Preliminary Drainage Report

for

The Shire at Old Ranch

Prepared for KESS Properties

February 27, 2024

by
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INTRODUCTION

This drainage report and it's proposed drainage solutions are unconventional versus typical developments. The owners have set intentions for the project that include best practices in water use and management. This drainage report and proposed strategies seek to treat storm water as an asset and intend to have as little stormwater leave the property as possible and prefer infiltrating. Our drainage strategies align with agricultural engineering more so than conventional civil engineering.

Our strategies focus on collecting stormwater from small basins that are adjacent to dedicated infiltration ponds. As such, conveyance needs are minimized and numerous vegetation lined ponds are proposed.

We've discussed our strategies for stormwater infiltration with our water attorney who indicates that pumping 'stored' water to other points on the property would certainly be considered as 'extracting a beneficial use' and would be considered contrary to Colorado water law. However, crops or commercial vegetation that gets 'watered' collaterally would not be a violation. Plantings in and around ponds would be helpful for erosion control and likely increase soil infiltration rates.

I PROJECT OVERVIEW

The Shire at Old Ranch is private development by the long time owners with the intent to create an educational and commercial experience focusing on gardening, health and wellness, and community. The project will include a garden center, cafe, meeting house, hand-craft workshops and agricultural endeavors including small animals and classes. The bulk of the land will be used for growing nursery and food crops.

II. GENERAL LOCATION

The project is located east of the intersection of Powers Blvd and Old Ranch Road. It is bounded by Old Ranch Rd to the south, Howells Rd to the west, Ridgeway Ln. to the north and adjacent properties to the east.

Township12S Range 66W SW4SW4 Sec 23 El Paso County, Colorado
These parcels are at the very southwest corner of the Black Forest and located within the Kettle Creek Drainage Basin. Most of the land to the north and east of the Shire has not been developed beyond large-lot residential uses.

There are no drainageways on our property and there are no indications of anything other than sheet flow entering or leaving the property. The North Fork at Briargate to the west of this property has built three detention ponds.
Surrounding Platted Developments include :

1. Several small platted properties to the east
2. Academy High School Filing No. 5 and North Fork at Briargate Filing No. 6 to the west
3. Several Cordera Filings to the south
4. There aren't any new plattings filed to the north.

III.
DESCRIPTION OF PROPERTY

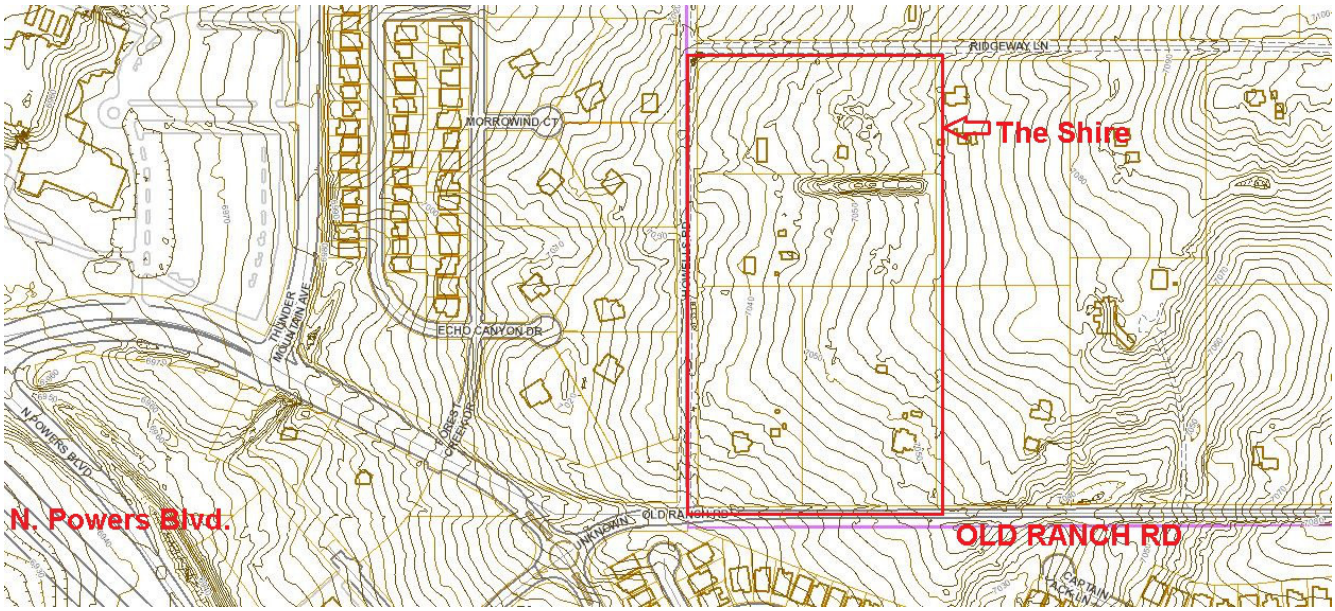
The project is comprised of four contiguous 5 acre parcels, these parcels are at the very southwest corner of the Black Forest.:

3820 Old Ranch Rd	#6226000061
3890 Old Ranch Rd.	#6226000060
10655 Howells Rd.	#6226000059
10755 Howells Rd.	#6226000058

Each of the four properties has a single family residence with wells and individual septic systems. The land hasn't been reshaped over the years and has natural grasses, small trees and shrubs throughout. The land slopes generally to the west at 2-5%. There are three sub-drainages within the 20 acres that flow to the northwest, west and south. The property is bound by Ridgeway Ln to the north, Howells Rd. to the west and Old Ranch Rd. to the south respectively.

The existing vegetation consists of trees (Blue Spruce, Sib Elm, Scrub Oak, Ponderosa, Black Locust...),

Shrubs (Juniper, Choke Cherry, Goji, Elderberry, American Plum, Sib. Pea, Currants, Goose Cherry...), all of which will be kept.



Based on geotechnical explorations that have been done, the soils beneath a few inches of top soil are fairly consistent fine sands, SW, SM. Sandstone was hit at 13' in just one test hole in the upper reach (east side). All other test bores showed sand/silt down to 20' maximum test depth. Percolation tests have found the soil capable of infiltrating water at 1.18 to 1.67 inches/hour.

USDA identifies this soils as sandy loam with some sand-clay loam (Peyton-Pring). The soil has a hydrologic Group B classification and a capacity of the most limiting layer to be 2.0-6.0 inches/hour. Areas to the east and north have similar soil (Group B) and slopes.

There are no drainageways or structures on the property and there is no sign that anything other than sheet flow may have ever entered the property along the east side or flowed off this property. There are no irrigation systems presently however the project will employ high efficiency irrigation methods when built. The only utilities within the property are those serving the existing residences.

IV. MAJOR BASIN DESCRIPTION

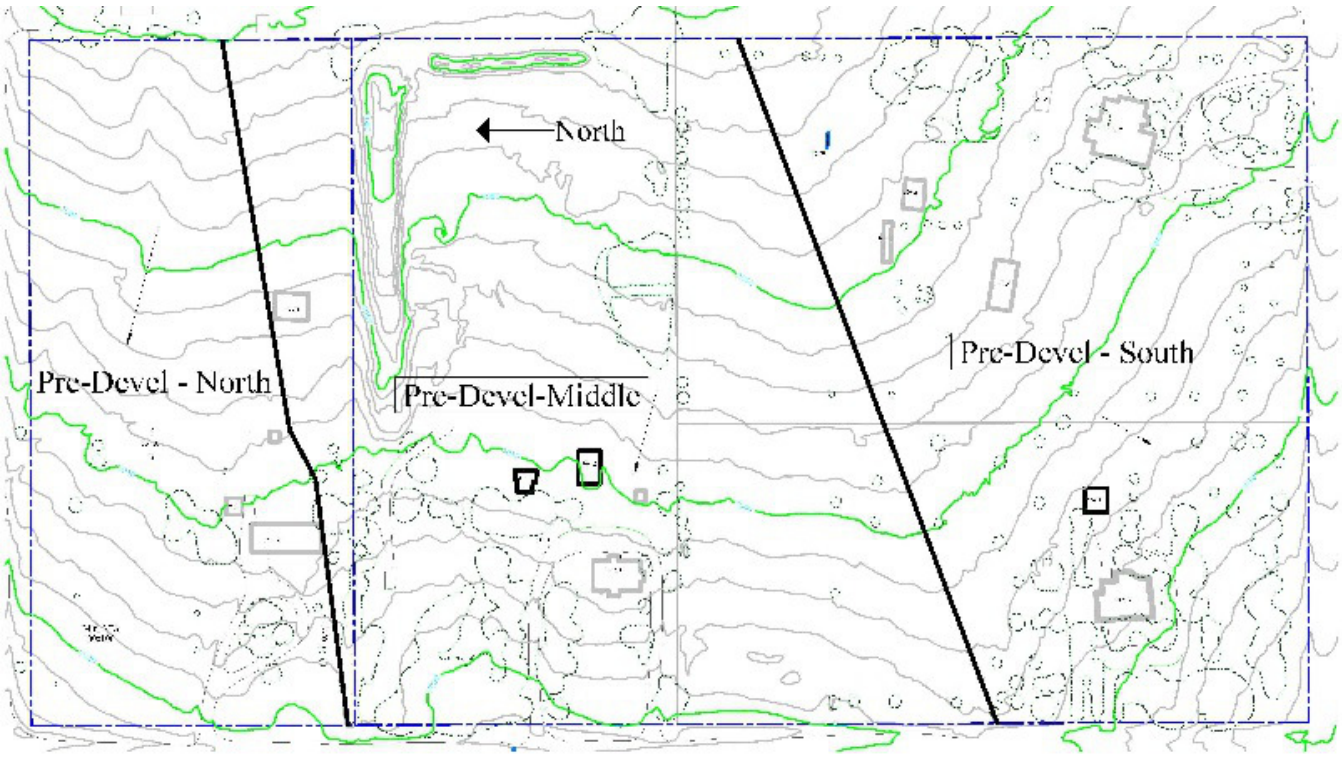
The property is within the area studied by JR Engineering in April 2001 for the Kettle Creek Drainage Basin-Old Ranch Road Tributary Drainage Basin Planning Study and Master Development Plan. This in the first study to to address the entire Kettle Creek Watershed. Our property is within this study area near Basin Identifiers D10 & D12 . The drainage management plan proposed in this study 'calls for the major land owners/developers in the study area to construct the drainage infrastructure required to support the proposed development within the study area' and 'calls for several regional detention facilities'. The study acknowledges that much of the Kettle Creek Watershed is within the city limits of Colorado Springs and they would have jurisdiction. Also, since the watershed flows to the US Air Force Academy property, the City required 2,5,10,25, 50 and 100 year storm events to be analyzed.

Most of the land to the north and east of the Shire has not been developed beyond large lot residential. The Kettle Creek and Old Ranch Road Drainage Basin Planning Studies address drainage for the larger area whereas the a Drainage Report for the new subdivision (North Fork at Briargate Fil 2) is the nearest and most recent drainage study, albeit down stream from our project.

The property is not within a designated floodplain and FEMA classifies our property as “Area of Minimal Flood Hazard”

V. SUB-BASIN DESCRIPTION

Historic drainage patterns within the property generally flow to the west. Three sub-basins have been identified: South, Middle and North for the pre-development analysis.



Historic Runoff

Analysis of the existing hydrologic conditions reveal a 10 year storm produces 1.27 Acre-Feet of runoff and 1.91 Acre-Feet for a 100 year storm. Flow rates are calculated for each sub-basin along with stormwater volume using the Rational Method. Hydrographs of these basins is found in the Appendix.

Storm Runoff - Pre-Development				10 Yr Storm		100 Yr Storm	
				Rate of Run-off	Volume of Run-off	Rate of Run-off	Volume of Run-off
Run Free	Basin	Composite Area (ac)	Composite Coeff RO	Q cfs 10yr	Volume cf 10 yr	Q cfs 100 yr	Volume cf 100yr
Pre Development	South	3.956	0.23	2.303	20,178	3.461	30315
	Middle	9.221	0.21	3.036	24,226	4.545	36,265
	North	6.806	0.23	1.496	11,128	2.233	16,613
			Total Pre-Dev RO	**3.21**	**55,532**	**10.239**	**83,193**
			Acre Feet		**1.27**		**1.91**

VI. DESIGN CRITERIA

The Kettle Creek/ORR DBPS used 2,5,10,25, 50 and 100 year storm events to be analyzed whereas our project uses 10 and 100 year storm events.

VII. FOUR STEP

Our runoff reduction methods will include : Limiting hardscape to heavy traffic areas, use of permeable pavers in most walkways, rooftop waters directed to ponds*, limited concrete curb and gutter (another hardscape), 'contour plowing' in crop areas, maintain many areas with dense vegetation.

Maintaining stable drainageways will be simplified by employing ; numerous low volume, low velocity drainageways and allowing historic sheet flow to run directly to dedicated ponds. Some roof waters will be piped but most conveyances will be via small channels.

Our proposed WQCV would include all stormwaters infiltrated into the ground. We will be developing and implementing some unique 'best practices'.

* The term 'Pond' refers to infiltration ponds of various types and sizes, from vegetation lined pits scattered around, grass buffers and constructed basins.

VIII. HYDROLOGIC CRITERIA

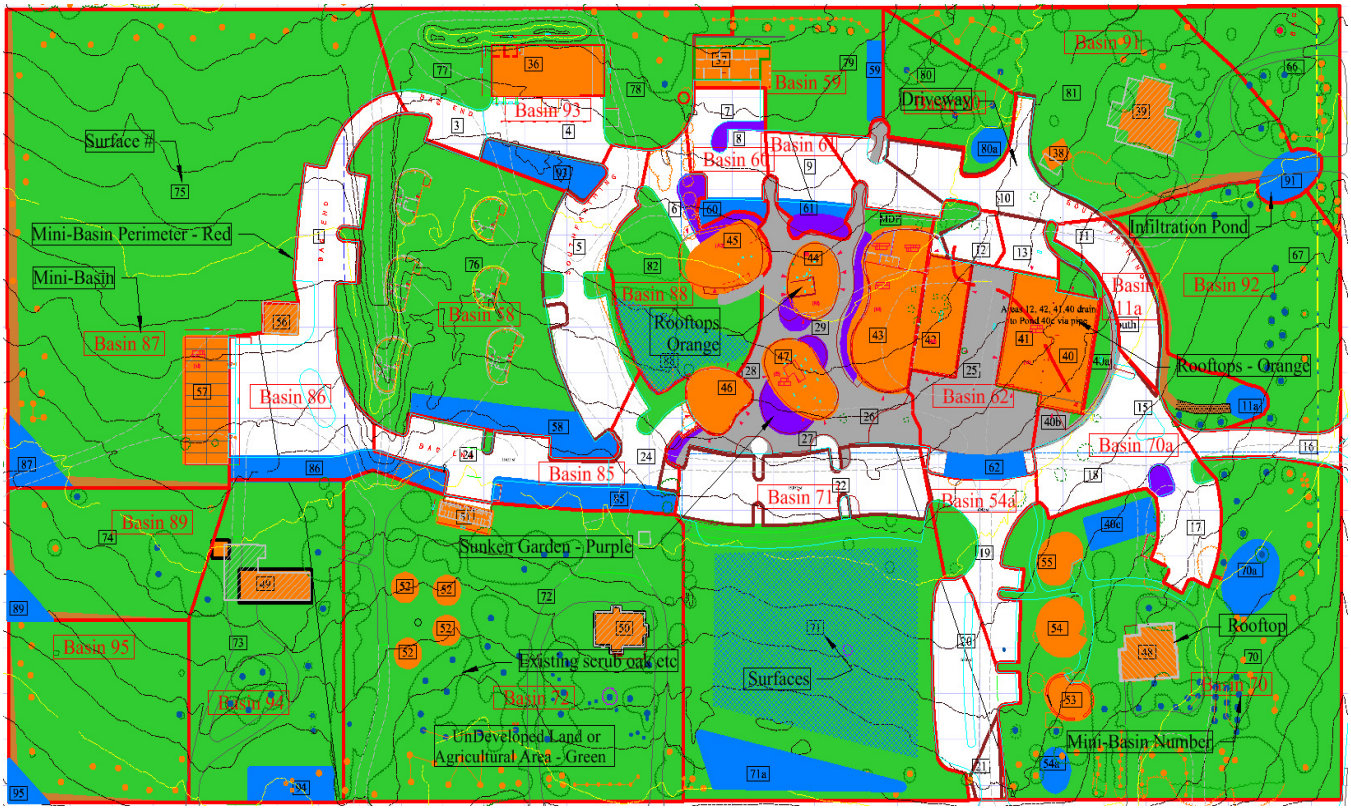
Design Storm for this report is the Rational Method and SCS Type II 24 hour storm for both 10 year and 100 year event. Hydrologic analysis was done using HYDROLOGY STUDIO v3.0.0.26 software. Rainfall data was downloaded from NOAA for Colorado Springs.

To size infiltration ponds, the Pond Design feature was utilized with the outflow volume reduced to 0.0001cfs. This gives the required size of pond to capture 100% of a given storm flow entirely.

IX. DRAINAGE FACILITY DESIGN CONCEPTS

A major objective of the project is to require the least amount of overlot grading and to maintain the historic drainage patterns. Our Drainage Strategies will reduce overall stormwater from flowing from the property. Using numerous mini-basins, basins will collect and infiltrate their waters 100% and some basins will allow a historic flow to continue. The net off-site flow will be reduced significantly.

The Plan view below shows enumerated surfaces and the general surface type in colors. Areas that will be runoff controlled will have their own pattern of runoff, conveyance and infiltration pond.



Most surface areas would utilize historic sheet flows directed to infiltration ponds (blue). Agricultural areas (green) would utilize strategies such as 'contour plowing'. Roofs are shown in orange color. White colored areas are paved surface (asphalt or gravel). Gray area around building groups is permeable pavers. Purple areas are depressed gardens which would not contribute to runoff.

X. DRAINAGE FACILITY DESIGN-DETAILS

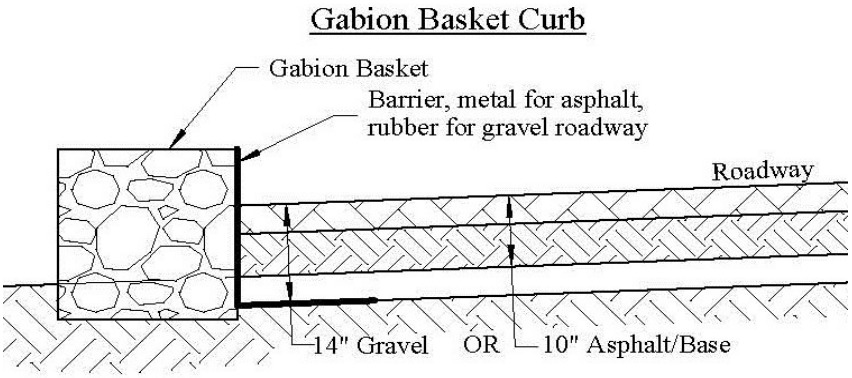
A project goal is to limit water flowing off property to volumes less than the historic, calculated volume. Some of the identified mini-basins are easier to achieve that goal without significant disruption to existing landscaping and land use. Throughout the property various combinations of strategies for reducing run-off will be used.

We will employ low impact land use and drainage strategies that :

1. Minimize grading
2. Use heavy vegetation and contour plowing to achieve lower run-off
3. Employ planters and gardens in small depressions to collect and infiltrate on the spot
4. Require the least curb and gutter
5. Maximize sheet flow directly into dedicated infiltration ponds

Different pond styles will be employed, both sloped side basins and some vertical wall ponds to conserve space. Details of the Pond Types is found in the Appendix.

Where curb and gutter is necessary, Owners wish to pursue a less carbon intensive manner as shown below. Uphill edges of roadways and parking would have no curb. Wheel stops would be used in parking areas. The 'barrier' noted in the diagram could be notched to allow water to spill over barrier and through the Gabion basket and then surface flow to it's dedicated pond. A similar detail could be used on the uphill side to route waters to a strategic road crossing.



Our drainage strategies will not adversely affect streets and utilities. Many intentions for the project will result in positive environmental elements that will enhance the visitor experience at the Shire. Since we will infiltrate rather than discharge to other drainage systems, we expect to have a very positive affect on downstream drainage systems.

FINAL DRAINAGE STRATEGIES

Our drainage strategies involve numerous small collection and infiltration ponds which take advantage of the existing terrain with limited over-lot grading. The property has been broken into mini-basins that take advantage of proposed roadways, buildings and surfaces to allow waters to flow in small volumes to adjacent ponds. All surfaces have been colored and numbered.

CALCULATION METHODS

For both the pre and post development runoff analysis, the contributing surfaces and their coefficient of runoff, slope and time of concentration were calculated.

Coefficients of Runoff used are as follows

Undeveloped Land, Future Agricultural areas	0.2
Asphalt Roads and Parking spaces	0.95
Gravel Roads and Parking spaces, Pavers	0.85
Roofs	0.95
Ponds them selves, assumed full	1.00

The Time of Concentration was typically quite long for pre-development flows and was adjusted for post development flows to find the surface that had the least and longest Tc. In some case's, if an Ag and Paved surface dominated the basin, Tc's for both surfaces were determined to find the largest flow (in cubic feet per second, cfs) to assess channel requirements.

FREE FLOWING AREAS

Some areas were found not to be good candidates for managing stormwater, usually areas at the bottom of the basins or areas with heavy vegetation. These areas are on the south and west sides of the property. Runoff from these areas was calculated for the 10 and 100 year storms to find there rate of flow and total runoff that would be discharged.

This is a summary of those areas which will be allowed to flow off site. Waters from these areas would tend to accumulate in borrow ditches along Old Ranch and Howells Roads. There no indications that anything other than sheet flow has ever occurred in off-site flows.

Basin 72, west side @ 10755 Howells Rd.
Area 20 & 21, low end of entry driveway, west side
Basin 70 southwest corner, 3820 Old Ranch Rd.
Area 16, 66 & 67, south entrance driveway, garden and 3890 Old Ranch Road

With these drainage strategies the net off site flows have been reduced by 0.97 and 1.47 acre feet for the 10 and 100 year storm events.

Storm Runoff - Pre-Development				10 Yr Storm		100 Yr Storm	
				Rate of Run-off	Volume of Run-off	Rate of Run-off	Volume of Run-off
Run Free	Basin	Composite Area (ac)	Composite Coeff RO	Q cfs 10yr	Volume cf 10 yr	Q cfs 100 yr	Volume cf 100yr
Pre Development	South	3.956	0.23	2.303	20,178	3.461	30315
	Middle	9.221	0.21	3.036	24,226	4.545	36,265
	North	6.806	0.23	1.496	11,128	2.233	16,613
			Total Pre-Dev RO	**3.21**	**55,532**	**10.239**	**83,193**
			Acre Feet		**1.27**		**1.91**
Storm Runoff - Post Development							
Free Flowing off-site	Basin 72			0.86	4,458	1.27	6,563
Free Flowing off-site	Basin 70			0.86	4,907	1.27	7,251
Free Flowing off-site	#20+#21			0.93	668	1.28	920
Free Flowing off-site	Basin 92			0.818	3044	1.19	4426
			Total Post-Dev RO	**3.468**	**13,077**	**5.01**	**19,160**
			Reduction of :	**-0.258**	**42,455**	**5.229**	**64,033**
				cfs	**cf**	**cfs**	**cf**
			Reduction of :		**0.97**		**1.47**
					acre-feet		**acre-feet**

PONDED BASINS

The bulk of the property has been broken into (20) mini-basins with infiltration ponds dedicated to the runoff in that basin. Ponds are placed where they can collect surface flows without channels as often as possible. Grassed Swales are employed when needed to convey waters.

The ponds are sized based on two parameters : the total volume required to collect storm waters, and the required infiltrative area to 'perc' storm waters into the ground within 40 hours. The width on a horizontal plane at the bottom of the pond was generally used as the 'infiltrative surface area'. The ponds will be maintained as they will also serves other productive purposes such as cash crops, walking paths, wildlife habitat, replanted vegetation and historic vegetation.

A copy of the Percolation Tests performed by Entech Engineering is in the Appendix.

The infiltration ponds are rectangular, oval and triangular and possible organic shapes, generally with 3:1 side slopes. Drawings attached show their design.

The pond sizes in this report may vary as the infiltration rate may differ, and pond shape may change as development proceeds, hence we will work with the owner during construction and offer final design afterward. Pond sizes will be larger than the L1 & L2 specified in this report as a 6" high freeboard is required on all ponds and channels. Owner may ask to use 2:1 side slopes with vegetation or riprap.

The next page describes the format of results of the hydrologic analysis and the results.

Following that are individual basin calculations and solutions, beginning with the pre-development hydrology and the basin that will be allowed to flow freely off site. The Appendix includes Percolation Tests and Pond concepts.

The pond sizes shown on subsequent pages are based on full water surface dimensions. A page showing constructed sizes is included at the end of this file and on drawing sheet DR-2. These dimensions include a 6" free board.

Also attached is the spreadsheet of the many surface areas used in the analysis.

The following is the Pre-Develoment Hydrology

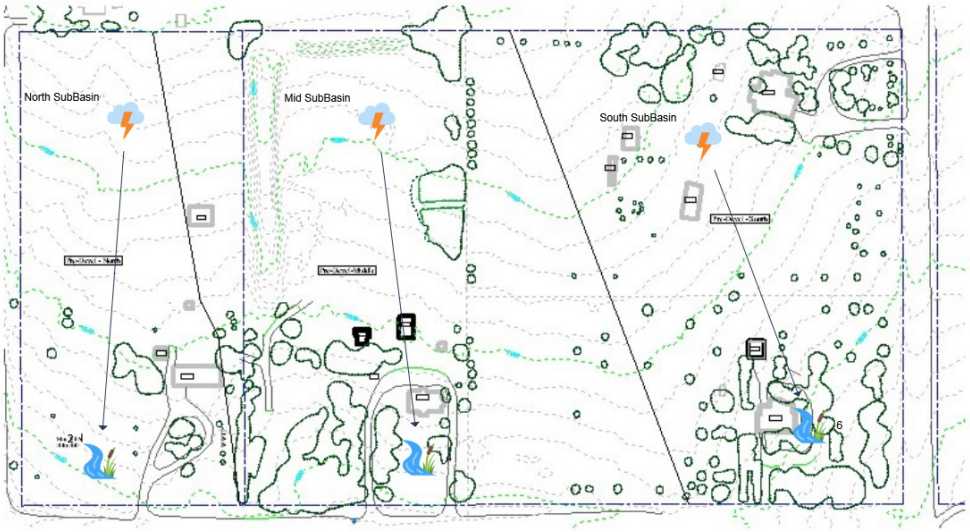
Basin Model

Hydrology Studio v 3.0.0.26

Project Name: Shire on ORR - Pre-Devel

03-29-2023

PRE DEVELOPMENT RUN OFF



Hydrograph by Return Period

Project Name: Shire on ORR - Pre-Devel

03-29-2023

Hydrology Studio v 3.0.0.26

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Outflow (cfs)							
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
1	Rational	North SubBasin					1.496			2.233
2	Reach						0.000			0.000
3	Rational	Mid SubBasin					3.036			4.545
4	Reach						0.000			0.000
5	Rational	South SubBasin					2.303			3.461
6	Reach						0.000			0.000

Hydrograph 10-yr Summary

Project Name: Shire on ORR - Pre-Devel

03-29-2023

Hydrology Studio v 3.0.0.26

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	Rational	North SubBasin	1.496	2.07	11,128	----		
2	Reach		0.000	0.00	0.000	1		
3	Rational	Mid SubBasin	3.036	2.22	24,226	----		
4	Reach		0.000	0.00	0.000	3		
5	Rational	South SubBasin	2.303	2.43	20,178	----		
6	Reach		0.000	0.00	0.000	5		

Hydrograph Report

Project Name: Shire on ORR - Pre-Devel

Hydrology Studio v 3.0.0.26

03-29-2023

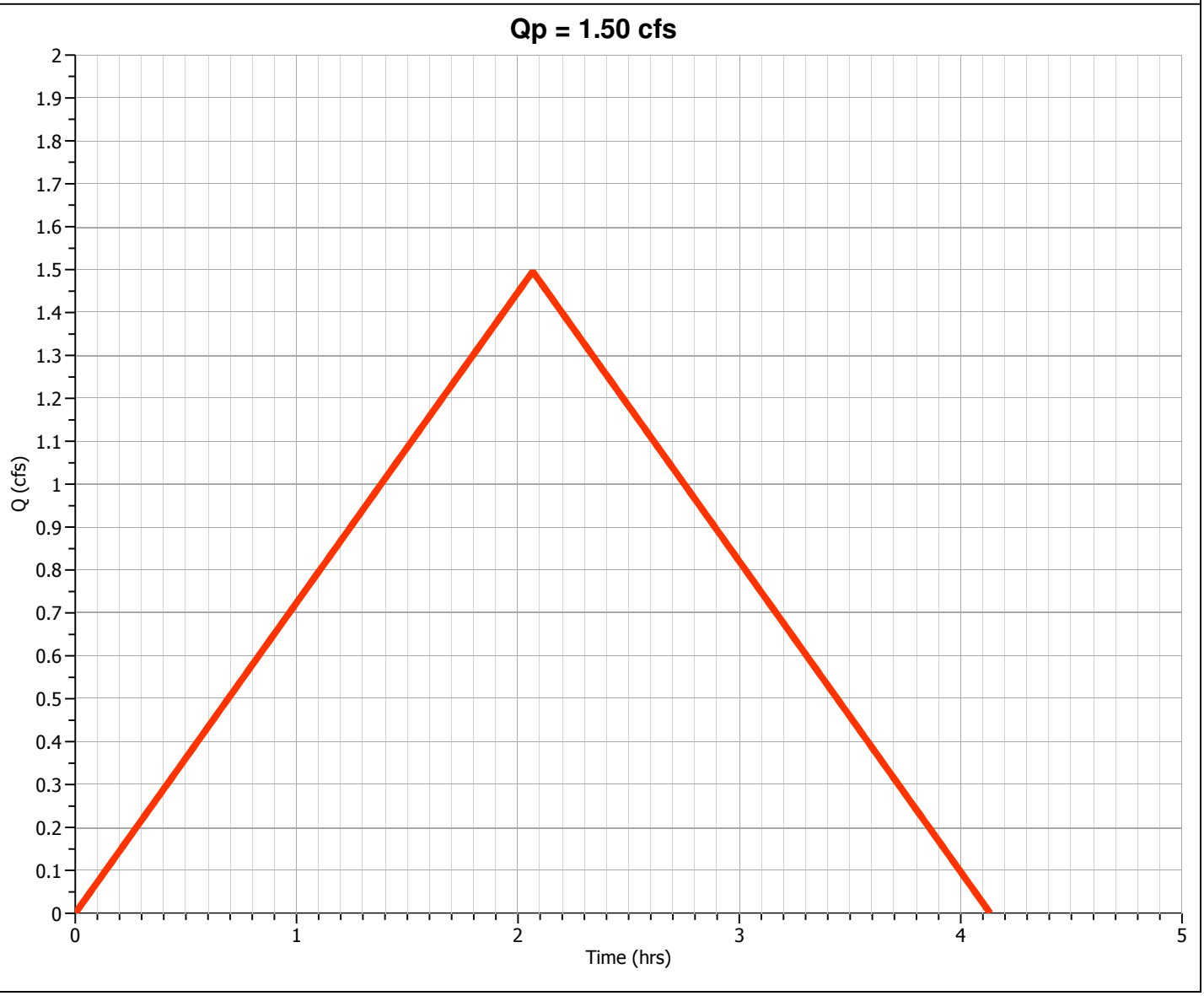
North SubBasin

Hyd. No. 1

Hydrograph Type	= Rational	Peak Flow	= 1.496 cfs
Storm Frequency	= 10-yr	Time to Peak	= 2.07 hrs
Time Interval	= 1 min	Runoff Volume	= 11,128 cuft
Drainage Area	= 3.956 ac	Runoff Coeff.	= 0.23*
Tc Method	= User	Time of Conc. (Tc)	= 124.0 min
IDF Curve	= Colorado Springs.idf	Intensity	= 1.64 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.041	0.95	Roof
0.122	0.85	Road
3.793	0.20	Land
3.956	**0.23**	



Hydrograph Report

Project Name: Shire on ORR - Pre-Devel

Hydrology Studio v 3.0.0.26

03-29-2023

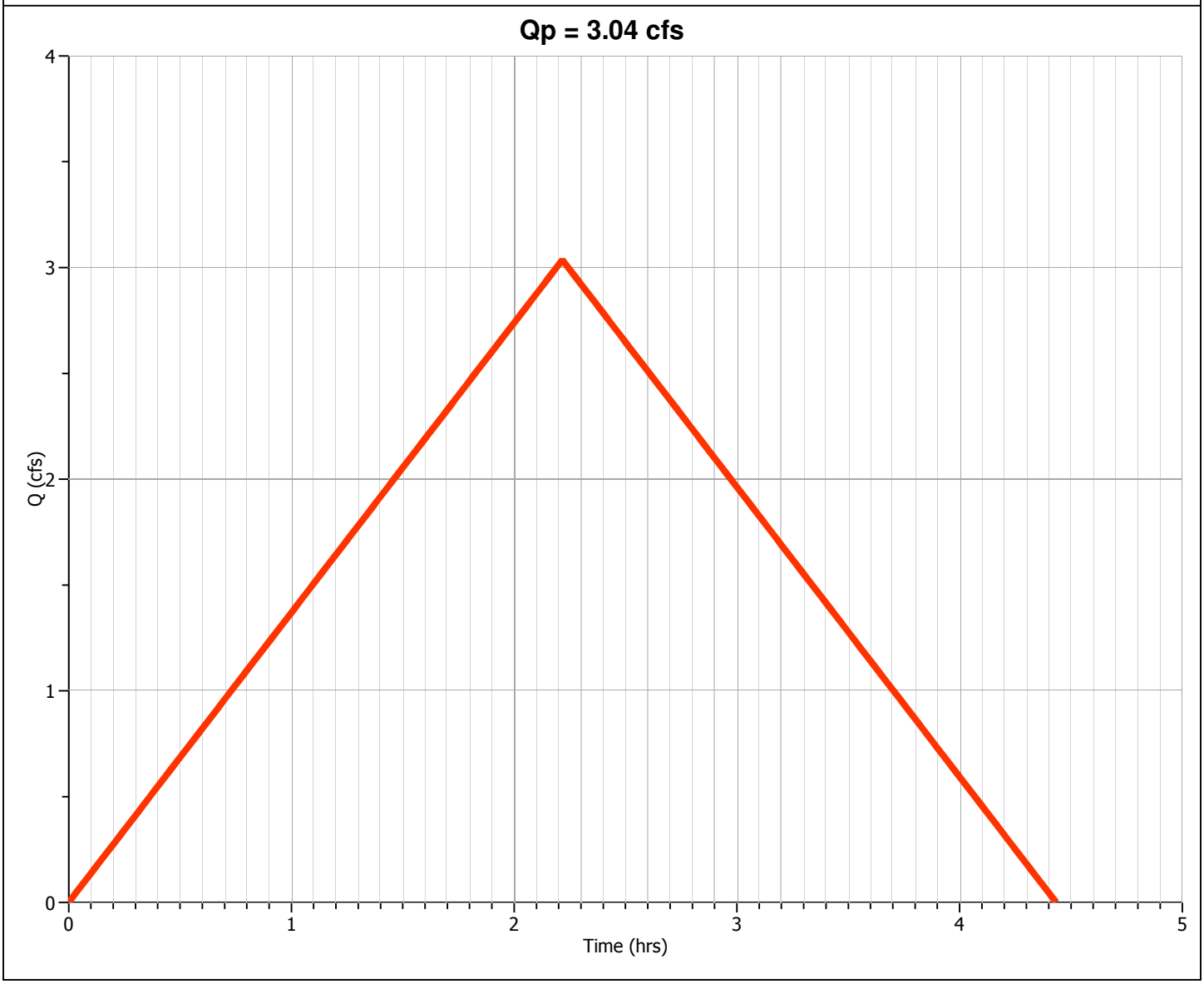
Mid SubBasin

Hyd. No. 3

Hydrograph Type	= Rational	Peak Flow	= 3.036 cfs
Storm Frequency	= 10-yr	Time to Peak	= 2.22 hrs
Time Interval	= 1 min	Runoff Volume	= 24,226 cuft
Drainage Area	= 9.221 ac	Runoff Coeff.	= 0.21*
Tc Method	= User	Time of Conc. (Tc)	= 133.0 min
IDF Curve	= Colorado Springs.idf	Intensity	= 1.57 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.052	0.95	Roof
0.144	0.85	Road
9.025	0.20	Land
9.221	**0.21**	



Hydrograph Report

Project Name: Shire on ORR - Pre-Devel

Hydrology Studio v 3.0.0.26

03-29-2023

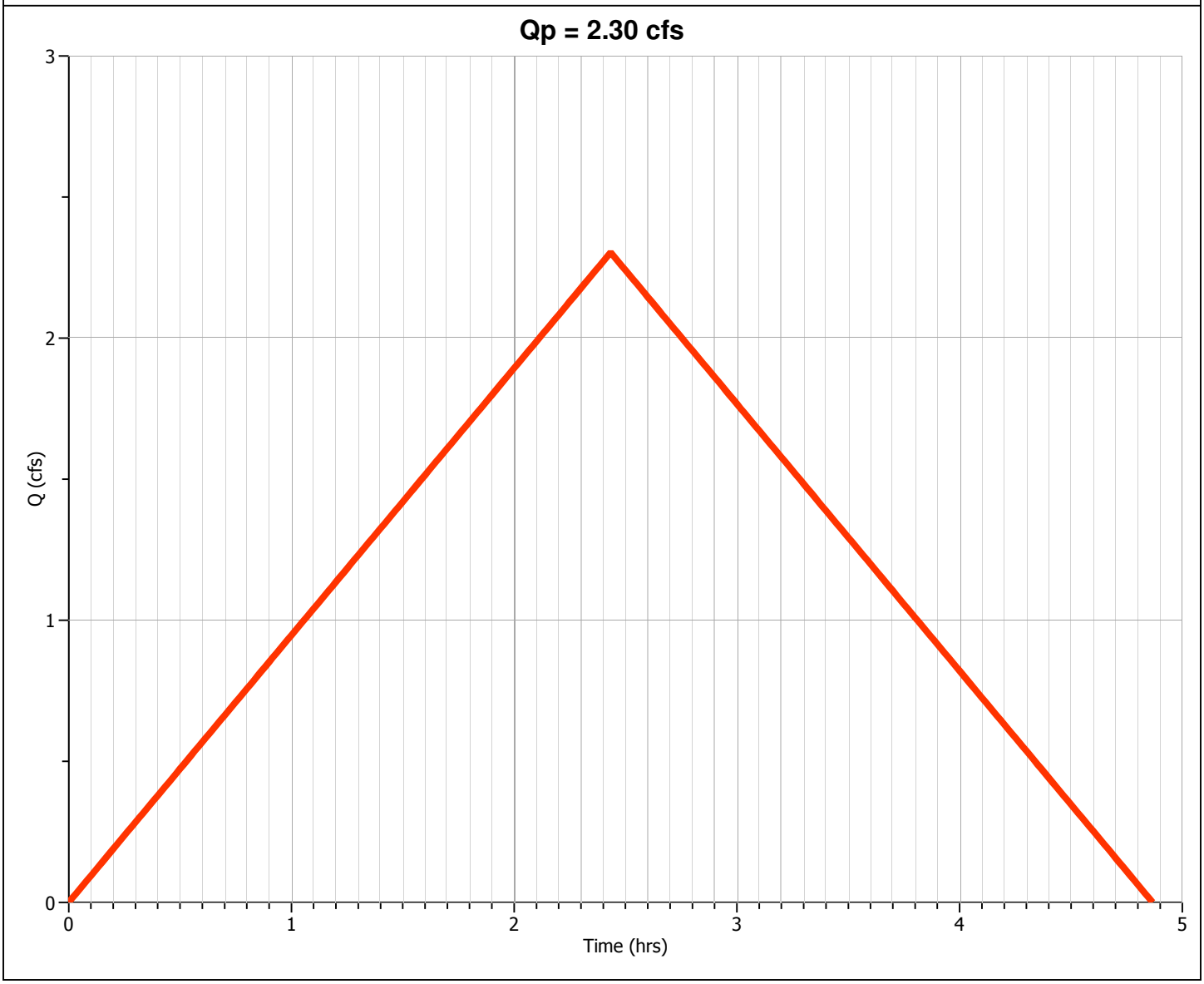
South SubBasin

Hyd. No. 5

Hydrograph Type	= Rational	Peak Flow	= 2.303 cfs
Storm Frequency	= 10-yr	Time to Peak	= 2.43 hrs
Time Interval	= 1 min	Runoff Volume	= 20,178 cuft
Drainage Area	= 6.806 ac	Runoff Coeff.	= 0.23*
Tc Method	= User	Time of Conc. (Tc)	= 146.0 min
IDF Curve	= Colorado Springs.idf	Intensity	= 1.47 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.129	0.95	Roof
0.133	0.85	Road
6.544	0.20	Land
6.806	**0.23**	



Design Storm Report

Custom Storm filename: COS Rainfall SCS Type IIA-SH.cds

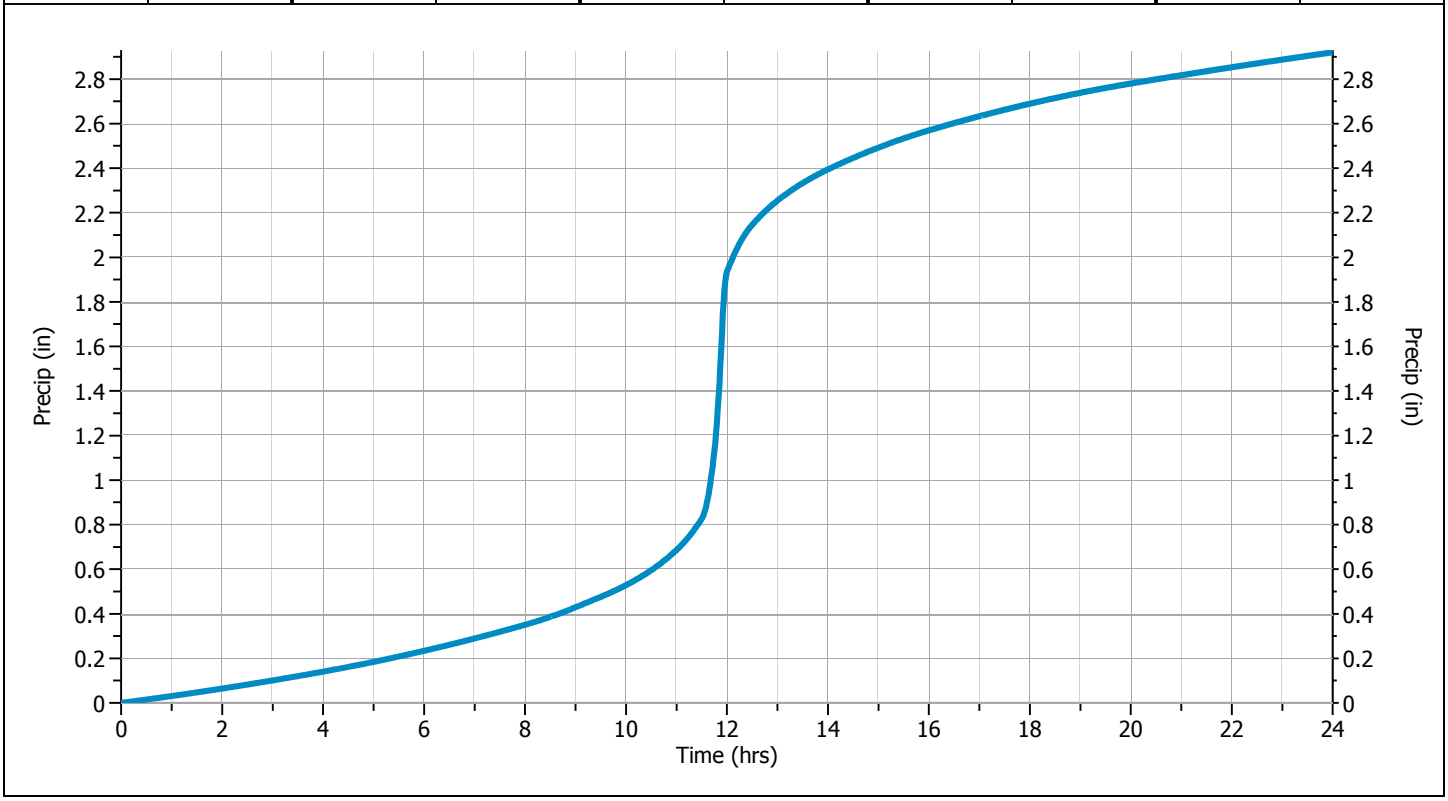
Hydrology Studio v 3.0.0.26

03-29-2023

Storm Distribution: NRCS/SCS - Type II, 24-hr

Storm Duration	Total Rainfall Volume (in)								
	1-yr	2-yr	3-yr	5-yr	✓ 10-yr	25-yr	50-yr	100-yr	
24 hrs	1.62	1.89	0.00	2.41	2.92	3.72	4.43	5.21	

Incremental Rainfall Distribution, 10-yr									
Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)
11.42	0.005412	11.60	0.016404	11.78	0.042662	11.97	0.040178	12.15	0.008210
11.43	0.005490	11.62	0.018325	11.80	0.048005	11.98	0.028020	12.17	0.008025
11.45	0.005567	11.63	0.020245	11.82	0.053347	12.00	0.015861	12.18	0.007840
11.47	0.005645	11.65	0.022166	11.83	0.058690	12.02	0.010016	12.20	0.007655
11.48	0.005723	11.67	0.024087	11.85	0.064032	12.03	0.009505	12.22	0.007470
11.50	0.005801	11.68	0.026008	11.87	0.069375	12.05	0.009320	12.23	0.007285
11.52	0.006822	11.70	0.027928	11.88	0.074717	12.07	0.009135	12.25	0.007101
11.53	0.008721	11.72	0.029849	11.90	0.080060	12.08	0.008950	12.27	0.006916
11.55	0.010642	11.73	0.031770	**11.92**	**0.085402**	12.10	0.008765	12.28	0.006731
11.57	0.012563	11.75	0.033690	11.93	0.055846	12.12	0.008580	12.30	0.006546
11.58	0.014483	11.77	0.037037	11.95	0.052337	12.13	0.008395	12.32	0.006361



