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 in the water and when organic matter is consumed by microorganisms then dissolved oxygen 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, 5) metals.

2.5.2 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:

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 slow 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°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 alkalinity of photosynthetic light to penetrate. Turbidity is an indicator of the property of water that causes light to become scattered or absorbed. Turbidity is caused by suspended clays and other organic particles. 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. Important methods of measurement include detecting orthophosphate and total phosphorus.

2.5.3 Existing Storm Water Quality

Water quality monitoring has been conducted on Big Bear Lake. The monitoring has resulted in Big Bear Lake being listed on the Santa Ana Regional Water Quality Board Section 303(d) list for impaired water bodies. Table 4 contains the 303(d) list of the pollutants found in the lake and the source of the pollutant.

Table No. 4 – Big Bear Lake Pollutant List[1]

Pollutant Stressors	Source	Priority
Copper	Resource Extraction	High
Mercury	Resource Extraction	High

[1] Draft 2002 Clean Water Act Section 303(D) List and TMDL Priority Schedule

Table No. 4 – Big Bear Lake Pollutant List[1]

Pollutant Stressors	Source	Priority
Metals	Resource Extraction	High
Noxious Aquatic Plants	Unknown Non-Point Source	High
Nutrients	Construction and Snow Skiing Activities	High
Sedimentation and Siltation	Construction, Snow Skiing Activities and Unknown Non-Point Source	High

The proposed project site lacks 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.

Currently, the site contains a few homes, but is primarily open space with trees and shrubs. The watershed is primarily open land with 83.7% of the watershed 100% pervious (natural area), 4.7% is 80% pervious (1 dwelling unit per acre), 9.2% is 70% pervious (2.5 dwelling units per acre) and 2.4% is 60% pervious (4 dwelling units per acre). The expected existing pollutants in the existing condition storm water runoff from the residential area is trash, nutrients, bacteria, oil and grease, and household hazardous wastes from the residential development. There is also oil and grease associated with automobile use on site and on Highway 38. The natural areas that make up most of the site will contribute suspended solids.

Currently, the site does not contain any structural Best Management Practices (BMP), which would potentially decrease the amount of pollutants in storm water runoff. It is likely that portions of potential pollutants are removed through the use of natural conveyance. Conveying flows overland through vegetation affords some infiltration and biofiltration of runoff and thus, potential pollutant removal. However, the residential areas are on the lakeshore end of the site, providing little natural conveyance. A draw back to conveying flows overland is that it tends to create erosion problems and thus increase suspended solids in the runoff. Problems associated with suspended solids and erosion is evident on site (See Figure 5).

Figure 5 – Cross Culvert with Sediment and Silt Fence for Erosion Control

2.6 Groundwater

3.0 PROPOSED PROJECT

This section discusses the proposed project evaluation, which is then compared to the existing conditions analysis to determine impacts associated with the development of the property. Proposed conditions investigated include: land use, proposed storm drain configuration, hydrology, floodplain mapping, and surface water quality. Hicks and Hartwick, Inc conducted a preliminary drainage study on the proposed development.

3.1 Proposed Land Use Plan

The proposed project involves the development of residential subdivision on 62.4 acres along the north shore of Big Bear Lake. The project proposes a 95-lot residential subdivision. Each lot will be sold and developed on an individual basis. The proposed site will contain a Tentative Tract Map for 92 numbered and three lettered lots. The three lettered lots are identified as follows: (1) Lot "A" is a private street designed to provide access to the southernmost lots; (2) Lot "B" is a 1.4-acre strip of land that will remain between the relocation of State Highway 38 and the private Street, Lot "A"; and (3) Lot "C" is a gated entrance to the project, including a proposed boat dock, consisting of 100 boat slips, which would be available for use by residents of the tract and accessible by Lot "C". See Figure 6 for proposed site plan for Tentative Tract #16136.

