Appendix G

Hydrology and Water Quality

The Triangle Specific Plan

HYDROLOGY AND WATER QUALITY TECHNICAL APPENDIX

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Prepared:
March 2008

Revision History	
Date	Comment
02/14/2008	Original
03/20/2008	CEQA style format
04/09/2008	First Revision
12/01/2011	Second Revision

JN 15-102215.002

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1.0 INTRODUCTION

The following study represents the Hydrology and Water Quality Technical Appendix prepared as part of *The Triangle, Specific Plan No. 276, Amendment No.1* (previously adopted as the Murrieta Springs Mall Specific Plan No. 276). The project is located in the City of Murrieta, Riverside County, California. The site is located between the I-15 and I-215 freeways, south of Murrieta Hot Springs Road. (See Figures 1 and 2 for a Regional and Project Vicinity Map). The project site encompasses approximately 64.3 acres. This report is a technical engineering study/evaluation intended to support the *Master Planning and Infrastructure Program* for the project on issues related to drainage, surface hydrology, and water quality.

The project consists of new mixed-use commercial center in an icon site in the City of Murrieta. The proposed project involves retail, class A office, hotel, dining and entertainment uses.

All assessments and technical analyses in this report comply with the local drainage policies and requirements for the City of Murrieta, San Diego Regional Water Quality Control Board, Riverside County, and the California Environmental Quality Act (CEQA) of 1970, as amended. The hydrology analysis and drainage assessments have been prepared at a preliminary engineering level based upon available information.

1.1 Background and History.

This project lies within the boundaries of Riverside County "Murrieta Creek Area Drainage Plan (ADP), Warm Springs Valley Sub-Watershed, Zone 7 and is subject to drainage fees. Approximately 38 acres of offsite drainage area enters the site from the east through three (3) culverts crossing the I-215 Freeway and discharges the flows into the natural drainage courses within the project site. Offsite hydrology study is in Appendix G.

Three (3) culverts located along the I-15 Freeway (54", 30" and 48") pick up the majority of the site runoff in addition to the 84" storm drain located at the northwest corner of the site. This storm drain runs under Murrieta Hot Springs Road and the I-15 Freeway. It has a 30" reinforced concrete pipe (RCP) lateral with a drop inlet that picks up some of the onsite drainage. See these culverts on Figure 3. The 30" lateral will be used in the tables in this report.

All the culverts crossing the I-15 and the I-215 freeways are maintained by and are within the California Department of Transportation (CALTRANS) right of way.

The majority of the storm water runoff generated from the site travels in a southerly direction and is conveyed offsite through the three culverts located along the I-15 Freeway. After crossing the freeway, the culverts outlet in natural drainage courses that drains to Warm Spring Creek near the Murrieta Creek confluence.

One unnamed blue line stream crosses the site at the southeast corner as shown on1:24,000 USGS Quadrangle Map for Murrieta, CA. See Figure 4.

A review of the drainage study per the original Specific Plan 276 (Murrieta Springs Mall) was performed. Figure 5 was taken from that study and shows the offsite flows. Such study was prepared in 1990 and apparently, there were offsite tributary flows to the site from north of Murrieta Hot Springs Road. This road was improved in 2003 and it has curb and gutter, and cross-gutters that convey these flows to the catch basins that are part of the 84" reinforced concrete pipe (RCP) storm drain under Murrieta Hot Springs Road and I-15. These offsite flows are not tributary to the project site any longer.

In addition, the existing watersheds were delineated with the most recent aerial topography of the project site. It was found that they differ considerably from the original study due to incomplete grading of previous project on the same site. As a result, larger and smaller flows have been discharged to the existing culverts across I-15 from the original design. However, after crossing the I-15 Freeways these flows converge to the same point approximately 300' downstream. Figure 6 shows this existing drainage as interim conditions.

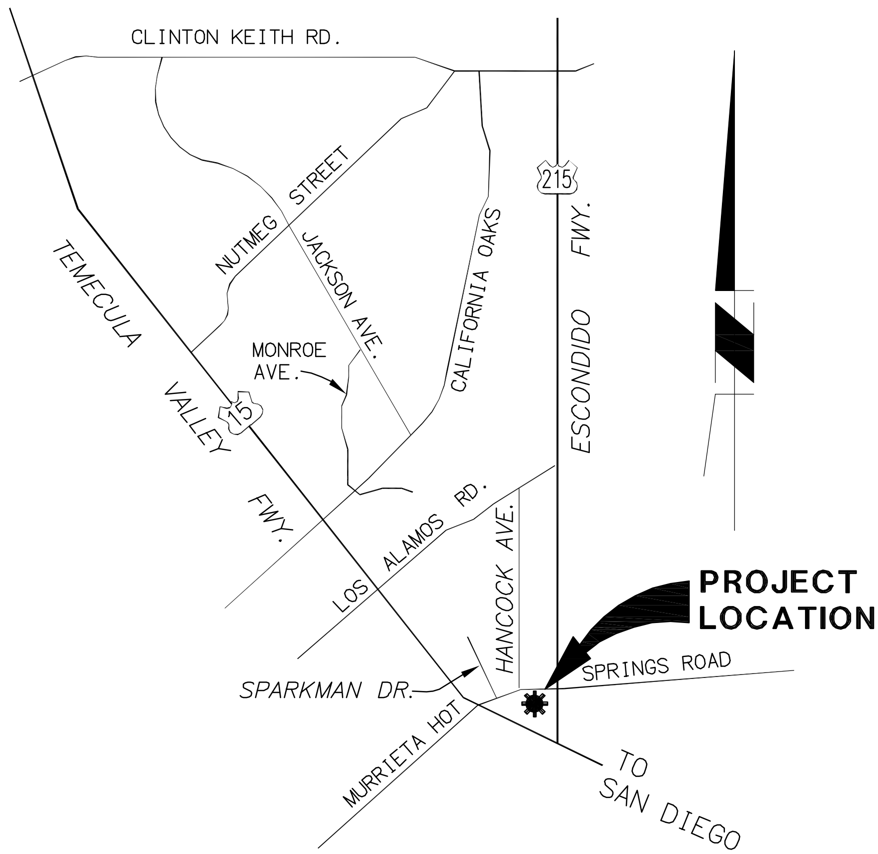
In order to compare the proposed development with the historic drainage prior to the existing grading, topographic maps from Riverside Flood Control and Water Conservation District were obtained and used for the hydrology calculations. Figure 7 shows this case with a topographic aerial flown on 2/02/1995.

Federal, state and local drainage laws and regulations govern the evaluation of impacts to surface water drainage. For this evaluation, impacts to surface water drainage would be considered significant if the project alters the drainage patterns of the site, which would result in substantial erosion, siltation, or increase runoff that would result in increased flooding. An increase in the amount of runoff could be considered a significant cause of erosion due to the concentration of flows.

The evaluation of impacts to storm water quality is of growing concern throughout the country. The City of Murrieta adheres to the Riverside County Drainage Area Management Plan (DAMP) for Santa Ana and Santa Margarita Regions prepared by the County of Riverside, July 2005.

FIGURE 1

REGIONAL VICINITY MAP



VICINITY MAP

NOT TO SCALE

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FIGURE 2
THE TRIANGLE

VICINITY MAP

H:\PDATA\15101717\CADD\LAND\DLV\HYDRO\1717-VICINITY-FIG2.DWG JSTOUFFER 3/20/08 11:12 am

1.2 Development Planning for Storm Water Management

The requirement to implement a program for development planning was based on federal and state statutes including (Section 402 9p) of the Clean Water Act and the California Water Code. The Clean Water Act amendments of 1987 established a framework for regulating storm water discharges from municipal, industrial, and construction activities under the NPDES program. The primary objectives of the municipal storm water program requirements are to:

1. Effectively prohibit non-storm water discharges, and
2. Reduce the discharge of pollutants from the storm water conveyance system to the "Maximum Extent Practicable".

For this evaluation, impacts to storm water quality would be considered significant if the project did not attempt to address storm water pollution to the maximum extent practicable. Currently, there are no definitive water quality standards for individual pollutants. Therefore, impacts to storm water quality would be considered less than significant if they meet the requirements of the Riverside County Water Quality Management Plan (WQMP) for Urban Runoff.

The WQMP requirements for commercial/institutional developments include the following:

1. Post development peak storm discharge rates shall not exceed the estimated pre-development rate for developments where increased peak storm water discharge rate would result in increased potential for downstream erosion.
2. Conserve natural areas by using cluster development, limiting clearing and grading of native vegetation, maximize trees and other vegetation, promote natural vegetation, and preserve riparian area and wetlands.
3. Minimize storm water pollutants of concern by incorporating BMPs or combinations of BMPs best suited to maximize the reduction of pollutant loadings in runoff to the maximum extent practicable.
4. Protect slopes and channels to decrease the potential for erosion and the subsequent impacts to storm water runoff.
5. Provide storm drain system stenciling and signage.
6. Properly design outdoor material storage areas.
7. Properly design trash storage areas.
8. Provide proof of ongoing BMP maintenance.
9. Comply with County WQMP standards for design of structural or treatment control BMPs.
10. Properly design loading/unloading dock areas.
11. Properly design repair/maintenance bays.
12. Properly design vehicle/equipment wash areas.
13. Design parking areas to reduce impervious land coverage in order to encourage the infiltration and treatment of runoff before it enters the storm drain system.

2.0 EXISTING CONDITIONS

The purpose of this existing conditions evaluation is to establish a baseline for comparison of the pre- and the post-project conditions. Baseline conditions investigated include: land use, hydrology, floodplain mapping, and surface water quality.

A copy of the receiving water map was taken from the preliminary water quality magement plan (WQMP) for this project and is included in figure 4A. It shows the flow route from the project site to the Murrieta Creek to Santa Margarita River and to the Pacific Ocean

2.1 Existing Land Use

The project site generally drains to the southwest. The project area consists of vacant land with seasonal Christmas tree lot and Halloween pumpkin patch. Approximately fifty percent of the site was partially graded per a previous project. The existing condition hydrology was based on an undeveloped watershed condition (0% impervious).

2.2 Hydrology

RBF conducted a local hydrology analysis that provides the basis for the existing condition hydrology for the Project Specific Plan. Hydrologic calculations to evaluate surface water runoff associated with the 10-year and 100-year storm frequencies were performed in accordance with the criteria and procedures in the *Riverside County Flood Control and Water Conservation District (RCFC&WCD) Hydrology Manual* dated April 1978, referred to hereafter as “Hydrology Manual”.

The Hydrology Manual provided the hydrologic parameters used in the analysis, such as rainfall intensities, percent impervious values, time of concentration and hydrologic soil classification.

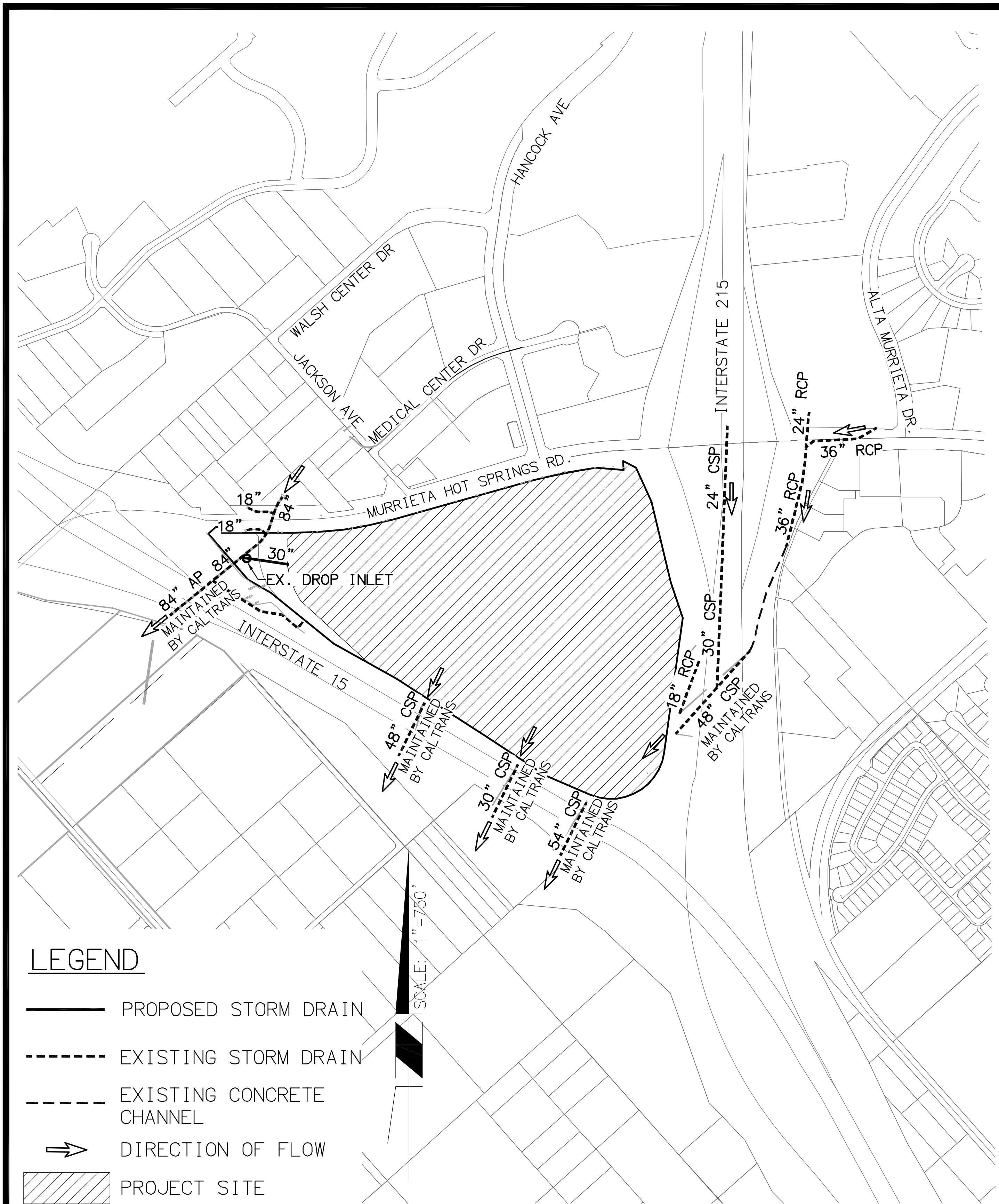

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FIGURE 3
THE TRIANGLE

EXISTING OFF-SITE DRAINAGE

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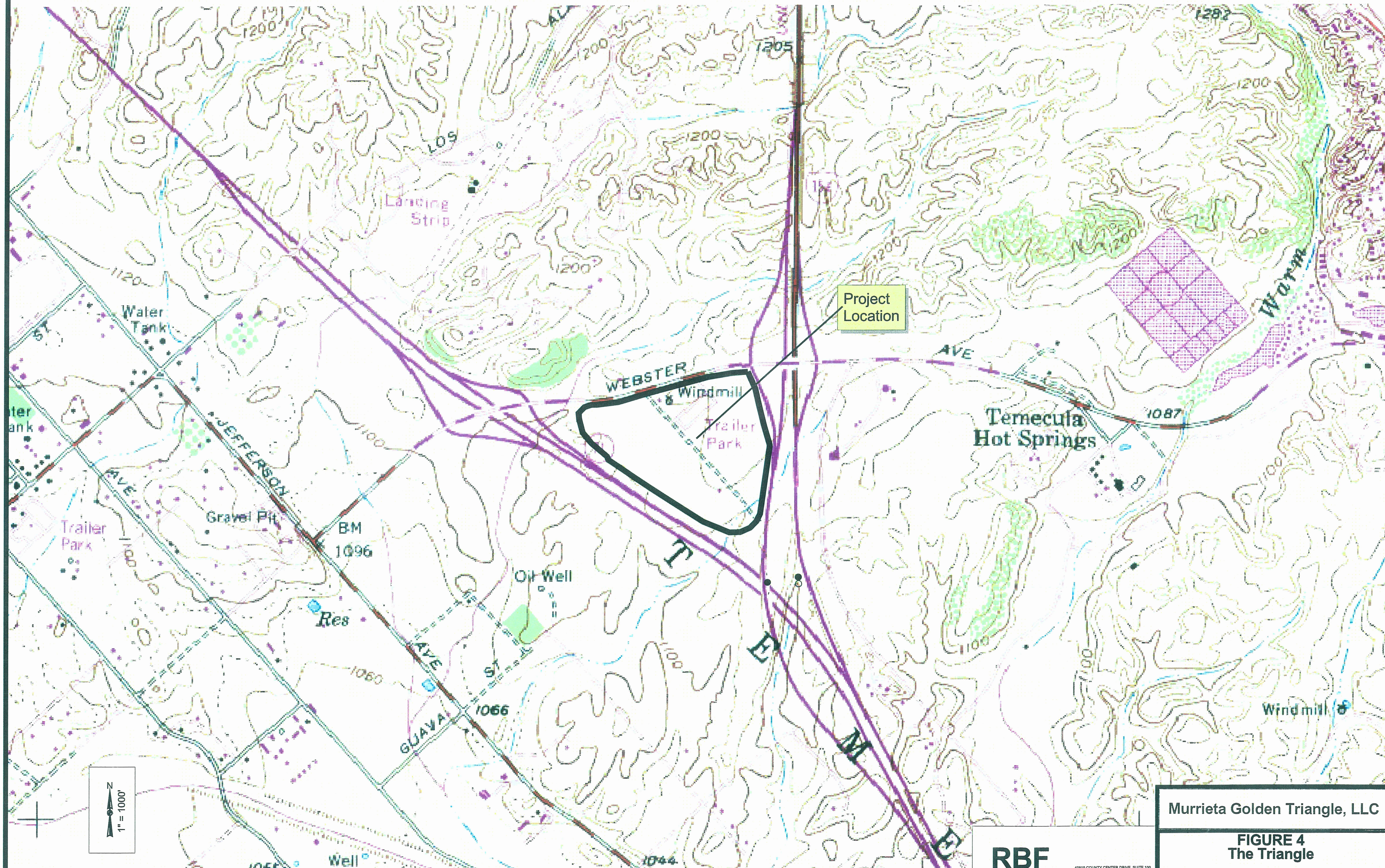

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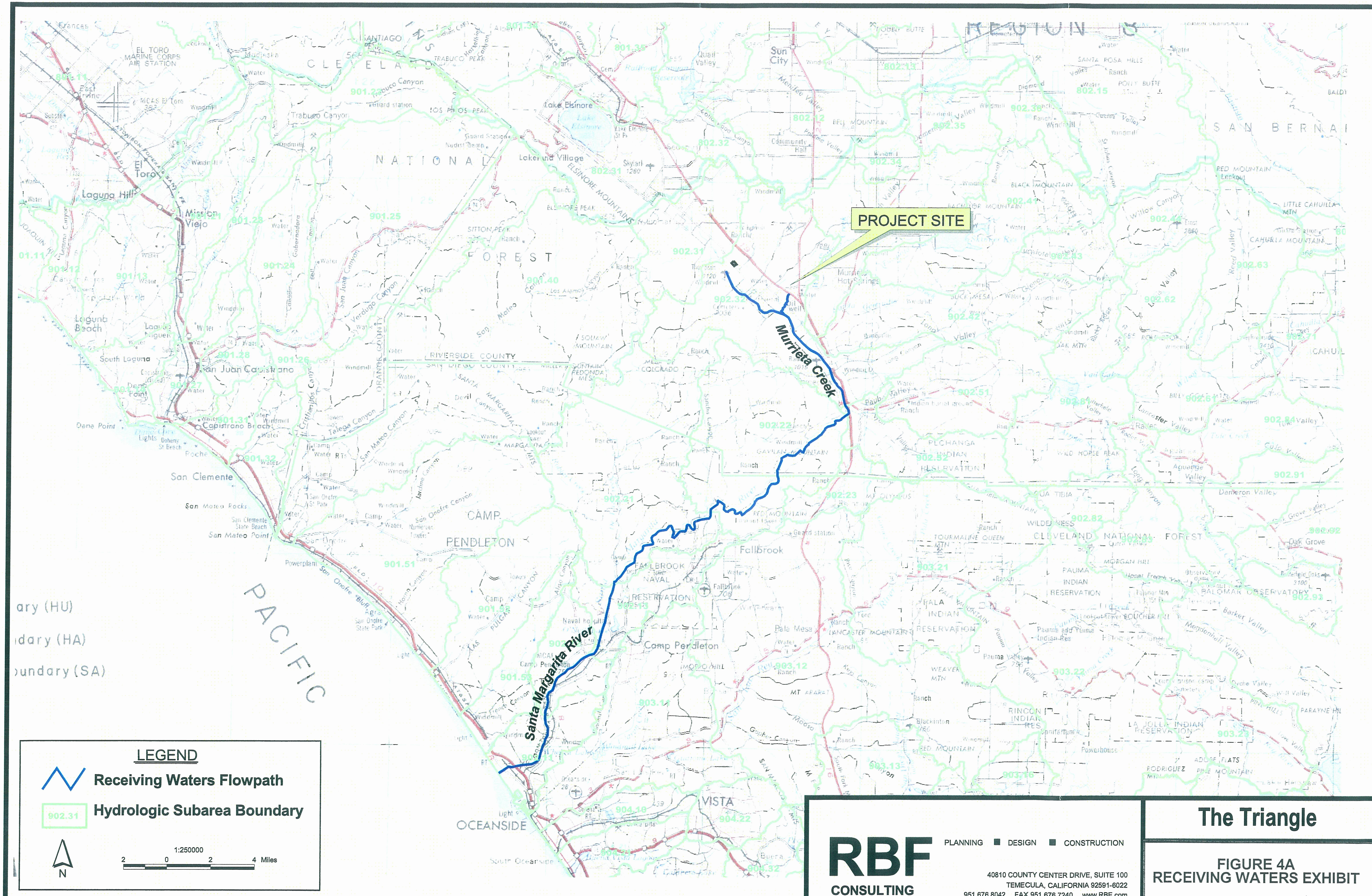
Murrieta Golden Triangle, LLC

FIGURE 4
The Triangle

USGS Quadrangle Map



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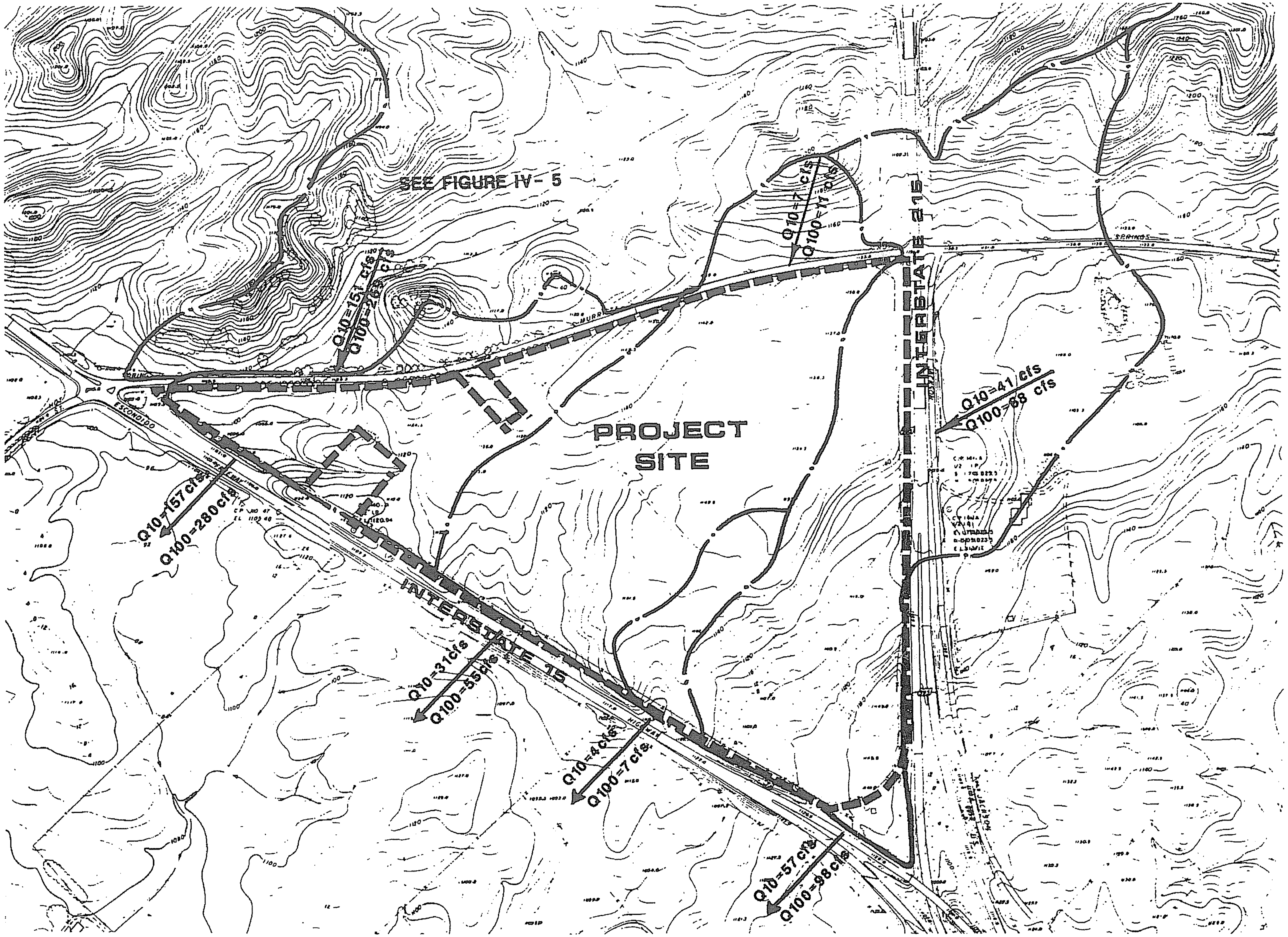
The Triangle

FIGURE 4A
RECEIVING WATERS EXHIBIT



OFFSITE STORM RUNOFF

LEGEND

Q10=5 cfs / Q100=10 cfs	10 & 100 YEAR STORM RUN-OFF ENTERING PROJECT SITE
	LIMITS OF WATERSHEDS
	PROPERTY LINE

NTS

~~Figure no. IV-6~~

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MURRIETA SPRINGS MALL

REGIONAL MALL MURRIETA, CA.

DONAHUE SCHRIBER

FIGURE 5
1990 DRAINAGE CONDITIONS

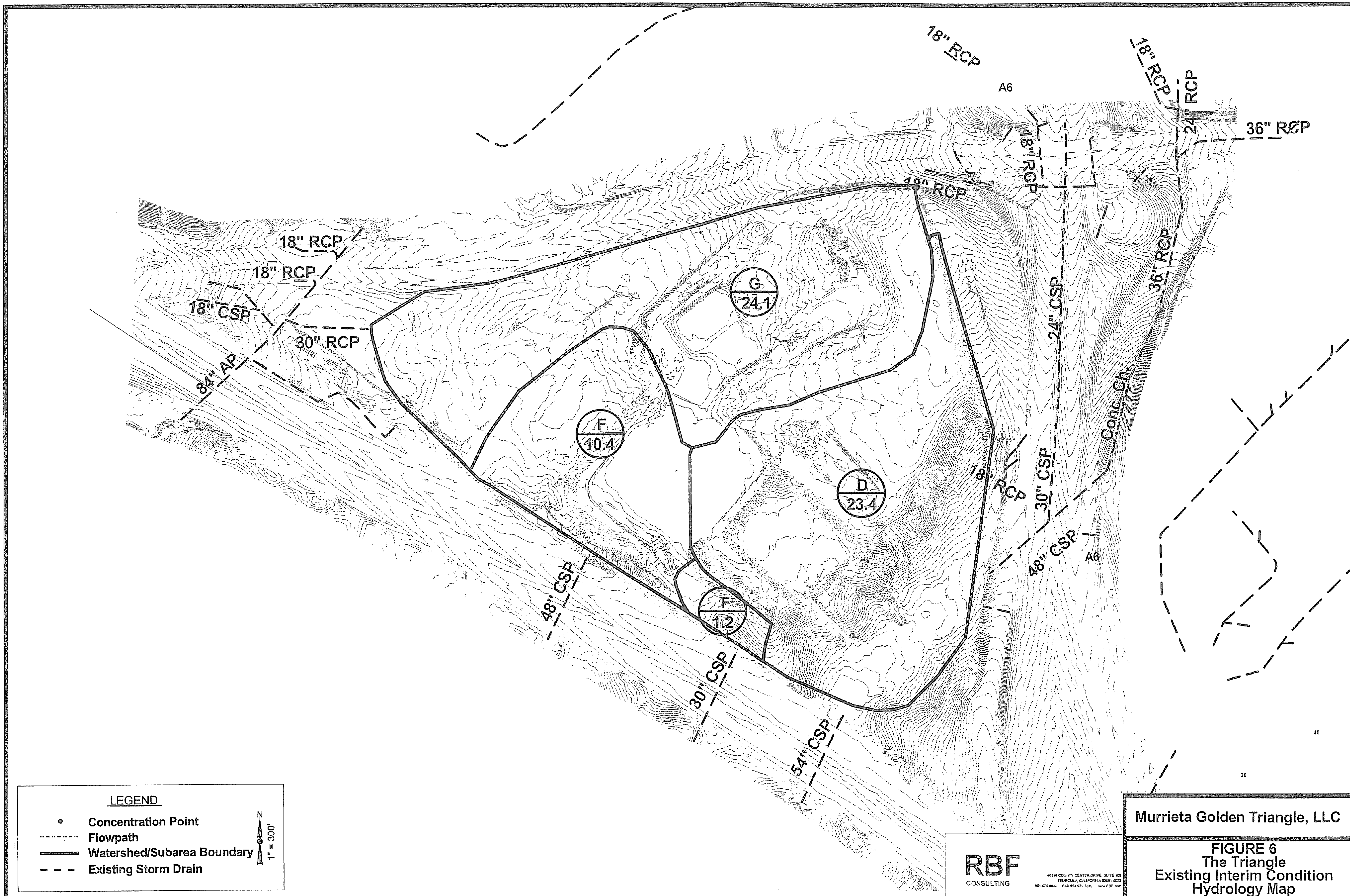

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FIGURE 6
The Triangle
Existing Interim Condition
Hydrology Map

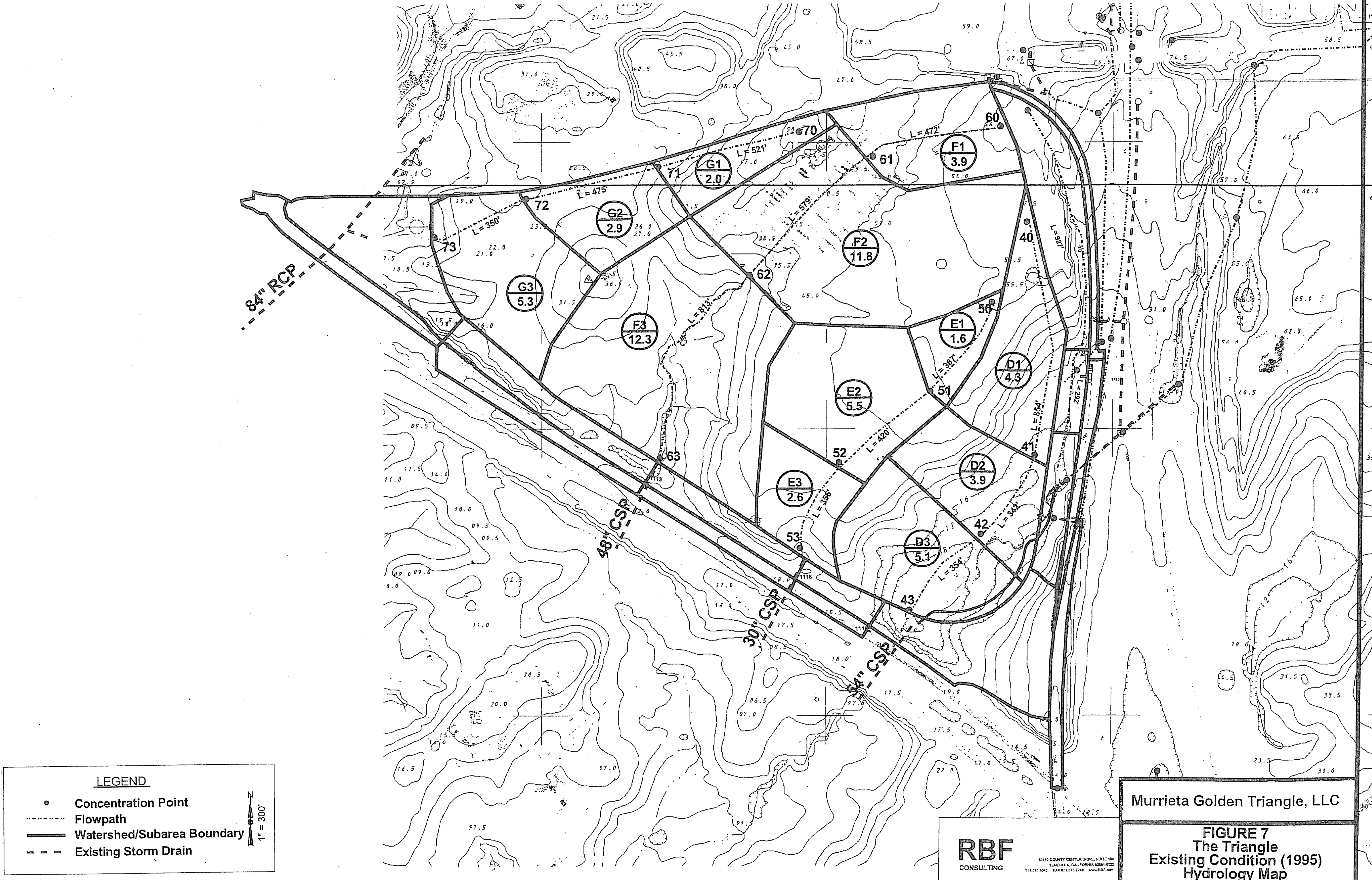

FIGURE 7
The Triangle
Existing Condition (1995)
Hydrology Map

2.2.1 Rational Method

The hydrologic calculations to determine the 10- and 100-year discharges were performed using the Rational Method in accordance with the Hydrology Manual. The Rational Method is an empirical computation procedure for developing a peak runoff rate (discharge) from relatively small drainage areas. This procedure is the most common method for small area urban drainage design since the peak discharge is generally the only required parameter for hydraulic design of drainage facilities. The Rational Method equation is based on the assumption that the peak flow rate is directly proportional to the drainage area, rainfall intensity, and a loss coefficient related to land use and soil type. The peak discharge from a drainage area using the rational method occurs at a critical time when the entire drainage area is contributing runoff known as the "time of concentration" for the watershed area. The following assumptions/guidelines were applied for use of the Rational Methods:

1. The Rational Method hydrology includes the effects of infiltration caused by soil surface characteristics. The soils map from *Riverside County Hydrology Manual* indicates that the study area consists of soil types "B" and "C." However, since this site was previously graded without completion, the soils map may not reflect the current locations of soils B and C through out the site. For this study soil C was considered because produces a conservative value.