Hydrograph 100-yr Summary

Project Name: Shire on ORR - Pre-Devel

03-29-2023

Hydrology Studio v 3.0.0.26

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	Rational	North SubBasin	2.233	2.07	16,613	----		
2	Reach		0.000	0.00	0.000	1		
3	Rational	Mid SubBasin	4.545	2.22	36,265	----		
4	Reach		0.000	0.00	0.000	3		
5	Rational	South SubBasin	3.461	2.43	30,315	----		
6	Reach		0.000	0.00	0.000	5		

Hydrograph Report

Project Name: Shire on ORR - Pre-Devel

Hydrology Studio v 3.0.0.26

03-29-2023

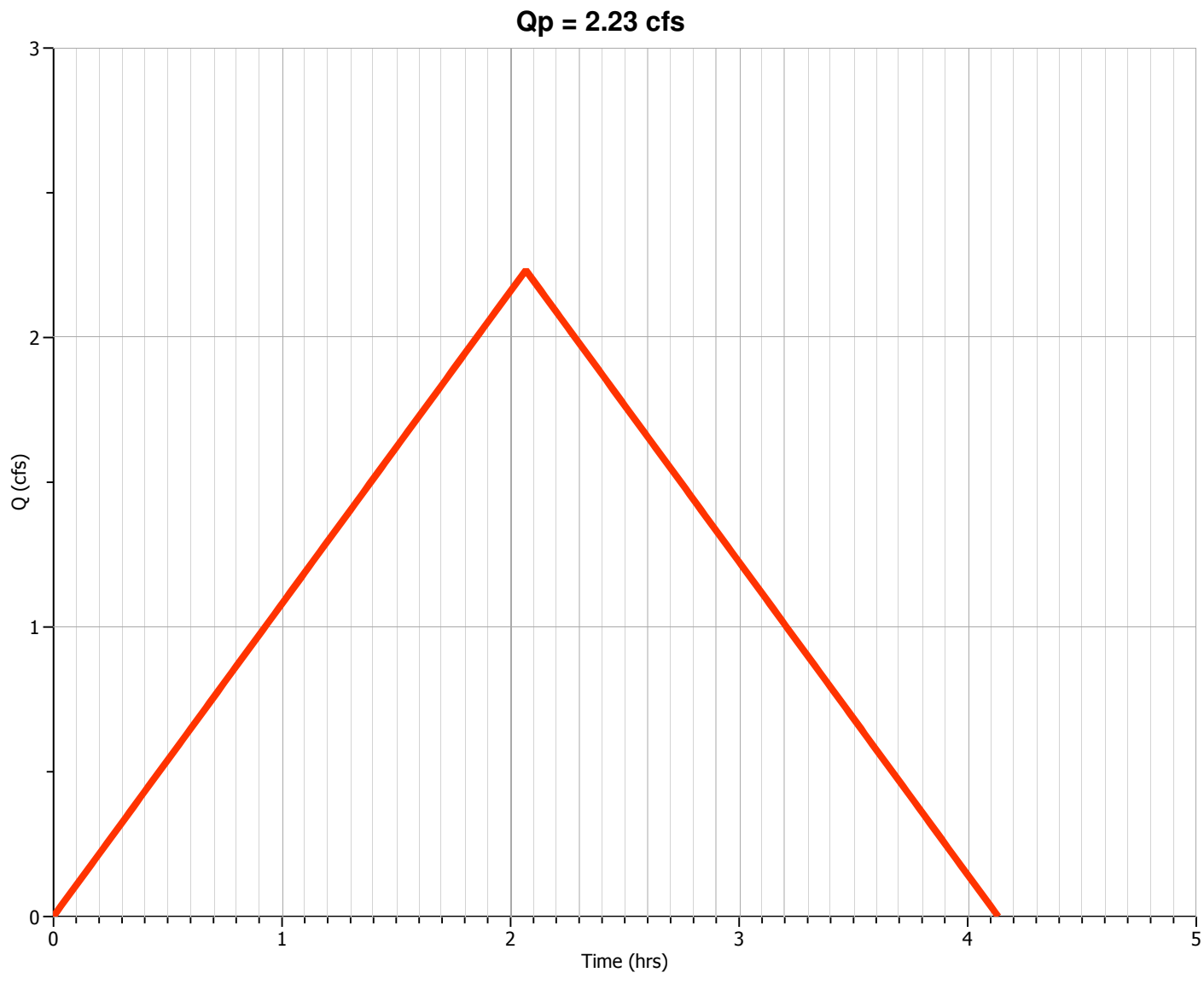
North SubBasin

Hyd. No. 1

Hydrograph Type	= Rational	Peak Flow	= 2.233 cfs
Storm Frequency	= 100-yr	Time to Peak	= 2.07 hrs
Time Interval	= 1 min	Runoff Volume	= 16,613 cuft
Drainage Area	= 3.956 ac	Runoff Coeff.	= 0.23*
Tc Method	= User	Time of Conc. (Tc)	= 124.0 min
IDF Curve	= Colorado Springs.idf	Intensity	= 2.45 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.041	0.95	Roof
0.122	0.85	Road
3.793	0.20	Land
3.956	**0.23**	



Hydrograph Report

Project Name: Shire on ORR - Pre-Devel

Hydrology Studio v 3.0.0.26

03-29-2023

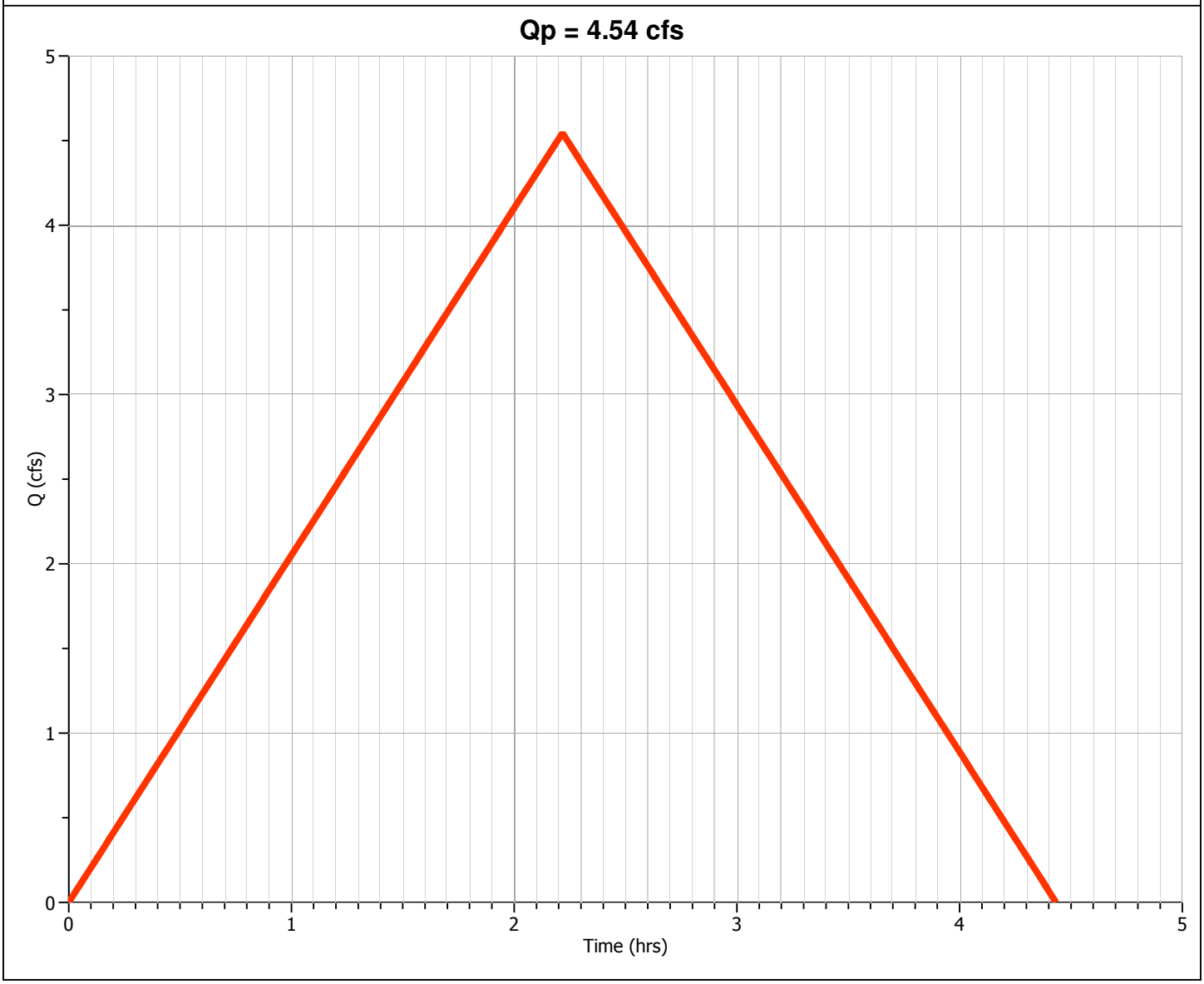
Mid SubBasin

Hyd. No. 3

Hydrograph Type	= Rational	Peak Flow	= 4.545 cfs
Storm Frequency	= 100-yr	Time to Peak	= 2.22 hrs
Time Interval	= 1 min	Runoff Volume	= 36,265 cuft
Drainage Area	= 9.221 ac	Runoff Coeff.	= 0.21*
Tc Method	= User	Time of Conc. (Tc)	= 133.0 min
IDF Curve	= Colorado Springs.idf	Intensity	= 2.35 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.052	0.95	Roof
0.144	0.85	Road
9.025	0.20	Land
9.221	**0.21**	



Hydrograph Report

Project Name: Shire on ORR - Pre-Devel

Hydrology Studio v 3.0.0.26

03-29-2023

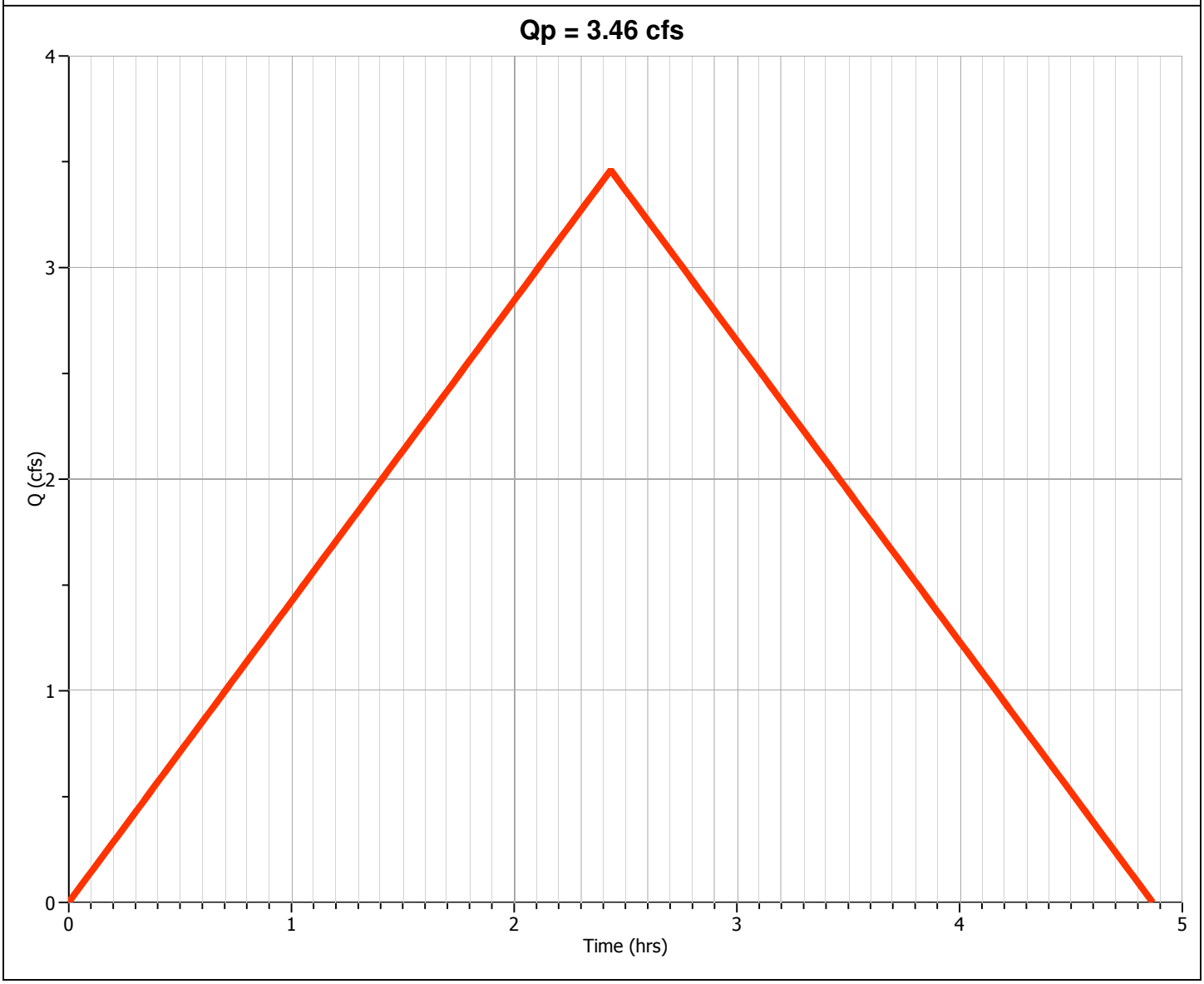
South SubBasin

Hyd. No. 5

Hydrograph Type	= Rational	Peak Flow	= 3.461 cfs
Storm Frequency	= 100-yr	Time to Peak	= 2.43 hrs
Time Interval	= 1 min	Runoff Volume	= 30,315 cuft
Drainage Area	= 6.806 ac	Runoff Coeff.	= 0.23*
Tc Method	= User	Time of Conc. (Tc)	= 146.0 min
IDF Curve	= Colorado Springs.idf	Intensity	= 2.21 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.129	0.95	Roof
0.133	0.85	Road
6.544	0.20	Land
6.806	**0.23**	



Design Storm Report

Custom Storm filename: COS Rainfall SCS Type IIA-SH.cds

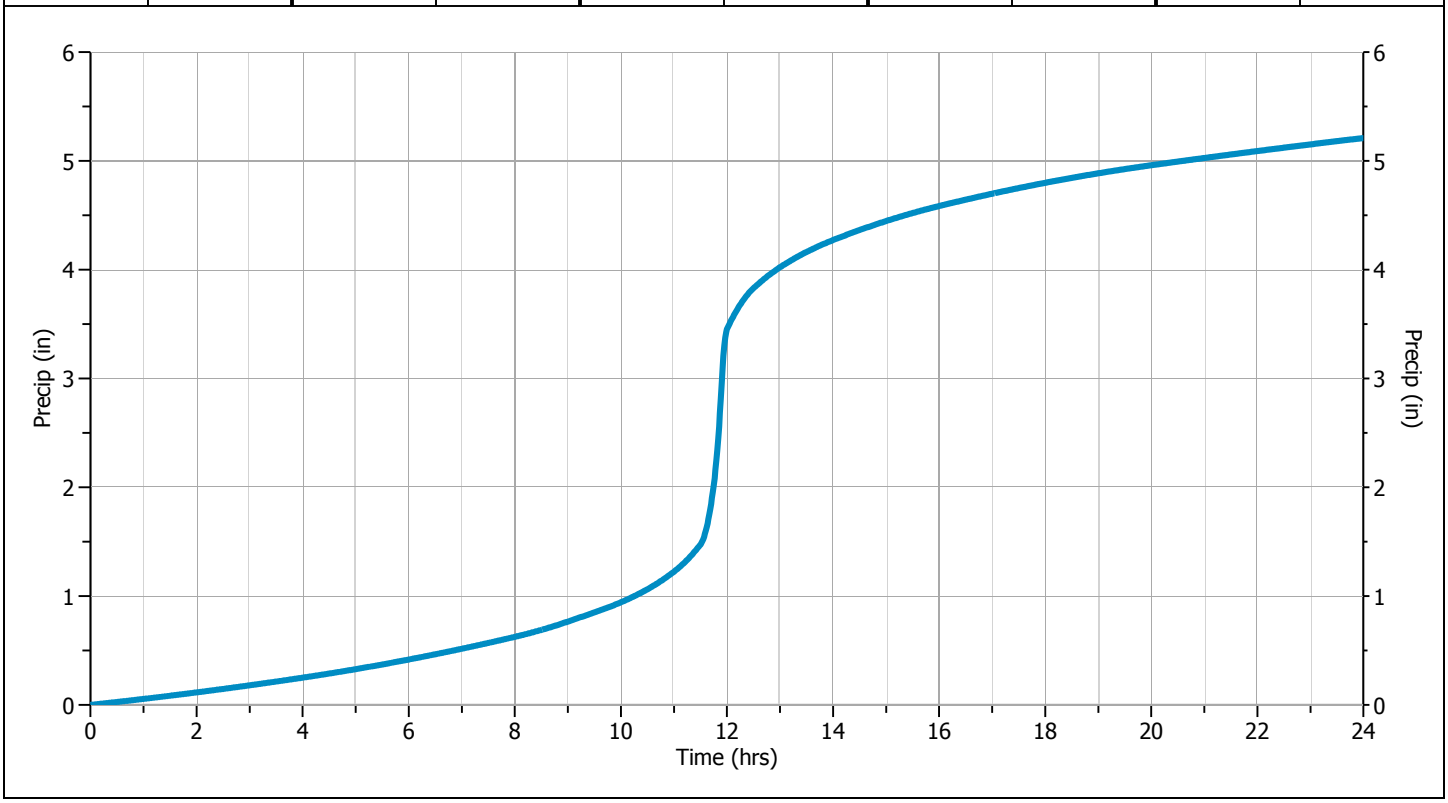
Hydrology Studio v 3.0.0.26

03-29-2023

Storm Distribution: NRCS/SCS - Type II, 24-hr

Storm Duration	Total Rainfall Volume (in)								
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	✓ 100-yr	
24 hrs	1.62	1.89	0.00	2.41	2.92	3.72	4.43	5.21	

Incremental Rainfall Distribution, 100-yr									
Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)
11.42	0.009656	11.60	0.029269	11.78	0.076120	11.97	0.071688	12.15	0.014649
11.43	0.009795	11.62	0.032696	11.80	0.085652	11.98	0.049994	12.17	0.014319
11.45	0.009934	11.63	0.036123	11.82	0.095185	12.00	0.028300	12.18	0.013989
11.47	0.010073	11.65	0.039550	11.83	0.104717	12.02	0.017872	12.20	0.013659
11.48	0.010212	11.67	0.042977	11.85	0.114250	12.03	0.016959	12.22	0.013329
11.50	0.010351	11.68	0.046404	11.87	0.123782	12.05	0.016629	12.23	0.012999
11.52	0.012173	11.70	0.049831	11.88	0.133314	12.07	0.016299	12.25	0.012669
11.53	0.015561	11.72	0.053258	11.90	0.142847	12.08	0.015969	12.27	0.012339
11.55	0.018988	11.73	0.056685	**11.92**	**0.152379**	12.10	0.015639	12.28	0.012009
11.57	0.022415	11.75	0.060112	11.93	0.099643	12.12	0.015309	12.30	0.011679
11.58	0.025842	11.77	0.066084	11.95	0.093382	12.13	0.014979	12.32	0.011349



IDF Report

IDF filename: Colorado Springs.idf

Hydrology Studio v 3.0.0.26

03-29-2023

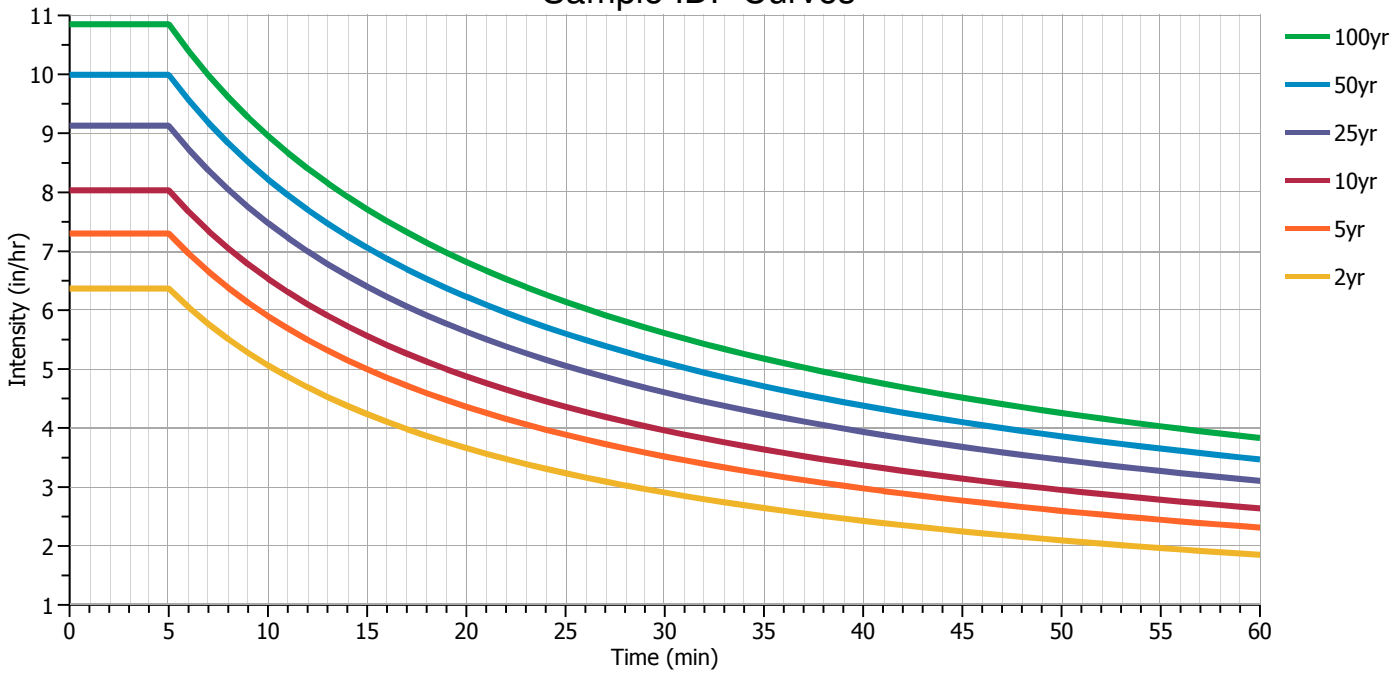
Equation Coefficients	Intensity = B / (Tc + D)^E (in/hr)								
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
B	0.0000	58.1215	0.0000	57.1446	58.8780	63.5498	67.7965	72.2003	
D	0.0000	10.3000	0.0000	10.3000	10.3000	10.4000	10.5000	10.6000	
E	0.0000	0.8106	0.0000	0.7542	0.7303	0.7097	0.6986	0.6898	

Minimum Tc = 5 minutes

Tc (min)	Intensity Values (in/hr)								
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
Cf	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
5	0	6.37	0	7.30	8.03	9.13	9.99	10.85	
10	0	5.06	0	5.90	6.53	7.48	8.22	8.96	
15	0	4.24	0	5.00	5.56	6.40	7.06	7.71	
20	0	3.66	0	4.36	4.88	5.63	6.23	6.82	
25	0	3.23	0	3.89	4.36	5.06	5.60	6.14	
30	0	2.90	0	3.52	3.96	4.60	5.11	5.61	
35	0	2.64	0	3.22	3.64	4.24	4.71	5.18	
40	0	2.43	0	2.98	3.37	3.94	4.38	4.82	
45	0	2.25	0	2.77	3.14	3.68	4.10	4.52	
50	0	2.10	0	2.60	2.95	3.46	3.86	4.26	
55	0	1.96	0	2.44	2.78	3.27	3.65	4.03	
60	0	1.85	0	2.31	2.64	3.10	3.47	3.83	

Cf = Correction Factor applied to Rational Method runoff coefficient.

Sample IDF Curves



Precipitation Report

Precipitation filename: ColoradoSpringsCO.pcp

Hydrology Studio v 3.0.0.26 (Rainfall totals in Inches)

03-29-2023

	Active	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Active						✓			✓
SCS Storms	**> SCS Dimensionless Storms**								
SCS 6hr		1.25	1.41	0	1.77	2.15	2.79	3.38	4.05
Type I, 24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
Type IA, 24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
Type II, 24-hr	✓	1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
Type II FL, 24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
Type III, 24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
Synthetic Storms	**> IDF-Based Synthetic Storms**								
1-hr		0	1.85	0	2.31	2.64	3.10	3.47	3.83
2-hr		0	2.24	0	2.90	3.36	4.01	4.51	5.01
3-hr		0	2.48	0	3.27	3.82	4.60	5.20	5.79
6-hr		0	2.89	0	3.96	4.70	5.73	6.53	7.32
12-hr		0	3.33	0	4.75	5.73	7.08	8.13	9.17
24-hr		0	3.82	0	5.66	6.94	8.70	10.07	11.42
Huff Distribution	**> 1st Quartile (0 to 6 hrs)**								
1-hr		0.79	0.93	0	1.20	1.45	1.83	2.16	2.53
2-hr		0.97	1.13	0	1.44	1.74	2.23	2.65	3.12
3-hr		1.07	1.23	0	1.55	1.88	2.42	2.91	3.46
6-hr		1.25	1.41	0	1.77	2.15	2.79	3.38	4.05
Huff Distribution	**> 2nd Quartile (>6 to 12 hrs)**								
8-hr		0	0	0	0	0	0	0	0
12-hr		1.42	1.64	0	2.07	2.51	3.24	3.90	4.64
Huff Distribution	**> 3rd Quartile (>12 to 24 hrs)**								
18-hr		0	0	0	0	0	0	0	0
24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
Custom Storms	**> Custom Storm Distributions**								
Colorado Springs		0	0	0	0	0	0	0	0
My Custom Storm 2		0	0	0	0	0	0	0	0
My Custom Storm 3		0	0	0	0	0	0	0	0
My Custom Storm 4		0	0	0	0	0	0	0	0
My Custom Storm 5		0	0	0	0	0	0	0	0
My Custom Storm 6		0	0	0	0	0	0	0	0
My Custom Storm 7		0	0	0	0	0	0	0	0
My Custom Storm 8		0	0	0	0	0	0	0	0
My Custom Storm 9		0	0	0	0	0	0	0	0
My Custom Storm 10		0	0	0	0	0	0	0	0

Hydrograph by Return Period

Project Name:

03-27-2023

Hydrology Studio v 3.0.0.26

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Outflow (cfs)							
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
1	Rational	Pre Pre					0.691			1.017
2	Rational	Post					0.377			0.555
3	Pond Route	Post #72 Runs Free					0.000			0.000

Hydrograph 10-yr Summary

Project Name:

Hydrology Studio v 3.0.0.26

03-27-2023

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	Rational	Pre Pre	0.691	1.43	3,567	----		
2	Rational	Post	0.377	1.43	1,944	----		
3	Pond Route	Post #72 Runs Free	0.000	0.00	0.000	2	101.58	4,458

Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.26

03-27-2023

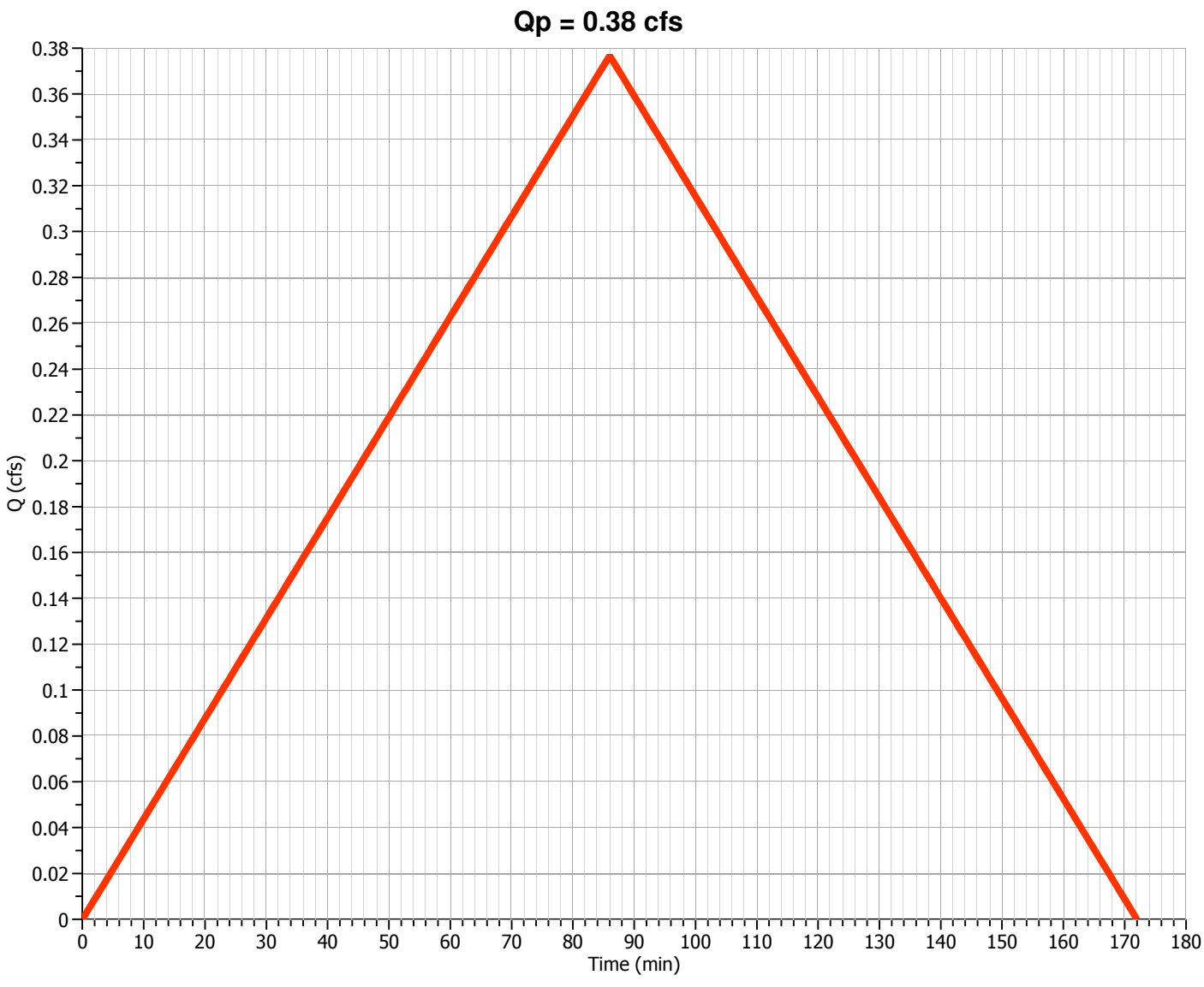
Post

Hyd. No. 2

Hydrograph Type	= Rational	Peak Flow	= 0.377 cfs
Storm Frequency	= 10-yr	Time to Peak	= 1.43 hrs
Time Interval	= 1 min	Runoff Volume	= 1,944 cuft
Drainage Area	= 0.473 ac	Runoff Coeff.	= 0.38*
Tc Method	= User	Time of Conc. (Tc)	= 86.0 min
IDF Curve	= Colorado Springs.idf	Intensity	= 2.10 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.12	0.90	Road-Asphalt
0.353	0.20	Land-Undevel
0.473	**0.38**	



Hydrograph 100-yr Summary

Project Name:

03-27-2023

Hydrology Studio v 3.0.0.26

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	Rational	Pre Pre	1.017	1.43	5,250	----		
2	Rational	Post	0.555	1.43	2,861	----		
3	Pond Route	Post #72 Runs Free	0.000	0.00	0.000	2	102.08	6,563

Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.26

03-27-2023

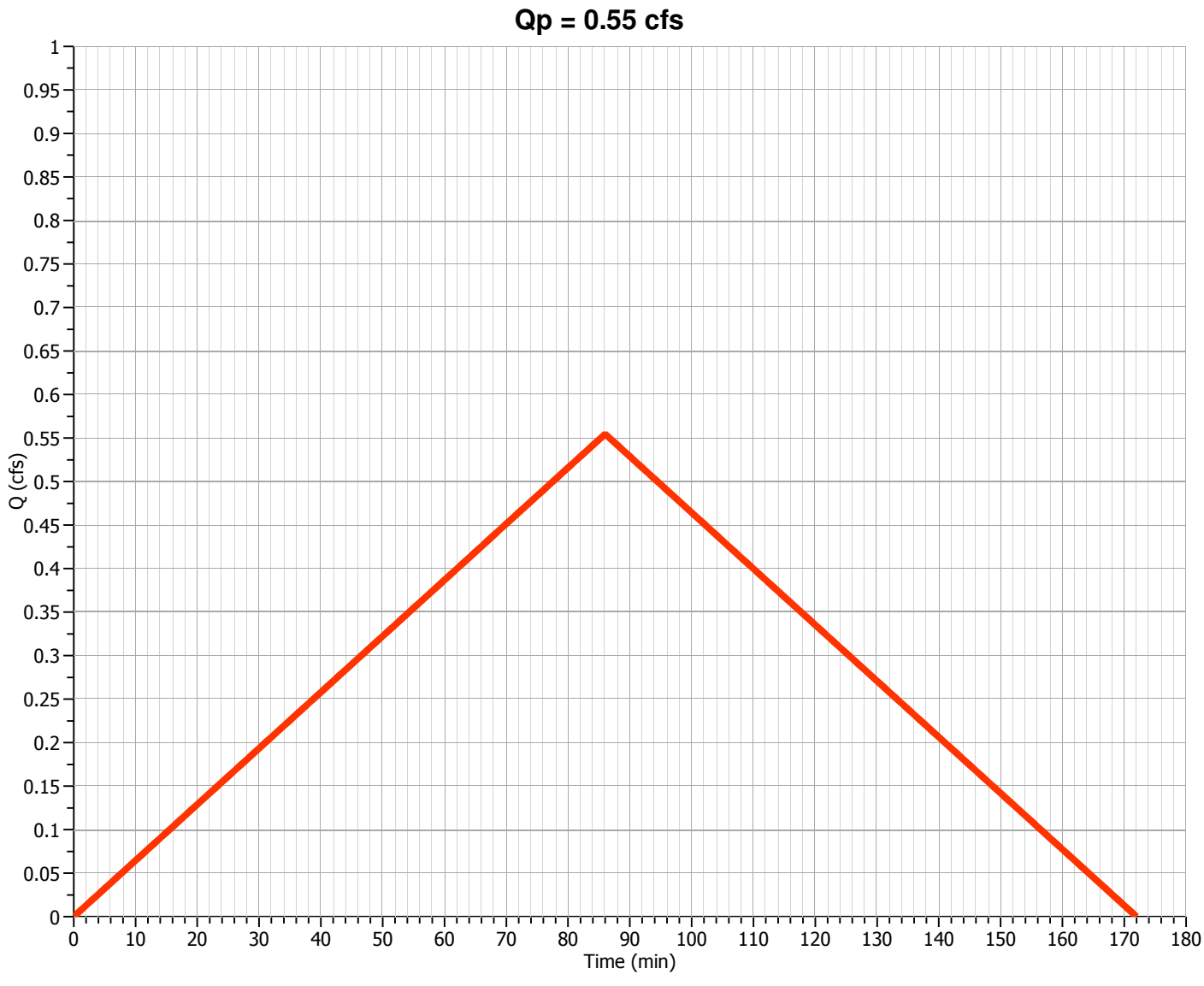
Post

Hyd. No. 2

Hydrograph Type	= Rational	Peak Flow	= 0.555 cfs
Storm Frequency	= 100-yr	Time to Peak	= 1.43 hrs
Time Interval	= 1 min	Runoff Volume	= 2,861 cuft
Drainage Area	= 0.473 ac	Runoff Coeff.	= 0.38*
Tc Method	= User	Time of Conc. (Tc)	= 86.0 min
IDF Curve	= Colorado Springs.idf	Intensity	= 3.09 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.12	0.90	Road-Asphalt
0.353	0.20	Land-Undevel
0.473	**0.38**	



IDF Report

IDF filename: Colorado Springs.idf

Hydrology Studio v 3.0.0.26

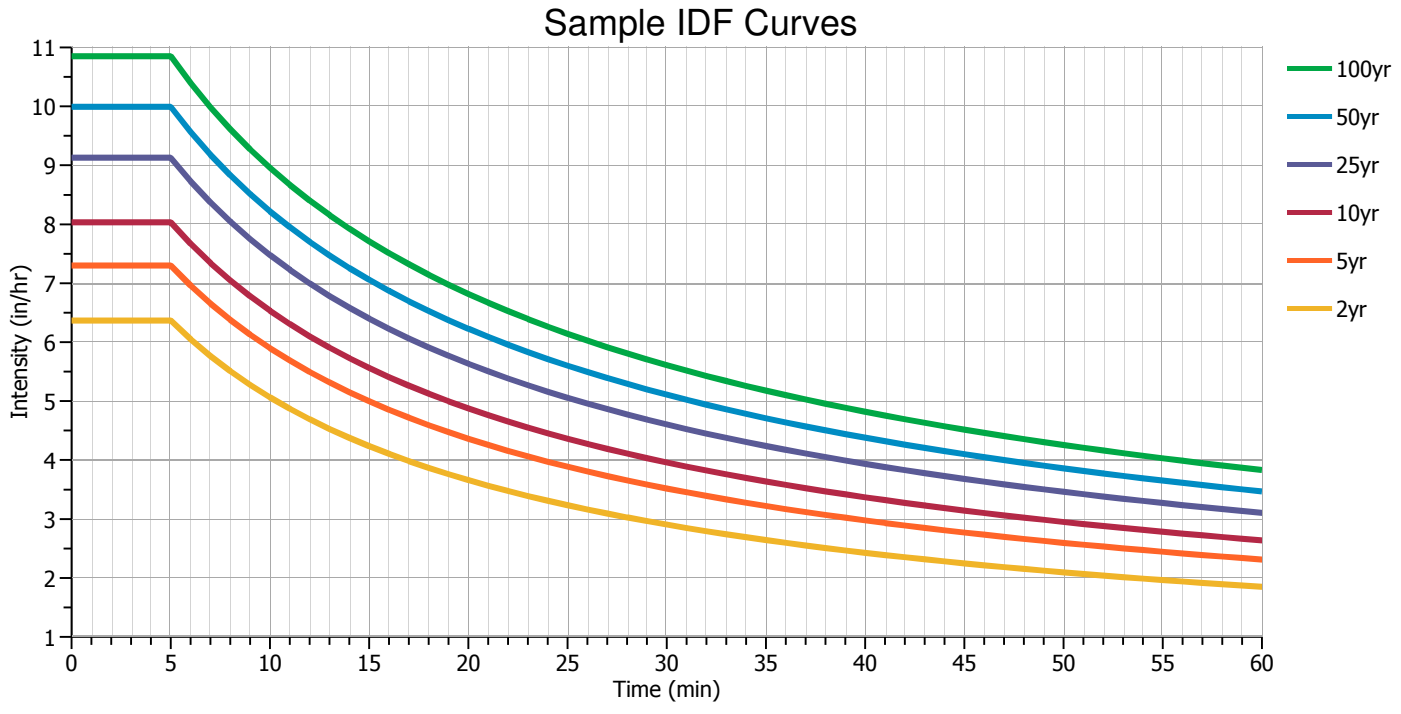
03-27-2023

Equation Coefficients	Intensity = B / (Tc + D)^E (in/hr)								
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
B	0.0000	58.1215	0.0000	57.1446	58.8780	63.5498	67.7965	72.2003	
D	0.0000	10.3000	0.0000	10.3000	10.3000	10.4000	10.5000	10.6000	
E	0.0000	0.8106	0.0000	0.7542	0.7303	0.7097	0.6986	0.6898	

Minimum Tc = 5 minutes

Tc (min)	Intensity Values (in/hr)								
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
Cf	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
5	0	6.37	0	7.30	8.03	9.13	9.99	10.85	
10	0	5.06	0	5.90	6.53	7.48	8.22	8.96	
15	0	4.24	0	5.00	5.56	6.40	7.06	7.71	
20	0	3.66	0	4.36	4.88	5.63	6.23	6.82	
25	0	3.23	0	3.89	4.36	5.06	5.60	6.14	
30	0	2.90	0	3.52	3.96	4.60	5.11	5.61	
35	0	2.64	0	3.22	3.64	4.24	4.71	5.18	
40	0	2.43	0	2.98	3.37	3.94	4.38	4.82	
45	0	2.25	0	2.77	3.14	3.68	4.10	4.52	
50	0	2.10	0	2.60	2.95	3.46	3.86	4.26	
55	0	1.96	0	2.44	2.78	3.27	3.65	4.03	
60	0	1.85	0	2.31	2.64	3.10	3.47	3.83	

Cf = Correction Factor applied to Rational Method runoff coefficient.



Precipitation Report

Precipitation filename: ColoradoSpringsCO.pcp

Hydrology Studio v 3.0.0.26 (Rainfall totals in Inches)

03-27-2023

	Active	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Active						✓			✓
SCS Storms	**> SCS Dimensionless Storms**								
SCS 6hr		1.25	1.41	0	1.77	2.15	2.79	3.38	4.05
Type I, 24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
Type IA, 24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
Type II, 24-hr	✓	1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
Type II FL, 24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
Type III, 24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
Synthetic Storms	**> IDF-Based Synthetic Storms**								
1-hr		0	1.85	0	2.31	2.64	3.10	3.47	3.83
2-hr		0	2.24	0	2.90	3.36	4.01	4.51	5.01
3-hr		0	2.48	0	3.27	3.82	4.60	5.20	5.79
6-hr		0	2.89	0	3.96	4.70	5.73	6.53	7.32
12-hr		0	3.33	0	4.75	5.73	7.08	8.13	9.17
24-hr		0	3.82	0	5.66	6.94	8.70	10.07	11.42
Huff Distribution	**> 1st Quartile (0 to 6 hrs)**								
1-hr		0.79	0.93	0	1.20	1.45	1.83	2.16	2.53
2-hr		0.97	1.13	0	1.44	1.74	2.23	2.65	3.12
3-hr		1.07	1.23	0	1.55	1.88	2.42	2.91	3.46
6-hr		1.25	1.41	0	1.77	2.15	2.79	3.38	4.05
Huff Distribution	**> 2nd Quartile (>6 to 12 hrs)**								
8-hr		0	0	0	0	0	0	0	0
12-hr		1.42	1.64	0	2.07	2.51	3.24	3.90	4.64
Huff Distribution	**> 3rd Quartile (>12 to 24 hrs)**								
18-hr		0	0	0	0	0	0	0	0
24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
Custom Storms	**> Custom Storm Distributions**								
Colorado Springs		0	0	0	0	0	0	0	0
My Custom Storm 2		0	0	0	0	0	0	0	0
My Custom Storm 3		0	0	0	0	0	0	0	0
My Custom Storm 4		0	0	0	0	0	0	0	0
My Custom Storm 5		0	0	0	0	0	0	0	0
My Custom Storm 6		0	0	0	0	0	0	0	0
My Custom Storm 7		0	0	0	0	0	0	0	0
My Custom Storm 8		0	0	0	0	0	0	0	0
My Custom Storm 9		0	0	0	0	0	0	0	0
My Custom Storm 10		0	0	0	0	0	0	0	0

Precipitation Report Cont'd

Precipitation filename: ColoradoSpringsCO.pcp

Rainfall totals in Inches

03-27-2023

	Active	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Active						✓			✓
Huff Indiana	**> Indianapolis**								
30-min		0.61	0.73	0	0.95	1.15	1.44	1.68	1.93
1-hr		0.79	0.93	0	1.20	1.45	1.83	2.16	2.53
2-hr		0.97	1.13	0	1.44	1.74	2.23	2.65	3.12
3-hr		1.07	1.23	0	1.55	1.88	2.42	2.91	3.46
6-hr		1.25	1.41	0	1.77	2.15	2.79	3.38	4.05
12-hr		1.42	1.64	0	2.07	2.51	3.24	3.90	4.64
24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
Huff Indiana	**> Evansville**								
30-min		0.61	0.73	0	0.95	1.15	1.44	1.68	1.93
1-hr		0.79	0.93	0	1.20	1.45	1.83	2.16	2.53
2-hr		0.97	1.13	0	1.44	1.74	2.23	2.65	3.12
3-hr		1.07	1.23	0	1.55	1.88	2.42	2.91	3.46
6-hr		1.25	1.41	0	1.77	2.15	2.79	3.38	4.05
12-hr		1.42	1.64	0	2.07	2.51	3.24	3.90	4.64
24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
Huff Indiana	**> Fort Wayne**								
30-min		0.61	0.73	0	0.95	1.15	1.44	1.68	1.93
1-hr		0.79	0.93	0	1.20	1.45	1.83	2.16	2.53
2-hr		0.97	1.13	0	1.44	1.74	2.23	2.65	3.12
3-hr		1.07	1.23	0	1.55	1.88	2.42	2.91	3.46
6-hr		1.25	1.41	0	1.77	2.15	2.79	3.38	4.05
12-hr		1.42	1.64	0	2.07	2.51	3.24	3.90	4.64
24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
Huff Indiana	**> South Bend**								
30-min		0.61	0.73	0	0.95	1.15	1.44	1.68	1.93
1-hr		0.79	0.93	0	1.20	1.45	1.83	2.16	2.53
2-hr		0.97	1.13	0	1.44	1.74	2.23	2.65	3.12
3-hr		1.07	1.23	0	1.55	1.88	2.42	2.91	3.46
6-hr		1.25	1.41	0	1.77	2.15	2.79	3.38	4.05
12-hr		1.42	1.64	0	2.07	2.51	3.24	3.90	4.64
24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21

Precipitation Report Cont'd

Precipitation filename: ColoradoSpringsCO.pcp

Rainfall totals in Inches

03-27-2023

	Active	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Active						✓			✓
NRCS Storms	**> NRCS Dimensionless Storms**								
NRCS MSE1, 24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
NRCS MSE2, 24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
NRCS MSE3, 24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
NRCS MSE4, 24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
NRCS MSE5, 24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
NRCS MSE6, 24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
NOAA-A, 24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
NOAA-B, 24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
NOAA-C, 24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
NOAA-D, 24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
NRCC-A, 24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
NRCC-B, 24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
NRCC-C, 24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
NRCC-D, 24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
CA-1, 24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
CA-2, 24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
CA-3, 24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
CA-4, 24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
CA-5, 24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
CA-6, 24-hr		1.62	1.89	0	2.41	2.92	3.72	4.43	5.21
FDOT Storms	**> Florida DOT Storms**								
FDOT, 1-hr		0	0	0	0	0	0	0	0
FDOT, 2-hr		0	0	0	0	0	0	0	0
FDOT, 4-hr		0	0	0	0	0	0	0	0
FDOT, 8-hr		0	0	0	0	0	0	0	0
FDOT, 24-hr		0	0	0	0	0	0	0	0
FDOT, 72-hr		0	0	0	0	0	0	0	0
SFWMD, 72-hr		0	0	0	0	0	0	0	0
Austin Storms	**> Austin Frequency Storms**								
Austin Zone 1, 24-hr		0	0	0	0	0	0	0	0
Austin Zone 2, 24-hr		0	0	0	0	0	0	0	0

Surface #

Mini-Basin Perimeter - Red

Mini-Basin

Basin 87

Basin 86

Basin 89

Basin 95

Basin 94

Basin 93

Basin 58

Basin 88

Rooftops Orange

Basin 85

Sunken Garden - Purple

Basin 72

Existing scrub oak etc

UnDeveloped Land or Agricultural Area - Green

Basin 59

Basin 60

Basin 61

Basin 71

Surfaces

Basin 62

Areas 12, 42, 41,40 drain to Pond 40c via pipe

Basin 91

Driveway 0

Infiltration Pond

Basin 11a

Basin 92

Rooftops - Orange

Basin 70a

Basin 54a

Rooftop

Basin 70

Mini-Basin Number

Howells Road

Old Ranch Road

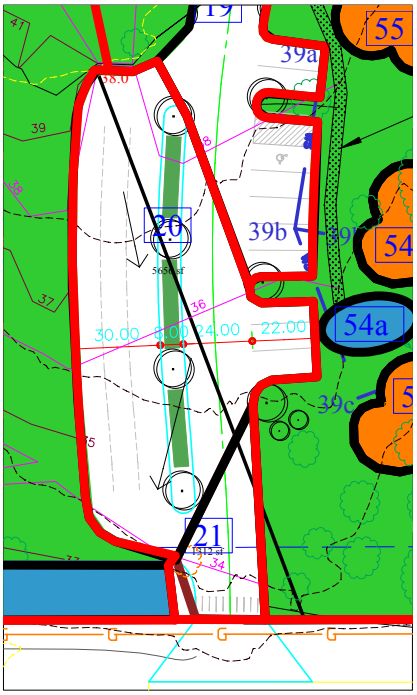
Surface Area Color Coding and Runoff Coefficients

- Agricultural, Garden, Native and Vegetated Areas C=0.2
- Roads and Parking Areas C=0.95 for Concrete, 0.85 for Gravel
- Roof Areas, Exiting ad New C=0.95
- Sunken Gardens, no in or out flow Not contributing to runoff,
- Infiltration Ponds C=1.0
- Sidewalks C=0.95 for concrete, 0.85 for pavers
- Grassed Swales C=0.2

The Shire - Drainage Plan Legend

These Areas are have no Drainage Control

Area 20 + 21



This drainage area is comprised of asphalt roadway. Some of the flow from #20 may be collected into the pond #89. This area will run free.

