	4.21 in

BASIN CHARACTERISTICS:

ELEVATION	AREA
355.7 ft	122,275 sf
357.8 ft	231,323 sf

PERCOLATION RATE (in/hr)	0.49 in/hr
DRYWELL DATA	
NUMBER USED	0
PERCOLATION RATE	
LOWEST FLOWLINE ELEVATION	358.84
LOWEST PAD ELEVATION	363.1

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD BASIC DATA CALCULATION FORM	PROJECT: Thermal Ranch TTM 38578 Job No.: 2735 BY: RRR DATE: 3/8/24

PHYSICAL DATA

[1] CONCENTRATION POINT	Retention Basin 2B
[2] AREA DESIGNATION	DA-2B
[3] AREA - ACRES	107.500
[4] L-FEET	5724
[5] L-MILES	1.084
[6] La-FEET	3090.00
[7] La-MILES	0.585
[8] ELEVATION OF HEADWATER	372.4
[9] ELEVATION OF CONCENTRATION POINT	358.3
[10] H-FEET	14.1
[11] S-FEET/MILE	13.0
[12] S^0.5	3.61
[13] L*LCA/S^0.5	0.176
[14] AVERAGE MANNINGS 'N'	0.02
[15] LAG TIME-HOURS	0.25
[16] LAG TIME-MINUTES	14.9
[17] 100% OF LAG-MINUTES	14.9
[18] 200% OF LAG-MINUTES	29.8

RAINFALL DATA

[1] AMC	II
[2] FREQUENCY-YEARS	100
FROM NOAA ATLAS	**14**
[3] STORM DURATION:	Point Rain
1-HOUR	1.22 in
3-HOUR	2.00 in
6-HOUR	2.66 in
24-HOUR	4.21 in

STORM EVENT SUMMARY

STORM DURATION		1-HOUR	3-HOUR	6-HOUR	24-HOUR
RAINFALL VOLUME	(cu ft)	476,076	780,453	1,038,003	**1,642,854**
SOIL LOSSES	(cu ft)	147,214	411,828	644,449	**1,311,477**
EFFECTIVE RAIN	(in)	0.84	0.94	1.01	0.85
FLOOD VOLUME	(cu ft)	328,862	368,625	**393,554**	331,377
	(acre-ft)	7.55	8.46	**9.03**	7.61
PEAK FLOW	(cfs)	n/a	172.43	152.87	26.86
OVERFLOW VOLUME RECEIVED	(cu ft)	29,775	38,498	48,853	0
	(acre-ft)	0.68	0.88	1.12	0.00
TOTAL VOLUME INTO BASIN	(cu ft)	358,637	407,123	442,406	331,377
	(acre-ft)	8.23	9.35	10.16	7.61
STORAGE PROVIDED	(cu ft)	365,246			
	(acre-ft)	8.38			
PERCOLATION RATE	(in/hr)	0.49			
PERCOLATION VOLUME	(cu ft)	280,592	318,223	334,272	255,522
	(acre-ft)	6.44	7.31	7.67	5.87
DRAIN TILE LOSS VOLUME	(cu ft)	78,045	87,075	92,719	75,855
	(acre-ft)	1.79	2.00	2.13	1.74
OVERFLOW VOLUME	(cu ft)	0	1,824	15,416	0
	(acre-ft)	0.00	0.04	0.35	0.00
TOTAL VOLUME LOSSES	(cu ft)	358,637	407,123	442,406	331,377
	(acre-ft)	8.23	9.35	10.16	7.61
BASIN DEWATERING TIME	(hours)	39.4	42.1	42.0	19.5
MAXIMUM VOLUME IN BASIN	(cu ft)	350,208	380,798	380,798	200,571
	(acre-ft)	8.04	8.74	8.74	4.60
MAXIMUM WSEL	(ft)	**357.71**	357.52	357.43	356.85
DEPTH	(ft)	**2.01**	1.82	1.73	1.15
LOWEST FLOWLINE ELEVATION		358.84			
DIFFERENCE	(ft)	1.13	1.32	1.41	1.99
LOWEST PAD ELEVATION		363.1			
DIFFERENCE	(ft)	5.39	5.58	5.67	6.25

NOTE: PEAK FLOW FOR THE 1-HOUR STORM IS NOT REPRESENTATIVE. PER RCFCD PEAK DISCHARGES FROM THE 3-HOUR STORM SHOULD NORMALLY COMPARE WELL WITH RATIONAL PEAKS.

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD BASIC DATA CALCULATION FORM AMC II	PROJECT: Thermal Ranch TTM 38578 Job No.: 2735 Area ID: DA-2B By: RRR Date: 3/8/24

AVERAGE ADJUSTED LOSS RATE

SOIL GROUP [Plate C-1]	LAND USE	RI NUMBER [Plate E-6.1]	PERVIOUS AREA INFILTRATION RATE (in/hr) [Plate E-6.2]	DECIMAL PERCENT OF AREA IMPERVIOUS [Plate E-6.3]	ADJUSTED INFILTRATION RATE (in/hr)	AREA	AREA WEIGHTED AVERAGE	MAX AVERAGE ADJUSTED INFILTRATION RATE (in/hr)	LOW LOSS CONDITION	LOW LOSS RATE PER RCFC/2322	MIN AVERAGE ADJUSTED INFILTRATION RATE
B	SF - 1 ACRE	56	0.51	20%	0.42	93.800	0.873	0.3649	DEVELOPED	0.7400	0.6457
B	OFFSITE STREETS	56	0.51	90%	0.10	13.700	0.127	0.0123	DEVELOPED	0.1800	0.0229
					SUM	107.500	SUM	0.3773			0.6686

VARIABLE LOSS RATE CURVE (24-HOUR STORM ONLY)

Fm= 0.188626465

C= 0.00349

F_t=C(24-(T/60))^1.55+F_m = 0.00349 (24-(T/60))^1.55 + 0.19 in/hr

CONSTANT LOSS RATE (3 & 6 HOUR STORMS) = **0.3773**

LOW LOSS RATE = **0.8500**

Where:

T=Time in minutes. To get an average value for each unit time period, Use T=1/2 the unit time for the first time period, T=1 1/2 unit time for the second period, etc.

NOTE: Low loss rates established per RCFC/2322 (Dated: May-30-95)
For 10 Year Storms or Less
Undeveloped Condition: Low Loss = 90%
Developed Condition: Low Loss = 0.9 - (0.8 * %impervious)
Basin Site: Low Loss = 10%
For 100 Year Storm - Low Loss should be between 80% & 90% of the Rainfall Rate

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

1-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-2B
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	107.50
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	14.88
UNIT TIME-PERCENT OF LAG	33.6
TOTAL ADJUSTED STORM RAIN-INCHES	1.22
CONSTANT LOSS RATE-in/hr	0.38
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	0.49 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu ft	Overflow In cu ft	Basin Volume cu ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu ft	Basin Losses Percolation Out cu ft	Basin Losses Drain Tile Out cu ft	Basin Losses Overflow Out cu ft	Total In Basin cu ft	Total In Basin ac-ft	Basin WSEL ft
1	5	0.08	3.6	0.53	0.38	0.45	0.15	16.24	4,871	0	4,871	123,729	421	421	161	0	4,289	0.10	355.72
2	10	0.17	4.2	0.61	0.38	0.52	0.24	25.76	7,727	0	12,016	125,863	428	428	161	0	11,426	0.26	355.77
3	15	0.25	4.4	0.64	0.38	0.55	0.27	28.93	8,680	0	20,106	128,278	437	437	161	0	19,508	0.45	355.81
4	20	0.33	4.6	0.67	0.38	0.57	0.30	32.11	9,632	0	29,140	130,975	446	446	161	0	28,533	0.66	355.86
5	25	0.42	5.0	0.73	0.38	0.62	0.35	38.45	11,536	0	40,069	134,238	457	457	161	0	39,451	0.91	355.93
6	30	0.50	5.6	0.82	0.38	0.70	0.44	47.97	14,392	0	53,843	138,351	471	471	161	0	53,211	1.22	356.01
7	35	0.58	6.4	0.94	0.38	0.80	0.56	60.67	18,201	0	71,412	143,596	489	489	161	0	70,762	1.62	356.11
8	40	0.67	8.1	1.19	0.38	1.01	0.81	87.65	26,294	0	97,057	151,252	515	515	161	0	96,381	2.21	356.25
9	45	0.75	13.1	1.92	0.38	1.63	1.54	166.99	50,098	0	146,479	166,008	565	565	161	0	145,753	3.35	356.54
10	50	0.83	34.5	5.05	0.38	4.29	4.67	**506.60**	**151,979**	10,964	308,696	214,439	730	730	161	0	307,805	7.07	357.47
11	55	0.92	6.7	0.98	0.38	0.83	0.60	65.43	19,629	15,422	342,856	224,638	764	764	161	0	341,931	7.85	357.67
12	60	1.00	3.8	0.56	0.38	0.47	0.18	19.41	5,823	3,388	351,142	227,112	773	773	161	0	**350,208**	**8.04**	**357.71**

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL	1.22 in
RAINFALL VOLUME	476,076 cu ft
SOIL LOSSES	147,214 cu ft
EFFECTIVE RAIN	0.84 in
FLOOD VOLUME	7.55 ac-ft
FLOOD VOLUME	328,862 cu ft
REQUIRED STORAGE	8.04 ac-ft
REQUIRED STORAGE	350,208 cu ft
MAX WSEL	357.71 ft
PEAK FLOW RATE	506.60 cfs
TOTAL BASIN LOSSES	358,637 cu ft
TOTAL OVERFLOW OUT	0 cu ft

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

3-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-2B
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	107.50
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	14.88
UNIT TIME-PERCENT OF LAG	33.6
TOTAL ADJUSTED STORM RAIN (in)	2.00
CONSTANT LOSS RATE (in/hr)	0.38
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	0.49 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu ft	Overflow In cu ft	Basin Volume cu ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu ft	Basin Losses Percolation Out cu ft	Basin Losses Drain Tile Out cu ft	Basin Losses Overflow Out cu ft	Total In Basin cu ft	Total In Basin ac-ft	Basin WSEL ft
1	5	0.08	1.3	0.31	0.38	0.27	0.05	5.07	1,522	0	1,522	122,729	418	418	161	0	943	0.02	355.71
2	10	0.17	1.3	0.31	0.38	0.27	0.05	5.07	1,522	0	2,465	123,011	419	419	161	0	1,885	0.04	355.71
3	15	0.25	1.1	0.26	0.38	0.22	0.04	4.29	1,288	0	3,173	123,222	419	419	161	0	2,592	0.06	355.71
4	20	0.33	1.5	0.36	0.38	0.31	0.05	5.85	1,756	0	4,348	123,573	420	420	161	0	3,767	0.09	355.72
5	25	0.42	1.5	0.36	0.38	0.31	0.05	5.85	1,756	0	5,523	123,924	422	422	161	0	4,940	0.11	355.73
6	30	0.50	1.8	0.43	0.38	0.37	0.05	5.93	1,780	0	6,720	124,281	423	423	161	0	6,136	0.14	355.74
7	35	0.58	1.5	0.36	0.38	0.31	0.05	5.85	1,756	0	7,892	124,631	424	424	161	0	7,306	0.17	355.74
8	40	0.67	1.8	0.43	0.38	0.37	0.05	5.93	1,780	0	9,087	124,988	425	425	161	0	8,500	0.20	355.75
9	45	0.75	1.8	0.43	0.38	0.37	0.05	5.93	1,780	0	10,281	125,344	427	427	161	0	9,693	0.22	355.76
10	50	0.83	1.5	0.36	0.38	0.31	0.05	5.85	1,756	0	11,449	125,693	428	428	161	0	10,860	0.25	355.76
11	55	0.92	1.6	0.38	0.38	0.33	0.01	0.73	219	0	11,079	125,583	427	427	161	0	10,491	0.24	355.76
12	60	1.00	1.8	0.43	0.38	0.37	0.05	5.93	1,780	0	12,271	125,939	429	429	161	0	11,681	0.27	355.77
13	65	1.08	2.2	0.53	0.38	0.45	0.15	16.34	4,902	0	16,583	127,226	433	433	161	0	15,989	0.37	355.79
14	70	1.17	2.2	0.53	0.38	0.45	0.15	16.34	4,902	0	20,891	128,512	437	437	161	0	20,293	0.47	355.82
15	75	1.25	2.2	0.53	0.38	0.45	0.15	16.34	4,902	0	25,195	129,797	442	442	161	0	24,592	0.56	355.84
16	80	1.33	2.0	0.48	0.38	0.41	0.10	11.14	3,341	0	27,933	130,615	444	444	161	0	27,327	0.63	355.86
17	85	1.42	2.6	0.62	0.38	0.53	0.25	26.75	8,024	0	35,351	132,830	452	452	161	0	34,738	0.80	355.90
18	90	1.50	2.7	0.65	0.38	0.55	0.27	29.35	8,804	0	43,543	135,275	460	460	161	0	42,921	0.99	355.95
19	95	1.58	2.4	0.58	0.38	0.49	0.20	21.54	6,463	0	49,384	137,019	466	466	161	0	48,756	1.12	355.98
20	100	1.67	2.7	0.65	0.38	0.55	0.27	29.35	8,804	0	57,561	139,460	475	475	161	0	56,925	1.31	356.03
21	105	1.75	3.3	0.79	0.38	0.67	0.41	44.96	13,487	0	70,412	143,297	488	488	161	0	69,763	1.60	356.10
22	110	1.83	3.1	0.74	0.38	0.63	0.37	39.75	11,926	0	81,690	146,664	499	499	161	0	81,029	1.86	356.17
23	115	1.92	2.9	0.70	0.38	0.59	0.32	34.55	10,365	0	91,395	149,562	509	509	161	0	90,724	2.08	356.22
24	120	2.00	3.0	0.72	0.38	0.61	0.34	37.15	11,146	0	101,870	152,689	520	520	161	0	101,189	2.32	356.28
25	125	2.08	3.1	0.74	0.38	0.63	0.37	39.75	11,926	0	113,115	156,047	531	531	161	0	112,423	2.58	356.35
26	130	2.17	4.2	1.01	0.38	0.86	0.63	68.37	20,511	0	132,934	161,964	551	551	161	0	132,222	3.04	356.46
27	135	2.25	5.0	1.20	0.38	1.02	0.82	89.18	26,755	0	158,977	169,739	578	578	161	0	158,238	3.63	356.61
28	140	2.33	3.5	0.84	0.38	0.71	0.46	50.16	15,048	0	173,286	174,011	592	592	161	0	172,533	3.96	356.69
29	145	2.42	6.8	1.63	0.38	1.39	1.25	136.01	40,803	0	213,336	185,969	633	633	161	0	212,542	4.88	356.92
30	150	2.50	7.3	1.75	0.38	1.49	1.37	149.02	44,705	0	257,247	199,079	677	677	161	0	256,408	5.89	357.17
31	155	2.58	8.2	1.97	0.38	1.67	1.59	**172.43**	**51,729**	9,518	317,655	217,114	739	739	161	0	316,755	7.27	**357.52**
32	160	2.67	5.9	1.42	0.38	1.20	1.04	112.60	33,779	27,755	378,289	231,323	787	787	161	0	377,341	8.66	
33	165	2.75	2.0	0.48	0.38	0.41	0.10	11.14	3,341	1,225	381,907	231,323	787	787	161	161	**380,798**	**8.74**	
34	170	2.83	1.8	0.43	0.38	0.37	0.05	5.93	1,780	0	382,578	231,323	787	787	161	832	**380,798**	**8.74**	
35	175	2.92	1.8	0.43	0.38	0.37	0.05	5.93	1,780	0	382,578	231,323	787	787	161	832	**380,798**	**8.74**	
36	180	3.00	0.6	0.14	0.38	0.12	0.02	2.34	702	0	381,500	231,323	787	787	161	0	380,552	8.74	

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL	2.00 in
RAINFALL VOLUME	780,453 cu ft
SOIL LOSSES	411,828 cu ft
EFFECTIVE RAIN	0.94 in
FLOOD VOLUME	8.46 ac-ft
FLOOD VOLUME	368,625 cu ft
REQUIRED STORAGE	8.74 ac-ft
REQUIRED STORAGE	380,798 cu ft
MAX WSEL	357.52 ft
PEAK FLOW RATE	172.43 cfs
TOTAL BASIN LOSSES	405,298 cu ft
TOTAL OVERFLOW OUT	1,824 cu ft

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

6-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-2B
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	107.50
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	14.88
UNIT TIME-PERCENT OF LAG	33.6
TOTAL ADJUSTED STORM RAIN (in)	2.66
CONSTANT LOSS RATE (in/hr)	0.38
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	0.49 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu ft	Overflow In cu ft	Basin Volume cu ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu ft	Basin Losses Percolation Out cu ft	Basin Losses Drain Tile Out cu ft	Basin Losses Overflow Out cu ft	Total In Basin cu ft	Total In Basin ac-ft	Basin WSEL ft
1	5	0.08	0.5	0.16	0.38	0.14	0.02	2.60	779	0	779	122,507	417	417	161	0	200	0.00	355.70
2	10	0.17	0.6	0.19	0.38	0.16	0.03	3.11	934	0	1,135	122,614	417	417	161	0	556	0.01	355.70
3	15	0.25	0.6	0.19	0.38	0.16	0.03	3.11	934	0	1,490	122,720	418	418	161	0	911	0.02	355.71
4	20	0.33	0.6	0.19	0.38	0.16	0.03	3.11	934	0	1,846	122,826	418	418	161	0	1,266	0.03	355.71
5	25	0.42	0.6	0.19	0.38	0.16	0.03	3.11	934	0	2,201	122,932	418	418	161	0	1,621	0.04	355.71
6	30	0.50	0.7	0.22	0.38	0.19	0.03	3.63	1,090	0	2,711	123,084	419	419	161	0	2,131	0.05	355.71
7	35	0.58	0.7	0.22	0.38	0.19	0.03	3.63	1,090	0	3,221	123,237	419	419	161	0	2,640	0.06	355.72
8	40	0.67	0.7	0.22	0.38	0.19	0.03	3.63	1,090	0	3,730	123,389	420	420	161	0	3,149	0.07	355.72
9	45	0.75	0.7	0.22	0.38	0.19	0.03	3.63	1,090	0	4,239	123,541	420	420	161	0	3,657	0.08	355.72
10	50	0.83	0.7	0.22	0.38	0.19	0.03	3.63	1,090	0	4,747	123,692	421	421	161	0	4,165	0.10	355.72
11	55	0.92	0.7	0.22	0.38	0.19	0.03	3.63	1,090	0	5,255	123,844	421	421	161	0	4,672	0.11	355.73
12	60	1.00	0.8	0.26	0.38	0.22	0.04	4.15	1,246	0	5,918	124,042	422	422	161	0	5,335	0.12	355.73
13	65	1.08	0.8	0.26	0.38	0.22	0.04	4.15	1,246	0	6,580	124,240	423	423	161	0	5,996	0.14	355.73
14	70	1.17	0.8	0.26	0.38	0.22	0.04	4.15	1,246	0	7,242	124,437	423	423	161	0	6,657	0.15	355.74
15	75	1.25	0.8	0.26	0.38	0.22	0.04	4.15	1,246	0	7,903	124,634	424	424	161	0	7,317	0.17	355.74
16	80	1.33	0.8	0.26	0.38	0.22	0.04	4.15	1,246	0	8,563	124,832	425	425	161	0	7,977	0.18	355.75
17	85	1.42	0.8	0.26	0.38	0.22	0.04	4.15	1,246	0	9,223	125,028	425	425	161	0	8,636	0.20	355.75
18	90	1.50	0.8	0.26	0.38	0.22	0.04	4.15	1,246	0	9,881	125,225	426	426	161	0	9,294	0.21	355.75
19	95	1.58	0.8	0.26	0.38	0.22	0.04	4.15	1,246	0	10,540	125,422	427	427	161	0	9,952	0.23	355.76
20	100	1.67	0.8	0.26	0.38	0.22	0.04	4.15	1,246	0	11,197	125,618	427	427	161	0	10,609	0.24	355.76
21	105	1.75	0.8	0.26	0.38	0.22	0.04	4.15	1,246	0	11,854	125,814	428	428	161	0	11,265	0.26	355.76
22	110	1.83	0.8	0.26	0.38	0.22	0.04	4.15	1,246	0	12,510	126,010	429	429	161	0	11,920	0.27	355.77
23	115	1.92	0.8	0.26	0.38	0.22	0.04	4.15	1,246	0	13,166	126,206	429	429	161	0	12,575	0.29	355.77
24	120	2.00	0.9	0.29	0.38	0.24	0.04	4.67	1,401	0	13,977	126,448	430	430	161	0	13,385	0.31	355.78
25	125	2.08	0.8	0.26	0.38	0.22	0.04	4.15	1,246	0	14,631	126,643	431	431	161	0	14,038	0.32	355.78
26	130	2.17	0.9	0.29	0.38	0.24	0.04	4.67	1,401	0	15,440	126,885	432	432	161	0	14,847	0.34	355.79
27	135	2.25	0.9	0.29	0.38	0.24	0.04	4.67	1,401	0	16,248	127,126	433	433	161	0	15,654	0.36	355.79
28	140	2.33	0.9	0.29	0.38	0.24	0.04	4.67	1,401	0	17,056	127,367	433	433	161	0	16,461	0.38	355.79
29	145	2.42	0.9	0.29	0.38	0.24	0.04	4.67	1,401	0	17,862	127,608	434	434	161	0	17,267	0.40	355.80
30	150	2.50	0.9	0.29	0.38	0.24	0.04	4.67	1,401	0	18,668	127,849	435	435	161	0	18,072	0.41	355.80
31	155	2.58	0.9	0.29	0.38	0.24	0.04	4.67	1,401	0	19,473	128,089	436	436	161	0	18,876	0.43	355.81
32	160	2.67	0.9	0.29	0.38	0.24	0.04	4.67	1,401	0	20,277	128,329	437	437	161	0	19,679	0.45	355.81
33	165	2.75	1.0	0.32	0.38	0.27	0.05	5.19	1,557	0	21,236	128,615	438	438	161	0	20,637	0.47	355.82
34	170	2.83	1.0	0.32	0.38	0.27	0.05	5.19	1,557	0	22,194	128,901	439	439	161	0	21,595	0.50	355.82
35	175	2.92	1.0	0.32	0.38	0.27	0.05	5.19	1,557	0	23,152	129,187	440	440	161	0	22,551	0.52	355.83
36	180	3.00	1.0	0.32	0.38	0.27	0.05	5.19	1,557	0	24,108	129,473	441	441	161	0	23,506	0.54	355.84
37	185	3.08	1.0	0.32	0.38	0.27	0.05	5.19	1,557	0	25,063	129,758	442	442	161	0	24,460	0.56	355.84
38	190	3.17	1.1	0.35	0.38	0.30	0.05	5.71	1,713	0	26,173	130,089	443	443	161	0	25,569	0.59	355.85
39	195	3.25	1.1	0.35	0.38	0.30	0.05	5.71	1,713	0	27,282	130,420	444	444	161	0	26,677	0.61	355.85
40	200	3.33	1.1	0.35	0.38	0.30	0.05	5.71	1,713	0	28,389	130,751	445	445	161	0	27,783	0.64	355.86
41	205	3.42	1.2	0.38	0.38	0.33	0.01	0.63	188	0	27,971	130,626	444	444	161	0	27,366	0.63	355.86
42	210	3.50	1.3	0.41	0.38	0.35	0.04	4.09	1,226	0	28,592	130,811	445	445	161	0	27,985	0.64	355.86
43	215	3.58	1.4	0.45	0.38	0.38	0.07	7.55	2,264	0	30,250	131,306	447	447	161	0	29,641	0.68	355.87
44	220	3.67	1.4	0.45	0.38	0.38	0.07	7.55	2,264	0	31,906	131,801	448	448	161	0	31,296	0.72	355.88
45	225	3.75	1.5	0.48	0.38	0.41	0.10	11.01	3,302	0	34,598	132,605	451	451	161	0	33,986	0.78	355.90
46	230	3.83	1.5	0.48	0.38	0.41	0.10	11.01	3,302	0	37,288	133,408	454	454	161	0	36,673	0.84	355.91
47	235	3.92	1.6	0.51	0.38	0.43	0.13	14.47	4,340	0	41,013	134,520	458	458	161	0	40,394	0.93	355.93
48	240	4.00	1.6	0.51	0.38	0.43	0.13	14.47	4,340	0	44,734	135,631	462	462	161	0	44,111	1.01	355.95
49	245	4.08	1.7	0.54	0.38	0.46	0.17	17.93	5,378	0	49,489	137,051	466	466	161	0	48,862	1.12	355.98
50	250	4.17	1.8	0.57	0.38	0.49	0.20	21.39	6,416	0	55,278	138,779	472	472	161	0	54,645	1.25	356.01
51	255	4.25	1.9	0.61	0.38	0.52	0.23	24.85	7,454	0	62,099	140,815	479	479	161	0	61,458	1.41	356.05
52	260	4.33	2.0	0.64	0.38	0.54	0.26	28.31	8,492	0	69,951	143,159	487	487	161	0	69,302	1.59	356.10
53	265	4.42	2.1	0.67	0.38	0.57	0.29	31.77	9,530	0	78,832	145,811	496	496	161	0	78,175	1.79	356.15

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

6-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-2B
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	107.50
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	14.88
UNIT TIME-PERCENT OF LAG	33.6
TOTAL ADJUSTED STORM RAIN (in)	2.66
CONSTANT LOSS RATE (in/hr)	0.38
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	0.49 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu ft	Overflow In cu ft	Basin Volume cu ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu ft	Basin Losses Percolation Out cu ft	Basin Losses Drain Tile Out cu ft	Basin Losses Overflow Out cu ft	Total In Basin cu ft	Total In Basin ac-ft	Basin WSEL ft
54	270	4.50	2.1	0.67	0.38	0.57	0.29	31.77	9,530	0	87,705	148,460	505	505	161	0	87,039	2.00	356.20
55	275	4.58	2.2	0.70	0.38	0.60	0.32	35.23	10,568	0	97,607	151,417	515	515	161	0	96,931	2.23	356.26
56	280	4.67	2.3	0.73	0.38	0.62	0.36	38.69	11,606	0	108,537	154,680	526	526	161	0	107,849	2.48	356.32
57	285	4.75	2.4	0.77	0.38	0.65	0.39	42.15	12,644	0	120,493	158,250	538	538	161	0	119,794	2.75	356.39
58	290	4.83	2.4	0.77	0.38	0.65	0.39	42.15	12,644	0	132,438	161,816	551	551	161	0	131,726	3.02	356.46
59	295	4.92	2.5	0.80	0.38	0.68	0.42	45.61	13,682	0	145,408	165,688	564	564	161	0	144,683	3.32	356.53
60	300	5.00	2.6	0.83	0.38	0.71	0.45	49.07	14,720	0	159,403	169,867	578	578	161	0	158,664	3.64	356.61
61	305	5.08	3.1	0.99	0.38	0.84	0.61	66.37	19,910	0	178,574	175,590	597	597	161	0	177,816	4.08	356.72
62	310	5.17	3.6	1.15	0.38	0.98	0.77	83.67	25,100	0	202,916	182,858	622	622	161	0	202,132	4.64	356.86
63	315	5.25	3.9	1.24	0.38	1.06	0.87	94.05	28,214	0	230,347	191,047	650	650	161	0	229,535	5.27	357.02
64	320	5.33	4.2	1.34	0.38	1.14	0.96	104.43	31,328	0	260,864	200,159	681	681	161	0	260,021	5.97	357.20
65	325	5.42	4.7	1.50	0.38	1.28	1.12	121.73	36,518	4,623	301,163	212,190	722	722	161	0	300,279	6.89	**357.43**
66	330	5.50	5.6	1.79	0.38	1.52	1.41	**152.87**	**45,860**	38,286	384,425	231,323	787	787	161	2,679	**380,798**	**8.74**	
67	335	5.58	1.9	0.61	0.38	0.52	0.23	24.85	7,454	4,810	393,062	231,323	787	787	161	11,316	**380,798**	**8.74**	
68	340	5.67	0.9	0.29	0.38	0.24	0.04	4.67	1,401	695	382,894	231,323	787	787	161	1,148	**380,798**	**8.74**	
69	345	5.75	0.6	0.19	0.38	0.16	0.03	3.11	934	287	382,020	231,323	787	787	161	273	**380,798**	**8.74**	
70	350	5.83	0.5	0.16	0.38	0.14	0.02	2.60	779	152	381,728	231,323	787	787	161	0	380,780	8.74	
71	355	5.92	0.3	0.10	0.38	0.08	0.01	1.56	467	0	381,247	231,323	787	787	161	0	380,298	8.73	
72	360	6.00	0.2	0.06	0.38	0.05	0.01	1.04	311	0	380,610	231,323	787	787	161	0	379,661	8.72	

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL	2.66 in
RAINFALL VOLUME	1,038,003 cu ft
SOIL LOSSES	644,449 cu ft
EFFECTIVE RAIN	1.01 in
FLOOD VOLUME	9.03 ac-ft
FLOOD VOLUME	393,554 cu ft
REQUIRED STORAGE	8.74 ac-ft
REQUIRED STORAGE	380,798 cu ft
MAX WSEL	357.43 ft
PEAK FLOW RATE	152.87 cfs
TOTAL BASIN LOSSES	35,719 cu ft
TOTAL OVERFLOW OUT	15,416 cu ft

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

24-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-2B
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	107.50
UNIT TIME-MINUTES	15
LAG TIME - MINUTES	14.88
UNIT TIME-PERCENT OF LAG	101%
TOTAL ADJUSTED STORM RAIN (in)	4.21

VARIABLE LOSS RATE (AVG) IN/HR	
Fm = Minimum value on loss curve (in/hr)	0.19
C	0.00349
Low Loss Rate (percent)	85.00%

Basin Percolation Rate	0.49 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu ft	Overflow In cu ft	Basin Volume cu ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu ft	Basin Losses Percolation Out cu ft	Basin Losses Drain Tile Out cu ft	Basin Losses Overflow Out cu ft	Total In Basin cu ft	Total In Basin ac-ft	Basin WSEL ft
1	15	0.25	0.2	0.034	0.666	0.029	0.01	0.55	493	0	493	122,422	1,250	493	0	0	0	0.00	355.70
2	30	0.50	0.3	0.051	0.658	0.043	0.01	0.82	739	0	739	122,496	1,250	739	0	0	0	0.00	355.70
3	45	0.75	0.3	0.051	0.651	0.043	0.01	0.82	739	0	739	122,496	1,250	739	0	0	0	0.00	355.70
4	60	1.00	0.4	0.067	0.643	0.057	0.01	1.10	986	0	986	122,569	1,251	986	0	0	0	0.00	355.70
5	75	1.25	0.3	0.051	0.636	0.043	0.01	0.82	739	0	739	122,496	1,250	739	0	0	0	0.00	355.70
6	90	1.50	0.3	0.051	0.628	0.043	0.01	0.82	739	0	739	122,496	1,250	739	0	0	0	0.00	355.70
7	105	1.75	0.3	0.051	0.620	0.043	0.01	0.82	739	0	739	122,496	1,250	739	0	0	0	0.00	355.70
8	120	2.00	0.4	0.067	0.613	0.057	0.01	1.10	986	0	986	122,569	1,251	986	0	0	0	0.00	355.70
9	135	2.25	0.4	0.067	0.606	0.057	0.01	1.10	986	0	986	122,569	1,251	986	0	0	0	0.00	355.70
10	150	2.50	0.4	0.067	0.598	0.057	0.01	1.10	986	0	986	122,569	1,251	986	0	0	0	0.00	355.70
11	165	2.75	0.5	0.084	0.591	0.072	0.01	1.37	1,232	0	1,232	122,643	1,252	1,232	0	0	0	0.00	355.70
12	180	3.00	0.5	0.084	0.584	0.072	0.01	1.37	1,232	0	1,232	122,643	1,252	1,232	0	0	0	0.00	355.70
13	195	3.25	0.5	0.084	0.576	0.072	0.01	1.37	1,232	0	1,232	122,643	1,252	1,232	0	0	0	0.00	355.70
14	210	3.50	0.5	0.084	0.569	0.072	0.01	1.37	1,232	0	1,232	122,643	1,252	1,232	0	0	0	0.00	355.70
15	225	3.75	0.5	0.084	0.562	0.072	0.01	1.37	1,232	0	1,232	122,643	1,252	1,232	0	0	0	0.00	355.70
16	240	4.00	0.6	0.101	0.555	0.086	0.02	1.64	1,479	0	1,479	122,716	1,253	1,253	226	0	0	0.00	355.70
17	255	4.25	0.6	0.101	0.548	0.086	0.02	1.64	1,479	0	1,479	122,716	1,253	1,253	226	0	0	0.00	355.70
18	270	4.50	0.7	0.118	0.541	0.100	0.02	1.92	1,725	0	1,725	122,790	1,253	1,253	472	0	0	0.00	355.70
19	285	4.75	0.7	0.118	0.534	0.100	0.02	1.92	1,725	0	1,725	122,790	1,253	1,253	472	0	0	0.00	355.70
20	300	5.00	0.8	0.135	0.527	0.115	0.02	2.19	1,971	0	1,971	122,864	1,254	1,254	484	0	233	0.01	355.70
21	315	5.25	0.6	0.101	0.520	0.086	0.02	1.64	1,479	0	1,712	122,786	1,253	1,253	459	0	0	0.00	355.70
22	330	5.50	0.7	0.118	0.514	0.100	0.02	1.92	1,725	0	1,725	122,790	1,253	1,253	472	0	0	0.00	355.70
23	345	5.75	0.8	0.135	0.507	0.115	0.02	2.19	1,971	0	1,971	122,864	1,254	1,254	484	0	233	0.01	355.70
24	360	6.00	0.8	0.135	0.500	0.115	0.02	2.19	1,971	0	2,205	122,933	1,255	1,255	484	0	466	0.01	355.70
25	375	6.25	0.9	0.152	0.494	0.129	0.02	2.46	2,218	0	2,684	123,076	1,256	1,256	484	0	944	0.02	355.71
26	390	6.50	0.9	0.152	0.487	0.129	0.02	2.46	2,218	0	3,162	123,219	1,258	1,258	484	0	1,420	0.03	355.71
27	405	6.75	1.0	0.168	0.480	0.143	0.03	2.74	2,464	0	3,884	123,435	1,260	1,260	484	0	2,141	0.05	355.71
28	420	7.00	1.0	0.168	0.474	0.143	0.03	2.74	2,464	0	4,605	123,650	1,262	1,262	484	0	2,859	0.07	355.72
29	435	7.25	1.0	0.168	0.468	0.143	0.03	2.74	2,464	0	5,323	123,864	1,264	1,264	484	0	3,575	0.08	355.72
30	450	7.50	1.1	0.185	0.461	0.157	0.03	3.01	2,711	0	6,286	124,152	1,267	1,267	484	0	4,535	0.10	355.73
31	465	7.75	1.2	0.202	0.455	0.172	0.03	3.29	2,957	0	7,492	124,512	1,271	1,271	484	0	5,737	0.13	355.73
32	480	8.00	1.3	0.219	0.449	0.186	0.03	3.56	3,204	0	8,940	124,944	1,275	1,275	484	0	7,181	0.16	355.74
33	495	8.25	1.5	0.253	0.442	0.215	0.04	4.11	3,696	0	10,878	125,523	1,281	1,281	484	0	9,112	0.21	355.75
34	510	8.50	1.5	0.253	0.436	0.215	0.04	4.11	3,696	0	12,809	126,099	1,287	1,287	484	0	11,038	0.25	355.76
35	525	8.75	1.6	0.269	0.430	0.229	0.04	4.38	3,943	0	14,981	126,748	1,294	1,294	484	0	13,203	0.30	355.78
36	540	9.00	1.7	0.286	0.424	0.243	0.04	4.65	4,189	0	17,392	127,468	1,301	1,301	484	0	15,607	0.36	355.79
37	555	9.25	1.9	0.320	0.418	0.272	0.05	5.20	4,682	0	20,290	128,333	1,310	1,310	484	0	18,496	0.42	355.81
38	570	9.50	2.0	0.337	0.412	0.286	0.05	5.48	4,929	0	23,424	129,269	1,320	1,320	484	0	21,621	0.50	355.82
39	585	9.75	2.1	0.354	0.406	0.301	0.05	5.75	5,175	0	26,796	130,275	1,330	1,330	484	0	24,982	0.57	355.84
40	600	10.00	2.2	0.370	0.400	0.315	0.06	6.02	5,421	0	30,404	131,352	1,341	1,341	484	0	28,579	0.66	355.86
41	615	10.25	1.5	0.253	0.395	0.215	0.04	4.11	3,696	0	32,275	131,911	1,347	1,347	484	0	30,445	0.70	355.88
42	630	10.50	1.5	0.253	0.389	0.215	0.04	4.11	3,696	0	34,142	132,468	1,352	1,352	484	0	32,306	0.74	355.89
43	645	10.75	2.0	0.337	0.383	0.286	0.05	5.48	4,929	0	37,234	133,392	1,362	1,362	484	0	35,389	0.81	355.90
44	660	11.00	2.0	0.337	0.378	0.286	0.05	5.48	4,929	0	40,317	134,312	1,371	1,371	484	0	38,462	0.88	355.92
45	675	11.25	1.9	0.320	0.372	0.272	0.05	5.20	4,682	0	43,144	135,156	1,380	1,380	484	0	41,281	0.95	355.94
46	690	11.50	1.9	0.320	0.367	0.272	0.05	5.20	4,682	0	45,963	135,998	1,388	1,388	484	0	44,091	1.01	355.95
47	705	11.75	1.7	0.286	0.361	0.243	0.04	4.65	4,189	0	48,280	136,690	1,395	1,395	484	0	46,401	1.07	355.97
48	720	12.00	1.8	0.303	0.356	0.258	0.05	4.93	4,436	0	50,837	137,453	1,403	1,403	484	0	48,950	1.12	355.98
49	735	12.25	2.5	0.421	0.350	0.358	0.07	7.65	6,888	0	55,838	138,946	1,418	1,418	484	0	53,936	1.24	356.01
50	750	12.50	2.6	0.438	0.345	0.372	0.09	10.05	9,043	0	62,979	141,078	1,440	1,440	484	0	61,055	1.40	356.05
51	765	12.75	2.8	0.472	0.340	0.401	0.13	14.26	12,835	0	73,890	144,336	1,473	1,473	484	0	71,932	1.65	356.11
52	780	13.00	2.9	0.488	0.335	0.415	0.15	16.64	14,977	0	86,910	148,223	1,513	1,513	484	0	84,913	1.95	356.19
53	795	13.25	3.4	0.573	0.330	0.487	0.24	26.32	23,685	0	108,598	154,698	1,579	1,579	484	0	106,535	2.45	356.31
54	810	13.50	3.4	0.573	0.325	0.487	0.25	**26.86**	**24,173**	0	130,708	161,299	1,647	1,647	484	0	128,578	2.95	356.44
55	825	13.75	2.3	0.387	0.320	0.329	0.07	7.31	6,583	0	135,161	162,629	1,660	1,660	484	0	133,017	3.05	356.46
56	840	14.00	2.3	0.387	0.315	0.329	0.07	7.84	7,058	0	140,074	164,096	1,675	1,675	484	0	137,915	3.17	356.49

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

24-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-2B
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	107.50
UNIT TIME-MINUTES	15
LAG TIME - MINUTES	14.88
UNIT TIME-PERCENT OF LAG	101%
TOTAL ADJUSTED STORM RAIN (in)	4.21

VARIABLE LOSS RATE (AVG) IN/HR	
Fm = Minimum value on loss curve (in/hr)	0.19
C	0.00349
Low Loss Rate (percent)	85.00%