2. The type of vegetation or ground cover and percentage of impervious surfaces affect the infiltration rate. Per the Hydrology Manual recommendations, 90% impervious was assumed for the commercial areas.

3. The time of concentration (T_c) was determined in accordance with the Hydrology Manual. It is a function of many variables including the length of the flow path from the most remote point of an area to the concentration point, the slope and other characteristics of the soil, and the amount and type of development.

4. Plate D-4.1 of the Hydrology Manual provided the rainfall intensities used in this study. The 10-year 10-minute and the 10-year 60-minute intensity of 2.36 and 0.88 inches per hour, respectively were used. The 100-year 10-minute and 100-year 60-minute of 3.48 and 1.30 inches per hour, respectively were used.

5. Drainage patterns were determined using information obtained from existing storm drain plans and Flood Control topography maps flown on February 10, 1995.

2.2.2 Existing Watershed Description

The drainage pattern for the areas flows generally to the southwest towards the I-15 Freeway. There are four (4) existing watersheds delineated within the project area and each of them is associated with a culvert in the I-15 Freeway.

The maximum elevation differential of the watersheds is approximately 56 feet (from 1,160 ft at the highest point onsite to elevation 1,104 ft at the invert of the 54" culvert crossing I-15). **Table 2.1** provided the existing condition subarea characteristics. The subareas listed correspond with Figure 7.

The watershed consists of vacant land and dirt roads. The watershed subarea boundaries were delineated utilizing topographic mapping and storm drain plans.

Table 2.1 – Existing On-Site Subarea Characteristics						
Subarea	**Cover Type**	**Land use**	**Area (ac)**	**Length (ft)**	**Soil Type**	**% Impervious***
D1	Barren	Undeveloped	4.3	854	C	0
D2	Barren	Undeveloped	3.9	342	C	0
D3	Barren	Undeveloped	5.1	354	C	0
E1	Barren	Undeveloped	1.6	387	C	0
E2	Barren	Undeveloped	5.5	420	C	0
E3	Barren	Undeveloped	2.6	356	C	0
F1	Barren	Undeveloped	3.9	472	C	0
F2	Barren	Undeveloped	11.8	579	C	0
F3	Barren	Undeveloped	12.3	813	C	0
G1	Barren	Undeveloped	2.0	521	C	0
G2	Barren	Undeveloped	2.9	475	C	0
G3	Barren	Undeveloped	5.3	350	C	0

* **Note:** % Impervious was based on area average impervious area throughout the project.

2.2.3 Existing Condition Surface Water Hydrology

To establish the baseline hydrologic conditions for the project area, the 10-year and 100-year frequency storms were analyzed. The results of the rational method analysis are summarized in **Table 2.2** and the detailed output for the existing condition analyses are included in **Appendix C**.

Table 2.2 – Existing Condition Hydrology Summary				
Node	**Location**	**Drainage Area (ac)**	**10-Year Peak Q (cfs)**	**100-Year. Peak Q (cfs)**
43	54” CSP at I-15	13.3	16.1	25.8
53	30” CSP at I-15	9.7	11.6	18.6
63	48” CSP at I-15	28.0	35.1	56.4
73	30” RCP at northwest corner	10.2	12.9	20.7

2.3 Floodplain Mapping

The Triangle project site is well protected from off site flooding due to the construction of the I-215 Freeway and Murrieta Hot Springs Road which would as a protective barrier from offsite flows. Prior to the construction of the 84” storm drain, the site may have been susceptible to some local flooding due to the approximately 300 acre tributary area at this location. The closest FEMA 100-year floodplain to the site is Warm Springs Creek, located approximately 4,000 feet due east, which posses no hazard to the site.

Another possible flooding hazard is due to nearby dam failures. The closest dam to the project is Skinner Reservoir (a.k.a. Lake Skinner). This dam is located approximately 7 miles from the project site. The Riverside County Integrated Project (RCIP) database contains information on dams located within the County of Riverside. Included in the database is a hazard rating classification. Final rating is based on age, construction material, height, storage capacity vs. drainage area, and pathway hazard potential. High ratings are given to dams that hold back a lake or significant amounts of water year round. If construction materials incorporate gravity or hydraulic fill they were automatically put into this category due to the potential for seismic failure. Lake Skinner has a “High Hazard Rating” per the RCIP database. Based on the dam inundations area delineations provided in the RCIP, this site is not located within this area. The Domenigoni Reservoir is also located nearby, but at this time the RCIP database has no delineations for this dam.

Also, The City of Murrieta is a participant in the National Flood Insurance Program (NFIP). Communities participating in the NFIP must adopt and enforce minimum floodplain management standards, including identification of flood hazards and flooding risks. Participation in the NFIP allows communities to purchase low cost insurance protection against losses from flooding.

The project site is located on Flood Insurance Rate Map (FIRM) number 0607512745A. The FIRM indicates that there is no existing flood hazard within the project site.

2.4 Storm Water Quality

The project site is tributary to the Santa Margarita River and it is overseen by the San Diego Regional Water Quality Control Board. As indicated in **Section 1.2**, storm water quality is a significant concern in Southern California. This section discusses typical pollutants found in storm water runoff and discusses the types of contaminants that may be found in existing storm water runoff.

2.4.1 Nonpoint Source Pollutants

A net effect of urbanization can be to increase pollutant export. However, an important consideration in evaluating storm water quality from the project is to assess if it impairs the beneficial use to the receiving waters. Nonpoint source pollutants have been characterized by the following major categories in order to assist in determining the pertinent data and its use. Receiving waters can assimilate a limited quantity of various constituent elements, however there are thresholds beyond which the measured amount becomes a pollutant and results in an undesirable impact. Background of these standard water quality categories provide an understanding of typical urbanization impacts.

Sediment **-** Sediment is made up of tiny soil particles that are washed or blown into surface waters. It is the major pollutant by volume in surface water. Suspended soil particles can cause the water to look cloudy or turbid. The fine sediment particles also act as a vehicle to transport other pollutants including nutrients, trace metals, and hydrocarbons. Construction sites are typically the largest source of sediment for urban areas under development.

Nutrients - Nutrients are a major concern for surface water quality. Phosphorous and nitrogen are of special concern because they can cause algal blooms and excessive vegetative growth. Of the two, phosphorus is usually the limiting nutrient that controls the growth of algae in lakes. The orthophosphorous form of phosphorus is readily available for plant growth. The ammonium form of nitrogen can also have severe effects on surface water quality. The ammonium is converted to nitrate and nitrite forms of nitrogen in a process called nitrification. This process consumes large amounts of oxygen, which can impair the dissolved oxygen levels in water. The nitrate form of nitrogen is very soluble and is found naturally at low levels in water. When nitrogen fertilizer is applied to lawns or other areas in excess of plant needs, nitrates can leach below the root zone, eventually reaching ground water. Orthophosphate from auto emissions also contributes phosphorus in areas with heavy automobile traffic. As a general rule of thumb, nutrient export is greatest from development sites with the most impervious areas. Other problems resulting from excess nutrients are 1) surface algal scums, 2) water discolorations, 3) odors, 4) toxic releases, and 5) overgrowth of plants. Common measures for nutrients are total nitrogen, organic nitrogen, total Kjeldahl nitrogen (TKN), nitrate, ammonia, total phosphate, and total organic carbon (TOC).

Pathogens - Pathogens (bacteria and viruses) are ubiquitous microorganisms that thrive under certain environmental conditions. Their proliferation is typically caused by the transport of animal or human fecal wastes from the watershed. Water, containing excessive bacteria and viruses can alter the aquatic habitat and create a harmful environment for humans and aquatic life. Also, the decomposition of excess organic waste causes increased growth of undesirable organisms in the water.

Pesticides – Pesticides (including herbicides) are chemical compounds commonly used to control nuisance growth or prevalence of organisms. Excessive or improper application of a pesticide may result in runoff containing toxic levels of its active ingredient.

Trash and Debris – Trash (such as paper, plastic, polystyrene packing foam, and aluminum materials) and biodegradable organic matter (such as leaves, grass cuttings, and food waste) are general waste products on the landscape. The presence of trash and debris may have a significant impact on the recreational value of a water body and aquatic habitat. Excess organic matter can create a high biochemical oxygen demand in a stream and thereby lower its water quality. In addition, in areas where stagnant water exists, the presence of excess organic matter can promote septic conditions resulting in the growth of undesirable organisms and the release of odorous and hazardous compounds such as hydrogen sulfide.

Trace Metals - Trace metals are primarily a concern because of their toxic effects on aquatic life and their potential to contaminate drinking water supplies. The most common trace metals found in urban runoff are lead, zinc, and copper. Fallout from automobile emissions is also a major source of lead in urban areas. A large fraction of the trace metals in urban runoff are attached to sediment and this effectively reduces the level, which is immediately available for biological uptake and subsequent bioaccumulation. Metals associated with the sediment settle out rapidly and accumulate in the soils. Also, urban runoff events typically occur over a shorter duration, which reduces the amount of exposure, which could be toxic to the aquatic environment. The toxicity of trace metals in runoff varies with the hardness of the receiving water. As total hardness of the water increases, the threshold concentration levels for adverse effects increases.

Oxygen-Demanding Substances - Aquatic life is dependent on the dissolved oxygen (DO) in the water and when organic matter is consumed by microorganisms then DO is consumed in the process. A rainfall event can deposit large quantities of oxygen demanding substance in lakes and streams. The biochemical oxygen demand of typical urban runoff is on the same order of magnitude as the effluent from an effective secondary wastewater treatment plant. A problem from low DO results when the rate of oxygen-demanding material exceeds the rate of replenishment. Oxygen demand is estimated by direct measure of DO and indirect measures such as biochemical oxygen demand (BOD), chemical oxygen demand (COD), oils and greases, and total organic carbon (TOC).

Bacteria - Bacteria levels in undiluted urban runoff exceed public health standards for water contact recreation almost without exception. Studies have found that total coliform counts exceeded EPA water quality criteria at almost every site and almost every time it rained. The coliform bacteria that are detected may not be a health risk in themselves, but are often associated with human pathogens.

Oil and Grease - Oil and grease contain a wide variety of hydrocarbons some of which could be toxic to aquatic life in low concentrations. These materials initially float on water and create the familiar rainbow-colored film. Hydrocarbons have a strong affinity for sediment and quickly become absorbed to it. The major source of hydrocarbons in urban runoff is through leakage of crankcase oil and other lubricating agents from automobiles. Hydrocarbon levels are highest in the runoff from parking lots, roads, and service stations. Residential land uses generate less hydrocarbons export, although illegal disposal of waste oil into storm waters can be a local problem.

Other Toxic Chemicals - Priority pollutants are generally related to hazardous wastes or toxic chemicals and can be sometimes detected in storm water. Priority pollutant scans have been conducted in previous studies of urban runoff, which evaluated the presence of over 120 toxic chemicals and compounds. The scans rarely revealed toxins that exceeded the current safety criteria. The urban runoff scans were primarily conducted in suburban areas not expected to have many sources of toxic pollutants (with the possible exception of illegally disposed or applied household hazardous wastes). Measures of priority pollutants in storm water include - 1) phthalate (plasticizer compound), 2) phenols and creosols (wood preservatives), 3) pesticides and herbicides, 4) oils and greases, and 5) metals.

2.4.2 Physical Characteristics of Surface Water Quality

Standard parameters, which can assess the quality of storm water, provide a method of measuring impairment. A background of these typical characteristics assists in understanding water quality requirements. The quantity of a material in the environment and its characteristics determine the degree of availability as a pollutant in surface runoff. In an urban environment, the quantity of certain pollutants in the environment is a function of the intensity of the land use. For instance, a high density of automobile traffic makes a number of potential pollutants (such as lead and hydrocarbons) more available. The availability of a material, such as a fertilizer, is a function of the quantity and the manner in which it is applied. Applying fertilizer in quantities that exceed plant needs leaves the excess nutrients available for loss to surface or ground water.

The physical properties and chemical constituents of water traditionally have served as the primary means for monitoring and evaluating water quality. Evaluating the condition of water through a water quality standard refers to its physical, chemical, or biological characteristics. Water quality parameters for storm water comprise a long list and are classified in many ways. In many cases, the concentration of an urban pollutant, rather that the annual load of that pollutant, is needed to assess a water quality problem. Some of the physical, chemical or biological characteristics that evaluate the quality of the surface runoff are outlined below:

Dissolved Oxygen - Dissolved oxygen in the water has a pronounced effect on the aquatic organisms and the chemical reactions that occur. It is one of the most important biological water quality characteristics in the aquatic environment. The dissolved oxygen concentration of a water body is determined by the solubility of oxygen, which is inversely related to water temperature, pressure, and biological activity. Dissolved oxygen is a transient property that can fluctuate rapidly in time and space. Dissolved oxygen represents the status of the water system at a particular point and time of sampling. The decomposition of organic debris in water is a slow process and the resulting changes in oxygen status respond slowly also. The oxygen demand is an indication of the pollutant load and includes measurements of biochemical oxygen demand or chemical oxygen demand.

Biochemical Oxygen Demand (BOD) - The biochemical oxygen demand (BOD) is an index of the oxygen-demanding properties of the biodegradable material in the water. Samples are taken from the field and incubated in the laboratory at 20^{o}C, after which the residual dissolved oxygen is measured. The BOD value commonly referenced is the standard 5-day values. These values are useful in assessing stream pollution loads and for comparison purposes.

Chemical Oxygen Demand - The chemical oxygen demand (COD) is a measure of the pollutant loading in terms of complete chemical oxidation using strong oxidizing agents. It can be determined quickly because it does not rely on bacteriological actions as with BOD. COD does not necessarily provide a good index of oxygen demanding properties in natural waters.

Total Dissolved Solids (TDS) - TDS concentration is determined by evaporation of a filtered sample to obtain residue whose weight is divided by the sample volume. The TDS of natural waters varies widely. There are several reasons why TDS is an important indicator of water quality. Dissolved solids affect the ionic bonding strength related to other pollutants such as metals in the water. TDS are also a major determinant of aquatic habitat. TDS affects saturation concentration of dissolved oxygen and influences the ability of a water body to assimilate wastes. Eutrophication rates depend on total dissolved solids.

PH - The pH of water is the negative log, base 10, of the hydrogen ion (H^+) activity. A pH of 7 is neutral; a pH greater than 7 indicates alkaline water; a pH less than 7 represents acidic water. In natural water, carbon dioxide reactions are some of the most important in establishing pH. The pH at any one time is an indication of the balance of chemical equilibrium in water and affects the availability of certain chemicals or nutrients in water for uptake by plants. The pH of water directly affects fish and other aquatic life and generally toxic limits are pH values less than 4.8 and greater than 9.2.

Alkalinity - Alkalinity is the opposite of acidity, representing the capacity of water to neutralize acid. Alkalinity is also linked to pH and is caused by the presence of carbonate, bicarbonate, and hydroxide, which are formed when carbon dioxide is dissolved. A high alkalinity is associated with a high pH and excessive solids. Most streams have alkalinities less than 200 mg/l and ranges of alkalinity of 100-200mg/l seem to support well-diversified aquatic life.

Specific Conductance - The specific conductivity of water, or its ability to conduct an electric current, is related to the total dissolved ionic solids. Long term monitoring a project waters can develop a relationship between specific conductivity and TDS. Its measurement is quick and inexpensive and can be used to approximate TDS. Specific conductivities in excess of 2000 µohms/cm indicate a TDS level too high for most freshwater fish.

Turbidity - The clarity of water is an important indicator of water quality that relates to the ability of photosynthetic light to penetrate. Turbidity is an indicator of the property of water that causes light to become scattered or absorbed. Suspended clays and other organic particles cause turbidity. It can be used as an indicator of certain water quality constituents such as predicting the sediment concentrations.

Nitrogen (N) - Sources of nitrogen in storm water are from the additions of organic matter to water bodies or chemical additions. Ammonia and nitrate are important nutrients for the growth of algae and other plants. Excessive nitrogen can lead to eutrophication since nitrification consumes dissolved oxygen in the water. Nitrogen occurs in many forms. Organic Nitrogen breaks down into ammonia, which eventually becomes oxidized to nitrate-nitrogen, a form available for plants. High concentrations of nitrate-nitrogen (N/N) in water can stimulate growth of algae and other aquatic plants, but if phosphorus (P) is present, only about 0.30 mg/l of nitrate-nitrogen is needed for algal blooms. Some fish life can be affected when nitrate-nitrogen exceeds 4.2 mg/l. There are a number of ways to measure the various forms of aquatic nitrogen. Typical measurements of nitrogen include Kjeldahl nitrogen (organic nitrogen plus ammonia); ammonia; nitrite plus nitrate; nitrite; and nitrogen in plants. The principal water quality criteria for nitrogen focus on nitrate and ammonia.

Phosphorus (P) - Phosphorus is an important component of organic matter. In many water bodies, phosphorus is the limiting nutrient that prevents additional biological activity from occurring. The origin of this constituent in urban storm water discharge is generally from fertilizers and other industrial products. Orthophosphate is soluble and is considered to be the only biologically available form of phosphorus. Since phosphorus strongly associates with solid particles and is a significant part of organic material, sediments influence concentration in water and are an important component of the phosphorus cycle in streams. The primary methods of measurement include detecting orthophosphate and total phosphorus.

2.4.3 Existing Storm Water Quality

The project site lacks any measured data on storm water runoff quality. In the absence of site-specific data, expected storm water quality can be qualitatively discussed by relating typical pollutants to specific land uses.

One of the major pollutants expected from the existing site is sediment. Sediments are solid materials that are eroded from the land surface.

Sediments can increase turbidity, clog fish gills, reduce spawning habitat, lower young aquatic organisms survival rates, and suppress aquatic vegetation growth. Other expected pollutants are organic compounds, trash and debris, oil and grease and metals.

2.4.4 Site Characterization and Receiving Waters

A phase 1 site assessment has not been prepared for this project as of the date of this study. The site is located in the Santa Margarita Watershed and in the Murrieta Creek Sub-Watershed. It has Hydrologic basin number 2.32. The table in the following page lists the receiving water downstream with their beneficial use and distance to the project site

Receiving Waters for Urban Runoff from Site

Receiving Waters	**303(d) List Impairments**	**Designated Beneficial Uses**	**Proximity to RARE Beneficial Use**
Unnamed stream	N/A	N/A	Not a RARE waterbody (0 miles from site)
Murrieta Creek (2.32)	E. Coli, Copper, Chlorpyrifos, Iron, Manganese, Nitrogen, Toxicity	MUN, AGR, IND, PROC, REC2, WARM, WILD	Not a RARE waterbody (approximately 1.1 miles from project site)
Santa Margarita River–Upper reach Gavilan (2.22)	None	MUN, AGR, IND, REC1, REC2, WARM, COLD, WILD, RARE	RARE waterbody (approximately 6.9 miles from project site)
Santa Margarita River-Upper reach Gorge (2.21)	Iron, Manganese, Sulfates, Nitrogen	MUN, AGR, IND, REC1, REC2, WARM, COLD, WILD, RARE, SPWN	RARE waterbody (approximately 16.9 miles from project site)
Santa Margarita River-Lower reach Upper Ysidora (2.13)	Toxicity	MUN, AGR, IND, PROC, REC1, REC2, WARM, COLD, WILD, RARE	RARE waterbody (approximately 24.4 miles from project site)
Santa Margarita River-Lower reach Chappo (2.12)	None	MUN, AGR, IND, PROC, REC1, REC2, WARM, COLD, WILD, RARE	RARE waterbody (approximately 27.6 miles from project site)
Santa Margarita River-Lower reach Lower Ysidora (2.11)	Enterococcus, Fecal Coliform, Phosphorus, Total Nitrogen	MUN, AGR, IND, PROC, REC1, REC2, WARM, COLD, WILD, RARE	RARE waterbody (approximately 29.2 miles from project site)
Santa Margarita Lagoon (2.11)	Eutrophic	REC1, REC2, EST, WARM, COLD, WILD, RARE, MIGR, SPWN	RARE waterbody (approximately 32.6 miles from project site)
Pacific Ocean	None	IND, NAV, REC1, REC2, COMM, BIOL, WILD, RARE, SPWN, MAR, SHEL, MIGRA, AQUA	RARE waterbody (approximately 33.8 total miles from project site)

3.0 PROPOSED PROJECT

The following is an analysis of the proposed project evaluation, which is then compared to the existing conditions analysis, to determine impacts associated with development of the property. The impact analysis is presented in Section 4. Proposed conditions investigated include changes to land use, changes to drainage patterns, assumed storm drain configuration, hydrology, floodplain mapping, and surface water quality.

A proposed conditions hydrologic analysis was prepared for The Triangle Specific Plan. Hydrologic calculations to evaluate surface runoff associated with 10-year and 100-year storm frequencies from the tributary drainage areas were performed using the Advanced Engineering Software (AES).

3.1 Proposed Land Uses

The proposed project would consist of a combination of new commercial mixed use. The off-site improvements include widening of Murrieta Hot Springs Road and landscaping in the State and City Right of Ways. **Table 3.1** provides a detailed breakdown of the proposed on-site land uses.

Table 3.1 – Proposed Condition Land Use Distribution

Land Use	Area (s.f)
Retail	640,832
Restaurant	125,000
Office	779,082
Entertainment	75,000
Hotel	148,000
Total	1,767,914

The development of the Triangle Project will have a system of storm drains that will connect to the existing culverts on I-15 where the project site currently drains. Offsite flows from the I-215 culverts will be accepted and conveyed thru the construction of a new storm drain thru the project site and discharged to the original 54" culvert under the I-15 Freeway. As a result, there is no diversion of off-site flows.

3.2 Hydrology

Project hydrology was completed by RBF Consulting to determine the local impacts that the new development would have on runoff. Hydrologic calculations to evaluate surface runoff associated with the 10-year and 100-year design storm frequencies were performed using the Rational Method analysis.

The onsite drainage boundaries and patterns were based upon the "Conceptual Site Plan" and current topographic mapping of the area. The watershed boundaries and flow patterns were then verified in the field by a site visit. The proposed conditions hydrology map is shown on **Figure 8**.

3.2.1 Proposed Watershed Description

The proposed development will maintain the existing drainage patterns as much as possible. The tributary area for each of the developed watersheds is nearly the same as the existing watersheds. The developed condition land use is commercial development using the recommended value of 90% impervious per the Hydrology Manual.

Table 3.2 – Proposed Condition Onsite Subarea Characteristics

Subarea	Cover Type	Land Use	Area (ac)	Length (ft)	Soil Type	% Impervious
D1	Urban Landscaping	Commercial	2.8	445	C	90
D2	Urban Landscaping	Commercial	2.7	448	C	90
D3	Urban Landscaping	Commercial	1.5	216	C	90
D4	Urban Landscaping	Commercial	2.5	-	C	90
D5	Urban Landscaping	Commercial	3.5	941	C	90
D6	Urban Landscaping	Commercial	3.5	-	C	90
E1	Urban Landscaping	Commercial	4.3	739	C	90
E2	Urban Landscaping	Commercial	1.9	454	C	90
E3	Urban Landscaping	Commercial	1.8	-	C	90
F1	Urban Landscaping	Commercial	3.5	1000	C	90
F2	Urban Landscaping	Commercial	3.3	207	C	90
F3	Urban Landscaping	Commercial	2.0	287	C	90
F4	Urban Landscaping	Commercial	4.4	347	C	90
G1	Urban Landscaping	Commercial	1.6	486	C	90
G2	Urban Landscaping	Commercial	1.3	248	C	90
G3	Urban Landscaping	Commercial	4.1	433	C	90
G4	Urban Landscaping	Commercial	4.9	357	C	90
G5	Urban Landscaping	Commercial	5.3	367	C	90
G6	Urban Landscaping	Commercial	4.9	502	C	90
					C	90

Figure 8 – Proposed Condition – Hydrology Map

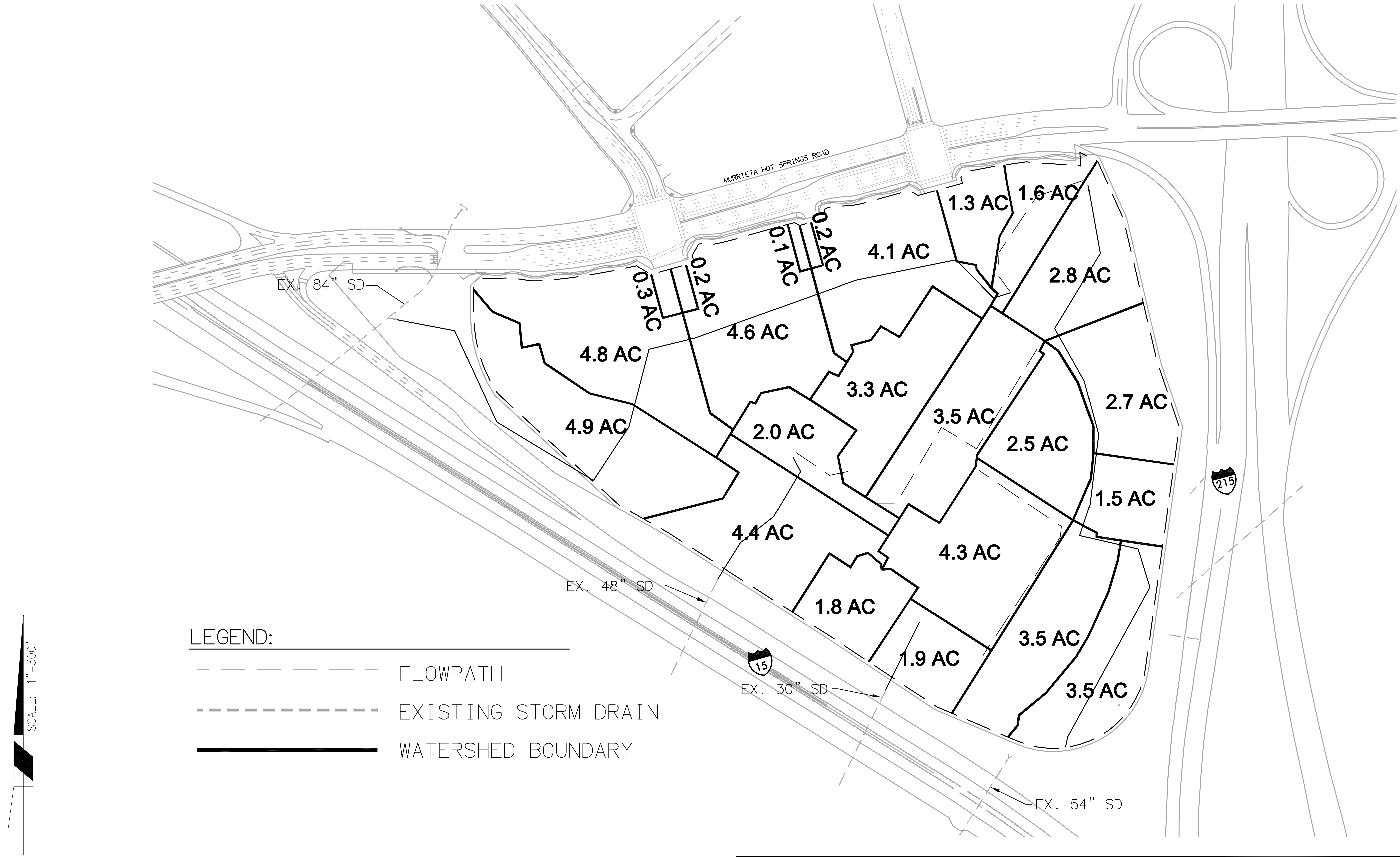

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FIGURE 8

THE TRIANGLE
DEVELOPED CONDITION HYDRO MAP

3.2.2 Proposed Condition Surface Water Hydrology

The results of the watershed analysis for the proposed development are summarized in **Table 3.3** and the detailed output are included in **Appendix D**.

Table 3.3 –Proposed Condition Hydrology Summary

Node	Location	Drainage Area (ac)	10-Year Peak Q (cfs)	100-Year Peak Q (cfs)
44	54” CSP at I-15	16.5	36.8	54.5
53	30” CSP at I-15	8.0	15.7	23.1
64	48” CSP at I-15	13.2	23.6	34.7
77	30” RCP at northwest corner	21.6	44.0	65.3

3.3 Floodplain Mapping

Since the project is not located in a mapped FEMA floodplain, the proposed development will not impact any existing floodplains.

3.4 Storm Water Quality

At the time of RBF’s analysis, a Preliminary Water Quality Management Plan (WQMP) for the proposed project had been prepared. A Final Project Specific WQMP must be implemented for this project per requirements of the San Diego Regional Water Quality Board. A WQMP outlines the proposed Best Management Practices (BMPs) the developer will implement with the construction of the site.

The water quality of the project site is expected to improve as a result of the proposed project. This is due to the proposed on-site mitigation and BMPs proposed to capture pollutants from I-15 and I-215 Freeways at the project frontage. **Section 4.0** details the proposed mitigation to address future and existing water quality issues in the project area.

4.0 PROPOSED IMPACTS AND SUGGESTED MITIGATION

Mitigation would be required to reduce impacts as a result of the development of the Triangle Specific Plan Project. The following section discusses both storm water conveyance and storm water quality mitigation measures.

4.1 Hydrologic and Hydraulic Impacts

The proposed project would alter the drainage patterns due to onsite grading and increases in the impervious area. This could result in existing culverts and storm drains being undersized due to increased flows. The impacts are potentially significant if not mitigated.

Hydrology was performed for the onsite area tributary to the culverts along I-15 freeway and at the 30" RCP lateral at the northwest corner. The proposed project would significantly increase the overall runoff rate and volume due to the proposed project. In the proposed conditions, surface runoff will be collected in a storm drain system to limit surface flows to street capacity. **Figure 7** contains a schematic for a potential storm drain for the project. Table 4.1 compares the overall flow rate from the site at the concentration points of each watershed.

Table 4.1 Flowrate Comparison

Watershed	Location	10-year Flowrate (cfs)		100-year Flowrate (cfs)	
		Existing Condition	Proposed Condition	Existing Condition	Proposed Condition
D	54" CSP at I-15	16.1	36.8	25.8	54.5
E	30" CSP at I-15	11.6	15.7	18.6	23.1
F	48" CSP at I-15	35.1	23.6	56.4	34.7
G	30" RCP at northwest corner	12.9	44.0	20.7	65.3

CSP = corrugated steel pipe
RCP= reinforced concrete pipe

As shown in Table 4.1, runoff from the project site has increased due mostly to the increased impervious areas. Therefore, as a result of this study analysis, there are significant increases in the runoff rates, resulting in significant downstream hydrologic impacts. Mitigation is required to reduce the impacts to less than significant.

Permanent underground storage system will be used to mitigate for the increase runoff due to development of the project. However, it is probable that this project may be developed in phases with temporary detention basins until the permanent facilities are constructed. In either case, the storage system will temporally store the increased volume and discharge the same pre-development flows at the points of connection of the proposed storm drain system to the existing culverts in I-15 and the existing 30" RCP at the northwest corner.

Table 4.2 compares the existing and developed 100-year 24-hour storm volumes for the onsite flows. The difference between the proposed and existing condition volumes is the required storage needed for mitigation. The increase volumes are due to the land use having a larger amount of impervious areas, shorter time of concentrations, and diversions in the drainage areas. Using the direct runoff method, the storm volumes were estimated. The effective rainfall was determined for the existing and developed condition and was then multiplied by the drainage area to estimate the storm volumes. The calculations are included in Appendix E. It is worth to mention that at the time of preparation of this report percolation data for the site was not available. The required storage volumes can be reduced during final design if percolation can be used in combination with underground storage.

Table 4.2 Increase Runoff Volume Estimate

Location	100-Year 24-Hour Storm Volumes (ac-ft.)		Required Storage Volume (ac-ft)
	Existing	Developed	
Watershed D (at 54" CSP)	2.74	4.68	+1.94
Watershed E (at 30" CSP)	2.00	2.27	+0.27
Watershed F (at 48" CSP)	5.76	3.74	-2.02
Watershed G (at 30" CSP)	2.10	6.12	+4.02

4.2 Floodplain Impacts

The proposed project does not impact any mapped floodplains. No mitigation is necessary.

4.3 Water Quality Impacts

The development of the proposed project would increase impervious areas and increase on-site activities, which would result in impacts to both construction and post construction storm water quality. Thus increasing pollutant loading immediately offsite.

4.3.1 Additional Permits

The following table list additional permits that will be required for this project:

Additional Permits/Approvals required for the Project

AGENCY	Permit required (Yes or No)
State Department of Fish and Game, 1601 Streambed Alteration Agreement	Yes
State Water Resources Control Board, Clean Water Act (CWA) section 401 Water Quality Certification	Yes
US Army Corps of Engineers, CWA section 404 permit	Yes
US Fish and Wildlife, Endangered Species Act section 7 biological opinion	Yes

4.3.2 Pollutants of Concern

Expected pollutants would include trash, nutrients, bacteria, pesticides and herbicides, oil and grease, and commercial hazardous wastes as itemized in the following tables:

1. For each of the proposed project discharge points, the proximate Receiving Water is specified using the hydrologic unit basin number as identified in the most recent version of the Water Quality Control Plan for the San Diego Region.

Proximate Receiving Water for Project Discharge Point		
Receiving Water Order	**Hydrologic Unit Basin Number**	**Receiving Water Name**
1st	N/A	Unnamed Stream
2nd	2.32	Murrieta Creek
3rd	2.22	Santa Margarita River

2. For each proximate identified above, the pollutant, if any, for which the proximate Receiving Waters are impaired is provided in the following table.

Pollutants for which the Proximate Receiving Waters are impaired	
Receiving Water	**Pollutant for which impaired**
Unnamed Stream	N/A
Murrieta Creek (2.32)	Phosphorus
Santa Margarita River (2.22)	Phosphorus

3. A comparison of the list of pollutants for which the proximate Receiving Waters are impaired with the pollutants expected to be generated by the project is provided in the table below.

Pollutant of Concern Summary Table				
Pollutant Type	**Expected**	**Potential**	**Not Expected**	**Present in Impaired Waterbody**
Sediment/Turbidity		X		
Nutrients		X		X
Organic Compounds	X			
Trash & Debris	X			
Oxygen Demanding Substances		X		X
Bacteria & Viruses		X		X
Oil & Grease	X			
Pesticides		X		
Metals		X		X

For the description of Urban Runoff Pollutants of Concern Expected, per above Table see section 2.4.

Applicant shall prepare a Final Project Specific WQMP addressing post construction BMPs per direction of the City of Murrieta.

4.3.3 Non-Structural/Source Control BMPs Mitigation

A WQMP would also include Non-Structural/Source Control BMPs in order to conform to the City of Murrieta's Storm Water Management Plan.

The following are the minimum required mitigation from the Riverside County Water Quality Management Plan for Urban Runoff.

Conserve Natural Areas – This BMP entails concentrating or clustering the development, limit the clearing and grading of natural vegetation, maximize trees and vegetation on site, promote natural vegetation in parking lot islands and other landscape areas.

Storm Water Pollutants of Concern – Minimize pollution by providing reduced width sidewalks and incorporated buffer areas, in addition use a permeable material for sidewalks.