10 yr Storm		100 yr Storm	
Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)
0.93	**668**	**1.28**	**920**
	120		**165**

Hydrograph 10-yr Summary

Project Name:

02-27-2024

Hydrology Studio v 3.0.0.26

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	Rational	Pre Pre	0.195	0.20	141	----		
2	Rational	Post	0.927	0.20	668	----		

Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.26

02-27-2024

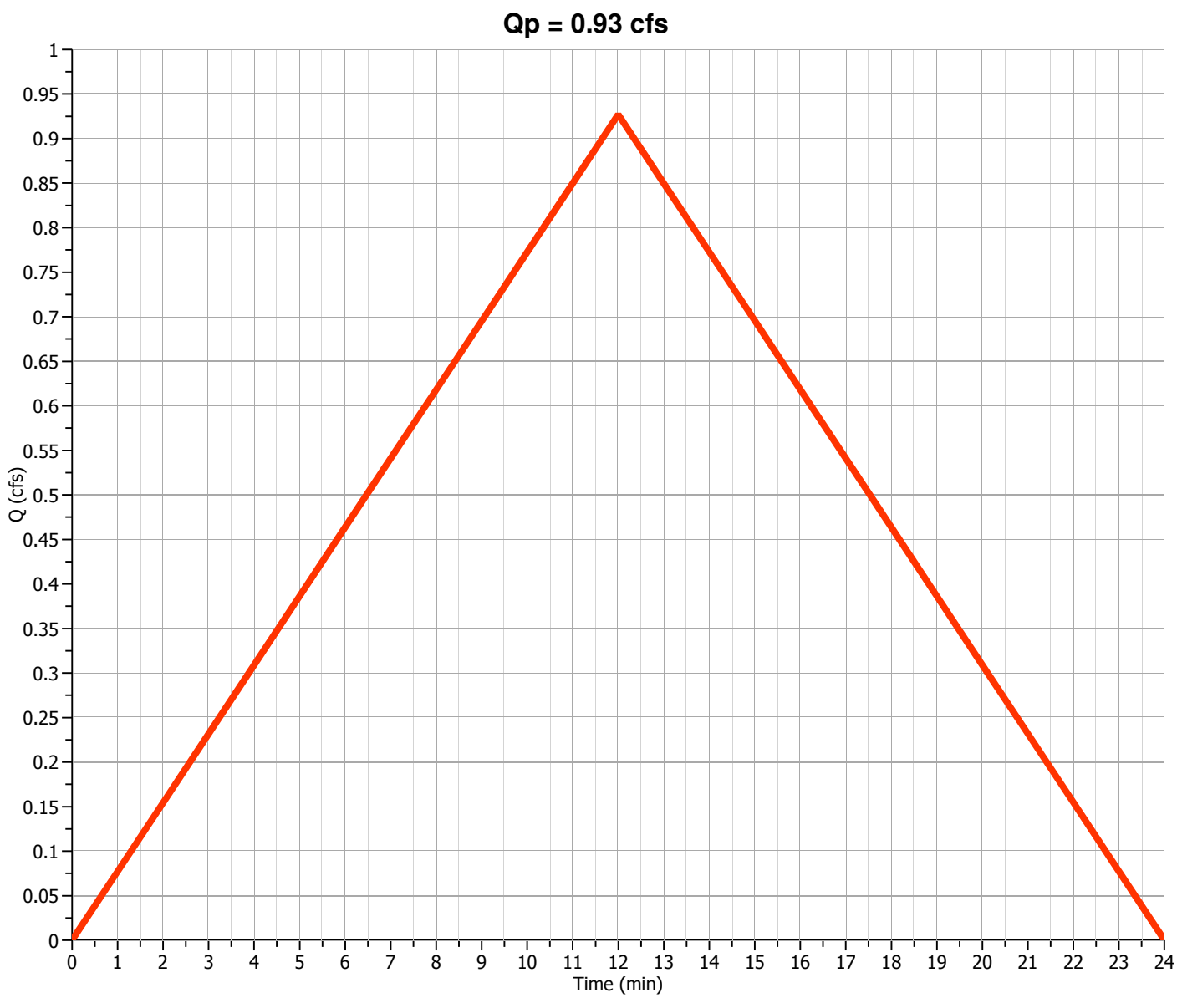
Post

Hyd. No. 2

Hydrograph Type	= Rational	Peak Flow	= 0.927 cfs
Storm Frequency	= 10-yr	Time to Peak	= 0.20 hrs
Time Interval	= 1 min	Runoff Volume	= 668 cuft
Drainage Area	= 0.16 ac	Runoff Coeff.	= 0.95*
Tc Method	= User	Time of Conc. (Tc)	= 12.0 min
IDF Curve	= Colorado Springs.idf	Intensity	= 6.10 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.16	0.95	Road-Asphalt
0.16	**0.95**	



Hydrograph 100-yr Summary

Project Name:

02-27-2024

Hydrology Studio v 3.0.0.26

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	Rational	Pre Pre	0.269	0.20	194	----		
2	Rational	Post	1.277	0.20	920	----		

Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.26

02-27-2024

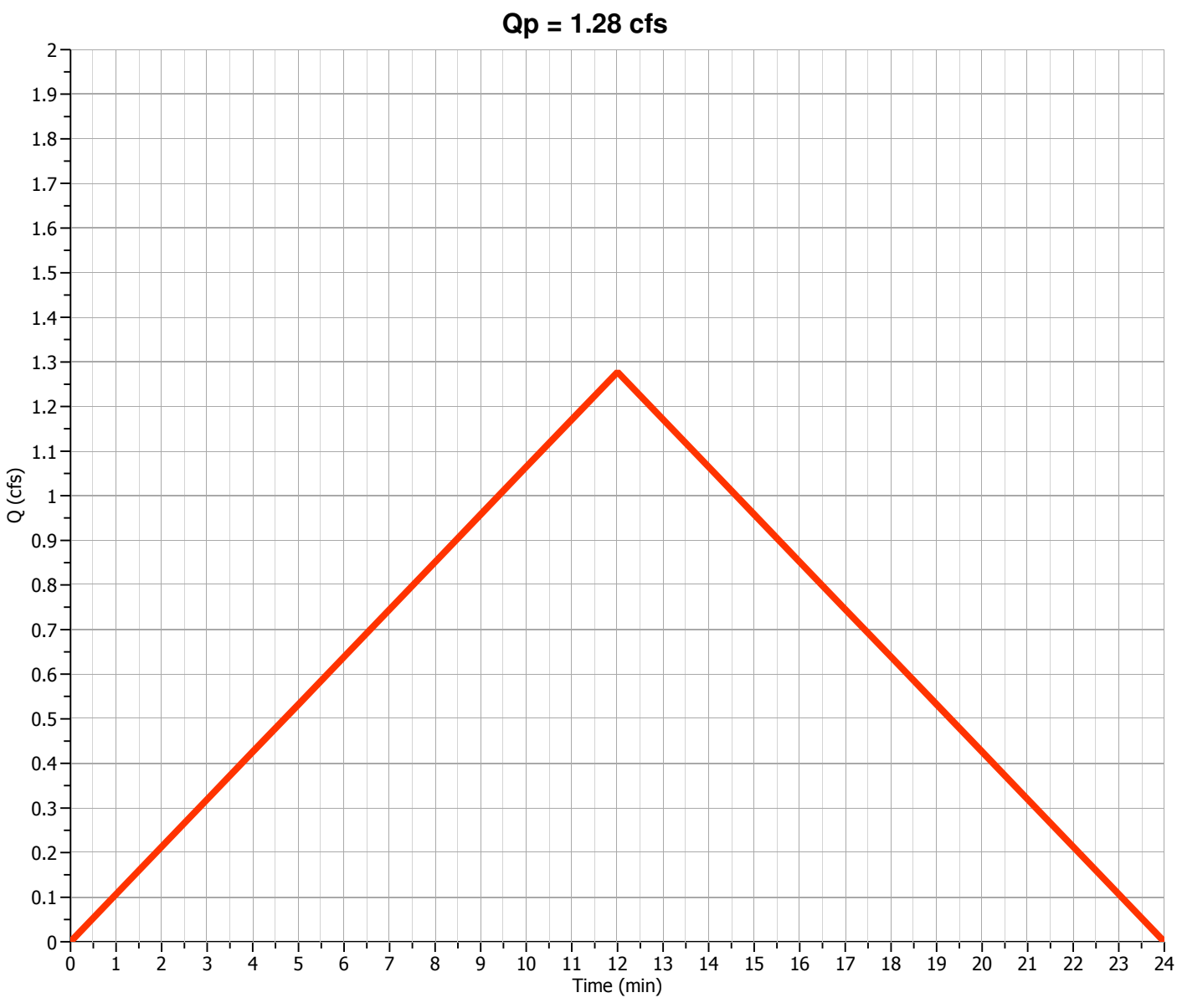
Post

Hyd. No. 2

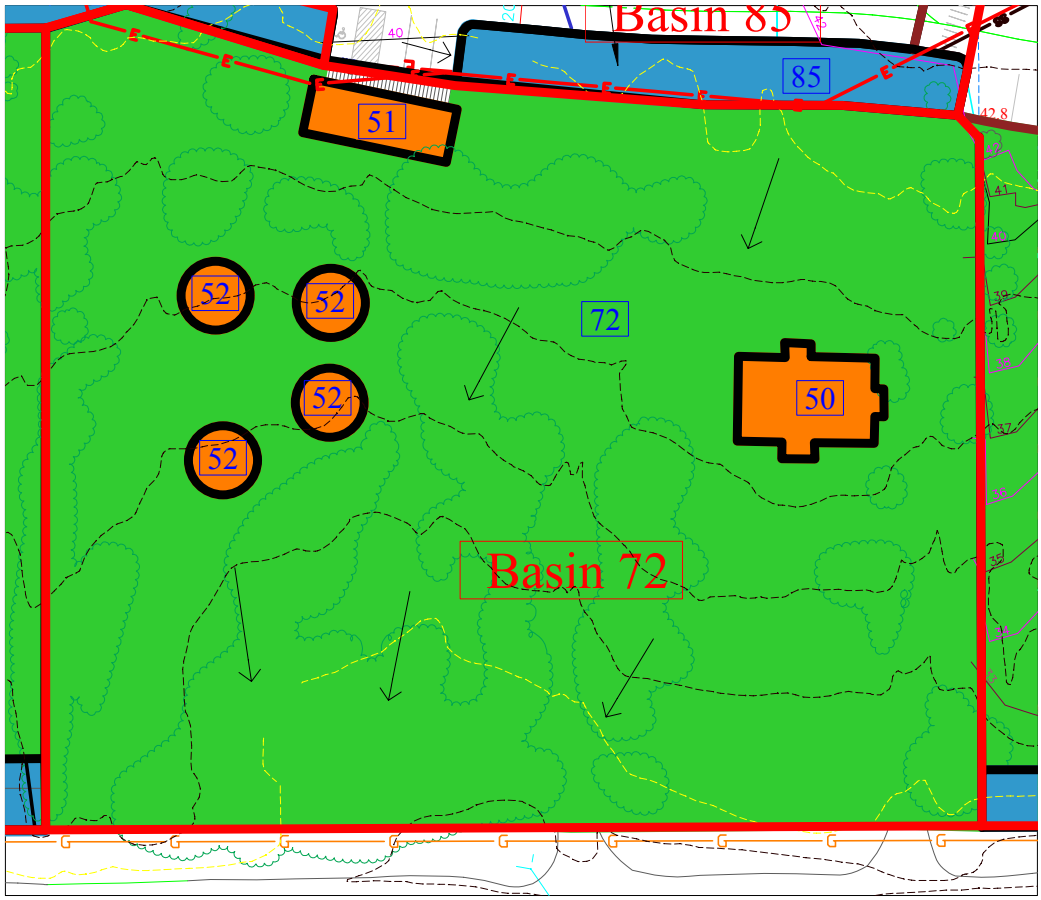
Hydrograph Type	= Rational	Peak Flow	= 1.277 cfs
Storm Frequency	= 100-yr	Time to Peak	= 0.20 hrs
Time Interval	= 1 min	Runoff Volume	= 920 cuft
Drainage Area	= 0.16 ac	Runoff Coeff.	= 0.95*
Tc Method	= User	Time of Conc. (Tc)	= 12.0 min
IDF Curve	= Colorado Springs.idf	Intensity	= 8.40 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.16	0.95	Road-Asphalt
0.16	**0.95**	



Basin 72



Basin 72 has no drainage control and is largely undeveloped land dominated by scrub oak and significant detritus accumulation.

This area will run free.

10 yr Storm		100 yr Storm	
Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)
0.86	**4,458**	**1.27**	**6,563**
Infiltration Surface Area Req'd (sf)	801		**1,179**

Hydrograph 10-yr Summary

Project Name:

02-27-2024

Hydrology Studio v 3.0.0.26

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	Rational	Pre Pre	0.691	1.43	3,567	----		
2	Rational	Post	0.864	1.43	4,458	----		

Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.26

02-27-2024

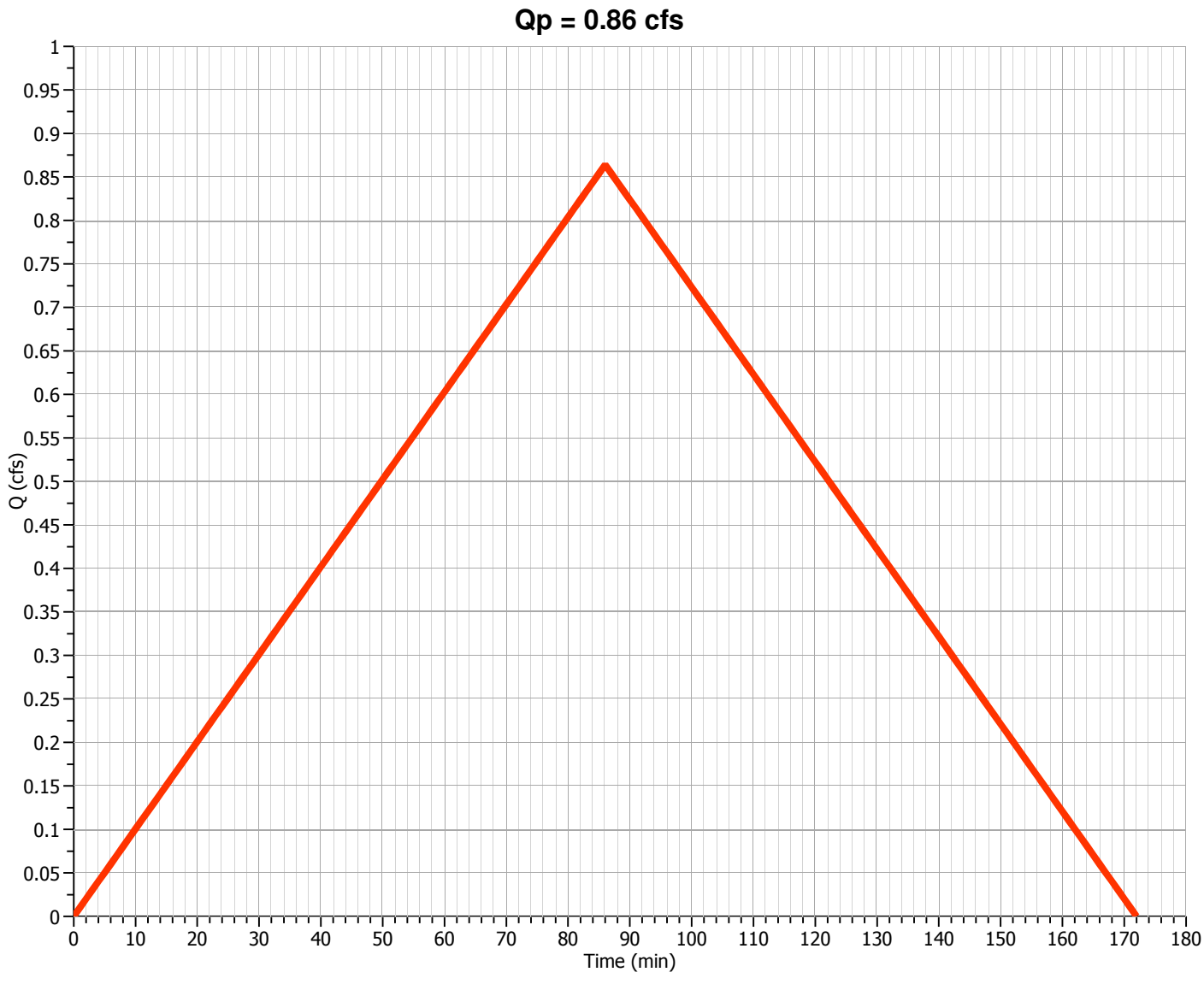
Post

Hyd. No. 2

Hydrograph Type	= Rational	Peak Flow	= 0.864 cfs
Storm Frequency	= 10-yr	Time to Peak	= 1.43 hrs
Time Interval	= 1 min	Runoff Volume	= 4,458 cuft
Drainage Area	= 1.649 ac	Runoff Coeff.	= 0.25*
Tc Method	= User	Time of Conc. (Tc)	= 86.0 min
IDF Curve	= Colorado Springs.idf	Intensity	= 2.10 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.107	0.95	Roof
1.542	0.20	Land-Undevel
1.649	**0.25**	



Hydrograph 100-yr Summary

Project Name:

02-27-2024

Hydrology Studio v 3.0.0.26

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	Rational	Pre Pre	1.017	1.43	5,250	----		
2	Rational	Post	1.272	1.43	6,563	----		

Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.26

02-27-2024

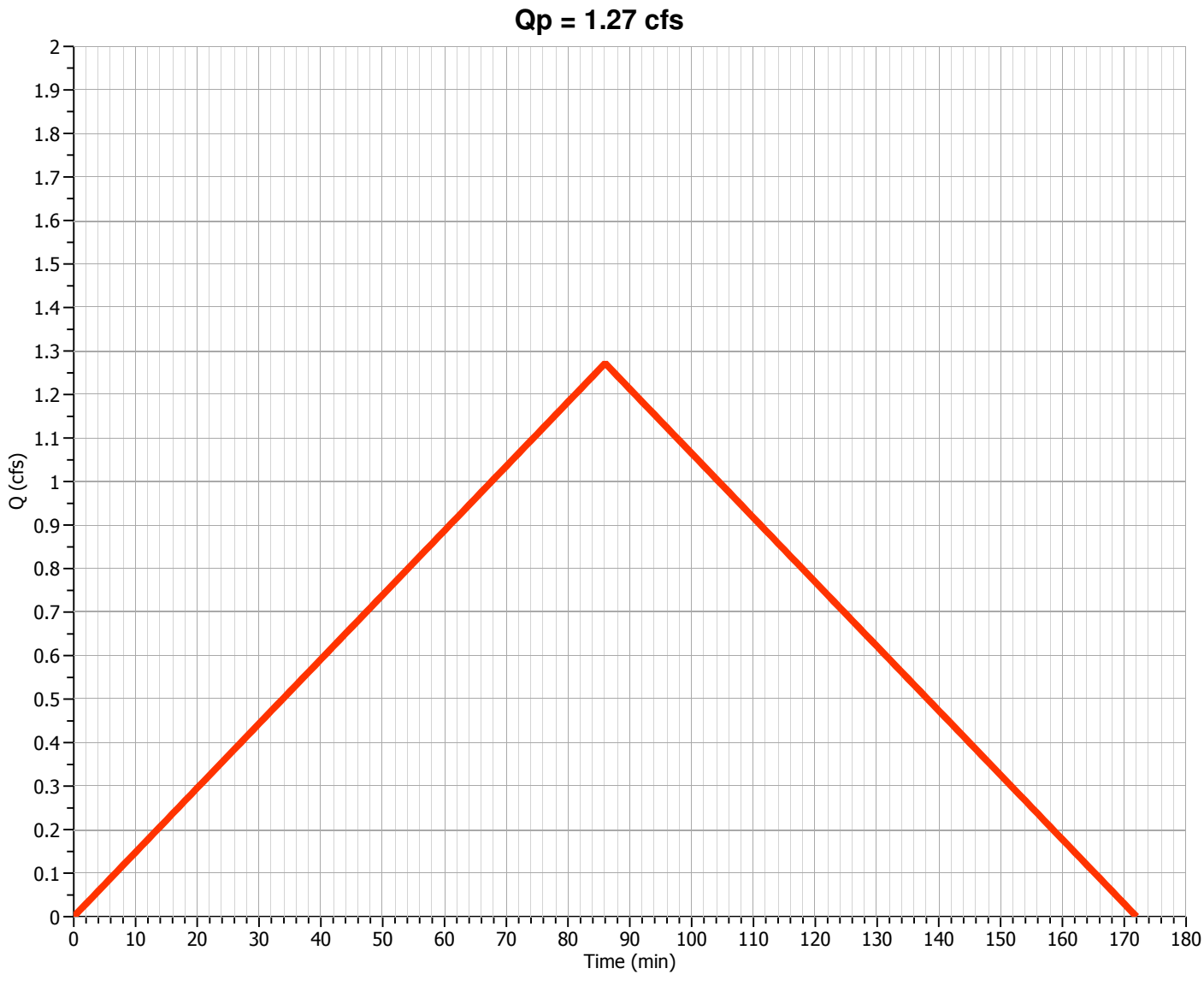
Post

Hyd. No. 2

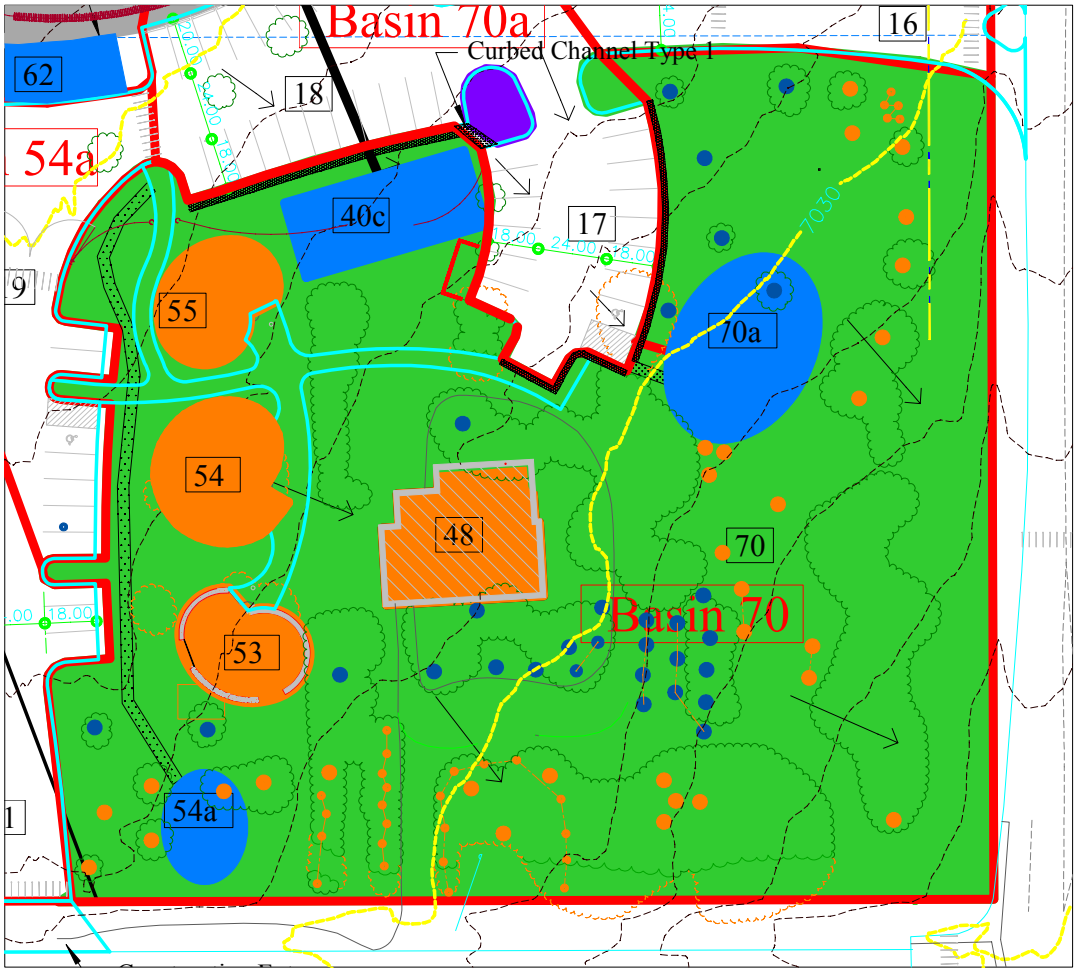
Hydrograph Type	= Rational	Peak Flow	= 1.272 cfs
Storm Frequency	= 100-yr	Time to Peak	= 1.43 hrs
Time Interval	= 1 min	Runoff Volume	= 6,563 cuft
Drainage Area	= 1.649 ac	Runoff Coeff.	= 0.25*
Tc Method	= User	Time of Conc. (Tc)	= 86.0 min
IDF Curve	= Colorado Springs.idf	Intensity	= 3.09 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.107	0.95	Roof
1.542	0.20	Land-Undevel
1.649	**0.25**	



Basin 70



This basin in the SW corner of the project will have no drainage control. Within this basin are infiltration ponds collecting waters from adjacent pavement of other basins. A runoff coefficient of 0.2, is probably low with extensive scrub oak and accumulated detritus.

Run off will continue in it's historical manner to the borrow ditch.

10 yr Storm		100 yr Storm	
Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)
0.86	**4,907**	**1.27**	**7,251**

Hydrograph 10-yr Summary

Project Name:

02-27-2024

Hydrology Studio v 3.0.0.26

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	Rational	Pre Pre	0.792	1.58	4,516	----		
2	Rational	Post	0.861	1.58	4,907	----		

Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.26

02-27-2024

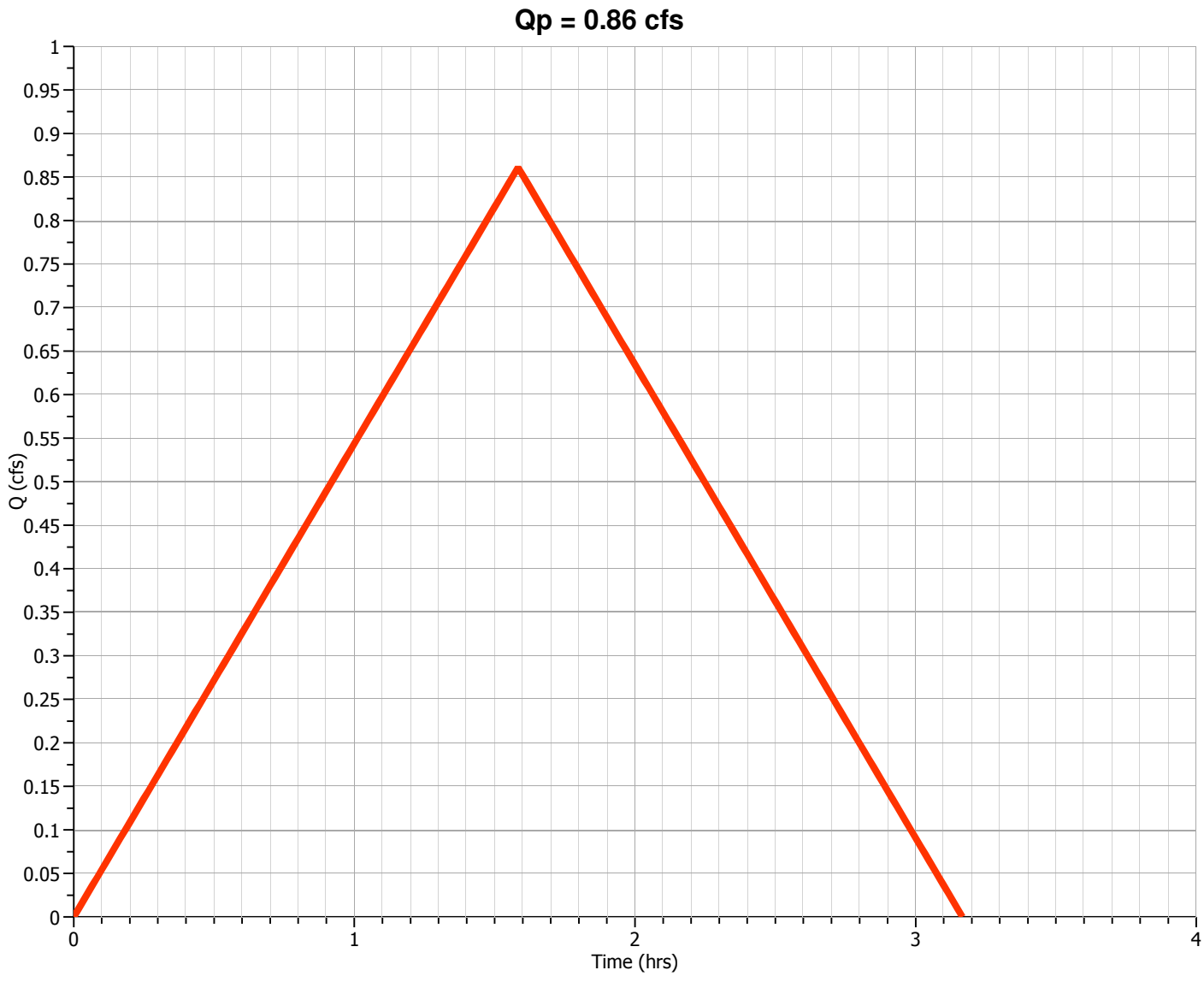
Post

Hyd. No. 2

Hydrograph Type	= Rational	Peak Flow	= 0.861 cfs
Storm Frequency	= 10-yr	Time to Peak	= 1.58 hrs
Time Interval	= 1 min	Runoff Volume	= 4,907 cuft
Drainage Area	= 1.754 ac	Runoff Coeff.	= 0.25*
Tc Method	= User	Time of Conc. (Tc)	= 95.0 min
IDF Curve	= Colorado Springs.idf	Intensity	= 1.96 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.126	0.95	Roof
1.628	0.20	Land-Undevel
1.754	**0.25**	



Hydrograph 100-yr Summary

Project Name:

02-27-2024

Hydrology Studio v 3.0.0.26

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	Rational	Pre Pre	1.171	1.58	6,672	----		
2	Rational	Post	1.272	1.58	7,251	----		

Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.26

02-27-2024

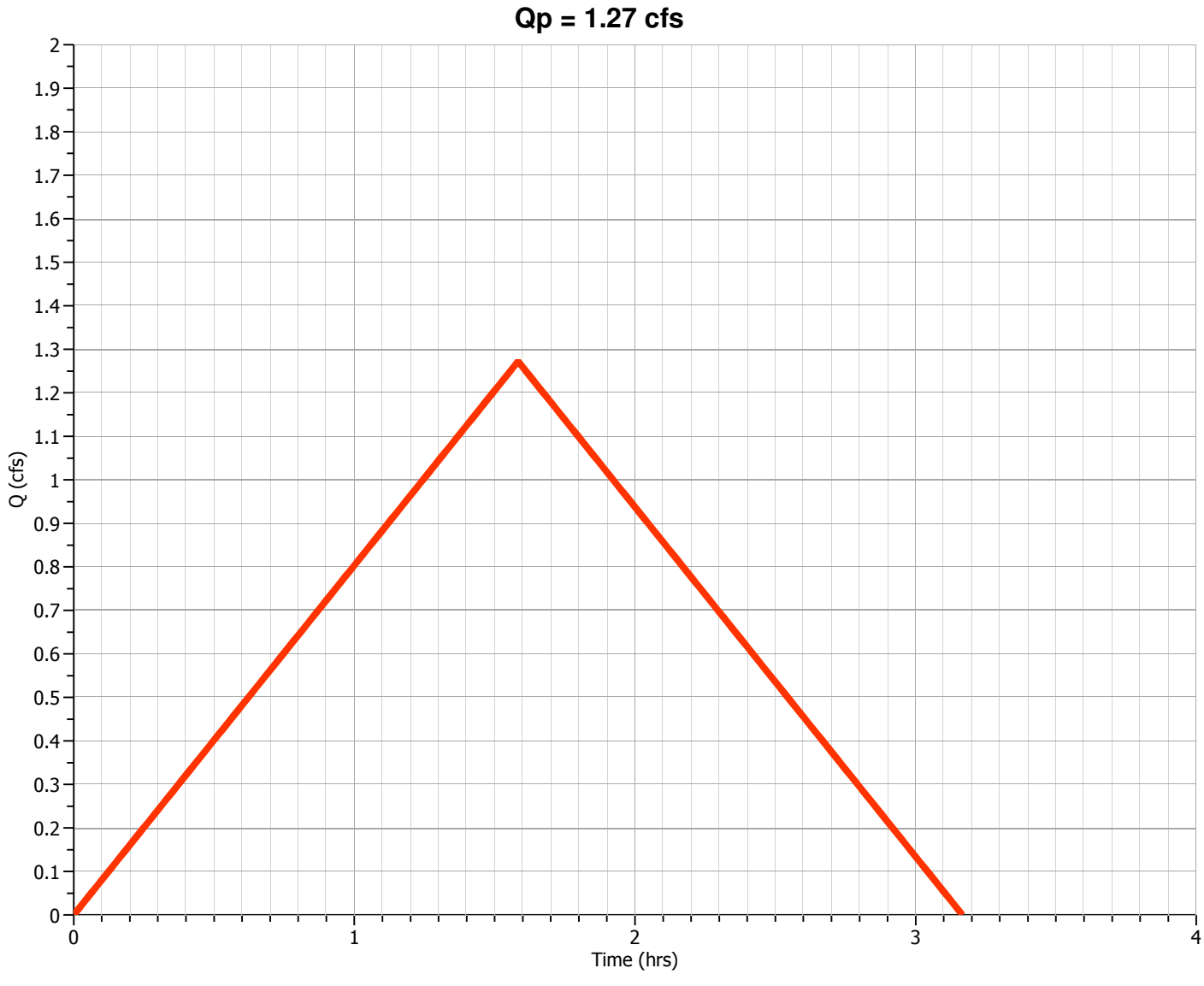
Post

Hyd. No. 2

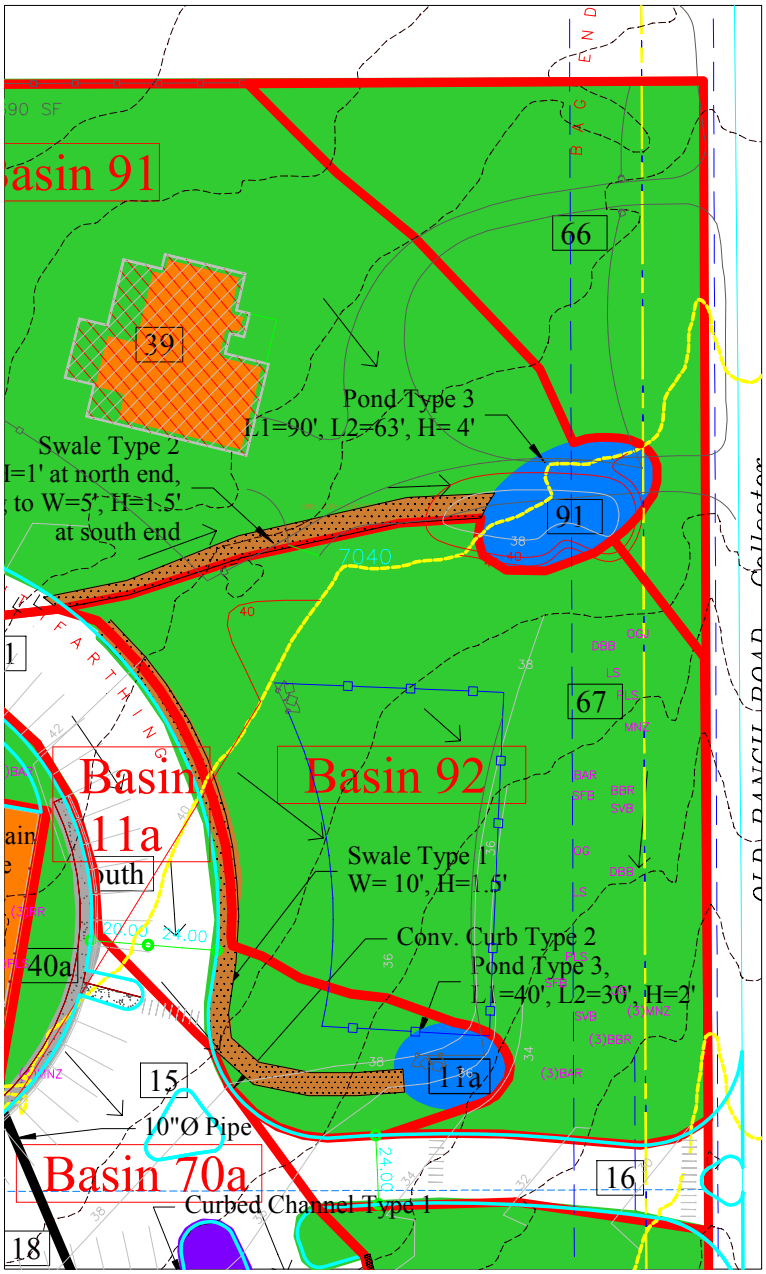
Hydrograph Type	= Rational	Peak Flow	= 1.272 cfs
Storm Frequency	= 100-yr	Time to Peak	= 1.58 hrs
Time Interval	= 1 min	Runoff Volume	= 7,251 cuft
Drainage Area	= 1.754 ac	Runoff Coeff.	= 0.25*
Tc Method	= User	Time of Conc. (Tc)	= 95.0 min
IDF Curve	= Colorado Springs.idf	Intensity	= 2.90 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.126	0.95	Roof
1.628	0.20	Land-Undevel
1.754	**0.25**	



Basin 92 - Area 16 + 66 + 67 to Free



This drainage area is comprised of asphalt roadway #16 and undeveloped land #66 & 67 in the SE corner of the property. These areas will run free.