In addition to the new development, the project will include the relocation of North Shore Drive to allow development of lake front lots. A segment of approximately 2,498 feet of road will need to be relocated. The maximum distance of relocation, as designed, is 207 feet to the north. The design includes a 76-foot road width, with 14-foot shoulder/bikeway access, resulting in a 104 feet of right-of-way. Project access includes a loop road for the northerly project area, allowing 64 lots to access North Shore Drive. Thirty-one lots, south of North Shore Drive, would be accessed via another loop road, which includes five separate cul-de-sac drives to access lakefront lots.

3.2 Hydrology

Project hydrology was completed by Hicks & Hartwick, to determine the impacts that the new development will have on runoff. Hydrologic calculations to evaluate surface runoff associated with 10-year and 100-year hypothetical design storm frequencies from the tributary drainage areas were performed using 1983-1994 Advanced Engineering Software (AES), in accordance with San Bernardino County Hydrology Manual. The watershed subarea boundaries were delineated according to physical constraints from the topography, existing drainage facities and proposed developments. The Proposed Conditions Hydrology Map can be found in Figure 7. Hydrologic parameters used in the analysis, such as rainfall and soil classification, are as presented in the *San Bernardino County Hydrology Manual*.

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MOON CAMP
LAND USE MAP
PROPOSED CONDITION

FIGURE **6**

3.2.1 Proposed Watershed Description

The drainage pattern for the areas follow the natural topography, south to north with the flow draining into Big Bear Lake. The proposed project has some redirection of flow and the elimination of sheet flow across Highway 38. All cross-culverts are to be designed to handle the 100-year storm event.

Due to onsite drainage patterns, the proposed project site was split into ten areas (A through J). Area "A" is on the eastern portion and area "J" is on the western end of the watershed. In the proposed condition the watershed delineation slightly changes from the existing condition, due to grading and adding of impervious areas.

Table No. 5 – Proposed Condition Drainage Area Breakdown		
Drainage Area	**Area (acres)**	**Number of Subareas**
A	96.9	9
B	6.6	1
C	2.3	1
D	9.6	3
E	0.2	1
F	1.0	1
G	39.7	3
H	0.3	1
I	0.2	1
J	14.2	4

The subareas for the eight drainage areas are illustrated in Figure 7.

Table No. 6 – Proposed Subwatershed Characteristics			
Nodes	**Area (acres)**	**Length (feet)**	**Soil Type / Development Type**
Watershed A			
A1 – A2	3	779	D / Natural
A2 – A3	12.5	730	D / Natural
A3 – A7	29.7	869	D / Natural
A4 – A5	4.7	890	D / Natural
A5 – A6	17.3	719	D / Natural
A6 – A7	26.1	719	D / Natural
A7 – A8	79.0	1261	C / Natural
A8 – A9	91.0	462	C / 2.5 AC
A9 – A10	96.9	671	C / 1D AC
Watershed B			
B1 – B2	6.6	603	C / 1D AC
Watershed C			
C1 – C2	2.3	407	C / 2D AC
Watershed D			
D1 – D2	2.4	579	C / 2.5 AC
D2 – D3	7.6	620	C / 1D AC
D3 – D4	9.6	322	C / 1D AC

Table No. 6 – Proposed Subwatershed Characteristics			
Nodes	**Area (acres)**	**Length (feet)**	**Soil Type / Development Type**
Watershed E			
E1 – E2	0.2	280	C / Commercial
Watershed F			
F1 – F2	1.0	831	C / Commercial
Watershed G			
G1 – G2	4.1	848	C / Natural
G2 – G3	33.8	1298	C / Natural
G3 – G4	39.7	537	C / 1D AC
Watershed H			
H1 – H2	0.3	511	C / Commercial
Watershed I			
I1 – I2	0.2	248	C / Commercial
Watershed J			
J1 – J2	4.3	1050	C / 4D AC
J2 – J3	1.2	400	C / 1D AC
J3 – J4	7.2	212	C / 1D AC
J4 – J5	14.2	210	C / 1D AC

In the proposed condition drainage area "A" would be composed of 9 subareas. Approximately 80 acres of drainage area "A" would consist of natural area. Of that about 56 acres are on a soil type of D and the remaining is on a soil type of C. In the proposed condition approximately 18 acres would contain development proposed on the lakeshore side of the watershed. Approximately 12 acres will consist of 2.5-acre lots and the remaining 6 acres will contain one dwelling per acre.

