2 Hydrology

This section details the onsite local Planning Area 3 and Planning Area 4 hydrology, including discussion on land use, local and regional hydrology, preliminary flood control basins, and water quality basins.

The hydrology analyses for the local and regional studies were completed using the same criteria and methodology as outlined in detail in the Ranch Plan ROMP. Modification or additions to the studies in that document are described in the following sections. In order to show conformance with both the Ranch Plan ROMP and the Ranch FEIR, several additional hydrology analyses were completed. The analyses include updated local analysis and regional studies, and integrated local and regional models.

The regional analysis provides the following: an update to the existing condition regional analysis from the Ranch Plan ROMP, an ultimate condition analysis, and a phased condition analysis. The ultimate condition assumes full build out of the Ranch. This study will comply with the requirements of the FEIR.

The Ranch Plan ROMP addressed local basins and regional impacts separately (local basins were not considered in the Regional Models). To comply with Mitigation Measure 4.5-5, this PA-3&4 report includes the integration of local basins and regional stream hydrology in the regional models. Mitigation analysis of the subregional Gobernadora models includes the local water quality basins from PA-3 subwatershed A for the 2- through 10-year storm events and includes the Gobernadora Multipurpose Basin for the 25- through 100-year storm events. This approach is consistent with the approach the local hydromodification basins along Chiquita Canyon were modeled in the approved PA-2 ROMP.

2.1 Approach

The FEIR expressed concern that the detention basins could affect the timing of the hydrograph peaks within the overall watershed stream network (MM4.5-5) and result in adverse impacts to the regional hydrology. An integrated local and regional hydrology analysis is included in this study for the evaluation of the PA-3&4 development impacts and for the identification of the detailed mitigation measures. The evaluation will balance the local and regional concerns to develop a detailed approach to mitigate impacts to the watershed. The PA-3&4 development area drains to two different streams, San Juan Creek, and Gobernadora Canyon. Gobernadora is a tributary of San Juan Creek, and confluences with the creek within the Ranch property between PA-2 and PA-3.

The PA-3&4 stormwater infrastructure in the Ranch Plan ROMP includes six outfalls to San Juan Creek (2013 Ranch Plan ROMP outfall Nos. 11, 13, 14, 17, 20, and 22) and one outfall to Gobernadora Canyon (2013 Ranch Plan ROMP outfall No. 9). In Spring 2018, the 2013 Ranch Plan ROMP outfall locations were revised to be consistent with the grading plan in this 2019 PA-3&4 ROMP. The outfall locations are shown in Figure 2-3 and Figure 2-4. This report will specify which set of outfalls are referred to when outfalls are mentioned.

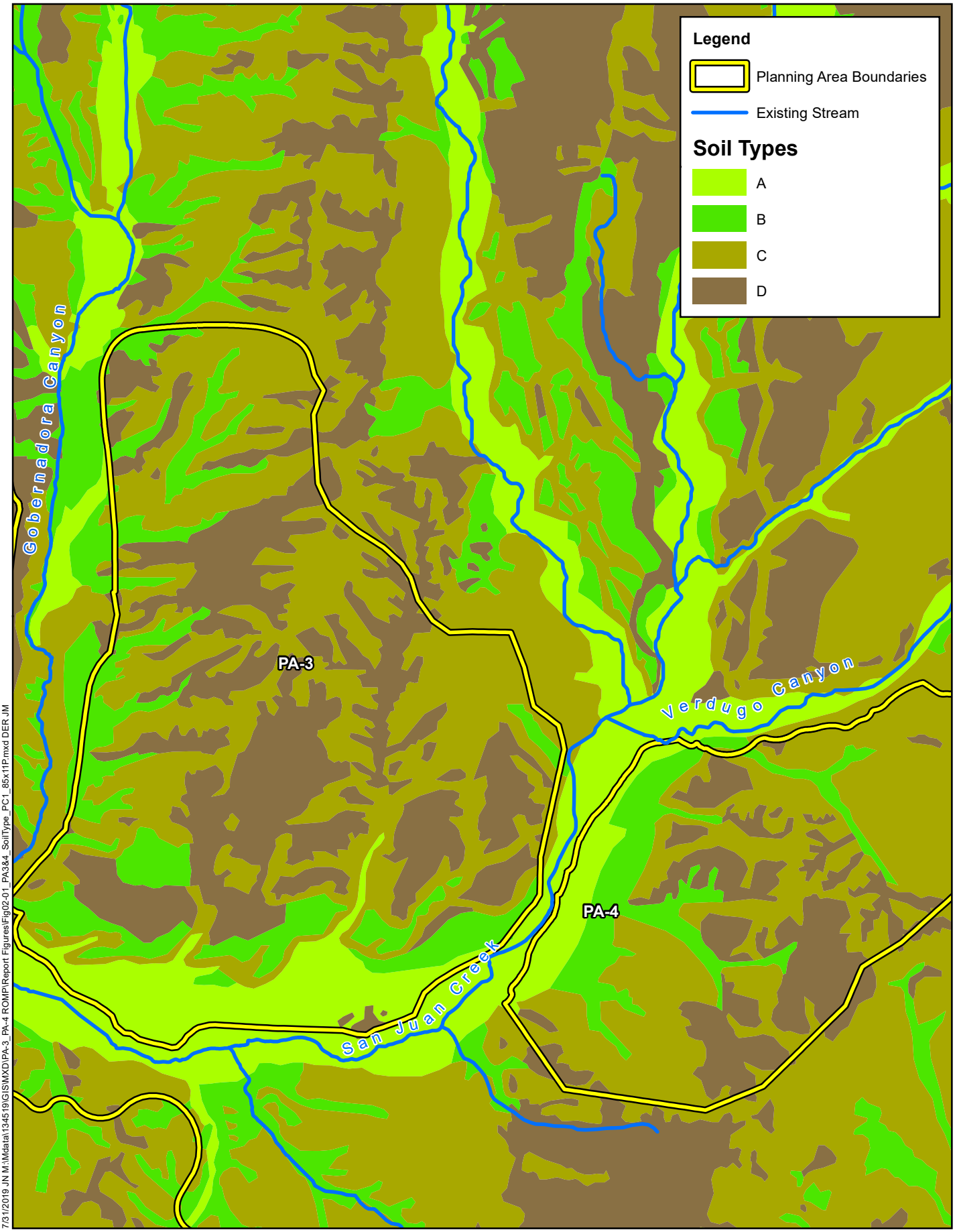
In the Ranch Plan ROMP, each of the outfalls for the development area has a tributary storm drain system and proposed local flood control and water quality basins. Offsite Area O (outfall 17) has a tributary area consisting solely of existing land use and will not have basins. The Ranch Plan ROMP developed basins to mitigate the local drainage area and did not consider the effects of the local basins on the regional channel systems. Six regional flood control basins were proposed and included in the Ranch Plan ROMP regional models but the attenuation from the local basins were not assessed in conjunction with these. This evaluation was delegated to the PA ROMPs where more detail on the facilities could be established. The overall goal of the PA ROMPs is to meet or exceed peak flow mitigation results previously established in the 2013 Ranch Plan ROMP.

The hydrologic analysis and basin flood routing were developed to document that the ultimate and phased improvements will conform to the mitigation goals along Gobernadora Canyon and San Juan Creek in conformance with the results from the Ranch Plan ROMP and subsequent white papers.

2.2 Local Planning Area Analysis

The local hydrology consists of the rational method analysis, loss rate calculations, small area hydrograph, single area, and complex unit hydrograph analysis. Local subwatershed hydrology is included in Appendix B. The hydrology models were prepared using the Advanced Engineering Software Version 2013 (AES). All models were performed in conformance with the Orange County Hydrology Manual (OCHM) (OC Public Works, 1986), including Addendum no. 1 (OC Public Works, 1996), which requires expected value analyses to use antecedent moisture condition (AMC) II and soil type B. The 2-, 5-, 10-, 25-, 50-, and 100-year expected value storm events and the 25- and 100-year high confidence storm events hydrology models were prepared. The 100-yr High Confidence analysis was used to size preliminary storm drain facilities. The Expected Value models were created for mitigation analysis. The local hydrology analysis steps are shown below:

1. Based on the proposed Master Area Grading plan from September 2017, the PA-3 and PA-4 land use maps were developed.
2. The GIS soils data from the Ranch Plan ROMP was used (shown in Figure 2-1).
3. The watershed hydrology map was developed in CADD and GIS.
4. Items 1-3 were intersected in GIS to generate input into the local hydrology.
5. The rational method was developed using the results from item #4 for all seven subwatersheds. To reduce rounding errors produced by subdividing the data, the GIS intersect results were adjusted to match the subarea area by changing the value of the largest land use-soil-area combination. This adjusted data was copied into the loss rate spreadsheets.
6. The rainfall data for the local area high confidence models is based on the Orange County Hydrology Manual for areas below 2,000 feet. The expected value rainfall numbers are based on Addendum No. 1 to the Hydrology Manual.
7. The loss rates for each subwatershed (A, B, C, D, G, E and F) (subwatersheds described in Section 2.2.3) were calculated using a spreadsheet, which implements the County Hydrology loss rate procedures and deviations in the Ranch Plan ROMP. Loss rates and hydrographs were not calculated for O because it does not have proposed basins.
8. The expected value hydrographs for the subwatersheds were calculated. Small area hydrographs were used for subwatersheds with areas of less than 640 ac, and single area unit hydrographs were used for area C, which has an area of greater than 640 ac.
    a. These local expected value single area hydrographs use the rational method Tc.
    b. Local event (EV) hydrographs use local rainfall depths, no depth area reductions (unless the watershed is greater than 640 ac), and AMC II for loss rate calculations. This is consistent with the methodology used in the PACE 2013 Ranch Plan ROMP.



7/31/2019 JN M:\Mdata\134519\GIS\MXD\PA-3_PA-4 ROMP\Report Figures\Fig02-01_PA3&4_SoilType_PC1_85x11P.mxd DER JM

Michael Baker INTERNATIONAL

0 1,000 2,000 Feet

Source:

RANCHO MISSION VIEJO - PA3&4 ROMP

PA-3 and PA-4 Soil Type Map

Figure 2-1

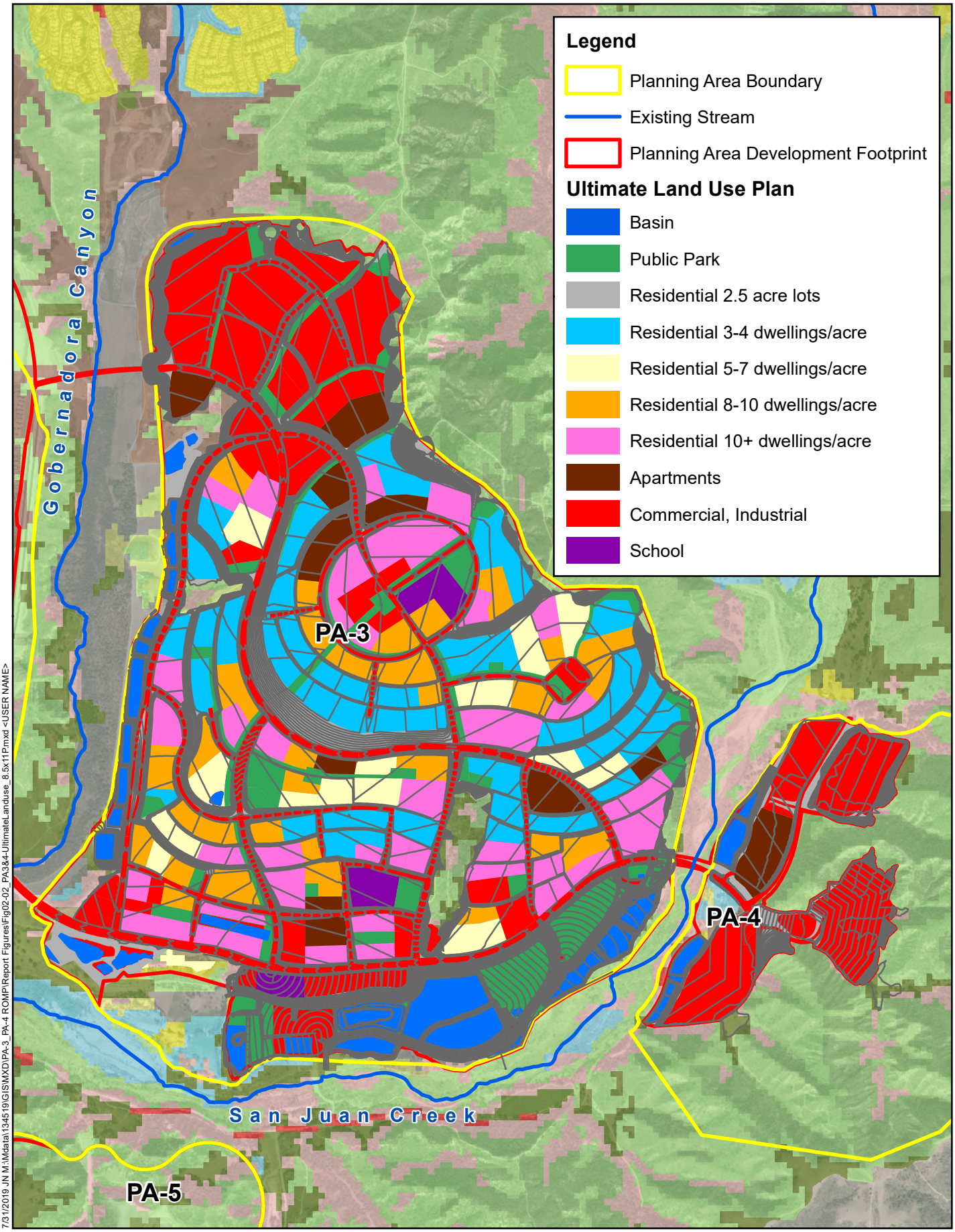
2.2.1 Land Use

Two grading plans were used for the study. For Cow Camp Road and the development north of Cow Camp Road, the hydrology study referenced the grading plan by Huitt-Zollars dated March 23, 2018. South of Cow Camp Road, an interim grading plan by Hunsaker and Associates titled "Heritage Cow Camp 2 Design Study2" dated April 23, 2018 was referenced because it had updated grading for the basins. The exhibits show the grading files combined.