Basin Percolation Rate	0.49 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu ft	Overflow In cu ft	Basin Volume cu ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu ft	Basin Losses Percolation Out cu ft	Basin Losses Drain Tile Out cu ft	Basin Losses Overflow Out cu ft	Total In Basin cu ft	Total In Basin ac-ft	Basin WSEL ft
57	855	14.25	2.7	0.455	0.310	0.386	0.14	15.66	14,098	0	152,013	167,660	1,712	1,712	484	0	149,818	3.44	356.56
58	870	14.50	2.6	0.438	0.305	0.372	0.13	14.35	12,917	0	162,735	170,861	1,744	1,744	484	0	160,507	3.68	356.62
59	885	14.75	2.6	0.438	0.301	0.372	0.14	14.86	13,372	0	173,879	174,188	1,778	1,778	484	0	171,617	3.94	356.69
60	900	15.00	2.5	0.421	0.296	0.358	0.12	13.53	12,178	0	183,795	177,149	1,808	1,808	484	0	181,503	4.17	356.74
61	915	15.25	2.4	0.404	0.292	0.344	0.11	12.20	10,978	0	192,481	179,742	1,835	1,835	484	0	190,162	4.37	356.79
62	930	15.50	2.3	0.387	0.287	0.329	0.10	10.86	9,770	0	199,932	181,967	1,858	1,858	484	0	197,591	4.54	356.84
63	945	15.75	1.9	0.320	0.283	0.272	0.04	4.03	3,627	0	201,218	182,351	1,861	1,861	484	0	198,873	4.57	356.84
64	960	16.00	1.9	0.320	0.278	0.272	0.04	4.50	4,049	0	202,922	182,859	1,867	1,867	484	0	**200,571**	**4.60**	**356.85**
65	975	16.25	0.4	0.067	0.274	0.057	0.01	1.10	986	0	201,557	182,452	1,863	1,863	484	0	199,211	4.57	356.85
66	990	16.50	0.4	0.067	0.270	0.057	0.01	1.10	986	0	200,196	182,046	1,858	1,858	484	0	197,854	4.54	356.84
67	1005	16.75	0.3	0.051	0.266	0.043	0.01	0.82	739	0	198,594	181,567	1,853	1,853	484	0	196,256	4.51	356.83
68	1020	17.00	0.3	0.051	0.262	0.043	0.01	0.82	739	0	196,996	181,090	1,849	1,849	484	0	194,663	4.47	356.82
69	1035	17.25	0.5	0.084	0.258	0.072	0.01	1.37	1,232	0	195,895	180,762	1,845	1,845	484	0	193,566	4.44	356.81
70	1050	17.50	0.5	0.084	0.254	0.072	0.01	1.37	1,232	0	194,799	180,434	1,842	1,842	484	0	192,473	4.42	356.81
71	1065	17.75	0.5	0.084	0.250	0.072	0.01	1.37	1,232	0	193,705	180,108	1,839	1,839	484	0	191,383	4.39	356.80
72	1080	18.00	0.4	0.067	0.247	0.057	0.01	1.10	986	0	192,368	179,709	1,835	1,835	484	0	190,050	4.36	356.79
73	1095	18.25	0.4	0.067	0.243	0.057	0.01	1.10	986	0	191,036	179,311	1,830	1,830	484	0	188,722	4.33	356.79
74	1110	18.50	0.4	0.067	0.239	0.057	0.01	1.10	986	0	189,707	178,914	1,826	1,826	484	0	187,397	4.30	356.78
75	1125	18.75	0.3	0.051	0.236	0.043	0.01	0.82	739	0	188,136	178,445	1,822	1,822	484	0	185,831	4.27	356.77
76	1140	19.00	0.2	0.034	0.233	0.029	0.01	0.55	493	0	186,324	177,904	1,816	1,816	484	0	184,024	4.22	356.76
77	1155	19.25	0.3	0.051	0.229	0.043	0.01	0.82	739	0	184,763	177,438	1,811	1,811	484	0	182,468	4.19	356.75
78	1170	19.50	0.4	0.067	0.226	0.057	0.01	1.10	986	0	183,454	177,047	1,807	1,807	484	0	181,163	4.16	356.74
79	1185	19.75	0.3	0.051	0.223	0.043	0.01	0.82	739	0	181,902	176,584	1,803	1,803	484	0	179,616	4.12	356.73
80	1200	20.00	0.2	0.034	0.220	0.029	0.01	0.55	493	0	180,109	176,048	1,797	1,797	484	0	177,828	4.08	356.72
81	1215	20.25	0.3	0.051	0.217	0.043	0.01	0.82	739	0	178,567	175,588	1,792	1,792	484	0	176,291	4.05	356.71
82	1230	20.50	0.3	0.051	0.214	0.043	0.01	0.82	739	0	177,030	175,129	1,788	1,788	484	0	174,759	4.01	356.70
83	1245	20.75	0.3	0.051	0.212	0.043	0.01	0.82	739	0	175,498	174,672	1,783	1,783	484	0	173,231	3.98	356.70
84	1260	21.00	0.2	0.034	0.209	0.029	0.01	0.55	493	0	173,724	174,142	1,778	1,778	484	0	171,462	3.94	356.69
85	1275	21.25	0.3	0.051	0.207	0.043	0.01	0.82	739	0	172,202	173,688	1,773	1,773	484	0	169,945	3.90	356.68
86	1290	21.50	0.2	0.034	0.204	0.029	0.01	0.55	493	0	170,438	173,161	1,768	1,768	484	0	168,186	3.86	356.67
87	1305	21.75	0.3	0.051	0.202	0.043	0.01	0.82	739	0	168,926	172,710	1,763	1,763	484	0	166,679	3.83	356.66
88	1320	22.00	0.2	0.034	0.200	0.029	0.01	0.55	493	0	167,172	172,186	1,758	1,758	484	0	164,930	3.79	356.65
89	1335	22.25	0.3	0.051	0.198	0.043	0.01	0.82	739	0	165,669	171,737	1,753	1,753	484	0	163,432	3.75	356.64
90	1350	22.50	0.2	0.034	0.196	0.029	0.01	0.55	493	0	163,925	171,217	1,748	1,748	484	0	161,694	3.71	356.63
91	1365	22.75	0.2	0.034	0.194	0.029	0.01	0.55	493	0	162,187	170,698	1,743	1,743	484	0	159,960	3.67	356.62
92	1380	23.00	0.2	0.034	0.193	0.029	0.01	0.55	493	0	160,453	170,180	1,737	1,737	484	0	158,232	3.63	356.61
93	1395	23.25	0.2	0.034	0.191	0.029	0.01	0.55	493	0	158,725	169,664	1,732	1,732	484	0	156,509	3.59	356.60
94	1410	23.50	0.2	0.034	0.190	0.029	0.01	0.55	493	0	157,002	169,150	1,727	1,727	484	0	154,792	3.55	356.59
95	1425	23.75	0.2	0.034	0.189	0.029	0.01	0.55	493	0	155,284	168,637	1,722	1,722	484	0	153,079	3.51	356.58
96	1440	24.00	0.2	0.034	0.189	0.029	0.01	0.55	493	0	153,572	168,126	1,716	1,716	484	0	151,372	3.48	356.57

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL	4.21 in
RAINFALL VOLUME	1,642,854 cu ft
SOIL LOSSES	1,311,477 cu ft
EFFECTIVE RAIN	0.85 in
FLOOD VOLUME	7.61 ac-ft
FLOOD VOLUME	331,377 cu ft
REQUIRED STORAGE	4.60 ac-ft
REQUIRED STORAGE	200,571 cu ft
MAX WSEL	356.85 ft
PEAK FLOW RATE	26.86 cfs
TOTAL BASIN LOSSES	331,377 cu ft
TOTAL OVERFLOW OUT	0 cu ft

BASIN VOLUME WORKSHEET

PROECT Thermal Ranch TTM 38578
JOB No. 2735
BASIN DESIGNATION: Retention Basin 2B

BASIN CHARACTERISTICS

CONTOUR ELEVATION	DEPTH		AREA		VOLUME		
	INCR (ft)	TOTAL (ft)	INCR (sf)	TOTAL (sf)	INCR (cuft)	TOTAL (cuft)	TOTAL (acre-ft)
355.7	0	0		122,275	0	0	0.00
357.8	2.1	2.1	109,048	231,323	365,246	365,246	8.38

WHERE: $$V = \frac{1}{3}(E_1 - E_2)\left(A_1 + A_2 + \sqrt{A_1 A_2}\right)$$

RCFCD SYNTHETIC UNIT HYDROGRAPH - SHORTCUT METHOD

DATA INPUT SHEET

DATE:	September 23, 2024
WORKSHEET PREPARED BY:	FOS
PROJECT NAME	Thermel Ranch TTM 38578
PROJECT NUMBER	2735
CONCENTRATION POINT DESIGNATION	Retention Basin 4
AREA DESIGNATION	DA-3A
AMC NUMBER	2

Low Loss Conditions: X=Existing; D=Developed; BS=Retention

AREA DESIG	SOIL GROUP	TRIBUTARY AREAS	ACRES	LOW LOSS CONDITION	RI NUMBER	AMC II INFILTRATION RATE	IMPERVIOUS PERCENT
5	B	SF - 1/4 ACRE	8.400	D	56	0.51	0.50
18	B	EQUESTRIAN CENTER	1.400	X	69	0.39	0.50
2	B	OFFSITE STREETS	2.000	D	56	0.51	0.90

LENGTH OF WATERCOURSE (L)	720 ft
LENGTH TO POINT OPPOSITE CENTROID (Lca)	170 ft
ELEVATION OF HEADWATER	357.9 ft
ELEVATION OF CONCENTRATION POINT	353.1 ft
AVERAGE MANNINGS 'N' VALUE	0.02
STORM FREQUENCY (YEAR)	100
LOW LOSS RATE (For Storms Greater Than 10 Years)	85%
POINT RAIN FROM NOAA ATLAS	**14**
1-HOUR	1.22 in
3-HOUR	2.00 in
6-HOUR	2.66 in
24-HOUR	4.21 in

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD BASIC DATA CALCULATION FORM	PROJECT: Thermel Ranch TTM 38578 Job No.: 2735 BY: FOS DATE: 9/23/24

PHYSICAL DATA

[1] CONCENTRATION POINT	Retention Basin 4
[2] AREA DESIGNATION	DA-3A
[3] AREA - ACRES	11.800
[4] L-FEET	720
[5] L-MILES	0.136
[6] La-FEET	170.00
[7] La-MILES	0.032
[8] ELEVATION OF HEADWATER	357.9
[9] ELEVATION OF CONCENTRATION POINT	353.1
[10] H-FEET	4.8
[11] S-FEET/MILE	35.2
[12] S^0.5	5.93
[13] L*LCA/S^0.5	0.001
[14] AVERAGE MANNINGS 'N'	0.02
[15] LAG TIME-HOURS	0.03
[16] LAG TIME-MINUTES	1.9
[17] 100% OF LAG-MINUTES	1.9
[18] 200% OF LAG-MINUTES	3.7

RAINFALL DATA

[1] AMC	II
[2] FREQUENCY-YEARS	100
NOAA ATLAS	**14**
[3] DURATION:	Point Rain
1-HOUR	1.22 in
3-HOUR	2.00 in
6-HOUR	2.66 in
24-HOUR	4.21 in

STORM EVENT SUMMARY

DURATION		1-HOUR	3-HOUR	6-HOUR	24-HOUR
TOTAL RAINFALL	(in)	1.22	2	2.66	4.21
RAINFALL VOLUME	(cuft)	52,258	85,668	113,939	180,332
SOIL LOSSES	(cuft)	10,347	30,615	57,572	121,843
EFFECTIVE RAIN	(in)	0.98	1.29	1.32	1.37
FLOOD VOLUME	(cu-ft)	41,911	55,054	56,367	58,489
	(acre-ft)	0.96	1.26	1.29	1.34
PEAK FLOW	(cfs)	N/A	20.54	18.39	4.34

NOTE: PEAK FLOW FOR THE 1-HOUR STORM IS NOT REPRESENTATIVE. PER RCFCD PEAK DISCHARGES FROM THE 3-HOUR STORM SHOULD NORMALLY COMPARE WELL WITH RATIONAL PEAKS.

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD BASIC DATA CALCULATION FORM AMC II	PROJECT:	Thermel Ranch TTM 38578		
		Job No.:	2735		
		BY:	FOS	DATE:	9/23/24

AVERAGE ADJUSTED LOSS RATE

SOIL GROUP [Plate C-1]	LAND USE	RI NUMBER [Plate E-6.1]	PERVIOUS AREA INFILTRATION RATE (in/hr) [Plate E-6.2]	DECIMAL PERCENT OF AREA IMPERVIOUS [Plate E-6.3]	ADJUSTED INFILTRATION RATE (in/hr)	AREA	AREA WEIGHTED AVERAGE	MAX AVERAGE ADJUSTED INFILTRATION RATE (in/hr)	LOW LOSS CONDITION	LOW LOSS RATE PER RCFC/2322 (in/hr)	MIN AVERAGE ADJUSTED INFILTRATION RATE (in/hr)
B	SF - 1/4 ACRE	56	0.51	50%	0.28	8.400	0.712	0.1997	DEVELOPED	0.5000	0.3559
B	EQUESTRIAN CENTER	69	0.39	50%	0.21	1.400	0.119	0.0254	UNDEVELOPED	0.9000	0.1068
B	OFFSITE STREETS	56	0.51	90%	0.10	2.000	0.169	0.0164	DEVELOPED	0.1800	0.0305
					SUM	11.800	SUM	0.2416			0.4932

VARIABLE LOSS RATE CURVE (24-HOUR STORM ONLY)

Fm= 0.120775424

C= 0.00224

Ft=C(24-(T/60))^1.55 = 0.00224 (24-(T/60))^1.55 + **0.12** in/hr

CONSTANT LOSS RATE (3 & 6 HOUR STORMS) = **0.2416** in/hr

LOW LOSS RATE = **0.8500** in/hr

Where:

T=Time in minutes. To get an average value for each unit time period, Use T=1/2 the unit time for the first time period, T=1 1/2 unit time for the second period, etc.

NOTE: Low loss rates established per RCFC/2322 (Dated: May-30-95)
For 10 Year Storms or Less
Undeveloped Condition: Low Loss = 90%
Developed Condition: Low Loss = 0.9 - (0.8 * %impervious)
Basin Site: Low Loss = 10%
For 100 Year Storm - Low Loss should be between 80% & 90% of the Rainfall Rate

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD SHORTCUT METHOD 1-HOUR STORM	PROJECT:	Thermel Ranch TTM 38578	
		Job No.:	2735	DATE
		BY:	FOS	9/23/24

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	11.80
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	1.86
UNIT TIME-PERCENT OF LAG	268.7
TOTAL ADJUSTED STORM RAIN-INCHES	1.22
CONSTANT LOSS RATE-in/hr	0.24
LOW LOSS RATE - PERCENT	85%

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs
1	5	0.08	3.6	0.53	0.24	0.45	0.29	3.40
2	10	0.17	4.2	0.61	0.24	0.52	0.37	4.44
3	15	0.25	4.4	0.64	0.24	0.55	0.40	4.79
4	20	0.33	4.6	0.67	0.24	0.57	0.43	5.14
5	25	0.42	5.0	0.73	0.24	0.62	0.49	5.84
6	30	0.50	5.6	0.82	0.24	0.70	0.58	6.88
7	35	0.58	6.4	0.94	0.24	0.80	0.70	8.27
8	40	0.67	8.1	1.19	0.24	1.01	0.94	11.24
9	45	0.75	13.1	1.92	0.24	1.63	1.68	19.95
10	50	0.83	34.5	5.05	0.24	4.29	4.81	**57.22**
11	55	0.92	6.7	0.98	0.24	0.83	0.74	8.80
12	60	1.00	3.8	0.56	0.24	0.47	0.31	3.75

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL (in)	1.22
RAINFALL VOLUME (cuft)	52,258
SOIL LOSSES (cuft)	10,347
EFFECTIVE RAIN (in)	0.98
FLOOD VOLUME (acft)	0.96
FLOOD VOLUME (cuft)	41,911
PEAK FLOW RATE (cfs)	57.22

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD SHORTCUT METHOD 3-HOUR STORM	PROJECT: Thermel Ranch TTM 38578 Job No.: 2735 DATE BY: FOS 9/23/24

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	11.80	
UNIT TIME-MINUTES	5	
LAG TIME - MINUTES	1.86	
UNIT TIME-PERCENT OF LAG	268.7	
TOTAL ADJUSTED STORM RAIN-INCHES	2.00	
CONSTANT LOSS RATE-in/hr		0.24
LOW LOSS RATE - PERCENT		85%

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs
1	5	0.08	1.3	0.31	0.24	0.27	0.07	0.84
2	10	0.17	1.3	0.31	0.24	0.27	0.07	0.84
3	15	0.25	1.1	0.26	0.24	0.22	0.02	0.27
4	20	0.33	1.5	0.36	0.24	0.31	0.12	1.41
5	25	0.42	1.5	0.36	0.24	0.31	0.12	1.41
6	30	0.50	1.8	0.43	0.24	0.37	0.19	2.27
7	35	0.58	1.5	0.36	0.24	0.31	0.12	1.41
8	40	0.67	1.8	0.43	0.24	0.37	0.19	2.27
9	45	0.75	1.8	0.43	0.24	0.37	0.19	2.27
10	50	0.83	1.5	0.36	0.24	0.31	0.12	1.41
11	55	0.92	1.6	0.38	0.24	0.33	0.14	1.69
12	60	1.00	1.8	0.43	0.24	0.37	0.19	2.27
13	65	1.08	2.2	0.53	0.24	0.45	0.29	3.41
14	70	1.17	2.2	0.53	0.24	0.45	0.29	3.41
15	75	1.25	2.2	0.53	0.24	0.45	0.29	3.41
16	80	1.33	2.0	0.48	0.24	0.41	0.24	2.84
17	85	1.42	2.6	0.62	0.24	0.53	0.38	4.55
18	90	1.50	2.7	0.65	0.24	0.55	0.41	4.84
19	95	1.58	2.4	0.58	0.24	0.49	0.33	3.98
20	100	1.67	2.7	0.65	0.24	0.55	0.41	4.84
21	105	1.75	3.3	0.79	0.24	0.67	0.55	6.55
22	110	1.83	3.1	0.74	0.24	0.63	0.50	5.98
23	115	1.92	2.9	0.70	0.24	0.59	0.45	5.41
24	120	2.00	3.0	0.72	0.24	0.61	0.48	5.69
25	125	2.08	3.1	0.74	0.24	0.63	0.50	5.98
26	130	2.17	4.2	1.01	0.24	0.86	0.77	9.12
27	135	2.25	5.0	1.20	0.24	1.02	0.96	11.40
28	140	2.33	3.5	0.84	0.24	0.71	0.60	7.12
29	145	2.42	6.8	1.63	0.24	1.39	1.39	16.54
30	150	2.50	7.3	1.75	0.24	1.49	1.51	17.97
31	155	2.58	8.2	1.97	0.24	1.67	1.73	**20.54**
32	160	2.67	5.9	1.42	0.24	1.20	1.17	13.97
33	165	2.75	2.0	0.48	0.24	0.41	0.24	2.84
34	170	2.83	1.8	0.43	0.24	0.37	0.19	2.27
35	175	2.92	1.8	0.43	0.24	0.37	0.19	2.27
36	180	3.00	0.6	0.14	0.24	0.12	0.02	0.26

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL (in)	2
RAINFALL VOLUME (cuft)	85,668
SOIL LOSSES (cuft)	30,615
EFFECTIVE RAIN (in)	1.29
FLOOD VOLUME (acft)	1.26
FLOOD VOLUME (cuft)	55,054
PEAK FLOW RATE (cfs)	20.54

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD SHORTCUT METHOD 6-HOUR STORM	PROJECT: Thermel Ranch TTM 38578 Job No.: 2735 DATE BY: FOS 9/23/24

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	11.80
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	1.86
UNIT TIME-PERCENT OF LAG	268.7
TOTAL ADJUSTED STORM RAIN-INCHES	2.66
CONSTANT LOSS RATE-in/hr	0.242
LOW LOSS RATE - PERCENT	85%

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs
1	5	0.08	0.5	0.160	0.24	0.14	0.02	0.28
2	10	0.17	0.6	0.192	0.24	0.16	0.03	0.34
3	15	0.25	0.6	0.192	0.24	0.16	0.03	0.34
4	20	0.33	0.6	0.192	0.24	0.16	0.03	0.34
5	25	0.42	0.6	0.192	0.24	0.16	0.03	0.34
6	30	0.50	0.7	0.223	0.24	0.19	0.03	0.40
7	35	0.58	0.7	0.223	0.24	0.19	0.03	0.40
8	40	0.67	0.7	0.223	0.24	0.19	0.03	0.40
9	45	0.75	0.7	0.223	0.24	0.19	0.03	0.40
10	50	0.83	0.7	0.223	0.24	0.19	0.03	0.40
11	55	0.92	0.7	0.223	0.24	0.19	0.03	0.40
12	60	1.00	0.8	0.255	0.24	0.22	0.01	0.16
13	65	1.08	0.8	0.255	0.24	0.22	0.01	0.16
14	70	1.17	0.8	0.255	0.24	0.22	0.01	0.16
15	75	1.25	0.8	0.255	0.24	0.22	0.01	0.16
16	80	1.33	0.8	0.255	0.24	0.22	0.01	0.16
17	85	1.42	0.8	0.255	0.24	0.22	0.01	0.16
18	90	1.50	0.8	0.255	0.24	0.22	0.01	0.16
19	95	1.58	0.8	0.255	0.24	0.22	0.01	0.16
20	100	1.67	0.8	0.255	0.24	0.22	0.01	0.16
21	105	1.75	0.8	0.255	0.24	0.22	0.01	0.16
22	110	1.83	0.8	0.255	0.24	0.22	0.01	0.16
23	115	1.92	0.8	0.255	0.24	0.22	0.01	0.16
24	120	2.00	0.9	0.287	0.24	0.24	0.05	0.54
25	125	2.08	0.8	0.255	0.24	0.22	0.01	0.16
26	130	2.17	0.9	0.287	0.24	0.24	0.05	0.54
27	135	2.25	0.9	0.287	0.24	0.24	0.05	0.54
28	140	2.33	0.9	0.287	0.24	0.24	0.05	0.54
29	145	2.42	0.9	0.287	0.24	0.24	0.05	0.54
30	150	2.50	0.9	0.287	0.24	0.24	0.05	0.54
31	155	2.58	0.9	0.287	0.24	0.24	0.05	0.54
32	160	2.67	0.9	0.287	0.24	0.24	0.05	0.54
33	165	2.75	1.0	0.319	0.24	0.27	0.08	0.92
34	170	2.83	1.0	0.319	0.24	0.27	0.08	0.92
35	175	2.92	1.0	0.319	0.24	0.27	0.08	0.92
36	180	3.00	1.0	0.319	0.24	0.27	0.08	0.92
37	185	3.08	1.0	0.319	0.24	0.27	0.08	0.92
38	190	3.17	1.1	0.351	0.24	0.30	0.11	1.30
39	195	3.25	1.1	0.351	0.24	0.30	0.11	1.30
40	200	3.33	1.1	0.351	0.24	0.30	0.11	1.30
41	205	3.42	1.2	0.383	0.24	0.33	0.14	1.68
42	210	3.50	1.3	0.415	0.24	0.35	0.17	2.06
43	215	3.58	1.4	0.447	0.24	0.38	0.21	2.44
44	220	3.67	1.4	0.447	0.24	0.38	0.21	2.44
45	225	3.75	1.5	0.479	0.24	0.41	0.24	2.82
46	230	3.83	1.5	0.479	0.24	0.41	0.24	2.82
47	235	3.92	1.6	0.511	0.24	0.43	0.27	3.20
48	240	4.00	1.6	0.511	0.24	0.43	0.27	3.20
49	245	4.08	1.7	0.543	0.24	0.46	0.30	3.58
50	250	4.17	1.8	0.575	0.24	0.49	0.33	3.96
51	255	4.25	1.9	0.606	0.24	0.52	0.36	4.34
52	260	4.33	2.0	0.638	0.24	0.54	0.40	4.72
53	265	4.42	2.1	0.670	0.24	0.57	0.43	5.10
54	270	4.50	2.1	0.670	0.24	0.57	0.43	5.10

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD SHORTCUT METHOD 6-HOUR STORM	PROJECT: Thermel Ranch TTM 38578 Job No.: 2735 DATE BY: FOS 9/23/24

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	11.80
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	1.86
UNIT TIME-PERCENT OF LAG	268.7
TOTAL ADJUSTED STORM RAIN-INCHES	2.66
CONSTANT LOSS RATE-in/hr	0.242
LOW LOSS RATE - PERCENT	85%

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs
55	275	4.58	2.2	0.702	0.24	0.60	0.46	5.48
56	280	4.67	2.3	0.734	0.24	0.62	0.49	5.86
57	285	4.75	2.4	0.766	0.24	0.65	0.52	6.24
58	290	4.83	2.4	0.766	0.24	0.65	0.52	6.24
59	295	4.92	2.5	0.798	0.24	0.68	0.56	6.62
60	300	5.00	2.6	0.830	0.24	0.71	0.59	7.00
61	305	5.08	3.1	0.990	0.24	0.84	0.75	8.90
62	310	5.17	3.6	1.149	0.24	0.98	0.91	10.80
63	315	5.25	3.9	1.245	0.24	1.06	1.00	11.94
64	320	5.33	4.2	1.341	0.24	1.14	1.10	13.08
65	325	5.42	4.7	1.500	0.24	1.28	1.26	14.98
66	330	5.50	5.6	1.788	0.24	1.52	1.55	**18.39**
67	335	5.58	1.9	0.606	0.24	0.52	0.36	4.34
68	340	5.67	0.9	0.287	0.24	0.24	0.05	0.54
69	345	5.75	0.6	0.192	0.24	0.16	0.03	0.34
70	350	5.83	0.5	0.160	0.24	0.14	0.02	0.28
71	355	5.92	0.3	0.096	0.24	0.08	0.01	0.17
72	360	6.00	0.2	0.064	0.24	0.05	0.01	0.11

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL (in)	2.66
RAINFALL VOLUME (cuft)	113,939
SOIL LOSSES (cuft)	57,572
EFFECTIVE RAIN (in)	1.32
FLOOD VOLUME (acft)	1.29
FLOOD VOLUME (cuft)	56,367
PEAK FLOW RATE (cfs)	18.39

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD SHORTCUT METHOD 24-HOUR STORM	PROJECT: Thermel Ranch TTM 38578 Job No.: 2735 DATE: BY: FOS 9/23/24

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	11.800	CONSTANT LOSS RATE-in/hr	n/a
UNIT TIME-MINUTES	15	VARIABLE LOSS RATE (AVG) in/hr	0.2416
LAG TIME - MINUTES	1.86	MINIMUM LOSS RATE (for var. loss) - in/hr	0.121
UNIT TIME-PERCENT OF LAG	806.1	LOW LOSS RATE - DECIMAL	0.85
TOTAL ADJUSTED STORM RAIN-INCHES	4.21	C	0.00224

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs
1	15	0.25	0.2	0.034	0.427	0.029	0.005	0.06
2	30	0.50	0.3	0.051	0.422	0.043	0.008	0.09
3	45	0.75	0.3	0.051	0.417	0.043	0.008	0.09
4	60	1.00	0.4	0.067	0.412	0.057	0.010	0.12
5	75	1.25	0.3	0.051	0.407	0.043	0.008	0.09
6	90	1.50	0.3	0.051	0.402	0.043	0.008	0.09
7	105	1.75	0.3	0.051	0.397	0.043	0.008	0.09
8	120	2.00	0.4	0.067	0.393	0.057	0.010	0.12
9	135	2.25	0.4	0.067	0.388	0.057	0.010	0.12
10	150	2.50	0.4	0.067	0.383	0.057	0.010	0.12
11	165	2.75	0.5	0.084	0.378	0.072	0.013	0.15
12	180	3.00	0.5	0.084	0.374	0.072	0.013	0.15
13	195	3.25	0.5	0.084	0.369	0.072	0.013	0.15
14	210	3.50	0.5	0.084	0.364	0.072	0.013	0.15
15	225	3.75	0.5	0.084	0.360	0.072	0.013	0.15
16	240	4.00	0.6	0.101	0.355	0.086	0.015	0.18
17	255	4.25	0.6	0.101	0.351	0.086	0.015	0.18
18	270	4.50	0.7	0.118	0.346	0.100	0.018	0.21
19	285	4.75	0.7	0.118	0.342	0.100	0.018	0.21
20	300	5.00	0.8	0.135	0.338	0.115	0.020	0.24
21	315	5.25	0.6	0.101	0.333	0.086	0.015	0.18
22	330	5.50	0.7	0.118	0.329	0.100	0.018	0.21
23	345	5.75	0.8	0.135	0.325	0.115	0.020	0.24
24	360	6.00	0.8	0.135	0.320	0.115	0.020	0.24
25	375	6.25	0.9	0.152	0.316	0.129	0.023	0.27
26	390	6.50	0.9	0.152	0.312	0.129	0.023	0.27
27	405	6.75	1.0	0.168	0.308	0.143	0.025	0.30
28	420	7.00	1.0	0.168	0.303	0.143	0.025	0.30
29	435	7.25	1.0	0.168	0.299	0.143	0.025	0.30
30	450	7.50	1.1	0.185	0.295	0.157	0.028	0.33
31	465	7.75	1.2	0.202	0.291	0.172	0.030	0.36
32	480	8.00	1.3	0.219	0.287	0.186	0.033	0.39
33	495	8.25	1.5	0.253	0.283	0.215	0.038	0.45
34	510	8.50	1.5	0.253	0.279	0.215	0.038	0.45
35	525	8.75	1.6	0.269	0.275	0.229	0.040	0.48
36	540	9.00	1.7	0.286	0.271	0.243	0.015	0.18
37	555	9.25	1.9	0.320	0.268	0.272	0.052	0.62
38	570	9.50	2.0	0.337	0.264	0.286	0.073	0.87
39	585	9.75	2.1	0.354	0.260	0.301	0.094	1.11
40	600	10.00	2.2	0.370	0.256	0.315	0.114	1.36
41	615	10.25	1.5	0.253	0.253	0.215	0.038	0.45
42	630	10.50	1.5	0.253	0.249	0.215	0.004	0.04
43	645	10.75	2.0	0.337	0.245	0.286	0.091	1.09
44	660	11.00	2.0	0.337	0.242	0.286	0.095	1.13
45	675	11.25	1.9	0.320	0.238	0.272	0.082	0.97
46	690	11.50	1.9	0.320	0.235	0.272	0.085	1.01
47	705	11.75	1.7	0.286	0.231	0.243	0.055	0.66
48	720	12.00	1.8	0.303	0.228	0.258	0.075	0.90
49	735	12.25	2.5	0.421	0.224	0.358	0.197	2.34
50	750	12.50	2.6	0.438	0.221	0.372	0.217	2.58
51	765	12.75	2.8	0.472	0.218	0.401	0.254	3.02
52	780	13.00	2.9	0.488	0.214	0.415	0.274	3.26
53	795	13.25	3.4	0.573	0.211	0.487	0.361	4.30
54	810	13.50	3.4	0.573	0.208	0.487	0.365	**4.34**
55	825	13.75	2.3	0.387	0.205	0.329	0.183	2.17
56	840	14.00	2.3	0.387	0.202	0.329	0.186	2.21
57	855	14.25	2.7	0.455	0.199	0.386	0.256	3.05
58	870	14.50	2.6	0.438	0.196	0.372	0.242	2.88
59	885	14.75	2.6	0.438	0.193	0.372	0.245	2.92
60	900	15.00	2.5	0.421	0.190	0.358	0.231	2.75
61	915	15.25	2.4	0.404	0.187	0.344	0.217	2.59
62	930	15.50	2.3	0.387	0.184	0.329	0.203	2.42
63	945	15.75	1.9	0.320	0.181	0.272	0.139	1.65

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD SHORTCUT METHOD 24-HOUR STORM	PROJECT: Thermel Ranch TTM 38578 Job No.: 2735 DATE: BY: FOS 9/23/24

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	11.800	CONSTANT LOSS RATE-in/hr	n/a
UNIT TIME-MINUTES	15	VARIABLE LOSS RATE (AVG) in/hr	0.2416
LAG TIME - MINUTES	1.86	MINIMUM LOSS RATE (for var. loss) - in/hr	0.121
UNIT TIME-PERCENT OF LAG	806.1	LOW LOSS RATE - DECIMAL	0.85
TOTAL ADJUSTED STORM RAIN-INCHES	4.21	C	0.00224

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs
64	960	16.00	1.9	0.320	0.178	0.272	0.142	1.69
65	975	16.25	0.4	0.067	0.176	0.057	0.010	0.12
66	990	16.50	0.4	0.067	0.173	0.057	0.010	0.12
67	1005	16.75	0.3	0.051	0.170	0.043	0.008	0.09
68	1020	17.00	0.3	0.051	0.168	0.043	0.008	0.09
69	1035	17.25	0.5	0.084	0.165	0.072	0.013	0.15
70	1050	17.50	0.5	0.084	0.163	0.072	0.013	0.15
71	1065	17.75	0.5	0.084	0.160	0.072	0.013	0.15
72	1080	18.00	0.4	0.067	0.158	0.057	0.010	0.12
73	1095	18.25	0.4	0.067	0.156	0.057	0.010	0.12
74	1110	18.50	0.4	0.067	0.153	0.057	0.010	0.12
75	1125	18.75	0.3	0.051	0.151	0.043	0.008	0.09
76	1140	19.00	0.2	0.034	0.149	0.029	0.005	0.06
77	1155	19.25	0.3	0.051	0.147	0.043	0.008	0.09
78	1170	19.50	0.4	0.067	0.145	0.057	0.010	0.12
79	1185	19.75	0.3	0.051	0.143	0.043	0.008	0.09
80	1200	20.00	0.2	0.034	0.141	0.029	0.005	0.06
81	1215	20.25	0.3	0.051	0.139	0.043	0.008	0.09
82	1230	20.50	0.3	0.051	0.137	0.043	0.008	0.09
83	1245	20.75	0.3	0.051	0.136	0.043	0.008	0.09
84	1260	21.00	0.2	0.034	0.134	0.029	0.005	0.06
85	1275	21.25	0.3	0.051	0.132	0.043	0.008	0.09
86	1290	21.50	0.2	0.034	0.131	0.029	0.005	0.06
87	1305	21.75	0.3	0.051	0.129	0.043	0.008	0.09
88	1320	22.00	0.2	0.034	0.128	0.029	0.005	0.06
89	1335	22.25	0.3	0.051	0.127	0.043	0.008	0.09
90	1350	22.50	0.2	0.034	0.126	0.029	0.005	0.06
91	1365	22.75	0.2	0.034	0.124	0.029	0.005	0.06
92	1380	23.00	0.2	0.034	0.123	0.029	0.005	0.06
93	1395	23.25	0.2	0.034	0.123	0.029	0.005	0.06
94	1410	23.50	0.2	0.034	0.122	0.029	0.005	0.06
95	1425	23.75	0.2	0.034	0.121	0.029	0.005	0.06
96	1440	24.00	0.2	0.034	0.121	0.029	0.005	0.06

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL (in)	4.21
RAINFALL VOLUME (cuft)	180,332
SOIL LOSSES (cuft)	121,843
EFFECTIVE RAIN (in)	1.37
FLOOD VOLUME (acft)	1.34
FLOOD VOLUME (cuft)	58,489
PEAK FLOW (cfs)	4.34

RCFCD SYNTHETIC UNIT HYDROGRAPH - SHORTCUT METHOD

DATA INPUT SHEET

DATE:	September 23, 2024
WORKSHEET PREPARED BY:	FOS
PROJECT NAME	Thermel Ranch TTM 38578
PROJECT NUMBER	2735
CONCENTRATION POINT DESIGNATION	Retention Basin 4
AREA DESIGNATION	DA-3B
AMC NUMBER	2

Low Loss Conditions: X=Existing; D=Developed; BS=Retention

AREA DESIG	SOIL GROUP	TRIBUTARY AREAS	ACRES	LOW LOSS CONDITION	RI NUMBER	AMC II INFILTRATION RATE	IMPERVIOUS PERCENT
5	B	SF - 1/4 ACRE	11.200	D	56	0.51	0.50
2	B	OFFSITE STREETS	1.100	D	56	0.51	0.90

LENGTH OF WATERCOURSE (L)	952 ft
LENGTH TO POINT OPPOSITE CENTROID (Lca)	541 ft
ELEVATION OF HEADWATER	357.9 ft
ELEVATION OF CONCENTRATION POINT	350.3 ft
AVERAGE MANNINGS 'N' VALUE	0.02
STORM FREQUENCY (YEAR)	100
LOW LOSS RATE (For Storms Greater Than 10 Years)	85%
POINT RAIN FROM NOAA ATLAS	**14**
1-HOUR	1.22 in
3-HOUR	2.00 in
6-HOUR	2.66 in
24-HOUR	4.21 in

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD BASIC DATA CALCULATION FORM	PROJECT: Thermel Ranch TTM 38578 Job No.: 2735 BY: FOS DATE: 9/23/24

PHYSICAL DATA

[1] CONCENTRATION POINT	Retention Basin 4
[2] AREA DESIGNATION	DA-3B
[3] AREA - ACRES	12.300
[4] L-FEET	952
[5] L-MILES	0.180
[6] La-FEET	541.00
[7] La-MILES	0.102
[8] ELEVATION OF HEADWATER	357.9
[9] ELEVATION OF CONCENTRATION POINT	350.3
[10] H-FEET	7.6
[11] S-FEET/MILE	42.2
[12] S^0.5	6.49
[13] L*LCA/S^0.5	0.003
[14] AVERAGE MANNINGS 'N'	0.02
[15] LAG TIME-HOURS	0.05
[16] LAG TIME-MINUTES	3.1
[17] 100% OF LAG-MINUTES	3.1
[18] 200% OF LAG-MINUTES	6.2

RAINFALL DATA

[1] AMC	II
[2] FREQUENCY-YEARS	100
NOAA ATLAS	**14**
[3] DURATION:	Point Rain
1-HOUR	1.22 in
3-HOUR	2.00 in
6-HOUR	2.66 in
24-HOUR	4.21 in

STORM EVENT SUMMARY

DURATION		1-HOUR	3-HOUR	6-HOUR	24-HOUR
TOTAL RAINFALL	(in)	1.22	2	2.66	4.21
RAINFALL VOLUME	(cuft)	54,472	89,298	118,767	187,973
SOIL LOSSES	(cuft)	11,791	34,698	62,515	132,219
EFFECTIVE RAIN	(in)	0.96	1.22	1.26	1.25
FLOOD VOLUME	(cu-ft)	42,681	54,600	56,251	55,754
	(acre-ft)	0.98	1.25	1.29	1.28
PEAK FLOW	(cfs)	N/A	21.13	18.89	4.28

NOTE: PEAK FLOW FOR THE 1-HOUR STORM IS NOT REPRESENTATIVE. PER RCFCD PEAK DISCHARGES FROM THE 3-HOUR STORM SHOULD NORMALLY COMPARE WELL WITH RATIONAL PEAKS.

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD BASIC DATA CALCULATION FORM AMC II	PROJECT:	Thermel Ranch TTM 38578		
		Job No.:	2735		
		BY:	FOS	DATE:	9/23/24

AVERAGE ADJUSTED LOSS RATE

SOIL GROUP [Plate C-1]	LAND USE	RI NUMBER [Plate E-6.1]	PERVIOUS AREA INFILTRATION RATE (in/hr) [Plate E-6.2]	DECIMAL PERCENT OF AREA IMPERVIOUS [Plate E-6.3]	ADJUSTED INFILTRATION RATE (in/hr)	AREA	AREA WEIGHTED AVERAGE	MAX AVERAGE ADJUSTED INFILTRATION RATE (in/hr)	LOW LOSS CONDITION	LOW LOSS RATE PER RCFC/2322 (in/hr)	MIN AVERAGE ADJUSTED INFILTRATION RATE (in/hr)
B	SF - 1/4 ACRE	56	0.51	50%	0.28	11.200	0.911	0.2554	DEVELOPED	0.5000	0.4553
B	OFFSITE STREETS	56	0.51	90%	0.10	1.100	0.089	0.0087	DEVELOPED	0.1800	0.0161
					SUM	12.300	SUM	0.2641			0.4714

VARIABLE LOSS RATE CURVE (24-HOUR STORM ONLY)

Fm= 0.132040244

C= 0.00245

Ft=C(24-(T/60))^1.55 = 0.00245 (24-(T/60))^1.55 + **0.13** in/hr

CONSTANT LOSS RATE (3 & 6 HOUR STORMS) = **0.2641** in/hr

LOW LOSS RATE = **0.8500** in/hr

Where:

T=Time in minutes. To get an average value for each unit time period, Use T=1/2 the unit time for the first time period, T=1 1/2 unit time for the second period, etc.