Slopes and Channels – Protect slopes and channels by conveying runoff safely from the tops of slopes, stabilize disturbed slopes, utilize natural drainage systems, and vegetate slopes with native or drought resistant vegetation.

Storm Drain System Stenciling and Signage – This BMP includes disseminating informational materials for area residents and employees and possibly posting signs informing people of the need to reduce downstream contamination and the possibility of negative impact associated with the use of the land. Provide storm drain stenciling and signage at all storm drain inlets and catch basins with in the project area that read "NO DUMPING – DRAINS TO WATERWAY", signs and prohibitive language and/or graphical icons must be place in at public access points, and signs and stencils must be maintained.

Loading and Unloading Dock Area – This BMP describes measures to prevent and reduce the discharge of pollutants to storm water from outdoor loading and unloading of materials. The primary design features to reduce pollution are: covering the loading/unloading docks; preventing storm runoff, and containing spills.

Repair and Maintenance Bay – This BMP details appropriate measures to keep oil and grease, heavy metals and toxic material from coming in contact with storm water runoff. Maintenance areas should either be indoors or designed to prevent storm water run-on and run-off. In addition, the areas need to be designed to capture all wash water, leaks and spills.

Vehicle and Equipment Washing - This BMP provides regulations for the cleaning of equipment used onsite. The BMP requires the consideration of utilizing off-site commercial washing and steam cleaning businesses. If on-site washing is preferred, the area must be connected to a sewer and self contained and/or covered.

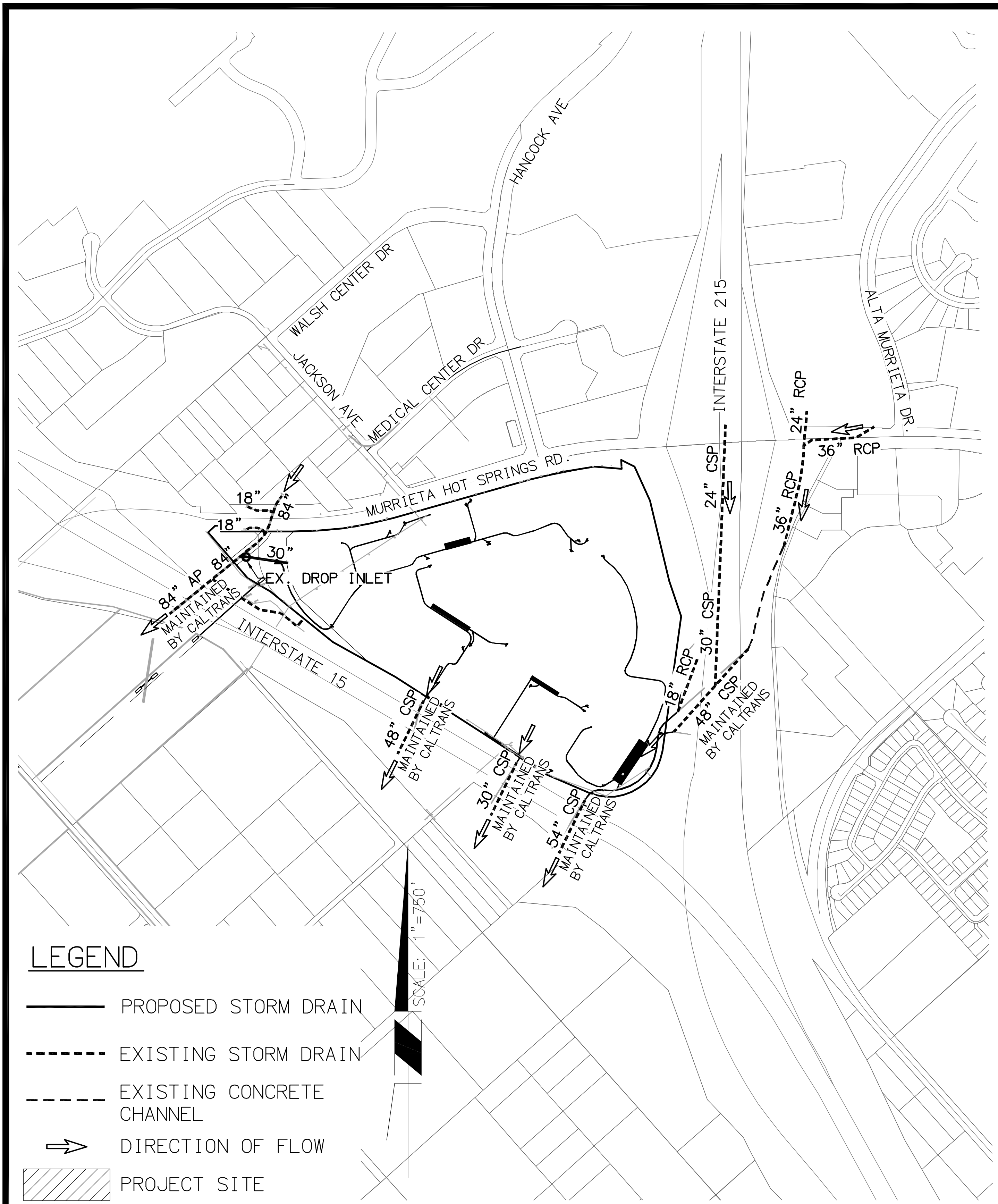

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FIGURE 8A
THE TRIANGLE

EXISTING OFF-SITE AND PROPOSED
ON-SITE DRAINAGE

H:\PDATA\15102215\CADD\LAND\EXHIBITS\SPECIFIC PLAN\NEW EXHIBITS REV 2011-10-10\2215-EX-001-FIGURE 8A.DWG MCABALCE 11/17/11 10:08 am

Figure 9 – Recommended Storm Drain Layout

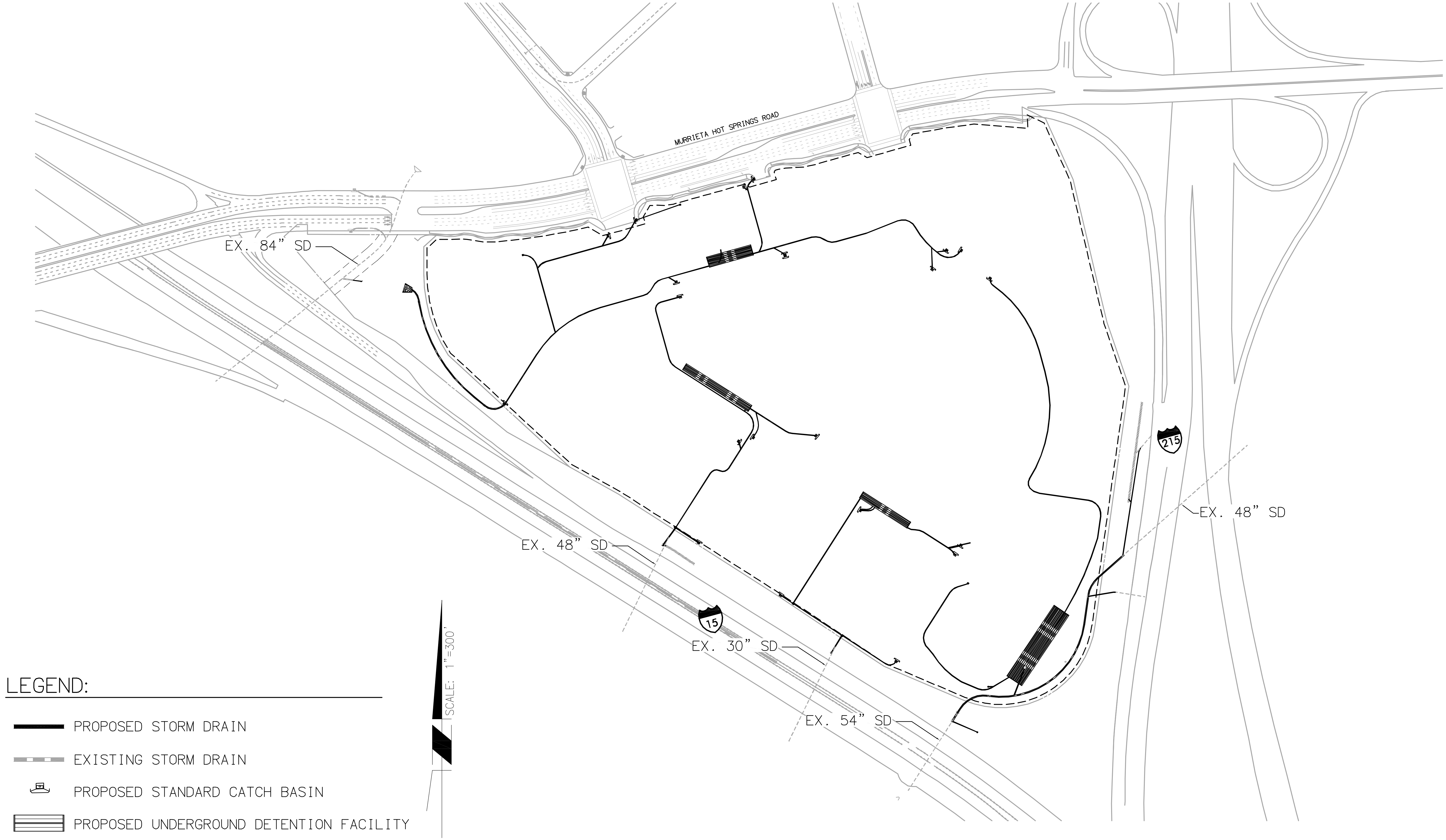

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FIGURE 9

THE TRIANGLE
RECOMMENDED ON-SITE STORM DRAIN LAYOUT

H:\PDATA\15102215\CADD\LAND\EXHIBITS\SPECIFIC PLAN\NEW EXHIBITS REV 2011-10-10\2215-EX-002-FIGURE 9.DWG MGONZALEZ 11/18/11 3:19 pm

Restaurant Equipment and Accessory Wash Areas – Needs to be self contained with a grease trap and connected to the sewer.

Parking Areas – Reduce the impervious land use of parking areas, treat and or infiltrate runoff before it reaches storm drain.

The following are proposed mitigations from the *California Storm Water Best Management Practice Handbook - Industrial/Commercial*:

SC10 Housekeeping Practices - This entails practices such as cleaning up spills, proper disposal of certain substances and wise application of chemicals.

SC32 Used Oil Recycling - Will apply to maintenance and security vehicle

SC70 Street Cleaning - Will include streets and parking areas.

SC71 Catch Basin Cleaning - This includes the maintenance of the inlet filtration devices and the catch basins.

SC72 Vegetation Controls - Although this primarily refers to maintenance practice on natural areas, the general principal can apply as well to grass areas in the project site, in order to avoid practices that would contribute to pollution and to maximize the beneficial uses of the swale.

SC73 Storm Drain Flushing - Although general storm drain gradients are sufficiently steep for self-cleansing, visual inspection may reveal a buildup of sediment and other pollutants at the energy dissipators at the outlets, in which case flushing may be advisable.

4.3.4 Structural/Treatment BMPs Mitigation

The WQMP will be created to include Structural/Treatment BMPs in order to conform to the City of Murrieta Storm Water Management Plan and NPDES permit, CARWQCB Order No. R-9-2010-0016, NPDES No. CAS018766 adopted November 10, 2010 or as amended.

<u>Post Construction</u>

Post construction of the proposed project site would increase trash, nutrients, bacteria, pesticides and herbicides, oil and grease, and commercial hazardous wastes from the development. The development will be required to implement Best Management Practice (BMPs) to reduce pollutant loadings. Thus water quality impacts due to the development of the site are potentially significant if not mitigated.

In order to mitigate the water quality due to development, several treatment BMPs have been selected in combination to improve the water quality. The proposed treatment control BMP selected are underground combined retention/infiltration basin, landscape detention areas, and roof/loading docks filter units.

Porous landscape retention areas will be used throughout the site, wherever there is appropriate space to design and implement this BMP.

Underground retention/infiltration basins will be designed to store the difference between the developed condition and existing condition storm runoff volumes and the outlet will have an outlet flow no larger than the existing flow rate. If soil types allow, the underground basin can have an open bottom to allow infiltration; otherwise, a perforated pipe will be needed.

Runoff from rooftops and loading docks will be routed into a filter unit for treatment.

Table 4.3 Water Quality Volumes

Location	Required Storage Volume (ac-ff)
Watershed D (at 54” CSP)	1.20
Watershed E (at 30” CSP)	0.58
Watershed F (at 48” CSP)	0.96
Watershed G (at 30” RCP)	1.58

The treatment control BMP selected for this project are volume based (roof filters are flow based BMP). Table 4.3 shows the required BMP volume for each watershed considering end of pipe treatment. Calculations are included in Appendix F. Depending on the number of porous landscape detention (PLD) areas and soil infiltration rates, the required BMP storage volume can be reduced.

4.3.5 Construction Erosion Controls Mitigation

Construction controls are separated from the rest of the water quality management because the measures are temporary and specific to the type of construction. Construction of the proposed redevelopment has the potential to produce typical pollutants such as nutrients, heavy metals, pesticides and herbicides, toxic chemicals related to construction and cleaning, waste materials including wash water, paints, wood, paper, concrete, food containers, and sanitary wastes, fuel, and lubricants.

As part of its compliance the NPDES requirements, a Notice of Intent (NOI) would need to be prepared and submitted to the California State Water Resources Control Board providing notification and intent to comply with the State of California general permit. Prior to construction, a Storm Water Pollution Prevention Plan (SWPPP) is required for the construction activities onsite. A copy of the SWPPP must be available and implemented at the construction site at all times. The SWPPP outlines the source control and/or treatment control BMPs that would avoid or mitigate runoff pollutants at the construction site to the “maximum extent practicable”. From the *California Storm Water Best Management Practice Handbook - Construction Activity:*

CA 1 Dewatering Operations – This operation requires the use of sediment controls to prevent or reduce the discharge of pollutant to storm water from dewatering operations.

CA 2 Paving Operations – Prevent or reduce the runoff of pollutant from paving operations by proper storage of materials, protecting storm drain facilities during construction and training employees.

CA 3 Structural Construction and Painting – Keep site and area clean and orderly, use erosion control, use proper storage facilities, use safe products and train employees to prevent and reduce pollutant discharge to storm water facilities from construction and painting.

CA 10 *Material Delivery and Storage* – Minimize the storage of hazardous materials onsite. If stored onsite keep in designated areas, install secondary containment, conduct regular inspections and train employees.

CA 11 *Material Use* – Prevent and reduce the discharge of pesticides, herbicides, fertilizers, detergents, plaster, petroleum products and hazardous materials from entering the storm water.

CA 20 Solid Waste Management - This BMP describes the requirements to properly design and maintain trash storage areas. The primary design feature requires the storage of trash in covered areas

CA 21 Hazardous Waste Management - This BMP describes the requirements to properly design and maintain waste areas.

CA 23 *Concrete Waste Management* – Prevent and reduce pollutant discharge to storm water from concrete waste by performing on and off-site washouts in designated areas and training employees and consultants.

CA 24 *Sanitary Septic Water Management* – Provide convenient, well-maintained facilities, and arrange regular service and disposal of sanitary waste.

CA 30 *Vehicle and Equipment Cleaning* – Use off-site facilities, or wash in designated areas to reduce pollutant discharge into the storm drain facilities.

CA 31 *Vehicle and Equipment Fueling* – Use off-site facilities, or designated areas with enclosing or coverings to reduce pollutant discharge into the storm drain facilities.

CA 32 *Vehicle and Equipment Maintenance* – Use off-site facilities, or designated areas with enclosing or coverings to reduce pollutant discharge into the storm drain facilities. In addition run a “dry site” to prevent pollution discharge into storm drains.

CA 40 *Employee and Subcontractor Training* – Have a training session for employees and subcontractors to understand the need for implementation and usage of BMPs.

ESC 2 *Preservation of Existing Vegetation* – Minimize the removal of existing trees and shrubs because they serve as erosion control.

ESC 10 *Seeding and Planting* – Provide soil stability by planting and seeding grasses, trees, shrubs, vines, and ground cover.

ESC 11*Mulching* – Stabilize cleared or freshly seeded areas with mulch.

ESC 20 *Geotextiles and Mats* – Natural or synthetics material can be used for soil stability.

ESC *Dust Control* – Reduce wind erosion and dust generated by construction activities by using dust control measures.

ESC 23 *Construction Road Stabilization* – All on-site vehicle transport routes will be stabilized immediately after grading and frequently maintained to prevent erosion and control dust.

ESC 24 *Stabilized Construction Entrance* – Stabilize the entrance pad to construction area to reduce amount of sediment tracked off site.

ESC 30 *Earth Dikes* – Construct earth dikes of compacted soil to divert runoff or channel water to a desired location.

ESC 31 *Temporary Drains and Swales* – Use temporary drains and swales to divert off-site runoff around the construction site, stabilized areas and direct flows into sediment basins or traps.

ESC 40 *Outlet Protection* – Use rock or grouted rock at outlet pipes to prevent scouring of soil caused by high flow velocities.

ESC 41 *Check Dams* – Check dams reduce velocities of concentrated flows, thereby reducing erosion, and promoting sedimentation behind the dams. Check dams are small and placed across swales and drainage ditches.

ESC 50 *Silt Fence* – Composed of filter fabric, which have been entrenched, attached to support poles and sometimes backed by wire fence support. Silt fences promote sedimentation behind the fence of sediment-laden water.

ESC 51 *Straw Bale Barrier* – Place straw bales end to end in a level contour in a shallow trench and stake them in place. The bales would detain runoff and promote sedimentation.

ESC 52 *Sand Bag Barriers* – By stacking sand bags on a level contour, creates a barrier to detain sediment-laden water. The barrier would promote sedimentation.

ESC 53 *Brush or Rock Filter* – Made of ¾ to 3-inch diameter rocks place on a level contour or composed of brush wrapped in filter cloth and staked to the toe of the slope would provide a sediment trap.

ESC 54 *Storm Drain Inlet Protection* – Devices that remove sediment from sediment laden storm water before entering the storm drain inlet or catch basin.

ESC 55 *Sediment Trap* – A sediment trap is a small, excavated or bermed area where runoff for small drainage areas can pass through allowing sediment to settle out.

<u>Construction</u>

Due to construction and associated earth moving, there will be additional impacts to storm water quality. Construction of the proposed development has the potential to produce typical pollutants such as nutrients, heavy metals, pesticides and herbicides, toxic chemicals related to construction and cleaning, waste materials including wash water, paints, wood, paper, concrete, food containers, and sanitary wastes, fuel, and lubricants. Prior to construction, a Notice of Intent (NOI) and a Storm Water Pollution Prevention Plan (SWPPP) would be required to reduce pollutant loadings. Impacts to water quality due to construction are significant if not mitigated.

The following are potential BMPs that may be outlined in the WQMP.

5.0 CONCLUSIONS

The Triangle Project involves the development of the parcel north of I-15 and I-215 and south of Murrieta Hot Spring Road. The proposed project consists of mixed-use commercial development. The following sections detail the results of the hydrology and water quality investigations.

5.1 Hydrologic Results

The results of the hydrologic analysis are presented again in **Table 5.1**. In general, storage will be necessary to mitigate for additional flows.

Table 5.1 Hydrology Summary Table

Condition	Location	Node Number	Area (ac)	10-Year (cfs)	100-Year (cfs)
Existing	54" CSP	43	13.3	16.1	25.8
Developed	54" CSP	44	16.5	36.8	54.5
Existing	30" CSP	53	9.7	11.6	18.6
Developed	30" CSP	52	8.0	15.7	23.1
Existing	48" CSP	63	28.0	35.1	56.4
Developed	48" CSP	64	13.2	23.6	34.7
Existing	30" RCP	73	10.2	12.9	20.7
Developed	30" RCP	77	21.6	44.0	65.3

5.2 Drainage Facility Requirements

The proposed project would generally increase the discharge to existing storm drain facilities. **Table 5.1** shows the proposed conditions expected discharges to the existing culverts in I-15. Additional study would be required to determine the actual effects on the existing storm drain system.

The proposed project would require on-site storm drain facilities to mitigate for the development of the site. Four on-site storm drain systems are proposed, one for each watershed. Each of them will connect to the corresponding existing lateral or culvert on I-15.

5.3 Water Quality Requirements

A combination of structural, non-structural, and construction Best Management Practices are recommended to decrease impacts of the proposed project to the water quality of the stormwater runoff. It is essential that the selected BMPs address treatment for all areas of the project area to assure that the runoff from the project site is being treated to the "maximum extent practicable".

5.4 Identified Data Gaps

Detailed topographic mapping of the project area and tributary areas would be required for a detailed hydrologic study. The existing mapping is adequate for planning level investigations only.

Hydrology studies that provide the basis of design for the local storm drains would also facilitate the detailed analysis. No such reports were available at the time of this study.

6.0 REFERENCES

California Stormwater Quality Association (CASQA). Stormwater Best Management Practice Handbook/Portal - Construction Activity. July 10, 2010.

California Stormwater Quality Association (CASQA). Stormwater Best Management Practice Handbook - Industrial/Commercial. January 2003.

California Stormwater Quality Association (CASQA). Stormwater Best Management Practice Handbook - Municipal. January 2003.

California Stormwater Quality Association (CASQA). Stormwater Best Management Practice Handbook - New Development and Redevelopment. January 2003.

Riverside County Drainage Area Management Plan. July 2005

Riverside County Water Quality Management Plan for Urban Runoff. Santa Margarita River Region. July 24, 2006. Errata corrected January 22, 2009.

Riverside County flood Control and Water Conservation District. Hydrology Manual. April 1978.

Water Resources Control Board Order No. 2009-0009-DWQ. NPDES No. CAS000002. Adopted September 2, 2009.

Water Resources Control Board Order No. R-9-2010-0016, NPDES No. CAS018766 adopted November 10, 2010.

APPENDIX A

RCFCD & WCD Standard Intensity-Duration Curves Plate D-4.1

RAINFALL INTENSITY–INCHES PER HOUR

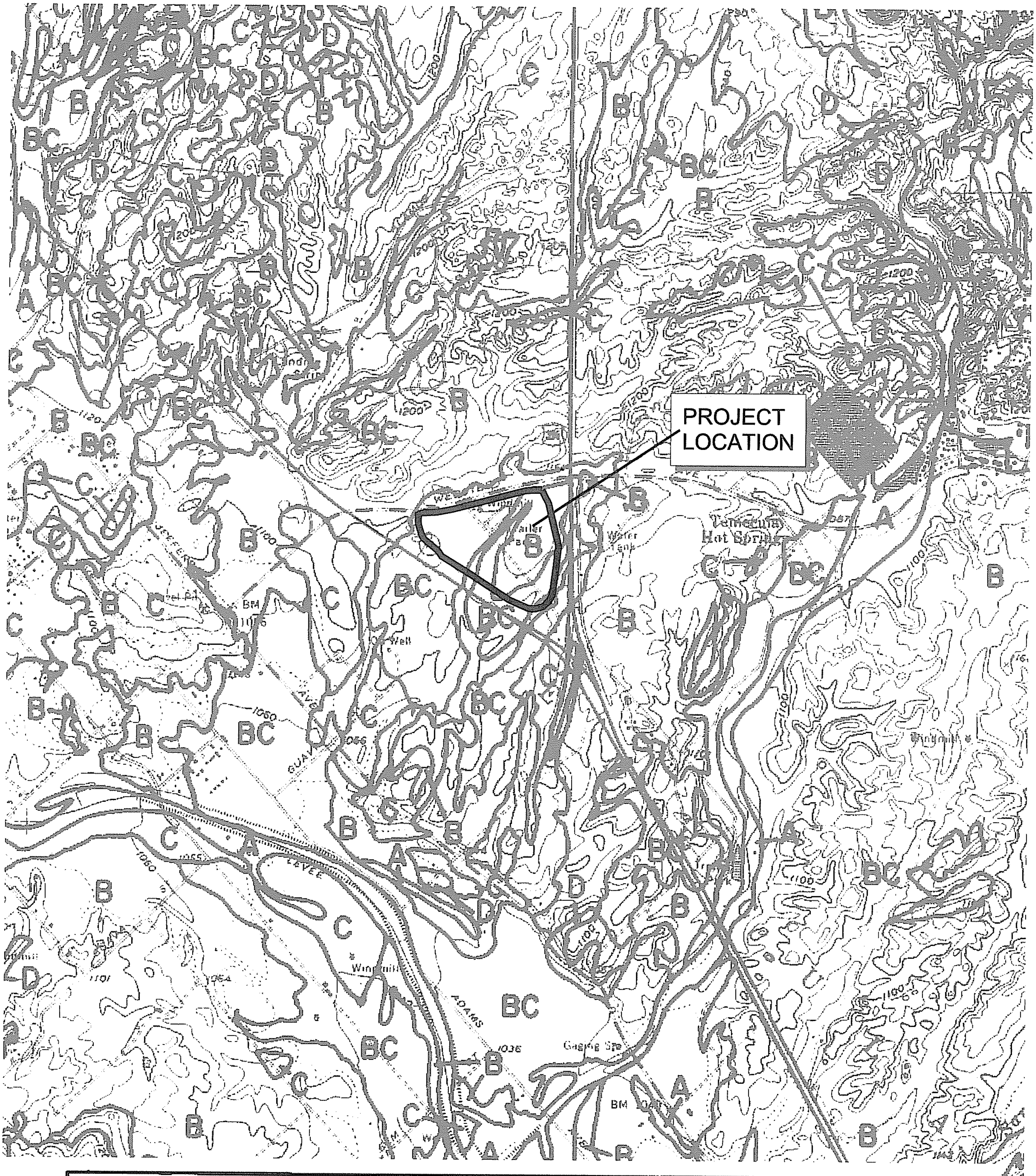
MIRA LOMA			MURRIETA - TEMECULA & RANCHO CALIFORNIA			NORCO			PALM SPRINGS			PERRIS VALLEY		
DURATION MINUTES	FREQUENCY		DURATION MINUTES	FREQUENCY		DURATION MINUTES	FREQUENCY		DURATION MINUTES	FREQUENCY		DURATION MINUTES	FREQUENCY	
	10 YEAR	100 YEAR		10 YEAR	100 YEAR		10 YEAR	100 YEAR		10 YEAR	100 YEAR		10 YEAR	100 YEAR
5	2.84	4.48	5	3.45	5.10	5	2.77	4.16	5	4.23	6.76	5	2.64	3.78
6	2.58	4.07	6	3.12	4.61	6	2.53	3.79	6	3.80	6.08	6	2.41	3.46
7	2.37	3.75	7	2.87	4.24	7	2.34	3.51	7	3.48	5.56	7	2.24	3.21
8	2.21	3.49	8	2.67	3.94	8	2.19	3.29	8	3.22	5.15	8	2.09	3.01
9	2.08	3.28	9	2.50	3.69	9	2.07	3.10	9	3.01	4.81	9	1.98	2.84
10	1.96	3.10	10	2.36	3.48	10	1.96	2.94	10	2.83	4.52	10	1.88	2.69
11	1.87	2.95	11	2.24	3.30	11	1.87	2.80	11	2.67	4.28	11	1.79	2.57
12	1.78	2.82	12	2.13	3.15	12	1.79	2.68	12	2.54	4.07	12	1.72	2.46
13	1.71	2.70	13	2.04	3.01	13	1.72	2.58	13	2.43	3.88	13	1.65	2.37
14	1.64	2.60	14	1.96	2.89	14	1.66	2.48	14	2.33	3.72	14	1.59	2.29
15	1.58	2.50	15	1.89	2.79	15	1.60	2.40	15	2.23	3.58	15	1.54	2.21
16	1.53	2.42	16	1.82	2.69	16	1.55	2.32	16	2.15	3.44	16	1.49	2.14
17	1.48	2.34	17	1.76	2.60	17	1.50	2.25	17	2.08	3.32	17	1.45	2.08
18	1.44	2.27	18	1.71	2.52	18	1.46	2.19	18	2.01	3.22	18	1.41	2.02
19	1.40	2.21	19	1.66	2.45	19	1.42	2.13	19	1.95	3.12	19	1.37	1.97
20	1.36	2.15	20	1.61	2.38	20	1.39	2.08	20	1.89	3.03	20	1.34	1.92
22	1.29	2.04	22	1.53	2.26	22	1.32	1.98	22	1.79	2.86	22	1.28	1.83
24	1.24	1.95	24	1.46	2.15	24	1.26	1.90	24	1.70	2.72	24	1.22	1.75
26	1.18	1.87	26	1.39	2.06	26	1.22	1.82	26	1.62	2.60	26	1.18	1.69
28	1.14	1.80	28	1.34	1.98	28	1.17	1.76	28	1.56	2.49	28	1.13	1.63
30	1.10	1.73	30	1.29	1.90	30	1.13	1.70	30	1.49	2.39	30	1.10	1.57
32	1.06	1.67	32	1.24	1.84	32	1.10	1.64	32	1.44	2.30	32	1.06	1.52
34	1.03	1.62	34	1.20	1.78	34	1.06	1.59	34	1.39	2.22	34	1.03	1.48
36	1.00	1.57	36	1.17	1.72	36	1.03	1.55	36	1.34	2.15	36	1.00	1.44
38	.97	1.53	38	1.13	1.67	38	1.01	1.51	38	1.30	2.09	38	.98	1.40
40	.94	1.49	40	1.10	1.62	40	.98	1.47	40	1.27	2.02	40	.95	1.37
45	.89	1.40	45	1.03	1.52	45	.92	1.39	45	1.18	1.89	45	.90	1.29
50	.84	1.32	50	.97	1.44	50	.88	1.31	50	1.11	1.78	50	.85	1.22
55	.80	1.26	55	.92	1.36	55	.84	1.25	55	1.05	1.68	55	.81	1.17
60	.76	1.20	60	.88	1.30	60	.80	1.20	60	1.00	1.60	60	.78	1.12
65	.73	1.15	65	.84	1.24	65	.77	1.15	65	.95	1.53	65	.75	1.08
70	.70	1.11	70	.81	1.19	70	.74	1.11	70	.91	1.46	70	.72	1.04
75	.68	1.07	75	.78	1.15	75	.72	1.07	75	.88	1.41	75	.70	1.00
80	.65	1.03	80	.75	1.11	80	.69	1.04	80	.85	1.35	80	.68	.97
85	.63	1.00	85	.73	1.07	85	.67	1.01	85	.82	1.31	85	.66	.94
SLOPE = .530			SLOPE = .550			SLOPE = .500			SLOPE = .580			SLOPE = .490		