The PA-3&4 study used the latest land use from SWA Group to create a GIS land use file with land uses consistent with the Orange County Hydrology Manual. In order to be consistent with the OCHM, some land uses from the SWA Group were modified to reflect land uses specific for the hydrology analysis. Figure 2-2 shows the PA-3 and PA-4 land use used in the local hydrologic analysis. Tables 2-1 and 2-2 summarize the hydrology land uses in PA-3 and PA-4 respectively and compare them to the Ranch Plan ROMP.

The current land use plan proposes a total developed area for PA-3 of 2,014 acres, which includes graded hillside on the outside of the development footprint. In the Ranch Plan ROMP, the total developed area was 1,909.5 acres. The increase in developed area is due to changes in the grading plan and proposed land uses. The PA-4 footprint was significantly reduced compared to the Ranch Plan ROMP. The current studies have a total developed area of 218.7 acres, versus the Ranch Plan ROMP which had 540 acres. Detailed grading studies found that the natural conditions within PA-4 create challenges to develop most of the area that was proposed in the Ranch Plan ROMP. Thus, current plans reduced the total developed footprint to include only the areas where it will be feasible to develop the land. Current plans also maintain the Ranch Plan ROMP proposed 86% imperviousness within the PA-4 planning area boundary. In both PA-3 and PA-4, graded hillslopes within and adjacent to the development were changed to "residential 2.5 acre lots" (10% impervious) to account for concrete v-ditches that will be installed to collect hillside runoff. It is important to also note that small slopes (less than 60 feet wide) use the adjacent land use for the hydrology analysis. These adjustments affect the total land use density when compared to the SWA Group land use plan, therefore the two plans will not match exactly. However, the land use plans are in substantial conformance. The hydrology land uses are summarized in Tables 2-1 and 2-2. Land uses listed in Tables 2-1 and 2-2 list all land use within the planning area boundaries.

The water quality analysis uses a separate land use plan which maintains a land use designation for the graded hillslopes as graded hillslopes. Additionally, the water quality analysis differentiates between graded hillside slopes that are greater than and less than 60 feet wide. Slopes greater than 60 feet wide (large slopes) have been determined to need concrete v-ditches. The 10% imperviousness is accounted for in this hydromodification analysis but not for Low Impact Development (LID) analysis. The imperviousness of the concrete v-ditches was removed for the LID analysis to eliminate treatment of areas used as drainage conveyance.



7/31/2019 JN M:\Mdata\134519\GIS\MXD\PA-3_PA-4 ROMP\Report Figures\Fig02-02_PA3&4-UltimateLanduse_8.5x11P.mxd <USER NAME>

Michael Baker INTERNATIONAL

0 5001,000 2,000 Feet

Source:

RANCHO MISSION VIEJO - PA3&4 ROMP

PA-3 and PA- 4 Land Use

Figure 2-2

Table 2-1: Ranch Plan ROMP Versus PA-3 Ultimate Land Use Data Comparison

Ranch Plan ROMP				PA-3&4 Ultimate Conditions			
Land Use	Soil Type	Area (ac)	A_p	Land Use	Soil Type	Area (ac)	A_p
Commercial, Industrial	A	6.9	10%	Commercial, Industrial	A	95.7	10%
Commercial, Industrial	B	28.1	10%	Commercial, Industrial	B	122.7	10%
Commercial, Industrial	C	83.5	10%	Commercial, Industrial	C	226.1	10%
Commercial, Industrial	D	78.3	10%	Commercial, Industrial	D	153.7	10%
Apartments	A	0.6	20%	Apartments	B	0.5	20%
Apartments	B	1.5	20%	Apartments	C	31.0	20%
Apartments	C	16.1	20%	Apartments	D	48.4	20%
Apartments	D	45.9	20%	Residential 10+ dwellings/acre	A	0.7	20%
Residential 1 acre lots	A	4.5	80%	Residential 10+ dwellings/acre	B	26.5	20%
Residential 1 acre lots	B	47.1	80%	Residential 10+ dwellings/acre	C	107.1	20%
Residential 1 acre lots	C	151.2	80%	Residential 10+ dwellings/acre	D	109.9	20%
Residential 1 acre lots	D	109.6	80%	Residential 8-10 dwellings/acre	B	20.8	40%
Residential 2 dwellings/acre	A	0.8	70%	Residential 8-10 dwellings/acre	C	77.9	40%
Residential 2 dwellings/acre	B	16.6	70%	Residential 8-10 dwellings/acre	D	68.9	40%
Residential 2 dwellings/acre	C	391.7	70%	Residential 5-7 dwellings/acre	A	4.4	50%
Residential 2 dwellings/acre	D	316.4	70%	Residential 5-7 dwellings/acre	B	15.6	50%
Residential 5-7 dwellings/acre	A	50.4	50%	Residential 5-7 dwellings/acre	C	47.7	50%
Residential 5-7 dwellings/acre	B	25.5	50%	Residential 5-7 dwellings/acre	D	36.1	50%
Residential 5-7 dwellings/acre	C	6.9	50%	Residential 3-4 dwellings/acre	B	9.4	60%
Residential 5-7 dwellings/acre	D	6.3	50%	Residential 3-4 dwellings/acre	C	121.2	60%
Residential 3-4 dwellings/acre	A	6.6	60%	Residential 3-4 dwellings/acre	D	133.8	60%
Residential 3-4 dwellings/acre	B	94.1	60%	School	A	0.9	60%
Residential 3-4 dwellings/acre	C	104.5	60%	School	B	1.4	60%
Residential 3-4 dwellings/acre	D	128.0	60%	School	C	16.4	60%
Residential 8-10 dwellings/acre	B	24.2	40%	School	D	12.5	60%
Residential 8-10 dwellings/acre	C	20.5	40%	Public Park	A	43.6	85%
Residential 8-10 dwellings/acre	D	11.1	40%	Public Park	B	29.8	85%
Public Park	A	25.2	85%	Public Park	C	70.9	85%
Public Park	B	1.4	85%	Public Park	D	66.7	85%
Public Park	C	2.6	85%	Residential 2.5 acre lots	A	22.5	90%
Public Park	D	2.5	85%	Residential 2.5 acre lots	B	59.0	90%
School	A	1.4	60%	Residential 2.5 acre lots	C	140.5	90%
School	B	30.0	60%	Residential 2.5 acre lots	D	91.7	90%
School	C	43.2	60%	Barren	A	14.5	100%
School	D	26.3	60%	Barren	B	1.4	100%
Barren	A	14.2	100%	Barren	C	4.2	100%
Barren	B	0.1	100%	Barren	D	1.5	100%
Chaparral, Broadleaf, Fair	A	0.2	100%	Chaparral, Broadleaf, Fair	A	1.1	100%
Chaparral, Broadleaf, Fair	B	0.7	100%	Chaparral, Broadleaf, Fair	C	8.7	100%
Chaparral, Broadleaf, Fair	C	5.3	100%	Chaparral, Broadleaf, Fair	D	2.2	100%
Chaparral, Broadleaf, Fair	D	0.6	100%	Chaparral, Narrowleaf, Fair	B	0.1	100%
Chaparral, Narrowleaf, Fair	B	0.0	100%	Chaparral, Narrowleaf, Fair	C	4.5	100%
Chaparral, Narrowleaf, Fair	C	3.5	100%	Chaparral, Narrowleaf, Fair	D	4.5	100%
Chaparral, Narrowleaf, Fair	D	2.7	100%	Fallow	B	2.0	100%
Grass, Annual or Perennial, Fair	A	32.8	100%	Fallow	C	1.1	100%
Grass, Annual or Perennial, Fair	B	5.3	100%	Fallow	D	0.5	100%

Table 2-1: Ranch Plan ROMP Versus PA-3 Ultimate Land Use Data Comparison

Ranch Plan ROMP				PA-3&4 Ultimate Conditions			
Land Use	**Soil Type**	**Area (ac)**	**A_p**	**Land Use**	**Soil Type**	**Area (ac)**	**A_p**
Grass, Annual or Perennial, Fair	C	14.3	100%	Grass, Annual or Perennial, Fair	A	13.7	100%
Grass, Annual or Perennial, Fair	D	0.1	100%	Grass, Annual or Perennial, Fair	B	1.1	100%
Meadows or Cienegas, Fair	A	2.4	100%	Grass, Annual or Perennial, Fair	C	9.9	100%
Open Brush, Fair	A	8.0	100%	Grass, Annual or Perennial, Fair	D	3.1	100%
Open Brush, Fair	B	6.7	100%	Meadows or Cienegas, Fair	A	1.3	100%
Open Brush, Fair	C	43.1	100%	Open Brush, Fair	A	8.1	100%
Open Brush, Fair	D	5.0	100%	Open Brush, Fair	B	6.0	100%
Woodland, Grass, Fair	A	6.3	100%	Open Brush, Fair	C	34.0	100%
Woodland, Grass, Fair	B	7.7	100%	Open Brush, Fair	D	5.3	100%
Woodland, Grass, Fair	C	18.9	100%	Orchards, Evergreen, Fair	B	2.5	100%
Woodland, Grass, Fair	D	1.0	100%	Orchards, Evergreen, Fair	C	0.6	100%
Orchards, Evergreen, Fair	B	1.5	100%	Orchards, Evergreen, Fair	D	0.7	100%
Orchards, Evergreen, Fair	C	1.8	100%	Row Crops, Poor	A	0.4	100%
Orchards, Evergreen, Fair	D	0.2	100%	Row Crops, Poor	B	6.3	100%
Row Crops, Good	D	0.1	100%	Row Crops, Poor	C	6.4	100%
Row Crops, Poor	A	50.5	100%	Row Crops, Poor	D	2.5	100%
Row Crops, Poor	B	18.6	100%	Woodland, Grass, Fair	A	3.8	100%
Row Crops, Poor	C	15.7	100%	Woodland, Grass, Fair	B	4.5	100%
Row Crops, Poor	D	8.5	100%	Woodland, Grass, Fair	C	13.6	100%
				Woodland, Grass, Fair	D	1.0	100%
Total Area[1]		**2185.3**	**65%**	**Total Area[1]**		**2185.0**	**48%**
Total Developed Area[2]		**1909.5**		**Total Developed Area[2]**		**2014.0**	

[1]Total Area is the Gross PA area.

[2]Total Developed Area is all graded development area, including basins and outside hillslopes. There is some impervious existing land use within the PA boundaries, such as the houses in Cow Camp.

Table 2-2: Ranch Plan ROMP Versus PA-4 Ultimate Land Use Data Comparison

Ranch Plan ROMP				PA-3&4 Ultimate Conditions			
Land Use	**Soil Type**	**Area (ac)**	**Ap**	**Land Use**	**Soil Type**	**Area (ac)**	**Ap**
Commercial, Industrial	A	8.5	10%	Commercial, Industrial	A	36.5	10%
Commercial, Industrial	B	9.3	10%	Commercial, Industrial	B	70.8	10%
Residential 1 acre lots	A	4.3	80%	Commercial, Industrial	C	23.3	10%
Residential 1 acre lots	B	24.0	80%	Commercial, Industrial	D	21.1	10%
Residential 1 acre lots	C	74.7	80%	Apartments	A	5.6	20%
Residential 1 acre lots	D	77.7	80%	Apartments	B	12.3	20%
Residential 2 dwellings/acre	A	4.3	70%	Residential 5-7 dwellings/acre	A	0.3	50%
Residential 2 dwellings/acre	B	38.7	70%	Public Park	A	6.1	85%
Residential 2 dwellings/acre	C	72.0	70%	Public Park	B	0.3	85%
Residential 2 dwellings/acre	D	108.8	70%	Residential 2.5 acre lots	A	11.1	90%
Residential 5-7 dwellings/acre	A	6.0	50%	Residential 2.5 acre lots	B	16.0	90%
Residential 5-7 dwellings/acre	B	14.7	50%	Residential 2.5 acre lots	C	7.4	90%
Residential 5-7 dwellings/acre	C	1.4	50%	Residential 2.5 acre lots	D	7.9	90%
Residential 3-4 dwellings/acre	B	17.5	60%	Chaparral, Broadleaf, Fair	A	0.3	100%
Residential 3-4 dwellings/acre	C	17.2	60%	Grass, Annual or Perennial, Fair	A	0.6	100%
Residential 3-4 dwellings/acre	D	4.8	60%	Open Brush, Fair	A	1.6	100%
Residential 8-10 dwellings/acre	A	6.8	40%	Row Crops, Poor	A	3.3	100%
Residential 8-10 dwellings/acre	B	12.1	40%	Woodland, Grass, Fair	A	4.8	100%
Public Park	A	22.9	85%	Chaparral, Broadleaf, Fair	B	16.0	100%
Public Park	B	14.3	85%	Grass, Annual or Perennial, Fair	B	7.7	100%
Chaparral, Broadleaf, Fair	A	0.5	100%	Open Brush, Fair	B	21.5	100%
Chaparral, Broadleaf, Fair	B	8.3	100%	Row Crops, Poor	B	0.5	100%
Chaparral, Broadleaf, Fair	C	194.2	100%	Woodland, Grass, Fair	B	13.6	100%
Chaparral, Broadleaf, Fair	D	29.5	100%	Chaparral, Broadleaf, Fair	C	256.8	100%
Grass, Annual or Perennial, Fair	A	0.4	100%	Grass, Annual or Perennial, Fair	C	12.6	100%
Grass, Annual or Perennial, Fair	B	0.0	100%	Open Brush, Fair	C	271.4	100%
Grass, Annual or Perennial, Fair	C	8.7	100%	Woodland, Grass, Fair	C	45.8	100%
Grass, Annual or Perennial, Fair	D	6.3	100%	Chaparral, Broadleaf, Fair	D	90.6	100%
Open Brush, Fair	A	0.8	100%	Grass, Annual or Perennial, Fair	D	8.5	100%
Open Brush, Fair	B	9.1	100%	Open Brush, Fair	D	134.4	100%
Open Brush, Fair	C	221.0	100%	Woodland, Grass, Fair	D	19.1	100%
Open Brush, Fair	D	50.9	100%				
Woodland, Grass, Fair	A	8.3	100%				
Woodland, Grass, Fair	B	10.5	100%				
Woodland, Grass, Fair	C	28.0	100%				
Woodland, Grass, Fair	D	3.4	100%				
Orchards, Evergreen, Fair	A	1.0	100%				
Row Crops, Poor	A	6.4	100%				
Total Area[1]		**1127**	**86%**	**Total Area[1]**		**1127**	**86%**
Total Developed Area[2]		**540.0**		**Total Developed Area[2]**		**218.7**	

[1] Total Area is the Gross PA area (area of the PA boundary)

[2] Total Developed Area is all graded development area within the PA boundary which includes imperviousness, including basins and outside hillslopes. There is some impervious existing land use within the PA boundaries, such as the houses in Cow Camp.

