HYDROLOGY & DRAINAGE ANALYSIS

FOR

BEYSTER RESIDENCE

12835 and 12829 Via Esperia
San Diego, CA 92014

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HYDROLOGY & HYDRAULICS REPORT
Beyster Residence

1. INTRODUCTION

The purpose of this report is to calculate the pre-development and post-development hydrology conditions for the proposed Beyster Residence Project. The proposed project is a two-story single family residence with a partial basement on a double lot located on APN's 310-101-11 & 310-101-12 at 12835 and 12829 Via Esperia in San Diego, CA. The proposed project site is 0.18 acres.

2. LOCATION

The project site is located at 12835 and 12829 Via Esperia in San Diego, CA ("the Site").

EXHIBIT A: VICINITY MAP

3. METHODOLOGY

This report has calculated the 100-year maximum peak discharge rates based on the San Diego County Hydrology Manual (June 2003) Rational Method.

4. EXISTING CONDITIONS CALCULATIONS

The project has been evaluated using the Rational Method from the San Diego County Hydrology Manual (June 2003) and the San Diego County Hydraulic Design Manual (September 2014) to determine the 100 year Design Storm Event Peak Discharge Rates.

Rational Method Formula

The Rational Method (RM) formula estimates the peak rate of runoff at any location in a watershed as a function of the drainage area (A), runoff coefficient (C), and rainfall intensity (I) for a duration equal to the time of concentration (Tc), which is the time required for water to flow from the most remote point of the basin to the location being analyzed. The RM formula is expressed as follows:

Q=CIA

Where as: Q = peak discharge, in cubic feet per second (cfs). C = runoff coefficient, proportion of the rainfall that runs off the surface (no units). I = average rainfall intensity for a duration equal to the Tc for the area, in inches per hour (note: If the computed Tc is less than 5 minutes, use 5 minutes for computing the peak discharge, Q). A = drainage area contributing to the design location, in acres.

Runoff Coefficient

Attachment C provides Table 3-1 from the San Diego County Hydrology Manual and lists the runoff coefficients for urban areas. The runoff coefficients are based on land use and soil type. An appropriate runoff coefficient (C) for each type of land use in the sub area should be selected from this table and multiplied by the percentage of the total area (A) included in that class. The sum of the products for all land uses is the weighted runoff coefficient (Σ[CA]). Good engineering judgment should be used when applying the values presented in Table 3-1 and adjustments may be made based on site characteristics.

The runoff coefficient can also be calculated for an area based on soil type and impervious percentage using the following formula:

$$C = 0.90 \times (\% \text{ Impervious}) + Cp \times (1 - \% \text{ Impervious})$$

Where as: Cp = Pervious Coefficient Runoff Value for the soil type (shown in Table 3-1 as Undisturbed Natural Terrain/Permanent Open Space, 0% Impervious). Soil type can

be determined from the soil type map provided in Appendix A.

Rainfall Intensity

The rainfall intensity (I) is the rainfall in inches per hour (in/hr) for a duration equal to the Tc for a selected storm frequency. Once a particular storm frequency has been selected for design and a Tc calculated for the drainage area, the rainfall intensity can be determined from the Intensity-Duration Design Chart (Figure 3-1) see Attachment B. The 6-hour storm rainfall amount (P6) and the 24-hour storm rainfall amount (P24) for the selected storm frequency are also needed for calculation of I.

P6 and P24 are shown on the isopluvial maps provided in Attachment D.

Time of Concentration

The Time of Concentration (Tc) is the time required for runoff to flow from the most remote part of the drainage area to the point of interest. The Tc is composed of two components: initial time of concentration (Ti) and travel time (Tt).

The Ti is the time required for runoff to travel across the surface of the most remote sub area in the study, or “initial sub area.” Guidelines for designating the initial sub area are provided within the discussion of computation of Ti. The Tt is the time required for the runoff to flow in a watercourse (e.g., swale, channel, gutter, pipe) or series of watercourses from the initial sub area to the point of interest. For the RM, the Tc at any point within the drainage area is given by:

$$Tc = Ti + Tt$$

4.1 EXISTING CONDITIONS

The site is 0.18 acres in size and is approximately 100 feet deep by 80 feet wide. The project site consists of two adjacent separate lots, each with an existing two story single family residence. The existing residences have attached garages and concrete driveways. Per the project scope both residences are to be demolished. Along the northern, eastern, and half of the southern property lines there is a wood fence installed on top of existing concrete masonry unit (CMU) retaining walls. There is also an existing retaining wall with a wood fence on top between the two lots--this will be demolished with the existing homes. The site is sloped from north to south with elevations ranging from 57 feet to 49 feet above Mean Sea Level (MSL).

The existing impervious area for this project is 5,064 square feet or 0.11 acres. 62.5% of the site.

4.2 SOIL CONDITIONS The geotechnical report that was completed for this project states that the lot is "underlain at relatively shallow depths by medium dense, silty sand soils referred to as Quaternary-age Old Paralic Deposits (Qop_6), overlain by approximately 1 to 3 feet of loose to medium dense fill soils." The Hydrologic Soil Type Classification is A per the NRCS Custom Soil Resource Report (refer to Attachment A).

4.3 EXISTING DRAINAGE

Northern Lot--12835 Via Esperia

The northerly lot has at least two area drains on the existing site along the northern property line that outlet to the street though the curb face. It appears that approximately half of the existing home roof and a portion of the concrete side yard drain to these two area drains. The rest of the property surface flows to the south west corner of the property onto Via Esperia. There is an existing retaining wall along the southern property line that does not allow any cross lot drainage to the property to the south. The northerly lot does not experience any offsite run-on from adjacent properties.

Southern Lot--12829 Via Esperia

The southerly lot has an area drain grate inlet at the face of the garage that outlets to the street through the curb face at the southwestern corner of the lot. Most of the concrete driveway drains to this grate inlet. A portion of the property in the rear yard surface flows onto the southerly neighbors property through an existing fence that is not installed on a CMU wall. The rest of the property surface flows to the south west corner of the property and onto Via Esperia.

Offsite Drainage

In the street there is an existing 24" RCP storm drain line that runs down the entire length of Via Esperia. There are two existing curb inlets at the southerly end of Via Esperia that collect the stormwater from the street. This stormwater then outlets to Soledad Lagoon and the Los Penasquitos Marsh.

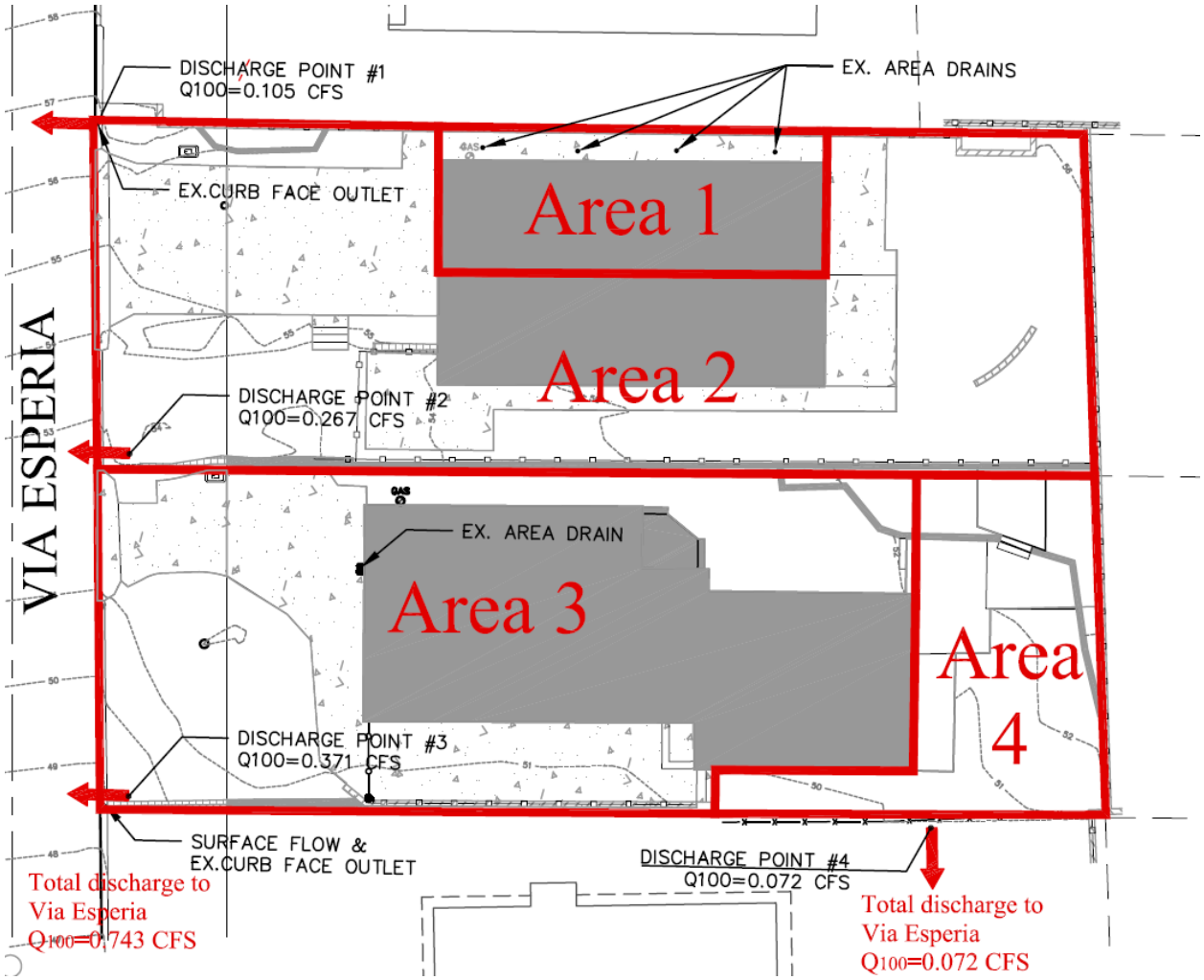


EXHIBIT B: EXISTING CONDITION

RUNOFF ESTIMATE FOR 2-YEAR, 6-HOUR PRECIPITATION EXISTING CONDITIONS (see EXHIBIT B for SUB AREA identification)
P6 = 1.2 inches, P6 (adj)=1.1 inches **P24 = 1.8 inches**

SUB AREA	AREA (SF)	AREA (AC)	% IMPERVIOUS	C	Tc	I (IN/HR)	Q (CFS
AREA 1	770	0.018	100%	0.9	5	2.89	0.046
AREA 2	3,906	0.090	36%	0.452	5	2.89	0.117
AREA 3	3,669	0.084	67%	0.669	5	2.89	0.163
AREA 4	975	0.022	41%	0.487	5	2.89	0.032
TOTAL:	9,320	0.214				**TOTAL:**	0.357

- Stormwater discharge towards Via Esperia Street is 0.326 CFS.
- Stormwater discharge towards the south property line is 0.032 CFS.

RUNOFF ESTIMATE FOR 10-YEAR, 6-HOUR PRECIPITATION EXISTING CONDITIONS (see EXHIBIT B for SUB AREA identification)
P6 = 1.6 inches **P24 = 2.5 inches**

SUB AREA	AREA (SF)	AREA (AC)	% IMPERVIOUS	C	Tc	I (IN/HR)	Q (CFS
AREA 1	770	0.018	100%	0.9	5	4.21	0.067
AREA 2	3,906	0.090	36%	0.452	5	4.21	0.171
AREA 3	3,669	0.084	67%	0.669	5	4.21	0.237
AREA 4	975	0.022	41%	0.487	5	4.21	0.046
TOTAL:	9,320	0.214				**TOTAL:**	0.521

- Stormwater discharge towards Via Esperia Street is 0.475 CFS.
- Stormwater discharge towards the south property line is 0.046 CFS.