NOTE: Low loss rates established per RCFC/2322 (Dated: May-30-95)
For 10 Year Storms or Less
Undeveloped Condition: Low Loss = 90%
Developed Condition: Low Loss = 0.9 - (0.8 * %impervious)
Basin Site: Low Loss = 10%
For 100 Year Storm - Low Loss should be between 80% & 90% of the Rainfall Rate

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD SHORTCUT METHOD 1-HOUR STORM	PROJECT:	Thermel Ranch TTM 38578	
		Job No.:	2735	DATE
		BY:	FOS	9/23/24

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	12.30
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	3.10
UNIT TIME-PERCENT OF LAG	161.1
TOTAL ADJUSTED STORM RAIN-INCHES	1.22
CONSTANT LOSS RATE-in/hr	0.26
LOW LOSS RATE - PERCENT	85%

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs
1	5	0.08	3.6	0.53	0.26	0.45	0.26	3.26
2	10	0.17	4.2	0.61	0.26	0.52	0.35	4.35
3	15	0.25	4.4	0.64	0.26	0.55	0.38	4.71
4	20	0.33	4.6	0.67	0.26	0.57	0.41	5.08
5	25	0.42	5.0	0.73	0.26	0.62	0.47	5.80
6	30	0.50	5.6	0.82	0.26	0.70	0.56	6.89
7	35	0.58	6.4	0.94	0.26	0.80	0.67	8.35
8	40	0.67	8.1	1.19	0.26	1.01	0.92	11.43
9	45	0.75	13.1	1.92	0.26	1.63	1.65	20.51
10	50	0.83	34.5	5.05	0.26	4.29	4.79	**59.37**
11	55	0.92	6.7	0.98	0.26	0.83	0.72	8.89
12	60	1.00	3.8	0.56	0.26	0.47	0.29	3.62

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL (in)	1.22
RAINFALL VOLUME (cuft)	54,472
SOIL LOSSES (cuft)	11,791
EFFECTIVE RAIN (in)	0.96
FLOOD VOLUME (acft)	0.98
FLOOD VOLUME (cuft)	42,681
PEAK FLOW RATE (cfs)	59.37

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD SHORTCUT METHOD 3-HOUR STORM	PROJECT:	Thermel Ranch TTM 38578	
		Job No.:	2735	DATE
		BY:	FOS	9/23/24

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	12.30	
UNIT TIME-MINUTES	5	
LAG TIME - MINUTES	3.10	
UNIT TIME-PERCENT OF LAG	161.1	
TOTAL ADJUSTED STORM RAIN-INCHES	2.00	
CONSTANT LOSS RATE-in/hr		0.26
LOW LOSS RATE - PERCENT		85%

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs
1	5	0.08	1.3	0.31	0.26	0.27	0.05	0.59
2	10	0.17	1.3	0.31	0.26	0.27	0.05	0.59
3	15	0.25	1.1	0.26	0.26	0.22	0.04	0.49
4	20	0.33	1.5	0.36	0.26	0.31	0.10	1.19
5	25	0.42	1.5	0.36	0.26	0.31	0.10	1.19
6	30	0.50	1.8	0.43	0.26	0.37	0.17	2.08
7	35	0.58	1.5	0.36	0.26	0.31	0.10	1.19
8	40	0.67	1.8	0.43	0.26	0.37	0.17	2.08
9	45	0.75	1.8	0.43	0.26	0.37	0.17	2.08
10	50	0.83	1.5	0.36	0.26	0.31	0.10	1.19
11	55	0.92	1.6	0.38	0.26	0.33	0.12	1.49
12	60	1.00	1.8	0.43	0.26	0.37	0.17	2.08
13	65	1.08	2.2	0.53	0.26	0.45	0.26	3.27
14	70	1.17	2.2	0.53	0.26	0.45	0.26	3.27
15	75	1.25	2.2	0.53	0.26	0.45	0.26	3.27
16	80	1.33	2.0	0.48	0.26	0.41	0.22	2.68
17	85	1.42	2.6	0.62	0.26	0.53	0.36	4.46
18	90	1.50	2.7	0.65	0.26	0.55	0.38	4.76
19	95	1.58	2.4	0.58	0.26	0.49	0.31	3.87
20	100	1.67	2.7	0.65	0.26	0.55	0.38	4.76
21	105	1.75	3.3	0.79	0.26	0.67	0.53	6.55
22	110	1.83	3.1	0.74	0.26	0.63	0.48	5.95
23	115	1.92	2.9	0.70	0.26	0.59	0.43	5.36
24	120	2.00	3.0	0.72	0.26	0.61	0.46	5.65
25	125	2.08	3.1	0.74	0.26	0.63	0.48	5.95
26	130	2.17	4.2	1.01	0.26	0.86	0.74	9.23
27	135	2.25	5.0	1.20	0.26	1.02	0.94	11.61
28	140	2.33	3.5	0.84	0.26	0.71	0.58	7.14
29	145	2.42	6.8	1.63	0.26	1.39	1.37	16.97
30	150	2.50	7.3	1.75	0.26	1.49	1.49	18.45
31	155	2.58	8.2	1.97	0.26	1.67	1.70	**21.13**
32	160	2.67	5.9	1.42	0.26	1.20	1.15	14.29
33	165	2.75	2.0	0.48	0.26	0.41	0.22	2.68
34	170	2.83	1.8	0.43	0.26	0.37	0.17	2.08
35	175	2.92	1.8	0.43	0.26	0.37	0.17	2.08
36	180	3.00	0.6	0.14	0.26	0.12	0.02	0.27

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL (in)	2
RAINFALL VOLUME (cuft)	89,298
SOIL LOSSES (cuft)	34,698
EFFECTIVE RAIN (in)	1.22
FLOOD VOLUME (acft)	1.25
FLOOD VOLUME (cuft)	54,600
PEAK FLOW RATE (cfs)	21.13

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD SHORTCUT METHOD 6-HOUR STORM	PROJECT: Thermel Ranch TTM 38578 Job No.: 2735 DATE BY: FOS 9/23/24

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	12.30
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	3.10
UNIT TIME-PERCENT OF LAG	161.1
TOTAL ADJUSTED STORM RAIN-INCHES	2.66
CONSTANT LOSS RATE-in/hr	0.264
LOW LOSS RATE - PERCENT	85%

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs
1	5	0.08	0.5	0.160	0.26	0.14	0.02	0.30
2	10	0.17	0.6	0.192	0.26	0.16	0.03	0.36
3	15	0.25	0.6	0.192	0.26	0.16	0.03	0.36
4	20	0.33	0.6	0.192	0.26	0.16	0.03	0.36
5	25	0.42	0.6	0.192	0.26	0.16	0.03	0.36
6	30	0.50	0.7	0.223	0.26	0.19	0.03	0.42
7	35	0.58	0.7	0.223	0.26	0.19	0.03	0.42
8	40	0.67	0.7	0.223	0.26	0.19	0.03	0.42
9	45	0.75	0.7	0.223	0.26	0.19	0.03	0.42
10	50	0.83	0.7	0.223	0.26	0.19	0.03	0.42
11	55	0.92	0.7	0.223	0.26	0.19	0.03	0.42
12	60	1.00	0.8	0.255	0.26	0.22	0.04	0.48
13	65	1.08	0.8	0.255	0.26	0.22	0.04	0.48
14	70	1.17	0.8	0.255	0.26	0.22	0.04	0.48
15	75	1.25	0.8	0.255	0.26	0.22	0.04	0.48
16	80	1.33	0.8	0.255	0.26	0.22	0.04	0.48
17	85	1.42	0.8	0.255	0.26	0.22	0.04	0.48
18	90	1.50	0.8	0.255	0.26	0.22	0.04	0.48
19	95	1.58	0.8	0.255	0.26	0.22	0.04	0.48
20	100	1.67	0.8	0.255	0.26	0.22	0.04	0.48
21	105	1.75	0.8	0.255	0.26	0.22	0.04	0.48
22	110	1.83	0.8	0.255	0.26	0.22	0.04	0.48
23	115	1.92	0.8	0.255	0.26	0.22	0.04	0.48
24	120	2.00	0.9	0.287	0.26	0.24	0.02	0.29
25	125	2.08	0.8	0.255	0.26	0.22	0.04	0.48
26	130	2.17	0.9	0.287	0.26	0.24	0.02	0.29
27	135	2.25	0.9	0.287	0.26	0.24	0.02	0.29
28	140	2.33	0.9	0.287	0.26	0.24	0.02	0.29
29	145	2.42	0.9	0.287	0.26	0.24	0.02	0.29
30	150	2.50	0.9	0.287	0.26	0.24	0.02	0.29
31	155	2.58	0.9	0.287	0.26	0.24	0.02	0.29
32	160	2.67	0.9	0.287	0.26	0.24	0.02	0.29
33	165	2.75	1.0	0.319	0.26	0.27	0.06	0.68
34	170	2.83	1.0	0.319	0.26	0.27	0.06	0.68
35	175	2.92	1.0	0.319	0.26	0.27	0.06	0.68
36	180	3.00	1.0	0.319	0.26	0.27	0.06	0.68
37	185	3.08	1.0	0.319	0.26	0.27	0.06	0.68
38	190	3.17	1.1	0.351	0.26	0.30	0.09	1.08
39	195	3.25	1.1	0.351	0.26	0.30	0.09	1.08
40	200	3.33	1.1	0.351	0.26	0.30	0.09	1.08
41	205	3.42	1.2	0.383	0.26	0.33	0.12	1.48
42	210	3.50	1.3	0.415	0.26	0.35	0.15	1.87
43	215	3.58	1.4	0.447	0.26	0.38	0.18	2.27
44	220	3.67	1.4	0.447	0.26	0.38	0.18	2.27
45	225	3.75	1.5	0.479	0.26	0.41	0.21	2.66
46	230	3.83	1.5	0.479	0.26	0.41	0.21	2.66
47	235	3.92	1.6	0.511	0.26	0.43	0.25	3.06
48	240	4.00	1.6	0.511	0.26	0.43	0.25	3.06
49	245	4.08	1.7	0.543	0.26	0.46	0.28	3.45
50	250	4.17	1.8	0.575	0.26	0.49	0.31	3.85
51	255	4.25	1.9	0.606	0.26	0.52	0.34	4.25
52	260	4.33	2.0	0.638	0.26	0.54	0.37	4.64
53	265	4.42	2.1	0.670	0.26	0.57	0.41	5.04
54	270	4.50	2.1	0.670	0.26	0.57	0.41	5.04

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD SHORTCUT METHOD 6-HOUR STORM	PROJECT: Thermel Ranch TTM 38578 Job No.: 2735 DATE BY: FOS 9/23/24

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	12.30
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	3.10
UNIT TIME-PERCENT OF LAG	161.1
TOTAL ADJUSTED STORM RAIN-INCHES	2.66
CONSTANT LOSS RATE-in/hr	0.264
LOW LOSS RATE - PERCENT	85%

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs
55	275	4.58	2.2	0.702	0.26	0.60	0.44	5.43
56	280	4.67	2.3	0.734	0.26	0.62	0.47	5.83
57	285	4.75	2.4	0.766	0.26	0.65	0.50	6.23
58	290	4.83	2.4	0.766	0.26	0.65	0.50	6.23
59	295	4.92	2.5	0.798	0.26	0.68	0.53	6.62
60	300	5.00	2.6	0.830	0.26	0.71	0.57	7.02
61	305	5.08	3.1	0.990	0.26	0.84	0.73	9.00
62	310	5.17	3.6	1.149	0.26	0.98	0.89	10.98
63	315	5.25	3.9	1.245	0.26	1.06	0.98	12.16
64	320	5.33	4.2	1.341	0.26	1.14	1.08	13.35
65	325	5.42	4.7	1.500	0.26	1.28	1.24	15.33
66	330	5.50	5.6	1.788	0.26	1.52	1.52	**18.89**
67	335	5.58	1.9	0.606	0.26	0.52	0.34	4.25
68	340	5.67	0.9	0.287	0.26	0.24	0.02	0.29
69	345	5.75	0.6	0.192	0.26	0.16	0.03	0.36
70	350	5.83	0.5	0.160	0.26	0.14	0.02	0.30
71	355	5.92	0.3	0.096	0.26	0.08	0.01	0.18
72	360	6.00	0.2	0.064	0.26	0.05	0.01	0.12

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL (in)	2.66
RAINFALL VOLUME (cuft)	118,767
SOIL LOSSES (cuft)	62,515
EFFECTIVE RAIN (in)	1.26
FLOOD VOLUME (acft)	1.29
FLOOD VOLUME (cuft)	56,251
PEAK FLOW RATE (cfs)	18.89

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD SHORTCUT METHOD 24-HOUR STORM	PROJECT: Thermel Ranch TTM 38578 Job No.: 2735 DATE: BY: FOS 9/23/24

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	12.300	CONSTANT LOSS RATE-in/hr	n/a
UNIT TIME-MINUTES	15	VARIABLE LOSS RATE (AVG) in/hr	0.2641
LAG TIME - MINUTES	3.10	MINIMUM LOSS RATE (for var. loss) - in/hr	0.132
UNIT TIME-PERCENT OF LAG	483.2	LOW LOSS RATE - DECIMAL	0.85
TOTAL ADJUSTED STORM RAIN-INCHES	4.21	C	0.00245

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs
1	15	0.25	0.2	0.034	0.466	0.029	0.005	0.06
2	30	0.50	0.3	0.051	0.461	0.043	0.008	0.09
3	45	0.75	0.3	0.051	0.456	0.043	0.008	0.09
4	60	1.00	0.4	0.067	0.450	0.057	0.010	0.13
5	75	1.25	0.3	0.051	0.445	0.043	0.008	0.09
6	90	1.50	0.3	0.051	0.440	0.043	0.008	0.09
7	105	1.75	0.3	0.051	0.434	0.043	0.008	0.09
8	120	2.00	0.4	0.067	0.429	0.057	0.010	0.13
9	135	2.25	0.4	0.067	0.424	0.057	0.010	0.13
10	150	2.50	0.4	0.067	0.419	0.057	0.010	0.13
11	165	2.75	0.5	0.084	0.414	0.072	0.013	0.16
12	180	3.00	0.5	0.084	0.409	0.072	0.013	0.16
13	195	3.25	0.5	0.084	0.404	0.072	0.013	0.16
14	210	3.50	0.5	0.084	0.398	0.072	0.013	0.16
15	225	3.75	0.5	0.084	0.394	0.072	0.013	0.16
16	240	4.00	0.6	0.101	0.389	0.086	0.015	0.19
17	255	4.25	0.6	0.101	0.384	0.086	0.015	0.19
18	270	4.50	0.7	0.118	0.379	0.100	0.018	0.22
19	285	4.75	0.7	0.118	0.374	0.100	0.018	0.22
20	300	5.00	0.8	0.135	0.369	0.115	0.020	0.25
21	315	5.25	0.6	0.101	0.364	0.086	0.015	0.19
22	330	5.50	0.7	0.118	0.360	0.100	0.018	0.22
23	345	5.75	0.8	0.135	0.355	0.115	0.020	0.25
24	360	6.00	0.8	0.135	0.350	0.115	0.020	0.25
25	375	6.25	0.9	0.152	0.345	0.129	0.023	0.28
26	390	6.50	0.9	0.152	0.341	0.129	0.023	0.28
27	405	6.75	1.0	0.168	0.336	0.143	0.025	0.31
28	420	7.00	1.0	0.168	0.332	0.143	0.025	0.31
29	435	7.25	1.0	0.168	0.327	0.143	0.025	0.31
30	450	7.50	1.1	0.185	0.323	0.157	0.028	0.34
31	465	7.75	1.2	0.202	0.318	0.172	0.030	0.38
32	480	8.00	1.3	0.219	0.314	0.186	0.033	0.41
33	495	8.25	1.5	0.253	0.310	0.215	0.038	0.47
34	510	8.50	1.5	0.253	0.305	0.215	0.038	0.47
35	525	8.75	1.6	0.269	0.301	0.229	0.040	0.50
36	540	9.00	1.7	0.286	0.297	0.243	0.043	0.53
37	555	9.25	1.9	0.320	0.293	0.272	0.027	0.34
38	570	9.50	2.0	0.337	0.288	0.286	0.048	0.60
39	585	9.75	2.1	0.354	0.284	0.301	0.069	0.86
40	600	10.00	2.2	0.370	0.280	0.315	0.090	1.12
41	615	10.25	1.5	0.253	0.276	0.215	0.038	0.47
42	630	10.50	1.5	0.253	0.272	0.215	0.038	0.47
43	645	10.75	2.0	0.337	0.268	0.286	0.069	0.85
44	660	11.00	2.0	0.337	0.264	0.286	0.073	0.90
45	675	11.25	1.9	0.320	0.260	0.272	0.060	0.74
46	690	11.50	1.9	0.320	0.257	0.272	0.063	0.79
47	705	11.75	1.7	0.286	0.253	0.243	0.034	0.42
48	720	12.00	1.8	0.303	0.249	0.258	0.054	0.67
49	735	12.25	2.5	0.421	0.245	0.358	0.176	2.18
50	750	12.50	2.6	0.438	0.242	0.372	0.196	2.43
51	765	12.75	2.8	0.472	0.238	0.401	0.234	2.90
52	780	13.00	2.9	0.488	0.234	0.415	0.254	3.15
53	795	13.25	3.4	0.573	0.231	0.487	0.342	4.24
54	810	13.50	3.4	0.573	0.227	0.487	0.345	**4.28**
55	825	13.75	2.3	0.387	0.224	0.329	0.163	2.03
56	840	14.00	2.3	0.387	0.220	0.329	0.167	2.07
57	855	14.25	2.7	0.455	0.217	0.386	0.238	2.95
58	870	14.50	2.6	0.438	0.214	0.372	0.224	2.78
59	885	14.75	2.6	0.438	0.211	0.372	0.227	2.82
60	900	15.00	2.5	0.421	0.207	0.358	0.214	2.65
61	915	15.25	2.4	0.404	0.204	0.344	0.200	2.48
62	930	15.50	2.3	0.387	0.201	0.329	0.186	2.31
63	945	15.75	1.9	0.320	0.198	0.272	0.122	1.51

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD SHORTCUT METHOD 24-HOUR STORM	PROJECT: Thermel Ranch TTM 38578 Job No.: 2735 DATE: BY: FOS 9/23/24

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	12.300	CONSTANT LOSS RATE-in/hr	n/a
UNIT TIME-MINUTES	15	VARIABLE LOSS RATE (AVG) in/hr	0.2641
LAG TIME - MINUTES	3.10	MINIMUM LOSS RATE (for var. loss) - in/hr	0.132
UNIT TIME-PERCENT OF LAG	483.2	LOW LOSS RATE - DECIMAL	0.85
TOTAL ADJUSTED STORM RAIN-INCHES	4.21	C	0.00245

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs
64	960	16.00	1.9	0.320	0.195	0.272	0.125	1.55
65	975	16.25	0.4	0.067	0.192	0.057	0.010	0.13
66	990	16.50	0.4	0.067	0.189	0.057	0.010	0.13
67	1005	16.75	0.3	0.051	0.186	0.043	0.008	0.09
68	1020	17.00	0.3	0.051	0.183	0.043	0.008	0.09
69	1035	17.25	0.5	0.084	0.181	0.072	0.013	0.16
70	1050	17.50	0.5	0.084	0.178	0.072	0.013	0.16
71	1065	17.75	0.5	0.084	0.175	0.072	0.013	0.16
72	1080	18.00	0.4	0.067	0.173	0.057	0.010	0.13
73	1095	18.25	0.4	0.067	0.170	0.057	0.010	0.13
74	1110	18.50	0.4	0.067	0.168	0.057	0.010	0.13
75	1125	18.75	0.3	0.051	0.165	0.043	0.008	0.09
76	1140	19.00	0.2	0.034	0.163	0.029	0.005	0.06
77	1155	19.25	0.3	0.051	0.161	0.043	0.008	0.09
78	1170	19.50	0.4	0.067	0.158	0.057	0.010	0.13
79	1185	19.75	0.3	0.051	0.156	0.043	0.008	0.09
80	1200	20.00	0.2	0.034	0.154	0.029	0.005	0.06
81	1215	20.25	0.3	0.051	0.152	0.043	0.008	0.09
82	1230	20.50	0.3	0.051	0.150	0.043	0.008	0.09
83	1245	20.75	0.3	0.051	0.148	0.043	0.008	0.09
84	1260	21.00	0.2	0.034	0.146	0.029	0.005	0.06
85	1275	21.25	0.3	0.051	0.145	0.043	0.008	0.09
86	1290	21.50	0.2	0.034	0.143	0.029	0.005	0.06
87	1305	21.75	0.3	0.051	0.141	0.043	0.008	0.09
88	1320	22.00	0.2	0.034	0.140	0.029	0.005	0.06
89	1335	22.25	0.3	0.051	0.139	0.043	0.008	0.09
90	1350	22.50	0.2	0.034	0.137	0.029	0.005	0.06
91	1365	22.75	0.2	0.034	0.136	0.029	0.005	0.06
92	1380	23.00	0.2	0.034	0.135	0.029	0.005	0.06
93	1395	23.25	0.2	0.034	0.134	0.029	0.005	0.06
94	1410	23.50	0.2	0.034	0.133	0.029	0.005	0.06
95	1425	23.75	0.2	0.034	0.133	0.029	0.005	0.06
96	1440	24.00	0.2	0.034	0.132	0.029	0.005	0.06

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL (in)	4.21
RAINFALL VOLUME (cuft)	187,973
SOIL LOSSES (cuft)	132,219
EFFECTIVE RAIN (in)	1.25
FLOOD VOLUME (acft)	1.28
FLOOD VOLUME (cuft)	55,754
PEAK FLOW (cfs)	4.28

RCFCD SYNTHETIC UNIT HYDROGRAPH - SHORTCUT METHOD

DATA INPUT SHEET

DATE:	September 23, 2024
WORKSHEET PREPARED BY:	FOS
PROJECT NAME	Thermel Ranch TTM 38578
PROJECT NUMBER	2735
CONCENTRATION POINT DESIGNATION	Retention Basin 4
AREA DESIGNATION	DA-3C
AMC NUMBER	2

Low Loss Conditions: X=Existing; D=Developed; BS=Retention

AREA DESIG	SOIL GROUP	TRIBUTARY AREAS	ACRES	LOW LOSS CONDITION	RI NUMBER	AMC II INFILTRATION RATE	IMPERVIOUS PERCENT
5	B	SF - 1/4 ACRE	8.800	D	56	0.51	0.50
2	B	OFFSITE STREETS	1.800	D	56	0.51	0.90

LENGTH OF WATERCOURSE (L)	438 ft
LENGTH TO POINT OPPOSITE CENTROID (Lca)	438 ft
ELEVATION OF HEADWATER	352.5 ft
ELEVATION OF CONCENTRATION POINT	349.6 ft
AVERAGE MANNINGS 'N' VALUE	0.02
STORM FREQUENCY (YEAR)	100
LOW LOSS RATE (For Storms Greater Than 10 Years)	85%
POINT RAIN FROM NOAA ATLAS	**14**
1-HOUR	1.22 in
3-HOUR	2.00 in
6-HOUR	2.66 in
24-HOUR	4.21 in

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD BASIC DATA CALCULATION FORM	PROJECT: Thermel Ranch TTM 38578 Job No.: 2735 BY: FOS DATE: 9/23/24

PHYSICAL DATA

[1] CONCENTRATION POINT	Retention Basin 4
[2] AREA DESIGNATION	DA-3C
[3] AREA - ACRES	10.600
[4] L-FEET	438
[5] L-MILES	0.083
[6] La-FEET	438.00
[7] La-MILES	0.083
[8] ELEVATION OF HEADWATER	352.5
[9] ELEVATION OF CONCENTRATION POINT	349.6
[10] H-FEET	2.9
[11] S-FEET/MILE	35.0
[12] S^0.5	5.91
[13] L*LCA/S^0.5	0.001
[14] AVERAGE MANNINGS 'N'	0.02
[15] LAG TIME-HOURS	0.04
[16] LAG TIME-MINUTES	2.2
[17] 100% OF LAG-MINUTES	2.2
[18] 200% OF LAG-MINUTES	4.4

RAINFALL DATA

[1] AMC	II
[2] FREQUENCY-YEARS	100
NOAA ATLAS	**14**
[3] DURATION:	Point Rain
1-HOUR	1.22 in
3-HOUR	2.00 in
6-HOUR	2.66 in
24-HOUR	4.21 in

STORM EVENT SUMMARY

DURATION		1-HOUR	3-HOUR	6-HOUR	24-HOUR
TOTAL RAINFALL	(in)	1.22	2	2.66	4.21
RAINFALL VOLUME	(cuft)	46,943	76,956	102,352	161,993
SOIL LOSSES	(cuft)	9,593	28,373	53,138	110,963
EFFECTIVE RAIN	(in)	0.97	1.26	1.28	1.33
FLOOD VOLUME	(cu-ft)	37,350	48,583	49,214	51,030
	(acre-ft)	0.86	1.12	1.13	1.17
PEAK FLOW	(cfs)	N/A	18.37	16.44	3.83

NOTE: PEAK FLOW FOR THE 1-HOUR STORM IS NOT REPRESENTATIVE. PER RCFCD PEAK DISCHARGES FROM THE 3-HOUR STORM SHOULD NORMALLY COMPARE WELL WITH RATIONAL PEAKS.

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD BASIC DATA CALCULATION FORM AMC II	PROJECT: Thermel Ranch TTM 38578 Job No.: 2735 BY: FOS DATE: 9/23/24

AVERAGE ADJUSTED LOSS RATE

SOIL GROUP [Plate C-1]	LAND USE	RI NUMBER [Plate E-6.1]	PERVIOUS AREA INFILTRATION RATE (in/hr) [Plate E-6.2]	DECIMAL PERCENT OF AREA IMPERVIOUS [Plate E-6.3]	ADJUSTED INFILTRATION RATE (in/hr)	AREA	AREA WEIGHTED AVERAGE	MAX AVERAGE ADJUSTED INFILTRATION RATE (in/hr)	LOW LOSS CONDITION	LOW LOSS RATE PER RCFC/2322 (in/hr)	MIN AVERAGE ADJUSTED INFILTRATION RATE (in/hr)
B	SF - 1/4 ACRE	56	0.51	50%	0.28	8.800	0.830	0.2329	DEVELOPED	0.5000	0.4151
B	OFFSITE STREETS	56	0.51	90%	0.10	1.800	0.170	0.0165	DEVELOPED	0.1800	0.0306
					SUM	10.600	SUM	0.2493			0.4457

VARIABLE LOSS RATE CURVE (24-HOUR STORM ONLY)

Fm= 0.124661321

C= 0.00231

Ft=C(24-(T/60))^1.55 = 0.00231 (24-(T/60))^1.55 + **0.12** in/hr

CONSTANT LOSS RATE (3 & 6 HOUR STORMS) = **0.2493** in/hr

LOW LOSS RATE = **0.8500** in/hr

Where:

T=Time in minutes. To get an average value for each unit time period, Use T=1/2 the unit time for the first time period, T=1 1/2 unit time for the second period, etc.

NOTE: Low loss rates established per RCFC/2322 (Dated: May-30-95)
For 10 Year Storms or Less
Undeveloped Condition: Low Loss = 90%
Developed Condition: Low Loss = 0.9 - (0.8 * %impervious)
Basin Site: Low Loss = 10%
For 100 Year Storm - Low Loss should be between 80% & 90% of the Rainfall Rate

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD SHORTCUT METHOD 1-HOUR STORM	PROJECT:	Thermel Ranch TTM 38578	
		Job No.:	2735	DATE
		BY:	FOS	9/23/24

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	10.60
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	2.21
UNIT TIME-PERCENT OF LAG	226.2
TOTAL ADJUSTED STORM RAIN-INCHES	1.22
CONSTANT LOSS RATE-in/hr	0.25
LOW LOSS RATE - PERCENT	85%

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs
1	5	0.08	3.6	0.53	0.25	0.45	0.28	2.97
2	10	0.17	4.2	0.61	0.25	0.52	0.37	3.91
3	15	0.25	4.4	0.64	0.25	0.55	0.39	4.22
4	20	0.33	4.6	0.67	0.25	0.57	0.42	4.53
5	25	0.42	5.0	0.73	0.25	0.62	0.48	5.16
6	30	0.50	5.6	0.82	0.25	0.70	0.57	6.10
7	35	0.58	6.4	0.94	0.25	0.80	0.69	7.35
8	40	0.67	8.1	1.19	0.25	1.01	0.94	10.01
9	45	0.75	13.1	1.92	0.25	1.63	1.67	17.83
10	50	0.83	34.5	5.05	0.25	4.29	4.80	**51.32**
11	55	0.92	6.7	0.98	0.25	0.83	0.73	7.82
12	60	1.00	3.8	0.56	0.25	0.47	0.31	3.28

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL (in)	1.22
RAINFALL VOLUME (cuft)	46,943
SOIL LOSSES (cuft)	9,593
EFFECTIVE RAIN (in)	0.97
FLOOD VOLUME (acft)	0.86
FLOOD VOLUME (cuft)	37,350
PEAK FLOW RATE (cfs)	51.32

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD SHORTCUT METHOD 3-HOUR STORM	PROJECT: Thermel Ranch TTM 38578 Job No.: 2735 DATE BY: FOS 9/23/24

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	10.60	
UNIT TIME-MINUTES	5	
LAG TIME - MINUTES	2.21	
UNIT TIME-PERCENT OF LAG	226.2	
TOTAL ADJUSTED STORM RAIN-INCHES	2.00	
CONSTANT LOSS RATE-in/hr		0.25
LOW LOSS RATE - PERCENT		85%

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs
1	5	0.08	1.3	0.31	0.25	0.27	0.06	0.67
2	10	0.17	1.3	0.31	0.25	0.27	0.06	0.67
3	15	0.25	1.1	0.26	0.25	0.22	0.01	0.16
4	20	0.33	1.5	0.36	0.25	0.31	0.11	1.18
5	25	0.42	1.5	0.36	0.25	0.31	0.11	1.18
6	30	0.50	1.8	0.43	0.25	0.37	0.18	1.95
7	35	0.58	1.5	0.36	0.25	0.31	0.11	1.18
8	40	0.67	1.8	0.43	0.25	0.37	0.18	1.95
9	45	0.75	1.8	0.43	0.25	0.37	0.18	1.95
10	50	0.83	1.5	0.36	0.25	0.31	0.11	1.18
11	55	0.92	1.6	0.38	0.25	0.33	0.13	1.44
12	60	1.00	1.8	0.43	0.25	0.37	0.18	1.95
13	65	1.08	2.2	0.53	0.25	0.45	0.28	2.98
14	70	1.17	2.2	0.53	0.25	0.45	0.28	2.98
15	75	1.25	2.2	0.53	0.25	0.45	0.28	2.98
16	80	1.33	2.0	0.48	0.25	0.41	0.23	2.47
17	85	1.42	2.6	0.62	0.25	0.53	0.37	4.00
18	90	1.50	2.7	0.65	0.25	0.55	0.40	4.26
19	95	1.58	2.4	0.58	0.25	0.49	0.33	3.49
20	100	1.67	2.7	0.65	0.25	0.55	0.40	4.26
21	105	1.75	3.3	0.79	0.25	0.67	0.54	5.80
22	110	1.83	3.1	0.74	0.25	0.63	0.49	5.29
23	115	1.92	2.9	0.70	0.25	0.59	0.45	4.77
24	120	2.00	3.0	0.72	0.25	0.61	0.47	5.03
25	125	2.08	3.1	0.74	0.25	0.63	0.49	5.29
26	130	2.17	4.2	1.01	0.25	0.86	0.76	8.11
27	135	2.25	5.0	1.20	0.25	1.02	0.95	10.16
28	140	2.33	3.5	0.84	0.25	0.71	0.59	6.31
29	145	2.42	6.8	1.63	0.25	1.39	1.38	14.78
30	150	2.50	7.3	1.75	0.25	1.49	1.50	16.06
31	155	2.58	8.2	1.97	0.25	1.67	1.72	**18.37**
32	160	2.67	5.9	1.42	0.25	1.20	1.17	12.47
33	165	2.75	2.0	0.48	0.25	0.41	0.23	2.47
34	170	2.83	1.8	0.43	0.25	0.37	0.18	1.95
35	175	2.92	1.8	0.43	0.25	0.37	0.18	1.95
36	180	3.00	0.6	0.14	0.25	0.12	0.02	0.23

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL (in)	2
RAINFALL VOLUME (cuft)	76,956
SOIL LOSSES (cuft)	28,373
EFFECTIVE RAIN (in)	1.26
FLOOD VOLUME (acft)	1.12
FLOOD VOLUME (cuft)	48,583
PEAK FLOW RATE (cfs)	18.37

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD SHORTCUT METHOD 6-HOUR STORM	PROJECT: Thermel Ranch TTM 38578 Job No.: 2735 DATE BY: FOS 9/23/24

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	10.60
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	2.21
UNIT TIME-PERCENT OF LAG	226.2
TOTAL ADJUSTED STORM RAIN-INCHES	2.66
CONSTANT LOSS RATE-in/hr	0.249
LOW LOSS RATE - PERCENT	85%

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs
1	5	0.08	0.5	0.160	0.25	0.14	0.02	0.26
2	10	0.17	0.6	0.192	0.25	0.16	0.03	0.31
3	15	0.25	0.6	0.192	0.25	0.16	0.03	0.31
4	20	0.33	0.6	0.192	0.25	0.16	0.03	0.31
5	25	0.42	0.6	0.192	0.25	0.16	0.03	0.31
6	30	0.50	0.7	0.223	0.25	0.19	0.03	0.36
7	35	0.58	0.7	0.223	0.25	0.19	0.03	0.36
8	40	0.67	0.7	0.223	0.25	0.19	0.03	0.36
9	45	0.75	0.7	0.223	0.25	0.19	0.03	0.36
10	50	0.83	0.7	0.223	0.25	0.19	0.03	0.36
11	55	0.92	0.7	0.223	0.25	0.19	0.03	0.36
12	60	1.00	0.8	0.255	0.25	0.22	0.01	0.06
13	65	1.08	0.8	0.255	0.25	0.22	0.01	0.06
14	70	1.17	0.8	0.255	0.25	0.22	0.01	0.06
15	75	1.25	0.8	0.255	0.25	0.22	0.01	0.06
16	80	1.33	0.8	0.255	0.25	0.22	0.01	0.06
17	85	1.42	0.8	0.255	0.25	0.22	0.01	0.06
18	90	1.50	0.8	0.255	0.25	0.22	0.01	0.06
19	95	1.58	0.8	0.255	0.25	0.22	0.01	0.06
20	100	1.67	0.8	0.255	0.25	0.22	0.01	0.06
21	105	1.75	0.8	0.255	0.25	0.22	0.01	0.06
22	110	1.83	0.8	0.255	0.25	0.22	0.01	0.06
23	115	1.92	0.8	0.255	0.25	0.22	0.01	0.06
24	120	2.00	0.9	0.287	0.25	0.24	0.04	0.41
25	125	2.08	0.8	0.255	0.25	0.22	0.01	0.06
26	130	2.17	0.9	0.287	0.25	0.24	0.04	0.41
27	135	2.25	0.9	0.287	0.25	0.24	0.04	0.41
28	140	2.33	0.9	0.287	0.25	0.24	0.04	0.41
29	145	2.42	0.9	0.287	0.25	0.24	0.04	0.41
30	150	2.50	0.9	0.287	0.25	0.24	0.04	0.41
31	155	2.58	0.9	0.287	0.25	0.24	0.04	0.41
32	160	2.67	0.9	0.287	0.25	0.24	0.04	0.41
33	165	2.75	1.0	0.319	0.25	0.27	0.07	0.75
34	170	2.83	1.0	0.319	0.25	0.27	0.07	0.75
35	175	2.92	1.0	0.319	0.25	0.27	0.07	0.75
36	180	3.00	1.0	0.319	0.25	0.27	0.07	0.75
37	185	3.08	1.0	0.319	0.25	0.27	0.07	0.75
38	190	3.17	1.1	0.351	0.25	0.30	0.10	1.09
39	195	3.25	1.1	0.351	0.25	0.30	0.10	1.09
40	200	3.33	1.1	0.351	0.25	0.30	0.10	1.09
41	205	3.42	1.2	0.383	0.25	0.33	0.13	1.43
42	210	3.50	1.3	0.415	0.25	0.35	0.17	1.77
43	215	3.58	1.4	0.447	0.25	0.38	0.20	2.11
44	220	3.67	1.4	0.447	0.25	0.38	0.20	2.11
45	225	3.75	1.5	0.479	0.25	0.41	0.23	2.45
46	230	3.83	1.5	0.479	0.25	0.41	0.23	2.45
47	235	3.92	1.6	0.511	0.25	0.43	0.26	2.79
48	240	4.00	1.6	0.511	0.25	0.43	0.26	2.79
49	245	4.08	1.7	0.543	0.25	0.46	0.29	3.14
50	250	4.17	1.8	0.575	0.25	0.49	0.33	3.48
51	255	4.25	1.9	0.606	0.25	0.52	0.36	3.82
52	260	4.33	2.0	0.638	0.25	0.54	0.39	4.16
53	265	4.42	2.1	0.670	0.25	0.57	0.42	4.50
54	270	4.50	2.1	0.670	0.25	0.57	0.42	4.50

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD SHORTCUT METHOD 6-HOUR STORM	PROJECT: Thermel Ranch TTM 38578 Job No.: 2735 DATE BY: FOS 9/23/24

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	10.60
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	2.21
UNIT TIME-PERCENT OF LAG	226.2
TOTAL ADJUSTED STORM RAIN-INCHES	2.66
CONSTANT LOSS RATE-in/hr	0.249
LOW LOSS RATE - PERCENT	85%

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs
55	275	4.58	2.2	0.702	0.25	0.60	0.45	4.84
56	280	4.67	2.3	0.734	0.25	0.62	0.48	5.18
57	285	4.75	2.4	0.766	0.25	0.65	0.52	5.52
58	290	4.83	2.4	0.766	0.25	0.65	0.52	5.52
59	295	4.92	2.5	0.798	0.25	0.68	0.55	5.86
60	300	5.00	2.6	0.830	0.25	0.71	0.58	6.21
61	305	5.08	3.1	0.990	0.25	0.84	0.74	7.91
62	310	5.17	3.6	1.149	0.25	0.98	0.90	9.62
63	315	5.25	3.9	1.245	0.25	1.06	1.00	10.64
64	320	5.33	4.2	1.341	0.25	1.14	1.09	11.66
65	325	5.42	4.7	1.500	0.25	1.28	1.25	13.37
66	330	5.50	5.6	1.788	0.25	1.52	1.54	**16.44**
67	335	5.58	1.9	0.606	0.25	0.52	0.36	3.82
68	340	5.67	0.9	0.287	0.25	0.24	0.04	0.41
69	345	5.75	0.6	0.192	0.25	0.16	0.03	0.31
70	350	5.83	0.5	0.160	0.25	0.14	0.02	0.26
71	355	5.92	0.3	0.096	0.25	0.08	0.01	0.15
72	360	6.00	0.2	0.064	0.25	0.05	0.01	0.10

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL (in)	2.66
RAINFALL VOLUME (cuft)	102,352
SOIL LOSSES (cuft)	53,138
EFFECTIVE RAIN (in)	1.28
FLOOD VOLUME (acft)	1.13
FLOOD VOLUME (cuft)	49,214
PEAK FLOW RATE (cfs)	16.44

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD SHORTCUT METHOD 24-HOUR STORM	PROJECT: Thermel Ranch TTM 38578 Job No.: 2735 DATE: BY: FOS 9/23/24