	10 yr Storm		100 yr Storm	
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)
	0.818	**3044**	**1.19**	**4,426**
Infiltration				
Infiltration Surface Area Req'd (CF/IR/40hr) = SF				

Hydrograph 10-yr Summary

Project Name:

02-27-2024

Hydrology Studio v 3.0.0.26

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	Rational	Pre Pre	0.584	1.03	2,174	----		
2	Rational	Post	0.818	1.03	3,044	----		

Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.26

02-27-2024

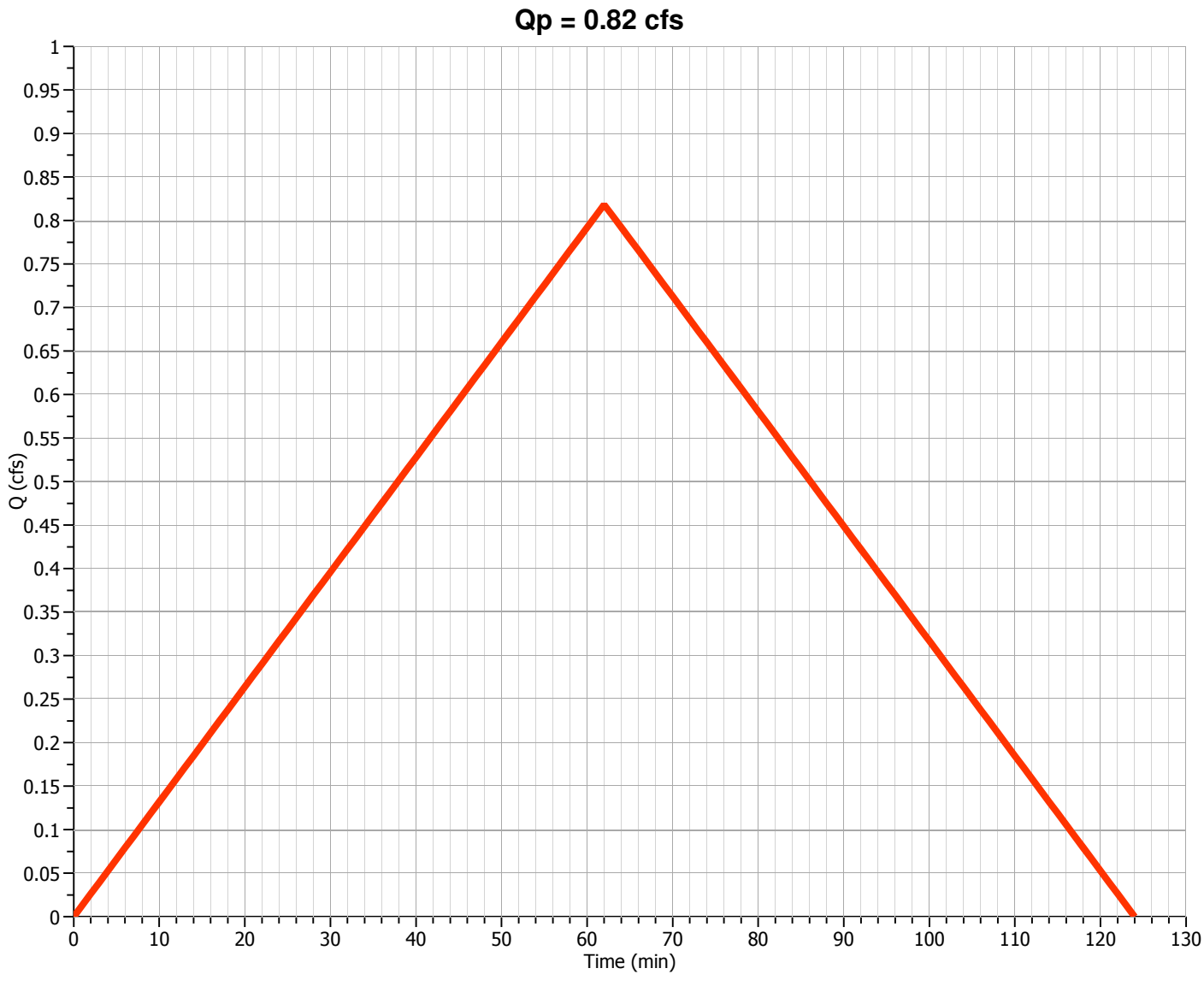
Post

Hyd. No. 2

Hydrograph Type	= Rational	Peak Flow	= 0.818 cfs
Storm Frequency	= 10-yr	Time to Peak	= 1.03 hrs
Time Interval	= 1 min	Runoff Volume	= 3,044 cuft
Drainage Area	= 1.131 ac	Runoff Coeff.	= 0.28*
Tc Method	= User	Time of Conc. (Tc)	= 62.0 min
IDF Curve	= Colorado Springs.idf	Intensity	= 2.58 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.12	0.95	Road-Asphalt
1.011	0.20	Land-Undevel
1.131	**0.28**	



Hydrograph 100-yr Summary

Project Name:

02-27-2024

Hydrology Studio v 3.0.0.26

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	Rational	Pre Pre	0.850	1.03	3,161	----		
2	Rational	Post	1.190	1.03	4,426	----		

Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.26

02-27-2024

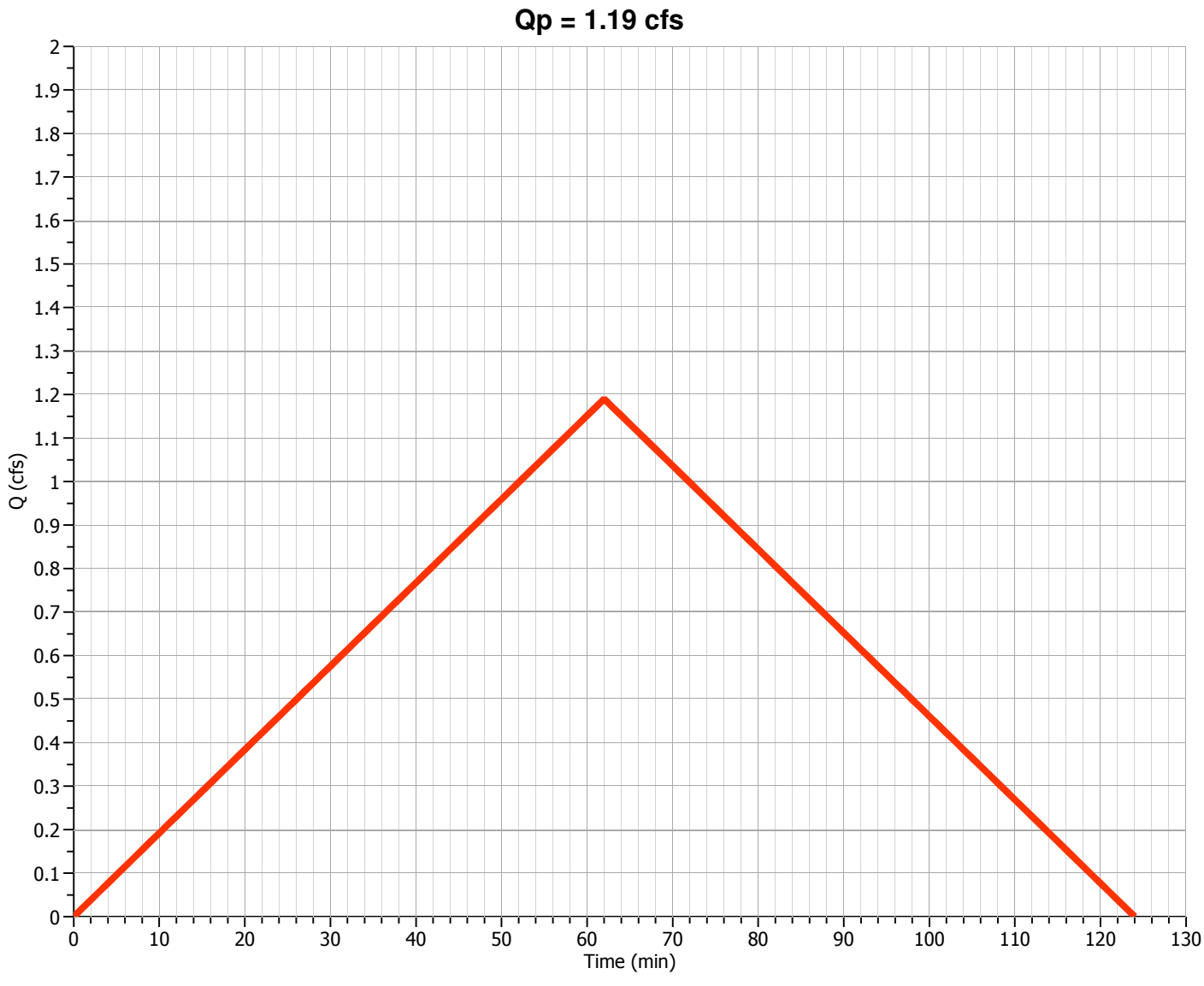
Post

Hyd. No. 2

Hydrograph Type	= Rational	Peak Flow	= 1.190 cfs
Storm Frequency	= 100-yr	Time to Peak	= 1.03 hrs
Time Interval	= 1 min	Runoff Volume	= 4,426 cuft
Drainage Area	= 1.131 ac	Runoff Coeff.	= 0.28*
Tc Method	= User	Time of Conc. (Tc)	= 62.0 min
IDF Curve	= Colorado Springs.idf	Intensity	= 3.76 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

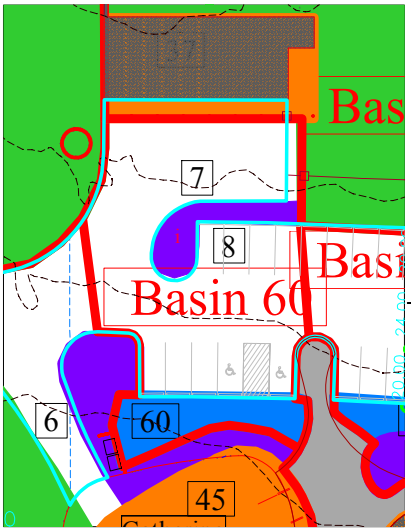
*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.12	0.95	Road-Asphalt
1.011	0.20	Land-Undevel
1.131	**0.28**	



Calculations for Areas with Dedicated Infiltration Ponds

Results Format



For each basin analyzed there is generally three pages of output. Below is the results of the Hydrology calculations these pages include.

Shows color coded surfaces and boundaries used for basin analysis

10 yr Storm		100 yr Storm	
Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)
0.83	**550**	**1.14**	**756**
	99		**136**

Shows expected total runoff volume in CF and flow in CFS for 10 yr and 100 yr storms

Shows the size of the pond required to infiltrate runoff within 40 hours

Infiltration Pond #58	Hydrology File		5+58+76 to 58.hys		
Infiltration Test	Emtech PH2				
Infiltration Rate (inches / hour / sf)	1.67				
Infiltration Rate (ft = ft / hour /sf)	0.139166667				
Receive Flows from :	5, 58,76				
	Area (ac)	Reach Length (Ft)	Slope	Coeff (C)	Tc (min)
Roof # EIHs	0.0663			0.95	
Roof				0.95	
Roads Gravel				0.85	
Roads #5 Asphalt	0.299	245	3.5%	0.95	13.3
Land #76	1.007	305	3.3%	0.2	90.8
Pond # 58	0.141			1	
Total	1.513				
Flow Coefficient of Runoff	0.40				
Composite Area	1.513				
Composite Curve #					
Hydrology Input	Tc (min)				
	70.6				
	10 yr Storm		100 yr Storm		
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)	
From #5 only	1.67	1304	2.31	1801	
From #76 only	0.81	4418	1.19	6517	
Aggregate	**2.48**	**5,722**	**3.5**	**8,318**	
Infiltration					
	Infiltration Surface Area Req'd (sf)				
Infiltration Surface Area Req'd (CF/IR/40hr) = SF		1,028		**1,494**	
Pond Sizing - Truncated Rectangular Pyramid					
Side Slope X:1	3				
Pond Top Length (ft)	200	L			
Pond Top Width (ft)	30	W			
Pond Bottom Length (ft)	176	l			
Pond Bottom Width (ft)	15	w			
Depth (ft)	2.5	h			
Infiltration Surface Area - FULL (sf)	6000				
Full Volume (cf)	8,350	Greater than	8,318		
Water Surface Area - FULL (sf)	6000				
Water Surface Area at HALF FULL	4320	Greater than	1,494		
Water Surface Area - EMPTY (sf)	2640	Greater than	1,494		
NOTES					
Road flows swale and directly to pond					
Grass Swale conveys waters to pond					

Shows Basin number and Hydrology file name

Shows contributing areas and #'s

Shows areas, reach, slope and coefficient of runoff

Shows Time of Concentration used for Pre and Post developement or different surface flows

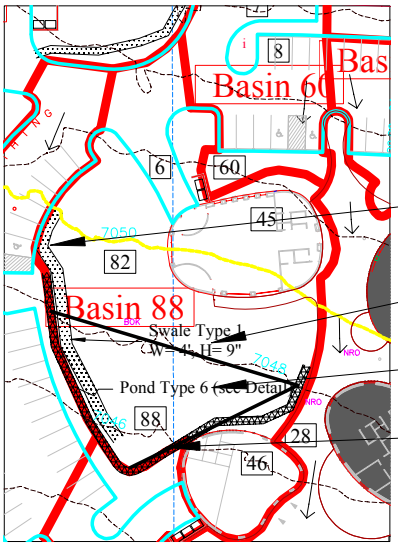
Shows Hydrology output

Shows Pond Type

Shows pond size calculation

Shows Volume test as compared to req'd volume

Shows infiltrative area test when pond is half full or empty



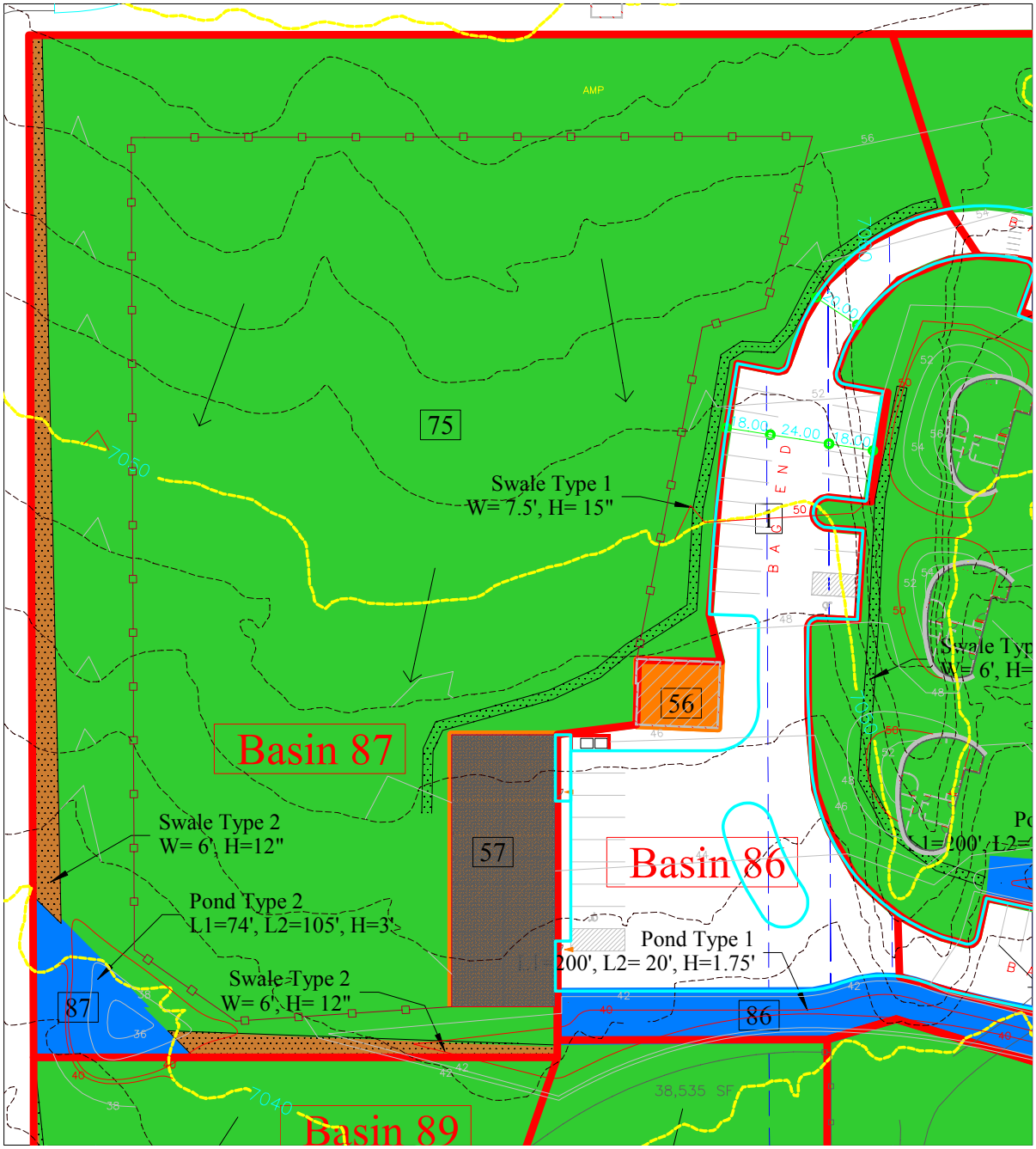
Shows Grassed Swale location and alignment

Shows Swale Type and size

Shows Pond Type and dimensions

Shows Pond location

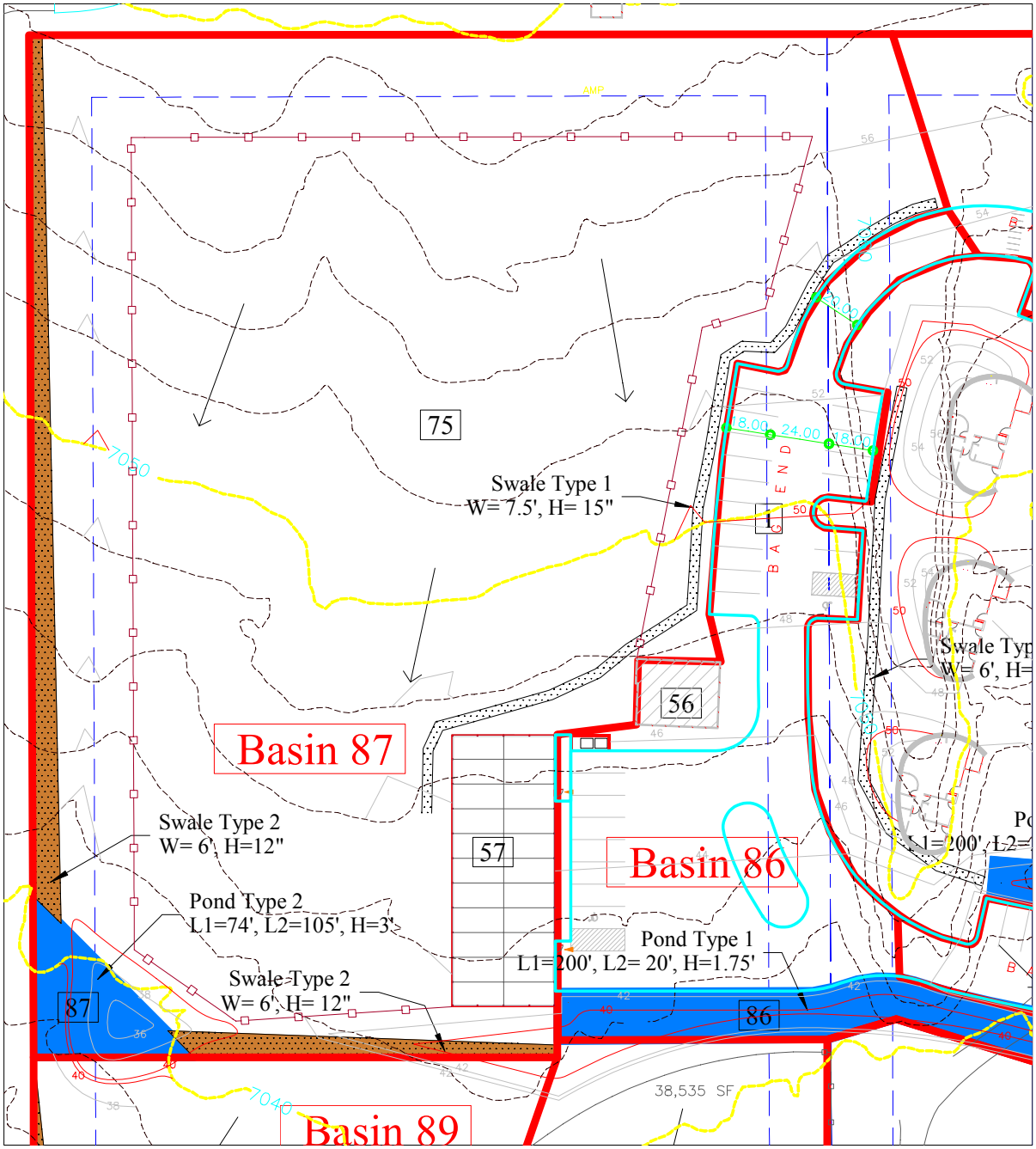
Basin 87

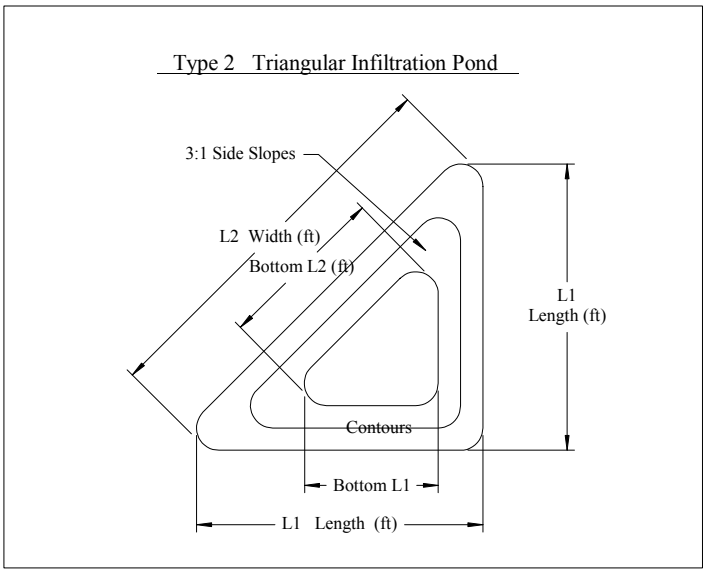


Area #75 in Basin 87 will remain predominantly agricultural use and will be contour plowed to further reduce runoff. Greenhouse roof #57 is included.

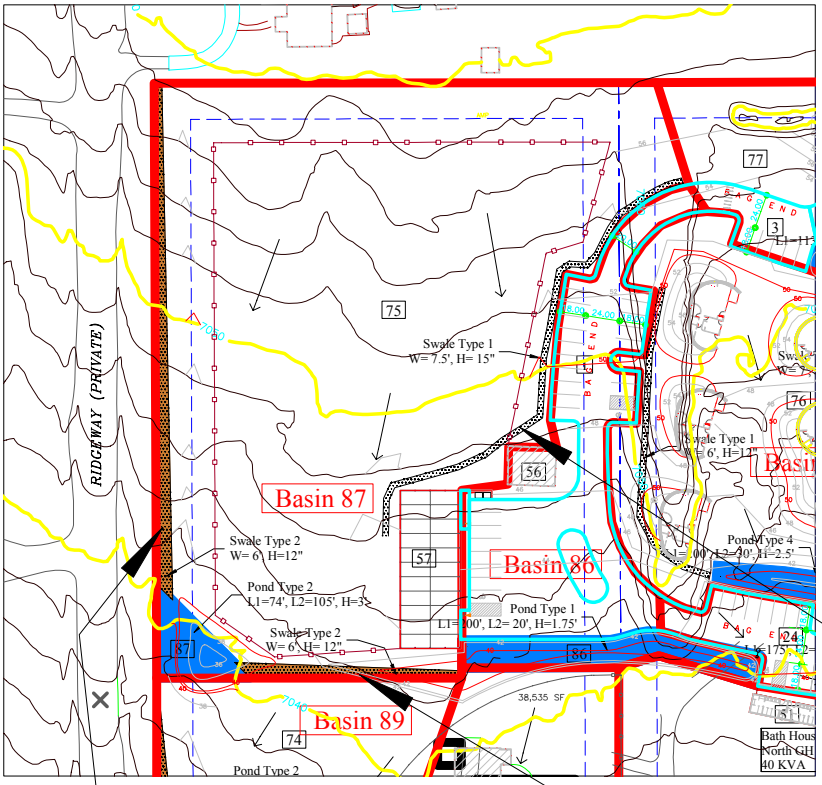
	10 yr Storm		100 yr Storm	
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)
	1.42	**8882**	**2.11**	**13,170**
Infiltration				
Infiltration Surface Area Req'd (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	1,596		**2,366**

Basin 87


75
Swale Type 1
W= 7.5', H= 15"
18.00
24.00
18.00
BACK END
56
Basin 87
Swale Type 2
W= 6', H=12"
57
Basin 86
Pond Type 2
L1=74', L2=105', H=3'
Pond Type 1
L1=200', L2= 20', H=1.75'
Swale Type 2
W= 6', H= 12"
87
86
38,535 SF
Basin 89


Type 2 Triangular Infiltration Pond
3:1 Side Slopes
L2 Width (ft)
Bottom L2 (ft)
L1
Length (ft)
Contours
Bottom L1
L1 Length (ft)

Basin 87



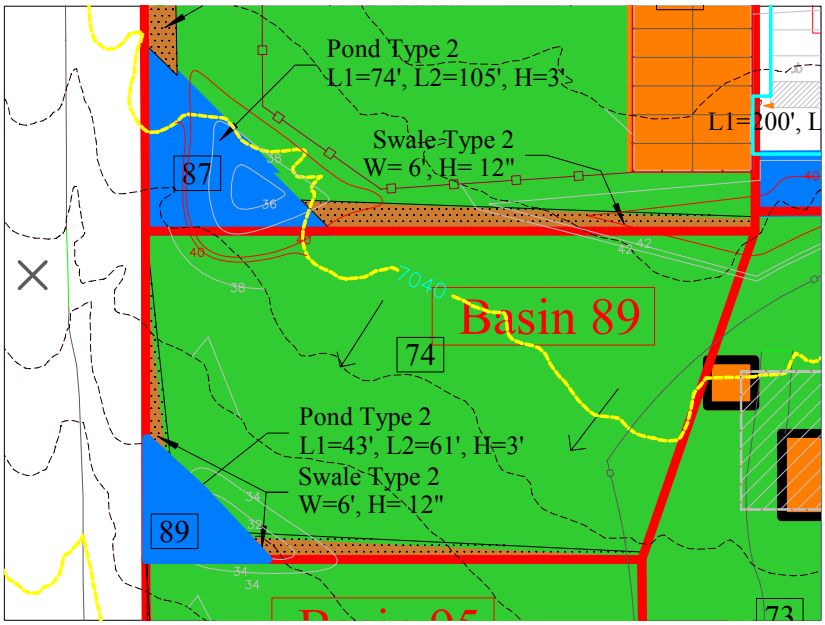
Channel Parameters	
Bottom Width (ft) b	0.00
Side Slope X:1	3.00
Depth (ft) h	1.25
Top Width (ft) W	7.50
Flow Area	
Area (sf)	4.69
Wetted Perimeter	7.91
Hydraulic Radius	0.59
Flow Calc	
Slope (%)	0.20%
Mannings (n)	0.03
Velocity (ft/sec)	1.57
Area (sf)	4.69
Flow (cf/sec)	**7.35**

Channel Parameters	
Bottom Width (ft) b	0.50
Side Slope X:1	3.00
Depth (ft) h	0.50
Top Width (ft) T	3.50
Flow Area	
Area (sf)	1.00
Wetted Perimeter	3.66
Hydraulic Radius	0.27
Flow Calc	
Slope (%)	5.14%
Mannings (n)	0.03
Velocity (ft/sec)	4.74
Area (sf)	1.00
Flow (cf/sec)	4.74

Channel Parameters	
Bottom Width (ft) b	0.50
Side Slope X:1	3.00
Depth (ft) H	0.75
Top Width (ft) T	5.00
Flow Area	
Area (sf)	2.06
Wetted Perimeter	5.24
Hydraulic Radius	0.39
Flow Calc	
Slope (%)	1.33%
Mannings (n)	0.03
Velocity (ft/sec)	3.08
Area (sf)	2.06
Flow (cf/sec)	6.35

Infiltration Pond #87	Hydrology File		75+56+87 to 87.hys		
Infiltration Test	Entech PH2				
Infiltration Rate (inches / hour / sf)	1.67				
Infiltration Rate (IR = ft / hour /sf)	0.1391666666667				
Receive Flows from :	75, 54, 87				
	Area (ac)	Reach Length (Ft)	Slope	Coeff (C)	Tc (Min)
Roof # 56	0.0201			0.95	
Roof #54	0.1096			0.95	
Basin 75	2.4782	453	4.0%	0.2	103.8
Pond # 87	0.1410			1	
Total	2.7489				
Flow Coefficient of Runoff	0.2800				
Composite Area	2.7490				
Composite Curve #					
Hydrology Input	Tc (min)	Composite Curve			
	103.8				
	10 yr Storm		100 yr Storm		
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)	
	1.42	**8882**	**2.11**	**13,170**	
Infiltration					
Infiltration Surface Area Req'd (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	1,596		**2,366**	
Pond Sizing - Truncated Triangular Pyramid					
Full Pyramid (defines top dimensions of pond)					
Side Slope X:1	3				
Base Length (ft)	**74**	**L1**			
Base Width (ft)	**104.7**	**L2**			
Height	24.7	h0			
Base Area (sf)	7744.2	BA			
Volume (cf)	63668.4	Vol			
Smaller Pyramid					
Depth	**3.0**	**h2 H**			
Base Length	56.0	l			
Base Width (ft)	86.7	w			
Top Cone Height (ft)	21.7	h1			
Top Cone Volume (cf) POND Size	35042.3				
Bottom Truncated Cone Volume (cf)	28626.1	Greater Than	13,170		
Base Area (sf)	2426.3	l x w /2			
Water Surface Area - FULL(sf)	3872.1				
Water Surface Area at HALF FULL	3149.2	Greater Than	2,366		
Water Surface Area - EMPTY	2426.3	Greater Than	2,366		

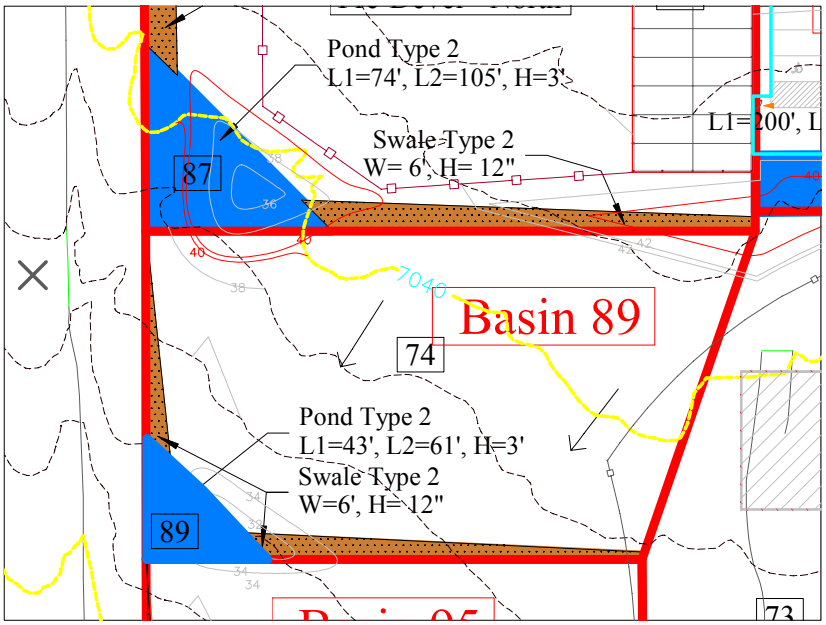
Basin 89

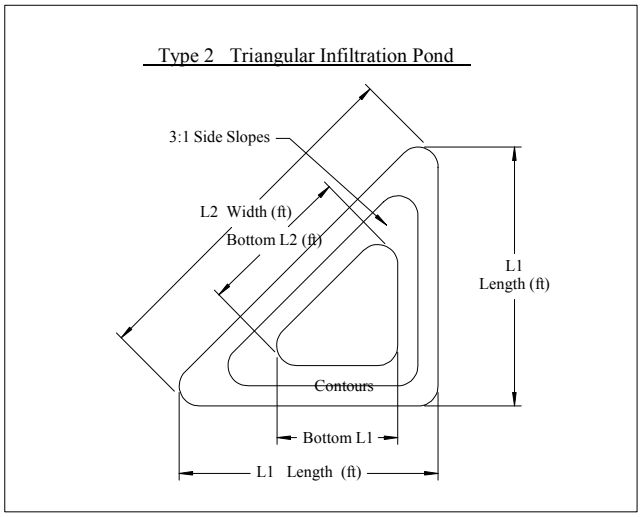


Basin #89, it's pond and conveyance swales is dedicated to reducing runoff from adversely affecting the OWTS Soil Treatment Area (#95).

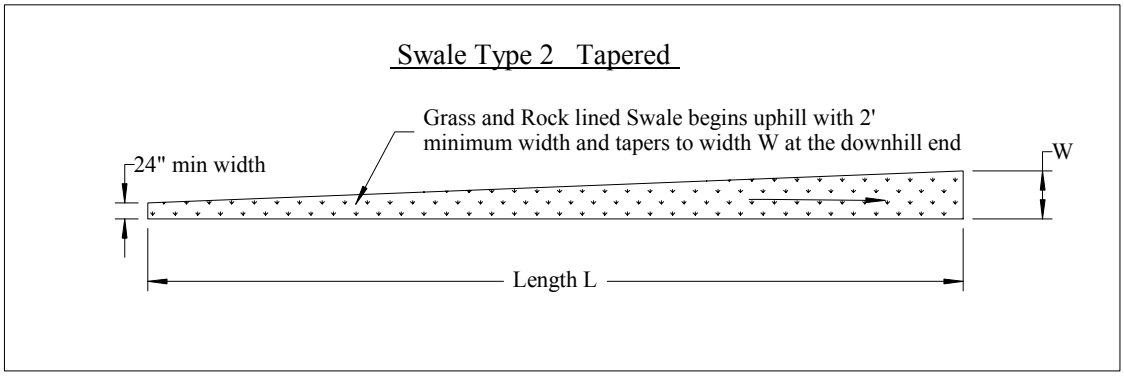
	10 yr Storm		100 yr Storm	
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)
	0.6	**1923**	**0.87**	**2,780**
Infiltration				
Infiltration Surface Area Req'd (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	345		**499**

Basin 89



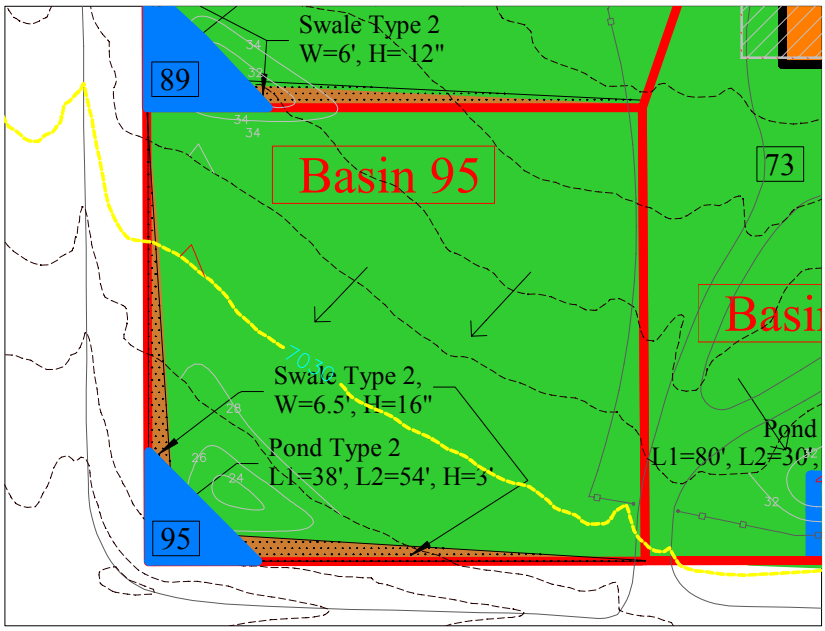


Channel Parameters	
Bottom Width (ft) b	0.50
Side Slope X:1	3.00
Depth (ft) h	0.50
Top Width (ft) T	3.50
Flow Area	
Area (sf)	1.00
Wetted Perimeter	3.66
Hydraulic Radius	0.27
Flow Calc	
Slope (%)	0.03
Mannings (n)	2.35%
Velocity (ft/sec)	4.23
Area (sf)	1.00
Flow (cf/sec)	4.23



Infiltration Pond #89	Hydrology File		74+89 to 89.hys		
Infiltration Test	Entech PH2				
Infiltration Rate (inches / hour / sf)	1.67				
Infiltration Rate (IR = ft / hour /sf)	0.139166667				
Receive Flows from :	74, 89				
	Area (ac)	Reach Length (Ft)	Slope	Coeff (C)	Tc (min)
Roof				0.95	
Roof				0.95	
Basin #74	0.3525	130	4.6%	0.2	53.0
Pond # 89	0.1410			1	
Total	0.4935				
Flow Coefficient of Runoff	0.4300				
Composite Area (ac)	0.4935				
Composite Curve #					
Hydrology Input	Tc (min)	Composite Curve			
	114				
	10 yr Storm		100 yr Storm		
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)	
	0.6	**1923**	**0.87**	**2,780**	
Infiltration					
Infiltration Surface Area Req'd (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	345		**499**	
Pond Sizing - Truncated Triangular Pyramid					
Full Pyramid (defines top dimensions of pond)					
Side Slope X:1	3.00				
Base Length	**43.00**	**W**			
Base Width	**60.81**	**L**			
Height	14.33	h0			
Base Area (sf)	2614.88	BA			
Volume (cf)	12492.07	Vol			
Smaller Pyramid					
Depth	**3.00**	**h2 H**			
Base Length	25.00	l			
Base Width (ft)	42.81	w			
Top Cone Height (ft)	11.33	h1			
Top Cone Volume (cf) POND Size	4042.87				
Bottom Truncated Cone Volume (cf)	8449.20	Greater Than	2,780		
Base Area (sf)	535.14	l x w /2			
Water Surface Area - FULL(sf)	1307.44				
Water Surface Area at HALF FULL	921.29	Greater Than	499		
Water Surface Area - EMPTY	535.14	Greater Than	499		

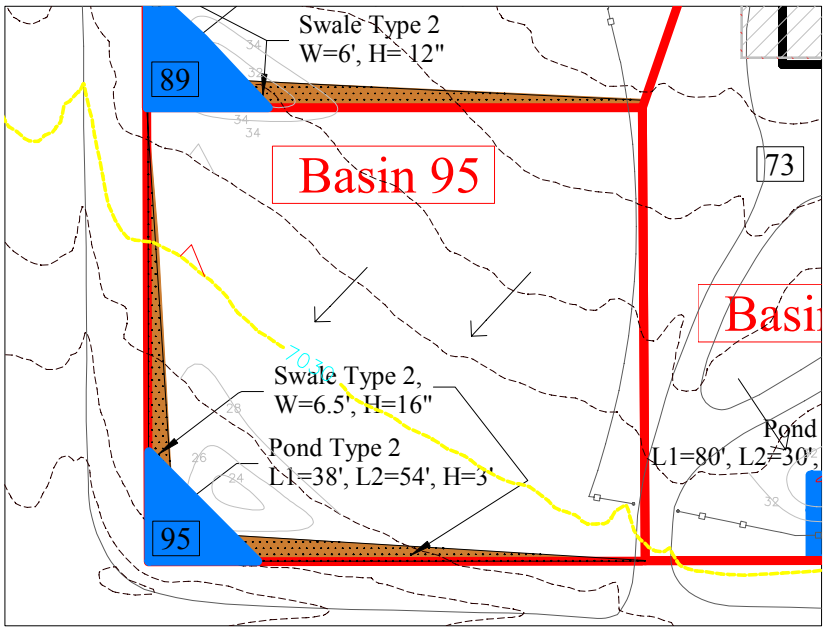
Basin 95

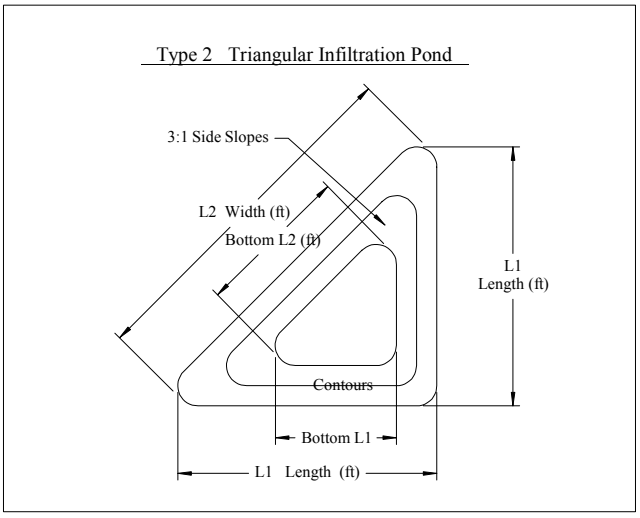


Basin 95 is space reserved for the Soil Treatment Area of the OWTS. The uphill side of the STA is protected from runoff by Pond #89. Swales will be created on the north and west sides to convey water to Pond #95a

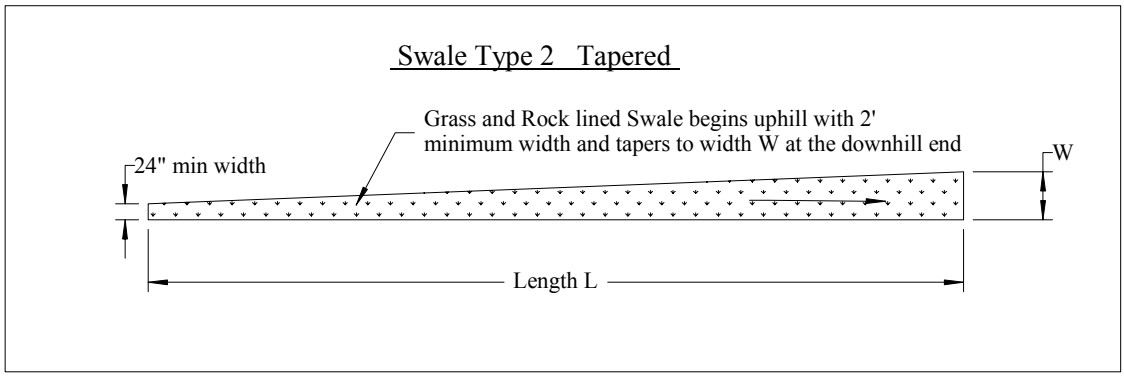
	10 yr Storm		100 yr Storm	
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)
	0.42	**1355**	**0.6**	**1,960**
Infiltration				
Infiltration Surface Area Req'd (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	243		**352**

Basin 95



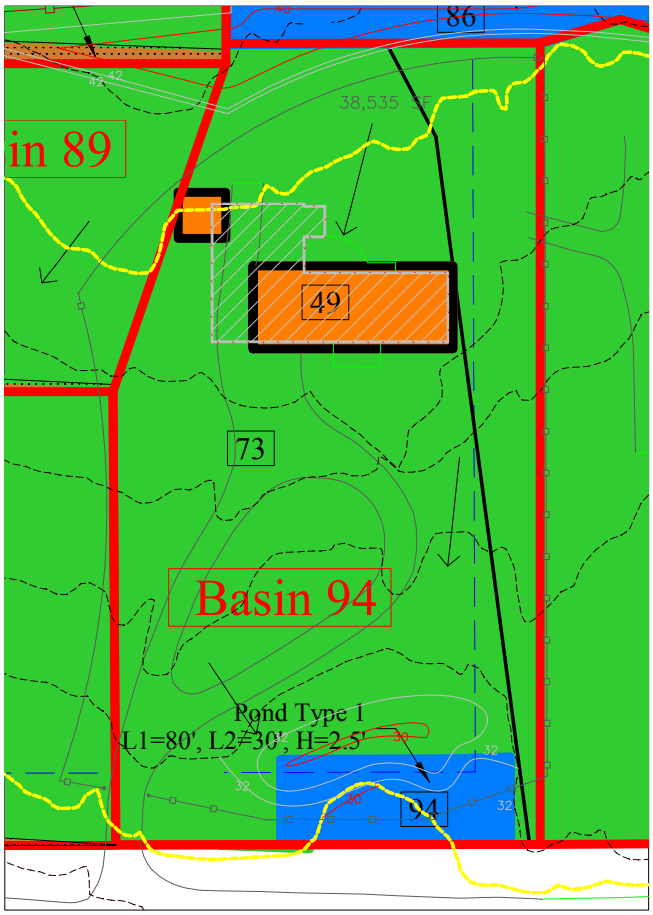


Channel Parameters	
Bottom Width (ft) b	0.50
Side Slope X:1	3.00
Depth (ft) h	1.00
Top Width (ft) T	6.50
Flow Area	
Area (sf)	3.50
Wetted Perimeter	6.82
Hydraulic Radius	0.51
Flow Calc	
Slope (%)	2.07%
Mannings (n)	0.03
Velocity (ft/sec)	4.58
Area (sf)	3.50
Flow (cf/sec)	16.03



Infiltration Pond #95	Hydrology File		STA 95 to 95a.hys		
Infiltration Test	Entech PH2				
Infiltration Rate (inches / hour / sf)	1.67				
Infiltration Rate (IR = ft / hour /sf)	0.139166667				
Receive Flows from :	STA,95				
	Area (ac)	Reach Length (Ft)	Slope	Coeff (C)	Tc (min)
Roof				0.95	
Roof				0.95	
BasinSTA+95	0.5908	150	5.3%	0.2	54.2
Pond	0.0280			1	
Total	0.6188				
Flow Coefficient of Runoff	0.2100				
Composite Area	0.6188				
Composite Curve #					
Hydrology Input	Tc (min)	Composite Curve			
	54.2	0.26			
	10 yr Storm		100 yr Storm		
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)	
	0.42	**1355**	**0.6**	**1,960**	
Infiltration					
Infiltration Surface Area Req'd (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	243		**352**	
Pond Sizing - Truncated Triangular Pyramid					
Full Pyramid (defines top dimensions of pond)					
Side Slope X:1	3.00				
Base Length	**38.00**	**L1**			
Base Width	**53.74**	**L2**			
Height	12.67	h0			
Base Area (sf)	2042.12	BA			
Volume (cf)	8621.44	Vol			
Smaller Pyramid					
Depth	**3.00**	**h2 H**			
Base Length	20.00	l			
Base Width (ft)	35.74	w			
Top Cone Height (ft)	9.67	h1			
Top Cone Volume (cf) POND Size	2303.02				
Bottom Truncated Cone Volume (cf)	6318.42	Greater Than	1,960		
Base Area (sf)	357.40	l x w /2			
Water Surface Area - FULL(sf)	1021.06				
Water Surface Area at HALF FULL	689.23	Greater Than	352		
Water Surface Area - EMPTY	357.40	Greater Than	352		

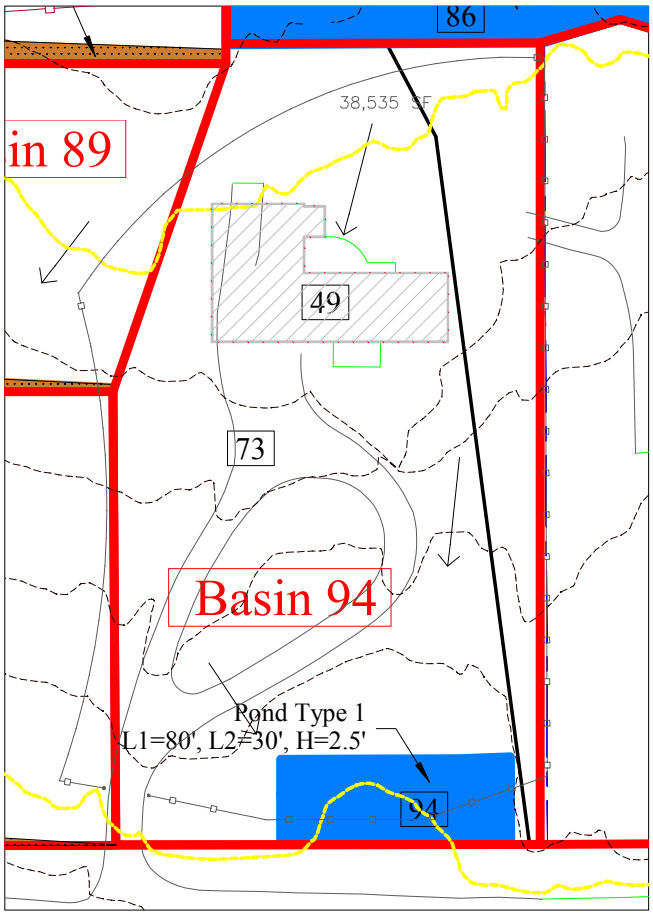
Basin 94

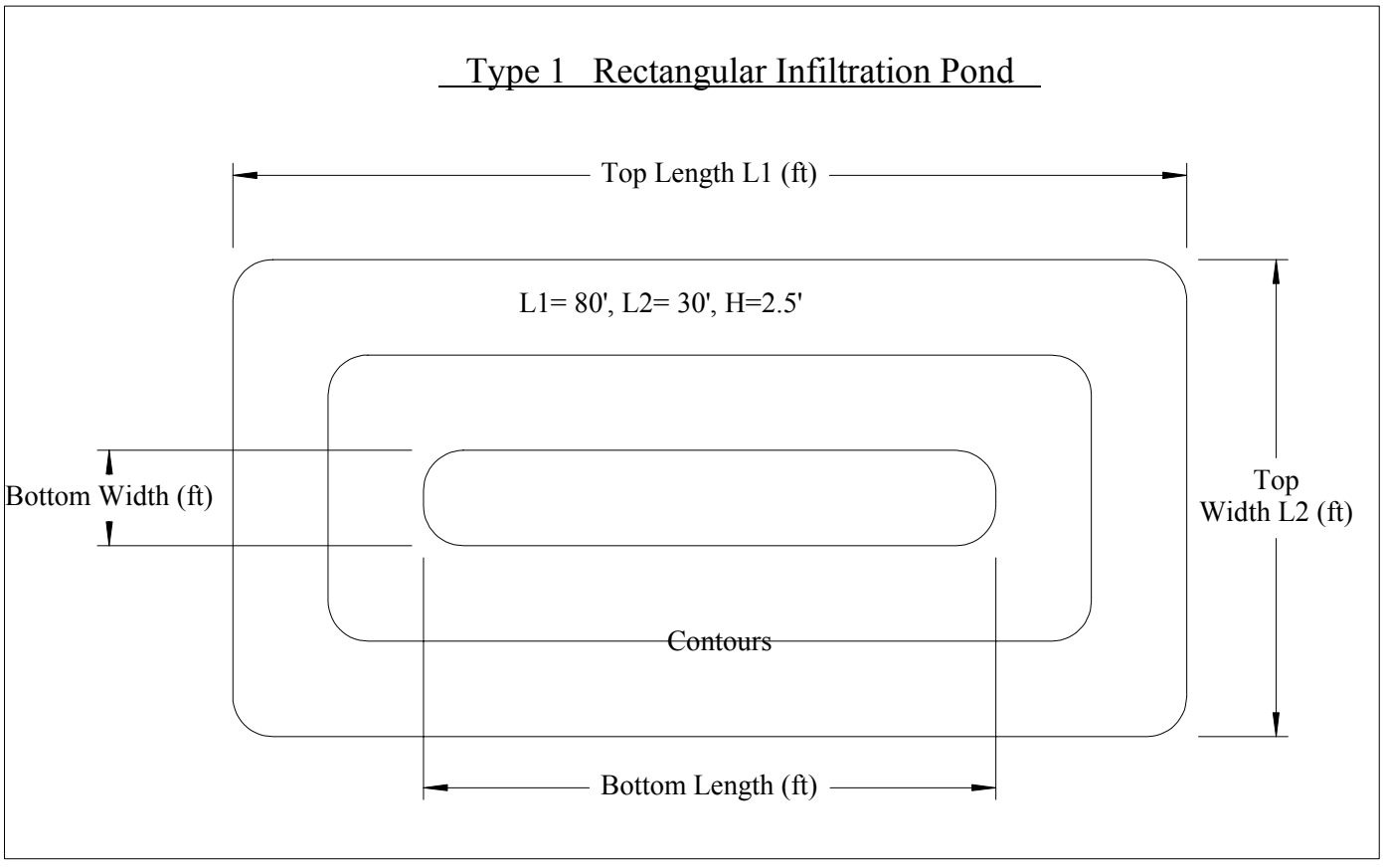


Pond 94 infiltrates waters from mostly undeveloped land #73 and roof #49. Runoff flows via sheet flow to low area of pond.