RUNOFF ESTIMATE FOR 100-YEAR, 6-HOUR PRECIPITATION EXISTING CONDITIONS (see EXHIBIT B for SUB AREA identification)
P6 = 2.5 inches **P24 = 4.0 inches**

SUB AREA	AREA (SF)	AREA (AC)	% IMPERVIOUS	C	Tc	I (IN/HR)	Q (CFS
AREA 1	770	0.018	100%	0.9	5	6.59	0.105
AREA 2	3,906	0.090	36%	0.452	5	6.59	0.267
AREA 3	3,669	0.084	67%	0.669	5	6.59	0.371
AREA 4	975	0.022	41%	0.487	5	6.59	0.072
TOTAL:	9,320	0.214				**TOTAL:**	0.815

- Stormwater discharge towards Via Esperia Street is 0.743 CFS.
- Stormwater discharge towards the south property line is 0.072 CFS.

5. PROPOSED DEVELOPMENT

The proposed development is a new 4,405 SF two story single family residence with partial basement on a double lot. The existing two story single family residences with attached garages and concrete driveways are to be demolished. The existing property edge fences installed on top of concrete masonry retaining walls are to remain except for the fence and wall located between the properties being developed. The new residence utilizes the existing grades at the property edges to maintain consistency with existing edge conditions.

Zajda Group has performed a simplified assessment of the site hydrology for the proposed development based on the Rational Method as specified in SECTION 3 of the County of San Diego Hydrology Manual.

Rainfall intensity was estimated using the County Hydrology Manual for 2, 10, and 100-year frequency, the Intensity-Duration Design Chart, and 6-hour duration precipitation maps (see ATTACHMENTS at the end of the report). Time of Concentration (Tc) was conservatively assumed to be 5 minutes. Discharges were calculated for sub areas of the lot as shown on EXHIBIT C.

HYDROLOGY CALCULATIONS-PROPOSED CONDITIONS

RUNOFF ESTIMATE FOR 2-YEAR, 6-HOUR PRECIPITATION PROPOSED CONDITIONS

(see EXHIBIT C for SUB AREA identification)

P6 = 1.2 inches, P6 (adj)=1.1 inches **P24 = 1.8 inches**

SUB AREA	AREA (SF)	AREA (AC)	% IMPERVIOUS	C	Tc	I (IN/HR)	Q (CFS
AREA 1	3,340	0.077	100%	0.9	5	2.89	0.199
AREA 2	3,150	0.072	16%	0.312	5	2.89	0.065
AREA 3	2,820	0.065	34%	0.438	5	2.89	0.082
TOTAL:	9,320	0.214				**TOTAL:**	0.347

- Stormwater discharge to Via Esperia Street: 0.347 CFS
- Stormwater discharge towards the south property line: 0.0 CFS.

HYDROLOGY CALCULATIONS-PROPOSED CONDITIONS

RUNOFF ESTIMATE FOR 10-YEAR, 6-HOUR PRECIPITATION PROPOSED CONDITIONS

(see EXHIBIT C for SUB AREA identification)

P6 = 1.6 inches **P24 = 2.5 inches**

SUB AREA	AREA (SF)	AREA (AC)	% IMPERVIOUS	C	Tc	I (IN/HR)	Q (CFS
AREA 1	3,340	0.077	100%	0.9	5	4.21	0.291
AREA 2	3,150	0.072	16%	0.312	5	4.21	0.095
AREA 3	2,820	0.065	34%	0.438	5	4.21	0.119
TOTAL:	9,320	0.214				**TOTAL:**	0.505

- Stormwater discharge to Via Esperia Street: 0.505 CFS
- Stormwater discharge towards the south property line: 0.0 CFS.

HYDROLOGY CALCULATIONS-PROPOSED CONDITIONS

RUNOFF ESTIMATE FOR 100-YEAR, 6-HOUR PRECIPITATION PROPOSED CONDITIONS

(see EXHIBIT C for SUB AREA identification)

P6 = 2.5 inches **P24 = 4.0 inches**

SUB AREA	AREA (SF)	AREA (AC)	% IMPERVIOUS	C	Tc	I (IN/HR)	Q (CFS
AREA 1	3,340	0.077	100%	0.9	5	6.59	0.455
AREA 2	3,150	0.072	16%	0.312	5	6.59	0.149
AREA 3	2,820	0.065	34%	0.438	5	6.59	0.187
TOTAL:	9,320	0.214				**TOTAL:**	0.790

- Stormwater discharge to Via Esperia Street: 0.790 CFS
- Stormwater discharge towards the south property line: 0.0 CFS.

The results of the rational method assessment indicate the proposed improvements without the installation of the proposed rain barrels and a detention basin would increase the 100-year storm event rates to Via Esperia Street by 0.047 CFS. The proposed improvements will eliminate the cross lot drainage to the southerly property line.

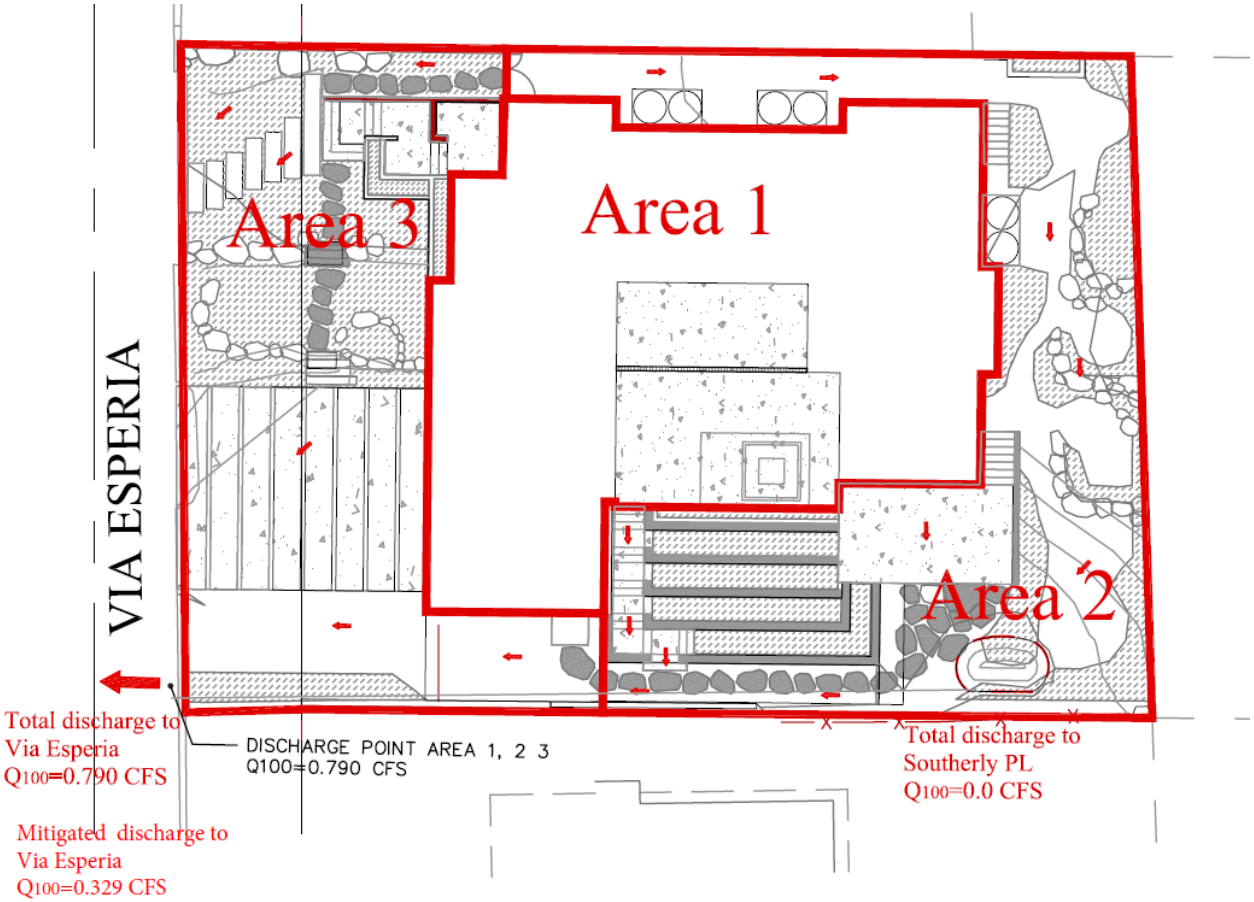


EXHIBIT C: PROPOSED CONDITION WITH NO DRAINAGE IMPROVEMENTS

5.1 Proposed Drainage Improvements

1) **Rain Barrels**--The proposed project intends to utilize six, 750 gallon rain barrels. The entire roof drainage of the home will be routed to these rain barrels. This allows for 4,500 gallons of stormwater to be stored on the property for use in irrigation of the landscape areas.
2) **Detention basin**-- The project proposes to use a detention basin in the south easterly portion of the project. The proposed detention basin has a storage capacity of approximately 90 cubic feet.

6.0 HYDROLOGY FOR PROPOSED DEVELOPMENT WITH THE DRAINAGE IMPROVEMENTS

Zajda Group has performed site hydrology calculations using HydroCad software for the proposed development. Rick RatHydro Software (Version 10.00) was used to generate the inflow hydrographs. The hydrograph information was entered manually into HydroCad. HydroCad generated the outflow hydrographs and the peak release rate data. See data below and Attachments E & F.

6.1 DETENTION

The project requires the use of detention because the post-construction runoff rate towards Via Esperia is greater than the pre-construction runoff rate. The project proposes using rain barrels with a total storage volume of 4,500 gallons (600 cubic feet) and a detention basin with a storage volume of approximately 670 gallons (90 cubic feet) to reduce the runoff rate.

The detention systems (rain barrels and detention basin) are modeled in HydroCad as “ponds”. “Ponds” are used in HydroCad to model stormwater detention/storage. The HydroCad model uses a “Vertical Cone/Cylinder” that has a diameter of 4’ and a height of 7.96’ for each rain barrel. The HydroCad model uses the “Custom Stage Data” option to model the detention basin using the plan elevations and the surface area.

With the combined use of the rain barrel detention system and the detention basin, the stormwater runoff rates towards Via Esperia for a 100-year, 6 hour storm will be approximately 0.329 cfs.

HYDROLOGY CALCULATIONS-PROPOSED CONDITIONS (MITIGATED)

RUNOFF ESTIMATE FOR 100-YEAR, 6-HOUR PRECIPITATION PROPOSED CONDITIONS

	TOTAL DISCHARGE, Q
STORM WATER DISCHARGE TO VIA ESPERIA (STREET)	0.329 CFS

7.0 CONCLUSION

The project will utilize detention in order to decrease the peak discharge rate. These drainage improvements will result in a decrease to the 100-year design storm event peak discharge rate. The proposed improvements also eliminate cross lot drainage on the southerly neighbors property. The proposed project will not have a significant impact on downstream properties and the drainage system is engineered to adequately manage site stormwater. In addition, the project disturbs less than one acre and is not part of a larger common plan development, therefore this project does not require approval from the Regional Water Quality Control Board Under Federal Clean Water Act (CWA) section 401 or 404.

