Safari Highlands Ranch
CEQA Drainage Study

W.O. 2374-017

Escondido, California

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Table of Contents

1. Introduction 1
   1.1. Scope of Work 1
   1.2. Project Description 1
   1.3. Existing Condition 2
   1.4. Proposed Condition 3
2. Methodology 5
   2.1. Rational Method Hydrologic Analysis 5
   2.2. NRCS Unit Hydrologic Analysis 5
      2.2.1 Basin Delineation 5
      2.2.2. Precipitation Data 7
      2.2.3. Loss Rates 8
      2.2.4. Unit Hydrograph 12
      2.2.5. Hydrograph Rating 12
      2.2.6. Detention Basin Analysis 13
      2.2.7. Hydraulics Analysis 14
3. Analysis and Results 15
4. References 20
5. Appendices
   1. Project Watershed Map
   2. FIRM Map
   3. Soils Information
   4. Hydrology Determination Data
   5. Hydrologic Model and Exhibits - Existing Condition
   6. Hydrologic Model and Exhibits - Proposed Condition
   7. Offsite Hydrology Model & Exhibits
   8. Basin and Culvert Location Exhibit
   9. Basin - Stage - Storage - Discharge Tables Culvert Analysis
   10. HEC-RAS Channel Analysis
   11. Super elevation Calculation
   12. Culvert Analysis

1. Introduction

1.1. Scope of Work

The purpose of this study is to provide preliminary hydrology calculations in support of a proposed residential development in the City of Escondido, California. This report will quantify runoff for the 100-year frequency storm event and address flood attenuation to ensure downstream conveyances will not be affected due to this development as well as recommend on-site storm drain infrastructure needed to safely convey stormwater through the site for a 100-year frequency storm. Treatment of stormwater runoff from the site has been addressed in a separate report entitled "Stormwater Quality Management for Safari Highlands" prepared by this office. That report also addresses the hydromodification management requirements.

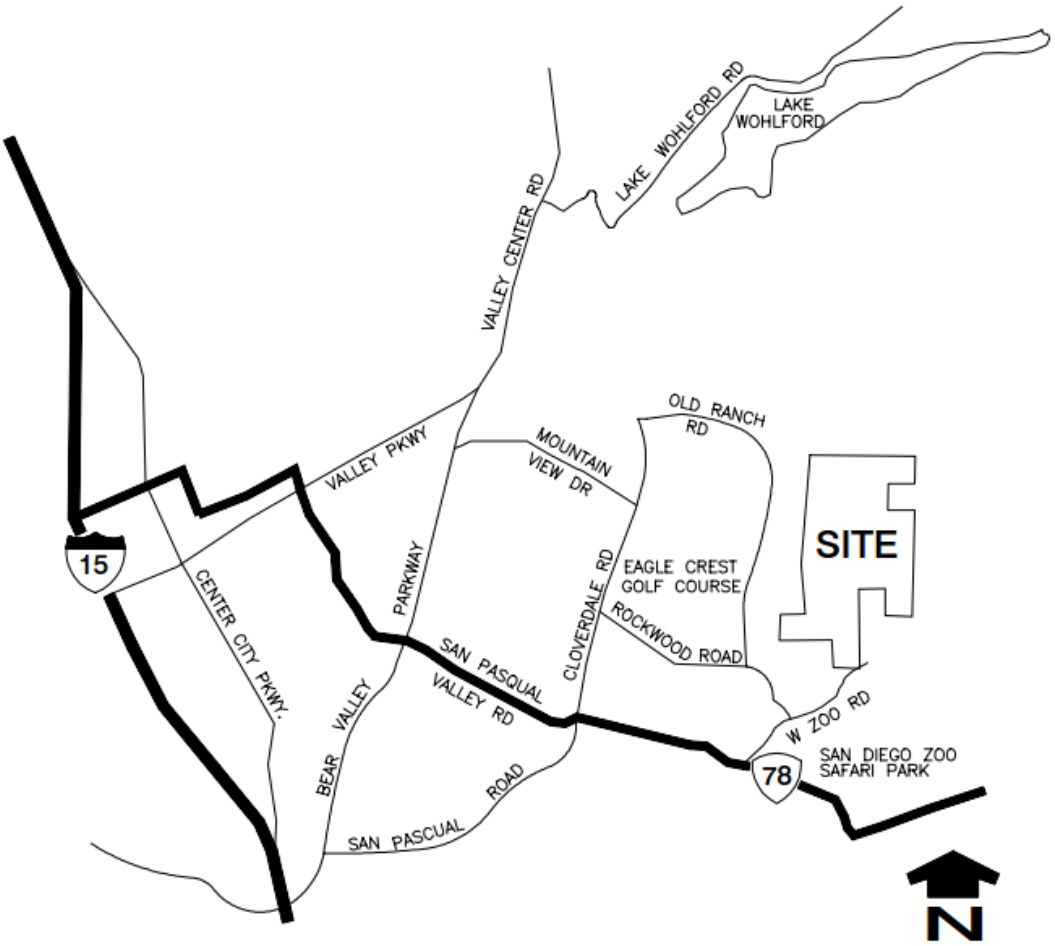
1.2. Project Description

The proposed project is approximately 1,100-acre site located in the Valley View area within the City of Escondido, north of Highway 78/San Pasqual Valley Road and the San Diego Zoo's Safari Park, and approximately 7 miles east of the I-15 and SR-78 intersection. An existing golf course/ residential community (Eagle Crest Golf Course/ Rancho San Pasqual Development) and another small (79 lot) residential community (Rancho Vistamonte) are located to the west and south. In the distant vicinity lies Lake Wohlford to the northwest. Rural single family residences on hilly terrain, dirt roads and trails are found to the east. The property obtains access from Rockwood Road, between the golf course and Rancho Vistamonte development. Refer to the project Vicinity map on the next page.

According to the FEMA Flood Insurance Rate Map (FIRM) for this site, the project is located within two FIRM panels (06073C1101G and 06073C0850G). FIRM Panel 06073C0850G shows the project site in an unshaded Zone X, which is defined as "Areas determined to be outside the 500-year floodplain". FIRM Panel 06073C1101G is an unprinted map. According to FEMA this means that no physical FIRM panel was printed for this area and typically FEMA uses the non-printed panel designation when the area is entirely located within a single flood zone. Since the surrounding panels show Zone X, it can be assumed that this portion, as well as the entire site, is located within the unshaded Zone X. Refer to the FIRM Map in **Appendix 2**.

A Geologic Reconnaissance Study has been prepared for the Safari Highlands Ranch Project by Geocon, Inc. on June 27, 2014. According to this report the site consists of rocks, alluvium and topsoil/colluvium consisting of loose, silty to clayey sand. Additionally, the Natural Resources Conservation Service Web Soil Survey (NRCS) has been used to determine the soil characteristics for this project for this stage of the project. According to the NRCS, the project consists of several soil types, most predominantly Cieneba rocky coarse sandy loam (CmE2) and Cieneba very rocky coarse sandy loam (CmrG). Both have a hydrologic soil rating of Type D. Type "D" soils are described as a having very low infiltration rate. Considering both of the above

soil analyses, Type D soils have been assumed for hydrologic analysis in this study. Refer to **Appendix 2** for complete soils information.



VICINITY MAP

NOT TO SCALE

1.3. Existing Condition

The project site currently consists of approximately 1,100 acres of mostly undeveloped natural open space, a portion of Zoo Road crossing the site at the lower south end of the project site. Topographically, the site consists of rugged, steeply sloping, hillside terrain with occasional, somewhat level valleys. Elevations across the overall property vary from approximately 400 feet in the southwest corner to a high of almost 1,800 feet in the northeast portion of the site.

There are no existing storm drain features onsite. A ridgeline that spans from approximately 3,800 feet offsite from the eastern project boundary that runs through the

project site separates the site into two drainage areas, to be referred to as **Drainage Area A** (the north) and **Drainage Area B** (the south). The two drainage areas flow across the site in a northeast to southwest direction.

Drainage Area A consists of approximately 412 acres in the northern portion of the site. The summit of the drainage area is located just north of the project boundary at an elevation of 1,765 feet. From there, runoff is conveyed southwesterly through a series of natural valleys that converge and eventually cross the western project boundary approximately 3,000 feet south of the northern boundary. Runoff continues from there southwesterly across undeveloped terrain and in natural valleys directly east of Rosewood Lane (a residential cul-de-sac within the Eagle Crest Golf Course/ Rancho San Pasqual development). This drainage course continues southwest and crosses under Old Ranch Road through an existing culvert and then discharges to the west within the golf course. From there runoff is conveyed southwest through the golf course, crosses under Rockwood Road west of San Pasqual Union Elementary School and continues south joining the San Dieguito River.

Drainage Area B, spans approximately 1,925 acres. The summit of the drainage area is approximately 4,700 feet northeast of the corner of the project boundary at an elevation of 1,880 feet. Runoff from this offsite area is conveyed southwesterly through a series of natural valleys and discharges at the southern end of the project site, flowing towards Rancho Vista Monte. Drainage Area B will then confluence with Drainage Area A after flowing past The San Pasqual Union Elementary School.

1.4. Proposed Condition

Development of the site will include 584 residential lots of various sizes in 7 neighborhoods, multi-purpose basins throughout the site, along with associated streets, sidewalks, and internal storm drainage systems. Safari Highlands Ranch Road will connect to the existing Rockwood Road and extend through the site to provide access to all of the neighborhoods. A fire station and private recreation facility will be developed in the southeastern portion of the site near the gated entry to the residential neighborhoods. The existing triple box culvert (8'x10') across Rockwood Road will be improved with addition of one more 8'x10' to improve conveyance of 100yr peak flows.

The proposed drainage patterns will remain the same as the existing condition with drainage areas A and B maintaining the same two points of discharge. Drainage Area A consists of 2 neighborhoods with half acre and 1 acre lots and is approximately 402 acres. Drainage Area B is approximately 1,958 acres and includes the remaining 5 neighborhoods with 7,000 to 9,900 square foot pads as well as the fire station and recreation facilities. The development is generally situated throughout the site and preserves the natural drainage courses within the tributary areas. Offsite drainage areas entering the site will be conveyed through the development to their original points of discharge on the west side, typically crossing under proposed roads in culverts. Some offsite drainage is picked by a series of brow ditches and/or separate storm drain system that will convey the runoff around the development to discharge into each tributaries natural conveyance channel. Calculation for proposed ditches and storm will

be provided during final engineering, sizing these to convey the stormwater with adequate freeboard. Runoff from the developed areas will be routed to the streets and conveyed via curb and gutter until it reaches curb inlets and intercepted by storm drain inlets. Each storm drain system is routed to multi-purpose basins proposed throughout the site. These basins will provide water quality treatment, hydromodification management and flood attenuation to treat and release urban runoff at peak flow rates at or below existing conditions. Rip rap or other energy dissipaters will be positioned at outfall locations in order to mitigate discharge velocities.

Development also includes offsite improvements to Old Guejito Grade Road on the northwest for use as an emergency access road. The existing road will be widened, regraded and realigned in some areas to accommodate passage of emergency vehicles. The runoff from upstream drainage areas will be allowed to flow across the road through culverts at two locations.

The Natural Resources Conservation Service (NRCS) Unit Hydrograph Method will be used as both drainage areas are in excess of 0.5 square miles and will be used to analyze the watershed in both pre and post development condition. The HEC-HMS analysis was subdivided to include the routing of the developed flow through the detention basins to account for peak flow attenuation. Methodology, presented in Section 2 of this report, is consistent with standards set forth in the County of San Diego's Hydrology Manual and City of Escondido's Design Standards.

2. Methodology

2.1. NRCS Unit Hydrograph Hydrologic Analysis

The Natural Resources Conservation Service (NRCS) Unit Hydrograph is necessary for hydrologic analyses of watershed areas approximately 0.5 square mile and greater in size. The HEC-HMS Version 4.1 program was used to produce 100-year, 24-hour hydrographs and peak flow rates at various points of interest for existing and proposed conditions. HEC-HMS, developed by the United States Army Corps of Engineers' Hydrologic Engineering Center, simulates the surface runoff response of a watershed to precipitation by representing the basin as an interconnected system of hydrologic and hydraulic components.

The NRCS Unit Hydrograph calculations and input parameters follow the guidelines in Section 4 of the 2003 San Diego County Hydrology Manual (SDCHM). The input that was required to produce the hydrographs included rainfall depth, rainfall distribution, drainage basin area, precipitation loss data, and data to determine overland and channel routing information. Output from the model is presented in the form of hydrographs, which are curves relating runoff flowrates to elapsed time from the beginning of rainfall. Thus, the distribution of the entire runoff response is available for analysis. The following sections discuss the parameters and assumptions specified within the analyses.

2.1.1 Basin Delineation

Existing Condition Drainage Area A

The watershed is approximately 0.7 square miles and was divided into 6 subareas based on terrain and gradient changes. The discharge point is at node J03 as it encompasses the whole drainage area for the proposed Safari Highlands' northern neighborhood. It will also be the point of comparison for the 100-year discharge.

Existing Condition Drainage Area B

The studied watershed is approximately three square miles and was divided into seven subareas based primarily upon gradient changes along the main flow path. The most downstream node (J07) is located near the downstream face of the Rockwood Road culvert and was chosen such that it encompasses the entirety of the proposed Safari Highlands impacts to the watershed of interest. Consequently, this node is designated as the location to which the proposed 100-year discharge will be compared.

Existing Condition Drainage Area Offsite (Northeast, North, and Northwest)

The studied watershed is approximately six square miles and was divided into 3 watershed areas, Northeast, North, and Northwest based on the topography.

Northeast is composed of the area just to the northwest of the most northwestern part of the project boundary. It sits in between 2 ridges and a saddle. The most downstream node (J2) is located downstream of an existing dirt road named Stronebridge Rd. This area was chosen as it encompasses the entirety of the proposed access road that is to provide access from Safari Highlands Ranch. This is also where the 100-year discharge will be compared.

The North watershed is the largest of the offsite drainage areas, comprising of 5.5 square miles. It includes multiple valleys and ridges that converge at the lowpoint of where the existing dirt road currently is before continuing to flow south to eventually confluence with drainage from the Northeast and Northwest. The North watershed

seven subareas based primarily upon gradient changes along the main flow path. The most downstream node (J07) is located near the downstream face of the Rockwood Road culvert and was chosen such that it encompasses the entirety of the proposed Safari Highlands impacts to the watershed of interest. Consequently, this node is designated as the location to which the proposed 100-year discharge will be compared.

Proposed Conditions Drainage Area A

The existing conditions subareas were modified to incorporate the proposed development. This included subarea delineations to calculate peak flow rates at four culverts. Additionally, subareas within the development were delineated based upon the tributary area to each detention basin as inflow hydrographs were needed for storage routing.

Proposed Conditions Drainage Area B

The existing conditions subareas were modified to incorporate the proposed development. This included subarea delineations to calculate peak flow rates at six culvert crossings. Additionally, subareas within the development were delineated based upon the tributary area to each detention basin as inflow hydrographs were needed for storage routing.

It should be noted that the southeastern corner of Basin I assumes that the proposed/improved roadway diverts runoff from an adjacent hillside, thus excluding it from the calculations. This is a slight discrepancy from the same location in the existing conditions model where the runoff from this hillside was included as part of the subarea due to the assumption of flow over the existing roadway.

Proposed Condition Drainage Area Offsite (Northeast, North, and Northwest)

The 3 watershed areas in existing condition, Northeast (Area E) , North (Area D), and Northwest (Area C), based on the topography will drain similar to existing conditions.

The North watershed is the largest of the offsite drainage areas, comprising of 5.5 square miles. It includes multiple valleys and ridges that converge at the lowpoint of where the existing dirt road currently is before continuing to flow south to eventually confluence with drainage from the Northeast and Northwest.

2.1.2 Precipitation Data

The precipitation data for this study consisted of the 100-year, 6-hour and 24-hour values from the SDCHM isopluvials (see Attachments). The values were interpolated for their use in the model and checked to verify that the 6-hour to 24-hour ratio was between 45 percent and 65 percent.

The point precipitation values are as follows:

$P_{100\text{-}6}$ = 3.6 inches

$P_{100\text{-}24}$ = 8.0 inches

To generate 24 hours of rainfall data at 5 minute intervals, these values are interpolated based upon the Rational Method intensity equation in the SDCHM up to the 6 hours and from log-log interpolation between 6 and 24 hours. They are then adjusted based upon depth-area factors presented in the SDCHM. Finally, the incremental ordinates are calculated and ordered based upon a 2/3, 1/3 distribution. The resulting output hyetographs are manually entered into the HEC-HMS program as part of the meteorological component.

2.1.3 Loss Rates

The curve number method was used in this study to account for precipitation losses. This method was developed by the NRCS and is based on hydrologic soil type and land use. Curb numbers describe runoff conditions. A larger curve number indicates a larger percentage of impervious cover, thus increasing runoff potential. Conversely, a lower curve number indicates a lower runoff potential. Curve numbers are related to storage within the watershed, which is a primary component of excess runoff.

Existing Conditions

The curve number selected for undeveloped portions of the watershed was 55 (Table 4-2 of the SDCHM). This was based upon a land cover of Sagebrush with grass understory, 'Good' hydrologic conditions (75 percent or more of coverage), and Type D soil.

In Drainage Area B, subarea EXSH906, the Rancho Vistamonte residential development encompasses approximately 25 percent of the subarea. Assuming 1/3-acre lots, Table 4-2 in the SDCHM indicates the curve number should be 86 for Type D soils. When this area weighted with the undeveloped portion of the subarea, the composite curve number is approximately 85.3

Once the composite curve numbers are calculated for each subarea, they are adjusted based upon the Precipitation Zone Number (PZN). The curve numbers listed within Table 4-2 of the SDCHM are for PZN 2.0, and based upon the watershed location, the actual PZN is 2.0 (see Attachments). So for this location, the PZN adjustment is not needed. Additional adjustments were then made based upon the design storm frequency (Table 4-6 of the Manual). For this project, a PZN of 3.0 was used for the 100-year event. The final curve numbers are then calculated using Table 4-10 of the SDCHM. This resulted in 94 being specified for all subareas.

Proposed Conditions

Curve numbers for the proposed conditions were calculated in the same manner as existing conditions. The principal cover types of Sagebrush with grass understory (curve number equal to 55) for the undeveloped areas, 1/3-acre residential for the existing Rancho Vistamonte development (curve number equal to 86), and 1/2-acre residential (curve number equal to 85) for the proposed Safari Highlands development were area

weighted within each subarea to calculate a composite curve number for PZN 2.0. They were then adjusted to PZN 3.0 to determine the final curve number used in the model. The results for each subarea can be seen in Table 1, below:

Drainage Area A Existing Conditions

Subarea	**$CN_{2.0}$**	**$CN_{3.0}$**
EXSH01	55	73
EXSH02	55	73
EXSH03	55	73
EXSH04	55	73
EXSH05	55	73
EXSH06	55	73

Drainage Area B Existing Conditions

Subarea	**$CN_{2.0}$**	**$CN_{3.0}$**
EXSH01	55	73
EXSH02	55	73
EXSH03	55	73
EXSH04	55	73
EXSH05	55	73
EXSH06	85.3	94
EXSH07	55	73

Drainage Area A Proposed Conditions

Subarea	**$CN_{2.0}$**	**$CN_{3.0}$**
PRSH01	55	73
PRSH02	55	73
PRSH03	55	73
BASIN D	85	94
PRSH04	55	73
BASIN C	85	94
PRSH05	55	73
BASIN F	85	94
PRSH06	55	73
BASIN B	85	94
PRSH07	55	73
PRSH08	55	73
PRSH09	55	73
BASIN A	85	94
PRSH10	55	73
PRSH11	55	73

Drainage Area B Proposed Conditions

Subarea	**$CN_{2.0}$**	**$CN_{3.0}$**
PRSH01	55	73
PRSH02	55	73
PRSH03	55	73
PRSH04	55	73
BASIN F	85	94
PRSH05	55	73
PRSH06	55	73
BASIN E	85	94
PRSH07	55	73
PRSH08	55	73
PRSH09	55	73
BASIN G	85	94
BASIN H	85	94
PRSH10	55	73
PRSH11	55	73
BASIN I	85	94
PRSH12	55	73
PRSH13	55	73
PRSH14	55	73
BASIN K	85	94
PRSH15	85.3	94
PRSH16	55	73

Drainage Area C Existing Conditions

Subarea	$CN_{2.0}$	$CN_{3.0}$
PRSH01	55	73
PRSH02	55	73
BASIN 1	55	73

Drainage Area C Proposed Conditions

Subarea	$CN_{2.0}$	$CN_{3.0}$
PRSH01	85	94
PRSH02	85	94
BASIN 1	85	95

Drainage Area D Existing Conditions

Subarea	$CN_{2.0}$	$CN_{3.0}$
PRSH01	55	73
PRSH02	55	73
PRSH03	55	73
PRSH04	55	73
PRSH05	55	73
PRSH06	55	73
PRSH07	55	73
BASIN 2	55	73
PRSH08	55	73
BASIN 3	55	73

Drainage Area D Proposed Conditions

Subarea	$CN_{2.0}$	$CN_{3.0}$
PRSH01	55	73
PRSH02	55	73
PRSH03	55	73
PRSH04	55	73
PRSH05	55	73
PRSH06	55	73
PRSH07	55	73
BASIN 2	85	94
PRSH08	55	73
BASIN 3	85	94

Drainage Area E Existing Conditions

Subarea	$CN_{2.0}$	$CN_{3.0}$
PRSH03	55	73
PRSH06	55	73
BASIN 7	55	73
BASIN 6	55	73
PRSH02	55	73
PRSH01	55	73
BASIN 8	55	73
PRSH04	55	73
PRSH05	55	73
PRSH07	55	73
PRSH08	55	73
BASIN 5	55	73
PRSH09	55	73
PRSH11	55	73
BASIN 4	55	73
PRSH10	55	73
PRSH12	55	73

Drainage Area E Proposed Conditions

Subarea	$CN_{2.0}$	$CN_{3.0}$
PRSH03	55	73
PRSH06	55	73
BASIN 6	85	94
BASIN 7	85	94
PRSH02	85	94
PRSH01	55	73
BASIN 8	85	94
PRSH04	55	73
PRSH05	55	73
PRSH07	55	73
PRSH08	55	73
BASIN 5	85	94
PRSH09	55	73
PRSH11	55	73
BASIN 4	85	94
PRSH10	55	73
PRSH12	55	73

2.1.4 Unit Hydrograph

The transform used to convert excess precipitation to direct runoff in this model is the NRCS dimensionless unit hydrograph. The NCRS lag time is the required input for this unit hydrograph and is defined as the time from the center of mass of excess rainfall to the peak of the unit hydrograph. The sub-basin Corps lag times are calculated using the equation below from measurable watershed characteristics:

$$Lag_{corps} = 24n((L \times L_c)/s^{0.5})^m$$

where:
- L = length of longest watercourse (miles)
- L_c = length along longest watercourse measured upstream to a point opposite the sub-basin centroid (miles)
- s = overall slope of drainage area between the headwaters and the collection point (feet/mile)
- m = a constant determined by regional flood reconstitution studies equal to 0.38
- n = average of the Manning's n-values of sub-basin watercourses and tributaries

The NRCS lag is related to the Corps lag using the following relationships from the Manual:

$$Lag_{NRCS} = T_p\text{-}D/2$$
$$T_p – 0.862*Lag_{corps}$$

where:
- T_p = Time to peak
- D = Period of effective rainfall (Computation interval equal to 1 minute)

Roughness coefficients were primarily determined form aerial photography. Average roughness coefficients varied from approximately 0.05 in the undeveloped portion of the watershed to 0.018 in the developed areas.

See the 'Lag Calcs' tab within the spreadsheet 'Hydrology Input Values.xls' for the subarea specific values and calculations.

2.1.5 Hydrograph Routing

The Miskingum-Cunge method was selected to route the flood hydrographs through the sub-basins. This method is applicable to the range of slopes that are evident throughout the routing reaches of this watershed. This method is also desirable because it relies on

measurable physical input parameters such as channel slope, reach length, and channel geometry. The only variable that needs to be estimated is the roughness coefficient. A representative channel was specified for each reach to maintain a limit on the model complexity and because modifications are not anticipated to significantly impact the peak discharge results.

See the 'Routing Calcs' tab within the spreadsheet 'Hydrology Input Values.xls' for the subarea specific values and calculations.

2.1.6 Detention Basin Analysis

Detention routing calculations were performed within the proposed HEC-HMS model and were primarily comprised of the inflow hydrograph, stage-storage relationship, and outflow rating curve. The outflow structure (riser) helps attenuate peak discharge values from the proposed developed areas. Consequently, the riser geometry for each detention basin was determined such that at the downstream most confluence node, the peak 100-year discharge value for the proposed conditions (node J11) was equal to or less than the existing conditions (node J06). Please note that freeboard values for each detention basin were not considered as part of these analyses.

The inflow hydrograph was generated within HEC-HMS and was linked to the detention basin node. Based upon the proposed grading, the stage-storing relationship was generated by calculating the area (acres) for each corresponding elevation. The starting ponding condition for each detention basin was set to one foot above the invert to allow for water quality volume. Finally, the outflow rating curve (elevation versus discharge) was developed external to HEC-HMS (see the spreadsheet 'Detention Basin Rating Curves.xls').

The outflow structure at each detention basin was assumed to be a circular or a rectangular box riser. Weir flow controlled at lower head elevations, while orifice flow controlled at higher head elevations. The transition from weir flow to orifice flow was assumed at the water surface elevation where the orifice flow produced a comparatively smaller discharge value. Finally, a 25 percent blockage factor was applied to the rating curve assuming that debris caught on the trash rack will reduce the inflow capacity of the riser.

All detention basins have capacity to convey the 100yr flow into existing stream bed and back areas adjacent to the basins.

2.1.7 Hydraulic Analysis

Hydraulic Analysis for Channel reach upstream of Rockwood Road triple box culvert (8'x10') was done with the HEC-RAS program developed by Hydraulics Engineering Center (HEC), US Army Corps of Engineers.

The effects of various obstructions such as bridges, culverts, weirs, and structures in the floodplain may be considered in the computations.

HEC-RAS was selected to check the existing conveyance capacity and Water Surface Elevation (WSEL) upstream of the triple box culverts at Rockwood Road. Analysis was then done with addition of one box culvert to help covey the 100-year peak flow through the culverts and prevent backwater upstream of Rockwood Road, which might otherwise raise the WSEL. Resulting WSEL are checked against existing conditions to the southeast and proposed Safari Highland Ranch Road including Basin K which abuts the Road and conveyance channel.

Review of HEC-RAS output indicates that channel velocity will be erosive between river station 517 and 801. In this area the channel includes steeper drop and width is constrained by Basin K. To mitigate the for the velocities a rip-rap slope protection will be provided extending 1ft minimum above the calculated WSEL.

Please refer to **Appendix 10** for results of HEC-RAS Analysis and **Figure 10.1** showing a section through the Basin K water surface elevations within the basin and adjacent channel are included in Developed Conditions Drainage Map.

HEC-RAS program does not compute the super elevation of water surface where the channel turns or meanders. There is one critical locations where the existing channel bends sharply will be above the proposed Safari Highland Ranch Road shown on sheet 15 of TM. The super elevation is computed to assure adequate freeboard to contain the peak flow within the channel and not flood the Safari Highland Ranch Road. Please refer to **Appendix 11** for Superelevation calculations per San Diego County Drainage Design Manual Section 5.10.6. **Figure 11.1** depicting the results and freeboard at this location section showing the superelevated WSEL through this critical location.

A hydraulic analysis was performed for proposed culverts calculated utilizing Hydraflow Express extension for AutoCAD Civil 3D. Please refer to **Appendix 12** Culvert Hydraulic Analysis**.**

Analysis and Results

Results from the NRCS Unit Hydrograph hydrologic analyses at the downstream comparison locations for Drainage Area A are shown in **Table 1**. Results for modeling of each basin are included below. Tabulation of basin geometric data follow later in the report. These results show increases in the peak 100-year flow rate from the existing to the proposed condition. Drainage Area A proposes 5 detention basins throughout the area to address peak flow mitigation. Detention routing calculations were performed within the proposed HEC-HMS model for this portion of the site. The proposed detention basins mitigate peak flow rates such that at the downstream comparison location, the proposed 100-year, 24-hour discharge rate of 1,334.8 cfs is less than the existing conditions flow rate of 1,352.7 cfs.

Table 1 Drainage Area A

	Node No./ Sub-Basin ID	Area (SQ. Mi.)	Q_{100} (CFS)
Existing Conditions	J03	0.64	1,352.7
Proposed Conditions	J08	0.62	1,334.8

Results from the NRCS Unit Hydrograph hydrologic analyses at the downstream comparison locations for Drainage Areas B are shown in **Table 2**. Drainage Area B proposes 6 detention basins throughout the area to address peak flow mitigation. Detention routing calculations were performed within the proposed HEC-HMS model for this portion of the site. The proposed detention basins mitigate peak flow rates such that at the downstream comparison location, the proposed 100-year, 24-hour discharge rate of 3684.8 cfs is less than the existing conditions flow rate of 3687.0 cfs.

Table 2 Drainage Area B

	Node No./ Sub-Basin ID	Area (SQ. Mi.)	Q_{100} (CFS)
Existing Conditions	J07	3.07	3687.0
Proposed Conditions	J12	3.11	3684.8

Results from the NRCS Unit Hydrograph hydrologic analyses at the downstream comparison locations for Drainage Areas C are shown in **Table 3**. Drainage Area C proposes 1 detention basin throughout the area to address peak flow mitigation. Detention routing calculations were performed within the proposed HEC-HMS model for this portion of the site. The proposed detention basins mitigate peak flow rates such that at the downstream comparison location, the proposed 100-year, 24-hour discharge rate of 357.0 cfs is less than the existing conditions flow rate of 362.1 cfs.

Table 3 Drainage Area C

	Node No./ Sub-Basin ID	Area (SQ. Mi.)	Q_{100} (CFS)
Existing Conditions	J2	0.12	448.74
Proposed Conditions	J2	0.12	442.43

Hydrology

Results from the NRCS Unit Hydrograph hydrologic analyses at the downstream comparison locations for Drainage Areas D are shown in **Table 4**. Drainage Area D proposes 2 detention basinS throughout the area to address peak flow mitigation. Detention routing calculations were performed within the proposed HEC-HMS model for this portion of the site. The proposed detention basins mitigate peak flow rates such that at the downstream comparison location, the proposed 100-year, 24-hour discharge rate of 6213.6 cfs is about 4.9 cfs higher than the existing conditions flow rate of 6218.5 cfs.

Table 4 Drainage Area D

	Node No./ Sub-Basin ID	Area (SQ. Mi.)	Q_{100} (CFS)
Existing Conditions	J05	5.53	7536.8
Proposed Conditions	J05	5.53	7533.3

Results from the NRCS Unit Hydrograph hydrologic analyses at the downstream comparison locations for Drainage Areas E are shown in **Table 5**. Drainage Area E proposes 5 detention swales throughout the area to address peak flow mitigation. Detention routing calculations were performed within the proposed HEC-HMS model for this portion of the site. The proposed detention basins mitigate peak flow rates such that at the downstream comparison location, the proposed 100-year, 24-hour discharge rate of 633.1 cfs is less than the existing conditions flow rate of 632.4 cfs.

Table 5 Drainage Area E

	Node No./ Sub-Basin ID	Area (SQ. Mi.)	Q_{100} (CFS)
Existing Conditions	J05	0.31	633.1
Proposed Conditions	J05	0.31	741.9

Table 6 summarizes the basic hydrologic information and riser dimensions for each detention basin in Drainage Area A.

TABLE 6 DETENTION ROUTING SUMMARY - DRAINAGE AREA A

DETENTION BASIN ID	RISER GEOMETRY (FT.)		PEAK 100-YEAR, 24-HOUR RESULTS				
	WIDTH	HEIGHT	TRIB. AREA (SQ. MI.)	INFLOW (CFS)	OUTFLOW* (CFS)	WSEL (FT)	STORAGE (AC-FT)
BASIN A	2X3	4	0.024	149.2	83.7	1582.7	2.8
BASIN B	2X3	4.5	0.053	181.0	112.5	1507.6	3.1
BASIN C	2X3	6	0.037	222.7	109.6	1547.0	4.0
BASIN D	2X3	9.0	0.035	215.6	72.3	1619.4	5.8

*See Appendix 10 for Stage Storage and Discharge input Tables

Table 7 summarizes the basic hydrologic information and riser dimensions for each detention basin in Drainage Area B.

TABLE 7 DETENTION ROUTING SUMMARY - DRAINAGE AREA B

DETENTION BASIN ID	RISER GEOMETRY (FT.)		PEAK 100-YEAR, 24-HOUR RESULTS				
	DIAMETER	HEIGHT	TRIB. AREA (SQ. MI.)	INFLOW (CFS)	OUTFLOW * (CFS)	WSEL (FT)	STORAGE (AC-FT)
BASIN E	3	4	0.005	288.9	164.2	1530.0	5.4
BASIN F	4	4	0.016	78.0	60.8	871.1	1.3
BASIN G	3	4	0.083	80.6	31.1	1632.5	5.9
BASIN H	4	4	0.031	570.4	297.6	1060.5	7.7
BASIN I	4	4	0.178	184.9	128.3	1249.9	2.2
BASIN J	4	4	0.014	485.2	322.4	862.7	6.8
BASIN K	4	2	0.035	65.6	50.8	423.1	0.7

*See Appendix 10 for Stage Storage and Discharge input Tables

Table 8 summarizes the basic hydrologic information and riser dimensions for each detention basin in Drainage Area C.

TABLE 8 DETENTION ROUTING SUMMARY - DRAINAGE AREA C

DETENTION BASIN ID	RISER GEOMETRY (FT.)		PEAK 100-YEAR, 24-HOUR RESULTS				
	WIDTH	HEIGHT	TRIB. AREA (SQ. MI.)	INFLOW (CFS)	OUTFLOW* (CFS)	WSEL (FT)	STORAGE (AC-FT)
BASIN O-L	2X3	2	0.002	7.3	6.6	1327.3	0.1

*See Appendix 10 for Stage Storage and Discharge input Tables

Table 9 summarizes the basic hydrologic information and riser dimensions for each detention basin in Drainage Area D.

TABLE 9 DETENTION ROUTING SUMMARY - DRAINAGE AREA D

DETENTION BASIN ID	RISER GEOMETRY (FT.)		PEAK 100-YEAR, 24-HOUR RESULTS				
	WIDTH	HEIGHT	TRIB. AREA (SQ. MI.)	INFLOW (CFS)	OUTFLOW* (CFS)	WSEL (FT)	STORAGE (AC-FT)
BASIN O-M	2X3	2	0.006	12.3	11.3	662.5	0.3
BASIN O-N	2X3	2	0.008	32.7	27.3	522.9	0.4

*See Appendix 10 for Stage Storage and Discharge input Tables

Table 10 summarizes the basic hydrologic information and riser dimensions for each detention basin in Drainage Area E.

TABLE 10 DETENTION ROUTING SUMMARY - DRAINAGE AREA E

DETENTION BASIN ID	RISER GEOMETRY (FT.)		PEAK 100-YEAR, 24-HOUR RESULTS				
	WIDTH	HEIGHT	TRIB. AREA (SQ. MI.)	INFLOW (CFS)	OUTFLOW* (CFS)	WSEL (FT)	STORAGE (AC-FT)
BASIN O-O	2X3	0.5	0.0019	6.1	5.5	1588.8	1.6
BASIN O-P	2X3	0.5	0.0008	3.6	3.4	1507.0	7.5
BASIN O-Q	2X3	0.5	0.0004	1.8	1.8	1547.1	7.0
BASIN O-R	2X3	0.5	0.0004	2.1	2.2	1624.2	9.5
BASIN O-S	2X3	0.5	0.0010	4.6	4.5	1589.3	0.6

*See Appendix 10 for Stage Storage and Discharge input Tables

These results show that the proposed development of this project will not increase peak flows for any point of discharge. This project will therefore not compromise the capacity of downstream drainage facilities and impacts downstream due to erosion and sedimentation are expected to be minimal to none.

3.1 Culvert Peak Flow Results

There are 13 proposed culvert crossings throughout the site. **Table 11** below summarizes these discharge results and preliminary sizes for the culverts.

TABLE 11 CULVERT DISCHARGE SUMMARY

CULVERT ID	HYDROLOGIC NODE	PEAK 100 YEAR DISCHARGE (CFS)	CULVERT SIZE
DRAINAGE AREA A			
CULVERT 1A	PRSH07	151.5	48”
CULVERT 2A	J01	346.1	2 X 60”
CULVERT 3A	J02	539.7	2 X 60”
CULVERT 4A	J03	591.5	2 X 72”
CULVERT 5A	J07	74.7	36”
DRAINAGE AREA B			
CULVERT 1B	J02	1241.8	2 - 6’ x 7’
CULVERT 2B	PRSH03	505.9	6’ x 6’
CULVERT 3B	J05	1838.9	2 – 8’ x 8’
CULVERT 4B	J07	3017.0	2 – 8’ x 10’
CULVERT 5B	J08	3269.2	2 – 10’ x 12’
CULVERT 6B	J11	3485.9	4 – 8’ X 10’
DRAINAGE AREA C			
CULVERT 1C	J1	201.6	60”

TABLE 12 CULVERT DISCHARGE SUMMARY

CULVERT ID	HYDROLOGIC NODE	PEAK 100 YEAR DISCHARGE (CFS)	CULVERT SIZE
DRAINAGE AREA D			
CULVERT 1	J8	4300	3 – 10’ X 12’

Culvert 1 in Drainage Area D is sized for the 10 year storm as the location is at the low point of the emergency access road. The 10 year storm is chosen instead of the 100 year due to the limited use the emergency access road is expected to have.

4. References

Hydrologic Engineering Center Hydrologic Modeling System (HEC-HMS). U.S. Army Corps of Engineers, Version 3.5, August 2010.

San Diego County Hydrology Manual. County of San Diego Department of Public Works, June 2003.

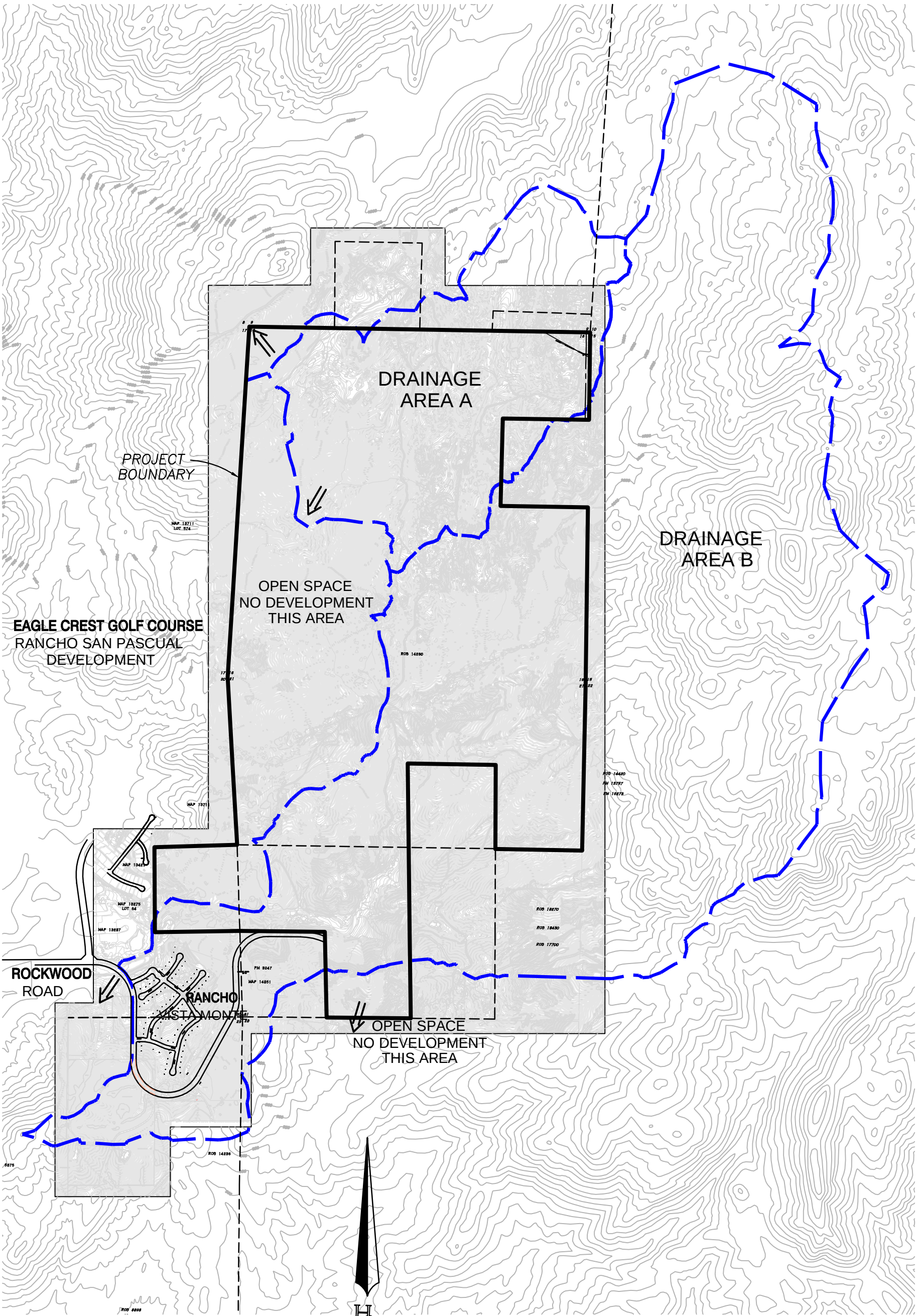
San Diego County Hydraulic Design Manual. County of San Diego Department of Public Works, September 2014.

Safari Highlands Ranch CEQA Preliminary Storm Water Management Plan by Hunsaker & Associates dated December 2014.

Federal Emergency Management Agency, "Flood Insurance Study; San Diego County, California and Incorporated Areas", Revised September 29, 2006.

5. Appendices

Appendix 1 – Project Watershed Map



HUNSAKER
& ASSOCIATES
SAN DIEGO, INC

PLANNING 9707 Waples Street
ENGINEERING San Diego, Ca 92121
SURVEYING PH(858)558-4500 · FX(858)558-1414

NOT TO SCALE

EXHIBIT 1
SAFARI HIGHLANDS RANCH
PROJECT WATERSHED MAP

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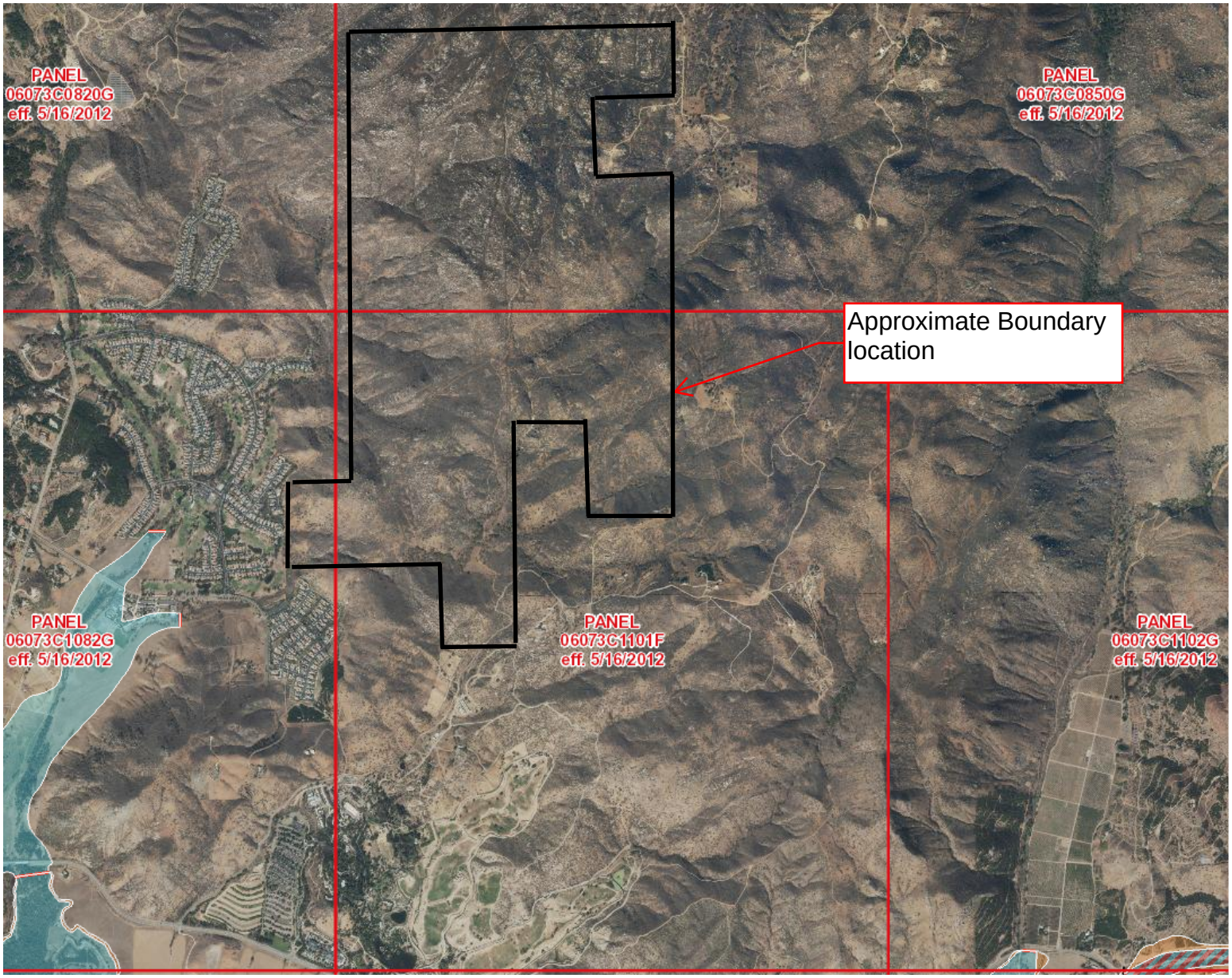
Appendix 2 - FIRM Map



Screenshot taken from FEMA. Property boundary spans a not printed panel. Printed panels provided below.

ance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

0 250 500 750 1,000 FEET

L IS LOCATED
WEST AND THE
ANT.

BOUNDARY

CITY OF ESCONDIDO
060290

CITY OF ESCONDIDO
SAN DIEGO COUNTY

SAN DIEGO COUNTY
UNINCORPORATED AREAS
060284

LIMIT OF STUDY

LIMIT OF STUDY

ZONE A

ZONE X

ZONE X

PROPERTY BOUNDARY

JOINS PANEL 1101

FALLBROOK PL
AMBER OAK LN
OLIVE KNOLL PL
HIDDEN OAKS LN
OLD RANCH RD
PLUM TREE LN
TIMBER CREEK LN
WYNWOOD CT
FERNCREEK LN
ROCKWOOD RD
PUBLIC RD
CITY OF SAN DIEGO
CITY OF ESCONDIDO
QUAIL CREEK PL
MAPLEWOOD PL
SPRUCEWOOD LN
OLD RANCH RD
WALDEN GLEN
VISTAMONTE GLEN
SKYLINE VIEW GLEN
MORNING GLEN TRL
OLD BATTLEFIELD RD
ROCKWOOD
Private Rd
Private
Rd
Sweetwater River
Dieguito River
Private Rd
Sun
19
20
198

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1082G

FIRM

FLOOD INSURANCE RATE MAP

SAN DIEGO COUNTY, CALIFORNIA AND INCORPORATED AREAS

PANEL 1082 OF 2375

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ESCONDIDO, CITY OF	060290	1082	G
SAN DIEGO COUNTY	060284	1082	G
SAN DIEGO, CITY OF	060295	1082	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06073C1082G

MAP REVISED
MAY 16, 2012

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

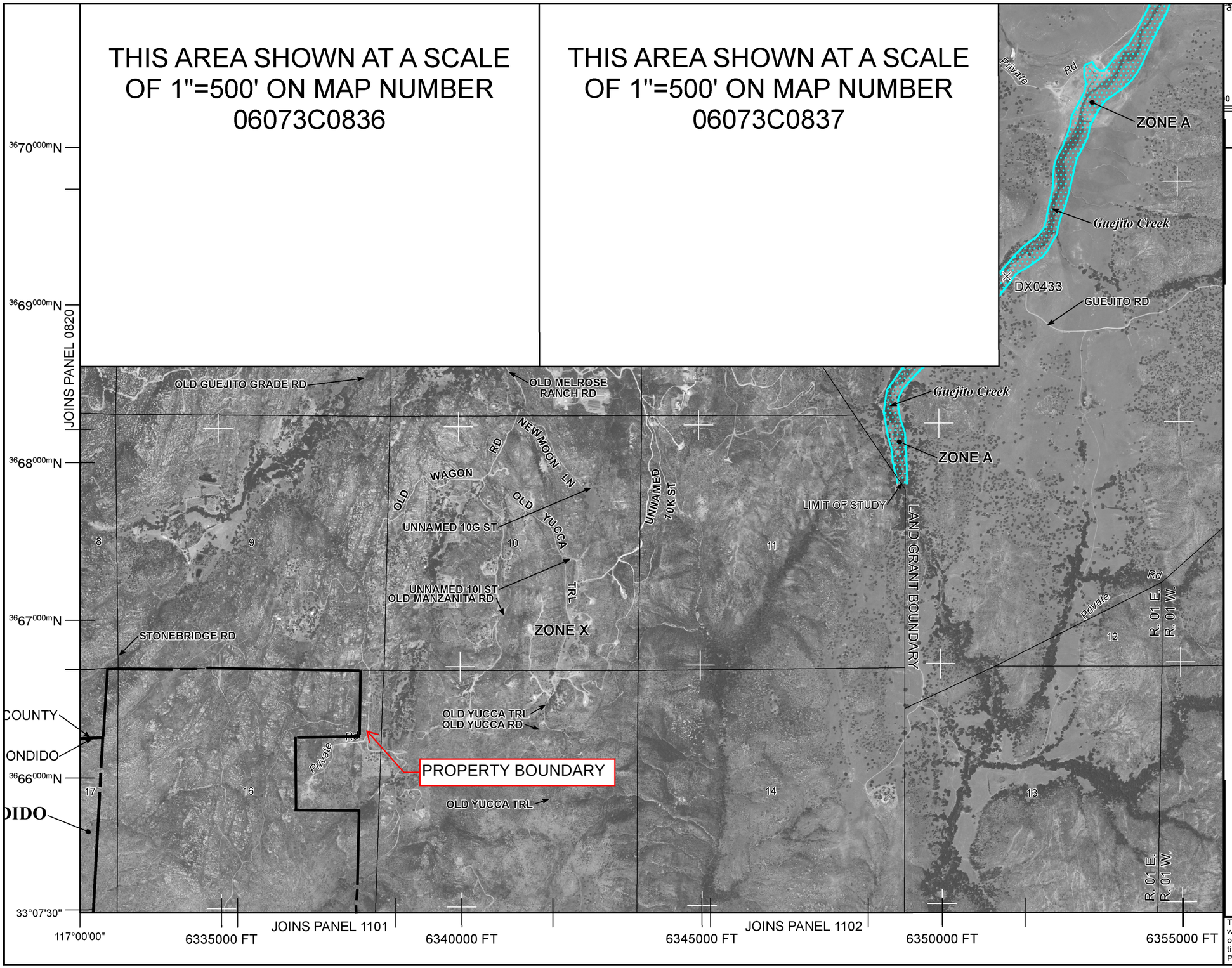
THIS AREA SHOWN AT A SCALE OF 1"=500' ON MAP NUMBER 06073C0836

THIS AREA SHOWN AT A SCALE OF 1"=500' ON MAP NUMBER 06073C0837

ance Program at 1-800-638-6620.

MAP SCALE 1" = 2000'

0 0 1,000 2,000 3,000 4,000 FEET



NFIP NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0850G

FIRM

FLOOD INSURANCE RATE MAP

SAN DIEGO COUNTY, CALIFORNIA AND INCORPORATED AREAS

PANEL 850 OF 2375

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ESCONDIDO, CITY OF	060290	0850	G
SAN DIEGO COUNTY	060284	0850	G

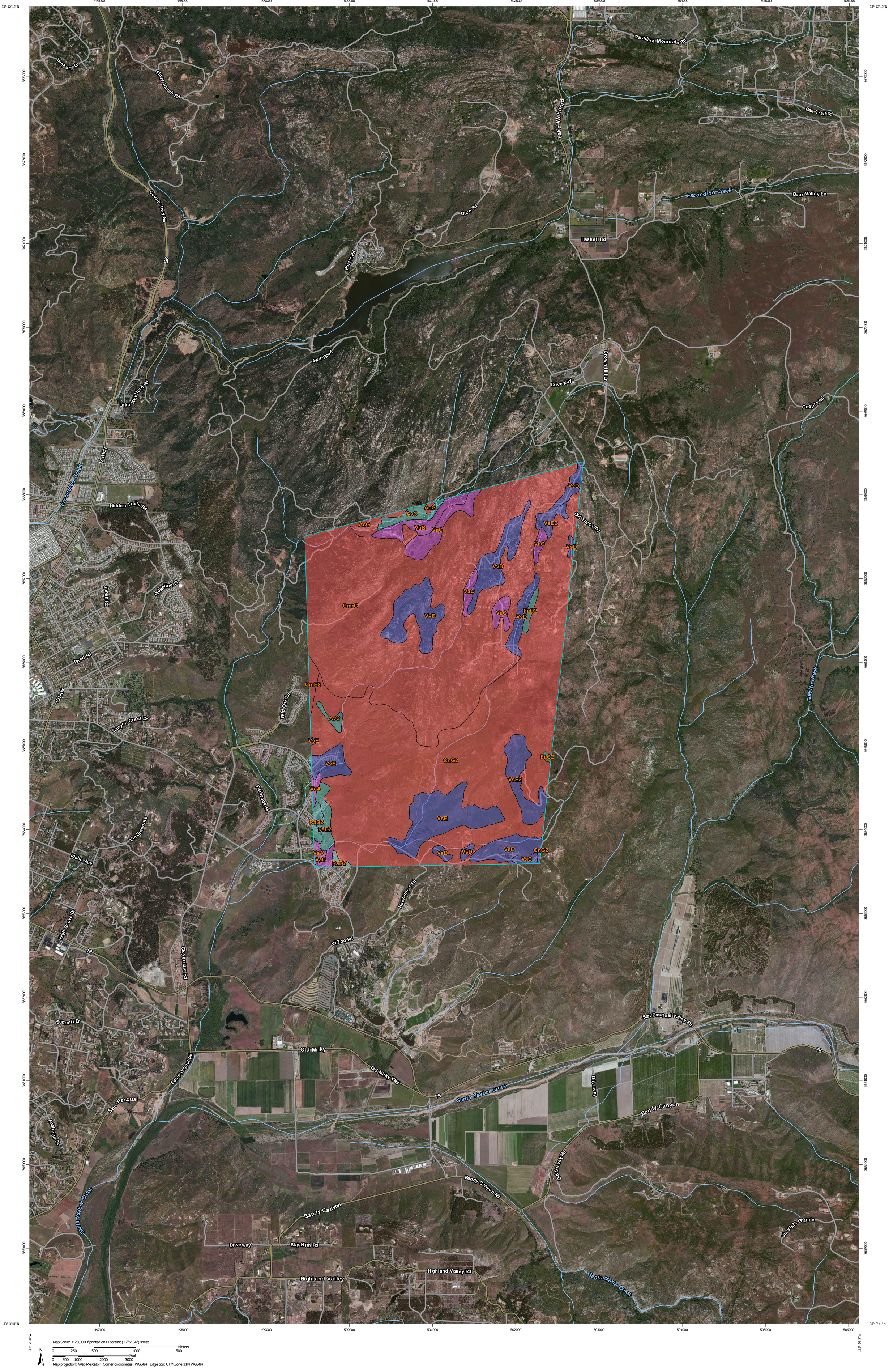
Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER 06073C0850G

MAP REVISED MAY 16, 2012

Federal Emergency Management Agency

Appendix 3 – Soils Information



Map Scale: 1:20,000 if printed on D portrait (22" x 34") sheet.