RCFC & WCD
HYDROLOGY MANUAL

STANDARD
INTENSITY – DURATION
CURVES DATA

APPENDIX B

RCFCD & WCD
Hydrologic Soil Group Maps



LEGEND

——— SOILS GROUP BOUNDARY

A SOILS GROUP DESIGNATION

RCFC & WCD
HYDROLOGY MANUAL

0 FEET 5000

HYDROLOGIC SOILS GROUP MAP
FOR
MURRIETA

APPENDIX C

Existing Condition
10-Year and 100-Year Hydrology
Rational Method Calculations

```
****************************************************************************
        RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM BASED ON
    RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
                 (RCFC&WCD)  1978 HYDROLOGY MANUAL
     (c) Copyright 1982-2006 Advanced Engineering Software (aes)
              (Rational Tabling Version 6.0D)
          Release Date: 06/01/2005  License ID 1264

                     Analysis prepared by:

                         RBF Consulting
                       14725 Alton Parkway
                        Irvine, CA  92618

 ************************** DESCRIPTION OF STUDY **************************
 * The TriAngle                                                             *
 * 10-Year Storm                                                            *
 * EXISTING CONDITION                                                       *
 **************************************************************************

  FILE NAME: 1717-EXT.DAT
  TIME/DATE OF STUDY: 12:16 03/20/2008
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  10-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  2.360
  10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  0.880
  100-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  3.480
  100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  1.300
  SLOPE OF 10-YEAR INTENSITY-DURATION CURVE =  0.5505732
  SLOPE OF 100-YEAR INTENSITY-DURATION CURVE =  0.5495536
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =   10.00   1-HOUR INTENSITY(INCH/HOUR) =   0.889
  SLOPE OF INTENSITY DURATION CURVE = 0.5506
  RCFC&WCD HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: COMPUTE CONFLUENCE VALUES ACCORDING TO RCFC&WCD HYDROLOGY MANUAL
        AND IGNORE OTHER CONFLUENCE COMBINATIONS FOR DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:  CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.  (FT)     (FT)     SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  =====  ====== ===== =======
  1  30.0     20.0     0.018/0.018/0.020   0.67    2.00  0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE     40.00 TO NODE     41.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS: UNDEVELOPED WITH POOR COVER
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   854.00
  UPSTREAM ELEVATION(FEET) =   1155.00
  DOWNSTREAM ELEVATION(FEET) =   1114.00
  ELEVATION DIFFERENCE(FEET) =     41.00
  TC = 0.533*[(  854.00**3)/(    41.00)]**.2 =   14.545
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.939
```

```
 UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .6876
 SOIL CLASSIFICATION IS "C"
 SUBAREA RUNOFF(CFS) =       5.73
 TOTAL AREA(ACRES) =       4.30   TOTAL RUNOFF(CFS) =       5.73

****************************************************************************
 FLOW PROCESS FROM NODE     41.00 TO NODE     42.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    1114.00  DOWNSTREAM(FEET) =    1110.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =    342.00   CHANNEL SLOPE =  0.0117
 CHANNEL FLOW THRU SUBAREA(CFS) =       5.73
 FLOW VELOCITY(FEET/SEC) =   2.36 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   2.42    Tc(MIN.) =  16.96
 LONGEST FLOWPATH FROM NODE     40.00 TO NODE     42.00 =  1196.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     42.00 TO NODE     42.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.782
 UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .6736
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =     3.90   SUBAREA RUNOFF(CFS) =     4.68
 TOTAL AREA(ACRES) =       8.20   TOTAL RUNOFF(CFS) =    10.41
 TC(MIN.) =  16.96

****************************************************************************
 FLOW PROCESS FROM NODE     42.00 TO NODE     43.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    1110.00  DOWNSTREAM(FEET) =    1104.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =    354.00   CHANNEL SLOPE =  0.0169
 CHANNEL FLOW THRU SUBAREA(CFS) =      10.41
 FLOW VELOCITY(FEET/SEC) =   3.29 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   1.79    Tc(MIN.) =  18.76
 LONGEST FLOWPATH FROM NODE     40.00 TO NODE     43.00 =  1550.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     43.00 TO NODE     43.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.686
 UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .6640
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =     5.10   SUBAREA RUNOFF(CFS) =     5.71
 TOTAL AREA(ACRES) =      13.30   TOTAL RUNOFF(CFS) =    16.12
 TC(MIN.) =  18.76

****************************************************************************
 FLOW PROCESS FROM NODE     50.00 TO NODE     51.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
        ASSUMED INITIAL SUBAREA UNIFORM
        DEVELOPMENT IS: UNDEVELOPED WITH POOR COVER
 TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    387.00
 UPSTREAM ELEVATION(FEET) =   1155.00
 DOWNSTREAM ELEVATION(FEET) =   1151.00
 ELEVATION DIFFERENCE(FEET) =      4.00
 TC = 0.533*[(  387.00**3)/(     4.00)]**.2 =   14.408
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.949
 UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .6884
```

```
 SOIL CLASSIFICATION IS "C"
 SUBAREA RUNOFF(CFS) =       2.15
 TOTAL AREA(ACRES) =       1.60   TOTAL RUNOFF(CFS) =       2.15

****************************************************************************
 FLOW PROCESS FROM NODE     51.00 TO NODE     52.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   1151.00  DOWNSTREAM(FEET) =   1142.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   420.00   CHANNEL SLOPE =  0.0214
 CHANNEL FLOW THRU SUBAREA(CFS) =       2.15
 FLOW VELOCITY(FEET/SEC) =   2.56 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   2.74   Tc(MIN.) =  17.15
 LONGEST FLOWPATH FROM NODE     50.00 TO NODE     52.00 =    807.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     52.00 TO NODE     52.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.771
 UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .6726
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =      5.50   SUBAREA RUNOFF(CFS) =     6.55
 TOTAL AREA(ACRES) =        7.10   TOTAL RUNOFF(CFS) =     8.70
 TC(MIN.) =  17.15

****************************************************************************
 FLOW PROCESS FROM NODE     52.00 TO NODE     53.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   1142.00  DOWNSTREAM(FEET) =   1134.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   356.00   CHANNEL SLOPE =  0.0225
 CHANNEL FLOW THRU SUBAREA(CFS) =       8.70
 FLOW VELOCITY(FEET/SEC) =   3.62 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   1.64   Tc(MIN.) =  18.79
 LONGEST FLOWPATH FROM NODE     50.00 TO NODE     53.00 =   1163.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     53.00 TO NODE     53.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.684
 UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .6639
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =      2.60   SUBAREA RUNOFF(CFS) =     2.91
 TOTAL AREA(ACRES) =        9.70   TOTAL RUNOFF(CFS) =    11.61
 TC(MIN.) =  18.79

****************************************************************************
 FLOW PROCESS FROM NODE     60.00 TO NODE     61.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
        ASSUMED INITIAL SUBAREA UNIFORM
        DEVELOPMENT IS: UNDEVELOPED WITH POOR COVER
 TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    472.00
 UPSTREAM ELEVATION(FEET) =   1156.00
 DOWNSTREAM ELEVATION(FEET) =   1141.50
 ELEVATION DIFFERENCE(FEET) =     14.50
 TC = 0.533*[(  472.00**3)/(    14.50)]**.2 =   12.546
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.104
 UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .7005
 SOIL CLASSIFICATION IS "C"
```

```
 SUBAREA RUNOFF(CFS) =        5.75
 TOTAL AREA(ACRES) =        3.90   TOTAL RUNOFF(CFS) =        5.75

****************************************************************************
 FLOW PROCESS FROM NODE      61.00 TO NODE      62.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   1141.50  DOWNSTREAM(FEET) =   1124.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   579.00   CHANNEL SLOPE =  0.0302
 CHANNEL FLOW THRU SUBAREA(CFS) =       5.75
 FLOW VELOCITY(FEET/SEC) =   3.79 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   2.55   Tc(MIN.) =  15.09
 LONGEST FLOWPATH FROM NODE      60.00 TO NODE      62.00 =  1051.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      62.00 TO NODE      62.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.900
 UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .6843
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =    11.80   SUBAREA RUNOFF(CFS) =    15.34
 TOTAL AREA(ACRES) =      15.70   TOTAL RUNOFF(CFS) =    21.09
 TC(MIN.) =  15.09

****************************************************************************
 FLOW PROCESS FROM NODE      62.00 TO NODE      63.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   1124.00  DOWNSTREAM(FEET) =   1108.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   813.00   CHANNEL SLOPE =  0.0197
 CHANNEL FLOW THRU SUBAREA(CFS) =      21.09
 FLOW VELOCITY(FEET/SEC) =   4.26 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   3.18   Tc(MIN.) =  18.27
 LONGEST FLOWPATH FROM NODE      60.00 TO NODE      63.00 =  1864.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      63.00 TO NODE      63.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.711
 UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .6666
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =    12.30   SUBAREA RUNOFF(CFS) =    14.02
 TOTAL AREA(ACRES) =      28.00   TOTAL RUNOFF(CFS) =    35.12
 TC(MIN.) =  18.27

****************************************************************************
 FLOW PROCESS FROM NODE      70.00 TO NODE      71.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
        ASSUMED INITIAL SUBAREA UNIFORM
        DEVELOPMENT IS: UNDEVELOPED WITH POOR COVER
 TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    521.00
 UPSTREAM ELEVATION(FEET) =   1150.50
 DOWNSTREAM ELEVATION(FEET) =   1130.00
 ELEVATION DIFFERENCE(FEET) =     20.50
 TC = 0.533*[(  521.00**3)/(    20.50)]**.2 =   12.421
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.115
 UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .7014
 SOIL CLASSIFICATION IS "C"
 SUBAREA RUNOFF(CFS) =      2.97
```

```
 TOTAL AREA(ACRES) =       2.00   TOTAL RUNOFF(CFS) =       2.97

****************************************************************************
 FLOW PROCESS FROM NODE     71.00 TO NODE     72.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   1130.00  DOWNSTREAM(FEET) =   1123.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   475.00   CHANNEL SLOPE =  0.0147
 CHANNEL FLOW THRU SUBAREA(CFS) =       2.97
 FLOW VELOCITY(FEET/SEC) =   2.27 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   3.48   Tc(MIN.) =  15.90
 LONGEST FLOWPATH FROM NODE     70.00 TO NODE     72.00 =    996.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     72.00 TO NODE     72.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.846
 UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .6795
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =      2.90   SUBAREA RUNOFF(CFS) =     3.64
 TOTAL AREA(ACRES) =        4.90   TOTAL RUNOFF(CFS) =     6.61
 TC(MIN.) =  15.90

****************************************************************************
 FLOW PROCESS FROM NODE     72.00 TO NODE     73.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   1123.00  DOWNSTREAM(FEET) =   1108.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   350.00   CHANNEL SLOPE =  0.0429
 CHANNEL FLOW THRU SUBAREA(CFS) =       6.61
 FLOW VELOCITY(FEET/SEC) =   4.67 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   1.25   Tc(MIN.) =  17.15
 LONGEST FLOWPATH FROM NODE     70.00 TO NODE     73.00 =   1346.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     73.00 TO NODE     73.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.771
 UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .6725
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =      5.30   SUBAREA RUNOFF(CFS) =     6.31
 TOTAL AREA(ACRES) =       10.20   TOTAL RUNOFF(CFS) =    12.92
 TC(MIN.) =  17.15
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)      =      10.20  TC(MIN.) =      17.15
 PEAK FLOW RATE(CFS)    =      12.92
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS
```

```
******************************************************************************
        RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM BASED ON
     RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
                (RCFC&WCD) 1978 HYDROLOGY MANUAL
       (c) Copyright 1982-2006 Advanced Engineering Software (aes)
                  (Rational Tabling Version 6.0D)
               Release Date: 06/01/2005  License ID 1264

                      Analysis prepared by:

                          RBF Consulting
                        14725 Alton Parkway
                         Irvine, CA  92618

 ************************** DESCRIPTION OF STUDY **************************
 * TheTRIANGLE                                                  *
 * 100-YEAR STORM                                                          *
 * EXISTING CONDITION                                                     *
 **************************************************************************

  FILE NAME: 1717-EXT.DAT
  TIME/DATE OF STUDY: 09:19 03/17/2008
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  10-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  2.360
  10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  0.880
  100-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  3.480
  100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  1.300
  SLOPE OF 10-YEAR INTENSITY-DURATION CURVE =  0.5505732
  SLOPE OF 100-YEAR INTENSITY-DURATION CURVE =  0.5495536
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =  100.00   1-HOUR INTENSITY(INCH/HOUR) =   1.300
  SLOPE OF INTENSITY DURATION CURVE = 0.5496
  RCFC&WCD HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: COMPUTE CONFLUENCE VALUES ACCORDING TO RCFC&WCD HYDROLOGY MANUAL
        AND IGNORE OTHER CONFLUENCE COMBINATIONS FOR DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.  (FT)     (FT)     SIDE / SIDE/ WAY    (FT)   (FT)  (FT)   (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE     40.00 TO NODE     41.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS: UNDEVELOPED WITH POOR COVER
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    854.00
  UPSTREAM ELEVATION(FEET) =   1155.00
  DOWNSTREAM ELEVATION(FEET) =   1114.00
  ELEVATION DIFFERENCE(FEET) =     41.00
  TC = 0.533*[(  854.00**3)/(    41.00)]**.2 =   14.545
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.832
```

```
 UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .7429
 SOIL CLASSIFICATION IS "C"
 SUBAREA RUNOFF(CFS) =       9.05
 TOTAL AREA(ACRES) =       4.30   TOTAL RUNOFF(CFS) =       9.05

****************************************************************************
 FLOW PROCESS FROM NODE      41.00 TO NODE      42.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   1114.00  DOWNSTREAM(FEET) =   1110.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =    342.00   CHANNEL SLOPE =  0.0117
 CHANNEL FLOW THRU SUBAREA(CFS) =       9.05
 FLOW VELOCITY(FEET/SEC) =   2.64 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   2.16   Tc(MIN.) =  16.71
 LONGEST FLOWPATH FROM NODE      40.00 TO NODE      42.00 =  1196.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      42.00 TO NODE      42.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.625
 UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .7328
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =     3.90   SUBAREA RUNOFF(CFS) =     7.50
 TOTAL AREA(ACRES) =       8.20   TOTAL RUNOFF(CFS) =    16.55
 TC(MIN.) =  16.71

****************************************************************************
 FLOW PROCESS FROM NODE      42.00 TO NODE      43.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   1110.00  DOWNSTREAM(FEET) =   1104.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =    354.00   CHANNEL SLOPE =  0.0169
 CHANNEL FLOW THRU SUBAREA(CFS) =      16.55
 FLOW VELOCITY(FEET/SEC) =   3.71 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   1.59   Tc(MIN.) =  18.30
 LONGEST FLOWPATH FROM NODE      40.00 TO NODE      43.00 =  1550.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      43.00 TO NODE      43.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.497
 UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .7258
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =     5.10   SUBAREA RUNOFF(CFS) =     9.24
 TOTAL AREA(ACRES) =      13.30   TOTAL RUNOFF(CFS) =    25.79
 TC(MIN.) =  18.30

****************************************************************************
 FLOW PROCESS FROM NODE      50.00 TO NODE      51.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
        ASSUMED INITIAL SUBAREA UNIFORM
        DEVELOPMENT IS: UNDEVELOPED WITH POOR COVER
 TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    387.00
 UPSTREAM ELEVATION(FEET) =   1155.00
 DOWNSTREAM ELEVATION(FEET) =   1151.00
 ELEVATION DIFFERENCE(FEET) =      4.00
 TC = 0.533*[(  387.00**3)/(     4.00)]**.2 =   14.408
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.847
 UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .7436
```

```
  SOIL CLASSIFICATION IS "C"
  SUBAREA RUNOFF(CFS) =       3.39
  TOTAL AREA(ACRES) =       1.60   TOTAL RUNOFF(CFS) =       3.39

****************************************************************************
  FLOW PROCESS FROM NODE     51.00 TO NODE     52.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1151.00  DOWNSTREAM(FEET) =   1142.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   420.00   CHANNEL SLOPE =  0.0214
  CHANNEL FLOW THRU SUBAREA(CFS) =      3.39
  FLOW VELOCITY(FEET/SEC) =   2.82 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   2.48   Tc(MIN.) =  16.89
  LONGEST FLOWPATH FROM NODE     50.00 TO NODE     52.00 =   807.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     52.00 TO NODE     52.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.609
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .7320
  SOIL CLASSIFICATION IS "C"
  SUBAREA AREA(ACRES) =     5.50   SUBAREA RUNOFF(CFS) =   10.50
  TOTAL AREA(ACRES) =       7.10   TOTAL RUNOFF(CFS) =   13.89
  TC(MIN.) =  16.89

****************************************************************************
  FLOW PROCESS FROM NODE     52.00 TO NODE     53.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1142.00  DOWNSTREAM(FEET) =   1134.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   356.00   CHANNEL SLOPE =  0.0225
  CHANNEL FLOW THRU SUBAREA(CFS) =     13.89
  FLOW VELOCITY(FEET/SEC) =   4.08 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   1.46   Tc(MIN.) =  18.34
  LONGEST FLOWPATH FROM NODE     50.00 TO NODE     53.00 =  1163.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     53.00 TO NODE     53.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.493
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .7257
  SOIL CLASSIFICATION IS "C"
  SUBAREA AREA(ACRES) =     2.60   SUBAREA RUNOFF(CFS) =    4.70
  TOTAL AREA(ACRES) =       9.70   TOTAL RUNOFF(CFS) =   18.60
  TC(MIN.) =  18.34

****************************************************************************
  FLOW PROCESS FROM NODE     60.00 TO NODE     61.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
        ASSUMED INITIAL SUBAREA UNIFORM
        DEVELOPMENT IS: UNDEVELOPED WITH POOR COVER
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   472.00
  UPSTREAM ELEVATION(FEET) =   1156.00
  DOWNSTREAM ELEVATION(FEET) =   1141.50
  ELEVATION DIFFERENCE(FEET) =     14.50
  TC = 0.533*[(  472.00**3)/(    14.50)]**.2 =   12.546
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.072
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .7531
  SOIL CLASSIFICATION IS "C"
```

```
 SUBAREA RUNOFF(CFS) =       9.02
 TOTAL AREA(ACRES) =       3.90   TOTAL RUNOFF(CFS) =       9.02

****************************************************************************
 FLOW PROCESS FROM NODE     61.00 TO NODE     62.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   1141.50  DOWNSTREAM(FEET) =   1124.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   579.00   CHANNEL SLOPE =  0.0302
 CHANNEL FLOW THRU SUBAREA(CFS) =       9.02
 FLOW VELOCITY(FEET/SEC) =   4.23 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   2.28   Tc(MIN.) =  14.82
 LONGEST FLOWPATH FROM NODE      60.00 TO NODE     62.00 =   1051.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     62.00 TO NODE     62.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.803
 UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .7415
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =    11.80   SUBAREA RUNOFF(CFS) =   24.53
 TOTAL AREA(ACRES) =      15.70   TOTAL RUNOFF(CFS) =   33.55
 TC(MIN.) =  14.82

****************************************************************************
 FLOW PROCESS FROM NODE     62.00 TO NODE     63.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   1124.00  DOWNSTREAM(FEET) =   1108.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   813.00   CHANNEL SLOPE =  0.0197
 CHANNEL FLOW THRU SUBAREA(CFS) =      33.55
 FLOW VELOCITY(FEET/SEC) =   4.85 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   2.80   Tc(MIN.) =  17.62
 LONGEST FLOWPATH FROM NODE      60.00 TO NODE     63.00 =   1864.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     63.00 TO NODE     63.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.549
 UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .7287
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =    12.30   SUBAREA RUNOFF(CFS) =   22.85
 TOTAL AREA(ACRES) =      28.00   TOTAL RUNOFF(CFS) =   56.40
 TC(MIN.) =  17.62

****************************************************************************
 FLOW PROCESS FROM NODE     70.00 TO NODE     71.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
        ASSUMED INITIAL SUBAREA UNIFORM
        DEVELOPMENT IS: UNDEVELOPED WITH POOR COVER
 TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   521.00
 UPSTREAM ELEVATION(FEET) =   1150.50
 DOWNSTREAM ELEVATION(FEET) =   1130.00
 ELEVATION DIFFERENCE(FEET) =     20.50
 TC = 0.533*[(  521.00**3)/(    20.50)]**.2 =   12.421
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.089
 UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .7538
 SOIL CLASSIFICATION IS "C"
 SUBAREA RUNOFF(CFS) =      4.66
```

```
 TOTAL AREA(ACRES) =       2.00   TOTAL RUNOFF(CFS) =       4.66

****************************************************************************
 FLOW PROCESS FROM NODE     71.00 TO NODE     72.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   1130.00  DOWNSTREAM(FEET) =   1123.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   475.00   CHANNEL SLOPE =  0.0147
 CHANNEL FLOW THRU SUBAREA(CFS) =      4.66
 FLOW VELOCITY(FEET/SEC) =   2.52 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   3.14   Tc(MIN.) =  15.56
 LONGEST FLOWPATH FROM NODE     70.00 TO NODE     72.00 =   996.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     72.00 TO NODE     72.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.729
 UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .7380
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =     2.90   SUBAREA RUNOFF(CFS) =     5.84
 TOTAL AREA(ACRES) =       4.90   TOTAL RUNOFF(CFS) =     10.50
 TC(MIN.) =  15.56

****************************************************************************
 FLOW PROCESS FROM NODE     72.00 TO NODE     73.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   1123.00  DOWNSTREAM(FEET) =   1108.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   350.00   CHANNEL SLOPE =  0.0429
 CHANNEL FLOW THRU SUBAREA(CFS) =     10.50
 FLOW VELOCITY(FEET/SEC) =   5.24 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   1.11   Tc(MIN.) =  16.68
 LONGEST FLOWPATH FROM NODE     70.00 TO NODE     73.00 =  1346.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     73.00 TO NODE     73.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.627
 UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .7329
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =     5.30   SUBAREA RUNOFF(CFS) =    10.21
 TOTAL AREA(ACRES) =      10.20   TOTAL RUNOFF(CFS) =    20.70
 TC(MIN.) =  16.68
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)     =     10.20  TC(MIN.) =     16.68
 PEAK FLOW RATE(CFS)   =     20.70
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS

▯
```

APPENDIX D

Developed Condition
10-Year and 100-Year Hydrology
Rational Method Calculations

```
****************************************************************************
     RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM BASED ON
     RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
              (RCFC&WCD) 1978 HYDROLOGY MANUAL
     (c) Copyright 1982-2006 Advanced Engineering Software (aes)
              (Rational Tabling Version 6.0D)
          Release Date: 06/01/2005  License ID 1264

                  Analysis prepared by:

                     RBF Consulting
                   14725 Alton Parkway
                    Irvine, CA  92618

 ************************** DESCRIPTION OF STUDY **************************
 * The TriAngle                                                            *
 * 10-Year Storm                                                           *
 * DEVELOPED CONDITIONS                                                    *
 **************************************************************************

  FILE NAME: 1717-DEV.DAT
  TIME/DATE OF STUDY: 12:13 03/20/2008
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  10-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  2.360
  10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  0.880
  100-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  3.480
  100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  1.300
  SLOPE OF 10-YEAR INTENSITY-DURATION CURVE =  0.5505732
  SLOPE OF 100-YEAR INTENSITY-DURATION CURVE =  0.5495536
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =   10.00   1-HOUR INTENSITY(INCH/HOUR) =   0.889
  SLOPE OF INTENSITY DURATION CURVE = 0.5506
  RCFC&WCD HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: COMPUTE CONFLUENCE VALUES ACCORDING TO RCFC&WCD HYDROLOGY MANUAL
        AND IGNORE OTHER CONFLUENCE COMBINATIONS FOR DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN- / OUT-/PARK-   HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.  (FT)    (FT)      SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)   (n)
===  =====  =========  =================  ======  =====  ====== ===== =======
 1   30.0    20.0      0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =   6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE     40.00 TO NODE     41.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS COMMERCIAL
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   445.00
  UPSTREAM ELEVATION(FEET) =   1150.00
  DOWNSTREAM ELEVATION(FEET) =   1136.90
  ELEVATION DIFFERENCE(FEET) =     13.10
  TC = 0.303*[(  445.00**3)/(    13.10)]**.2 =    7.033
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.893
```

```
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8846
 SOIL CLASSIFICATION IS "C"
 SUBAREA RUNOFF(CFS) =      7.17
 TOTAL AREA(ACRES) =      2.80   TOTAL RUNOFF(CFS) =      7.17

****************************************************************************
 FLOW PROCESS FROM NODE     41.00 TO NODE     42.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1136.90  DOWNSTREAM(FEET) =  1131.50
 FLOW LENGTH(FEET) =   448.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.60
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      7.17
 PIPE TRAVEL TIME(MIN.) =   1.13    Tc(MIN.) =   8.16
 LONGEST FLOWPATH FROM NODE     40.00 TO NODE     42.00 =   893.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     42.00 TO NODE     42.00 IS CODE =  81
----------------------------------------------------------------------------D2
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.665
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8835
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =     2.70   SUBAREA RUNOFF(CFS) =     6.36
 TOTAL AREA(ACRES) =      5.50   TOTAL RUNOFF(CFS) =    13.52
 TC(MIN.) =   8.16

****************************************************************************
 FLOW PROCESS FROM NODE     42.00 TO NODE     43.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1131.50  DOWNSTREAM(FEET) =  1129.80
 FLOW LENGTH(FEET) =   216.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  14.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.58
 ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     13.52
 PIPE TRAVEL TIME(MIN.) =   0.55    Tc(MIN.) =   8.71
 LONGEST FLOWPATH FROM NODE     40.00 TO NODE     43.00 =  1109.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     43.00 TO NODE     43.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.572
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8830
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =     2.50   SUBAREA RUNOFF(CFS) =     5.68
 TOTAL AREA(ACRES) =      8.00   TOTAL RUNOFF(CFS) =    19.20
 TC(MIN.) =   8.71

****************************************************************************
 FLOW PROCESS FROM NODE     43.00 TO NODE     43.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.572
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8830
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =     1.50   SUBAREA RUNOFF(CFS) =     3.41
 TOTAL AREA(ACRES) =      9.50   TOTAL RUNOFF(CFS) =    22.61
 TC(MIN.) =   8.71
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     43.00 TO NODE     44.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1129.80  DOWNSTREAM(FEET) =  1120.40
  FLOW LENGTH(FEET) =   941.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  17.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.15
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     22.61
  PIPE TRAVEL TIME(MIN.) =   1.93    Tc(MIN.) =  10.64
  LONGEST FLOWPATH FROM NODE     40.00 TO NODE     44.00 =  2050.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     44.00 TO NODE     44.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.304
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8814
  SOIL CLASSIFICATION IS "C"
  SUBAREA AREA(ACRES) =     3.50   SUBAREA RUNOFF(CFS) =     7.11
  TOTAL AREA(ACRES) =      13.00   TOTAL RUNOFF(CFS) =    29.71
  TC(MIN.) =  10.64

****************************************************************************
  FLOW PROCESS FROM NODE     44.00 TO NODE     44.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.304
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8814
  SOIL CLASSIFICATION IS "C"
  SUBAREA AREA(ACRES) =     3.50   SUBAREA RUNOFF(CFS) =     7.11
  TOTAL AREA(ACRES) =      16.50   TOTAL RUNOFF(CFS) =    36.82
  TC(MIN.) =  10.64

****************************************************************************
  FLOW PROCESS FROM NODE     50.00 TO NODE     51.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS COMMERCIAL
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    739.00
  UPSTREAM ELEVATION(FEET) =   1133.50
  DOWNSTREAM ELEVATION(FEET) =   1126.10
  ELEVATION DIFFERENCE(FEET) =      7.40
  TC = 0.303*[(  739.00**3)/(     7.40)]**.2 =   10.689
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.298
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8814
  SOIL CLASSIFICATION IS "C"
  SUBAREA RUNOFF(CFS) =      8.71
  TOTAL AREA(ACRES) =       4.30   TOTAL RUNOFF(CFS) =       8.71

****************************************************************************
  FLOW PROCESS FROM NODE     51.00 TO NODE     52.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 1126.10  DOWNSTREAM ELEVATION(FEET) = 1123.10
  STREET LENGTH(FEET) =   246.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 30.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
```

```
 INSIDE STREET CROSSFALL(DECIMAL) =  0.018
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      10.52
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.49
   HALFSTREET FLOOD WIDTH(FEET) =   18.24
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.32
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.62
 STREET FLOW TRAVEL TIME(MIN.) =   1.23   Tc(MIN.) =  11.92
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.164
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8805
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =    1.90      SUBAREA RUNOFF(CFS) =    3.62
 TOTAL AREA(ACRES) =      6.20        PEAK FLOW RATE(CFS) =      12.33

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.51   HALFSTREET FLOOD WIDTH(FEET) =  19.41
 FLOW VELOCITY(FEET/SEC.) =  3.46   DEPTH*VELOCITY(FT*FT/SEC.) =   1.76
 LONGEST FLOWPATH FROM NODE     50.00 TO NODE     52.00 =   985.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     52.00 TO NODE     53.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1119.10  DOWNSTREAM(FEET) =  1117.00
 FLOW LENGTH(FEET) =   208.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.4 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.00
 ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     12.33
 PIPE TRAVEL TIME(MIN.) =   0.50    Tc(MIN.) =  12.42
 LONGEST FLOWPATH FROM NODE     50.00 TO NODE     53.00 =  1193.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     53.00 TO NODE     53.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.116
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8801
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =    1.80   SUBAREA RUNOFF(CFS) =    3.35
 TOTAL AREA(ACRES) =      8.00   TOTAL RUNOFF(CFS) =   15.68
 TC(MIN.) =  12.42

****************************************************************************
 FLOW PROCESS FROM NODE     60.00 TO NODE     61.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
        ASSUMED INITIAL SUBAREA UNIFORM
        DEVELOPMENT IS COMMERCIAL
 TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
 INITIAL SUBAREA FLOW-LENGTH(FEET) =  1000.00
 UPSTREAM ELEVATION(FEET) =   1142.00
 DOWNSTREAM ELEVATION(FEET) =   1134.50
 ELEVATION DIFFERENCE(FEET) =      7.50
 TC = 0.303*[( 1000.00**3)/(     7.50)]**.2 =   12.781
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.082
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8799
 SOIL CLASSIFICATION IS "C"
 SUBAREA RUNOFF(CFS) =      6.41
```

```
 TOTAL AREA(ACRES) =       3.50   TOTAL RUNOFF(CFS) =       6.41

****************************************************************************
 FLOW PROCESS FROM NODE     61.00 TO NODE     62.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1134.50  DOWNSTREAM(FEET) =  1132.40
 FLOW LENGTH(FEET) =   207.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.02
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      6.41
 PIPE TRAVEL TIME(MIN.) =   0.57    Tc(MIN.) =  13.35
 LONGEST FLOWPATH FROM NODE     60.00 TO NODE     62.00 =  1207.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     62.00 TO NODE     62.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.033
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8795
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =     3.30   SUBAREA RUNOFF(CFS) =     5.90
 TOTAL AREA(ACRES) =       6.80   TOTAL RUNOFF(CFS) =    12.31
 TC(MIN.) =  13.35

****************************************************************************
 FLOW PROCESS FROM NODE     62.00 TO NODE     62.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.033
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8795
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =     2.00   SUBAREA RUNOFF(CFS) =     3.58
 TOTAL AREA(ACRES) =       8.80   TOTAL RUNOFF(CFS) =    15.89
 TC(MIN.) =  13.35

****************************************************************************
 FLOW PROCESS FROM NODE     62.00 TO NODE     63.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1132.40  DOWNSTREAM(FEET) =  1129.50
 FLOW LENGTH(FEET) =   287.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.51
 ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     15.89
 PIPE TRAVEL TIME(MIN.) =   0.64    Tc(MIN.) =  13.99
 LONGEST FLOWPATH FROM NODE     60.00 TO NODE     63.00 =  1494.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     63.00 TO NODE     63.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.981
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8791
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =     4.40   SUBAREA RUNOFF(CFS) =     7.66
 TOTAL AREA(ACRES) =      13.20   TOTAL RUNOFF(CFS) =    23.55
 TC(MIN.) =  13.99

****************************************************************************
 FLOW PROCESS FROM NODE     63.00 TO NODE     64.00 IS CODE =  31
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1129.50  DOWNSTREAM(FEET) =  1126.00
  FLOW LENGTH(FEET) =   347.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  18.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.24
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     23.55
  PIPE TRAVEL TIME(MIN.) =   0.70    Tc(MIN.) =  14.69
  LONGEST FLOWPATH FROM NODE      60.00 TO NODE     64.00 =  1841.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     70.00 TO NODE     71.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS COMMERCIAL
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   486.00
  UPSTREAM ELEVATION(FEET) =   1150.00
  DOWNSTREAM ELEVATION(FEET) =   1142.60
  ELEVATION DIFFERENCE(FEET) =      7.40
  TC = 0.303*[(  486.00**3)/(     7.40)]**.2 =    8.312
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.639
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8833
  SOIL CLASSIFICATION IS "C"
  SUBAREA RUNOFF(CFS) =       3.73
  TOTAL AREA(ACRES) =       1.60   TOTAL RUNOFF(CFS) =       3.73

****************************************************************************
  FLOW PROCESS FROM NODE     71.00 TO NODE     72.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1142.60  DOWNSTREAM(FEET) =  1137.60
  FLOW LENGTH(FEET) =   248.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.75
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      3.73
  PIPE TRAVEL TIME(MIN.) =   0.61    Tc(MIN.) =   8.92
  LONGEST FLOWPATH FROM NODE      70.00 TO NODE     72.00 =   734.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     72.00 TO NODE     72.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.538
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8828
  SOIL CLASSIFICATION IS "C"
  SUBAREA AREA(ACRES) =      1.30   SUBAREA RUNOFF(CFS) =     2.91
  TOTAL AREA(ACRES) =       2.90   TOTAL RUNOFF(CFS) =     6.64
  TC(MIN.) =    8.92

****************************************************************************
  FLOW PROCESS FROM NODE     72.00 TO NODE     73.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1137.60  DOWNSTREAM(FEET) =  1128.90
  FLOW LENGTH(FEET) =   433.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.7 INCHES
```

```
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.87
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       6.64
 PIPE TRAVEL TIME(MIN.) =   0.92    Tc(MIN.) =   9.84
 LONGEST FLOWPATH FROM NODE     70.00 TO NODE     73.00 =  1167.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     73.00 TO NODE     73.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.405
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8821
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =     4.10   SUBAREA RUNOFF(CFS) =     8.70
 TOTAL AREA(ACRES) =       7.00   TOTAL RUNOFF(CFS) =    15.34
 TC(MIN.) =   9.84

****************************************************************************
 FLOW PROCESS FROM NODE     73.00 TO NODE     74.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1128.90  DOWNSTREAM(FEET) =  1127.20
 FLOW LENGTH(FEET) =   111.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.64
 ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      15.34
 PIPE TRAVEL TIME(MIN.) =   0.21    Tc(MIN.) =  10.06
 LONGEST FLOWPATH FROM NODE     70.00 TO NODE     74.00 =  1278.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     74.00 TO NODE     74.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.376
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8819
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =     0.30   SUBAREA RUNOFF(CFS) =     0.63
 TOTAL AREA(ACRES) =       7.30   TOTAL RUNOFF(CFS) =    15.97
 TC(MIN.) =  10.06

****************************************************************************
 FLOW PROCESS FROM NODE     74.00 TO NODE     75.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1127.20  DOWNSTREAM(FEET) =  1123.20
 FLOW LENGTH(FEET) =   264.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  21.0 INCH PIPE IS  15.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.66
 ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      15.97
 PIPE TRAVEL TIME(MIN.) =   0.51    Tc(MIN.) =  10.56
 LONGEST FLOWPATH FROM NODE     70.00 TO NODE     75.00 =  1542.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     75.00 TO NODE     75.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.313
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8815
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =     4.60   SUBAREA RUNOFF(CFS) =     9.38
 TOTAL AREA(ACRES) =      11.90   TOTAL RUNOFF(CFS) =    25.34
```

```
 TC(MIN.) =  10.56

****************************************************************************
 FLOW PROCESS FROM NODE     75.00 TO NODE     76.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1123.20  DOWNSTREAM(FEET) =  1119.50
 FLOW LENGTH(FEET) =   367.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  27.0 INCH PIPE IS  19.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.34
 ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     25.34
 PIPE TRAVEL TIME(MIN.) =   0.73    Tc(MIN.) =  11.30
 LONGEST FLOWPATH FROM NODE     70.00 TO NODE     76.00 =  1909.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     76.00 TO NODE     76.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.229
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8809
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =     4.80   SUBAREA RUNOFF(CFS) =    9.42
 TOTAL AREA(ACRES) =      16.70   TOTAL RUNOFF(CFS) =   34.77
 TC(MIN.) =  11.30

****************************************************************************
 FLOW PROCESS FROM NODE     76.00 TO NODE     77.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1119.50  DOWNSTREAM(FEET) =  1114.50
 FLOW LENGTH(FEET) =   502.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  30.0 INCH PIPE IS  22.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.95
 ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     34.77
 PIPE TRAVEL TIME(MIN.) =   0.94    Tc(MIN.) =  12.23
 LONGEST FLOWPATH FROM NODE     70.00 TO NODE     77.00 =  2411.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     77.00 TO NODE     77.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.133
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8803
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =     4.90   SUBAREA RUNOFF(CFS) =    9.20
 TOTAL AREA(ACRES) =      21.60   TOTAL RUNOFF(CFS) =   43.97
 TC(MIN.) =  12.23
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)         =     21.60  TC(MIN.) =      12.23
 PEAK FLOW RATE(CFS)       =     43.97
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS

```

```
****************************************************************************
      RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM BASED ON
   RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
              (RCFC&WCD) 1978 HYDROLOGY MANUAL
     (c) Copyright 1982-2006 Advanced Engineering Software (aes)
              (Rational Tabling Version 6.0D)
           Release Date: 06/01/2005  License ID 1264

                   Analysis prepared by:

                       RBF Consulting
                     14725 Alton Parkway
                      Irvine, CA  92618

 ************************** DESCRIPTION OF STUDY **************************
 * The TriAngle                                                             *
 * 100-year storm                                                           *
 * DEVELOPED CONDITIONS                                                     *
 ****************************************************************************

  FILE NAME: 1717-DEV.DAT
  TIME/DATE OF STUDY: 09:55 03/20/2008
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  10-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  2.360
  10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  0.880
  100-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  3.480
  100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  1.300
  SLOPE OF 10-YEAR INTENSITY-DURATION CURVE =  0.5505732
  SLOPE OF 100-YEAR INTENSITY-DURATION CURVE =  0.5495536
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =  100.00   1-HOUR INTENSITY(INCH/HOUR) =   1.300
  SLOPE OF INTENSITY DURATION CURVE = 0.5496
  RCFC&WCD HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: COMPUTE CONFLUENCE VALUES ACCORDING TO RCFC&WCD HYDROLOGY MANUAL
        AND IGNORE OTHER CONFLUENCE COMBINATIONS FOR DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO  STREET-CROSSFALL:  CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL IN- / OUT-/PARK-   HEIGHT WIDTH  LIP   HIKE  FACTOR
NO.  (FT)     (FT)    SIDE / SIDE/ WAY    (FT)   (FT)  (FT)  (FT)    (n)
===  =====  ========= ================   ======  ===== ====== ===== =======
  1   30.0    20.0    0.018/0.018/0.020   0.67   2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    40.00 TO NODE    41.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS COMMERCIAL
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   445.00
  UPSTREAM ELEVATION(FEET) =   1150.00
  DOWNSTREAM ELEVATION(FEET) =   1136.90
  ELEVATION DIFFERENCE(FEET) =     13.10
  TC = 0.303*[(  445.00**3)/(    13.10)]**.2 =    7.033
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.223
```

```
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8888
 SOIL CLASSIFICATION IS "C"
 SUBAREA RUNOFF(CFS) =     10.51
 TOTAL AREA(ACRES) =      2.80   TOTAL RUNOFF(CFS) =     10.51

****************************************************************************
 FLOW PROCESS FROM NODE     41.00 TO NODE     42.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1136.90  DOWNSTREAM(FEET) =  1131.50
 FLOW LENGTH(FEET) =   448.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS  14.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.05
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     10.51
 PIPE TRAVEL TIME(MIN.) =   1.06    Tc(MIN.) =   8.09
 LONGEST FLOWPATH FROM NODE     40.00 TO NODE     42.00 =   893.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     42.00 TO NODE     42.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.909
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8880
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =     2.70   SUBAREA RUNOFF(CFS) =     9.37
 TOTAL AREA(ACRES) =       5.50   TOTAL RUNOFF(CFS) =   19.88
 TC(MIN.) =   8.09

****************************************************************************
 FLOW PROCESS FROM NODE     42.00 TO NODE     43.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1131.50  DOWNSTREAM(FEET) =  1129.80
 FLOW LENGTH(FEET) =   216.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  27.0 INCH PIPE IS  17.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.22
 ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     19.88
 PIPE TRAVEL TIME(MIN.) =   0.50    Tc(MIN.) =   8.59
 LONGEST FLOWPATH FROM NODE     40.00 TO NODE     43.00 =  1109.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     43.00 TO NODE     43.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.783
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8877
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =     2.50   SUBAREA RUNOFF(CFS) =     8.40
 TOTAL AREA(ACRES) =       8.00   TOTAL RUNOFF(CFS) =   28.28
 TC(MIN.) =   8.59

****************************************************************************
 FLOW PROCESS FROM NODE     43.00 TO NODE     43.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.783
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8877
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =     1.50   SUBAREA RUNOFF(CFS) =     5.04
 TOTAL AREA(ACRES) =       9.50   TOTAL RUNOFF(CFS) =   33.31
 TC(MIN.) =   8.59
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     43.00 TO NODE     44.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1129.80  DOWNSTREAM(FEET) =  1120.40
  FLOW LENGTH(FEET) =   941.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  21.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.90
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     33.31
  PIPE TRAVEL TIME(MIN.) =   1.76    Tc(MIN.) =  10.35
  LONGEST FLOWPATH FROM NODE     40.00 TO NODE     44.00 =  2050.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     44.00 TO NODE     44.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.414
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8866
  SOIL CLASSIFICATION IS "C"
  SUBAREA AREA(ACRES) =     3.50   SUBAREA RUNOFF(CFS) =   10.59
  TOTAL AREA(ACRES) =      13.00   TOTAL RUNOFF(CFS) =   43.91
  TC(MIN.) =  10.35

****************************************************************************
  FLOW PROCESS FROM NODE     44.00 TO NODE     44.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.414
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8866
  SOIL CLASSIFICATION IS "C"
  SUBAREA AREA(ACRES) =     3.50   SUBAREA RUNOFF(CFS) =   10.59
  TOTAL AREA(ACRES) =      16.50   TOTAL RUNOFF(CFS) =   54.50
  TC(MIN.) =  10.35

****************************************************************************
  FLOW PROCESS FROM NODE     50.00 TO NODE     51.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS COMMERCIAL
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   739.00
  UPSTREAM ELEVATION(FEET) =   1133.50
  DOWNSTREAM ELEVATION(FEET) =   1126.10
  ELEVATION DIFFERENCE(FEET) =      7.40
  TC = 0.303*[(  739.00**3)/(     7.40)]**.2 =   10.689
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.355
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8864
  SOIL CLASSIFICATION IS "C"
  SUBAREA RUNOFF(CFS) =     12.79
  TOTAL AREA(ACRES) =      4.30   TOTAL RUNOFF(CFS) =     12.79

****************************************************************************
  FLOW PROCESS FROM NODE     51.00 TO NODE     52.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 1126.10  DOWNSTREAM ELEVATION(FEET) = 1123.10
  STREET LENGTH(FEET) =   246.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 30.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
```

```
 INSIDE STREET CROSSFALL(DECIMAL) =  0.018
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      15.46
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.54
   HALFSTREET FLOOD WIDTH(FEET) =   21.21
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.67
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.99
 STREET FLOW TRAVEL TIME(MIN.) =    1.12   Tc(MIN.) =  11.81
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.177
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8857
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =     1.90      SUBAREA RUNOFF(CFS) =     5.35
 TOTAL AREA(ACRES) =       6.20        PEAK FLOW RATE(CFS) =      18.13

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.57   HALFSTREET FLOOD WIDTH(FEET) =  22.62
 FLOW VELOCITY(FEET/SEC.) =  3.81   DEPTH*VELOCITY(FT*FT/SEC.) =   2.16
 LONGEST FLOWPATH FROM NODE      50.00 TO NODE      52.00 =   985.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      52.00 TO NODE      53.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1119.10  DOWNSTREAM(FEET) =  1117.00
 FLOW LENGTH(FEET) =   208.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  16.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.69
 ESTIMATED PIPE DIAMETER(INCH) =  24.00     NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     18.13
 PIPE TRAVEL TIME(MIN.) =   0.45    Tc(MIN.) =  12.26
 LONGEST FLOWPATH FROM NODE      50.00 TO NODE      53.00 =  1193.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      53.00 TO NODE      53.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.112
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8855
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =     1.80   SUBAREA RUNOFF(CFS) =    4.96
 TOTAL AREA(ACRES) =       8.00   TOTAL RUNOFF(CFS) =   23.09
 TC(MIN.) =  12.26

****************************************************************************
 FLOW PROCESS FROM NODE      60.00 TO NODE      61.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
        ASSUMED INITIAL SUBAREA UNIFORM
        DEVELOPMENT IS COMMERCIAL
 TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
 INITIAL SUBAREA FLOW-LENGTH(FEET) =  1000.00
 UPSTREAM ELEVATION(FEET) =   1142.00
 DOWNSTREAM ELEVATION(FEET) =   1134.50
 ELEVATION DIFFERENCE(FEET) =      7.50
 TC = 0.303*[( 1000.00**3)/(     7.50)]**.2 =   12.781
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.041
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8852
 SOIL CLASSIFICATION IS "C"
 SUBAREA RUNOFF(CFS) =      9.42
```

```
 TOTAL AREA(ACRES) =       3.50   TOTAL RUNOFF(CFS) =       9.42

****************************************************************************
 FLOW PROCESS FROM NODE     61.00 TO NODE     62.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1134.50  DOWNSTREAM(FEET) =  1132.40
 FLOW LENGTH(FEET) =   207.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS  13.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.46
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       9.42
 PIPE TRAVEL TIME(MIN.) =   0.53    Tc(MIN.) =  13.32
 LONGEST FLOWPATH FROM NODE     60.00 TO NODE     62.00 =  1207.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     62.00 TO NODE     62.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.973
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8849
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =     3.30   SUBAREA RUNOFF(CFS) =     8.68
 TOTAL AREA(ACRES) =       6.80   TOTAL RUNOFF(CFS) =    18.10
 TC(MIN.) =  13.32

****************************************************************************
 FLOW PROCESS FROM NODE     62.00 TO NODE     62.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.973
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8849
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =     2.00   SUBAREA RUNOFF(CFS) =     5.26
 TOTAL AREA(ACRES) =       8.80   TOTAL RUNOFF(CFS) =    23.37
 TC(MIN.) =  13.32

****************************************************************************
 FLOW PROCESS FROM NODE     62.00 TO NODE     63.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1132.40  DOWNSTREAM(FEET) =  1129.50
 FLOW LENGTH(FEET) =   287.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  27.0 INCH PIPE IS  18.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.24
 ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      23.37
 PIPE TRAVEL TIME(MIN.) =   0.58    Tc(MIN.) =  13.90
 LONGEST FLOWPATH FROM NODE     60.00 TO NODE     63.00 =  1494.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     63.00 TO NODE     63.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.904
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8846
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =     4.40   SUBAREA RUNOFF(CFS) =    11.30
 TOTAL AREA(ACRES) =      13.20   TOTAL RUNOFF(CFS) =    34.67
 TC(MIN.) =  13.90

****************************************************************************
 FLOW PROCESS FROM NODE     63.00 TO NODE     64.00 IS CODE =  31
```

```
--------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1129.50  DOWNSTREAM(FEET) =  1126.00
  FLOW LENGTH(FEET) =   347.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  22.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.99
  ESTIMATED PIPE DIAMETER(INCH) =  30.00     NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     34.67
  PIPE TRAVEL TIME(MIN.) =   0.64    Tc(MIN.) =  14.54
  LONGEST FLOWPATH FROM NODE     60.00 TO NODE     64.00 =  1841.00 FEET.

********************************************************************************
  FLOW PROCESS FROM NODE     70.00 TO NODE     71.00 IS CODE =  21
--------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
================================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS COMMERCIAL
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   486.00
  UPSTREAM ELEVATION(FEET) =  1150.00
  DOWNSTREAM ELEVATION(FEET) =   1142.60
  ELEVATION DIFFERENCE(FEET) =      7.40
  TC = 0.303*[(  486.00**3)/(     7.40)]**.2 =    8.312
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.852
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8879
  SOIL CLASSIFICATION IS "C"
  SUBAREA RUNOFF(CFS) =        5.47
  TOTAL AREA(ACRES) =      1.60   TOTAL RUNOFF(CFS) =       5.47

********************************************************************************
  FLOW PROCESS FROM NODE     71.00 TO NODE     72.00 IS CODE =  31
--------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1142.60  DOWNSTREAM(FEET) =  1137.60
  FLOW LENGTH(FEET) =   248.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.49
  ESTIMATED PIPE DIAMETER(INCH) =  18.00     NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      5.47
  PIPE TRAVEL TIME(MIN.) =   0.55    Tc(MIN.) =   8.86
  LONGEST FLOWPATH FROM NODE     70.00 TO NODE     72.00 =   734.00 FEET.

********************************************************************************
  FLOW PROCESS FROM NODE     72.00 TO NODE     72.00 IS CODE =  81
--------------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.718
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8875
  SOIL CLASSIFICATION IS "C"
  SUBAREA AREA(ACRES) =      1.30   SUBAREA RUNOFF(CFS) =     4.29
  TOTAL AREA(ACRES) =        2.90   TOTAL RUNOFF(CFS) =     9.76
  TC(MIN.) =    8.86

********************************************************************************
  FLOW PROCESS FROM NODE     72.00 TO NODE     73.00 IS CODE =  31
--------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1137.60  DOWNSTREAM(FEET) =  1128.90
  FLOW LENGTH(FEET) =   433.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.62
```

```
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =         9.76
  PIPE TRAVEL TIME(MIN.) =   0.84    Tc(MIN.) =   9.70
  LONGEST FLOWPATH FROM NODE      70.00 TO NODE      73.00 =  1167.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      73.00 TO NODE      73.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.539
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8870
  SOIL CLASSIFICATION IS "C"
  SUBAREA AREA(ACRES) =     4.10   SUBAREA RUNOFF(CFS) =   12.87
  TOTAL AREA(ACRES) =       7.00   TOTAL RUNOFF(CFS) =   22.63
  TC(MIN.) =   9.70

****************************************************************************
  FLOW PROCESS FROM NODE      73.00 TO NODE      74.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1128.90  DOWNSTREAM(FEET) =  1127.20
  FLOW LENGTH(FEET) =   111.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.49
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =        22.63
  PIPE TRAVEL TIME(MIN.) =   0.19    Tc(MIN.) =   9.90
  LONGEST FLOWPATH FROM NODE      70.00 TO NODE      74.00 =  1278.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      74.00 TO NODE      74.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.500
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8868
  SOIL CLASSIFICATION IS "C"
  SUBAREA AREA(ACRES) =     0.30   SUBAREA RUNOFF(CFS) =    0.93
  TOTAL AREA(ACRES) =       7.30   TOTAL RUNOFF(CFS) =   23.56
  TC(MIN.) =   9.90

****************************************************************************
  FLOW PROCESS FROM NODE      74.00 TO NODE      75.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1127.20  DOWNSTREAM(FEET) =  1123.20
  FLOW LENGTH(FEET) =   264.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.51
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =        23.56
  PIPE TRAVEL TIME(MIN.) =   0.46    Tc(MIN.) =  10.36
  LONGEST FLOWPATH FROM NODE      70.00 TO NODE      75.00 =  1542.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      75.00 TO NODE      75.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.413
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8866
  SOIL CLASSIFICATION IS "C"
  SUBAREA AREA(ACRES) =     4.60   SUBAREA RUNOFF(CFS) =   13.92
  TOTAL AREA(ACRES) =      11.90   TOTAL RUNOFF(CFS) =   37.48
  TC(MIN.) =  10.36
```

```
******************************************************************************
  FLOW PROCESS FROM NODE     75.00 TO NODE     76.00 IS CODE =  31
------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1123.20  DOWNSTREAM(FEET) =  1119.50
  FLOW LENGTH(FEET) =   367.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  23.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.06
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     37.48
  PIPE TRAVEL TIME(MIN.) =   0.67    Tc(MIN.) =  11.03
  LONGEST FLOWPATH FROM NODE     70.00 TO NODE     76.00 =  1909.00 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE     76.00 TO NODE     76.00 IS CODE =  81
------------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.297
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8862
  SOIL CLASSIFICATION IS "C"
  SUBAREA AREA(ACRES) =    4.80   SUBAREA RUNOFF(CFS) =   14.02
  TOTAL AREA(ACRES) =     16.70   TOTAL RUNOFF(CFS) =   51.50
  TC(MIN.) =  11.03

******************************************************************************
  FLOW PROCESS FROM NODE     76.00 TO NODE     77.00 IS CODE =  31
------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1119.50  DOWNSTREAM(FEET) =  1114.50
  FLOW LENGTH(FEET) =   502.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  24.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.96
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     51.50
  PIPE TRAVEL TIME(MIN.) =   0.84    Tc(MIN.) =  11.87
  LONGEST FLOWPATH FROM NODE     70.00 TO NODE     77.00 =  2411.00 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE     77.00 TO NODE     77.00 IS CODE =  81
------------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.167
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8857
  SOIL CLASSIFICATION IS "C"
  SUBAREA AREA(ACRES) =    4.90   SUBAREA RUNOFF(CFS) =   13.74
  TOTAL AREA(ACRES) =     21.60   TOTAL RUNOFF(CFS) =   65.25
  TC(MIN.) =  11.87
==============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)       =     21.60  TC(MIN.) =     11.87
  PEAK FLOW RATE(CFS)     =     65.25
==============================================================================
==============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

APPENDIX E

Increase Runoff
Volume Calculations

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SHEET NO. OF

CALCULATED BY DATE

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SCALE

Approximate Flood Mitigation
Detention Storage For 100-Year Storm

24-Hour Rainfall = 4.80"

Existing Condition Effective Rainfall = 2.47"

Developed Condition Effective Rainfall = 3.40"

Watershed D

Area Existing = 13.3 ac, Area Developed 16.5 ac

Volume Required $= \left(\frac{3.4}{12} \times 16.5\right) - \left(\frac{2.47}{12} \times 13.3\right)$

$= 1.94$ ac-ft.

Watershed E, Area Existing = 9.7 ac, Area Devel = 8.0 ac

Volume Required $= \left(\frac{3.4}{12} \times 8.0\right) - \left(\frac{2.47}{12} \times 9.7\right) = -0.27$ ac-ft

No Volume Required due to Diversion

Watershed F, Area Existing = 28.0 ac
Area Developed = 13.2 ac

Volume Required $= \left(\frac{3.4}{12} \times 13.2\right) - \left(\frac{2.47}{12} \times 28.0\right) = -2.02$ ac-ft

No Volume Required due to Diversion

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Watershed G Area Existing = 10.2 ac
Area Developed = 21.6 ac

Volume Required $= \left(\frac{3.4}{12} \times 21.6\right) - \left(\frac{0.47}{12} \times 10.2\right) =$

$= 4.0$ ac-ft.

APPENDIX F

Water Quality

Volume Calculations

Worksheet 1

Design Procedure for BMP Design Volume
85th percentile runoff event

Designer: LAJ

Company: **RBF Consulting, Inc.**

Date: 12/1/2006

Project: The Triangle

Location: Subarea D.

1. Create Unit Storage Volume Graph		
a. Site location (Township, Range, and Section)	T S07 & RW03 Section 22	*(1)*
b. Slope value from the Design Volume Curve in **Appendix A**.	Slope = 1.2	*(2)*
c. Plot this value on the Unit Storage Volume Graph shown on **Figure 2.**		
d. Draw a straight line from this point to the origin, to create the graph	Is this graph attached? **Yes** ☒ **No** ☐	
2. Determine Runoff Coeffcient		
a. Determine total impervious area	$A_{impervious}$ = 14.85 acres	*(5)*
b. Determine total tributary area	A_{total} 16.5 acres	*(6)*
c. Determine Impervious fraction I = *(5) / (6)*	i = 0.9	*(7)*
d. Use *(7)* in **Figure 1** to find Runoff OR $C = .858i^3 - .78i^2 + .774i + .04$	C = 0.73	*(8)*
3. Determine 85% Unit Storage Volume Draw a Vertical line from (8) to the graph, then a Horizontal line to the desired V_u value	Vu = 0.88 in-acre / acre	*(9)*
4. Determine Design Storage Volume		
a. V_{BMP} = ***(9) x (6)*** [in-acres]	VBMP = 14.46 in-acre	*(10)*
b. V_{BMP} = ***(10)*** / 12 [ft-acres]	VBMP = 1.20 ft-acre	*(11)*
c. V_{BMP} = ***(11)*** x 43560 [ft^3]	VBMP = 52,488 ft3	*(12)*

Notes:

H:/pdata/91000/Strmwtr Management/Water Quality/bmp design/volume.xls

Worksheet 1

Design Procedure for BMP Design Volume
85th percentile runoff event

Designer: LAJ

Company: **RBF Consulting, Inc.**

Date: 12/1/2006

Project: The Triangle

Location: Subarea E.

1. Create Unit Storage Volume Graph		
a. Site location (Township, Range, and Section)	T S07 & RW03	
	Section 22	*(1)*
b. Slope value from the Design Volume Curve in **Appendix A**.	Slope = 1.2	*(2)*
c. Plot this value on the Unit Storage Volume Graph shown on **Figure 2.**		
d. Draw a straight line from this point to the origin, to create the graph	Is this graph attached? **Yes** ☒ **No** ☐	
2. Determine Runoff Coeffcient		
a. Determine total impervious area	$A_{impervious}$ = 7.2 acres	*(5)*
b. Determine total tributary area	A_{total} 8 acres	*(6)*
c. Determine Impervious fraction I = *(5) / (6)*	i = 0.9	*(7)*
d. Use *(7)* in **Figure 1** to find Runoff OR $C = .858i^3 - .78i^2 + .774i + .04$	C = 0.73	*(8)*
3. Determine 85% Unit Storage Volume Draw a Vertical line from (8) to the graph, then a Horizontal line to the desired V_u value	Vu = 0.88 in-acre / acre	*(9)*
4. Determine Design Storage Volume		
a. V_{BMP} = ***(9) x (6)*** [in-acres]	VBMP = 7.01 in-acre	*(10)*
b. V_{BMP} = ***(10)*** / 12 [ft-acres]	VBMP = 0.58 ft-acre	*(11)*
c. V_{BMP} = ***(11)*** x 43560 [ft^3]	VBMP = 25,449 ft3	*(12)*

Notes:

H:/pdata/91000/Strmwtr Management/Water Quality/bmp design/volume.xls

Worksheet 1

Design Procedure for BMP Design Volume
85th percentile runoff event

Designer: LAJ

Company: **RBF Consulting, Inc.**

Date: 12/1/2006

Project: The Triangle

Location: Subarea F.

1. Create Unit Storage Volume Graph		
a. Site location (Township, Range, and Section)	T S07 & RW03	
b. Slope value from the Design Volume Curve in **Appendix A**.	Section 22	*(1)*
	Slope = 1.2	*(2)*
c. Plot this value on the Unit Storage Volume Graph shown on **Figure 2.**		
d. Draw a straight line from this point to the origin, to create the graph	Is this graph attached? **Yes** ☒ **No** ☐	
2. Determine Runoff Coeffcient		
a. Determine total impervious area	$A_{impervious}$ = 11.88 acres	*(5)*
b. Determine total tributary area	A_{total} 13.2 acres	*(6)*
c. Determine Impervious fraction I = *(5) / (6)*	i = 0.9	*(7)*
d. Use *(7)* in **Figure 1** to find Runoff OR C = $.858i^3 - .78i^2 + .774i + .04$	C = 0.73	*(8)*
3. Determine 85% Unit Storage Volume Draw a Vertical line from (8) to the graph, then a Horizontal line to the desired V_u value	Vu = 0.88 in-acre / acre	*(9)*
4. Determine Design Storage Volume		
a. V_{BMP} = ***(9) x (6)*** [in-acres]	VBMP = 11.57 in-acre	*(10)*
b. V_{BMP} = ***(10)*** / 12 [ft-acres]	VBMP = 0.96 ft-acre	*(11)*
c. V_{BMP} = ***(11)*** x 43560 [ft^3]	VBMP = 41,991 ft3	*(12)*

Notes:

H:/pdata/91000/Strmwtr Management/Water Quality/bmp design/volume.xls

Worksheet 1

Design Procedure for BMP Design Volume
85th percentile runoff event

Designer: LAJ

Company: **RBF Consulting, Inc.**

Date: 12/1/2006

Project: The Triangle

Location: Subarea G.

1. Create Unit Storage Volume Graph		
a. Site location (Township, Range, and Section)	T S07 & RW03	
b. Slope value from the Design Volume Curve in **Appendix A**.	Section 22	*(1)*
	Slope = 1.2	*(2)*
c. Plot this value on the Unit Storage Volume Graph shown on **Figure 2.**		
d. Draw a straight line from this point to the origin, to create the graph	Is this graph attached? **Yes** ☒ **No** ☐	
2. Determine Runoff Coeffcient		
a. Determine total impervious area	$A_{impervious}$ = 19.44 acres	*(5)*
b. Determine total tributary area	A_{total} 21.6 acres	*(6)*
c. Determine Impervious fraction I = ***(5) / (6)***	i = 0.9	*(7)*
d. Use *(7)* in **Figure 1** to find Runoff OR $C = .858i^3 - .78i^2 + .774i + .04$	C = 0.73	*(8)*
3. Determine 85% Unit Storage Volume Draw a Vertical line from (8) to the graph, then a Horizontal line to the desired V_u value	Vu = 0.88 $\frac{\text{in-acre}}{\text{acre}}$	*(9)*
4. Determine Design Storage Volume		
a. V_{BMP} = ***(9) x (6)*** [in-acres]	VBMP = 18.93 in-acre	*(10)*
b. V_{BMP} = ***(10)*** / 12 [ft-acres]	VBMP = 1.58 ft-acre	*(11)*
c. V_{BMP} = ***(11)*** x 43560 [ft^3]	VBMP = 68,712 ft3	*(12)*

Notes:

H:/pdata/91000/Strmwtr Management/Water Quality/bmp design/volume.xls

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Water Quality Swale #1
$A_T = 4.4$ ac

JOB NAME TRI Angle Project
JOB NO.
SHEET NO. OF
DESIGNED BY LJ DATE
CHECKED BY DATE

Water Quality Flow Rate Calculation

$i = 0.2''/hr$, $A_1 = 3.1$ ac undeveloped

Soil Type "C"

$A_2 = 0.7$ ac Paved Surface

$A_3 = 0.6$ ac undeveloped

$C_1 = 0.90$ (Paved Surface)

$C_2 = 0.11 + 0.10 + 0.07 + 0.12 = 0.40$
(undeveloped)

Weighted Runoff Coefficient (C)

$$C = \frac{(0.9 \times 0.7) + (0.4 \times 3.7)}{4.4} = 0.48$$

$$Q_{wq} = CIA = 0.48 \times 0.20 \times 4.4 = \underline{\underline{0.42 \text{ cfs}}}$$

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JOB NAME

JOB NO.

SHEET NO. OF

DESIGNED BY DATE

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Swale #1, WQ Flow Rate = 0.42 cfs
25-Year Flow Rate = 4.41 cfs

Assumed Slope = 0.007,
SS = 4:1, b = 5', L_{min} = 100'
V_{25} max = 3.94 fps, V_{25} actual = 1.30 fps, OK
V_{WQ} max = 0.98 fps, V_{WQ} actual = 0.21 fps, OK
D_{WQ} max = 0.492', D_{WQ} actual = 0.32', OK
HRT = 5 minute (min), TT = 7.9 min, OK

HRT / D×V = 1.26 > 0.22 OK

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Worksheet for Water Quality Swale #1

Project Description

Friction Method	Manning Formula		
Solve For	Normal Depth		

Input Data

Roughness Coefficient		0.050	
Channel Slope		0.00700	ft/ft
Left Side Slope		4.00	ft/ft (H:V)
Right Side Slope		4.00	ft/ft (H:V)
Bottom Width		5.00	ft
Discharge		4.41	ft³/s

Results

Normal Depth		0.49	ft
Flow Area		3.40	ft²
Wetted Perimeter		9.03	ft
Top Width		8.91	ft
Critical Depth		0.27	ft
Critical Slope		0.06038	ft/ft
Velocity		1.30	ft/s
Velocity Head		0.03	ft
Specific Energy		0.52	ft
Froude Number		0.37	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth		0.00	ft
Length		0.00	ft
Number Of Steps		0	

GVF Output Data

Upstream Depth		0.00	ft
Profile Description			
Profile Headloss		0.00	ft
Downstream Velocity		Infinity	ft/s
Upstream Velocity		Infinity	ft/s
Normal Depth		0.49	ft
Critical Depth		0.27	ft
Channel Slope		0.00700	ft/ft
Critical Slope		0.06038	ft/ft

Worksheet for Water Quality Swale #1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.240	
Channel Slope	0.00700	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	5.00	ft
Discharge	0.42	ft³/s

Results

Normal Depth	0.32	ft
Flow Area	1.99	ft²
Wetted Perimeter	7.61	ft
Top Width	7.53	ft
Critical Depth	0.06	ft
Critical Slope	2.19328	ft/ft
Velocity	0.21	ft/s
Velocity Head	0.00	ft
Specific Energy	0.32	ft
Froude Number	0.07	
Flow Type	Subcritical	

GVF Input Data

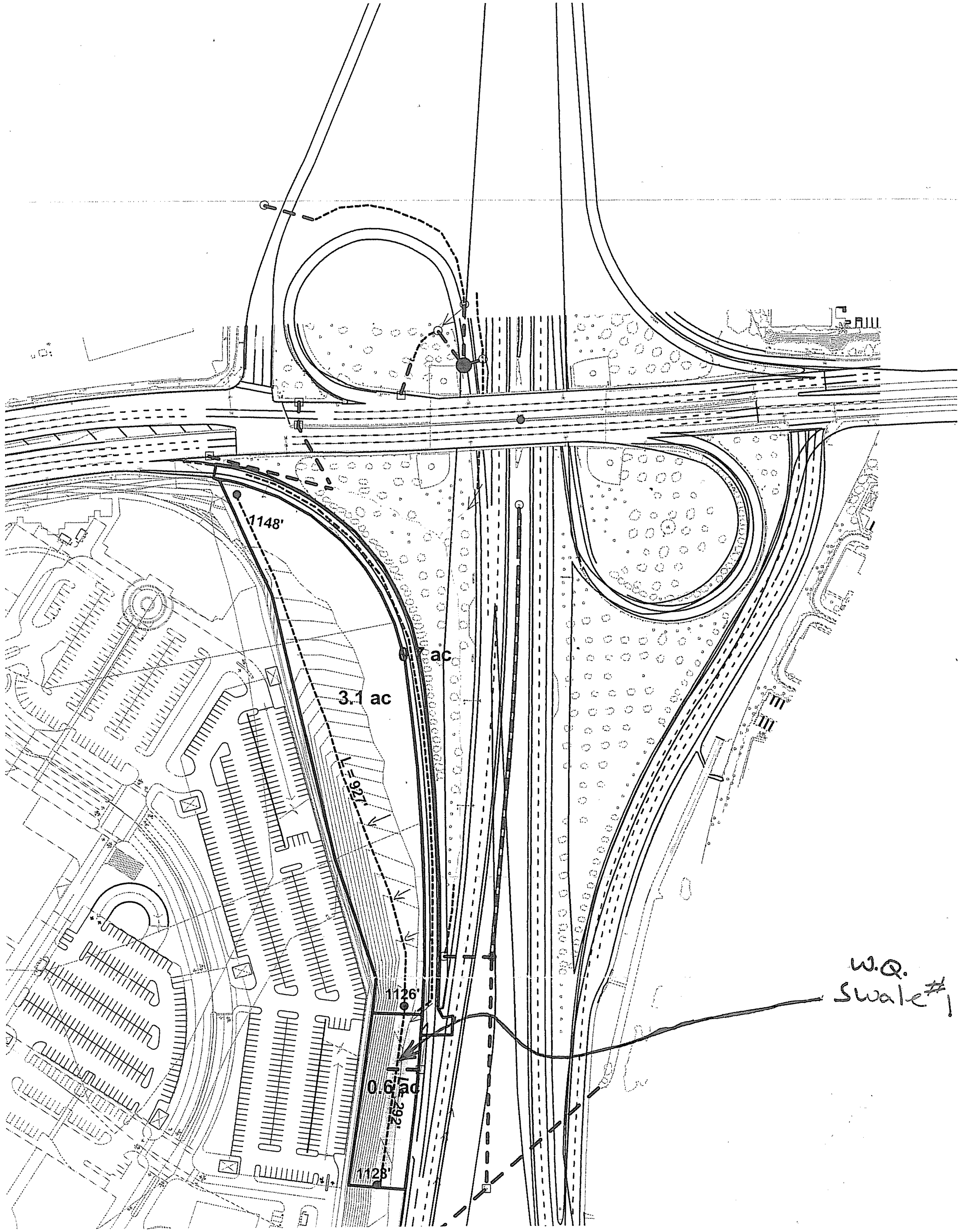
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.32	ft
Critical Depth	0.06	ft
Channel Slope	0.00700	ft/ft
Critical Slope	2.19328	ft/ft

```
****************************************************************************
        RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM BASED ON
    RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
                (RCFC&WCD) 1978 HYDROLOGY MANUAL
      (c) Copyright 1982-2006 Advanced Engineering Software (aes)
                (Rational Tabling Version 6.0D)
             Release Date: 06/01/2005  License ID 1264

                     Analysis prepared by:

                        RBF Consulting
                      14725 Alton Parkway
                       Irvine, CA  92618

 ************************** DESCRIPTION OF STUDY **************************
 * The TRI-angle Project                                                  *
 * 25-Year Flow Rate Determination                                        *
 * Water Quality Swale #1                                                 *
 **************************************************************************

  FILE NAME: 1717WQ-1.DAT
  TIME/DATE OF STUDY: 10:53 03/13/2008
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =   25.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  10-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  2.360
  10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  0.880
  100-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  3.480
  100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  1.300
  SLOPE OF 10-YEAR INTENSITY-DURATION CURVE =  0.5505732
  SLOPE OF 100-YEAR INTENSITY-DURATION CURVE =  0.5495536
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =   25.00   1-HOUR INTENSITY(INCH/HOUR) =   1.027
  SLOPE OF INTENSITY DURATION CURVE = 0.5504
  RCFC&WCD HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: COMPUTE CONFLUENCE VALUES ACCORDING TO RCFC&WCD HYDROLOGY MANUAL
        AND IGNORE OTHER CONFLUENCE COMBINATIONS FOR DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN- / OUT-/PARK-   HEIGHT  WIDTH  LIP   HIKE   FACTOR
NO.  (FT)     (FT)     SIDE / SIDE/ WAY    (FT)   (FT)   (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
 1   30.0     20.0     0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE     11.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS: UNDEVELOPED WITH GOOD COVER
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    927.00
  UPSTREAM ELEVATION(FEET) =   1148.00
  DOWNSTREAM ELEVATION(FEET) =   1126.00
  ELEVATION DIFFERENCE(FEET) =     22.00
  TC = 0.937*[(  927.00**3)/(   22.00)]**.2 =   30.457
   25 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.491
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .6421
  SOIL CLASSIFICATION IS "C"
  SUBAREA RUNOFF(CFS) =      2.97
  TOTAL AREA(ACRES) =      3.10   TOTAL RUNOFF(CFS) =      2.97
```

```
****************************************************************************
  FLOW PROCESS FROM NODE      11.00 TO NODE      11.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    25 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.491
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8742
  SOIL CLASSIFICATION IS "C"
  SUBAREA AREA(ACRES) =     0.70   SUBAREA RUNOFF(CFS) =    0.91
  TOTAL AREA(ACRES) =       3.80   TOTAL RUNOFF(CFS) =    3.88
  TC(MIN.) =  30.46

****************************************************************************
  FLOW PROCESS FROM NODE      11.00 TO NODE      12.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1126.00  DOWNSTREAM(FEET) =   1123.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   292.00   CHANNEL SLOPE =  0.0103
  CHANNEL BASE(FEET) =     5.00    "Z" FACTOR =   4.000
  MANNING'S FACTOR = 0.050   MAXIMUM DEPTH(FEET) =   3.00
    25 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.408
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .6314
  SOIL CLASSIFICATION IS "C"
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      4.15
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.46
  AVERAGE FLOW DEPTH(FEET) =   0.42   TRAVEL TIME(MIN.) =   3.34
  Tc(MIN.) =  33.79
  SUBAREA AREA(ACRES) =     0.60       SUBAREA RUNOFF(CFS) =    0.53
  TOTAL AREA(ACRES) =       4.40        PEAK FLOW RATE(CFS) =       4.41

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.44   FLOW VELOCITY(FEET/SEC.) =   1.49
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     12.00 =  1219.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)       =      4.40  TC(MIN.) =     33.79
  PEAK FLOW RATE(CFS)     =      4.41
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```



1148'
3.1 ac
927'
1126'
0.6 ac
292'
1128'
W.Q. Swale#1

Water Quality Swale #2
$A_T = 2.8$ ac

Water Quality Flow Rate Calculation

$i = 0.2''/hr$ (0.51 cm/hr),

Soil Type "C"

$A_4 = 0.6$ ac Landscaped Area
$A_5 = 0.3$ ac Paved Surface
$A_6 = 1.2$ ac Landscaped Area
$A_7 = 0.7$ ac Paved Surface

$C = 0.90$ (Paved Surface)
$C = 0.40$ (Landscaped Area)