ATTACHMENT A: NRCS Custom Soil Resource Report for San Diego County Area, California

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for San Diego County Area, California

Beyster Project-12835 & 12829 Via Esperia

June 23, 2020

Custom Soil Resource Report
Soil Map

6

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
CsC	Corralitos loamy sand, 5 to 9 percent slopes	0.2	100.0%
Totals for Area of Interest		**0.2**	**100.0%**

Map Unit Descriptions

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

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

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

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

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

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

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

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

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

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

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

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

San Diego County Area, California

CsC—Corralitos loamy sand, 5 to 9 percent slopes

Map Unit Setting

National map unit symbol: hbb1
Elevation: 30 to 1,000 feet
Mean annual precipitation: 12 to 30 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 300 to 330 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Corralitos and similar soils: 85 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Corralitos

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, rise
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium derived from calcareous sandstone

Typical profile

H1 - 0 to 9 inches: loamy sand
H2 - 9 to 43 inches: loamy fine sand, loamy sand
H2 - 9 to 43 inches: sand, fine sand
H3 - 43 to 72 inches:
H3 - 43 to 72 inches:

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.5 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Las flores

Percent of map unit: 5 percent

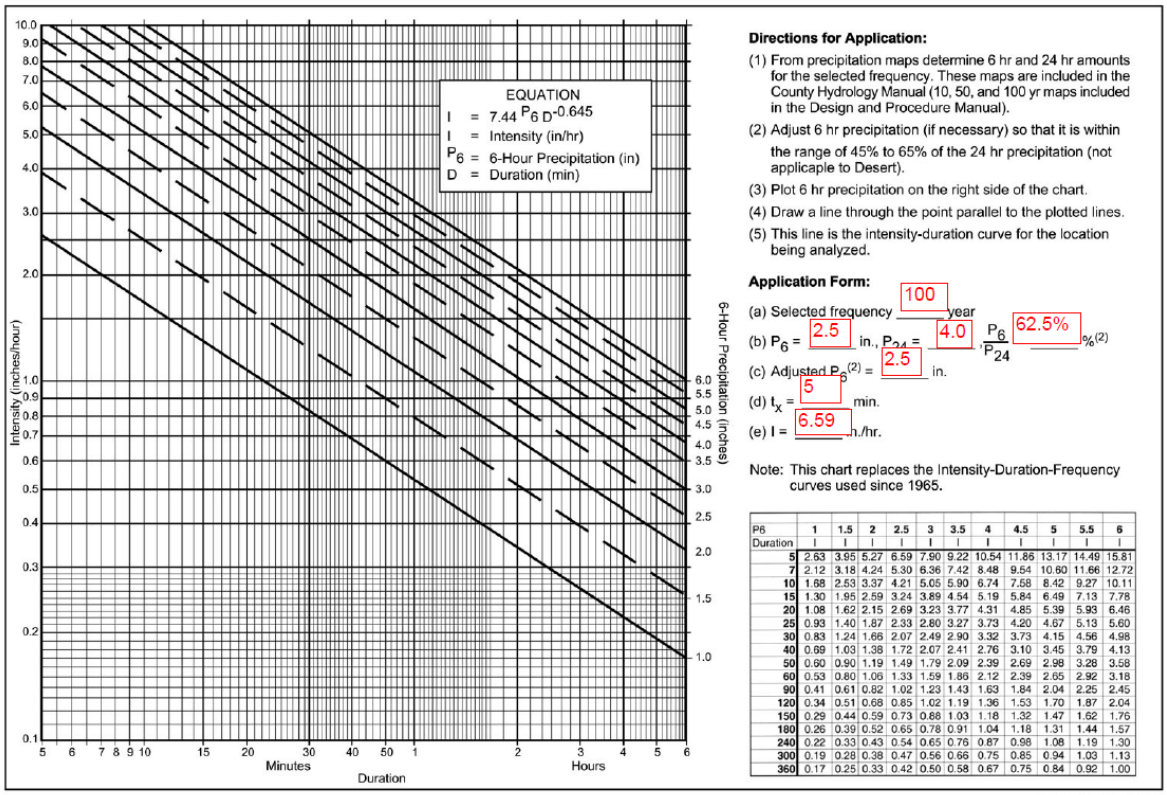
Hydric soil rating: No

Huerhuero

Percent of map unit: 5 percent
Hydric soil rating: No

ATTACHMENT B: INTENSITY-DURATION CHART

(Source: Intensity-Duration Design Chart--Template from Figure 3-1 of the 2003 San Diego County Hydrology Manual)



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency 100 year

(b) P_6 = 2.5 in., P_{24} = 4.0, $\frac{P_6}{P_{24}}$ = 62.5 %(2)

(c) Adjusted $P_6^{(2)}$ = 2.5 in.

(d) t_x = 5 min.

(e) I = 6.59 in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE 3-1

ATTACHMENT C:
TABLE 3-1: RUNOFF COEFFICIENTS FOR URBAN AREAS
(Source: Table 3-1 on Page 3-6 of the 2003 San Diego County Hydrology Manual)

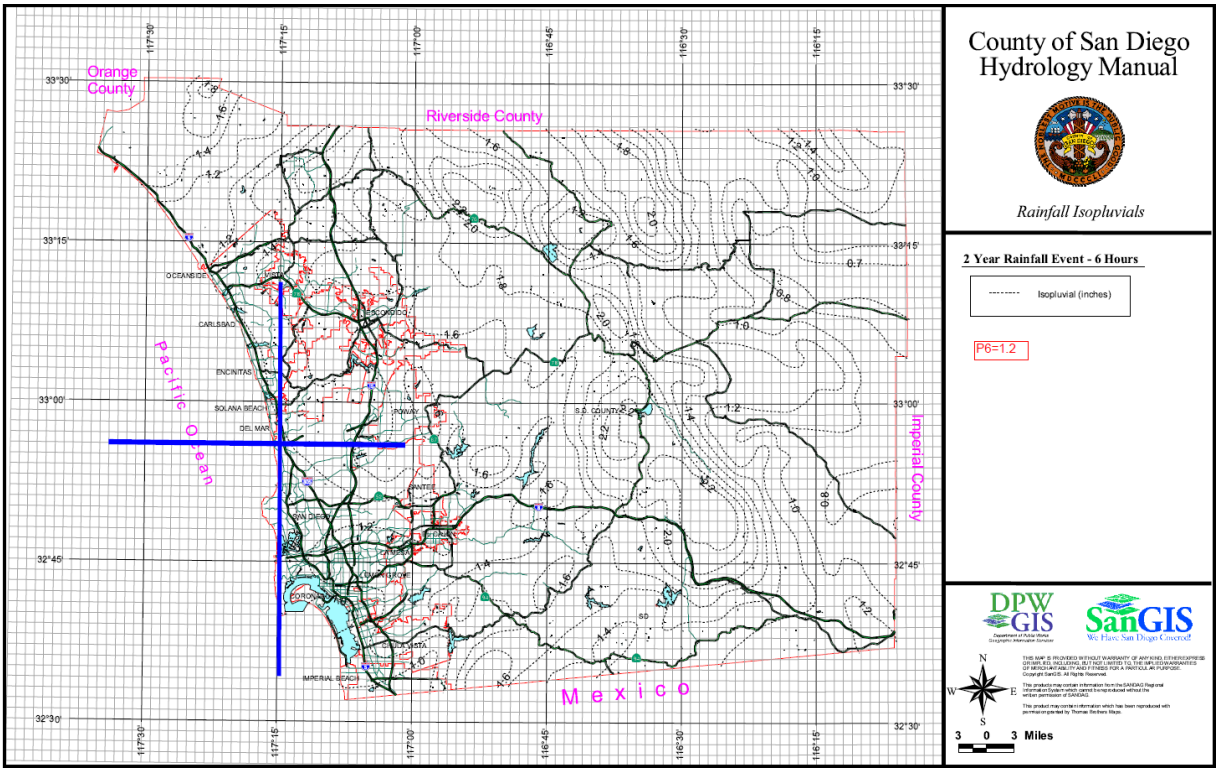
Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

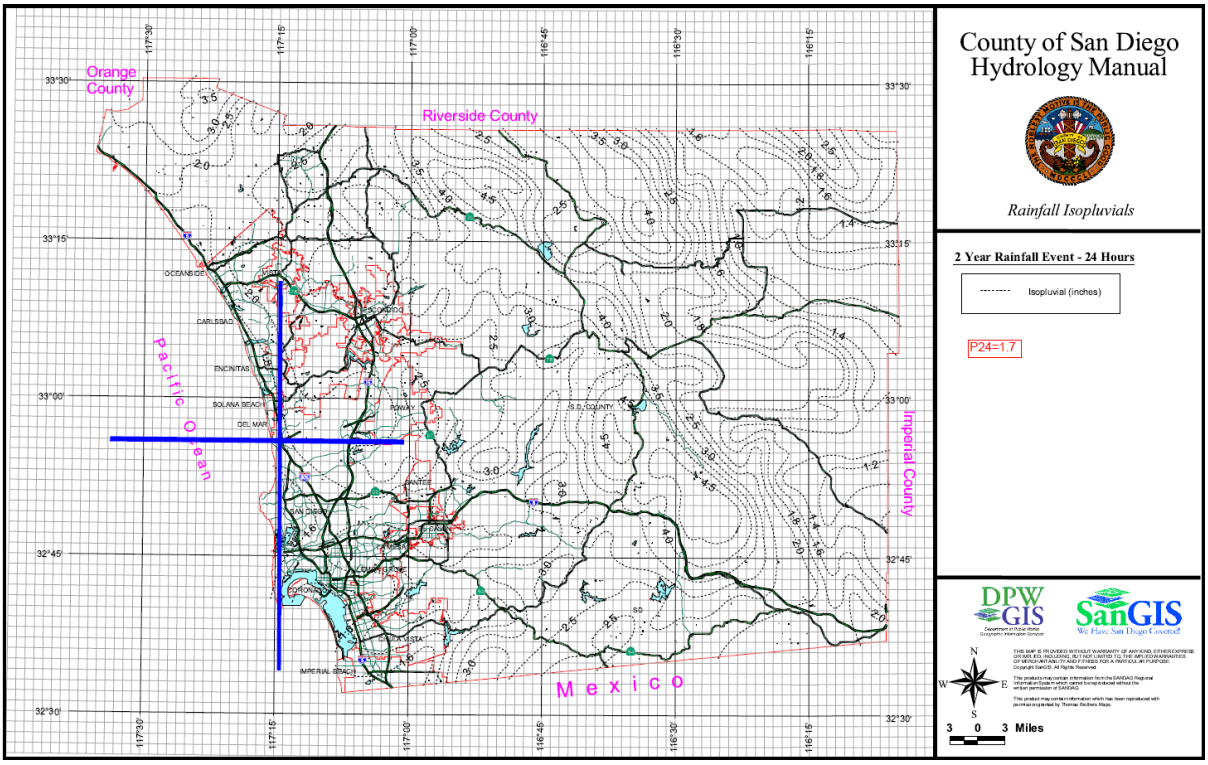
*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service