Area "B" would consist of 1 subarea. This area would contain one dwelling unit per acre in the proposed condition.

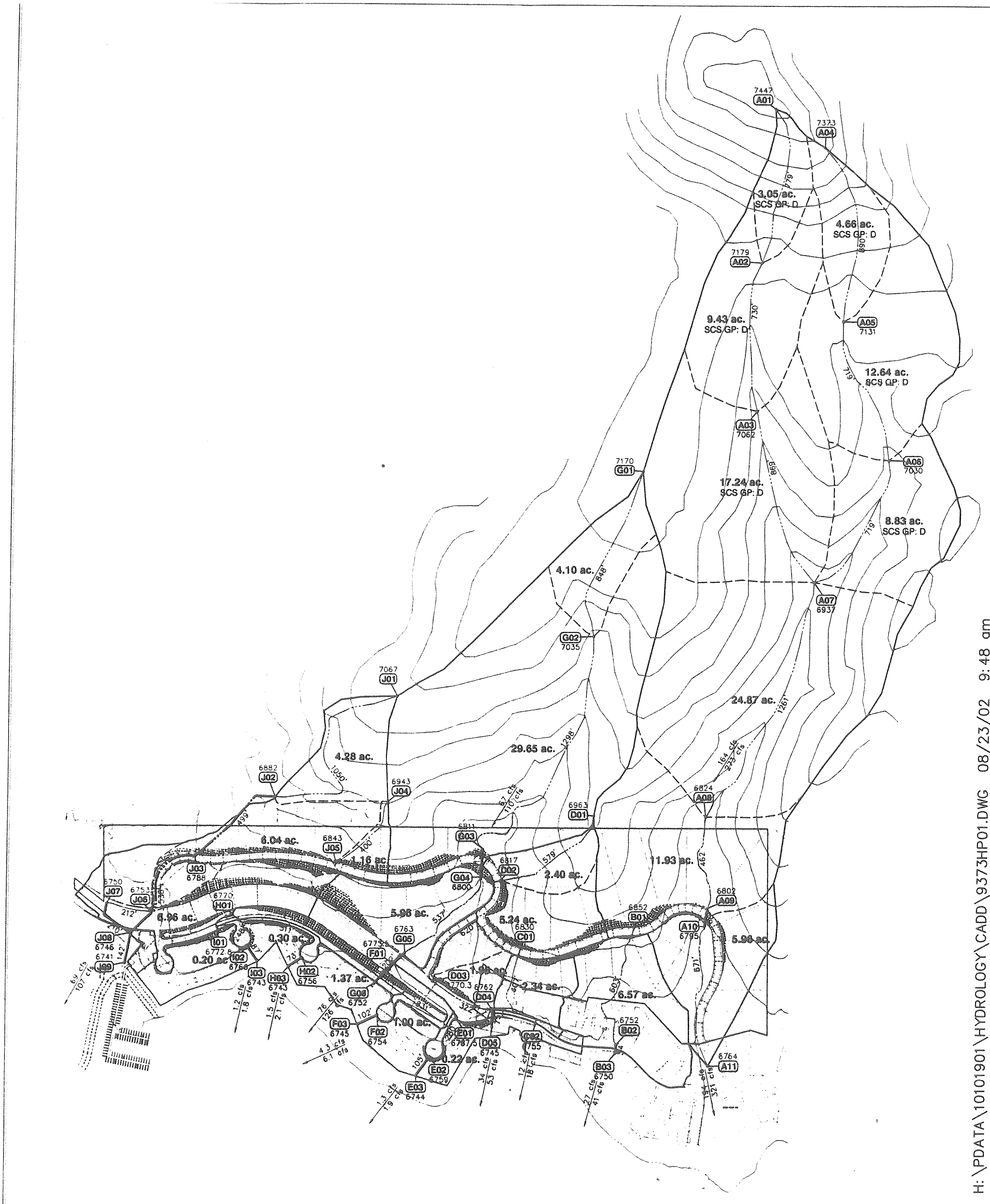
Area "C" would also contain 1 subarea. Within this drainage area the land would be composed of 2 dwellings units per acre.