Weighted Runoff Coefficient:

$$C = \frac{(0.9 \times 1.0) + (0.4 \times 1.8)}{2.8} = 0.58$$

$$Q_{WQ} = CIA = 0.58 \times 0.2 \times 2.8 = \underline{0.32 \text{ cfs}}$$

$Q_{25} = 4.89$ cfs

$S = 0.008$, $b = 5'$, $L = 100'$

$V_{25} = 1.40$ fps < 3.94 fps OK

$V_{WQ} = 0.20$ fps < 0.98 fps OK

$d_{WQ} = 0.26' < 0.49'$ OK

$HRT = \frac{L}{V}$, $L = 100'$, $HRT = \frac{100}{(0.2)(60)} = 8.3$ min. OK

Worksheet for Water Quality Swale #2

Project Description

Friction Method	Manning Formula	
Solve For	Normal Depth	

Input Data

Roughness Coefficient	0.240	
Channel Slope	0.00800	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	5.00	ft
Discharge	0.32	ft³/s

Results

Normal Depth	0.26	ft
Flow Area	1.58	ft²
Wetted Perimeter	7.16	ft
Top Width	7.09	ft
Critical Depth	0.05	ft
Critical Slope	2.31879	ft/ft
Velocity	0.20	ft/s
Velocity Head	0.00	ft
Specific Energy	0.26	ft
Froude Number	0.08	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.26	ft
Critical Depth	0.05	ft
Channel Slope	0.00800	ft/ft
Critical Slope	2.31879	ft/ft

Worksheet for Water Quality Swale #2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.050	
Channel Slope	0.00800	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	5.00	ft
Discharge	4.89	ft^3/s

Results

Normal Depth	0.50	ft
Flow Area	3.49	ft^2
Wetted Perimeter	9.11	ft
Top Width	8.99	ft
Critical Depth	0.29	ft
Critical Slope	0.05931	ft/ft
Velocity	1.40	ft/s
Velocity Head	0.03	ft
Specific Energy	0.53	ft
Froude Number	0.40	
Flow Type	Subcritical	

GVF Input Data

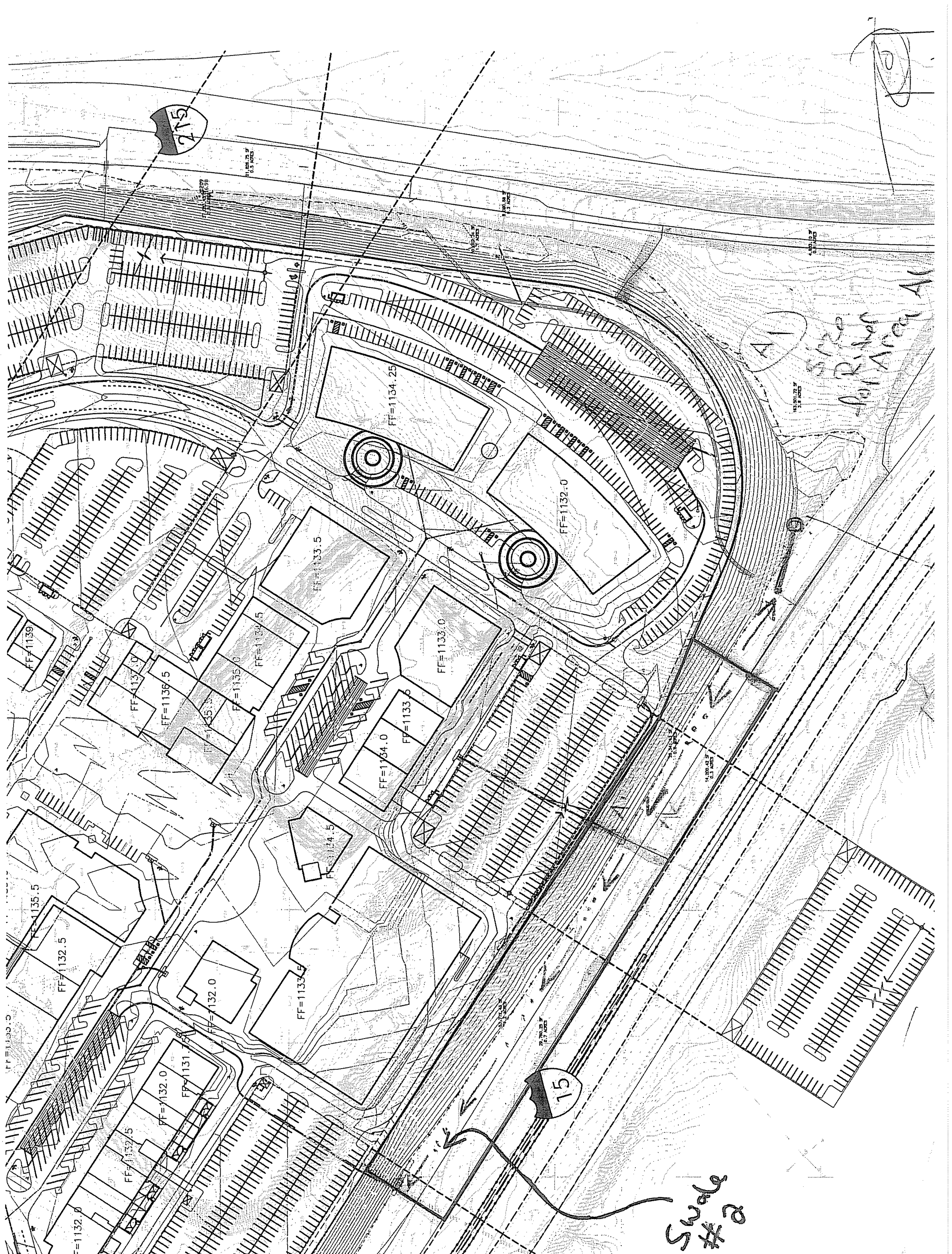
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.50	ft
Critical Depth	0.29	ft
Channel Slope	0.00800	ft/ft
Critical Slope	0.05931	ft/ft

```
****************************************************************************
          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM BASED ON
      RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
                 (RCFC&WCD)  1978 HYDROLOGY MANUAL
        (c) Copyright 1982-2006 Advanced Engineering Software (aes)
                 (Rational Tabling Version 6.0D)
              Release Date: 06/01/2005  License ID 1264

                      Analysis prepared by:

                          RBF Consulting
                       14725 Alton Parkway
                        Irvine, CA  92618

 ************************** DESCRIPTION OF STUDY **************************
 * The TRI-Angle Project                                                  *
 * 25-Year Flow Rate Determination                                        *
 * Water Quality Swale #2                                                 *
 **************************************************************************

  FILE NAME: 1717WQ-2.DAT
  TIME/DATE OF STUDY: 14:01 03/14/2008
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =   25.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  10-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  2.360
  10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  0.880
  100-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  3.480
  100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  1.300
  SLOPE OF 10-YEAR INTENSITY-DURATION CURVE =  0.5505732
  SLOPE OF 100-YEAR INTENSITY-DURATION CURVE =  0.5495536
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =   25.00   1-HOUR INTENSITY(INCH/HOUR) =   1.027
  SLOPE OF INTENSITY DURATION CURVE = 0.5504
  RCFC&WCD HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: COMPUTE CONFLUENCE VALUES ACCORDING TO RCFC&WCD HYDROLOGY MANUAL
        AND IGNORE OTHER CONFLUENCE COMBINATIONS FOR DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:  CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN- / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.  (FT)     (FT)     SIDE / SIDE/ WAY   (FT)    (FT)  (FT)  (FT)   (n)
===  =====  =========  ================= ======  ===== ====== ===== =======
  1  30.0     20.0     0.018/0.018/0.020  0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE     20.00 TO NODE     21.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS COMMERCIAL
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   304.00
  UPSTREAM ELEVATION(FEET) =   1119.00
  DOWNSTREAM ELEVATION(FEET) =   1118.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  TC = 0.303*[(  304.00**3)/(     1.00)]**.2 =    9.361
    25 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.854
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8844
  SOIL CLASSIFICATION IS "C"
  SUBAREA RUNOFF(CFS) =      0.76
  TOTAL AREA(ACRES) =      0.30   TOTAL RUNOFF(CFS) =      0.76
```

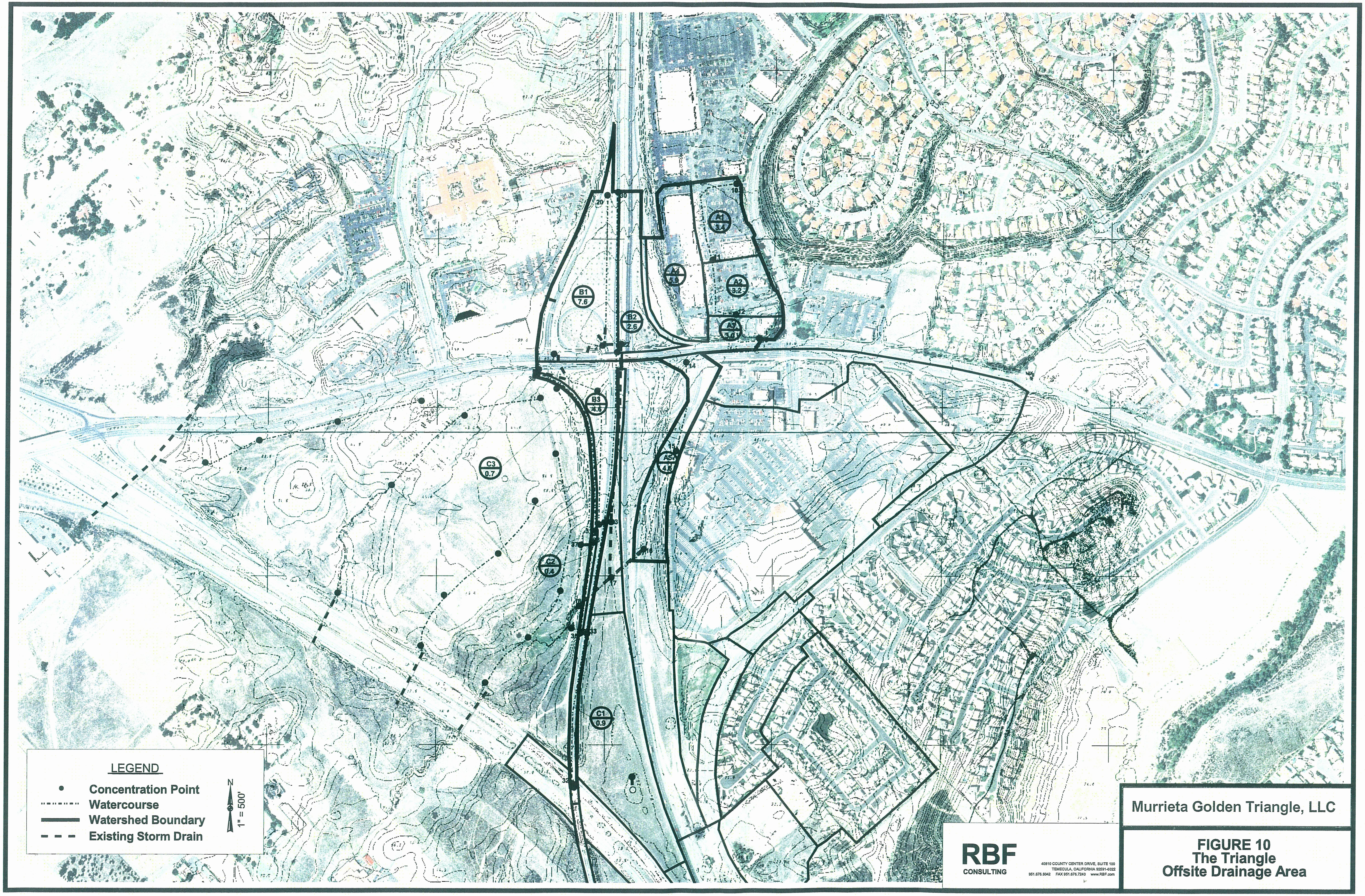
```
****************************************************************************
  FLOW PROCESS FROM NODE     21.00 TO NODE     21.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    25 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.854
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .7439
  SOIL CLASSIFICATION IS "C"
  SUBAREA AREA(ACRES) =     0.60   SUBAREA RUNOFF(CFS) =     1.27
  TOTAL AREA(ACRES) =       0.90   TOTAL RUNOFF(CFS) =    2.03
  TC(MIN.) =   9.36

****************************************************************************
  FLOW PROCESS FROM NODE     21.00 TO NODE     22.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1118.00  DOWNSTREAM(FEET) =   1113.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   631.00   CHANNEL SLOPE =  0.0079
  CHANNEL BASE(FEET) =     5.00   "Z" FACTOR =   4.000
  MANNING'S FACTOR = 0.050   MAXIMUM DEPTH(FEET) =   3.00
    25 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.980
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .6910
  SOIL CLASSIFICATION IS "C"
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      2.86
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.19
  AVERAGE FLOW DEPTH(FEET) =   0.37   TRAVEL TIME(MIN.) =   8.83
  Tc(MIN.) =  18.19
  SUBAREA AREA(ACRES) =      1.20       SUBAREA RUNOFF(CFS) =    1.64
  TOTAL AREA(ACRES) =       2.10         PEAK FLOW RATE(CFS) =        3.67

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.43   FLOW VELOCITY(FEET/SEC.) =   1.27
  LONGEST FLOWPATH FROM NODE     20.00 TO NODE     22.00 =   935.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     22.00 TO NODE     22.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    25 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.980
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8791
  SOIL CLASSIFICATION IS "C"
  SUBAREA AREA(ACRES) =     0.70   SUBAREA RUNOFF(CFS) =     1.22
  TOTAL AREA(ACRES) =       2.80   TOTAL RUNOFF(CFS) =    4.89
  TC(MIN.) =  18.19
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)       =      2.80  TC(MIN.) =     18.19
  PEAK FLOW RATE(CFS)     =      4.89
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS

▯
```



215
FF=1134.25
FF=1132.0
FF=1133.5
FF=1133.0
FF=1139
FF=1136.5
FF=1135.0
FF=1134.0
FF=1124.5
FF=1135.5
FF=1132.5
FF=1133.5
FF=1132.0
FF=1132.0
FF=1132.5
15
A1
Swale #2

APPENDIX G

OFF-SITE 10-Year and 100-Year Hydrology (Rational Method) Calculations



Murrieta Golden Triangle, LLC

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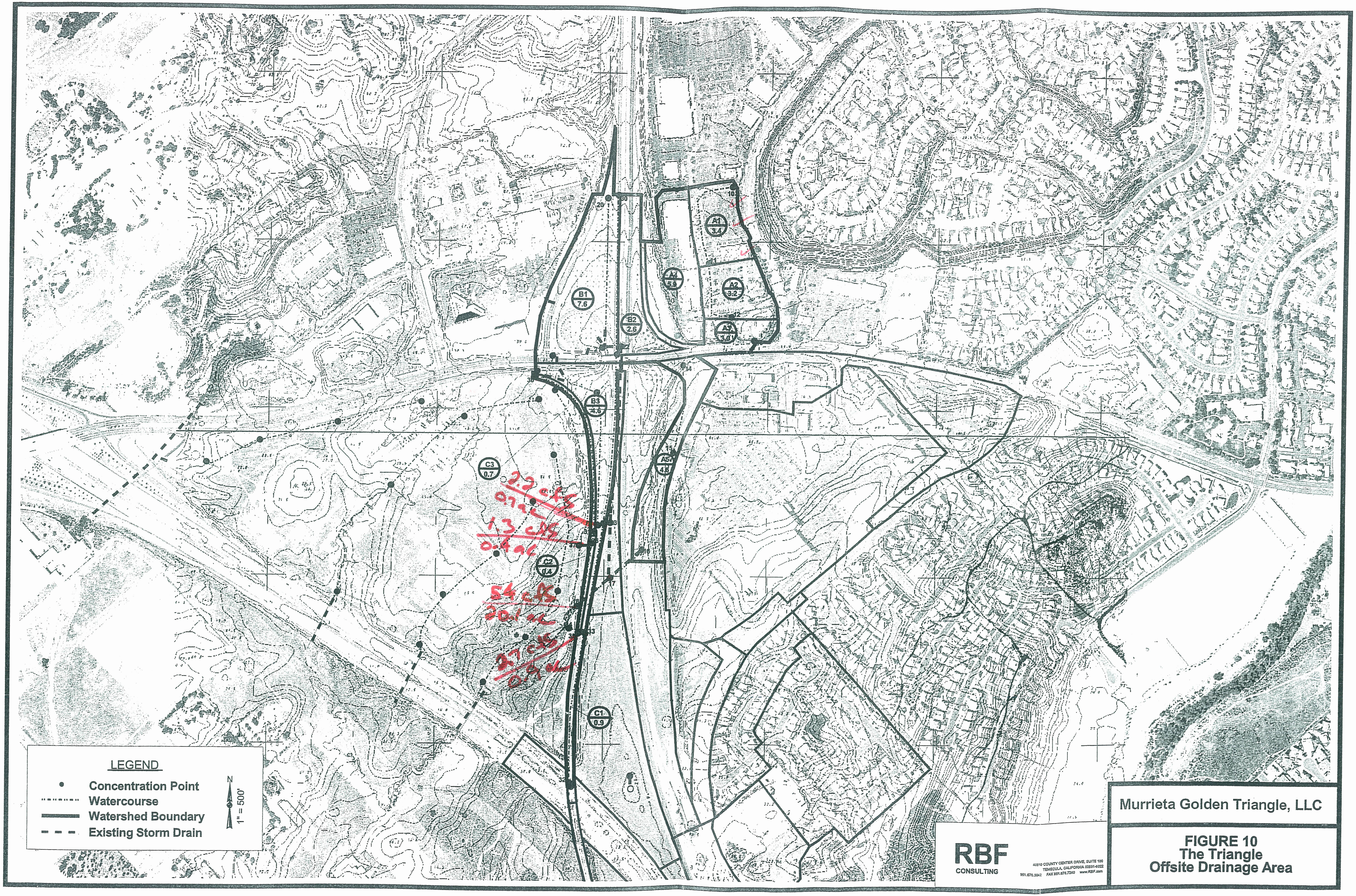
40810 COUNTY CENTER DRIVE, SUITE 100
TEMECULA, CALIFORNIA 92591-6022
951.676.8042 FAX 951.676.7240 www.RBF.com

FIGURE 10
The Triangle
Offsite Drainage Area



Murrieta Golden Triangle, LLC

FIGURE 10
The Triangle
Offsite Drainage Area

```
****************************************************************************
        RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM BASED ON
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                   (Rational Tabling Version 6.0D)
              Release Date: 06/01/2005  License ID 1264

                       Analysis prepared by:

                           RBF Consulting
                         14725 Alton Parkway
                          Irvine, CA  92618

 ************************** DESCRIPTION OF STUDY **************************
 * The Triangtle                                                          *
 * 100-Year Storm                                                         *
 * Offsite Area                                                           *
 **************************************************************************

  FILE NAME: 1717OFF.DAT
  TIME/DATE OF STUDY: 18:58 03/24/2008
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  10-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  2.360
  10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  0.880
  100-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  3.480
  100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  1.300
  SLOPE OF 10-YEAR INTENSITY-DURATION CURVE =  0.5505732
  SLOPE OF 100-YEAR INTENSITY-DURATION CURVE =  0.5495536
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =  100.00   1-HOUR INTENSITY(INCH/HOUR) =   1.300
  SLOPE OF INTENSITY DURATION CURVE = 0.5496
  RCFC&WCD HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: COMPUTE CONFLUENCE VALUES ACCORDING TO RCFC&WCD HYDROLOGY MANUAL
        AND IGNORE OTHER CONFLUENCE COMBINATIONS FOR DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.  (FT)     (FT)     SIDE / SIDE/ WAY    (FT)   (FT)  (FT)   (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
 1   30.0     20.0     0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE     11.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS COMMERCIAL
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   645.00
  UPSTREAM ELEVATION(FEET) =   1192.00
  DOWNSTREAM ELEVATION(FEET) =   1180.00
  ELEVATION DIFFERENCE(FEET) =     12.00
  TC = 0.303*[(  645.00**3)/(    12.00)]**.2 =    8.943
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.700
```

```
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8801
 SOIL CLASSIFICATION IS "B"
 SUBAREA RUNOFF(CFS) =     11.07
 TOTAL AREA(ACRES) =      3.40   TOTAL RUNOFF(CFS) =     11.07

****************************************************************************
 FLOW PROCESS FROM NODE     11.00 TO NODE     12.00 IS CODE =  91
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =   1180.00
 DOWNSTREAM NODE ELEVATION(FEET) =   1171.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   414.00
 "V" GUTTER WIDTH(FEET) =   3.00   GUTTER HIKE(FEET) =  0.100
 PAVEMENT LIP(FEET) =  0.017   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   0.50
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.313
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8784
 SOIL CLASSIFICATION IS "B"
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     13.63
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.47
 AVERAGE FLOW DEPTH(FEET) =   0.30   FLOOD WIDTH(FEET) =   38.76
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.99   Tc(MIN.) =  10.93
 SUBAREA AREA(ACRES) =     1.76       SUBAREA RUNOFF(CFS) =     5.12
 TOTAL AREA(ACRES) =      5.16         PEAK FLOW RATE(CFS) =      16.20

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.31   FLOOD WIDTH(FEET) =   41.75
 FLOW VELOCITY(FEET/SEC.) =   3.57   DEPTH*VELOCITY(FT*FT/SEC) =   1.11
 LONGEST FLOWPATH FROM NODE     10.00 TO NODE     12.00 =  1059.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     12.00 TO NODE     12.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.313
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8862
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =     1.44   SUBAREA RUNOFF(CFS) =     4.23
 TOTAL AREA(ACRES) =      6.60   TOTAL RUNOFF(CFS) =   20.42
 TC(MIN.) =  10.93

****************************************************************************
 FLOW PROCESS FROM NODE     12.00 TO NODE     13.00 IS CODE =  91
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =   1171.00
 DOWNSTREAM NODE ELEVATION(FEET) =   1160.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   271.00
 "V" GUTTER WIDTH(FEET) =   3.00   GUTTER HIKE(FEET) =  0.200
 PAVEMENT LIP(FEET) =  0.017   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.00500
 MAXIMUM DEPTH(FEET) =   0.50
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.148
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8775
 SOIL CLASSIFICATION IS "B"
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     22.41
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.24
 AVERAGE FLOW DEPTH(FEET) =   0.37   FLOOD WIDTH(FEET) =   62.92
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.07   Tc(MIN.) =  12.00
 SUBAREA AREA(ACRES) =     1.44       SUBAREA RUNOFF(CFS) =     3.98
 TOTAL AREA(ACRES) =      8.04         PEAK FLOW RATE(CFS) =      24.40

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.37   FLOOD WIDTH(FEET) =   65.13
 FLOW VELOCITY(FEET/SEC.) =   4.33   DEPTH*VELOCITY(FT*FT/SEC) =   1.61
 LONGEST FLOWPATH FROM NODE     10.00 TO NODE     13.00 =  1330.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     13.00 TO NODE     13.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.148
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8856
  SOIL CLASSIFICATION IS "C"
  SUBAREA AREA(ACRES) =     1.56   SUBAREA RUNOFF(CFS) =     4.35
  TOTAL AREA(ACRES) =       9.60   TOTAL RUNOFF(CFS) =   28.75
  TC(MIN.) =  12.00

****************************************************************************
  FLOW PROCESS FROM NODE     13.00 TO NODE     14.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1160.00  DOWNSTREAM(FEET) =  1152.00
  FLOW LENGTH(FEET) =   456.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  17.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.71
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      28.75
  PIPE TRAVEL TIME(MIN.) =   0.71    Tc(MIN.) =  12.71
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     14.00 =  1786.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     14.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.050
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8770
  SOIL CLASSIFICATION IS "B"
  SUBAREA AREA(ACRES) =     4.02   SUBAREA RUNOFF(CFS) =   10.75
  TOTAL AREA(ACRES) =      13.62   TOTAL RUNOFF(CFS) =   39.51
  TC(MIN.) =  12.71

****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     14.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.050
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .6699
  SOIL CLASSIFICATION IS "B"
  SUBAREA AREA(ACRES) =     1.88   SUBAREA RUNOFF(CFS) =     3.84
  TOTAL AREA(ACRES) =      15.50   TOTAL RUNOFF(CFS) =   43.35
  TC(MIN.) =  12.71

****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     15.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1152.00  DOWNSTREAM(FEET) =  1146.00
  FLOW LENGTH(FEET) =   529.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  22.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.02
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      43.35
  PIPE TRAVEL TIME(MIN.) =   0.88    Tc(MIN.) =  13.59
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     15.00 =  2315.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     15.00 TO NODE     16.00 IS CODE =  51
----------------------------------------------------------------------------
```

```
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   1146.00  DOWNSTREAM(FEET) =   1120.40
 CHANNEL LENGTH THRU SUBAREA(FEET) =   617.00   CHANNEL SLOPE =  0.0415
 CHANNEL BASE(FEET) =    4.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   2.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.850
 SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .8218
 SOIL CLASSIFICATION IS "C"
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     47.39
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  12.96
 AVERAGE FLOW DEPTH(FEET) =   0.68   TRAVEL TIME(MIN.) =   0.79
 Tc(MIN.) =  14.38
 SUBAREA AREA(ACRES) =      3.45       SUBAREA RUNOFF(CFS) =    8.08
 TOTAL AREA(ACRES) =     18.95          PEAK FLOW RATE(CFS) =      51.43

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.71   FLOW VELOCITY(FEET/SEC.) =  13.31
 LONGEST FLOWPATH FROM NODE      10.00 TO NODE      16.00 =  2932.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     16.00 TO NODE     16.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.850
 SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .7790
 SOIL CLASSIFICATION IS "B"
 SUBAREA AREA(ACRES) =     1.15   SUBAREA RUNOFF(CFS) =    2.55
 TOTAL AREA(ACRES) =     20.10   TOTAL RUNOFF(CFS) =   53.98
 TC(MIN.) =  14.38

****************************************************************************
 FLOW PROCESS FROM NODE     16.00 TO NODE     17.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1120.40  DOWNSTREAM(FEET) =  1118.30
 FLOW LENGTH(FEET) =   263.00   MANNING'S N =  0.024
 DEPTH OF FLOW IN  45.0 INCH PIPE IS  35.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.73
 ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    53.98
 PIPE TRAVEL TIME(MIN.) =   0.77    Tc(MIN.) =  15.15
 LONGEST FLOWPATH FROM NODE      10.00 TO NODE      17.00 =  3195.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     10.00 TO NODE     17.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =  15.15
 RAINFALL INTENSITY(INCH/HR) =   2.77
 TOTAL STREAM AREA(ACRES) =   20.10
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     53.98

****************************************************************************
 FLOW PROCESS FROM NODE     20.00 TO NODE     21.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
        ASSUMED INITIAL SUBAREA UNIFORM
        DEVELOPMENT IS: UNDEVELOPED WITH POOR COVER
 TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   907.00
 UPSTREAM ELEVATION(FEET) =   1172.00
```

```
  DOWNSTREAM ELEVATION(FEET) =   1152.00
  ELEVATION DIFFERENCE(FEET) =     20.00
  TC = 0.533*[(  907.00**3)/(    20.00)]**.2 =   17.408
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.566
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .6391
  SOIL CLASSIFICATION IS "B"
  SUBAREA RUNOFF(CFS) =       9.84
  TOTAL AREA(ACRES) =       6.00   TOTAL RUNOFF(CFS) =       9.84

****************************************************************************
  FLOW PROCESS FROM NODE     21.00 TO NODE     21.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.566
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8830
  SOIL CLASSIFICATION IS "C"
  SUBAREA AREA(ACRES) =     1.60   SUBAREA RUNOFF(CFS) =     3.63
  TOTAL AREA(ACRES) =       7.60   TOTAL RUNOFF(CFS) =    13.46
  TC(MIN.) =  17.41

****************************************************************************
  FLOW PROCESS FROM NODE     21.00 TO NODE     22.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1152.00  DOWNSTREAM(FEET) =  1150.35
  FLOW LENGTH(FEET) =   165.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  15.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.07
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     13.46
  PIPE TRAVEL TIME(MIN.) =   0.39    Tc(MIN.) =  17.80
  LONGEST FLOWPATH FROM NODE     20.00 TO NODE     22.00 =  1072.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     22.00 TO NODE     22.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.535
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .6368
  SOIL CLASSIFICATION IS "B"
  SUBAREA AREA(ACRES) =     2.60   SUBAREA RUNOFF(CFS) =     4.20
  TOTAL AREA(ACRES) =      10.20   TOTAL RUNOFF(CFS) =    17.66
  TC(MIN.) =  17.80

****************************************************************************
  FLOW PROCESS FROM NODE     22.00 TO NODE     23.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1150.35  DOWNSTREAM(FEET) =  1140.00
  FLOW LENGTH(FEET) =  1053.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  16.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.57
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     17.66
  PIPE TRAVEL TIME(MIN.) =   2.32    Tc(MIN.) =  20.12
  LONGEST FLOWPATH FROM NODE     20.00 TO NODE     23.00 =  2125.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     23.00 TO NODE     23.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.370
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8724
```

```
 SOIL CLASSIFICATION IS "B"
 SUBAREA AREA(ACRES) =     2.30   SUBAREA RUNOFF(CFS) =    4.76
 TOTAL AREA(ACRES) =      12.50   TOTAL RUNOFF(CFS) =    22.42
 TC(MIN.) =  20.12

****************************************************************************
 FLOW PROCESS FROM NODE     23.00 TO NODE     23.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.370
 UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .6241
 SOIL CLASSIFICATION IS "B"
 SUBAREA AREA(ACRES) =     2.30   SUBAREA RUNOFF(CFS) =    3.40
 TOTAL AREA(ACRES) =      14.80   TOTAL RUNOFF(CFS) =    25.82
 TC(MIN.) =  20.12

****************************************************************************
 FLOW PROCESS FROM NODE     23.00 TO NODE     17.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1124.50  DOWNSTREAM(FEET) =  1118.30
 FLOW LENGTH(FEET) =    338.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  10.45
 ESTIMATED PIPE DIAMETER(INCH) =  24.00     NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       25.82
 PIPE TRAVEL TIME(MIN.) =   0.54    Tc(MIN.) =  20.65
 LONGEST FLOWPATH FROM NODE      20.00 TO NODE      17.00 =  2463.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     20.00 TO NODE     17.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =  20.65
 RAINFALL INTENSITY(INCH/HR) =   2.34
 TOTAL STREAM AREA(ACRES) =    14.80
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     25.82

 ** CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY       AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)     (ACRE)
     1       53.98    15.15       2.770          20.10
     2       25.82    20.65       2.336          14.80

 *********************************WARNING**********************************
 IN THIS COMPUTER PROGRAM, THE CONFLUENCE VALUE USED IS BASED
 ON THE RCFC&WCD FORMULA OF PLATE D-1 AS DEFAULT VALUE. THIS FORMULA
 WILL NOT NECESSARILY RESULT IN THE MAXIMUM VALUE OF PEAK FLOW.
 **************************************************************************

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1       72.92    15.15       2.770
     2       71.35    20.65       2.336

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      72.92   Tc(MIN.) =    15.15
 TOTAL AREA(ACRES) =       34.90
 LONGEST FLOWPATH FROM NODE      10.00 TO NODE      17.00 =  3195.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     17.00 TO NODE     18.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1118.00  DOWNSTREAM(FEET) =  1116.00
  FLOW LENGTH(FEET) =   258.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  30.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.83
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     72.92
  PIPE TRAVEL TIME(MIN.) =   0.44    Tc(MIN.) =  15.59
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     18.00 =  3453.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     30.00 TO NODE     31.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS COMMERCIAL
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =  1000.00
  UPSTREAM ELEVATION(FEET) =   1160.00
  DOWNSTREAM ELEVATION(FEET) =   1126.00
  ELEVATION DIFFERENCE(FEET) =     34.00
  TC = 0.303*[( 1000.00**3)/(    34.00)]**.2 =    9.447
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.591
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8871
  SOIL CLASSIFICATION IS "C"
  SUBAREA RUNOFF(CFS) =       2.23
  TOTAL AREA(ACRES) =       0.70   TOTAL RUNOFF(CFS) =       2.23

****************************************************************************
  FLOW PROCESS FROM NODE     32.00 TO NODE     33.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS COMMERCIAL
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   904.00
  UPSTREAM ELEVATION(FEET) =   1145.00
  DOWNSTREAM ELEVATION(FEET) =   1132.00
  ELEVATION DIFFERENCE(FEET) =     13.00
  TC = 0.303*[(  904.00**3)/(    13.00)]**.2 =   10.777
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.340
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8863
  SOIL CLASSIFICATION IS "C"
  SUBAREA RUNOFF(CFS) =       2.66
  TOTAL AREA(ACRES) =       0.90   TOTAL RUNOFF(CFS) =       2.66

****************************************************************************
  FLOW PROCESS FROM NODE     33.00 TO NODE     34.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1132.00  DOWNSTREAM(FEET) =  1115.00
  FLOW LENGTH(FEET) =    95.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  13.32
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      2.66
  PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =  10.90
  LONGEST FLOWPATH FROM NODE     32.00 TO NODE     34.00 =   999.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE      35.00 TO NODE      36.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS COMMERCIAL
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    545.00
  UPSTREAM ELEVATION(FEET) =   1133.00
  DOWNSTREAM ELEVATION(FEET) =   1126.00
  ELEVATION DIFFERENCE(FEET) =      7.00
  TC = 0.303*[(  545.00**3)/(     7.00)]**.2 =    9.003
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.687
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8874
  SOIL CLASSIFICATION IS "C"
  SUBAREA RUNOFF(CFS) =       1.31
  TOTAL AREA(ACRES) =      0.40   TOTAL RUNOFF(CFS) =      1.31

****************************************************************************
  FLOW PROCESS FROM NODE      36.00 TO NODE      37.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1126.00  DOWNSTREAM(FEET) =  1120.00
  FLOW LENGTH(FEET) =     58.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.90
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      1.31
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =   9.11
  LONGEST FLOWPATH FROM NODE      35.00 TO NODE     37.00 =   603.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)       =       0.40  TC(MIN.) =       9.11
  PEAK FLOW RATE(CFS)     =       1.31
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

APPENDIX H

Storm Drain Hydraulics
(WSPG Input/Output)