	10 yr Storm		100 yr Storm	
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)
	0.53	**2798**	**0.78**	**4,122**
Infiltration				
Infiltration Surface Area Req'd (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	503		**740**

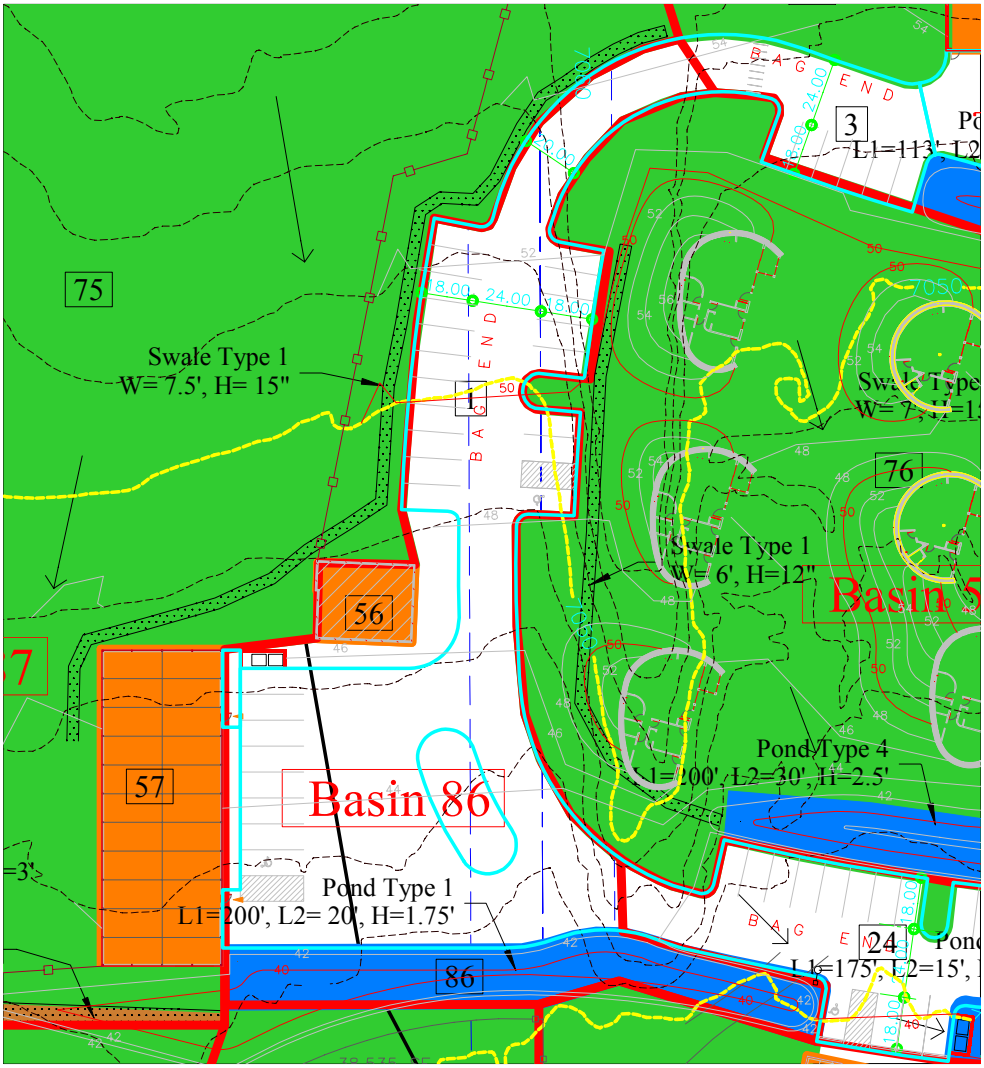
Basin 94


86
38,535 SF
in 89
49
73
Basin 94
Pond Type 1
L1=80', L2=30', H=2.5'
94


Type 1 Rectangular Infiltration Pond
Top Length L1 (ft)
L1= 80', L2= 30', H=2.5'
Bottom Width (ft)
Top
Width L2 (ft)
Contours
Bottom Length (ft)

Infiltration Pond #94	Hydrology File		49+73+94 to 94.hys		
Infiltration Test	Entech PH2				
Infiltration Rate (inches / hour / sf)	1.67				
Infiltration Rate (IR = ft / hour /sf)	0.139166667				
Receive Flows from :	49,73,94				
	Area (ac)	Reach Length (Ft)	Slope	Coeff (C)	Tc (min)
Roof #49	0.0500			0.95	
Roof				0.95	
Basin #73	0.7804	270	3.0%	0.2	88.3
Pond # 94	0.0550			1	
Total	0.8854				
Flow Coefficient of Runoff	0.2900				
Composite Area	0.8854				
Composite Curve #					
Hydrology Input	Tc (min)	Composite Curve			
	88.3				
	10 yr Storm		100 yr Storm		
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)	
	0.53	**2798**	**0.78**	**4,122**	
Infiltration					
Infiltration Surface Area Req'd (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	503		**740**	
Trapezoidal Pond Sizing	Input Values				
Side Slope X:1	3				
Pond Top Length (ft)	80	L			
Pond Top Width (ft)	30	W			
Pond Bottom Length (ft)	65	l			
Pond Bottom Width (ft)	15	w			
Depth (ft)	2.5	h			
Infiltation Surface Area - FULL (sf)	2400				
Full Volume (cf)	4,125	Greater Than	4,122		
Water Surface Area - FULL (sf)	2400				
Water Surface Area at HALF FULL	1687.5	Greater than	740		
Water Surface Area - EMPTY (sf)	975	Greater than	740		
NOTES					

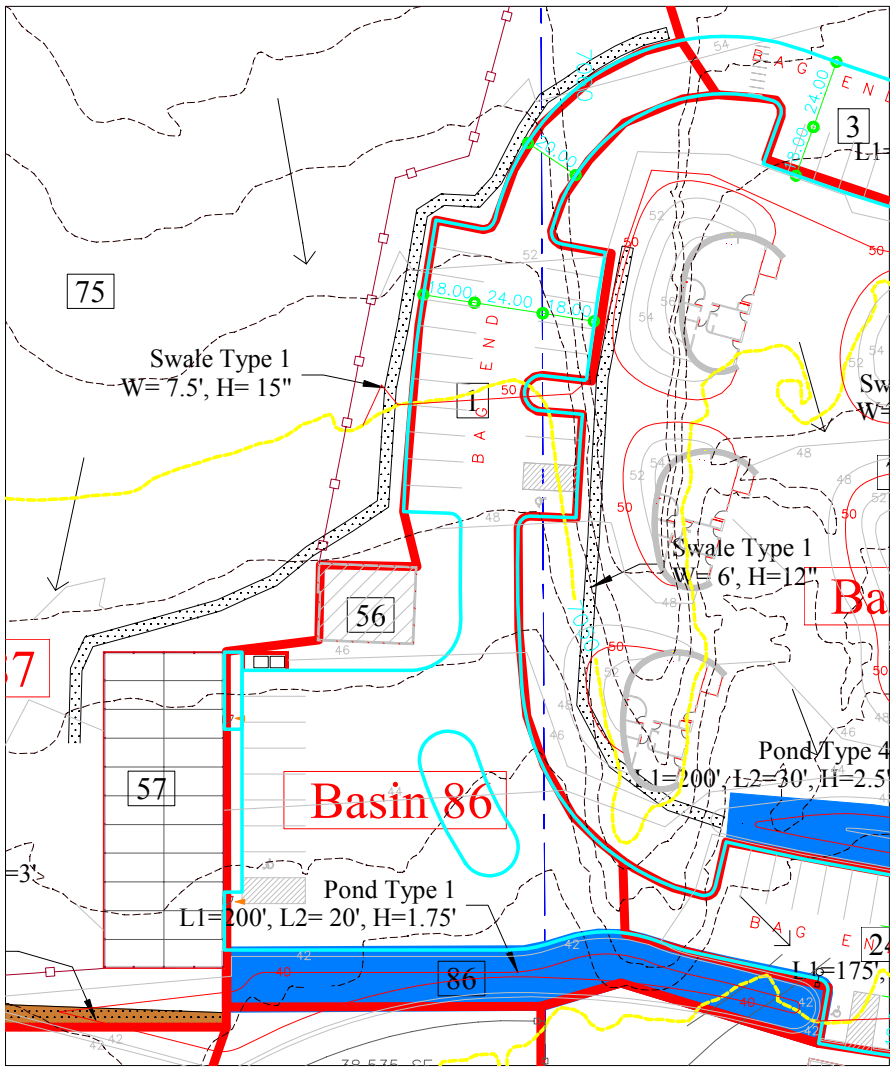
Basin 86



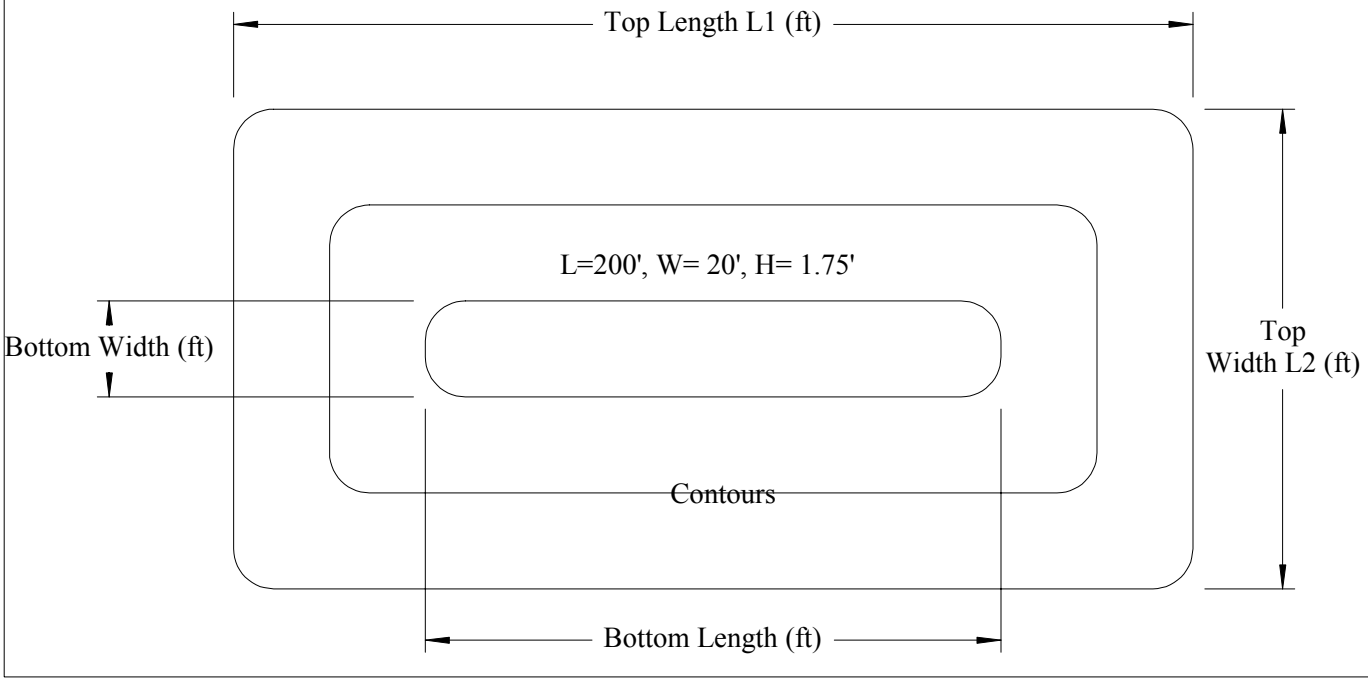
Pond 86 infiltrates waters from the gravel roadway #1 and a small shed #56. Runoff flows via sheet flow to pond #86.

	10 yr Storm		100 yr Storm	
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)
	2.49	**3432**	**3.49**	**4,821**
Infiltration				
Infiltration Surface Area Req'd to drain within 40 hrs (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	617		**866**

Basin 86

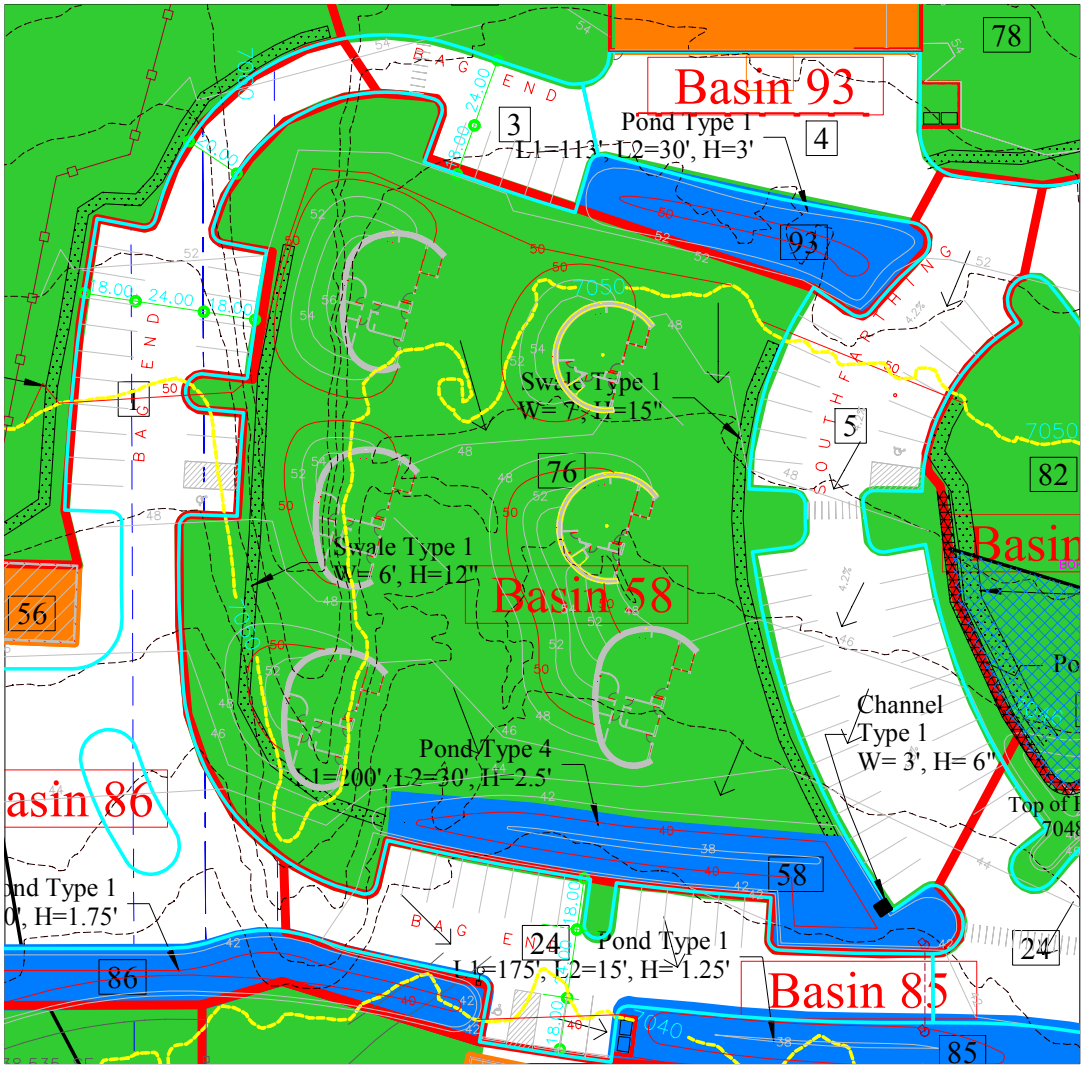


Type 1 Rectangular Infiltration Pond



Infiltration Pond #86	Hydrology File		1+56+86.hys		
Infiltration Test	Entech PH2				
Infiltration Rate (inches / hour / sf)	1.67				
Infiltration Rate (IR = ft / hour /sf)	0.139166667				
Receive Flows from :	1, 56, 86				
	Area (ac)	Reach Length (Ft)	Slope	Coeff (C)	Tc (min)
Roof					
Roof #56	0.02			0.95	
Roads Gravel #1	0.507	313	4.5%	0.85	23.1
Roads Asphalt				0.95	
Land		313	4.5%	0.2	83.0
Pond # 86	0.094			1	
Total	0.621	ac			
Flow Coefficient of Runoff	0.880				
Composite Area	0.621				
Composite Curve #					
Hydrology Input	Tc (min)				
	23.1				
	10 yr Storm		100 yr Storm		
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)	
	2.49	**3432**	**3.49**	**4,821**	
Infiltration					
Infiltration Surface Area Req'd to drain within 40 hrs (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	617		**866**	
Pond Sizing - Truncated Rectangular Pyramid					
Side Slope X:1	3				
Pond Top Length (ft)	**200**	L			
Pond Top Width (ft)	**20**	W			
Pond Bottom Length (ft)	176	l			
Pond Bottom Width (ft)	9.5	w			
Depth (ft)	**1.75**	h			
Infiltation Surface Area - FULL (sf)	4000				
Full Volume (cf)	4,890	Greater than	4,821		
Water Surface Area - FULL (sf)	4000				
Water Surface Area at HALF FULL	2836	Greater than	866		
Water Surface Area - EMPTY (sf)	1672				

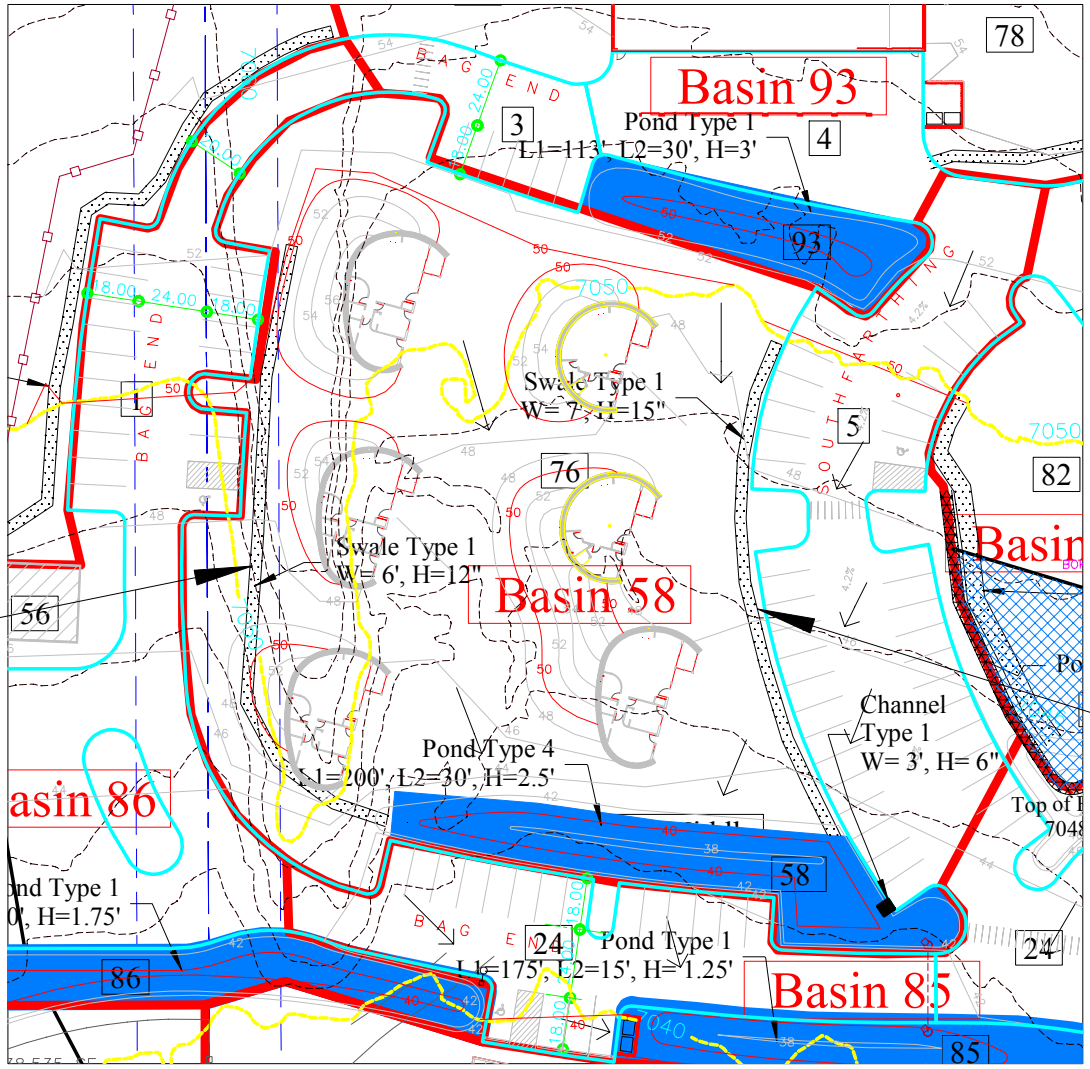
Basin 58



Pond 58 collects waters from paved area #5 and landscaped area #76 via grassed swales and sheet flow from land. The six small buildings are earth sheltered and their area has been included as roofs.

	10 yr Storm		100 yr Storm	
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)
From #5 only	1.67	1304	2.31	1801
From #76 only	0.81	4418	1.19	6517
Aggregate	**2.48**	**5,722**	**3.5**	**8,318**
Infiltration				
Infiltration Surface Area Req'd (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	1,028		**1,494**

Basin 58



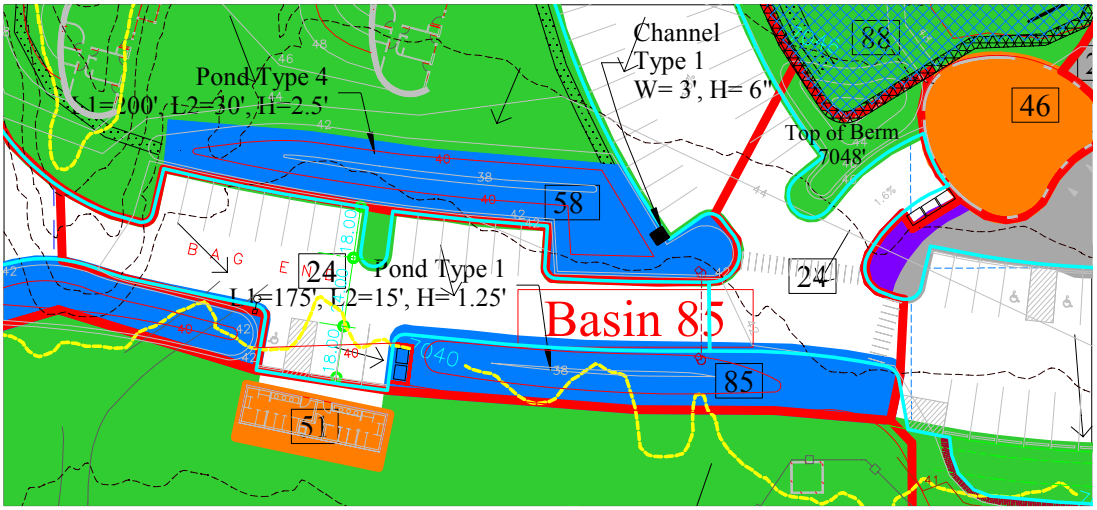
Pond 58 infiltrates waters and is generally trapezoidal with the dimensions shown. Both swales are Type 2 which begin a minimum of 2' wide and finish with the dimensions shown.

Channel Parameters	
Bottom Width (ft) b	1.5
Side Slope X:1	3
Depth (ft) H	0.75
Top Width (ft) W	6
Flow Area	
Area (sf)	2.8125
Wetted Perimeter	6.24341649
Hydraulic Radius	0.450474513
Flow Calc	
Slope (%)	3.0%
Mannings (n)	0.3
Velocity (ft/sec)	0.505789734
Area (sf)	2.8125
Flow (cf/sec)	1.422533627

Channel Parameters	
Bottom Width (ft) b	1
Side Slope X:1	3
Depth (ft) H	1
Top Width (ft) W	7
Flow Area	
Area (sf)	4
Wetted Perimeter	7.32455532
Hydraulic Radius	0.546108238
Flow Calc	
Slope (%)	4.2%
Mannings (n)	0.3
Velocity (ft/sec)	0.683753708
Area (sf)	4
Flow (cf/sec)	2.735014831

Infiltration Pond #58	Hydrology File		5+58+76 to	58.hys	
Infiltration Test	Entech PH2				
Infiltration Rate (inches / hour / sf)	1.67				
Infiltration Rate (IR = ft / hour /sf)	0.139166667				
Receive Flows from :	5, 58,76				
	Area (ac)	Reach Length (Ft)	Slope	Coeff (C)	Tc (min)
Roof # EIH's	0.0663			0.95	
Roof				0.95	
Roads Gravel				0.85	
Roads #5 Asphalt	0.299	245	3.5%	0.95	13.3
Land #76	0.866	305	3.3%	0.2	90.8
Pond # 58	0.141			1	
Total	1.372				
Flow Coefficient of Runoff	0.40				
Composite Area	1.372				
Composite Curve #					
Hydrology Input	Tc (min)				
	70.6				
	10 yr Storm		100 yr Storm		
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)	
From #5 only	1.67	1304	2.31	1801	
From #76 only	0.81	4418	1.19	6517	
Aggregate	**2.48**	**5,722**	**3.5**	**8,318**	
Infiltration					
Infiltration Surface Area Req'd (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	1,028		**1,494**	
Pond Sizing - Truncated Rectangular Pyramid					
Side Slope X:1	3				
Pond Top Length (ft)	**200**	L			
Pond Top Width (ft)	**30**	W			
Pond Bottom Length (ft)	176	l			
Pond Bottom Width (ft)	15	w			
Depth (ft)	2.5	h			
Infiltation Surface Area - FULL (sf)	6000				
Full Volume (cf)	8,350	Greater than	8,318		
Water Surface Area - FULL (sf)	6000				
Water Surface Area at HALF FULL	4320	Greater than	1,494		
Water Surface Area - EMPTY (sf)	2640	Greater than	1,494		

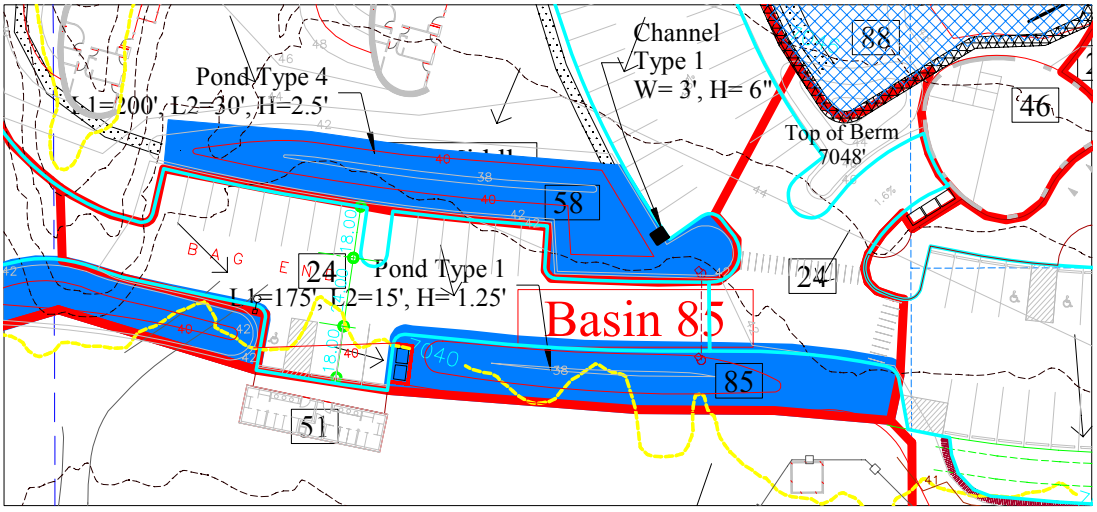
Basin 85



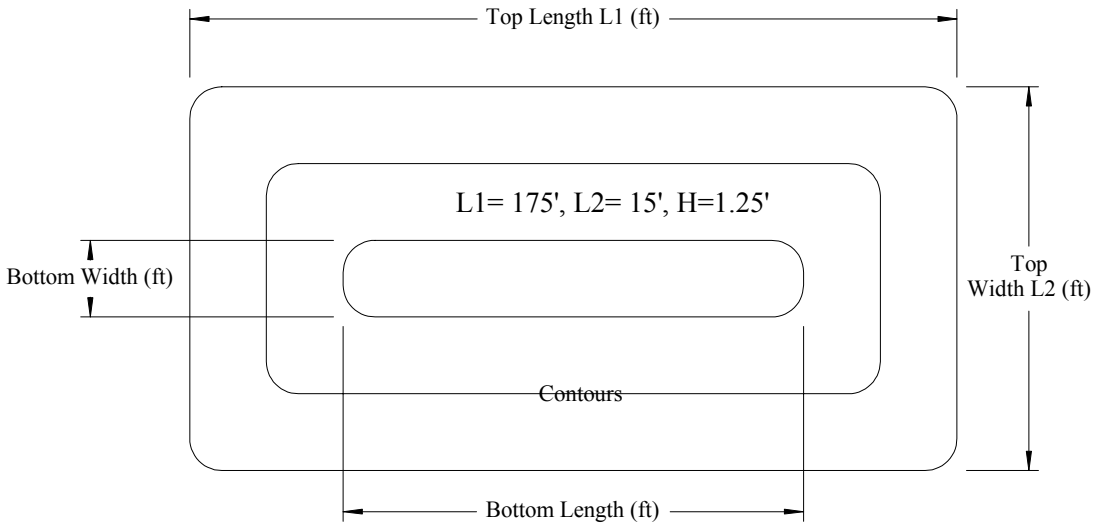
Pond #85 collects waters from mostly gravel road area #24. Waters sheet flow to pond.

	10 yr Storm		100 yr Storm	
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)
	2.42	**1343**	**3.07**	**1,842**
Infiltration				
Infiltration Surface Area Req'd (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	241		**331**

Basin 85

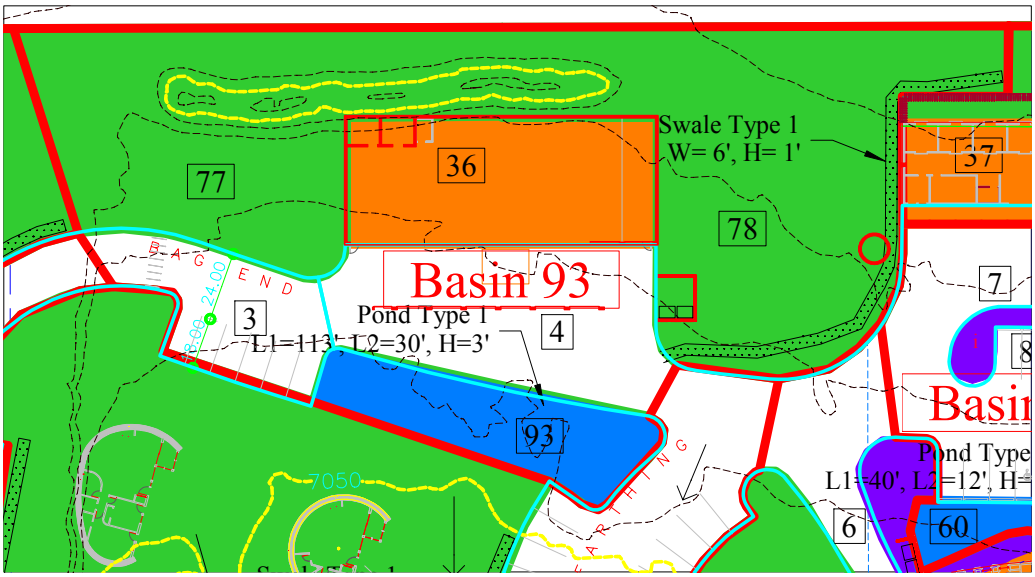


Type 1 Rectangular Infiltration Pond



Infiltration Pond #85	Hydrology File		24+85 to 85.hys		
Infiltration Test	Entech PH2				
Infiltration Rate (inches / hour / sf)	1.67				
Infiltration Rate (IR = ft / hour /sf)	0.139166667				
Receive Flows from :	24,85				
	Area (ac)	Reach Length (Ft)	Slope	Coeff (C)	Tc (min)
Roof				0.95	
Asphalt #24	0.2765	100	2.0%	0.95	10.2
Basin		100	2.0%	0.2	61.2
Pond #85	0.0799			1	
Total	0.3564				
		0.02			
Flow Coefficient of Runoff	0.9600				
Composite Area (ac)	0.3564				
Composite Curve #	0.9600				
Hydrology Input	Tc (min)	Composite Curve			
	8	0.26			
	10 yr Storm		100 yr Storm		
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)	
	2.42	**1343**	**3.07**	**1,842**	
Infiltration					
Infiltration Surface Area Req'd (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	241		**331**	
Pond Sizing - Truncated Rectangular Pyramid	Input Values				
Side Slope X:1	3				
Pond Top Length (ft)	**175**	L			
Pond Top Width (ft)	**15**	W			
Pond Bottom Length (ft)	167.5	l			
Pond Bottom Width (ft)	7.5	w			
Depth (ft)	**1.25**	h			
Infiltation Surface Area - FULL (sf)	2625				
Full Volume (cf)	2,414	Greater Than	1,842		
Water Surface Area - FULL (sf)	2625				
Water Surface Area at HALF FULL	1940.625	Greater than	331		
Water Surface Area - EMPTY (sf)	1256.25				

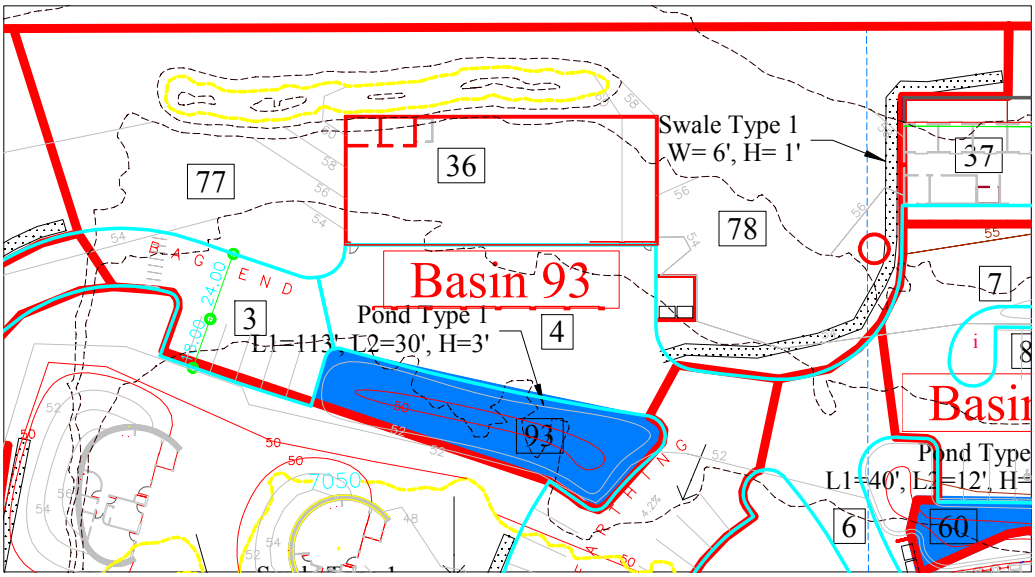
Basin 93



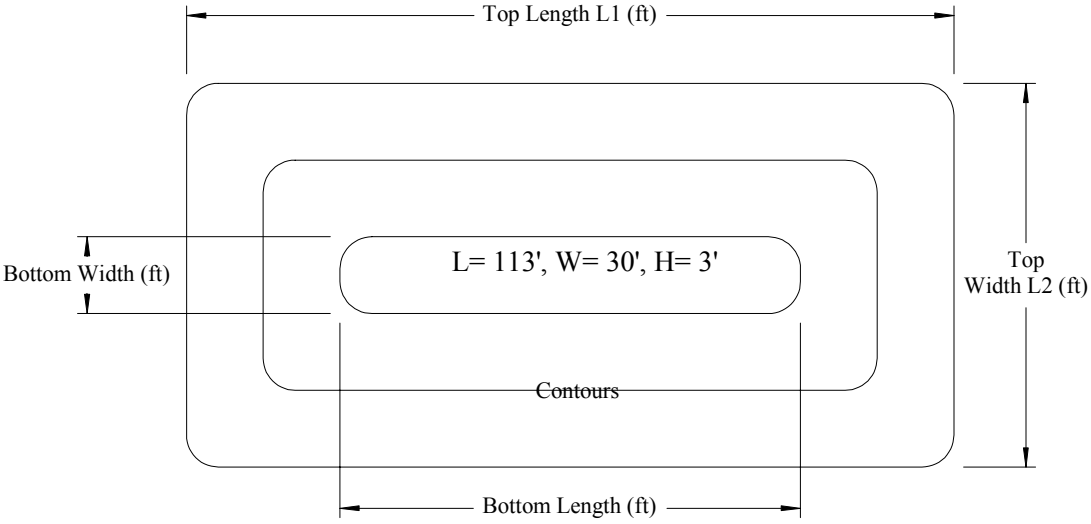
Pond #93 receives waters from land #77,78, roof #36 and pavement areas #3,4

	10 yr Storm		100 yr Storm	
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)
	1.13	**4,269**	**1.64**	**6,211**
Infiltration				
Infiltration Surface Area Req'd to drain within 40 hrs (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	767		**1,116**

Basin 93

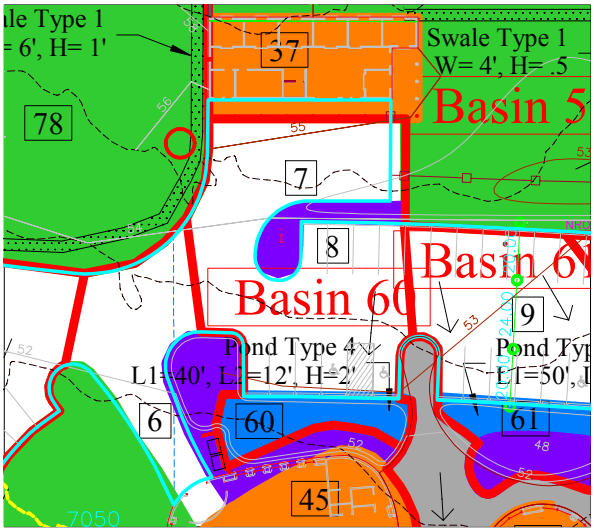


Type 1 Rectangular Infiltration Pond



Infiltration Pond #93	Hydrology File		77+36+3+4+78+93 to 93-F2.hys		
Infiltration Test	Entech PH2				
Infiltration Rate (inches / hour / sf)	1.67				
Infiltration Rate (IR = ft / hour /sf)	0.139166667				
Receive Flows from :	77,36,3,4,78,93				
	Area (ac)	Reach Length (Ft)	Slope	Coeff (C)	Tc (min)
Roof #36	0.1091			0.95	
Roof				0.95	
Roads Gravel / Pavers #3,#4	0.194			0.85	
Roads Asphalt	0.000			0.95	
Land #77,#78	0.512	161	3.7%	0.2	63.2
Pond # 93	0.078			1	
Total	0.892	ac			
Flow Coefficient of Runoff	0.500				
Composite Area	0.892				
Composite Curve #					
Hydrology Input	Tc (min)				
	63.2				
	10 yr Storm		100 yr Storm		
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)	
	1.13	**4,269**	**1.64**	**6,211**	
Infiltration					
Infiltration Surface Area Req'd to drain within 40 hrs (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	767		**1,116**	
Pond Sizing - Truncated Rectangular Pyramid					
Side Slope X:1	3				
Length (ft)	113	L			
Pond Top Width (ft)	30	W			
Pond Bottom Length (ft)	95	l			
Pond Bottom Width (ft)	12	w			
Depth (ft)	3	H			
Infiltation Surface Area - FULL (sf)	3390				
Full Volume (cf)	6,633.0	Greater than	6,211		
Water Surface Area - FULL (sf)	3390				
Water Surface Area at HALF FULL	2265	Greater than	1,116		
Water Surface Area - EMPTY (sf)	1140	Greater than	1,116		

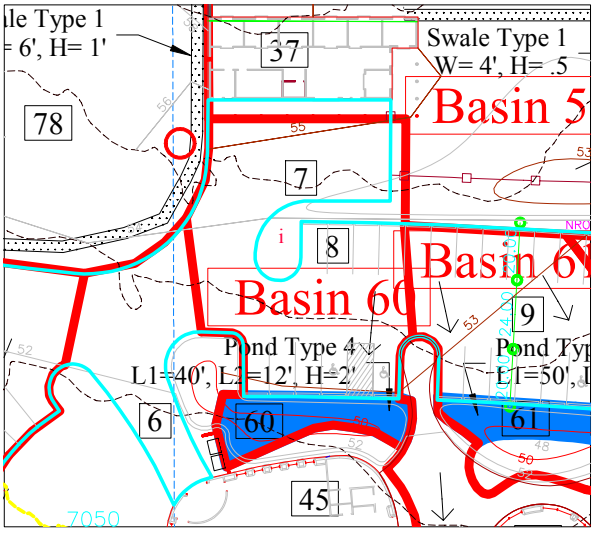
Basin 60



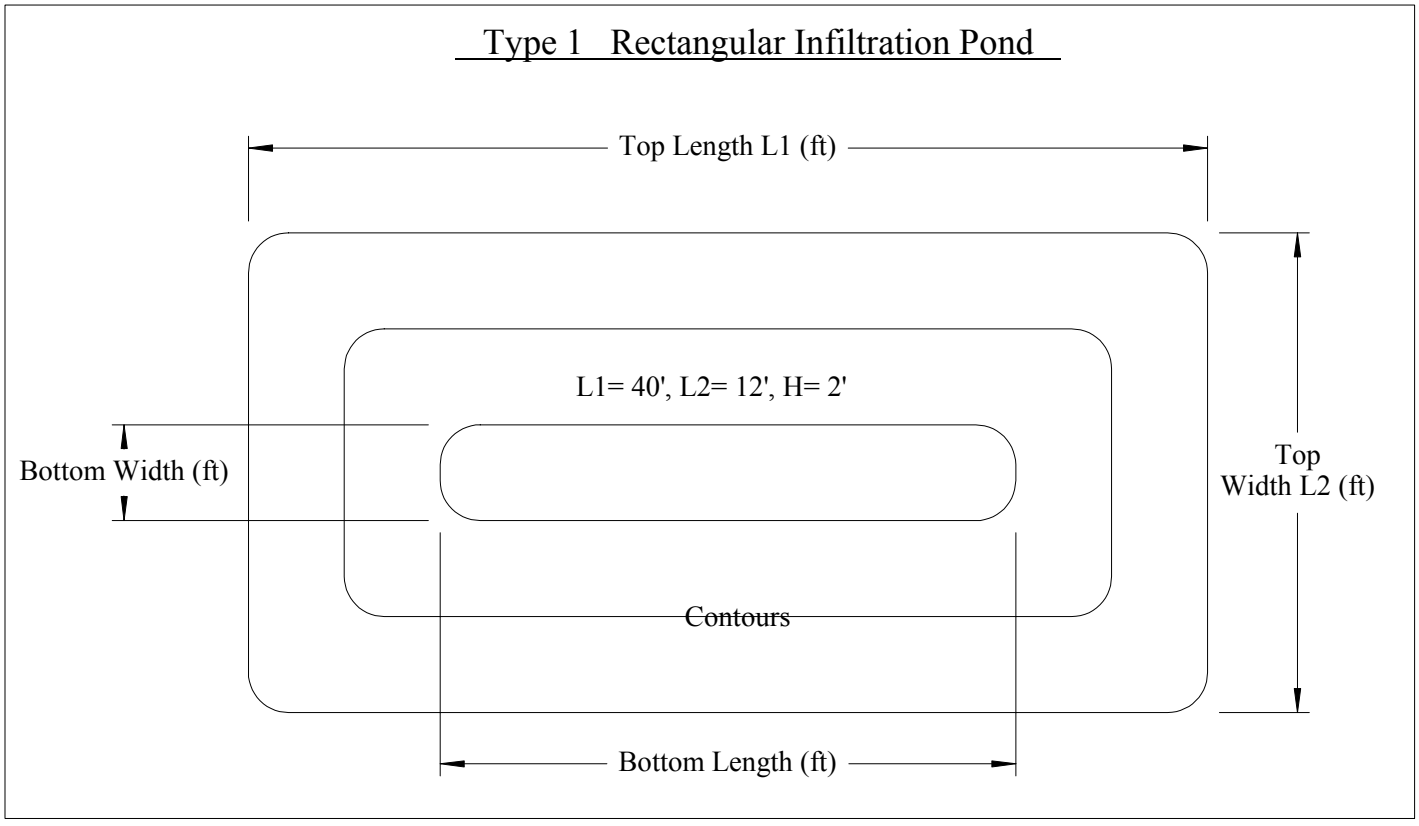
Pond #60 infiltrates waters from pavements #7, 8.