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	10.600	CONSTANT LOSS RATE-in/hr	n/a
UNIT TIME-MINUTES	15	VARIABLE LOSS RATE (AVG) in/hr	0.2493
LAG TIME - MINUTES	2.21	MINIMUM LOSS RATE (for var. loss) - in/hr	0.125
UNIT TIME-PERCENT OF LAG	678.7	LOW LOSS RATE - DECIMAL	0.85
TOTAL ADJUSTED STORM RAIN-INCHES	4.21	C	0.00231

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs
1	15	0.25	0.2	0.034	0.440	0.029	0.005	0.05
2	30	0.50	0.3	0.051	0.435	0.043	0.008	0.08
3	45	0.75	0.3	0.051	0.430	0.043	0.008	0.08
4	60	1.00	0.4	0.067	0.425	0.057	0.010	0.11
5	75	1.25	0.3	0.051	0.420	0.043	0.008	0.08
6	90	1.50	0.3	0.051	0.415	0.043	0.008	0.08
7	105	1.75	0.3	0.051	0.410	0.043	0.008	0.08
8	120	2.00	0.4	0.067	0.405	0.057	0.010	0.11
9	135	2.25	0.4	0.067	0.400	0.057	0.010	0.11
10	150	2.50	0.4	0.067	0.395	0.057	0.010	0.11
11	165	2.75	0.5	0.084	0.391	0.072	0.013	0.13
12	180	3.00	0.5	0.084	0.386	0.072	0.013	0.13
13	195	3.25	0.5	0.084	0.381	0.072	0.013	0.13
14	210	3.50	0.5	0.084	0.376	0.072	0.013	0.13
15	225	3.75	0.5	0.084	0.372	0.072	0.013	0.13
16	240	4.00	0.6	0.101	0.367	0.086	0.015	0.16
17	255	4.25	0.6	0.101	0.362	0.086	0.015	0.16
18	270	4.50	0.7	0.118	0.358	0.100	0.018	0.19
19	285	4.75	0.7	0.118	0.353	0.100	0.018	0.19
20	300	5.00	0.8	0.135	0.348	0.115	0.020	0.22
21	315	5.25	0.6	0.101	0.344	0.086	0.015	0.16
22	330	5.50	0.7	0.118	0.339	0.100	0.018	0.19
23	345	5.75	0.8	0.135	0.335	0.115	0.020	0.22
24	360	6.00	0.8	0.135	0.331	0.115	0.020	0.22
25	375	6.25	0.9	0.152	0.326	0.129	0.023	0.24
26	390	6.50	0.9	0.152	0.322	0.129	0.023	0.24
27	405	6.75	1.0	0.168	0.318	0.143	0.025	0.27
28	420	7.00	1.0	0.168	0.313	0.143	0.025	0.27
29	435	7.25	1.0	0.168	0.309	0.143	0.025	0.27
30	450	7.50	1.1	0.185	0.305	0.157	0.028	0.30
31	465	7.75	1.2	0.202	0.301	0.172	0.030	0.32
32	480	8.00	1.3	0.219	0.296	0.186	0.033	0.35
33	495	8.25	1.5	0.253	0.292	0.215	0.038	0.40
34	510	8.50	1.5	0.253	0.288	0.215	0.038	0.40
35	525	8.75	1.6	0.269	0.284	0.229	0.040	0.43
36	540	9.00	1.7	0.286	0.280	0.243	0.006	0.06
37	555	9.25	1.9	0.320	0.276	0.272	0.044	0.47
38	570	9.50	2.0	0.337	0.272	0.286	0.064	0.69
39	585	9.75	2.1	0.354	0.268	0.301	0.085	0.91
40	600	10.00	2.2	0.370	0.265	0.315	0.106	1.13
41	615	10.25	1.5	0.253	0.261	0.215	0.038	0.40
42	630	10.50	1.5	0.253	0.257	0.215	0.038	0.40
43	645	10.75	2.0	0.337	0.253	0.286	0.084	0.89
44	660	11.00	2.0	0.337	0.250	0.286	0.087	0.93
45	675	11.25	1.9	0.320	0.246	0.272	0.074	0.79
46	690	11.50	1.9	0.320	0.242	0.272	0.078	0.83
47	705	11.75	1.7	0.286	0.239	0.243	0.048	0.51
48	720	12.00	1.8	0.303	0.235	0.258	0.068	0.73
49	735	12.25	2.5	0.421	0.232	0.358	0.189	2.02
50	750	12.50	2.6	0.438	0.228	0.372	0.210	2.24
51	765	12.75	2.8	0.472	0.225	0.401	0.247	2.64
52	780	13.00	2.9	0.488	0.221	0.415	0.267	2.85
53	795	13.25	3.4	0.573	0.218	0.487	0.355	3.79
54	810	13.50	3.4	0.573	0.215	0.487	0.358	**3.83**
55	825	13.75	2.3	0.387	0.211	0.329	0.176	1.88
56	840	14.00	2.3	0.387	0.208	0.329	0.179	1.91
57	855	14.25	2.7	0.455	0.205	0.386	0.250	2.67
58	870	14.50	2.6	0.438	0.202	0.372	0.236	2.52
59	885	14.75	2.6	0.438	0.199	0.372	0.239	2.56
60	900	15.00	2.5	0.421	0.196	0.358	0.225	2.41
61	915	15.25	2.4	0.404	0.193	0.344	0.211	2.26
62	930	15.50	2.3	0.387	0.190	0.329	0.198	2.11
63	945	15.75	1.9	0.320	0.187	0.272	0.133	1.42

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD SHORTCUT METHOD 24-HOUR STORM	PROJECT: Thermel Ranch TTM 38578 Job No.: 2735 DATE: BY: FOS 9/23/24

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	10.600	CONSTANT LOSS RATE-in/hr	n/a
UNIT TIME-MINUTES	15	VARIABLE LOSS RATE (AVG) in/hr	0.2493
LAG TIME - MINUTES	2.21	MINIMUM LOSS RATE (for var. loss) - in/hr	0.125
UNIT TIME-PERCENT OF LAG	678.7	LOW LOSS RATE - DECIMAL	0.85
TOTAL ADJUSTED STORM RAIN-INCHES	4.21	C	0.00231

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs
64	960	16.00	1.9	0.320	0.184	0.272	0.136	1.45
65	975	16.25	0.4	0.067	0.181	0.057	0.010	0.11
66	990	16.50	0.4	0.067	0.178	0.057	0.010	0.11
67	1005	16.75	0.3	0.051	0.176	0.043	0.008	0.08
68	1020	17.00	0.3	0.051	0.173	0.043	0.008	0.08
69	1035	17.25	0.5	0.084	0.170	0.072	0.013	0.13
70	1050	17.50	0.5	0.084	0.168	0.072	0.013	0.13
71	1065	17.75	0.5	0.084	0.165	0.072	0.013	0.13
72	1080	18.00	0.4	0.067	0.163	0.057	0.010	0.11
73	1095	18.25	0.4	0.067	0.161	0.057	0.010	0.11
74	1110	18.50	0.4	0.067	0.158	0.057	0.010	0.11
75	1125	18.75	0.3	0.051	0.156	0.043	0.008	0.08
76	1140	19.00	0.2	0.034	0.154	0.029	0.005	0.05
77	1155	19.25	0.3	0.051	0.152	0.043	0.008	0.08
78	1170	19.50	0.4	0.067	0.149	0.057	0.010	0.11
79	1185	19.75	0.3	0.051	0.147	0.043	0.008	0.08
80	1200	20.00	0.2	0.034	0.145	0.029	0.005	0.05
81	1215	20.25	0.3	0.051	0.144	0.043	0.008	0.08
82	1230	20.50	0.3	0.051	0.142	0.043	0.008	0.08
83	1245	20.75	0.3	0.051	0.140	0.043	0.008	0.08
84	1260	21.00	0.2	0.034	0.138	0.029	0.005	0.05
85	1275	21.25	0.3	0.051	0.137	0.043	0.008	0.08
86	1290	21.50	0.2	0.034	0.135	0.029	0.005	0.05
87	1305	21.75	0.3	0.051	0.133	0.043	0.008	0.08
88	1320	22.00	0.2	0.034	0.132	0.029	0.005	0.05
89	1335	22.25	0.3	0.051	0.131	0.043	0.008	0.08
90	1350	22.50	0.2	0.034	0.130	0.029	0.005	0.05
91	1365	22.75	0.2	0.034	0.128	0.029	0.005	0.05
92	1380	23.00	0.2	0.034	0.127	0.029	0.005	0.05
93	1395	23.25	0.2	0.034	0.127	0.029	0.005	0.05
94	1410	23.50	0.2	0.034	0.126	0.029	0.005	0.05
95	1425	23.75	0.2	0.034	0.125	0.029	0.005	0.05
96	1440	24.00	0.2	0.034	0.125	0.029	0.005	0.05

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL (in)	4.21
RAINFALL VOLUME (cuft)	161,993
SOIL LOSSES (cuft)	110,963
EFFECTIVE RAIN (in)	1.33
FLOOD VOLUME (acft)	1.17
FLOOD VOLUME (cuft)	51,030
PEAK FLOW (cfs)	3.83

RCFCD SYNTHETIC UNIT HYDROGRAPH - SHORTCUT METHOD

DATA INPUT SHEET

DATE	March 8, 2024
WORKSHEET PREPARED BY:	RRR
PROJECT NAME	Thermal Ranch TTM 38578
PROJECT NUMBER	2735
CONCENTRATION POINT DESIGNATION	Retention Basin 4
AREA DESIGNATION	DA-4
AMC NUMBER	2

Low Loss Conditions: X=Existing; D=Developed; BS=Retention

AREA DESIG	SOIL GROUP	TRIBUTARY AREAS	ACRES	LOW LOSS CONDITION	RI NUMBER	AMC II INFILTRATION RATE	IMPERVIOUS PERCENT
18	B	EQUESTRIAN CENTER	33.2	X	69	0.39	0.50
8	B	WORKFORCE HOUSING	30.3	D	56	0.51	0.75
5	B	SF - 1/4 ACRE	17.4	D	56	0.51	0.50

LENGTH OF WATERCOURSE (L)	2,366 ft
LENGTH TO POINT OPPOSITE CENTROID (Lca)	237 ft
ELEVATION OF HEADWATER	360.7 ft
ELEVATION OF CONCENTRATION POINT	350.2 ft
AVERAGE MANNINGS 'N' VALUE	0.020
STORM FREQUENCY (YEAR)	100
LOW LOSS RATE (Storm Events > 10 Years)	**85%**
POINT RAIN FROM NOAA ATLAS	**14**
1-HOUR	1.22 in
3-HOUR	2.00 in
6-HOUR	2.66 in
24-HOUR	4.21 in

BASIN CHARACTERISTICS:

ELEVATION	AREA
346.4 ft	437,506 sf
348.4 ft	499,913 sf

PERCOLATION RATE (in/hr)	0.83 in/hr
DRYWELL DATA	
NUMBER USED	0
PERCOLATION RATE	
LOWEST FLOWLINE ELEVATION	349.44
LOWEST PAD ELEVATION	352.6

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD BASIC DATA CALCULATION FORM	PROJECT: Thermal Ranch TTM 38578 Job No.: 2735 BY: RRR DATE: 3/8/24

PHYSICAL DATA

[1] CONCENTRATION POINT	Retention Basin 4
[2] AREA DESIGNATION	DA-4
[3] AREA - ACRES	80.900
[4] L-FEET	2366
[5] L-MILES	0.448
[6] La-FEET	237.00
[7] La-MILES	0.045
[8] ELEVATION OF HEADWATER	360.7
[9] ELEVATION OF CONCENTRATION POINT	350.2
[10] H-FEET	10.5
[11] S-FEET/MILE	23.4
[12] S^0.5	4.84
[13] L*LCA/S^0.5	0.004
[14] AVERAGE MANNINGS 'N'	0.02
[15] LAG TIME-HOURS	0.06
[16] LAG TIME-MINUTES	3.6
[17] 100% OF LAG-MINUTES	3.6
[18] 200% OF LAG-MINUTES	7.2

RAINFALL DATA

[1] AMC	II
[2] FREQUENCY-YEARS	100
FROM NOAA ATLAS	**14**
[3] STORM DURATION:	Point Rain
1-HOUR	1.22 in
3-HOUR	2.00 in
6-HOUR	2.66 in
24-HOUR	4.21 in

STORM EVENT SUMMARY

STORM DURATION		1-HOUR	3-HOUR	6-HOUR	24-HOUR
RAINFALL VOLUME	(cu ft)	358,275	587,336	781,157	**1,236,343**
SOIL LOSSES	(cu ft)	61,799	183,241	354,322	**782,388**
EFFECTIVE RAIN	(in)	1.01	1.38	1.45	1.55
FLOOD VOLUME	(cu ft)	296,477	404,095	426,836	**453,955**
	(acre-ft)	6.81	9.28	9.80	**10.42**
PEAK FLOW	(cfs)	n/a	143.37	128.65	31.93
OVERFLOW VOLUME RECEIVED	(cu ft)	246,478	406,185	430,315	356,129
	(acre-ft)	5.66	9.32	9.88	8.18
TOTAL VOLUME INTO BASIN	(cu ft)	542,955	810,280	857,151	810,084
	(acre-ft)	12.46	18.60	19.68	18.60
STORAGE PROVIDED	(cu ft)	936,726			
	(acre-ft)	21.50			
PERCOLATION RATE	(in/hr)	0.83			
PERCOLATION VOLUME	(cu ft)	518,928	775,089	821,231	777,041
	(acre-ft)	11.91	17.79	18.85	17.84
DRAIN TILE LOSS VOLUME	(cu ft)	24,027	35,191	35,920	33,043
	(acre-ft)	0.55	0.81	0.82	0.76
TOTAL VOLUME LOSSES	(cu ft)	542,955	810,280	857,151	810,084
	(acre-ft)	12.46	18.60	19.68	18.60
BASIN DEWATERING TIME	(hours)	15.6	21.5	21.4	8.8
MAXIMUM VOLUME IN BASIN	(cu ft)	510,499	716,171	721,662	528,304
	(acre-ft)	11.72	16.44	16.57	12.13
MAXIMUM WSEL	(ft)	347.49	347.93	**347.94**	347.53
DEPTH	(ft)	1.09	1.53	**1.54**	1.13
LOWEST FLOWLINE ELEVATION		349.44			
DIFFERENCE	(ft)	1.95	1.51	1.50	1.91
LOWEST PAD ELEVATION		352.6			
DIFFERENCE	(ft)	5.11	4.67	4.66	5.07

NOTE: PEAK FLOW FOR THE 1-HOUR STORM IS NOT REPRESENTATIVE. PER RCFCD PEAK DISCHARGES FROM THE 3-HOUR STORM SHOULD NORMALLY COMPARE WELL WITH RATIONAL PEAKS.

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD BASIC DATA CALCULATION FORM AMC II	PROJECT: Thermal Ranch TTM 38578 Job No.: 2735 Area ID: DA-4 By: RRR Date: 3/8/24

AVERAGE ADJUSTED LOSS RATE

SOIL GROUP [Plate C-1]	LAND USE	RI NUMBER [Plate E-6.1]	PERVIOUS AREA INFILTRATION RATE (in/hr) [Plate E-6.2]	DECIMAL PERCENT OF AREA IMPERVIOUS [Plate E-6.3]	ADJUSTED INFILTRATION RATE (in/hr)	AREA	AREA WEIGHTED AVERAGE	MAX AVERAGE ADJUSTED INFILTRATION RATE (in/hr)	LOW LOSS CONDITION	LOW LOSS RATE PER RCFC/2322	MIN AVERAGE ADJUSTED INFILTRATION RATE
B	EQUESTRIAN CENTER	69	0.39	50%	0.21	33.200	0.410	0.0880	UNDEVELOPED	0.9000	0.3693
B	WORKFORCE HOUSING	56	0.51	75%	0.17	30.300	0.375	0.0621	DEVELOPED	0.3000	0.1124
B	SF - 1/4 ACRE	56	0.51	50%	0.28	17.400	0.215	0.0603	DEVELOPED	0.5000	0.1075
					SUM	80.900	SUM	0.2104			0.5892

VARIABLE LOSS RATE CURVE (24-HOUR STORM ONLY)

Fm= 0.105218325

C= 0.00195

F_t=C(24-(T/60))^1.55+F_m = 0.00195 (24-(T/60))^1.55 + 0.11 in/hr

CONSTANT LOSS RATE (3 & 6 HOUR STORMS) = **0.2104**

LOW LOSS RATE = **0.8500**

Where:

T=Time in minutes. To get an average value for each unit time period, Use T=1/2 the unit time for the first time period, T=1 1/2 unit time for the second period, etc.

NOTE: Low loss rates established per RCFC/2322 (Dated: May-30-95)
For 10 Year Storms or Less
Undeveloped Condition: Low Loss = 90%
Developed Condition: Low Loss = 0.9 - (0.8 * %impervious)
Basin Site: Low Loss = 10%
For 100 Year Storm - Low Loss should be between 80% & 90% of the Rainfall Rate

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

1-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-4
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	80.90
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	3.58
UNIT TIME-PERCENT OF LAG	139.5
TOTAL ADJUSTED STORM RAIN-INCHES	1.22
CONSTANT LOSS RATE-in/hr	0.21
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	0.83 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu ft	Overflow In cu ft	Basin Volume cu ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu ft	Basin Losses Percolation Out cu ft	Basin Losses Drain Tile Out cu ft	Basin Losses Overflow Out cu ft	Total In Basin cu ft	Total In Basin ac-ft	Basin WSEL ft
1	5	0.08	3.6	0.53	0.21	0.45	0.32	25.83	7,748	0	7,748	438,022	2,525	2,525	121	0	5,102	0.12	346.41
2	10	0.17	4.2	0.61	0.21	0.52	0.40	32.99	9,898	0	15,000	438,505	2,527	2,527	121	0	12,351	0.28	346.43
3	15	0.25	4.4	0.64	0.21	0.55	0.43	35.38	10,614	0	22,965	439,036	2,531	2,531	121	0	20,313	0.47	346.44
4	20	0.33	4.6	0.67	0.21	0.57	0.46	37.77	11,331	0	31,644	439,614	2,534	2,534	121	0	28,989	0.67	346.46
5	25	0.42	5.0	0.73	0.21	0.62	0.52	42.55	12,764	0	41,753	440,288	2,538	2,538	121	0	39,093	0.90	346.48
6	30	0.50	5.6	0.82	0.21	0.70	0.61	49.71	14,914	0	54,007	441,104	2,542	2,542	121	0	51,343	1.18	346.51
7	35	0.58	6.4	0.94	0.21	0.80	0.73	59.27	17,780	0	69,123	442,111	2,548	2,548	121	0	66,453	1.53	346.54
8	40	0.67	8.1	1.19	0.21	1.01	0.98	79.57	23,870	0	90,324	443,524	2,556	2,556	121	0	87,646	2.01	346.59
9	45	0.75	13.1	1.92	0.21	1.63	1.71	139.28	41,784	7,693	137,123	446,641	2,574	2,574	121	0	134,427	3.09	346.69
10	50	0.83	34.5	5.05	0.21	4.29	4.84	**394.85**	**118,455**	193,238	446,120	467,228	2,693	2,693	121	0	443,306	10.18	347.35
11	55	0.92	6.7	0.98	0.21	0.83	0.77	62.85	18,855	31,987	494,147	470,427	2,711	2,711	121	0	491,314	11.28	347.45
12	60	1.00	3.8	0.56	0.21	0.47	0.35	28.22	8,465	13,561	513,340	471,706	2,719	2,719	121	0	**510,499**	**11.72**	**347.49**

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL	1.22 in
RAINFALL VOLUME	358,275 cu ft
SOIL LOSSES	61,799 cu ft
EFFECTIVE RAIN	1.01 in
FLOOD VOLUME	6.81 ac-ft
FLOOD VOLUME	296,477 cu ft
REQUIRED STORAGE	11.72 ac-ft
REQUIRED STORAGE	510,499 cu ft
MAX WSEL	347.49 ft
PEAK FLOW RATE	394.85 cfs
TOTAL BASIN LOSSES	542,955 cu ft
TOTAL OVERFLOW OUT	0 cu ft

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

3-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-4
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	80.90
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	3.58
UNIT TIME-PERCENT OF LAG	139.5
TOTAL ADJUSTED STORM RAIN (in)	2.00
CONSTANT LOSS RATE (in/hr)	0.21
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	0.83 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu ft	Overflow In cu ft	Basin Volume cu ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu ft	Basin Losses Percolation Out cu ft	Basin Losses Drain Tile Out cu ft	Basin Losses Overflow Out cu ft	Total In Basin cu ft	Total In Basin ac-ft	Basin WSEL ft
1	5	0.08	1.3	0.31	0.21	0.27	0.10	8.28	2,485	0	2,485	437,672	2,523	2,485	0	0	0	0.00	346.40
2	10	0.17	1.3	0.31	0.21	0.27	0.10	8.28	2,485	0	2,485	437,672	2,523	2,485	0	0	0	0.00	346.40
3	15	0.25	1.1	0.26	0.21	0.22	0.05	4.37	1,311	0	1,311	437,593	2,522	1,311	0	0	0	0.00	346.40
4	20	0.33	1.5	0.36	0.21	0.31	0.15	12.20	3,660	0	3,660	437,750	2,523	2,523	121	0	1,016	0.02	346.40
5	25	0.42	1.5	0.36	0.21	0.31	0.15	12.20	3,660	0	4,676	437,818	2,524	2,524	121	0	2,031	0.05	346.40
6	30	0.50	1.8	0.43	0.21	0.37	0.22	18.07	5,422	0	7,453	438,003	2,525	2,525	121	0	4,807	0.11	346.41
7	35	0.58	1.5	0.36	0.21	0.31	0.15	12.20	3,660	0	8,467	438,070	2,525	2,525	121	0	5,821	0.13	346.41
8	40	0.67	1.8	0.43	0.21	0.37	0.22	18.07	5,422	0	11,243	438,255	2,526	2,526	121	0	8,596	0.20	346.42
9	45	0.75	1.8	0.43	0.21	0.37	0.22	18.07	5,422	0	14,018	438,440	2,527	2,527	121	0	11,369	0.26	346.42
10	50	0.83	1.5	0.36	0.21	0.31	0.15	12.20	3,660	0	15,030	438,507	2,528	2,528	121	0	12,381	0.28	346.43
11	55	0.92	1.6	0.38	0.21	0.33	0.17	14.16	4,248	0	16,628	438,614	2,528	2,528	121	0	13,979	0.32	346.43
12	60	1.00	1.8	0.43	0.21	0.37	0.22	18.07	5,422	0	19,401	438,799	2,529	2,529	121	0	16,750	0.38	346.44
13	65	1.08	2.2	0.53	0.21	0.45	0.32	25.91	7,772	0	24,522	439,140	2,531	2,531	121	0	21,869	0.50	346.45
14	70	1.17	2.2	0.53	0.21	0.45	0.32	25.91	7,772	0	29,641	439,481	2,533	2,533	121	0	26,987	0.62	346.46
15	75	1.25	2.2	0.53	0.21	0.45	0.32	25.91	7,772	0	34,758	439,822	2,535	2,535	121	0	32,102	0.74	346.47
16	80	1.33	2.0	0.48	0.21	0.41	0.27	21.99	6,597	0	38,698	440,084	2,537	2,537	121	0	36,041	0.83	346.48
17	85	1.42	2.6	0.62	0.21	0.53	0.41	33.74	10,121	0	46,161	440,581	2,539	2,539	121	0	43,501	1.00	346.49
18	90	1.50	2.7	0.65	0.21	0.55	0.44	35.69	10,708	0	54,209	441,118	2,543	2,543	121	0	51,545	1.18	346.51
19	95	1.58	2.4	0.58	0.21	0.49	0.37	29.82	8,946	0	60,491	441,536	2,545	2,545	121	0	57,825	1.33	346.52
20	100	1.67	2.7	0.65	0.21	0.55	0.44	35.69	10,708	0	68,533	442,072	2,548	2,548	121	0	65,864	1.51	346.54
21	105	1.75	3.3	0.79	0.21	0.67	0.58	47.44	14,232	0	80,096	442,842	2,552	2,552	121	0	77,422	1.78	346.57
22	110	1.83	3.1	0.74	0.21	0.63	0.53	43.53	13,058	0	90,479	443,534	2,556	2,556	121	0	87,802	2.02	346.59
23	115	1.92	2.9	0.70	0.21	0.59	0.49	39.61	11,883	1,770	101,454	444,265	2,561	2,561	121	0	98,772	2.27	346.61
24	120	2.00	3.0	0.72	0.21	0.61	0.51	41.57	12,470	17,387	128,630	446,076	2,571	2,571	121	0	125,937	2.89	346.67
25	125	2.08	3.1	0.74	0.21	0.63	0.53	43.53	13,058	19,988	158,982	448,098	2,583	2,583	121	0	156,278	3.59	346.73
26	130	2.17	4.2	1.01	0.21	0.86	0.80	65.06	19,518	30,504	206,300	451,250	2,601	2,601	121	0	203,578	4.67	346.83
27	135	2.25	5.0	1.20	0.21	1.02	0.99	80.72	24,217	38,152	265,947	455,224	2,624	2,624	121	0	263,202	6.04	346.96
28	140	2.33	3.5	0.84	0.21	0.71	0.63	51.36	15,407	23,813	302,421	457,654	2,638	2,638	121	0	299,662	6.88	347.04
29	145	2.42	6.8	1.63	0.21	1.39	1.42	115.96	34,789	55,361	389,812	463,476	2,671	2,671	121	0	387,020	8.88	347.23
30	150	2.50	7.3	1.75	0.21	1.49	1.54	125.75	37,726	64,702	489,447	470,114	2,710	2,710	121	0	486,616	11.17	347.44
31	155	2.58	8.2	1.97	0.21	1.67	1.76	**143.37**	**43,012**	74,832	604,461	477,777	2,754	2,754	121	0	601,585	13.81	347.68
32	160	2.67	5.9	1.42	0.21	1.20	1.21	98.34	29,503	50,875	681,963	482,940	2,784	2,784	121	0	679,058	15.59	347.85
33	165	2.75	2.0	0.48	0.21	0.41	0.27	21.99	6,597	10,413	696,068	483,880	2,789	2,789	121	0	693,158	15.91	347.88
34	170	2.83	1.8	0.43	0.21	0.37	0.22	18.07	5,422	9,001	707,581	484,647	2,793	2,793	121	0	704,666	16.18	347.90
35	175	2.92	1.8	0.43	0.21	0.37	0.22	18.07	5,422	9,001	719,090	485,414	2,798	2,798	121	0	**716,171**	**16.44**	**347.93**
36	180	3.00	0.6	0.14	0.21	0.12	0.02	1.76	529	386	717,085	485,280	2,797	2,797	121	0	714,166	16.39	347.92

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL	2.00 in
RAINFALL VOLUME	587,336 cu ft
SOIL LOSSES	183,241 cu ft
EFFECTIVE RAIN	1.38 in
FLOOD VOLUME	9.28 ac-ft
FLOOD VOLUME	404,095 cu ft
REQUIRED STORAGE	16.44 ac-ft
REQUIRED STORAGE	716,171 cu ft
MAX WSEL	347.93 ft
PEAK FLOW RATE	143.37 cfs
TOTAL BASIN LOSSES	810,280 cu ft
TOTAL OVERFLOW OUT	0 cu ft

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

6-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-4
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	80.90
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	3.58
UNIT TIME-PERCENT OF LAG	139.5
TOTAL ADJUSTED STORM RAIN (in)	2.66
CONSTANT LOSS RATE (in/hr)	0.21
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	0.83 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu ft	Overflow In cu ft	Basin Volume cu ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu ft	Basin Losses Percolation Out cu ft	Basin Losses Drain Tile Out cu ft	Basin Losses Overflow Out cu ft	Total In Basin cu ft	Total In Basin ac-ft	Basin WSEL ft
1	5	0.08	0.5	0.16	0.21	0.14	0.02	1.95	586	0	586	437,545	2,522	586	0	0	0	0.00	346.40
2	10	0.17	0.6	0.19	0.21	0.16	0.03	2.34	703	0	703	437,553	2,522	703	0	0	0	0.00	346.40
3	15	0.25	0.6	0.19	0.21	0.16	0.03	2.34	703	0	703	437,553	2,522	703	0	0	0	0.00	346.40
4	20	0.33	0.6	0.19	0.21	0.16	0.03	2.34	703	0	703	437,553	2,522	703	0	0	0	0.00	346.40
5	25	0.42	0.6	0.19	0.21	0.16	0.03	2.34	703	0	703	437,553	2,522	703	0	0	0	0.00	346.40
6	30	0.50	0.7	0.22	0.21	0.19	0.01	1.06	318	0	318	437,527	2,522	318	0	0	0	0.00	346.40
7	35	0.58	0.7	0.22	0.21	0.19	0.01	1.06	318	0	318	437,527	2,522	318	0	0	0	0.00	346.40
8	40	0.67	0.7	0.22	0.21	0.19	0.01	1.06	318	0	318	437,527	2,522	318	0	0	0	0.00	346.40
9	45	0.75	0.7	0.22	0.21	0.19	0.01	1.06	318	0	318	437,527	2,522	318	0	0	0	0.00	346.40
10	50	0.83	0.7	0.22	0.21	0.19	0.01	1.06	318	0	318	437,527	2,522	318	0	0	0	0.00	346.40
11	55	0.92	0.7	0.22	0.21	0.19	0.01	1.06	318	0	318	437,527	2,522	318	0	0	0	0.00	346.40
12	60	1.00	0.8	0.26	0.21	0.22	0.04	3.66	1,099	0	1,099	437,579	2,522	1,099	0	0	0	0.00	346.40
13	65	1.08	0.8	0.26	0.21	0.22	0.04	3.66	1,099	0	1,099	437,579	2,522	1,099	0	0	0	0.00	346.40
14	70	1.17	0.8	0.26	0.21	0.22	0.04	3.66	1,099	0	1,099	437,579	2,522	1,099	0	0	0	0.00	346.40
15	75	1.25	0.8	0.26	0.21	0.22	0.04	3.66	1,099	0	1,099	437,579	2,522	1,099	0	0	0	0.00	346.40
16	80	1.33	0.8	0.26	0.21	0.22	0.04	3.66	1,099	0	1,099	437,579	2,522	1,099	0	0	0	0.00	346.40
17	85	1.42	0.8	0.26	0.21	0.22	0.04	3.66	1,099	0	1,099	437,579	2,522	1,099	0	0	0	0.00	346.40
18	90	1.50	0.8	0.26	0.21	0.22	0.04	3.66	1,099	0	1,099	437,579	2,522	1,099	0	0	0	0.00	346.40
19	95	1.58	0.8	0.26	0.21	0.22	0.04	3.66	1,099	0	1,099	437,579	2,522	1,099	0	0	0	0.00	346.40
20	100	1.67	0.8	0.26	0.21	0.22	0.04	3.66	1,099	0	1,099	437,579	2,522	1,099	0	0	0	0.00	346.40
21	105	1.75	0.8	0.26	0.21	0.22	0.04	3.66	1,099	0	1,099	437,579	2,522	1,099	0	0	0	0.00	346.40
22	110	1.83	0.8	0.26	0.21	0.22	0.04	3.66	1,099	0	1,099	437,579	2,522	1,099	0	0	0	0.00	346.40
23	115	1.92	0.8	0.26	0.21	0.22	0.04	3.66	1,099	0	1,099	437,579	2,522	1,099	0	0	0	0.00	346.40
24	120	2.00	0.9	0.29	0.21	0.24	0.08	6.27	1,881	0	1,881	437,631	2,522	1,881	0	0	0	0.00	346.40
25	125	2.08	0.8	0.26	0.21	0.22	0.04	3.66	1,099	0	1,099	437,579	2,522	1,099	0	0	0	0.00	346.40
26	130	2.17	0.9	0.29	0.21	0.24	0.08	6.27	1,881	0	1,881	437,631	2,522	1,881	0	0	0	0.00	346.40
27	135	2.25	0.9	0.29	0.21	0.24	0.08	6.27	1,881	0	1,881	437,631	2,522	1,881	0	0	0	0.00	346.40
28	140	2.33	0.9	0.29	0.21	0.24	0.08	6.27	1,881	0	1,881	437,631	2,522	1,881	0	0	0	0.00	346.40
29	145	2.42	0.9	0.29	0.21	0.24	0.08	6.27	1,881	0	1,881	437,631	2,522	1,881	0	0	0	0.00	346.40
30	150	2.50	0.9	0.29	0.21	0.24	0.08	6.27	1,881	0	1,881	437,631	2,522	1,881	0	0	0	0.00	346.40
31	155	2.58	0.9	0.29	0.21	0.24	0.08	6.27	1,881	0	1,881	437,631	2,522	1,881	0	0	0	0.00	346.40
32	160	2.67	0.9	0.29	0.21	0.24	0.08	6.27	1,881	0	1,881	437,631	2,522	1,881	0	0	0	0.00	346.40
33	165	2.75	1.0	0.32	0.21	0.27	0.11	8.87	2,662	0	2,662	437,683	2,523	2,523	121	0	18	0.00	346.40
34	170	2.83	1.0	0.32	0.21	0.27	0.11	8.87	2,662	0	2,679	437,685	2,523	2,523	121	0	35	0.00	346.40
35	175	2.92	1.0	0.32	0.21	0.27	0.11	8.87	2,662	0	2,697	437,686	2,523	2,523	121	0	53	0.00	346.40
36	180	3.00	1.0	0.32	0.21	0.27	0.11	8.87	2,662	0	2,714	437,687	2,523	2,523	121	0	70	0.00	346.40
37	185	3.08	1.0	0.32	0.21	0.27	0.11	8.87	2,662	0	2,732	437,688	2,523	2,523	121	0	88	0.00	346.40
38	190	3.17	1.1	0.35	0.21	0.30	0.14	11.48	3,443	0	3,531	437,741	2,523	2,523	121	0	886	0.02	346.40
39	195	3.25	1.1	0.35	0.21	0.30	0.14	11.48	3,443	0	4,329	437,794	2,523	2,523	121	0	1,684	0.04	346.40
40	200	3.33	1.1	0.35	0.21	0.30	0.14	11.48	3,443	0	5,127	437,848	2,524	2,524	121	0	2,482	0.06	346.41
41	205	3.42	1.2	0.38	0.21	0.33	0.17	14.08	4,224	0	6,706	437,953	2,524	2,524	121	0	4,061	0.09	346.41
42	210	3.50	1.3	0.41	0.21	0.35	0.20	16.68	5,005	0	9,066	438,110	2,525	2,525	121	0	6,419	0.15	346.41
43	215	3.58	1.4	0.45	0.21	0.38	0.24	19.29	5,786	0	12,205	438,319	2,526	2,526	121	0	9,558	0.22	346.42
44	220	3.67	1.4	0.45	0.21	0.38	0.24	19.29	5,786	0	15,344	438,528	2,528	2,528	121	0	12,695	0.29	346.43
45	225	3.75	1.5	0.48	0.21	0.41	0.27	21.89	6,567	0	19,262	438,789	2,529	2,529	121	0	16,612	0.38	346.44
46	230	3.83	1.5	0.48	0.21	0.41	0.27	21.89	6,567	0	23,179	439,050	2,531	2,531	121	0	20,528	0.47	346.44
47	235	3.92	1.6	0.51	0.21	0.43	0.30	24.50	7,349	0	27,876	439,363	2,532	2,532	121	0	25,222	0.58	346.45
48	240	4.00	1.6	0.51	0.21	0.43	0.30	24.50	7,349	0	32,571	439,676	2,534	2,534	121	0	29,915	0.69	346.46
49	245	4.08	1.7	0.54	0.21	0.46	0.33	27.10	8,130	0	38,045	440,041	2,536	2,536	121	0	35,387	0.81	346.48
50	250	4.17	1.8	0.57	0.21	0.49	0.36	29.70	8,911	0	44,298	440,457	2,539	2,539	121	0	41,638	0.96	346.49
51	255	4.25	1.9	0.61	0.21	0.52	0.40	32.31	9,692	0	51,330	440,926	2,541	2,541	121	0	48,668	1.12	346.50
52	260	4.33	2.0	0.64	0.21	0.54	0.43	34.91	10,473	0	59,141	441,446	2,544	2,544	121	0	56,475	1.30	346.52
53	265	4.42	2.1	0.67	0.21	0.57	0.46	37.51	11,254	0	67,730	442,018	2,548	2,548	121	0	65,060	1.49	346.54

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

6-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-4
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	80.90
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	3.58
UNIT TIME-PERCENT OF LAG	139.5
TOTAL ADJUSTED STORM RAIN (in)	2.66
CONSTANT LOSS RATE (in/hr)	0.21
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	0.83 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu ft	Overflow In cu ft	Basin Volume cu ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu ft	Basin Losses Percolation Out cu ft	Basin Losses Drain Tile Out cu ft	Basin Losses Overflow Out cu ft	Total In Basin cu ft	Total In Basin ac-ft	Basin WSEL ft
54	270	4.50	2.1	0.67	0.21	0.57	0.46	37.51	11,254	0	76,315	442,590	2,551	2,551	121	0	73,642	1.69	346.56
55	275	4.58	2.2	0.70	0.21	0.60	0.49	40.12	12,036	13,423	99,101	444,108	2,560	2,560	121	0	96,420	2.21	346.61
56	280	4.67	2.3	0.73	0.21	0.62	0.52	42.72	12,817	19,597	128,833	446,089	2,571	2,571	121	0	126,141	2.90	346.67
57	285	4.75	2.4	0.77	0.21	0.65	0.56	45.33	13,598	20,868	160,607	448,206	2,583	2,583	121	0	157,902	3.62	346.74
58	290	4.83	2.4	0.77	0.21	0.65	0.56	45.33	13,598	20,869	192,369	450,322	2,596	2,596	121	0	189,652	4.35	346.80
59	295	4.92	2.5	0.80	0.21	0.68	0.59	47.93	14,379	22,140	226,171	452,574	2,609	2,609	121	0	223,441	5.13	346.88
60	300	5.00	2.6	0.83	0.21	0.71	0.62	50.53	15,160	23,412	262,013	454,962	2,622	2,622	121	0	259,270	5.95	346.95
61	305	5.08	3.1	0.99	0.21	0.84	0.78	63.55	19,066	29,770	308,106	458,033	2,640	2,640	121	0	305,344	7.01	347.05
62	310	5.17	3.6	1.15	0.21	0.98	0.94	76.57	22,972	36,128	364,444	461,786	2,662	2,662	121	0	361,661	8.30	347.17
63	315	5.25	3.9	1.24	0.21	1.06	1.03	84.38	25,315	40,642	427,618	465,995	2,686	2,686	121	0	424,811	9.75	347.31
64	320	5.33	4.2	1.34	0.21	1.14	1.13	92.20	27,659	47,604	500,074	470,822	2,714	2,714	121	0	497,238	11.41	347.46
65	325	5.42	4.7	1.50	0.21	1.28	1.29	105.22	31,565	54,532	583,335	476,369	2,746	2,746	121	0	580,467	13.33	347.64
66	330	5.50	5.6	1.79	0.21	1.52	1.58	**128.65**	**38,595**	69,680	688,743	483,392	2,786	2,786	121	0	685,835	15.74	347.86
67	335	5.58	1.9	0.61	0.21	0.52	0.40	32.31	9,692	27,057	722,585	485,646	2,799	2,799	121	0	719,664	16.52	347.94
68	340	5.67	0.9	0.29	0.21	0.24	0.08	6.27	1,881	3,039	724,583	485,780	2,800	2,800	121	0	**721,662**	**16.57**	**347.94**
69	345	5.75	0.6	0.19	0.21	0.16	0.03	2.34	703	968	723,333	485,696	2,799	2,799	121	0	720,412	16.54	347.94
70	350	5.83	0.5	0.16	0.21	0.14	0.02	1.95	586	488	721,486	485,573	2,799	2,799	121	0	718,566	16.50	347.93
71	355	5.92	0.3	0.10	0.21	0.08	0.01	1.17	352	99	719,016	485,409	2,798	2,798	121	0	716,097	16.44	347.93
72	360	6.00	0.2	0.06	0.21	0.05	0.01	0.78	234	0	716,331	485,230	2,797	2,797	121	0	713,413	16.38	347.92