```
T1 THE TRIANGLE                                                                    0
T2 LINE D
T3 100 YEAR CAPACITY ANALYSIS
SO     677.3101095.460  1                         1099.960
R      970.4201103.750  1      .014                                   .000    .000 0
JX     975.0801104.250  3  2   .013     9.500       1105.360           81.0          .000
R     1018.8301105.070  3      .013                                   .000    .000 0
R     1122.9301107.020  3      .013                                 66.272    .000 0
R     1203.9201107.830  3      .013                                -17.511    .000 1
JX    1203.9301107.830  5  4   .013    16.300       1108.830          -60.0         -.002
R     1542.2001111.210  5      .013                                -73.137    .000 0
R     1629.2601112.080  5      .013                                   .000    .000 0
JX    1633.9201112.130  7  6   .013     3.200       1113.350           72.0          .000
R     1697.3601112.760  7      .013                                 40.387    .000 0
R     1803.3601113.820  7      .013                                   .000    .000 0
JX    1808.0201113.880  9  8   .014    15.000       1115.070          -40.0          .000
R     2329.6301120.080  9      .014                                   .000    .000 0
SH    2329.6301120.080  9                         1120.080
CD    1   4    1     .000   4.500     .000  .000  .000   .00
CD    2   4    1     .000   1.500     .000  .000  .000   .00
CD    3   4    1     .000   4.000     .000  .000  .000   .00
CD    4   4    1     .000   2.000     .000  .000  .000   .00
CD    5   4    1     .000   4.000     .000  .000  .000   .00
CD    6   4    1     .000   1.500     .000  .000  .000   .00
CD    7   4    1     .000   4.000     .000  .000  .000   .00
CD    8   4    1     .000   1.500     .000  .000  .000   .00
CD    9   4    1     .000   4.000     .000  .000  .000   .00
Q             54.000    .0
```

W S P G W - CIVILDESIGN Version 14.06
Program Package Serial Number: 1374
WATER SURFACE PROFILE LISTING

Date: 5-27-2008 Time: 4: 8:14

THE TRIANGLE
LINE D
100 YEAR CAPACITY ANALYSIS

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
677.310	1095.460	1.757	1097.217	98.00	17.04	4.51	1101.73	.00	2.91	4.39	4.500	.000	.00	1 .0
69.095	.0283					.0274	1.90	1.76	2.62	1.75	.014	.00	.00	PIPE
746.405	1097.414	1.767	1099.181	98.00	16.91	4.44	1103.62	.00	2.91	4.40	4.500	.000	.00	1 .0
121.709	.0283					.0255	3.10	1.77	2.60	1.75	.014	.00	.00	PIPE
868.114	1100.856	1.831	1102.687	98.00	16.12	4.04	1106.72	.00	2.91	4.42	4.500	.000	.00	1 .0
50.826	.0283					.0224	1.14	1.83	2.42	1.75	.014	.00	.00	PIPE
918.940	1102.294	1.898	1104.192	98.00	15.37	3.67	1107.86	.00	2.91	4.44	4.500	.000	.00	1 .0
30.565	.0283					.0197	.60	1.90	2.26	1.75	.014	.00	.00	PIPE
949.505	1103.158	1.968	1105.126	98.00	14.66	3.34	1108.46	.00	2.91	4.46	4.500	.000	.00	1 .0
20.915	.0283					.0173	.36	1.97	2.11	1.75	.014	.00	.00	PIPE
970.420	1103.750	2.041	1105.791	98.00	13.98	3.03	1108.82	.00	2.91	4.48	4.500	.000	.00	1 .0
JUNCT STR	.1073					.0150	.07	2.04	1.97		.013	.00	.00	PIPE
975.080	1104.250	1.965	1106.215	88.50	14.41	3.22	1109.44	.00	2.85	4.00	4.000	.000	.00	1 .0
43.750	.0187					.0155	.68	1.96	2.05	1.88	.013	.00	.00	PIPE
1018.830	1105.070	2.011	1107.081	88.50	13.98	3.04	1110.12	.27	2.85	4.00	4.000	.000	.00	1 .0
20.224	.0187					.0145	.29	2.28	1.96	1.88	.013	.00	.00	PIPE
1039.054	1105.449	2.043	1107.492	88.50	13.71	2.92	1110.41	.26	2.85	4.00	4.000	.000	.00	1 .0
34.338	.0187					.0133	.46	2.30	1.90	1.88	.013	.00	.00	PIPE

FILE: sd-ln-d.WSW

W S P G W - CIVILDESIGN Version 14.06

Program Package Serial Number: 1374

WATER SURFACE PROFILE LISTING

Date: 5-27-2008 Time: 4: 8:14

THE TRIANGLE
LINE D
100 YEAR CAPACITY ANALYSIS

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth / Type Ch	Prs/Pip
1073.392	1106.092	2.122	1108.214	88.50	13.07	2.65	1110.87	.24	2.85	3.99	4.000	.000	.00	1	.0
22.606	.0187					.0117	.27	2.36	1.77	1.88	.013	.00	.00	PIPE	
1095.998	1106.516	2.204	1108.720	88.50	12.47	2.41	1111.13	.21	2.85	3.98	4.000	.000	.00	1	.0
15.754	.0187					.0104	.16	2.42	1.64	1.88	.013	.00	.00	PIPE	
1111.751	1106.811	2.292	1109.102	88.50	11.89	2.19	1111.30	.19	2.85	3.96	4.000	.000	.00	1	.0
11.179	.0187					.0091	.10	2.48	1.53	1.88	.013	.00	.00	PIPE	
1122.930	1107.020	2.384	1109.404	88.50	11.33	1.99	1111.40	.06	2.85	3.93	4.000	.000	.00	1	.0
16.724	.0100					.0084	.14	2.44	1.42	2.27	.013	.00	.00	PIPE	
1139.654	1107.187	2.411	1109.598	88.50	11.18	1.94	1111.54	.06	2.85	3.91	4.000	.000	.00	1	.0
35.344	.0100					.0078	.28	2.47	1.39	2.27	.013	.00	.00	PIPE	
1174.999	1107.541	2.510	1110.051	88.50	10.66	1.76	1111.82	.05	2.85	3.87	4.000	.000	.00	1	.0
17.858	.0100					.0069	.12	2.56	1.28	2.27	.013	.00	.00	PIPE	
1192.856	1107.719	2.616	1110.335	88.50	10.16	1.60	1111.94	.05	2.85	3.81	4.000	.000	.00	1	.0
8.593	.0100					.0062	.05	2.66	1.18	2.27	.013	.00	.00	PIPE	
1201.449	1107.805	2.729	1110.534	88.50	9.69	1.46	1111.99	.04	2.85	3.72	4.000	.000	.00	1	.0
2.471	.0100					.0055	.01	2.77	1.09	2.27	.013	.00	.00	PIPE	
1203.920	1107.830	2.851	1110.681	88.50	9.24	1.32	1112.01	.00	2.85	3.62	4.000	.000	.00	1	.0
JUNCT STR	.0000					.0037	.00	2.89	1.00		.013	.00	.00	PIPE	

Program Package Serial Number: 1374
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THE TRIANGLE
LINE D
100 YEAR CAPACITY ANALYSIS

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1203.930	1107.830	3.854	1111.684	72.20	5.81	.52	1112.21	.01	2.57	1.50	4.000	.000	.00	1 .0
29.730	.0100					.0022	.07	3.86	.36	2.01	.013	.00	.00	PIPE
1233.660	1108.127	3.571	1111.698	72.20	6.10	.58	1112.28	.01	2.57	2.48	4.000	.000	.00	1 .0
19.006	.0100					.0023	.04	3.58	.49	2.01	.013	.00	.00	PIPE
1252.666	1108.317	3.368	1111.685	72.20	6.39	.63	1112.32	.01	2.57	2.92	4.000	.000	.00	1 .0
9.954	.0100					.0025	.02	3.38	.57	2.01	.013	.00	.00	PIPE
1262.619	1108.417	3.253	1111.670	72.20	6.60	.68	1112.35	.02	2.57	3.12	4.000	.000	.00	1 .0
HYDRAULIC JUMP														
1262.619	1108.417	2.007	1110.423	72.20	11.44	2.03	1112.46	.06	2.57	4.00	4.000	.000	.00	1 .0
97.784	.0100					.0100	.98	2.07	1.61	2.01	.013	.00	.00	PIPE
1360.404	1109.393	2.007	1111.400	72.20	11.44	2.03	1113.43	.06	2.57	4.00	4.000	.000	.00	1 .0
181.796	.0100					.0094	1.71	2.07	1.61	2.01	.013	.00	.00	PIPE
1542.200	1111.210	2.079	1113.289	72.20	10.94	1.86	1115.15	.00	2.57	4.00	4.000	.000	.00	1 .0
25.064	.0100					.0087	.22	2.08	1.50	2.01	.013	.00	.00	PIPE
1567.264	1111.460	2.106	1113.567	72.20	10.76	1.80	1115.37	.00	2.57	3.99	4.000	.000	.00	1 .0
40.823	.0100					.0080	.33	2.11	1.46	2.01	.013	.00	.00	PIPE
1608.087	1111.868	2.188	1114.057	72.20	10.26	1.64	1115.69	.00	2.57	3.98	4.000	.000	.00	1 .0
21.173	.0100					.0071	.15	2.19	1.36	2.01	.013	.00	.00	PIPE

THE TRIANGLE
LINE D
100 YEAR CAPACITY ANALYSIS

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1629.260	1112.080	2.275	1114.355	72.20	9.79	1.49	1115.84	.00	2.57	3.96	4.000	.000	.00	1 .0
JUNCT STR	.0107					.0080	.04	2.41	1.26		.013	.00	.00	PIPE
1633.920	1112.130	1.988	1114.118	69.00	11.07	1.90	1116.02	.17	2.51	4.00	4.000	.000	.00	1 .0
63.440	.0099					.0091	.58	2.16	1.56	1.96	.013	.00	.00	PIPE
1697.360	1112.760	2.023	1114.783	69.00	10.82	1.82	1116.60	.00	2.51	4.00	4.000	.000	.00	1 .0
34.289	.0100					.0086	.29	2.02	1.51	1.95	.013	.00	.00	PIPE
1731.649	1113.103	2.064	1115.167	69.00	10.55	1.73	1116.90	.00	2.51	4.00	4.000	.000	.00	1 .0
35.354	.0100					.0078	.28	2.06	1.45	1.95	.013	.00	.00	PIPE
1767.004	1113.456	2.144	1115.600	69.00	10.06	1.57	1117.17	.00	2.51	3.99	4.000	.000	.00	1 .0
18.926	.0100					.0069	.13	2.14	1.35	1.95	.013	.00	.00	PIPE
1785.930	1113.646	2.228	1115.873	69.00	9.59	1.43	1117.30	.00	2.51	3.97	4.000	.000	.00	1 .0
10.559	.0100					.0061	.06	2.23	1.26	1.95	.013	.00	.00	PIPE
1796.489	1113.751	2.316	1116.067	69.00	9.15	1.30	1117.37	.00	2.51	3.95	4.000	.000	.00	1 .0
5.308	.0100					.0054	.03	2.32	1.17	1.95	.013	.00	.00	PIPE
1801.797	1113.804	2.410	1116.214	69.00	8.72	1.18	1117.40	.00	2.51	3.92	4.000	.000	.00	1 .0
1.563	.0100					.0048	.01	2.41	1.08	1.95	.013	.00	.00	PIPE
1803.360	1113.820	2.510	1116.330	69.00	8.31	1.07	1117.40	.00	2.51	3.87	4.000	.000	.00	1 .0
JUNCT STR	.0129					.0035	.02	2.51	1.00		.014	.00	.00	PIPE

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THE TRIANGLE
LINE D
100 YEAR CAPACITY ANALYSIS

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1808.020	1113.880	3.123	1117.003	54.00	5.13	.41	1117.41	.00	2.21	3.31	4.000	.000	.00	1 .0
10.331	.0119					.0019	.02	3.12	.51	1.69	.014	.00	.00	PIPE
1818.351	1114.003	2.979	1116.981	54.00	5.38	.45	1117.43	.00	2.21	3.49	4.000	.000	.00	1 .0
8.836	.0119					.0021	.02	2.98	.56	1.69	.014	.00	.00	PIPE
1827.187	1114.108	2.847	1116.955	54.00	5.64	.49	1117.45	.00	2.21	3.62	4.000	.000	.00	1 .0
HYDRAULIC JUMP														
1827.187	1114.108	1.688	1115.796	54.00	10.71	1.78	1117.58	.00	2.21	3.95	4.000	.000	.00	1 .0
197.154	.0119					.0119	2.34	1.69	1.67	1.69	.014	.00	.00	PIPE
2024.341	1116.451	1.688	1118.139	54.00	10.71	1.78	1119.92	.00	2.21	3.95	4.000	.000	.00	1 .0
140.863	.0119					.0117	1.65	1.69	1.67	1.69	.014	.00	.00	PIPE
2165.204	1118.125	1.701	1119.827	54.00	10.60	1.75	1121.57	.00	2.21	3.96	4.000	.000	.00	1 .0
92.331	.0119					.0108	1.00	1.70	1.65	1.69	.014	.00	.00	PIPE
2257.535	1119.223	1.764	1120.987	54.00	10.11	1.59	1122.57	.00	2.21	3.97	4.000	.000	.00	1 .0
33.445	.0119					.0095	.32	1.76	1.54	1.69	.014	.00	.00	PIPE
2290.980	1119.620	1.830	1121.450	54.00	9.64	1.44	1122.89	.00	2.21	3.99	4.000	.000	.00	1 .0
17.867	.0119					.0084	.15	1.83	1.43	1.69	.014	.00	.00	PIPE
2308.847	1119.833	1.898	1121.731	54.00	9.19	1.31	1123.04	.00	2.21	3.99	4.000	.000	.00	1 .0
10.506	.0119					.0074	.08	1.90	1.34	1.69	.014	.00	.00	PIPE

FILE: sd-ln-d.WSW

W S P G W - CIVILDESIGN Version 14.06

Program Package Serial Number: 1374

WATER SURFACE PROFILE LISTING

Date: 5-27-2008 Time: 4: 8:14

THE TRIANGLE
LINE D
100 YEAR CAPACITY ANALYSIS

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch	
2319.353	1119.958	1.970	1121.928	54.00	8.76	1.19	1123.12	.00	2.21	4.00	4.000	.000	.00	1	.0
6.150	.0119					.0065	.04	1.97	1.24	1.69	.014	.00	.00	PIPE	
2325.503	1120.031	2.045	1122.076	54.00	8.35	1.08	1123.16	.00	2.21	4.00	4.000	.000	.00	1	.0
3.182	.0119					.0057	.02	2.05	1.16	1.69	.014	.00	.00	PIPE	
2328.685	1120.069	2.124	1122.193	54.00	7.97	.99	1123.18	.00	2.21	3.99	4.000	.000	.00	1	.0
.945	.0119					.0050	.00	2.12	1.08	1.69	.014	.00	.00	PIPE	
2329.630	1120.080	2.208	1122.288	54.00	7.59	.89	1123.18	.00	2.21	3.98	4.000	.000	.00	1	.0

THE TRIANGLE

LINE D

100 YEAR CAPACITY ANALYSIS

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T1 THE TRIANGLE                                                              0
T2 LATERAL D1
T3 100 YEAR
SO     102.2801105.510  1                          1106.215
R      186.6401111.010  1       .013                                     .000     .000 0
SH     186.6401111.010  1                          1111.010
CD   1  4   1    .000   1.500      .000  .000  .000    .00
Q              9.500    .0
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THE TRIANGLE
LATERAL D1
100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
102.280	1105.510	.627	1106.137	9.50	13.58	2.86	1109.00	.00	1.19	1.48	1.500	.000	.00	1 .0
2.886	.0652					.0613	.18	.63	3.48	.62	.013	.00	.00	PIPE
105.166	1105.698	.628	1106.326	9.50	13.55	2.85	1109.18	.00	1.19	1.48	1.500	.000	.00	1 .0
30.165	.0652					.0574	1.73	.63	3.47	.62	.013	.00	.00	PIPE
135.331	1107.665	.651	1108.315	9.50	12.92	2.59	1110.91	.00	1.19	1.49	1.500	.000	.00	1 .0
14.294	.0652					.0504	.72	.65	3.24	.62	.013	.00	.00	PIPE
149.625	1108.597	.675	1109.271	9.50	12.32	2.36	1111.63	.00	1.19	1.49	1.500	.000	.00	1 .0
9.046	.0652					.0443	.40	.67	3.02	.62	.013	.00	.00	PIPE
158.671	1109.186	.700	1109.886	9.50	11.75	2.14	1112.03	.00	1.19	1.50	1.500	.000	.00	1 .0
6.418	.0652					.0390	.25	.70	2.82	.62	.013	.00	.00	PIPE
165.088	1109.605	.727	1110.331	9.50	11.20	1.95	1112.28	.00	1.19	1.50	1.500	.000	.00	1 .0
4.836	.0652					.0343	.17	.73	2.62	.62	.013	.00	.00	PIPE
169.924	1109.920	.754	1110.674	9.50	10.68	1.77	1112.44	.00	1.19	1.50	1.500	.000	.00	1 .0
3.773	.0652					.0302	.11	.75	2.44	.62	.013	.00	.00	PIPE
173.697	1110.166	.783	1110.949	9.50	10.18	1.61	1112.56	.00	1.19	1.50	1.500	.000	.00	1 .0
3.002	.0652					.0266	.08	.78	2.27	.62	.013	.00	.00	PIPE
176.699	1110.362	.814	1111.175	9.50	9.71	1.46	1112.64	.00	1.19	1.49	1.500	.000	.00	1 .0
2.422	.0652					.0235	.06	.81	2.11	.62	.013	.00	.00	PIPE

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WATER SURFACE PROFILE LISTING

Date: 7-17-2008 Time:11:24:25

THE TRIANGLE
LATERAL D1
100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth / Type Ch	Prs/Pip
179.121	1110.520	.846	1111.365	9.50	9.25	1.33	1112.70	.00	1.19	1.49	1.500	.000	.00	1	.0
1.960	.0652					.0207	.04	.85	1.96	.62	.013	.00	.00	PIPE	
181.081	1110.647	.879	1111.527	9.50	8.82	1.21	1112.74	.00	1.19	1.48	1.500	.000	.00	1	.0
1.584	.0652					.0183	.03	.88	1.82	.62	.013	.00	.00	PIPE	
182.665	1110.751	.915	1111.666	9.50	8.41	1.10	1112.76	.00	1.19	1.46	1.500	.000	.00	1	.0
1.267	.0652					.0162	.02	.92	1.69	.62	.013	.00	.00	PIPE	
183.933	1110.833	.953	1111.786	9.50	8.02	1.00	1112.79	.00	1.19	1.44	1.500	.000	.00	1	.0
.993	.0652					.0144	.01	.95	1.56	.62	.013	.00	.00	PIPE	
184.926	1110.898	.993	1111.891	9.50	7.65	.91	1112.80	.00	1.19	1.42	1.500	.000	.00	1	.0
.752	.0652					.0128	.01	.99	1.44	.62	.013	.00	.00	PIPE	
185.678	1110.947	1.037	1111.984	9.50	7.29	.83	1112.81	.00	1.19	1.39	1.500	.000	.00	1	.0
.531	.0652					.0114	.01	1.04	1.33	.62	.013	.00	.00	PIPE	
186.209	1110.982	1.083	1112.065	9.50	6.95	.75	1112.82	.00	1.19	1.34	1.500	.000	.00	1	.0
.319	.0652					.0102	.00	1.08	1.22	.62	.013	.00	.00	PIPE	
186.529	1111.003	1.134	1112.136	9.50	6.63	.68	1112.82	.00	1.19	1.29	1.500	.000	.00	1	.0
.111	.0652					.0092	.00	1.13	1.11	.62	.013	.00	.00	PIPE	
186.640	1111.010	1.191	1112.201	9.50	6.32	.62	1112.82	.00	1.19	1.21	1.500	.000	.00	1	.0

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T1 THE TRIANGLE                                                                              0
T2 LATERAL D2
T3 100 YEAR
SO     104.1001108.020  1                          111.680
R      140.7701108.200  1      .013                                         .000     .000 0
R      193.0001117.870  1      .013                                         .000     .000 0
SH     193.0001117.870  1                         1117.870
CD   1  4   1    .000   2.000      .000  .000  .000    .00
Q            25.800    .0
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THE TRIANGLE
LATERAL D2
100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch	
104.100	1108.020	.955	1108.974	25.80	17.43	4.72	1113.69	.00	1.78	2.00	2.000	.000	.00	1	.0
3.227	.0049					.0628	.20	.95	3.57	2.00	.013	.00	.00	PIPE	
107.327	1108.036	.939	1108.974	25.80	17.81	4.93	1113.90	.00	1.78	2.00	2.000	.000	.00	1	.0
7.149	.0049					.0691	.49	.94	3.69	2.00	.013	.00	.00	PIPE	
114.476	1108.071	.905	1108.976	25.80	18.68	5.42	1114.40	.00	1.78	1.99	2.000	.000	.00	1	.0
6.916	.0049					.0786	.54	.90	3.95	2.00	.013	.00	.00	PIPE	
121.392	1108.105	.873	1108.977	25.80	19.60	5.96	1114.94	.00	1.78	1.98	2.000	.000	.00	1	.0
6.684	.0049					.0895	.60	.87	4.24	2.00	.013	.00	.00	PIPE	
128.077	1108.138	.842	1108.979	25.80	20.55	6.56	1115.54	.00	1.78	1.97	2.000	.000	.00	1	.0
6.458	.0049					.1019	.66	.84	4.54	2.00	.013	.00	.00	PIPE	
134.535	1108.169	.812	1108.981	25.80	21.56	7.22	1116.20	.00	1.78	1.96	2.000	.000	.00	1	.0
6.235	.0049					.1161	.72	.81	4.87	2.00	.013	.00	.00	PIPE	
140.770	1108.200	.783	1108.983	25.80	22.61	7.94	1116.92	.00	1.78	1.95	2.000	.000	.00	1	.0
9.679	.1851					.1164	1.13	.78	5.21	.70	.013	.00	.00	PIPE	
150.449	1109.992	.811	1110.802	25.80	21.60	7.25	1118.05	.00	1.78	1.96	2.000	.000	.00	1	.0
7.612	.1851					.1025	.78	.81	4.88	.70	.013	.00	.00	PIPE	
158.061	1111.401	.840	1112.241	25.80	20.60	6.59	1118.83	.00	1.78	1.97	2.000	.000	.00	1	.0
5.970	.1851					.0900	.54	.84	4.56	.70	.013	.00	.00	PIPE	

THE TRIANGLE
LATERAL D2
100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
164.031	1112.506	.871	1113.377	25.80	19.64	5.99	1119.37	.00	1.78	1.98	2.000	.000	.00	1 .0
4.829	.1851					.0791	.38	.87	4.25	.70	.013	.00	.00	PIPE
168.860	1113.400	.903	1114.304	25.80	18.72	5.44	1119.75	.00	1.78	1.99	2.000	.000	.00	1 .0
3.988	.1851					.0695	.28	.90	3.97	.70	.013	.00	.00	PIPE
172.848	1114.139	.937	1115.076	25.80	17.85	4.95	1120.03	.00	1.78	2.00	2.000	.000	.00	1 .0
3.344	.1851					.0611	.20	.94	3.70	.70	.013	.00	.00	PIPE
176.192	1114.758	.972	1115.730	25.80	17.02	4.50	1120.23	.00	1.78	2.00	2.000	.000	.00	1 .0
2.833	.1851					.0538	.15	.97	3.45	.70	.013	.00	.00	PIPE
179.025	1115.282	1.009	1116.292	25.80	16.23	4.09	1120.38	.00	1.78	2.00	2.000	.000	.00	1 .0
2.418	.1851					.0474	.11	1.01	3.21	.70	.013	.00	.00	PIPE
181.443	1115.730	1.048	1116.778	25.80	15.47	3.72	1120.50	.00	1.78	2.00	2.000	.000	.00	1 .0
2.074	.1851					.0418	.09	1.05	2.99	.70	.013	.00	.00	PIPE
183.516	1116.114	1.089	1117.203	25.80	14.75	3.38	1120.58	.00	1.78	1.99	2.000	.000	.00	1 .0
1.783	.1851					.0369	.07	1.09	2.78	.70	.013	.00	.00	PIPE
185.299	1116.444	1.132	1117.576	25.80	14.07	3.07	1120.65	.00	1.78	1.98	2.000	.000	.00	1 .0
1.534	.1851					.0326	.05	1.13	2.58	.70	.013	.00	.00	PIPE
186.834	1116.728	1.177	1117.906	25.80	13.41	2.79	1120.70	.00	1.78	1.97	2.000	.000	.00	1 .0
1.318	.1851					.0288	.04	1.18	2.39	.70	.013	.00	.00	PIPE

THE TRIANGLE
LATERAL D2
100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
188.152	1116.972	1.225	1118.197	25.80	12.79	2.54	1120.74	.00	1.78	1.95	2.000	.000	.00	1 .0
1.128	.1851					.0255	.03	1.23	2.22	.70	.013	.00	.00	PIPE
189.279	1117.181	1.276	1118.457	25.80	12.19	2.31	1120.77	.00	1.78	1.92	2.000	.000	.00	1 .0
.958	.1851					.0226	.02	1.28	2.05	.70	.013	.00	.00	PIPE
190.238	1117.358	1.330	1118.689	25.80	11.63	2.10	1120.79	.00	1.78	1.89	2.000	.000	.00	1 .0
.805	.1851					.0201	.02	1.33	1.89	.70	.013	.00	.00	PIPE
191.043	1117.507	1.388	1118.896	25.80	11.09	1.91	1120.80	.00	1.78	1.84	2.000	.000	.00	1 .0
.663	.1851					.0180	.01	1.39	1.74	.70	.013	.00	.00	PIPE
191.706	1117.630	1.451	1119.081	25.80	10.57	1.73	1120.82	.00	1.78	1.79	2.000	.000	.00	1 .0
.529	.1851					.0161	.01	1.45	1.59	.70	.013	.00	.00	PIPE
192.235	1117.728	1.519	1119.247	25.80	10.08	1.58	1120.82	.00	1.78	1.71	2.000	.000	.00	1 .0
.399	.1851					.0145	.01	1.52	1.45	.70	.013	.00	.00	PIPE
192.634	1117.802	1.594	1119.396	25.80	9.61	1.43	1120.83	.00	1.78	1.61	2.000	.000	.00	1 .0
.263	.1851					.0131	.00	1.59	1.31	.70	.013	.00	.00	PIPE
192.897	1117.851	1.679	1119.530	25.80	9.16	1.30	1120.83	.00	1.78	1.47	2.000	.000	.00	1 .0
.103	.1851					.0120	.00	1.68	1.17	.70	.013	.00	.00	PIPE
193.000	1117.870	1.781	1119.651	25.80	8.73	1.18	1120.83	.00	1.78	1.25	2.000	.000	.00	1 .0

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T1 THE TRIANGLE                                                                    0
T2 LATERAL D3
T3 100 YEAR
SO     102.1001113.390  2                           1114.355
R      180.8501115.170  2      .013                                          .000     .000 0
R      188.1501115.340  2      .013                                        18.589     .000 0
R      282.2301126.300  2      .013                                          .000     .000 0
SH     282.2301126.300  2                           1126.300
CD   1  4   1    .000   1.500      .000  .000  .000    .00
CD   2  4   1    .000   1.500      .000  .000  .000    .00
Q               2.700    .0
```

THE TRIANGLE
LATERAL D3
100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
102.100	1113.390	.965	1114.355	2.70	2.25	.08	1114.43	.00	.62	1.44	1.500	.000	.00	1 .0
1.444	.0226					.0013	.00	.96	.43	.42	.013	.00	.00	PIPE
103.544	1113.423	.926	1114.349	2.70	2.36	.09	1114.44	.00	.62	1.46	1.500	.000	.00	1 .0
1.102	.0226					.0014	.00	.93	.47	.42	.013	.00	.00	PIPE
104.646	1113.448	.890	1114.337	2.70	2.47	.09	1114.43	.00	.62	1.47	1.500	.000	.00	1 .0
HYDRAULIC JUMP														
104.646	1113.448	.417	1113.865	2.70	6.73	.70	1114.57	.00	.62	1.34	1.500	.000	.00	1 .0
8.370	.0226					.0231	.19	.42	2.17	.42	.013	.00	.00	PIPE
113.017	1113.637	.417	1114.054	2.70	6.73	.70	1114.76	.00	.62	1.34	1.500	.000	.00	1 .0
25.810	.0226					.0248	.64	.42	2.17	.42	.013	.00	.00	PIPE
138.827	1114.220	.403	1114.623	2.70	7.06	.77	1115.40	.00	.62	1.33	1.500	.000	.00	1 .0
11.141	.0226					.0283	.32	.40	2.32	.42	.013	.00	.00	PIPE
149.968	1114.472	.390	1114.862	2.70	7.40	.85	1115.71	.00	.62	1.32	1.500	.000	.00	1 .0
7.366	.0226					.0324	.24	.39	2.48	.42	.013	.00	.00	PIPE
157.334	1114.638	.377	1115.015	2.70	7.76	.94	1115.95	.00	.62	1.30	1.500	.000	.00	1 .0
5.620	.0226					.0370	.21	.38	2.65	.42	.013	.00	.00	PIPE
162.954	1114.765	.364	1115.130	2.70	8.14	1.03	1116.16	.00	.62	1.29	1.500	.000	.00	1 .0
4.601	.0226					.0423	.19	.36	2.83	.42	.013	.00	.00	PIPE

Program Package Serial Number: 1374

WATER SURFACE PROFILE LISTING

Date: 7-17-2008 Time: 1:43:30

THE TRIANGLE
LATERAL D3
100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
167.555	1114.869	.352	1115.221	2.70	8.54	1.13	1116.35	.00	.62	1.27	1.500	.000	.00	1 .0
3.935	.0226					.0484	.19	.35	3.02	.42	.013	.00	.00	PIPE
171.490	1114.958	.341	1115.299	2.70	8.96	1.25	1116.54	.00	.62	1.26	1.500	.000	.00	1 .0
3.456	.0226					.0554	.19	.34	3.22	.42	.013	.00	.00	PIPE
174.946	1115.036	.329	1115.366	2.70	9.39	1.37	1116.74	.00	.62	1.24	1.500	.000	.00	1 .0
3.093	.0226					.0634	.20	.33	3.44	.42	.013	.00	.00	PIPE
178.039	1115.106	.318	1115.425	2.70	9.85	1.51	1116.93	.00	.62	1.23	1.500	.000	.00	1 .0
2.811	.0226					.0725	.20	.32	3.67	.42	.013	.00	.00	PIPE
180.850	1115.170	.308	1115.478	2.70	10.33	1.66	1117.14	.18	.62	1.21	1.500	.000	.00	1 .0
.063	.0233					.0776	.00	.49	3.92	.42	.013	.00	.00	PIPE
180.913	1115.172	.308	1115.479	2.70	10.35	1.66	1117.14	.18	.62	1.21	1.500	.000	.00	1 .0
2.601	.0233					.0833	.22	.49	3.93	.42	.013	.00	.00	PIPE
183.514	1115.232	.298	1115.530	2.70	10.85	1.83	1117.36	.19	.62	1.20	1.500	.000	.00	1 .0
2.403	.0233					.0953	.23	.49	4.19	.42	.013	.00	.00	PIPE
185.917	1115.288	.288	1115.576	2.70	11.38	2.01	1117.59	.21	.62	1.18	1.500	.000	.00	1 .0
2.233	.0233					.1091	.24	.50	4.48	.42	.013	.00	.00	PIPE
188.150	1115.340	.279	1115.619	2.70	11.94	2.21	1117.83	.00	.62	1.17	1.500	.000	.00	1 .0
31.385	.1165					.1165	3.66	.28	4.78	.28	.013	.00	.00	PIPE

THE TRIANGLE
LATERAL D3
100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
219.535	1118.996	.279	1119.275	2.70	11.94	2.21	1121.49	.00	.62	1.17	1.500	.000	.00	1 .0
25.784	.1165					.1127	2.91	.28	4.78	.28	.013	.00	.00	PIPE
245.319	1122.000	.283	1122.283	2.70	11.66	2.11	1124.39	.00	.62	1.17	1.500	.000	.00	1 .0
12.680	.1165					.1021	1.29	.28	4.63	.28	.013	.00	.00	PIPE
257.999	1123.477	.293	1123.770	2.70	11.12	1.92	1125.69	.00	.62	1.19	1.500	.000	.00	1 .0
6.036	.1165					.0892	.54	.29	4.34	.28	.013	.00	.00	PIPE
264.035	1124.180	.303	1124.483	2.70	10.60	1.75	1126.23	.00	.62	1.20	1.500	.000	.00	1 .0
3.850	.1165					.0780	.30	.30	4.06	.28	.013	.00	.00	PIPE
267.885	1124.629	.313	1124.942	2.70	10.11	1.59	1126.53	.00	.62	1.22	1.500	.000	.00	1 .0
2.763	.1165					.0681	.19	.31	3.80	.28	.013	.00	.00	PIPE
270.648	1124.951	.323	1125.274	2.70	9.64	1.44	1126.72	.00	.62	1.23	1.500	.000	.00	1 .0
2.109	.1165					.0596	.13	.32	3.56	.28	.013	.00	.00	PIPE
272.757	1125.197	.334	1125.531	2.70	9.19	1.31	1126.84	.00	.62	1.25	1.500	.000	.00	1 .0
1.673	.1165					.0521	.09	.33	3.34	.28	.013	.00	.00	PIPE
274.430	1125.391	.346	1125.737	2.70	8.76	1.19	1126.93	.00	.62	1.26	1.500	.000	.00	1 .0
1.359	.1165					.0455	.06	.35	3.13	.28	.013	.00	.00	PIPE
275.789	1125.550	.358	1125.907	2.70	8.35	1.08	1126.99	.00	.62	1.28	1.500	.000	.00	1 .0
1.125	.1165					.0398	.04	.36	2.93	.28	.013	.00	.00	PIPE

□ FILE: SD-LN-D-LAT-D3.WSW

SD-LN-D-LAT-D3.OUT
W S P G W - CIVILDESIGN Version 14.06
Program Package Serial Number: 1374
WATER SURFACE PROFILE LISTING

Date: 7-17-2008 Time: 1:43:30

THE TRIANGLE
LATERAL D3
100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
276.914	1125.681	.370	1126.051	2.70	7.96	.99	1127.04	.00	.62	1.29	1.500	.000	.00	1 .0
.939	.1165					.0348	.03	.37	2.74	.28	.013	.00	.00	PIPE
277.854	1125.790	.383	1126.173	2.70	7.59	.90	1127.07	.00	.62	1.31	1.500	.000	.00	1 .0
.793	.1165					.0304	.02	.38	2.57	.28	.013	.00	.00	PIPE
278.646	1125.883	.396	1126.278	2.70	7.24	.81	1127.09	.00	.62	1.32	1.500	.000	.00	1 .0
.671	.1165					.0266	.02	.40	2.40	.28	.013	.00	.00	PIPE
279.317	1125.961	.410	1126.370	2.70	6.90	.74	1127.11	.00	.62	1.34	1.500	.000	.00	1 .0
.570	.1165					.0233	.01	.41	2.25	.28	.013	.00	.00	PIPE
279.887	1126.027	.424	1126.451	2.70	6.58	.67	1127.12	.00	.62	1.35	1.500	.000	.00	1 .0
.483	.1165					.0204	.01	.42	2.10	.28	.013	.00	.00	PIPE
280.370	1126.083	.439	1126.522	2.70	6.28	.61	1127.13	.00	.62	1.36	1.500	.000	.00	1 .0
.409	.1165					.0179	.01	.44	1.97	.28	.013	.00	.00	PIPE
280.779	1126.131	.454	1126.585	2.70	5.98	.56	1127.14	.00	.62	1.38	1.500	.000	.00	1 .0
.344	.1165					.0156	.01	.45	1.84	.28	.013	.00	.00	PIPE
281.122	1126.171	.470	1126.641	2.70	5.71	.51	1127.15	.00	.62	1.39	1.500	.000	.00	1 .0
.286	.1165					.0137	.00	.47	1.72	.28	.013	.00	.00	PIPE
281.409	1126.204	.486	1126.691	2.70	5.44	.46	1127.15	.00	.62	1.40	1.500	.000	.00	1 .0
.235	.1165					.0120	.00	.49	1.61	.28	.013	.00	.00	PIPE