ATTACHMENT D: ISOPLUVIAL CHARTS

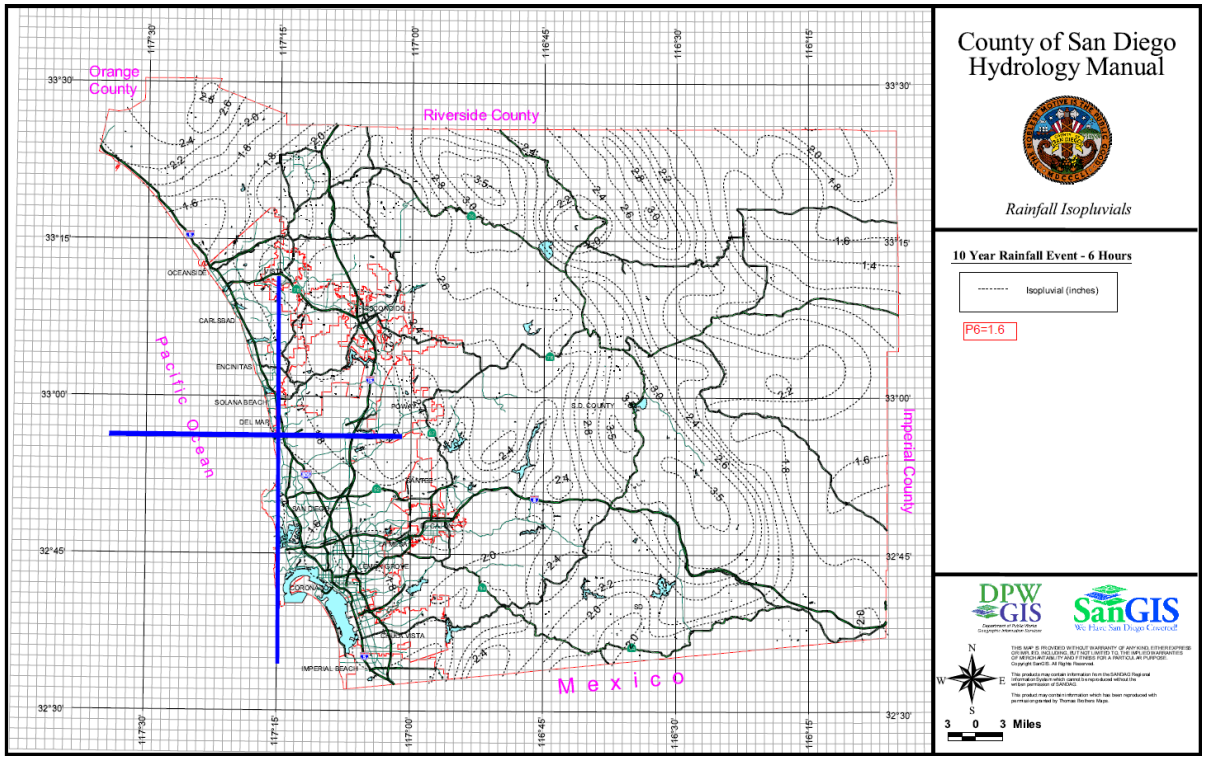
2-YEAR RAINFALL EVENT - 6 HOUR ISOPLUVIAL CHART



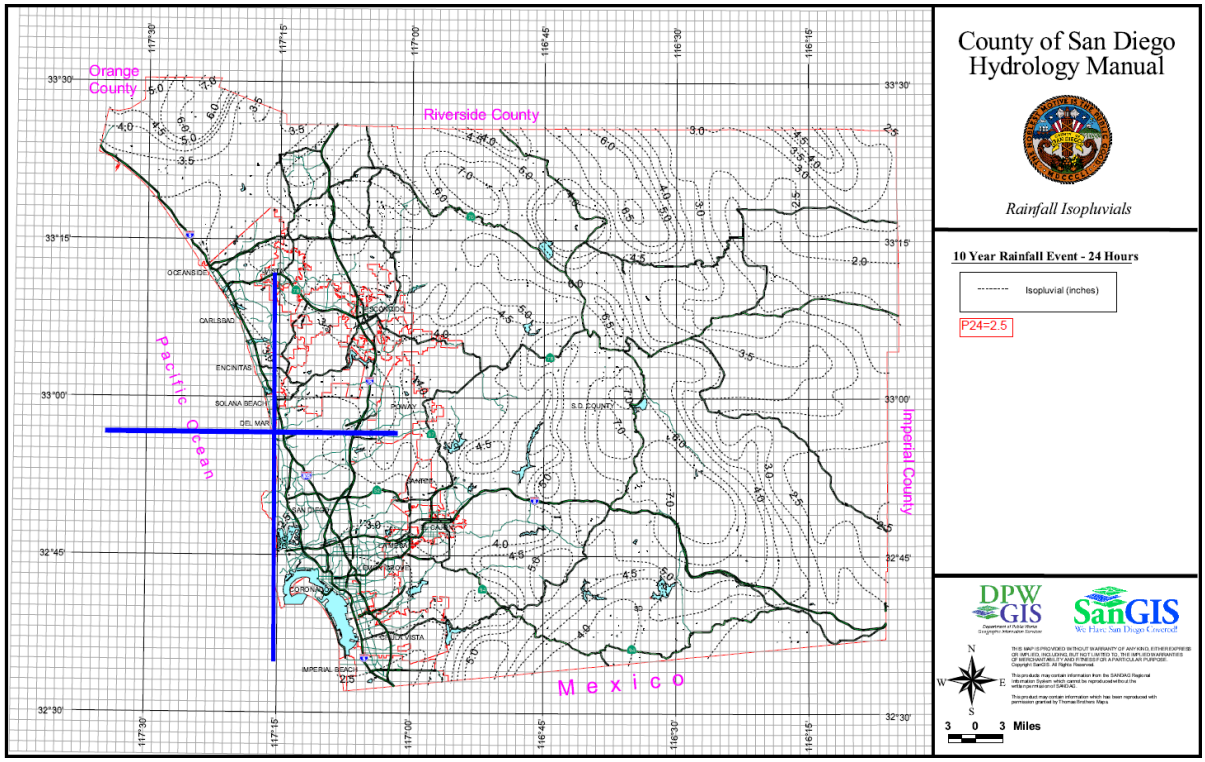
2-YEAR RAINFALL EVENT - 24 HOUR ISOPLUVIAL CHART



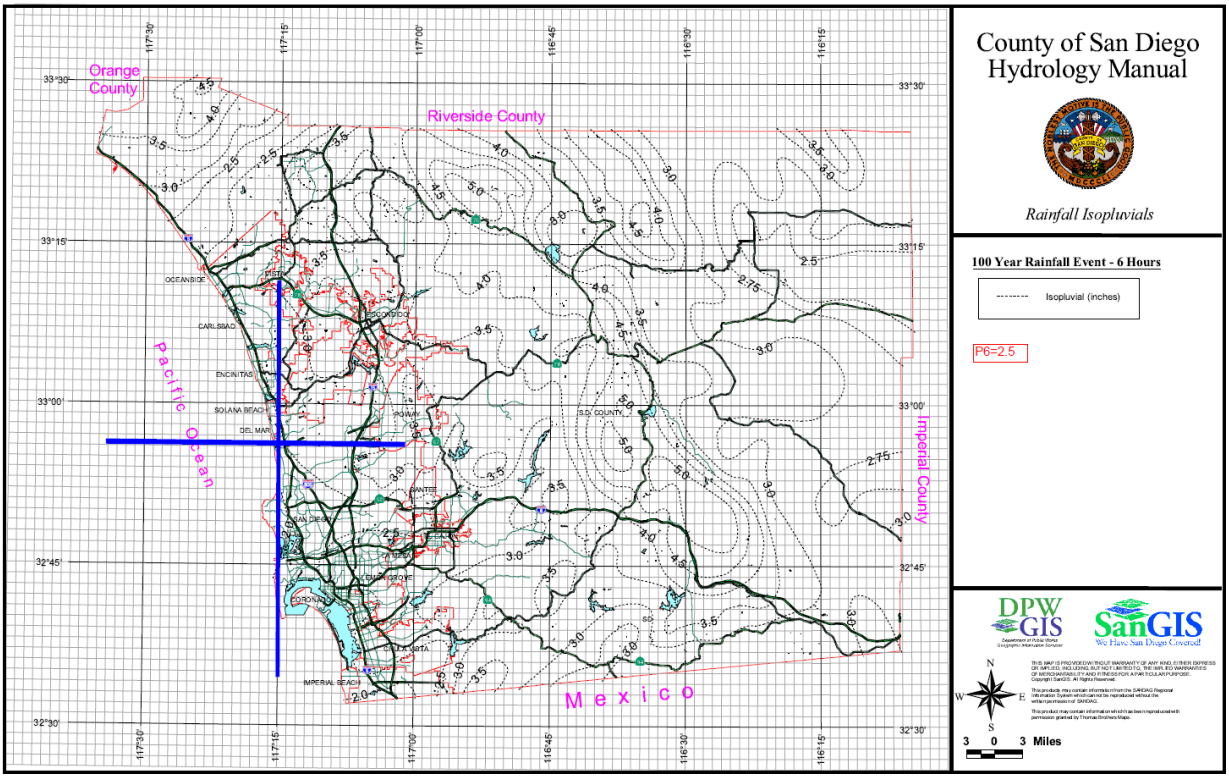
10-YEAR RAINFALL EVENT - 6 HOUR ISOPLUVIAL CHART



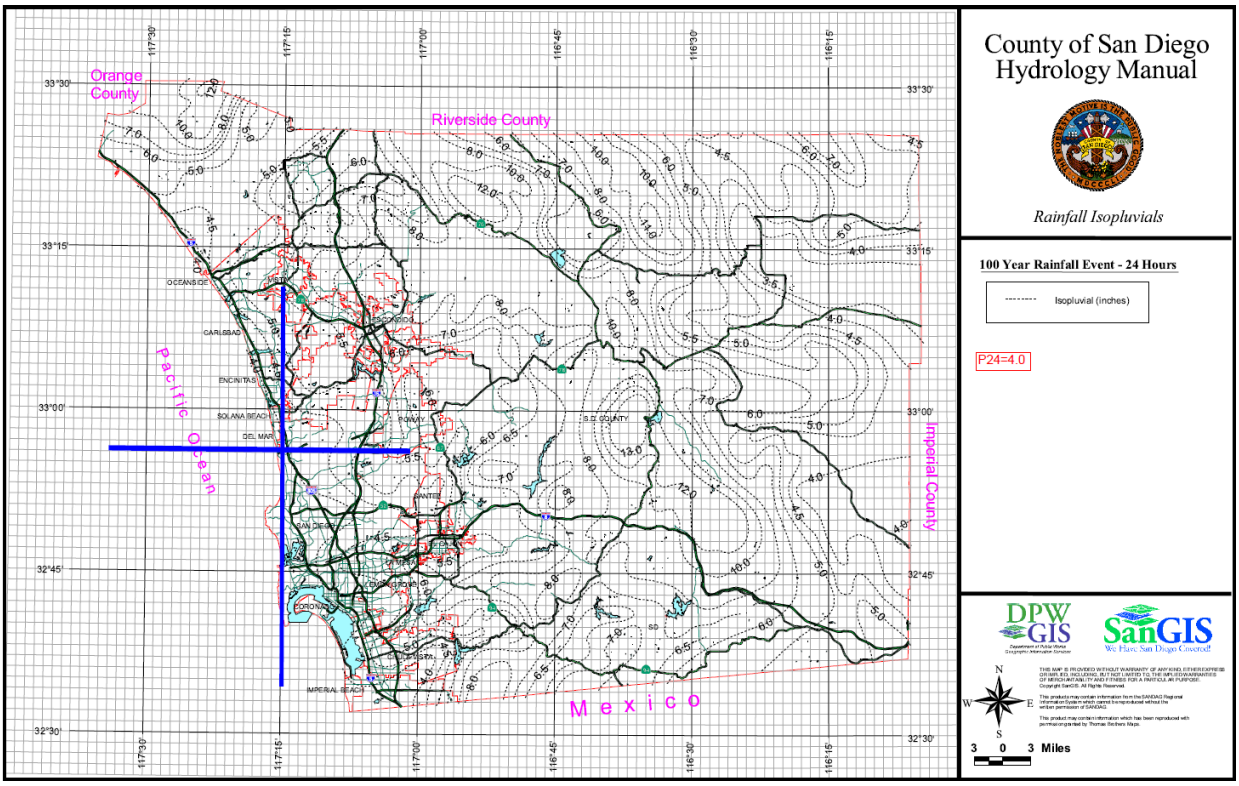
10-YEAR RAINFALL EVENT - 24 HOUR ISOPLUVIAL CHART