	10 yr Storm		100 yr Storm	
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)
	0.94	**564**	**1.29**	**774**
Infiltration				
Infiltration Surface Area Req'd to drain within 40 hrs (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	101		**139**

Basin 60

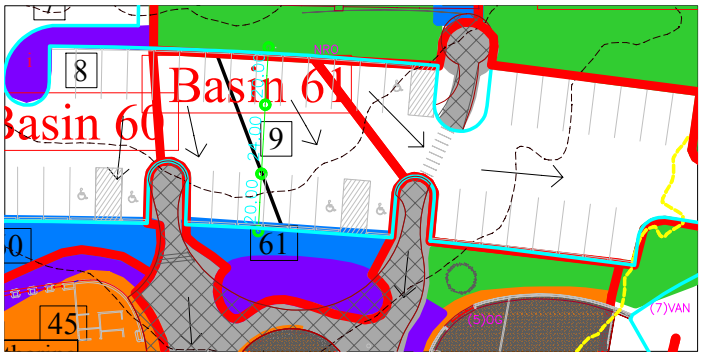


Waters sheet flow to infiltration pond #60



Infiltration Pond #60	Hydrology File		7+8+60 to 60.hys		
Infiltration Test	Entech PH2				
Infiltration Rate (inches / hour / sf)	1.67				
Infiltration Rate (IR = ft / hour /sf)	0.139166667				
Receive Flows from :	37, 7, 8, 60				
	Area (ac)	Reach Length (Ft)	Slope	Coeff (C)	Tc (min)
Roof					
Roof				0.95	
Roads Gravel #7	0.055	130	4.6%	0.85	14.7
Roads Asphalt #8	0.081	130	4.6%	0.95	8.8
Land				0.2	
Pond # 60	0.024			1	
Total	0.159	ac			
Flow Coefficient of Runoff	0.910				
Composite Area	0.159				
Composite Curve #					
Hydrology Input	Tc (min)				
	14.7				
	10 yr Storm		100 yr Storm		
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)	
	0.94	**564**	**1.29**	**774**	
Infiltration					
Infiltration Surface Area Req'd to drain within 40 hrs (CF /IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	101		**139**	
Pond Sizing - Truncated Rectangular Pyramid					
Side Slope X:1	0.1				
Pond Top Length (ft)	**40**	L			
Pond Top Width (ft)	**12**	W			
Pond Bottom Length (ft)	39.6	l			
Pond Bottom Width (ft)	11.6	w			
Depth (ft)	**2**	h			
Infiltation Surface Area - FULL (sf)	480				
Full Volume (cf)	939	Greater than	774		
Water Surface Area - FULL (sf)	480				
Water Surface Area at HALF FULL	469.68	Greater than	139		
Water Surface Area - EMPTY (sf)	459.36	Greater than	139		

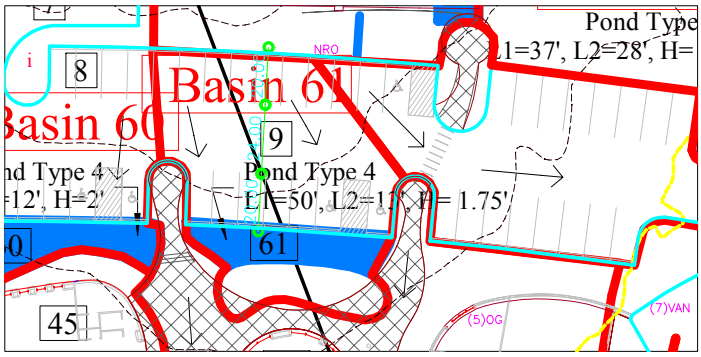
Basin 61



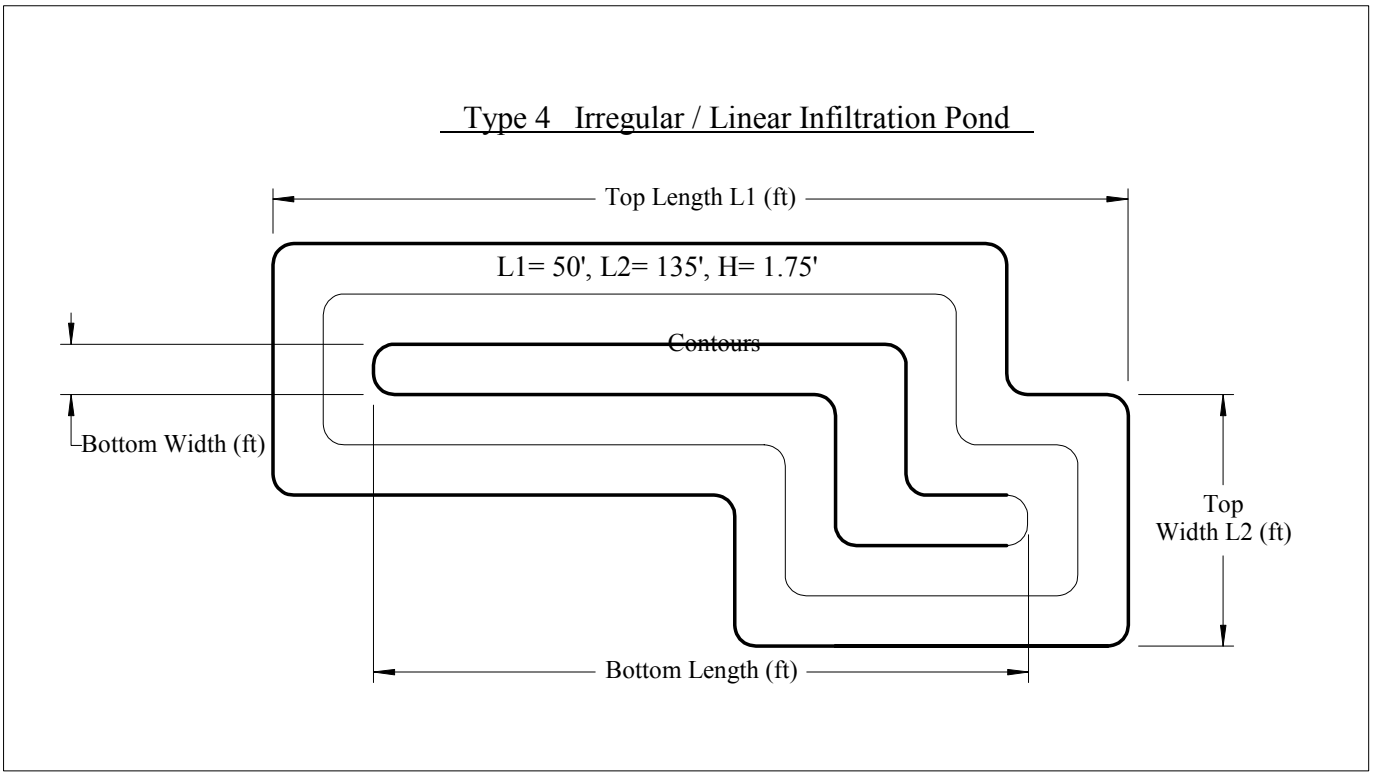
Pond #61 infiltrates waters from pavement #9. The purple area shown is a depressed garden and does no impact the runoff.

	10 yr Storm		100 yr Storm	
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)
	0.69	**290**	**0.94**	**394**
Infiltration				
Infiltration Surface Area Req'd to drain within 40 hrs (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	52		**71**

Basin 61

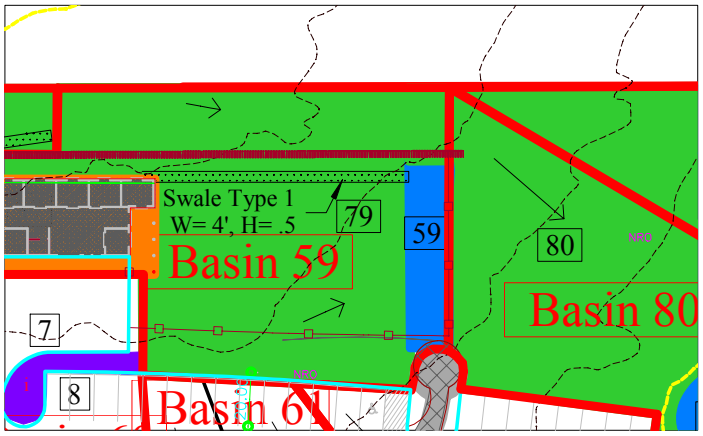


Waters sheet flow directly to infiltration pond #61



Infiltration Pond #61	Hydrology File		9+61 to 61.hys		
Infiltration Test	Entech PH2				
Infiltration Rate (inches / hour / sf)	1.67				
Infiltration Rate (IR = ft / hour /sf)	0.139166667				
Receive Flows from :	9, 61				
	Area (ac)	Reach Length (Ft)	Slope	Coeff (C)	Tc (min)
Roof				0.95	
Roof				0.95	
Roads Gravel				0.85	
Roads Asphalt #9	0.093	60	3.3%	0.95	6.7
Land	0.015			0.2	
Pond # 61	0.015			1	
Total	0.123	ac			
Flow Coefficient of Runoff	0.960				
Composite Area	0.123				
Composite Curve #					
Hydrology Input	Tc (min)				
	6.7				
	10 yr Storm		100 yr Storm		
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)	
	0.69	**290**	**0.94**	**394**	
Infiltration					
Infiltration Surface Area Req'd to drain within 40 hrs (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	52		**71**	
Pond Sizing - Truncated Rectangular Pyramid					
Side Slope X:1	3				
Pond Top Length (ft)	**50**	L			
Pond Top Width (ft)	**13**	W			
Pond Bottom Length (ft)	39.5	l			
Pond Bottom Width (ft)	2.5	w			
Depth (ft)	**1.75**	h			
Infiltation Surface Area - FULL (sf)	650				
Full Volume (cf)	623	Greater than	394		
Water Surface Area - FULL (sf)	650				
Water Surface Area at HALF FULL	374.375	Greater than	71		
Water Surface Area - EMPTY (sf)	98.75	Greater than	71		

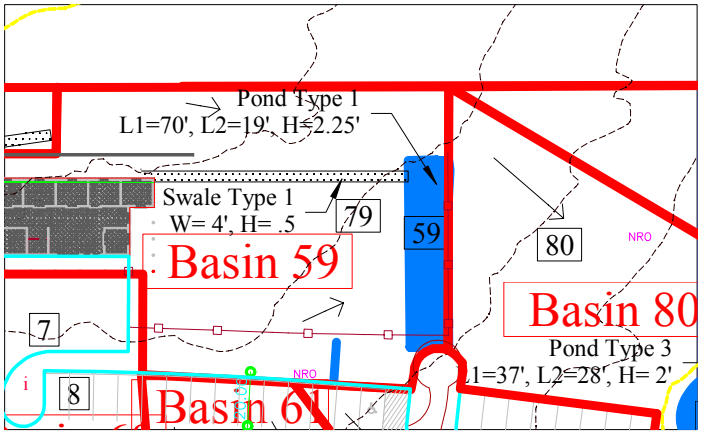
Basin 59

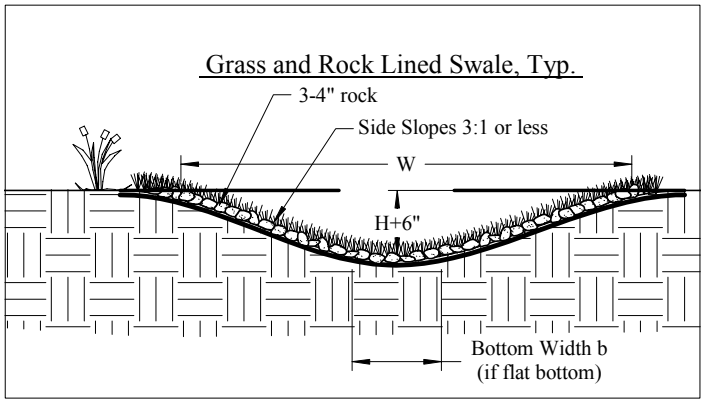


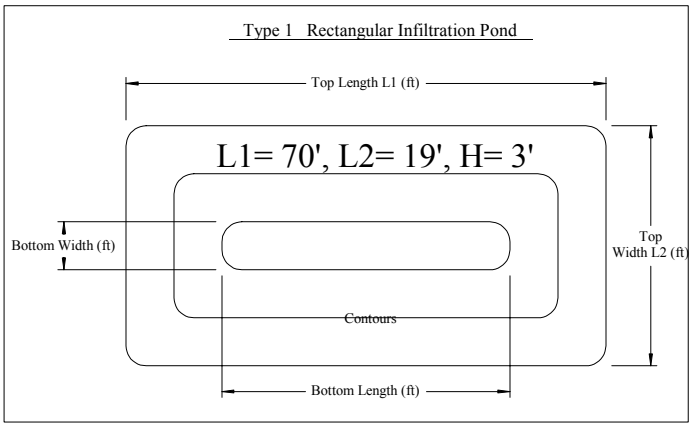
Pond #59 receives waters from area #79 which has a corral for goats etc. This is assumed to be fairly compacted soil so a runoff coefficient of .85 was used.

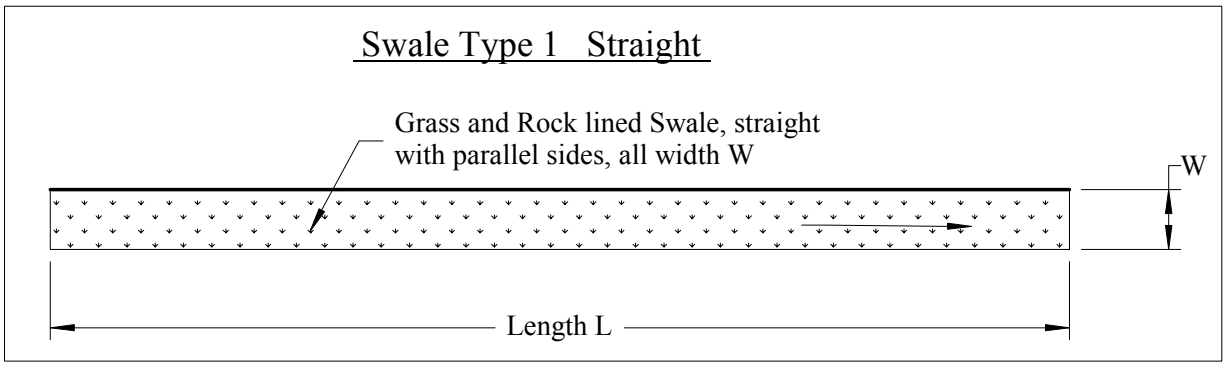
	10 yr Storm		100 yr Storm	
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)
	1.93	**1391**	**2.66**	**1,917**
Infiltration				
Infiltration Surface Area Req'd to drain within 40 hrs (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	250		**344**

Basin 59





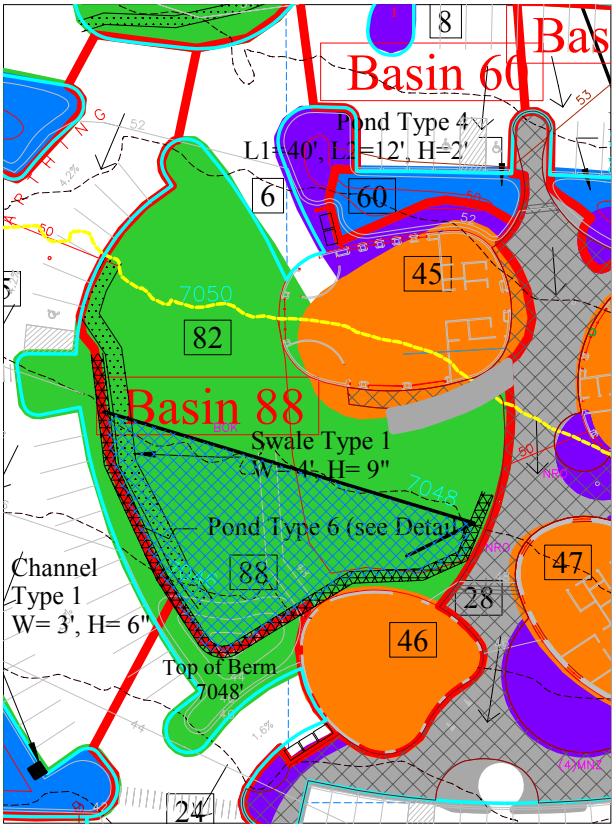




Channel Parameters		
Bottom Width (ft) b	1.00	b
Side Slope X:1	3.00	
Depth (ft) h	0.50	H
Top Width (ft) W	4.00	W
Flow Area		
Area (sf)	1.25	
Wetted Perimeter	4.16	
Hydraulic Radius	0.30	
Flow Calc		
Slope (%)	1.25%	
Mannings (n)	0.03	
Velocity (ft/sec)	2.49	
Area (sf)	1.25	
Flow (cf/sec)	**3.12**	

Infiltration Pond #59	Hydrology File		37+79+59 to 59-F2.hys		
Infiltration Test	Entech PH2				
Infiltration Rate (inches / hour / sf)	1.67				
Infiltration Rate (IR = ft / hour /sf)	0.139166667				
Receive Flows from :	79, 59				
	Area (ac)	Reach Length (Ft)	Slope	Coeff (C)	Tc (min)
Roof					
Roof #37	0.0562	100	2.1%	0.95	10.0
Roads Gravel				0.85	
Roads Asphalt				0.95	
Land #79	0.270	108	3.8%	0.85	14.3
Pond # 59	0.034			1	
Total	0.361	ac			
Flow Coefficient of Runoff	0.350				
Composite Area	0.361				
Composite Curve #					
Hydrology Input	Tc (min)				
	14.3				
	10 yr Storm		100 yr Storm		
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)	
	1.93	**1391**	**2.66**	**1,917**	
Infiltration					
Infiltration Surface Area Req'd to drain within 40 hrs (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	250		**344**	
Pond Sizing - Truncated Rectangular Pyramid					
Side Slope X:1	3				
Pond Top Length (ft)	**70**	L			
Pond Top Width (ft)	**19**	W			
Pond Bottom Length (ft)	52	l			
Pond Bottom Width (ft)	1	w			
Depth (ft)	**3**	h			
Infiltation Surface Area - FULL (sf)	1330				
Full Volume (cf)	1,911	TOO SMALL	1,917		
Water Surface Area - FULL (sf)	1330				
Water Surface Area at HALF FULL	691	Greater than	344		
Water Surface Area - EMPTY (sf)	52	TOO SMALL	344		

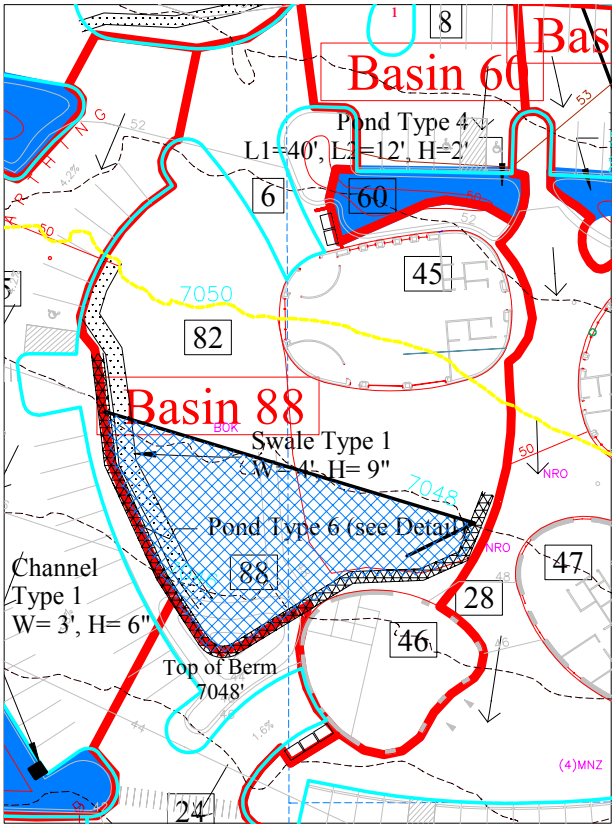
Basin 88



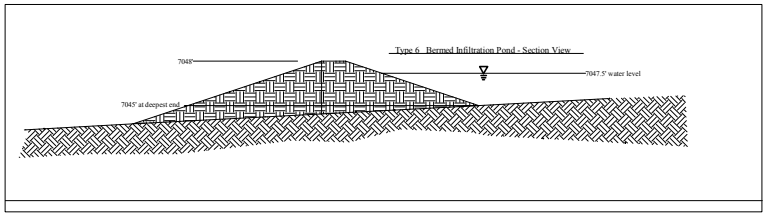
Pond #88 collects waters from land #82, roofs #45, 46 and pavement #6. Waters are conveyed to Pond 88 via grass swales. This pond is impounded by vegetated berms. See Plan and Detail DR-2

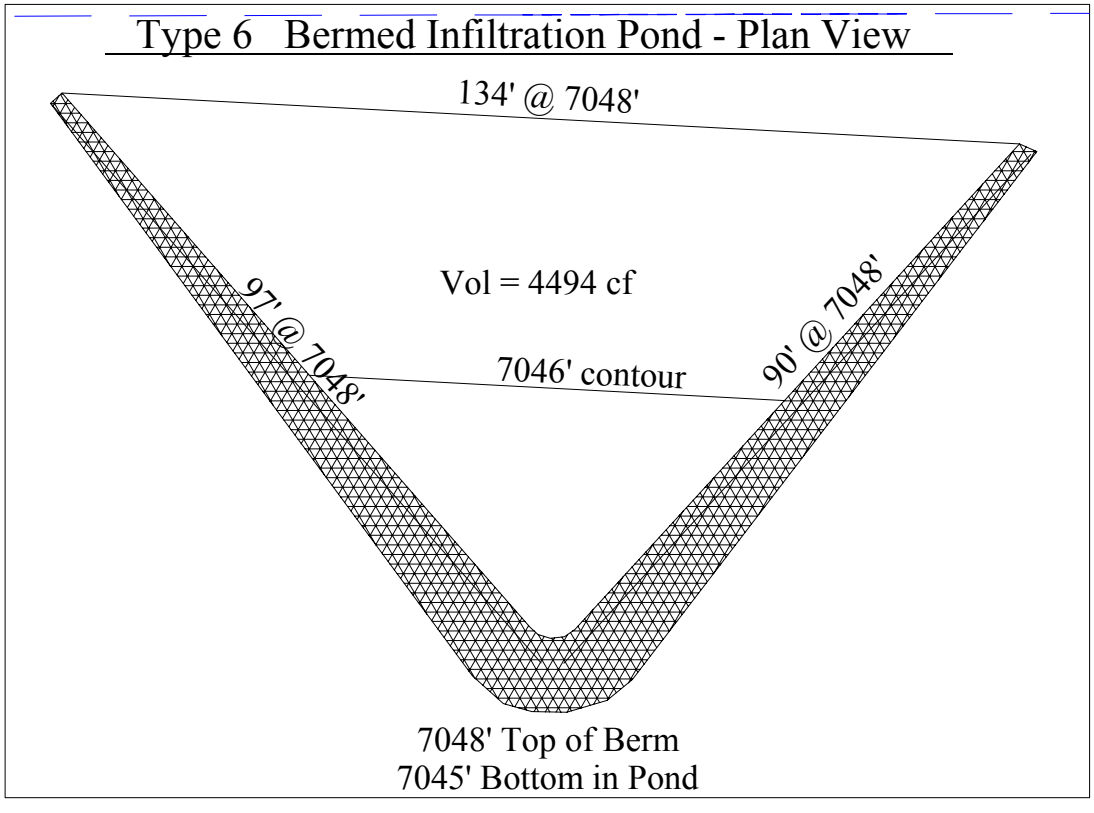
	10 yr Storm		100 yr Storm	
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)
	0.92	**2993**	**1.34**	**4,330**
Infiltration				
Infiltration Surface Area Req'd to drain within 40 hrs (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	538		**778**

Basin 88



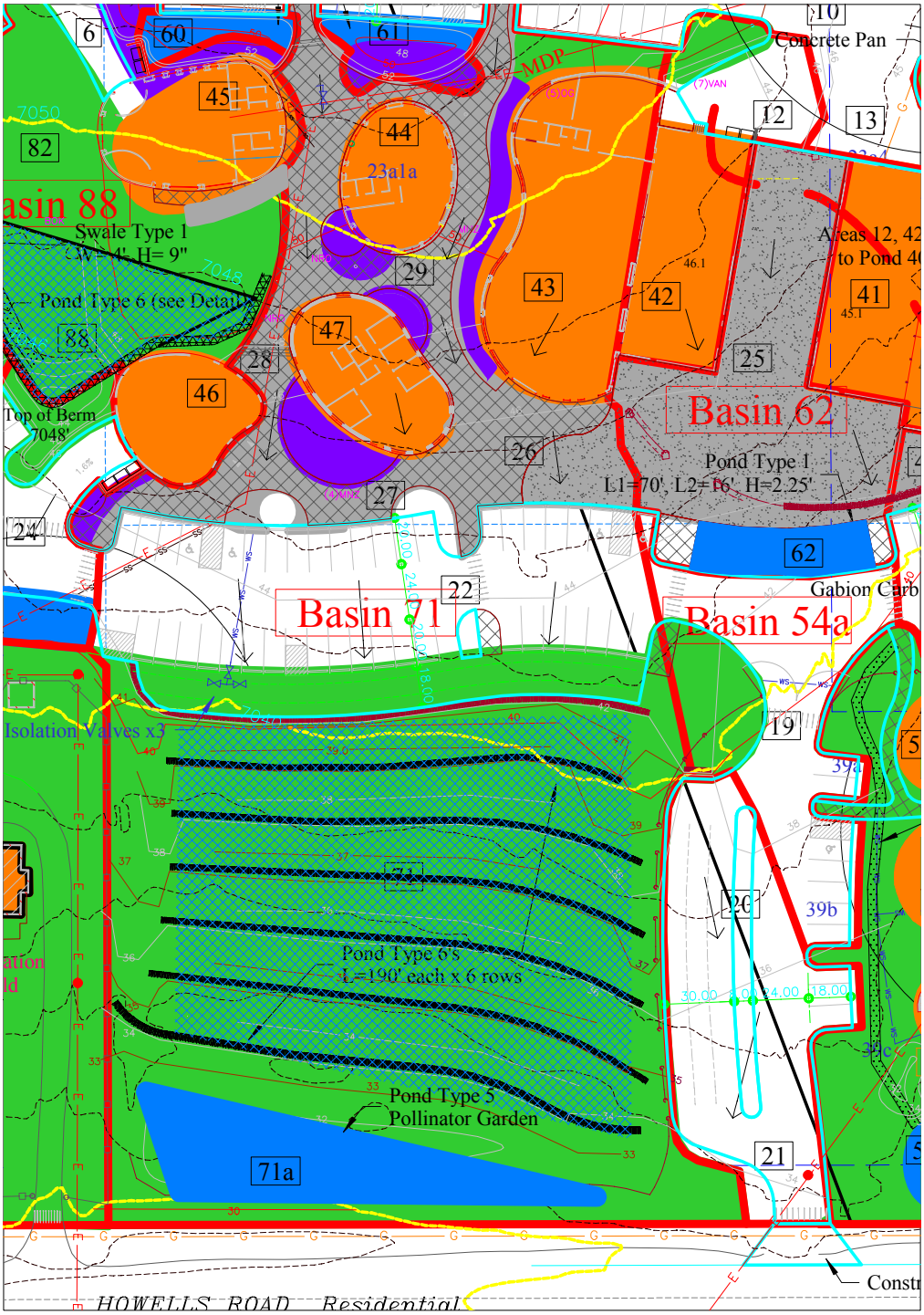
Channel Parameters	
Bottom Width (ft) b	1.00
Side Slope X:1	3.00
Depth (ft) H	**0.50**
Top Width (ft) T	**4.00**
Flow Area	
Area (sf)	1.25
Wetted Perimeter	4.16
Hydraulic Radius	0.30
Flow Calc	
Slope (%)	0.05
Mannings (n)	2.86%
Velocity (ft/sec)	5.41
Area (sf)	1.25
Flow (cf/sec)	6.76





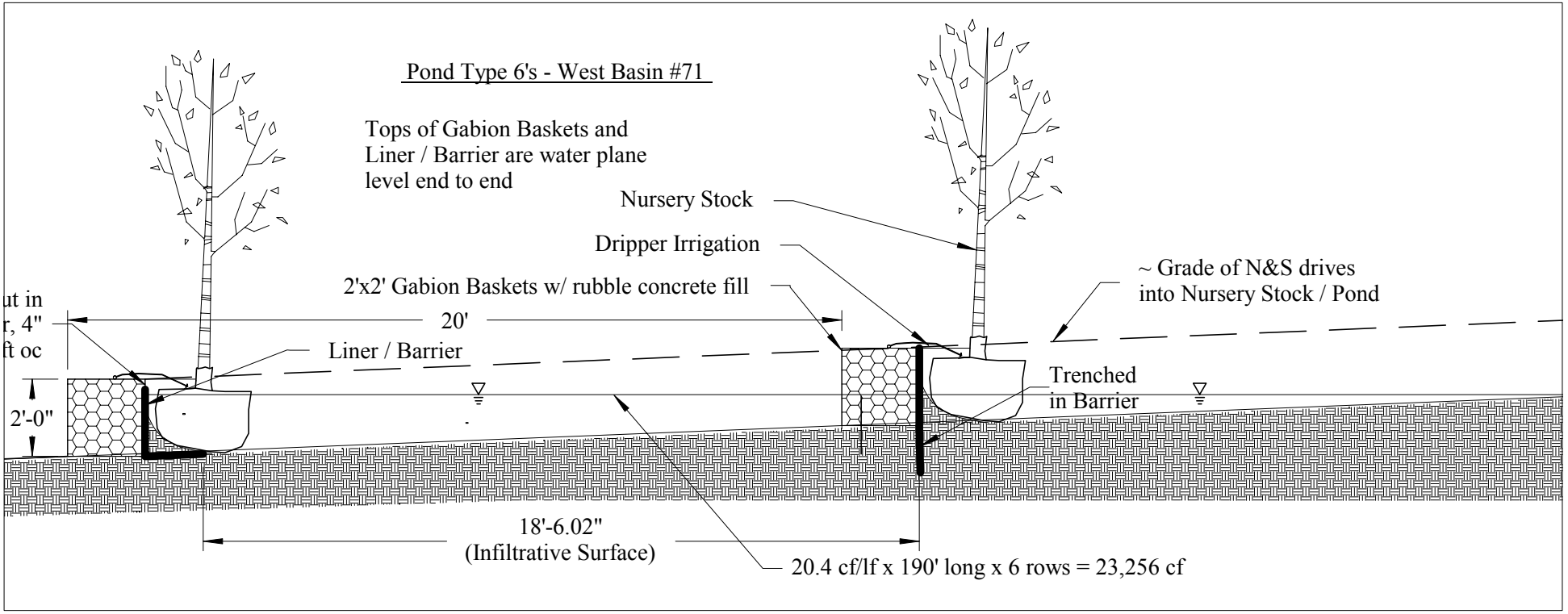
Infiltration Pond #88	Hydrology File		6+45+46+82 to 88.hys		
Infiltration Test	Entech PH2				
Infiltration Rate (inches / hour / sf)	1.67				
Infiltration Rate (IR = ft / hour /sf)	0.139166667				
Receive Flows from :	6, 45, 46, 82, 88				
	Area (ac)	Reach Length (Ft)	Slope	Coeff (C)	Tc (min)
Roof #45,#46	0.1473			0.95	
Roof				0.95	
Roads Gravel				0.85	
Roads Asphalt #6	0.069			0.95	
Land #82 + .5 * #88	0.261	150	5.3%	0.2	54.2
Pond # 88 x .5	0.070			1	
Total	0.547	ac			
Flow Coefficient of Runoff	0.200				
Composite Area	0.547				
Composite Curve #	0.52				
Hydrology Input	Tc (min)	7.4			
	10 yr Storm		100 yr Storm		
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)	
	0.92	**2993**	**1.34**	**4,330**	
Infiltration					
Infiltration Surface Area Req'd to drain within 40 hrs (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	538		**778**	
Half Triangular Prism Volume					
Side a	134				
Side b	90				
Side c	97				
Height h	2.2				
Semi Perimeter (lf)	160.5	(a+b+c)/2			
Base Area (sf)	6134.5	sf			
Volume = (cf) triangle based pyramid	4494.1	cf = 1/3 x Base Area x h			
Water Surface Area - FULL (sf)	6134.5	far Greater than	4,330		
			1		
Full Volume (cf)	4494.1	Greater than	4,330		

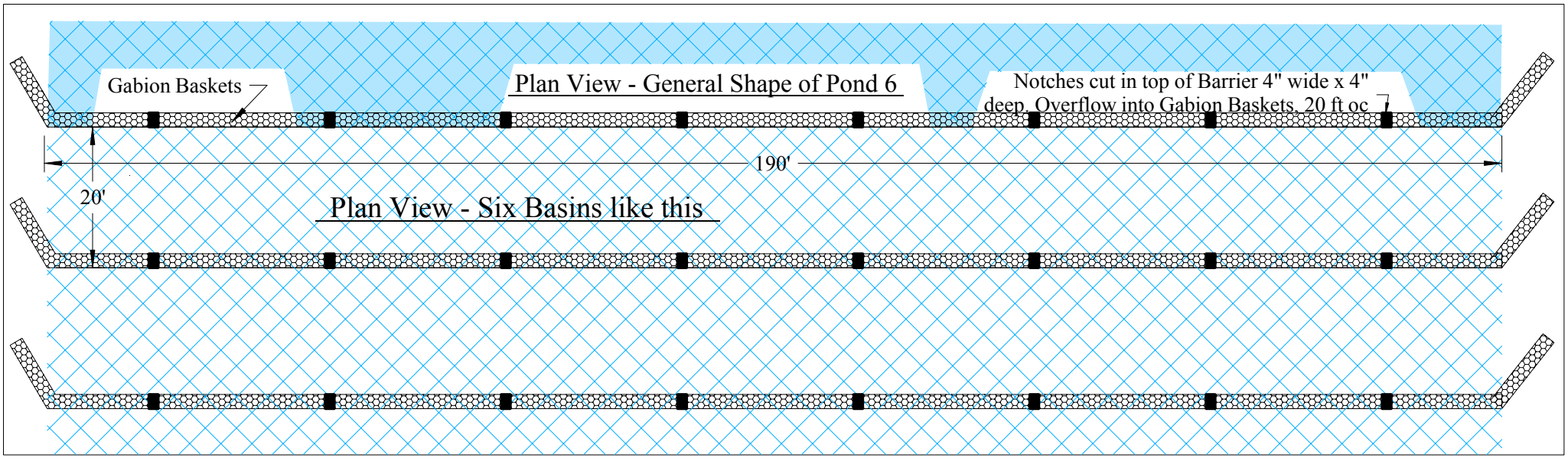
Basin 71



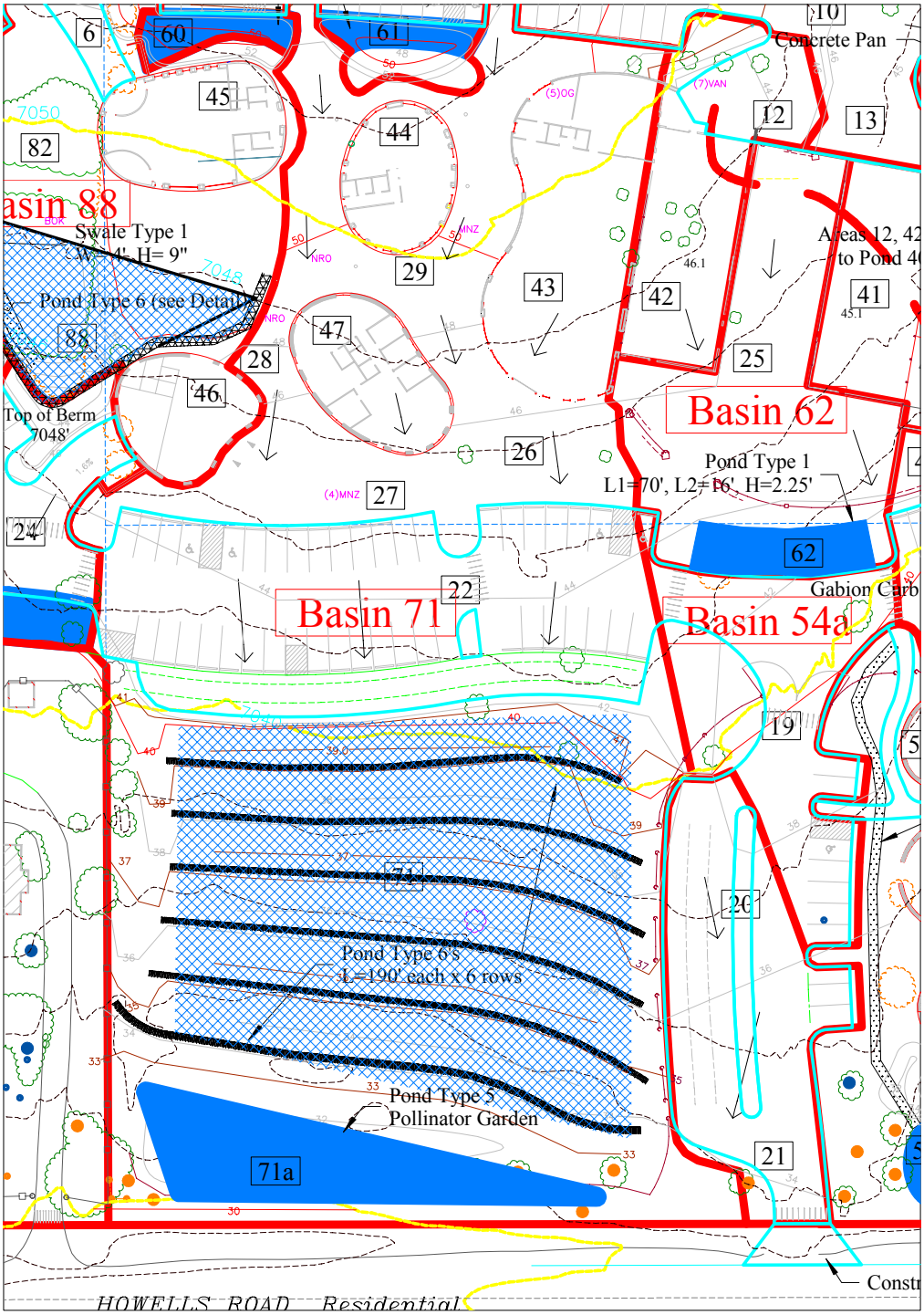
Basin 71 is the largest collecting waters from roofs #42,43,44, pavers #26,27,28,29, pavement #22 and the Nursery area #71. The Nursery area is where 'ball and burlap' trees are staged for sale in wide rows separated by Gabion basket 'dams', all of which are infiltration ponds. Pond #71a captures any waters that fall below the last 'dam'. It's irregular in shape and depth.