2.2.2 Rainfall

For the local analysis, the 2013 Ranch Plan ROMP used the user-defined option for the rainfall intensity in the Rational Method. The user-defined ordinates are from the regression equation on Figure B-3 per the OCHM. AES follows the OCHM and is approved by the county. Therefore, the user defined rainfall intensity input is not required for the 10-, 25-, and 100-year expected value storm events. The 2-, 5-, and 50-year expected value storm events require user-defined input. See the local hydrology appendix in the 2013 Ranch Plan ROMP.

2.2.3 Subwatershed Descriptions

As part of this study, the PA-3&4 onsite subwatershed areas were updated from the areas in the Ranch Plan ROMP. In the approved Ranch Plan ROMP, within PA-3 there were six storm drain outfalls: 9, 10, 12, 13, 15, and 17 (see Figure 2-3). Within PA-4 there were five storm drain outfalls: 18, 19, 20, 21, and 22 (see Figure 2-4). Preliminary grading and hydrology studies concluded that to achieve the hydrologic mitigation requirements for the ultimate condition the following modifications were appropriate.

- PA-3 areas tributary to Gobernadora Canyon at outfall 9 (subwatershed A) will be treated through infiltration basins and several biofiltration basins. Hydromodification mitigation will be provided through a series of hydromodification detention basins which will detain the hydromodification volume per Section 5 of this report. These basins will also serve as a mitigation device for local flood control for the 2-, 5- and 10-year storm events. Properly sized energy dissipation will be implemented during final design and construction at the outfall locations, per Section 15.2.3 of the 2013 Ranch Plan ROMP. The existing Gobernadora Multipurpose Basin will mitigate 25-, 50- and 100-year storm events. Section 2.2.5 provides a detailed discussion of the Gobernadora Canyon modeling.
- PA-3 areas tributary to San Juan Creek were divided into five subwatersheds: B, C, D, G, and O. Subwatersheds B, C, D, and G will be treated and mitigated through a series of basins located in the most downstream portions of each subwatershed tributary to 2018 outfalls 11, 13, and 14 respectively. The offsite (O) subwatershed will drain to outfall 17. The outlet for each basin will be extended into the 10-year floodplain within San Juan Creek. Properly sized energy dissipation will be implemented during final design and construction at the outfall locations, per Section 15.2.3 of the 2013 Ranch Plan ROMP. Therefore, hydromodification is not required. These basins will provide local and regional mitigation for PA-3.
- PA-4 development areas will be tributary to San Juan Creek. This development area was significantly reduced in size compared to the Ranch Plan ROMP. There are two subwatershed areas: E and F, which will be treated and mitigated through basins at outfalls 20 and 22 (2013 outfalls) respectively. The outlet for each basin will be extended into the 10-year floodplain within San Juan Creek. Properly sized energy dissipation will be implemented during final design and construction at the outfall locations, per Section 15.2.3 of the 2013 Ranch Plan ROMP. Therefore, hydromodification basins are not required.
- Outfall 8 is not considered a proposed storm drain outfall, because this outfall will not be used for flood control mitigation, nor will it receive peak flows from the 2- through 100-year storm events. Discharges at outfall 8 will be low flows controlled by the diversion structures and will maintain the existing flows to Gobernadora Ecological Restoration Area (GERA).

The PA-3&4 watersheds include subwatersheds: A, B, C, D, G, O, E and F. Detailed description of each watershed is provided below. The PA-3 and PA-4 Ultimate Hydrology Maps are shown on Exhibit 1 and Exhibit 2, respectively. Exhibit 3 shows the preliminary PA-3 and PA-4 grading, storm drains, proposed basins and outlet locations.

Subwatershed A is located in the northern portion of the PA-3 development and it is tributary to 2018 outfall 9, which is the exact same location as the 2013 Ranch Plan ROMP outfall 9. It has a total drainage area of 510.2 acres, and outlets to a tributary drainage that confluences with Gobernadora Canyon. This subwatershed contains several basins that provide water quality, hydromodification, and local flood control mitigation benefits for the 2-, 5- and 10-year expected value storm events. In an effort to protect the habitat adjacent to Gobernadora Canyon known as the GERA, a series of small basins that will receive water quality storm flows, dry weather runoff and nuisance flows are proposed. These small basins will provide water quality treatment following LID requirements and will receive and discharge low flows to irrigate the existing habitat along the Gobernadora Canyon overbank. More detailed information is provided in Section 5, Water Quality Program.

Subwatershed B is located in the southwest portion of the PA-3 development and it is tributary to 2018 proposed outfall 11. It has a total drainage area of 214.7 acres. Subwatershed B is the focus of current grading plans. Basin B will receive runoff flows from this subwatershed and will provide flood control mitigation prior to discharging to San Juan Creek. The Ranch Plan ROMP had a large proposed basin for this subwatershed, as well as portions of subwatershed C. The PA-3&4 ROMP reduces the area tributary to this basin and proposes two smaller flood control basins south of Cow Camp Road for subwatershed B. The basin B system will also consist of water quality treatment basins consisting of an infiltration basin (3B-5) south of Cow Camp Road and two advanced treatment systems (3B-6 and 3B-3) within the development north of Cow Camp Road. Grading constraints also require a small portion of subwatershed B to be treated by biofiltration basin (3A-12) in the subwatershed A on the west side of the development. Basins 3B-1, 3B-2, and 3B-4 will provide flood control mitigation prior to discharging to San Juan Creek.

Subwatershed C is located in the south-center portion of the PA-3 development and is tributary to 2018 outfall 13. This subwatershed is 870.6 acres in size and is the largest in the development. Since the total area is more than 640 acres, a unit hydrograph analysis is required for the local hydrology analysis of this subwatershed. Runoff from this subwatershed is conveyed in two mainline storm drain systems, each of which conveys water to a combination basin prior to treatment in the infiltration basin. The combination basin consists of both water quality treatment and flood control capacity through allowing flood control ponding space on top of a permanent pool (lake). The offsite pipe system outlets to the natural canyon in Subwatershed C, where flows will be treated with a debris basin, and then conveyed via culvert under Cow Camp Road to the second flood control basin.

Flood control in subwatershed C will be provided by three basins. The combination basin (3C-1) is the first flood basin, in which the two main storm drain lines initially drain. After the water quality volume exits 3C-1 to the infiltration basin (3C-2), any additional flood control volume will fill 3C-1 and overflow via weir to the second flood control basin (3C-3) in larger storm events. In the largest storm events, both 3C-1 and 3C-3 will be full, and water will overflow via weir from 3C-3 to the third flood control basin (3C-5). Additionally, the combination basin (3C-1) may be used as local harvest and use through irrigation of the adjacent sports park area. The C basins may also be used to hold stormwater to pump to Trampas Reservoir comingling with SMWD recycled water. The current grading plan indicated that a local biofiltration basin (3C-4) is needed for a portion (71.8 acres) of subwatershed C.

Subwatershed D is located to the east of Subwatershed C. The total drainage area is 439.5 acres, and it is tributary to 2018 outfall 14, which is the exact same location as the 2013 Ranch Plan ROMP outfall 14. A series of three basins will provide flood control mitigation for this subwatershed. Water quality treatment will be provided by a pretreatment forebay (3D-4) south of Cow Camp Road in area D, from which water will be conveyed by storm drain to an underground infiltration basin under the parking lot in Cow Camp in subwatershed G. The Ranch Plan ROMP did not include flood control basins in area D.

Flood control basins were included as part of the flood control mitigation plans after preliminary analyses showed that an additional basin was required to achieve the mitigation goals of the EIR. The current grading plan indicated that a local biofiltration basin (3D-6) is needed for a portion (2.2 acres) of subwatershed D.

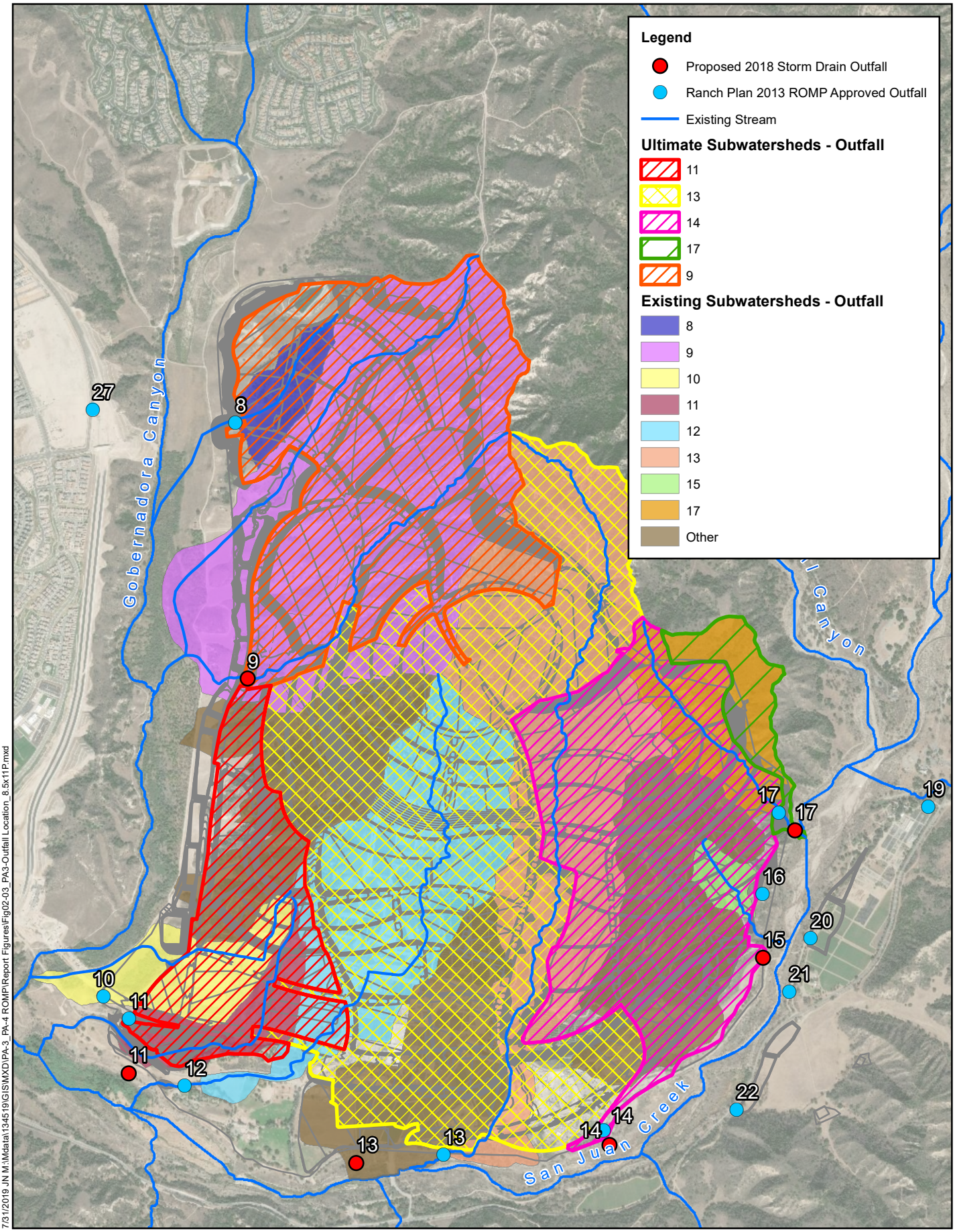
Subwatershed O is located on the eastern portion of PA-3. The total drainage area is 48.4 acres. It consists of natural areas with small drainages around the development that will not be disturbed by the proposed development. Subwatershed O will be maintained as a separate watershed from the developed areas in order to maintain natural drainage patterns and minimize impacts to the existing regional watershed S26. Some of the flows from this drainage area will be collected through a separate storm drain system and discharged into San Juan Creek at 2018 outfall 17, which is the exact same location as the 2013 Ranch Plan ROMP outfall 17. The natural runoff flows will be routed through an oversized pipe to deliver flow and sediment to San Juan Creek. Other flows will be routed to the same location through ditches that will only receive the undeveloped area runoff flows.

Subwatershed G is located on the southwest side of Cow Camp Road in PA-3. It is a small 19.4-acre drainage area that is planned to be self-contained. The onsite basin (3G-1) will provide water quality treatment and flood control, and under normal operation, no water will leave the subwatershed. The combined flood control and water quality basin will have a permanent pool on the bottom, with infiltration volume on top of the pool, and flood control volume on top. The basin is very shallow to provide maximum area for infiltration, and it is located in an area with very high natural infiltration rates. The basin may also be used as irrigation storage for the surrounding fields and sports park. The water quality portion of this combined basin is referred to as 3G-1a. Subwatershed G local rational method is included in Appendix B. Overtopping of the basin is not anticpated but emergency overflow routing will be assessed in later reports.