0 250 500 1000 1500 Meters

0 500 1000 2000 3000 Feet

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

MAP LEGEND

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

Soils
- Soil Survey Areas

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 8, Sep 17, 2014

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

Date(s) aerial images were photographed: May 2, 2010—Jun 7, 2012

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — San Diego County Area, California (CA638)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
AcG	Acid igneous rock land	D	20.8	0.6%
AvC	Arlington coarse sandy loam, 2 to 9 percent slopes	C	31.0	1.0%
CmE2	Cieneba rocky coarse sandy loam, 9 to 30 percent slopes , eroded	D	11.8	0.4%
CmrG	Cieneba very rocky coarse sandy loam, 30 to 75 percent slopes	D	1,282.5	39.4%
CnG2	Cieneba-Fallbrook rocky sandy loams, 30 to 65 percent s lopes, eroded	D	1,234.4	37.9%
FaC2	Fallbrook sandy loam, 5 to 9 percent slopes, eroded	C	2.2	0.1%
FaD2	Fallbrook sandy loam, 9 to 15 percent slopes, eroded	C	8.9	0.3%
FeE2	Fallbrook rocky sandy loam, 9 to 30 percent slopes, ero ded	C	24.9	0.8%
RaD2	Ramona sandy loam, 9 to 15 percent slopes, eroded	C	15.0	0.5%
VaA	Visalia sandy loam, 0 to 2 percent slopes	A	12.6	0.4%
VaB	Visalia sandy loam, 2 to 5 percent slopes	A	37.3	1.1%
VaC	Visalia sandy loam, 5 to 9 percent slopes	A	84.6	2.6%
VsC	Vista coarse sandy loam, 5 to 9 percent slopes	B	7.7	0.2%
VsD	Vista coarse sandy loam, 9 to 15 percent slopes	B	14.8	0.5%
VsD2	Vista coarse sandy loam, 9 to 15 percent slopes, eroded	B	18.0	0.6%
VsE	Vista coarse sandy loam, 15 to 30 percent slopes	B	170.8	5.2%

Hydrologic Soil Group— Summary by Map Unit — San Diego County Area, California (CA638)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
VsE2	Vista coarse sandy loam, 15 to 30 percent slopes, erode d	B	57.8	1.8%
VvD	Vista rocky coarse sandy loam, 5 to 15 percent slopes	B	187.1	5.7%
VvE	Vista rocky coarse sandy loam, 15 to 30 percent slopes	B	33.0	1.0%
Totals for Area of Interest			**3,255.1**	**100.0%**

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Appendix 4 –Hydrology Determination Data

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

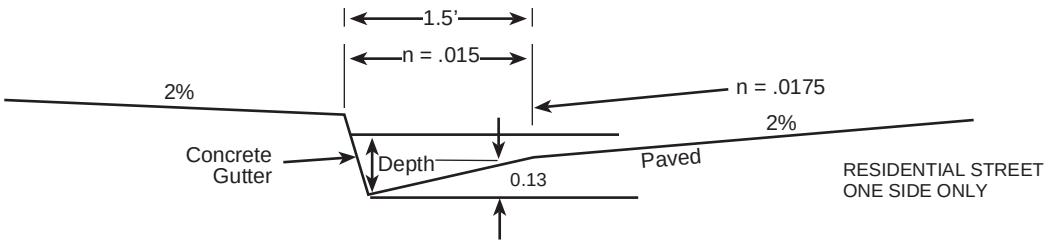
*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area 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

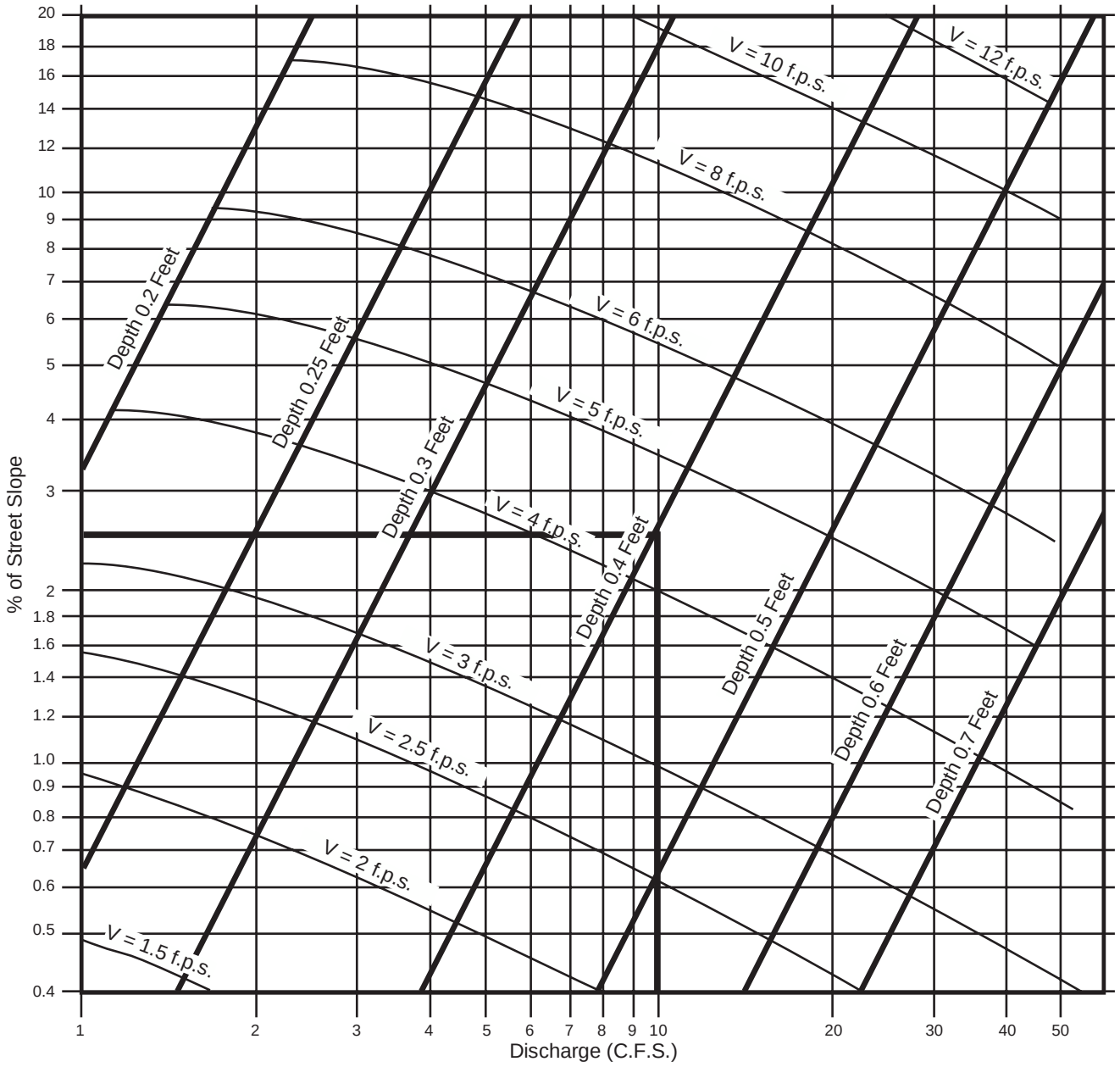
Table 3-2

MAXIMUM OVERLAND FLOW LENGTH (L_M) & INITIAL TIME OF CONCENTRATION (T_i)

Element*	DU/ Acre	.5%		1%		2%		3%		5%		10%	
		L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9
LDR	1	50	12.2	70	11.5	85	10.0	100	9.5	100	8.0	100	6.4
LDR	2	50	11.3	70	10.5	85	9.2	100	8.8	100	7.4	100	5.8
LDR	2.9	50	10.7	70	10.0	85	8.8	95	8.1	100	7.0	100	5.6
MDR	4.3	50	10.2	70	9.6	80	8.1	95	7.8	100	6.7	100	5.3
MDR	7.3	50	9.2	65	8.4	80	7.4	95	7.0	100	6.0	100	4.8
MDR	10.9	50	8.7	65	7.9	80	6.9	90	6.4	100	5.7	100	4.5
MDR	14.5	50	8.2	65	7.4	80	6.5	90	6.0	100	5.4	100	4.3
HDR	24	50	6.7	65	6.1	75	5.1	90	4.9	95	4.3	100	3.5
HDR	43	50	5.3	65	4.7	75	4.0	85	3.8	95	3.4	100	2.7
N. Com		50	5.3	60	4.5	75	4.0	85	3.8	95	3.4	100	2.7
G. Com		50	4.7	60	4.1	75	3.6	85	3.4	90	2.9	100	2.4
O.P./Com		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
Limited I.		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
General I.		50	3.7	60	3.2	70	2.7	80	2.6	90	2.3	100	1.9

*See Table 3-1 for more detailed description





EXAMPLE:
Given: Q = 10 S = 2.5%
Chart gives: Depth = 0.4, Velocity = 4.4 f.p.s.

SOURCE: San Diego County Department of Special District Services Design Manual

F I G U R E

Gutter and Roadway Discharge - Velocity Chart

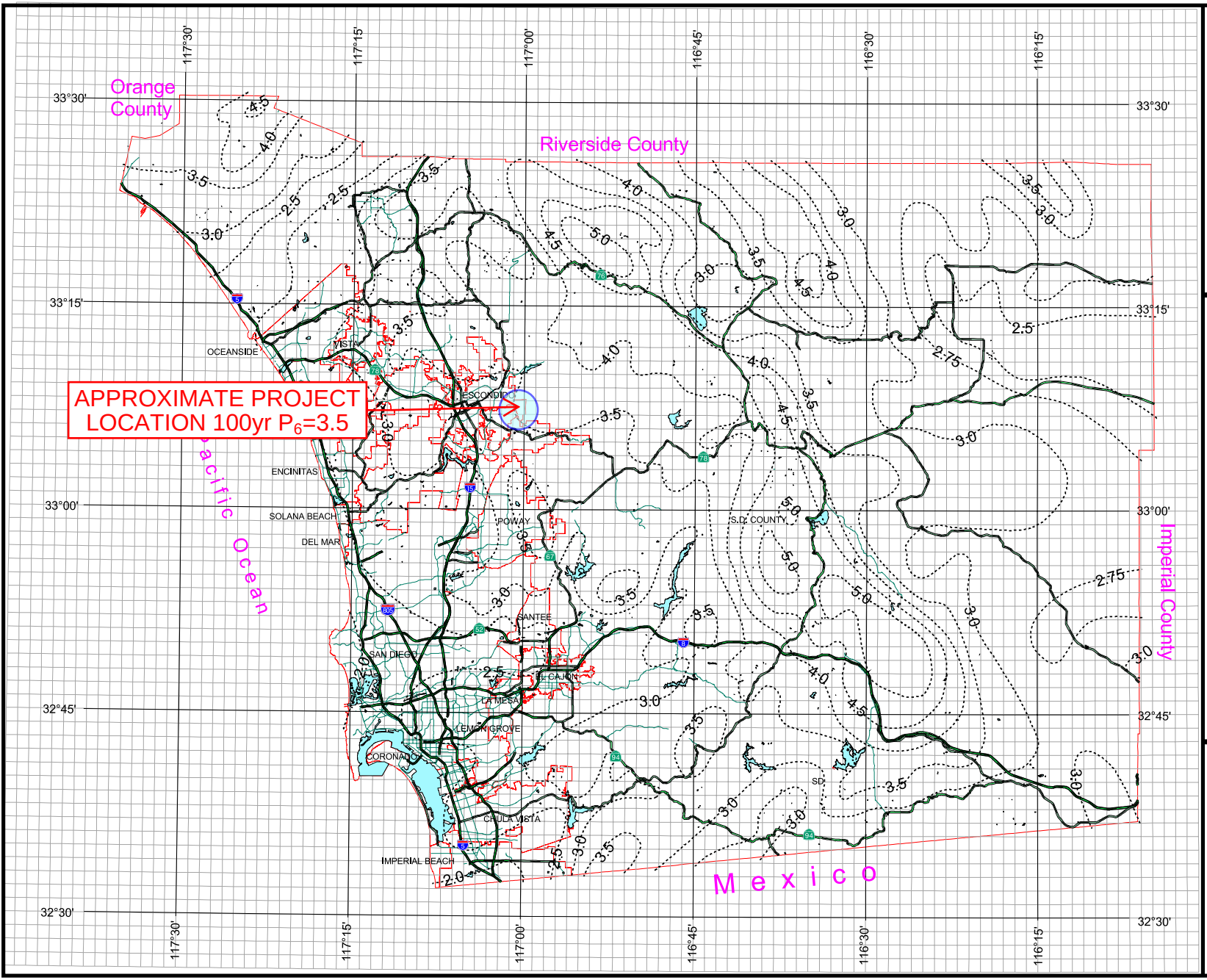
3-6

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)



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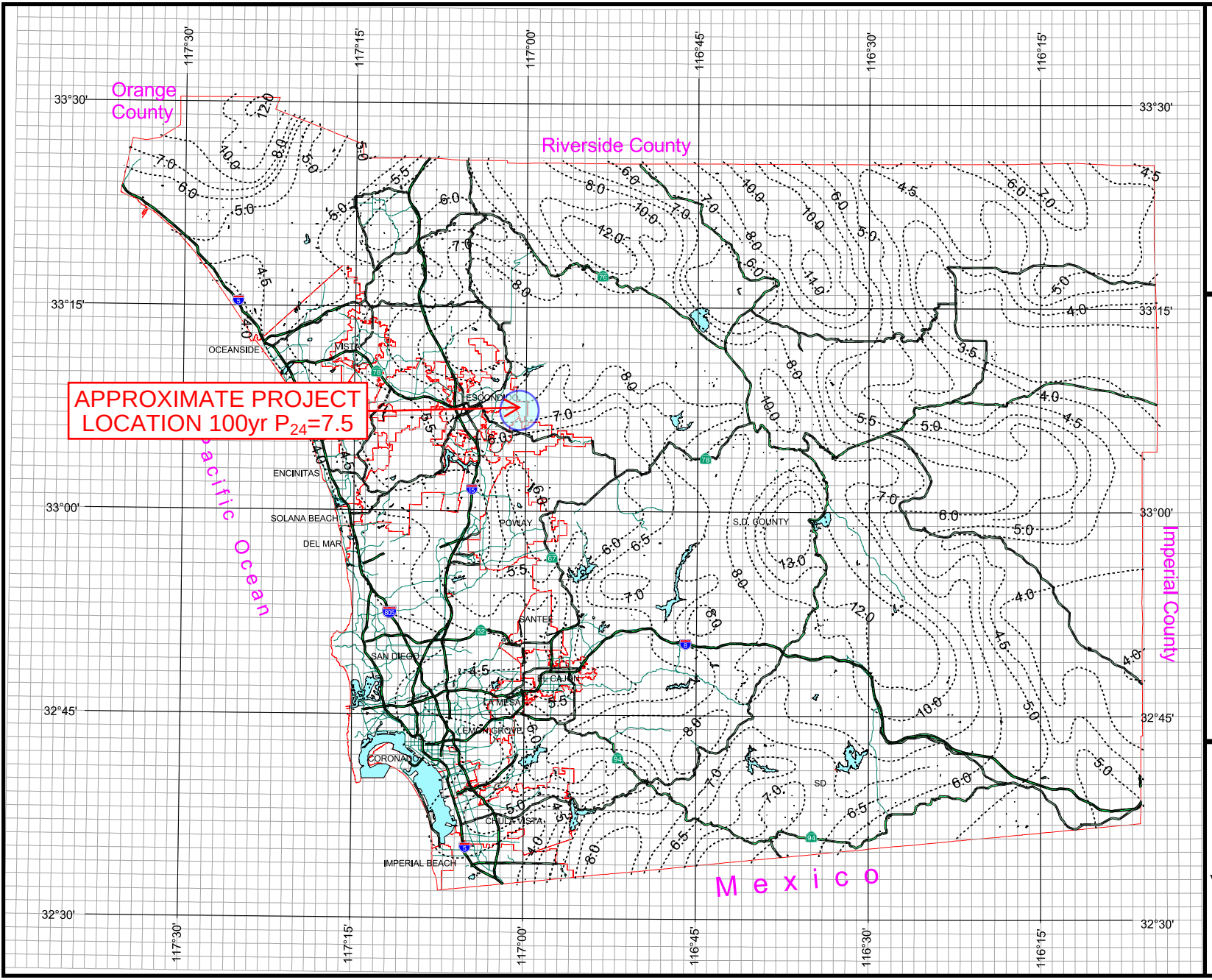
N
W E
S

3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

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3 0 3 Miles

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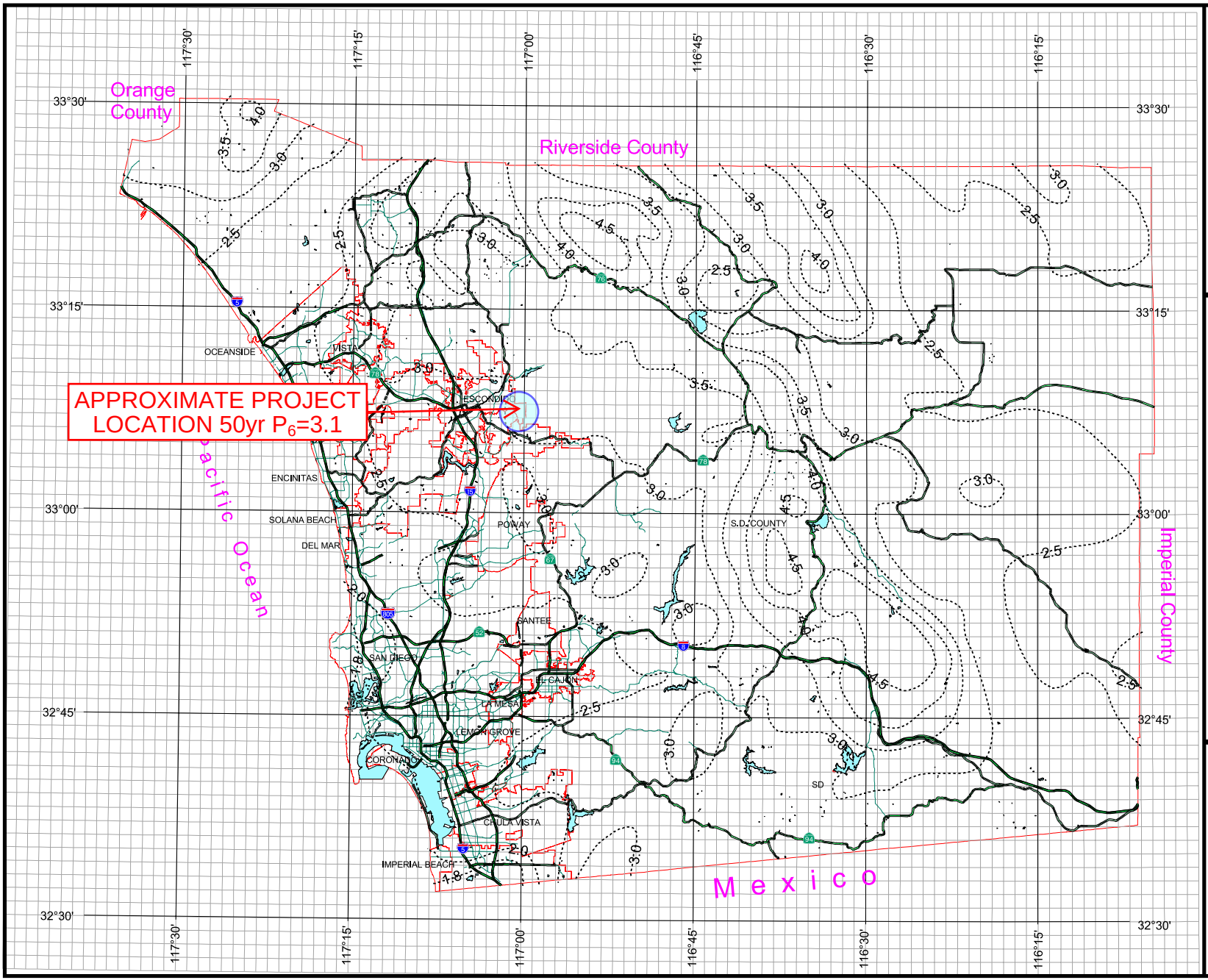
Rainfall Isopluvials

50 Year Rainfall Event - 6 Hours

Isopluvial (inches)



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N
W E
S

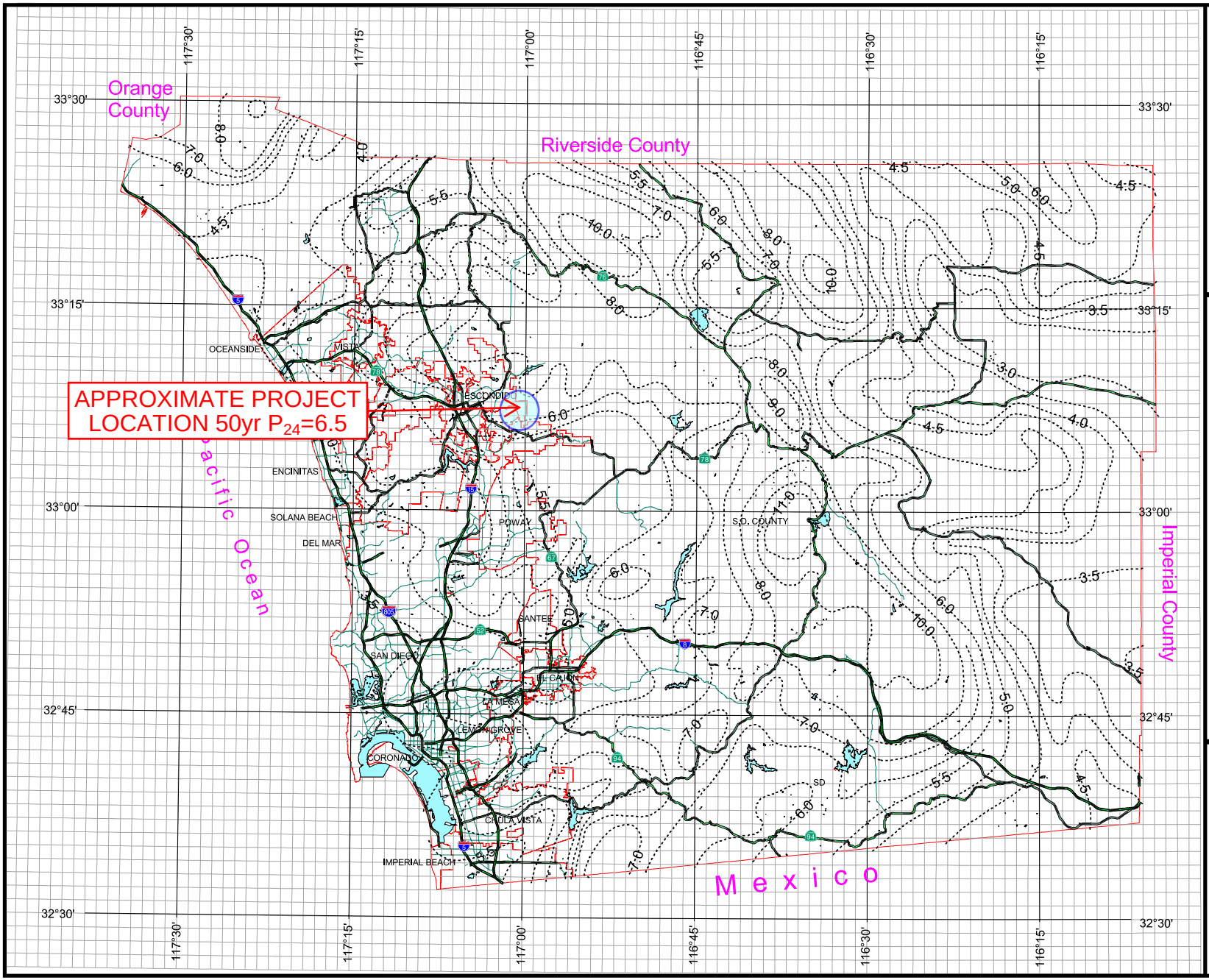
3 0 3 Miles

County of San Diego Hydrology Manual

Rainfall Isopluvials

50 Year Rainfall Event - 24 Hours

Isopluvial (inches)



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N
W E
S

3 0 3 Miles

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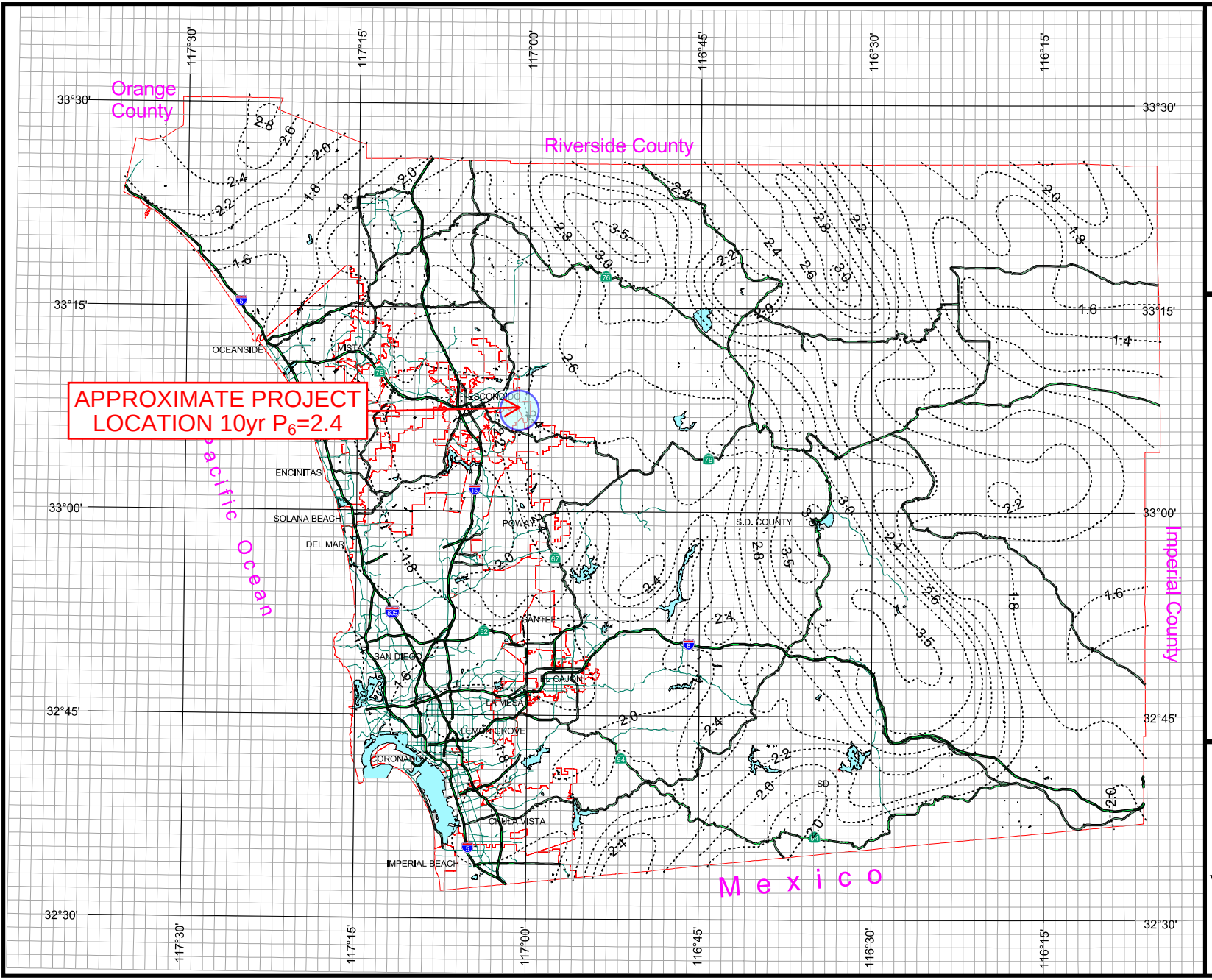
Rainfall Isopluvials

10 Year Rainfall Event - 6 Hours

Isopluvial (inches)



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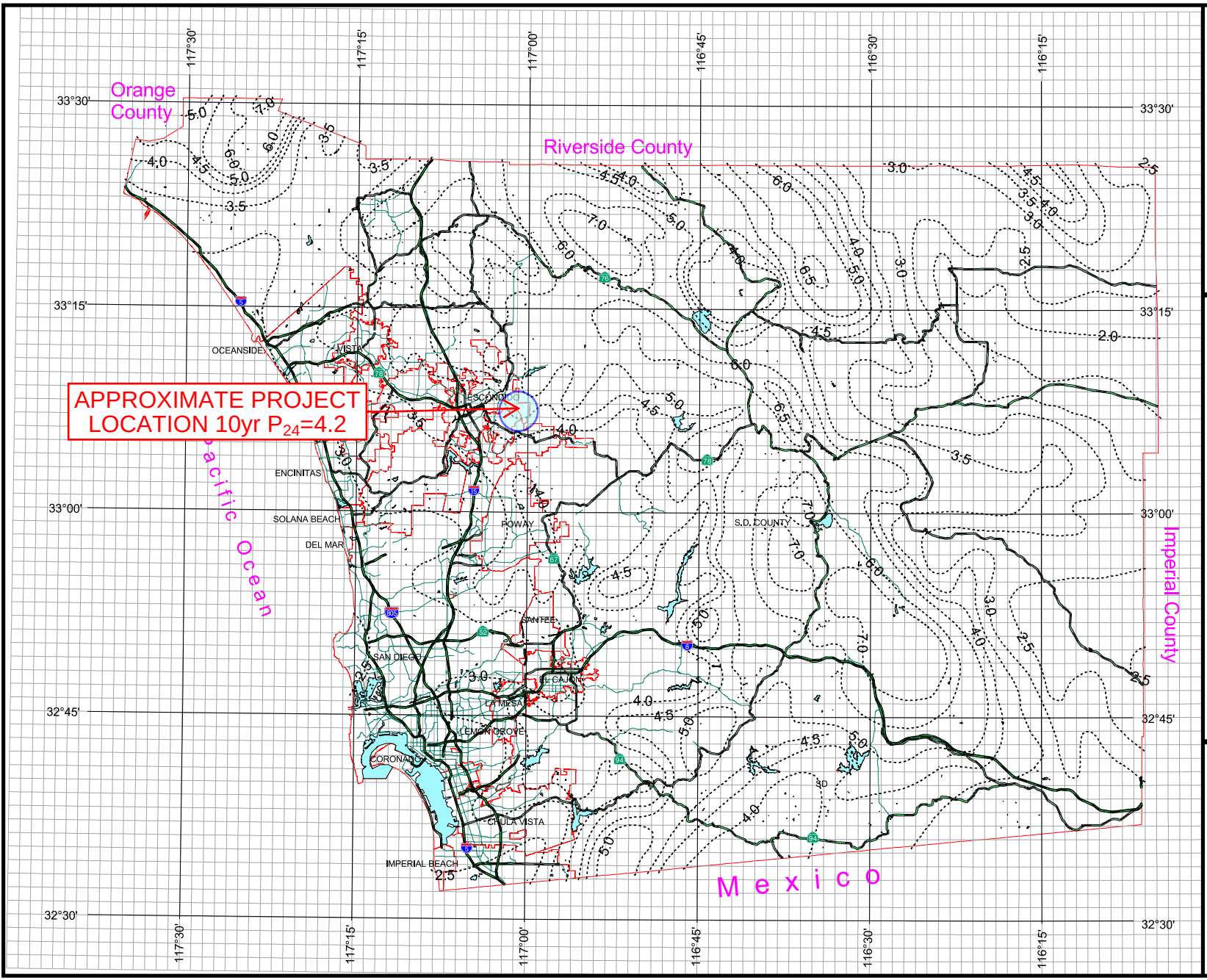
N
W E
S

3 0 3 Miles

County of San Diego Hydrology Manual

Rainfall Isopluvials



10 Year Rainfall Event - 24 Hours

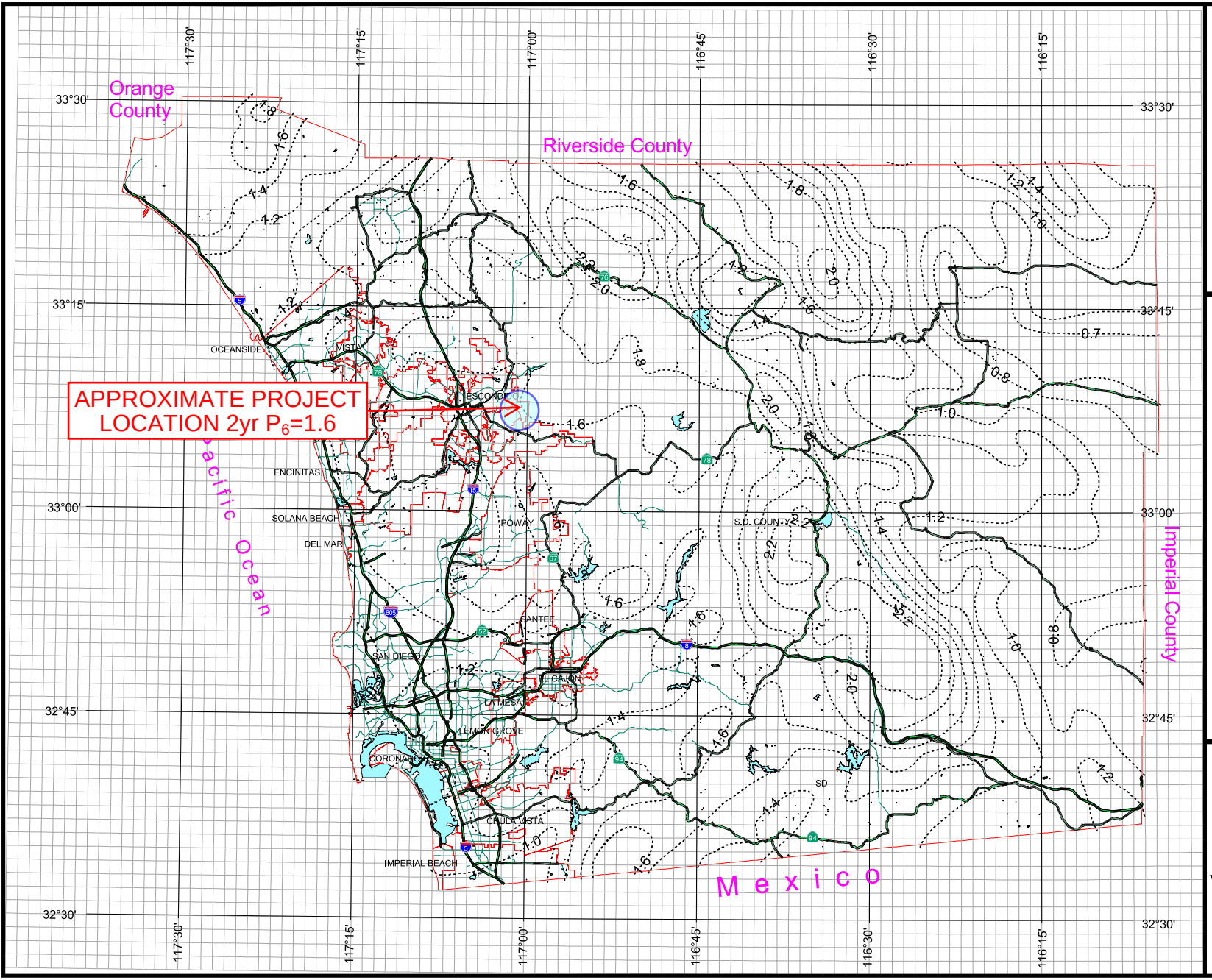
Isopluvial (inches)

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

N
W E
S

3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

2 Year Rainfall Event - 6 Hours

Isopluvial (inches)

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
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N
W E
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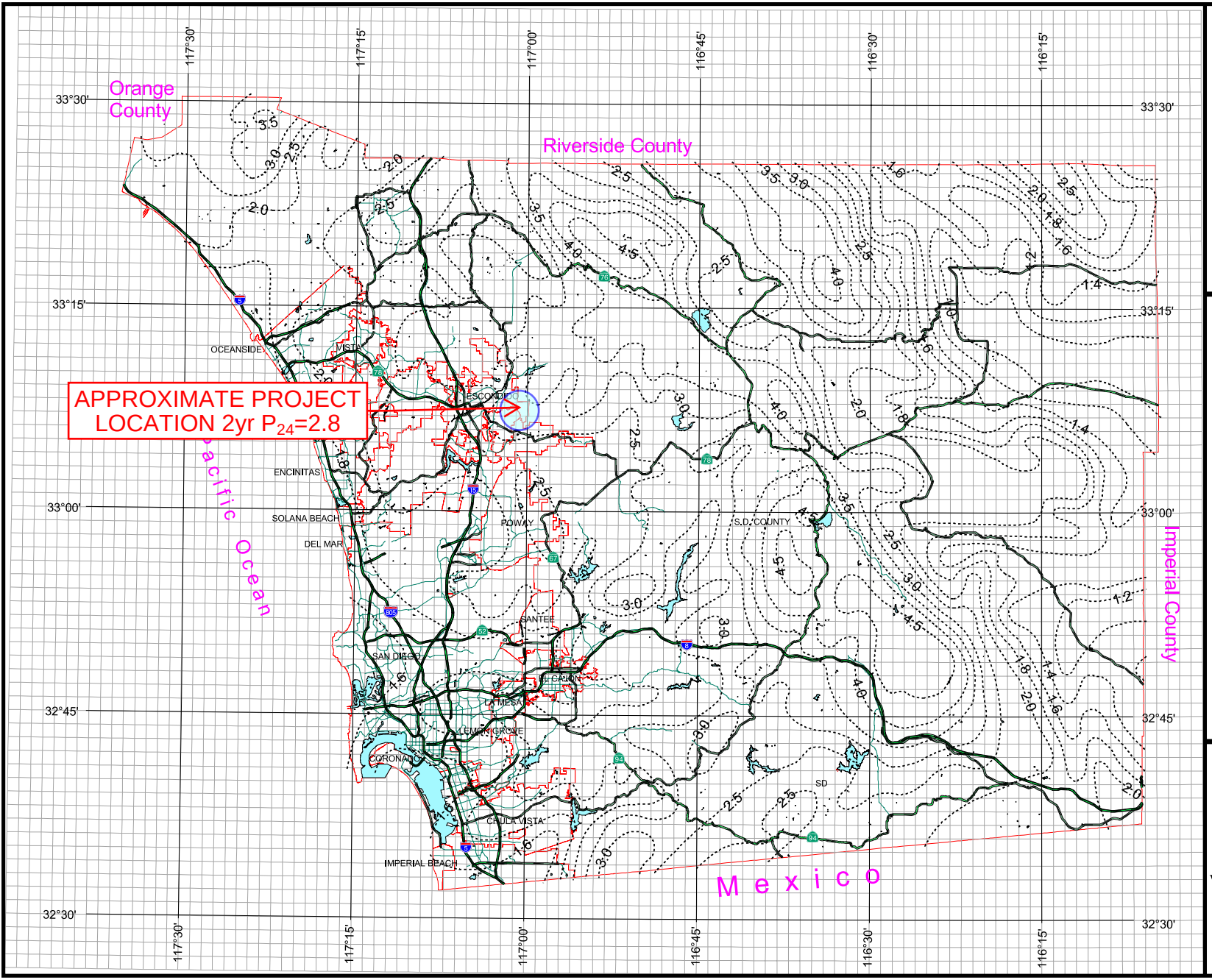
3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

2 Year Rainfall Event - 24 Hours

Isopluvial (inches)

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
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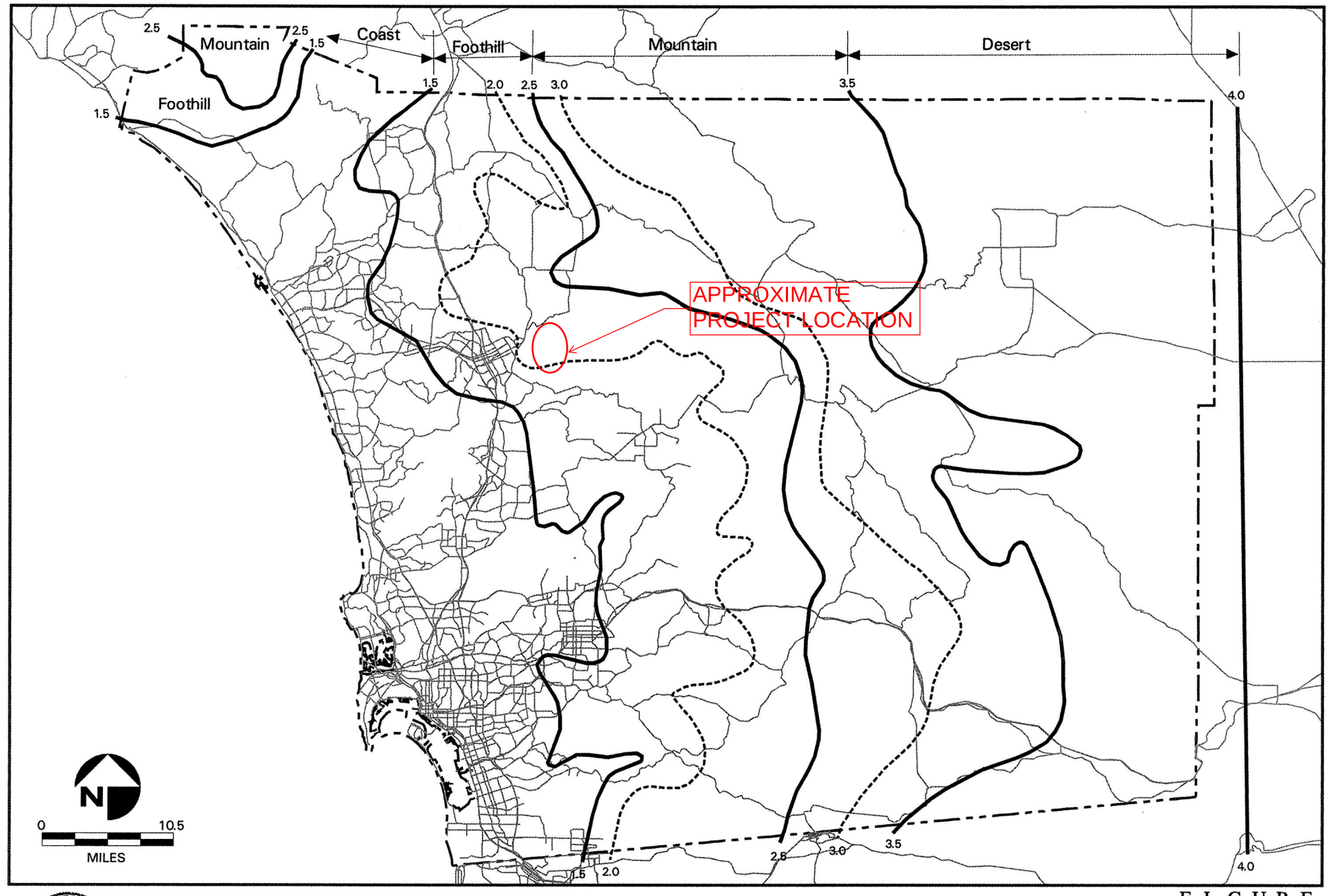
N
W E
S

3 0 3 Miles



County of San Diego Hydrology Manual

Precipitation Zone Numbers (PZN)

FIGURE

C-1

Appendix 5 – Hydrologic Model & Exhibits - Existing Condition

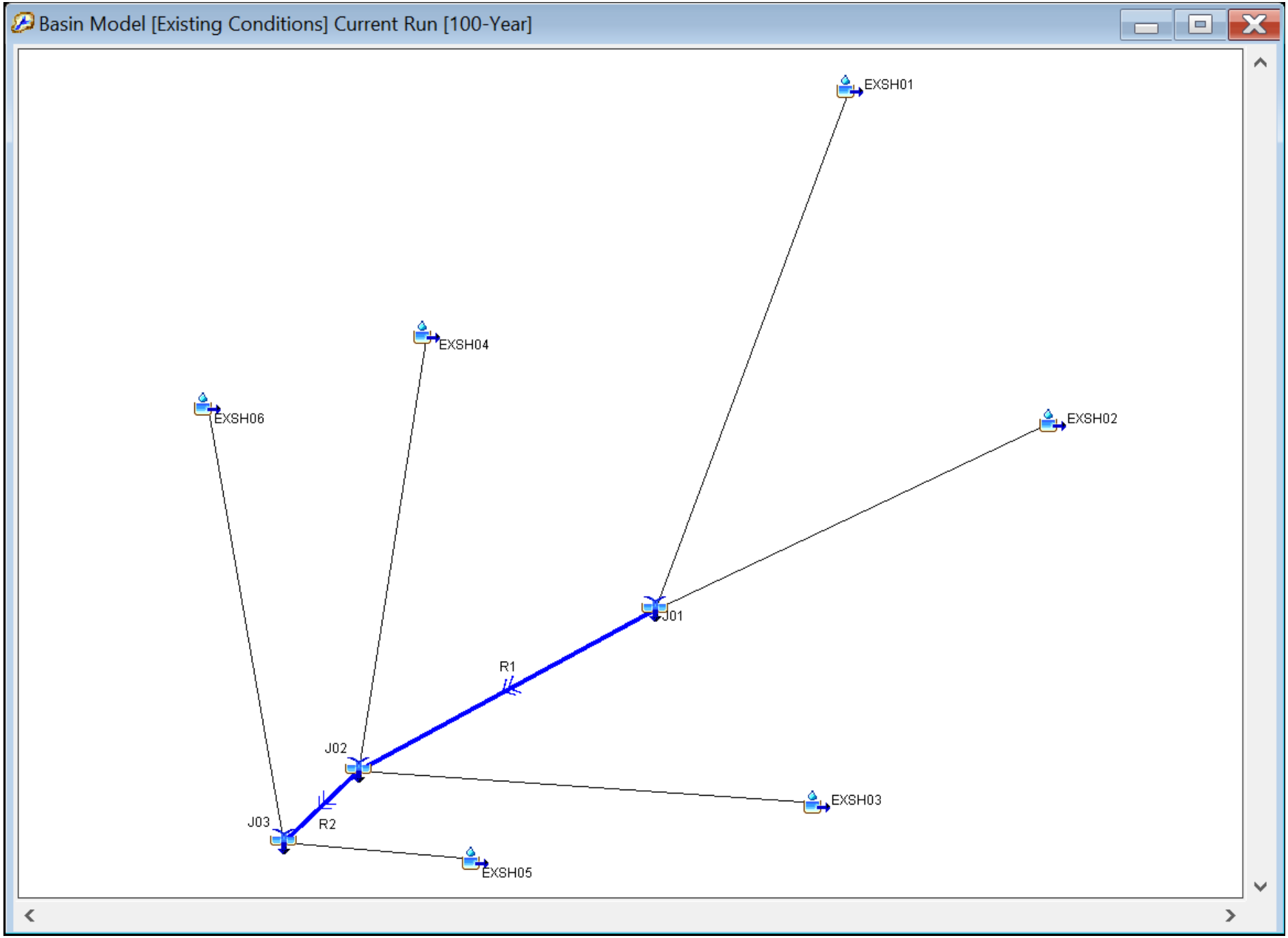
Drainage Area **A**

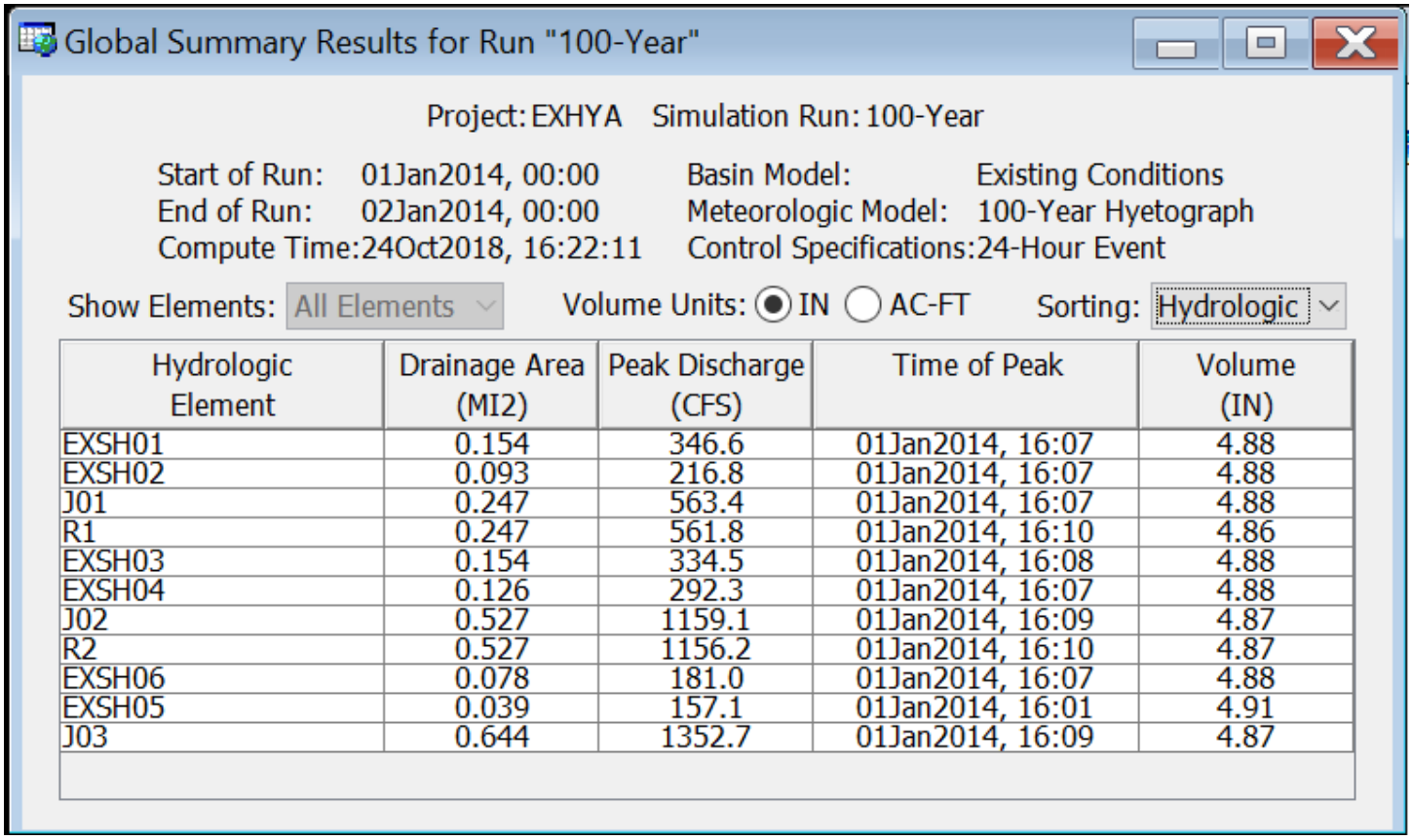
Drainage Area AHEC-HMS Routing Input-Existing Conditions

Subarea	Reach	U/S Node	D/S Node	Length (ft)	U/S Elev (ft)	D/S Elev (ft)	Slope (ft/ft)	Slope (ft/mi)	"n" value	Channel Type	Dimensions
EXSH02	R1	J01	J02	3733	1602.0	1120.0	0.12912	681.74658	0.05	Trap	15' (W), 3H:1V
EXSH03	R2	J02	J03	778	860.0	820.0	0.05141	271.46530	0.05	Trap	20' (W), 8H:1V