100-YEAR RAINFALL EVENT - 6 HOUR ISOPLUVIAL CHART



100-YEAR RAINFALL EVENT - 24 HOUR ISOPLUVIAL CHART



ATTACHMENT E:
Rick Rat Hydrograph

RATIONAL METHOD HYDROGRAPH PROGRAM
COPYRIGHT 1992, 2001 RICK ENGINEERING COMPANY

RUN DATE 7/9/2020
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 5 MIN.
6 HOUR RAINFALL 2.5 INCHES
BASIN AREA 0.077 ACRES
RUNOFF COEFFICIENT 0.95
PEAK DISCHARGE 0.455 CFS

AREA 1

TIME (MIN) = 0	DISCHARGE (CFS) = 0
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RATIONAL METHOD HYDROGRAPH PROGRAM
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AREA 2

RUN DATE 7/9/2020
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 5 MIN.
6 HOUR RAINFALL 2.5 INCHES
BASIN AREA 0.072 ACRES
RUNOFF COEFFICIENT 0.312
PEAK DISCHARGE 0.149 CFS

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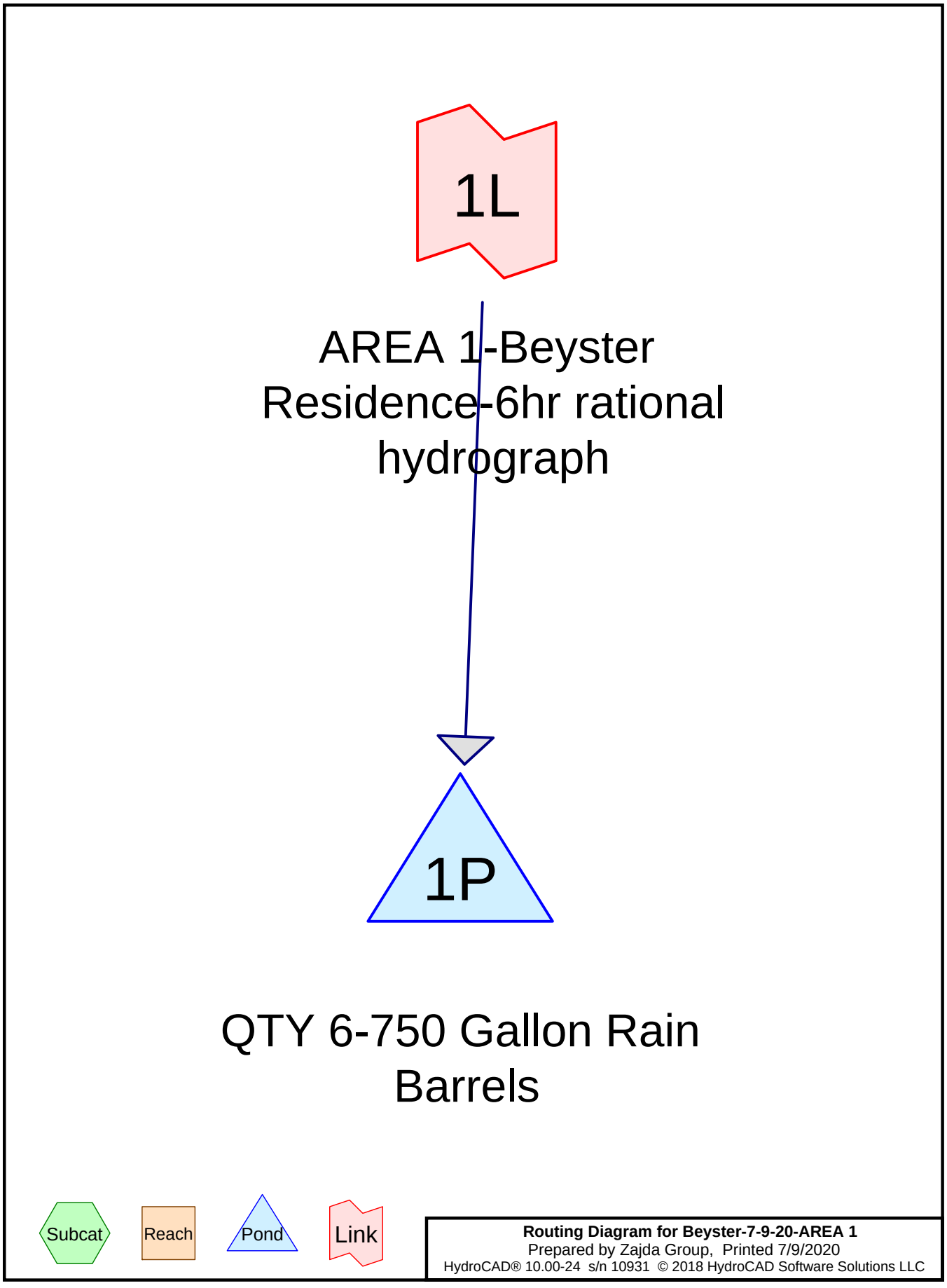
Attachment F
HydroCAD Report for AREAS 1 & 2



Routing Diagram for Beyster-7-9-20-AREA 1
Prepared by Zajda Group, Printed 7/9/2020

Summary for Pond 1P: QTY 6-750 Gallon Rain Barrels

Inflow Area = 0.077 ac, 95.00% Impervious, Inflow Depth = 1.20"
Inflow = 0.46025 cfs @ 4.08 hrs, Volume= 0.008 af
Outflow = 0.14175 cfs @ 4.15 hrs, Volume= 0.006 af, Atten= 69%, Lag= 4.3 min
Primary = 0.14175 cfs @ 4.15 hrs, Volume= 0.006 af

Routing by Stor-Ind method, Time Span= 0.00-12.00 hrs, dt= 0.01 hrs
Peak Elev= 57.90' @ 4.15 hrs Surf.Area= 75 sf Storage= 219 cf

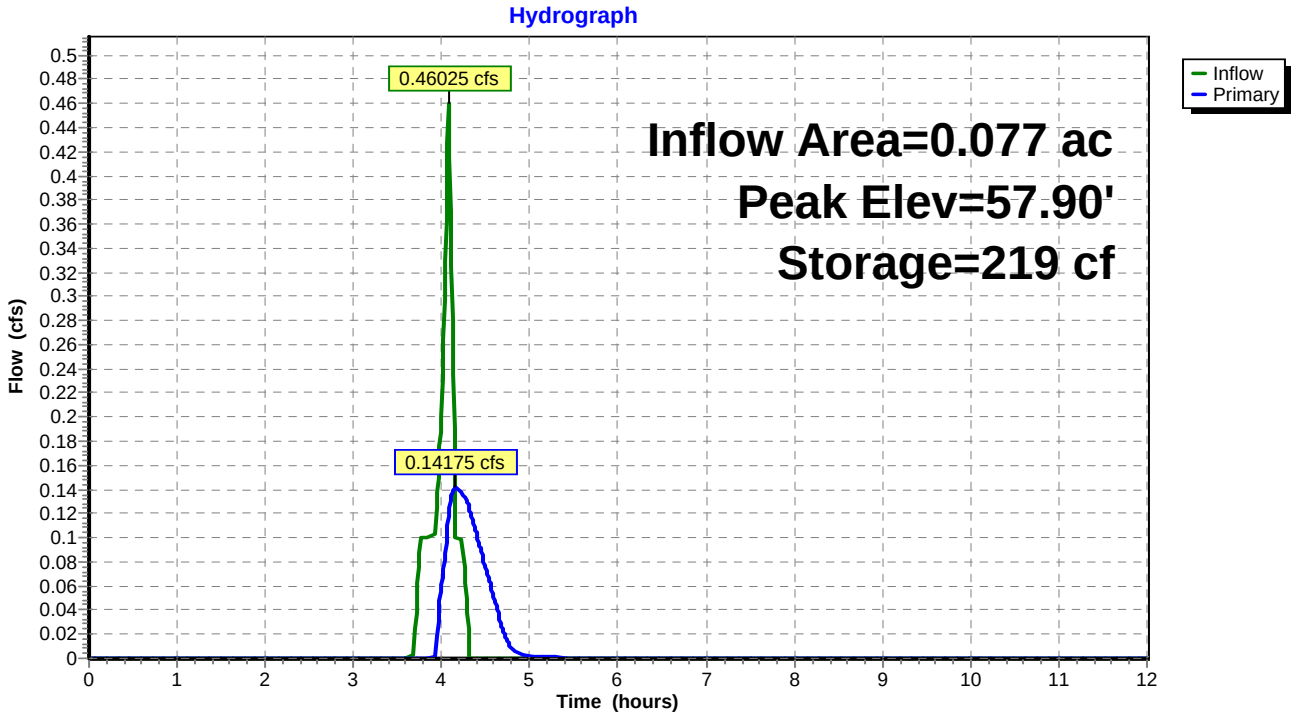
Plug-Flow detention time= 19.8 min calculated for 0.006 af (77% of inflow)
Center-of-Mass det. time= 16.9 min (258.4 - 241.5)

Volume	Invert	Avail.Storage	Storage Description
#1	55.00'	600 cf	**4.00'D x 7.96'H Vertical Cone/Cylinder** x 6