Subwatershed E is located in the northern-west portion of PA-4. It has a total drainage area of 171 acres. This subwatershed will collect off-site runoff through the storm drain system and comingle with runoff flows from the developed areas. The off-site runoff originates from natural hills that will not be developed. The two basins in subwatershed E will be located in the most downstream portion of this subwatershed and will be sized to accommodate the entire watershed, not only the developed areas. A flood control and pretreatment forebay will provide flood mitigation and pretreatment for the infiltration basin. An infiltration basin directly downstream will treat the water quality volume. The flows will be discharged to San Juan Creek through storm drain outfall 20.

Subwatershed F is located in the southern-east portion of PA-4. It has a total drainage area of 553.8 acres. This subwatershed will collect off-site runoff flow through the storm drain system and comingle with runoff flows from the developed areas. The off-site runoff originates from natural hills that will not be developed. A flood control and pretreatment forebay will provide flood mitigation and pretreatment for the infiltration basin. The two basins in subwatershed F will be located in the most downstream portion of this subwatershed. The flood control basin will provide flood mitigation for the entire watershed, not only the developed areas but the infiltration basin directly downstream will treat the water quality volume of only the developed areas. The flows will be discharged to San Juan Creek through storm drain outfall 22.

The 2018 Outfalls 12.1, 13.1, 14.1, and 15 are not currently used in the ultimate PA-3 and PA-4 storm drain plan; however, they may be used in future planning efforts.



7/31/2019 JN M:\Mdata\134519\GIS\MXD\PA-3_PA-4 ROMP\Report Figures\Fig02-03_PA3-Outfall Location_8.5x11P.mxd

Michael Baker INTERNATIONAL

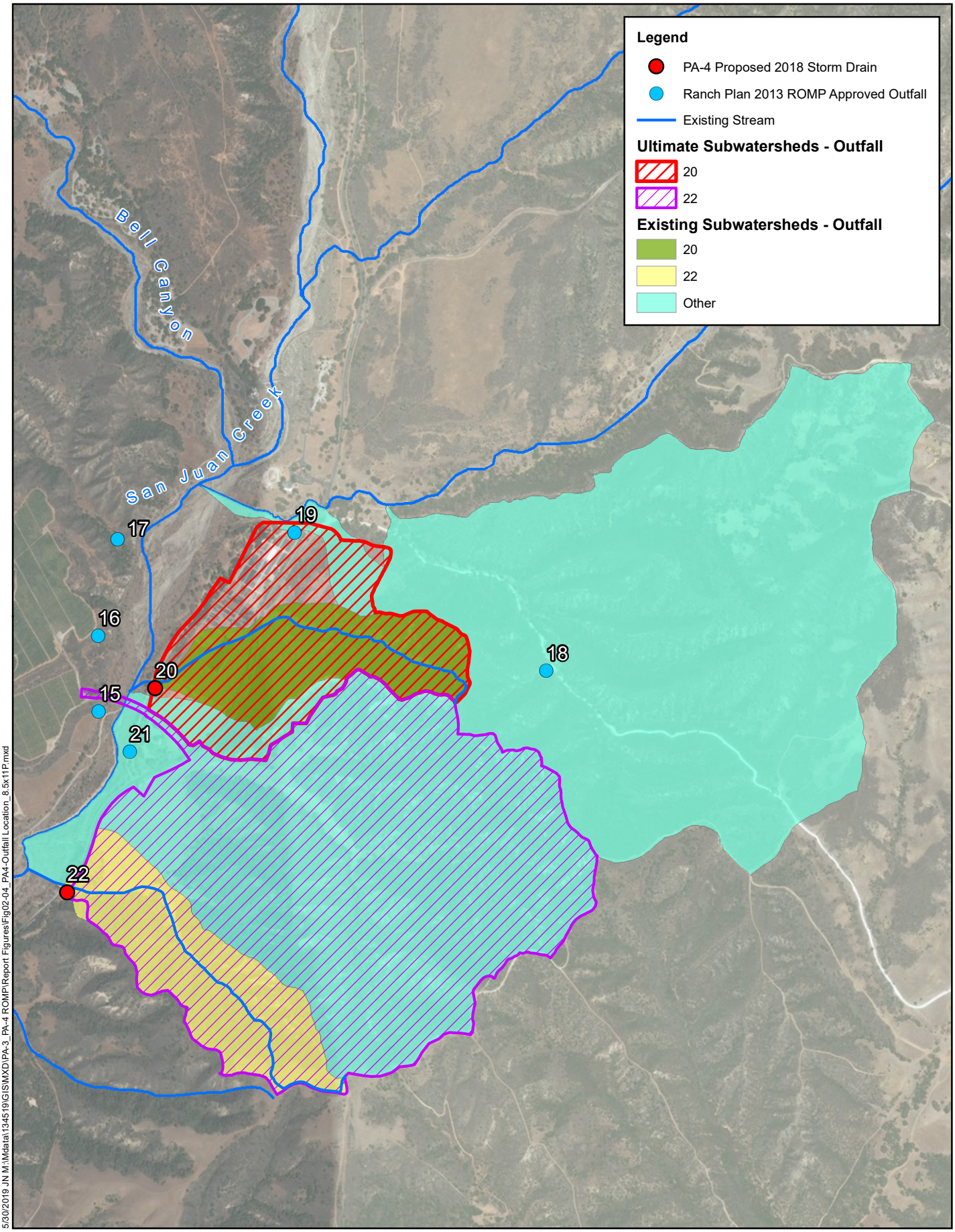
0 500 1,000 2,000 Feet

Source: ArcGIS Online

RANCHO MISSION VIEJO - PA3&4 ROMP

PA-3 Outfall Location

Figure 2-3



5/30/2019 JN M:\Mdata\134519\GIS\MXD\PA-3_PA-4 ROMP\Report Figures\Fig02-04_PA4-Outfall Location_8.5x11P.mxd

Michael Baker INTERNATIONAL

0 500 1,000 2,000 Feet

Source: ArcGIS Online

RANCHO MISSION VIEJO - PA3&4 ROMP

PA-4 Outfall Location

Figure 2-4

2.2.4 Hydrology Results

The results of the local analysis are summarized in the tables below as required by item 4.4 of Table 19-1 of the Ranch Plan ROMP. The proposed discharges in Table 2-3 represent the unmitigated condition. Table 2-4 provides existing, proposed unmitigated and mitigated values.

Table 2-3: Proposed Condition Local Rational Method Hydrology Results

Description				Expected Value (cfs)						High Confidence (cfs)	
Planning Area	Sub-watershed	2013 Ranch Plan Outfall # (2018)	Area (ac)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	100-yr	25-yr
3	A	9 (Gobernadora) (9)	510.2	214.0	387.7	636.6	831.1	949.3	1020.7	1356.2	1032.9
3	B	11 (San Juan) (11)	214.7	89.5	162.1	270.5	352.0	399.1	432.8	570.2	436.3
3	C	13 (San Juan) (13)	870.6	239.7	460.1	835.0	1100.5	1251.9	1367.6	1831.1	1390.2
3	D	14 (San Juan) (14)	439.5	144.2	279.9	491.8	646.1	734.6	796.6	1060.6	808.5
3	G	N/A (self-retaining)	19.4	13.1	21.7	34.2	44.4	49.8	53.9	69.6	53.2
N/A	O	17 (San Juan) (17)	48.4	4.9	24.5	55.6	74.6	85.4	93.3	126.5	95.5
4	E	20 (San Juan) (20)	171.0	94.5	167.2	274.2	358.2	408.3	435.8	573.5	438.6
4	F	22 (San Juan) (22)	553.8	162.3	345.8	646.8	865.7	991.4	1081.3	1468.8	1110.8

Table 2-4: Local Discharge Existing Versus Proposed PA-3&4 ROMP 2019

Existing Condition Subwatershed[1]	Tributary to	Existing Condition (PA3&4 ROMP)							Planning Area	2018 Outfall # (2018)	Proposed Condition Subwatershed (Tributary to)	Ultimate Condition (PA3&4 ROMP)												
												Area	Unmitigated						Mitigated					
		Area	2	5	10	25	50	100					2	5	10	25	50	100	2	5	10	25	50	100
		ac				cfs						ac	cfs						cfs					
3	Gobernadora	8.5	0.8	3.1	8.2	11.2	12.8	14.1		-		-	-	-	-	-	-	-	-	-	-	-	-	-
4A	Gobernadora	24.4	8.6	20.8	39.3	51.9	58.6	63.7		-		-	-	-	-	-	-	-	-	-	-	-	-	-
4B	Gobernadora	42.0	8.2	28.2	58.0	77.6	89.5	96.3		8		-	-	-	-	-	-	-	-	-	-	-	-	-
5A	Gobernadora	152.9	14.0	69.0	163.6	220.9	253.8	277.3	3	-	A[1,3]	-	-	-	-	-	-	-	-	-	-	-	-	-
5D	Gobernadora	57.1	8.0	33.6	72.8	97.8	111.7	121.8		-	(Gobernadora)	-	-	-	-	-	-	-	-	-	-	-	-	-
5B	Gobernadora	61.5	9.6	37.0	79.1	105.7	120.6	131.5		-		-	-	-	-	-	-	-	-	-	-	-	-	-
5C	Gobernadora	187.2	9.0	68.0	183.0	249.9	286.7	316.5		9		510.2	214.0	387.7	636.6	831.1	949.3	1020.7	13.8	77.8	233.5	350.8	465.3	579.7
TOTAL		**533.6**	**58.1**	**259.7**	**604.0**	**814.8**	**933.6**	**1021.3**			**TOTAL**	**510.2**	**214.0**	**387.7**	**636.6**	**831.1**	**949.3**	**1020.7**	**13.8**	**77.8**	**233.5**	**350.8**	**465.3**	**579.7**
6	Gobernadora	9.9	2.5	7.1	13.9	18.4	21.0	22.6		-		-	-	-	-	-	-	-	-	-	-	-	-	-
7	Gobernadora	74.0	8.3	37.2	85.8	115.8	132.6	145.1		-		-	-	-	-	-	-	-	-	-	-	-	-	-
8	Gobernadora	49.3	6.5	28.2	61.0	81.7	92.5	101.7		-		-	-	-	-	-	-	-	-	-	-	-	-	-
9A	Gobernadora	31.2	5.1	18.8	39.7	52.9	60.1	68.4		-		-	-	-	-	-	-	-	-	-	-	-	-	-
9B	Gobernadora	12.3	2.2	7.6	16.0	21.2	24.2	26.3	3	-	B[1,2]	-	-	-	-	-	-	-	-	-	-	-	-	-
10	Gobernadora	48.7	6.3	27.8	60.2	80.6	91.3	100.4		-	(SJC)	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-		10		-	-	-	-	-	-	-	-	-	-	-	-	-
11	SJC	52.8	2.9	21.2	53.3	72.2	82.4	91.1		11		214.7	89.5	162.1	270.5	352.0	399.1	432.8	8.6	17.0	35.7	49.5	68.8	90.6
TOTAL		**278.2**	**33.8**	**147.8**	**329.8**	**442.8**	**504.1**	**555.5**			**TOTAL**	**214.7**	**89.5**	**162.1**	**270.5**	**352.0**	**399.1**	**432.8**	**8.6**	**17.0**	**35.7**	**49.5**	**68.8**	**90.6**
12	SJC	283.8	10.7	81.7	233.2	321.9	371.2	412.3		-		-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-		12		-	-	-	-	-	-	-	-	-	-	-	-	-
13	SJC	120.4	4.8	40.1	110.1	150.3	173.1	190.7	3	13	C[4,2]	870.6	278.7	484.2	877.4	1144.9	1288.7	1414.7	2.8	10.8	39.8	81.2	113.7	136.1
14	SJC	481.0	5.9	91.8	311.0	437.7	512.4	570.6			(SJC)	-	-	-	-	-	-	-	-	-	-	-	-	-
15	SJC	47.0	5.5	21.1	46.3	62.0	70.9	77.7		-		-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL		**932.2**	**26.9**	**234.7**	**700.6**	**971.9**	**1127.7**	**1251.2**			**TOTAL**	**870.6**	**278.7**	**484.2**	**877.4**	**1144.9**	**1288.7**	**1414.7**	**2.8**	**10.8**	**39.8**	**81.2**	**113.7**	**136.1**
-	-	-	-	-	-	-	-	-		14		439.5	144.2	279.9	491.8	646.1	734.6	796.6	0.9	28.2	92.2	171.3	211.0	227.7
16	SJC	191.6	5.9	56.7	164.5	226.2	260.7	288.7		-		-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-		15		-	-	-	-	-	-	-	-	-	-	-	-	-
17A	SJC	18.3	2.9	10.8	22.8	30.4	34.3	37.6	3	-	D[1,2]	-	-	-	-	-	-	-	-	-	-	-	-	-
17B	SJC	25.2	2.8	13.5	29.6	39.5	45.1	49.2		-	(SJC)	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-		16		-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL		**235.1**	**11.6**	**81.0**	**216.9**	**296.1**	**340.1**	**375.5**			**TOTAL**	**439.5**	**144.2**	**279.9**	**491.8**	**646.1**	**734.6**	**796.6**	**0.9**	**28.2**	**92.2**	**171.3**	**211.0**	**227.7**
18	SJC	118.8	9.1	48.9	116.4	157.7	180.9	198.3	3	17	O[1] (SJC)	48.4	4.9	24.5	55.6	74.6	85.4	93.3	4.9	24.5	55.6	74.6	85.4	93.3
-	-	-	-	-	-	-	-	-		18		-	-	-	-	-	-	-	-	-	-	-	-	-
2	SJC	33.5	6.1	20.9	44.0	58.7	67.1	72.8	4	19	E[1,2]	-	-	-	-	-	-	-	-	-	-	-	-	-
3	SJC	130.9	6.3	57.8	138.2	186.7	213.8	234.8		20	(SJC)	171.0	94.5	167.2	274.2	358.2	408.3	435.8	1.7	3.9	101.3	176.4	208.2	232.5
TOTAL		**164.4**	**12.4**	**118.6**	**182.2**	**245.4**	**280.9**	**307.6**			**TOTAL**	**171.0**	**94.5**	**167.2**	**274.2**	**358.2**	**408.3**	**435.8**	**1.7**	**3.9**	**101.3**	**176.4**	**208.2**	**232.5**
4	SJC	394.6	37.9	176.6	414.0	561.8	647.2	708.0		21		-	-	-	-	-	-	-	-	-	-	-	-	-
5	SJC	78.0	13.8	43.4	93.6	125.7	143.5	156.6	4	-	F[1,2] (SJC)	-	-	-	-	-	-	-	-	-	-	-	-	-
6	SJC	105.9	6.4	42.4	107.7	146.2	167.0	184.5		22		553.8	162.3	345.8	646.8	865.7	991.4	1081.3	19.6	206.5	538.1	720.3	824.9	912.7
TOTAL		**578.5**	**58.0**	**262.4**	**615.2**	**833.7**	**957.7**	**1049.2**			**TOTAL**	**553.8**	**162.3**	**345.8**	**646.8**	**865.7**	**991.4**	**1081.3**	**19.6**	**206.5**	**538.1**	**720.3**	**824.9**	**912.7**

[1]Rational method discharges were used for the existing condition and unmitigated ultimate condition less than 640 acres.
[2]Complex unit hydrograph peak discharges were used for the mitigated ultimate condition
[3]Subwatershed A mitigated peak discharges are from PCSWMM as the PCSWMM results are more conservative than the AES results. Additionally, there were instability issues in AES pipe routing (peak Q increased), which were removed in the models.
[4]Single area hydrograph peak discharges were used for the unmitigated ultimate condition for areas greater than 640 acres.