Area "D" would be composed of 3 subareas. The upper subarea would contain 2.5 dwelling units per acre. The remaining subareas would contain one dwelling unit per acre.

Areas "E", "F", "H" and "I" would be composed of 1 subarea. These drainage areas would contain commercial dwellings.

Area "G" would be composed of 3 subareas. Approximately 34 acres would be natural land with no proposed development. On the remaining 6 acres, the land would consist of approximately one dwelling unit per acre.

Area "J" would be composed of 4 subareas. The upper 4.3 acres would contain 4 dwelling units per acre. The remaining 14.2 acres would contain approximately one dwelling unit per acre.



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MOON CAMP
PROPOSED CONDITION
HYDROLOGY MAP

FIGURE
7

Approximately 35% of the overall watershed that contains Moon Camp will be developed. The 95-lots will contain custom homes along the north shore of Big Bear Lake. Table 7 shows the percent impervious values for the types of land uses on the project site. The values presented are from the *San Bernardino County Hydrology Manual*.

Table No. 7 – Percent Impervious Based on Land Use	
Land Use	**Percent Pervious**
One Dwelling per Acre	80%
Two Dwellings per Acre	60%
Four Dwellings per Acre	50%
2.5 Acre Lots	90%
Commercial	10%
Natural Area – Soil Type C	100%
Natural Area – Soil Type D	100%

3.2.2 Rational Method

The hydrologic calculations to determine the 10-year and 100-year peak flow rates were performed by Hicks & Hartwick Inc using the *San Bernardino County Hydrology Manual* dated May 1983. The Rational Method is an empirical computation procedures for developing a peak runoff rate (discharge) for storms of a specific recurrence interval. Rational Method equations are based on the assumption that the peak flowrate is directly proportional to the drainage area, rainfall intensity, and a loss coefficient, which describes the effects of land use and soil type. The design discharges were computed by generating a hydrologic "link-node" model, which divides the area into drainage subareas. These subareas are tributary to a concentration point or hydrologic "node" point determined by the existing terrain and street layout. The following assumptions/guidelines were applied for use of the Rational Method:

1. The Rational Method hydrology includes the effects of infiltration caused by soil surface characteristics. The soils map from the *San Bernardino County Hydrology Manual* indicates that the study area consists of soil types "C and D."

2. The infiltration rate is also affected by the type of vegetation or ground cover and percentage of impervious surfaces. The amount of imperviousness used for the proposed condition ranged from 0% for natural open areas, 10% to 50% for single family housing and 90% for commercial use.

3. The time of concentration (T_c) is determined from the *San Bernardino County Hydrology Manual.*

4. The gutter flow option was used to model the natural channel since the side slopes and Manning's "n" values can be changed.

5. Standard Intensity-Duration Curve data was obtained from the *San Bernardino County Hydrology Manual.*

3.2.3 Proposed Condition Surface Water Hydrology

Appendix B displays the results from the Hicks & Hartwick analysis for the 10-year and the 100-year storm events for the proposed condition. Results of the proposed condition hydrologic analysis are summarized in the following table.