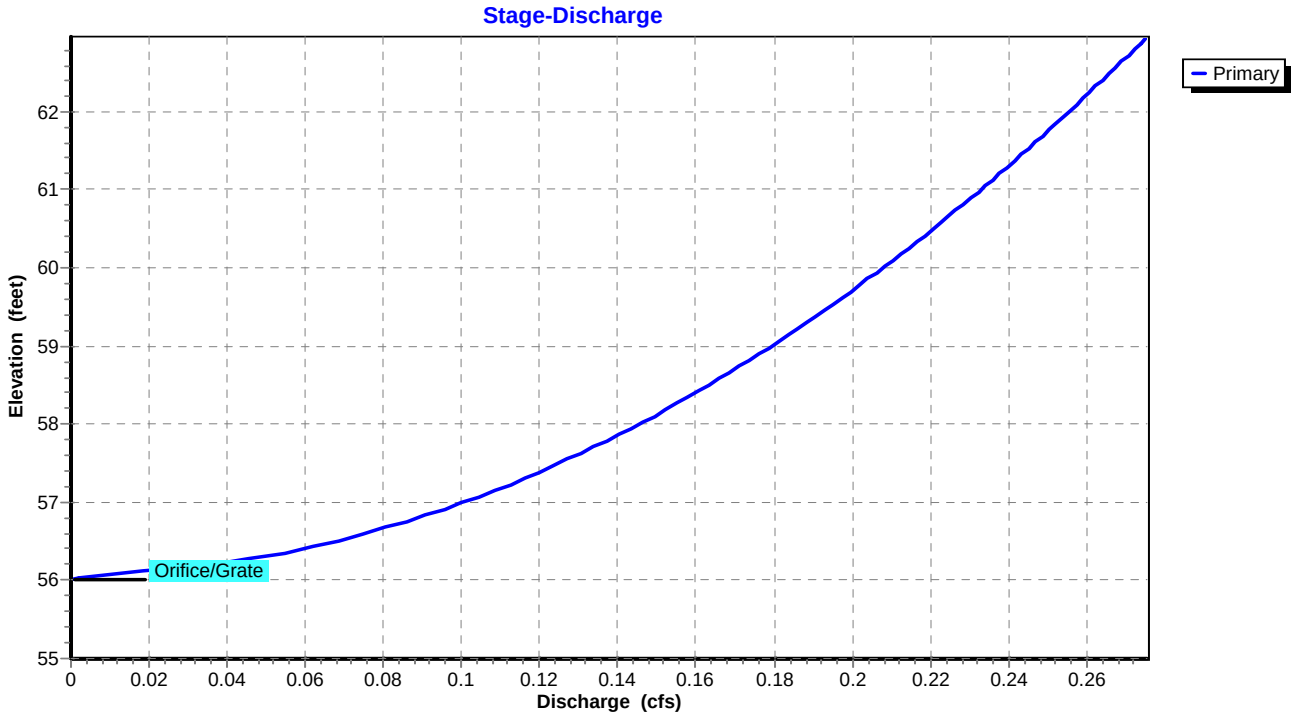
Device	Routing	Invert	Outlet Devices
#1	Primary	56.00'	**2.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.14173 cfs @ 4.15 hrs HW=57.90' (Free Discharge)
1=Orifice/Grate (Orifice Controls 0.14173 cfs @ 6.50 fps)

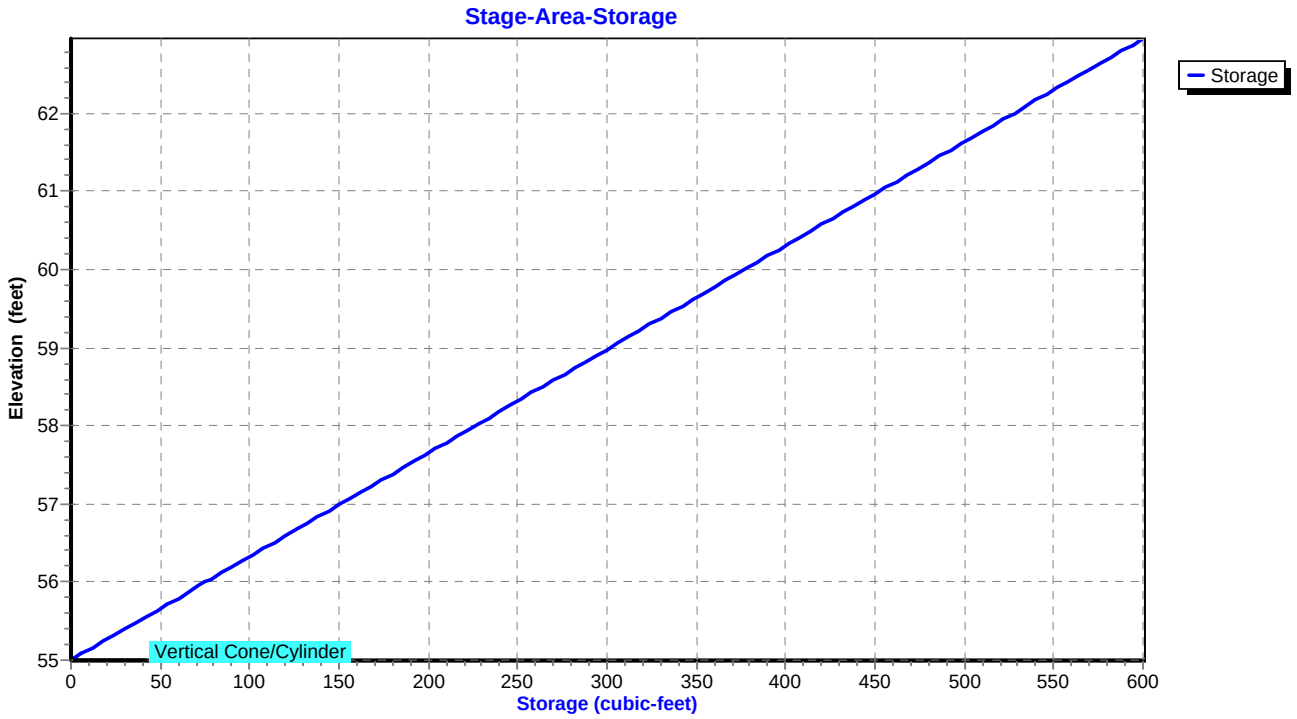
Pond 1P: QTY 6-750 Gallon Rain Barrels



Pond 1P: QTY 6-750 Gallon Rain Barrels



Pond 1P: QTY 6-750 Gallon Rain Barrels



Hydrograph for Pond 1P: QTY 6-750 Gallon Rain Barrels

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00000	0	55.00	0.00000
0.50	0.00000	0	55.00	0.00000
1.00	0.00000	0	55.00	0.00000
1.50	0.00000	0	55.00	0.00000
2.00	0.00000	0	55.00	0.00000
2.50	0.00000	0	55.00	0.00000
3.00	0.00000	0	55.00	0.00000
3.50	0.00000	0	55.00	0.00000
4.00	**0.20000**	**107**	**56.42**	**0.06071**
4.50	**0.00000**	**120**	**56.59**	**0.07503**
5.00	0.00000	78	56.03	0.00176
5.50	0.00000	76	56.01	0.00042
6.00	0.00000	76	56.00	0.00010
6.50	0.00000	75	56.00	0.00002
7.00	0.00000	75	56.00	0.00001
7.50	0.00000	75	56.00	0.00000
8.00	0.00000	75	56.00	0.00000
8.50	0.00000	75	56.00	0.00000
9.00	0.00000	75	56.00	0.00000
9.50	0.00000	75	56.00	0.00000
10.00	0.00000	75	56.00	0.00000
10.50	0.00000	75	56.00	0.00000
11.00	0.00000	75	56.00	0.00000
11.50	0.00000	75	56.00	0.00000
12.00	0.00000	75	56.00	0.00000

Summary for Link 1L: AREA 1-Beyster Residence-6hr rational hydrograph

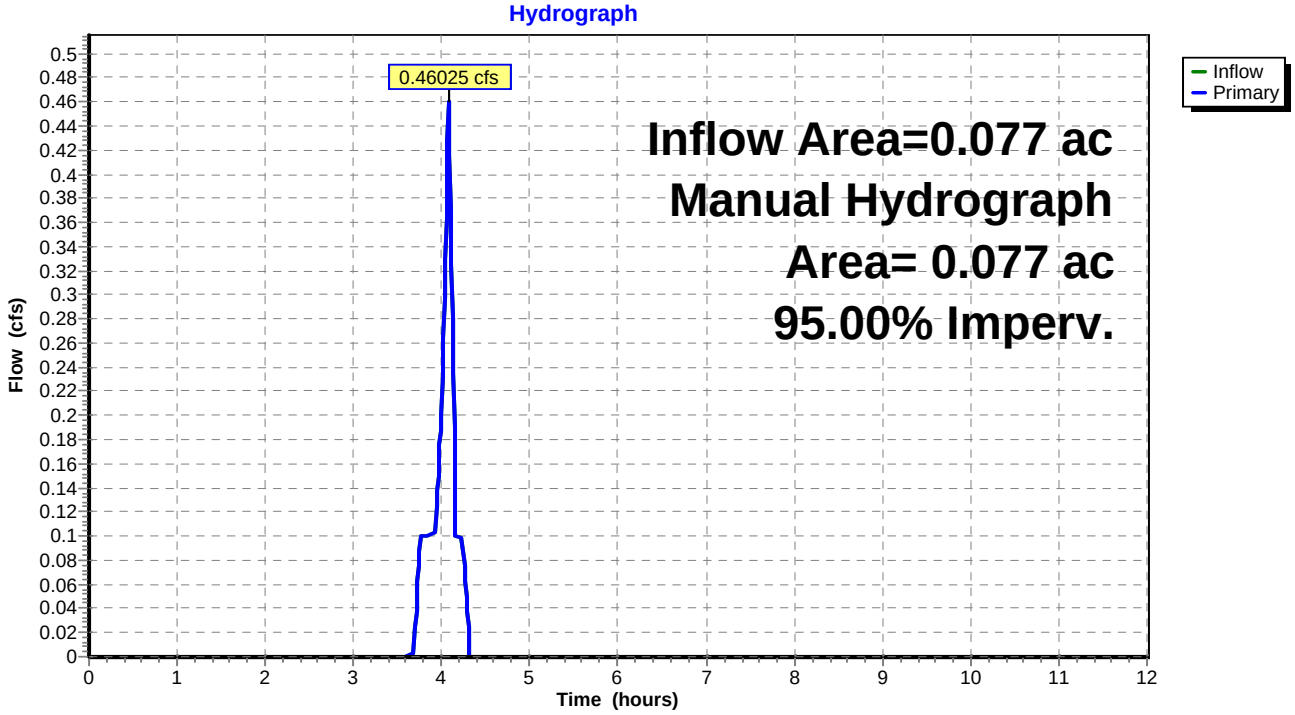
Inflow Area = 0.077 ac, 95.00% Impervious, Inflow Depth = 1.20"
Inflow = 0.46025 cfs @ 4.08 hrs, Volume= 0.008 af
Primary = 0.46025 cfs @ 4.08 hrs, Volume= 0.008 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-12.00 hrs, dt= 0.01 hrs