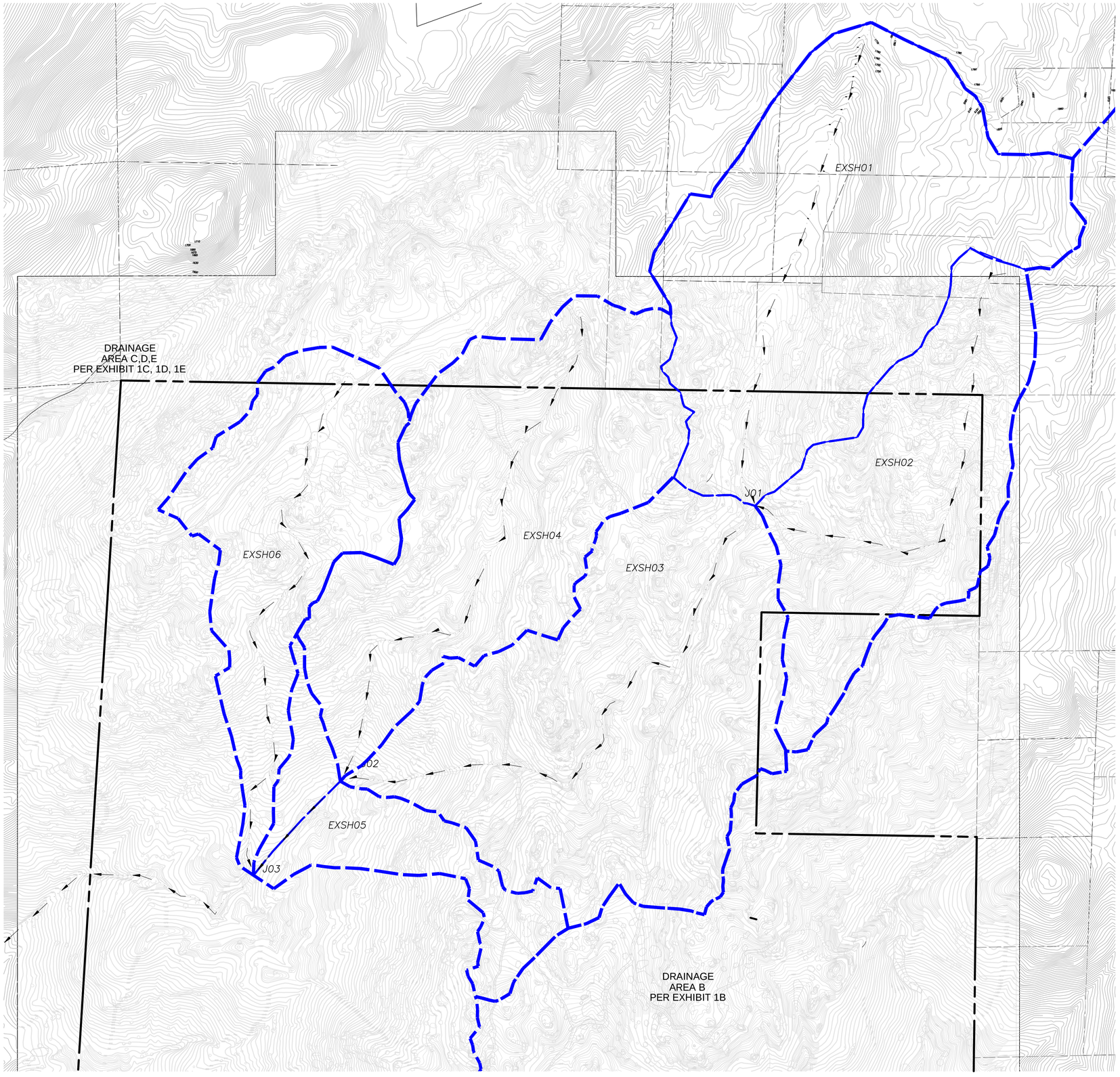
HEC-HMS Basin Input-Existing Conditions Drainage Area A

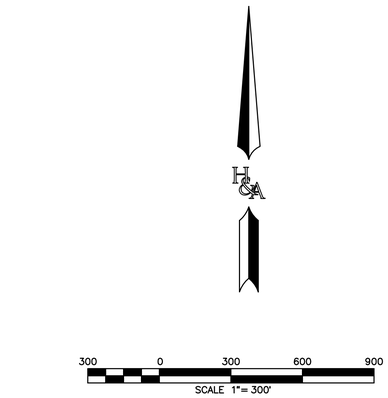
Subarea	Area (ft^2)	Area (mi^2)	"n" value	L (ft)	L_c (ft)	L (miles)	L_c (miles)	$Elev_1$ (ft)	$Elev_2$ (ft)	$Elev_{(1-2)}$ (ft)	Slope (ft/mile)	Corps T_1 (hrs)	NRCS T_1 (hrs)	NRCS T_1 (min)
EXSH01	4302980.0	0.154	0.050	3152	1355	0.597	0.257	1765.0	1602.0	163	273.046	0.20	0.17	9.98
EXSH02	2581237.0	0.093	0.050	3137	2040	0.594	0.386	2100.0	1602.0	498	838.202	0.19	0.16	9.37
EXSH03	4303730.0	0.154	0.050	3733	2107	0.707	0.399	1602.0	1120.0	482	681.747	0.21	0.18	10.61
EXSH04	3507524.0	0.126	0.050	3750	1656	0.710	0.314	1655.0	1120.0	535	753.280	0.19	0.16	9.46
EXSH05	1086799.0	0.039	0.050	778	404	0.147	0.077	1120.0	1046.0	74	502.211	0.07	0.05	2.96
EXSH06	2180584.0	0.078	0.050	3692	889	0.699	0.168	1630.0	1046.0	584	835.190	0.15	0.12	7.17
Total Check	17962854.0	0.644												


Basin Model [Existing Conditions] Current Run [100-Year]
EXSH01
EXSH04
EXSH06
EXSH02
J01
R1
J02
EXSH03
J03
R2
EXSH05



Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
EXSH01	0.154	346.6	01Jan2014, 16:07	4.88
EXSH02	0.093	216.8	01Jan2014, 16:07	4.88
J01	0.247	563.4	01Jan2014, 16:07	4.88
R1	0.247	561.8	01Jan2014, 16:10	4.86
EXSH03	0.154	334.5	01Jan2014, 16:08	4.88
EXSH04	0.126	292.3	01Jan2014, 16:07	4.88
J02	0.527	1159.1	01Jan2014, 16:09	4.87
R2	0.527	1156.2	01Jan2014, 16:10	4.87
EXSH06	0.078	181.0	01Jan2014, 16:07	4.88
EXSH05	0.039	157.1	01Jan2014, 16:01	4.91
J03	0.644	1352.7	01Jan2014, 16:09	4.87





LEGEND

DRAINAGE WATERSHED BOUNDARY	
FLOW DIRECTION	
HYDROLOGIC NODE (HEC-HMS JUNCTION)	EXSH03

PREPARED BY:

HUNSAKER & ASSOCIATES SAN DIEGO, INC.
PLANNING 9707 Waples Street
ENGINEERING San Diego, Ca 92121
SURVEYING PH(858)558-4500 · FX(858)558-1414

EXISTING CONDITION HYDROLOGY MAP FOR:

SAFARI HIGHLANDS RANCH

DRAINAGE AREA A

CITY OF ESCONDIDO, CA

EXHIBIT **1A**

W.O. 2374-17

R:\1211\&Hyd\ACAD\EXHIBIT 1A-Exist Condition.dwg[]Apr-21-2017:14:41

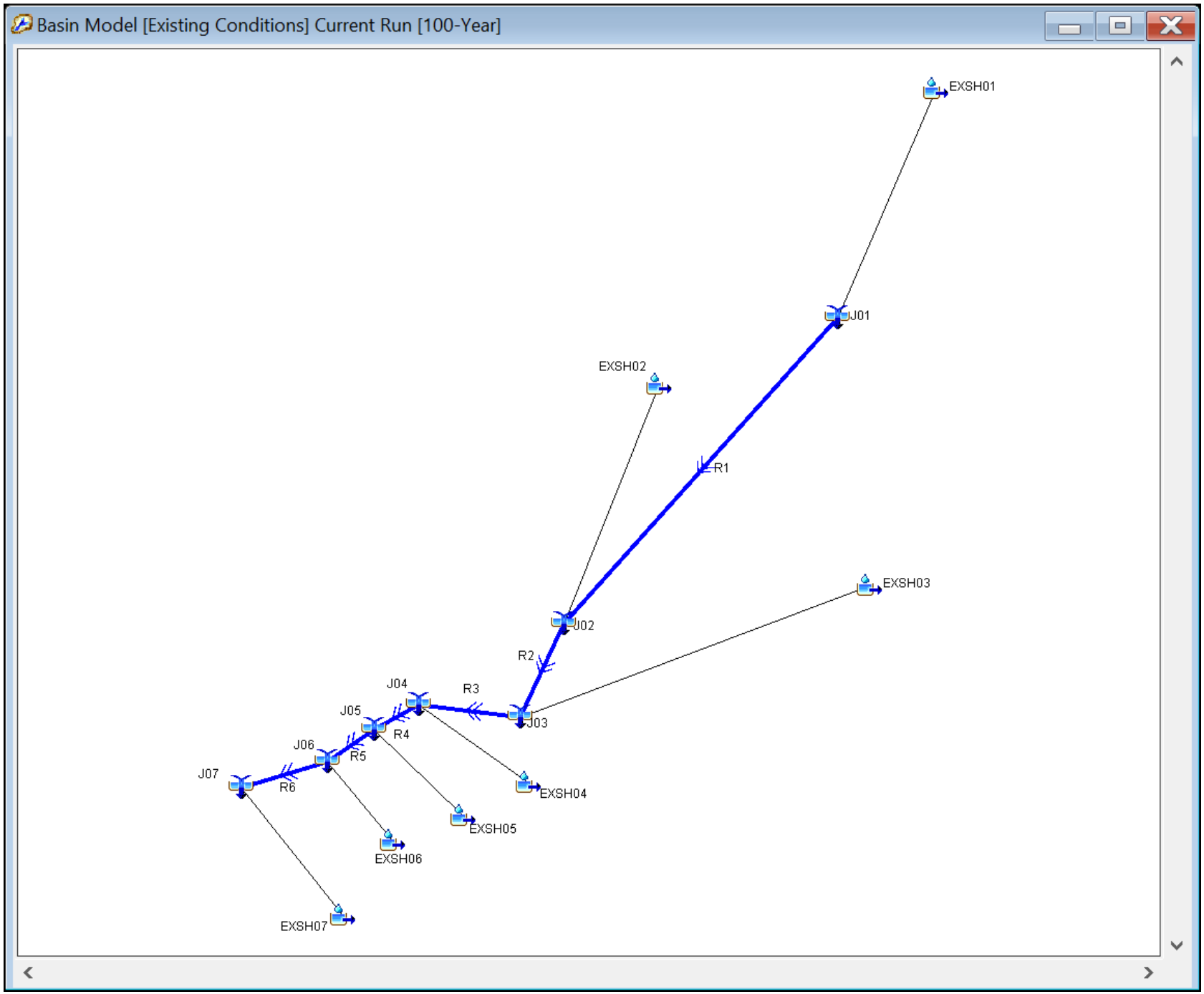
Drainage Area **B** (NRCS Hydrologic Model Method)

HEC-HMS Routing Input-Existing Conditions

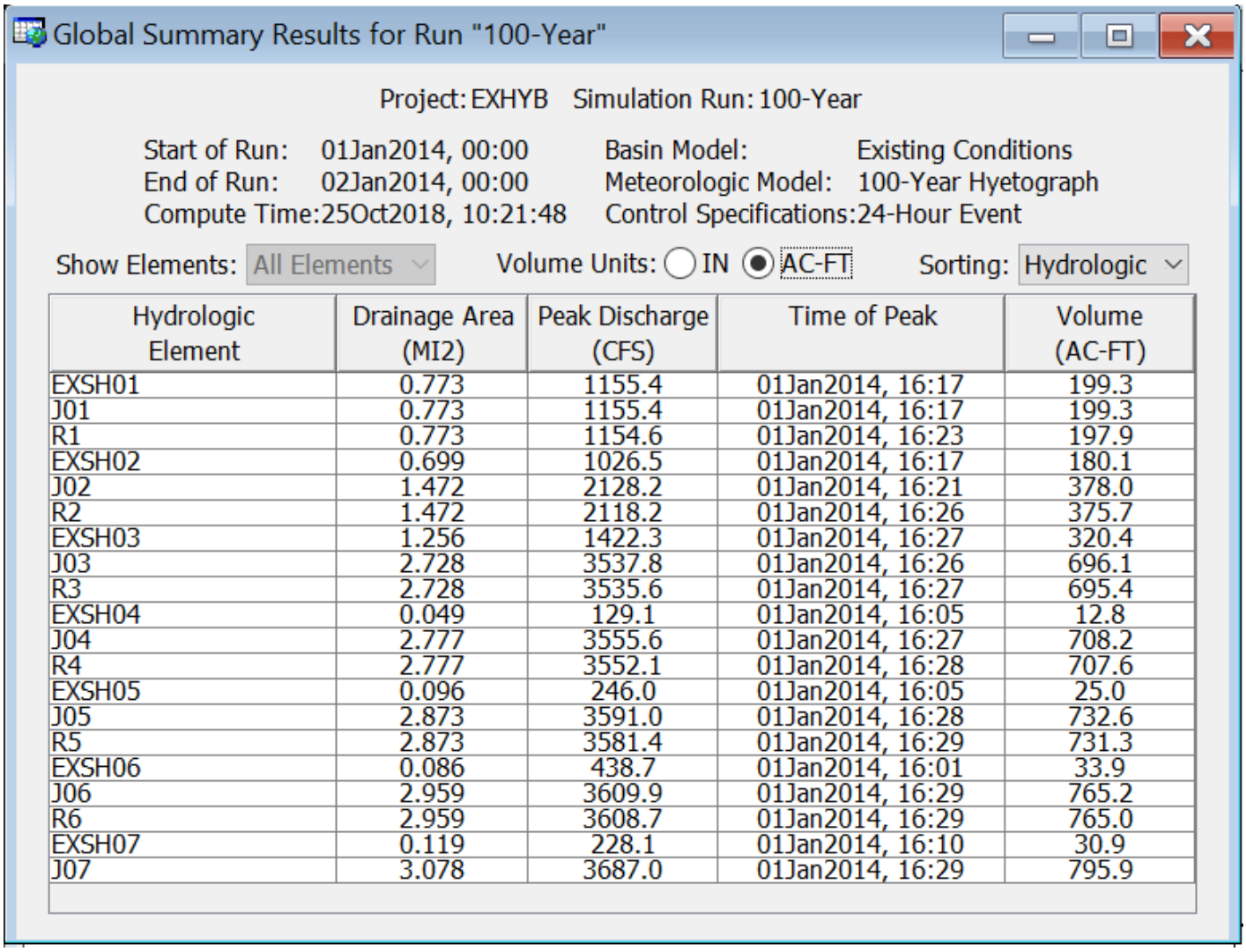
Subarea	Reach	U/S Node	D/S Node	Length (ft)	U/S Elev (ft)	D/S Elev (ft)	Slope (ft/ft)	Slope (ft/mi)	"n" value	Channel Type	Dimensions
EXSH02	R1	J01	J02	8015	1565.0	860.0	0.08796	464.42920	0.05	Trap	15' (W), 3H:1V
EXSH03	R2	J02	J03	2897	860.0	820.0	0.01381	72.90300	0.05	Trap	35' (W), 8H:1V
EXSH04	R3	J03	J04	2154	820.0	420.0	0.18570	980.50139	0.05	Trap	15' (W), 3H:1V
EXSH05	R4	J04	J05	543	420.0	414.0	0.01105	58.34254	0.05	Trap	20' (W), 3H:1V
EXSH06	R5	J05	J06	787	414.0	408.0	0.00762	40.25413	0.05	Trap	60' (W), 4H:1V
EXSH07	R6	J06	J07	234	408.0	406.0	0.00855	45.12821	0.018	Rect	30' (W)

HEC-HMS Basin Input-Existing Conditions

Subarea	Area (ft^2)	Area (mi^2)	"n" value	L (ft)	L_c (ft)	L (miles)	L_c (miles)	$Elev_1$ (ft)	$Elev_2$ (ft)	$Elev_{(1-2)}$ (ft)	Slope (ft/mile)	Corps T_1 (hrs)	NRCS T_1 (hrs)	NRCS T_1 (min)
EXSH01	21546035.7	0.773	0.050	7147	3139	1.354	0.595	1880.0	1565.0	315	232.713	0.39	0.33	19.79
EXSH02	19439649.1	0.697	0.050	9466	4572	1.793	0.866	2200.0	860.0	1340	747.433	0.40	0.34	20.37
EXSH03	34181823.2	1.226	0.050	14593	6473	2.764	1.226	1960.0	820.0	1140	412.472	0.61	0.52	30.93
EXSH04	1296883.5	0.047	0.050	2772	1589	0.525	0.301	1022.0	420.0	602	1146.667	0.16	0.13	7.57
EXSH05	2573064.6	0.092	0.050	3355	1228	0.635	0.233	921.0	414.0	507	797.902	0.16	0.13	7.93
EXSH06	2396067.7	0.086	0.018	2473	1099	0.468	0.208	560.0	413.0	147	313.854	0.06	0.04	2.59
EXSH07	3311088.3	0.119	0.050	5005	2578	0.948	0.488	1000.0	406.0	594	626.637	0.26	0.22	13.12
Total Check	81433523.9	3.040												


Basin Model [Existing Conditions] Current Run [100-Year]
EXSH01
J01
EXSH02
R1
EXSH03
J02
R2
J04
R3
J05
R4
J06
R5
J07
R6
J03
EXSH04
EXSH05
EXSH06
EXSH07

Drainage Area B



Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
EXSH01	0.773	1155.4	01Jan2014, 16:17	199.3
J01	0.773	1155.4	01Jan2014, 16:17	199.3
R1	0.773	1154.6	01Jan2014, 16:23	197.9
EXSH02	0.699	1026.5	01Jan2014, 16:17	180.1
J02	1.472	2128.2	01Jan2014, 16:21	378.0
R2	1.472	2118.2	01Jan2014, 16:26	375.7
EXSH03	1.256	1422.3	01Jan2014, 16:27	320.4
J03	2.728	3537.8	01Jan2014, 16:26	696.1
R3	2.728	3535.6	01Jan2014, 16:27	695.4
EXSH04	0.049	129.1	01Jan2014, 16:05	12.8
J04	2.777	3555.6	01Jan2014, 16:27	708.2
R4	2.777	3552.1	01Jan2014, 16:28	707.6
EXSH05	0.096	246.0	01Jan2014, 16:05	25.0
J05	2.873	3591.0	01Jan2014, 16:28	732.6
R5	2.873	3581.4	01Jan2014, 16:29	731.3
EXSH06	0.086	438.7	01Jan2014, 16:01	33.9
J06	2.959	3609.9	01Jan2014, 16:29	765.2
R6	2.959	3608.7	01Jan2014, 16:29	765.0
EXSH07	0.119	228.1	01Jan2014, 16:10	30.9
J07	3.078	3687.0	01Jan2014, 16:29	795.9

DRAINAGE AREA C,D,E
PER EXHIBIT 1C, 1D, AND 1E

DRAINAGE AREA A
PER EXHIBIT 1A

PROJECT BOUNDARY

EXSH01

EXSH02

EXSH03

EXSH04

EXSH05

EXSH06

EXSH07

J01

J02

J03

J04

J05

J06

J07

ROCKWOOD ROAD

EAGLE CREST GOLF COURSE
RANCHO SAN PASCUAL
DEVELOPMENT

RANCHO
VISTA MONTE

0 400 800 1200
SCALE 1" = 400'

600 0 600 1200 1800
SCALE 1" = 600'

LEGEND

HYDROLOGIC SUBAREA (HEC-HMS BOUNDARY)
HYDROLOGIC NODE (HEC-HMS JUNCTION) J01
MAIN CHANNEL PATH

PREPARED BY:

HUNSAKER & ASSOCIATES
SAN DIEGO, INC

PLANNING
ENGINEERING
SURVEYING

9707 Waples Street
San Diego, Ca 92121
PH(858)558-4500· FX(858)558-1414

EXISTING CONDITION HYDROLOGIC WORKMAP FOR:

SAFARI HIGHLANDS RANCH

DRAINAGE AREA B

CITY OF ESCONDIDO, CA

EXHIBIT **1B**

W.O. 2374-17

R:\1211\&Hyd\ACAD\EXIBIT 1B-Exist Condition.dwg[]Apr-21-2017:14:55

Drainage Area C, D, and E
- Offsite, Northeast, North, Northwest
(NRCS Hydrologic Model Method)

HEC-HMS Basin Input-Existing Conditions Drainage Area C (Offsite - Northwest)

Subarea	Area (ft^2)	Area (mi^2)	"n" value	L (ft)	L_c (ft)	L (miles)	L_c (miles)	$Elev_1$ (ft)	$Elev_2$ (ft)	$Elev_{(1-2)}$ (ft)	Slope (ft/mile)	Corps T_1 (hrs)	NRCS T_1 (hrs)	NRCS T_1 (min)
EX01	888217.0	0.032	0.050	1463	893	0.277	0.169	1577.0	1312.0	265	956.391	0.10	0.08	4.77
EX02	2420911.0	0.087	0.050	2149	1179	0.407	0.223	1312.0	842.0	470	1154.770	0.13	0.10	6.03
Total Check	3309128.0	0.119												

HEC-HMS Basin Input-Existing Conditions Drainage Area D (Offsite - north)

Subarea	Area (ft^2)	Area (mi^2)	"n" value	L (ft)	L_c (ft)	L (miles)	L_c (miles)	$Elev_1$ (ft)	$Elev_2$ (ft)	$Elev_{(1-2)}$ (ft)	Slope (ft/mile)	Corps T_1 (hrs)	NRCS T_1 (hrs)	NRCS T_1 (min)
EX01	52628830.0	1.888	0.050	11964	3967	2.266	0.751	2040.0	1350.0	690	304.514	0.50	0.42	25.13
EX02	11627753.0	0.417	0.050	6297	2921	1.193	0.553	1800.0	1340.0	460	385.707	0.33	0.28	16.59
EX03	20274336.0	0.727	0.050	3363	1689	0.637	0.320	1340.0	1300.0	40	62.801	0.30	0.25	14.94
EX04	4419569.0	0.159	0.050	2933	1192	0.555	0.226	1577.0	1300.0	277	498.657	0.17	0.14	8.16
EX05	32806681.0	1.177	0.050	11152	5437	2.112	1.030	1300.0	710.0	590	279.340	0.55	0.47	28.10
EX06	16732719.0	0.600	0.050	6055	2708	1.147	0.513	1800.0	710.0	1090	950.487	0.27	0.22	13.29
EX07	15791050.0	0.566	0.050	4399	1580	0.833	0.299	710.0	516.0	194	232.853	0.25	0.21	12.50
Total Check	154280938.0	5.534												

HEC-HMS Basin Input-Existing Conditions Drainage Area E (Offsite - Northeast)

Subarea	Area (ft^2)	Area (mi^2)	"n" value	L (ft)	L_c (ft)	L (miles)	L_c (miles)	$Elev_1$ (ft)	$Elev_2$ (ft)	$Elev_{(1-2)}$ (ft)	Slope (ft/mile)	Corps T_1 (hrs)	NRCS T_1 (hrs)	NRCS T_1 (min)
PR01	827459.0	0.0297	0.050	1763	912	0.334	0.173	1480.0	860.0	620	1856.835	0.10	0.08	4.52
BASIN 8	18004.0	0.0006	0.050	549	274.5	0.104	0.052	879.0	860.0	19	182.732	0.06	0.04	2.67
PR02	877393.0	0.0315	0.050	1007	628	0.191	0.119	860.0	808.0	52	272.651	0.10	0.08	4.57
PR03	2796589.0	0.1003	0.050	3196	2014	0.605	0.381	1480.0	875.0	605	999.499	0.19	0.15	9.07
BASIN 7	10400.0	0.0004	0.050	135	67.5	0.026	0.013	879.0	875.0	4	156.444	0.02	0.01	0.63
PR04	114842.0	0.0041	0.050	693	201	0.131	0.038	870.0	808.0	62	472.381	0.05	0.03	2.07
PR06	544631.0	0.0195	0.050	1397	601	0.265	0.114	1240.0	870.0	370	1398.425	0.08	0.06	3.64
BASIN 6	11496.0	0.0004	0.050	193	96.5	0.037	0.018	879.0	876.0	3	82.073	0.03	0.02	1.17
PR05	669739.0	0.0240	0.050	711	355.5	0.135	0.067	808.0	760.0	48	356.456	0.07	0.05	2.90
PR08	140874.0	0.0051	0.050	654	522	0.124	0.099	1000.0	880.0	120	968.807	0.06	0.04	2.65
BASIN 5	23259.0	0.0008	0.050	489	244.5	0.093	0.046	884.0	875.0	9	97.178	0.06	0.05	2.78
PR09	74551.0	0.0027	0.050	412	130	0.078	0.025	878.0	750.0	128	1640.388	0.03	0.02	0.91
PR07	115689.0	0.0041	0.050	812	710	0.154	0.134	760.0	750.0	10	65.025	0.12	0.10	5.93
PR10	698133.0	0.0250	0.050	1038	338	0.197	0.064	750.0	690.0	60	305.202	0.08	0.06	3.47
PR11	1087863.0	0.0390	0.050	2770	1273	0.525	0.241	1240.0	890.0	350	667.148	0.16	0.13	7.72
BASIN 4	51609.0	0.0019	0.050	1515	705	0.287	0.134	918.0	884.0	34	118.495	0.14	0.11	6.75
PR12	498340.0	0.0179	0.050	801	287	0.152	0.054	880.0	690.0	190	1252.434	0.05	0.03	2.08
Total Check	8560871.0	0.3071												

Global Summary Results for Run "100-Year"

Project: N_Offsite_DirtRD_EX Simulation Run: 100-Year

Start of Run: 01Jan2014, 00:00
End of Run: 02Jan2014, 00:00
Compute Time: 25Oct2018, 06:10:45

Basin Model: Existing Conditions
Meteorologic Model: 100-Year Hyetograph
Control Specifications: 24-Hour Event

Show Elements: All Elements Volume Units: ○ IN ◉ AC-FT Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
EX01	1.888	2437.1	01Jan2014, 16:22	484.3
EX02	0.417	694.0	01Jan2014, 16:14	107.8
J01	2.305	3025.7	01Jan2014, 16:19	592.1
R1	2.305	3012.6	01Jan2014, 16:24	588.8
EX03	0.727	1289.9	01Jan2014, 16:12	188.3
EX04	0.159	400.3	01Jan2014, 16:06	41.4
J02	3.191	4010.4	01Jan2014, 16:19	818.5
R2	3.191	4005.8	01Jan2014, 16:27	811.6
EX05	1.177	1417.1	01Jan2014, 16:25	301.1
EX06	0.600	1140.6	01Jan2014, 16:10	155.6
J03	4.968	5888.8	01Jan2014, 16:25	1268.3
R3	4.968	5884.9	01Jan2014, 16:28	1264.8
EX07	0.462	944.8	01Jan2014, 16:09	120.0
BASIN 2	0.006	9.8	01Jan2014, 16:14	1.6
J04	5.436	6185.2	01Jan2014, 16:27	1386.4
R4	5.436	6182.1	01Jan2014, 16:28	1385.2
EX08	0.090	297.3	01Jan2014, 16:03	23.5
BASIN 3	0.008	26.4	01Jan2014, 16:03	2.1
J05	5.534	6213.6	01Jan2014, 16:28	1410.8

Global Summary Results for Run "100-Year"

Project: NE_Offsite_EX Simulation Run: 100-Year

Start of Run: 01Jan2014, 00:00
End of Run: 02Jan2014, 00:00
Compute Time: 25Oct2018, 06:18:23

Basin Model: Existing Conditions
Meteorologic Model: 100-Year Hyetograph
Control Specifications: 24-Hour Event

Show Elements: All Elements Volume Units: ◉ IN ○ AC-FT Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
EX02	0.087	258.3	01Jan2014, 16:04	4.90
EX01	0.032	106.1	01Jan2014, 16:03	4.90
J1	0.032	106.1	01Jan2014, 16:03	4.90
R1	0.032	106.1	01Jan2014, 16:05	4.89
J2	0.119	362.1	01Jan2014, 16:04	4.89

Global Summary Results for Run "100-Year"

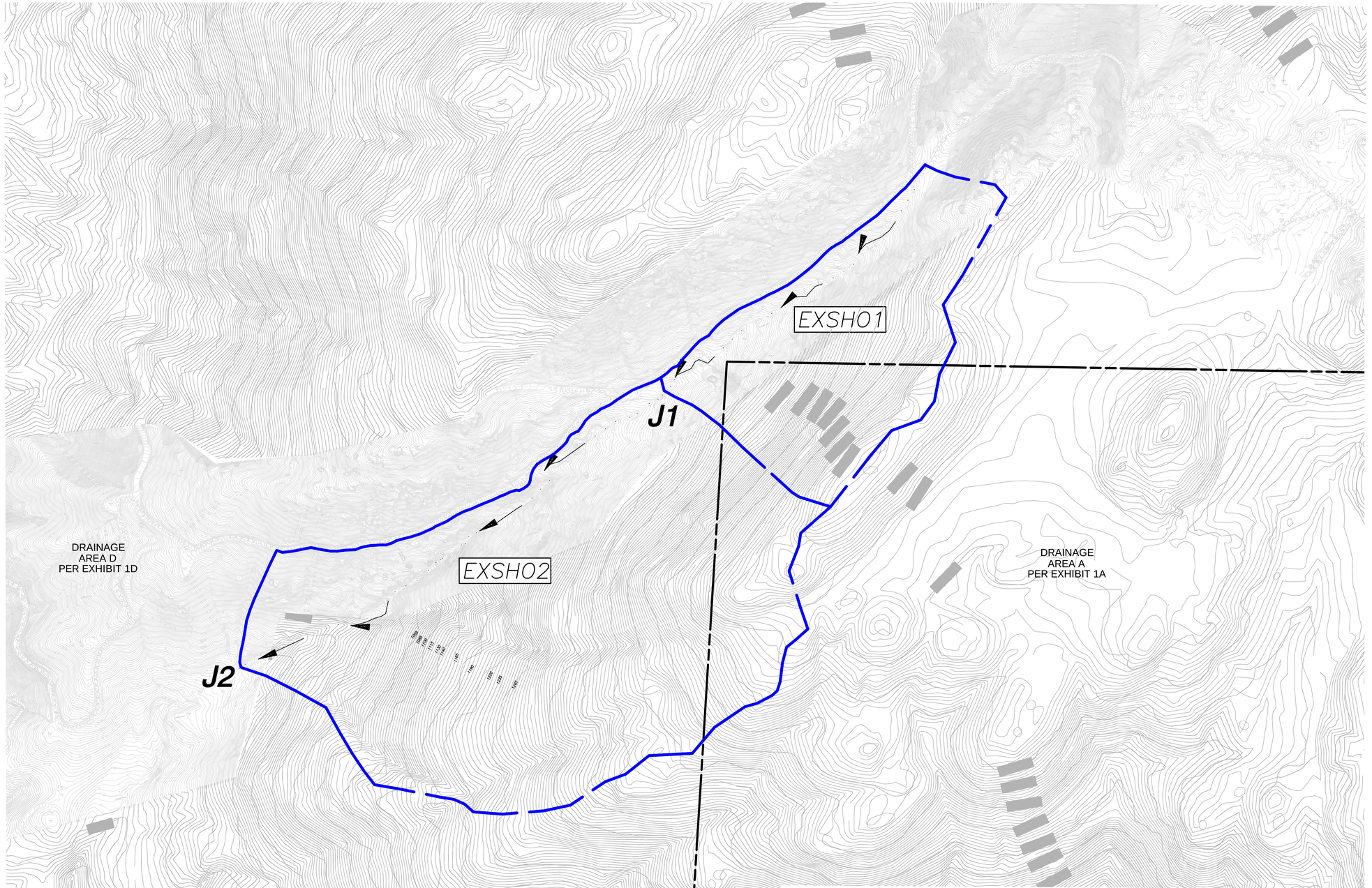
Project: NW_ALT_Offsite_EX Simulation Run: 100-Year

Start of Run: 01Jan2014, 00:00
End of Run: 02Jan2014, 00:00
Compute Time: 25Oct2018, 06:37:52

Basin Model: Existing Conditions
Meteorologic Model: 100-Year Hyetograph
Control Specifications: 24-Hour Event

Show Elements: All Elements Volume Units: IN (AC-FT) Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
PRSH03	0.100	224.3	01Jan2014, 16:06	26.0
PRSH06	0.0195	61.3	01Jan2014, 16:00	5.1
BASIN 7	0.0004	2.1	01Jan2014, 16:00	0.2
BASIN 6	0.0004	1.8	01Jan2014, 16:00	0.2
J06	0.1203	258.6	01Jan2014, 16:06	31.4
R5	0.1203	257.1	01Jan2014, 16:06	31.4
PRSH02	0.0315	118.1	01Jan2014, 16:03	12.4
PRSH01	0.030	91.3	01Jan2014, 16:03	7.8
BASIN 8	0.001	4.5	01Jan2014, 16:00	0.4
J01	0.031	94.5	01Jan2014, 16:03	8.2
R1	0.031	88.4	01Jan2014, 16:03	8.2
PRSH04	0.0041	16.5	01Jan2014, 16:00	1.1
J02	0.1869	438.7	01Jan2014, 16:03	53.1
R2	0.1869	431.1	01Jan2014, 16:06	53.1
PRSH05	0.0240	85.3	01Jan2014, 16:00	6.3
PRSH07	0.004	11.1	01Jan2014, 16:03	1.0
J03	0.2149	487.1	01Jan2014, 16:03	60.4
R3	0.2149	480.7	01Jan2014, 16:06	60.3
PRSH08	0.005	18.5	01Jan2014, 16:00	1.3
BASIN 5	0.0008	3.6	01Jan2014, 16:00	0.3
J07	0.0058	22.0	01Jan2014, 16:00	1.6
R6	0.0058	19.9	01Jan2014, 16:00	1.6
PRSH09	0.0027	11.7	01Jan2014, 16:00	0.7
J04	0.2234	493.4	01Jan2014, 16:06	62.6
R4	0.2234	474.9	01Jan2014, 16:06	62.5
PRSH11	0.039	93.3	01Jan2014, 16:06	10.2
BASIN 4	0.0019	6.0	01Jan2014, 16:03	0.7
J08	0.0409	99.0	01Jan2014, 16:06	10.9
R7	0.0409	97.9	01Jan2014, 16:06	10.9
PRSH10	0.025	80.9	01Jan2014, 16:00	6.5
PRSH12	0.0179	72.1	01Jan2014, 16:00	4.7
J05	0.3072	633.1	01Jan2014, 16:06	84.7



LEGEND

HYDROLOGIC SUBAREA (HEC-HMS BOUNDARY)

HYDROLOGIC NODE (HEC-HMS JUNCTION) J01

MAIN CHANNEL PATH

0 200 400 600

SCALE 1"= 200'

PREPARED BY:

HUNSAKER & ASSOCIATES SAN DIEGO, INC

PLANNING 9707 Waples Street
ENGINEERING San Diego, Ca 92121
SURVEYING PH(858)558-4500· FX(858)558-1414

EXISTING HYDROLOGY MAP FOR SAFARI HIGHLANDS RANCH DRAINAGE AREA C

CITY OF ESCONDIDO, CA

SHEET 1C

W.O. 2374-0017

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EXSH06

EXSH05

EXSH02

EXSH01

EXSH03

EXSH04

EXSH07

J1

J2

J3

J4

DRAINAGE
AREA E
PER EXHIBIT 1E

DRAINAGE
AREA C
PER EXHIBIT 1C

LEGEND

HYDROLOGIC SUBAREA (HEC-HMS BOUNDARY)

HYDROLOGIC NODE (HEC-HMS JUNCTION) J01

MAIN CHANNEL PATH

H&A

PREPARED BY:

HUNSAKER & ASSOCIATES
SAN DIEGO, INC
PLANNING 9707 Waples Street
ENGINEERING San Diego, Ca 92121
SURVEYING PH(858)558-4500 · FX(858)558-1414

EXISTING HYDROLOGY MAP
FOR SAFARI HIGHLANDS RANCH
DRAINAGE AREA D

CITY OF ESCONDIDO, CA

SHEET 1D

W.O. 2374-0017

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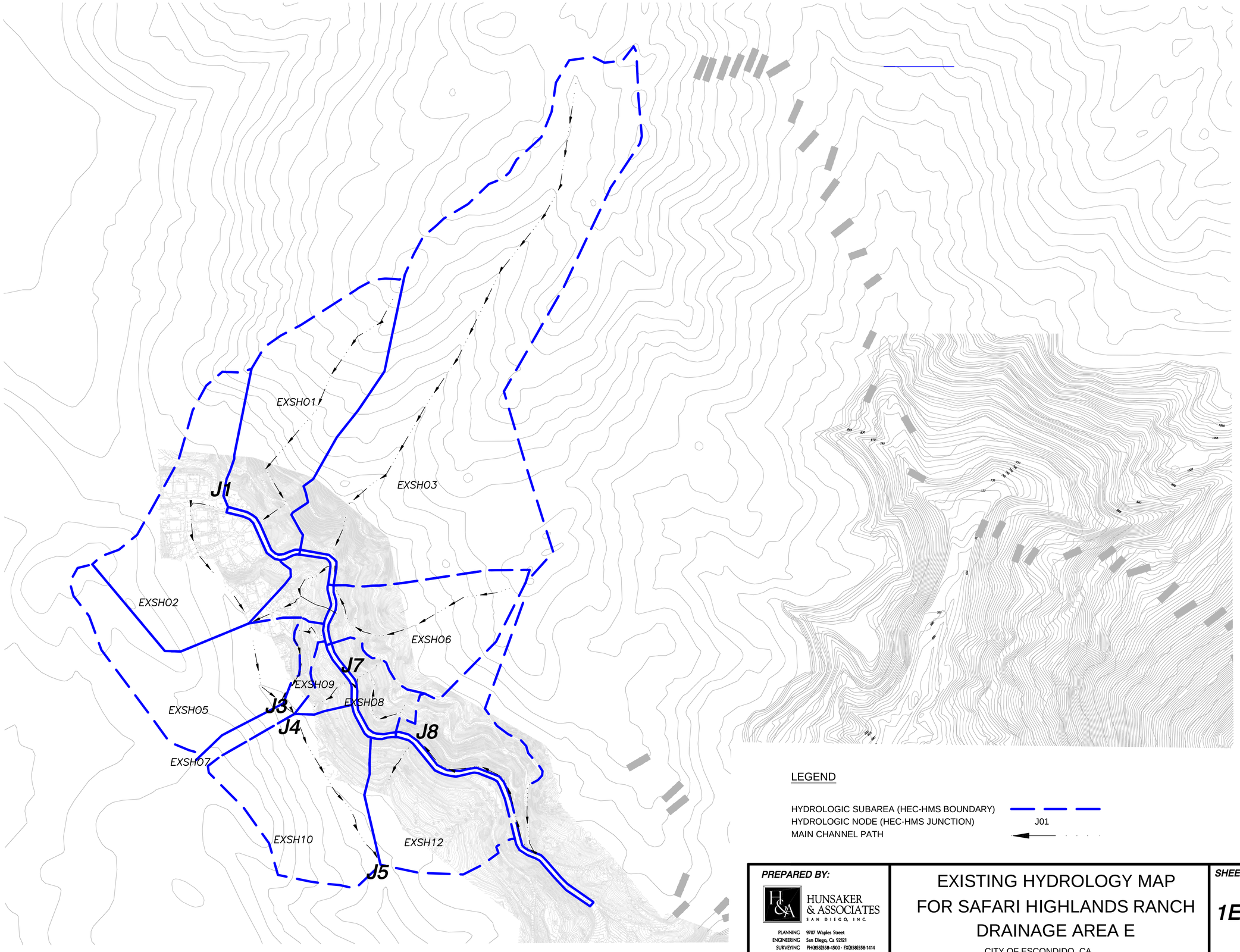

0 250 500 750
SCALE 1" = 250'

LEGEND

HYDROLOGIC SUBAREA (HEC-HMS BOUNDARY)
HYDROLOGIC NODE (HEC-HMS JUNCTION) J01
MAIN CHANNEL PATH

PREPARED BY:

HUNSAKER & ASSOCIATES
SAN DIEGO, INC
PLANNING 9707 Waples Street
ENGINEERING San Diego, Ca 92121
SURVEYING PH(858)558-4500 - FX(858)558-1414

EXISTING HYDROLOGY MAP FOR SAFARI HIGHLANDS RANCH DRAINAGE AREA E

CITY OF ESCONDIDO, CA

SHEET 1E

W.O. 2374-0017

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Appendix 6 – Hydrologic Model & Exhibits - Proposed Condition

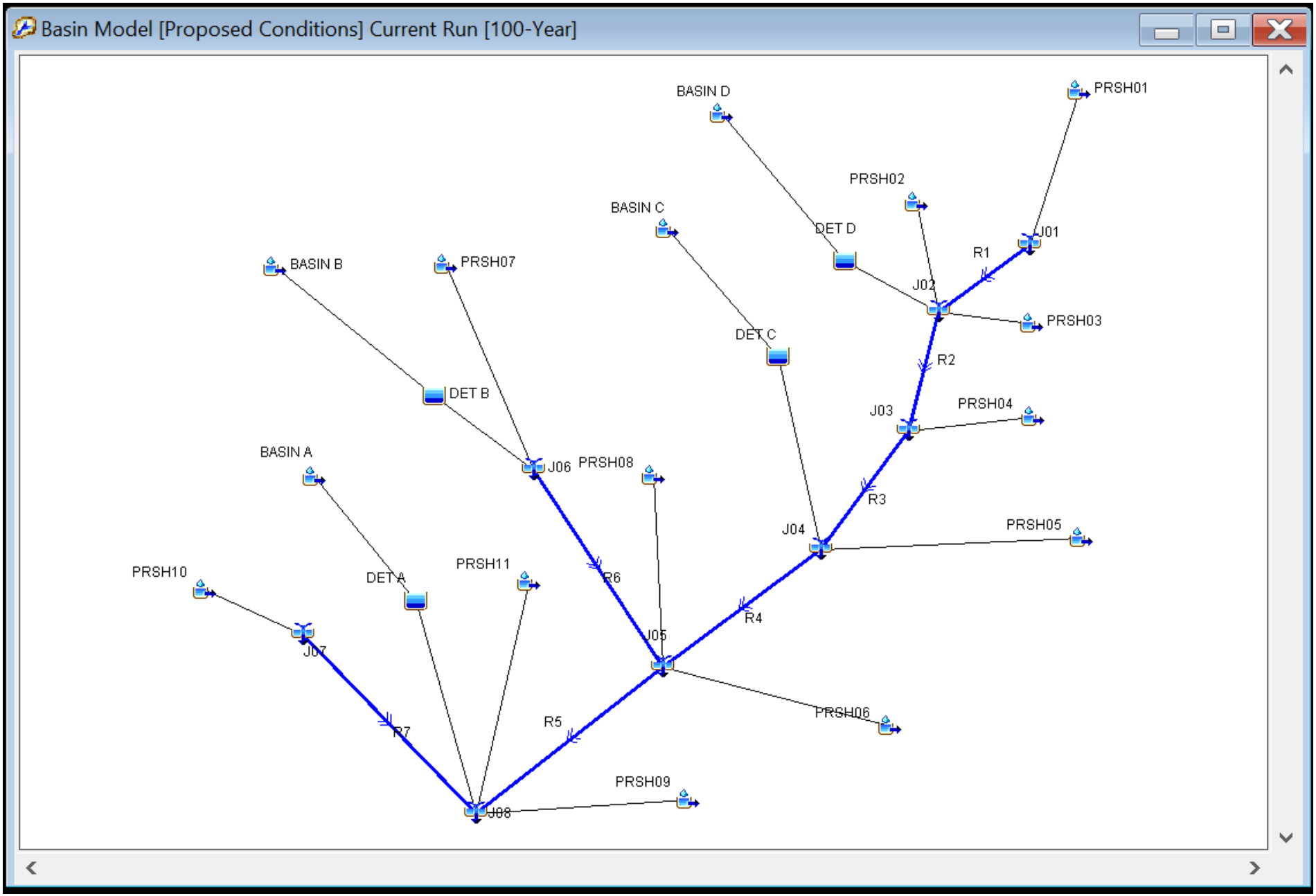
Drainage Area **A**

HEC-HMS Basin Input-Proposed Conditions Drainage Area A

Subarea	Area (ft^2)	Area (mi^2)	"n" value	L (ft)	L_c (ft)	L (miles)	L_c (miles)	$Elev_1$ (ft)	$Elev_2$ (ft)	$Elev_{(1-2)}$ (ft)	Slope (ft/mile)	Corps T_1 (hrs)	NRCS T_1 (hrs)	NRCS T_1 (min)
PRSH01	3930383.0	0.141	0.050	2546	1168	0.482	0.221	1765.0	1620.0	145	300.707	0.17	0.14	8.47
PRSH02	282095.0	0.010	0.050	1050	422	0.199	0.080	1620.0	1590.0	30	150.857	0.10	0.07	4.46
PRSH03	1319939.0	0.047	0.050	3137	1994	0.594	0.378	1900.0	1600.0	300	504.941	0.21	0.17	10.28
BASIN D	1012392.0	0.036	0.018	2963	1459	0.561	0.276	1671.0	1630.0	41	73.061	0.09	0.07	4.37
PRSH04	1517933.0	0.054	0.050	598	578	0.113	0.109	1590.0	1550.0	40	353.177	0.07	0.06	3.34
BASIN C	1042628.0	0.037	0.018	1230	1002	0.233	0.190	1625.0	1540.0	85	364.878	0.04	0.03	1.73
PRSH05	445416.0	0.016	0.050	1167	746	0.221	0.141	1550.0	1130.0	420	1900.257	0.08	0.06	3.46
BASIN F'	126427.0	0.005	0.018	1493	928	0.283	0.176	1791.0	1586.0	205	724.983	0.04	0.03	1.54
PRSH06	902514.0	0.032	0.050	1387	600	0.263	0.114	1492.0	1130.0	362	1378.053	0.08	0.06	3.64
BASIN B	1488357.0	0.053	0.018	3030	2107	0.574	0.399	1686.0	1507.0	179	311.921	0.08	0.06	3.79
PRSH07	1334477.0	0.048	0.050	1690	821	0.320	0.155	1650.0	1514.0	136	424.899	0.12	0.10	5.79
PRSH08	946687.0	0.034	0.050	1728	940	0.327	0.178	1514.0	1130.0	384	1173.333	0.11	0.08	5.00
PRSH09	563503.0	0.020	0.050	893	327	0.169	0.062	1130.0	1054.0	76	449.362	0.07	0.05	2.94
BASIN A	671887.0	0.024	0.018	1541	1267	0.292	0.240	1629.0	1585.0	44	150.759	0.06	0.04	2.64
PRSH10	563503.0	0.020	0.050	592	488	0.112	0.092	1630.0	1610.0	20	178.378	0.08	0.06	3.58
PRSH11	1065337.0	0.038	0.050	3084	1654	0.584	0.313	1610.0	1054.0	556	951.907	0.17	0.14	8.34
Total Check	2331493.1	0.579												

Drainage Area A HEC-HMS Routing Input-Proposed Conditions

Subarea	Reach	U/S Node	D/S Node	Length (ft)	U/S Elev (ft)	D/S Elev (ft)	Slope (ft/ft)	Slope (ft/mi)	"n" value	Channel Type	Dimensions
PRSH02	R1	J01	J02	1050	1620.0	1590.0	0.02857	150.85714	0.05	Trap	15' (W), 3H:1V
PRSH04	R2	J02	J03	598	1590.0	1550.0	0.06689	353.17726	0.05	Trap	15' (W), 3H:1V
PRSH05	R3	J03	J04	1167	1550.0	1130.0	0.35990	1900.25707	0.05	Trap	15' (W), 3H:1V
PRSH06	R4	J04	J05	1387	1492.0	1130.0	0.26099	1378.05335	0.05	Trap	15' (W), 3H:1V
PRSH09	R5	J05	J08	893	1130.0	1054.0	0.08511	449.36170	0.05	Trap	15' (W), 3H:1V
PRSH07	R6	J06	J05	1690	1650.0	1514.0	0.08047	424.89941	0.05	Trap	15' (W), 3H:1V
PRSH10	R7	J07	J08	1638	1630.0	1610.0	0.01221	64.46886	0.05	Trap	15' (W), 3H:1V


Basin Model [Proposed Conditions] Current Run [100-Year]
BASIN D
PRSH01
PRSH02
BASIN C
DET D
J01
R1
BASIN B
PRSH07
J02
PRSH03
DET C
R2
DET B
J03
PRSH04
BASIN A
J06
PRSH08
R3
J04
PRSH05
PRSH10
DET A
PRSH11
R6
R4
J07
J05
PRSH06
R5
R7
PRSH09
J08

Global Summary Results for Run "100-Year"

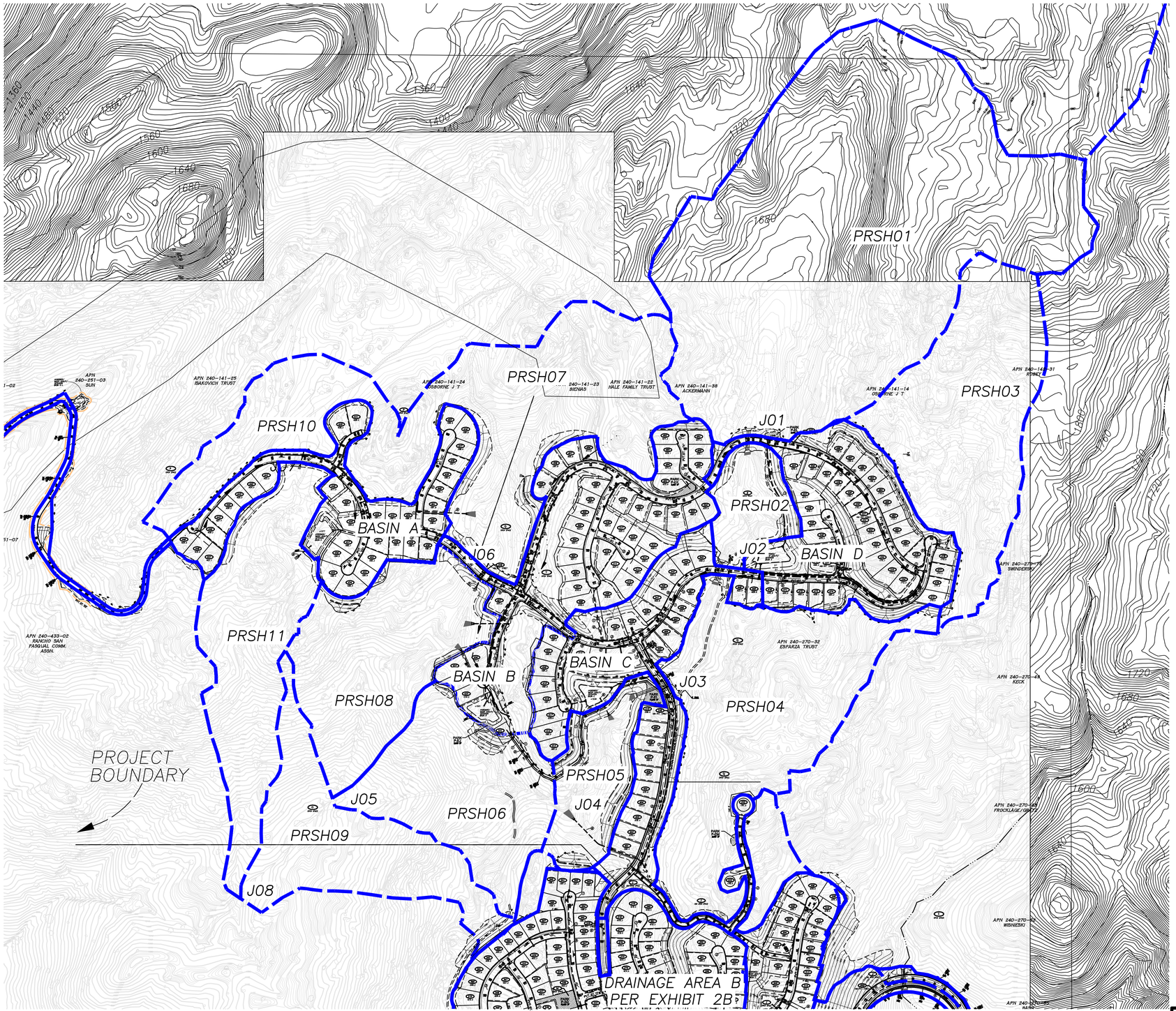
Project: PRHYA Simulation Run: 100-Year

Start of Run: 01Jan2014, 00:00
End of Run: 02Jan2014, 00:00
Compute Time: 19Feb2020, 09:13:49

Basin Model: Proposed Conditions
Meteorologic Model: 100-Year Hyetograph
Control Specifications: 24-Hour Event

Show Elements: All Elements Volume Units: IN AC-FT Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
BASIN A	0.03	149.227	01Jan2014, 16:01	11.823
BASIN B	0.04	181.015	01Jan2014, 16:02	15.759
BASIN C	0.04	222.738	01Jan2014, 16:00	15.767
BASIN D	0.05	215.615	01Jan2014, 16:02	19.693
DET A	0.03	86.742	01Jan2014, 16:04	10.637
DET B	0.04	126.559	01Jan2014, 16:04	14.513
DET C	0.04	129.292	01Jan2014, 16:02	14.279
DET D	0.05	139.739	01Jan2014, 16:06	18.105
J01	0.14	346.152	01Jan2014, 16:06	36.477
J02	0.25	605.917	01Jan2014, 16:07	70.132
J03	0.30	661.901	01Jan2014, 16:07	83.166
J04	0.36	778.724	01Jan2014, 16:06	102.622
J05	0.51	1189.752	01Jan2014, 16:05	145.740
J06	0.09	277.231	01Jan2014, 16:04	27.571
J07	0.02	74.752	01Jan2014, 16:01	5.231
J08	0.62	1455.904	01Jan2014, 16:06	177.126
PRSH01	0.14	346.152	01Jan2014, 16:06	36.477
PRSH02	0.01	34.511	01Jan2014, 16:02	2.614
PRSH03	0.05	110.389	01Jan2014, 16:07	13.006
PRSH04	0.05	192.912	01Jan2014, 16:01	13.080
PRSH05	0.02	75.988	01Jan2014, 16:01	5.231
PRSH06	0.03	111.158	01Jan2014, 16:01	7.846
PRSH07	0.05	151.485	01Jan2014, 16:03	13.058
PRSH08	0.03	98.073	01Jan2014, 16:03	7.839
PRSH09	0.02	80.717	01Jan2014, 16:01	5.233
PRSH10	0.02	74.752	01Jan2014, 16:01	5.231
PRSH11	0.04	99.678	01Jan2014, 16:06	10.423
R1	0.14	343.382	01Jan2014, 16:08	36.407
R2	0.25	602.795	01Jan2014, 16:08	70.086
R3	0.30	659.778	01Jan2014, 16:07	83.112
R4	0.36	777.895	01Jan2014, 16:07	102.538
R5	0.51	1185.374	01Jan2014, 16:06	145.637
R6	0.09	275.415	01Jan2014, 16:06	27.517
R7	0.02	70.326	01Jan2014, 16:07	5.196



H&A

300 0 300 600 900

SCALE 1" = 300'

LEGEND

DRAINAGE WATERSHED BOUNDARY	
FLOW DIRECTION	
HYDROLOGIC NODE (HEC-HMS JUNCTION)	J03

PREPARED BY:

HUNSAKER & ASSOCIATES SAN DIEGO, INC

PLANNING 9707 Waples Street
ENGINEERING San Diego, Ca 92121
SURVEYING PH(858)558-4500 FX(858)558-1414

PROPOSED CONDITION HYDROLOGY MAP FOR:

SAFARI HIGHLANDS RANCH

DRAINAGE AREA A

CITY OF ESCONDIDO, CA

EXHIBIT **2A**

W.O.