Table No. 8 – Proposed Condition Peak Flow Rate					
Subarea	**Area (acres)**	**Total Area (acres)**	**Tc (min)**	**Total 10-Yr. Peak Q (cfs)**	**Total 100-Yr. Peak Q (cfs)**
Watershed A					
A1 – A2	3.0	3	16.6	7.8	12.2
A2 – A3	9.4	12.5	17.8	30.3	48.4
A3 – A7	17.2	29.7	18.8	69.0	111.0
A4 – A5	4.7	4.7	18.4	11.0	17.4
A5 – A6	12.6	17.3	19.2	39.4	62.5
A6 – A7	8.8	26.1	20.1	57.4	91.6
A7 – A8	24.9	79.0	1.4	170.1	277.3
A8 – A9	11.9	91.0	0.7	189.9	311.6
A9 – A10	6.0	96.9	1.0	194.3	321.0
Watershed B					
B1 – B2	6.6	6.6	8.7	27.5	41.5
Watershed C					
C1 – C2	2.3	2.3	6.8	11.9	17.7
Watershed D					
D1 – D2	2.4	2.4	8.2	10.4	15.8
D2 – D3	5.2	7.6	9.8	29.1	45.1
D3 – D4	2.0	9.6	10.7	34.1	53.5
Watershed E					
E1 – E2	0.2	0.2	5.8	1.3	1.9
Watershed F					
F1 – F2	1.0	1.0	9.5	4.3	6.1
Watershed G					
G1 – G2	4.1	4.1	20.0	8.6	14.1
G2 – G3	29.6	33.8	21.4	66.7	110.2
G3 – G4	6.0	39.7	22.3	76.1	126.0
Watershed H					
H1 – H2	0.3	0.3	7.6	1.5	2.1
Watershed I					
I1 – I2	0.2	0.2	5.7	1.2	1.8
Watershed J					
J1 – J2	4.3	4.3	9.4	17.3	25.7
J2 – J3	1.2	1.2	6.8	5.9	8.7
J3 – J4	6.0	7.2	9.6	28.0	43.6
J4 – J5	7.0	14.2	10.3	51.9	81.3

The proposed condition has more impervious areas than the existing condition. The change in impervious area would have the potential to cause significant downstream impacts. In the proposal for Tract # 16136 Hicks & Hartwick have proposed to upsized the cross culverts to contain the 100-year storm water flow along Highway 38 and eliminate sheet flow across the highway. They have also proposed to add catch basins and cross culverts along the residential roads. All flow would be directed into the Big Bear Lake, similar to current condition. From the existing condition, the overall watershed flow rate in the proposed condition increases 8.7 cfs in the 10-year storm event and an 9.5 cfs in the 100-year storm event. This was determined by subtracting the total runoff in the proposed condition from the existing condition.

3.3 Floodplain Mapping

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

3.4 Jurisdictional Waters

Based on a field survey conducted on March 15, 2002 by RBF Consulting, it was determined that of 0.15 acres of jurisdictional waters, 0.04 acres will be impacted.

3.5 Storm Water Quality

At the time of the analysis there was no storm water quality plan for Moon Camp Tentative Track # 16136. A Water Quality Management Plan will need to be developed for the Moon Camp property under the guidelines in the *Water Quality Management Plan (WQMP) For Urban Runoff* prepared by San Bernardino County. The WQMP conforms to the new National Pollutant Discharge Elimination System (NPDES) permit requirement for San Bernardino County effective as of June 2004.

3.5.1 Construction

Construction of a project such as Moon Camp development typically produces potential 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.

3.6 Groundwater

3.7 Cumulative Projects

The basis for the cumulative analysis as presented in the Moon Camp TT # 16136 Environmental Impact Report. For the purposes of drainage and water quality analysis, commutative impacts are considered for projects in the same watershed as Moon Camp. Tract 12217 (Marina Point), Tract 15465 (Kelsch) and Relocation of the Moonridge Zoo adjacent to the Discovery Center are all in the same watershed or adjacent watersheds as Moon Camp. All 3 of these cumulative projects drain into Big Bear Lake and will have to comply with the same TMDL standards and the Water Quality Management Plan for Urban Runoff as outlined in the Santa Ana Regions NPDES Permit and Water Discharge Requirements. Therefore, the cumulative impacts and mitigation for the project would be limited to those associated with Moon Camp project.

4.0 PROPOSED MITIGATION

Mitigation is required to reduce impacts due to the development of Moon Camp Tentative Tract 16136. The following section discussed both storm water conveyance and storm water quality mitigation measures that will need to be addressed to bring the proposed impacts to a less than significant level.