78 Point manual hydrograph, To= 0.00 hrs, dt= 0.08 hrs, Area= 0.077 ac, 95.00% Imp., cfs =

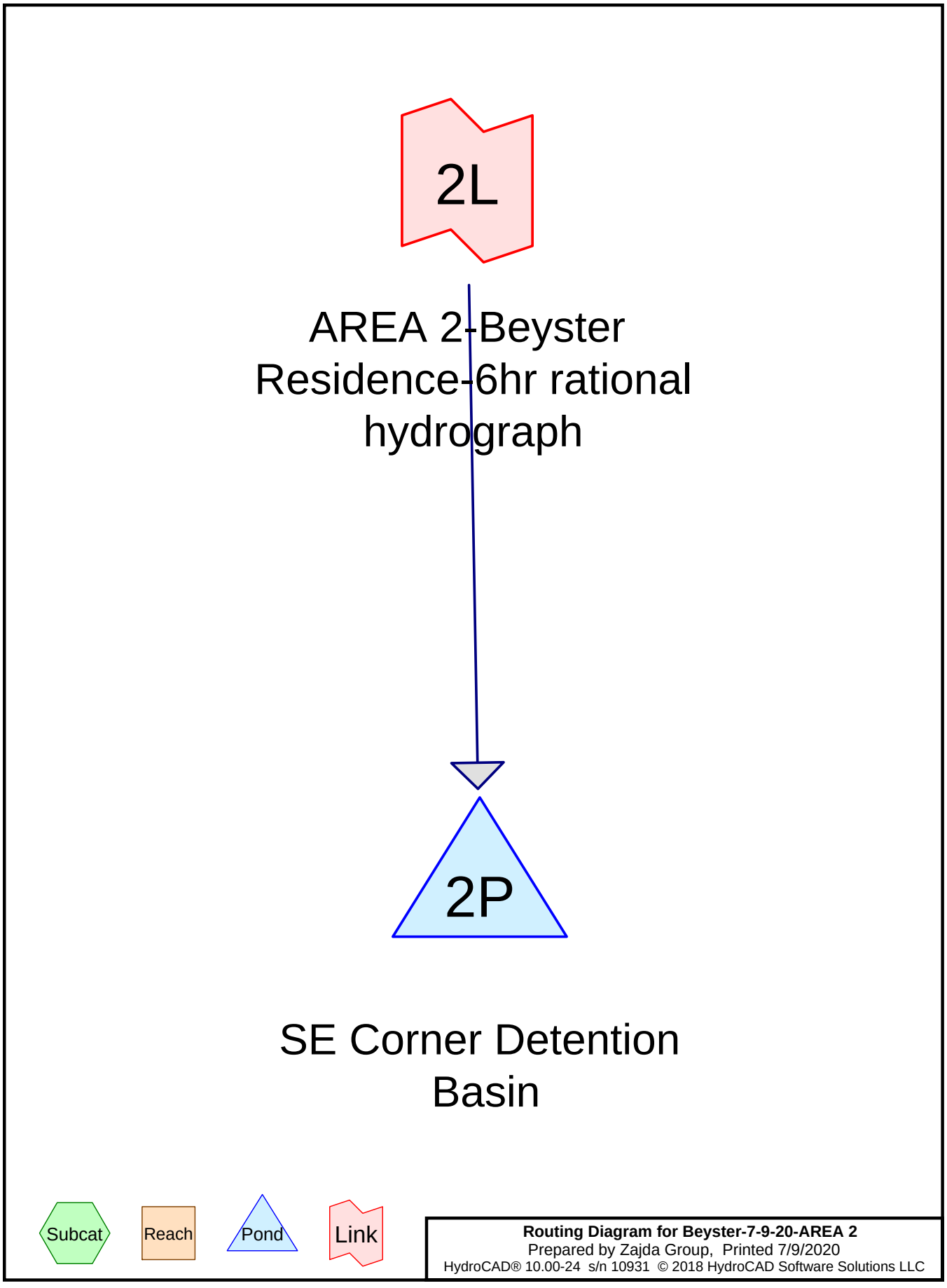
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.10
0.20	0.46	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		

Link 1L: AREA 1-Beyster Residence-6hr rational hydrograph



Hydrograph for Link 1L: AREA 1-Beyster Residence-6hr rational hydrograph

Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00000	**0.00**	0.00000
0.20	0.00000	0.00	0.00000
0.40	0.00000	0.00	0.00000
0.60	0.00000	0.00	0.00000
0.80	0.00000	0.00	0.00000
1.00	0.00000	0.00	0.00000
1.20	0.00000	0.00	0.00000
1.40	0.00000	0.00	0.00000
1.60	0.00000	0.00	0.00000
1.80	0.00000	0.00	0.00000
2.00	0.00000	0.00	0.00000
2.20	0.00000	0.00	0.00000
2.40	0.00000	0.00	0.00000
2.60	0.00000	0.00	0.00000
2.80	0.00000	0.00	0.00000
3.00	0.00000	0.00	0.00000
3.20	0.00000	0.00	0.00000
3.40	0.00000	0.00	0.00000
3.60	0.00000	0.00	0.00000
3.80	0.10000	0.00	0.10000
4.00	**0.20000**	0.00	**0.20000**
4.20	**0.10000**	0.00	**0.10000**
4.40	0.00000	0.00	0.00000
4.60	0.00000	0.00	0.00000
4.80	0.00000	0.00	0.00000
5.00	0.00000	0.00	0.00000
5.20	0.00000	0.00	0.00000
5.40	0.00000	0.00	0.00000
5.60	0.00000	0.00	0.00000
5.80	0.00000	0.00	0.00000
6.00	0.00000	0.00	0.00000
6.20	0.00000	0.00	0.00000
6.40	0.00000	0.00	0.00000
6.60	0.00000	0.00	0.00000
6.80	0.00000	0.00	0.00000
7.00	0.00000	0.00	0.00000
7.20	0.00000	0.00	0.00000
7.40	0.00000	0.00	0.00000
7.60	0.00000	0.00	0.00000
7.80	0.00000	0.00	0.00000
8.00	0.00000	0.00	0.00000
8.20	0.00000	0.00	0.00000
8.40	0.00000	0.00	0.00000
8.60	0.00000	0.00	0.00000
8.80	0.00000	0.00	0.00000
9.00	0.00000	0.00	0.00000
9.20	0.00000	0.00	0.00000
9.40	0.00000	0.00	0.00000
9.60	0.00000	0.00	0.00000
9.80	0.00000	0.00	0.00000
10.00	0.00000	0.00	0.00000
10.20	0.00000	0.00	0.00000
10.40	0.00000	0.00	0.00000
10.60	0.00000	0.00	0.00000
10.80	0.00000	0.00	0.00000
11.00	0.00000	0.00	0.00000
11.20	0.00000	0.00	0.00000
11.40	0.00000	0.00	0.00000
11.60	0.00000	0.00	0.00000
11.80	0.00000	0.00	0.00000
12.00	0.00000	0.00	0.00000



Routing Diagram for Beyster-7-9-20-AREA 2
Prepared by Zajda Group, Printed 7/9/2020

Summary for Pond 2P: SE Corner Detention Basin

Inflow Area = 0.072 ac, 16.00% Impervious, Inflow Depth = 0.17"
Inflow = 0.15000 cfs @ 4.08 hrs, Volume= 0.001 af
Outflow = 0.00000 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00000 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-12.00 hrs, dt= 0.01 hrs
Peak Elev= 49.96' @ 4.16 hrs Surf.Area= 28 sf Storage= 43 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

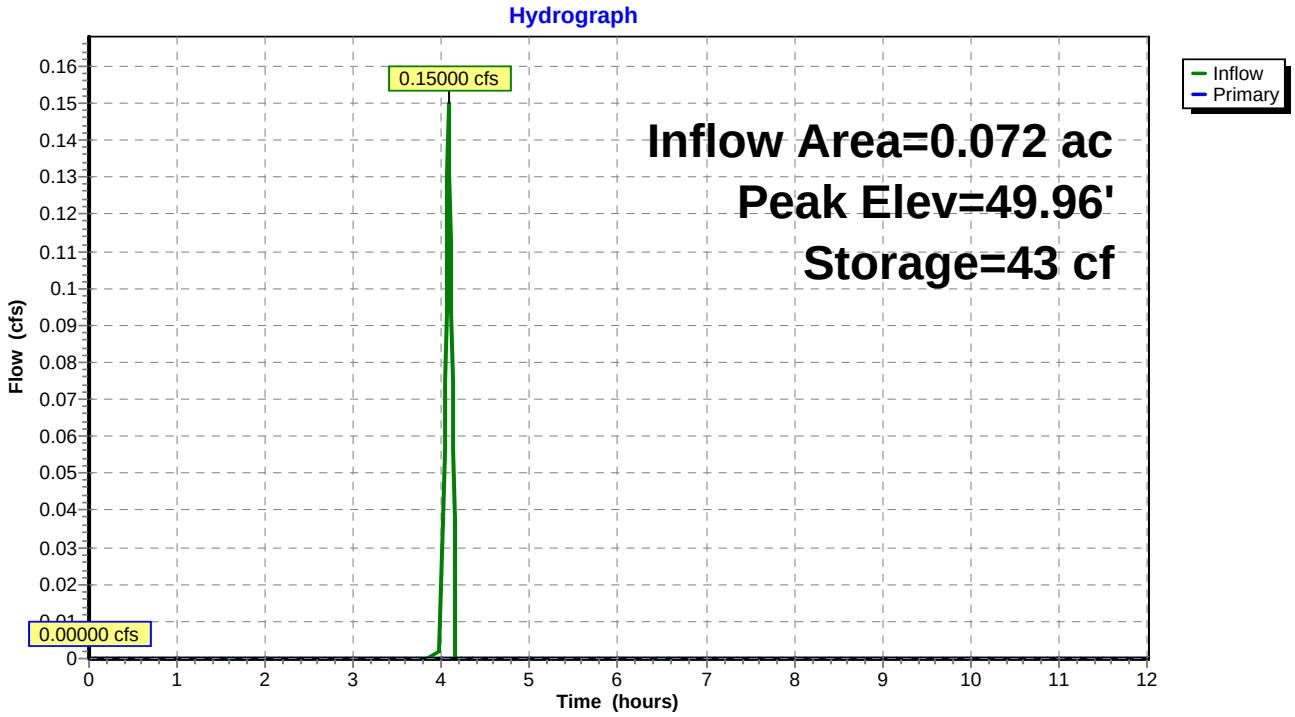
Volume	Invert	Avail.Storage	Storage Description
#1	47.90'	90 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
47.90	2	0	0
48.00	4	0	0
49.00	28	16	16
50.00	28	28	44
51.00	64	46	90

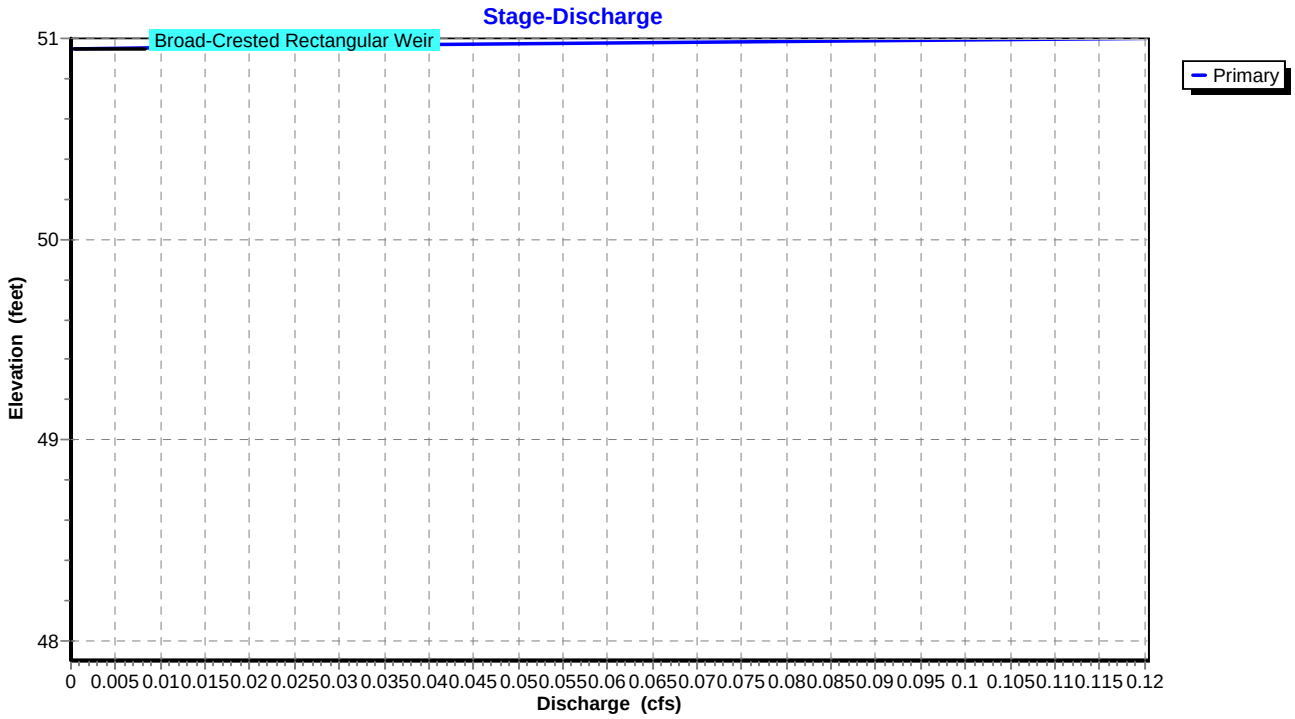
Device	Routing	Invert	Outlet Devices
#1	Primary	50.95'	**4.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=0.00000 cfs @ 0.00 hrs HW=47.90' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00000 cfs)