2.3 Gobernadora Canyon Hydrology Analysis

The northern portion of PA-3, Subwatershed A, will discharge into Gobernadora Canyon at outfall 9. The Gobernadora Multipurpose Basin (GMB) is located upstream of this outfall. This basin was designed to provide flood control mitigation for the 25-, 50-, and 100-year storm events. As part of this PA-3&4 ROMP, infiltration basins, biofiltration basins, and hydromodification basins are proposed at outfall 9. These basins will provide water quality treatment and hydromodification control (see Section 5) and flood control mitigation for the 2-, 5- and 10-year storm events. A diversion structure located in the storm drain master plan facility will collect the runoff flows from Subwatershed A and divert the 2-, 5- and 10-year storm event runoff flows into the basins. A schematic of hydrograph routing through the Gobernadora Basin is shown on Figure 2-5, and the schematic of the 2-year through 10-year hydrograph routing for subwatershed A at node 13305 is shown in Figure 2-6. Figure 2-7 shows the configuration of the A basins.

2.3.1 Local Analysis

2.3.1.1 Subwatershed A Basins

The Ranch Plan ROMP includes local and regional basins. Per the Ranch Plan ROMP, local basins are for mitigation of flow along San Juan Creek tributaries and regional basins are for mitigation along San Juan Creek (see Ranch Plan ROMP, Section 11.1.3). The Subwatersheds A Basins volumes were designed using South Orange Hydrology Model (SOHM) from Clear Creek Solutions, Inc. SOHM is a tool that optimizes stormwater and water quality impacts due to land use changes on local streams. A Personal Computer Storm Water Management Model (PCSWMM) model from Computational Hydraulics International (CHI) was used to supplement the hydraulics throughout the A basin system and to model the water discharged from each basin into Gobernadora Canyon.

The diversion structures located in the storm drain master plan facility will collect the runoff flows from Subwatershed A and divert the flow simultaneously to the basin 3A-2, 3A-5, 3A-6, 3A-7, and 3A-9. Runoff from basin 3A-2 are distributed to basin 3A-3 and 3A-4 for infiltration. Basins are designed to have a 1-foot of freeboard to the crest of the spillway structure in the 100-yr event. Basin 3A-5, 3A-6, and 3A-7 are biofiltration basins, and basins 3A-9, 3A-10, and 3A-11 are detention basins in series. Flows from the biofiltration basins and detention basins are discharged into Gobernadora Canyon. For a detailed schematic, see Figure 2-7.

Unit hydrographs for 2-, 5-, and 10-year storm events were generated for the developed and offsite areas of subwatershed A in the local hydrology analysis and added to the PCSWWM basin routing model. The developed area hydrograph was applied at Junction 1 and the hydrograph for the offsite area was added at the outfall location. Continuous flow is used to determine if the basins meet the hydromodification requirements. Time series for continuous simulation was exported from SOHM. Continuous simulation was completed with time series from 1958 to 2005 for every 15 minutes increment.

Biofiltration basins are modeled with 1.2-feet of equivalent water depth and 5-feet of available depth above the gravel. A 6-inch underdrain is located at the bottom of each biofiltration basin to discharge flows to Gobernadora Canyon. The hydromodification basins were connected in series and have outlet pipes to simulate the flows outletting to Gobernadora Canyon.

2.3.1.2 Local Gobernadora Results

Table 2-5 shows the local flows out of each basin compared to the existing rational method flows. The cumulative proposed discharge from the basins is less than the existing condition.

Table 2-5: Existing and Basin Outflow Comparison

2019 Outfall #	Existing Condition Watershed	Existing Condition (PA3&4 ROMP)							Ultimate Mitigated[1]						
		Area	2	5	10	25	50	100	Basin	2	5	10	25	50	100
		ac	cfs							cfs					
-	3	8.5	0.8	3.1	8.2	11.2	12.8	14.1	-	-	-	-	-	-	-
-	4A	24.4	8.6	20.8	39.3	51.9	58.6	63.7	-	-	-	-	-	-	-
8	4B	42.0	8.2	28.2	58.0	77.6	89.5	96.3	-	-	-	-	-	-	-
-	5A	152.9	14.0	69.0	163.6	220.9	253.8	277.3	-	-	-	-	-	-	-
-	5D	57.1	8.0	33.6	72.8	97.8	111.7	121.8	-	-	-	-	-	-	-
-	5B	61.5	9.6	37.0	79.1	105.7	120.6	131.5	3A-5	3.6	36.3	42.3	43.0	43.5	43.8
9	-	-	-	-	-	-	-	-	-	0.0	0.0	0.0	112.6	185.2	264.3
	5C	187.2	9.0	68.0	183.0	249.9	286.7	316.5	3A-6	2.9	28.9	70.1	70.1	70.8	71.4
-	6	9.9	2.5	7.1	13.9	18.4	21.0	22.6	3A-7	2.0	2.2	4.5	14.9	19.8	21.6
-	7	74.0	8.3	37.2	85.8	115.8	132.6	145.1	3A-9	1.2	2.5	43.2	74.9	81.8	84.4
-	8	49.3	6.5	28.2	61.0	81.7	92.5	101.7	3A-10	1.0	2.5	45.1	80.4	96.1	103.4
-	9A	31.2	5.1	18.8	39.7	52.9	60.1	68.4	3A-11	1.3	10.4	77.8	104.4	117.4	123.3
-	9B	12.3	2.2	7.6	16.0	21.2	24.2	26.3	-	-	-	-	-	-	-
-	10	48.7	6.3	27.8	60.2	80.6	91.3	100.4	-	-	-	-	-	-	-

[1]Basin peak discharges are from PCSWMM.

2.3.2 Subregional Analysis

A subregional analysis was created to assess the effects of discharging the post-development runoff flows from Subwatershed A into Gobernadora Canyon and the GERA at node 13305 along Gobernadora Canyon. Node 13305 is an intermediate node in the Ranch Plan ROMP. The use of node 13305 allows a hydrology analysis comparison that better captures the differences between the existing and ultimate condition runoff flows within Gobernadora Canyon, which is immediately adjacent to the basins in Subwatershed A. This Gobernadora subregional hydrology analysis consists of the existing and ultimate condition rational method and unit hydrographs for the area tributary to node 13305. This analysis includes the single area, free draining and complex with basin hydrograph models. A description of these hydrographs is below.

The unit hydrographs for the local Gobernadora analysis, in accordance with Section K of the Orange County Hydrology Manual, included:

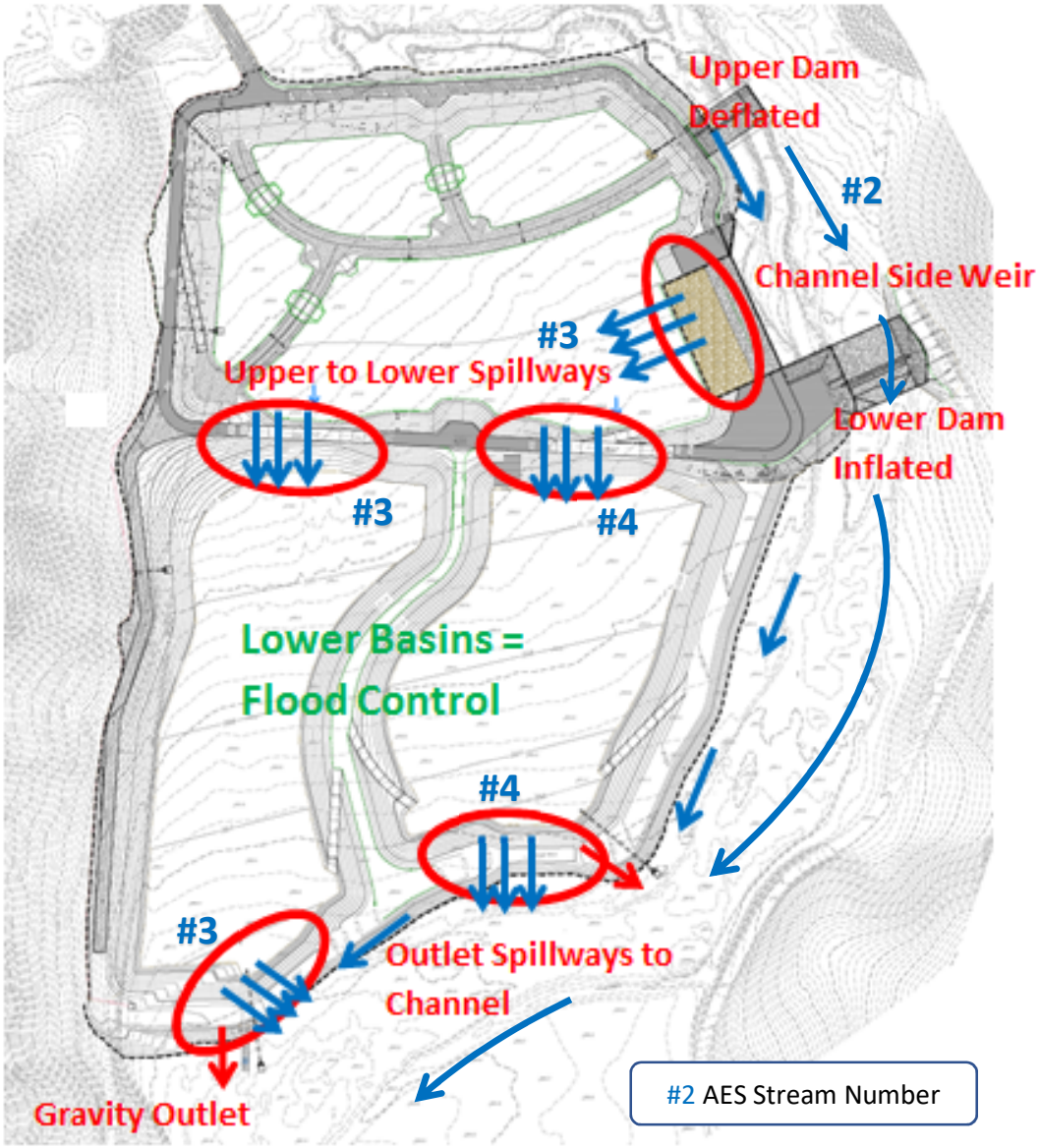
1. Single Area Model: single hydrograph to a concentration point
2. Free Draining Model: multiple hydrographs (due to watershed division into subwatersheds) that are linked together by routing processes to the same concentration point as the single area runoff hydrograph
3. Calibrated Free Draining: free draining model with increased rainfall so that the free draining model is equal to or greater than the single area model. Free draining models with flows within 2% of the single area model were not calibrated

4. Complex with Basin Model: free draining or calibrated free draining model with proposed basins inserted in the model

The Gobernadora Multipurpose Basin routing used the final design rating curves from the Gobernadora Basin Report (PACE, 2014). The local basin stage-storage-outflow curve is based on the PCSWMM model. The diversion flows into the local basins are also based on the water quality models described in Section 5 of this report. The existing condition unit hydrograph model for Node 13305 is based on the approved Ranch Plan ROMP rational method models. It consisted of modifying the unit hydrograph models to use the time of concentration (T_c) at node 13305 and excluding all areas downstream of 13305. The unit hydrograph model was then run following the Orange County methodology and the unique considerations for areas within San Juan Creek Watershed per Chapter 5 of the Ranch Plan ROMP including modeling of the development with AMC II and undeveloped areas with AMC I for more frequent storms (2-, 5-, and 10-year). Appendix C provides the rational method and unit hydrograph hydrology models. The ultimate condition watershed tributary to node 13305 is shown on Exhibit 9. Table 2-6 provides a summary of the hydrology results for the existing and ultimate conditions.