4.1 Hydrologic Impacts

The Moon Camp Development will result in an increase in impervious areas on site. There is a net increase of 8.7 cfs in the 10-year storm event and 9.5 cfs in the 100-year storm will flow into Big Bear Lake. The developer plans on placing cross culverts and catch basins along the road to catch the storm water, to prevent flooding and erosion onsite. In addition, the cross culverts under Highway 38 will be sized to contain the 100-year storm event. All runoff flows would be outleted into Big Bear Lake.

4.1.1 Hydrologic Mitigation

Provided that the proposed cross culverts are sized for 100-year burn and bulking flow rates. The burn and bulking method will increase the runoff from the natural areas. San Bernardino County Hydrology Manual does not contain a burning and bulking method, therefore the method found in the Los Angeles County Hydrology Manual is recommended. In addition, the cross culverts should all be designed with headwalls to prevent CMP crushing, and maintained adequately. No additional hydrologic mitigation is required.

4.2 Floodplain Impacts

The proposed development does not impact any mapped flood plains. Moon Camp is defined by the Federal Emergency Management Agency as an area outside of the 100-year and 500-year flood zones. No mitigation is proposed.

4.3 Jurisdictional Water Impacts

The project will impact the riparian habitat associated with the development of Tract #16136. This impact will require mitigation in the form of resource agency permitting.

4.3.1 Resource Agency Permitting

The project would likely have to obtain the following permits for the expansion project:

1. U.S. Army Corps of Engineers 404 Permit
2. Santa Ana Regional Water Quantity Control Board – Clean Water Act Section 401 Permit.
3. California State Water Resource Control Board – General Storm Water Permit for Construction and Storm Water Pollution Prevention Plan (SWPPP)
4. California Department of Fish and Game Section 1603 Streambed Alteration Agreement

4.4 Water Quality Impacts

The development of Tract # 16136 will increase the impervious area, which will impact storm water quality. The project will increase pollutant loading in Big Bear Lake, which is immediately offsite. The lake is impaired due to the following pollutants: copper, mercury, metals, noxious aquatic plants, nutrients, and sediment and siltation. The 303(d) list currently indicates that all of the listed pollutants are a "high" priority. A "high" priority indicates that the receiving water body will be subject to Total Maximum Loads (TMDL) by the year 2005. Based on the current Draft 303(d) list it appears that the Santa Ana Regional Water Quality Control Board is currently developing TMDLs for Big Bear Lake. Therefore, the proposed mitigation should focus on meeting potential TMDLs for Big Bear Lake. Mitigation is required for water quality impacts. Mitigation must include the development of a Water Quality Management Plan (WQMP) containing both structural and non-structural Best Management Practices (BMPs). The WQMP will be based on the San Bernardino County WQMP guidelines and NPDES permits that will be in effect as of January 2004(As discussed in Section 1.2).

4.4.1 Non-Structural and Source Control BMPs Mitigation

The Water Quality Management Plan must be developed, which includes both Non-Structural and Source Control BMPs. The development of the WQMP must conform to the San Bernardino County Draft NPDES permit and the WQMP standards.

The following are the minimum required mitigation from the *Water Quality Management Plan (WQMP) for Urban Runoff.*

Education for Property Owners, Tenants and Occupations – The Property Owners Association is required to provide awareness educational material, including information provided by San Bernardino County. The materials will include a description of chemicals that should be limited to the property and proper disposal, including prohibition of hosing waste directly to gutters, catch basins, storm drains or the lake.

Activity Restrictions – The developer will prepare conditions, covenants and restriction of the protection of surface water quality.

Common Area Landscape Management – For the common landscape areas ongoing maintenance consistent with County Administrative Design Guidelines or city equivalent, plus fertilizer and pesticide usage consistent with the instructions contained on product labels and with regulation administered by the State Department of Pesticide Regulation or county equivalent.