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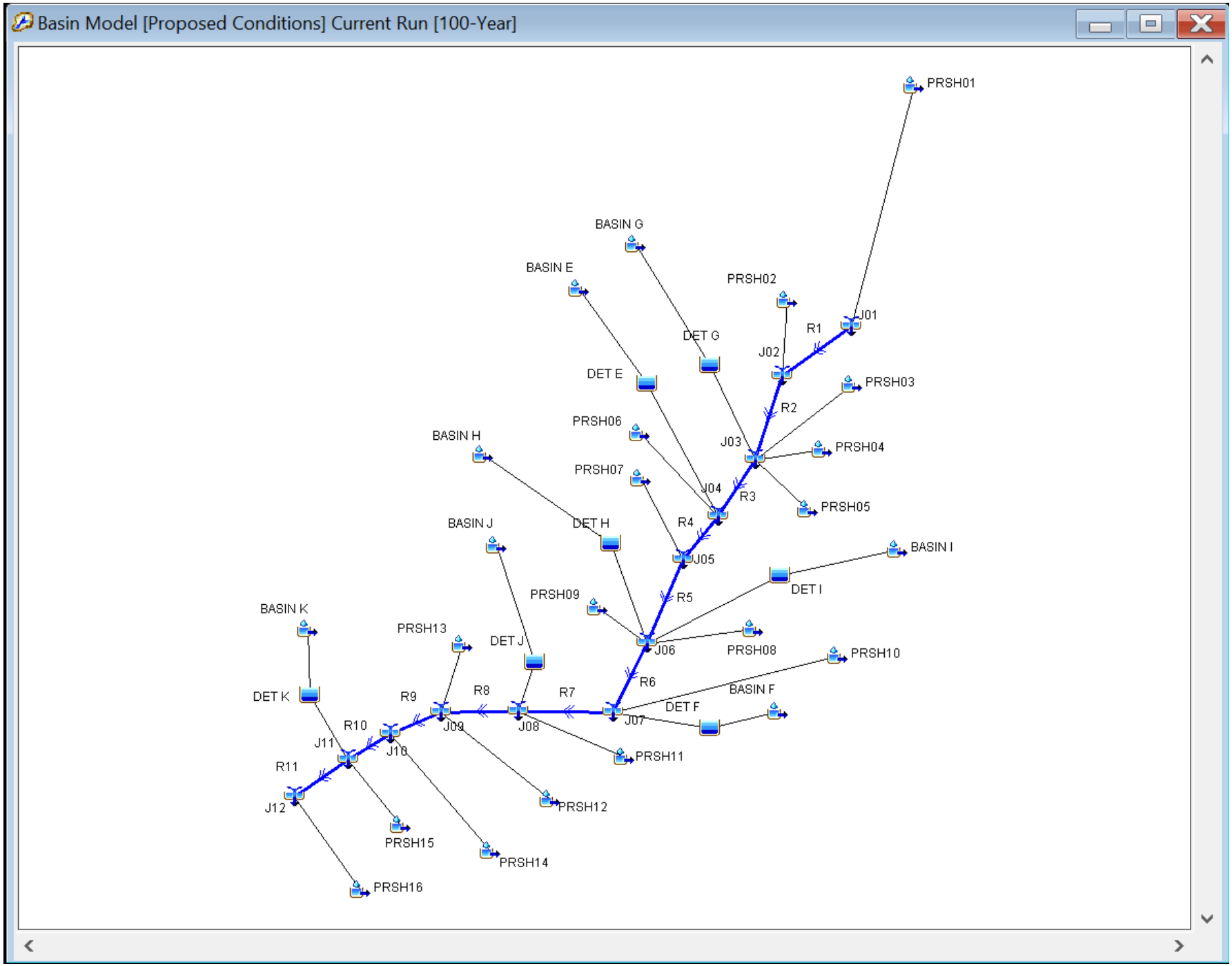
Drainage Area **B**

HEC-HMS Basin Input-Proposed Conditions Drainage Area B

Subarea	Area (ft^2)	Area (mi^2)	"n" value	L (ft)	L_c (ft)	L (miles)	L_c (miles)	$Elev_1$ (ft)	$Elev_2$ (ft)	$Elev_{(1-2)}$ (ft)	Slope (ft/mile)	Corps T_1 (hrs)	NRCS T_1 (hrs)	NRCS T_1 (min)
PRSH01	21546035.7	0.773	0.050	7147	3139	1.354	0.595	1880.0	1565.0	315	232.713	0.39	0.33	19.79
PRSH02	2835992.7	0.102	0.050	2626	1400	0.497	0.265	1756.0	1440.0	316	635.369	0.16	0.13	7.93
PRSH03	5476632.9	0.196	0.050	3922	1254	0.743	0.238	2200.0	1308.0	892	1200.857	0.16	0.13	7.84
PRSH04	1017035.0	0.036	0.050	1836	870	0.348	0.165	1500.0	1207.5	292.5	841.176	0.11	0.09	5.32
BASIN F	436166.6	0.016	0.018	831	245	0.157	0.046	1678.5	1628.0	50.5	320.866	0.02	0.01	0.65
PRSH05	335324.8	0.012	0.050	1053	560	0.199	0.106	1528.0	1310.0	218	1093.105	0.07	0.05	3.29
PRSH06	1801807.0	0.065	0.050	2014	659	0.381	0.125	1573.6	1104.0	469.6	1231.126	0.10	0.08	4.55
BASIN E	1909527.8	0.068	0.018	2307	1069	0.437	0.202	1608.0	1525.0	83	189.961	0.06	0.05	2.78
PRSH07	1520143.8	0.055	0.050	2697	1515	0.511	0.287	1597.0	1070.0	527	1031.724	0.15	0.13	7.50
PRSH08	2652453.6	0.095	0.050	2555	1211	0.484	0.229	1278.5	856.5	422	872.078	0.14	0.12	6.94
PRSH09	379632.9	0.014	0.050	997	223	0.189	0.042	1129.0	980.0	149	789.087	0.05	0.04	2.29
BASIN G	2311700.0	0.083	0.018	6918	2080	1.310	0.394	1654.0	1060.0	594	453.356	0.11	0.08	4.94
BASIN H	850988.2	0.031	0.018	1788	803	0.339	0.152	1340.0	1244.0	96	283.490	0.05	0.03	1.98
PRSH10	27907181.5	1.001	0.050	13071	8034	2.476	1.522	1960.0	844.0	1116	450.806	0.62	0.53	31.67
PRSH11	831004.0	0.030	0.050	1540	638	0.292	0.121	880.0	800.0	80	274.286	0.12	0.09	5.49
BASIN I	4958959.0	0.178	0.018	6622	3022	1.254	0.572	1146.5	855.0	291.5	232.425	0.14	0.11	6.50
PRSH12	1224009.0	0.044	0.050	2772	1589	0.525	0.301	1022.0	420.0	602	1146.667	0.16	0.13	7.57
PRSH13	523341.5	0.019	0.050	963	396	0.182	0.075	1064.0	660.0	404	2215.078	0.05	0.04	2.31
PRSH14	2719784.7	0.098	0.050	3355	1228	0.635	0.233	921.0	414.0	507	797.902	0.16	0.13	7.93
BASIN J	401313.9	0.014	0.018	3763	2082	0.713	0.394	909.0	416.0	493	691.746	0.08	0.06	3.48
PRSH15	2331493.1	0.084	0.018	2473	1099	0.468	0.208	560.0	413.0	147	313.854	0.06	0.04	2.59
PRSH16	3311088.3	0.119	0.050	5005	2578	0.948	0.488	1000.0	406.0	594	626.637	0.26	0.22	13.12
Total Check	2331493.1	3.131												

Drainage Area B HEC-HMS Routing Input-Proposed Conditions

Subarea	Reach	U/S Node	D/S Node	Length (ft)	U/S Elev (ft)	D/S Elev (ft)	Slope (ft/ft)	Slope (ft/mi)	"n" value	Channel Type	Dimensions
PRSH02	R1	J01	J02	1763	1565.0	1440.0	0.07090	374.36188	0.05	Trap	15' (W), 3H:1V
PRSH04	R2	J02	J03	1845	1440.0	1207.5	0.12602	665.36585	0.05	Trap	15' (W), 3H:1V
PRSH06	R3	J03	J04	1492	1207.5	1104.0	0.06937	366.27346	0.05	Trap	15' (W), 3H:1V
PRSH07	R4	J04	J05	1219	1104.0	1070.0	0.02789	147.26825	0.05	Trap	15' (W), 3H:1V
PRSH08	R5	J05	J06	1879	1070.0	856.5	0.11362	599.93614	0.05	Trap	15' (W), 3H:1V
PRSH10	R6	J06	J07	1217	856.5	844.0	0.01027	54.23172	0.05	Trap	35' (W), 8H:1V
PRSH11	R7	J07	J08	1638	844.0	800.0	0.02686	141.83150	0.05	Trap	35' (W), 8H:1V
PRSH12	R8	J08	J09	2009	800.0	420.0	0.18915	998.70582	0.05	Trap	15' (W), 3H:1V
PRSH14	R9	J09	J10	543	420.0	414.0	0.01105	58.34254	0.05	Trap	20' (W), 3H:1V
PRSH15	R10	J10	J11	787	414.0	408.0	0.00762	40.25413	0.05	Trap	60' (W), 4H:1V
PRSH16	R11	J11	J12	234	408.0	406.0	0.00855	45.12821	0.018	Rect	30' (W)


Basin Model [Proposed Conditions] Current Run [100-Year]
PRSH01
BASIN G
BASIN E
PRSH02
J01
R1
DET G
J02
DET E
PRSH03
R2
PRSH06
BASIN H
J03
PRSH04
PRSH07
J04
R3
PRSH05
BASIN J
DET H
R4
J05
BASIN I
DET I
PRSH09
R5
BASIN K
PRSH13
DET J
J06
PRSH08
PRSH10
R6
DET K
R9
R8
R7
BASIN F
DET F
R10
J09
J08
J07
J11
J10
PRSH11
R11
J12
PRSH12
PRSH15
PRSH14
PRSH16

Global Summary Results for Run "100-Year"

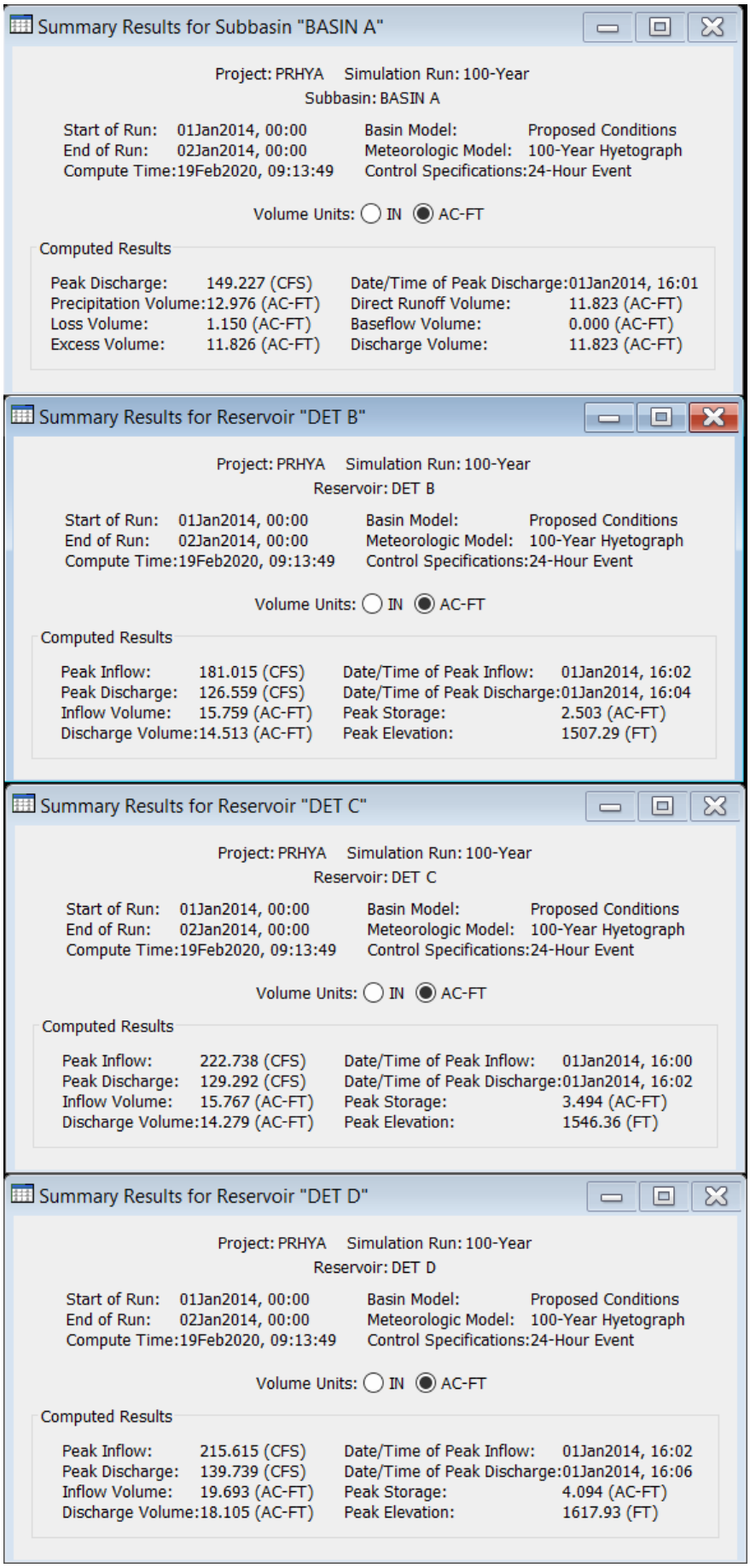
Project: PRHYB Simulation Run: 100-Year

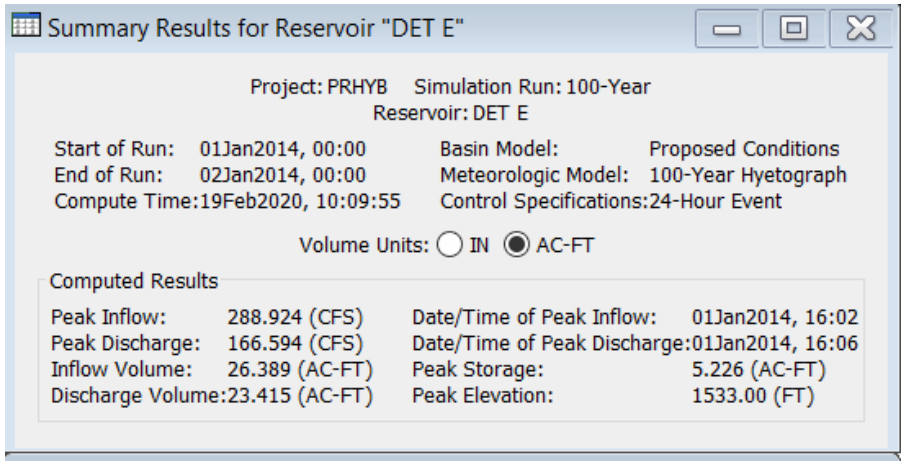
Start of Run: 01Jan2014, 00:00
End of Run: 02Jan2014, 00:00
Compute Time: 19Feb2020, 10:09:55

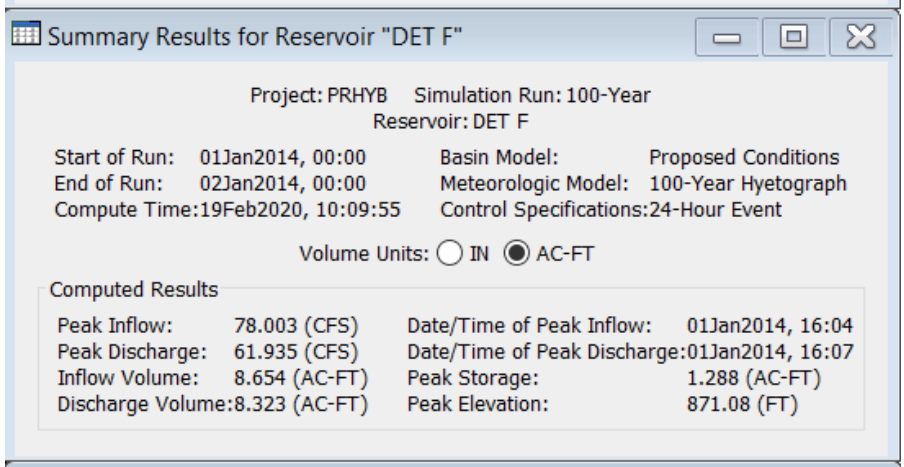
Basin Model: Proposed Conditions
Meteorologic Model: 100-Year Hyetograph
Control Specifications: 24-Hour Event

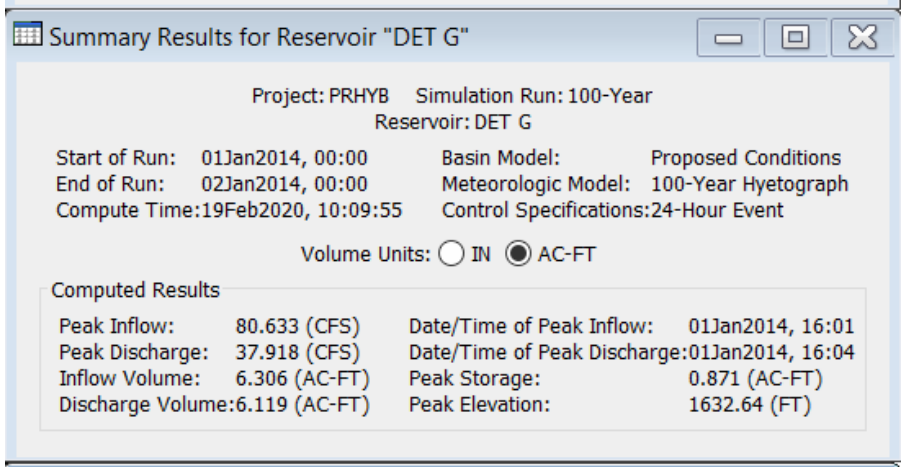
Show Elements: All Elements | Volume Units: IN / AC-FT | Sorting: Hydrologic

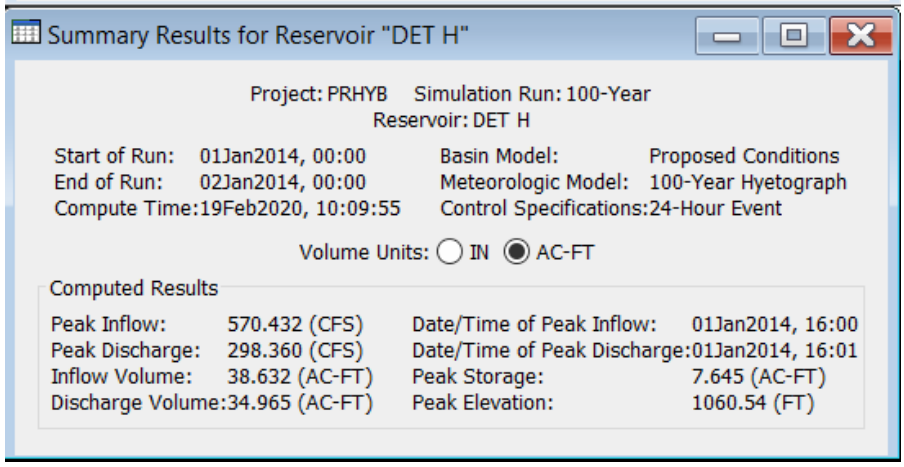
Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
PRSH01	0.773	1156.084	01Jan2014, 16:17	199.291
J01	0.773	1156.084	01Jan2014, 16:17	199.291
R1	0.773	1155.644	01Jan2014, 16:18	198.961
PRSH02	0.102	261.393	01Jan2014, 16:05	26.589
J02	0.875	1241.848	01Jan2014, 16:17	225.550
R2	0.875	1240.828	01Jan2014, 16:18	225.244
PRSH03	0.196	505.909	01Jan2014, 16:05	51.097
PRSH04	0.036	114.525	01Jan2014, 16:03	9.405
BASIN G	0.016	80.633	01Jan2014, 16:01	6.306
DET G	0.016	37.918	01Jan2014, 16:04	6.119
PRSH05	0.012	46.588	01Jan2014, 16:01	3.139
J03	1.135	1502.922	01Jan2014, 16:07	295.005
R3	1.135	1501.874	01Jan2014, 16:09	294.631
BASIN E	0.067	288.924	01Jan2014, 16:02	26.389
DET E	0.067	166.594	01Jan2014, 16:06	23.415
PRSH06	0.065	221.813	01Jan2014, 16:02	16.991
J04	1.267	1758.808	01Jan2014, 16:07	335.036
R4	1.267	1754.506	01Jan2014, 16:09	334.554
PRSH07	0.055	145.658	01Jan2014, 16:05	14.343
J05	1.322	1877.271	01Jan2014, 16:08	348.897
R5	1.322	1873.236	01Jan2014, 16:09	348.455
BASIN H	0.098	570.432	01Jan2014, 16:00	38.632
DET H	0.098	298.360	01Jan2014, 16:01	34.965
PRSH08	0.095	261.488	01Jan2014, 16:04	24.786
BASIN I	0.034	184.953	01Jan2014, 16:00	13.402
DET I	0.034	136.214	01Jan2014, 16:02	12.735
PRSH09	0.014	59.553	01Jan2014, 16:00	3.664
J06	1.563	2314.200	01Jan2014, 16:08	424.605
R6	1.563	2294.614	01Jan2014, 16:10	423.422
PRSH10	1.001	1118.626	01Jan2014, 16:28	255.177
J07	2.586	3051.313	01Jan2014, 16:11	686.922
R7	2.586	3046.801	01Jan2014, 16:13	685.435
BASIN J	0.120	485.152	01Jan2014, 16:03	47.249
DET J	0.120	352.524	01Jan2014, 16:06	42.963
PRSH11	0.030	93.845	01Jan2014, 16:03	7.837
J08	2.736	3295.531	01Jan2014, 16:13	736.235
R8	2.736	3291.887	01Jan2014, 16:13	735.543
PRSH12	0.044	115.935	01Jan2014, 16:05	11.473
PRSH13	0.019	80.609	01Jan2014, 16:00	4.972
J09	2.799	3357.143	01Jan2014, 16:13	751.988
R9	2.799	3350.017	01Jan2014, 16:14	751.348
PRSH14	0.098	251.143	01Jan2014, 16:05	25.546
J10	2.897	3467.775	01Jan2014, 16:13	776.894
R10	2.897	3455.095	01Jan2014, 16:15	775.546
PRSH15	0.084	428.472	01Jan2014, 16:01	33.107
BASIN K	0.014	65.588	01Jan2014, 16:01	5.516
DET K	0.014	50.792	01Jan2014, 16:03	5.079
J11	2.995	3517.647	01Jan2014, 16:15	813.731
R11	2.995	3516.434	01Jan2014, 16:15	813.583
PRSH16	0.119	228.134	01Jan2014, 16:10	30.873
J12	3.114	3717.132	01Jan2014, 16:15	844.456
BASIN F	0.022	78.003	01Jan2014, 16:04	8.654
DET F	0.022	61.935	01Jan2014, 16:07	8.323

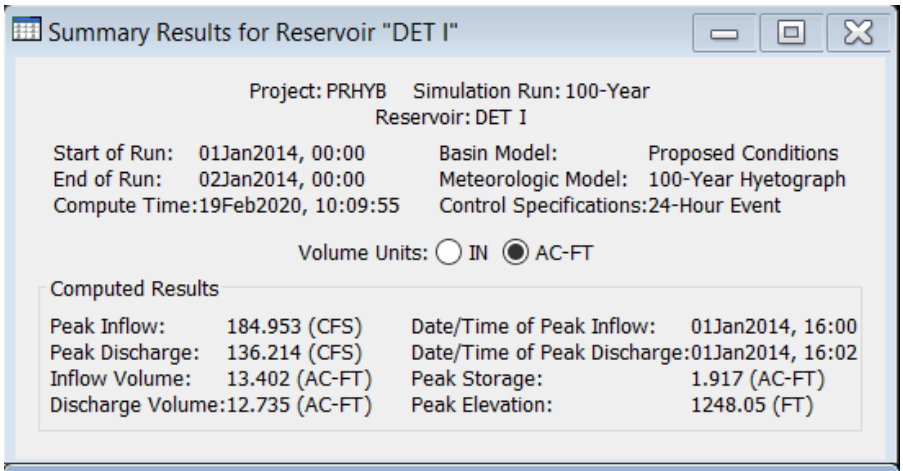

Summary Results for Subbasin "BASIN A"
Project: PRHYA Simulation Run: 100-Year
Subbasin: BASIN A
Start of Run: 01Jan2014, 00:00
End of Run: 02Jan2014, 00:00
Compute Time: 19Feb2020, 09:13:49
Basin Model: Proposed Conditions
Meteorologic Model: 100-Year Hyetograph
Control Specifications: 24-Hour Event
Volume Units: IN AC-FT
Computed Results
Peak Discharge: 149.227 (CFS)
Precipitation Volume: 12.976 (AC-FT)
Loss Volume: 1.150 (AC-FT)
Excess Volume: 11.826 (AC-FT)
Date/Time of Peak Discharge: 01Jan2014, 16:01
Direct Runoff Volume: 11.823 (AC-FT)
Baseflow Volume: 0.000 (AC-FT)
Discharge Volume: 11.823 (AC-FT)
Summary Results for Reservoir "DET B"
Project: PRHYA Simulation Run: 100-Year
Reservoir: DET B
Start of Run: 01Jan2014, 00:00
End of Run: 02Jan2014, 00:00
Compute Time: 19Feb2020, 09:13:49
Basin Model: Proposed Conditions
Meteorologic Model: 100-Year Hyetograph
Control Specifications: 24-Hour Event
Volume Units: IN AC-FT
Computed Results
Peak Inflow: 181.015 (CFS)
Peak Discharge: 126.559 (CFS)
Inflow Volume: 15.759 (AC-FT)
Discharge Volume: 14.513 (AC-FT)
Date/Time of Peak Inflow: 01Jan2014, 16:02
Date/Time of Peak Discharge: 01Jan2014, 16:04
Peak Storage: 2.503 (AC-FT)
Peak Elevation: 1507.29 (FT)
Summary Results for Reservoir "DET C"
Project: PRHYA Simulation Run: 100-Year
Reservoir: DET C
Start of Run: 01Jan2014, 00:00
End of Run: 02Jan2014, 00:00
Compute Time: 19Feb2020, 09:13:49
Basin Model: Proposed Conditions
Meteorologic Model: 100-Year Hyetograph
Control Specifications: 24-Hour Event
Volume Units: IN AC-FT
Computed Results
Peak Inflow: 222.738 (CFS)
Peak Discharge: 129.292 (CFS)
Inflow Volume: 15.767 (AC-FT)
Discharge Volume: 14.279 (AC-FT)
Date/Time of Peak Inflow: 01Jan2014, 16:00
Date/Time of Peak Discharge: 01Jan2014, 16:02
Peak Storage: 3.494 (AC-FT)
Peak Elevation: 1546.36 (FT)
Summary Results for Reservoir "DET D"
Project: PRHYA Simulation Run: 100-Year
Reservoir: DET D
Start of Run: 01Jan2014, 00:00
End of Run: 02Jan2014, 00:00
Compute Time: 19Feb2020, 09:13:49
Basin Model: Proposed Conditions
Meteorologic Model: 100-Year Hyetograph
Control Specifications: 24-Hour Event
Volume Units: IN AC-FT
Computed Results
Peak Inflow: 215.615 (CFS)
Peak Discharge: 139.739 (CFS)
Inflow Volume: 19.693 (AC-FT)
Discharge Volume: 18.105 (AC-FT)
Date/Time of Peak Inflow: 01Jan2014, 16:02
Date/Time of Peak Discharge: 01Jan2014, 16:06
Peak Storage: 4.094 (AC-FT)
Peak Elevation: 1617.93 (FT)

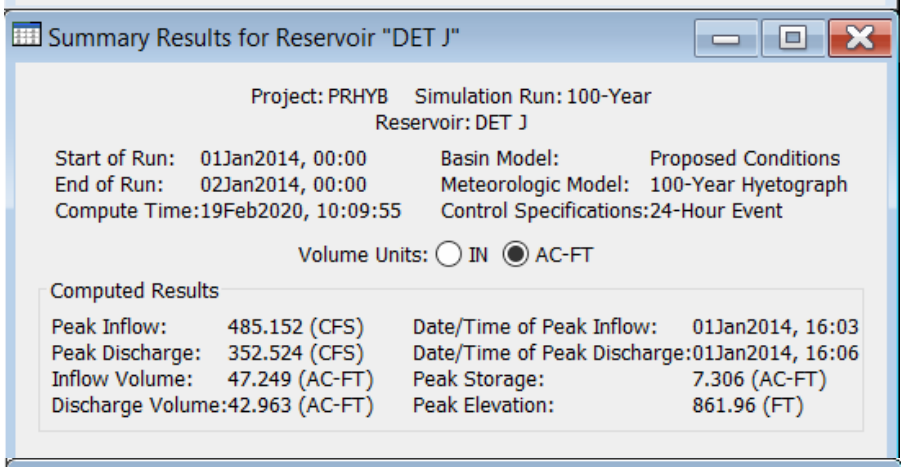

Summary Results for Reservoir "DET E"
Project: PRHYB Simulation Run: 100-Year
Reservoir: DET E
Start of Run: 01Jan2014, 00:00
End of Run: 02Jan2014, 00:00
Compute Time: 19Feb2020, 10:09:55
Basin Model: Proposed Conditions
Meteorologic Model: 100-Year Hyetograph
Control Specifications: 24-Hour Event
Volume Units: IN AC-FT
Computed Results
Peak Inflow: 288.924 (CFS)
Peak Discharge: 166.594 (CFS)
Inflow Volume: 26.389 (AC-FT)
Discharge Volume: 23.415 (AC-FT)
Date/Time of Peak Inflow: 01Jan2014, 16:02
Date/Time of Peak Discharge: 01Jan2014, 16:06
Peak Storage: 5.226 (AC-FT)
Peak Elevation: 1533.00 (FT)

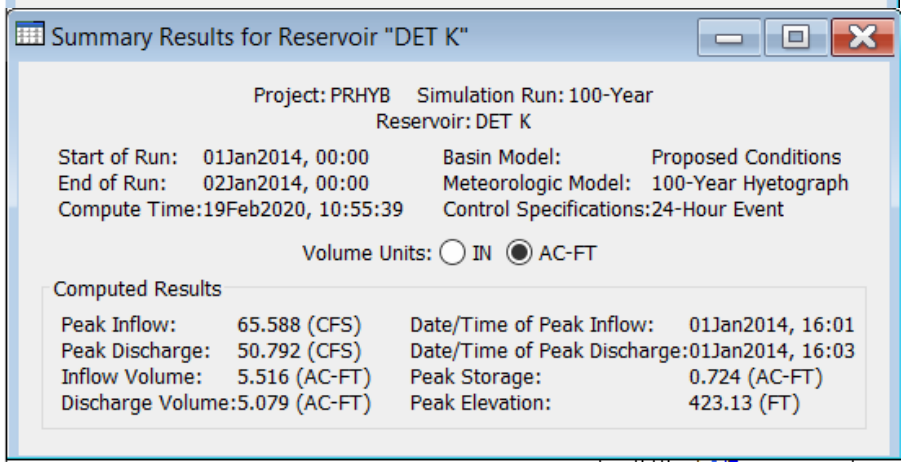

Summary Results for Reservoir "DET F"
Project: PRHYB Simulation Run: 100-Year
Reservoir: DET F
Start of Run: 01Jan2014, 00:00
End of Run: 02Jan2014, 00:00
Compute Time: 19Feb2020, 10:09:55
Basin Model: Proposed Conditions
Meteorologic Model: 100-Year Hyetograph
Control Specifications: 24-Hour Event
Volume Units: IN AC-FT
Computed Results
Peak Inflow: 78.003 (CFS)
Peak Discharge: 61.935 (CFS)
Inflow Volume: 8.654 (AC-FT)
Discharge Volume: 8.323 (AC-FT)
Date/Time of Peak Inflow: 01Jan2014, 16:04
Date/Time of Peak Discharge: 01Jan2014, 16:07
Peak Storage: 1.288 (AC-FT)
Peak Elevation: 871.08 (FT)


Summary Results for Reservoir "DET G"
Project: PRHYB Simulation Run: 100-Year
Reservoir: DET G
Start of Run: 01Jan2014, 00:00
End of Run: 02Jan2014, 00:00
Compute Time: 19Feb2020, 10:09:55
Basin Model: Proposed Conditions
Meteorologic Model: 100-Year Hyetograph
Control Specifications: 24-Hour Event
Volume Units: IN AC-FT
Computed Results
Peak Inflow: 80.633 (CFS)
Peak Discharge: 37.918 (CFS)
Inflow Volume: 6.306 (AC-FT)
Discharge Volume: 6.119 (AC-FT)
Date/Time of Peak Inflow: 01Jan2014, 16:01
Date/Time of Peak Discharge: 01Jan2014, 16:04
Peak Storage: 0.871 (AC-FT)
Peak Elevation: 1632.64 (FT)


Summary Results for Reservoir "DET H"
Project: PRHYB Simulation Run: 100-Year
Reservoir: DET H
Start of Run: 01Jan2014, 00:00
End of Run: 02Jan2014, 00:00
Compute Time: 19Feb2020, 10:09:55
Basin Model: Proposed Conditions
Meteorologic Model: 100-Year Hyetograph
Control Specifications: 24-Hour Event
Volume Units: IN AC-FT
Computed Results
Peak Inflow: 570.432 (CFS)
Peak Discharge: 298.360 (CFS)
Inflow Volume: 38.632 (AC-FT)
Discharge Volume: 34.965 (AC-FT)
Date/Time of Peak Inflow: 01Jan2014, 16:00
Date/Time of Peak Discharge: 01Jan2014, 16:01
Peak Storage: 7.645 (AC-FT)
Peak Elevation: 1060.54 (FT)

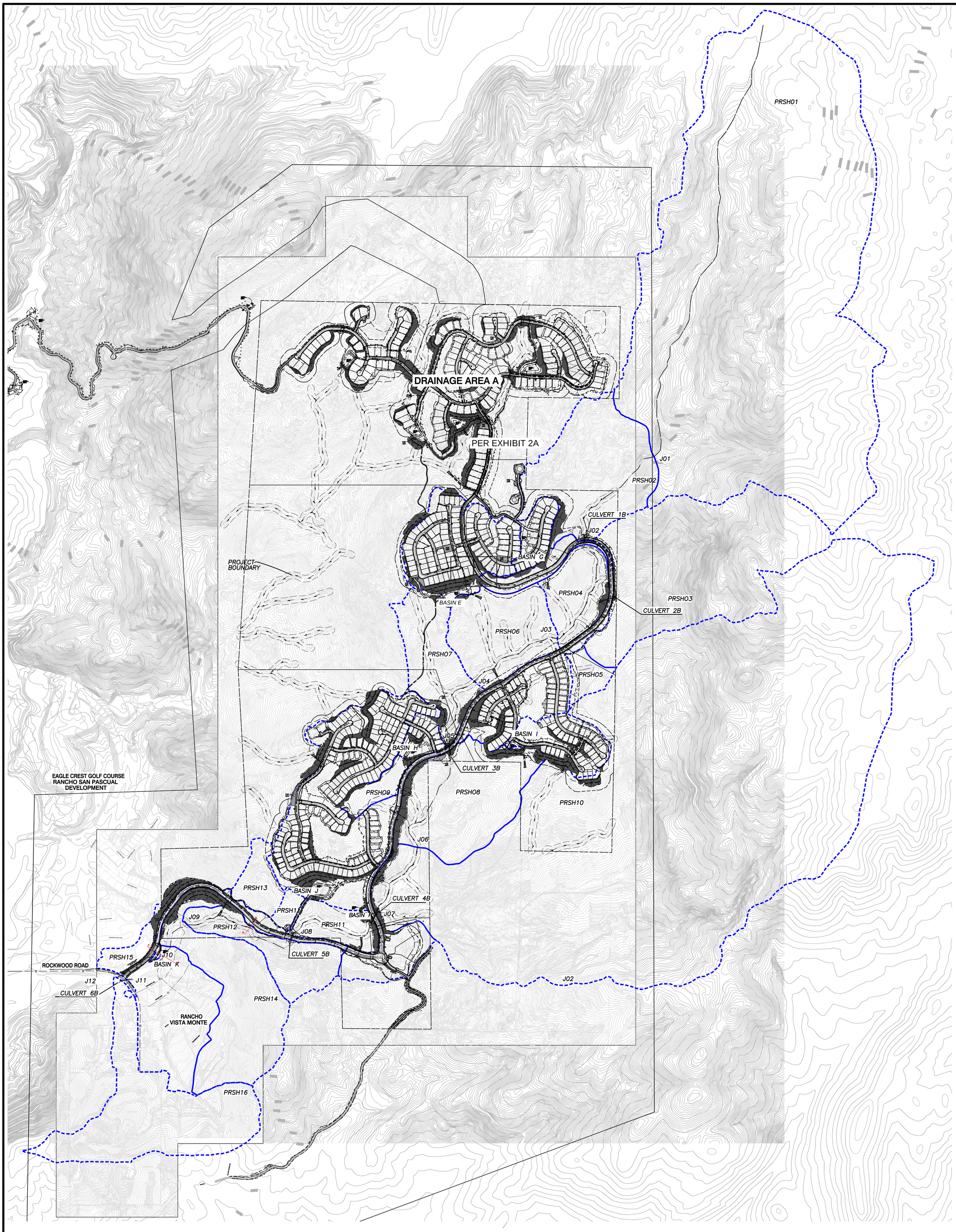

Summary Results for Reservoir "DET I"
Project: PRHYB Simulation Run: 100-Year
Reservoir: DET I
Start of Run: 01Jan2014, 00:00
End of Run: 02Jan2014, 00:00
Compute Time: 19Feb2020, 10:09:55
Basin Model: Proposed Conditions
Meteorologic Model: 100-Year Hyetograph
Control Specifications: 24-Hour Event
Volume Units: IN AC-FT
Computed Results
Peak Inflow: 184.953 (CFS)
Peak Discharge: 136.214 (CFS)
Inflow Volume: 13.402 (AC-FT)
Discharge Volume: 12.735 (AC-FT)
Date/Time of Peak Inflow: 01Jan2014, 16:00
Date/Time of Peak Discharge: 01Jan2014, 16:02
Peak Storage: 1.917 (AC-FT)
Peak Elevation: 1248.05 (FT)


Summary Results for Reservoir "DET J"
Project: PRHYB Simulation Run: 100-Year
Reservoir: DET J
Start of Run: 01Jan2014, 00:00
End of Run: 02Jan2014, 00:00
Compute Time: 19Feb2020, 10:09:55
Basin Model: Proposed Conditions
Meteorologic Model: 100-Year Hyetograph
Control Specifications: 24-Hour Event
Volume Units: IN AC-FT
Computed Results
Peak Inflow: 485.152 (CFS)
Peak Discharge: 352.524 (CFS)
Inflow Volume: 47.249 (AC-FT)
Discharge Volume: 42.963 (AC-FT)
Date/Time of Peak Inflow: 01Jan2014, 16:03
Date/Time of Peak Discharge: 01Jan2014, 16:06
Peak Storage: 7.306 (AC-FT)
Peak Elevation: 861.96 (FT)


Summary Results for Reservoir "DET K"
Project: PRHYB Simulation Run: 100-Year
Reservoir: DET K
Start of Run: 01Jan2014, 00:00
End of Run: 02Jan2014, 00:00
Compute Time: 19Feb2020, 10:55:39
Basin Model: Proposed Conditions
Meteorologic Model: 100-Year Hyetograph
Control Specifications: 24-Hour Event
Volume Units: IN AC-FT
Computed Results
Peak Inflow: 65.588 (CFS)
Peak Discharge: 50.792 (CFS)
Inflow Volume: 5.516 (AC-FT)
Discharge Volume: 5.079 (AC-FT)
Date/Time of Peak Inflow: 01Jan2014, 16:01
Date/Time of Peak Discharge: 01Jan2014, 16:03
Peak Storage: 0.724 (AC-FT)
Peak Elevation: 423.13 (FT)

STRUCTURAL BMPS - DETENTION SUMAMRY

DMA	BMP ID	REQUIRED FOOTPRINT (SQFT)	PROVIDED FOOTPRINT (SQFT)	BASIN BOTTOM ELEVATION (FT)	BASIN TOP ELEVATION (FT)	DEPTH (FT)	WATER SURFACE ELEVATION (FT)	FREEBOARD (FT)
A	BF-A	**14315**	**15077**	1577	1585	8	1582.7	2.3
B	BF-B	**13345**	**13427**	1501	1510	9	1507.3	2.7
C	BF-C	13969	**15583**	1539	1549	10	1546.4	2.6
D	BF-D	**12282**	**12605**	1609	1622	13	1617.9	4.1
E	BF-E	**23597**	**23619**	1526	1535	9	1533.0	2.0
F	BF-F	**7934**	**8070**	866	873	7	871.0	2.0
G	BF-G	**5413**	**5771**	1628	1635	7	1632.6	2.4
H	BF-H	**33377**	**33461**	1053	1063	10	1060.5	2.5
I	BF-I	**9486**	**9754**	1242	1250	8	1248.0	2.0
J	BF-J	**30865**	**30953**	854	864	10	862.0	2.0
K	BF-K	**6700**	**7567**	420	425	5	423.0	2.0



500 0 500 1000 1500

SCALE 1"= 500'

LEGEND

HYDROLOGIC SUBAREA (HEC-HMS BOUNDARY)	
HYDROLOGIC NODE (HEC-HMS JUNCTION)	J01
MAIN CHANNEL PATH	

PREPARED BY:

HUNSAKER & ASSOCIATES SAN DIEGO, INC

PLANNING 9707 Waples Street
ENGINEERING San Diego, Ca. 92121
SURVEYING PH(858)558-4500 · FX(858)558-1414

PROPOSED CONDITION HYDROLOGIC WORKMAP FOR:

SAFARI HIGHLANDS RANCH

DRAINAGE AREA B

CITY OF ESCONDIDO, CA

EXHIBIT **2B**

W.O.

R:\1211\&Hyd\ACAD\EXIBIT 2B-Proposed Condition-R1.dwg[]Apr-11-2019:05:00

Appendix 7 – Offsite Hydrology Model & Exhibit

Drainage Area C, D, E
(Northeast, North, Northwest)

HEC-HMS Basin Input-Proposed Conditions Drainage Area C (Offsite)

Subarea	Area (ft^2)	Area (mi^2)	"n" value	L (ft)	L_c (ft)	L (miles)	L_c (miles)	$Elev_1$ (ft)	$Elev_2$ (ft)	$Elev_{(1-2)}$ (ft)	Slope (ft/mile)	Corps T_1 (hrs)	NRCS T_1 (hrs)	NRCS T_1 (min)
PR01	1412863.0	0.051	0.050	1383	893	0.262	0.169	1577.0	1321.0	256	977.354	0.10	0.08	4.63
BASIN 1	64183.0	0.002	0.050	2083	1040	0.395	0.197	1628.0	1321.0	307	778.185	0.13	0.10	6.14
PR02	1826132.0	0.066	0.050	2029	932	0.384	0.177	1321.0	842.0	479	1246.486	0.11	0.09	5.26
Total Check	3303178.0	0.118												

HEC-HMS Basin Input-Proposed Conditions Drainage Area D (Offsite - north)

Subarea	Area (ft^2)	Area (mi^2)	"n" value	L (ft)	L_c (ft)	L (miles)	L_c (miles)	$Elev_1$ (ft)	$Elev_2$ (ft)	$Elev_{(1-2)}$ (ft)	Slope (ft/mile)	Corps T_1 (hrs)	NRCS T_1 (hrs)	NRCS T_1 (min)
PR01	52628830.0	1.888	0.050	11964	3967	2.266	0.751	2040.0	1350.0	690	304.514	0.50	0.42	25.13
PR02	11627753.0	0.417	0.050	6297	2921	1.193	0.553	1800.0	1340.0	460	385.707	0.33	0.28	16.59
PR03	20274336.0	0.727	0.050	3363	1689	0.637	0.320	1340.0	1300.0	40	62.801	0.30	0.25	14.94
PR04	4419569.0	0.159	0.050	2933	1192	0.555	0.226	1577.0	1300.0	277	498.657	0.17	0.14	8.16
PR05	32806681.0	1.177	0.050	11152	5437	2.112	1.030	1300.0	710.0	590	279.340	0.55	0.47	28.10
PR06	16732719.0	0.600	0.050	6055	2708	1.147	0.513	1800.0	710.0	1090	950.487	0.27	0.22	13.29
PR07	12891314.0	0.462	0.050	2831	1580	0.536	0.299	710.0	640.0	70	130.555	0.24	0.20	11.77
BASIN 2	162476.0	0.006	0.050	6796	3345	1.287	0.634	1330.0	670.0	660	512.772	0.34	0.28	17.05
BASIN 3	224290.0	0.008	0.050	7325	4125	1.387	0.781	670.0	516.0	154	111.006	0.51	0.43	25.65
PR08	2512970.0	0.090	0.050	1523	597	0.288	0.113	640.0	516.0	124	429.888	0.10	0.08	4.84
Total Check	154280938.0	5.534												

HEC-HMS Basin Input-Proposed Conditions Drainage Area E (Offsite - northeast)

Subarea	Area (ft^2)	Area (mi^2)	"n" value	L (ft)	L_c (ft)	L (miles)	L_c (miles)	$Elev_1$ (ft)	$Elev_2$ (ft)	$Elev_{(1-2)}$ (ft)	Slope (ft/mile)	Corps T_1 (hrs)	NRCS T_1 (hrs)	NRCS T_1 (min)
PR01	827459.0	0.0297	0.050	1763	912	0.334	0.173	1480.0	860.0	620	1856.835	0.10	0.08	4.52
BASIN 8	18004.0	0.0006	0.050	549	274.5	0.104	0.052	879.0	860.0	19	182.732	0.06	0.04	2.67
PR02	877393.0	0.0315	0.050	1007	628	0.191	0.119	860.0	808.0	52	272.651	0.10	0.08	4.57
PR03	2796589.0	0.1003	0.050	3196	2014	0.605	0.381	1480.0	875.0	605	999.499	0.19	0.15	9.07
BASIN 7	10400.0	0.0004	0.050	135	67.5	0.026	0.013	879.0	875.0	4	156.444	0.02	0.01	0.63
PR04	114842.0	0.0041	0.050	693	201	0.131	0.038	870.0	808.0	62	472.381	0.05	0.03	2.07
PR06	544631.0	0.0195	0.050	1397	601	0.265	0.114	1240.0	870.0	370	1398.425	0.08	0.06	3.64
BASIN 6	11496.0	0.0004	0.050	193	96.5	0.037	0.018	879.0	876.0	3	82.073	0.03	0.02	1.17
PR05	669739.0	0.0240	0.050	711	355.5	0.135	0.067	808.0	760.0	48	356.456	0.07	0.05	2.90
PR08	140874.0	0.0051	0.050	654	522	0.124	0.099	1000.0	880.0	120	968.807	0.06	0.04	2.65
BASIN 5	23259.0	0.0008	0.050	489	244.5	0.093	0.046	884.0	875.0	9	97.178	0.06	0.05	2.78
PR09	74551.0	0.0027	0.050	412	130	0.078	0.025	878.0	750.0	128	1640.388	0.03	0.02	0.91
PR07	115689.0	0.0041	0.050	812	710	0.154	0.134	760.0	750.0	10	65.025	0.12	0.10	5.93
PR10	698133.0	0.0250	0.050	1038	338	0.197	0.064	750.0	690.0	60	305.202	0.08	0.06	3.47
PR11	1087863.0	0.0390	0.050	2770	1273	0.525	0.241	1240.0	890.0	350	667.148	0.16	0.13	7.72
BASIN 4	51609.0	0.0019	0.050	1515	705	0.287	0.134	918.0	884.0	34	118.495	0.14	0.11	6.75
PR12	498340.0	0.0179	0.050	801	287	0.152	0.054	880.0	690.0	190	1252.434	0.05	0.03	2.08
Total Check	8560871.0	0.3071												

Drainage Area C HEC-HMS Routing Input-Proposed Conditions

Subarea	Reach	U/S Node	D/S Node	Length (ft)	U/S Elev (ft)	D/S Elev (ft)	Slope (ft/ft)	Slope (ft/mi)	"n" value	Channel Type	Dimensions
PRSH03	R1	J01	J02	3363	1340.0	1300.0	0.01189	62.80107	0.05	Trap	15' (W), 3H:1V
PRSH05	R2	J02	J03	11152	1300.0	710.0	0.05291	279.34003	0.05	Trap	15' (W), 3H:1V
PRSH07	R3	J03	J04	2831	710.0	640.0	0.02473	130.55457	0.05	Trap	15' (W), 3H:1V
PRSH08	R4	J04	J05	1523	640.0	516.0	0.08142	429.88838	0.05	Trap	15' (W), 3H:1V

Drainage Area D HEC-HMS Routing Input-Proposed Conditions

Subarea	Reach	U/S Node	D/S Node	Length (ft)	U/S Elev (ft)	D/S Elev (ft)	Slope (ft/ft)	Slope (ft/mi)	"n" value	Channel Type	Dimensions
PRSH02	R1	J01	J02	2029	1321.0	842.0	0.23608	1246.48595	0.05	Trap	15' (W), 3H:1V

Drainage Area E HEC-HMS Routing Input-Proposed Conditions

Subarea	Reach	U/S Node	D/S Node	Length (ft)	U/S Elev (ft)	D/S Elev (ft)	Slope (ft/ft)	Slope (ft/mi)	"n" value	Channel Type	Dimensions
PRSH02	R1	J01	J02	1007	860.0	808.0	0.05164	272.65144	0.05	Trap	15' (W), 3H:1V
PRSH05	R2	J02	J03	711	808.0	760.0	0.06751	356.45570	1.05	Trap	15' (W), 3H:1V
PRSH07	R3	J03	J04	812	760.0	750.0	0.01232	65.02463	0.05	Trap	15' (W), 3H:1V
PRSH010	R4	J04	J05	1038	750.0	690.0	0.05780	305.20231	0.05	Trap	15' (W), 3H:1V
PRSH04	R5	J06	J02	693	870.0	808.0	0.08947	472.38095	1.05	Trap	15' (W), 3H:1V
PRSH09	R6	J07	J04	412	878.0	750.0	0.31068	1640.38835	2.05	Trap	15' (W), 3H:1V
PRSH012	R7	J08	J05	801	880.0	690.0	0.23720	1252.43446	3.05	Trap	15' (W), 3H:1V

DRAINAGE AREA C

Global Summary Results for Run "100-Year"

Project: Copy of NE EX Simulation Run: 100-Year

Start of Run: 01Jan2014, 00:00
End of Run: 02Jan2014, 00:00
Compute Time: 13Apr2017, 14:26:23

Basin Model: Existing Conditions
Meteorologic Model: 100-Year Hyetograph
Control Specifications: 24-Hour Event

Show Elements: All Elements Volume Units: IN / AC-FT Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
EX02	0.087	319.314	01Jan2014, 16:04	34.234
EX01	0.032	131.347	01Jan2014, 16:02	12.601
J1	0.032	131.347	01Jan2014, 16:02	12.601
R1	0.032	130.146	01Jan2014, 16:05	12.583
J2	0.119	448.742	01Jan2014, 16:04	46.817

Global Summary Results for Run "100-Year"

Project: NE_Offsite_RD_PR Simulation Run: 100-Year

Start of Run: 01Jan2014, 00:00
End of Run: 02Jan2014, 00:00
Compute Time: DATA CHANGED, RECOMPUTE

Basin Model: Proposed Conditions
Meteorologic Model: 100-Year Hyetograph
Control Specifications: 24-Hour Event

Show Elements: All Elements Volume Units: IN / AC-FT Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
PR02	0.066	261.022	01Jan2014, 16:03	25.983
PR01	0.051	196.013	01Jan2014, 16:03	20.074
BASIN 1	0.002	7.313	01Jan2014, 16:04	0.800
DET 1	0.002	6.571	01Jan2014, 16:06	0.676
J01	0.053	201.625	01Jan2014, 16:03	20.750
R1	0.053	200.629	01Jan2014, 16:05	20.722
J02	0.119	442.430	01Jan2014, 16:04	46.705

BASIN O-L

DRAINAGE AREA D

Global Summary Results for Run "100-Year"

Project: N_Offsite_DirtRD_EX Simulation Run: 100-Year

Start of Run: 01Jan2014, 00:00
End of Run: 02Jan2014, 00:00
Compute Time: 13Apr2017, 15:39:22
Basin Model: Existing Conditions
Meteorologic Model: 100-Year Hyetograph
Control Specifications: 24-Hour Event

Show Elements: All Elements | Volume Units: IN / AC-FT | Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
EX01	1.888	2931.000	01Jan2014, 16:22	661.337
EX02	0.417	832.923	01Jan2014, 16:13	147.025
J01	2.305	3641.491	01Jan2014, 16:19	808.362
R1	2.305	3623.813	01Jan2014, 16:23	804.839
EX03	0.727	1547.391	01Jan2014, 16:12	256.646
EX04	0.159	496.050	01Jan2014, 16:05	62.480
J02	3.191	4848.900	01Jan2014, 16:19	1123.966
R2	3.191	4840.922	01Jan2014, 16:26	1116.654
EX05	1.177	1706.174	01Jan2014, 16:24	411.345
EX06	0.600	1368.360	01Jan2014, 16:10	212.077
J03	4.968	7130.810	01Jan2014, 16:25	1740.076
R3	4.968	7125.757	01Jan2014, 16:27	1736.385
EX07	0.462	1132.139	01Jan2014, 16:09	163.487
BASIN 2	0.006	12.229	01Jan2014, 16:14	2.343
J04	5.436	7502.390	01Jan2014, 16:26	1902.215
R4	5.436	7499.129	01Jan2014, 16:27	1900.942
EX08	0.090	354.578	01Jan2014, 16:03	32.005
BASIN 3	0.008	32.617	01Jan2014, 16:03	3.150
J05	5.534	7536.746	01Jan2014, 16:27	1936.097

Global Summary Results for Run "100-Year"