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL	2.66 in
RAINFALL VOLUME	781,157 cu ft
SOIL LOSSES	354,322 cu ft
EFFECTIVE RAIN	1.45 in
FLOOD VOLUME	9.80 ac-ft
FLOOD VOLUME	426,836 cu ft
REQUIRED STORAGE	16.57 ac-ft
REQUIRED STORAGE	721,662 cu ft
MAX WSEL	347.94 ft
PEAK FLOW RATE	128.65 cfs
TOTAL BASIN LOSSES	138,884 cu ft
TOTAL OVERFLOW OUT	0 cu ft

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

24-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-4
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	80.90
UNIT TIME-MINUTES	15
LAG TIME - MINUTES	3.58
UNIT TIME-PERCENT OF LAG	418%
TOTAL ADJUSTED STORM RAIN (in)	4.21

VARIABLE LOSS RATE (AVG) IN/HR	
Fm = Minimum value on loss curve (in/hr)	0.11
C	0.00195
Low Loss Rate (percent)	85.00%

Basin Percolation Rate	0.83 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu ft	Overflow In cu ft	Basin Volume cu ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu ft	Basin Losses Percolation Out cu ft	Basin Losses Drain Tile Out cu ft	Basin Losses Overflow Out cu ft	Total In Basin cu ft	Total In Basin ac-ft	Basin WSEL ft
1	15	0.25	0.2	0.034	0.372	0.029	0.01	0.41	371	0	371	437,531	7,566	371	0	0	0	0.00	346.40
2	30	0.50	0.3	0.051	0.367	0.043	0.01	0.62	556	0	556	437,543	7,566	556	0	0	0	0.00	346.40
3	45	0.75	0.3	0.051	0.363	0.043	0.01	0.62	556	0	556	437,543	7,566	556	0	0	0	0.00	346.40
4	60	1.00	0.4	0.067	0.359	0.057	0.01	0.82	742	0	742	437,555	7,566	742	0	0	0	0.00	346.40
5	75	1.25	0.3	0.051	0.355	0.043	0.01	0.62	556	0	556	437,543	7,566	556	0	0	0	0.00	346.40
6	90	1.50	0.3	0.051	0.350	0.043	0.01	0.62	556	0	556	437,543	7,566	556	0	0	0	0.00	346.40
7	105	1.75	0.3	0.051	0.346	0.043	0.01	0.62	556	0	556	437,543	7,566	556	0	0	0	0.00	346.40
8	120	2.00	0.4	0.067	0.342	0.057	0.01	0.82	742	0	742	437,555	7,566	742	0	0	0	0.00	346.40
9	135	2.25	0.4	0.067	0.338	0.057	0.01	0.82	742	0	742	437,555	7,566	742	0	0	0	0.00	346.40
10	150	2.50	0.4	0.067	0.334	0.057	0.01	0.82	742	0	742	437,555	7,566	742	0	0	0	0.00	346.40
11	165	2.75	0.5	0.084	0.330	0.072	0.01	1.03	927	0	927	437,568	7,566	927	0	0	0	0.00	346.40
12	180	3.00	0.5	0.084	0.326	0.072	0.01	1.03	927	0	927	437,568	7,566	927	0	0	0	0.00	346.40
13	195	3.25	0.5	0.084	0.322	0.072	0.01	1.03	927	0	927	437,568	7,566	927	0	0	0	0.00	346.40
14	210	3.50	0.5	0.084	0.318	0.072	0.01	1.03	927	0	927	437,568	7,566	927	0	0	0	0.00	346.40
15	225	3.75	0.5	0.084	0.314	0.072	0.01	1.03	927	0	927	437,568	7,566	927	0	0	0	0.00	346.40
16	240	4.00	0.6	0.101	0.310	0.086	0.02	1.24	1,113	0	1,113	437,580	7,566	1,113	0	0	0	0.00	346.40
17	255	4.25	0.6	0.101	0.306	0.086	0.02	1.24	1,113	0	1,113	437,580	7,566	1,113	0	0	0	0.00	346.40
18	270	4.50	0.7	0.118	0.302	0.100	0.02	1.44	1,298	0	1,298	437,592	7,567	1,298	0	0	0	0.00	346.40
19	285	4.75	0.7	0.118	0.298	0.100	0.02	1.44	1,298	0	1,298	437,592	7,567	1,298	0	0	0	0.00	346.40
20	300	5.00	0.8	0.135	0.294	0.115	0.02	1.65	1,484	0	1,484	437,605	7,567	1,484	0	0	0	0.00	346.40
21	315	5.25	0.6	0.101	0.290	0.086	0.02	1.24	1,113	0	1,113	437,580	7,566	1,113	0	0	0	0.00	346.40
22	330	5.50	0.7	0.118	0.286	0.100	0.02	1.44	1,298	0	1,298	437,592	7,567	1,298	0	0	0	0.00	346.40
23	345	5.75	0.8	0.135	0.283	0.115	0.02	1.65	1,484	0	1,484	437,605	7,567	1,484	0	0	0	0.00	346.40
24	360	6.00	0.8	0.135	0.279	0.115	0.02	1.65	1,484	0	1,484	437,605	7,567	1,484	0	0	0	0.00	346.40
25	375	6.25	0.9	0.152	0.275	0.129	0.02	1.85	1,669	0	1,669	437,617	7,567	1,669	0	0	0	0.00	346.40
26	390	6.50	0.9	0.152	0.272	0.129	0.02	1.85	1,669	0	1,669	437,617	7,567	1,669	0	0	0	0.00	346.40
27	405	6.75	1.0	0.168	0.268	0.143	0.03	2.06	1,855	0	1,855	437,630	7,567	1,855	0	0	0	0.00	346.40
28	420	7.00	1.0	0.168	0.264	0.143	0.03	2.06	1,855	0	1,855	437,630	7,567	1,855	0	0	0	0.00	346.40
29	435	7.25	1.0	0.168	0.261	0.143	0.03	2.06	1,855	0	1,855	437,630	7,567	1,855	0	0	0	0.00	346.40
30	450	7.50	1.1	0.185	0.257	0.157	0.03	2.27	2,040	0	2,040	437,642	7,568	2,040	0	0	0	0.00	346.40
31	465	7.75	1.2	0.202	0.254	0.172	0.03	2.47	2,225	0	2,225	437,654	7,568	2,225	0	0	0	0.00	346.40
32	480	8.00	1.3	0.219	0.250	0.186	0.03	2.68	2,411	0	2,411	437,667	7,568	2,411	0	0	0	0.00	346.40
33	495	8.25	1.5	0.253	0.247	0.215	0.01	0.48	431	0	431	437,535	7,566	431	0	0	0	0.00	346.40
34	510	8.50	1.5	0.253	0.243	0.215	0.01	0.76	683	0	683	437,552	7,566	683	0	0	0	0.00	346.40
35	525	8.75	1.6	0.269	0.240	0.229	0.03	2.41	2,170	0	2,170	437,651	7,568	2,170	0	0	0	0.00	346.40
36	540	9.00	1.7	0.286	0.237	0.243	0.05	4.06	3,654	0	3,654	437,749	7,569	3,654	0	0	0	0.00	346.40
37	555	9.25	1.9	0.320	0.233	0.272	0.09	7.08	6,373	0	6,373	437,931	7,573	6,373	0	0	0	0.00	346.40
38	570	9.50	2.0	0.337	0.230	0.286	0.11	8.73	7,853	0	7,853	438,029	7,574	7,574	278	0	0	0.00	346.40
39	585	9.75	2.1	0.354	0.227	0.301	0.13	10.37	9,330	0	9,330	438,128	7,576	7,576	364	0	1,390	0.03	346.40
40	600	10.00	2.2	0.370	0.223	0.315	0.15	12.01	10,806	0	12,196	438,319	7,579	7,579	364	0	4,253	0.10	346.41
41	615	10.25	1.5	0.253	0.220	0.215	0.03	2.65	2,388	0	6,640	437,948	7,573	6,640	0	0	0	0.00	346.40
42	630	10.50	1.5	0.253	0.217	0.215	0.04	2.91	2,622	0	2,622	437,681	7,568	2,622	0	0	0	0.00	346.40
43	645	10.75	2.0	0.337	0.214	0.286	0.12	10.04	9,036	0	9,036	438,108	7,576	7,576	364	0	1,096	0.03	346.40
44	660	11.00	2.0	0.337	0.211	0.286	0.13	10.29	9,265	0	10,362	438,196	7,577	7,577	364	0	2,420	0.06	346.41
45	675	11.25	1.9	0.320	0.208	0.272	0.11	9.17	8,256	0	10,677	438,217	7,578	7,578	364	0	2,735	0.06	346.41
46	690	11.50	1.9	0.320	0.204	0.272	0.12	9.42	8,481	0	11,216	438,253	7,578	7,578	364	0	3,274	0.08	346.41
47	705	11.75	1.7	0.286	0.201	0.243	0.08	6.92	6,231	0	9,505	438,139	7,576	7,576	364	0	1,565	0.04	346.40
48	720	12.00	1.8	0.303	0.198	0.258	0.10	8.54	7,687	0	9,252	438,122	7,576	7,576	364	0	1,312	0.03	346.40
49	735	12.25	2.5	0.421	0.195	0.358	0.23	18.40	16,559	0	17,871	438,697	7,586	7,586	364	0	9,921	0.23	346.42
50	750	12.50	2.6	0.438	0.193	0.372	0.25	20.01	18,010	0	27,931	439,367	7,597	7,597	364	0	19,970	0.46	346.44
51	765	12.75	2.8	0.472	0.190	0.401	0.28	22.99	20,695	184	40,849	440,227	7,612	7,612	364	0	32,873	0.75	346.47
52	780	13.00	2.9	0.488	0.187	0.415	0.30	24.60	22,141	20,676	75,690	442,549	7,652	7,652	364	0	67,673	1.55	346.54
53	795	13.25	3.4	0.573	0.184	0.487	0.39	31.70	28,530	42,910	139,113	446,774	7,725	7,725	364	0	131,024	3.01	346.68
54	810	13.50	3.4	0.573	0.181	0.487	0.39	**31.93**	**28,735**	43,274	203,033	451,033	7,799	7,799	364	0	194,870	4.47	346.82
55	825	13.75	2.3	0.387	0.178	0.329	0.21	17.04	15,337	21,507	231,715	452,943	7,832	7,832	364	0	223,518	5.13	346.88
56	840	14.00	2.3	0.387	0.176	0.329	0.21	17.26	15,537	21,862	260,917	454,889	7,866	7,866	364	0	252,687	5.80	346.94

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

24-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578		
Job No.:	2735	Area ID:	DA-4
By:	RRR	Date:	3/8/24

DRAINAGE AREA-ACRES	80.90
UNIT TIME-MINUTES	15
LAG TIME - MINUTES	3.58
UNIT TIME-PERCENT OF LAG	418%
TOTAL ADJUSTED STORM RAIN (in)	4.21

VARIABLE LOSS RATE (AVG) IN/HR	
Fm = Minimum value on loss curve (in/hr)	0.11
C	0.00195
Low Loss Rate (percent)	85.00%

Basin Percolation Rate	0.83 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu ft	Overflow In cu ft	Basin Volume cu ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu ft	Basin Losses Percolation Out cu ft	Basin Losses Drain Tile Out cu ft	Basin Losses Overflow Out cu ft	Total In Basin cu ft	Total In Basin ac-ft	Basin WSEL ft
57	855	14.25	2.7	0.455	0.173	0.386	0.28	22.98	20,679	30,258	303,624	457,734	7,915	7,915	364	0	295,345	6.78	347.03
58	870	14.50	2.6	0.438	0.170	0.372	0.27	21.82	19,636	28,592	343,573	460,396	7,961	7,961	364	0	335,248	7.70	347.12
59	885	14.75	2.6	0.438	0.168	0.372	0.27	22.03	19,828	28,932	384,008	463,090	8,008	8,008	364	0	375,636	8.62	347.20
60	900	15.00	2.5	0.421	0.165	0.358	0.26	20.87	18,780	29,251	423,667	465,732	8,053	8,053	364	0	415,250	9.53	347.29
61	915	15.25	2.4	0.404	0.163	0.344	0.24	19.70	17,729	27,670	460,649	468,196	8,096	8,096	364	0	452,189	10.38	347.37
62	930	15.50	2.3	0.387	0.160	0.329	0.23	18.53	16,675	25,834	494,699	470,464	8,135	8,135	364	0	486,200	11.16	347.44
63	945	15.75	1.9	0.320	0.158	0.272	0.16	13.23	11,910	17,417	515,526	471,852	8,159	8,159	364	0	507,003	11.64	347.48
64	960	16.00	1.9	0.320	0.155	0.272	0.16	13.43	12,087	17,761	536,851	473,272	8,184	8,184	364	0	**528,304**	**12.13**	**347.53**
65	975	16.25	0.4	0.067	0.153	0.057	0.01	0.82	742	0	529,046	472,752	8,175	8,175	364	0	520,507	11.95	347.51
66	990	16.50	0.4	0.067	0.151	0.057	0.01	0.82	742	0	521,249	472,233	8,166	8,166	364	0	512,719	11.77	347.49
67	1005	16.75	0.3	0.051	0.148	0.043	0.01	0.62	556	0	513,275	471,702	8,157	8,157	364	0	504,755	11.59	347.48
68	1020	17.00	0.3	0.051	0.146	0.043	0.01	0.62	556	0	505,311	471,171	8,147	8,147	364	0	496,800	11.40	347.46
69	1035	17.25	0.5	0.084	0.144	0.072	0.01	1.03	927	0	497,727	470,666	8,139	8,139	364	0	489,224	11.23	347.44
70	1050	17.50	0.5	0.084	0.142	0.072	0.01	1.03	927	0	490,152	470,161	8,130	8,130	364	0	481,658	11.06	347.43
71	1065	17.75	0.5	0.084	0.140	0.072	0.01	1.03	927	0	482,585	469,657	8,121	8,121	364	0	474,100	10.88	347.41
72	1080	18.00	0.4	0.067	0.138	0.057	0.01	0.82	742	0	474,841	469,141	8,112	8,112	364	0	466,365	10.71	347.40
73	1095	18.25	0.4	0.067	0.136	0.057	0.01	0.82	742	0	467,107	468,626	8,103	8,103	364	0	458,640	10.53	347.38
74	1110	18.50	0.4	0.067	0.134	0.057	0.01	0.82	742	0	459,381	468,111	8,094	8,094	364	0	450,923	10.35	347.36
75	1125	18.75	0.3	0.051	0.132	0.043	0.01	0.62	556	0	451,479	467,585	8,085	8,085	364	0	443,030	10.17	347.35
76	1140	19.00	0.2	0.034	0.130	0.029	0.01	0.41	371	0	443,401	467,046	8,076	8,076	364	0	434,961	9.99	347.33
77	1155	19.25	0.3	0.051	0.128	0.043	0.01	0.62	556	0	435,517	466,521	8,067	8,067	364	0	427,086	9.80	347.31
78	1170	19.50	0.4	0.067	0.126	0.057	0.01	0.82	742	0	427,828	466,009	8,058	8,058	364	0	419,406	9.63	347.30
79	1185	19.75	0.3	0.051	0.124	0.043	0.01	0.62	556	0	419,962	465,485	8,049	8,049	364	0	411,549	9.45	347.28
80	1200	20.00	0.2	0.034	0.123	0.029	0.01	0.41	371	0	411,920	464,949	8,040	8,040	364	0	403,516	9.26	347.26
81	1215	20.25	0.3	0.051	0.121	0.043	0.01	0.62	556	0	404,073	464,426	8,031	8,031	364	0	395,678	9.08	347.24
82	1230	20.50	0.3	0.051	0.120	0.043	0.01	0.62	556	0	396,234	463,904	8,022	8,022	364	0	387,848	8.90	347.23
83	1245	20.75	0.3	0.051	0.118	0.043	0.01	0.62	556	0	388,405	463,382	8,013	8,013	364	0	380,028	8.72	347.21
84	1260	21.00	0.2	0.034	0.117	0.029	0.01	0.41	371	0	380,399	462,849	8,003	8,003	364	0	372,032	8.54	347.19
85	1275	21.25	0.3	0.051	0.115	0.043	0.01	0.62	556	0	372,588	462,329	7,994	7,994	364	0	364,229	8.36	347.18
86	1290	21.50	0.2	0.034	0.114	0.029	0.01	0.41	371	0	364,600	461,797	7,985	7,985	364	0	356,251	8.18	347.16
87	1305	21.75	0.3	0.051	0.113	0.043	0.01	0.62	556	0	356,807	461,277	7,976	7,976	364	0	348,467	8.00	347.14
88	1320	22.00	0.2	0.034	0.111	0.029	0.01	0.41	371	0	348,838	460,746	7,967	7,967	364	0	340,507	7.82	347.13
89	1335	22.25	0.3	0.051	0.110	0.043	0.01	0.62	556	0	341,063	460,228	7,958	7,958	364	0	332,741	7.64	347.11
90	1350	22.50	0.2	0.034	0.109	0.029	0.01	0.41	371	0	333,112	459,699	7,949	7,949	364	0	324,799	7.46	347.09
91	1365	22.75	0.2	0.034	0.108	0.029	0.01	0.41	371	0	325,170	459,170	7,940	7,940	364	0	316,866	7.27	347.08
92	1380	23.00	0.2	0.034	0.108	0.029	0.01	0.41	371	0	317,237	458,641	7,931	7,931	364	0	308,942	7.09	347.06
93	1395	23.25	0.2	0.034	0.107	0.029	0.01	0.41	371	0	309,313	458,113	7,922	7,922	364	0	301,027	6.91	347.04
94	1410	23.50	0.2	0.034	0.106	0.029	0.01	0.41	371	0	301,398	457,586	7,912	7,912	364	0	293,122	6.73	347.03
95	1425	23.75	0.2	0.034	0.106	0.029	0.01	0.41	371	0	293,493	457,059	7,903	7,903	364	0	285,225	6.55	347.01
96	1440	24.00	0.2	0.034	0.105	0.029	0.01	0.41	371	0	285,596	456,533	7,894	7,894	364	0	277,338	6.37	346.99

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL	4.21 in
RAINFALL VOLUME	1,236,343 cu ft
SOIL LOSSES	782,388 cu ft
EFFECTIVE RAIN	1.55 in
FLOOD VOLUME	10.42 ac-ft
FLOOD VOLUME	453,955 cu ft
REQUIRED STORAGE	12.13 ac-ft
REQUIRED STORAGE	528,304 cu ft
MAX WSEL	347.53 ft
PEAK FLOW RATE	31.93 cfs
TOTAL BASIN LOSSES	810,084 cu ft
TOTAL OVERFLOW OUT	0 cu ft

BASIN VOLUME WORKSHEET

PROECT Thermal Ranch TTM 38578
JOB No. 2735
BASIN DESIGNATION: Retention Basin 4

BASIN CHARACTERISTICS

CONTOUR ELEVATION	DEPTH		AREA		VOLUME		
	INCR (ft)	TOTAL (ft)	INCR (sf)	TOTAL (sf)	INCR (cuft)	TOTAL (cuft)	(acre-ft)
346.4	0	0		437,506	0	0	0.00
348.4	2	2	62,407	499,913	936,726	936,726	21.50

WHERE: $$V = \frac{1}{3}(E_1 - E_2)\left(A_1 + A_2 + \sqrt{A_1 A_2}\right)$$

RCFCD SYNTHETIC UNIT HYDROGRAPH - SHORTCUT METHOD

DATA INPUT SHEET

DATE	March 8, 2024
WORKSHEET PREPARED BY:	RRR
PROJECT NAME	Thermal Ranch TTM 38578
PROJECT NUMBER	2735
CONCENTRATION POINT DESIGNATION	Retention Basin 5
AREA DESIGNATION	DA-5
AMC NUMBER	2

Low Loss Conditions: X=Existing; D=Developed; BS=Retention

AREA DESIG	SOIL GROUP	TRIBUTARY AREAS	ACRES	LOW LOSS CONDITION	RI NUMBER	AMC II INFILTRATION RATE	IMPERVIOUS PERCENT
2	B	OFFSITE STREETS	8.7	D	56	0.51	0.90
2	C	OFFSITE STREETS	4.7	D	69	0.39	0.90
6	B	RESORT/COMMERCIAL	31.3	D	56	0.51	0.65
6	C	RESORT/COMMERCIAL	40.4	D	69	0.39	0.65
8	B	WORKFORCE HOUSING	2.2	D	56	0.51	0.75
8	C	WORKFORCE HOUSING	4.5	D	69	0.39	0.75
18	B	EQUESTRIAN CENTER	7.0	X	69	0.39	0.50

LENGTH OF WATERCOURSE (L)	2,141 ft
LENGTH TO POINT OPPOSITE CENTROID (Lca)	1,473 ft
ELEVATION OF HEADWATER	368.0 ft
ELEVATION OF CONCENTRATION POINT	362.0 ft
AVERAGE MANNINGS 'N' VALUE	0.020
STORM FREQUENCY (YEAR)	100
LOW LOSS RATE (Storm Events > 10 Years)	**85%**
POINT RAIN FROM NOAA ATLAS	**14**
1-HOUR	1.22 in
3-HOUR	2.00 in
6-HOUR	2.66 in
24-HOUR	4.21 in

BASIN CHARACTERISTICS:

ELEVATION	AREA
360.0 ft	285,651 sf
362.1 ft	332,665 sf

PERCOLATION RATE (in/hr)	0.06 in/hr
DRYWELL DATA	
NUMBER USED	0
PERCOLATION RATE	
LOWEST FLOWLINE ELEVATION	355.60
LOWEST PAD ELEVATION	

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD BASIC DATA CALCULATION FORM	PROJECT: Thermal Ranch TTM 38578 Job No.: 2735 BY: RRR DATE: 3/8/24

PHYSICAL DATA

[1] CONCENTRATION POINT	Retention Basin 5
[2] AREA DESIGNATION	DA-5
[3] AREA - ACRES	98.800
[4] L-FEET	2141
[5] L-MILES	0.405
[6] La-FEET	1473.00
[7] La-MILES	0.279
[8] ELEVATION OF HEADWATER	368
[9] ELEVATION OF CONCENTRATION POINT	362
[10] H-FEET	6
[11] S-FEET/MILE	14.8
[12] S^0.5	3.85
[13] L*LCA/S^0.5	0.029
[14] AVERAGE MANNINGS 'N'	0.02
[15] LAG TIME-HOURS	0.13
[16] LAG TIME-MINUTES	7.5
[17] 100% OF LAG-MINUTES	7.5
[18] 200% OF LAG-MINUTES	15.1

RAINFALL DATA

[1] AMC	II
[2] FREQUENCY-YEARS	100
FROM NOAA ATLAS	**14**
[3] STORM DURATION:	Point Rain
1-HOUR	1.22 in
3-HOUR	2.00 in
6-HOUR	2.66 in
24-HOUR	4.21 in

STORM EVENT SUMMARY

STORM DURATION		1-HOUR	3-HOUR	6-HOUR	24-HOUR
RAINFALL VOLUME	(cu-ft)	437,547	717,291	953,997	**1,509,897**
SOIL LOSSES	(cu-ft)	60,952	181,436	357,560	**847,428**
EFFECTIVE RAIN	(in)	1.05	1.49	1.66	1.85
FLOOD VOLUME	(cu-ft)	376,595	535,855	596,437	**662,469**
	(acre-ft)	8.65	12.30	13.69	**15.21**
REQUIRED STORAGE	(cu-ft)	375,112	531,352	587,495	**625,546**
	(acre-ft)	8.61	12.20	13.49	**14.36**
FACTOR OF SAFETY		1.73	1.22	1.10	1.04
STORAGE PROVIDED	(cu-ft)	648,605			
	(acre-ft)	14.89			
PEAK FLOW	(cfs)	n/a	179.13	161.15	42.46
MAXIMUM WSEL	(ft)	361.21	361.72	361.90	**362.03**
DEPTH	(ft)	1.21	1.72	1.90	**2.03**
LOWEST FLOWLINE ELEVATION		355.60			
DIFFERENCE	(ft)	-5.61	-6.12	-6.30	-6.43
LOWEST PAD ELEVATION					
DIFFERENCE	(ft)				
ESTIMATED TIME TO DEWATER BASIN Based on Total Flood Volume & Average Percolation Rate	(days)	10.6	14.9	16.7	17.9

NOTE: PEAK FLOW FOR THE 1-HOUR STORM IS NOT REPRESENTATIVE. PER RCFCD PEAK DISCHARGES FROM THE 3-HOUR STORM SHOULD NORMALLY COMPARE WELL WITH RATIONAL PEAKS.

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD BASIC DATA CALCULATION FORM AMC II	PROJECT: Thermal Ranch TTM 38578 Job No.: 2735 Area ID: DA-5 By: RRR Date: 3/8/24

AVERAGE ADJUSTED LOSS RATE

SOIL GROUP [Plate C-1]	LAND USE	RI NUMBER [Plate E-6.1]	PERVIOUS AREA INFILTRATION RATE (in/hr) [Plate E-6.2]	DECIMAL PERCENT OF AREA IMPERVIOUS [Plate E-6.3]	ADJUSTED INFILTRATION RATE (in/hr)	AREA	AREA WEIGHTED AVERAGE	MAX AVERAGE ADJUSTED INFILTRATION RATE (in/hr)	LOW LOSS CONDITION	LOW LOSS RATE PER RCFC/2322	MIN AVERAGE ADJUSTED INFILTRATION RATE
B	OFFSITE STREETS	56	0.51	90%	0.10	8.700	0.088	0.0085	DEVELOPED	0.1800	0.0159
C	OFFSITE STREETS	69	0.39	90%	0.07	4.700	0.048	0.0035	DEVELOPED	0.1800	0.0086
B	RESORT/COMMERCIAL	56	0.51	65%	0.21	31.300	0.317	0.0671	DEVELOPED	0.3800	0.1204
C	RESORT/COMMERCIAL	69	0.39	65%	0.16	40.400	0.409	0.0662	DEVELOPED	0.3800	0.1554
B	WORKFORCE HOUSING	56	0.51	75%	0.17	2.200	0.022	0.0037	DEVELOPED	0.3000	0.0067
C	WORKFORCE HOUSING	69	0.39	75%	0.13	4.500	0.046	0.0058	DEVELOPED	0.3000	0.0137
B	EQUESTRIAN CENTER	69	0.39	50%	0.21	7.000	0.071	0.0152	UNDEVELOPED	0.9000	0.0638
					SUM	98.800	SUM	0.1700			0.3843

VARIABLE LOSS RATE CURVE (24-HOUR STORM ONLY)

Fm= 0.084975759

C= 0.00157

F_t=C(24-(T/60))^1.55+F_m = 0.00157 (24-(T/60))^1.55 + 0.08 in/hr

CONSTANT LOSS RATE (3 & 6 HOUR STORMS) = **0.1700**

LOW LOSS RATE = **0.8500**

Where:

T=Time in minutes. To get an average value for each unit time period, Use T=1/2 the unit time for the first time period, T=1 1/2 unit time for the second period, etc.

NOTE: Low loss rates established per RCFC/2322 (Dated: May-30-95)
For 10 Year Storms or Less
Undeveloped Condition: Low Loss = 90%
Developed Condition: Low Loss = 0.9 - (0.8 * %impervious)
Basin Site: Low Loss = 10%
For 100 Year Storm - Low Loss should be between 80% & 90% of the Rainfall Rate

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

1-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-5
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	98.80
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	7.54
UNIT TIME-PERCENT OF LAG	66.3
TOTAL ADJUSTED STORM RAIN-INCHES	1.22
CONSTANT LOSS RATE-in/hr	0.17
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	0.1 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu-ft	Basin Volume cu-ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu-ft	Basin Losses Percolation Out cu-ft	Total In Basin cu-ft	Total In Basin ac-ft	Basin WSEL ft
1	5	0.08	3.6	0.53	0.17	0.45	0.36	35.57	10,672	10,672	286,425	119	119	10,553	0.24	360.03
2	10	0.17	4.2	0.61	0.17	0.52	0.44	44.33	13,298	23,851	287,380	120	120	23,731	0.54	360.08
3	15	0.25	4.4	0.64	0.17	0.55	0.47	47.24	14,173	37,904	288,398	120	120	37,783	0.87	360.12
4	20	0.33	4.6	0.67	0.17	0.57	0.50	50.16	15,048	52,831	289,480	121	121	52,711	1.21	360.17
5	25	0.42	5.0	0.73	0.17	0.62	0.56	55.99	16,798	69,509	290,689	121	121	69,388	1.59	360.22
6	30	0.50	5.6	0.82	0.17	0.70	0.65	64.74	19,423	88,811	292,088	122	122	88,689	2.04	360.29
7	35	0.58	6.4	0.94	0.17	0.80	0.77	76.41	22,924	111,613	293,741	122	122	111,490	2.56	360.36
8	40	0.67	8.1	1.19	0.17	1.01	1.02	101.21	30,362	141,852	295,933	123	123	141,729	3.25	360.46
9	45	0.75	13.1	1.92	0.17	1.63	1.75	174.13	52,239	193,968	299,711	125	125	193,844	4.45	360.63
10	50	0.83	34.5	5.05	0.17	4.29	4.88	**486.25**	**145,874**	339,718	310,275	129	129	339,589	7.80	361.10
11	55	0.92	6.7	0.98	0.17	0.83	0.81	80.79	24,236	363,825	312,023	130	130	363,695	8.35	361.18
12	60	1.00	3.8	0.56	0.17	0.47	0.39	38.49	11,547	375,242	312,850	130	130	**375,112**	**8.61**	**361.21**

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY	
TOTAL RAINFALL	1.22 in
RAINFALL VOLUME	437,547 cu-ft
SOIL LOSSES	60,952 cu-ft
EFFECTIVE RAIN	1.05 in
FLOOD VOLUME	8.65 acft
FLOOD VOLUME	376,595 cu-ft
REQUIRED STORAGE	8.61
REQUIRED STORAGE	375,112 cu-ft
MAX WSEL	361.21 ft
PEAK FLOW RATE	486.25 cfs
TOTAL BASIN LOSSES	1,483 cu-ft
AVERAGE PERCOLATION RATE	24.72 cf/min

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

3-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-5
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	98.80
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	7.54
UNIT TIME-PERCENT OF LAG	66.3
TOTAL ADJUSTED STORM RAIN (in)	2.00
CONSTANT LOSS RATE (in/hr)	0.17
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	0.1 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu-ft	Basin Volume cu-ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu-ft	Basin Losses Percolation Out cu-ft	Total In Basin cu-ft	Total In Basin ac-ft	Basin WSEL ft
1	5	0.08	1.3	0.31	0.17	0.27	0.14	14.15	4,245	4,245	285,959	119	119	4,126	0.09	360.01
2	10	0.17	1.3	0.31	0.17	0.27	0.14	14.15	4,245	8,372	286,258	119	119	8,252	0.19	360.03
3	15	0.25	1.1	0.26	0.17	0.22	0.09	9.37	2,811	11,063	286,453	119	119	10,944	0.25	360.04
4	20	0.33	1.5	0.36	0.17	0.31	0.19	18.93	5,680	16,624	286,856	120	120	16,504	0.38	360.05
5	25	0.42	1.5	0.36	0.17	0.31	0.19	18.93	5,680	22,184	287,259	120	120	22,065	0.51	360.07
6	30	0.50	1.8	0.43	0.17	0.37	0.26	26.11	7,832	29,897	287,818	120	120	29,777	0.68	360.10
7	35	0.58	1.5	0.36	0.17	0.31	0.19	18.93	5,680	35,457	288,221	120	120	35,337	0.81	360.11
8	40	0.67	1.8	0.43	0.17	0.37	0.26	26.11	7,832	43,168	288,780	120	120	43,048	0.99	360.14
9	45	0.75	1.8	0.43	0.17	0.37	0.26	26.11	7,832	50,880	289,339	121	121	50,759	1.17	360.16
10	50	0.83	1.5	0.36	0.17	0.31	0.19	18.93	5,680	56,439	289,742	121	121	56,319	1.29	360.18
11	55	0.92	1.6	0.38	0.17	0.33	0.21	21.32	6,397	62,716	290,197	121	121	62,595	1.44	360.20
12	60	1.00	1.8	0.43	0.17	0.37	0.26	26.11	7,832	70,427	290,756	121	121	70,306	1.61	360.23
13	65	1.08	2.2	0.53	0.17	0.45	0.36	35.67	10,701	81,007	291,523	121	121	80,885	1.86	360.26
14	70	1.17	2.2	0.53	0.17	0.45	0.36	35.67	10,701	91,586	292,290	122	122	91,465	2.10	360.30
15	75	1.25	2.2	0.53	0.17	0.45	0.36	35.67	10,701	102,166	293,056	122	122	102,044	2.34	360.33
16	80	1.33	2.0	0.48	0.17	0.41	0.31	30.89	9,266	111,310	293,719	122	122	111,188	2.55	360.36
17	85	1.42	2.6	0.62	0.17	0.53	0.45	45.23	13,570	124,758	294,694	123	123	124,635	2.86	360.40
18	90	1.50	2.7	0.65	0.17	0.55	0.48	47.62	14,287	138,923	295,721	123	123	138,799	3.19	360.45
19	95	1.58	2.4	0.58	0.17	0.49	0.41	40.45	12,136	150,935	296,591	124	124	150,811	3.46	360.49
20	100	1.67	2.7	0.65	0.17	0.55	0.48	47.62	14,287	165,099	297,618	124	124	164,975	3.79	360.53
21	105	1.75	3.3	0.79	0.17	0.67	0.62	61.97	18,591	183,566	298,957	125	125	183,441	4.21	360.59
22	110	1.83	3.1	0.74	0.17	0.63	0.57	57.19	17,157	200,598	300,191	125	125	200,473	4.60	360.65
23	115	1.92	2.9	0.70	0.17	0.59	0.53	52.41	15,722	216,195	301,322	126	126	216,070	4.96	360.70
24	120	2.00	3.0	0.72	0.17	0.61	0.55	54.80	16,439	232,509	302,504	126	126	232,383	5.33	360.75
25	125	2.08	3.1	0.74	0.17	0.63	0.57	57.19	17,157	249,540	303,739	127	127	249,413	5.73	360.81

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

3-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-5
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	98.80
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	7.54
UNIT TIME-PERCENT OF LAG	66.3
TOTAL ADJUSTED STORM RAIN (in)	2.00
CONSTANT LOSS RATE (in/hr)	0.17
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	0.1 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu-ft	Basin Volume cu-ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu-ft	Basin Losses Percolation Out cu-ft	Total In Basin cu-ft	Total In Basin ac-ft	Basin WSEL ft
26	130	2.17	4.2	1.01	0.17	0.86	0.84	83.49	25,047	274,460	305,545	127	127	274,333	6.30	360.89
27	135	2.25	5.0	1.20	0.17	1.02	1.03	102.62	30,785	305,118	307,767	128	128	304,989	7.00	360.99
28	140	2.33	3.5	0.84	0.17	0.71	0.67	66.75	20,026	325,015	309,210	129	129	324,886	7.46	361.05
29	145	2.42	6.8	1.63	0.17	1.39	1.46	145.65	43,696	368,583	312,368	130	130	368,453	8.46	361.19
30	150	2.50	7.3	1.75	0.17	1.49	1.58	157.61	47,283	415,736	315,785	132	132	415,604	9.54	361.35
31	155	2.58	8.2	1.97	0.17	1.67	1.80	**179.13**	**53,738**	469,342	319,671	133	133	469,209	10.77	361.52
32	160	2.67	5.9	1.42	0.17	1.20	1.25	124.14	37,241	506,450	322,361	134	134	506,316	11.62	361.64
33	165	2.75	2.0	0.48	0.17	0.41	0.31	30.89	9,266	515,582	323,023	135	135	515,448	11.83	361.67
34	170	2.83	1.8	0.43	0.17	0.37	0.26	26.11	7,832	523,280	323,581	135	135	523,145	12.01	361.69
35	175	2.92	1.8	0.43	0.17	0.37	0.26	26.11	7,832	530,977	324,139	135	135	530,842	12.19	361.72
36	180	3.00	0.6	0.14	0.17	0.12	0.02	2.15	646	531,487	324,176	135	135	**531,352**	**12.20**	**361.72**

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAIN	2.00 in
RAINFALL VOLUME	717,291 cu-ft
SOIL LOSSES	181,436 cu-ft
EFFECTIVE RAIN	1.49 in
FLOOD VOLUME	12.30 acft
FLOOD VOLUME	535,855 cu-ft
REQUIRED STORAGE	12.20 acft
REQUIRED STORAGE	531,352 cu-ft
MAX WSEL	361.72 ft
PEAK FLOW RATE	179.13 cfs
TOTAL BASIN LOSSES	4,503 cu-ft
AVERAGE PERCOLATION RATE	25.02 cf/min

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

6-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578
Job No.:	2735
Area ID:	DA-5
By:	RRR
Date:	3/8/24

DRAINAGE AREA-ACRES	98.80
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	7.54
UNIT TIME-PERCENT OF LAG	66.3
TOTAL ADJUSTED STORM RAIN (in)	2.66
CONSTANT LOSS RATE (in/hr)	0.17
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	0.1 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu-ft	Basin Volume cu-ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu-ft	Basin Losses Percolation Out cu-ft	Total In Basin cu-ft	Total In Basin ac-ft	Basin WSEL ft
1	5	0.08	0.5	0.16	0.17	0.14	0.02	2.38	715	715	285,703	119	119	596	0.01	360.00
2	10	0.17	0.6	0.19	0.17	0.16	0.02	2.15	645	1,241	285,741	119	119	1,122	0.03	360.00
3	15	0.25	0.6	0.19	0.17	0.16	0.02	2.15	645	1,767	285,779	119	119	1,648	0.04	360.01
4	20	0.33	0.6	0.19	0.17	0.16	0.02	2.15	645	2,292	285,817	119	119	2,173	0.05	360.01
5	25	0.42	0.6	0.19	0.17	0.16	0.02	2.15	645	2,818	285,855	119	119	2,699	0.06	360.01
6	30	0.50	0.7	0.22	0.17	0.19	0.05	5.33	1,599	4,297	285,962	119	119	4,178	0.10	360.01
7	35	0.58	0.7	0.22	0.17	0.19	0.05	5.33	1,599	5,777	286,070	119	119	5,657	0.13	360.02
8	40	0.67	0.7	0.22	0.17	0.19	0.05	5.33	1,599	7,256	286,177	119	119	7,137	0.16	360.02
9	45	0.75	0.7	0.22	0.17	0.19	0.05	5.33	1,599	8,735	286,284	119	119	8,616	0.20	360.03
10	50	0.83	0.7	0.22	0.17	0.19	0.05	5.33	1,599	10,215	286,391	119	119	10,095	0.23	360.03
11	55	0.92	0.7	0.22	0.17	0.19	0.05	5.33	1,599	11,694	286,499	119	119	11,575	0.27	360.04
12	60	1.00	0.8	0.26	0.17	0.22	0.09	8.51	2,553	14,127	286,675	119	119	14,008	0.32	360.05
13	65	1.08	0.8	0.26	0.17	0.22	0.09	8.51	2,553	16,561	286,851	120	120	16,441	0.38	360.05
14	70	1.17	0.8	0.26	0.17	0.22	0.09	8.51	2,553	18,994	287,028	120	120	18,874	0.43	360.06
15	75	1.25	0.8	0.26	0.17	0.22	0.09	8.51	2,553	21,427	287,204	120	120	21,307	0.49	360.07
16	80	1.33	0.8	0.26	0.17	0.22	0.09	8.51	2,553	23,860	287,380	120	120	23,740	0.54	360.08
17	85	1.42	0.8	0.26	0.17	0.22	0.09	8.51	2,553	26,292	287,557	120	120	26,173	0.60	360.08
18	90	1.50	0.8	0.26	0.17	0.22	0.09	8.51	2,553	28,725	287,733	120	120	28,605	0.66	360.09
19	95	1.58	0.8	0.26	0.17	0.22	0.09	8.51	2,553	31,158	287,909	120	120	31,038	0.71	360.10
20	100	1.67	0.8	0.26	0.17	0.22	0.09	8.51	2,553	33,591	288,086	120	120	33,471	0.77	360.11
21	105	1.75	0.8	0.26	0.17	0.22	0.09	8.51	2,553	36,023	288,262	120	120	35,903	0.82	360.12
22	110	1.83	0.8	0.26	0.17	0.22	0.09	8.51	2,553	38,456	288,438	120	120	38,336	0.88	360.12
23	115	1.92	0.8	0.26	0.17	0.22	0.09	8.51	2,553	40,888	288,615	120	120	40,768	0.94	360.13
24	120	2.00	0.9	0.29	0.17	0.24	0.12	11.69	3,507	44,274	288,860	120	120	44,154	1.01	360.14