Basin 71


Pond Type 6's - West Basin #71
Tops of Gabion Baskets and
Liner / Barrier are water plane
level end to end
Nursery Stock
Dripper Irrigation
2'x2' Gabion Baskets w/ rubble concrete fill
~ Grade of N&S drives
into Nursery Stock / Pond
ut in
r, 4"
ft oc
20'
Liner / Barrier
Trenched
in Barrier
2'-0"
18'-6.02"
(Infiltrative Surface)
20.4 cf/lf x 190' long x 6 rows = 23,256 cf

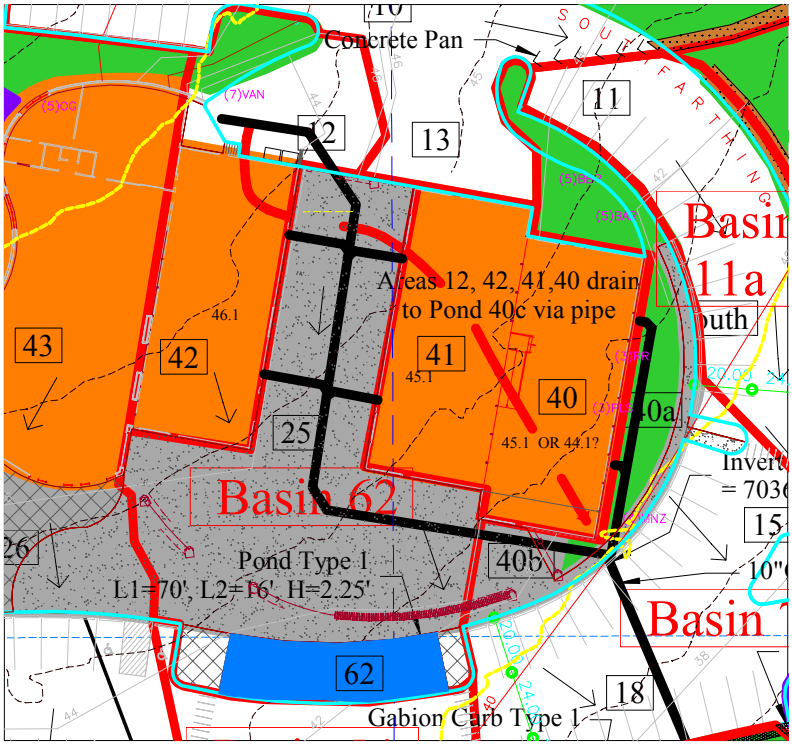

Gabion Baskets
Plan View - General Shape of Pond 6
Notches cut in top of Barrier 4" wide x 4"
deep, Overflow into Gabion Baskets, 20 ft oc
190'
20'
Plan View - Six Basins like this

Basin 71


Basin 88
Swale Type 1
W= 4', H= 9"
Pond Type 6 (see Detail)
Top of Berm
7048'
Basin 71
Basin 62
Pond Type 1
L1=70', L2=16', H=2.25'
Basin 54a
Gabion Curb
Pond Type 6's
L=190' each x 6 rows
Pond Type 5
Pollinator Garden
Concrete Pan
Areas 12, 42
to Pond 4
HOWELLS ROAD Residential
Constr

Infiltration Pond #71 Half	Hydrology File		26+27+28+	29+43+44+47+22+71 to 71H.hys	
Infiltration Test	Entech PH2				
Infiltration Rate (inches / hour / sf)	1.67				
Infiltration Rate (IR = ft / hour /sf)	0.139166667				
Receive Flows from :	26,27,28,29,44,47,43,22,71				
	Area (ac)	Reach Length (Ft)	Slope	Coeff (C)	Tc (min)
Roof #43,#44,#47	0.3374			0.95	
Roof				0.95	
Roads Gravel / Pavers #26,#27,#28,#29	0.373			0.85	
Roads Asphalt #22	0.318			0.95	
Land #71	0.650	300	3.8%	0.7	38.1
Pond # 71	0.650			1	
Total	2.329	ac			
Flow Coefficient of Runoff	0.700				
Composite Area	2.329				
Composite Curve #	0.79				
Hydrology Input	Tc (min)				
	38.0				
	10 yr Storm		100 yr Storm		
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)	
	7.03	**16,019**	**10.04**	**22,882**	
Infiltration					
Infiltration Surface Area Req'd to drain within 40 hrs (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	2,878		**4,111**	
Pond Sizing					
Side Slope X:1	3				
Pond Top Length (ft) 6 x 190' ea	1140	L			
Pond Top Width (ft)	20	W			
Pond Bottom Length (ft)	1129.5	l			
Pond Bottom Width (ft)	9.5	w			
Depth (ft) ave depth of water between Gabions	1.75	h			
Infiltation Surface Area - FULL (sf)	22800				
Full Volume (cf)	**29,307**	**Greater than**	**22,882**		
Water Surface Area - FULL (sf)	22800				
Water Surface Area at HALF FULL	16765.125	Greater than	4,111		
Water Surface Area - EMPTY (sf)	10730.25				
Overflow into Pond 71a					

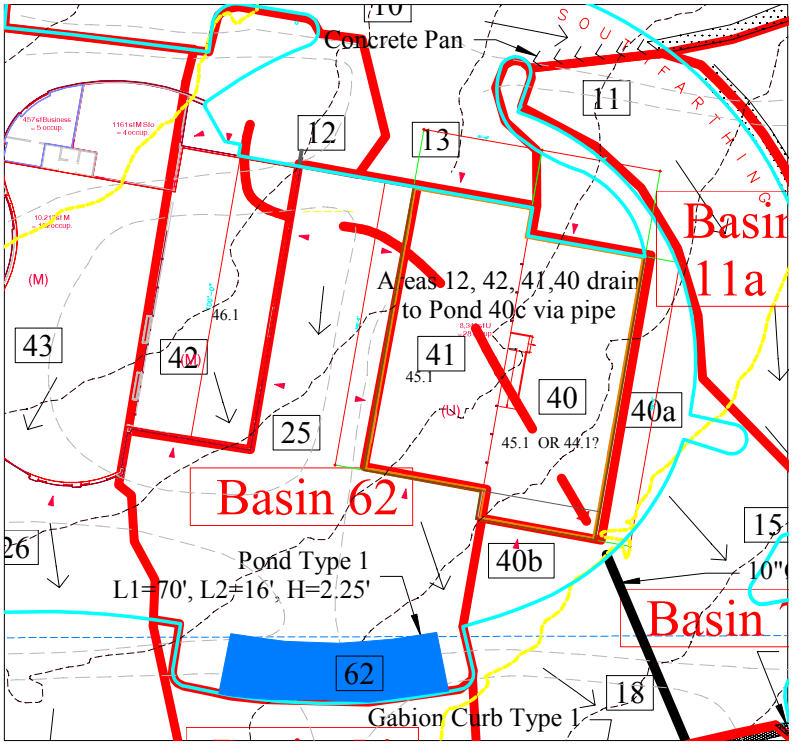
Basin 62



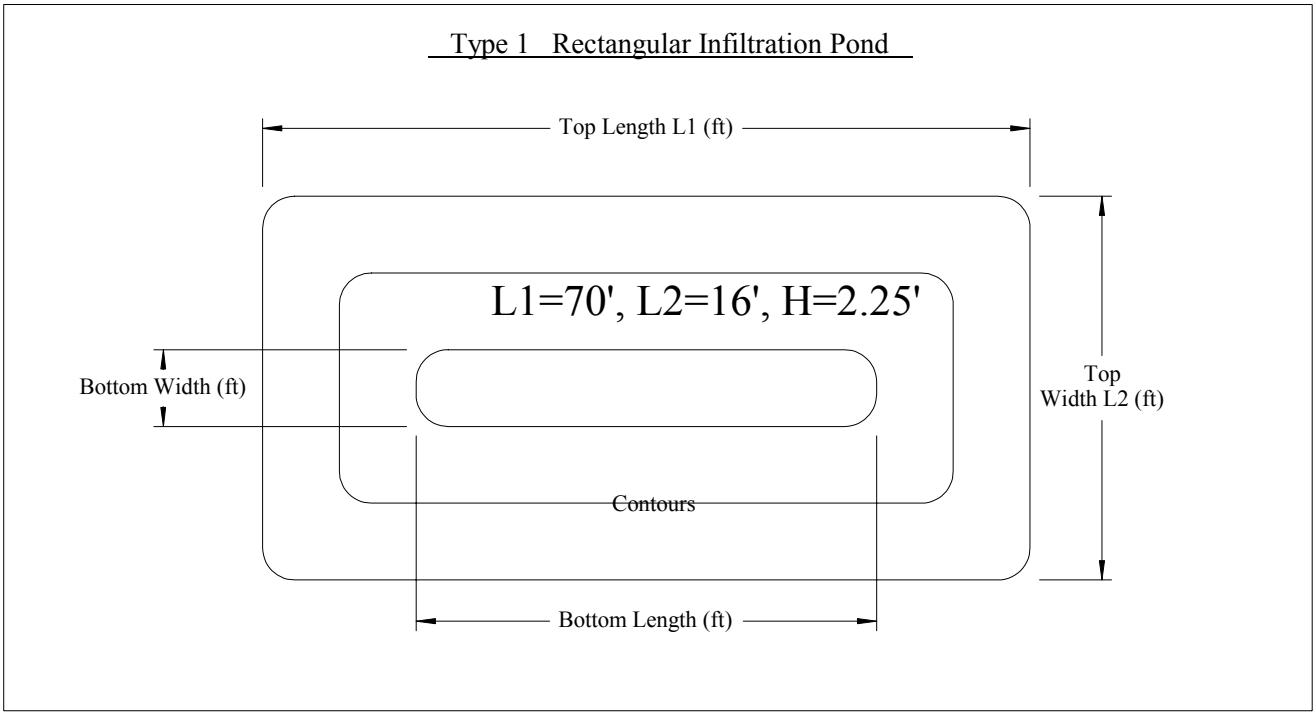
Pond 62 receives waters from plaza pavers #25. All waters sheet flow to pond.

	10 yr Storm		100 yr Storm	
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)
	1.66	**1495**	**2.3**	**2,072**
Infiltration				
Infiltration Surface Area Req'd to drain within 40 hrs (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	269		**372**

Basin 62

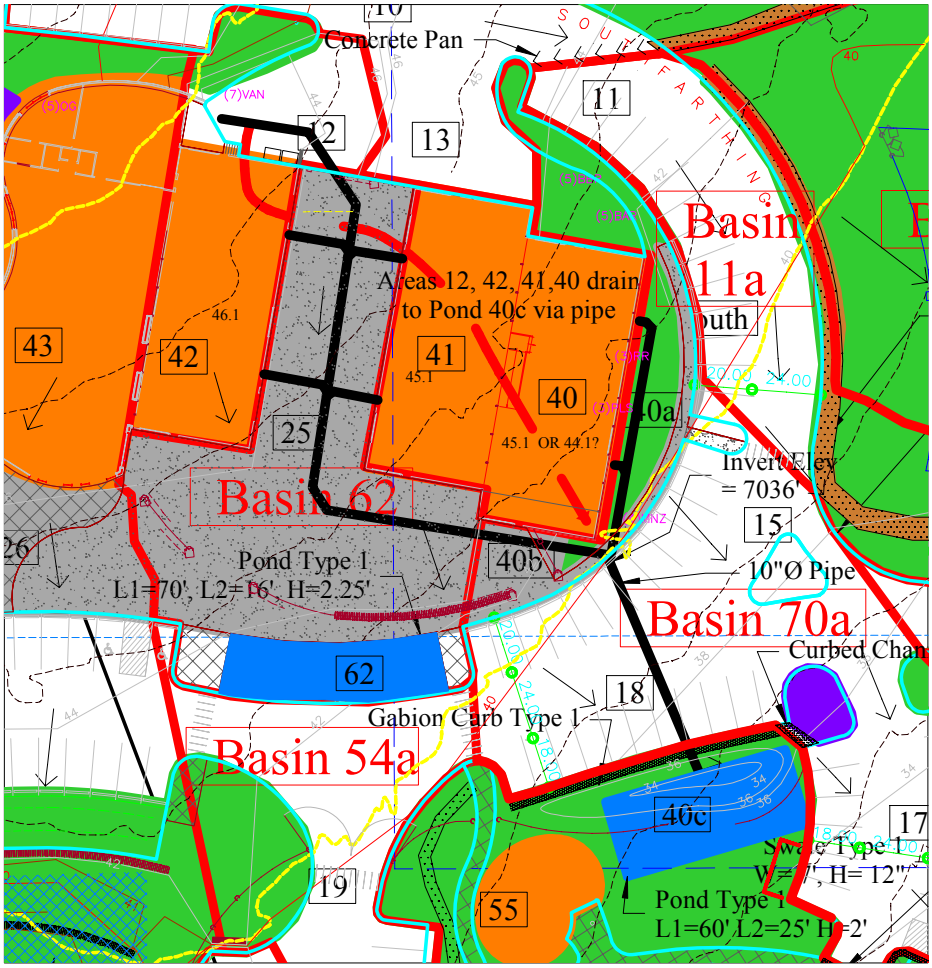


Waters sheet flow directly to infiltration pond #62



Infiltration Pond #62	Hydrology File		25+62 to 62.hys		
Infiltration Test	Entech PH2				
Infiltration Rate (inches / hour / sf)	1.67				
Infiltration Rate (IR = ft / hour /sf)	0.139166667				
Receive Flows from :	25,62				
	Area (ac)	Reach Length (Ft)	Slope	Coeff (C)	Tc (min)
Roof				0.95	
Roof				0.95	
Roads Gravel / Pavers				0.85	
Roads Concrete/Asphalt #25	0.268	165	1.2%	0.95	15.5
Land		165	1.2%	0.2	93.0
Pond # 62	0.043			1	
Total	0.311	ac			
Flow Coefficient of Runoff	0.910				
Composite Area	0.311				
Composite Curve #	0.91				
Hydrology Input	Tc (min)				
	7.4				
	10 yr Storm		100 yr Storm		
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)	
	1.66	**1495**	**2.3**	**2,072**	
Infiltration					
Infiltration Surface Area Req'd to drain within 40 hrs (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	269		**372**	
Pond Sizing - Truncated Rectangular Pyramid					
Side Slope X:1	1				
Pond Top Length (ft)	**70**	L			
Pond Top Width (ft)	**16**	W			
Pond Bottom Length (ft)	65.5	l			
Pond Bottom Width (ft)	11.5	w			
Depth (ft)	**2.25**	h			
Infiltation Surface Area - FULL (sf)	1120				
Full Volume (cf)	2,100	Greater than	2,072		
Water Surface Area - FULL (sf)	1120				
Water Surface Area at HALF FULL	936.625	Greater than	372		
Water Surface Area - EMPTY (sf)	753.25	Greater than	372		

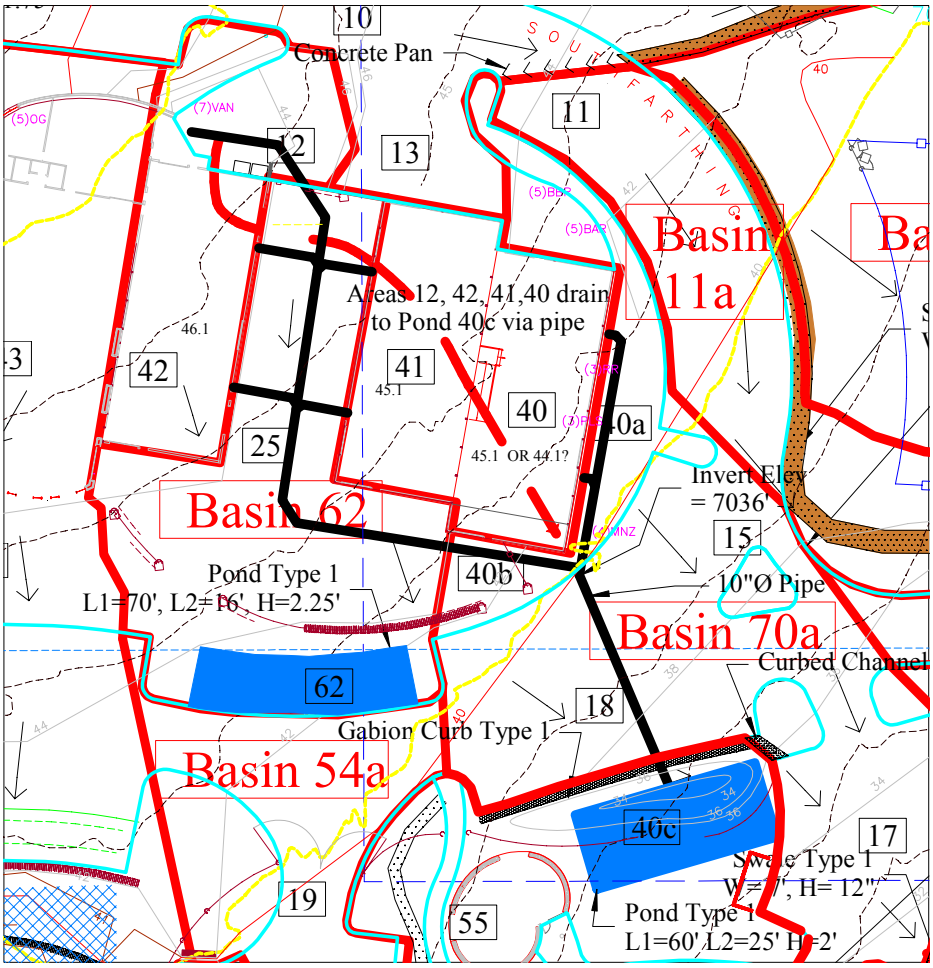
Pond 40c



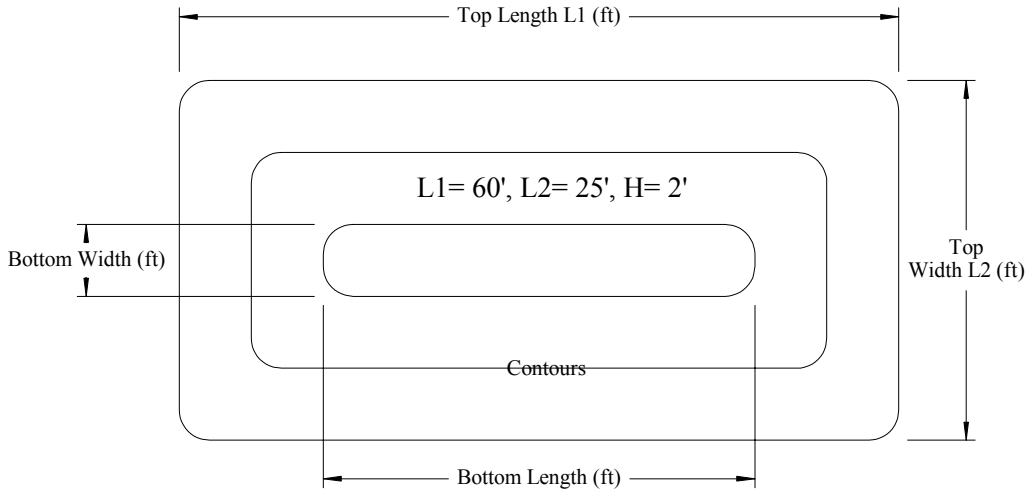
Pond 40c receives waters from loading dock pit #12 and roofs #40, 41, 42. All waters flow via underground pipe to pond.

	10 yr Storm		100 yr Storm	
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)
	2.02	**1,451**	**2.78**	**2,000**
Infiltration				
Infiltration Surface Area Req'd to drain within 40 hrs (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	261		**359**

Pond 40c



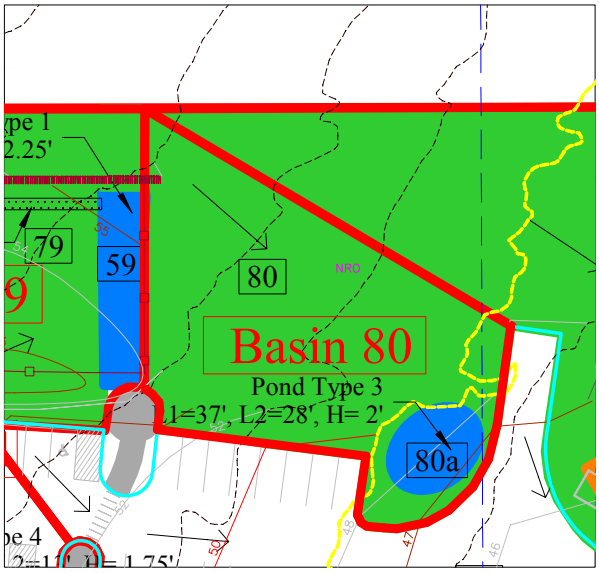
Type 1 Rectangular Infiltration Pond



Pipe Flow, Full			
Slope (%) 2' drop over 83'	0.02		
Pipe Diameter (in)	10		
Pipe Diameter (ft)	0.8333		
Pipe Area (sf)	0.5456		
Wetted Perimeter (ft)	2.6190		
Hydraulic Radius (ft) Rh	0.2083		
Velocity, Gravity Flow (ft/s)	8.1150	(1.486/M)*Rh^0.66*S^0.5	
Flow Volume (cfs)	**4.43**	cfs	

Pond 40c	Hydrology File		12+42+40+41 to 40c.hys		
Infiltration Test	Entech PH2				
Infiltration Rate (inches / hour / sf)	1.67				
Infiltration Rate (IR = ft / hour /sf)	0.139166667				
Receive Flows from :	12, 40, 41, 42				
	Area (ac)	Reach Length (Ft)	Slope	Coeff (C)	Tc (min)
Roof #40,41,42	0.2893	330	3.3%	0.95	15.7
Roads Gravel / Pavers				0.85	
Roads Asphalt #12	0.045	213	4.2%	0.95	11.6
Land #40a	0.074	287	4.2%	0.2	81.3
Pond				1	
Total	0.408	ac			
Flow Coefficient of Runoff	0.950				
Composite Area	0.408				
Composite Curve #					
Hydrology Input	Tc (min)				
	7.7				
	10 yr Storm		100 yr Storm		
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)	
	2.02	**1,451**	**2.78**	**2,000**	
Infiltration					
Infiltration Surface Area Req'd to drain within 40 hrs (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	261		**359**	
Pond Sizing - Truncated Rectangular Pyramid					
Side Slope X:1	3				
Pond Top Length (ft) (long side)	**60**	L	A		
Pond Top Width (ft) (short side)	**25**	W	B		
Pond Bottom Length (ft) (long side)	48	l	a		
Pond Bottom Width (ft) (short side)	13	w	b		
Depth (ft)	2	h	h		
Infiltation Surface Area - FULL (sf)	1500				
Full Volume (cf)	2,076	Greater than	2,000		
Water Surface Area - FULL (sf)	1500				
Water Surface Area - EMPTY (sf)	624	Greater than	359		

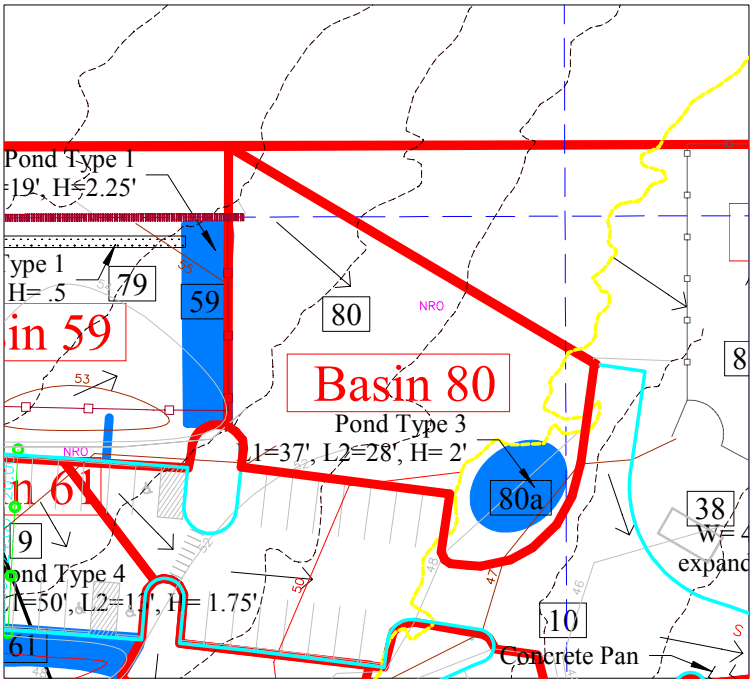
Basin 80a



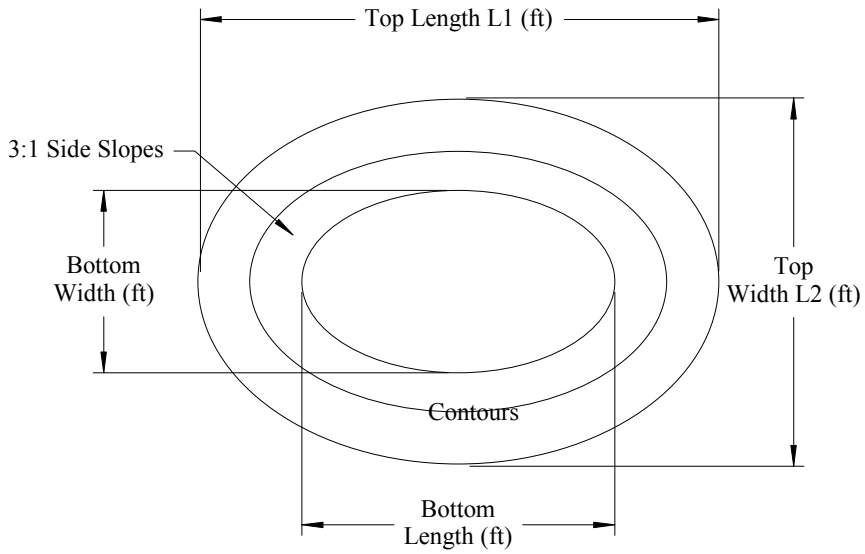
Pond 80a collects waters from undeveloped Basin 80.

	10 yr Storm		100 yr Storm	
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)
	0.28	**667**	**0.4**	**954**
	2.17 off #10		2.99 off #10	
Infiltration				
Infiltration Surface Area Req'd (CF/IR/40hr) = SF		120		**171**

Basin 80a

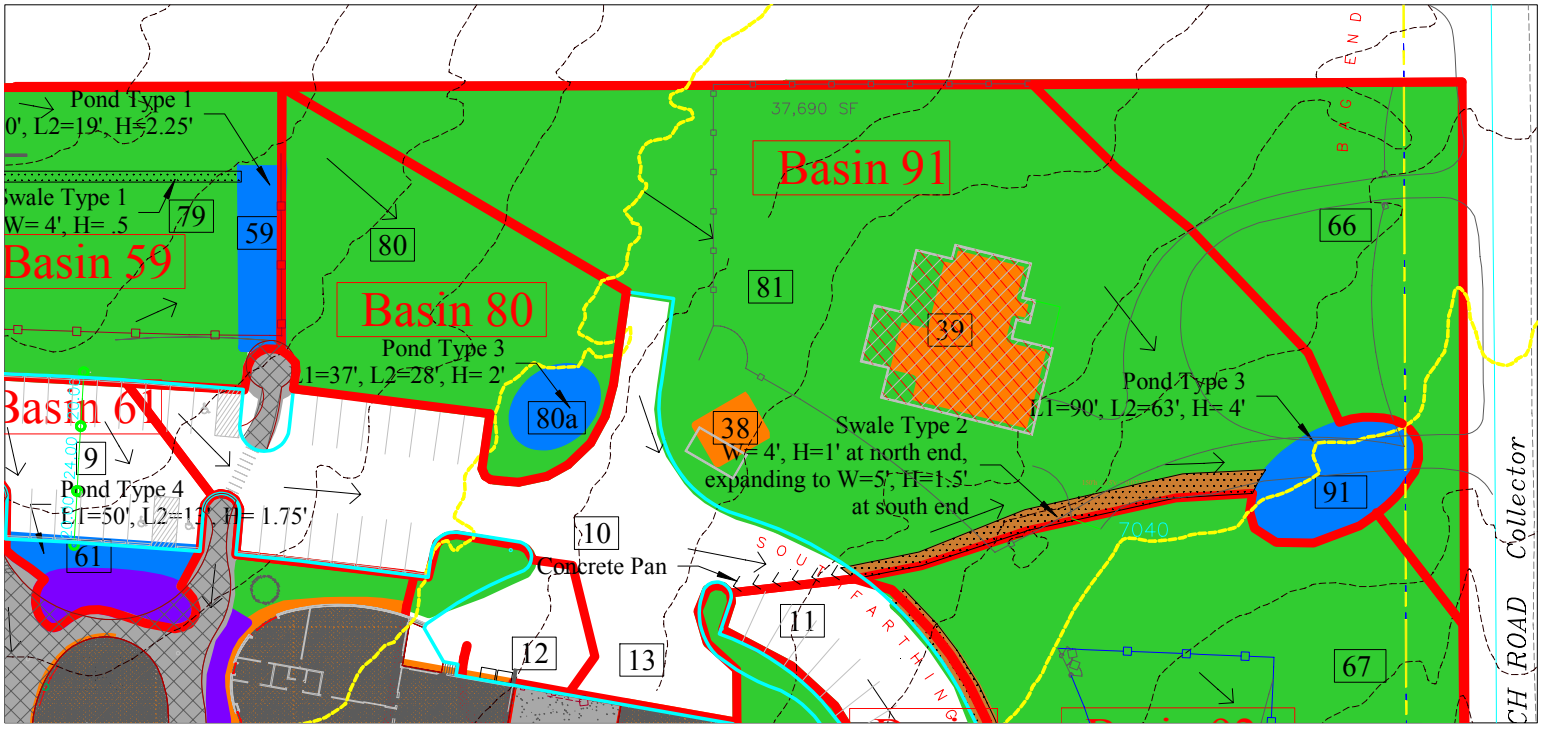


Type 3 Elliptical Infiltration Pond



Infiltration Pond #80a	Hydrology File		80+80a to 80a		
Infiltration Test	Entech PH2				
Infiltration Rate (inches / hour / sf)	1.67				
Infiltration Rate (IR = ft / hour /sf)	0.139166667				
Receive Flows from :	#80,#80a				
	Area (ac)	Reach Length (Ft)	Slope	Coeff (C)	Tc (min)
Roof				0.95	
Asphalt					
UnDeveloped Land #80	0.3670	135	11.1%	0.2	40.4
Pond #80a	0.0081			1	
Total	0.3751				
Flow Coefficient of Runoff	0.4100				
Composite Area (ac)	0.3751				
Composite Curve #					
Hydrology Input	Tc (min)	Composite Curve			
	40.4				
	10 yr Storm		100 yr Storm		
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)	
	0.28	**667**	**0.4**	**954**	
	2.17 off #10		2.99 off #10		
Infiltration					
Infiltration Surface Area Req'd (CF/IR/40hr) = SF		120		**171**	
Pond Sizing - Truncated Conical Ellipse - FULL					
Full Cone (top dimensions)					
Desired Depth	**2**				
Side Slope X:1	**3**				
Full Size (L1)	**37**				
Base Length 'a' Long Axis radius (ft)	18.5	W			
Full Size (L2)	**28**				
Base Length 'b' Short Axis radius (ft)	14	L			
Height of Full Cone (based on Side Slope) (ft) h1	4.7	h1			
Volume (cf)	1,266.1				
Missing Cone (bottom dimensions)					
Missing Cone Height (ft) h2	2.7				
Base Length 'c' Long Axis radius (ft)	**10.6**	w			
Base Length 'd' Short Axis radius (ft)	**8.0**	l			
Volume (missing cone) (cf)	236				
Truncated Pond Volume (cf)	1,030	Greater Than	954		
Full Pond Surface Area (sf)	814	sf			
Pond Bottom Surface Area (sf)	266	Greater Than	171		

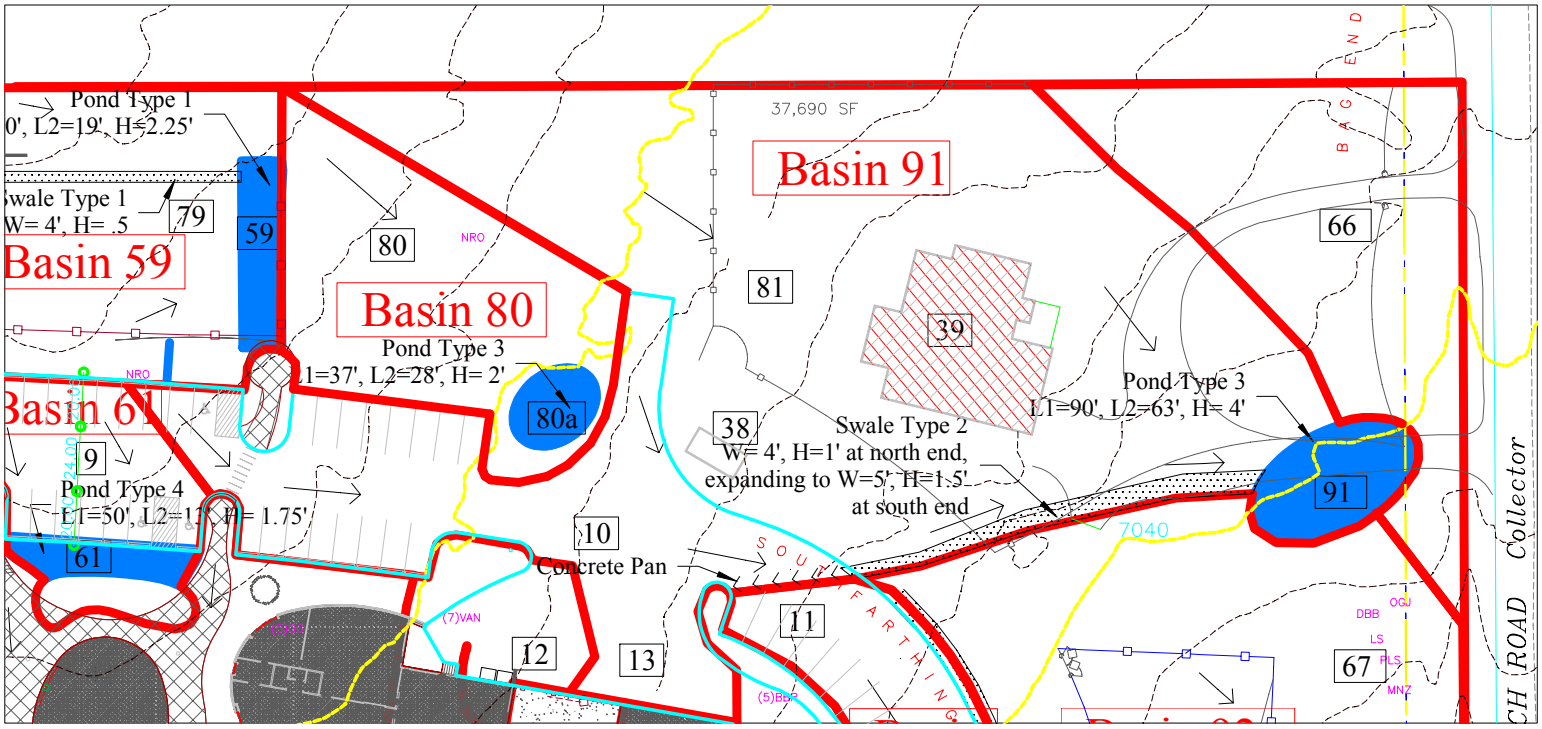
Basin 91



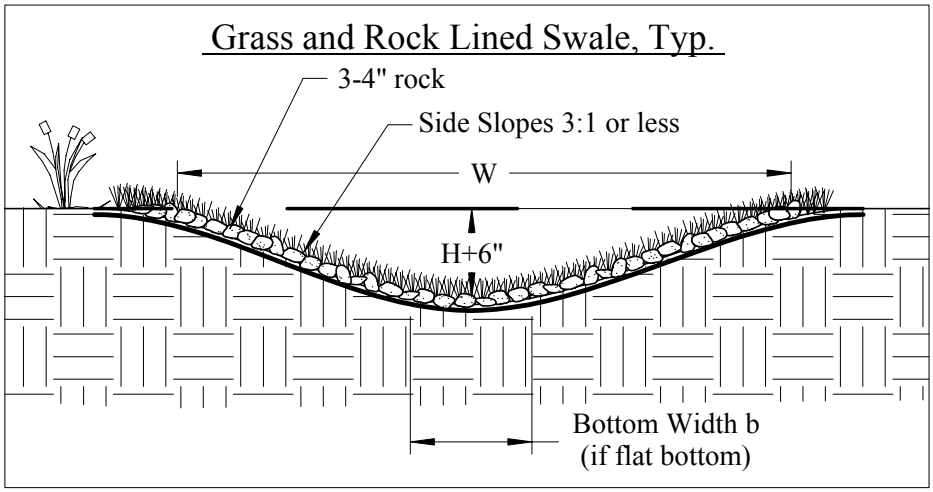
Pond #91 receives waters from mostly undeveloped land, some pavement and roof. Pavement waters are conveyed via grassed swale to pond #91

	10 yr Storm		100 yr Storm	
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)
	1.8	**6486**	**2.62**	**9,420**
	2.17 off #10		2.99 off #10	
Infiltration				
Infiltration Surface Area Req'd (CF/IR/40hr) = SF		1,165		**1,692**

Basin 91

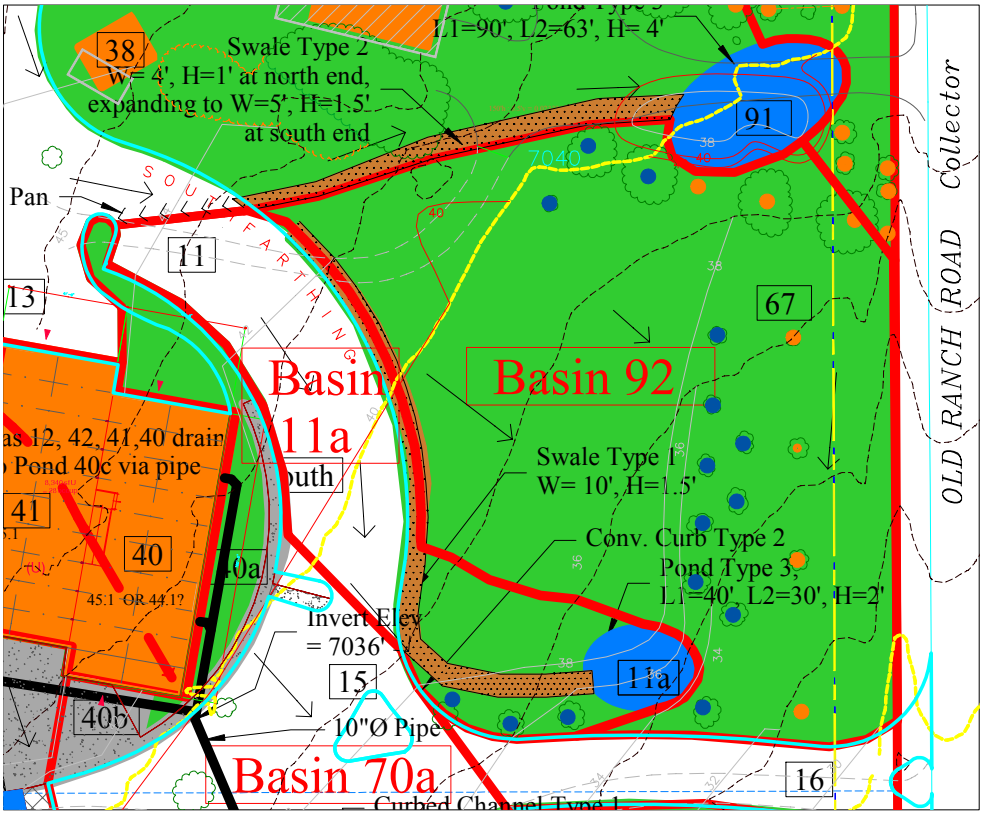


Channel Parameters		
Bottom Width (ft) b	1.00	b
Side Slope X:1	3.00	
Depth (ft) h	0.50	H
Top Width (ft) W	4.00	W
Flow Area		
Area (sf)	1.25	
Wetted Perimeter	4.16	
Hydraulic Radius	0.30	
Flow Calc		
Slope (%)	1.25%	
Mannings (n)	0.03	
Velocity (ft/sec)	2.49	
Area (sf)	1.25	
Flow (cf/sec)	**3.12**	



Infiltration Pond #91	Hydrology File		10+13+81+38+39+91 to		91.hys
Infiltration Test	Entech PH2				
Infiltration Rate (inches / hour / sf)	1.67				
Infiltration Rate (IR = ft / hour /sf)	0.139166667				
Receive Flows from :	10,13,81,38,39,91				
	Area (ac)	Reach Length (Ft)	Slope	Coeff (C)	Tc (min)
Roof #38,#39	0.0000			0.95	
Asphalt #10, #13	0.0000	215	0.0428	0.95	11.6
UnDeveloped Land#80,#81	0.0000	450	3.3%	0.2	109.7
Pond #91	0.0000			1	
Total	0.0000				
Flow Coefficient of Runoff	0.4100				
Composite Area (ac)	0.0000				
Composite Curve #					
Hydrology Input	Tc (min)	Composite Curve			
	109.7				
	10 yr Storm		100 yr Storm		
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)	
	1.77	**6369**	**2.57**	**9,250**	
	2.17 off #10		2.99 off #10		
Infiltration					
Infiltration Surface Area Req'd (CF/IR/40hr) = SF		1,144		**1,662**	
Pond Sizing - Truncated Conical Ellipse					
Full Cone (top dimensions)					
Desired Depth	**4**				
Side Slope X:1	**3**				
Full Size (L1)	**90**	L			
Base Length 'a' Long Axis radius (ft)	45	a			
Full Size (L2)	**63**	W			
Base Length 'b' Short Axis radius (ft)	31.5	b			
Height of Full Cone (based on Side Slope) (ft) h1	10.5	h1			
Volume (cf)	15,590.9				
Missing Cone (bottom dimensions)					
Missing Cone Height (ft) h2	6.5				
Base Length 'c' Long Axis radius (ft)	**27.9**	c			
Base Length 'd' Short Axis radius (ft)	**19.5**	d			
Volume (missing cone) (cf)	3,699				
Truncated Pond Volume (cf)	11,892	Greater Than	9,250		
Full Pond Surface Area (sf)	4455	sf			
Pond Bottom Surface Area (sf)	1707	Greater Than	1,662		

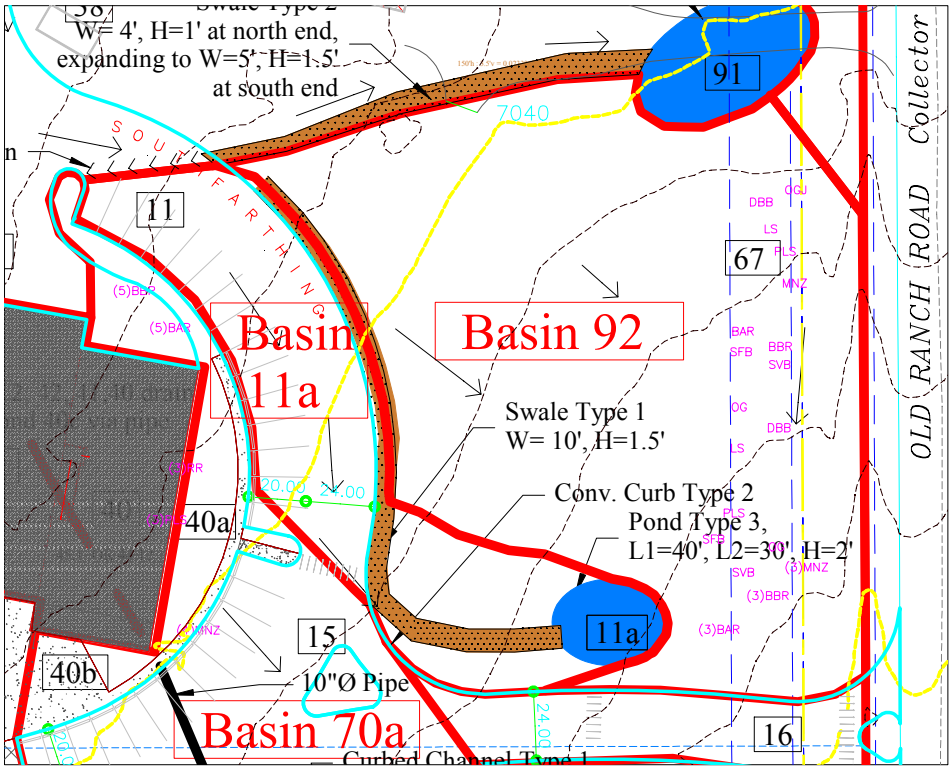
Basin 11a



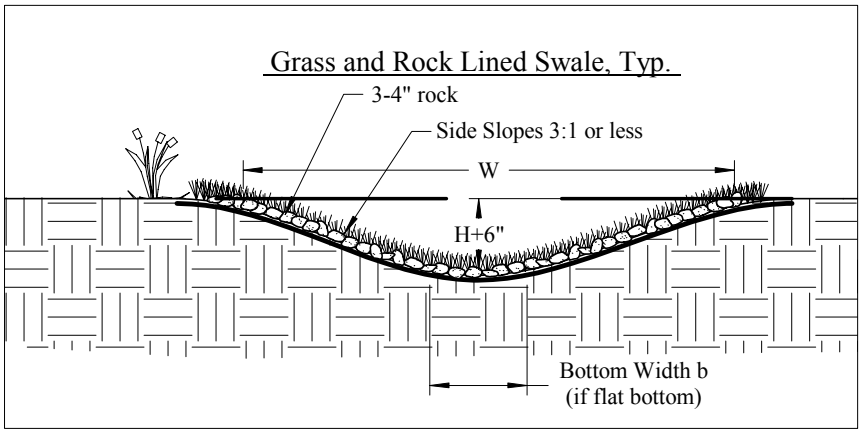
Pond #11a infiltrates waters from mostly concrete pavement and portion along the Basin 92.