Project: N_Offsite_Rd_PR Simulation Run: 100-Year

Start of Run: 01Jan2014, 00:00
End of Run: 02Jan2014, 00:00
Compute Time: 25Oct2018, 06:25:28
Basin Model: Proposed Conditions
Meteorologic Model: 100-Year Hyetograph
Control Specifications: 24-Hour Event

Show Elements: All Elements | Volume Units: IN / AC-FT | Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
PR01	1.888	2437.109	01Jan2014, 16:22	484.300
PR02	0.417	693.985	01Jan2014, 16:14	107.834
J01	2.305	3025.729	01Jan2014, 16:19	592.134
R1	2.305	3012.595	01Jan2014, 16:24	588.763
PR03	0.727	1289.909	01Jan2014, 16:12	188.290
PR04	0.159	400.298	01Jan2014, 16:06	41.439
J02	3.191	4010.422	01Jan2014, 16:19	818.492
R2	3.191	4005.809	01Jan2014, 16:27	811.582
PR05	1.177	1417.113	01Jan2014, 16:25	301.066
PR06	0.600	1140.636	01Jan2014, 16:10	155.637
J03	4.968	5888.810	01Jan2014, 16:25	1268.286
R3	4.968	5884.875	01Jan2014, 16:28	1264.817
PR07	0.462	944.804	01Jan2014, 16:09	120.011
BASIN 2	0.006	12.276	01Jan2014, 16:14	2.382
DET 2	0.006	11.338	01Jan2014, 16:19	2.106
J04	5.436	6188.514	01Jan2014, 16:27	1386.934
R4	5.436	6185.419	01Jan2014, 16:28	1385.733
PRSH08	0.090	297.290	01Jan2014, 16:03	23.521
BASIN 3	0.008	32.735	01Jan2014, 16:03	3.201
DET 3	0.008	27.328	01Jan2014, 16:05	2.921
J05	5.534	6218.534	01Jan2014, 16:28	1412.176

BASIN O-M

BASIN O-N

DRAINAGE AREA E

Global Summary Results for Run "100-Year"

Project: NW_ALT_Offsite_EX Simulation Run: 100-Year

Start of Run: 01Jan2014, 00:00 Basin Model: Existing Conditions
End of Run: 02Jan2014, 00:00 Meteorologic Model: 100-Year Hyetograph
Compute Time: 07Apr2019, 19:30:46 Control Specifications: 24-Hour Event

Show Elements: All Elements Volume Units: IN AC-FT Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
PRSH03	0.100	224.260	01Jan2014, 16:06	26.033
PRSH06	0.0195	61.280	01Jan2014, 16:00	5.098
BASIN 7	0.0004	2.126	01Jan2014, 16:00	0.158
BASIN 6	0.0004	1.791	01Jan2014, 16:00	0.158
J06	0.1203	258.614	01Jan2014, 16:06	31.447
R5	0.1203	257.055	01Jan2014, 16:06	31.390
PRSH02	0.0315	118.115	01Jan2014, 16:03	12.402
PRSH01	0.030	91.270	01Jan2014, 16:03	7.839
BASIN 8	0.001	4.550	01Jan2014, 16:00	0.394
J01	0.031	94.536	01Jan2014, 16:03	8.233
R1	0.031	88.413	01Jan2014, 16:03	8.218
PRSH04	0.0041	16.542	01Jan2014, 16:00	1.073
J02	0.1869	438.748	01Jan2014, 16:03	53.082
R2	0.1869	431.068	01Jan2014, 16:06	53.051
PRSH05	0.0240	85.343	01Jan2014, 16:00	6.277
PRSH07	0.004	11.122	01Jan2014, 16:03	1.044
J03	0.2149	487.122	01Jan2014, 16:03	60.373
R3	0.2149	480.726	01Jan2014, 16:06	60.278
PRSH08	0.005	18.464	01Jan2014, 16:00	1.308
BASIN 5	0.0008	3.582	01Jan2014, 16:00	0.315
J07	0.0058	22.046	01Jan2014, 16:00	1.623
R6	0.0058	19.914	01Jan2014, 16:00	1.624
PRSH09	0.0027	11.690	01Jan2014, 16:00	0.707
J04	0.2234	493.435	01Jan2014, 16:06	62.608
R4	0.2234	474.850	01Jan2014, 16:06	62.535
PRSH11	0.039	93.285	01Jan2014, 16:06	10.165
BASIN 4	0.0019	6.020	01Jan2014, 16:03	0.747
J08	0.0409	99.014	01Jan2014, 16:06	10.912
R7	0.0409	97.917	01Jan2014, 16:06	10.905
PRSH10	0.025	80.939	01Jan2014, 16:00	6.537
PRSH12	0.0179	72.120	01Jan2014, 16:00	4.683
J05	0.3072	633.088	01Jan2014, 16:06	84.660

Global Summary Results for Run "100-Year"

Project: NW_Offsite_RD_PR Simulation Run: 100-Year

Start of Run: 01Jan2014, 00:00 Basin Model: Proposed Conditions
End of Run: 02Jan2014, 00:00 Meteorologic Model: 100-Year Hyetograph
Compute Time: 07Apr2019, 19:29:23 Control Specifications: 24-Hour Event

Show Elements: All Elements Volume Units: IN AC-FT Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
PRSH03	0.100	268.670	01Jan2014, 16:06	35.450
PRSH06	0.0195	73.425	01Jan2014, 16:00	6.937
BASIN 6	0.0004	1.810	01Jan2014, 16:00	0.168
DET 6	0.0004	1.781	01Jan2014, 16:00	0.164
BASIN 7	0.0004	2.149	01Jan2014, 16:00	0.168
DET 7	0.0004	2.169	01Jan2014, 16:00	0.164
J06	0.1203	309.232	01Jan2014, 16:06	42.715
R5	0.1203	308.274	01Jan2014, 16:06	42.652
PRSH02	0.0315	118.115	01Jan2014, 16:03	12.402
PRSH01	0.030	108.823	01Jan2014, 16:03	10.667
BASIN 8	0.001	4.599	01Jan2014, 16:00	0.420
DET 8	0.001	4.488	01Jan2014, 16:00	0.415
J01	0.031	112.394	01Jan2014, 16:03	11.082
R1	0.031	105.153	01Jan2014, 16:03	11.065
PRSH04	0.0041	19.691	01Jan2014, 16:00	1.459
J02	0.1869	506.432	01Jan2014, 16:03	67.579
R2	0.1869	498.420	01Jan2014, 16:06	67.547
PRSH05	0.0240	101.971	01Jan2014, 16:00	8.540
PRSH07	0.004	13.306	01Jan2014, 16:03	1.421
J03	0.2149	566.375	01Jan2014, 16:03	77.509
R3	0.2149	557.698	01Jan2014, 16:06	77.399
PRSH08	0.005	22.040	01Jan2014, 16:00	1.779
BASIN 5	0.0008	3.620	01Jan2014, 16:00	0.336
DET 5	0.0008	3.395	01Jan2014, 16:00	0.329
J07	0.0058	25.436	01Jan2014, 16:00	2.108
R6	0.0058	23.113	01Jan2014, 16:00	2.109
PRSH09	0.0027	13.884	01Jan2014, 16:00	0.961
J04	0.2234	572.490	01Jan2014, 16:06	80.469
R4	0.2234	555.242	01Jan2014, 16:06	80.395
PRSH11	0.039	111.471	01Jan2014, 16:06	13.839
BASIN 4	0.0019	6.088	01Jan2014, 16:03	0.796
DET 4	0.0019	5.454	01Jan2014, 16:06	0.741
J08	0.0409	116.925	01Jan2014, 16:06	14.580
R7	0.0409	115.481	01Jan2014, 16:06	14.572
PRSH10	0.025	96.918	01Jan2014, 16:00	8.894
PRSH12	0.0179	85.852	01Jan2014, 16:00	6.371
J05	0.3072	741.959	01Jan2014, 16:06	110.232

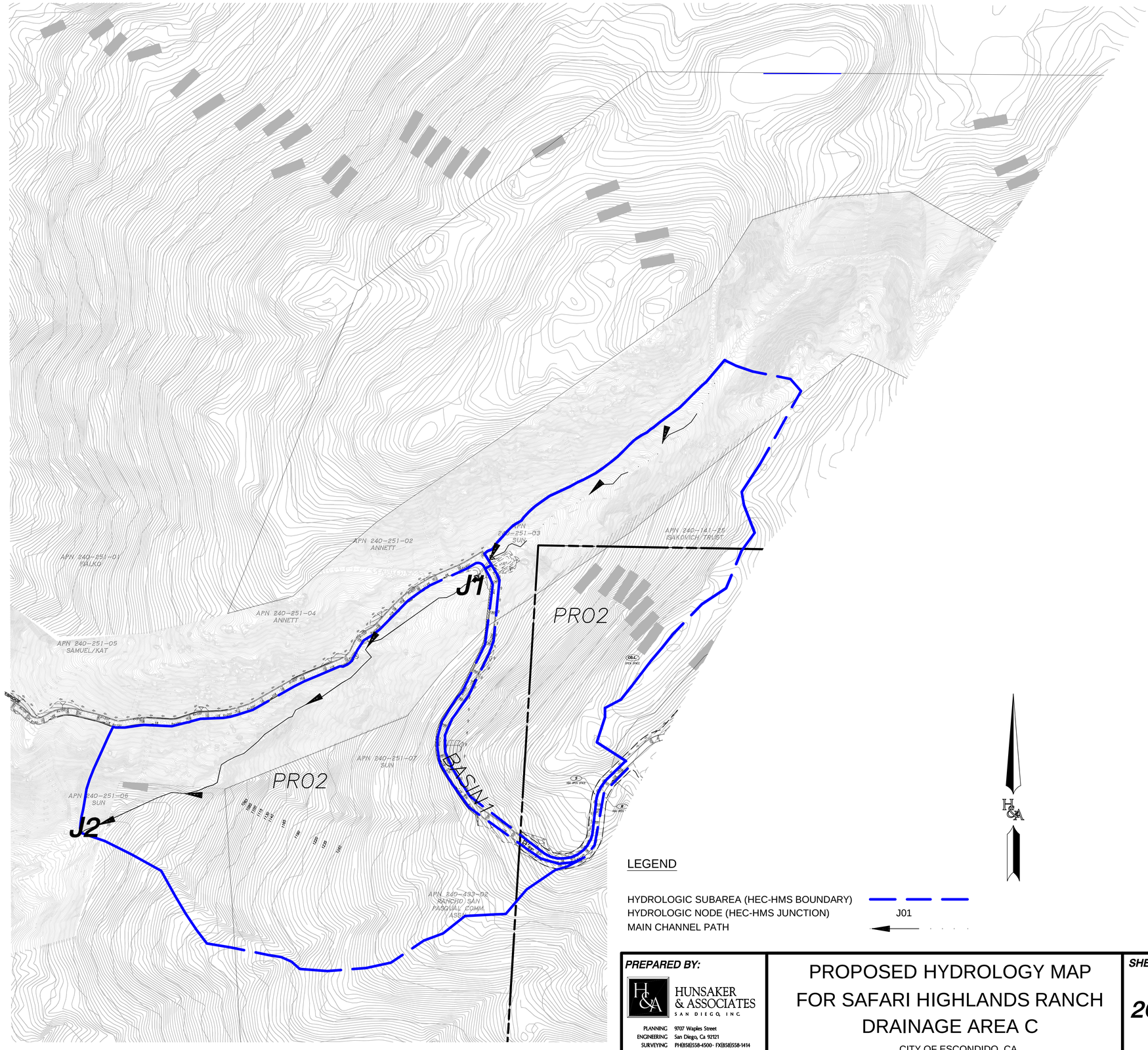
BASIN O-Q

BASIN O-R

BASIN O-S

BASIN O-P

BASIN O-O



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HUNSAKER & ASSOCIATES
SAN DIEGO, INC

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ENGINEERING San Diego, Ca 92121
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PROPOSED HYDROLOGY MAP FOR SAFARI HIGHLANDS RANCH DRAINAGE AREA C

CITY OF ESCONDIDO, CA

SHEET

2C

W.O. 2374-0017

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PR06

PR05

PR02

PR01

PR03

PR04

PR07

PR08

J1

J2

J3

J4

J5

J6

J2

BASIN 2

BASIN 3

LEGEND

HYDROLOGIC SUBAREA (HEC-HMS BOUNDARY)

HYDROLOGIC NODE (HEC-HMS JUNCTION) J01

MAIN CHANNEL PATH

H&A

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PROPOSED HYDROLOGY MAP FOR SAFARI HIGHLANDS RANCH DRAINAGE AREA D

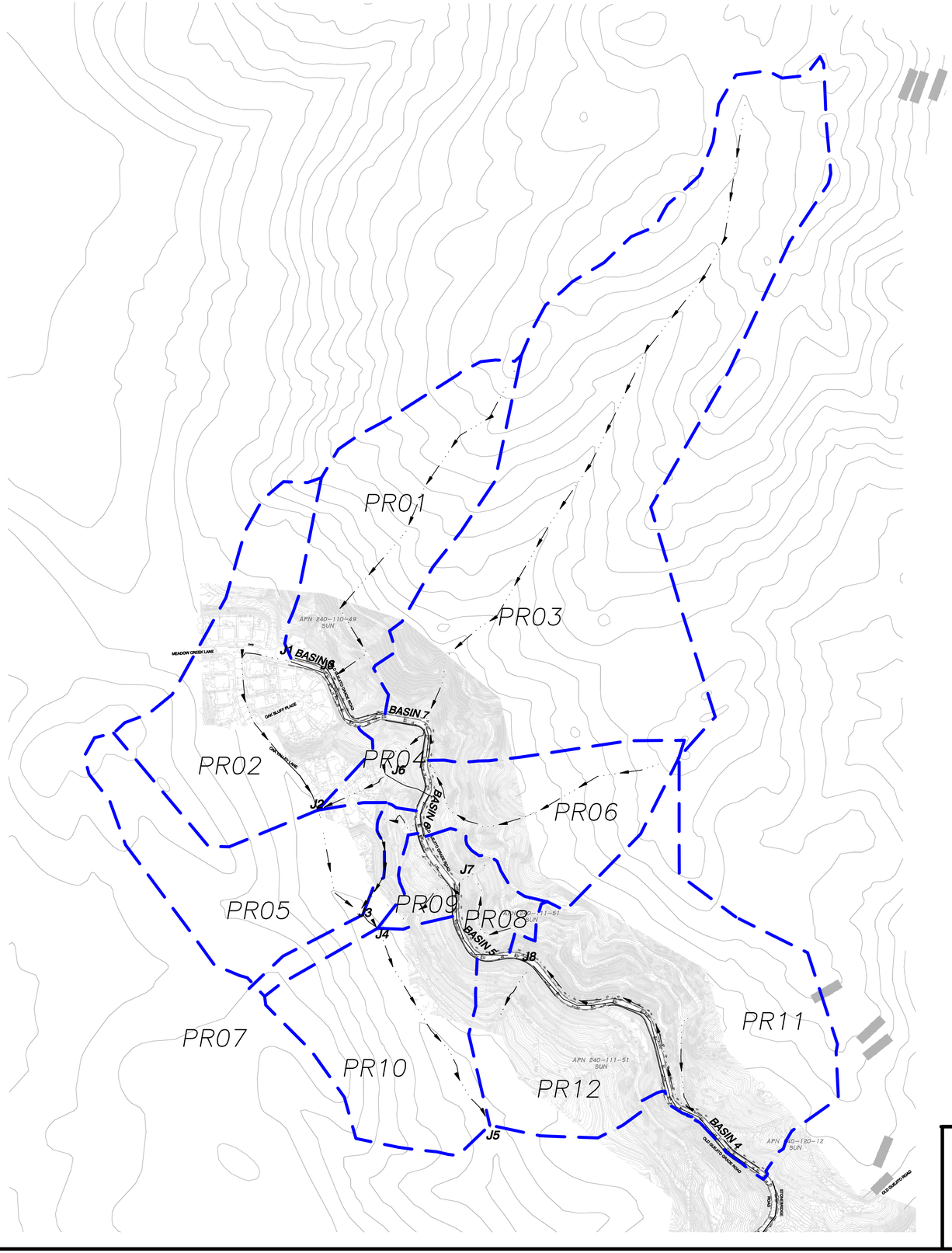
CITY OF ESCONDIDO, CA

SHEET

2D

W.O. 2374-0017

R:\1211\&Hyd\ACAD\1211-HYD-OFFSITE.dwg[ ]Apr-21-2017:16:33



0 250 500 750
SCALE 1" = 250'

LEGEND

HYDROLOGIC SUBAREA (HEC-HMS BOUNDARY)
HYDROLOGIC NODE (HEC-HMS JUNCTION) J01
MAIN CHANNEL PATH

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PROPOSED HYDROLOGY MAP FOR SAFARI HIGHLANDS RANCH DRAINAGE AREA E

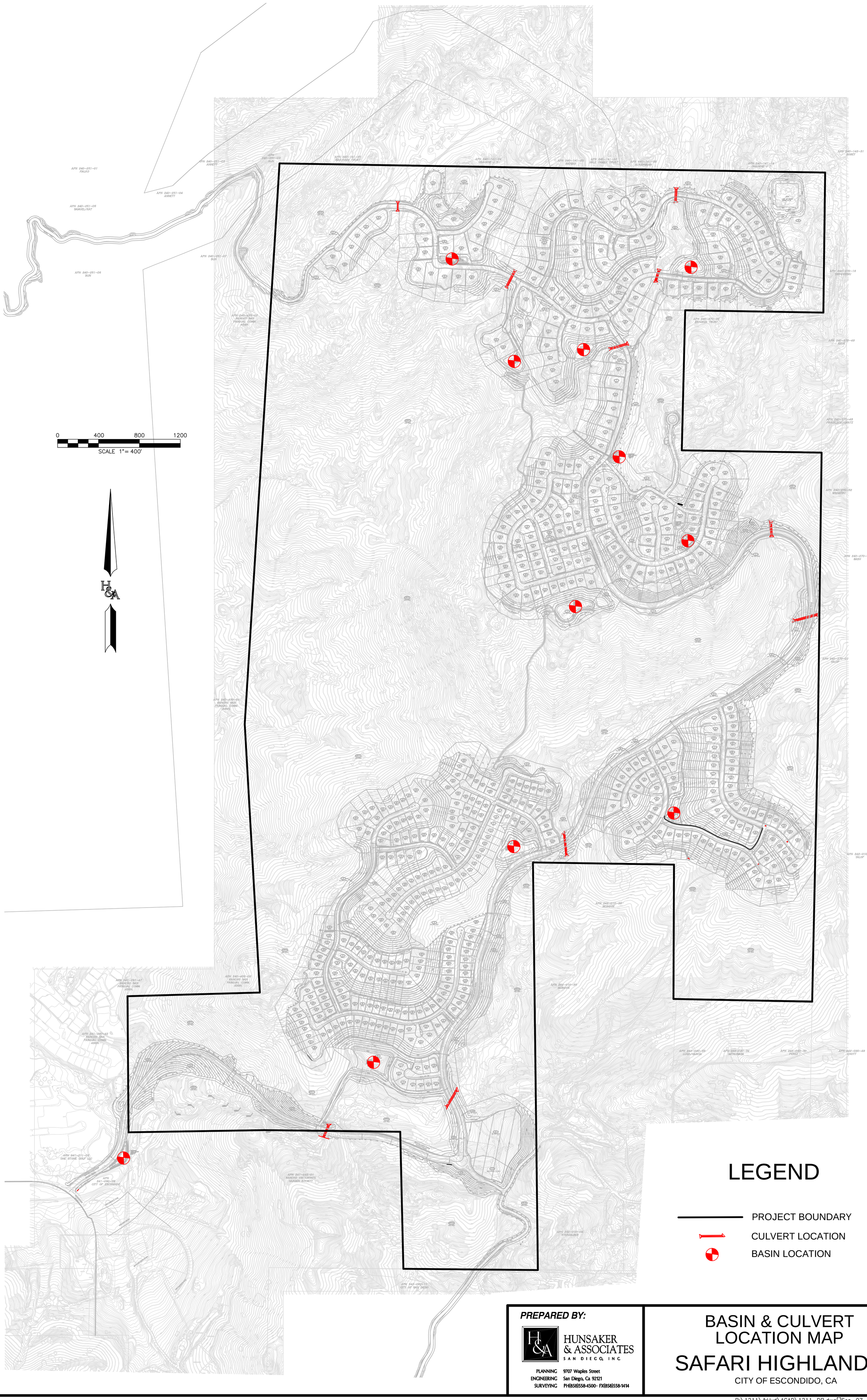
CITY OF ESCONDIDO, CA

SHEET 2E

W.O. 2374-0017

R:\1211\&Hyd\ACAD\1211-HYD-OFFSITE.dwg[]Apr-21-2017:16:46

Appendix 8 – Basin and Culvert Location Exhibit



LEGEND

- PROJECT BOUNDARY
- CULVERT LOCATION
- BASIN LOCATION

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BASIN & CULVERT LOCATION MAP

SAFARI HIGHLANDS

CITY OF ESCONDIDO, CA

W.O. 2321-0016

R:\1211\&Hyd\ACAD\1211-DR.dwg[]Sep-07-2016:12:48

0 60 120 180

SCALE 1"= 60'

438
1594.6

437
1593.1

436
1594.9

435
1595.4

434
1595.4

431
1591.0

432
1593.3

433
1594.9

PVT. ST. 'DD'

PVT.ST. 'U'

x1577

HYDROMOD WATER QUALITY DETENTION BASIN A

DET A OUTLET

ROCKS

ROCKS

1590 1580 1600 1570

LEGEND

DRAINAGE OUTLET

RIP RAP

FLOW LINE, WATERS OF THE U.S.

FLOW LINE 50' BUFFER, WATERS OF THE U.S.

PREPARED BY:

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DRAINAGE OUTLET DETAIL, DET A AREA A

SAFARI HIGHLANDS

CITY OF ESCONDIDO, CALIFORNIA

W.O. 2374-17

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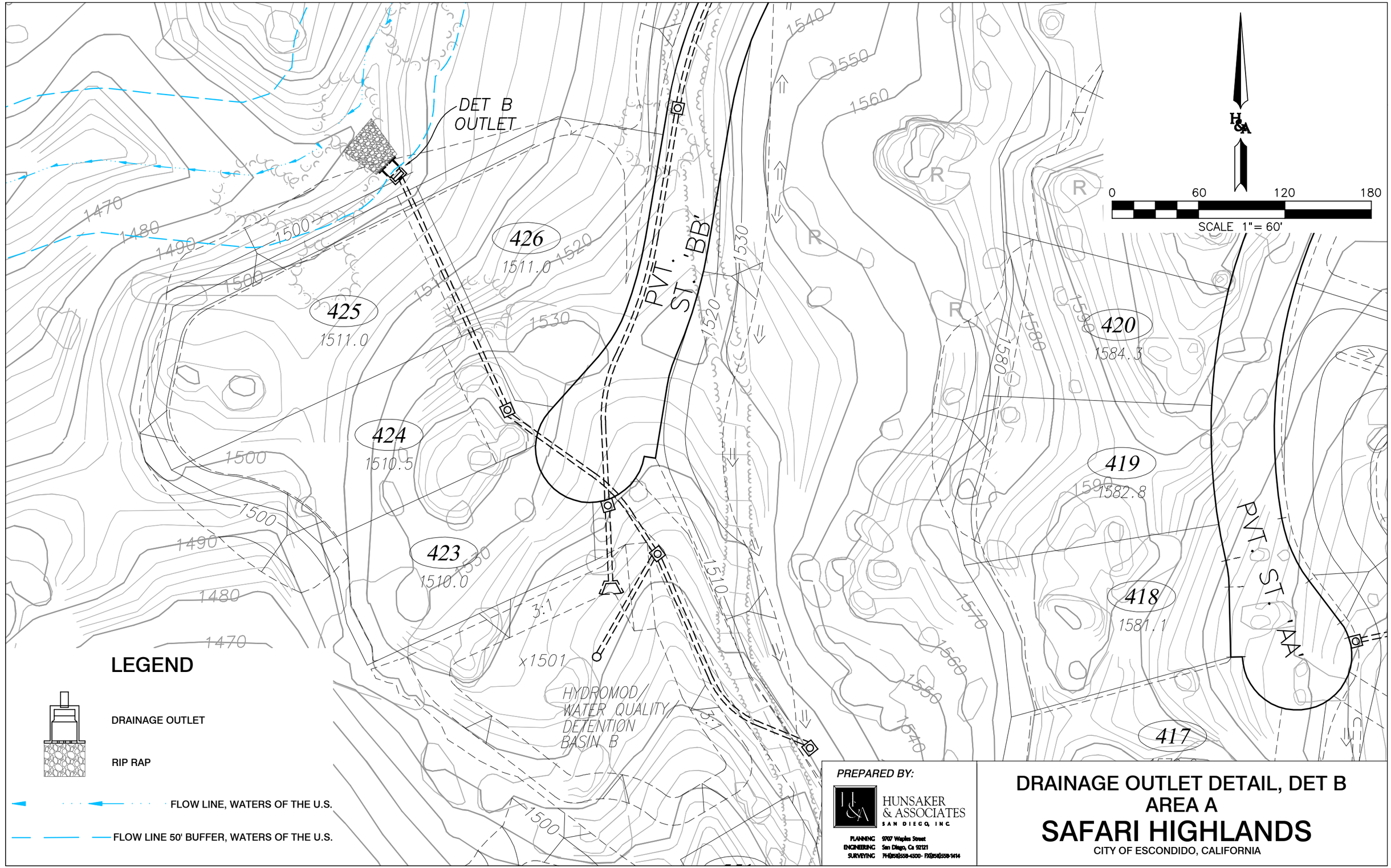

LEGEND

DRAINAGE OUTLET

RIP RAP

FLOW LINE, WATERS OF THE U.S.

FLOW LINE 50' BUFFER, WATERS OF THE U.S.

PREPARED BY:

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DRAINAGE OUTLET DETAIL, DET B
AREA A
SAFARI HIGHLANDS

CITY OF ESCONDIDO, CALIFORNIA

W.O. 2374-17

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0 60 120 180

SCALE 1"= 60'

ROCKS

1588.3

1586.0

1570

1560

1550

1540

1530

2:1

3:1

HYDROMOD/
WATER QUALITY/
DETENTION
BASIN C

x1539

J03
OUTLET

CULVERT
4A
P=1552

DET C
OUTLET

PVT. ST. - AA -

SAFARI HIGHLANDS RANCH RD.

418
1581.1

417
1579.6

416

410
1556.0

558
HOA PVT. STREET

409
1559.2

408
1562.0

1582.8

LEGEND

DRAINAGE OUTLET

RIP RAP

FLOW LINE, WATERS OF THE U.S.

FLOW LINE 50' BUFFER, WATERS OF THE U.S.

PREPARED BY:

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DRAINAGE OUTLET DETAIL, DET C & J03
AREA A
SAFARI HIGHLANDS
CITY OF ESCONDIDO, CALIFORNIA

W.O. 2374-17

R:\1211\&Hyd\ACAD\DRAINAGE OUTLET EXHIBITS\Drainage Outlet Detail_AREA A_DET C & J03.dwg[]Oct-10-2018:16:53

0 60 120 180

SCALE 1"= 60'

515
1628.5

544
1608.5

543
1609.0

545
1606.9

546
1605.3

467
1608.0

468
1622.9

469
1629.8

470
1636.9

471
1644.0

472
1650.9

CULVERT 3A

J02 OUTLET

HYDROMOD WATER QUALITY / DETENTION BASIN D

x1609

PVT.ST. 'U'

ROCKS

3:1

2:1

1660 1640 1630 1620 1610 1600

LEGEND

DRAINAGE OUTLET

RIP RAP

FLOW LINE, WATERS OF THE U.S.

FLOW LINE 50' BUFFER, WATERS OF THE U.S.

PREPARED BY:

HUNSAKER & ASSOCIATES SAN DIEGO, INC

PLANNING 9707 Waples Street
ENGINEERING San Diego, Ca 92121
SURVEYING PH(858)558-4500 FX(858)558-1414

DRAINAGE OUTLET DETAIL, DET D & J02 AREA A

SAFARI HIGHLANDS

CITY OF ESCONDIDO, CALIFORNIA

W.O. 2374-17

R:\1211\&Hyd\ACAD\DRAINAGE OUTLET EXHIBITS\Drainage Outlet Detail_AREA A_DET D & J02.dwg[]Oct-10-2018:17:03

0 60 120 180

SCALE 1"= 60'

PVT. ST. 'D'

PVT. ST. 'F'

ST. 'D' OUTLET

135 1049.5

136 1048.6

137 1047.9

138 1071.5

139 1080.2

120 1045.6

121 1042.9

119 1056.6

118 1064.6

117 1074.2

111

562

LEGEND

DRAINAGE OUTLET

RIP RAP

FLOW LINE, WATERS OF THE U.S.

FLOW LINE 50' BUFFER, WATERS OF THE U.S.

PREPARED BY:

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ENGINEERING San Diego, Ca 92121
SURVEYING PH(858)558-4500 FX(858)558-1414

DRAINAGE OUTLET DETAIL, ST. 'D'
AREA B
SAFARI HIGHLANDS

CITY OF ESCONDIDO, CALIFORNIA

W.O. 2374-17

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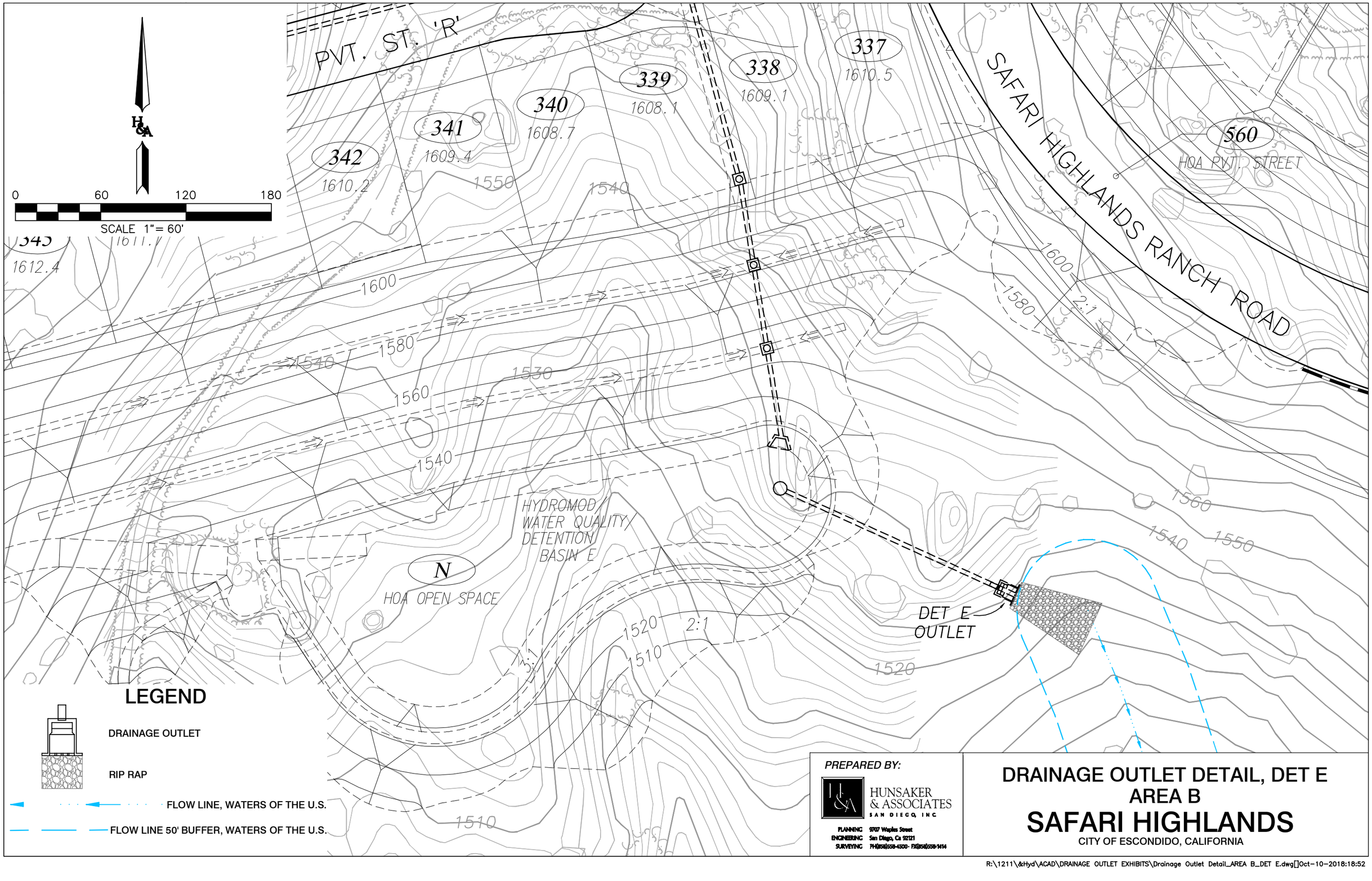

LEGEND

DRAINAGE OUTLET

RIP RAP

FLOW LINE, WATERS OF THE U.S.

FLOW LINE 50' BUFFER, WATERS OF THE U.S.

PREPARED BY:

HUNSAKER & ASSOCIATES
SAN DIEGO, INC

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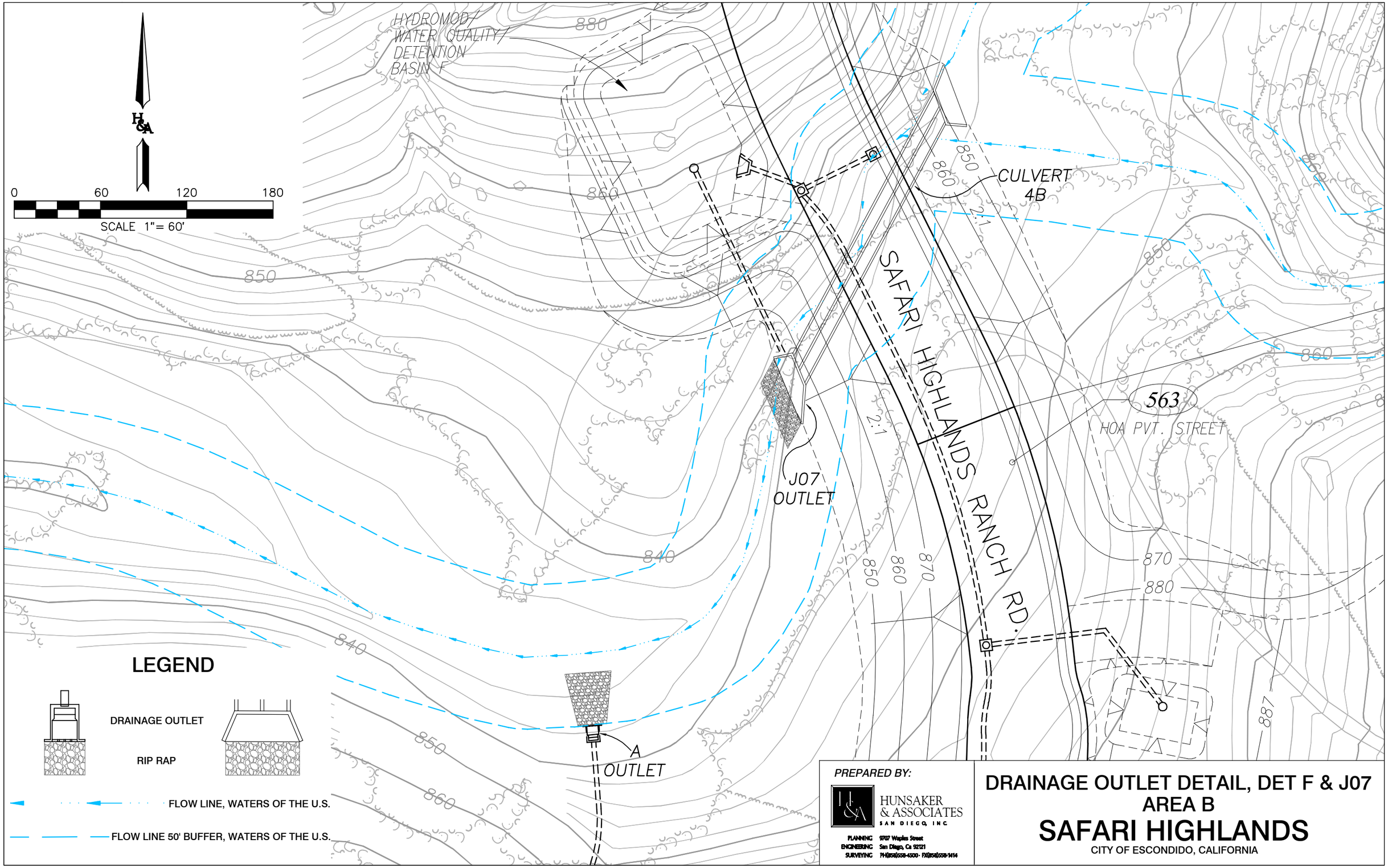
SURVEYING PH(858)558-4500 FX(858)558-1414

DRAINAGE OUTLET DETAIL, DET E
AREA B
SAFARI HIGHLANDS

CITY OF ESCONDIDO, CALIFORNIA

W.O. 2374-17

R:\1211\&Hyd\ACAD\DRAINAGE OUTLET EXHIBITS\Drainage Outlet Detail_AREA B_DET E.dwg[]Oct-10-2018:18:52



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SAN DIEGO, INC

PLANNING 9707 Waples Street
ENGINEERING San Diego, Ca 92121
SURVEYING PH(858)558-4500 FX(858)558-1414

DRAINAGE OUTLET DETAIL, DET F & J07
AREA B
SAFARI HIGHLANDS
CITY OF ESCONDIDO, CALIFORNIA

W.O. 2374-17

R:\1211\&Hyd\ACAD\DRAINAGE OUTLET EXHIBITS\Drainage Outlet Detail_AREA B_DET F & J07.dwg[]Oct-11-2018:08:18

PVT. ST. 'P'

SAFARI HIGHLANDS RANCH RD.

320
1647.2

321
1653.0

322
1658.8

323
1663.8

324
1665.9

1640
1630
1620
1610
1600
1590
1580
1570
1550
1540
1530

DET G
OUTLET

ROCKS

H&A

0 60 120 180

SCALE 1"= 60'

LEGEND

DRAINAGE OUTLET

RIP RAP

FLOW LINE, WATERS OF THE U.S.

FLOW LINE 50' BUFFER, WATERS OF THE U.S.

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DRAINAGE OUTLET DETAIL, DET G
AREA B
SAFARI HIGHLANDS
CITY OF ESCONDIDO, CALIFORNIA

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R:\1211\&Hyd\ACAD\DRAINAGE OUTLET EXHIBITS\Drainage Outlet Detail_AREA B_DET G.dwg[]Oct-11-2018:08:23

F
OPEN SPACE

562
HOA PVT. STREET

DET H
OUTLET

SAFARI HIGHLANDS RANCH RD.

1.5:1

2:1

F
OUTLET

E
HOA OPEN SPACE

1080 1070 1060 1050 1040 1030 1020 1010 1000

990 980 970 960 950 940 930 920 910 900 890 880 870

0 60 120 180
SCALE 1"= 60'

LEGEND

DRAINAGE OUTLET

RIP RAP

FLOW LINE, WATERS OF THE U.S.

FLOW LINE 50' BUFFER, WATERS OF THE U.S.

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DRAINAGE OUTLET DETAIL, DET H
AREA B
SAFARI HIGHLANDS
CITY OF ESCONDIDO, CALIFORNIA

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R:\1211\&Hyd\ACAD\DRAINAGE OUTLET EXHIBITS\Drainage Outlet Detail_AREA B_DET H.dwg[]Oct-11-2018:08:31

PVT. ST. 'L'

HYDROMOD/
WATER QUALITY/
DETENTION
BASIN I

DET I
OUTLET

G
OUTLET

G
OPEN SPACE

226
1273.1

225
1276.7

224
1282.1

223
1287.7

222
1292.9

1.5:1
3:1
2:1

1290
1280
1270
1260
1250
1240
1230
1220
1210
1200
1190
1180

0 60 120 180
SCALE 1"= 60'

LEGEND

DRAINAGE OUTLET

RIP RAP

FLOW LINE, WATERS OF THE U.S.

FLOW LINE 50' BUFFER, WATERS OF THE U.S.

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DRAINAGE OUTLET DETAIL, DET I
AREA B
SAFARI HIGHLANDS

CITY OF ESCONDIDO, CALIFORNIA

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R:\1211\&Hyd\ACAD\DRAINAGE OUTLET EXHIBITS\Drainage Outlet Detail_AREA B_DET I.dwg[]Oct-11-2018:08:36

PVT. ST. 'C'

PVT. ST. 'C'

8
17
955.4
16
954.5
15
953.7
14
953.0
951.7
949.4
947.5
10
946.1
9
944.7
8
943.3
7
941.8
6
940.2
5
938.7

940
920
900
880
860
850
930
910
2:1
3:1

HYDROMOD/70
WATER QUALITY/
DETENTION
BASIN J

X 854
X 864

DET J
OUTLET

LEGEND

DRAINAGE OUTLET

RIP RAP

FLOW LINE, WATERS OF THE U.S.

FLOW LINE 50' BUFFER, WATERS OF THE U.S.

0 60 120 180

SCALE 1"= 60'

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DRAINAGE OUTLET DETAIL, DET J
AREA B
SAFARI HIGHLANDS

CITY OF ESCONDIDO, CALIFORNIA

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R:\1211\&Hyd\ACAD\DRAINAGE OUTLET EXHIBITS\Drainage Outlet Detail_AREA B_DET J.dwg[]Oct-11-2018:08:43

LEGEND

DRAINAGE OUTLET

RIP RAP

FLOW LINE, WATERS OF THE U.S.

FLOW LINE 50' BUFFER, WATERS OF THE U.S.

H&A

0 60 120 180

SCALE 1"= 60'

SAFARI HIGHLANDS RANCH ROAD

HYDROMOD/ WATER QUALITY/ DETENTION BASIN K

ROCKWOOD RD.

DET K OUTLET

J12 OUTLET

J11 OUTLET

CULVERT 6B

420

410

430

440

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DRAINAGE OUTLET DETAIL, DET K & J11
AREA B
SAFARI HIGHLANDS

CITY OF ESCONDIDO, CALIFORNIA

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R:\1211\&Hyd\ACAD\DRAINAGE OUTLET EXHIBITS\Drainage Outlet Detail_AREA B_DET K & J11.dwg[]Oct-11-2018:10:54

Appendix 9–Basin - Stage - Storage - Discharge Tables

Basin A

Elevation Discharge Table

Paired Data | Table | Graph

Elevation (FT)	Discharge (CFS)
1577.0	0.00
1577.5	0.01
1578.0	0.14
1578.5	0.20
1579.0	0.25
1579.5	3.26
1580.0	5.01
1580.5	6.28
1581.0	7.34
1581.5	20.03
1582.0	42.38
1582.5	71.01
1583.0	104.72

Elevation Area Table

Paired Data | Table | Graph

Elevation (FT)	Area (AC)
1577.0	0.377
1577.5	0.396
1578.0	0.415
1578.5	0.435
1579.0	0.455
1579.5	0.476
1580.0	0.497
1580.5	0.518
1581.0	0.540
1581.5	0.562
1582.0	0.584
1582.5	0.623
1583.0	0.662

Basin B

Elevation Discharge Table

Paired Data | Table | Graph

Elevation (FT)	Area (AC)
1501.0	0.344
1501.5	0.362
1502.0	0.380
1502.5	0.398
1503.0	0.417
1503.5	0.436
1504.0	0.455
1504.5	0.475
1505.0	0.495
1505.5	0.516
1506.0	0.536
1506.5	0.571
1507.0	0.606
1507.5	0.670
1508.0	0.734

Elevation Area Table

Paired Data | Table | Graph

Elevation (FT)	Discharge (CFS)
1501.0	0.00
1501.5	0.01
1502.0	0.14
1502.5	0.20
1503.0	0.25
1503.5	3.26
1504.0	5.01
1504.5	6.28
1505.0	7.34
1505.5	8.25
1506.0	20.85
1506.5	43.13
1507.0	71.71
1507.5	105.38
1508.0	143.44

Basin C

Elevation Discharge Table

Paired Data | Table | Graph

Elevation (FT)	Discharge (CFS)
1539.0	0.00
1539.5	0.01
1540.0	0.14
1540.5	0.20
1541.0	0.25
1541.5	3.26
1542.0	5.01
1542.5	6.28
1543.0	7.34
1543.5	8.25
1544.0	9.08
1544.5	9.83
1545.0	10.53
1545.5	22.96
1546.0	45.11
1546.5	73.58
1547.0	107.15
1547.5	145.13
1548.0	182.69

Elevation Area Table

Paired Data | Table | Graph

Elevation (FT)	Area (AC)
1539.0	0.3387
1539.5	0.3570
1540.0	0.3753
1540.5	0.3943
1541.0	0.4132
1541.5	0.4329
1542.0	0.4525
1542.5	0.4728
1543.0	0.4930
1543.5	0.5140
1544.0	0.5349
1544.5	0.5565
1545.0	0.5781
1545.5	0.6004
1546.0	0.6226
1546.5	0.6455
1547.0	0.6685
1547.5	0.7184
1548.0	0.7684

Basin D

Elevation Discharge Table

Paired Data | Table | Graph

Elevation (FT)	Discharge (CFS)
1609.00	0.00
1609.50	0.01
1610.00	0.14
1610.50	0.24
1611.00	0.31
1611.50	0.36
1612.00	3.37
1612.50	5.13
1613.00	6.41
1613.50	7.46
1614.00	8.39
1614.50	9.22
1615.00	9.98
1615.50	10.68
1616.00	11.34
1616.50	11.97
1617.00	12.56
1617.50	13.13
1618.00	13.67
1618.50	25.97
1619.00	48.00
1619.50	76.36
1620.00	109.84

Elevation Area Table

Paired Data | Table | Graph

Elevation (FT)	Area (AC)
1609.00	0.340
1609.50	0.358
1610.00	0.377
1610.50	0.405
1611.00	0.432
1611.50	0.444
1612.00	0.457
1612.50	0.477
1613.00	0.498
1613.50	0.520
1614.00	0.541
1614.50	0.563
1615.00	0.585
1615.50	0.608
1616.00	0.631
1616.50	0.654
1617.00	0.678
1617.50	0.702
1618.00	0.726
1618.50	0.751
1619.00	0.775
1619.50	0.819
1620.00	0.862

Basin E

Elevation Discharge Table

Paired Data | Table | Graph

Elevation (FT)	Discharge (CFS)
1523.00	0.00
1523.25	0.10
1523.50	0.10
1523.75	0.14
1524.00	0.17
1524.25	0.19
1524.50	0.20
1524.75	0.21
1525.00	0.23
1525.25	0.24
1525.50	0.25
1525.75	0.26
1526.00	0.26
1526.25	0.27
1526.50	0.28
1526.75	0.29
1527.00	0.30
1527.25	4.22
1527.50	11.40
1527.75	20.69
1528.00	31.69
1528.25	44.17
1528.50	57.96
1528.75	72.96
1529.00	89.07
1529.25	106.22
1529.50	124.35
1529.75	143.42
1530.00	163.37
1530.25	184.16
1530.50	205.78
1530.75	228.18
1531.00	251.34

Elevation Area Table

Paired Data | Table | Graph

Elevation (FT)	Area (AC)
1523.00	0.545
1523.25	0.560
1523.50	0.574
1523.75	0.589
1524.00	0.603
1524.25	0.618
1524.50	0.633
1524.75	0.647
1525.00	0.662
1525.25	0.677
1525.50	0.693
1525.75	0.708
1526.00	0.723
1526.25	0.738
1526.50	0.754
1526.75	0.769
1527.00	0.785
1527.25	0.800
1527.50	0.816
1527.75	0.832
1528.00	0.848
1528.25	0.864
1528.50	0.880
1528.75	0.896
1529.00	0.912
1529.25	0.929
1529.50	0.945
1529.75	0.961
1530.00	0.978
1530.25	0.994
1530.50	1.011
1530.75	1.027
1531.00	1.071

Basin F

Elevation Discharge Table

Paired Data | Table | Graph

Elevation (FT)	Discharge (CFS)
866.00	0.00
866.25	0.11
866.50	0.12
866.75	0.62
867.00	0.93
867.25	2.12
867.50	3.09
867.75	3.76
868.00	4.32
868.25	4.81
868.50	5.25
868.75	5.66
869.00	6.04
869.25	7.42
869.50	9.20
869.75	10.31
870.00	11.26
870.25	17.32
870.50	27.65
870.75	40.75
871.00	56.08
871.25	73.34
871.50	92.33
871.75	112.90
872.00	134.94

Elevation Area Table

Paired Data | Table | Graph

Elevation (FT)	Area (AC)
866.000	0.193
866.250	0.200
866.500	0.206
866.750	0.212
867.000	0.219
867.250	0.226
867.500	0.232
867.750	0.239
868.000	0.246
868.250	0.253
868.500	0.260
868.750	0.267
869.000	0.274
869.250	0.281
869.500	0.288
869.750	0.296
870.000	0.303
870.250	0.311
870.500	0.318
870.750	0.326
871.000	0.334
871.250	0.342
871.500	0.350
871.750	0.358
872.000	0.366

Basin G

Elevation Discharge Table

Paired Data | Table | Graph

Elevation (FT)	Discharge (CFS)
1628.00	0.00
1628.25	0.25
1628.50	0.35
1628.75	0.40
1629.00	0.42
1629.25	1.88
1629.50	4.78
1629.75	6.36
1630.00	7.61
1630.25	9.39
1630.50	11.77
1630.75	13.40
1631.00	14.80
1631.25	16.06
1631.50	17.21
1631.75	18.28
1632.00	19.29
1632.25	24.17
1632.50	32.25
1632.75	42.40
1633.00	54.23
1633.25	67.51
1633.50	82.08
1633.75	97.82
1634.00	114.66

Elevation Area Table

Paired Data | Table | Graph

Elevation (FT)	Area (AC)
1628.00	0.16
1628.25	0.17
1628.50	0.17
1628.75	0.18
1629.00	0.18
1629.25	0.19
1629.50	0.20
1629.75	0.20
1630.00	0.21
1630.25	0.22
1630.50	0.22
1630.75	0.23
1631.00	0.24
1631.25	0.24
1631.50	0.25
1631.75	0.26
1632.00	0.27
1632.25	0.27
1632.50	0.28
1632.75	0.29
1633.00	0.30
1633.25	0.30
1633.50	0.31
1633.75	0.32
1634.00	0.33

Basin H

Elevation Discharge Table

Paired Data | Table | Graph

Elevation (FT)	Discharge (CFS)
1053.00	0.00
1053.25	0.10
1053.50	0.11
1053.75	0.62
1054.00	0.93
1054.25	2.12
1054.50	3.09
1054.75	3.76
1055.00	4.32
1055.25	4.81
1055.50	5.25
1055.75	5.66
1056.00	6.04
1056.25	7.42
1056.50	9.20
1056.75	10.31
1057.00	11.26
1057.25	17.32
1057.50	27.65
1057.75	40.75
1058.00	56.08
1058.25	73.34
1058.50	92.33
1058.75	112.90
1059.00	134.94
1059.25	158.34
1059.50	183.03
1059.75	208.94
1060.00	236.03
1060.25	264.23
1060.50	293.51
1060.75	323.82
1061.00	355.14

Elevation Area Table

Paired Data | Table | Graph

Elevation (FT)	Area (AC)
1053.00	0.771
1053.25	0.787
1053.50	0.803
1053.75	0.818
1054.00	0.834
1054.25	0.850
1054.50	0.866
1054.75	0.882
1055.00	0.898
1055.25	0.915
1055.50	0.931
1055.75	0.948
1056.00	0.964
1056.25	0.981
1056.50	0.998
1056.75	1.014
1057.00	1.031
1057.25	1.048
1057.50	1.065
1057.75	1.082
1058.00	1.099
1058.25	1.117
1058.50	1.134
1058.75	1.152
1059.00	1.169
1059.25	1.186
1059.50	1.204
1059.75	1.221
1060.00	1.240
1060.25	1.256
1060.50	1.273
1060.75	1.291
1061.00	1.312

Basin I

Elevation Discharge Table

Paired Data | Table | Graph

Elevation (FT)	Discharge (CFS)
1244.00	0.00
1244.25	0.01
1244.50	0.02
1244.75	0.04
1245.00	0.07
1245.25	0.57
1245.50	0.99
1245.75	1.26
1246.00	1.48
1246.25	2.90
1246.50	4.80
1246.75	5.91
1247.00	6.82
1247.25	7.61
1247.50	8.32
1247.75	8.98
1248.00	9.58
1248.25	15.38
1248.50	25.48
1248.75	38.37
1249.00	53.52
1249.25	70.61
1249.50	89.45
1249.75	109.87
1250.00	131.77

Elevation Area Table

Paired Data | Table | Graph

Elevation (FT)	Area (AC)
1244.00	0.26
1244.25	0.27
1244.50	0.28
1244.75	0.29
1245.00	0.29
1245.25	0.30
1245.50	0.31
1245.75	0.32
1246.00	0.33
1246.25	0.34
1246.50	0.35
1246.75	0.36
1247.00	0.37
1247.25	0.37
1247.50	0.38
1247.75	0.39
1248.00	0.40
1248.25	0.41
1248.50	0.42
1248.75	0.43
1249.00	0.44
1249.25	0.45
1249.50	0.46
1249.75	0.47
1250.00	0.48

Basin J

Elevation Discharge Table

Paired Data | Table | Graph

Elevation (FT)	Discharge (CFS)
855.00	0.00
855.25	0.02
855.50	0.03
855.75	0.07
856.00	0.09
856.25	1.09
856.50	1.89
856.75	2.42
857.00	2.85
857.25	4.45
857.50	6.51
857.75	7.77
858.00	8.82
858.25	9.74
858.50	10.57
858.75	11.34
859.00	12.05
859.25	17.95
859.50	28.15
859.75	41.14
860.00	56.38
860.25	73.57
860.50	92.49
860.75	113.00
861.00	134.98
861.25	158.33
861.50	182.97
861.75	208.84
862.00	235.88
862.25	264.05
862.50	293.29
862.75	323.57
863.00	354.86

Elevation Area Table

Paired Data | Table | Graph

Elevation (FT)	Area (AC)
855.00	0.679
855.25	0.691
855.50	0.703
855.75	0.715
856.00	0.727
856.25	0.739
856.50	0.752
856.75	0.764
857.00	0.776
857.25	0.789
857.50	0.801
857.75	0.814
858.00	0.827
858.25	0.840
858.50	0.853
858.75	0.866
859.00	0.878
859.25	0.892
859.50	0.905
859.75	0.918
860.00	0.931
860.25	0.945
860.50	0.959
860.75	0.972
861.00	0.986
861.25	1.000
861.50	1.014
861.75	1.028
862.00	1.041
862.25	1.056
862.50	1.070
862.75	1.084
863.00	1.098