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD SHORTCUT METHOD 6-HOUR STORM UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM	PROJECT: Thermal Ranch TTM 38578 Job No.: 2735 Area ID: DA-5 By: RRR Date: 3/8/24

DRAINAGE AREA-ACRES	98.80	Basin Percolation Rate	0.1 in/hr
UNIT TIME-MINUTES	5		
LAG TIME - MINUTES	7.54	Maxwell Drywells	
UNIT TIME-PERCENT OF LAG	66.3	Number	0
TOTAL ADJUSTED STORM RAIN (in)	2.66	Drywell Percolation Rate	0.00 cfs 0.00 cfm
CONSTANT LOSS RATE (in/hr)	0.17		
LOW LOSS RATE - PERCENT	85.00%		

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu-ft	Basin Volume cu-ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu-ft	Basin Losses Percolation Out cu-ft	Total In Basin cu-ft	Total In Basin ac-ft	Basin WSEL ft
25	125	2.08	0.8	0.26	0.17	0.22	0.09	8.51	2,553	46,707	289,037	120	120	46,586	1.07	360.15
26	130	2.17	0.9	0.29	0.17	0.24	0.12	11.69	3,507	50,093	289,282	121	121	49,972	1.15	360.16
27	135	2.25	0.9	0.29	0.17	0.24	0.12	11.69	3,507	53,479	289,527	121	121	53,358	1.22	360.17
28	140	2.33	0.9	0.29	0.17	0.24	0.12	11.69	3,507	56,865	289,773	121	121	56,744	1.30	360.18
29	145	2.42	0.9	0.29	0.17	0.24	0.12	11.69	3,507	60,251	290,018	121	121	60,130	1.38	360.19
30	150	2.50	0.9	0.29	0.17	0.24	0.12	11.69	3,507	63,637	290,264	121	121	63,516	1.46	360.21
31	155	2.58	0.9	0.29	0.17	0.24	0.12	11.69	3,507	67,022	290,509	121	121	66,901	1.54	360.22
32	160	2.67	0.9	0.29	0.17	0.24	0.12	11.69	3,507	70,408	290,754	121	121	70,287	1.61	360.23
33	165	2.75	1.0	0.32	0.17	0.27	0.15	14.87	4,461	74,747	291,069	121	121	74,626	1.71	360.24
34	170	2.83	1.0	0.32	0.17	0.27	0.15	14.87	4,461	79,087	291,384	121	121	78,965	1.81	360.26
35	175	2.92	1.0	0.32	0.17	0.27	0.15	14.87	4,461	83,426	291,698	122	122	83,304	1.91	360.27
36	180	3.00	1.0	0.32	0.17	0.27	0.15	14.87	4,461	87,765	292,013	122	122	87,643	2.01	360.28
37	185	3.08	1.0	0.32	0.17	0.27	0.15	14.87	4,461	92,104	292,327	122	122	91,982	2.11	360.30
38	190	3.17	1.1	0.35	0.17	0.30	0.18	18.05	5,415	97,397	292,711	122	122	97,275	2.23	360.31
39	195	3.25	1.1	0.35	0.17	0.30	0.18	18.05	5,415	102,689	293,094	122	122	102,567	2.35	360.33
40	200	3.33	1.1	0.35	0.17	0.30	0.18	18.05	5,415	107,982	293,478	122	122	107,859	2.48	360.35
41	205	3.42	1.2	0.38	0.17	0.33	0.21	21.23	6,369	114,228	293,931	122	122	114,106	2.62	360.37
42	210	3.50	1.3	0.41	0.17	0.35	0.25	24.41	7,323	121,428	294,453	123	123	121,305	2.78	360.39
43	215	3.58	1.4	0.45	0.17	0.38	0.28	27.59	8,277	129,582	295,044	123	123	129,459	2.97	360.42
44	220	3.67	1.4	0.45	0.17	0.38	0.28	27.59	8,277	137,736	295,635	123	123	137,613	3.16	360.45
45	225	3.75	1.5	0.48	0.17	0.41	0.31	30.77	9,231	146,843	296,295	123	123	146,720	3.37	360.48
46	230	3.83	1.5	0.48	0.17	0.41	0.31	30.77	9,231	155,950	296,955	124	124	155,827	3.58	360.50
47	235	3.92	1.6	0.51	0.17	0.43	0.34	33.95	10,185	166,011	297,684	124	124	165,887	3.81	360.54
48	240	4.00	1.6	0.51	0.17	0.43	0.34	33.95	10,185	176,072	298,414	124	124	175,947	4.04	360.57
49	245	4.08	1.7	0.54	0.17	0.46	0.37	37.13	11,139	187,086	299,212	125	125	186,961	4.29	360.61
50	250	4.17	1.8	0.57	0.17	0.49	0.40	40.31	12,093	199,054	300,079	125	125	198,929	4.57	360.64

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD SHORTCUT METHOD 6-HOUR STORM UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM	PROJECT: Thermal Ranch TTM 38578 Job No.: 2735 Area ID: DA-5 By: RRR Date: 3/8/24

DRAINAGE AREA-ACRES	98.80	Basin Percolation Rate	0.1 in/hr
UNIT TIME-MINUTES	5		
LAG TIME - MINUTES	7.54	Maxwell Drywells	
UNIT TIME-PERCENT OF LAG	66.3	Number	0
TOTAL ADJUSTED STORM RAIN (in)	2.66	Drywell Percolation Rate	0.00 cfs 0.00 cfm
CONSTANT LOSS RATE (in/hr)	0.17		
LOW LOSS RATE - PERCENT	85.00%		

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu-ft	Basin Volume cu-ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu-ft	Basin Losses Percolation Out cu-ft	Total In Basin cu-ft	Total In Basin ac-ft	Basin WSEL ft
51	255	4.25	1.9	0.61	0.17	0.52	0.44	43.49	13,047	211,975	301,016	125	125	211,850	4.86	360.69
52	260	4.33	2.0	0.64	0.17	0.54	0.47	46.67	14,001	225,851	302,022	126	126	225,725	5.18	360.73
53	265	4.42	2.1	0.67	0.17	0.57	0.50	49.85	14,955	240,679	303,097	126	126	240,553	5.52	360.78
54	270	4.50	2.1	0.67	0.17	0.57	0.50	49.85	14,955	255,508	304,171	127	127	255,381	5.86	360.83
55	275	4.58	2.2	0.70	0.17	0.60	0.53	53.03	15,909	271,289	305,315	127	127	271,162	6.23	360.88
56	280	4.67	2.3	0.73	0.17	0.62	0.56	56.21	16,863	288,025	306,528	128	128	287,897	6.61	360.93
57	285	4.75	2.4	0.77	0.17	0.65	0.60	59.39	17,817	305,714	307,811	128	128	305,585	7.02	360.99
58	290	4.83	2.4	0.77	0.17	0.65	0.60	59.39	17,817	323,402	309,093	129	129	323,273	7.42	361.05
59	295	4.92	2.5	0.80	0.17	0.68	0.63	62.57	18,771	342,044	310,444	129	129	341,914	7.85	361.11
60	300	5.00	2.6	0.83	0.17	0.71	0.66	65.75	19,725	361,639	311,864	130	130	361,509	8.30	361.17
61	305	5.08	3.1	0.99	0.17	0.84	0.82	81.65	24,495	386,003	313,630	131	131	385,873	8.86	361.25
62	310	5.17	3.6	1.15	0.17	0.98	0.98	97.55	29,265	415,137	315,742	132	132	415,006	9.53	361.34
63	315	5.25	3.9	1.24	0.17	1.06	1.07	107.09	32,127	447,132	318,061	133	133	447,000	10.26	361.45
64	320	5.33	4.2	1.34	0.17	1.14	1.17	116.63	34,989	481,988	320,588	134	134	481,855	11.06	361.56
65	325	5.42	4.7	1.50	0.17	1.28	1.33	132.53	39,758	521,613	323,460	135	135	521,478	11.97	361.69
66	330	5.50	5.6	1.79	0.17	1.52	1.62	**161.15**	**48,344**	569,823	326,954	136	136	569,687	13.08	361.84
67	335	5.58	1.9	0.61	0.17	0.52	0.44	43.49	13,047	582,733	327,890	137	137	582,597	13.37	361.89
68	340	5.67	0.9	0.29	0.17	0.24	0.12	11.69	3,507	586,103	328,135	137	137	585,966	13.45	361.90
69	345	5.75	0.6	0.19	0.17	0.16	0.02	2.15	645	586,611	328,171	137	137	586,474	13.46	361.90
70	350	5.83	0.5	0.16	0.17	0.14	0.02	2.38	715	587,190	328,213	137	137	587,053	13.48	361.90
71	355	5.92	0.3	0.10	0.17	0.08	0.01	1.43	429	587,482	328,235	137	137	587,346	13.48	361.90
72	360	6.00	0.2	0.06	0.17	0.05	0.01	0.95	286	587,632	328,245	137	137	**587,495**	**13.49**	**361.90**

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL	2.66 in
RAINFALL VOLUME	953,997 cu-ft
SOIL LOSSES	357,560 cu-ft
EFFECTIVE RAIN	1.66 in
FLOOD VOLUME	13.69 acft
FLOOD VOLUME	596,437 cu-ft
REQUIRED STORAGE	13.49 acft
REQUIRED STORAGE	587,495 cu-ft
MAX WSEL	361.90 ft
PEAK FLOW RATE	161.15 cfs
TOTAL BASIN LOSSES	8,942 cu-ft
AVERAGE PERCOLATION RATE	24.84 cf/min

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

24-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578		
Job No.:	2735	Area ID:	DA-5
By:	RRR	Date:	3/8/24

DRAINAGE AREA-ACRES	98.80	VARIABLE LOSS RATE (AVG) IN/HR		Basin Percolation Rate	0.1 in/hr
UNIT TIME-MINUTES	15	Fm = Minimum value on loss curve (in/hr)	0.08		
LAG TIME - MINUTES	7.54	C	0.00157	Maxwell Drywells	
UNIT TIME-PERCENT OF LAG	199%	Low Loss Rate (percent)	85.00%	Number	0
TOTAL ADJUSTED STORM RAIN (in)	4.21			Drywell Percolation Rate	0.00 cfs 0.00 cfm

Unit Time Period	Time Minutes	Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu-ft	Basin Volume cu-ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu-ft	Basin Losses Percolation Out cu-ft	Total In Basin cu-ft	Total In Basin ac-ft	Basin WSEL ft
1	15	0.25	0.2	0.034	0.300	0.029	0.01	0.50	453	453	285,684	357	357	96	0.00	360.00
2	30	0.50	0.3	0.051	0.297	0.043	0.01	0.75	679	775	285,707	357	357	418	0.01	360.00
3	45	0.75	0.3	0.051	0.293	0.043	0.01	0.75	679	1,098	285,731	357	357	740	0.02	360.00
4	60	1.00	0.4	0.067	0.290	0.057	0.01	1.01	906	1,646	285,770	357	357	1,289	0.03	360.00
5	75	1.25	0.3	0.051	0.286	0.043	0.01	0.75	679	1,969	285,794	357	357	1,611	0.04	360.01
6	90	1.50	0.3	0.051	0.283	0.043	0.01	0.75	679	2,291	285,817	357	357	1,934	0.04	360.01
7	105	1.75	0.3	0.051	0.280	0.043	0.01	0.75	679	2,613	285,840	357	357	2,256	0.05	360.01
8	120	2.00	0.4	0.067	0.276	0.057	0.01	1.01	906	3,162	285,880	357	357	2,804	0.06	360.01
9	135	2.25	0.4	0.067	0.273	0.057	0.01	1.01	906	3,710	285,920	357	357	3,353	0.08	360.01
10	150	2.50	0.4	0.067	0.270	0.057	0.01	1.01	906	4,259	285,960	357	357	3,901	0.09	360.01
11	165	2.75	0.5	0.084	0.266	0.072	0.01	1.26	1,132	5,034	286,016	358	358	4,676	0.11	360.02
12	180	3.00	0.5	0.084	0.263	0.072	0.01	1.26	1,132	5,809	286,072	358	358	5,451	0.13	360.02
13	195	3.25	0.5	0.084	0.260	0.072	0.01	1.26	1,132	6,584	286,128	358	358	6,226	0.14	360.02
14	210	3.50	0.5	0.084	0.256	0.072	0.01	1.26	1,132	7,358	286,184	358	358	7,001	0.16	360.02
15	225	3.75	0.5	0.084	0.253	0.072	0.01	1.26	1,132	8,133	286,241	358	358	7,775	0.18	360.03
16	240	4.00	0.6	0.101	0.250	0.086	0.02	1.51	1,359	9,134	286,313	358	358	8,776	0.20	360.03
17	255	4.25	0.6	0.101	0.247	0.086	0.02	1.51	1,359	10,135	286,386	358	358	9,777	0.22	360.03
18	270	4.50	0.7	0.118	0.244	0.100	0.02	1.76	1,585	11,363	286,475	358	358	11,004	0.25	360.04
19	285	4.75	0.7	0.118	0.241	0.100	0.02	1.76	1,585	12,590	286,564	358	358	12,232	0.28	360.04
20	300	5.00	0.8	0.135	0.238	0.115	0.02	2.01	1,812	14,043	286,669	358	358	13,685	0.31	360.04
21	315	5.25	0.6	0.101	0.234	0.086	0.02	1.51	1,359	15,044	286,741	358	358	14,686	0.34	360.05
22	330	5.50	0.7	0.118	0.231	0.100	0.02	1.76	1,585	16,271	286,830	359	359	15,912	0.37	360.05
23	345	5.75	0.8	0.135	0.228	0.115	0.02	2.01	1,812	17,724	286,936	359	359	17,366	0.40	360.06
24	360	6.00	0.8	0.135	0.225	0.115	0.02	2.01	1,812	19,178	287,041	359	359	18,819	0.43	360.06
25	375	6.25	0.9	0.152	0.222	0.129	0.02	2.26	2,038	20,857	287,163	359	359	20,498	0.47	360.07
26	390	6.50	0.9	0.152	0.219	0.129	0.02	2.26	2,038	22,537	287,285	359	359	22,177	0.51	360.07
27	405	6.75	1.0	0.168	0.216	0.143	0.03	2.52	2,265	24,442	287,423	359	359	24,083	0.55	360.08
28	420	7.00	1.0	0.168	0.214	0.143	0.03	2.52	2,265	26,348	287,561	359	359	25,988	0.60	360.08
29	435	7.25	1.0	0.168	0.211	0.143	0.03	2.52	2,265	28,253	287,699	360	360	27,894	0.64	360.09
30	450	7.50	1.1	0.185	0.208	0.157	0.03	2.77	2,491	30,385	287,853	360	360	30,025	0.69	360.10
31	465	7.75	1.2	0.202	0.205	0.172	0.03	3.02	2,718	32,743	288,024	360	360	32,383	0.74	360.10
32	480	8.00	1.3	0.219	0.202	0.186	0.02	1.68	1,511	33,894	288,108	360	360	33,534	0.77	360.11
33	495	8.25	1.5	0.253	0.199	0.215	0.05	5.31	4,782	38,316	288,428	361	361	37,955	0.87	360.12
34	510	8.50	1.5	0.253	0.196	0.215	0.06	5.59	5,031	42,986	288,767	361	361	42,625	0.98	360.14
35	525	8.75	1.6	0.269	0.194	0.229	0.08	7.54	6,788	49,413	289,233	362	362	49,052	1.13	360.16
36	540	9.00	1.7	0.286	0.191	0.243	0.10	9.49	8,542	57,594	289,826	362	362	57,232	1.31	360.19
37	555	9.25	1.9	0.320	0.188	0.272	0.13	13.12	11,805	69,037	290,655	363	363	68,673	1.58	360.22
38	570	9.50	2.0	0.337	0.186	0.286	0.15	15.06	13,555	82,228	291,611	365	365	81,863	1.88	360.27
39	585	9.75	2.1	0.354	0.183	0.301	0.17	17.00	15,303	97,166	292,694	366	366	96,800	2.22	360.31
40	600	10.00	2.2	0.370	0.180	0.315	0.19	18.94	17,048	113,848	293,903	367	367	113,481	2.61	360.37
41	615	10.25	1.5	0.253	0.178	0.215	0.07	7.46	6,712	120,193	294,363	368	368	119,826	2.75	360.39
42	630	10.50	1.5	0.253	0.175	0.215	0.08	7.72	6,944	126,769	294,840	369	369	126,401	2.90	360.41
43	645	10.75	2.0	0.337	0.173	0.286	0.16	16.36	14,722	141,122	295,880	370	370	140,752	3.23	360.46

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

24-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578				
Job No.:	2735	Area ID:	DA-5		
By:	RRR	Date:	3/8/24		

DRAINAGE AREA-ACRES	98.80	VARIABLE LOSS RATE (AVG) IN/HR		Basin Percolation Rate	0.1 in/hr
UNIT TIME-MINUTES	15	Fm = Minimum value on loss curve (in/hr)	0.08		
LAG TIME - MINUTES	7.54	C	0.00157	Maxwell Drywells	
UNIT TIME-PERCENT OF LAG	199%	Low Loss Rate (percent)	85.00%	Number	0
TOTAL ADJUSTED STORM RAIN (in)	4.21			Drywell Percolation Rate	0.00 cfs 0.00 cfm

Unit Time Period	Time Minutes	Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu-ft	Basin Volume cu-ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu-ft	Basin Losses Percolation Out cu-ft	Total In Basin cu-ft	Total In Basin ac-ft	Basin WSEL ft
44	660	11.00	2.0	0.337	0.170	0.286	0.17	16.61	14,948	155,701	296,937	371	371	155,330	3.57	360.50
45	675	11.25	1.9	0.320	0.168	0.272	0.15	15.18	13,662	168,992	297,900	372	372	168,620	3.87	360.55
46	690	11.50	1.9	0.320	0.165	0.272	0.15	15.43	13,884	182,504	298,880	374	374	182,130	4.18	360.59
47	705	11.75	1.7	0.286	0.163	0.243	0.12	12.32	11,084	193,214	299,656	375	375	192,839	4.43	360.62
48	720	12.00	1.8	0.303	0.160	0.258	0.14	14.23	12,811	205,650	300,557	376	376	205,274	4.71	360.66
49	735	12.25	2.5	0.421	0.158	0.358	0.26	26.22	23,594	228,868	302,240	378	378	228,491	5.25	360.74
50	750	12.50	2.6	0.438	0.155	0.372	0.28	28.13	25,316	253,807	304,048	380	380	253,427	5.82	360.82
51	765	12.75	2.8	0.472	0.153	0.401	0.32	31.72	28,545	281,972	306,090	383	383	281,590	6.46	360.91
52	780	13.00	2.9	0.488	0.151	0.415	0.34	33.62	30,262	311,852	308,256	385	385	311,466	7.15	361.01
53	795	13.25	3.4	0.573	0.149	0.487	0.42	42.24	38,016	349,483	310,983	389	389	349,094	8.01	361.13
54	810	13.50	3.4	0.573	0.146	0.487	0.43	**42.46**	**38,218**	387,312	313,725	392	392	386,920	8.88	361.25
55	825	13.75	2.3	0.387	0.144	0.329	0.24	24.23	21,808	408,728	315,278	394	394	408,334	9.37	361.32
56	840	14.00	2.3	0.387	0.142	0.329	0.25	24.45	22,005	430,339	316,844	396	396	429,943	9.87	361.39
57	855	14.25	2.7	0.455	0.140	0.386	0.31	31.38	28,239	458,182	318,862	399	399	457,783	10.51	361.48
58	870	14.50	2.6	0.438	0.138	0.372	0.30	29.91	26,920	484,703	320,785	401	401	484,302	11.12	361.57
59	885	14.75	2.6	0.438	0.135	0.372	0.30	30.12	27,109	511,411	322,721	403	403	511,008	11.73	361.65
60	900	15.00	2.5	0.421	0.133	0.358	0.29	28.65	25,785	536,792	324,560	406	406	536,387	12.31	361.74
61	915	15.25	2.4	0.404	0.131	0.344	0.27	27.18	24,458	560,844	326,304	408	408	560,436	12.87	361.81
62	930	15.50	2.3	0.387	0.129	0.329	0.26	25.70	23,128	583,565	327,951	410	410	583,155	13.39	361.89
63	945	15.75	1.9	0.320	0.127	0.272	0.19	19.18	17,266	600,421	329,172	411	411	600,009	13.77	361.94
64	960	16.00	1.9	0.320	0.125	0.272	0.19	19.38	17,440	617,450	330,407	413	413	617,037	14.17	362.00
65	975	16.25	0.4	0.067	0.124	0.057	0.01	1.01	906	617,943	330,442	413	413	617,529	14.18	362.00
66	990	16.50	0.4	0.067	0.122	0.057	0.01	1.01	906	618,435	330,478	413	413	618,022	14.19	362.00
67	1005	16.75	0.3	0.051	0.120	0.043	0.01	0.75	679	618,702	330,497	413	413	618,289	14.19	362.00
68	1020	17.00	0.3	0.051	0.118	0.043	0.01	0.75	679	618,968	330,517	413	413	618,555	14.20	362.00
69	1035	17.25	0.5	0.084	0.116	0.072	0.01	1.26	1,132	619,687	330,569	413	413	619,274	14.22	362.01
70	1050	17.50	0.5	0.084	0.114	0.072	0.01	1.26	1,132	620,407	330,621	413	413	619,993	14.23	362.01
71	1065	17.75	0.5	0.084	0.113	0.072	0.01	1.26	1,132	621,126	330,673	413	413	620,712	14.25	362.01
72	1080	18.00	0.4	0.067	0.111	0.057	0.01	1.01	906	621,618	330,709	413	413	621,205	14.26	362.01
73	1095	18.25	0.4	0.067	0.109	0.057	0.01	1.01	906	622,111	330,745	413	413	621,697	14.27	362.01
74	1110	18.50	0.4	0.067	0.108	0.057	0.01	1.01	906	622,603	330,780	413	413	622,190	14.28	362.01
75	1125	18.75	0.3	0.051	0.106	0.043	0.01	0.75	679	622,869	330,800	413	413	622,456	14.29	362.02
76	1140	19.00	0.2	0.034	0.105	0.029	0.01	0.50	453	622,909	330,802	414	414	622,495	14.29	362.02
77	1155	19.25	0.3	0.051	0.103	0.043	0.01	0.75	679	623,175	330,822	414	414	622,761	14.30	362.02
78	1170	19.50	0.4	0.067	0.102	0.057	0.01	1.01	906	623,667	330,857	414	414	623,254	14.31	362.02
79	1185	19.75	0.3	0.051	0.100	0.043	0.01	0.75	679	623,933	330,877	414	414	623,519	14.31	362.02
80	1200	20.00	0.2	0.034	0.099	0.029	0.01	0.50	453	623,972	330,879	414	414	623,559	14.31	362.02
81	1215	20.25	0.3	0.051	0.098	0.043	0.01	0.75	679	624,238	330,899	414	414	623,825	14.32	362.02
82	1230	20.50	0.3	0.051	0.097	0.043	0.01	0.75	679	624,504	330,918	414	414	624,090	14.33	362.02
83	1245	20.75	0.3	0.051	0.095	0.043	0.01	0.75	679	624,770	330,937	414	414	624,356	14.33	362.02
84	1260	21.00	0.2	0.034	0.094	0.029	0.01	0.50	453	624,809	330,940	414	414	624,396	14.33	362.02
85	1275	21.25	0.3	0.051	0.093	0.043	0.01	0.75	679	625,075	330,959	414	414	624,661	14.34	362.02
86	1290	21.50	0.2	0.034	0.092	0.029	0.01	0.50	453	625,114	330,962	414	414	624,701	14.34	362.02

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

24-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT:	Thermal Ranch TTM 38578			
Job No.:	2735	Area ID:	DA-5	
By:	RRR	Date:	3/8/24	

DRAINAGE AREA-ACRES	98.80	VARIABLE LOSS RATE (AVG) IN/HR		Basin Percolation Rate	0.1 in/hr
UNIT TIME-MINUTES	15	Fm = Minimum value on loss curve (in/hr)	0.08		
LAG TIME - MINUTES	7.54	C	0.00157	Maxwell Drywells	
UNIT TIME-PERCENT OF LAG	199%	Low Loss Rate (percent)	85.00%	Number	0
TOTAL ADJUSTED STORM RAIN (in)	4.21			Drywell Percolation Rate	0.00 cfs 0.00 cfm

Unit Time Period	Time Minutes	Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu-ft	Basin Volume cu-ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu-ft	Basin Losses Percolation Out cu-ft	Total In Basin cu-ft	Total In Basin ac-ft	Basin WSEL ft
87	1305	21.75	0.3	0.051	0.091	0.043	0.01	0.75	679	625,380	330,982	414	414	624,966	14.35	362.02
88	1320	22.00	0.2	0.034	0.090	0.029	0.01	0.50	453	625,419	330,984	414	414	625,006	14.35	362.02
89	1335	22.25	0.3	0.051	0.089	0.043	0.01	0.75	679	625,685	331,004	414	414	625,271	14.35	362.02
90	1350	22.50	0.2	0.034	0.088	0.029	0.01	0.50	453	625,724	331,006	414	414	625,310	14.36	362.02
91	1365	22.75	0.2	0.034	0.088	0.029	0.01	0.50	453	625,763	331,009	414	414	625,350	14.36	362.02
92	1380	23.00	0.2	0.034	0.087	0.029	0.01	0.50	453	625,803	331,012	414	414	625,389	14.36	362.02
93	1395	23.25	0.2	0.034	0.086	0.029	0.01	0.50	453	625,842	331,015	414	414	625,428	14.36	362.02
94	1410	23.50	0.2	0.034	0.086	0.029	0.01	0.50	453	625,881	331,018	414	414	625,467	14.36	362.03
95	1425	23.75	0.2	0.034	0.085	0.029	0.01	0.50	453	625,920	331,021	414	414	625,506	14.36	362.03
96	1440	24.00	0.2	0.034	0.085	0.029	0.01	0.50	453	625,959	331,024	414	414	**625,546**	**14.36**	**362.03**

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL	4.21 in
RAINFALL VOLUME	1,509,897 cu-ft
SOIL LOSSES	847,428 cu-ft
EFFECTIVE RAIN	1.85 in
FLOOD VOLUME	15.21 acft
FLOOD VOLUME	662,469 cu-ft
REQUIRED STORAGE	14.36 acft
REQUIRED STORAGE	625,546 cu-ft
MAX WSEL	362.03 ft
PEAK FLOW RATE	42.46 cfs
TOTAL BASIN LOSSES	36,924 cu-ft
AVERAGE PERCOLATION RATE	25.64 cf/min

BASIN VOLUME WORKSHEET

PROECT Thermal Ranch TTM 38578
JOB No. 2735
BASIN DESIGNATION: Retention Basin 5

BASIN CHARACTERISTICS

CONTOUR ELEVATION	DEPTH		AREA		VOLUME		
	INCR (ft)	TOTAL (ft)	INCR (sf)	TOTAL (sf)	INCR (cuft)	TOTAL (cuft)	TOTAL (acre-ft)
360	0	0		285,651	0	0	0.00
362.1	2.1	2.1	47,014	332,665	648,605	648,605	14.89

WHERE: $$V = \frac{1}{3}(E_1 - E_2)\left(A_1 + A_2 + \sqrt{A_1 A_2}\right)$$

RCFCD SYNTHETIC UNIT HYDROGRAPH - SHORTCUT METHOD

DATA INPUT SHEET

DATE:	March 8, 2024
WORKSHEET PREPARED BY:	RRR
PROJECT NAME	Thermal Ranch TTM 38578
PROJECT NUMBER	2735
CONCENTRATION POINT DESIGNATION	Catch Basin
AREA DESIGNATION	DA-2Q
AMC NUMBER	2

Low Loss Conditions: X=Existing; D=Developed; BS=Retention

AREA DESIG	SOIL GROUP	TRIBUTARY AREAS	ACRES	LOW LOSS CONDITION	RI NUMBER	AMC II INFILTRATION RATE	IMPERVIOUS PERCENT
3	B	SF - 1 ACRE	26.4	D	56	0.51	0.20

LENGTH OF WATERCOURSE (L)	1,437 ft
LENGTH TO POINT OPPOSITE CENTROID (Lca)	268 ft
ELEVATION OF HEADWATER	366.4 ft
ELEVATION OF CONCENTRATION POINT	359.8 ft
AVERAGE MANNINGS 'N' VALUE	0.020
STORM FREQUENCY (YEAR)	100
LOW LOSS RATE (For Storms Greater Than 10 Years)	85%
POINT RAIN FROM NOAA ATLAS	**14**
1-HOUR	1.22 in
3-HOUR	2.00 in
6-HOUR	2.66 in
24-HOUR	4.21 in

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD BASIC DATA CALCULATION FORM	PROJECT: Thermal Ranch TTM 38578 Job No.: 2735 BY: RRR DATE: 3/8/24

PHYSICAL DATA

[1] CONCENTRATION POINT	Catch Basin
[2] AREA DESIGNATION	DA-2Q
[3] AREA - ACRES	26.400
[4] L-FEET	1437
[5] L-MILES	0.272
[6] La-FEET	268.00
[7] La-MILES	0.051
[8] ELEVATION OF HEADWATER	366.4
[9] ELEVATION OF CONCENTRATION POINT	359.8
[10] H-FEET	6.6
[11] S-FEET/MILE	24.3
[12] S^0.5	4.92
[13] L*LCA/S^0.5	0.003
[14] AVERAGE MANNINGS 'N'	0.02
[15] LAG TIME-HOURS	0.05
[16] LAG TIME-MINUTES	3.1
[17] 100% OF LAG-MINUTES	3.1
[18] 200% OF LAG-MINUTES	6.2

RAINFALL DATA

[1] AMC	II
[2] FREQUENCY-YEARS	100
NOAA ATLAS	**14**
[3] DURATION:	Point Rain
1-HOUR	1.22 in
3-HOUR	2.00 in
6-HOUR	2.66 in
24-HOUR	4.21 in

STORM EVENT SUMMARY

DURATION		1-HOUR	3-HOUR	6-HOUR	24-HOUR
TOTAL RAINFALL	(in)	1.22	2	2.66	4.21
RAINFALL VOLUME	(cuft)	116,915	191,665	254,914	403,454
SOIL LOSSES	(cuft)	40,077	109,560	165,831	335,108
EFFECTIVE RAIN	(in)	0.80	0.86	0.93	0.71
FLOOD VOLUME	(cu-ft)	76,838	82,104	89,083	68,346
	(acre-ft)	1.76	1.88	2.05	1.57
PEAK FLOW	(cfs)	N/A	41.26	36.45	5.66

NOTE: PEAK FLOW FOR THE 1-HOUR STORM IS NOT REPRESENTATIVE. PER RCFCD PEAK DISCHARGES FROM THE 3-HOUR STORM SHOULD NORMALLY COMPARE WELL WITH RATIONAL PEAKS.

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD BASIC DATA CALCULATION FORM AMC II	PROJECT: Thermal Ranch TTM 38578 Job No.: 2735 Area ID: DA-2Q By: RRR Date: 3/8/24

AVERAGE ADJUSTED LOSS RATE

SOIL GROUP [Plate C-1]	LAND USE	RI NUMBER [Plate E-6.1]	PERVIOUS AREA INFILTRATION RATE (in/hr) [Plate E-6.2]	DECIMAL PERCENT OF AREA IMPERVIOUS [Plate E-6.3]	ADJUSTED INFILTRATION RATE (in/hr)	AREA	AREA WEIGHTED AVERAGE	MAX AVERAGE ADJUSTED INFILTRATION RATE (in/hr)	LOW LOSS CONDITION	LOW LOSS RATE PER RCFC/2322 (in/hr)	MIN AVERAGE ADJUSTED INFILTRATION RATE (in/hr)
B	SF - 1 ACRE	56	0.51	20%	0.42	26.400	1.000	0.4182	DEVELOPED	0.7400	0.7400
					SUM	26.400	SUM	0.4182			0.7400

VARIABLE LOSS RATE CURVE (24-HOUR STORM ONLY)

Fm= 0.2091

C= 0.00387

Ft=C(24-(T/60))^1.55 = 0.00387 (24-(T/60))^1.55 + **0.21** in/hr

CONSTANT LOSS RATE (3 & 6 HOUR STORMS) = **0.4182** in/hr

LOW LOSS RATE = **0.8500** in/hr

Where:

T=Time in minutes. To get an average value for each unit time period, Use T=1/2 the unit time for the first time period, T=1 1/2 unit time for the second period, etc.

NOTE: Low loss rates established per RCFC/2322 (Dated: May-30-95)
For 10 Year Storms or Less
Undeveloped Condition: Low Loss = 90%
Developed Condition: Low Loss = 0.9 - (0.8 * %impervious)
Basin Site: Low Loss = 10%
For 100 Year Storm - Low Loss should be between 80% & 90% of the Rainfall Rate

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD SHORTCUT METHOD 3-HOUR STORM	PROJECT: Thermal Ranch TTM 38578 Job No.: 2735 DATE BY: RRR 3/8/24

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA DESIGNATION	DA-2Q	
DRAINAGE AREA-ACRES	26.40	
UNIT TIME-MINUTES	5	
LAG TIME - MINUTES	3.09	
UNIT TIME-PERCENT OF LAG	161.9	
TOTAL ADJUSTED STORM RAIN-INCHES	2.00	
CONSTANT LOSS RATE-in/hr		0.42
LOW LOSS RATE - PERCENT		85%

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs
1	5	0.08	1.3	0.31	0.42	0.27	0.05	1.25
2	10	0.17	1.3	0.31	0.42	0.27	0.05	1.25
3	15	0.25	1.1	0.26	0.42	0.22	0.04	1.05
4	20	0.33	1.5	0.36	0.42	0.31	0.05	1.44
5	25	0.42	1.5	0.36	0.42	0.31	0.05	1.44
6	30	0.50	1.8	0.43	0.42	0.37	0.01	0.37
7	35	0.58	1.5	0.36	0.42	0.31	0.05	1.44
8	40	0.67	1.8	0.43	0.42	0.37	0.01	0.37
9	45	0.75	1.8	0.43	0.42	0.37	0.01	0.37
10	50	0.83	1.5	0.36	0.42	0.31	0.05	1.44
11	55	0.92	1.6	0.38	0.42	0.33	0.06	1.53
12	60	1.00	1.8	0.43	0.42	0.37	0.01	0.37
13	65	1.08	2.2	0.53	0.42	0.45	0.11	2.92
14	70	1.17	2.2	0.53	0.42	0.45	0.11	2.92
15	75	1.25	2.2	0.53	0.42	0.45	0.11	2.92
16	80	1.33	2.0	0.48	0.42	0.41	0.06	1.65
17	85	1.42	2.6	0.62	0.42	0.53	0.21	5.48
18	90	1.50	2.7	0.65	0.42	0.55	0.23	6.12
19	95	1.58	2.4	0.58	0.42	0.49	0.16	4.20
20	100	1.67	2.7	0.65	0.42	0.55	0.23	6.12
21	105	1.75	3.3	0.79	0.42	0.67	0.37	9.95
22	110	1.83	3.1	0.74	0.42	0.63	0.33	8.67
23	115	1.92	2.9	0.70	0.42	0.59	0.28	7.40
24	120	2.00	3.0	0.72	0.42	0.61	0.30	8.03
25	125	2.08	3.1	0.74	0.42	0.63	0.33	8.67
26	130	2.17	4.2	1.01	0.42	0.86	0.59	15.70
27	135	2.25	5.0	1.20	0.42	1.02	0.78	20.81
28	140	2.33	3.5	0.84	0.42	0.71	0.42	11.23
29	145	2.42	6.8	1.63	0.42	1.39	1.21	32.31
30	150	2.50	7.3	1.75	0.42	1.49	1.33	35.51
31	155	2.58	8.2	1.97	0.42	1.67	1.55	**41.26**
32	160	2.67	5.9	1.42	0.42	1.20	1.00	26.56
33	165	2.75	2.0	0.48	0.42	0.41	0.06	1.65
34	170	2.83	1.8	0.43	0.42	0.37	0.01	0.37
35	175	2.92	1.8	0.43	0.42	0.37	0.01	0.37
36	180	3.00	0.6	0.14	0.42	0.12	0.02	0.57

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL (in)	2
RAINFALL VOLUME (cuft)	191,665
SOIL LOSSES (cuft)	109,560
EFFECTIVE RAIN (in)	0.86
FLOOD VOLUME (acft)	1.88
FLOOD VOLUME (cuft)	82,104
PEAK FLOW RATE (cfs)	**41.26**

RCFCD SYNTHETIC UNIT HYDROGRAPH - SHORTCUT METHOD

DATA INPUT SHEET

DATE:	March 8, 2024
WORKSHEET PREPARED BY:	RRR
PROJECT NAME	Thermal Ranch TTM 38578
PROJECT NUMBER	2735
CONCENTRATION POINT DESIGNATION	Retention Basin
AREA DESIGNATION	DA-3Q
AMC NUMBER	2

Low Loss Conditions: X=Existing; D=Developed; BS=Retention

AREA DESIG	SOIL GROUP	TRIBUTARY AREAS	ACRES	LOW LOSS CONDITION	RI NUMBER	AMC II INFILTRATION RATE	IMPERVIOUS PERCENT
5	B	SF - 1/4 ACRE	11.1	D	56	0.51	0.50

LENGTH OF WATERCOURSE (L)	1,332 ft
LENGTH TO POINT OPPOSITE CENTROID (Lca)	491 ft
ELEVATION OF HEADWATER	360.8 ft
ELEVATION OF CONCENTRATION POINT	354.0 ft
AVERAGE MANNINGS 'N' VALUE	0.020
STORM FREQUENCY (YEAR)	100
LOW LOSS RATE (For Storms Greater Than 10 Years)	85%
POINT RAIN FROM NOAA ATLAS	**14**
1-HOUR	1.22 in
3-HOUR	2.00 in
6-HOUR	2.66 in
24-HOUR	4.21 in

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD BASIC DATA CALCULATION FORM	PROJECT: Thermal Ranch TTM 38578 Job No.: 2735 BY: RRR DATE: 3/8/24

PHYSICAL DATA

[1] CONCENTRATION POINT	Retention Basin
[2] AREA DESIGNATION	DA-3Q
[3] AREA - ACRES	11.100
[4] L-FEET	1332
[5] L-MILES	0.252
[6] La-FEET	491.00
[7] La-MILES	0.093
[8] ELEVATION OF HEADWATER	360.8
[9] ELEVATION OF CONCENTRATION POINT	354
[10] H-FEET	6.8
[11] S-FEET/MILE	27.0
[12] S^0.5	5.19
[13] L*LCA/S^0.5	0.005
[14] AVERAGE MANNINGS 'N'	0.02
[15] LAG TIME-HOURS	0.06
[16] LAG TIME-MINUTES	3.7
[17] 100% OF LAG-MINUTES	3.7
[18] 200% OF LAG-MINUTES	7.4

RAINFALL DATA

[1] AMC	II
[2] FREQUENCY-YEARS	100
NOAA ATLAS	**14**
[3] DURATION:	Point Rain
1-HOUR	1.22 in
3-HOUR	2.00 in
6-HOUR	2.66 in
24-HOUR	4.21 in

STORM EVENT SUMMARY

DURATION		1-HOUR	3-HOUR	6-HOUR	24-HOUR
TOTAL RAINFALL	(in)	1.22	2	2.66	4.21
RAINFALL VOLUME	(cuft)	49,158	80,586	107,180	169,634
SOIL LOSSES	(cuft)	11,302	33,187	58,842	123,206
EFFECTIVE RAIN	(in)	0.94	1.18	1.20	1.15
FLOOD VOLUME	(cu-ft)	37,855	47,399	48,338	46,428
	(acre-ft)	0.87	1.09	1.11	1.07
PEAK FLOW	(cfs)	N/A	18.89	16.87	3.71

NOTE: PEAK FLOW FOR THE 1-HOUR STORM IS NOT REPRESENTATIVE. PER RCFCD PEAK DISCHARGES FROM THE 3-HOUR STORM SHOULD NORMALLY COMPARE WELL WITH RATIONAL PEAKS.