	10 yr Storm		100 yr Storm	
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)
	1.05	**818**	**1.45**	**1,130**
	2.17 off #10		2.99 off #10	
Infiltration				
Infiltration Surface Area Req'd (CF/IR/40hr) = SF		147		**203**

Basin 11a

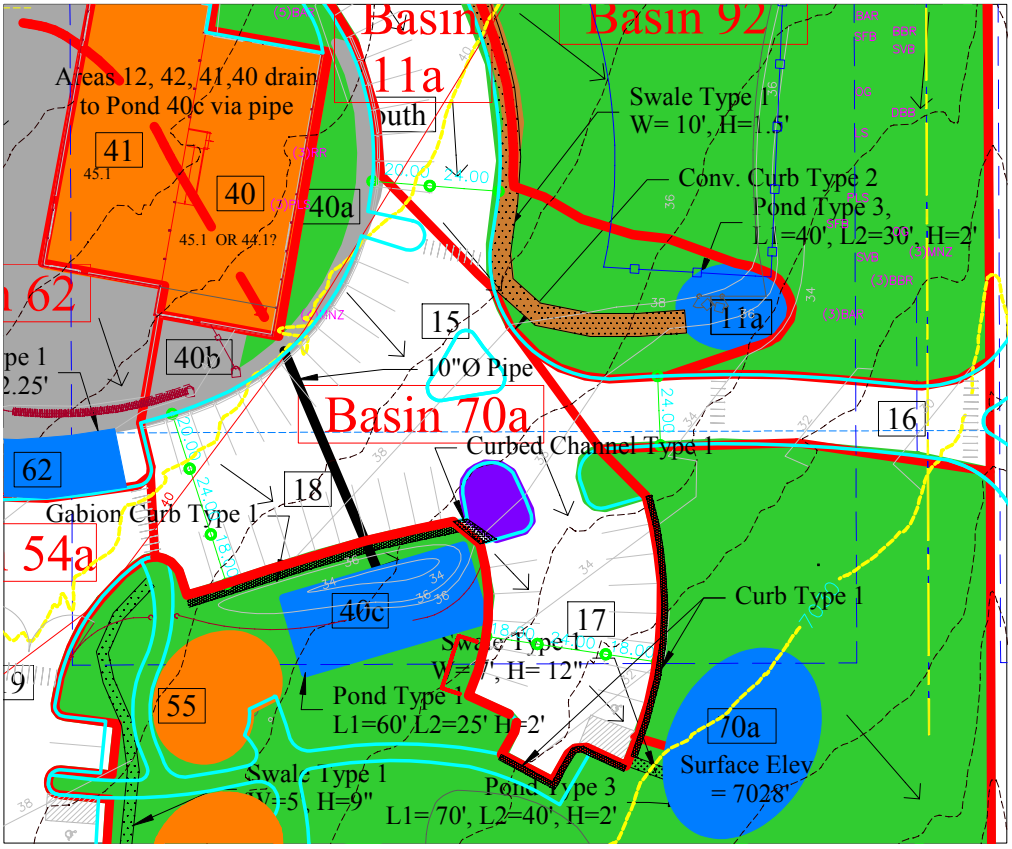


Channel Parameters		
Bottom Width (ft) b	1.00	b
Side Slope X:1	3.00	
Depth (ft) H	1.50	H
Top Width (ft) W	10.00	W
Flow Area		
Area (sf)	8.25	
Wetted Perimeter	10.49	
Hydraulic Radius	0.79	
Flow Calc		
Slope (%)	3.00%	
Mannings (n)	0.30	
Velocity (ft/sec)	0.73	
Area (sf)	8.25	
Flow (cf/sec)	6.05	



Infiltration Pond #11a	Hydrology File		11 to 11a-F2.hys		
Infiltration Test	Entech PH2				
Infiltration Rate (inches / hour / sf)	1.67				
Infiltration Rate (IR = ft / hour /sf)	0.139166667				
Receive Flows from :	11+portion of #92				
	Area (ac)	Reach Length (Ft)	Slope	Coeff (C)	Tc (min)
Roof				0.95	
Asphalt	0.1403	250	0.038	0.95	13.0
UnDeveloped Land	0.0988	250	3.8%	0.2	78.3
Pond #11a	0.0261			1	
Total	0.2652				
Flow Coefficient of Runoff	0.4100				
Composite Area (ac)	0.2652				
Composite Curve #					
Hydrology Input	Tc (min)	Composite Curve			
	78.3				
	10 yr Storm		100 yr Storm		
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)	
	1.05	**818**	**1.45**	**1,130**	
	2.17 off #10		2.99 off #10		
Infiltration					
Infiltration Surface Area Req'd (CF/IR/40hr) = SF		147		**203**	
Pond Sizing - Truncated Conical Ellipse - FULL					
Full Cone (top dimensions)					
Desired Depth	**2**				
Side Slope X:1	**3**				
Full Size (L1)	**40**				
Base Length 'a' Long Axis radius (ft)	20	W			
Full Size (L2)	**30**				
Base Length 'b' Short Axis radius (ft)	15	L			
Height of Full Cone (based on Side Slope) (ft) h1	5.0	h1			
Volume (cf)	1,571.3				
Missing Cone (bottom dimensions)					
Missing Cone Height (ft) h2	3.0				
Base Length 'c' Long Axis radius (ft)	**12.0**	w			
Base Length 'd' Short Axis radius (ft)	**9.0**	l			
Volume (missing cone) (cf)	339				
Truncated Pond Volume (cf)	1,232	Greater Than	1,130		
Full Pond Surface Area (sf)	943	sf			
Pond Bottom Surface Area (sf)	339	Greater Than	203		

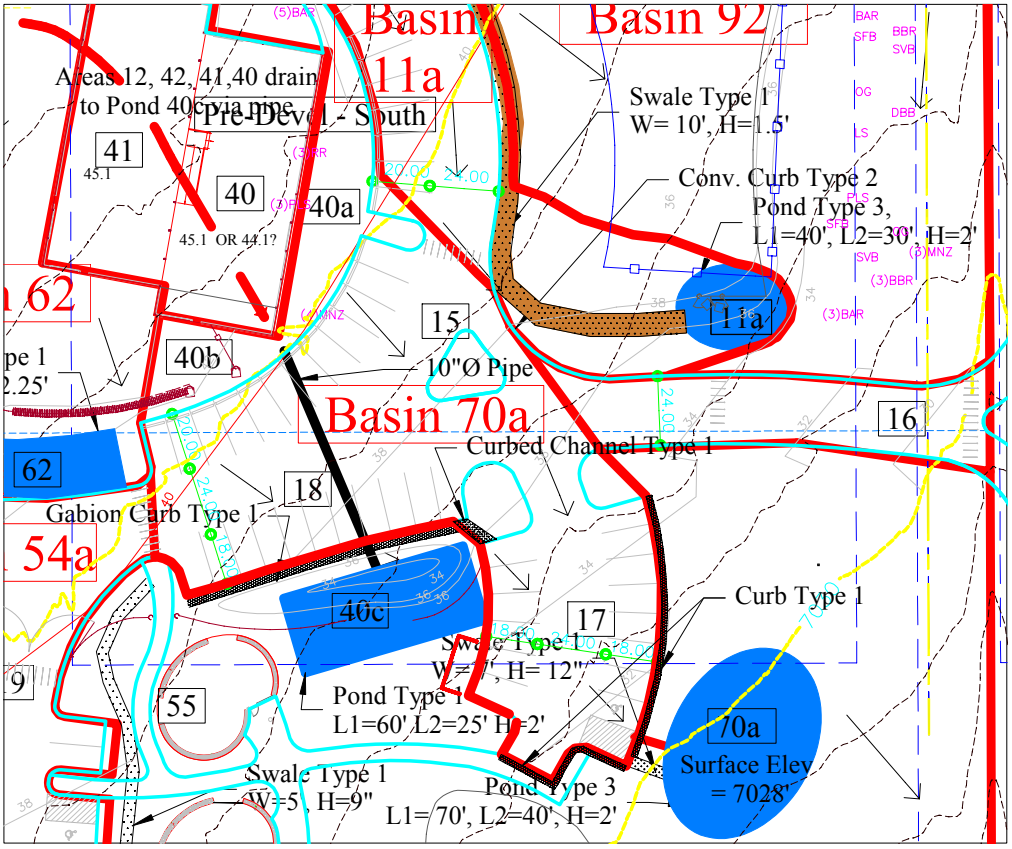
Basin 70a



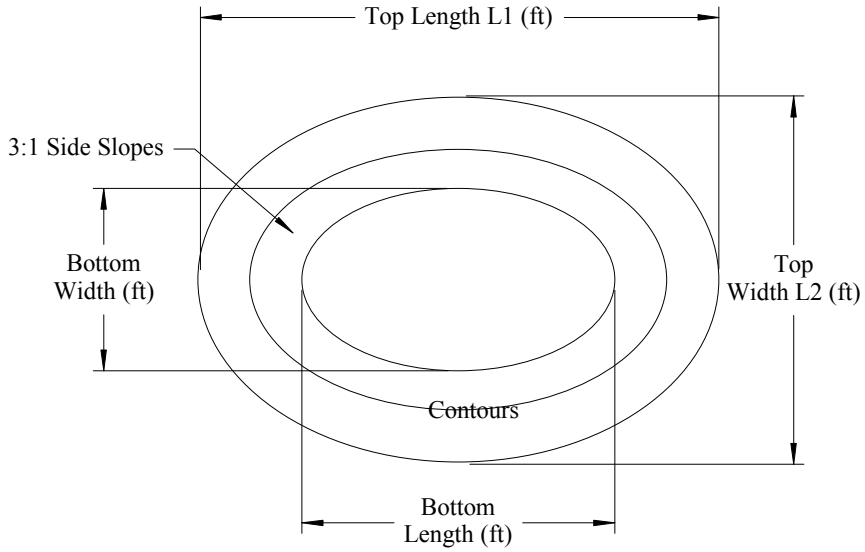
This basin collects waters from paved areas 15, 17, 18 and conveys waters via sheet flow to channels and then to pond #70a. #18 flows to a channel that discharges onto parking area #17 and then flows to 70a

	10 yr Storm		100 yr Storm	
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)
	3.24	**2,330**	**4.46**	**3,210**
Infiltration				
Infiltration Surface Area Req'd to drain within 40 hrs (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	419		**577**

Basin 70a



Type 3 Elliptical Infiltration Pond



Pond 70a	Hydrology File		15+17+18 to 70a.hys		
Infiltration Test	Entech PH2				
Infiltration Rate (inches / hour / sf)	1.67				
Infiltration Rate (IR = ft / hour /sf)	0.13916666666667				
Receive Flows from :	15, 17, 18				
	Area (ac)	Reach Length (Ft)	Slope	Coeff (C)	Tc (min)
Roof		330	3.3%	0.95	15.7
Roads Gravel / Pavers				0.85	
Roads Asphalt #15,#17,#18,#40b	0.489	213	4.2%	0.95	11.6
Land #40a	0.074	300	3.3%	0.2	89.6
Pond #70a	0.054			1	
Total	0.617	ac			
Flow Coefficient of Runoff	0.950				
Composite Area	0.617				
Composite Curve #					
Hydrology Input	Tc (min)				
	7.7				
	10 yr Storm		100 yr Storm		
Hydrology Output	Qp (cfs)	Vol (cf)	Qp (cfs)	Vol (cf)	
	3.24	**2,330**	**4.46**	**3,210**	
Infiltration					
Infiltration Surface Area Req'd to drain within 40 hrs (CF/IR/40hr) = SF	Infiltration Surface Area Req'd (sf)	419		**577**	
Pond Sizing - Truncated Conical Ellipse					
Full Cone (top dimensions)					
Desired Depth	**2**				
Side Slope X:1	**3**				
Full Size (L1)	**75**				
Base Length 'a' Long Axis radius (ft)	37.5	W			
Full Size (L2)	**40**				
Base Length 'b' Short Axis radius (ft)	20	L			
Height of Full Cone (based on Side Slope) (ft) h1	6.7	h1			
Volume (cf)	5,237.6				
Missing Cone (bottom dimensions)					
Missing Cone Height (ft) h2	4.7				
Base Length 'a' Long Axis radius (ft)	**25.5**	w			
Base Length 'b' Short Axis radius (ft)	**8**	l			
Volume (missing cone) (cf)	997				
Truncated Pond Volume (cf)	4,240	Greater Than	3,210		
Full Pond Surface Area (sf)	2357	sf			
Empty Pond Surface Area (sf)	641	Greater Than	577		

				10 Yr Storm		100 Yr Storm		
Storm Runoff - Pre-Development				Rate of Run -off	Volume of Run -off	Rate of Run-off	Volume of Run-off	
Run Free	Basin	Composite Area (ac)	Composite Coeff RO	Q cfs 10yr	Volume cf 10 yr	Q cfs 100 yr	Volume cf 100yr	Includes
Pre Development	South	3.956	0.23	2.303	20,178	3.461	30315	
	Middle	9.221	0.21	3.036	24,226	4.545	36,265	
	North	6.806	0.23	1.496	11,128	2.233	16,613	
		Total Pre-Dev RO		**3.21**	**55,532**	**10.239**	**83,193**	
			Acre Feet		**1.27**		**1.91**	
Storm Runoff - Post Development								
Free Flowing off-site	Basin 72			0.86	4,458	1.27	6,563	51, 52, 72, 50
Free Flowing off-site	Basin 70			0.86	4,907	1.27	7,251	53+54+55+48+70
Free Flowing off-site	#20+#21			0.93	668	1.28	920	20,21
Free Flowing off-site	Basin 92			0.818	3044	1.19	4426	16,66,67
		Total Post-Dev RO		**3.468**	**13,077**	**5.01**	**19,160**	
		Reduction of :		**-0.258**	**42,455**	**5.229**	**64,033**	
				cfs	**cf**	**cfs**	**cf**	
		Reduction of :			**0.97**		**1.47**	
					acre-feet		**acre-feet**	

Surface Area Color Coding and Runoff Coefficients

- Agricultural, Garden, Native and Vegetated Areas C=0.2
- Roads and Parking Areas C=0.95 for Concrete, 0.85 for Gravel
- Roof Areas, Exiting ad New C=0.95
- Sunken Gardens, no in or out flow Not contributing to runoff,
- Infiltration Ponds C=1.0
- Sidewalks C=0.95 for concrete, 0.85 for pavers
- Grassed Swales C=0.2

Legend

General

- Existing Building
- New Building
- Vegetation, Aerial Identified
- Vegetation, Human Identified or New
- Driveway, Concrete
- Driveway, Gravel
- Sidewalk
- Existing/Native Contour Lines
- New Contour Lines

Drainage Elements

- Gabion Curb Type 1
- Conventional Concrete Curb
- Grass Lined Swale
- Berm 0 to ~ 2 ft tall
- Rectangular Infiltration Pond, Type 1
- Triangular Infiltration Pond, Type 2
- Elliptical Infiltration Pond, Type 3

Erosion Control Elements

- Drainage direction
- Strawbales SBB
- Sediment Control Logs SCL
- Silt Fence SF
- I Initial Erosion Control Measures
- II Intermediate Erosion Control Measures
- III Final Erosion Control Measures

Utilities Elements

- Sanitary Sewer
- Water Supply
- 23a Water System Nodes
- 23a Yard Hydrant @ Node
- Electric Lines OH w/ Poles
- Electric Lines UG
- Gas

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Client Information:
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Colorado Springs, CO 80908

Mark Phelan 719-243-2678

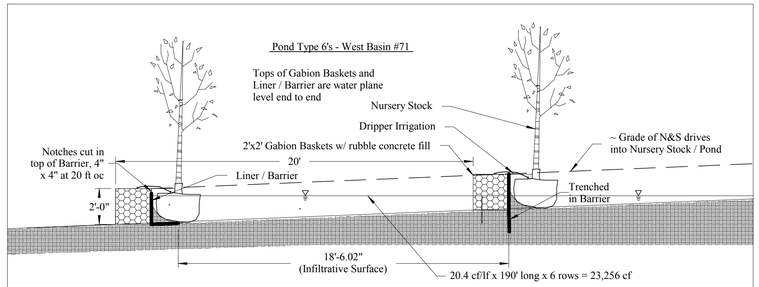
REVISIONS

Number	Date	Purpose

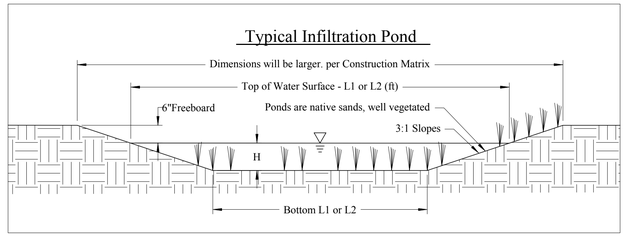
Project Number : 14010
Project Phase: Development Plan
Drawn by : RSH
Drawing Date : 27 Feb 2024

DR-1
Drainage Plan

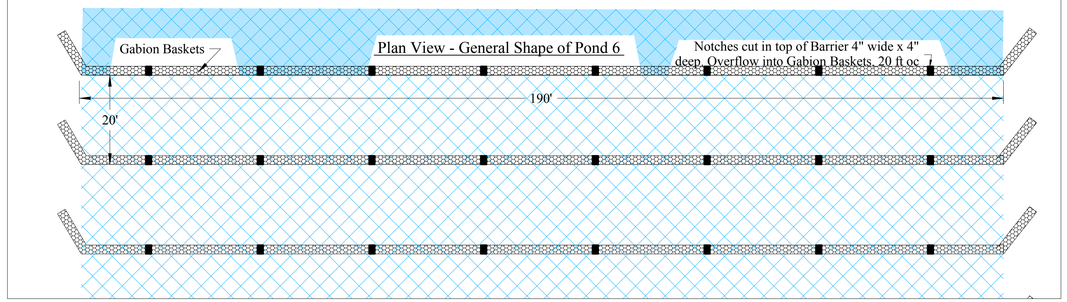
Pond Type 6's - West Basin #71



Typical Infiltration Pond



Plan View - General Shape of Pond 6

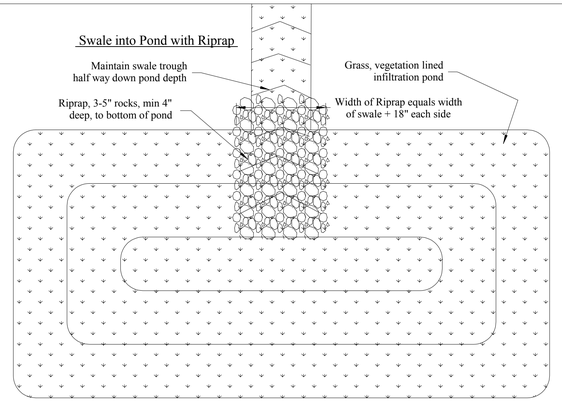


Pond Construction Dimensions

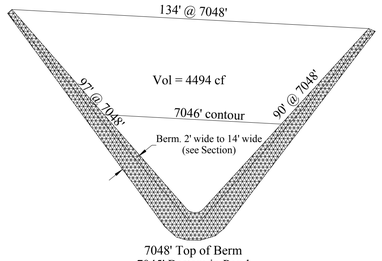
Pond Number	Location	Pond Type	Shape	From Drainage Plan * Surface Dimensions, Full L1	L2	H	Slope x:1	Constructed w/ 6" freeboard ** Pond TOP Dimensions L1	L2	w/ Free Board H	Required Full Volume CF
11a	S	3	Oval	40	30	2	3	44	31.5	2.5	1,130
40c	SW	1	Rectangular	65	27	2	3	68	30	2.5	2,000
54a	SW	3	Oval	20	15	2	3	23	18	2.5	1,014
58	NW	1	~ Rectangular	200	30	2.5	3	203	33	3	8,318
59	E		~ Rectangular	70	19	2.25	3	73	22	2.75	1,917
60	E	4	~ Rectangular	40	12	2	3	43	15	2.5	774
61	E	4	~ Rectangular	50	5	1.75	1	53	8	2.25	394
62	W		Rectangular	70	16	2.25	3	73	19	2.75	2,072
70a	SW	3	Oval	75	40	2	3	78	43	2.5	3,437
71a	W		Series of Ponds				3	See Detail			
80a	E	3	Oval	37	28	2	3	40	31	2.5	954
85	NW		~ Rectangular	175	15	1.25	3	178	18	1.75	1,842
86	NW	1	~ Rectangular	200	20	1.75	3	203	23	2.25	4,821
87	NW	2	Triangular	74	104.7	3.0	3	77	107.65	3.5	13,170
88	Middle	2	Triangular				3	See Detail			4,330
89	NW	2	Triangular	43.00	60.81	3.00	3	46	63.811	3.5	2,780
91	SE	3	Oval	90	63	4	3	93	66	4.5	9,250
93	NE	1	~ Rectangular	113	30	3	3	116	33	3.5	6,211
94	NW	1	Rectangular	80	30	2.5	3	83	33	3	4,122
95	NW	2	Triangular	38	54	3	3	41	57	3.5	1,960

Note * Based on water volume
** Based on constructed size

Swale into Pond with Riprap

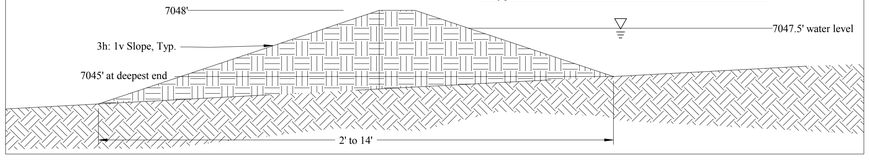


Type 6 Bermed Infiltration Pond - Plan View

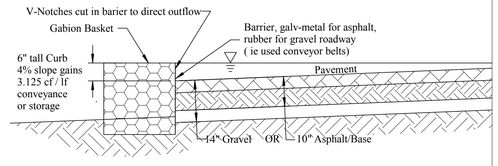


7048' Top of Berm
7045' Bottom in Pond
h= 7048 - .5 - 7045 = 2.5'

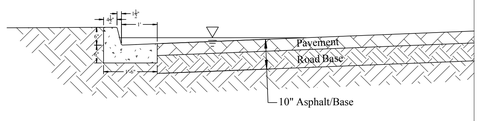
Type 6 Bermed Infiltration Pond - Section View



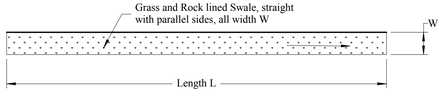
Type 1 Curb - Gabion Basket



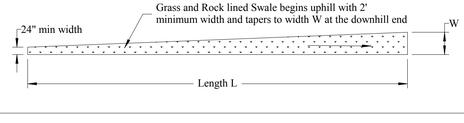
Type 2 Curb - Standard Concrete Curb



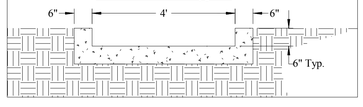
Swale Type 1 Straight



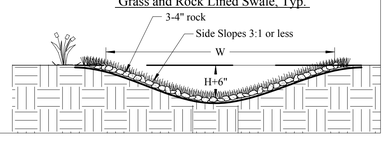
Swale Type 2 Tapered



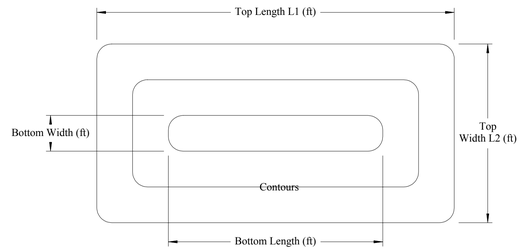
Curbed Channel Type 1



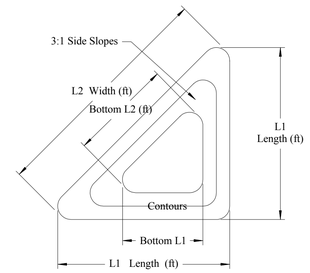
Grass and Rock Lined Swale, Typ.



Type 1 Rectangular Infiltration Pond

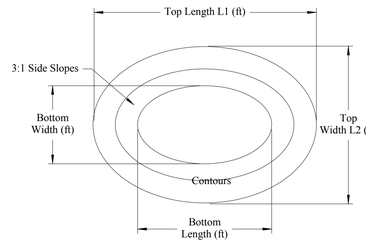


Type 2 Triangular Infiltration Pond

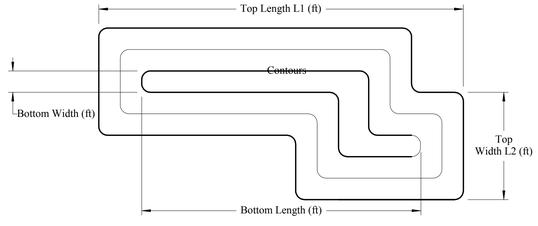


NOTE - Any linear / symmetrical shaped pond can be built in a more organic shape if surveying proves required volume and bottom area

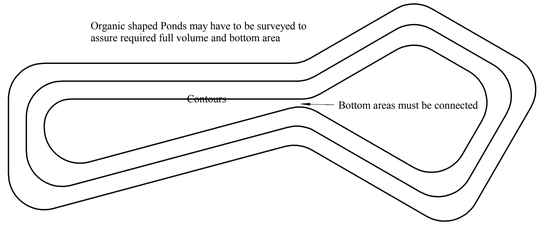
Type 3 Elliptical Infiltration Pond



Type 4 Irregular / Linear Infiltration Pond



Type 5 Organic, Non-Linear Infiltration Pond



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Mark Phelan 719-243-2678

REVISIONS

Number	Date	Purpose

Project Number : 14010
Project Phase:Development Plan
Drawn by : RSH
Drawing Date : 27 Feb 2024

DR-2
Drainage Details

Pond Construction Dimensions

Pond Number	Location	Pond Type	Shape	From Drainage Plan * Surface Dimensions, Full L1	L2	H	Slope x:1	Constructed w/ 6" freeboard ** Pond TOP Dimensions L1	L2	w/ Free Board H	Full Volume CF
11a	S	3	Oval	40	30	2	3	44	31.5	2.5	1,130
40c	SW	1	Rectangular	60	25	2	3	63	28	2.5	2,000
54a	SW	3	Oval	20	15	2	3	23	18	2.5	1,014
58	NW	1	~ Rectangular	200	30	2.5	3	203	33	3	8,318
59	E		~ Rectangular	70	19	2.25	3	73	22	2.75	1,917
60	E	4	~ Rectangular	40	12	2	3	43	15	2.5	774
61	E	4	~ Rectangular	50	13	1.75	1	53	16	2.25	394
62	W		Rectangular	70	16	2.25	3	73	19	2.75	2,072
70a	SW	3	Oval	75	40	2	3	78	43	2.5	3,210
71a	W		Series of Ponds				3	See Detail			
80a	E	3	Oval	37	28	2	3	40	31	2.5	954
85	NW		~ Rectangular	175	15	1.25	3	178	18	1.75	1,842
86	NW	1	~ Rectangular	200	20	1.75	3	203	23	2.25	4,821
87	NW	2	Triangular	74	104.7	3.0	3	77	107.65	3.5	13,170
88	Middle	2	Triangular				3	See Detail			4,330
89	NW	2	Triangular	43.00	60.81	3.00	3	46	63.811	3.5	2,780
91	SE	3	Oval	90	63	4	3	93	66	4.5	9,250
93	NE	1	~ Rectangular	113	30	3	3	116	33	3.5	6,211
94	NW	1	Rectangular	80	30	2.5	3	83	33	3	4,122
95	NW	2	Triangular	38	54	3	3	41	57	3.5	1,960

Note * Based on water volume

** Based on constructed size

	Surface Areas List							
Sub Basin	Location	Type	Surface	Coeff of RO 10yr	Coeff of RO 100yr	Area (sf)	Area (ac)	Area (sq mile)
0	Pre-Development							
1	North Greenhouse (rd & lot)	P & D	Gravel	0.8	0.85	22,074	0.5067	0.000792
2	not used			0.8	0.85	20,036	0.4600	0.000719
3	NE Lot	P & D	Paved	0.9	0.95	3,243	0.0744	0.000116
4	Maintenance Building Lot	P & D	Gravel	0.8	0.85	5,195	0.1193	0.000186
5	North Lot	P & D	Paved	0.9	0.95	13,004	0.2985	0.000466
							0.4922	
6	NE Gathering Driveway	Driving	Paved	0.9	0.95	3,001	0.0689	0.000108
7	Barn Driveway	Driving	Gravel	0.8	0.85	2,395	0.0550	0.000086
8	Barn Parking	Parking	Paved	0.9	0.95	3,511	0.0806	0.000126
9	East Lot north	P & D	Paved	0.9	0.95	4,044	0.0928	0.000145
10	East Lot middle	P & D	Paved	0.9	0.95	3,222	0.0740	0.000116
11	East Lot south & South Lot	P & D	Paved	0.9	0.95	6,111	0.1403	0.000219
12	Truck Dock @ Coop	Driving	Paved	0.9	0.95	1,965	0.0451	0.000070
13	Staging Area	Storage	Gravel	0.8	0.85	3,146	0.0722	0.000113
14	not used							0.000000
15	South Junction	Driving	Paved	0.9	0.95	4,471	0.1026	0.000160
16	South Entrance	Driving	Paved	0.9	0.95	5,213	0.1197	0.000187
17	SSW Parking	Parking	Paved	0.9	0.95	5,209	0.1196	0.000187
18	SW Parking	P & D	Paved	0.9	0.95	6,425	0.1475	0.000230
19	West Entrance	Driving	Paved	0.9	0.95	6,042	0.1387	0.000217
20	Truck Dock	Driving	Paved	0.9	0.95	5,638	0.1294	0.000202
21	West Entrance (fork)	Driving	Paved	0.9	0.95	1,311	0.0301	0.000047
22	West Paking	Xeriscaped		0.05	0.25	13,861	0.3182	0.000497
23	not used							0.000000
24	NW & Bathhouse	P & D	Gravel	0.8	0.85	12,045	0.2765	0.000432
25	Main Courtyard	Walking	Pavers	0.6	0.75	11,666	0.2678	0.000418
26	Courtyard west of N coop	Walking	Pavers	0.6	0.75	5,492	0.1261	0.000197
27	Courtyard west of Vistor Ctr	Walking	Pavers	0.6	0.75	992	0.0228	0.000036
28	Courtyard north of Cafe	Walking	Pavers	0.6	0.75	6,607	0.1517	0.000237
29	Courtyard between Health & Ca	Walking	Pavers	0.6	0.75	3,153	0.0724	0.000113
								0.000000
	ROOFS							0.000000
								0.000000
30	EIH	Earth Sheltered				400	0.0092	0.000014
31	EIH	Earth Sheltered				563	0.0129	0.000020
32	EIH	Earth Sheltered				400	0.0092	0.000014
33	EIH	Earth Sheltered				563	0.0129	0.000020
34	EIH	Earth Sheltered				400	0.0092	0.000014
35	EIH 6= 2889sf=5.5% of #76	Earth Sheltered				563	0.0129	0.000020
36	Maintenance Bldg	Roof		0.9	0.95	4,752	0.1091	0.000170
37	Barn Bldg	Roof		0.9	0.95	2,448	0.0562	0.000088
38	Well House	Roof		0.9	0.95	384	0.0088	0.000014

39	House @ 3890 ORR	Roof		0.9	0.95	3,246	0.0745	0.000116
40	Greenhouse, South	Roof		0.9	0.95	4,200	0.0964	0.000151
40a	Crescent of land below #40	Land				3,224	0.0740	0.000116
40b	Hard walk below #40	Paving				1,649	0.0379	0.000059
41	Greenhouse, North	Roof		0.9	0.95	4200	0.0964	0.000151
42	Coop Bldg, South	Roof		0.9	0.95	4,200	0.0964	0.000151
43	Coop Bldg, North	Roof		0.9	0.95	8,750	0.2009	0.000314
44	Health Bldg	Roof		0.9	0.95	2,609	0.0599	0.000094
45	Gathering Bldg	Roof		0.9	0.95	3,704	0.0850	0.000133
46	Cafe	Roof		0.9	0.95	2,712	0.0623	0.000097
47	Visitor Ctr	Roof		0.9	0.95	3,335	0.0766	0.000120
48	House @ 3820 ORR	Roof		0.9	0.95	2,177	0.0500	0.000078
49	House @ 10855 Howells Rd	Roof		0.9	0.95	1,550	0.0356	0.000056
50	House @ 10755 Howells Rd	Roof		0.9	0.95	1,932	0.0444	0.000069
51	Bath House	Roof		0.9	0.95	931	0.0214	0.000033
52	Yurts x 4	Roof		0.9	0.95	1,812	0.0416	0.000065
53	Craft 1			0.9	0.95	1,100	0.0253	0.000039
54	Craft 2			0.9	0.95	1,100	0.0253	0.000039
54a	Pond 54a					1,571	0.0361	
55	Craft 3			0.9	0.95	1,100	0.0253	0.000039
56	North Shed					877	0.0201	0.000031
57	North Greenhouse	Roof		0.9	0.95	4,773	0.1096	0.000171
58	Pond					6,000	0.1377	0.000215
59	Pond adjacent to Corral					1,487	0.0341	0.000053
60	Pond west of Barn					1,024	0.0235	0.000037
61	Pond west of Corral					802	0.0184	0.000029
62	Pond west of Plaza					1,894	0.0435	0.000068
63	Swale at south entrance						0.0000	0.000000
64	Swale at south entrance						0.0000	0.000000
65	Borders ORR near S Entrance					2,219	0.0509	0.000080
66	SE corner of 3890					13,332	0.3061	0.000478
67	SEE Garden, South					30,723	0.7053	0.001102
68	Not used						0.0000	0.000000
69	LAND						0.0000	0.000000
70	LOT 3820 Old Ranch	Ag / Undevel'd		0.15	0.2	73,253	1.6817	0.002628
70a	Pond at 3820 ORR					2,357	0.0541	
71	Nursery Stock	Ag / Undevel'd		0.15	0.2	56,613	1.2997	0.002031
71a	Pollinator Garden							
72	LOT 10655 Howells	Ag / Undevel'd		0.15	0.2	67,180	1.5422	0.002410
73	LOT 10755 Howells	Ag / Undevel'd		0.15	0.2	33,996	0.7804	0.001219
74	East of Leach Field	Ag / Undevel'd		0.15	0.2	15,355	0.3525	0.000551
75	NE Garden	Ag / Undevel'd		0.15	0.2	107,949	2.4782	0.003872
76	Hobbit Town	Ag / Undevel'd		0.15	0.2	46,774	1.0738	0.001678
77	North of Shop	Ag / Undevel'd		0.15	0.2	9,624	0.2209	0.000345
78	Between Shop and Barn	Ag / Undevel'd		0.15	0.2	12,665	0.2907	0.000454
79	South of Barn	Ag / Undevel'd		0.15	0.2	11,780	0.2704	0.000423
80	Between Barn and 3890	Ag / Undevel'd		0.15	0.2	16,338	0.3751	0.000586
80a	Pond #80a					354	0.0081	
81	LOT 3890 Old Ranch	Ag / Undevel'd		0.15	0.2	78,589	1.8042	0.002819
81R	LOT 3890 Old Ranch	Ag/Paved				38,831	0.8914	

82	North of Cafe/Gathering	Ag / Undevel'd		0.15	0.2	11,359	0.2608	0.000407
83	3890 ORR	#81 subdivided				33862	0.7774	
84	Pond						0.0000	
85	Pond, west of corral	Retension					0.0000	
86	Pond, west of #1 near Bathhouse					4,073	0.0935	
87	Pond east of Health					6,119	0.1405	
88	Pond (triangular pyramid top)	N&W of STA				6134.5	0.1408	
89	Pond above STA						0.0000	
90							0.0000	
91	Pond at 3890 ORR					4,455	0.1023	
92	Pond at South Entrance						0.0000	
93	Pond near Maintenance					2,960	0.0680	
94	Pond at 10755 Howells							
95	Pond at STA						0.6163	
96	Pond 96 in area 70					1,672	0.0384	
97								

ENTECH
ENGINEERING, INC.

505 ELKTON DRIVE
COLORADO SPRINGS, CO 80907
PHONE (719) 531-5599
FAX (719) 531-5238

November 24, 2021

Kess Properties
49955 Austin Bluffs Parkway
Colorado Springs, CO 80918

Attn: Mark Phelan

Re: Infiltration Rates (Percolation Test Method)
The Shire at Old Ranch
10755 Howells Road
Colorado Springs, Colorado

Dear Mr. Phelan:

As requested, personnel of Entech Engineering, Inc. have performed percolation testing at the above referenced site to evaluate the site soils to determine the infiltration rate for the proposed detention pond.

The testing was performed on October 19 and November 3, 2021. The test locations are shown in Figure 1. The Test Boring Logs, Percolation Test results, Infiltration Rates, and Laboratory Test results are shown in Figures 2 through 6. Soils encountered in the profile and percolation holes consisted of silty sand.

The average percolation rates were 3 to 5 minutes/inch. The percolation rates correspond to adjusted average Infiltration Rate of 1.18 inches/hour for PH-1, and 1.67 inches/hour for PH-2.

We trust that this has provided you with the information you required. If you have any questions or need additional information, please do not hesitate to contact us.

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Logan L. Langford, P.G.
Geologist

Reviewed by:

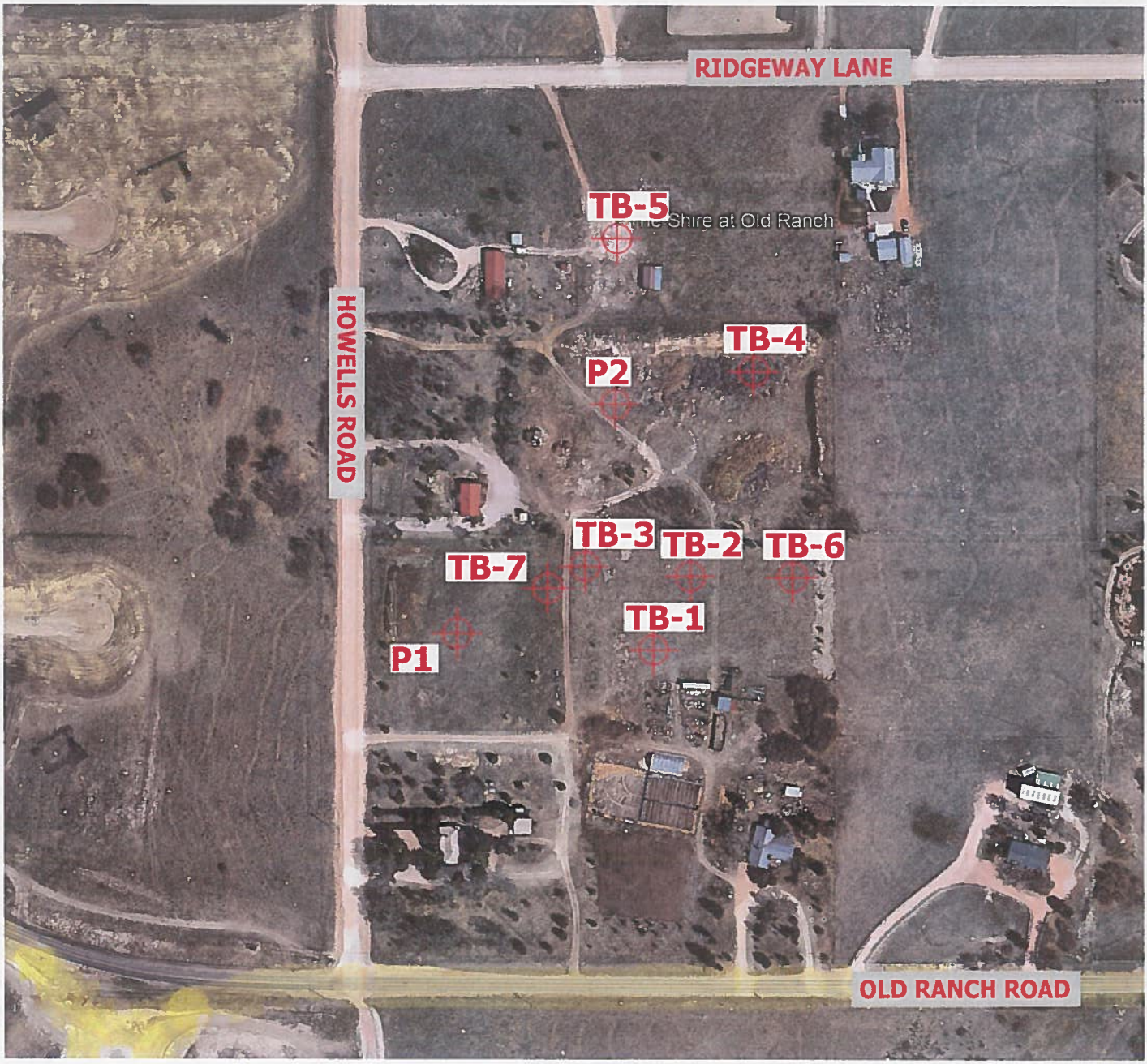
COLORADO LICENSED
AUSTIN M NOSSOKOFF
53477
12-6-21
PROFESSIONAL ENGINEER

Austin M. Nossokoff, P.E.
Project Engineer

LLL/jr

Encl.

Entech Job No. 212362
AAprojects/2021/212362 Infiltration Rate



TB- APPROXIMATE TEST BORING LOCATIONS AND NUMBERS

P- APPROXIMATE PERCOLATION BORING LOCATIONS AND NUMBERS

N

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505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

TEST BORING LOCATION MAP
THE SHIRE AT OLD RANCH
10755 HOWELLS RD
COLORADO SPRINGS, CO
FOR: KESS PROPERTIES

DRAWN:	DATE:	CHECKED:	DATE:
JHR	12/1/21	AMN	

JOB NO.: 212362

FIG NO.: 1

PROFILE HOLE NO. 1
DATE DRILLED 10/20/2021
Job # 212362

REMARKS

DRY TO 10', 10/20/21

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
						SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE TO DENSE, DRY TO MOIST
			26	2.7	1	
5			28	1.2	1	
10			34	3.4	1	
15						
20						

PROFILE HOLE NO. 2
DATE DRILLED 10/19/2021
CLIENT KESS PROPERTIES
LOCATION THE SHIRE AT OLD RANCH

REMARKS

DRY TO 19', 10/20/21

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
						SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE TO VERY DENSE, MOIST
			28	3.2	1	
5			50/11"	4.9	1	
10			41	5.1	1	
15						
20						

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PROFILE HOLE LOG

DRAWN:	DATE:	CHECKED: LLL	DATE: 11/19/21

JOB NO.: 212362
FIG NO.: 2

Client: Kess Properties
Test Location: The Shire at Old Ranch

Job Number: 212362

PERCOLATION HOLES

Date Holes Prepared: 10/20/2021

Date Hole Completed: 11/3/2021

Hole No. 1A
Depth: 46"

Trial	Time (min.)	Water Level Change (in.)
1	10	4
2	10	7
3	10	2

Perc Rate (min./in.): 5

Hole No. 1B
Depth: 34"

Trial	Time (min.)	Water Level Change (in.)
1	10	4
2	10	2
3	10	2

Perc Rate (min./in.): 5

Average Perc Rate (min./in.) 5

Hole No. 2A
Depth: 48"

Trial	Time (min.)	Water Level Change (in.)
1	10	5
2	10	2
3	10	3

Perc Rate (min./in.): 3

Hole No. 2B
Depth: 38"

Trial	Time (min.)	Water Level Change (in.)
1	10	3
2	10	5
3	10	2

Perc Rate (min./in.): 5

Observer: Nicholas S.

By:

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

PERCOLATION TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	11/19/21

JOB NO.: 212362
FIG NO.: 3

Infiltration Rate (I) = Percolation Rate (P)/ Reduction Factor(R_F)
$I=P/R_F$

$R_f = [(2d_1 - \Delta d) / dia] + 1$

d_1 = initial water depth (in.)

Δd = final water level drop (in.)

dia = diameter of the percolation hole (in.)

Test No. P1 (PH-1)
Perc Rate= 12 in/hr
dia = 8

P1
d_1 = 41.0
Δd = 5.0
R_f = 10.6

I = 1.13 in/hr

Test No. P2 (PH-1)
Perc Rate= 12 in/hr
dia = 8

P2
d_1 = 36.0
Δd = 3.0
R_f = 9.6

I = 1.25 in/hr

(PH-1) I_{AVG}= 1.19 in/hr

Test No. P1 (PH-2)
Perc Rate= 20 in/hr
dia = 8

P1
d_1 = 39.0
Δd = 4.0
R_f = 10.3

I = 1.95 in/hr

Test No. P2 (PH-2)
Perc Rate= 12 in/hr
dia = 8

P2
d_1 = 33.0
Δd = 5.0
R_f = 8.6

I = 1.39 in/hr

(PH-2) I_{AVG}= 1.67 in/hr

CLIENT KESS PROPERTIES
PROJECT THE SHIRE AT OLD RANCH
JOB NO. 212362

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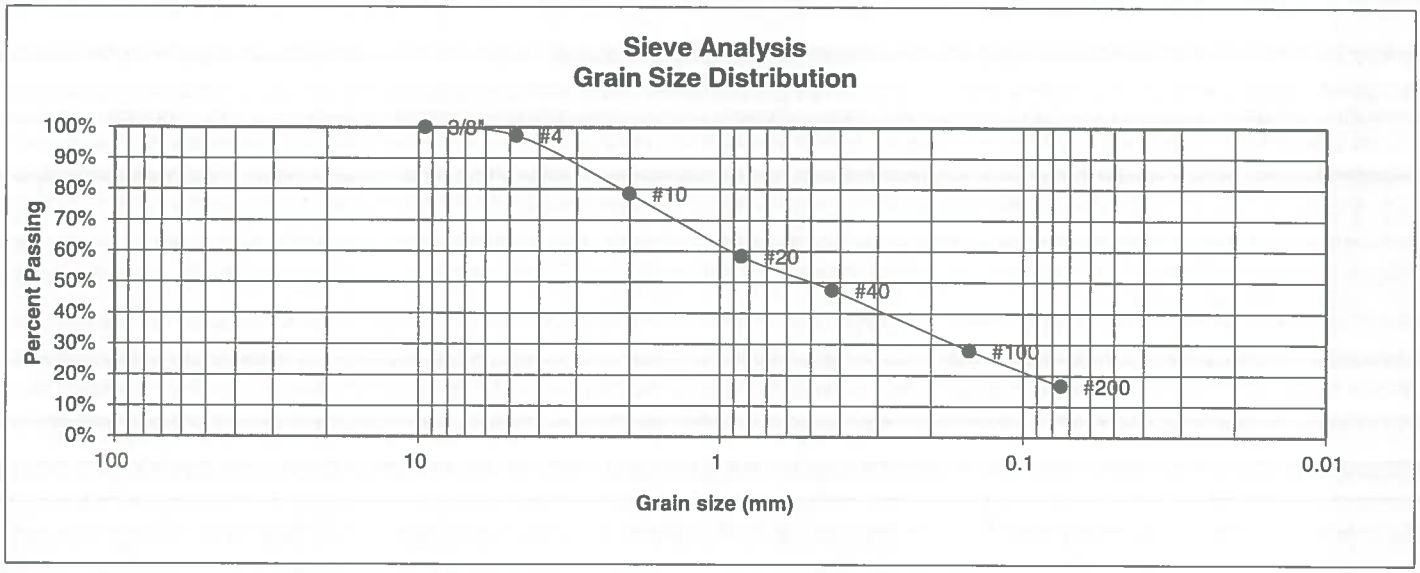
COLORADO SPRINGS, COLORADO 80907

INFILTRATION TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	11/24/14

JOB NO.: 212362
FIG NO.: 4

UNIFIED CLASSIFICATION	SM	CLIENT	KESS PROPERTIES
SOIL TYPE #	1	PROJECT	THE SHIRE AT OLD RANCH
TEST BORING #	P1	JOB NO.	212362
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	97.3%
10	78.5%
20	58.4%
40	47.5%
100	28.0%
200	16.6%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

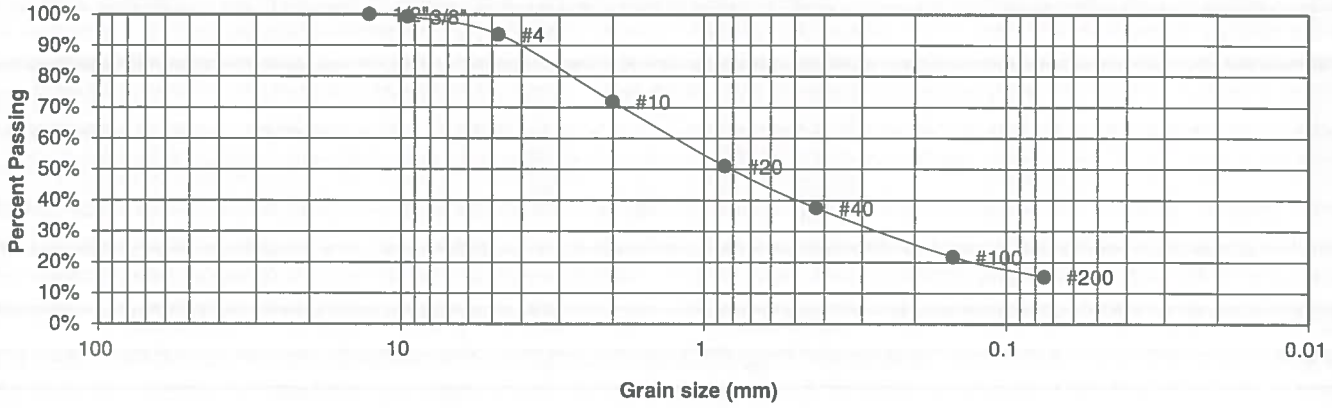
DRAWN:	DATE:	CHECKED:	DATE:
		LLL	11/19/21

JOB NO.: 212362

FIG NO.: 5

UNIFIED CLASSIFICATION	SM	CLIENT	KESS PROPERTIES
SOIL TYPE #	1	PROJECT	THE SHIRE AT OLD RANCH
TEST BORING #	P2	JOB NO.	212362
DEPTH (FT)	2-3	TEST BY	BL

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	99.2%
4	93.5%
10	71.8%
20	51.0%
40	37.5%
100	21.7%
200	15.3%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	11/19/21

JOB NO.: 212362

FIG NO.: 6