Common Area Catch Basin Inspection – Property Owners Associations are required to have privately owned catch basins cleaned and maintained, as needed. To prevent sediment, garden waste, trash and other pollutants from entering the public streets and storm drain systems.

Common Area Litter Control – POAs are required to implement trash management and litter control procedures to minimize pollution to drainage waters.

Street Sweeping Private Streets and Parking Lots – Streets and Parking lots need to be sweeped as needed, to prevent sediment, garden waste, trash and other pollutants from entering the public streets and storm drain systems.

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

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 - May apply to maintenance and security vehicles.

SC72 Vegetation Controls – Vegetation control typically includes chemical (herbicide) application and mechanical methods. Chemical methods are discussed in SC10. Mechanical methods include leaving existing vegetation, cutting less frequently, hand cutting, planting low maintenance vegetation, collecting and properly disposing of clippings and cuttings, and educating employees and the public.

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 inlets or outlets, in which case flushing may be advisable.

4.4.2 Structural/Treatment BMPs Mitigation

The Water Quality Management Plan (WQMP) includes Structural or Treatment BMPs. The structural BMPs utilized should focus on meeting potential TMDL requirements for noxious aquatic plants, nutrients, sedimentation and siltation. The structural BMPs should conform to the San Bernardino County NPDES permit and the San Bernardino WQMP standards.

The WQMP guidelines contained in the *Draft National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirements* for San Bernardino County states that Structural BMPs will be required for all new developments. They will be sized to comply with one of the following numeric sizing criteria or be considered by the permittees to provide equivalent or better treatment.

Volume Based BMPs shall be designed to infiltrate or treat either:

1. The volume of runoff produced from the 85th percentile 24-hour storm event, as determined from the local historical rainfall record; or
2. The volume of the annual runoff produced by the 85th percentile 24-hours rainfall event, determined as the maximized capture storm water volume for the area, from the formula recommended in Urban Runoff Quality Management, WEF Manual of Practice No. 23/ASCE Manual of Practice No. 87 (1998); or
3. The volume of annual runoff based on unit basin storage volume, to achieve 80% or more volume treatment by the method recommended in California Stormwater Best Management Practice Handbook – Industrial/Commercial (1993); or
4. The volume of runoff, as determined from the local historical rainfall record, that achieves approximately the same reduction in pollutant loads and flows as achieved by mitigation of the 85th percentile 24-hour runoff event.

OR

Flow –based BMPs shall be designed to infiltrate or treat either:

1. The maximum flow rate of runoff produced from a rainfall intensity of 0.2 inch of rainfall per hour; or
2. The maximum flow rate of runoff produced by the 85th percentile hourly rainfall intensity, as determined from the local historical rainfall record, multiplied by a factor of two; or
3. The maximum flow rate of runoff, as determined from the local historical rainfall record that achieved by mitigation of the 85th percentile hourly rainfall intensity multiplied be a factor of two.

The following are the minimum required mitigation from the *Water Quality Management Plan (WQMP) for Urban Runoff.*

Control of Impervious Runoff – Surface runoff shall be directed to landscape areas or pervious areas.

Common area Efficient Irrigation – Physical implementation of landscape plan consistent with County Administrative Design Guidelines or city equivalent, which may include provision of water sensors, programmable irrigation times, etc.

Common Area Runoff-Minimizing Landscape Design – Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration.

Catch Basin Stenciling – Put "No Dumping – Flows to Lake" or equivalent effective phrase, to be stenciled on catch basins to alert the public as to the destination of pollutant discharging into storm drain.

Debris Posts – Are necessary to prevent large floatable debris from entering the storm drains. They are place upstream of the cross culverts.

Inlet Trash Racks – Where appropriate to reduce intake and transport through the storm drain system of large floatable debris, trash racks shall be provided where drainage from open areas entering storm drain or cross culverts.