Table 2-6: Local Node 13305 Discharge Results

Storm Event	Existing Condition Model	Ultimate Condition			
		Single Area Model	Free Draining Model	Calibrated Model	Complex Model
100	3826	3859	3828	-	2849
50	3399	3435	3329	3423	2611
25	2845	2874	2815	2882	2289
10	1868	1941	1856	1895	1659
5	813	882	845	878	781
2	368	409	386	407	393



Citation: PACE August 2014 Design Report: Gobernadora Multipurpose Basin

Figure 2.5: Gobernadora Multipurpose Basin Routing

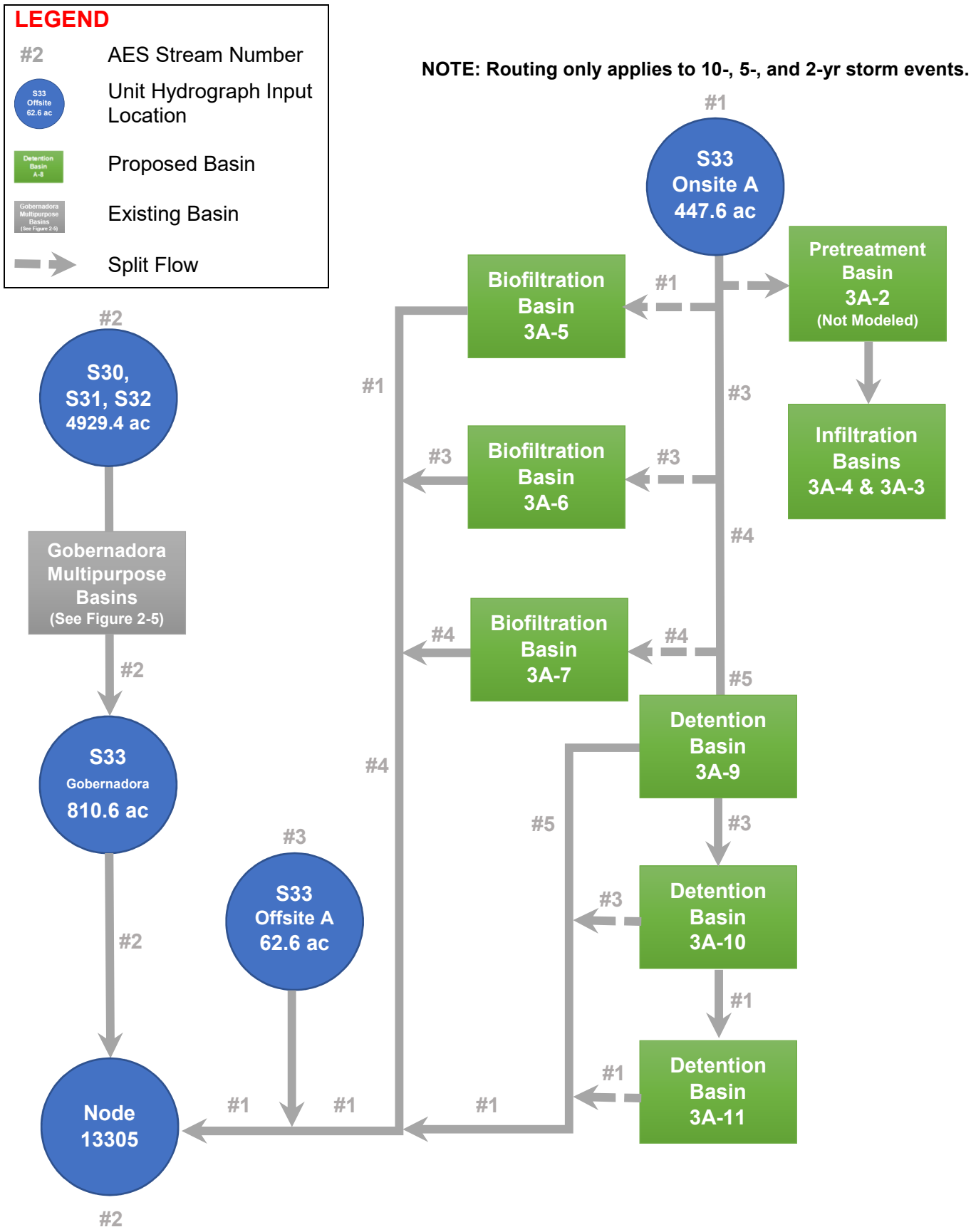
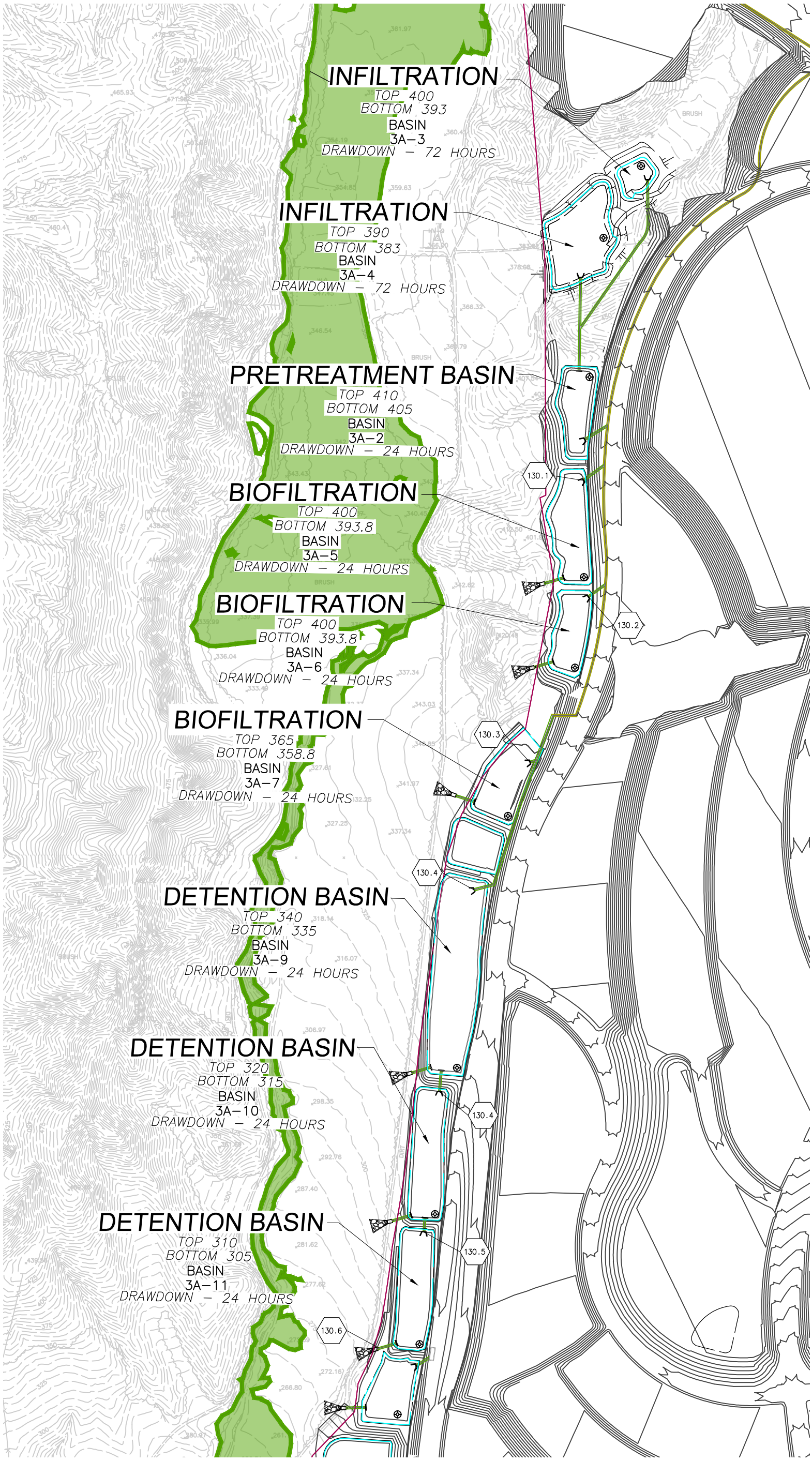


Figure 2-6: Proposed Subwatershed A Basin Routing to Node 13305 PCSWWM Routing



RANCHO MISSION VIEJO PA3&4 ROMP
PROPOSED SUBWATERSHED A BASIN MAP
FIGURE 2-7

Michael Baker
INTERNATIONAL
5 Hutton Centre Drive, Suite 500, Santa Ana, CA 92707
Phone: (949) 472-3505 · MBAKERINTL.COM

2.4 Regional Analysis

In order to address the Ranch Plan ROMP Chapter 19 requirements and Mitigation Measure 4.5-5, the regional hydrology analysis includes the following:

- Revised existing conditions analysis;
- Sub-regional analysis for Gobernadora Canyon;
- Phased condition regional hydrology;
- Ultimate condition regional hydrology; and
- Final Recommendations.

The hydrology methods used in the regional analysis are consistent with the methods used in the Ranch Plan ROMP including the use of AMC I for undeveloped areas and AMCII for developed areas for the higher frequency storms. A complete discussion of the regional hydrology methods can be found in the Ranch Plan ROMP Chapter 5. Unit Hydrograph Parameter Development is included in Appendix H. The following summarizes the hydrologic inputs to the various models.

2.4.1 Regional Rational Method

The rational method was used in the regional study to determine lag times for use in the unit hydrograph models according to the Orange County Hydrology Manual Equation E.1 Lag= 0.8 Tc except for the 2-year and 5-year. The 2-year and 5-year analysis required the use of the unit yield method in natural areas (0% impervious) where the rainfall intensity becomes less than the loss rate. The unit yield calculations are included in Appendix H.6 through H.8.

The rainfall intensity for the regional rational method required the use of both non-mountainous and mountainous weighted average depending on the location of the concentration point in the watershed. The rainfall data used in this updated PA-3&4 ROMP is included in Appendix D.4, E.7, F.7, and G.7 for the Existing, Phase and Ultimate Conditions, respectively.

The regional rational method model includes the use of .DNA files for concentration points upstream of the studied concentration points. For this update the only regional areas studied are: S19 (existing area northeast of PA-4), S26 (PA-4 and San Juan Creek), S27 (PA-3 and San Juan Creek), S29 (PA-5 and San Juan Creek), and S33 (Gobernadora Canyon and San Juan Creek confluence). Exhibit 9 shows the rational method regional watershed basins. For the phased and ultimate analysis, a regional rational method with embedded basins (complex model) is included in Appendices E.6 and F.6 for Phased and G.6 for Ultimate Conditions. These models are developed with the basin outflow to estimate lag time for complex models (with basins). The basins mitigate outflow and decrease the velocity and increase the travel time for the stream segments downstream of the basin. The outflow is simulated by re-inputting the max outflow into the free draining rational method model. The calculation of effective area for basin outflow uses the local rainfall unit hydrograph for the area directly tributary to that basin (Appendix B.8).

2.4.2 Basins

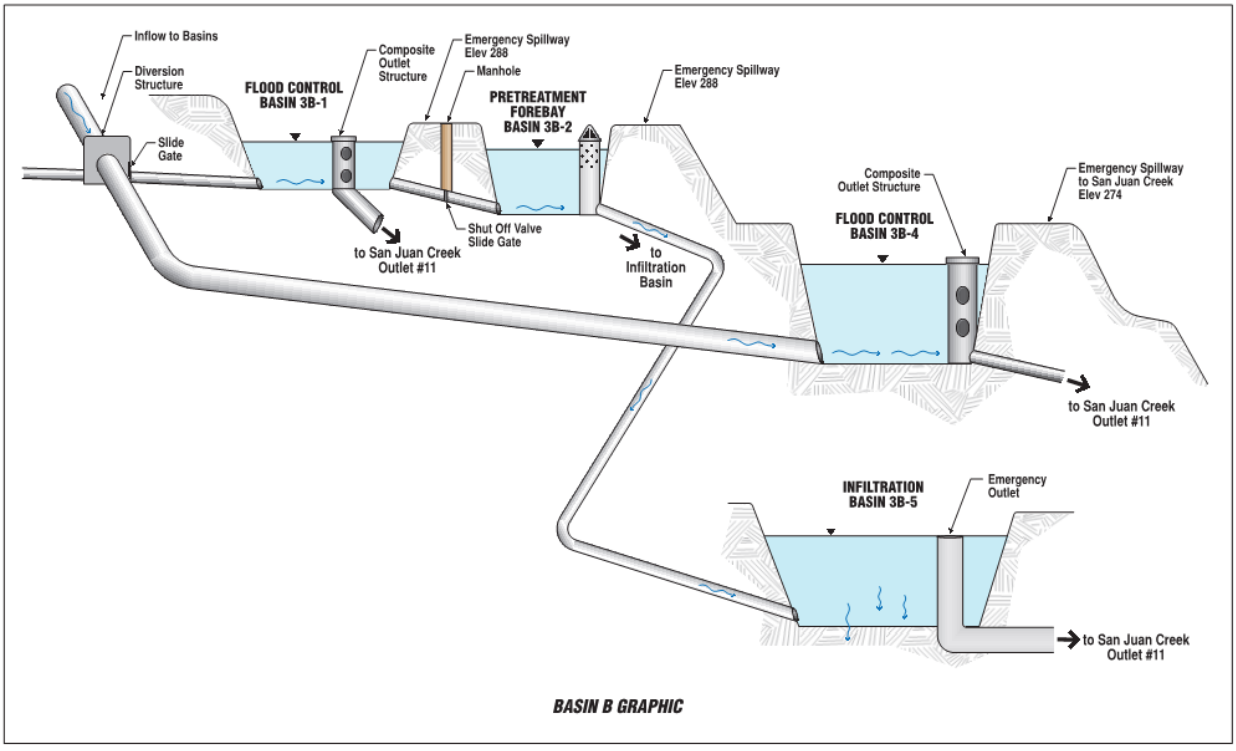
Five (5) regional basin systems are proposed within the PA-3&4 development. Basins in subwatersheds B, C, D, E, and F provide regional mitigation and are included in the regional hydrology models. These basins have been sized for local watershed requirements. They are able to detain the local multiday storms and provide the required two (2) feet of freeboard to the crest of the emergency spillways. Basin design conforms with the County Design Criteria and Division of Safety of Dams (DSOD) requirements. Basins in subwatershed A provide subregional mitigation and are only included in subregional

Gobernadora models. Proposed basins are shown on Exhibit 3. The basin systems will provide water quality treatment, hydromodification mitigation, and flood control for the planning areas. Regional basins outside of PA-3&4 include Gobernadora Basin in regional area S33 (see Plans for Construction of Facility L07B01 Canada Gobernadora Detention Basin dated July 2014) and the proposed basin in PA-5, which is unchanged from the 2013 Ranch Plan ROMP. This ROMP provides a programmatic evaluation of the storm drains, bypasses, and preliminary footprints of all the basins. Detail for each facility will be provided with final design.