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD BASIC DATA CALCULATION FORM AMC II	PROJECT: Thermal Ranch TTM 38578 Job No.: 2735 Area ID: DA-3Q By: RRR Date: 3/8/24

AVERAGE ADJUSTED LOSS RATE

SOIL GROUP [Plate C-1]	LAND USE	RI NUMBER [Plate E-6.1]	PERVIOUS AREA INFILTRATION RATE (in/hr) [Plate E-6.2]	DECIMAL PERCENT OF AREA IMPERVIOUS [Plate E-6.3]	ADJUSTED INFILTRATION RATE (in/hr)	AREA	AREA WEIGHTED AVERAGE	MAX AVERAGE ADJUSTED INFILTRATION RATE (in/hr)	LOW LOSS CONDITION	LOW LOSS RATE PER RCFC/2322 (in/hr)	MIN AVERAGE ADJUSTED INFILTRATION RATE (in/hr)
B	SF - 1/4 ACRE	56	0.51	50%	0.28	11.100	1.000	0.2805	DEVELOPED	0.5000	0.5000
					SUM	11.100	SUM	0.2805			0.5000

VARIABLE LOSS RATE CURVE (24-HOUR STORM ONLY)

Fm= 0.14025

C= 0.00260

Ft=C(24-(T/60))^1.55 = 0.00260 (24-(T/60))^1.55 + **0.14** in/hr

CONSTANT LOSS RATE (3 & 6 HOUR STORMS) = **0.2805** in/hr

LOW LOSS RATE = **0.8500** in/hr

Where:

T=Time in minutes. To get an average value for each unit time period, Use T=1/2 the unit time for the first time period, T=1 1/2 unit time for the second period, etc.

NOTE: Low loss rates established per RCFC/2322 (Dated: May-30-95)
For 10 Year Storms or Less
Undeveloped Condition: Low Loss = 90%
Developed Condition: Low Loss = 0.9 - (0.8 * %impervious)
Basin Site: Low Loss = 10%
For 100 Year Storm - Low Loss should be between 80% & 90% of the Rainfall Rate

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD SHORTCUT METHOD 3-HOUR STORM	PROJECT: Thermal Ranch TTM 38578 Job No.: 2735 DATE BY: RRR 3/8/24

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA DESIGNATION	DA-3Q	
DRAINAGE AREA-ACRES	11.10	
UNIT TIME-MINUTES	5	
LAG TIME - MINUTES	3.70	
UNIT TIME-PERCENT OF LAG	135.1	
TOTAL ADJUSTED STORM RAIN-INCHES	2.00	
CONSTANT LOSS RATE-in/hr		0.28
LOW LOSS RATE - PERCENT		85%

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs
1	5	0.08	1.3	0.31	0.28	0.27	0.03	0.35
2	10	0.17	1.3	0.31	0.28	0.27	0.03	0.35
3	15	0.25	1.1	0.26	0.28	0.22	0.04	0.44
4	20	0.33	1.5	0.36	0.28	0.31	0.08	0.89
5	25	0.42	1.5	0.36	0.28	0.31	0.08	0.89
6	30	0.50	1.8	0.43	0.28	0.37	0.15	1.70
7	35	0.58	1.5	0.36	0.28	0.31	0.08	0.89
8	40	0.67	1.8	0.43	0.28	0.37	0.15	1.70
9	45	0.75	1.8	0.43	0.28	0.37	0.15	1.70
10	50	0.83	1.5	0.36	0.28	0.31	0.08	0.89
11	55	0.92	1.6	0.38	0.28	0.33	0.10	1.16
12	60	1.00	1.8	0.43	0.28	0.37	0.15	1.70
13	65	1.08	2.2	0.53	0.28	0.45	0.25	2.77
14	70	1.17	2.2	0.53	0.28	0.45	0.25	2.77
15	75	1.25	2.2	0.53	0.28	0.45	0.25	2.77
16	80	1.33	2.0	0.48	0.28	0.41	0.20	2.23
17	85	1.42	2.6	0.62	0.28	0.53	0.34	3.84
18	90	1.50	2.7	0.65	0.28	0.55	0.37	4.11
19	95	1.58	2.4	0.58	0.28	0.49	0.30	3.31
20	100	1.67	2.7	0.65	0.28	0.55	0.37	4.11
21	105	1.75	3.3	0.79	0.28	0.67	0.51	5.72
22	110	1.83	3.1	0.74	0.28	0.63	0.46	5.19
23	115	1.92	2.9	0.70	0.28	0.59	0.42	4.65
24	120	2.00	3.0	0.72	0.28	0.61	0.44	4.92
25	125	2.08	3.1	0.74	0.28	0.63	0.46	5.19
26	130	2.17	4.2	1.01	0.28	0.86	0.73	8.14
27	135	2.25	5.0	1.20	0.28	1.02	0.92	10.29
28	140	2.33	3.5	0.84	0.28	0.71	0.56	6.26
29	145	2.42	6.8	1.63	0.28	1.39	1.35	15.13
30	150	2.50	7.3	1.75	0.28	1.49	1.47	16.47
31	155	2.58	8.2	1.97	0.28	1.67	1.69	**18.89**
32	160	2.67	5.9	1.42	0.28	1.20	1.14	12.71
33	165	2.75	2.0	0.48	0.28	0.41	0.20	2.23
34	170	2.83	1.8	0.43	0.28	0.37	0.15	1.70
35	175	2.92	1.8	0.43	0.28	0.37	0.15	1.70
36	180	3.00	0.6	0.14	0.28	0.12	0.02	0.24

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL (in)	2
RAINFALL VOLUME (cuft)	80,586
SOIL LOSSES (cuft)	33,187
EFFECTIVE RAIN (in)	1.18
FLOOD VOLUME (acft)	1.09
FLOOD VOLUME (cuft)	47,399
PEAK FLOW RATE (cfs)	**18.89**

Appendix F

Riverside County Whitewater River Region WQMP Worksheets

Whitewater Watershed

BMP Design Volume, V_{BMP} & Design Flow Rate, Q_{BMP} (Rev. 06-2014)

Legend:		
		Required Entries
		Calculated Cells

Company Name	MSA Consulting, Inc	Date	March 8, 2024
Designed By	RRR	County/City Case No.	
Company Project Number/Name	2735 / DESERT EQUESTRIAN HOLDINGS		
Drainage Area Number/Name	DA-1A		

Enter the Area Tributary to this Feature (A_{TRIB}) — A_{TRIB} = 109.0 acres

Determine the Impervious Area Ratio

Determine the Impervious Area Within A_{TRIB} (A_{IMP}) — A_{IMP} = 54.5 acres

Calculate the Impervious Area Ratio (I_F)

$I_F = A_{IMP}/A_{TRIB}$ — I_F = 0.50

Calculate the Composite Runoff Coefficient, C for the BMP Tributary Area

Use the following equation based on the WEF/ASCE Method

$C_{BMP} = 0.858I_f^3 - 0.78I_f^2 + 0.774I_f + 0.04$ — C_{BMP} = 0.34

Determine Design Storage Volume, V_{BMP}

Calculate V_U, the 80% Unit Storage Volume $V_U = 0.40 \times C_{BMP}$ — V_U = 0.14 (in*ac)/ac

Calculate the design storage volume of the BMP, V_{BMP}

$$V_{BMP}\ (ft^3) = \frac{V_U\ (in\text{-}ac/ac) \times A_T\ (ac) \times 43{,}560\ (ft^2/ac)}{12(in/ft)}$$

V_{BMP} = 53,693 ft^3

BMP Design Flow Rate, Q_{BMP}

$Q_{BMP} = C_{BMP} \times I \times A_{TRIB}$ — Q_{BMP} = 7.40 ft^3/s

I = Design Rainfall Intensity, 0.2 in/hr

Notes:

Whitewater Watershed

BMP Design Volume, V_{BMP} & Design Flow Rate, Q_{BMP} (Rev. 06-2014)

Legend:		
		Required Entries
		Calculated Cells

Company Name	MSA Consulting, Inc	Date	March 8, 2024
Designed By	RRR	County/City Case No.	
Company Project Number/Name	2735 / DESERT EQUESTRIAN HOLDINGS		
Drainage Area Number/Name	DA-1B		

Enter the Area Tributary to this Feature (A_{TRIB}) — A_{TRIB} = 108.8 acres

Determine the Impervious Area Ratio

Determine the Impervious Area Within A_{TRIB} (A_{IMP}) — A_{IMP} = 54.4 acres

Calculate the Impervious Area Ratio (I_F)

$I_F = A_{IMP}/A_{TRIB}$ — I_F = 0.50

Calculate the Composite Runoff Coefficient, C for the BMP Tributary Area

Use the following equation based on the WEF/ASCE Method

$C_{BMP} = 0.858I_f^3 - 0.78I_f^2 + 0.774I_f + 0.04$ — C_{BMP} = 0.34

Determine Design Storage Volume, V_{BMP}

Calculate V_U, the 80% Unit Storage Volume $V_U = 0.40 \times C_{BMP}$ — V_U = 0.14 (in*ac)/ac

Calculate the design storage volume of the BMP, V_{BMP}

$$V_{BMP}\ (ft^3) = \frac{V_U\ (in\text{-}ac/ac) \times A_T\ (ac) \times 43{,}560\ (ft^2/ac)}{12(in/ft)}$$

V_{BMP} = 53,594 ft^3

BMP Design Flow Rate, Q_{BMP}

$Q_{BMP} = C_{BMP} \times I \times A_{TRIB}$ — Q_{BMP} = 7.38 ft^3/s

I = Design Rainfall Intensity, 0.2 in/hr

Notes:

Whitewater Watershed

BMP Design Volume, V_{BMP} & Design Flow Rate, Q_{BMP} (Rev. 06-2014)

Legend:		
		Required Entries
		Calculated Cells

Company Name	MSA Consulting, Inc	Date	March 8, 2024
Designed By	RRR	County/City Case No.	
Company Project Number/Name	2735 / DESERT EQUESTRIAN HOLDINGS		
Drainage Area Number/Name	DA-2A		

Enter the Area Tributary to this Feature (A_{TRIB}) — A_{TRIB} = 93.7 acres

Determine the Impervious Area Ratio

Determine the Impervious Area Within A_{TRIB} (A_{IMP}) — A_{IMP} = 18.7 acres

Calculate the Impervious Area Ratio (I_F)

$I_F = A_{IMP}/A_{TRIB}$ — I_F = 0.20

Calculate the Composite Runoff Coefficient, C for the BMP Tributary Area

Use the following equation based on the WEF/ASCE Method

$C_{BMP} = 0.858I_f^3 - 0.78I_f^2 + 0.774I_f + 0.04$ — C_{BMP} = 0.17

Determine Design Storage Volume, V_{BMP}

Calculate V_U, the 80% Unit Storage Volume $V_U = 0.40 \times C_{BMP}$ — V_U = 0.07 (in*ac)/ac

Calculate the design storage volume of the BMP, V_{BMP}

$$V_{BMP}\ (ft^3) = \frac{V_U\ (in\text{-}ac/ac) \times A_T\ (ac) \times 43{,}560\ (ft^2/ac)}{12(in/ft)}$$

V_{BMP} = 23,159 ft^3

BMP Design Flow Rate, Q_{BMP}

$Q_{BMP} = C_{BMP} \times I \times A_{TRIB}$ — Q_{BMP} = 3.19 ft^3/s

I = Design Rainfall Intensity, 0.2 in/hr

Notes:

Whitewater Watershed

BMP Design Volume, V_{BMP} & Design Flow Rate, Q_{BMP} (Rev. 06-2014)

Legend:		
		Required Entries
		Calculated Cells

Company Name	MSA Consulting, Inc	Date	February 7, 2024
Designed By	RRR	County/City Case No.	
Company Project Number/Name	2735 / DESERT EQUESTRIAN HOLDINGS		
Drainage Area Number/Name	DA-2B		

Enter the Area Tributary to this Feature (A_{TRIB}) — A_{TRIB} = 107.5 acres

Determine the Impervious Area Ratio

Determine the Impervious Area Within A_{TRIB} (A_{IMP}) — A_{IMP} = 31.1 acres

Calculate the Impervious Area Ratio (I_F)

$I_F = A_{IMP}/A_{TRIB}$ — I_F = 0.29

Calculate the Composite Runoff Coefficient, C for the BMP Tributary Area

Use the following equation based on the WEF/ASCE Method

$C_{BMP} = 0.858I_f^3 - 0.78I_f^2 + 0.774I_f + 0.04$ — C_{BMP} = 0.22

Determine Design Storage Volume, V_{BMP}

Calculate V_U, the 80% Unit Storage Volume $V_U = 0.40 \times C_{BMP}$ — V_U = 0.09 (in*ac)/ac

Calculate the design storage volume of the BMP, V_{BMP}

$$V_{BMP}\ (ft^3) = \frac{V_U\ (in\text{-}ac/ac) \times A_T\ (ac) \times 43{,}560\ (ft^2/ac)}{12(in/ft)}$$

V_{BMP} = 34,248 ft^3

BMP Design Flow Rate, Q_{BMP}

$Q_{BMP} = C_{BMP} \times I \times A_{TRIB}$ — Q_{BMP} = 4.72 ft^3/s

I = Design Rainfall Intensity, 0.2 in/hr

Notes:

Whitewater Watershed

BMP Design Volume, V_{BMP} & Design Flow Rate, Q_{BMP} (Rev. 06-2014)

Legend:		
		Required Entries
		Calculated Cells

Company Name	MSA Consulting, Inc	Date	February 7, 2024
Designed By	RRR	County/City Case No.	
Company Project Number/Name	2735 / DESERT EQUESTRIAN HOLDINGS		
Drainage Area Number/Name	DA-3A		

Enter the Area Tributary to this Feature (A_{TRIB}) — A_{TRIB} = 11.8 acres

Determine the Impervious Area Ratio

Determine the Impervious Area Within A_{TRIB} (A_{IMP}) — A_{IMP} = 6.7 acres

Calculate the Impervious Area Ratio (I_F)

$I_F = A_{IMP}/A_{TRIB}$ — I_F = 0.57

Calculate the Composite Runoff Coefficient, C for the BMP Tributary Area

Use the following equation based on the WEF/ASCE Method

$C_{BMP} = 0.858I_f^3 - 0.78I_f^2 + 0.774I_f + 0.04$ — C_{BMP} = 0.39

Determine Design Storage Volume, V_{BMP}

Calculate V_U, the 80% Unit Storage Volume $V_U = 0.40 \times C_{BMP}$ — V_U = 0.15 (in*ac)/ac

Calculate the design storage volume of the BMP, V_{BMP}

$$V_{BMP}\ (ft^3) = \frac{V_U\ (in\text{-}ac/ac) \times A_T\ (ac) \times 43{,}560\ (ft^2/ac)}{12(in/ft)}$$

V_{BMP} = 6,598 ft^3

BMP Design Flow Rate, Q_{BMP}

$Q_{BMP} = C_{BMP} \times I \times A_{TRIB}$ — Q_{BMP} = 0.91 ft^3/s

I = Design Rainfall Intensity, 0.2 in/hr

Notes:

Whitewater Watershed

BMP Design Volume, V_{BMP} & Design Flow Rate, Q_{BMP} (Rev. 06-2014)

Legend:		
		Required Entries
		Calculated Cells

Company Name	MSA Consulting, Inc	Date	February 7, 2024
Designed By	RRR	County/City Case No.	
Company Project Number/Name	2735 / DESERT EQUESTRIAN HOLDINGS		
Drainage Area Number/Name	DA-3B		

Enter the Area Tributary to this Feature (A_{TRIB}) — A_{TRIB} = 12.3 acres

Determine the Impervious Area Ratio

Determine the Impervious Area Within A_{TRIB} (A_{IMP}) — A_{IMP} = 6.6 acres

Calculate the Impervious Area Ratio (I_F)

$I_F = A_{IMP}/A_{TRIB}$ — I_F = 0.54

Calculate the Composite Runoff Coefficient, C for the BMP Tributary Area

Use the following equation based on the WEF/ASCE Method

$C_{BMP} = 0.858I_f^3 - 0.78I_f^2 + 0.774I_f + 0.04$ — C_{BMP} = 0.36

Determine Design Storage Volume, V_{BMP}

Calculate V_U, the 80% Unit Storage Volume $V_U = 0.40 \times C_{BMP}$ — V_U = 0.15 (in*ac)/ac

Calculate the design storage volume of the BMP, V_{BMP}

$$V_{BMP}\ (ft^3) = \frac{V_U\ (in\text{-}ac/ac) \times A_T\ (ac) \times 43{,}560\ (ft^2/ac)}{12(in/ft)}$$

V_{BMP} = 6,488 ft^3

BMP Design Flow Rate, Q_{BMP}

$Q_{BMP} = C_{BMP} \times I \times A_{TRIB}$ — Q_{BMP} = 0.89 ft^3/s

I = Design Rainfall Intensity, 0.2 in/hr

Notes:

Whitewater Watershed

BMP Design Volume, V_{BMP} & Design Flow Rate, Q_{BMP} (Rev. 06-2014)

Legend:		
		Required Entries
		Calculated Cells

Company Name	MSA Consulting, Inc	Date	February 7, 2024
Designed By	RRR	County/City Case No.	
Company Project Number/Name	2735 / DESERT EQUESTRIAN HOLDINGS		
Drainage Area Number/Name	DA-3C		

Enter the Area Tributary to this Feature (A_{TRIB}) — A_{TRIB} = 10.6 acres

Determine the Impervious Area Ratio

Determine the Impervious Area Within A_{TRIB} (A_{IMP}) — A_{IMP} = 6.0 acres

Calculate the Impervious Area Ratio (I_F)

$I_F = A_{IMP}/A_{TRIB}$ — I_F = 0.57

Calculate the Composite Runoff Coefficient, C for the BMP Tributary Area

Use the following equation based on the WEF/ASCE Method

$C_{BMP} = 0.858I_f^3 - 0.78I_f^2 + 0.774I_f + 0.04$ — C_{BMP} = 0.38

Determine Design Storage Volume, V_{BMP}

Calculate V_U, the 80% Unit Storage Volume $V_U = 0.40 \times C_{BMP}$ — V_U = 0.15 (in*ac)/ac

Calculate the design storage volume of the BMP, V_{BMP}

$$V_{BMP}\ (ft^3) = \frac{V_U\ (in\text{-}ac/ac) \times A_T\ (ac) \times 43{,}560\ (ft^2/ac)}{12(in/ft)}$$

V_{BMP} = 5,907 ft^3

BMP Design Flow Rate, Q_{BMP}

$Q_{BMP} = C_{BMP} \times I \times A_{TRIB}$ — Q_{BMP} = 0.81 ft^3/s

I = Design Rainfall Intensity, 0.2 in/hr

Notes:

Whitewater Watershed

BMP Design Volume, V_{BMP} & Design Flow Rate, Q_{BMP} (Rev. 06-2014)

Legend:		
		Required Entries
		Calculated Cells

Company Name	MSA Consulting, Inc	Date	March 8, 2024
Designed By	RRR	County/City Case No.	
Company Project Number/Name	2735 / DESERT EQUESTRIAN HOLDINGS		
Drainage Area Number/Name	DA-4		

Enter the Area Tributary to this Feature (A_{TRIB}) — A_{TRIB} = 80.9 acres

Determine the Impervious Area Ratio

Determine the Impervious Area Within A_{TRIB} (A_{IMP}) — A_{IMP} = 48.0 acres

Calculate the Impervious Area Ratio (I_F)

$I_F = A_{IMP}/A_{TRIB}$ — I_F = 0.59

Calculate the Composite Runoff Coefficient, C for the BMP Tributary Area

Use the following equation based on the WEF/ASCE Method

$C_{BMP} = 0.858I_f^3 - 0.78I_f^2 + 0.774I_f + 0.04$ — C_{BMP} = 0.40

Determine Design Storage Volume, V_{BMP}

Calculate V_U, the 80% Unit Storage Volume $V_U = 0.40 \times C_{BMP}$ — V_U = 0.16 (in*ac)/ac

Calculate the design storage volume of the BMP, V_{BMP}

$$V_{BMP}\ (ft^3) = \frac{V_U\ (in\text{-}ac/ac) \times A_T\ (ac) \times 43{,}560\ (ft^2/ac)}{12(in/ft)}$$

V_{BMP} = 47,440 ft^3

BMP Design Flow Rate, Q_{BMP}

$Q_{BMP} = C_{BMP} \times I \times A_{TRIB}$ — Q_{BMP} = 6.53 ft^3/s

I = Design Rainfall Intensity, 0.2 in/hr

Notes:

Whitewater Watershed

BMP Design Volume, V_{BMP} & Design Flow Rate, Q_{BMP} (Rev. 06-2014)

Legend:		
		Required Entries
		Calculated Cells

Company Name	MSA Consulting, Inc	Date	February 7, 2024
Designed By	RRR	County/City Case No.	
Company Project Number/Name	2735 / DESERT EQUESTRIAN HOLDINGS		
Drainage Area Number/Name	DA-5		

Enter the Area Tributary to this Feature (A_{TRIB}) — A_{TRIB} = 98.8 acres

Determine the Impervious Area Ratio

Determine the Impervious Area Within A_{TRIB} (A_{IMP}) — A_{IMP} = 67.2 acres

Calculate the Impervious Area Ratio (I_F)

$I_F = A_{IMP}/A_{TRIB}$ — I_F = 0.68

Calculate the Composite Runoff Coefficient, C for the BMP Tributary Area

Use the following equation based on the WEF/ASCE Method

$C_{BMP} = 0.858I_f^3 - 0.78I_f^2 + 0.774I_f + 0.04$ — C_{BMP} = 0.48

Determine Design Storage Volume, V_{BMP}

Calculate V_U, the 80% Unit Storage Volume $V_U = 0.40 \times C_{BMP}$ — V_U = 0.19 (in*ac)/ac

Calculate the design storage volume of the BMP, V_{BMP}

$$V_{BMP}\ (ft^3) = \frac{V_U\ (in\text{-}ac/ac) \times A_T\ (ac) \times 43{,}560\ (ft^2/ac)}{12(in/ft)}$$

V_{BMP} = 68,225 ft^3

BMP Design Flow Rate, Q_{BMP}

$Q_{BMP} = C_{BMP} \times I \times A_{TRIB}$ — Q_{BMP} = 9.40 ft^3/s

I = Design Rainfall Intensity, 0.2 in/hr

Notes:

Appendix G

Peak Flow Rate Estimates
Street Capacity Calculations

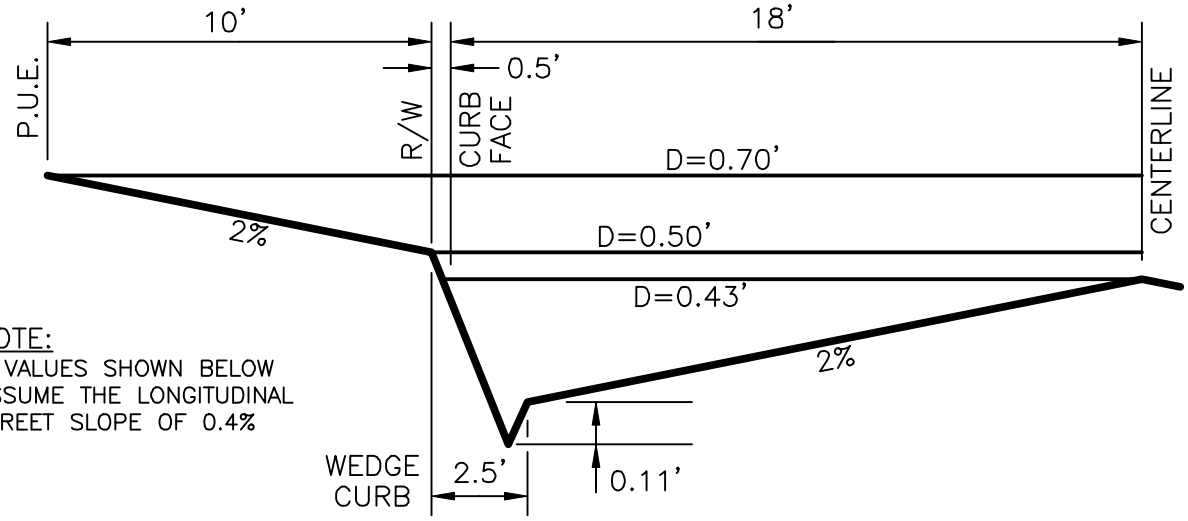
ESTIMATED 100-YEAR PEAK FLOW RATES

The preliminary peak flow rates at catch basins (or pairs of catch basins in some cases), as tabulated below, were estimated on a pro rata basis as compared to the 3-hour peak flow rate for a representative tributary drainage area, as established by its synthetic unit hydrograph (see hydrograph worksheets in Appendix E and Hydrology Exhibit in Appendix I). The asterisks indicate the tributary areas for which peak flow rates were calculated through the SUH and serve as a basis for the pro rata estimates immediately following. Italicized entries indicate the basis larger drainage areas that are not tributary to only a single low point.

CATCH BASIN ID	TRIBUTARY AREA (ac)	PEAK INFLOW (cfs)
DA-2Q*	14.5	41.3
DA-2A.1a	4.9	14.0
DA-2A.1b	6.9	19.7
DA-2A.2a	8.8	25.1
DA-2A.2b	16.2	46.1
DA-2A.3a	6.7	19.1
DA-2A.3b	5.3	15.1
DA-2A.4a	14.6	41.6
DA-2A.4b	5.0	14.2
DA-2A.5	1.3	3.7
DA-2A.6a	1.4	4.0
DA-2A.6b	5.6	16.0
DA-2A.7	6.4	18.2
DA-2B.1	1.3	3.7
DA-2B.2a	6.7	19.1
DA-2B.2b	6.6	18.8
DA-2B.3a	12.9	36.7
DA-2B.4a	7.3	20.8
DA-2B.4b	3.9	11.1
DA-2B.5a	15.1	43.0
DA-2B.5b	8.4	23.9
DA-2B.6a	1.6	4.6
DA-2B.6b	1.5	4.3

CATCH BASIN ID	TRIBUTARY AREA (ac)	PEAK INFLOW (cfs)
DA-3Q*	11.1	18.9
DA-1A.4	3.7	6.3
DA-1A.5a	1.0	1.7
DA-1A.5b	0.9	1.5
DA-1A.6a	2.7	4.6
DA-1A.6b	1.4	2.4
DA-1B.3a	2.0	3.4
DA-1B.3b	1.3	2.2
DA-1B.4a	3.1	5.3
DA-1B.4b	1.6	2.7
DA-1B.5	7.6	12.9
DA-3A.1a	0.4	0.7
DA-3A.1b	1.1	1.9
DA-3A.2a	2.0	3.4
DA-3A.2b	2.9	4.9
DA-3B.1a	1.0	1.7
DA-3B.1b	0.6	1.0
DA-3B.2	1.0	1.7
DA-3B.3a	4.5	7.7
DA-3B.3b	2.0	3.4
DA-3C.1	0.8	1.4
DA-3C.2a	0.3	0.5
DA-3C.2b	0.5	0.9
DA-3C.2c	0.4	0.7
DA-3C.3a	1.5	2.6
DA-3C.3b	0.9	1.5
DA-3C.4	0.8	1.4

CATCH BASIN ID	TRIBUTARY AREA (ac)	PEAK INFLOW (cfs)
*DA-1A**	*109.0*	*191.0*
DA-1A.1	33.4	58.5
DA-1A.2	33.1	58.0
DA-1A.3	1.1	1.9
*DA-1B**	*108.8*	*191.0*
DA-1B.1	72.0	126.4
DA-1B.2	10.3	18.1
*DA-4**	*80.9*	*143.4*
DA-4.1	11.3	20.0
DA-4.2	1.1	1.9
DA-4.3	1.2	2.1
DA-4.4	3.5	6.2
DA-4.5	6.6	11.7
DA-4.6	24.2	42.9
DA-4.7	0.8	1.4
DA-4.8	2.9	5.1
*DA-5**	*98.8*	*179.1*
DA-5.1	16.7	30.3
DA-5.2	6.7	12.1
DA-5.3	6.9	12.5
DA-5.4	4.1	7.4



NOTE:
Q VALUES SHOWN BELOW ASSUME THE LONGITUDINAL STREET SLOPE OF 0.4%

DEPTH (FT)	A (SF)	P (FT)	Q (CFS)	
			HALF STREET	FULL STREET
0.70	9.10	28.58	26.59	53.18
0.69	8.82	28.08	25.54	51.08
0.68	8.54	27.58	24.49	48.98
0.67	8.27	27.08	23.50	47.00
0.66	8.00	26.58	22.51	45.02
0.65	7.74	26.08	21.58	43.16
0.64	7.48	25.58	20.65	41.30
0.63	7.23	25.08	19.77	39.54
0.62	6.98	24.58	18.89	37.78
0.61	6.74	24.08	18.07	36.14
0.60	6.50	23.58	17.25	34.50
0.59	6.27	23.08	16.48	32.96
0.58	6.04	22.58	15.71	31.42
0.57	5.82	22.08	14.99	29.98
0.56	5.60	21.58	14.27	28.54
0.55	5.39	21.08	13.60	27.20
0.54	5.18	20.58	12.94	25.88
0.53	4.98	20.08	12.32	24.64
0.52	4.78	19.58	11.70	23.40
0.51	4.59	19.08	11.12	22.24
0.50	4.40	18.58	10.55	21.10
0.49	4.22	18.54	9.86	19.72
0.48	4.03	18.49	9.14	18.28
0.47	3.85	18.45	8.49	16.98
0.46	3.67	18.41	7.85	15.70
0.45	3.48	18.37	7.19	14.38
0.44	3.30	18.33	6.59	13.18
0.43	3.12	18.29	6.01	12.02
0.42	2.94	17.75	5.56	11.12
0.41	2.76	17.21	5.10	10.20
0.40	2.59	16.66	4.69	9.38
0.39	2.43	16.12	4.31	8.62
0.38	2.27	15.58	3.94	7.88
0.37	2.12	15.04	3.60	7.20
0.36	1.97	14.50	3.26	6.52

DEPTH (FT)	A (SF)	P (FT)	Q (CFS)	
			HALF STREET	FULL STREET
0.35	1.83	13.96	2.96	5.92
0.34	1.70	13.42	2.69	5.38
0.33	1.57	12.87	2.42	4.84
0.32	1.44	12.33	2.16	4.32
0.31	1.32	11.79	1.92	3.84
0.30	1.20	11.25	1.71	3.42
0.29	1.10	10.71	1.51	3.02
0.28	0.99	10.17	1.31	2.62
0.27	0.89	9.63	1.14	2.28
0.26	0.80	9.09	0.99	1.98
0.25	0.71	8.54	0.85	1.70
0.24	0.63	8.00	0.73	1.46
0.23	0.55	7.46	0.61	1.22
0.22	0.48	6.92	0.51	1.02
0.21	0.42	6.38	0.43	0.86
0.20	0.35	5.84	0.34	0.68
0.19	0.30	5.30	0.28	0.56
0.18	0.25	4.75	0.22	0.44
0.17	0.21	4.21	0.18	0.36
0.16	0.17	3.67	0.14	0.28
0.15	0.13	3.13	0.10	0.20
0.14	0.10	2.59	0.07	0.14
0.13	0.08	2.05	0.06	0.12
0.12	0.06	1.51	0.04	0.08
0.11	0.05	0.97	0.04	0.08
0.10	0.04	0.88	0.03	0.06
0.09	0.03	0.79	0.02	0.04
0.08	0.03	0.70	0.02	0.04
0.07	0.02	0.61	0.01	0.02
0.06	0.02	0.53	0.01	0.02
0.05	0.01	0.44	0.01	0.02
0.04	0.01	0.35	0.01	0.02
0.03	0.00	0.26	0.00	0.00
0.02	0.00	0.18	0.00	0.00
0.01	0.00	0.09	0.00	0.00

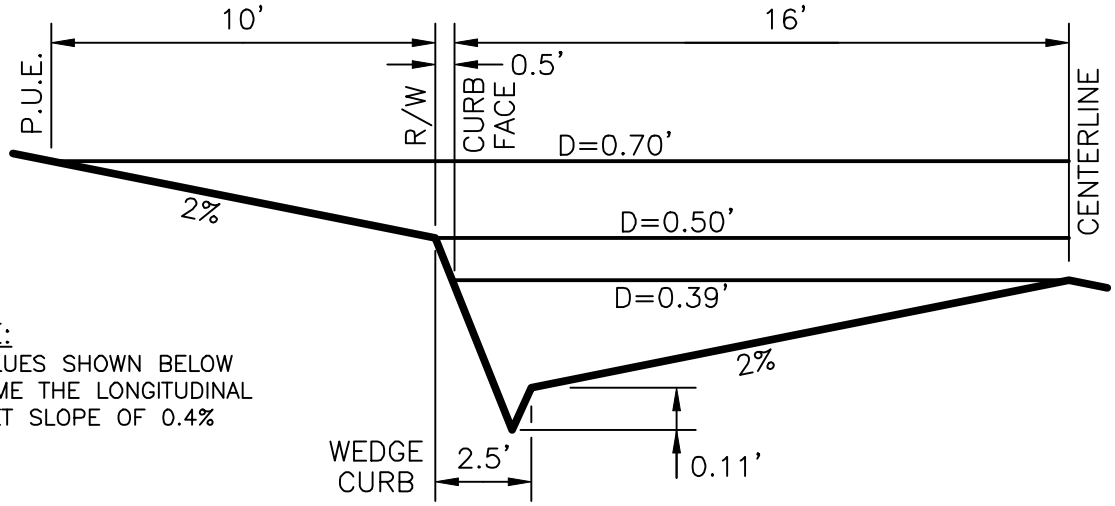
VALUES FOR Q CALCULATED FROM MANNING'S EQUATION:

$$Q = \frac{1.486}{n} A (A/P)^{2/3} S^{1/2}$$

WHERE Q = RATE OF FLOW IN STREET (CFS)
n = ROUGHNESS COEFFICIENT = 0.015
A = CROSS-SECTIONAL AREA OF FLOW (SF)
P = WETTED PERIMETER OF FLOW (FT)
S = LONGITUDINAL STREET SLOPE

STREET FLOW CAPACITY CHART

PRIVATE ON-SITE ROADS
SECTION F-F



NOTE:
Q VALUES SHOWN BELOW ASSUME THE LONGITUDINAL STREET SLOPE OF 0.4%

DEPTH (FT)	A (SF)	P (FT)	Q (CFS)	
			HALF STREET	FULL STREET
0.70	8.52	26.58	25.00	50.00
0.69	8.26	26.08	24.05	48.10
0.68	8.00	25.58	23.09	46.18
0.67	7.75	25.08	22.19	44.38
0.66	7.50	24.58	21.30	42.60
0.65	7.26	24.08	20.45	40.90
0.64	7.02	23.58	19.61	39.22
0.63	6.79	23.08	18.82	37.64
0.62	6.56	22.58	18.03	36.06
0.61	6.34	22.08	17.29	34.58
0.60	6.12	21.58	16.55	33.10
0.59	5.91	21.08	15.86	31.72
0.58	5.70	20.58	15.17	30.34
0.57	5.50	20.08	14.53	29.06
0.56	5.30	19.58	13.90	27.80
0.55	5.11	19.08	13.30	26.60
0.54	4.92	18.58	12.71	25.42
0.53	4.74	18.08	12.17	24.34
0.52	4.56	17.58	11.62	23.24
0.51	4.39	17.08	11.12	22.24
0.50	4.22	16.58	10.62	21.24
0.49	4.06	16.54	9.97	19.94
0.48	3.89	16.49	9.31	18.62
0.47	3.73	16.45	8.69	17.38
0.46	3.57	16.41	8.09	16.18
0.45	3.40	16.37	7.47	14.94
0.44	3.24	16.33	6.91	13.82
0.43	3.08	16.29	6.36	12.72
0.42	2.92	16.25	5.83	11.66
0.41	2.75	16.21	5.28	10.56
0.40	2.59	16.16	4.79	9.58
0.39	2.43	16.12	4.31	8.62
0.38	2.27	15.58	3.94	7.88
0.37	2.12	15.04	3.60	7.20
0.36	1.97	14.50	3.26	6.52

DEPTH (FT)	A (SF)	P (FT)	Q (CFS)	
			HALF STREET	FULL STREET
0.35	1.83	13.96	2.96	5.92
0.34	1.70	13.42	2.69	5.38
0.33	1.57	12.87	2.42	4.84
0.32	1.44	12.33	2.16	4.32
0.31	1.32	11.79	1.92	3.84
0.30	1.21	11.25	1.71	3.42
0.29	1.10	10.71	1.51	3.02
0.28	0.99	10.17	1.31	2.62
0.27	0.89	9.63	1.14	2.28
0.26	0.80	9.09	0.99	1.98
0.25	0.71	8.54	0.85	1.70
0.24	0.63	8.00	0.73	1.46
0.23	0.55	7.46	0.61	1.22
0.22	0.48	6.92	0.51	1.02
0.21	0.42	6.38	0.43	0.86
0.20	0.35	5.84	0.34	0.68
0.19	0.30	5.30	0.28	0.56
0.18	0.25	4.75	0.22	0.44
0.17	0.21	4.21	0.18	0.36
0.16	0.17	3.67	0.14	0.28
0.15	0.13	3.13	0.10	0.20
0.14	0.10	2.59	0.07	0.14
0.13	0.08	2.05	0.06	0.12
0.12	0.06	1.51	0.04	0.08
0.11	0.05	0.97	0.04	0.08
0.10	0.04	0.88	0.03	0.06
0.09	0.03	0.79	0.02	0.04
0.08	0.03	0.70	0.02	0.04
0.07	0.02	0.61	0.01	0.02
0.06	0.02	0.53	0.01	0.02
0.05	0.01	0.44	0.01	0.02
0.04	0.01	0.35	0.01	0.02
0.03	0.00	0.26	0.00	0.00
0.02	0.00	0.18	0.00	0.00
0.01	0.00	0.09	0.00	0.00

VALUES FOR Q CALCULATED FROM MANNING'S EQUATION:

$$Q = \frac{1.486}{n} A (A/P)^{2/3} S^{1/2}$$

WHERE Q = RATE OF FLOW IN STREET (CFS)
n = ROUGHNESS COEFFICIENT = 0.015
A = CROSS-SECTIONAL AREA OF FLOW (SF)
P = WETTED PERIMETER OF FLOW (FT)
S = LONGITUDINAL STREET SLOPE

STREET FLOW CAPACITY CHART

PRIVATE ON-SITE ROADS
SECTION G-G

Appendix H

Percolation Test Results
CVWD Farm Drain Tile Discharge Table

July 25, 2024
J.N. 21-483

DESERT EQUESTRIAN HOLDINGS, LLC
19312 Canyon Drive
Villa Park, California 92861

Attention: Mr. Jeremy Smith

Subject: **Results of Percolation Testing, *Equestrian Estates Development*, APN's 751-020-002, 751-020-006, 751-020-007, 751-020-003, Approximately 628 Acres, NEC of Avenue 64 and Harrison Street, Thermal Area, Riverside County, California**

References: 1) Updated Geotechnical Report, Equestrian Estates Development, Assessor's Parcel Numbers 751-020-002, 751-020-006, 751-020-007, and 951-020-003, Approximately 628 Acres, Northeast Corner of Avenue 64 and Harrison Street, Thermal Area, Riverside County, California, J.N. 21-483, dated April 13, 2022.

2) Review Comments, County Geologic Report No. 240008, Updated Geotechnical Report, Equestrian Estates Development, APN's 751-020-002, 751-020-006, 751-020-007, 751-020-003, Approximately 628 Acres, NEC of Avenue 64 and Harrison Street, Thermal Area, Riverside County, California, dated April 13, 2022; Review Comments by Riverside County Planning Department, dated April 18, 2024.

Dear Mr. Smith

Petra Geosciences, Inc. (Petra) has prepared this letter to presenting the results of percolation testing for the Thermal Ranch project. Petra conducted six percolation tests in boreholes using the falling head method. The results are presented in the table below and in the attached figure.