Basin K

Elevation Discharge Table

Paired Data | Table | Graph

Elevation (FT)	Discharge (CFS)
1420.00	0.00
1420.25	0.30
1420.50	0.35
1420.75	0.40
1421.00	0.42
1421.25	0.44
1421.50	0.45
1421.75	0.47
1422.00	0.48
1422.25	5.72
1422.50	15.29
1422.75	27.68
1423.00	42.34
1423.25	58.98
1423.50	77.37
1423.75	97.37
1424.00	118.85

Elevation Area Table

Paired Data | Table | Graph

Elevation (FT)	Area (AC)
1420.00	0.174
1420.25	0.183
1420.50	0.192
1420.75	0.201
1421.00	0.209
1421.25	0.219
1421.50	0.228
1421.75	0.237
1422.00	0.247
1422.25	0.256
1422.50	0.266
1422.75	0.276
1423.00	0.285
1423.25	0.298
1423.50	0.311
1423.75	0.324
1424.00	0.337

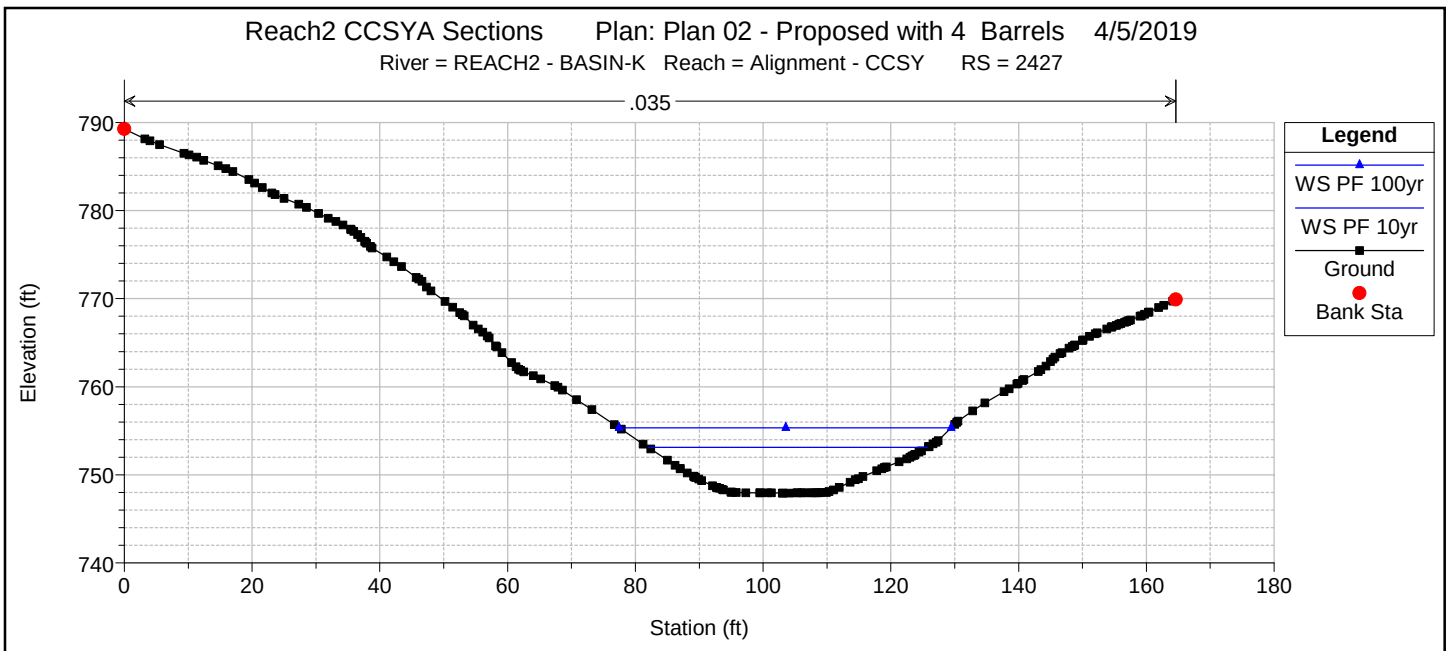
Appendix 10– HEC-RAS Channel Analysis

HEC-RAS Plan: Plan2 4B River: REACH2 - BASIN-K Reach: Alignment - CCSY Profile: PF 100yr

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Alignment - CCSY	2427	PF 100yr	3356.00	747.91	755.33	755.33	757.87	0.011224	12.76	263.00	51.99	1.00
Alignment - CCSY	2366	PF 100yr	3356.00	744.36	751.38	751.38	753.82	0.011475	12.53	267.89	54.95	1.00
Alignment - CCSY	2328	PF 100yr	3356.00	739.25	749.11	749.11	752.05	0.011991	13.75	244.14	41.88	1.00
Alignment - CCSY	2281	PF 100yr	3356.00	709.23	720.38	720.38	724.43	0.014897	16.14	207.98	25.87	1.00
Alignment - CCSY	2241	PF 100yr	3356.00	689.79	704.00	704.00	708.28	0.017064	16.59	202.27	23.80	1.00
Alignment - CCSY	2182	PF 100yr	3356.00	679.93	690.93	690.93	694.48	0.012899	15.12	222.02	31.71	1.01
Alignment - CCSY	2098	PF 100yr	3356.00	640.13	650.10	650.10	652.90	0.011952	13.43	249.96	45.49	1.01
Alignment - CCSY	2001	PF 100yr	3356.00	607.87	615.38	615.38	617.74	0.011836	12.32	272.38	58.49	1.01
Alignment - CCSY	1885	PF 100yr	3356.00	569.19	580.86	580.86	583.03	0.013446	11.84	283.50	65.62	1.00
Alignment - CCSY	1806	PF 100yr	3356.00	542.83	552.19	552.19	554.67	0.011676	12.65	265.31	53.46	1.00
Alignment - CCSY	1730	PF 100yr	3356.00	522.48	535.24	535.24	538.42	0.013709	14.30	234.67	37.22	1.00
Alignment - CCSY	1680	PF 100yr	3356.00	515.78	523.13	523.13	525.73	0.011292	12.92	259.81	50.19	1.00
Alignment - CCSY	1630	PF 100yr	3356.00	505.18	513.24	513.24	515.97	0.011451	13.25	253.27	46.51	1.00
Alignment - CCSY	1556	PF 100yr	3356.00	487.42	493.75	493.75	496.02	0.011370	12.10	277.45	61.03	1.00
Alignment - CCSY	1442	PF 100yr	3356.00	459.08	469.38	469.38	472.63	0.012287	14.48	231.83	35.81	1.00
Alignment - CCSY	1320.72	PF 100yr	3356.00	420.00	424.29	424.29	425.39	0.014089	8.42	398.52	182.20	1.00
Alignment - CCSY	1256	PF 100yr	3356.00	420.00	424.59		424.77	0.000931	3.44	976.30	223.30	0.29
Alignment - CCSY	1169.53	PF 100yr	3356.00	419.97	424.55		424.69	0.000676	2.94	1140.60	259.51	0.25
Alignment - CCSY	1085.03	PF 100yr	3356.00	419.97	424.51		424.63	0.000581	2.70	1244.11	288.70	0.23
Alignment - CCSY	995.55	PF 100yr	3356.00	419.91	424.45	421.67	424.57	0.000597	2.77	1211.32	278.27	0.23
Alignment - CCSY	870.86	PF 100yr	3465.00	419.94	424.21	422.06	424.45	0.001327	3.94	879.39	214.04	0.34
Alignment - CCSY	801	PF 100yr	3465.00	419.97	423.64	422.63	424.26	0.004399	6.33	547.71	161.41	0.61
Alignment - CCSY	701.97	PF 100yr	3465.00	419.00	422.43	422.36	423.55	0.011130	8.70	415.34	169.14	0.93
Alignment - CCSY	605	PF 100yr	3465.00	415.89	420.81	420.81	422.37	0.012372	10.01	346.02	111.34	1.00
Alignment - CCSY	517	PF 100yr	3465.00	411.49	418.14	415.52	418.54	0.001905	5.10	679.09	147.47	0.42
Alignment - CCSY	410	PF 100yr	3465.00	409.97	418.19	413.55	418.37	0.000600	3.39	1023.34	172.44	0.25
Alignment - CCSY	311	PF 100yr	3465.00	409.94	418.16	413.21	418.30	0.000631	3.06	1133.55	230.38	0.24
Alignment - CCSY	207	PF 100yr	3513.20	409.84	418.10	413.16	418.23	0.000576	2.93	1198.75	242.57	0.23
Alignment - CCSY	155	PF 100yr	3513.20	409.81	418.03	413.45	418.20	0.000737	3.25	1080.09	225.54	0.26
Alignment - CCSY	111	PF 100yr	3513.20	406.68	417.97	412.01	418.17	0.000513	3.57	984.50	134.46	0.23
Alignment - CCSY	100		Culvert									
Alignment - CCSY	0	PF 100yr	3513.20	405.60	411.71	410.29	411.94	0.002002	3.91	914.09	333.65	0.40

HEC-RAS Plan: Plan2 4B River: REACH2 - BASIN-K Reach: Alignment - CCSY Profile: PF 10yr

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Alignment - CCSY	2427	PF 10yr	1669.00	747.91	753.10	753.10	754.89	0.012369	10.72	155.72	43.65	1.00
Alignment - CCSY	2366	PF 10yr	1669.00	744.36	749.36	749.36	751.01	0.012747	10.30	162.01	49.14	1.00
Alignment - CCSY	2328	PF 10yr	1669.00	739.25	746.34	746.34	748.52	0.013006	11.83	141.04	32.52	1.00
Alignment - CCSY	2281	PF 10yr	1669.00	709.23	716.67	716.67	719.59	0.015306	13.71	121.77	21.09	1.01
Alignment - CCSY	2241	PF 10yr	1669.00	689.79	699.71	699.71	703.02	0.018196	14.60	114.33	17.24	1.00
Alignment - CCSY	2182	PF 10yr	1669.00	679.93	687.80	687.80	690.32	0.013434	12.74	131.05	26.01	1.00
Alignment - CCSY	2098	PF 10yr	1669.00	640.13	647.61	647.61	649.61	0.012889	11.34	147.14	36.83	1.00
Alignment - CCSY	2001	PF 10yr	1669.00	607.87	613.30	613.30	614.97	0.013303	10.36	161.15	49.29	1.01
Alignment - CCSY	1885	PF 10yr	1669.00	569.19	578.90	578.90	580.49	0.014930	10.13	164.73	51.06	0.99
Alignment - CCSY	1806	PF 10yr	1669.00	542.83	549.65	549.65	551.58	0.012651	11.15	149.75	38.90	1.00
Alignment - CCSY	1730	PF 10yr	1669.00	522.48	532.08	532.08	534.52	0.015429	12.54	133.11	27.40	1.00
Alignment - CCSY	1680	PF 10yr	1669.00	515.78	520.93	520.93	522.70	0.012438	10.69	156.06	43.93	1.00
Alignment - CCSY	1630	PF 10yr	1669.00	505.18	510.86	510.86	512.76	0.012434	11.08	150.62	39.60	1.00
Alignment - CCSY	1556	PF 10yr	1669.00	487.42	491.85	491.85	493.39	0.012711	9.95	167.77	54.59	1.00
Alignment - CCSY	1442	PF 10yr	1669.00	459.08	466.32	466.32	468.73	0.013336	12.46	134.00	28.17	1.01
Alignment - CCSY	1320.72	PF 10yr	1669.00	420.00	423.02	423.02	423.96	0.014966	7.78	214.48	115.41	1.01
Alignment - CCSY	1256	PF 10yr	1669.00	420.00	423.21		423.31	0.000760	2.48	673.91	216.88	0.25
Alignment - CCSY	1169.53	PF 10yr	1669.00	419.97	423.17		423.24	0.000560	2.12	786.19	254.76	0.21
Alignment - CCSY	1085.03	PF 10yr	1669.00	419.97	423.13		423.20	0.000498	1.97	849.27	283.44	0.20
Alignment - CCSY	995.55	PF 10yr	1669.00	419.91	423.09	421.03	423.15	0.000499	2.00	835.56	272.37	0.20
Alignment - CCSY	870.86	PF 10yr	1748.00	419.94	422.92	421.30	423.05	0.001137	2.88	606.21	210.08	0.30
Alignment - CCSY	801	PF 10yr	1748.00	419.97	422.57	421.68	422.90	0.003681	4.63	377.68	155.98	0.52
Alignment - CCSY	701.97	PF 10yr	1748.00	419.00	421.45	421.45	422.23	0.013167	7.16	253.29	163.01	0.94
Alignment - CCSY	605	PF 10yr	1748.00	415.89	419.40	419.40	420.55	0.013523	8.59	203.60	88.36	1.00
Alignment - CCSY	517	PF 10yr	1748.00	411.49	414.20	414.20	415.29	0.013905	8.37	208.83	96.18	1.00
Alignment - CCSY	410	PF 10yr	1748.00	409.97	414.13	412.31	414.40	0.001845	4.14	421.72	122.27	0.39
Alignment - CCSY	311	PF 10yr	1748.00	409.94	413.99	412.05	414.22	0.001500	3.86	452.54	124.35	0.36
Alignment - CCSY	207	PF 10yr	1778.00	409.84	413.81	412.01	414.06	0.001709	3.97	448.13	130.89	0.38
Alignment - CCSY	155	PF 10yr	1778.00	409.81	413.57	412.22	413.93	0.002830	4.84	367.72	116.52	0.48
Alignment - CCSY	111	PF 10yr	1778.00	406.68	413.60	410.42	413.82	0.001005	3.75	473.94	99.86	0.30
Alignment - CCSY	100		Culvert									
Alignment - CCSY	0	PF 10yr	1778.00	405.60	410.68	408.99	410.82	0.002001	3.04	586.58	299.61	0.38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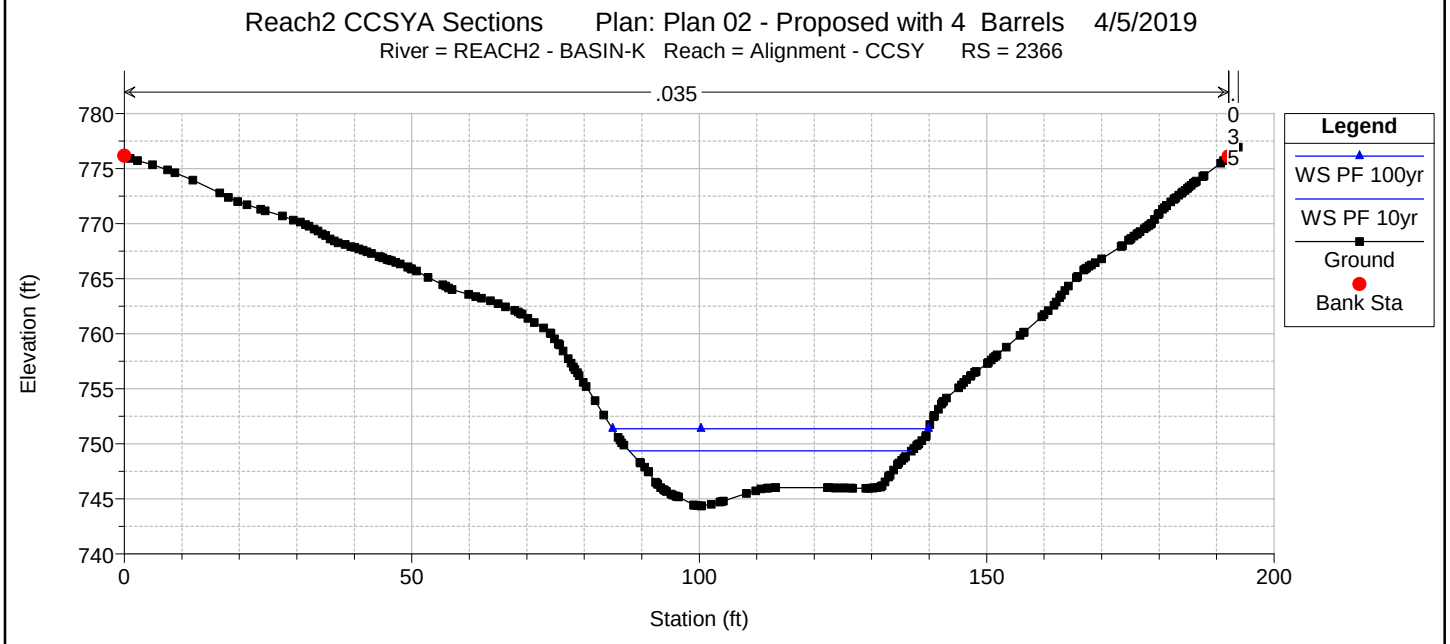
Elevation (ft)
Station (ft)
Legend
WS PF 100yr
WS PF 10yr
Ground
Bank Sta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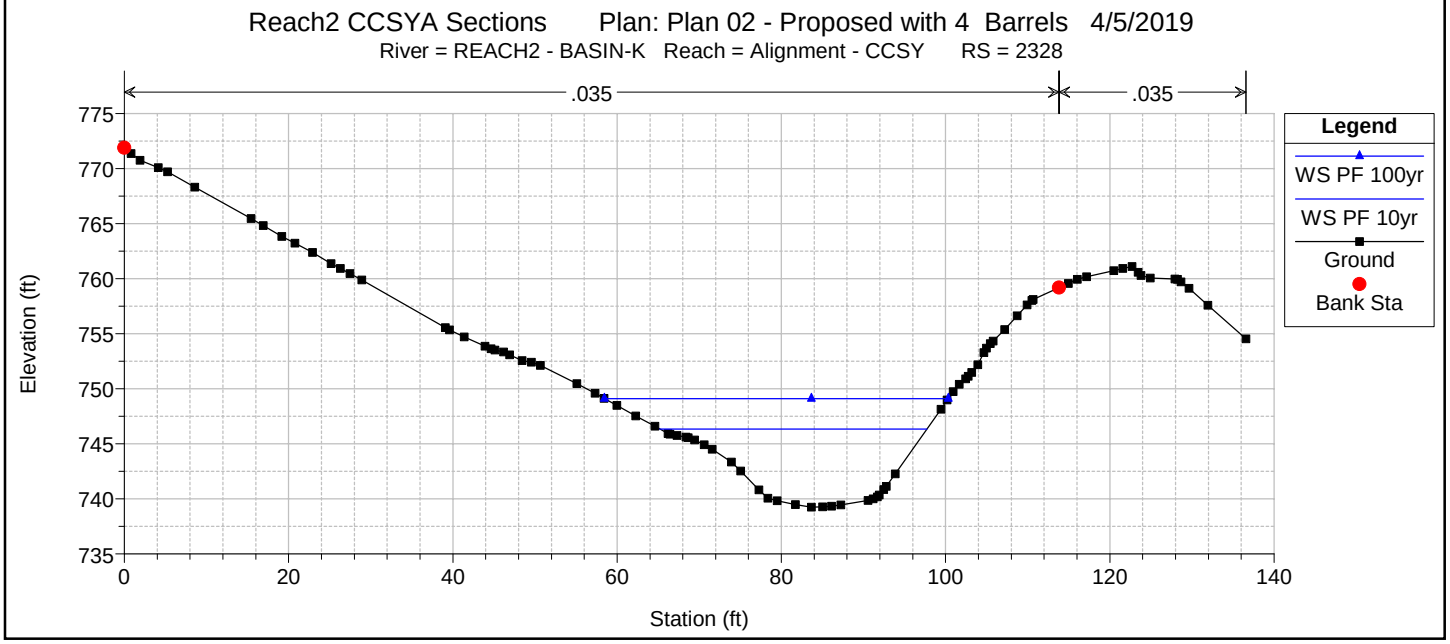
.035
Elevation (ft)
Station (ft)
Legend
WS PF 100yr
WS PF 10yr
Ground
Bank Sta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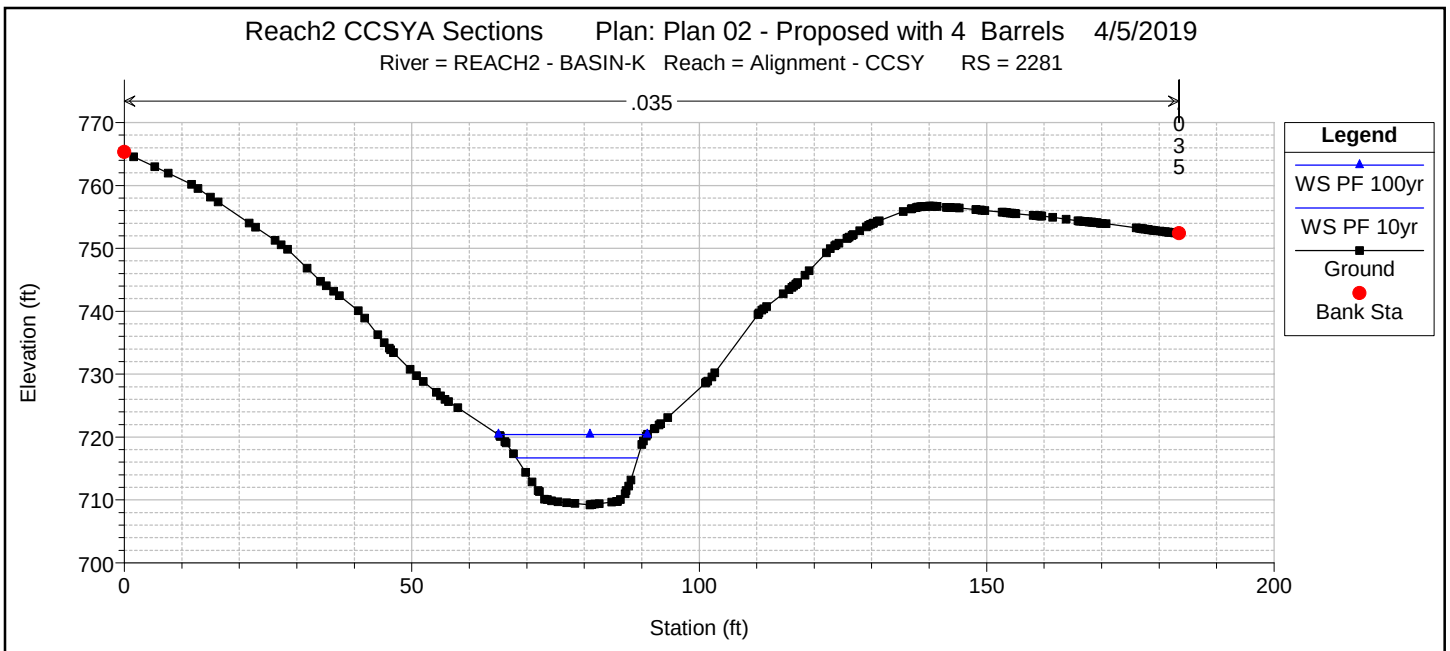
.035
.035
Elevation (ft)
Station (ft)
Legend
WS PF 100yr
WS PF 10yr
Ground
Bank Sta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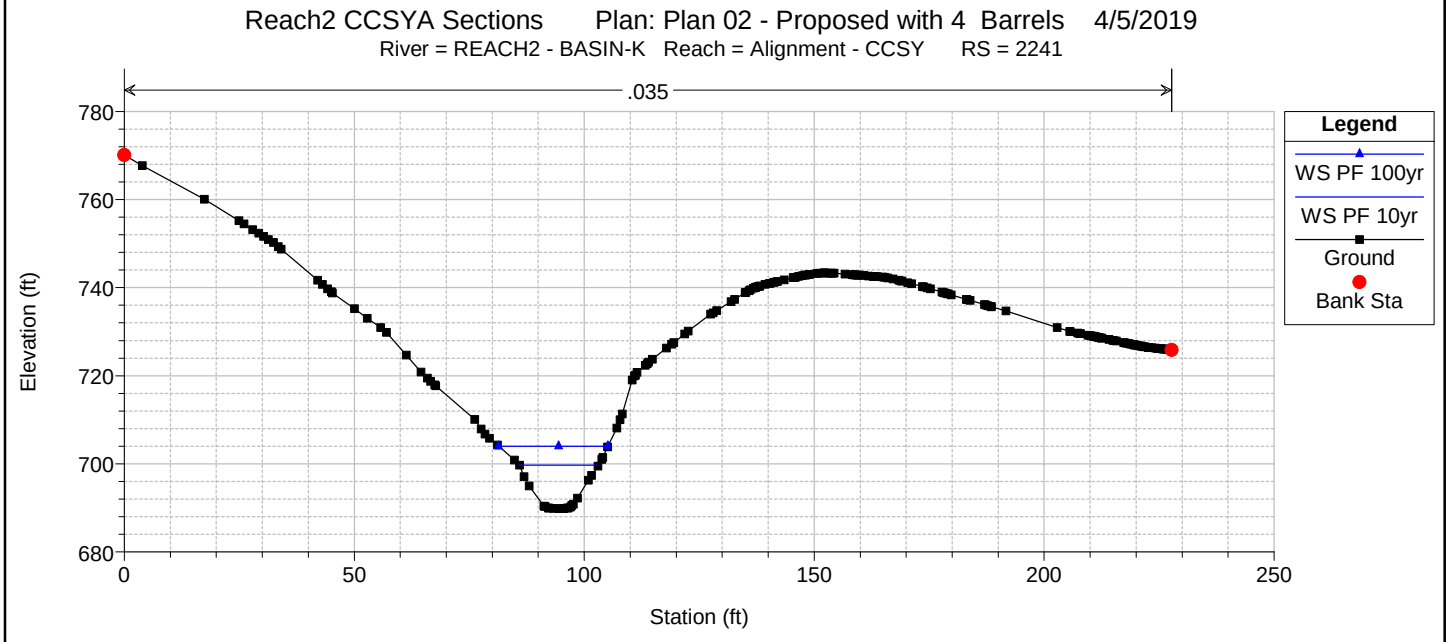
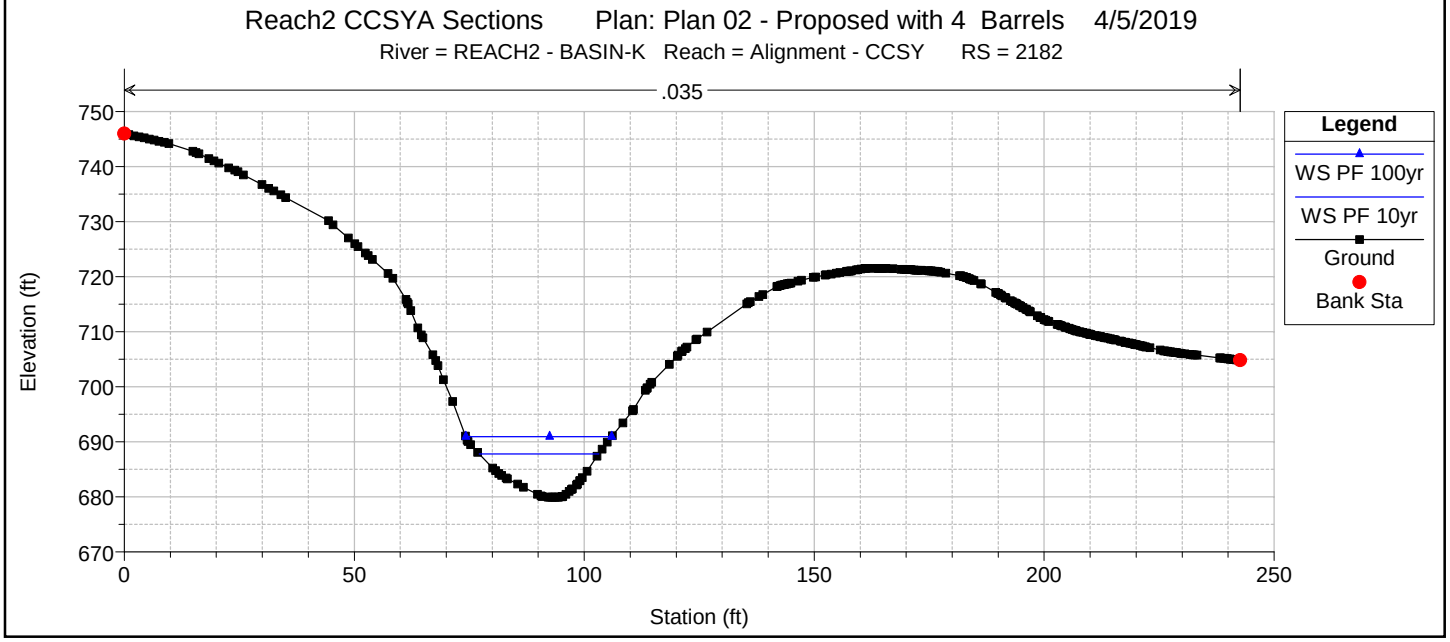
.035
0
3
5
Legend
WS PF 100yr
WS PF 10yr
Ground
Bank Sta
Elevation (ft)
770
760
750
740
730
720
710
700
0
50
100
150
200
Station (ft)


Reach2 CCSYA Sections Plan: Plan 02 - Proposed with 4 Barrels 4/5/2019
River = REACH2 - BASIN-K Reach = Alignment - CCSY RS = 2241
.035
Legend
WS PF 100yr
WS PF 10yr
Ground
Bank Sta
Elevation (ft)
780
760
740
720
700
680
0
50
100
150
200
250
Station (ft)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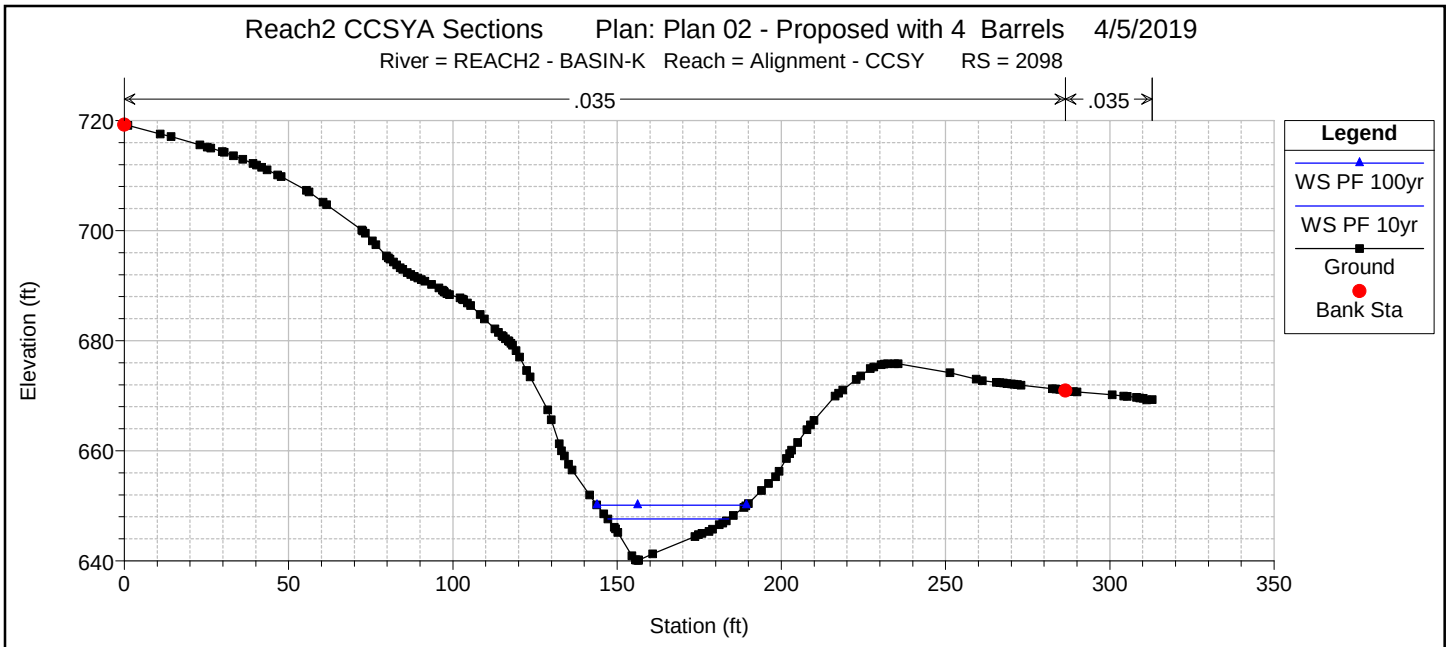
.035
Legend
WS PF 100yr
WS PF 10yr
Ground
Bank Sta
Elevation (ft)
750
740
730
720
710
700
690
680
670
0
50
100
150
200
250
Station (ft)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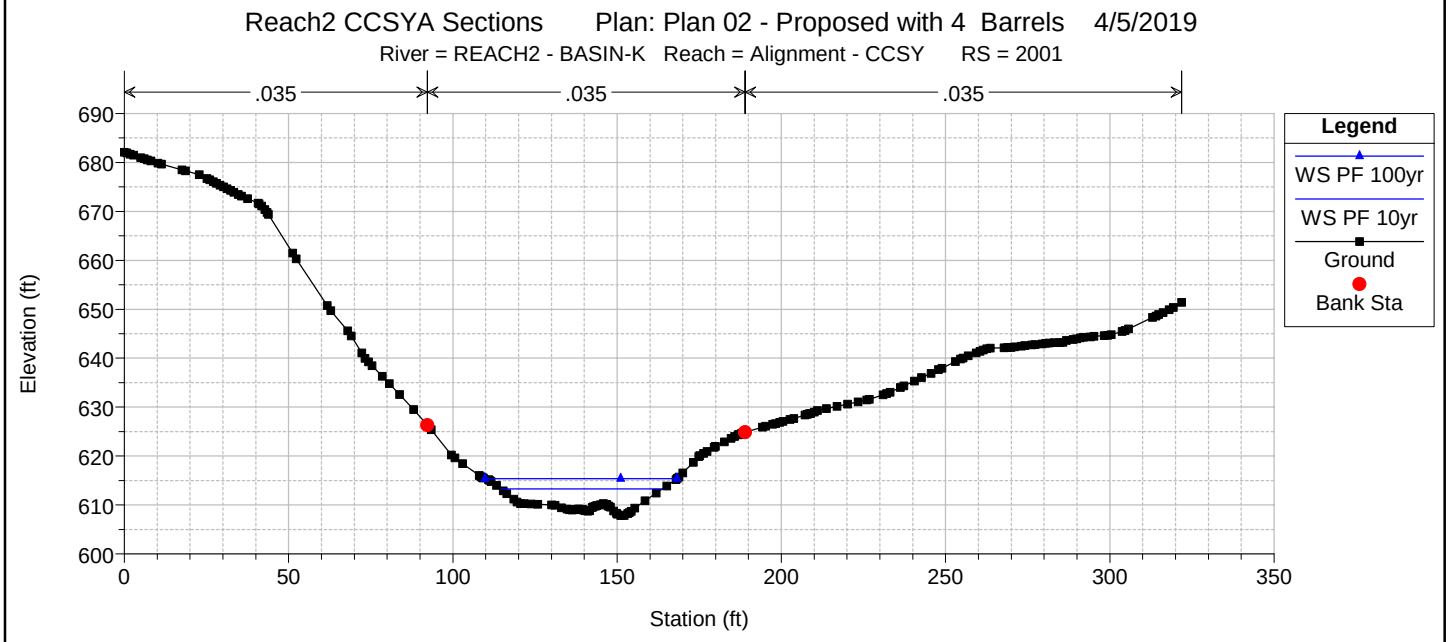
.035
.035
Legend
WS PF 100yr
WS PF 10yr
Ground
Bank Sta
Elevation (ft)
720
700
680
660
640
0
50
100
150
200
250
300
350
Station (ft)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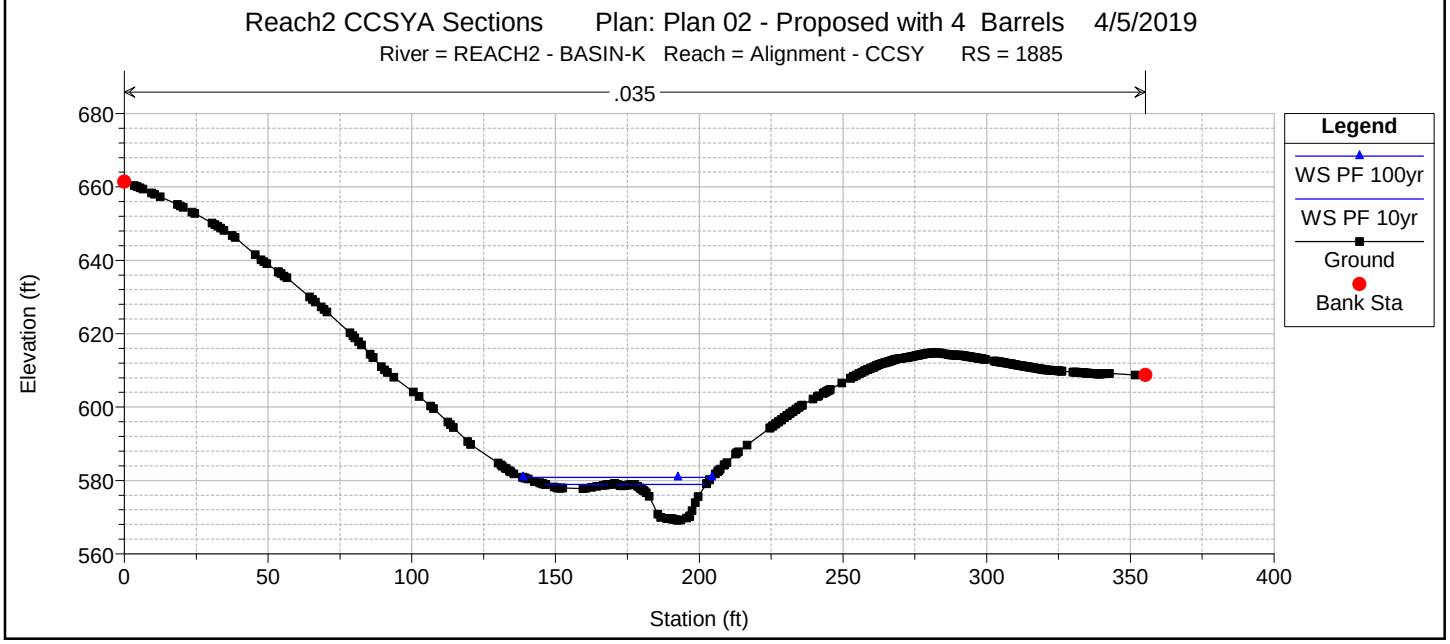
.035
.035
.035
Legend
WS PF 100yr
WS PF 10yr
Ground
Bank Sta
Elevation (ft)
690
680
670
660
650
640
630
620
610
600
0
50
100
150
200
250
300
350
Station (ft)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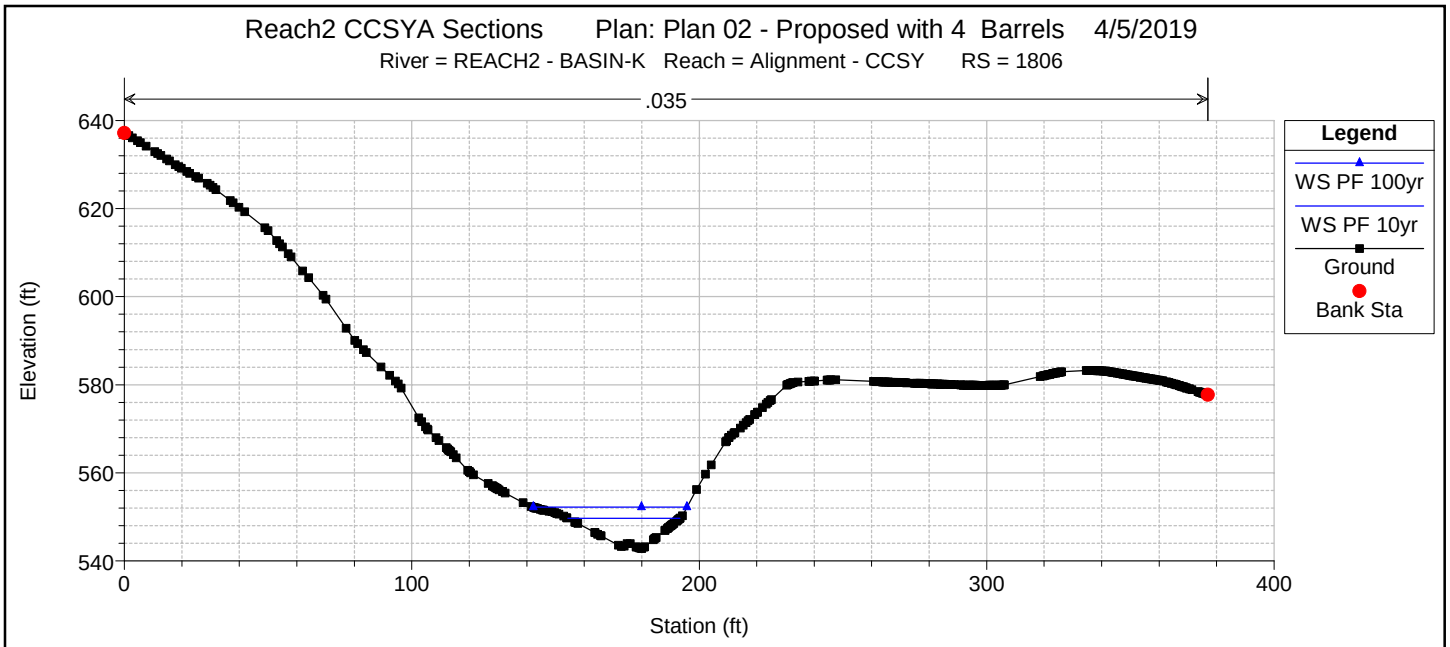
.035
Legend
WS PF 100yr
WS PF 10yr
Ground
Bank Sta
Elevation (ft)
680
660
640
620
600
580
560
0
50
100
150
200
250
300
350
400
Station (ft)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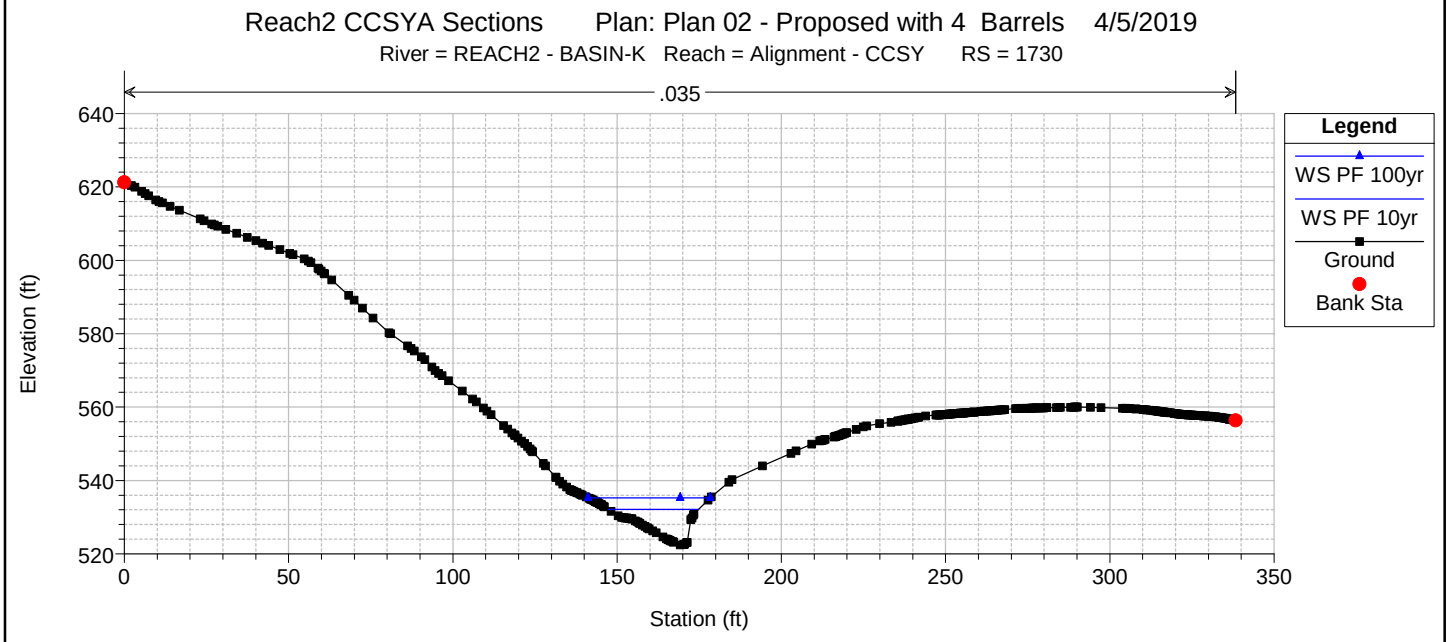
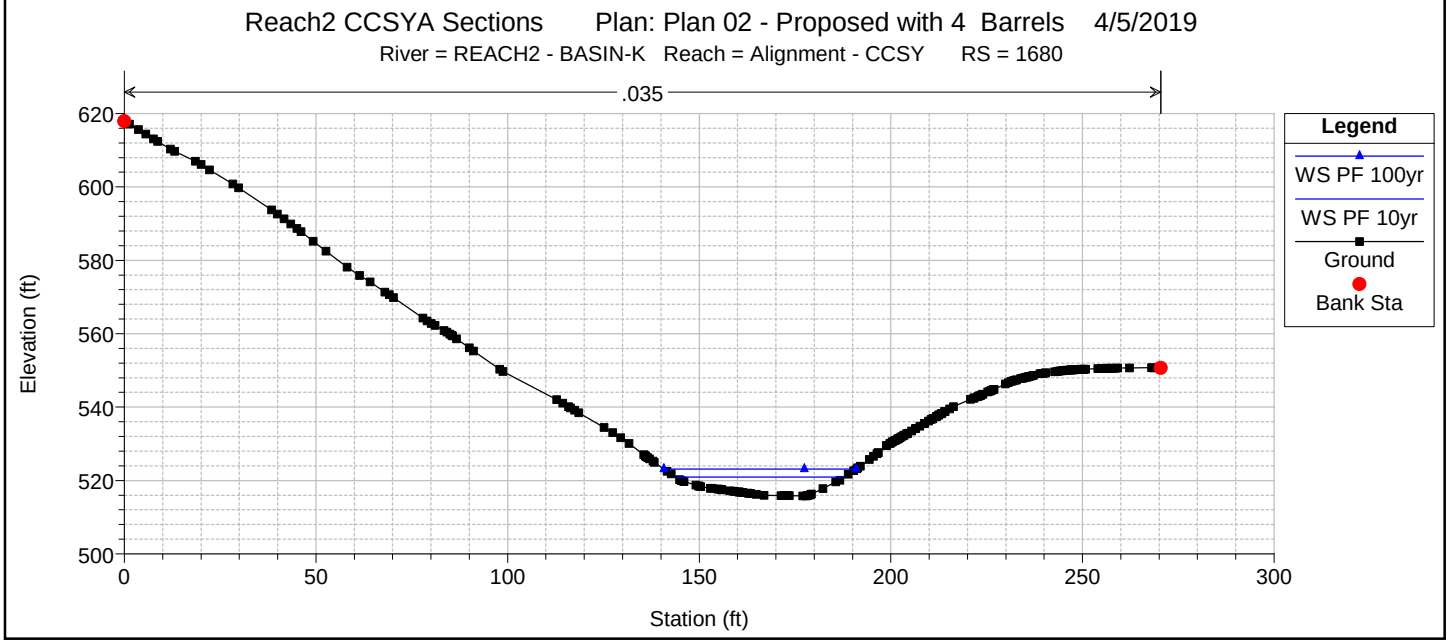
.035
Legend
WS PF 100yr
WS PF 10yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
640
620
600
580
560
540
0
100
200
300
400


Reach2 CCSYA Sections Plan: Plan 02 - Proposed with 4 Barrels 4/5/2019
River = REACH2 - BASIN-K Reach = Alignment - CCSY RS = 1730
.035
Legend
WS PF 100yr
WS PF 10yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
640
620
600
580
560
540
520
0
50
100
150
200
250
300
350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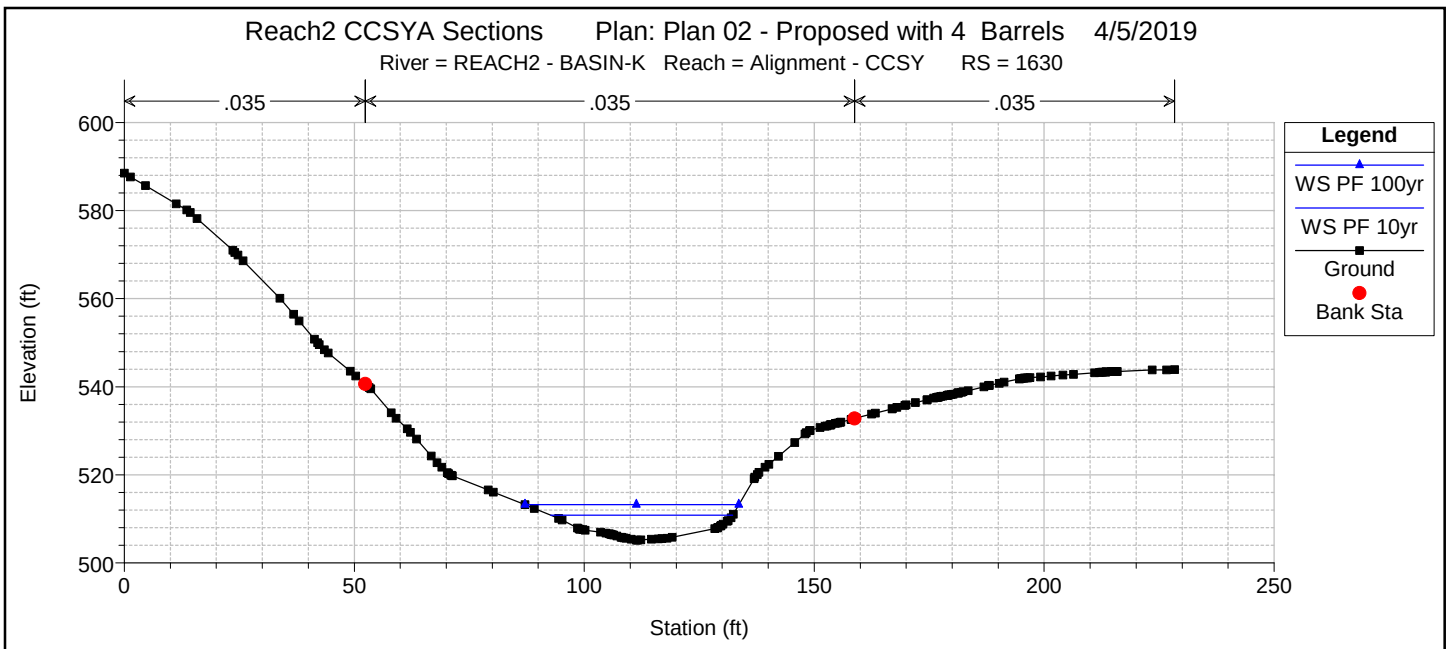
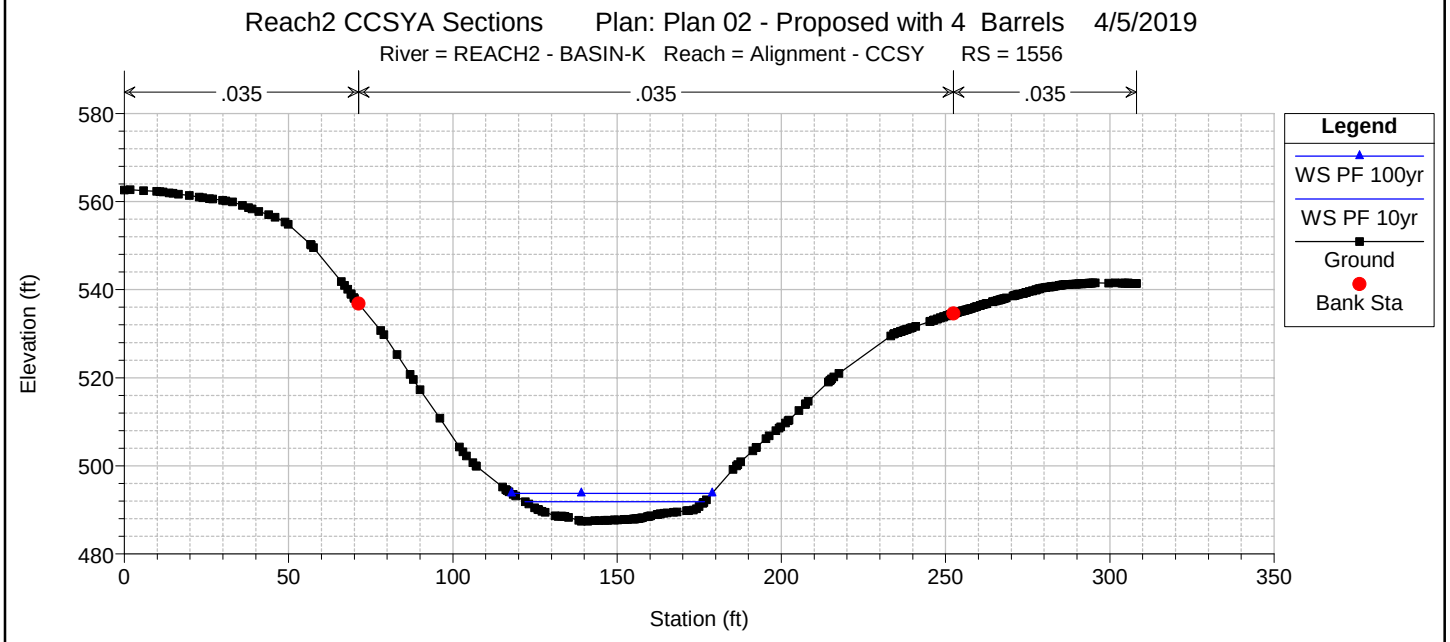
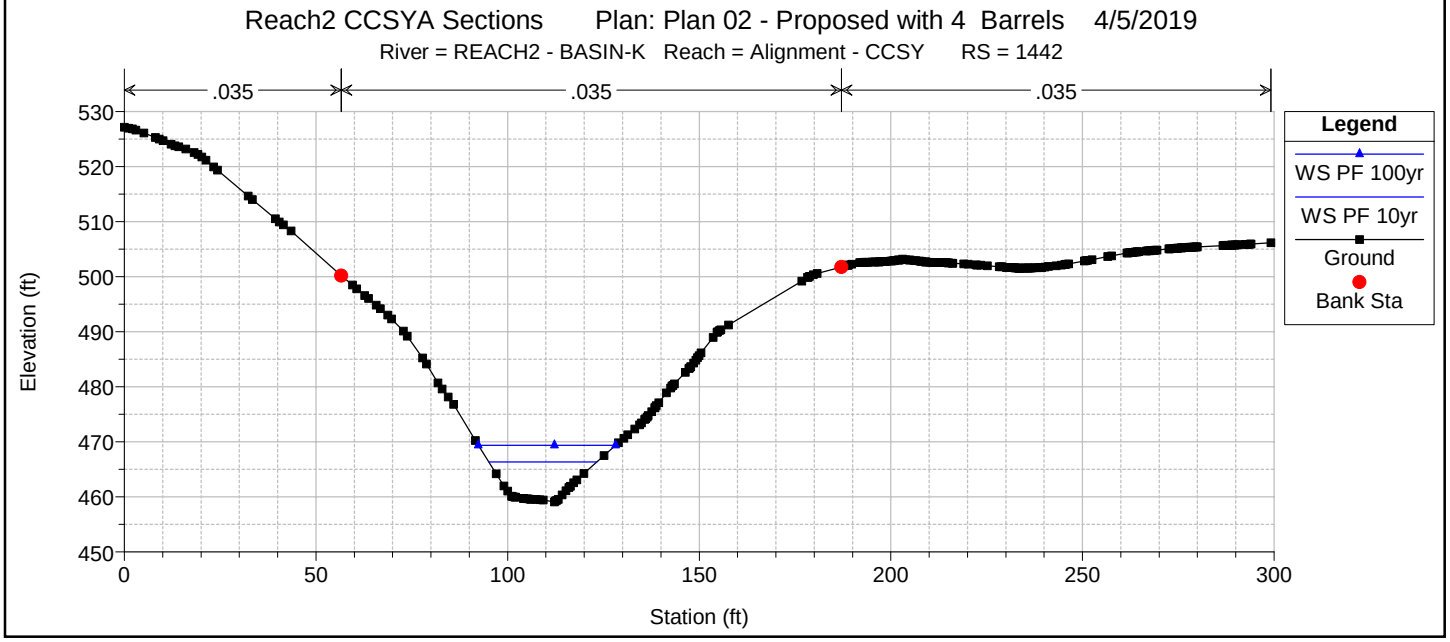
River = REACH2 - BASIN-K Reach = Alignment - CCSY RS = 1680
.035
Legend
WS PF 100yr
WS PF 10yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
620
600
580
560
540
520
500
0
50
100
150
200
250
300