Basin System A will provide water quality treatment and hydromodification mitigation for local flows through approximately the 10-year event in subwatershed A. Basins in System A are located on the north and northwestern portion of PA-3. The basin system will outlet into Gobernadora Canyon and is included in the subregional analysis at Node 13305 2-, 5-, and 10-year models. The Basin System A, which is primarily for LID, water balance and hydromodification, is discussed in detail in Section 5.

Basin System B will provide water quality treatment and flood control for Subwatershed B Basins. The system is located south of Cow Camp Road just east of the Gobernadora Canyon. Subwatershed B basins include two flood control basins, a pretreatment forebay, and an infiltration basin for water quality. There are also two advanced treatment systems in Subwatershed B, which are water quality features that are discussed in Section 5.5.2. The lower flows are directed to the easterly flood control basin 3B-1, which is also connected to the pretreatment forebay and infiltration basins (3B-2 and 3B-5). The remaining flows will be conveyed to the larger westerly flood control basin (3B-4) and outlet directly to San Juan Creek at Outlet 11 (regional hydrology node 129). A graphic of the B basin system is shown in Figure 2-8. A schematic of Basin System B functions is shown in Figure 2-9, and a map of the Basin System B layout is shown in Figure 2-10. Basin System B final design is included on the Cow Camp Road Phase 2B plans.

Figure 2-8: Proposed Subwatershed B Basin Graphic



Basin System C consists of four (4) interconnected basins located south of Cow Camp Road and the PA-3 development. Three of these basins are flood control and the fourth is an infiltration basin. Flows from the developed portion of subwatershed C drain into two main lines that outlet into the first flood control basin. The first flood control basin (3C-1) contains a permanent pool (Advanced Treatment), which will serve as a forebay basin for the infiltration basin (3C-2) and can be used as irrigation for the surrounding fields. Water quality flows are diverted from this first flood control basin to the infiltration basin (3C-2). The first flood control basin (3C-1) was sized to contain the 2- and 5-year storm events. The 10- through 100-year storm events will overflow via a weir into the next flood control basin (3C-3). Offsite flows from subwatershed C drain into this second flood control basin (3C-3). Based on the current basin grading, the second flood control basin is large enough to contain up to the 100-year expected value storm event. The third flood control basin (3C-5) is reserved for the 100-year high confidence and multiday storm events. Outflows from Basin System C will enter San Juan Creek downstream of Gibby Road at outlet 13 (regional hydrology node 127). A schematic of how Basin System C functions is included in Figure 2-11, and a map of the Basin System C layout is included in Figure 2-12.

Basin System D consists of five basins located on the southeastern side of PA-3 in subwatershed D. Three of these basins are for flood control, one is a pretreatment forebay, and the last is an underground infiltration basin. The two northern flood control basins (3D-1 and 3D-2) are connected in a series and take flows from the northeastern portion of subwatershed D. The third most southern flood control basin (3D-3) takes flows from the southwestern portion of subwatershed D. Water quality flows are diverted off the main storm drain lines prior to entering the flood control basins. These water quality flows are taken to the pretreatment forebay (3D-4) located southwest of the third flood control basin (3D-3). Flows from 3D-4 are then piped to an underground infiltration basin (3D-5), which is located in subwatershed G, where the best infiltration rates are found. Outflows from Basin System D will enter San Juan Creek at outlet 14 (regional hydrology node 126). A schematic of Basin System D is shown in Figure 2-13, and a map of the Basin System D layout is shown in Figure 2-14.

Basin System E consists of a flood control basin and a water quality basin located on the western side of PA-4 subwatershed E. The flood control basin (4E-1) will serve as a sediment forebay for the water quality infiltration basin (4E-2). The basins have been sized to consider the flow from the entire watershed, not only the developed area. Low flows will enter the water quality basin, and higher flows will discharge into San Juan Creek at outlet 20 (regional hydrology node 126). A plan view of the configuration for Basin System E is included in Figure 2-15.

Basin System F consists of a flood control basin and a water quality basin located on the northwestern side of PA-4 subwatershed F. The flood control basin (4F-1) will serve as a sediment forebay for the water quality infiltration basin (4F-2). The basins have been sized to consider the flow from the entire watershed, not only the developed area. Low flows will enter the water quality basin, and higher flows will discharge into San Juan Creek at outlet 21 (regional node 126). A plan view of the configuration for Basin System F is included in Figure 2-16.

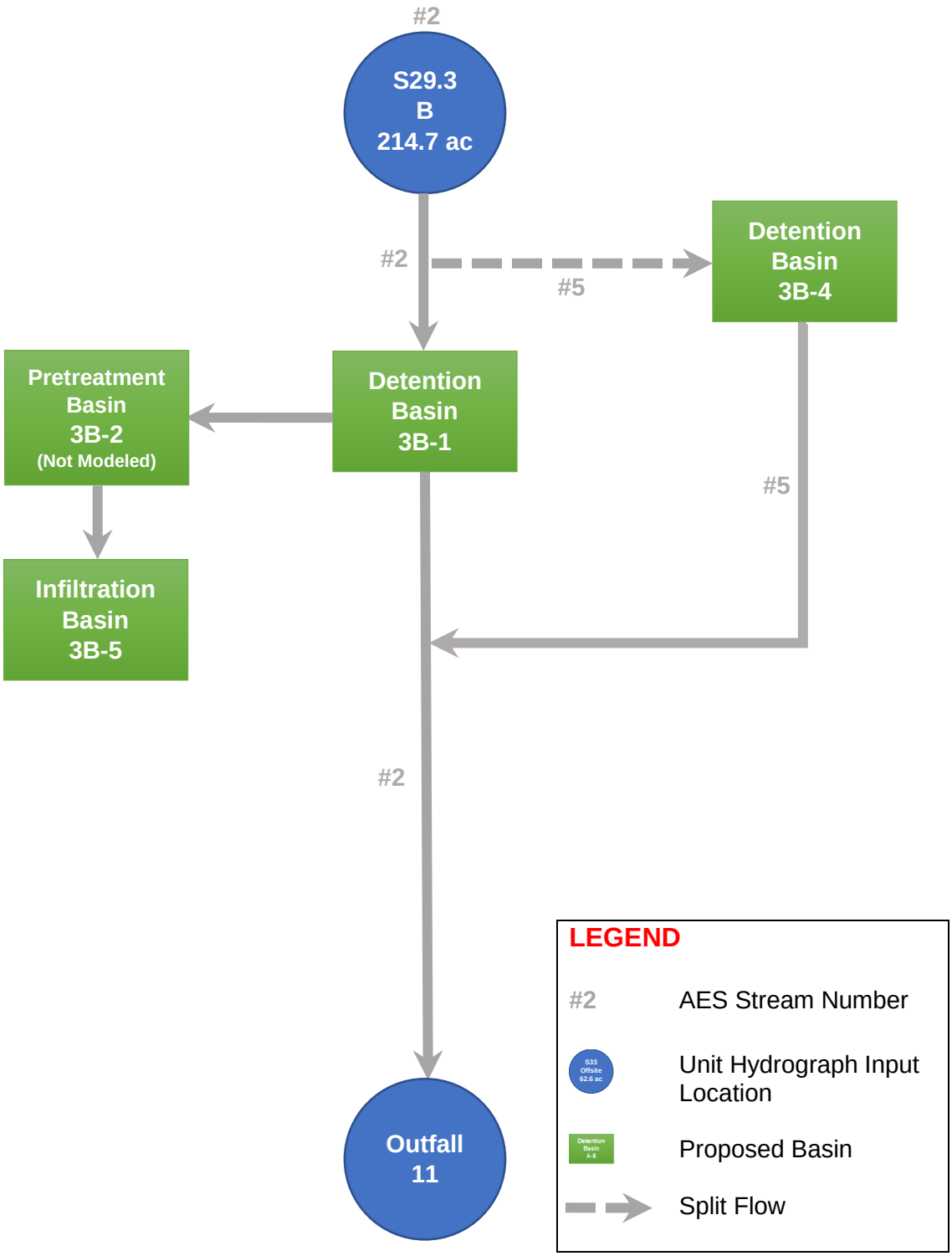
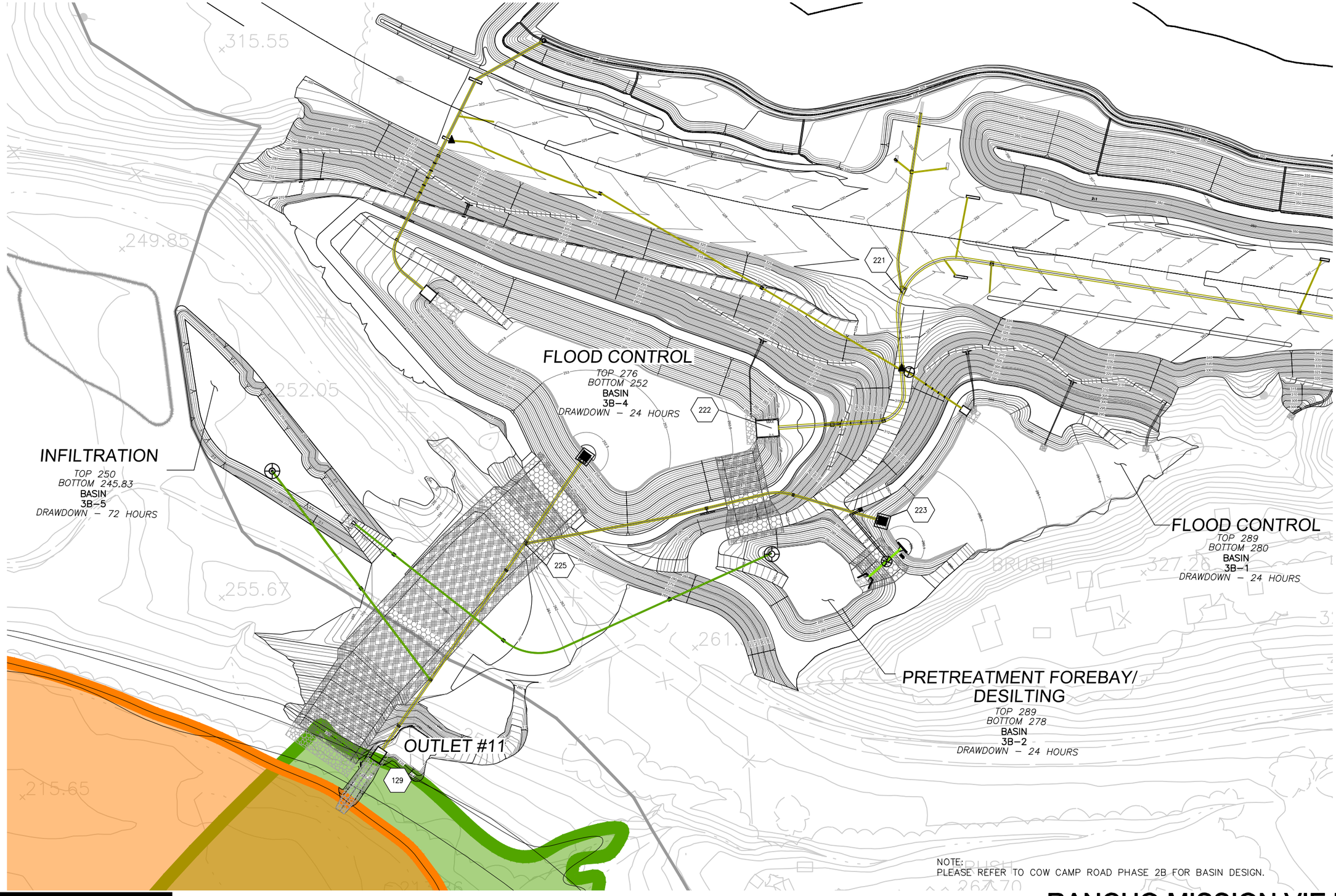


Figure 2-9: Proposed Subwatershed B Basin Routing



NOTE:
PLEASE REFER TO COW CAMP ROAD PHASE 2B FOR BASIN DESIGN.