THE TRIANGLE
LATERAL D3
100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
281.644	1126.232	.503	1126.735	2.70	5.19	.42	1127.15	.00	.62	1.42	1.500	.000	.00	1 .0
.189	.1165					.0105	.00	.50	1.51	.28	.013	.00	.00	PIPE
281.833	1126.254	.521	1126.775	2.70	4.95	.38	1127.15	.00	.62	1.43	1.500	.000	.00	1 .0
.148	.1165					.0092	.00	.52	1.41	.28	.013	.00	.00	PIPE
281.982	1126.271	.540	1126.811	2.70	4.72	.35	1127.16	.00	.62	1.44	1.500	.000	.00	1 .0
.111	.1165					.0081	.00	.54	1.32	.28	.013	.00	.00	PIPE
282.093	1126.284	.559	1126.843	2.70	4.50	.31	1127.16	.00	.62	1.45	1.500	.000	.00	1 .0
.077	.1165					.0071	.00	.56	1.23	.28	.013	.00	.00	PIPE
282.170	1126.293	.579	1126.872	2.70	4.29	.29	1127.16	.00	.62	1.46	1.500	.000	.00	1 .0
.045	.1165					.0062	.00	.58	1.15	.28	.013	.00	.00	PIPE
282.215	1126.298	.600	1126.899	2.70	4.09	.26	1127.16	.00	.62	1.47	1.500	.000	.00	1 .0
.015	.1165					.0054	.00	.60	1.07	.28	.013	.00	.00	PIPE
282.230	1126.300	.623	1126.923	2.70	3.89	.23	1127.16	.00	.62	1.48	1.500	.000	.00	1 .0

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T1 THE TRIANGLE                                                                          0
T2 LATERAL D4
T3 100 YEAR
SO     103.1401115.090  1                            1117.000
R      266.0601116.247  1       .013                                         .000    .000 0
JX     271.0601116.290  4  2    .013    13.700         1116.540             -45.0           .000
R      432.8701117.450  4       .013                                         .000    .000 0
R      445.5201117.540  4       .013                                       32.213    .000 0
R      499.6501119.050  4       .013                                         .000    .000 0
SH     499.6501119.050  4                            1119.050
CD   1  4   1    .000   1.500     .000  .000  .000    .00
CD   2  4   1    .000   1.000     .000  .000  .000    .00
CD   4  4   1    .000   1.500     .000  .000  .000    .00
Q               1.300    .0
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FILE: SD-LN-D-LAT-D4.WSW

W S P G W - CIVILDESIGN Version 14.06

Program Package Serial Number: 1374

WATER SURFACE PROFILE LISTING

Date: 7-17-2008 Time:11:58:43

THE TRIANGLE
LATERAL D4
100 YEAR

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
103.140	1115.090	1.910	1117.000	15.00	8.49	1.12	1118.12	.00	1.41	.00	1.500	.000	.00	1 .0
162.920	.0071					.0204	3.32	1.91	.00	1.50	.013	.00	.00	PIPE
266.060	1116.247	4.075	1120.322	15.00	8.49	1.12	1121.44	.00	1.41	.00	1.500	.000	.00	1 .0
JUNCT STR	.0086					.0103	.05	4.08	.00		.013	.00	.00	PIPE
271.060	1116.290	5.194	1121.484	1.30	.74	.01	1121.49	.00	.43	.00	1.500	.000	.00	1 .0
161.810	.0072					.0002	.02	5.19	.00	.39	.013	.00	.00	PIPE
432.870	1117.450	4.059	1121.509	1.30	.74	.01	1121.52	.00	.43	.00	1.500	.000	.00	1 .0
12.650	.0071					.0002	.00	.00	.00	.39	.013	.00	.00	PIPE
445.520	1117.540	3.972	1121.512	1.30	.74	.01	1121.52	.00	.43	.00	1.500	.000	.00	1 .0
54.130	.0279					.0002	.01	3.97	.00	.28	.013	.00	.00	PIPE
499.650	1119.050	2.470	1121.520	1.30	.74	.01	1121.53	.00	.43	.00	1.500	.000	.00	1 .0

THE TRIANGLE

LATERAL D4

100 YEAR

```
T1 THE TRIANGLE                                                                                    0
T2 LINE E
T3 100 YEAR CAPACITY ANALYSIS
SO   1000.0001107.480  1                              1109.980
R    1245.7001113.765  1       .013                                              .000    .000 0
R    1250.3601113.880  1       .013                                              .000    .000 1
R    1309.7301117.560  1       .013                                              .000    .000 0
JX   1311.7301118.070  3  2    .013    6.200            1118.450                  90.0          .000
R    1313.7301118.080  3       .013                                              .000 -90.000 0
R    1494.4101119.020  3       .013                                              .000    .000 0
JX   1498.4101119.540  5  4    .013    4.400            1119.790                  90.0          .000
R    1540.0901119.760  5       .013                                              .000    .000 0
SH   1540.0901119.760  5                              1119.760
CD   1   4   1    .000   2.500     .000  .000  .000   .00
CD   2   4   1    .000   1.000     .000  .000  .000   .00
CD   3   4   1    .000   2.000     .000  .000  .000   .00
CD   4   4   1    .000   1.000     .000  .000  .000   .00
CD   5   4   1    .000   1.500     .000  .000  .000   .00
Q             8.000    .0
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W S P G W - CIVILDESIGN Version 14.06
Program Package Serial Number: 1374
WATER SURFACE PROFILE LISTING

Date: 7- 2-2008 Time:11:46:26

THE TRIANGLE
LINE E
100 YEAR CAPACITY ANALYSIS

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch	
1000.000	1107.480	2.500	1109.980	18.60	3.79	.22	1110.20	.00	1.46	.00	2.500	.000	.00	1	.0
.000	.0256					.0020	.00	2.50	.00	.91	.013	.00	.00	PIPE	
1000.000	1107.480	2.500	1109.980	18.60	3.79	.22	1110.20	.00	1.46	.00	2.500	.000	.00	1	.0
8.809	.0256					.0019	.02	2.50	.00	.91	.013	.00	.00	PIPE	
1008.809	1107.705	2.268	1109.974	18.60	3.97	.25	1110.22	.00	1.46	1.45	2.500	.000	.00	1	.0
.515	.0256					.0018	.00	2.27	.39	.91	.013	.00	.00	PIPE	
1009.323	1107.719	2.254	1109.972	18.60	3.99	.25	1110.22	.00	1.46	1.49	2.500	.000	.00	1	.0
HYDRAULIC JUMP															
1009.323	1107.719	.906	1108.625	18.60	11.58	2.08	1110.71	.00	1.46	2.40	2.500	.000	.00	1	.0
91.392	.0256					.0261	2.38	.91	2.50	.91	.013	.00	.00	PIPE	
1100.715	1110.056	.906	1110.963	18.60	11.58	2.08	1113.04	.00	1.46	2.40	2.500	.000	.00	1	.0
76.605	.0256					.0279	2.14	.91	2.50	.91	.013	.00	.00	PIPE	
1177.320	1112.016	.875	1112.891	18.60	12.15	2.29	1115.18	.00	1.46	2.38	2.500	.000	.00	1	.0
31.891	.0256					.0318	1.01	.88	2.67	.91	.013	.00	.00	PIPE	
1209.211	1112.832	.845	1113.677	18.60	12.74	2.52	1116.20	.00	1.46	2.37	2.500	.000	.00	1	.0
20.777	.0256					.0363	.75	.85	2.86	.91	.013	.00	.00	PIPE	
1229.988	1113.363	.816	1114.179	18.60	13.36	2.77	1116.95	.00	1.46	2.34	2.500	.000	.00	1	.0
15.712	.0256					.0415	.65	.82	3.06	.91	.013	.00	.00	PIPE	

SD-LN-E.OUT

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WATER SURFACE PROFILE LISTING

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THE TRIANGLE
LINE E
100 YEAR CAPACITY ANALYSIS

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1245.700	1113.765	.789	1114.554	18.60	14.01	3.05	1117.60	.00	1.46	2.32	2.500	.000	.00	1 .0
4.660	.0247					.0453	.21	.79	3.27	.92	.013	.00	.00	PIPE
1250.360	1113.880	.779	1114.659	18.60	14.25	3.15	1117.81	.00	1.46	2.32	2.500	.000	.00	1 .0
5.465	.0620					.0454	.25	.78	3.35	.72	.013	.00	.00	PIPE
1255.825	1114.219	.787	1115.006	18.60	14.04	3.06	1118.07	.00	1.46	2.32	2.500	.000	.00	1 .0
12.361	.0620					.0417	.52	.79	3.28	.72	.013	.00	.00	PIPE
1268.185	1114.985	.815	1115.800	18.60	13.39	2.78	1118.58	.00	1.46	2.34	2.500	.000	.00	1 .0
8.811	.0620					.0365	.32	.81	3.06	.72	.013	.00	.00	PIPE
1276.996	1115.531	.844	1116.375	18.60	12.77	2.53	1118.91	.00	1.46	2.36	2.500	.000	.00	1 .0
6.674	.0620					.0320	.21	.84	2.87	.72	.013	.00	.00	PIPE
1283.671	1115.945	.874	1116.818	18.60	12.17	2.30	1119.12	.00	1.46	2.38	2.500	.000	.00	1 .0
5.245	.0620					.0281	.15	.87	2.68	.72	.013	.00	.00	PIPE
1288.916	1116.270	.905	1117.175	18.60	11.61	2.09	1119.27	.00	1.46	2.40	2.500	.000	.00	1 .0
4.219	.0620					.0246	.10	.90	2.50	.72	.013	.00	.00	PIPE
1293.135	1116.531	.937	1117.469	18.60	11.07	1.90	1119.37	.00	1.46	2.42	2.500	.000	.00	1 .0
3.441	.0620					.0216	.07	.94	2.34	.72	.013	.00	.00	PIPE
1296.575	1116.745	.971	1117.716	18.60	10.55	1.73	1119.44	.00	1.46	2.44	2.500	.000	.00	1 .0
2.832	.0620					.0189	.05	.97	2.19	.72	.013	.00	.00	PIPE

THE TRIANGLE
LINE E
100 YEAR CAPACITY ANALYSIS

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1299.407	1116.920	1.006	1117.927	18.60	10.06	1.57	1119.50	.00	1.46	2.45	2.500	.000	.00	1 .0
2.339	.0620					.0166	.04	1.01	2.04	.72	.013	.00	.00	PIPE
1301.747	1117.065	1.043	1118.108	18.60	9.59	1.43	1119.54	.00	1.46	2.47	2.500	.000	.00	1 .0
1.932	.0620					.0146	.03	1.04	1.91	.72	.013	.00	.00	PIPE
1303.678	1117.185	1.081	1118.266	18.60	9.14	1.30	1119.56	.00	1.46	2.48	2.500	.000	.00	1 .0
1.587	.0620					.0128	.02	1.08	1.78	.72	.013	.00	.00	PIPE
1305.266	1117.283	1.121	1118.405	18.60	8.72	1.18	1119.59	.00	1.46	2.49	2.500	.000	.00	1 .0
1.292	.0620					.0113	.01	1.12	1.66	.72	.013	.00	.00	PIPE
1306.558	1117.363	1.163	1118.526	18.60	8.31	1.07	1119.60	.00	1.46	2.49	2.500	.000	.00	1 .0
1.034	.0620					.0099	.01	1.16	1.55	.72	.013	.00	.00	PIPE
1307.592	1117.427	1.207	1118.634	18.60	7.93	.98	1119.61	.00	1.46	2.50	2.500	.000	.00	1 .0
.805	.0620					.0087	.01	1.21	1.44	.72	.013	.00	.00	PIPE
1308.397	1117.477	1.253	1118.730	18.60	7.56	.89	1119.62	.00	1.46	2.50	2.500	.000	.00	1 .0
.599	.0620					.0077	.00	1.25	1.34	.72	.013	.00	.00	PIPE
1308.996	1117.515	1.301	1118.815	18.60	7.21	.81	1119.62	.00	1.46	2.50	2.500	.000	.00	1 .0
.413	.0620					.0068	.00	1.30	1.25	.72	.013	.00	.00	PIPE
1309.409	1117.540	1.351	1118.891	18.60	6.87	.73	1119.62	.00	1.46	2.49	2.500	.000	.00	1 .0
.242	.0620					.0060	.00	1.35	1.16	.72	.013	.00	.00	PIPE

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WATER SURFACE PROFILE LISTING

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THE TRIANGLE
LINE E
100 YEAR CAPACITY ANALYSIS

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1309.651	1117.555	1.404	1118.959	18.60	6.55	.67	1119.63	.00	1.46	2.48	2.500	.000	.00	1 .0
.079	.0620					.0053	.00	1.40	1.08	.72	.013	.00	.00	PIPE
1309.730	1117.560	1.461	1119.021	18.60	6.24	.60	1119.63	.00	1.46	2.46	2.500	.000	.00	1 .0
JUNCT STR	.2549					.0040	.01	1.46	1.00		.013	.00	.00	PIPE
1311.730	1118.070	1.606	1119.676	12.40	4.58	.33	1120.00	.00	1.27	1.59	2.000	.000	.00	1 .0
2.000	.0050					.0031	.01	1.61	.62	1.32	.013	.00	.00	PIPE
1313.730	1118.080	1.600	1119.680	12.40	4.60	.33	1120.01	.00	1.27	1.60	2.000	.000	.00	1 .0
22.780	.0052					.0033	.08	1.60	.62	1.30	.013	.00	.00	PIPE
1336.510	1118.198	1.525	1119.723	12.40	4.83	.36	1120.08	.00	1.27	1.70	2.000	.000	.00	1 .0
21.313	.0052					.0037	.08	1.52	.69	1.30	.013	.00	.00	PIPE
1357.823	1118.309	1.456	1119.765	12.40	5.06	.40	1120.16	.00	1.27	1.78	2.000	.000	.00	1 .0
21.282	.0052					.0041	.09	1.46	.76	1.30	.013	.00	.00	PIPE
1379.105	1118.420	1.393	1119.813	12.40	5.31	.44	1120.25	.00	1.27	1.84	2.000	.000	.00	1 .0
24.527	.0052					.0046	.11	1.39	.83	1.30	.013	.00	.00	PIPE
1403.632	1118.548	1.335	1119.882	12.40	5.57	.48	1120.36	.00	1.27	1.88	2.000	.000	.00	1 .0
24.716	.0052					.0050	.12	1.33	.90	1.30	.013	.00	.00	PIPE
1428.348	1118.676	1.304	1119.980	12.40	5.72	.51	1120.49	.00	1.27	1.91	2.000	.000	.00	1 .0
66.062	.0052					.0052	.34	1.30	.94	1.30	.013	.00	.00	PIPE

FILE: SD-LN-E.WSW

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Program Package Serial Number: 1374

WATER SURFACE PROFILE LISTING

Date: 7- 2-2008 Time:11:46:26

THE TRIANGLE
LINE E
100 YEAR CAPACITY ANALYSIS

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1494.410	1119.020	1.304	1120.324	12.40	5.72	.51	1120.83	.00	1.27	1.91	2.000	.000	.00	1 .0
JUNCT STR	.1300					.0052	.02	1.30	.94		.013	.00	.00	PIPE
1498.410	1119.540	1.327	1120.867	8.00	4.84	.36	1121.23	.00	1.10	.96	1.500	.000	.00	1 .0
41.680	.0053					.0052	.22	1.33	.65	1.31	.013	.00	.00	PIPE
1540.090	1119.760	1.322	1121.082	8.00	4.85	.37	1121.45	.00	1.10	.97	1.500	.000	.00	1 .0

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T1 THE TRIANGLE                                                                0
T2 LINE G
T3 100 YEAR CAPACITY ANALYSIS
SO    1223.2201107.610  1                          1111.000
R     1663.2301109.890  1      .013                                   .000     .000 0
R     1735.7401110.530  1      .013                                   .000     .000 0
WE    1735.7401110.530  2      .500
SH    1735.7401110.530  2                          1110.530
CD    1  4    1    .000    3.500     .000  .000  .000    .00
CD    2  4    1    .000    3.500     .000  .000  .000    .00
Q              65.300    .0
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W S P G W - CIVILDESIGN Version 14.06
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WATER SURFACE PROFILE LISTING

Date:11-20-2008 Time: 7:46:41

THE TRIANGLE
LINE G
100 YEAR CAPACITY ANALYSIS

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch	
1223.220	1107.610	3.390	1111.000	65.30	6.85	.73	1111.73	.00	2.53	1.22	3.500	.000	.00	1	.0
124.405	.0052					.0037	.46	3.39	.43	2.60	.013	.00	.00	PIPE	
1347.625	1108.255	3.134	1111.389	65.30	7.19	.80	1112.19	.00	2.53	2.14	3.500	.000	.00	1	.0
75.829	.0052					.0039	.29	3.13	.61	2.60	.013	.00	.00	PIPE	
1423.455	1108.648	2.955	1111.602	65.30	7.54	.88	1112.48	.00	2.53	2.54	3.500	.000	.00	1	.0
64.203	.0052					.0042	.27	2.95	.72	2.60	.013	.00	.00	PIPE	
1487.658	1108.980	2.804	1111.784	65.30	7.90	.97	1112.75	.00	2.53	2.79	3.500	.000	.00	1	.0
65.935	.0052					.0046	.31	2.80	.81	2.60	.013	.00	.00	PIPE	
1553.593	1109.322	2.670	1111.992	65.30	8.29	1.07	1113.06	.00	2.53	2.98	3.500	.000	.00	1	.0
52.026	.0052					.0050	.26	2.67	.90	2.60	.013	.00	.00	PIPE	
1605.620	1109.591	2.600	1112.191	65.30	8.52	1.13	1113.32	.00	2.53	3.06	3.500	.000	.00	1	.0
HYDRAULIC JUMP															
1605.620	1109.591	2.500	1112.092	65.30	8.88	1.22	1113.32	.00	2.53	3.16	3.500	.000	.00	1	.0
12.911	.0052					.0060	.08	2.50	1.03	2.60	.013	.00	.00	PIPE	
1618.530	1109.658	2.394	1112.052	65.30	9.31	1.35	1113.40	.00	2.53	3.25	3.500	.000	.00	1	.0
22.138	.0052					.0068	.15	2.39	1.12	2.60	.013	.00	.00	PIPE	
1640.668	1109.773	2.294	1112.068	65.30	9.77	1.48	1113.55	.00	2.53	3.33	3.500	.000	.00	1	.0
22.562	.0052					.0076	.17	2.29	1.21	2.60	.013	.00	.00	PIPE	

FILE: SD-LN-G.WSW

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WATER SURFACE PROFILE LISTING

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THE TRIANGLE
LINE G
100 YEAR CAPACITY ANALYSIS

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1663.230	1109.890	2.202	1112.092	65.30	10.24	1.63	1113.72	.00	2.53	3.38	3.500	.000	.00	1 .0
21.221	.0088					.0080	.17	2.20	1.31	2.14	.013	.00	.00	PIPE
1684.451	1110.077	2.227	1112.305	65.30	10.11	1.59	1113.89	.00	2.53	3.37	3.500	.000	.00	1 .0
34.618	.0088					.0074	.26	2.23	1.29	2.14	.013	.00	.00	PIPE
1719.068	1110.383	2.322	1112.705	65.30	9.64	1.44	1114.15	.00	2.53	3.31	3.500	.000	.00	1 .0
13.243	.0088					.0066	.09	2.32	1.19	2.14	.013	.00	.00	PIPE
1732.311	1110.500	2.423	1112.923	65.30	9.19	1.31	1114.23	.00	2.53	3.23	3.500	.000	.00	1 .0
3.429	.0088					.0059	.02	2.42	1.09	2.14	.013	.00	.00	PIPE
WALL ENTRANCE														
1735.740	1110.530	2.534	1113.064	65.30	8.75	1.19	1114.25	.00	2.53	3.13	3.500	.000	.00	0 .0

APPENDIX I

Reference Material
Copy of WSPG Output for MHSR SD line A

MURRIETA HOT SPRINGS ROAD

HYDROLOGY/HYDRAULIC CALCULATIONS

May 15, 1997

Prepared For:
CITY OF MURRIETA

REGISTERED PROFESSIONAL ENGINEER
HECTOR LUCIO CORREA
No. 36308
CIVIL ENGINEERING
STATE OF CALIFORNIA

Prepared By:

HLC CIVIL ENGINEERING
441661 Enterprise Circle North
Suite 225
Temecula, CA 92590
(909) 676-6225

SECTION 1
LINE A
HYDRAULIC CALCULATION

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1                                                                                                                              PAGE    3
                                                          WATER SURFACE PROFILE LISTING
                                       MURRIETA HOT SPRINGS ROAD 3/30/97
                                       STORM DRAIN IMPROVEMENTS
                                       LINE "A" ------ CITY OF MURRIETA
0 STATION     INVERT   DEPTH     W.S.         Q        VEL      VEL     ENERGY    SUPER  CRITICAL              HGT/    BASE/    ZL    NO  AVBPR
               ELEV   OF FLOW    ELEV                           HEAD   GRD.EL.    ELEV    DEPTH                DIA    ID NO.         PIER
0 L/ELEM        SO                                             SF AVE     HF                       NORM DEPTH                  ZR
******************************************************************************************************************************************
0   784.67  1099.04     5.98   1105.02      528.0   15.09      3.54   1108.55     .00      5.98                 7.00      .00    .00   0    .00
0JUNCT STR   .00857                                          .00818      .04                                                    .00
0   789.33  1099.08     6.92   1106.00      513.0   13.36      2.77   1108.77     .00      5.91                 7.00      .00    .00   0    .00
0    60.42   .00811                                          .00576      .35                      5.15                          .00
0   849.75  1099.57     6.71   1106.28      513.0   13.53      2.84   1109.12     .00      5.91                 7.00      .00    .00   0    .00
0JUNCT STR   .00824                                          .00560      .10                                                    .00
0   866.75  1099.71     7.48   1107.19      478.0   12.42      2.40   1109.58     .00      5.73                 7.00      .00    .00   0    .00
0   106.31   .00865                                          .00560      .60                      4.76                          .00
0   973.06  1100.63     7.15   1107.78      478.0   12.42      2.40   1110.18     .00      5.73                 7.00      .00    .00   0    .00
0    57.36   .00823                                          .00557      .32                      4.85                          .00
0  1030.42  1101.10     7.00   1108.10      478.0   12.42      2.40   1110.50     .00      5.73                 7.00      .00    .00   0    .00
0     7.08   .00823                                          .00544      .04                      4.85                          .00
0  1037.50  1101.16     6.98   1108.14      478.0   12.42      2.40   1110.54     .00      5.73                 7.00      .00    .00   0    .00
0JUNCT STR   .01001                                          .00526      .01                                                    .00
0  1039.50  1101.18     7.18   1108.36      460.0   11.95      2.22   1110.58     .00      5.63                 7.00      .00    .00   0    .00
0    49.74   .00844                                          .00518      .26                      4.67                          .00
0  1089.24  1101.60     7.23   1108.83      460.0   11.95      2.22   1111.05     .00      5.63                 7.00      .00    .00   0    .00
0    64.54   .00874                                          .00516      .33                      4.61                          .00
0  1153.78  1102.16     7.00   1109.16      460.0   11.95      2.22   1111.38     .00      5.63                 7.00      .00    .00   0    .00
0     7.57   .00874                                          .00502      .04                      4.61                          .00
0  1161.35  1102.23     6.97   1109.20      460.0   11.96      2.22   1111.42     .00      5.63                 7.00      .00    .00   0    .00
0JUNCT STR   .02002                                          .00482      .00                                                    .00
  1162.35  1102.25     7.15   1109.40      440.0   11.43      2.03   1111.43     .00      5.52                 7.00      .00    .00   0    .00
0    23.87   .00754                                          .00474      .11                      4.71                          .00
0  1186.22  1102.43     7.08   1109.51      440.0   11.43      2.03   1111.55     .00      5.52                 7.00      .00    .00   0    .00
0    22.67   .00904                                          .00472      .11                      4.42                          .00
0  1208.89  1102.64     7.00   1109.64      440.0   11.43      2.03   1111.67     .00      5.52                 7.00      .00    .00   0    .00
0    51.41   .00904                                          .00441      .23                      4.42                          .00
0  1260.30  1103.10     6.70   1109.80      440.0   11.61      2.09   1111.89     .00      5.52                 7.00      .00    .00   0    .00
0    12.62   .00476                                          .00412      .05                      5.73                          .00
0  1272.92  1103.16     6.69   1109.85      440.0   11.62      2.10   1111.94     .00      5.52                 7.00      .00    .00   0    .00
0TRANS STR   .00380                                          .00275      .03                                                    .00
0  1283.42  1103.20     8.97   1112.17      440.0     .99       .02   1112.18     .00      2.06                 3.50    22.75   3.00   0    .00
1
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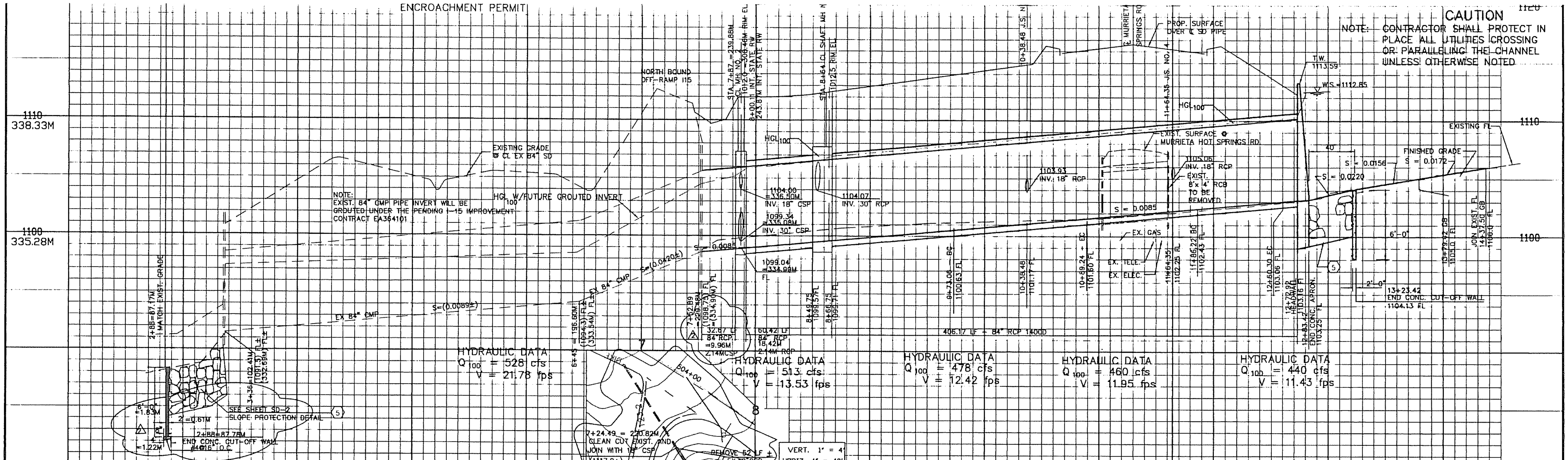
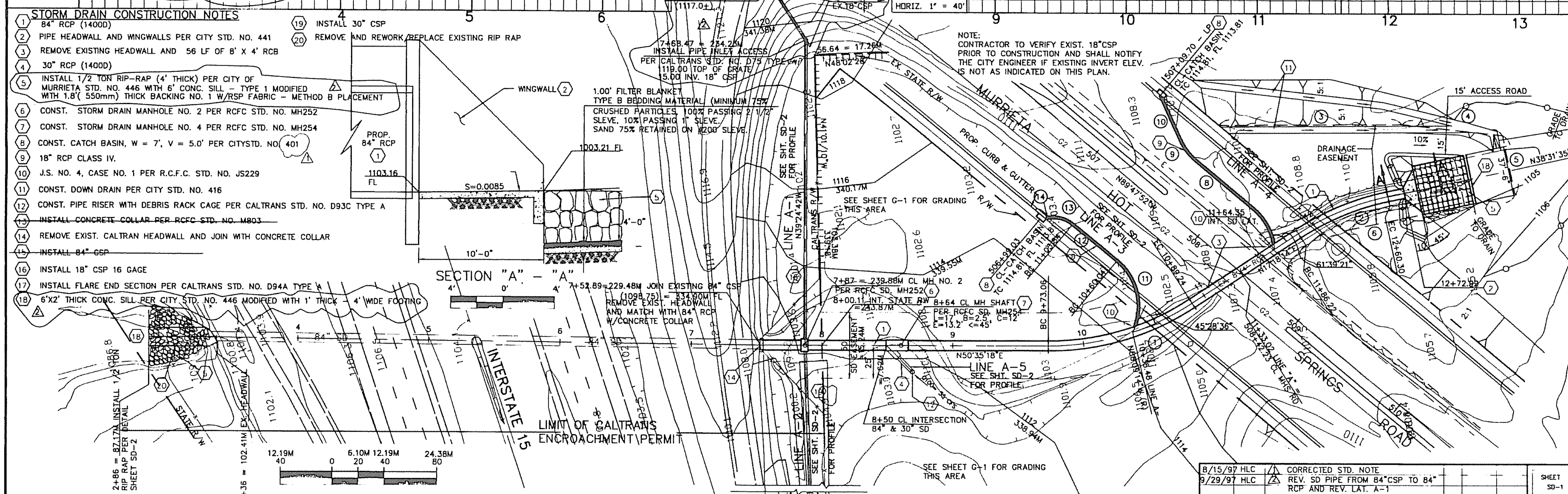


STORM DRAIN CONSTRUCTION NOTES

1. 84" RCP (1400D)
2. PIPE HEADWALL AND WINGWALLS PER CITY STD. NO. 441
3. REMOVE EXISTING HEADWALL AND 56 LF OF 8' X 4' RCB
4. 30" RCP (1400D)
5. INSTALL 1/2 TON RIP-RAP (4' THICK) PER CITY OF MURRIETA STD. NO. 446 WITH 6' CONC. SILL - TYPE 1 MODIFIED WITH 1.8'(550mm) THICK BACKING NO. 1 W/RSP FABRIC - METHOD B PLACEMENT
6. CONST. STORM DRAIN MANHOLE NO. 2 PER RCFC STD. NO. MH252
7. CONST. STORM DRAIN MANHOLE NO. 4 PER RCFC STD. NO. MH254
8. CONST. CATCH BASIN, W = 7', V = 5.0' PER CITYSTD. NO 401
9. 18" RCP CLASS IV.
10. J.S. NO. 4, CASE NO. 1 PER R.C.F.C. STD. NO. JS229
11. CONST. DOWN DRAIN PER CITY STD. NO. 416
12. CONST. PIPE RISER WITH DEBRIS RACK CAGE PER CALTRANS STD. NO. D93C TYPE A
13. ~~INSTALL CONCRETE COLLAR PER RCFC STD. NO. M803~~
14. REMOVE EXIST. CALTRAN HEADWALL AND JOIN WITH CONCRETE COLLAR
15. ~~INSTALL 84" CSP~~
16. INSTALL 18" CSP 16 GAGE
17. INSTALL FLARE END SECTION PER CALTRANS STD. NO. D94A TYPE A
18. 6'X2' THICK CONC. SILL PER CITY STD. NO. 446 MODIFIED WITH 1' THICK - 4' WIDE FOOTING
19. INSTALL 30" CSP
20. REMOVE AND REWORK/REPLACE EXISTING RIP RAP



DATA TABLE

◯	Δ/BEARING	RAD	LENGTH	TAN.
1	21°13'21"	200.00'	74.08'	37.47'
2	33°17'04"	200.00'	116.18'	59.78'
3	N50°12'08"E		139.57'	
4	N56°39'52"E		77.31'	
5	N51°28'25"W		45.83'	
6	N38°31'35"E		132.57'	
7	45°26'45"	45.00'	35.69'	18.85'
8	N89°47'52"W		56.67'	
9	25°46'36"	45.00'	20.25'	10.30'
10	N64°01'16"W		37.13'	
11	76°26'44"	45.00'	60.04'	35.44'
12	N89°55'26"E		43.80'	
13	44°43'19"	22.50'	17.56'	9.26'
14	N45°12'08"E		4.92'	
15				
16				
17				
18				
19				
20				

Underground Service Alert

Call TOLL FREE 1-800 422-4133

TWO WORKING DAYS BEFORE YOU DIG

PRIVATE ENGINEERING NOTE
Construction contractor agrees that in accordance with generally accepted construction practices, construction contractor will be required to assume sole and complete responsibility for job site conditions during the course of construction of the project, including safety of all persons and property; that this requirement shall be made to apply continuously and not be limited to normal working hours, and construction contractor further agrees to defend, indemnify and hold design professional harmless from any and all liability, real or alleged, in connection with the performance of work on this project, excepting liability arising from the sole negligence of design professional.

The private engineer signing these plans is responsible for assuring the accuracy and acceptability of the design hereon. In the event of discrepancies arising after city approval or during construction, the private engineer shall be responsible for determining an acceptable solution and revising the plans for approval by the city.

CAUTION !

AN UNDERGROUND GAS LINE IS PRESENT IN THE VICINITY OF THIS PROJECT. THE LOCATION SHOWN IS APPROXIMATE ONLY ! IT IS THE CONTRACTORS RESPONSIBILITY TO VERIFY THE EXACT LOCATION OF THESE FACILITIES, CONTACT UNDERGROUND SERVICE ALERT, AND THE GAS COMPANY PRIOR TO ANY WORK. THE CONTRACTOR SHALL EXERCISE ALL DUE CAUTION IN PROTECTING THESE FACILITIES.

SEAL: REGISTERED PROFESSIONAL ENGINEER HECTOR L CORREA No. 36306 Exp. 6/30/00 CIVIL STATE OF CALIFORNIA

HLC civil engineering
41661 ENTERPRISE CIRCLE NORTH, SUITE 225 (909) 676-6225 (909)676-7976 FAX
Temecula, California 92590

PREPARED UNDER THE DIRECTION OF:
ENGINEER: R.C.E. 36306
EXP. DATE: JUNE 30, 2000 DATE 10/6/97

DATE	INITIAL		REVISION DESCRIPTION	SHT. NO.	DATE	INITIAL
8/15/97	HLC	1	CORRECTED STD. NOTE			
9/29/97	HLC	2	REV. SD PIPE FROM 84"CSP TO 84" RCP AND REV. LAT. A-1			
ENGINEER OF WORK					CITY APPROVAL	

SHEET SD-1 | CITY OF MURRIETA DEPARTMENT OF PUBLIC WORKS | SHEETS SD-2

MURRIETA HOT SPRINGS ROAD LINE "A"

STORM DRAIN STA 7+52.89 TO STA 14+37.50

APPROVED BY: DANIEL R. CLARK
RCE 36281 EXPIRES: 6/30/00 ASST. CITY ENGINEER 10/6/97 DATE

DWN BY:
CHKD BY:
FIELD BK:

PROJECT NO. 96-142

DRAWING NO. 99-042

SD-02.DWG 9/29/97