Reach2 CCSYA Sections Plan: Plan 02 - Proposed with 4 Barrels 4/5/2019
River = REACH2 - BASIN-K Reach = Alignment - CCSY RS = 1630
.035
.035
.035
Legend
WS PF 100yr
WS PF 10yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
600
580
560
540
520
500
0
50
100
150
200
250


Reach2 CCSYA Sections Plan: Plan 02 - Proposed with 4 Barrels 4/5/2019
River = REACH2 - BASIN-K Reach = Alignment - CCSY RS = 1556
.035
.035
.035
Legend
WS PF 100yr
WS PF 10yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
580
560
540
520
500
480
0
50
100
150
200
250
300
350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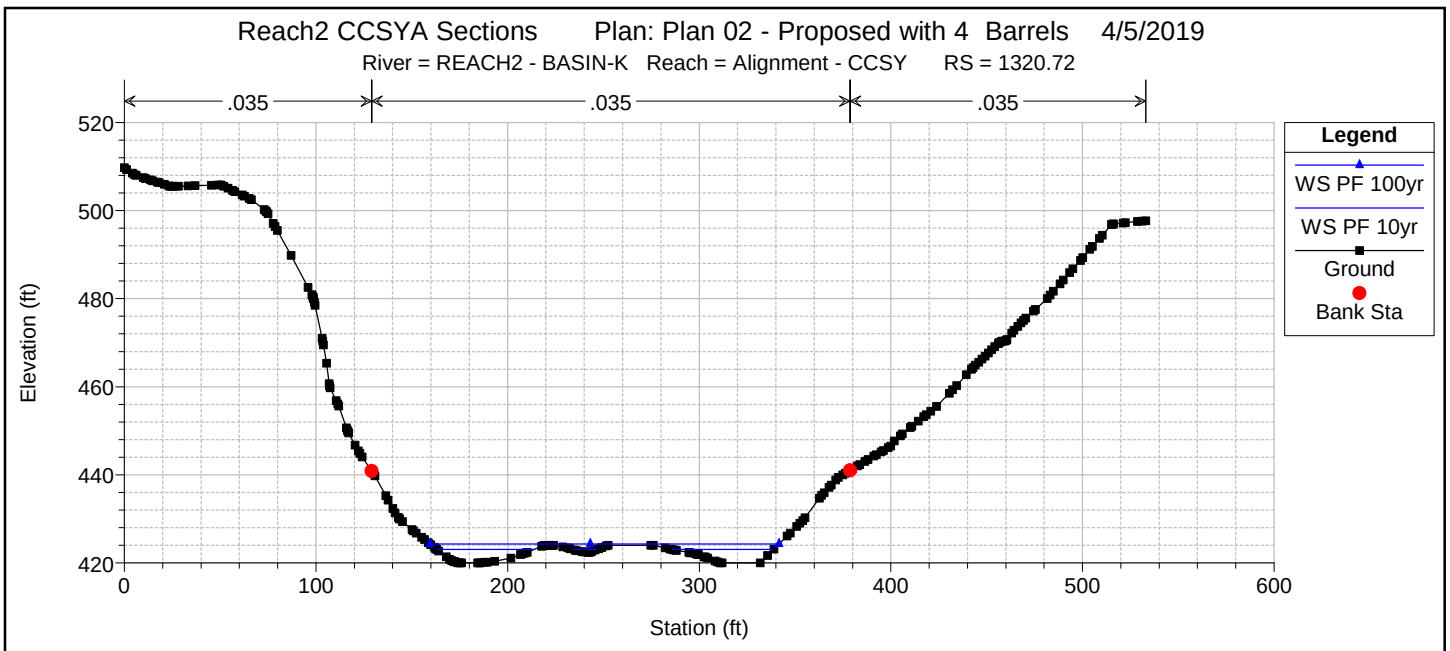
River = REACH2 - BASIN-K Reach = Alignment - CCSY RS = 1442
.035
.035
.035
Legend
WS PF 100yr
WS PF 10yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
530
520
510
500
490
480
470
460
450
0
50
100
150
200
250
300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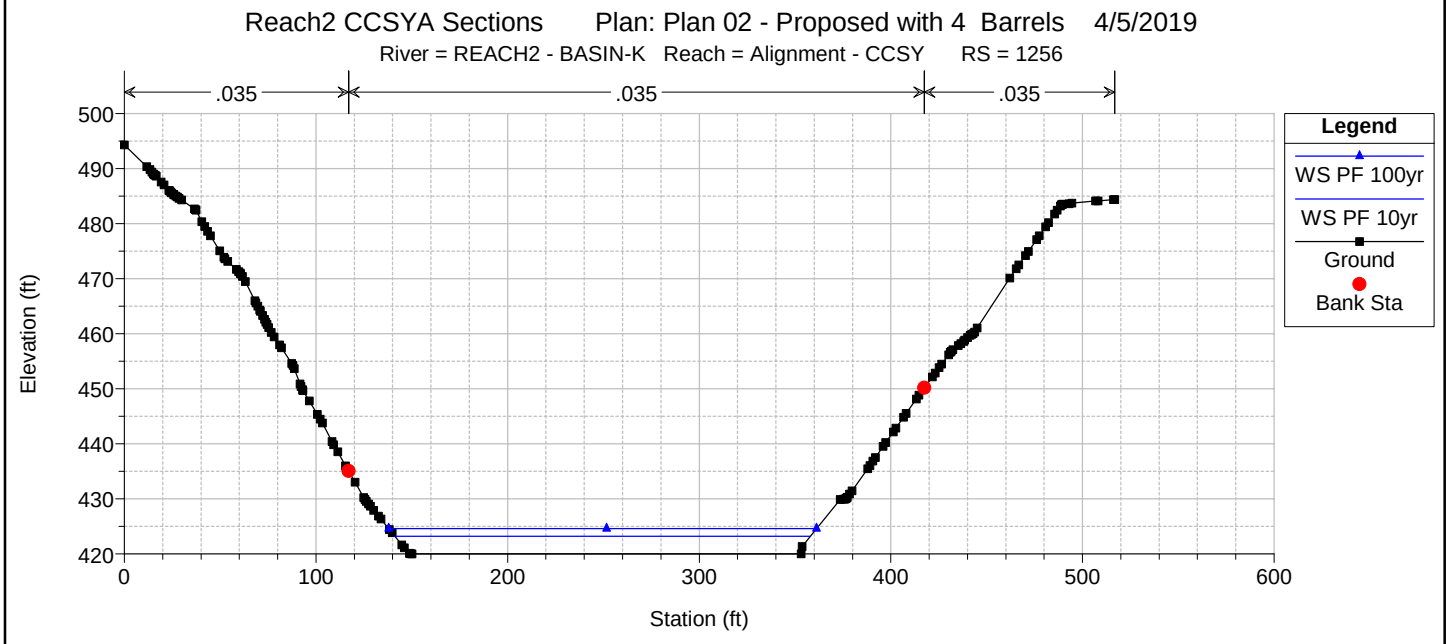
.035
.035
.035
Legend
WS PF 100yr
WS PF 10yr
Ground
Bank Sta
Elevation (ft)
Station (ft)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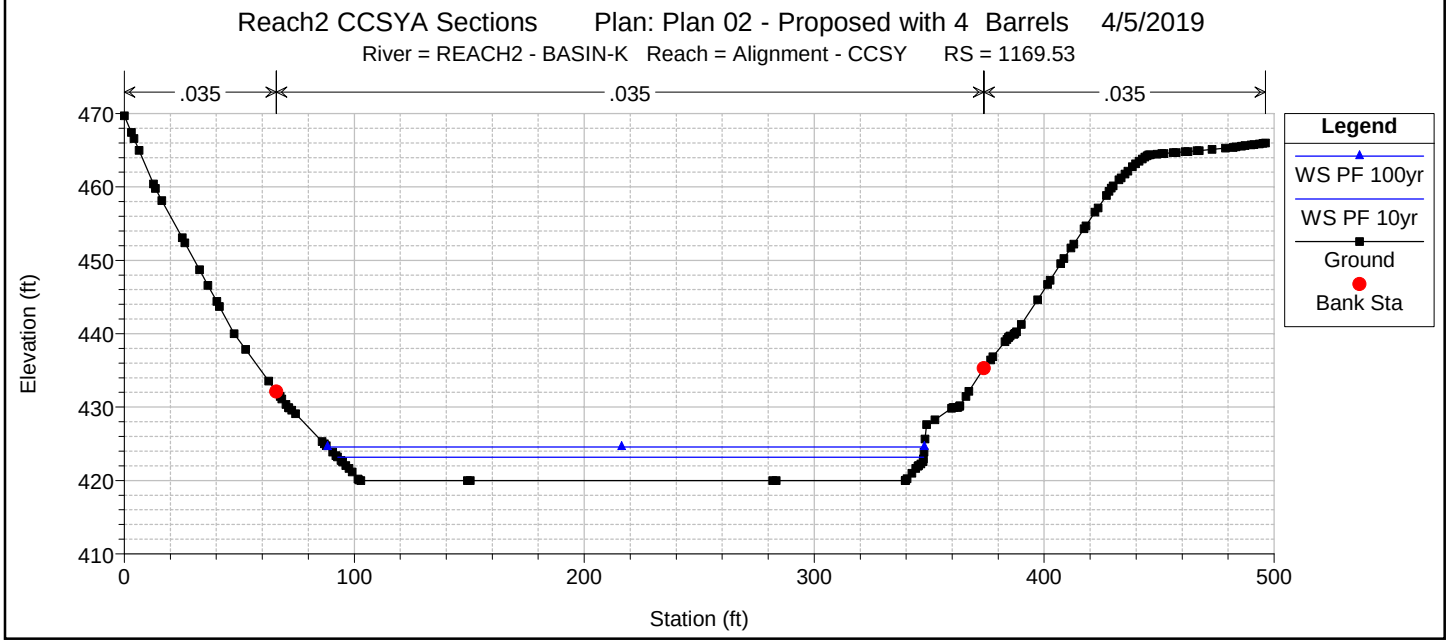
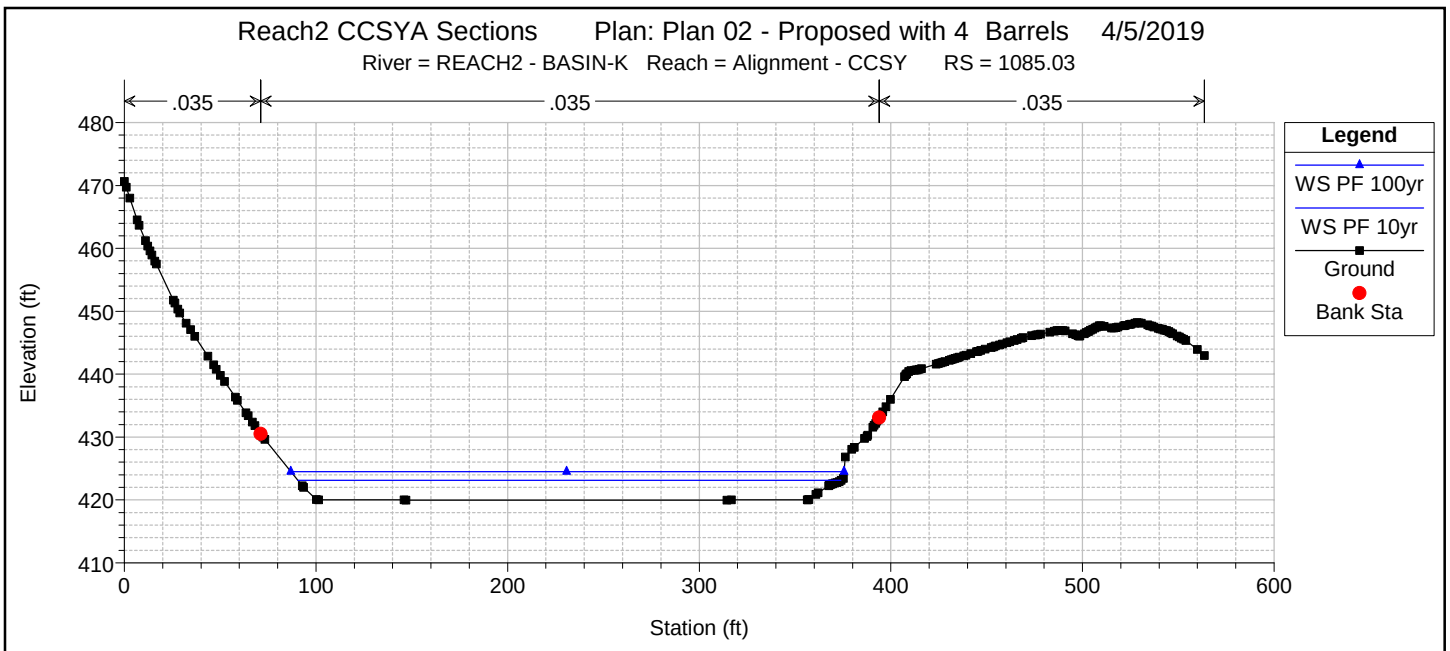
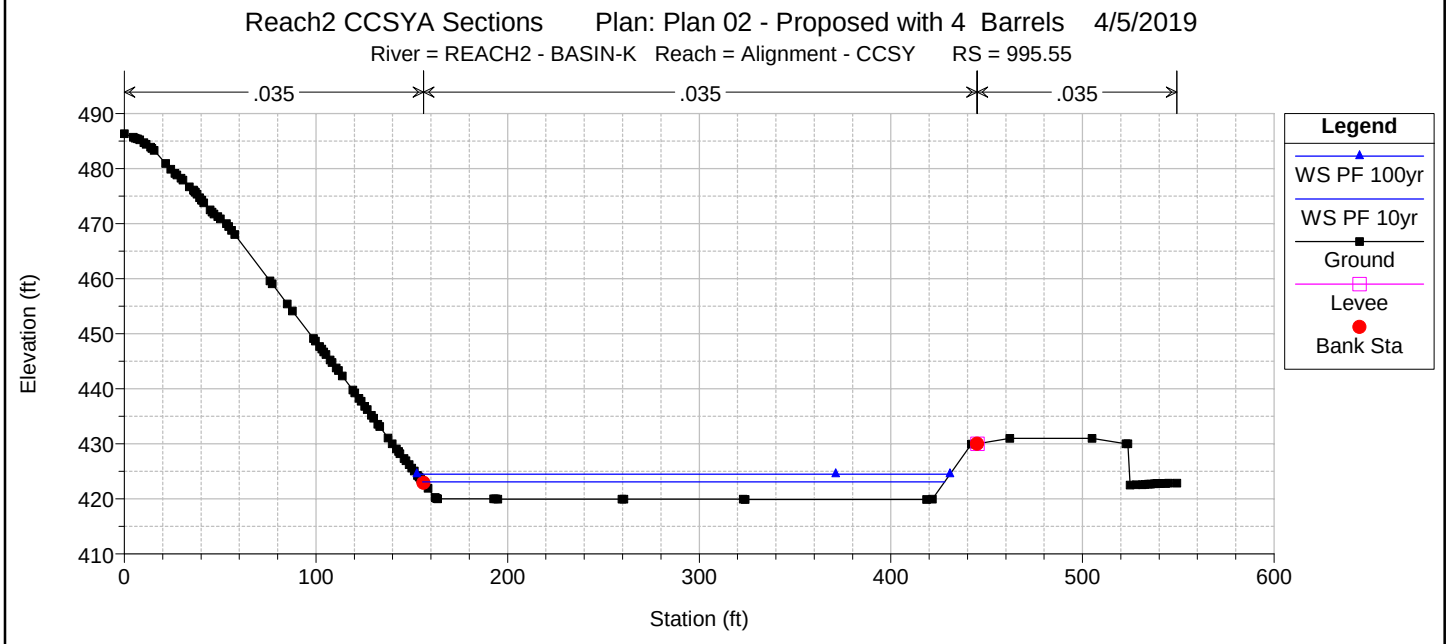
River = REACH2 - BASIN-K Reach = Alignment - CCSY RS = 1256
.035
.035
.035
Legend
WS PF 100yr
WS PF 10yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


Reach2 CCSYA Sections Plan: Plan 02 - Proposed with 4 Barrels 4/5/2019
River = REACH2 - BASIN-K Reach = Alignment - CCSY RS = 1169.53
.035
.035
.035
Legend
WS PF 100yr
WS PF 10yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


Reach2 CCSYA Sections Plan: Plan 02 - Proposed with 4 Barrels 4/5/2019
River = REACH2 - BASIN-K Reach = Alignment - CCSY RS = 1085.03
.035
.035
.035
Legend
WS PF 100yr
WS PF 10yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


Reach2 CCSYA Sections Plan: Plan 02 - Proposed with 4 Barrels 4/5/2019
River = REACH2 - BASIN-K Reach = Alignment - CCSY RS = 995.55
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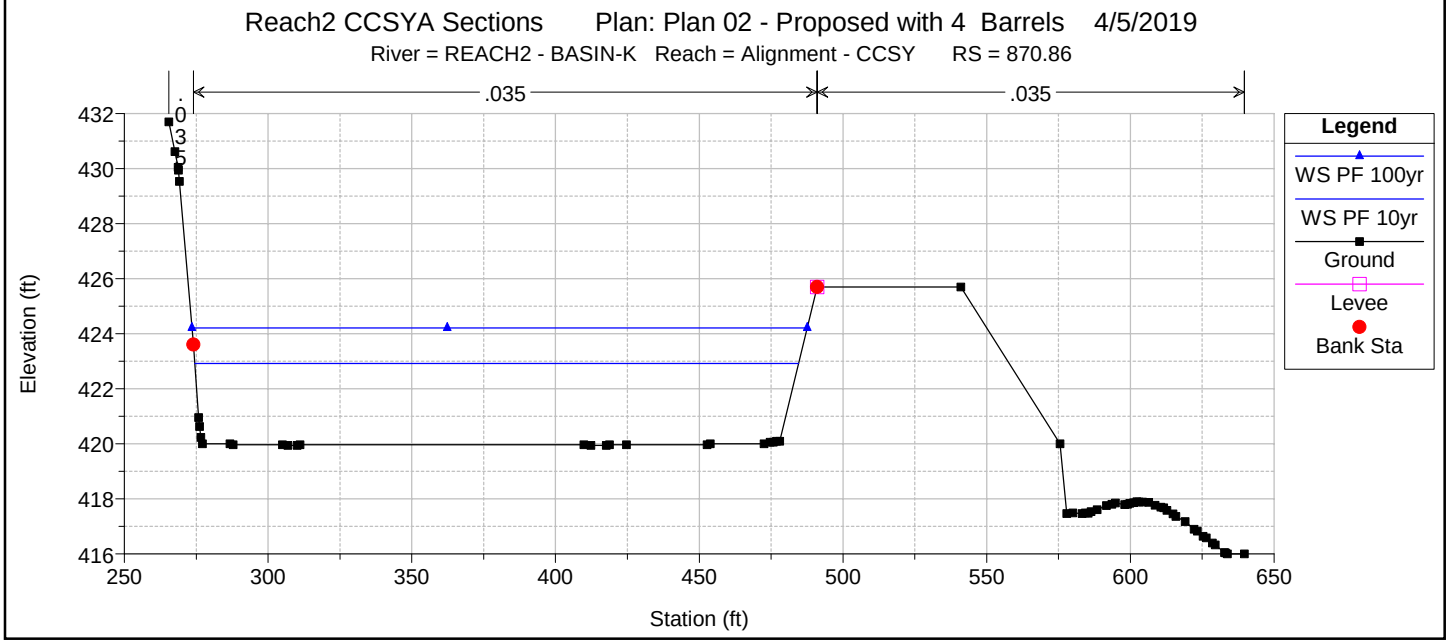
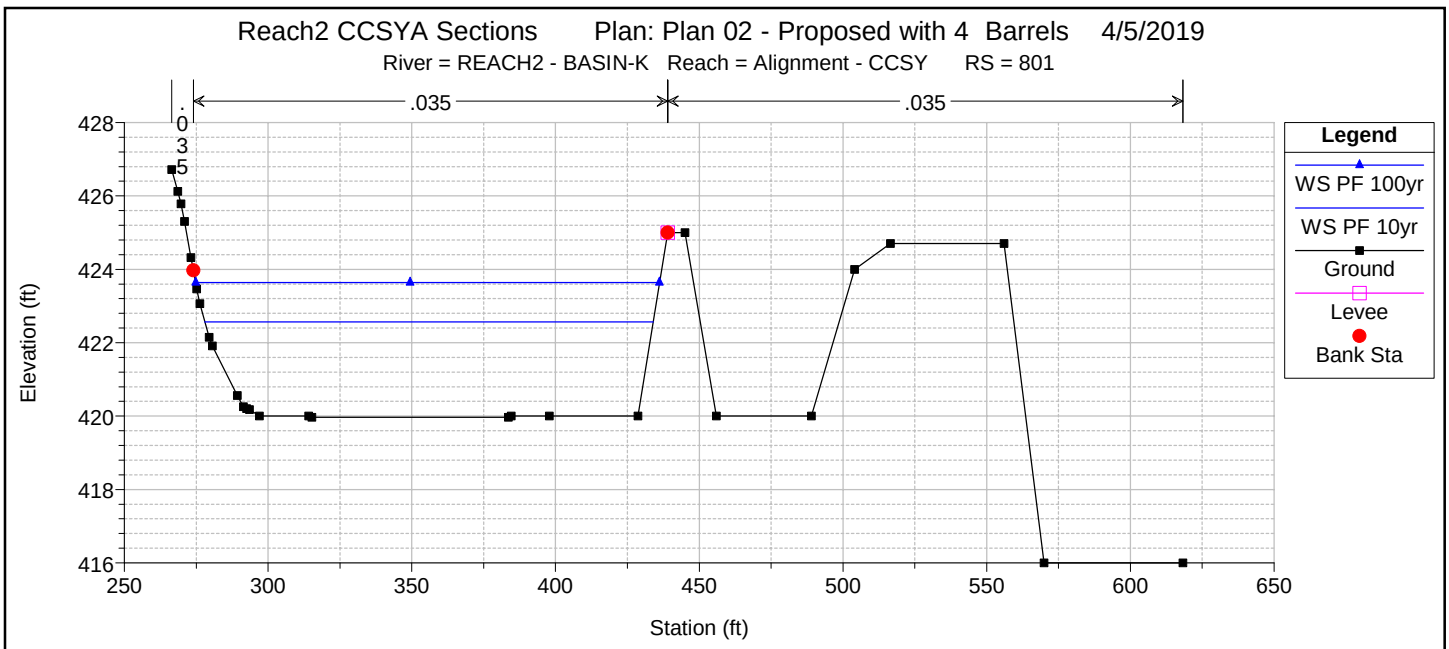
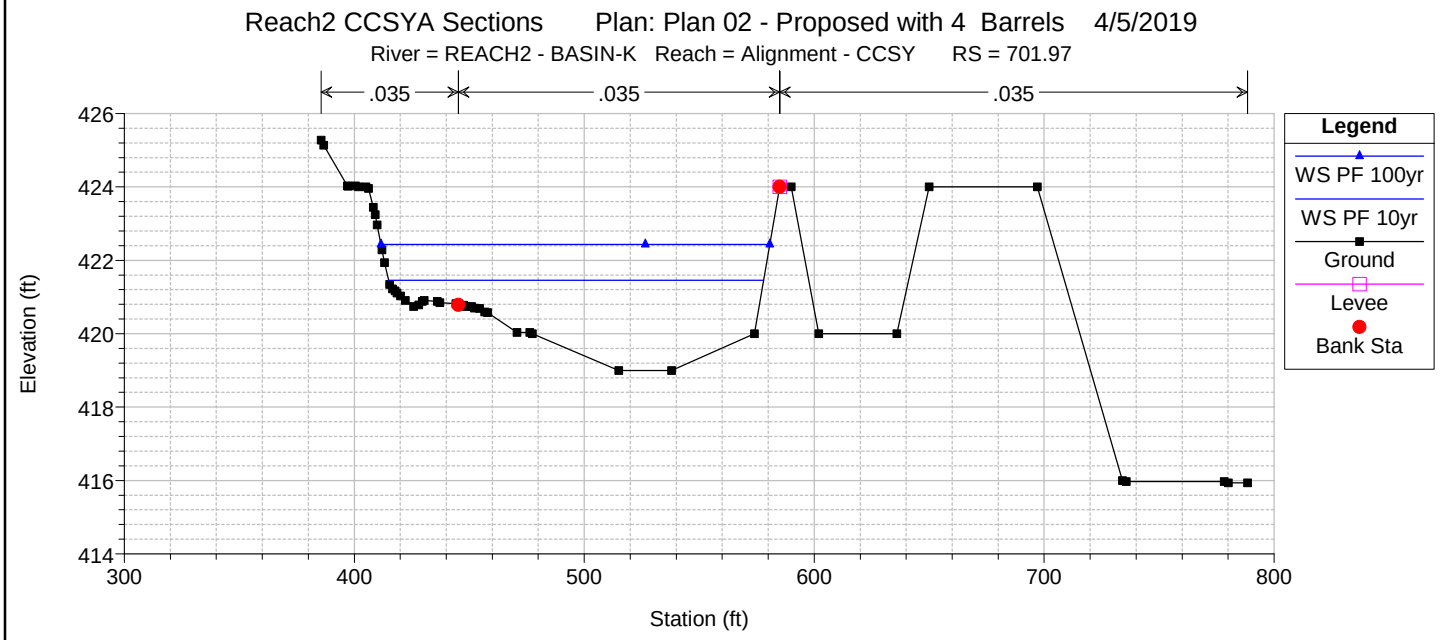
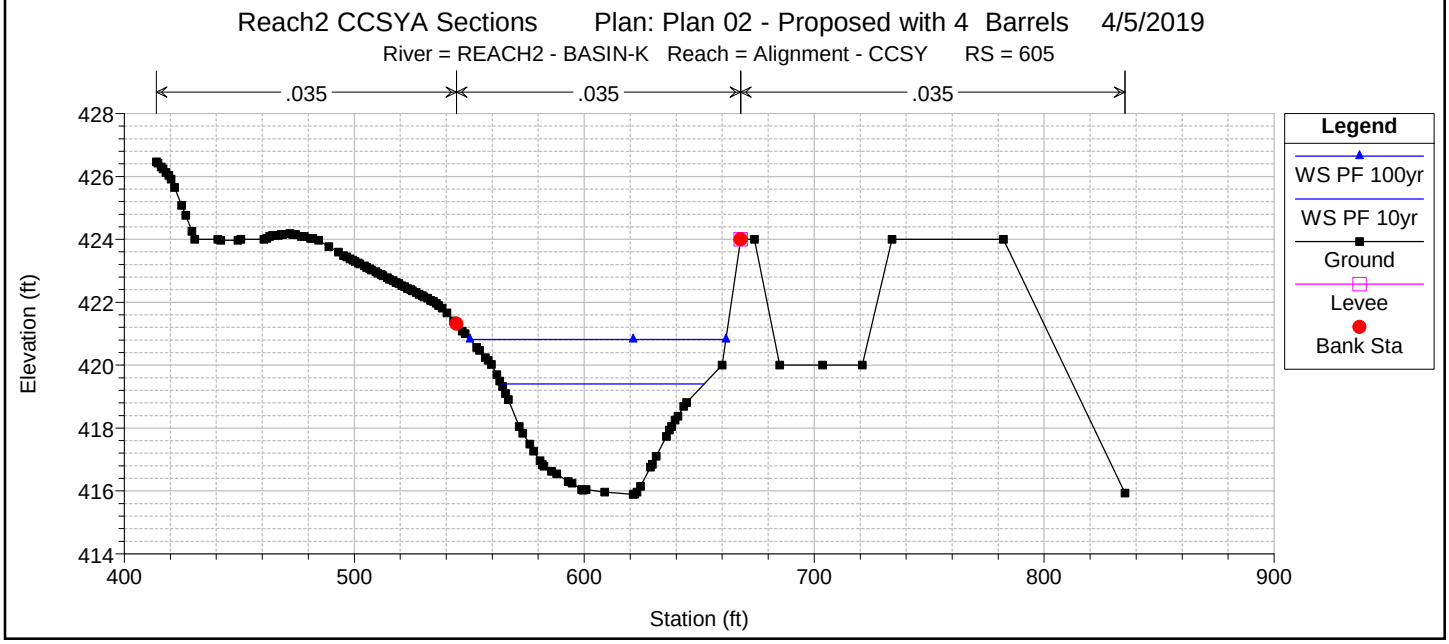
.035
Legend
WS PF 100yr
WS PF 10yr
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)


Reach2 CCSYA Sections Plan: Plan 02 - Proposed with 4 Barrels 4/5/2019
River = REACH2 - BASIN-K Reach = Alignment - CCSY RS = 870.86
.035
.035
Legend
WS PF 100yr
WS PF 10yr
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)


Reach2 CCSYA Sections Plan: Plan 02 - Proposed with 4 Barrels 4/5/2019
River = REACH2 - BASIN-K Reach = Alignment - CCSY RS = 801
.035
.035
Legend
WS PF 100yr
WS PF 10yr
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)


Reach2 CCSYA Sections Plan: Plan 02 - Proposed with 4 Barrels 4/5/2019
River = REACH2 - BASIN-K Reach = Alignment - CCSY RS = 701.97
.035
.035
.035
Legend
WS PF 100yr
WS PF 10yr
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)


Reach2 CCSYA Sections Plan: Plan 02 - Proposed with 4 Barrels 4/5/2019
River = REACH2 - BASIN-K Reach = Alignment - CCSY RS = 605
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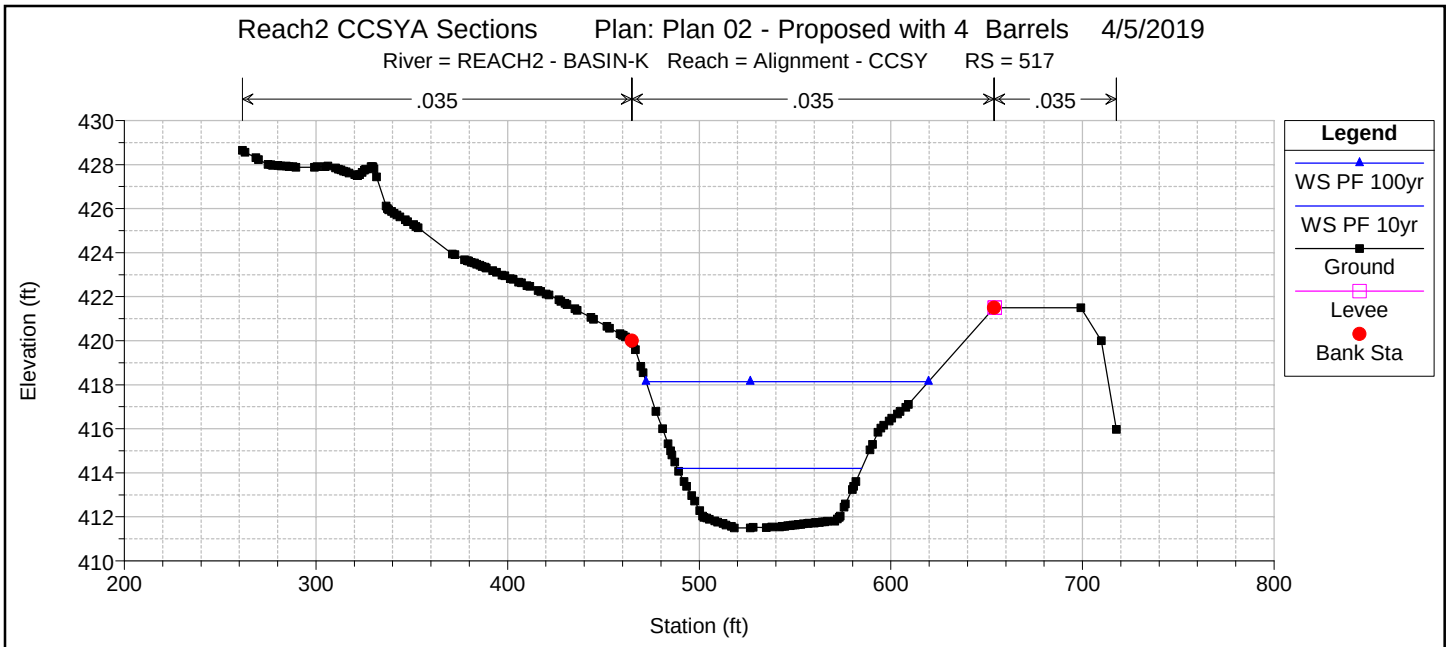
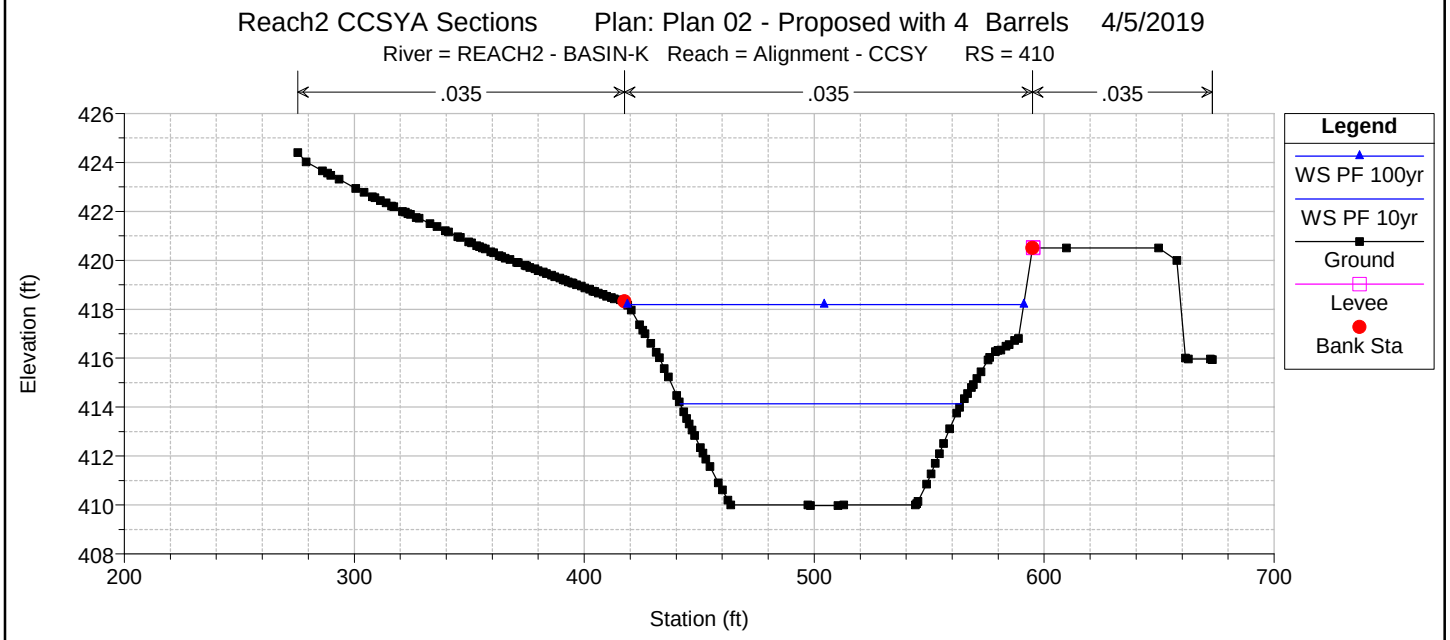
Legend
WS PF 100yr
WS PF 10yr
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)


Reach2 CCSYA Sections Plan: Plan 02 - Proposed with 4 Barrels 4/5/2019
River = REACH2 - BASIN-K Reach = Alignment - CCSY RS = 517
.035
.035
.035
Elevation (ft)
Station (ft)
Legend
WS PF 100yr
WS PF 10yr
Ground
Levee
Bank Sta


Reach2 CCSYA Sections Plan: Plan 02 - Proposed with 4 Barrels 4/5/2019
River = REACH2 - BASIN-K Reach = Alignment - CCSY RS = 410
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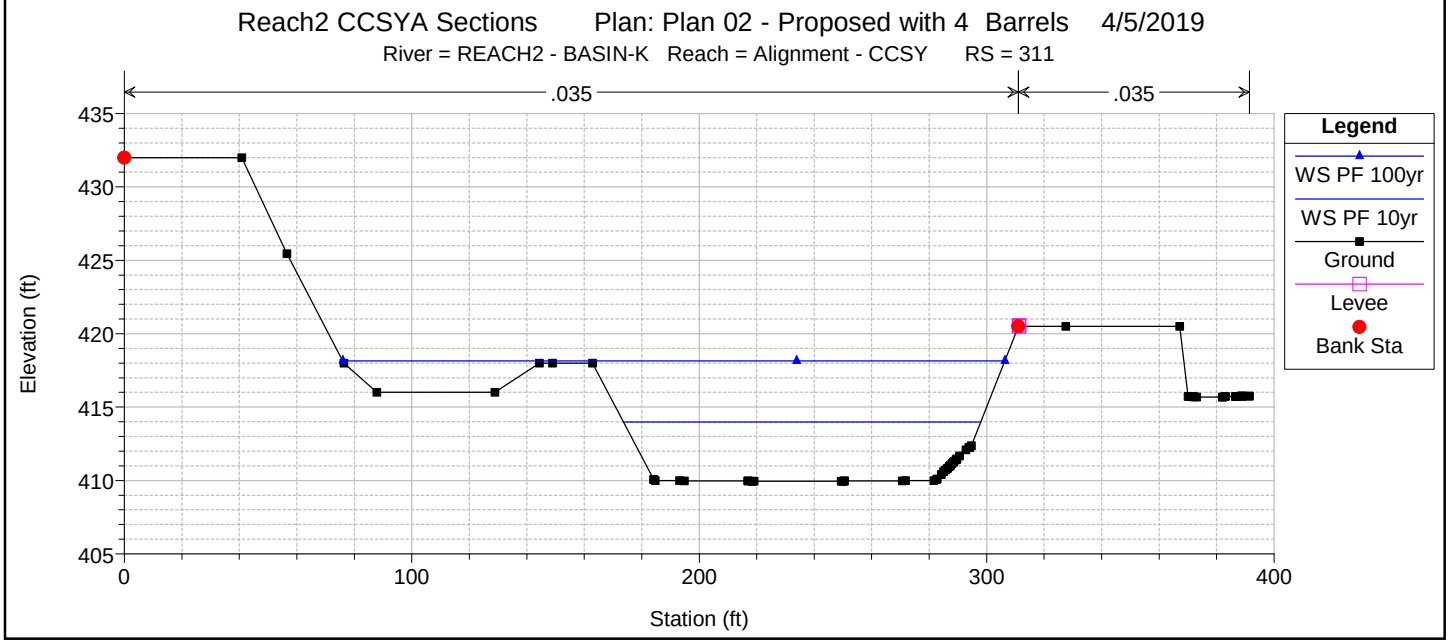
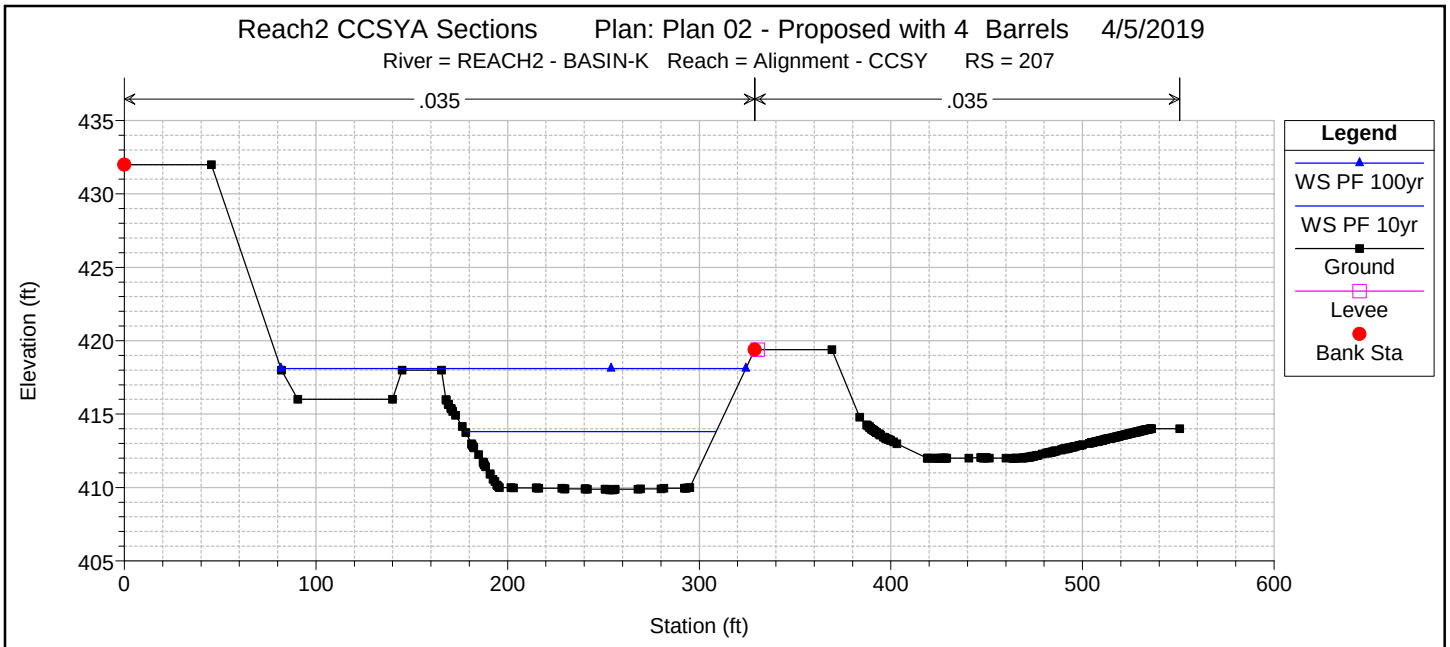
.035
.035
Elevation (ft)
Station (ft)
Legend
WS PF 100yr
WS PF 10yr
Ground
Levee
Bank Sta


Reach2 CCSYA Sections Plan: Plan 02 - Proposed with 4 Barrels 4/5/2019
River = REACH2 - BASIN-K Reach = Alignment - CCSY RS = 311
.035
.035
Elevation (ft)
Station (ft)
Legend
WS PF 100yr
WS PF 10yr
Ground
Levee
Bank Sta


Reach2 CCSYA Sections Plan: Plan 02 - Proposed with 4 Barrels 4/5/2019
River = REACH2 - BASIN-K Reach = Alignment - CCSY RS = 207
.035
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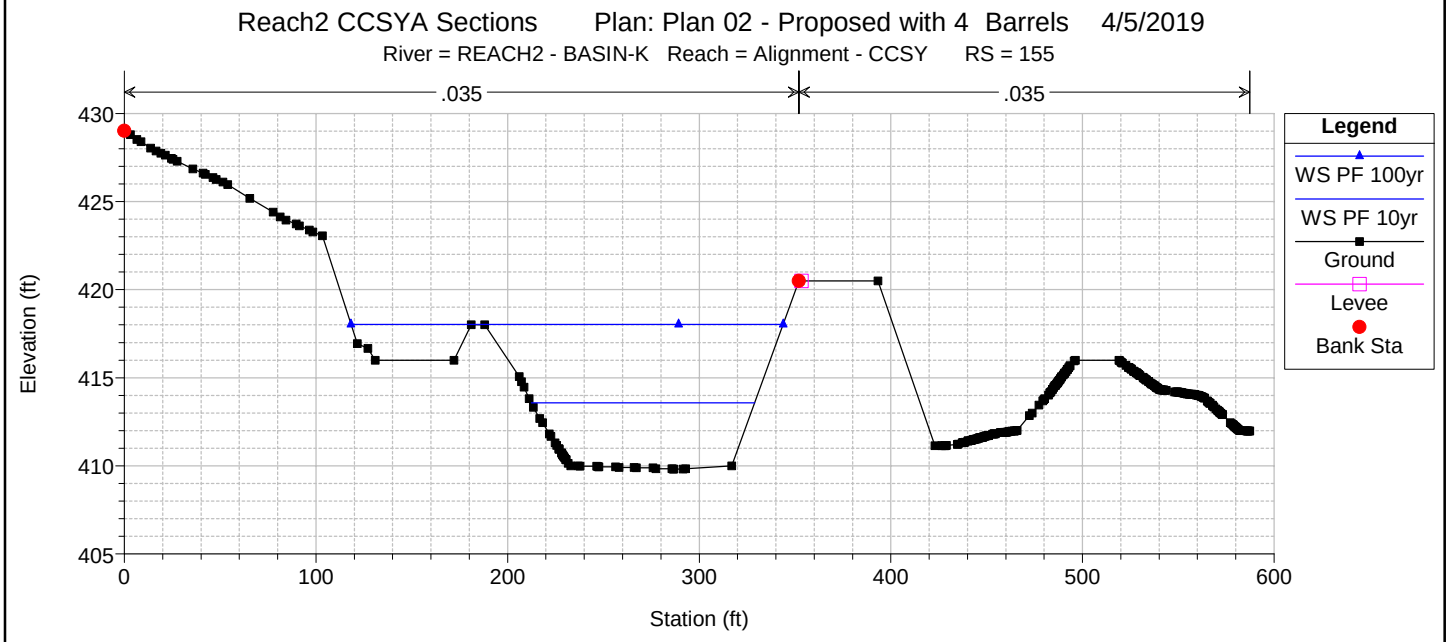
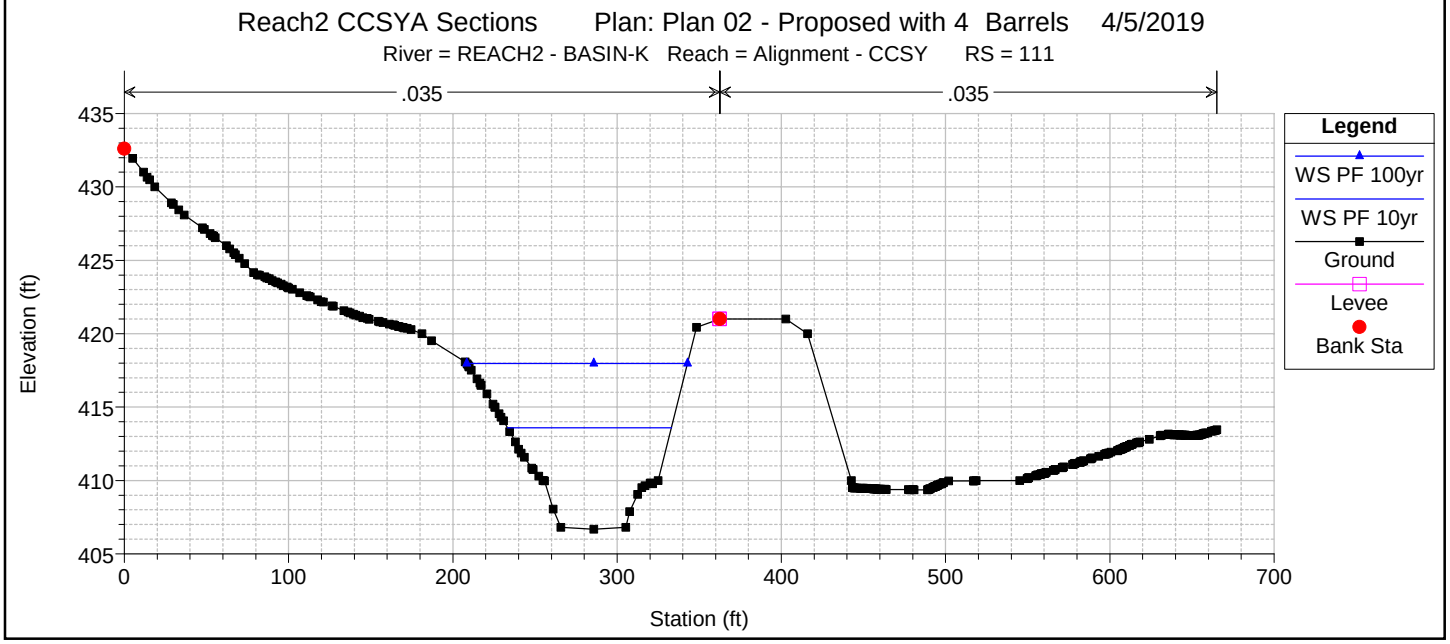
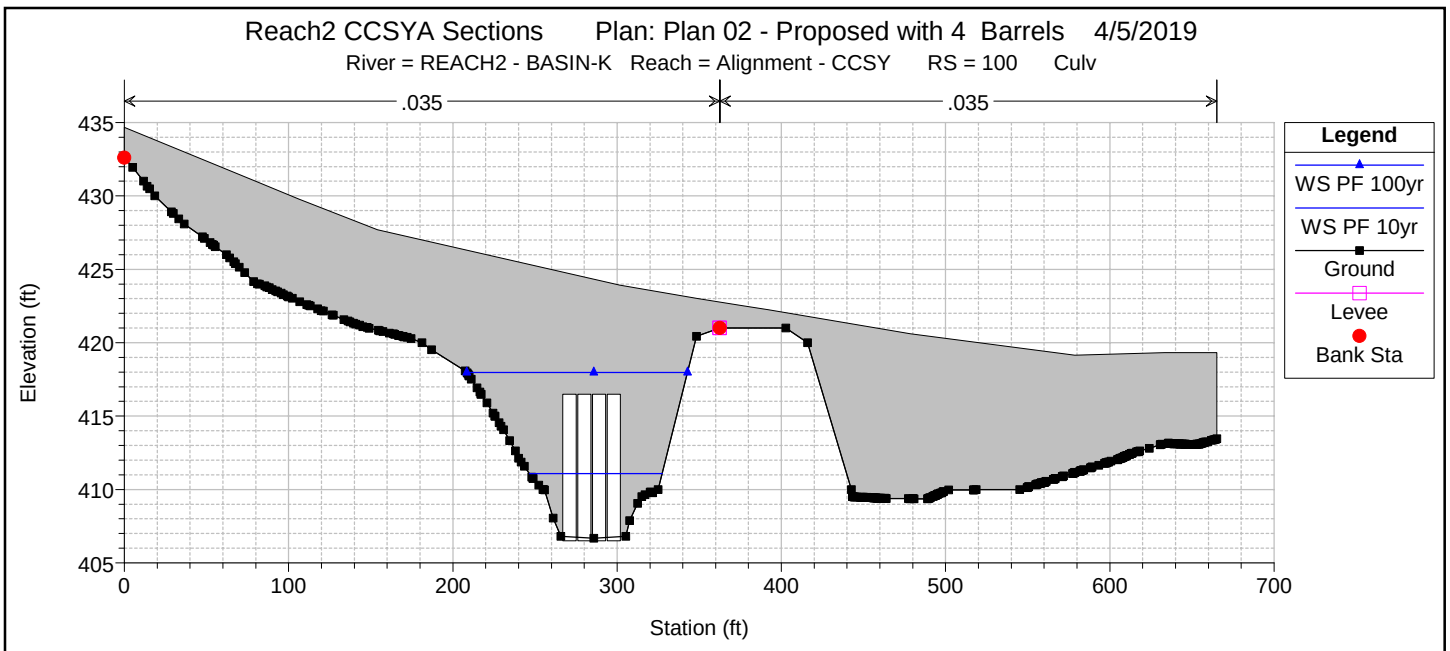
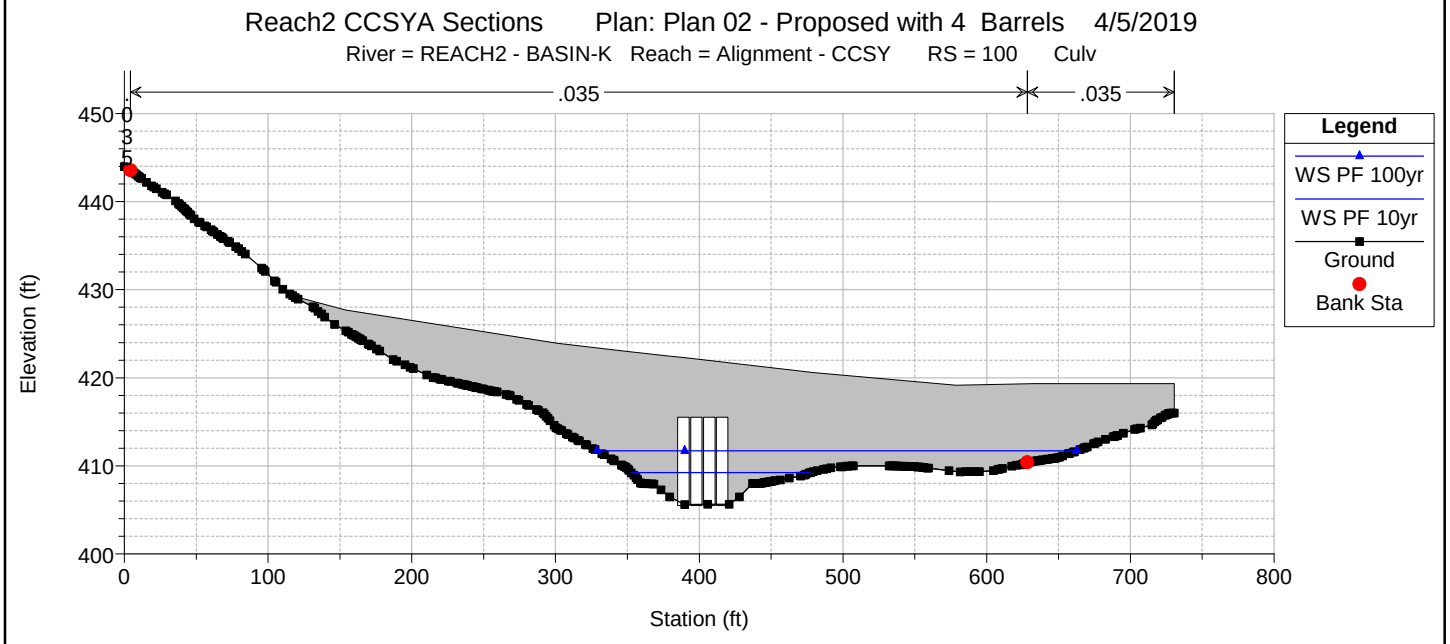
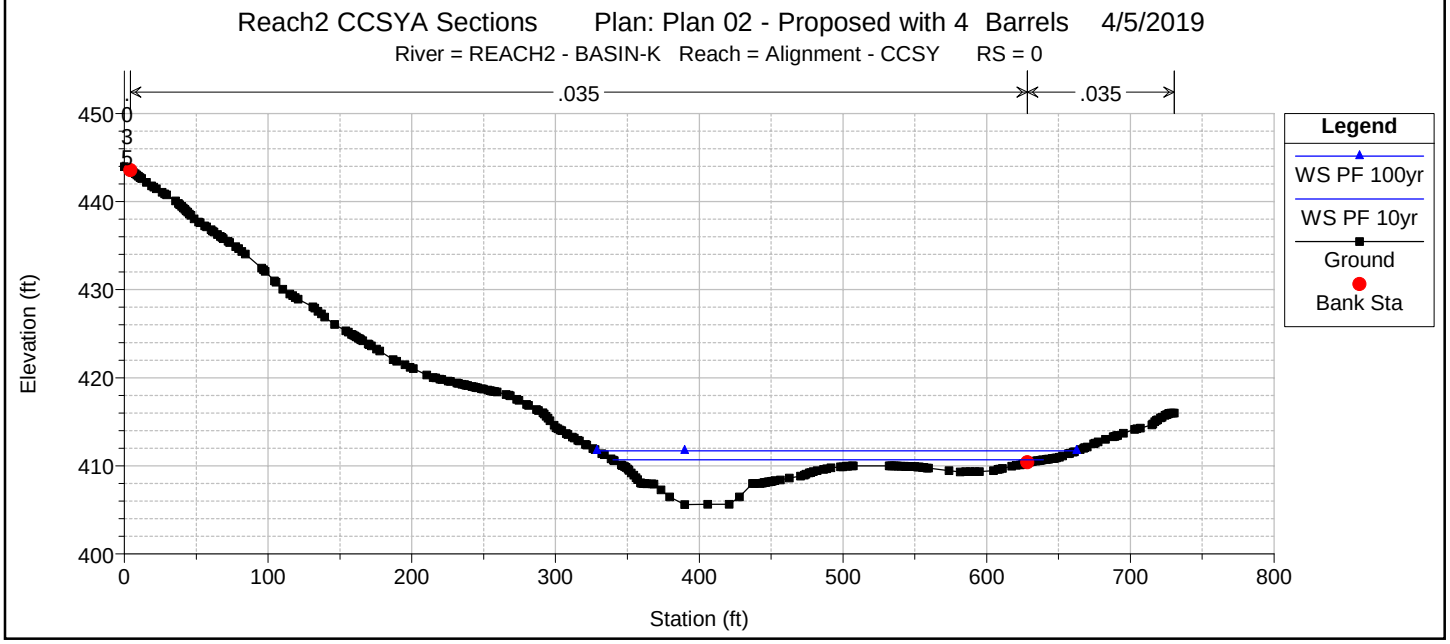
Elevation (ft)
Station (ft)
Legend
WS PF 100yr
WS PF 10yr
Ground
Levee
Bank Sta