Michael Baker
INTERNATIONAL
5 Hutton Centre Drive, Suite 500, Santa Ana, CA 92707
Phone: (949) 472-3505 · MBAKERINTL.COM

150 75 0 150 300 450
SCALE: 1"=150'

RANCHO MISSION VIEJO PA3&4 ROMP
PROPOSED SUBWATERSHED B BASIN MAP
FIGURE 2-10

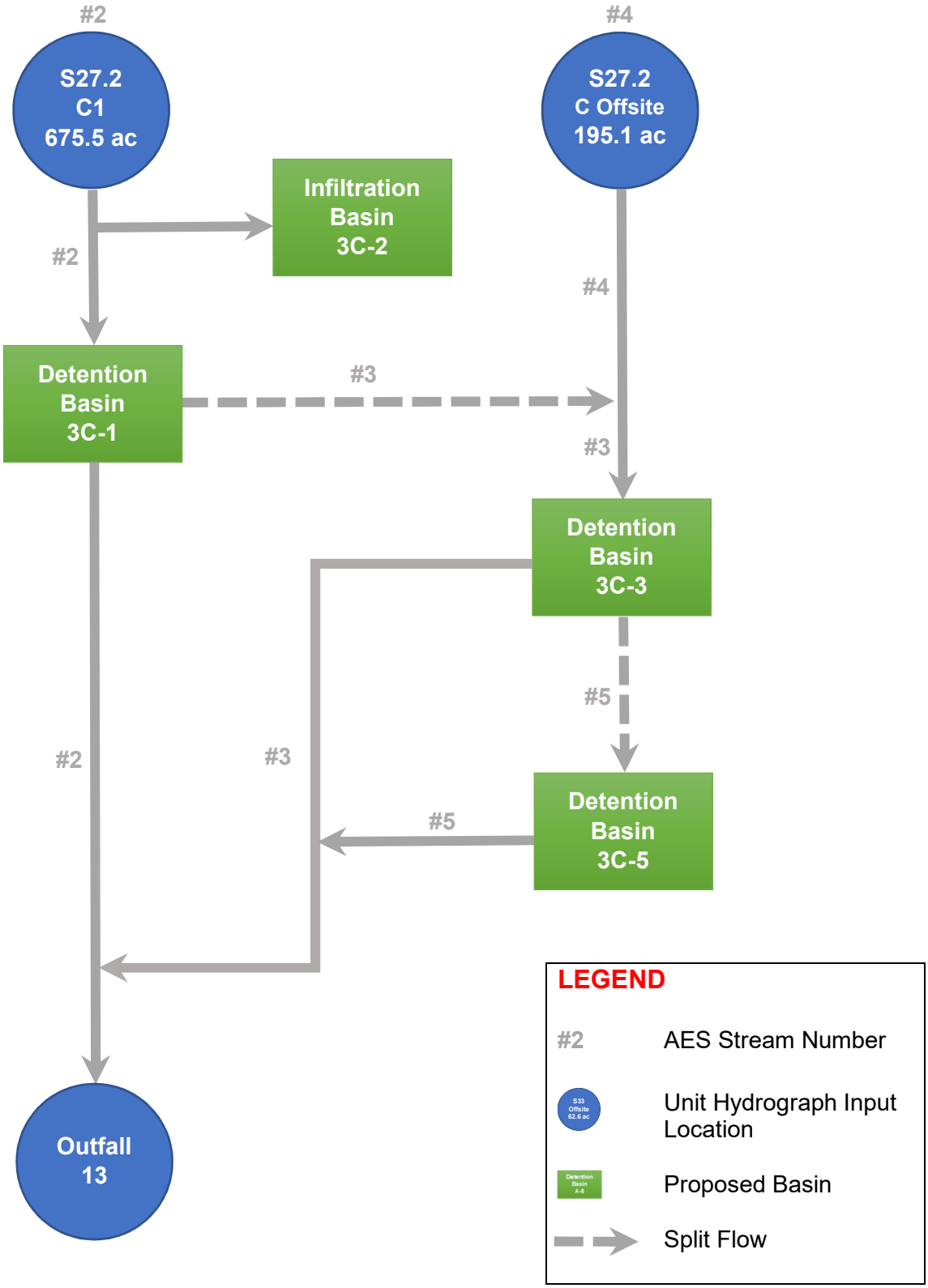
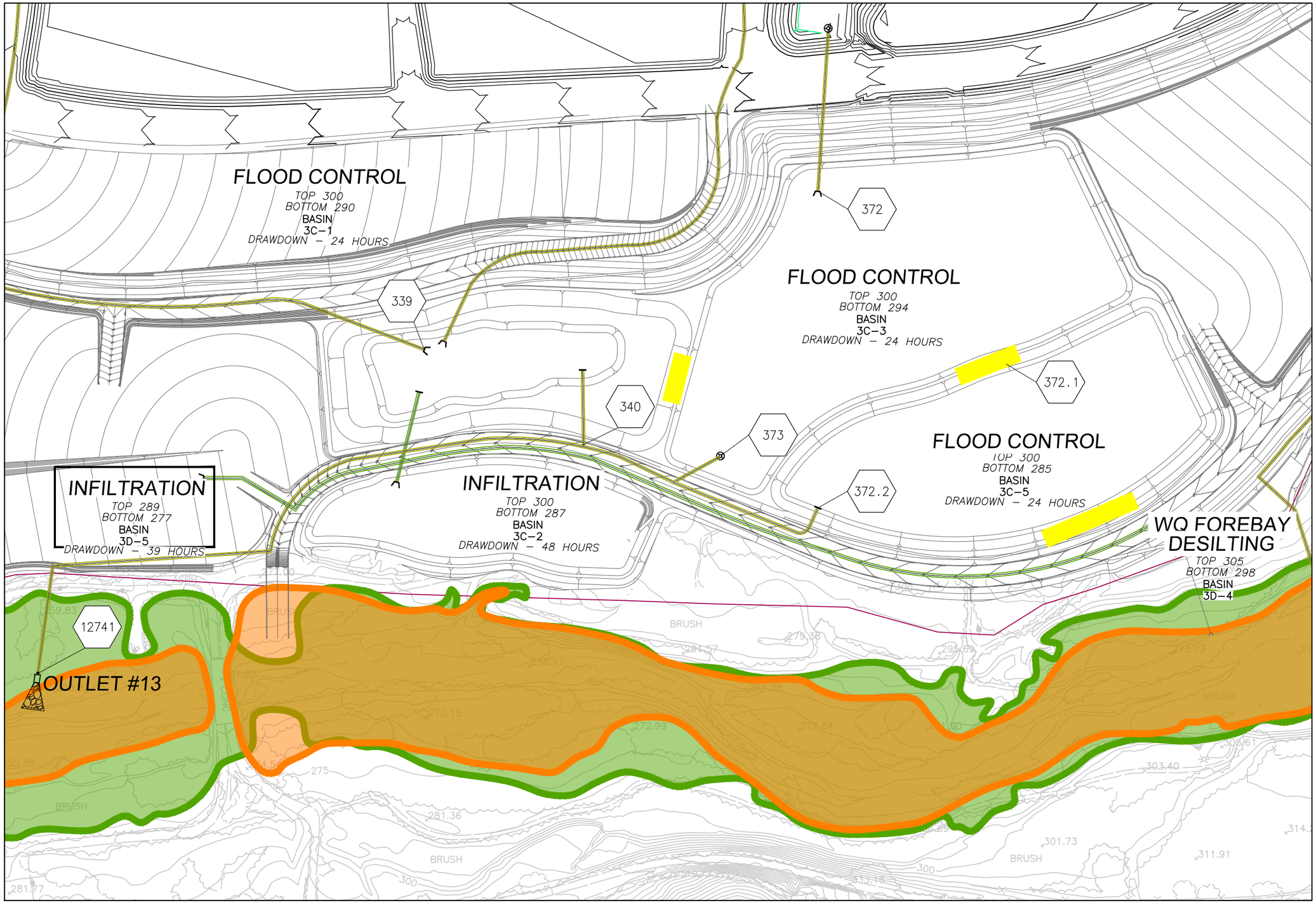


Figure 2-11: Proposed Subwatershed C Basin Routing



LEGEND

- SD OUTLET STRUCTURE
- HEADWALL–PIPE INLET
- CMP RISER
- WATER QUALITY PIPE
- FLOOD CONTROL PIPE
- 10–YR FLOODPLAIN
- 100–YR PROPOSED FLOODPLAIN
- PLANNING AREA BOUNDARY
- WEIR

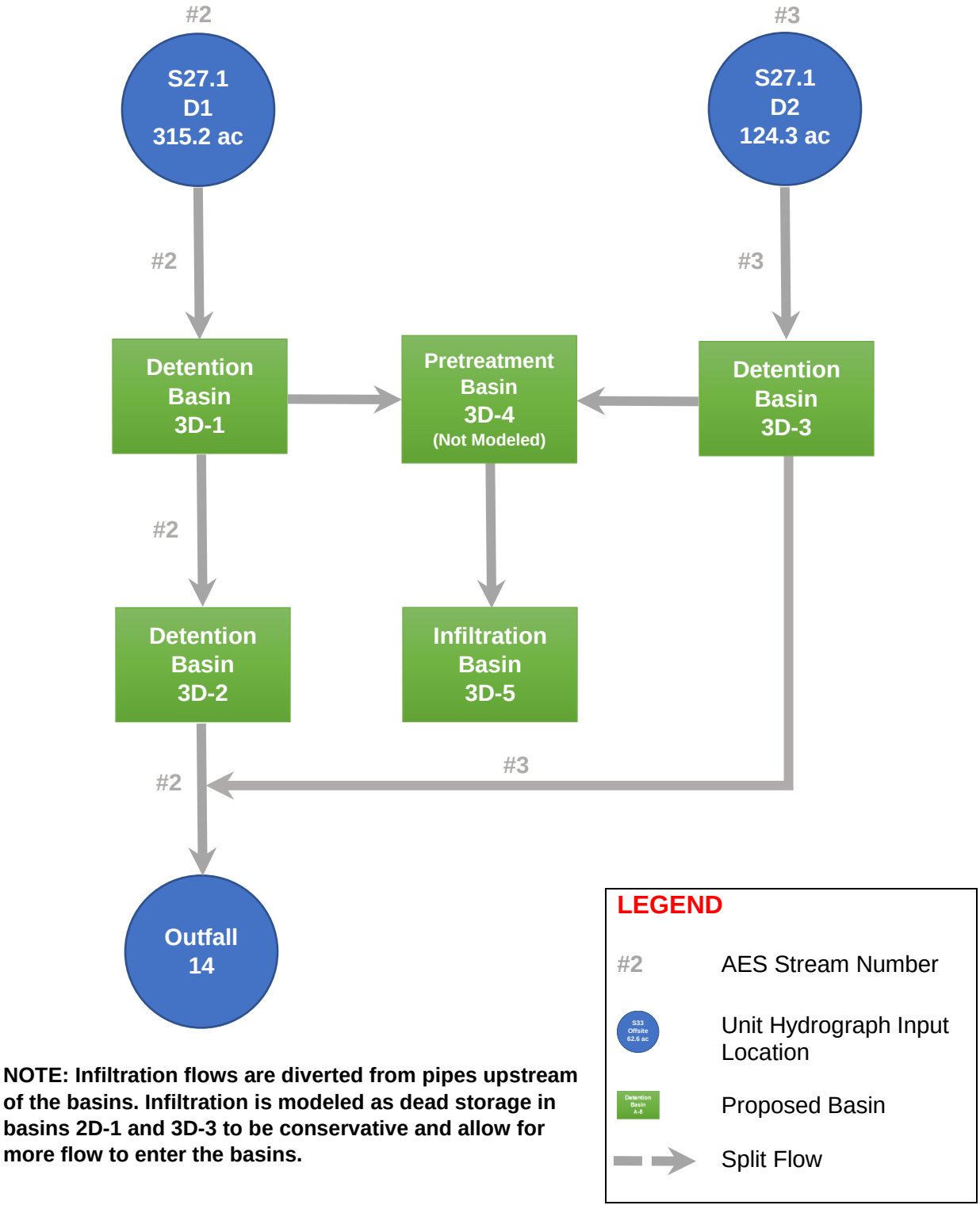
SCALE 1"=300'

300 150 0 300 600 900

SCALE: 1"=300'

Michael Baker
INTERNATIONAL
5 Hutton Centre Drive, Suite 500, Santa Ana, CA 92707
Phone: (949) 472-3505 · MBAKERINTL.COM

RANCHO MISSION VIEJO PA3&4 ROMP
PROPOSED SUBWATERSHED C BASIN MAP
FIGURE 2-12



NOTE: Infiltration flows are diverted from pipes upstream of the basins. Infiltration is modeled as dead storage in basins 2D-1 and 3D-3 to be conservative and allow for more flow to enter the basins.

Figure 2-13: Proposed Subwatershed D Basin Routing

LEGEND

- SD OUTLET STRUCTURE
- HEADWALL– PIPE INLET
- CMP RISER
- WATER QUALITY PIPE
- FLOOD CONTROL PIPE
- PLANNING AREA BOUNDARY

420

FLOOD CONTROL
TOP 336
BOTTOM 325
BASIN
3D–1

420.5

FLOOD CONTROL
TOP 320
BOTTOM 311
BASIN
3D–2

425

FLOOD CONTROL
TOP 316
BOTTOM 305
BASIN
3D–3

427

426

12720.5

WQ FOREBAY DESILTING
TOP 305
BOTTOM 298
BASIN
3D–4

OUTLET #14

INFILTRATION
TOP 289
BOTTOM 277
BASIN
3D–5
DRAWDOWN – 39 HOURS

12741

OUTLET #13

SCALE 1"=300'

Michael Baker
INTERNATIONAL
5 Hutton Centre Drive, Suite 500, Santa Ana, CA 92707
Phone: (949) 472-3505 · MBAKERINTL.COM

300 150 0 300 600 900

SCALE: 1"=300'

RANCHO MISSION VIEJO PA3&4 ROMP
PROPOSED SUBWATERSHED D BASIN MAP
FIGURE 2-14

LEGEND

- SD OUTLET STRUCTURE
- HEADWALL– PIPE INLET
- CMP RISER
- WATER QUALITY PIPE
- FLOOD CONTROL PIPE
- WEIR

FLOOD CONTROL
TOP 350
BOTTOM 340
BASIN
4E–1
DRAWDOWN – 24 HOURS

INFILTRATION
TOP 350
BOTTOM 340
BASIN
4E–2
DRAWDOWN – 48 HOURS

OUTLET #20

809

12603

SCALE 1"=200'

200 100 0 200 400 600

SCALE: 1"=200'

Michael Baker INTERNATIONAL
5 Hutton Centre Drive, Suite 500, Santa Ana, CA 92707
Phone: (949) 472-3505 · MBAKERINTL.COM

RANCHO MISSION VIEJO PA3&4 ROMP
PROPOSED SUBWATERSHED E BASIN MAP
FIGURE 2-15

LEGEND

- SD OUTLET STRUCTURE
- HEADWALL– PIPE INLET
- CMP RISER
- WATER QUALITY PIPE
- FLOOD CONTROL PIPE
- WEIR

905

126

OUTLET #22

FLOOD CONTROL

TOP 340
BOTTOM 330
BASIN
4F–1
DRAWDOWN – 24 HOURS

INFILTRATION

TOP 300
BOTTOM 287
BASIN
4F–2
DRAWDOWN – 72 HOURS

SCALE 1"=200'

Michael Baker
INTERNATIONAL
5 Hutton Centre Drive, Suite 500, Santa Ana, CA 92707
Phone: (949) 472-3505 · MBAKERINTL.COM

200 100 0 200 400 600.001

SCALE: 1"=200'

RANCHO MISSION VIEJO PA3&4 ROMP
PROPOSED SUBWATERSHED F BASIN MAP
FIGURE 2-16