Percolation Test	Depth to Groundwater	Percolation Rate (inches/hour)
Perc 1	6.5 feet	0.9
Perc 2	4.2 feet	1.5
Perc 3	2.9 feet	0.7
Perc 4	3.8 feet	0.4
Perc 5	2.5 feet	2.5
Perc 6	4.0 feet	0.2

We understand that planned retention basin elevations will result in separation from groundwater on the order of three feet. Based on the brackish designation by the Colorado River Regional Water Quality Control Board for the near-surface groundwater within the southern Coachella Valley/Mecca area, it is our opinion that the project as proposed provides adequate groundwater protection. In addition, our experience with the design of septic systems they have been approved with as little as two feet of groundwater separation in the Mecca area

Respectfully submitted,

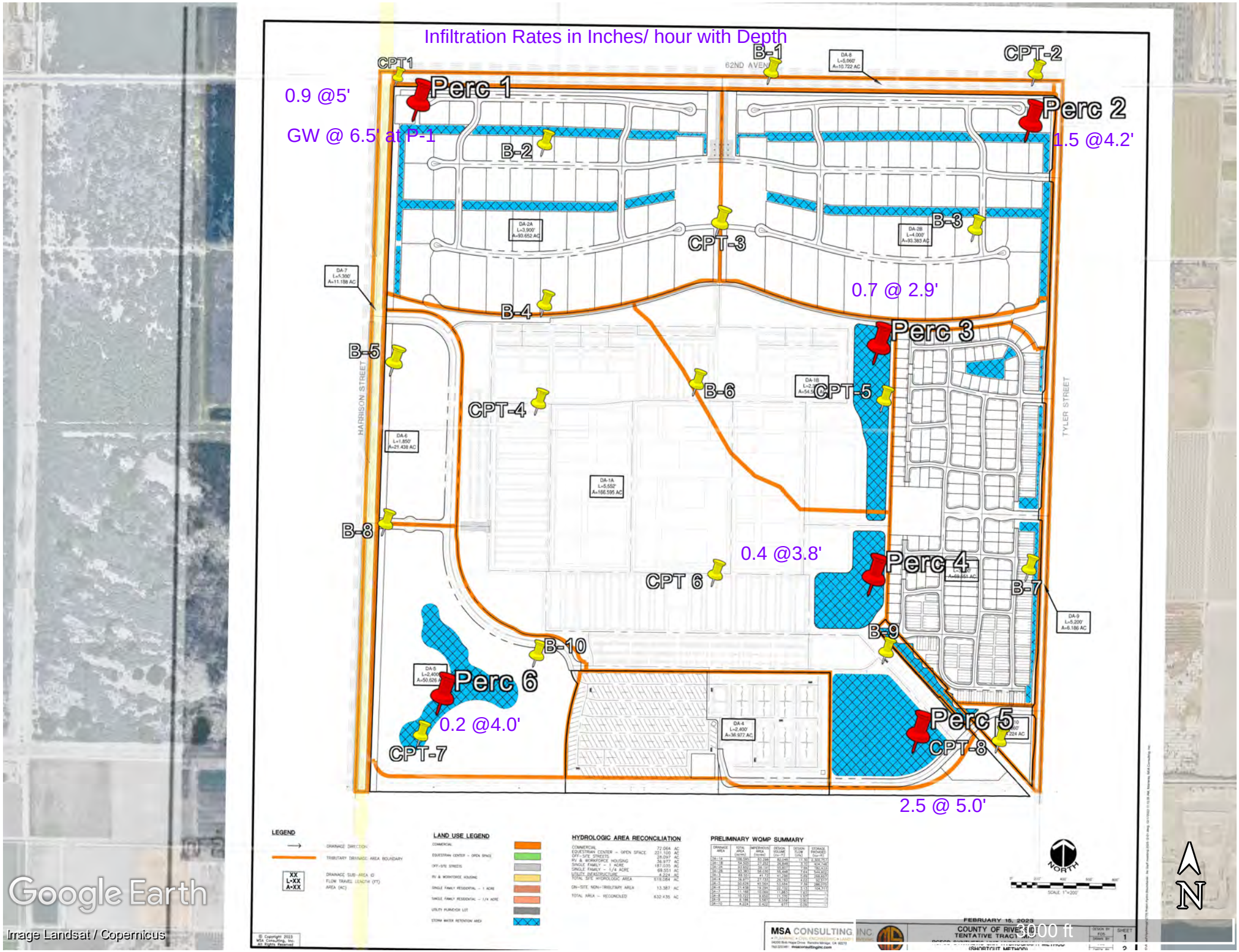
PETRA GEOSCIENCES, INC.

Alan Pace
Senior Associate Geologist
CEG 1952

AP/SJ/lv

Attachment: Figure showing Percolation Test Result Locations

W:\2020-2025\2021\400\21-483\Reports\21-483 110 Perc Test Results.docx


Infiltration Rates in Inches/ hour with Depth
CPT1
B-1
CPT-2
62ND AVEN
Perc 1
Perc 2
0.9 @5'
GW @ 6.5' at P-1
1.5 @4.2'
B-2
B-3
CPT-3
0.7 @ 2.9'
B-4
Perc 3
B-5
HARRISON STREET
B-6
CPT-5
CPT-4
TYLER STREET
0.4 @3.8'
Perc 4
CPT 6
B-7
B-8
B-9
B-10
Perc 6
0.2 @4.0'
CPT-7
Perc 5
CPT-8
2.5 @ 5.0'
LEGEND
LAND USE LEGEND
HYDROLOGIC AREA RECONCILIATION
PRELIMINARY WQMP SUMMARY
NORTH
SCALE 1"=200'
MSA CONSULTING, INC.
FEBRUARY 15, 2023
COUNTY OF RIVERSIDE
TENTATIVE TRACT
SHEET 1
Google Earth
Image Landsat / Copernicus
3000 ft
N

COACHELLA VALLEY WATER DISTRICT

FARM DRAIN TILE TABLE

Table No. 1

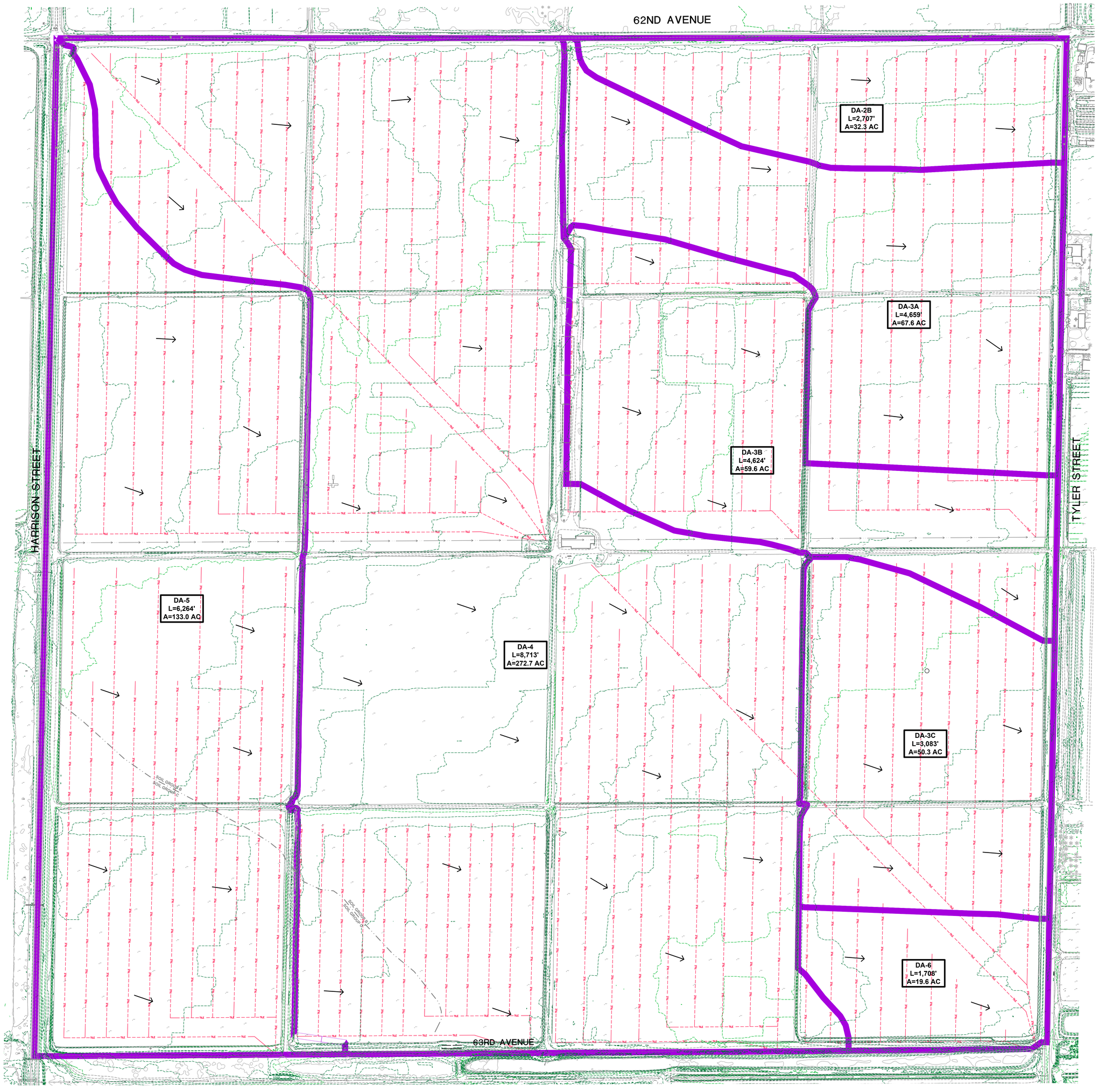
No.	Acres	Q in Sec-Feet	
1	40	0.4	Q 0.005 per Acre
2	80	0.7	
3	120	0.9	
4	160	1.1	
5	200	1.3	
6	240	1.5	
7	280	1.7	
8	320	1.9	
9	360	2.1	
10	400	2.3	
11	440	2.5	
12	480	2.7	
13	520	2.9	
14	560	3.1	
15	600	3.3	
16	640	3.5	
17	680	3.7	
18	720	3.9	
19	760	4.1	
20	800	4.3	
21	840	4.5	
22	880	4.7	
23	920	4.8	
24	960	4.9	

No.	Acres	Q in Sec-Feet	
25	1000	5.0	Q 0.0025 per Acre
30	1200	5.5	
35	1400	6.0	
40	1600	6.5	
45	1800	7.0	
50	2000	7.5	
55	2200	8.0	
60	2400	8.5	
65	2600	9.0	
70	2800	9.5	
75	3000	10.0	
	3500	11.0	
100	4000	12.0	Q 0.0020 per Acre
	4500	13.0	
125	5000	14.0	
	5500	15.0	
150	6000	16.0	
	6500	17.0	
175	7000	18.0	
	7500	19.0	
200	8000	20.0	
	8500	21.0	
225	9000	22.0	
	9500	23.0	
250	10,000	24.0	

CVCWD-213
(RECREATE 04/09/09)

Appendix I

Existing Conditions Exhibit
Synthetic Unit Hydrograph Exhibit



LEGEND

→	DRAINAGE DIRECTION
▬	TRIBUTARY DRAINAGE AREA BOUNDARY
DA-1A L=3,252' A=128.1 AC	DRAINAGE SUB-AREA ID FLOW TRAVEL LENGTH (FT) AREA (AC)
- - - TILE - - - TILE - - -	EXISTING DRAIN TILE LINE

NOTE:
EXISTING DRAIN TILE LINES (IN RED ABOVE) ARE 7–9 FEET BELOW EXISTING SURFACE, BASED ON AVAILABLE DRAIN TILE PLATS. A SEPARATE PLAN WILL BE PREPARED TO SHOW ALL RELOCATED DRAIN TILE LINES AND PROTECTED-IN-PLACE LINES.

NORTH

0' 200' 400' 600' 800'
SCALE 1"=200'

MARCH 6, 2023

MSA CONSULTING, INC.
> PLANNING > CIVIL ENGINEERING > LAND SURVEYING
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760.320.9811 msaconsultinginc.com

COUNTY OF RIVERSIDE
TENTATIVE TRACT MAP -
RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD (SHORTCUT METHOD)
EXISTING CONDITION HYDROLOGY EXHIBIT

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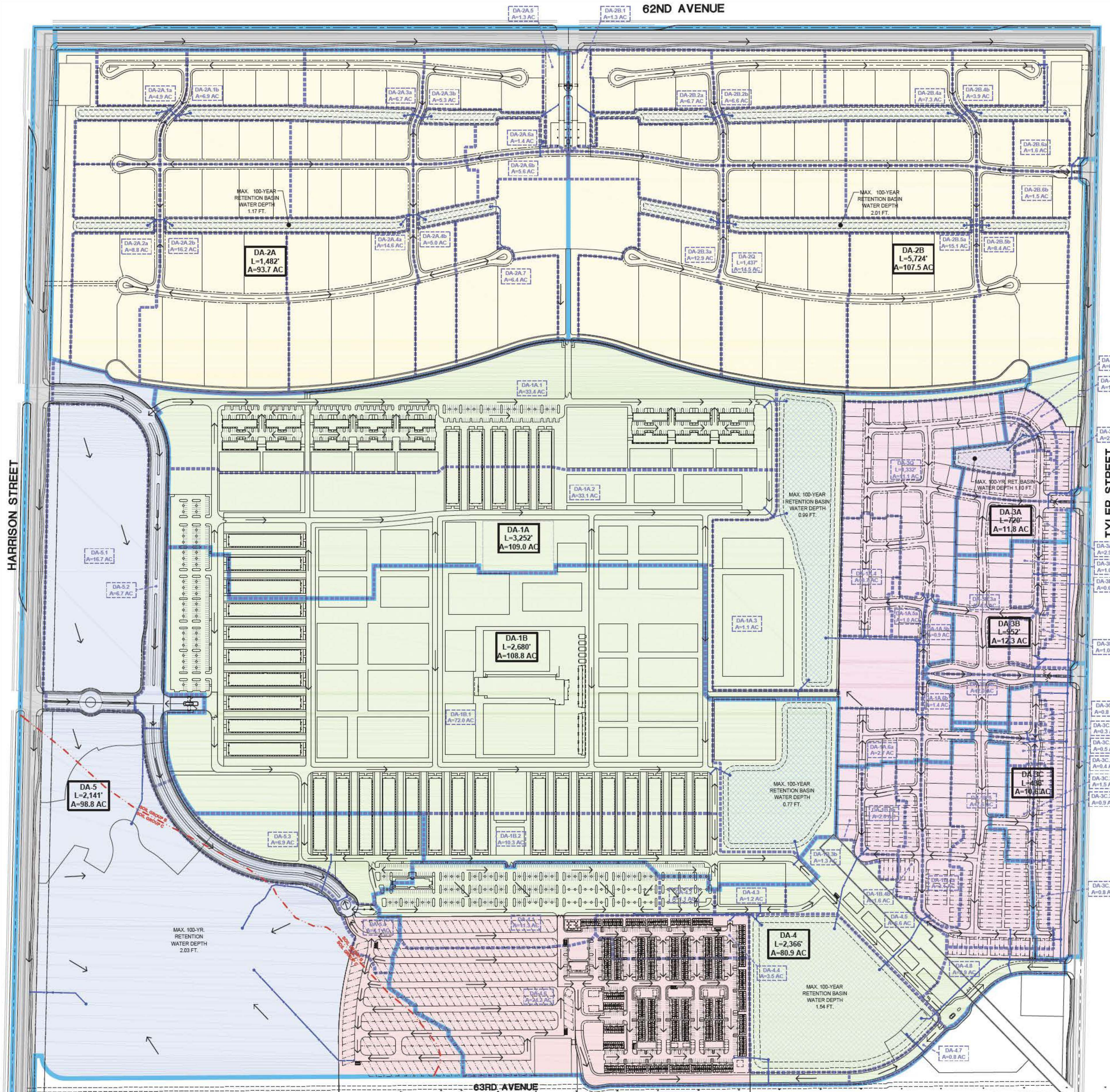
R:\2735\Acad\Hydrology\2735 Prelim Hydro Exhibit.dwg, 4/2/2024 8:35:22 AM, mead, MSA Consulting, Inc.



MAP LEGEND

Symbol	Description
→	DRAINAGE DIRECTION
(solid line)	TRIBUTARY DRAINAGE AREA BOUNDARY
(dashed line)	TRIBUTARY DRAINAGE AREA BOUNDARY FOR PEAK FLOW CALCULATION
DA-1A L=3,252' A=128.1 AC	DRAINAGE SUB-AREA ID FLOW TRAVEL LENGTH (FT) AREA (AC)

LAND USE LEGEND

- COMMERCIAL
- EQUESTRIAN CENTER – OPEN SPACE
- OFF-SITE STREETS
- RV & WORKFORCE HOUSING
- SINGLE FAMILY RESIDENTIAL – 1 ACRE
- SINGLE FAMILY RESIDENTIAL – 1/4 ACRE
- STORM WATER RETENTION AREA

VICINITY MAP
N.T.S.

HYDROLOGIC AREA RECONCILIATION

RESORT/COMMERCIAL	71.7 AC
EQUESTRIAN CENTER – OPEN SPACE	219.4 AC
OFF-SITE STREETS	32.9 AC
RV & WORKFORCE HOUSING	37.0 AC
SINGLE FAMILY – 1 ACRE	187.5 AC
SINGLE FAMILY – 1/4 ACRE	84.9 AC
TOTAL SITE HYDROLOGIC AREA	633.4 AC

PRELIMINARY WQMP SUMMARY

DRAINAGE AREA	TOTAL AREA (acres)	IMPERVIOUS AREA (acres)	DESIGN VOLUME (cu-ft)	DESIGN FLOW (cfs)	STORAGE PROVIDED (cu-ft)
DA-1A	109.0	54.5	53,693	7.40	269,505
DA-1B	108.8	54.4	53,594	7.38	249,329
DA-2A	93.7	18.7	23,159	3.19	191,799
DA-2B	107.5	31.1	34,248	4.72	365,246
DA-3A	11.8	6.7	6,598	0.91	35,151
DA-3B	12.3	6.6	6,488	0.89	18,911
DA-3C	10.6	6.0	5,907	0.81	19,664
DA-4	80.9	48.0	47,440	6.53	936,726
DA-5	98.8	67.2	68,225	9.40	648,605

0' 200' 400' 600' 800'
SCALE 1"=200'

NORTH

DRAINAGE AREA 'DA-1A'

DEVELOPED LAND USE SUMMARY

LAND USE	AREA (acres)	RI NUMBER	AMC II INFILTRATION RATE (in/hr)	IMPERVIOUS PERCENTAGE
EQUESTRIAN CENTER	85.1	69	0.39	0.50
SF - 1/4 ACRE	23.9	56	0.51	0.50
TOTAL	109.0			

DEVELOPED 100-YEAR STORM EVENT SUMMARY

STORM DURATION		1-HOUR	3-HOUR	6-HOUR	24-HOUR
RAINFALL VOLUME	(cu ft)	482,719	791,343	1,052,486	1,665,777
SOIL LOSSES	(cu ft)	90,598	268,279	508,170	1,099,189
EFFECTIVE RAIN	(in)	0.99	1.32	1.38	1.43
FLOOD VOLUME	(cu ft)	392,122	523,064	544,317	566,589
	(acre-ft)	9.00	12.01	12.50	13.01
PEAK FLOW	(cfs)	n/a	191.13	171.30	41.26
STORAGE PROVIDED	(cu ft)	269,505			
	(acre-ft)	6.19			
PERCOLATION RATE	(cfs)	0.24			
PERCOLATION VOLUME	(cu ft)	230,920	241,403	255,788	319,984
	(acre-ft)	5.30	5.54	5.87	7.35
DRAIN TILE LOSS VOLUME	(cu ft)	84,039	87,963	93,819	112,230
	(acre-ft)	1.93	2.02	2.15	2.58
OVERFLOW VOLUME	(cu ft)	77,163	193,699	194,710	134,374
	(acre-ft)	1.77	4.45	4.47	3.08
TOTAL VOLUME LOSSES	(cu ft)	392,122	523,064	544,317	566,589
	(acre-ft)	9.00	12.01	12.50	13.01
BASIN DEWATERING TIME	(hours)	41.9	41.9	41.8	37.3
MAXIMUM VOLUME IN BASIN	(cu ft)	307,797	307,797	307,797	307,797
	(acre-ft)	7.07	7.07	7.07	7.07
MAXIMUM WSEL	(ft)	352.21	352.39	352.44	352.49
MAXIMUM DEPTH	(ft)	0.71	0.89	0.94	0.99

BASIN VOLUME SUMMARY

CONTOUR ELEVATION (ft)	BASIN DEPTH (ft)	COUNTOUR AREA (sf)	VOLUME INCREMENT (cu ft)	TOTAL VOLUME (cu ft)	TOTAL VOLUME (ac-ft)
351.5	0.0	238,510	0	0	0.00
352.5	1.0	301,737	269,505	269,505	6.19

DEVELOPED WQMP SUMMARY

DRAINAGE AREA ID	TOTAL AREA (ac)	IMPERVIOUS AREA (ac)	DESIGN VOLUME (cu ft)	DESIGN FLOW (cfs)
DA-1A	109.0	54.5	53,693	7.40

DRAINAGE AREA 'DA-1B'

DEVELOPED LAND USE SUMMARY

LAND USE	AREA (acres)	RI NUMBER	AMC II INFILTRATION RATE (in/hr)	IMPERVIOUS PERCENTAGE
EQUESTRIAN CENTER	92.7	69	0.39	0.50
SF - 1/4 ACRE	16.1	56	0.51	0.50
TOTAL	108.8			

DEVELOPED 100-YEAR STORM EVENT SUMMARY

STORM DURATION		1-HOUR	3-HOUR	6-HOUR	24-HOUR
RAINFALL VOLUME	(cu ft)	481,834	789,891	1,050,555	1,662,721
SOIL LOSSES	(cu ft)	88,573	262,367	498,411	1,084,239
EFFECTIVE RAIN	(in)	1.00	1.34	1.40	1.46
FLOOD VOLUME	(cu ft)	393,260	527,525	552,144	578,481
	(acre-ft)	9.03	12.11	12.68	13.28
PEAK FLOW	(cfs)	n/a	191.30	171.50	41.63
OVERFLOW VOLUME RECEIVED	(cu ft)	42	166	283	669
	(acre-ft)	0.00	0.00	0.01	0.02
TOTAL VOLUME INTO BASIN	(cu ft)	393,302	527,690	552,427	579,151
	(acre-ft)	9.03	12.11	12.68	13.30
STORAGE PROVIDED	(cu ft)	249,329			
	(acre-ft)	5.72			
PERCOLATION RATE	(cfs)	0.13			
PERCOLATION VOLUME	(cu ft)	113,356	118,785	126,337	166,340
	(acre-ft)	2.60	2.73	2.90	3.82
DRAIN TILE LOSS VOLUME	(cu ft)	84,190	88,107	93,915	120,798
	(acre-ft)	1.93	2.02	2.16	2.77
OVERFLOW VOLUME	(cu ft)	195,756	320,799	332,175	292,013
	(acre-ft)	4.49	7.36	7.63	6.70
TOTAL VOLUME LOSSES	(cu ft)	393,302	527,690	552,427	579,151
	(acre-ft)	9.03	12.11	12.68	13.30
BASIN DEWATERING TIME	(hours)	42.0	42.0	42.0	39.3
MAXIMUM VOLUME IN BASIN	(cu ft)	192,903	192,903	192,903	192,903
	(acre-ft)	4.43	4.43	4.43	4.43
MAXIMUM WSEL	(ft)	351.27	351.27	351.27	351.27
MAXIMUM DEPTH	(ft)	0.77	0.77	0.77	0.77

BASIN VOLUME SUMMARY

CONTOUR ELEVATION (ft)	BASIN DEPTH (ft)	COUNTOUR AREA (sf)	VOLUME INCREMENT (cu ft)	TOTAL VOLUME (cu ft)	TOTAL VOLUME (ac-ft)
350.5	0.0	222,055	0	0	0.00
351.5	1.0	277,637	249,329	249,329	5.72

DEVELOPED WQMP SUMMARY

DRAINAGE AREA ID	TOTAL AREA (ac)	IMPERVIOUS AREA (ac)	DESIGN VOLUME (cu ft)	DESIGN FLOW (cfs)
DA-1B	108.8	54.4	53,594	7.38

DRAINAGE AREA 'DA-2A'

DEVELOPED LAND USE SUMMARY

LAND USE	AREA (acres)	RI NUMBER	AMC II INFILTRATION RATE (in/hr)	IMPERVIOUS PERCENTAGE
SF - 1 ACRE	93.7	56	0.51	0.20
	0.0			
TOTAL	93.7			

DEVELOPED 100-YEAR STORM EVENT SUMMARY

STORM DURATION		1-HOUR	3-HOUR	6-HOUR	24-HOUR
RAINFALL VOLUME	(cu ft)	414,961	680,265	904,752	1,431,957
SOIL LOSSES	(cu ft)	142,243	388,856	588,575	1,189,381
EFFECTIVE RAIN	(in)	0.80	0.86	0.93	0.71
FLOOD VOLUME	(cu ft)	272,718	291,408	316,177	242,576
	(acre-ft)	6.26	6.69	7.26	5.57
PEAK FLOW	(cfs)	n/a	146.43	129.37	20.08
STORAGE PROVIDED	(cu ft)	191,799			
	(acre-ft)	4.40			
PERCOLATION RATE	(cfs)	0.29			
PERCOLATION VOLUME	(cu ft)	170,466	177,154	186,508	166,251
	(acre-ft)	3.91	4.07	4.28	3.82
DRAIN TILE LOSS VOLUME	(cu ft)	72,478	75,756	80,816	76,325
	(acre-ft)	1.66	1.74	1.86	1.75
OVERFLOW VOLUME	(cu ft)	29,775	38,498	48,853	0
	(acre-ft)	0.68	0.88	1.12	0.00
TOTAL VOLUME LOSSES	(cu ft)	272,718	291,408	316,177	242,576
	(acre-ft)	6.26	6.69	7.26	5.57
BASIN DEWATERING TIME	(hours)	42.0	42.0	42.0	23.5
MAXIMUM VOLUME IN BASIN	(cu ft)	237,709	237,709	237,709	149,775
	(acre-ft)	5.46	5.46	5.46	3.44
MAXIMUM WSEL	(ft)	363.14	363.44	363.57	363.34
MAXIMUM DEPTH	(ft)	0.74	1.04	1.17	0.94

BASIN VOLUME SUMMARY

CONTOUR ELEVATION (ft)	BASIN DEPTH (ft)	COUNTOUR AREA (sf)	VOLUME INCREMENT (cu ft)	TOTAL VOLUME (cu ft)	TOTAL VOLUME (ac-ft)
362.4	0.0	108,827	0	0	0.00
363.6	1.2	216,998	191,799	191,799	4.40

DEVELOPED WQMP SUMMARY

DRAINAGE AREA ID	TOTAL AREA (ac)	IMPERVIOUS AREA (ac)	DESIGN VOLUME (cu ft)	DESIGN FLOW (cfs)
DA-2A	93.7	18.7	23,192	3.19

DRAINAGE AREA 'DA-2B'

DEVELOPED LAND USE SUMMARY

LAND USE	AREA (acres)	RI NUMBER	AMC II INFILTRATION RATE (in/hr)	IMPERVIOUS PERCENTAGE
SF - 1 ACRE	93.8	56	0.51	0.20
OFFSITE STREETS	13.7	56	0.51	0.90
TOTAL	107.5			

DEVELOPED 100-YEAR STORM EVENT SUMMARY

STORM DURATION		1-HOUR	3-HOUR	6-HOUR	24-HOUR
RAINFALL VOLUME	(cu ft)	476,076	780,453	1,038,003	1,642,854
SOIL LOSSES	(cu ft)	147,214	411,828	644,449	1,311,477
EFFECTIVE RAIN	(in)	0.84	0.94	1.01	0.85
FLOOD VOLUME	(cu ft)	328,862	368,625	393,554	331,377
	(acre-ft)	7.55	8.46	9.03	7.61
PEAK FLOW	(cfs)	n/a	172.43	152.87	26.86
OVERFLOW VOLUME RECEIVED	(cu ft)	29,775	38,498	48,853	0
	(acre-ft)	0.68	0.88	1.12	0.00
TOTAL VOLUME INTO BASIN	(cu ft)	358,637	407,123	442,406	331,377
	(acre-ft)	8.23	9.35	10.16	7.61
STORAGE PROVIDED	(cu ft)	365,246			
	(acre-ft)	8.38			
PERCOLATION RATE	(cfs)	0.49			
PERCOLATION VOLUME	(cu ft)	280,592	318,223	334,272	255,522
	(acre-ft)	6.44	7.31	7.67	5.87
DRAIN TILE LOSS VOLUME	(cu ft)	78,045	87,075	92,719	75,855
	(acre-ft)	1.79	2.00	2.13	1.74
OVERFLOW VOLUME	(cu ft)	0	1,824	15,416	0
	(acre-ft)	0.00	0.04	0.35	0.00
TOTAL VOLUME LOSSES	(cu ft)	358,637	407,123	442,406	331,377
	(acre-ft)	8.23	9.35	10.16	7.61
BASIN DEWATERING TIME	(hours)	39.4	42.1	42.0	19.5
MAXIMUM VOLUME IN BASIN	(cu ft)	350,208	380,798	380,798	200,571
	(acre-ft)	8.04	8.74	8.74	4.60
MAXIMUM WSEL	(ft)	357.71	357.52	357.43	356.85
MAXIMUM DEPTH	(ft)	2.01	1.82	1.73	1.15

BASIN VOLUME SUMMARY

CONTOUR ELEVATION (ft)	BASIN DEPTH (ft)	COUNTOUR AREA (sf)	VOLUME INCREMENT (cu ft)	TOTAL VOLUME (cu ft)	TOTAL VOLUME (ac-ft)
355.7	0.0	122,275	0	0	0.00
357.8	2.1	231,323	365,246	365,246	8.38

DEVELOPED WQMP SUMMARY

DRAINAGE AREA ID	TOTAL AREA (ac)	IMPERVIOUS AREA (ac)	DESIGN VOLUME (cu ft)	DESIGN FLOW (cfs)
DA-2B	107.5	31.1	34,240	4.72

DRAINAGE AREA 'DA-3A'

DEVELOPED LAND USE SUMMARY

LAND USE	AREA (acres)	RI NUMBER	AMC II INFILTRATION RATE (in/hr)	IMPERVIOUS PERCENTAGE
SF - 1/4 ACRE	8.4	56	0.51	0.50
EQUESTRIAN CENTER	1.4	69	0.39	0.50
OFFSITE STREETS	2.0	56	0.51	0.90
TOTAL	11.8			

DEVELOPED 100-YEAR STORM EVENT SUMMARY

STORM DURATION		1-HOUR	3-HOUR	6-HOUR	24-HOUR
TOTAL RAINFALL	(in)	1.22	2	2.66	4.21
RAINFALL VOLUME	(cuft)	52,258	85,668	113,939	180,332
SOIL LOSSES	(cuft)	10,347	30,615	57,572	121,843
EFFECTIVE RAIN	(in)	0.98	1.29	1.32	1.37
FLOOD VOLUME	(cu-ft)	41,911	55,054	56,367	58,489
	(acre-ft)	0.96	1.26	1.29	1.34
PEAK FLOW	(cfs)	N/A	20.54	18.39	4.34

DEVELOPED WQMP SUMMARY

DRAINAGE AREA ID	TOTAL AREA (ac)	IMPERVIOUS AREA (ac)	DESIGN VOLUME (cu ft)	DESIGN FLOW (cfs)
DA-3A	11.8	6.7	6,598	0.91

DRAINAGE AREA 'DA-3B'

DEVELOPED LAND USE SUMMARY

LAND USE	AREA (acres)	RI NUMBER	AMC II INFILTRATION RATE (in/hr)	IMPERVIOUS PERCENTAGE
SF - 1/4 ACRE	11.2	56	0.51	0.50
OFFSITE STREETS	1.1	56	0.51	0.90
TOTAL	12.3			

DEVELOPED 100-YEAR STORM EVENT SUMMARY

STORM DURATION		1-HOUR	3-HOUR	6-HOUR	24-HOUR
TOTAL RAINFALL	(in)	1.22	2	2.66	4.21
RAINFALL VOLUME	(cuft)	54,472	89,298	118,767	187,973
SOIL LOSSES	(cuft)	11,791	34,698	62,515	132,219
EFFECTIVE RAIN	(in)	0.96	1.22	1.26	1.25
FLOOD VOLUME	(cu-ft)	42,681	54,600	56,251	55,754
	(acre-ft)	0.98	1.25	1.29	1.28
PEAK FLOW	(cfs)	N/A	21.13	18.89	4.28

DEVELOPED WQMP SUMMARY

DRAINAGE AREA ID	TOTAL AREA (ac)	IMPERVIOUS AREA (ac)	DESIGN VOLUME (cu ft)	DESIGN FLOW (cfs)
DA-3B	12.3	6.6	6,488	0.89

DRAINAGE AREA 'DA-3C'

DEVELOPED LAND USE SUMMARY

LAND USE	AREA (acres)	RI NUMBER	AMC II INFILTRATION RATE (in/hr)	IMPERVIOUS PERCENTAGE
SF - 1/4 ACRE	8.8	56	0.51	0.50
OFFSITE STREETS	1.8	56	0.51	0.90
TOTAL	10.6			

DEVELOPED 100-YEAR STORM EVENT SUMMARY

STORM DURATION		1-HOUR	3-HOUR	6-HOUR	24-HOUR
TOTAL RAINFALL	(in)	1.22	2	2.66	4.21
RAINFALL VOLUME	(cuft)	46,943	76,956	102,352	161,993
SOIL LOSSES	(cuft)	9,593	28,373	53,138	110,963
EFFECTIVE RAIN	(in)	0.97	1.26	1.28	1.33
FLOOD VOLUME	(cu-ft)	37,350	48,583	49,214	51,030
	(acre-ft)	0.86	1.12	1.13	1.17
PEAK FLOW	(cfs)	N/A	18.37	16.44	3.83

DEVELOPED WQMP SUMMARY

DRAINAGE AREA ID	TOTAL AREA (ac)	IMPERVIOUS AREA (ac)	DESIGN VOLUME (cu ft)	DESIGN FLOW (cfs)
DA-3C	10.6	6.0	5,907	0.81

DRAINAGE AREA 'DA-4'

DEVELOPED LAND USE SUMMARY

LAND USE	AREA (acres)	RI NUMBER	AMC II INFILTRATION RATE (in/hr)	IMPERVIOUS PERCENTAGE
EQUESTRIAN CENTER	33.2	69	0.39	0.50
WORKFORCE HOUSING	30.3	56	0.51	0.75
TOTAL	80.9			

DEVELOPED 100-YEAR STORM EVENT SUMMARY

STORM DURATION		1-HOUR	3-HOUR	6-HOUR	24-HOUR
RAINFALL VOLUME	(cu ft)	358,275	587,336	781,157	1,236,343
SOIL LOSSES	(cu ft)	61,799	183,241	354,322	782,388
EFFECTIVE RAIN	(in)	1.01	1.38	1.45	1.55
FLOOD VOLUME	(cu ft)	296,477	404,095	426,836	453,955
	(acre-ft)	6.81	9.28	9.80	10.42
PEAK FLOW	(cfs)	n/a	143.37	128.65	31.93
OVERFLOW VOLUME RECEIVED	(cu ft)	246,478	406,185	430,315	356,129
	(acre-ft)	5.66	9.32	9.88	8.18
TOTAL VOLUME INTO BASIN	(cu ft)	542,955	810,280	857,151	810,084
	(acre-ft)	12.46	18.60	19.68	18.60
STORAGE PROVIDED	(cu ft)	936,726			
	(acre-ft)	21.50			
PERCOLATION RATE	(cfs)	0.63			
PERCOLATION VOLUME	(cu ft)	518,928	775,089	821,231	777,041
	(acre-ft)	11.91	17.79	18.85	17.84
DRAIN TILE LOSS VOLUME	(cu ft)	24,027	35,191	35,920	33,043
	(acre-ft)	0.55	0.81	0.82	0.76
TOTAL VOLUME LOSSES	(cu ft)	542,955	810,280	857,151	810,084
	(acre-ft)	12.46	18.60	19.68	18.60
BASIN DEWATERING TIME	(hours)	15.6	21.5	21.4	8.8
MAXIMUM VOLUME IN BASIN	(cu ft)	510,499	716,171	721,662	528,304
	(acre-ft)	11.72	16.44	16.57	12.13
MAXIMUM WSEL	(ft)	347.49	347.93	347.94	347.53
MAXIMUM DEPTH	(ft)	1.09	1.53	1.54	1.13

BASIN VOLUME SUMMARY

CONTOUR ELEVATION (ft)	BASIN DEPTH (ft)	COUNTOUR AREA (sf)	VOLUME INCREMENT (cu ft)	TOTAL VOLUME (cu ft)	TOTAL VOLUME (ac-ft)
346.4	0.0	437,506	0	0	0.00
348.4	2.0	499,913	936,726	936,726	21.50

DEVELOPED WQMP SUMMARY

DRAINAGE AREA ID	TOTAL AREA (ac)	IMPERVIOUS AREA (ac)	DESIGN VOLUME (cu ft)	DESIGN FLOW (cfs)
DA-4	80.9	48.0	47,467	6.54

DRAINAGE AREA 'DA-5'

DEVELOPED LAND USE SUMMARY

LAND USE	AREA (acres)	RI NUMBER	AMC II INFILTRATION RATE (in/hr)	IMPERVIOUS PERCENTAGE
OFFSITE STREETS	8.7	56	0.51	0.90
OFFSITE STREETS	4.7	69	0.39	0.90
RESORT/COMMERCIAL	31.3	56	0.51	0.65
RESORT/COMMERCIAL	40.4	69	0.39	0.65
WORKFORCE HOUSING	2.2	56	0.51	0.75
WORKFORCE HOUSING	4.5	69	0.39	0.75
EQUESTRIAN CENTER	7.0	69	0.39	0.50
TOTAL	98.8			

DEVELOPED 100-YEAR STORM EVENT SUMMARY

STORM DURATION		1-HOUR	3-HOUR	6-HOUR	24-HOUR
RAINFALL VOLUME	(cu ft)	437,547	717,291	953,997	1,509,897
SOIL LOSSES	(cu ft)	60,952	181,436	357,560	847,428
EFFECTIVE RAIN	(in)	1.05	1.49	1.66	1.65
FLOOD VOLUME	(cu ft)	376,595	535,855	596,437	662,469
	(acre-ft)	8.65	12.30	13.69	15.21
REQUIRED STORAGE	(cu ft)	375,112	531,352	587,495	**625,546**
	(acre-ft)	8.61	12.20	13.49	**14.36**
STORAGE PROVIDED	(cu ft)	648,605			
	(acre-ft)	14.89			
MAXIMUM WSEL	(ft)	361.21	361.72	361.90	**362.03**
DEPTH	(ft)	1.21	1.72	1.90	**2.03**

BASIN VOLUME SUMMARY

CONTOUR ELEVATION (ft)	BASIN DEPTH (ft)	COUNTOUR AREA (sf)	VOLUME INCREMENT (cu ft)	TOTAL VOLUME (cu ft)	TOTAL VOLUME (ac-ft)
360.0	0.0	285,651	0	0	0.00
362.1	2.1	332,665	648,605	648,605	14.89

DEVELOPED WQMP SUMMARY

DRAINAGE AREA ID	TOTAL AREA (ac)	IMPERVIOUS AREA (ac)	DESIGN VOLUME (cu ft)	DESIGN FLOW (cfs)
DA-5	98.8	67.2	68,212	9.40

SEPTEMBER 20, 2024

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COUNTY OF RIVERSIDE
TENTATIVE TRACT MAP - RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD (SHORTCUT METHOD) DEVELOPED CONDITION HYDROLOGY EXHIBIT

DESIGN BY	RRR
DRAWN BY	RRR
CHECK BY	JAD

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