Reach2 CCSYA Sections Plan: Plan 02 - Proposed with 4 Barrels 4/5/2019
River = REACH2 - BASIN-K Reach = Alignment - CCSY RS = 155
.035
.035
Elevation (ft)
Station (ft)
Legend
WS PF 100yr
WS PF 10yr
Ground
Levee
Bank Sta

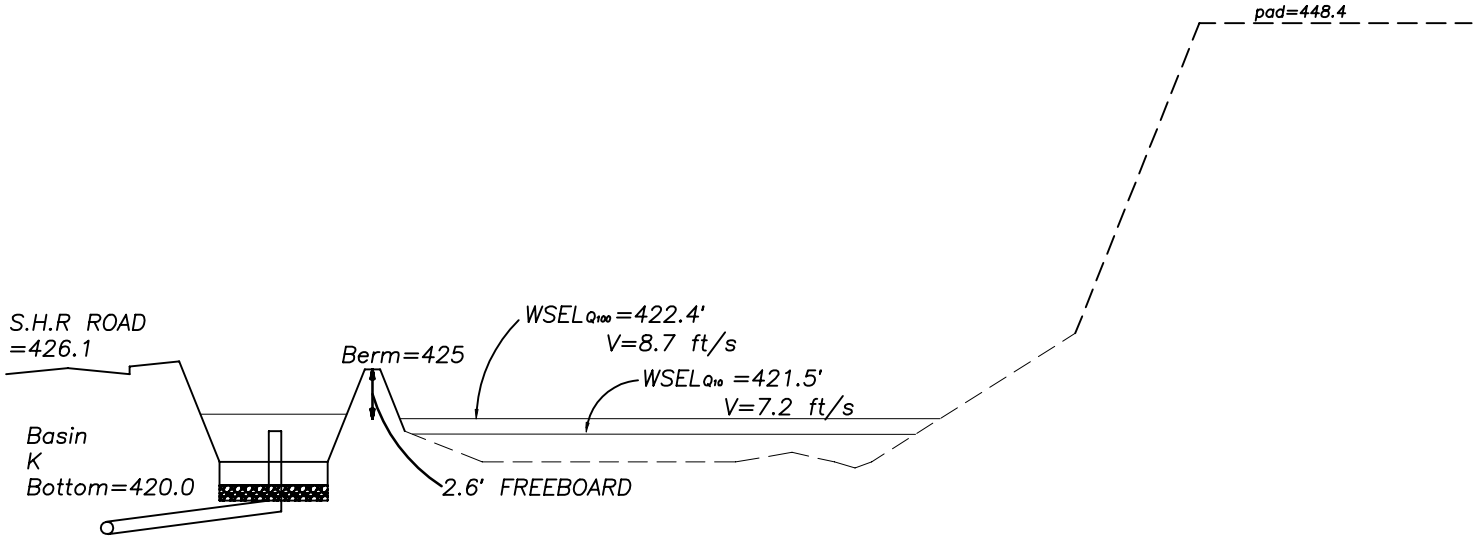

Reach2 CCSYA Sections Plan: Plan 02 - Proposed with 4 Barrels 4/5/2019
River = REACH2 - BASIN-K Reach = Alignment - CCSY RS = 111
.035
.035
Elevation (ft)
Station (ft)
Legend
WS PF 100yr
WS PF 10yr
Ground
Levee
Bank Sta


Reach2 CCSYA Sections Plan: Plan 02 - Proposed with 4 Barrels 4/5/2019
River = REACH2 - BASIN-K Reach = Alignment - CCSY RS = 100 Culv
.035
.035
Legend
WS PF 100yr
WS PF 10yr
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)


Reach2 CCSYA Sections Plan: Plan 02 - Proposed with 4 Barrels 4/5/2019
River = REACH2 - BASIN-K Reach = Alignment - CCSY RS = 100 Culv
.035
.035
Legend
WS PF 100yr
WS PF 10yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

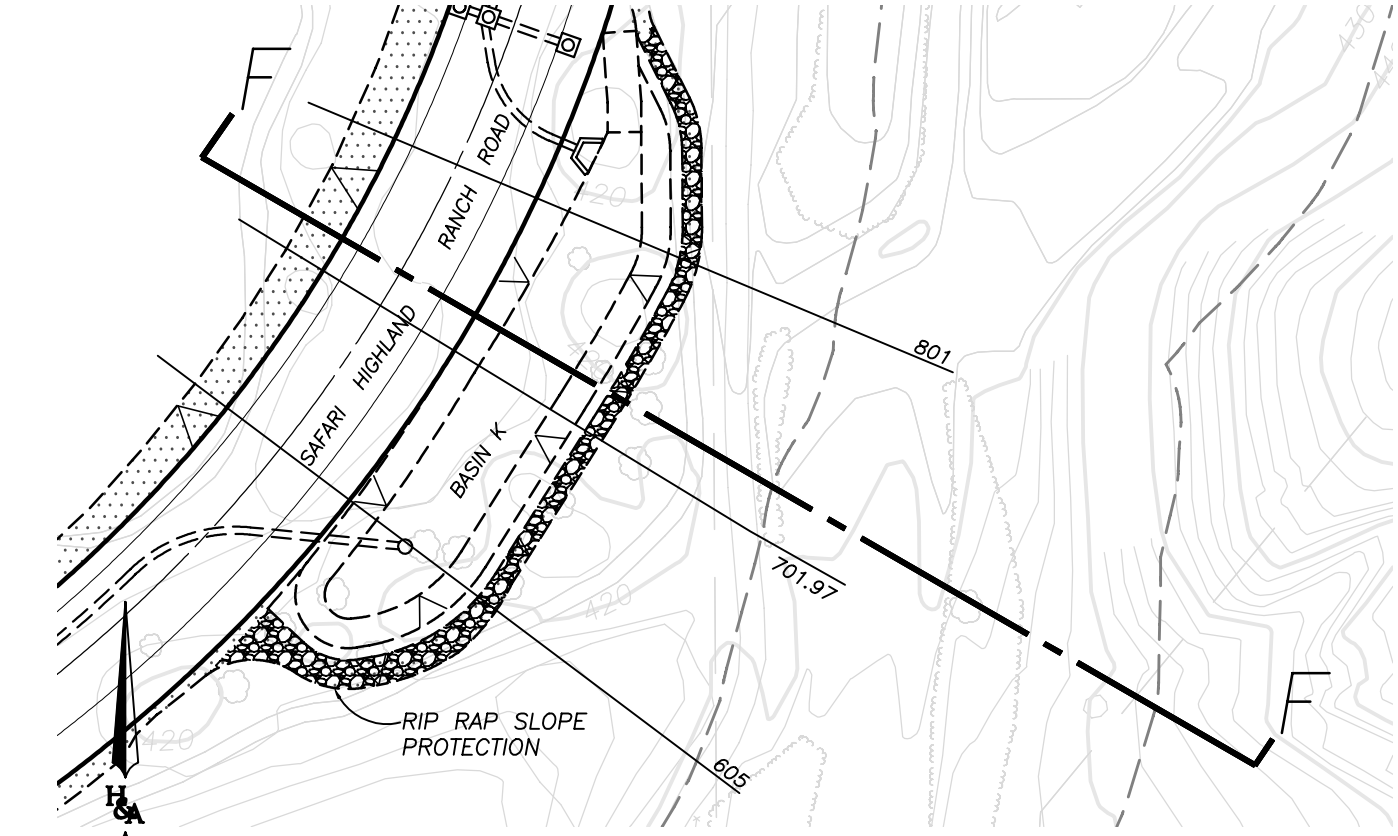

Reach2 CCSYA Sections Plan: Plan 02 - Proposed with 4 Barrels 4/5/2019
River = REACH2 - BASIN-K Reach = Alignment - CCSY RS = 0
.035
.035
Legend
WS PF 100yr
WS PF 10yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

WSEL BASIN K AND CHANNEL



SECTION F FIGURE 10.1

NOT TO SCALE



PREPARED BY: HUNSAKER & ASSOCIATES SAN DIEGO, INC. PLANNING ENGINEERING SURVEYING 9707 Waples Street San Diego, Ca 92121 PH(858)558-4500 FX(858)558-1414	PROPOSED CONDITION HYDROLOGIC WORKMAP FOR: SAFARI HIGHLANDS RANCH DRAINAGE AREA A CITY OF ESCONDIDO, CA	FIGURE *10.1*

W.O. 2374-17

Appendix 11– Super Elevation Calculation

Safari Highland Ranch

Super Elevation Calculations (Per San Diego County Drainage Design Manual)
SAFARI HEC-RAS RIVER STATION - 2366

100YR FLOW - Q_{100}	3356.00	cfs
Ceter Line WSE =	751.38	ft
Top Width =	54.95	ft
Mean Channel Velocity =	12.53	fps
Cuvature Coefficient =	0.5	(Subcritical - Trapizoidal No Transition)
Radius of Curvature =	50	ft
Gravitational Acceleration =	32.2	ft/sec2

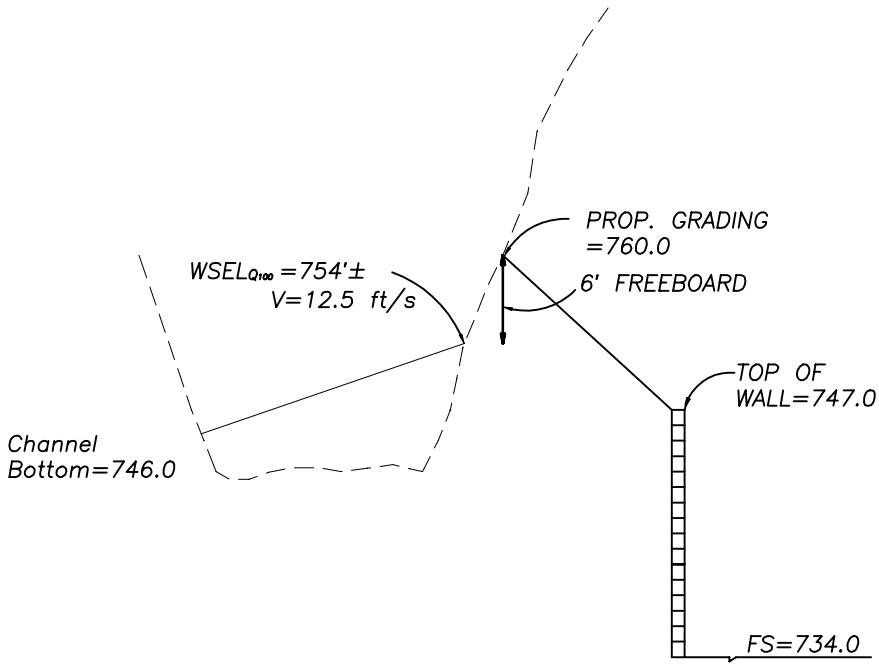
$$\Delta y = \frac{CV^2 T_W}{rg} = \mathbf{2.68\ ft}$$

where ...
Δy = rise in water surface between design water surface at centerline of channel and outside water surface elevation (ft);
C = curvature coefficient (see Table 5-9);
r = radius of curvature at centerline of channel (ft);
T_W = top width at the design water surface at channel centerline (ft);
V = mean channel velocity (ft/s); and
g = gravitational acceleration (ft/s2).

WSE on the outside of the bend = 754.06 ft

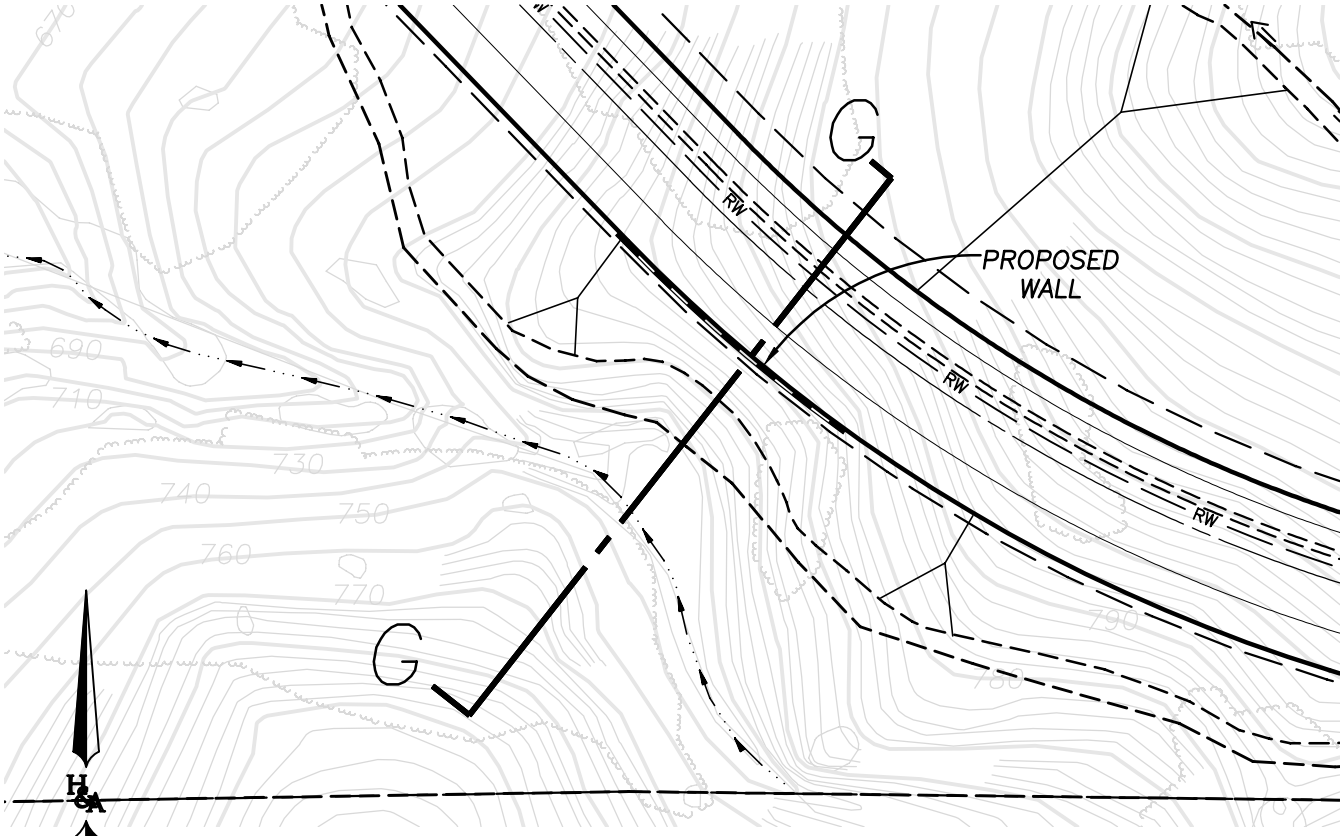
ELEVATION AT GRADING LIMIT = **760.00 ft**
FREEBOARD UPTO THE LIMITS OF GRADING = **5.94 ft**

CHANNEL WSEL WITH SUPERELEVATION ADJACENT TO SAFARI HIGHLAND RANCH ROAD



SECTION G FIGURE 11.1

NOT TO SCALE



0 80 160 240

SCALE 1" =80'

PREPARED BY:

HUNSAKER & ASSOCIATES SAN DIEGO, INC.

PLANNING ENGINEERING SURVEYING

9707 Waples Street San Diego, Ca 92121

PROPOSED CONDITION HYDROLOGIC WORKMAP FOR:

SAFARI HIGHLANDS RANCH

DRAINAGE AREA B

CITY OF ESCONDIDO, CA

FIGURE

11.1

W.O. 2374-17

Appendix 12 – Culvert Analysis

Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Apr 11 2019

Culvert 1A

Invert Elev Dn (ft)	=	1505.00
Pipe Length (ft)	=	170.00
Slope (%)	=	4.71
Invert Elev Up (ft)	=	1513.00
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

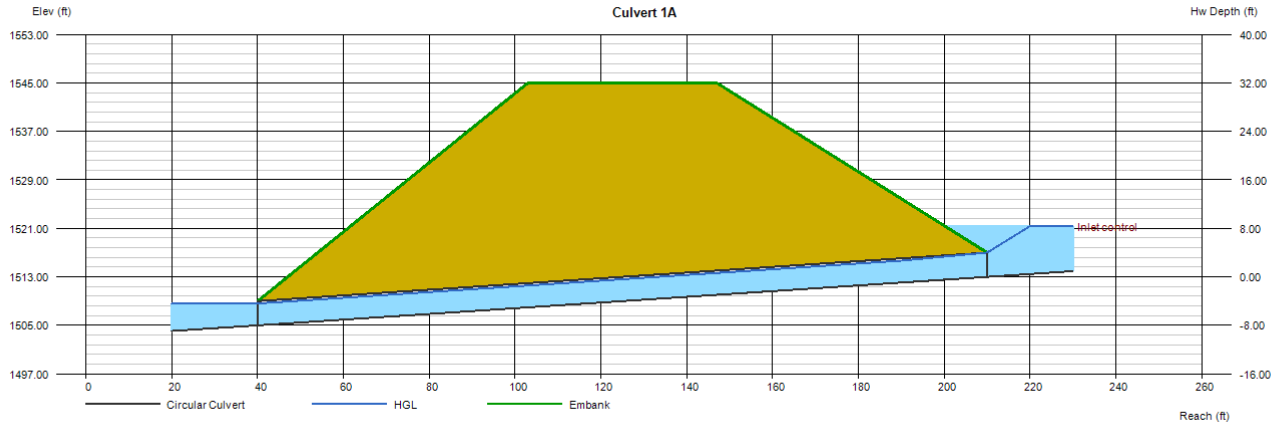
Top Elevation (ft)	=	1545.00
Top Width (ft)	=	44.00
Crest Width (ft)	=	0.00

Calculations

Qmin (cfs)	=	151.50
Qmax (cfs)	=	151.50
Tailwater Elev (ft)	=	0.00

Highlighted

Qtotal (cfs)	=	151.50
Qpipe (cfs)	=	151.50
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	12.70
Veloc Up (ft/s)	=	12.70
HGL Dn (ft)	=	1508.61
HGL Up (ft)	=	1516.61
Hw Elev (ft)	=	1521.37
Hw/D (ft)	=	2.09
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Apr 8 2019

Culvert 2A

Invert Elev Dn (ft)	=	1615.00
Pipe Length (ft)	=	119.00
Slope (%)	=	4.20
Invert Elev Up (ft)	=	1620.00
Rise (in)	=	60.0
Shape	=	Circular
Span (in)	=	60.0
No. Barrels	=	2
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

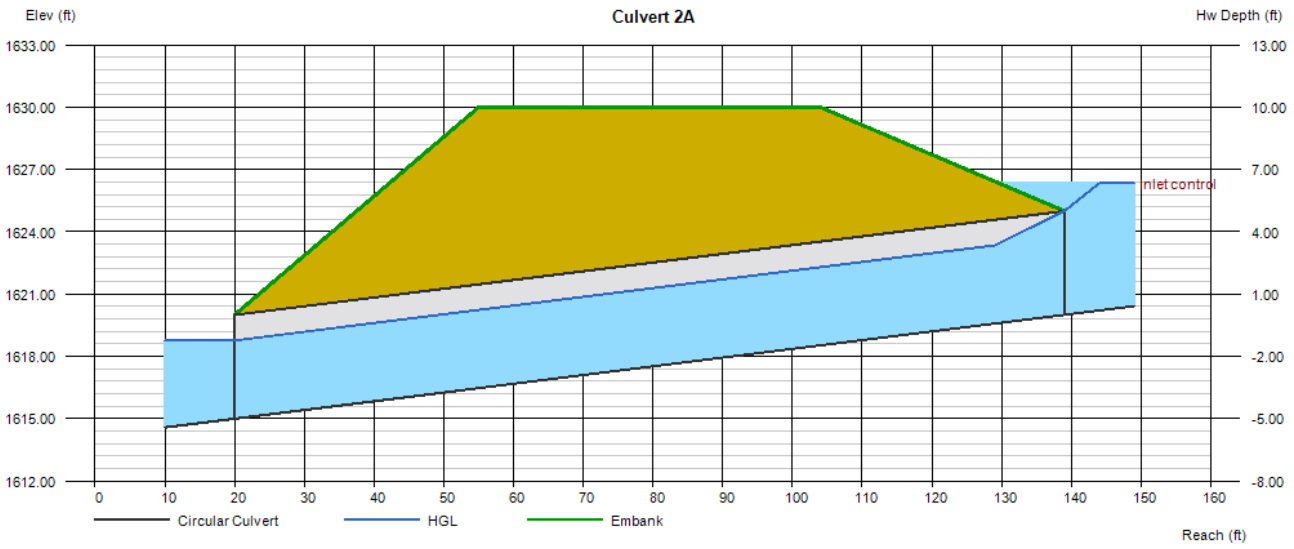
Top Elevation (ft)	=	1630.00
Top Width (ft)	=	49.00
Crest Width (ft)	=	0.00

Calculations

Qmin (cfs)	=	346.10
Qmax (cfs)	=	346.10
Tailwater Elev (ft)	=	0.00

Highlighted

Qtotal (cfs)	=	346.10
Qpipe (cfs)	=	346.10
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	10.91
Veloc Up (ft/s)	=	10.91
HGL Dn (ft)	=	1618.77
HGL Up (ft)	=	1623.77
Hw Elev (ft)	=	1626.34
Hw/D (ft)	=	1.27
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Apr 8 2019

Culvert 3A

Invert Elev Dn (ft)	=	1585.00
Pipe Length (ft)	=	110.00
Slope (%)	=	4.55
Invert Elev Up (ft)	=	1590.00
Rise (in)	=	60.0
Shape	=	Circular
Span (in)	=	60.0
No. Barrels	=	2
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

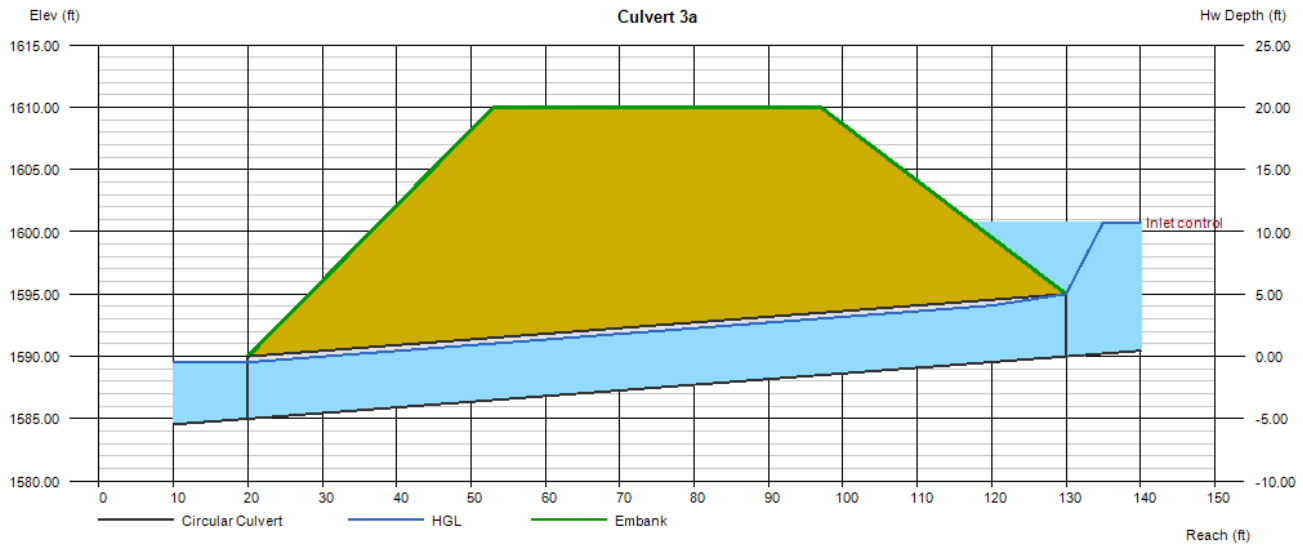
Top Elevation (ft)	=	1610.00
Top Width (ft)	=	44.00
Crest Width (ft)	=	0.00

Calculations

Qmin (cfs)	=	539.70
Qmax (cfs)	=	539.70
Tailwater Elev (ft)	=	0.00

Highlighted

Qtotal (cfs)	=	539.70
Qpipe (cfs)	=	539.70
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	14.42
Veloc Up (ft/s)	=	14.42
HGL Dn (ft)	=	1589.53
HGL Up (ft)	=	1594.53
Hw Elev (ft)	=	1600.75
Hw/D (ft)	=	2.15
Flow Regime	=	Inlet Control



Culvert Report

Culvert 4A

Invert Elev Dn (ft)	=	1530.00
Pipe Length (ft)	=	168.00
Slope (%)	=	8.93
Invert Elev Up (ft)	=	1545.00
Rise (in)	=	72.0
Shape	=	Circular
Span (in)	=	72.0
No. Barrels	=	2
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

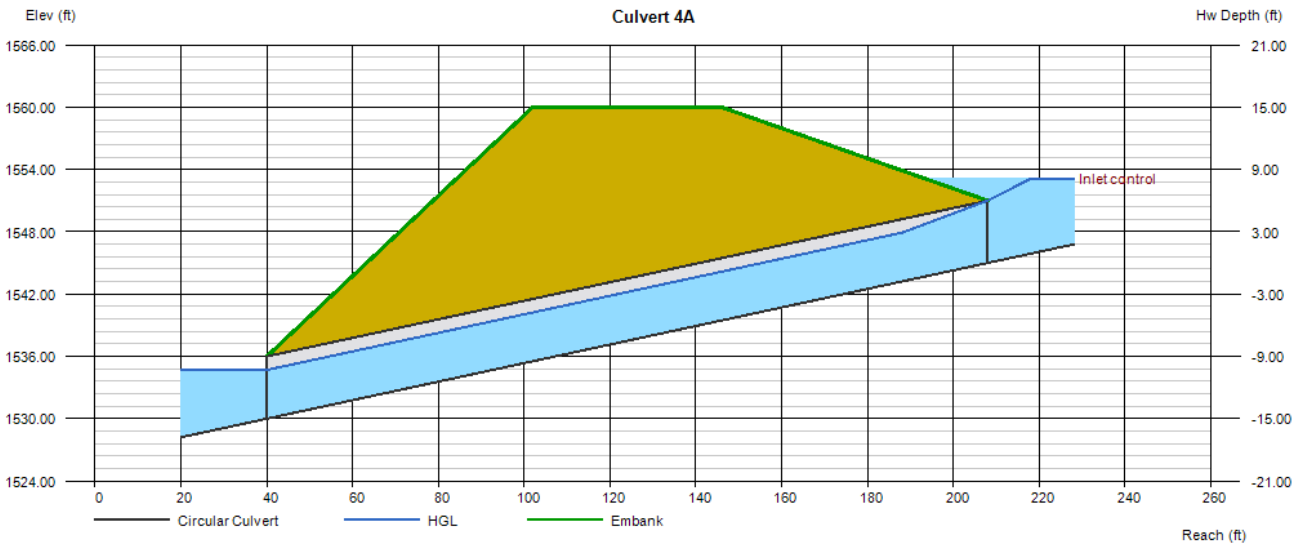
Top Elevation (ft)	=	1560.00
Top Width (ft)	=	44.00
Crest Width (ft)	=	0.00

Calculations

Qmin (cfs)	=	591.50
Qmax (cfs)	=	591.50
Tailwater Elev (ft)	=	0.00

Highlighted

Qtotal (cfs)	=	591.50
Qpipe (cfs)	=	591.50
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	12.45
Veloc Up (ft/s)	=	12.45
HGL Dn (ft)	=	1534.70
HGL Up (ft)	=	1549.70
Hw Elev (ft)	=	1553.11
Hw/D (ft)	=	1.35
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc.

Culvert 5a

Invert Elev Dn (ft)	=	1606.00
Pipe Length (ft)	=	70.00
Slope (%)	=	5.71
Invert Elev Up (ft)	=	1610.00
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

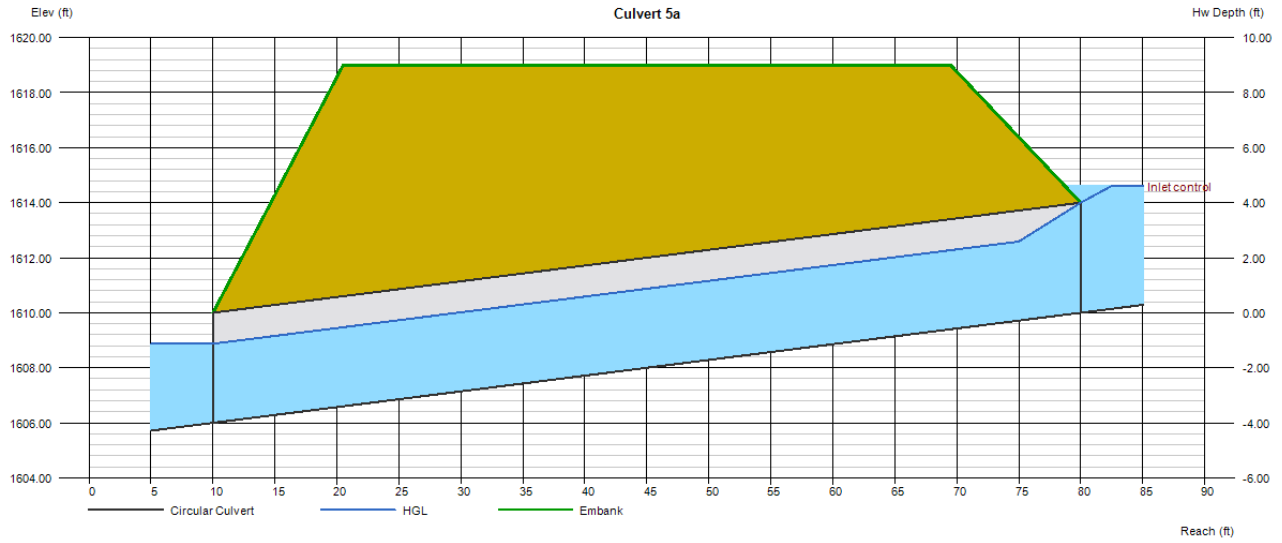
Top Elevation (ft)	=	1619.00
Top Width (ft)	=	49.00
Crest Width (ft)	=	0.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	94.00
Tailwater Elev (ft)	=	0.00

Highlighted

Qtotal (cfs)	=	90.00
Qpipe (cfs)	=	90.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	9.31
Veloc Up (ft/s)	=	9.31
HGL Dn (ft)	=	1608.87
HGL Up (ft)	=	1612.87
Hw Elev (ft)	=	1614.61
Hw/D (ft)	=	1.15
Flow Regime	=	Inlet Control



Culvert Report

Culvert 1b

Invert Elev Dn (ft)	=	1390.00
Pipe Length (ft)	=	126.00
Slope (%)	=	39.68
Invert Elev Up (ft)	=	1440.00
Rise (in)	=	72.0
Shape	=	Box
Span (in)	=	84.0
No. Barrels	=	2
n-Value	=	0.012
Culvert Type	=	Flared Wingwalls
Culvert Entrance	=	30D to 75D wingwall flares
Coeff. K,M,c,Y,k	=	0.026, 1, 0.0347, 0.81, 0.4

Embankment

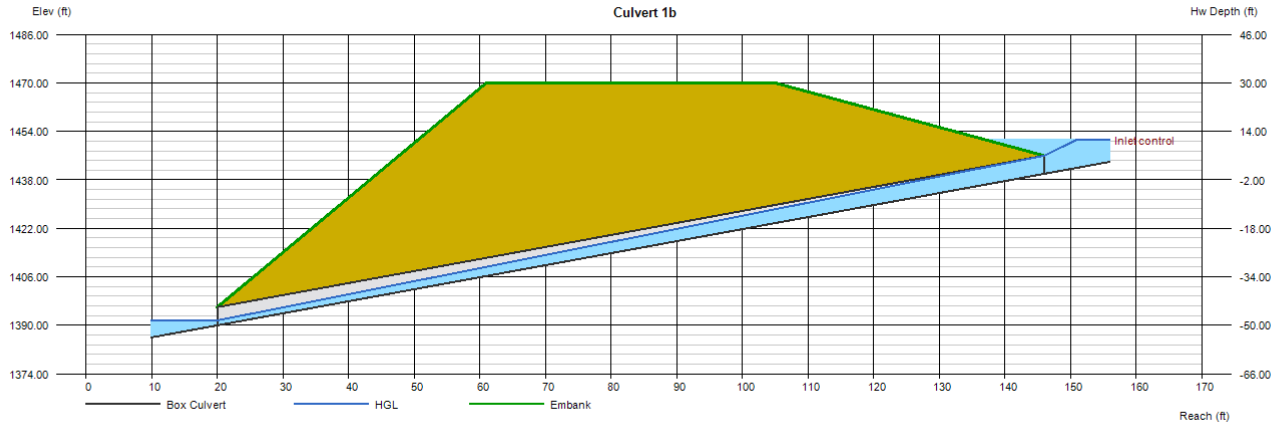
Top Elevation (ft)	=	1470.00
Top Width (ft)	=	44.00
Crest Width (ft)	=	0.00

Calculations

Qmin (cfs)	=	1241.80
Qmax (cfs)	=	1241.80
Tailwater Elev (ft)	=	0.00

Highlighted

Qtotal (cfs)	=	1241.80
Qpipe (cfs)	=	1241.80
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	54.75
Veloc Up (ft/s)	=	14.78
HGL Dn (ft)	=	1391.62
HGL Up (ft)	=	1446.00
Hw Elev (ft)	=	1451.25
Hw/D (ft)	=	1.88
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Apr 11 2019

Culvert 2b

Invert Elev Dn (ft)	=	1280.00
Pipe Length (ft)	=	200.00
Slope (%)	=	15.00
Invert Elev Up (ft)	=	1310.00
Rise (in)	=	72.0
Shape	=	Box
Span (in)	=	72.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Flared Wingwalls
Culvert Entrance	=	30D to 75D wingwall flares
Coeff. K,M,c,Y,k	=	0.026, 1, 0.0347, 0.81, 0.4

Embankment

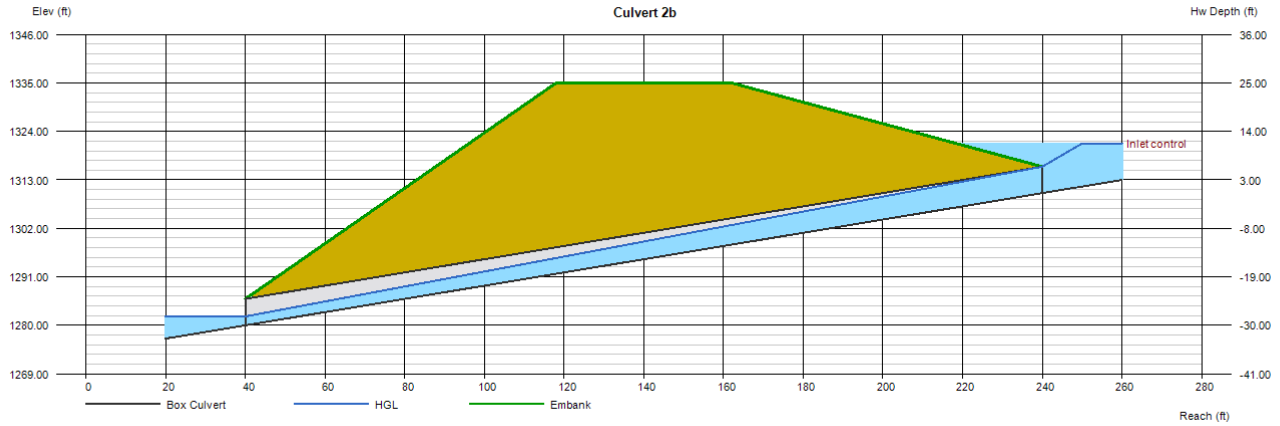
Top Elevation (ft)	=	1335.00
Top Width (ft)	=	44.00
Crest Width (ft)	=	25.00

Calculations

Qmin (cfs)	=	505.90
Qmax (cfs)	=	505.90
Tailwater Elev (ft)	=	0.00

Highlighted

Qtotal (cfs)	=	505.90
Qpipe (cfs)	=	505.90
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	41.54
Veloc Up (ft/s)	=	14.05
HGL Dn (ft)	=	1282.03
HGL Up (ft)	=	1316.00
Hw Elev (ft)	=	1321.26
Hw/D (ft)	=	1.88
Flow Regime	=	Inlet Control



Culvert Report

Culvert 3b

Invert Elev Dn (ft)	=	1040.00
Pipe Length (ft)	=	200.00
Slope (%)	=	10.00
Invert Elev Up (ft)	=	1060.00
Rise (in)	=	96.0
Shape	=	Box
Span (in)	=	96.0
No. Barrels	=	2
n-Value	=	0.012
Culvert Type	=	Flared Wingwalls
Culvert Entrance	=	30D to 75D wingwall flares
Coeff. K,M,c,Y,k	=	0.026, 1, 0.0347, 0.81, 0.4

Embankment

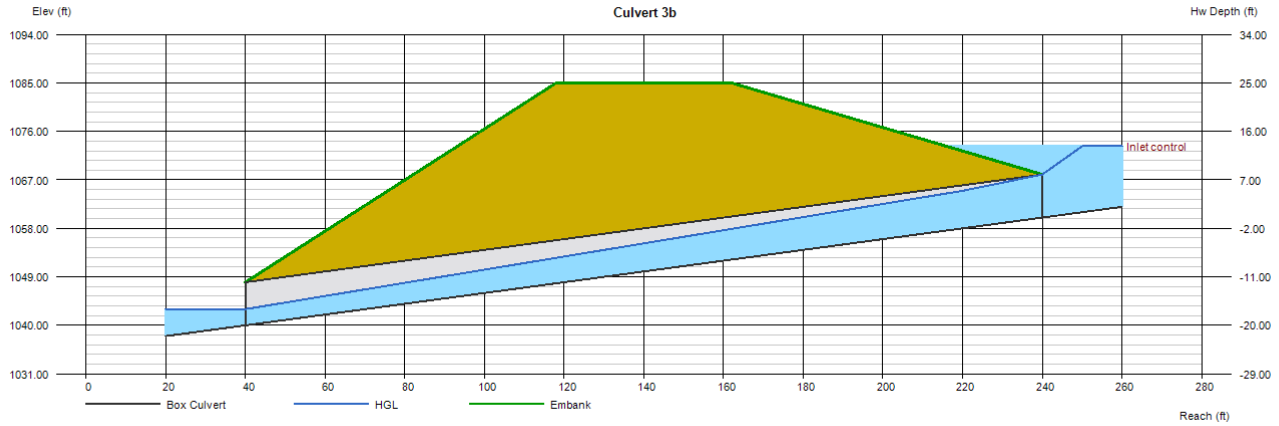
Top Elevation (ft)	=	1085.00
Top Width (ft)	=	44.00
Crest Width (ft)	=	0.00

Calculations

Qmin (cfs)	=	1838.90
Qmax (cfs)	=	1838.90
Tailwater Elev (ft)	=	0.00

Highlighted

Qtotal (cfs)	=	1838.90
Qpipe (cfs)	=	1838.90
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	38.18
Veloc Up (ft/s)	=	15.49
HGL Dn (ft)	=	1043.01
HGL Up (ft)	=	1067.42
Hw Elev (ft)	=	1073.24
Hw/D (ft)	=	1.66
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Apr 11 2019

Culvert 4b

Invert Elev Dn (ft)	=	840.00
Pipe Length (ft)	=	189.00
Slope (%)	=	2.12
Invert Elev Up (ft)	=	844.00
Rise (in)	=	96.0
Shape	=	Box
Span (in)	=	120.0
No. Barrels	=	2
n-Value	=	0.012
Culvert Type	=	Flared Wingwalls
Culvert Entrance	=	30D to 75D wingwall flares
Coeff. K,M,c,Y,k	=	0.026, 1, 0.0347, 0.81, 0.4

Embankment

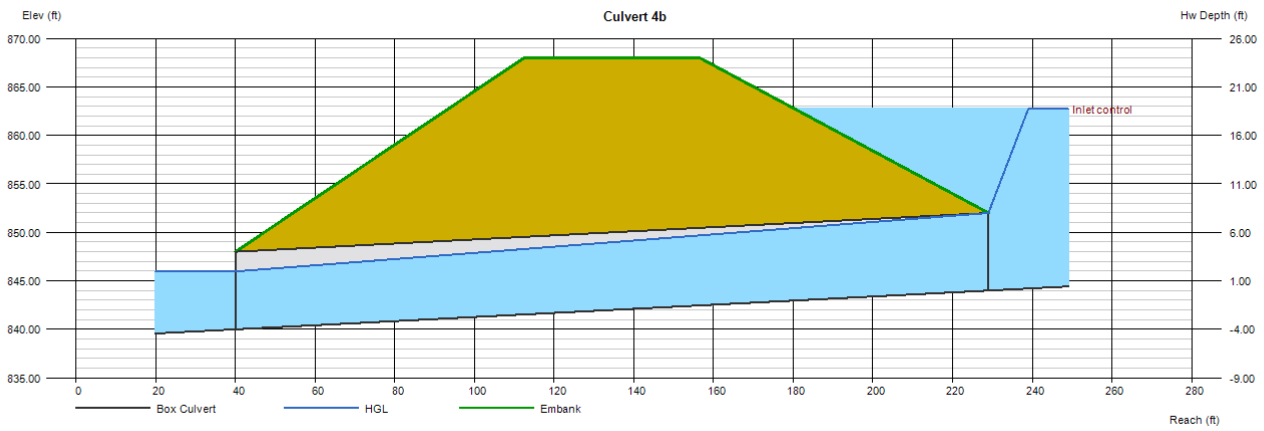
Top Elevation (ft)	=	868.00
Top Width (ft)	=	44.00
Crest Width (ft)	=	0.00

Calculations

Qmin (cfs)	=	3017.00
Qmax (cfs)	=	3017.00
Tailwater Elev (ft)	=	0.00

Highlighted

Qtotal (cfs)	=	3017.00
Qpipe (cfs)	=	3017.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	25.27
Veloc Up (ft/s)	=	18.86
HGL Dn (ft)	=	845.97
HGL Up (ft)	=	852.00
Hw Elev (ft)	=	862.73
Hw/D (ft)	=	2.34
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Apr 11 2019

Culvert 5b

Invert Elev Dn (ft)	=	784.00
Pipe Length (ft)	=	126.00
Slope (%)	=	12.70
Invert Elev Up (ft)	=	800.00
Rise (in)	=	120.0
Shape	=	Box
Span (in)	=	144.0
No. Barrels	=	2
n-Value	=	0.012
Culvert Type	=	Flared Wingwalls
Culvert Entrance	=	30D to 75D wingwall flares
Coeff. K,M,c,Y,k	=	0.026, 1, 0.0347, 0.81, 0.4

Embankment

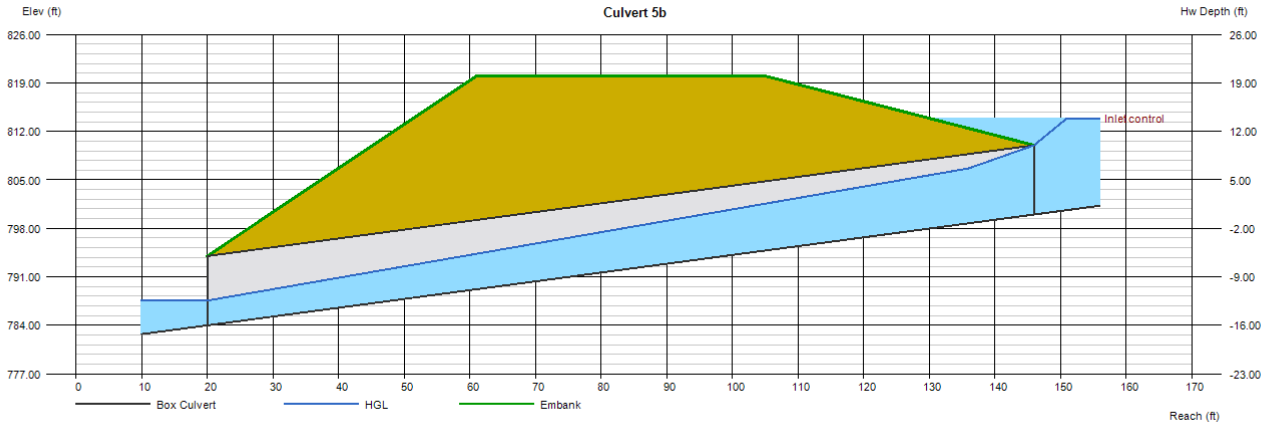
Top Elevation (ft)	=	820.00
Top Width (ft)	=	44.00
Crest Width (ft)	=	0.00

Calculations

Qmin (cfs)	=	3269.20
Qmax (cfs)	=	3269.20
Tailwater Elev (ft)	=	0.00

Highlighted

Qtotal (cfs)	=	3269.20
Qpipe (cfs)	=	3269.20
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	38.05
Veloc Up (ft/s)	=	16.40
HGL Dn (ft)	=	787.58
HGL Up (ft)	=	808.31
Hw Elev (ft)	=	813.90
Hw/D (ft)	=	1.39
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Sunday, Apr 23 2017

CULVERT 1C

Invert Elev Dn (ft)	=	1310.00
Pipe Length (ft)	=	92.60
Slope (%)	=	13.00
Invert Elev Up (ft)	=	1322.04
Rise (in)	=	60.0
Shape	=	Circular
Span (in)	=	60.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

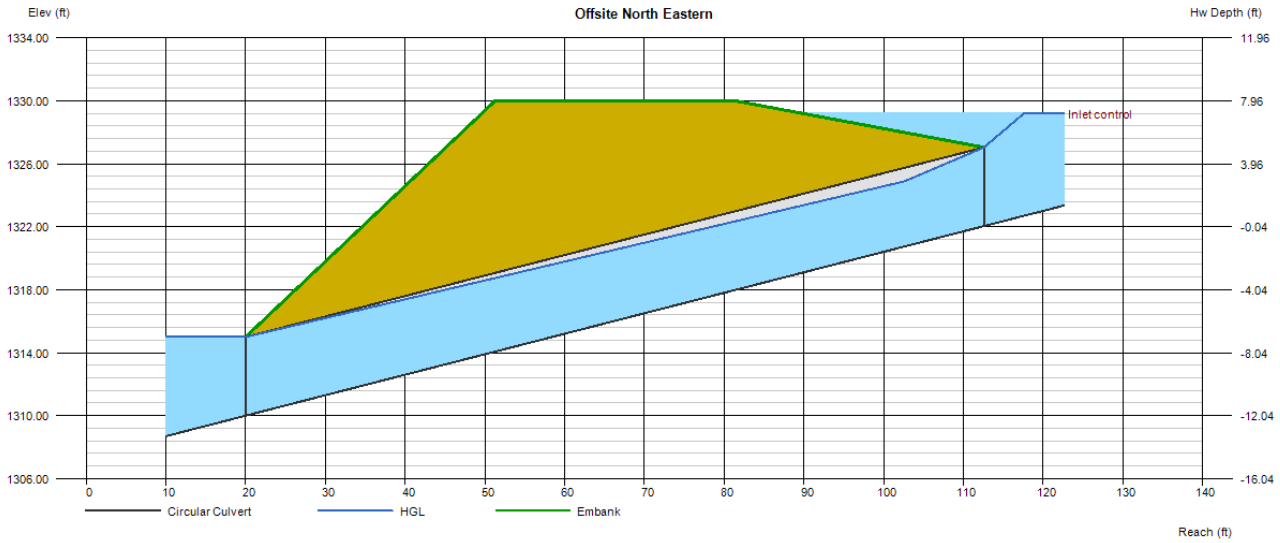
Top Elevation (ft)	=	1330.00
Top Width (ft)	=	30.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	100.00
Qmax (cfs)	=	201.00
Tailwater Elev (ft)	=	Crown

Highlighted

Qtotal (cfs)	=	200.00
Qpipe (cfs)	=	200.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	10.19
Veloc Up (ft/s)	=	11.78
HGL Dn (ft)	=	1315.00
HGL Up (ft)	=	1326.07
Hw Elev (ft)	=	1329.19
Hw/D (ft)	=	1.43
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Sunday, Apr 23 2017

CULVERT 1D

Invert Elev Dn (ft)	= 520.00
Pipe Length (ft)	= 50.00
Slope (%)	= 2.00
Invert Elev Up (ft)	= 521.00
Rise (in)	= 144.0
Shape	= Box
Span (in)	= 120.0
No. Barrels	= 3
n-Value	= 0.012
Culvert Type	= Flared Wingwalls
Culvert Entrance	= 30D to 75D wingwall flares
Coeff. K,M,c,Y,k	= 0.026, 1, 0.0347, 0.81, 0.4

Embankment

Top Elevation (ft)	= 536.00
Top Width (ft)	= 35.00
Crest Width (ft)	= 100.00

Calculations

Qmin (cfs)	= 4300.00
Qmax (cfs)	= 7500.00
Tailwater Elev (ft)	= (dc+D)/2

Highlighted

Qtotal (cfs)	= 4300.00
Qpipe (cfs)	= 4300.00
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 13.92
Veloc Up (ft/s)	= 16.68
HGL Dn (ft)	= 530.30
HGL Up (ft)	= 529.59
Hw Elev (ft)	= 535.55
Hw/D (ft)	= 1.21
Flow Regime	= Inlet Control