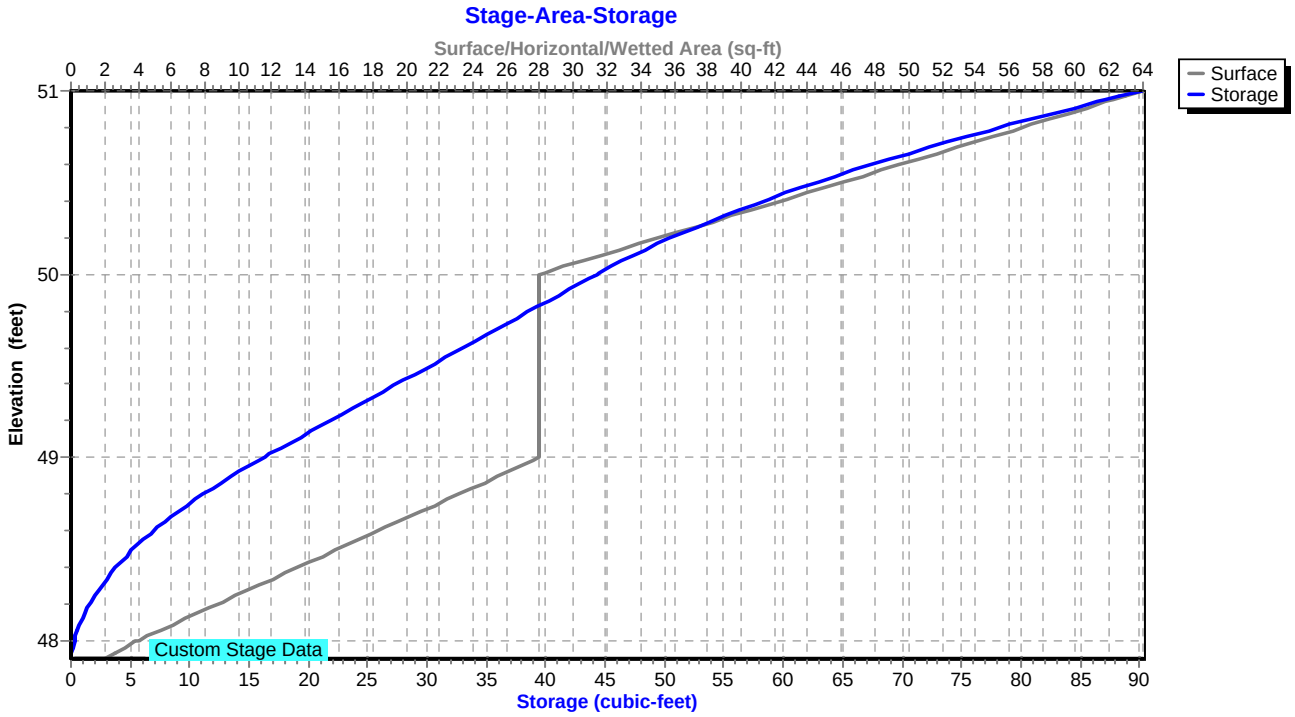
Pond 2P: SE Corner Detention Basin



Pond 2P: SE Corner Detention Basin



Pond 2P: SE Corner Detention Basin



Hydrograph for Pond 2P: SE Corner Detention Basin

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00000	0	47.90	**0.00000**
0.50	0.00000	0	47.90	0.00000
1.00	0.00000	0	47.90	0.00000
1.50	0.00000	0	47.90	0.00000
2.00	0.00000	0	47.90	0.00000
2.50	0.00000	0	47.90	0.00000
3.00	0.00000	0	47.90	0.00000
3.50	0.00000	0	47.90	0.00000
4.00	**0.00000**	**0**	**47.90**	0.00000
4.50	**0.00000**	**43**	**49.96**	0.00000
5.00	0.00000	43	49.96	0.00000
5.50	0.00000	43	49.96	0.00000
6.00	0.00000	43	49.96	0.00000
6.50	0.00000	43	49.96	0.00000
7.00	0.00000	43	49.96	0.00000
7.50	0.00000	43	49.96	0.00000
8.00	0.00000	43	49.96	0.00000
8.50	0.00000	43	49.96	0.00000
9.00	0.00000	43	49.96	0.00000
9.50	0.00000	43	49.96	0.00000
10.00	0.00000	43	49.96	0.00000
10.50	0.00000	43	49.96	0.00000
11.00	0.00000	43	49.96	0.00000
11.50	0.00000	43	49.96	0.00000
12.00	0.00000	43	49.96	0.00000

Summary for Link 2L: AREA 2-Beyster Residence-6hr rational hydrograph

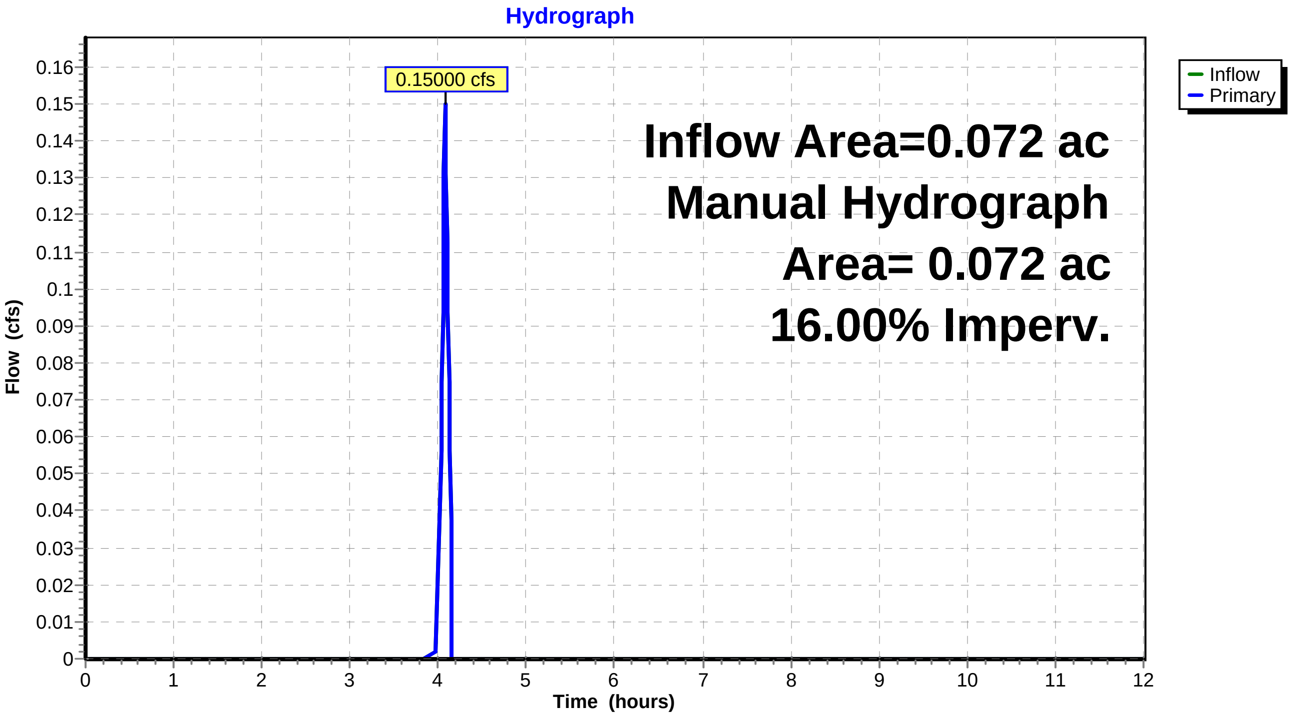
Inflow Area = 0.072 ac, 16.00% Impervious, Inflow Depth = 0.17"
Inflow = 0.15000 cfs @ 4.08 hrs, Volume= 0.001 af
Primary = 0.15000 cfs @ 4.08 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-12.00 hrs, dt= 0.01 hrs

78 Point manual hydrograph, To= 0.00 hrs, dt= 0.08 hrs, Area= 0.072 ac, 16.00% Imp., cfs =

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		

Link 2L: AREA 2-Beyster Residence-6hr rational hydrograph



Hydrograph for Link 2L: AREA 2-Beyster Residence-6hr rational hydrograph

Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00000	**0.00**	0.00000
0.20	0.00000	0.00	0.00000
0.40	0.00000	0.00	0.00000
0.60	0.00000	0.00	0.00000
0.80	0.00000	0.00	0.00000
1.00	0.00000	0.00	0.00000
1.20	0.00000	0.00	0.00000
1.40	0.00000	0.00	0.00000
1.60	0.00000	0.00	0.00000
1.80	0.00000	0.00	0.00000
2.00	0.00000	0.00	0.00000
2.20	0.00000	0.00	0.00000
2.40	0.00000	0.00	0.00000
2.60	0.00000	0.00	0.00000
2.80	0.00000	0.00	0.00000
3.00	0.00000	0.00	0.00000
3.20	0.00000	0.00	0.00000
3.40	0.00000	0.00	0.00000
3.60	0.00000	0.00	0.00000
3.80	0.00000	0.00	0.00000
4.00	**0.00000**	0.00	**0.00000**
4.20	**0.00000**	0.00	**0.00000**
4.40	0.00000	0.00	0.00000
4.60	0.00000	0.00	0.00000
4.80	0.00000	0.00	0.00000
5.00	0.00000	0.00	0.00000
5.20	0.00000	0.00	0.00000
5.40	0.00000	0.00	0.00000
5.60	0.00000	0.00	0.00000
5.80	0.00000	0.00	0.00000
6.00	0.00000	0.00	0.00000
6.20	0.00000	0.00	0.00000
6.40	0.00000	0.00	0.00000
6.60	0.00000	0.00	0.00000
6.80	0.00000	0.00	0.00000
7.00	0.00000	0.00	0.00000
7.20	0.00000	0.00	0.00000
7.40	0.00000	0.00	0.00000
7.60	0.00000	0.00	0.00000
7.80	0.00000	0.00	0.00000
8.00	0.00000	0.00	0.00000
8.20	0.00000	0.00	0.00000
8.40	0.00000	0.00	0.00000
8.60	0.00000	0.00	0.00000
8.80	0.00000	0.00	0.00000
9.00	0.00000	0.00	0.00000
9.20	0.00000	0.00	0.00000
9.40	0.00000	0.00	0.00000
9.60	0.00000	0.00	0.00000
9.80	0.00000	0.00	0.00000
10.00	0.00000	0.00	0.00000
10.20	0.00000	0.00	0.00000
10.40	0.00000	0.00	0.00000
10.60	0.00000	0.00	0.00000
10.80	0.00000	0.00	0.00000
11.00	0.00000	0.00	0.00000
11.20	0.00000	0.00	0.00000
11.40	0.00000	0.00	0.00000
11.60	0.00000	0.00	0.00000
11.80	0.00000	0.00	0.00000
12.00	0.00000	0.00	0.00000