Since no treatment BMPs are currently proposed on site, the mitigation for storm water treatment under the NPDES Permit and the future TMDL requirements will require the construction of treatment BMPs. The Treatment BMPs appropriate for onsite use are infiltration trenches and basins, swales, inlet filtration, and/or water quality basins. The mitigation requires that all storm water runoff be treated before leaving the site to reduce pollutants in Big Bear Lake. It is possible that by the time the project is developed that the site will be subject to TMDL requirements.

Infiltration Trenches and Basins

Infiltration Trenches and/or Basins may be used on site to meet potential future TMDLs for noxious aquatic plants and nutrients. Infiltration trenches and basins treat storm water runoff through filtration. A typical infiltration trench is essentially an excavated trench, which is lined with filter fabric and backfilled with stones. Depth of the infiltration trench ranges from 3 to 8 feet and functions best in areas with permeable soils, and water table and bedrock depth situated well below the bottom of the trench. Trenches should not be used to trap coarse sediments, because large sediment will likely clog the trench. Grass buffers can be installed to capture sediment before it enters the trench to minimize clogging. Infiltration basins are generally used for drainage areas between 5 to 50 acres. Infiltration basins can be either in-line or off-line, and may treat different volumes such as the water quality volume or the 2-year or 10-year storm.

Swales

One appropriate treatment is either vegetative swales, enhanced vegetated swales utilizing check dams and wide depressions, a series of small detention facilities designed similarly to a dry detention basin, or a combination of these treatment methods into a treatment train (A series of Structural BMPs). It is essential that the Water Quality Management Plan address treatment for Moon Camp to assure that the runoff from the site be treated to the "maximum extent practicable".

In order for the vegetation swales to be effective in the removal of potential pollutants, the swales must be treated as water quality features and must be maintained differently than grass areas. Specifically, pesticides, herbicide, and fertilizers, which may be used on the grass areas, must not be used in the vegetation swales.

Filtration

Another appropriate treatment is filtration, which could be accomplished using drop-in infiltration devices or inline devices.

Drop-infiltration devices at all curb inlets within the internal parking lots could provide potential pollutant removal. Existing examples of these filtration devices include the Drain Pac Storm Drain Inserts and Fossil Filters. These types of devices are efficient at removing oil and grease, debris, and suspended solids from treated waters. Some of these devices have also exhibited high efficiencies at removing heavy metals and other pollutants.

Inline devices suggested for use onsite include the Continuous Deflection Separator (CDS® unit). Once the runoff has entered the storm drain, an in-line diversion will direct the treatment flow to a CDS® unit. The CDS® unit is a non-blocking, non-mechanical screening system, which will provide a second line of defense for solids removal. Adsorption materials can be added within the CDS® unit to aid in the removal of oil and grease. The treated flow will exit the CDS® unit and continue downstream.

To assure the efficiency of these filtration devices, monitoring is necessary. The use of street sweeps on the parking lots and streets will help reduce the amounts of sediment and debris that flow through the devices. This will extend the effectiveness of the devices during a storm and will lower the frequency of required maintenance. Even so, the devices should be checked and cleaned, if necessary, once a month during the rainy season, following any precipitation and at the end of the dry season prior to the first precipitation event of the rainy season.

These filtration units could potentially be used in other areas besides the parking lot inlets. Another potential locations is at the downstream end of the tributary pipes that feed the discharge point. Sitting these units a downstream point will allow for the treatment of more runoff.

Water Quality / Extended Detention Basin

Another effective mitigation measure for impacts to water quality is the construction of a water quality basin. The purpose of the extended detention basin is to aid in the removal mechanism: settling or sedimentation; adsorption to sediments, vegetation, or detritus: filtration by plants; microbial uptake and/or transformation; and uptake by wetland plants or algae. The removal of the urban runoff pollutants occurs during the slow draining of the basin (minimum 24-hours).

Water Quality Basins are expected to reduce the following pollutants: total suspended solids, total phosphorous, total nitrogen, chemical oxygen demand (COD), total lead, total zinc, total copper, and bacteria. This will help reduce the pollutants entering Big Bear Lake.

4.4.3 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 a project such as Moon Camp development typically produces potential 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) will need to be prepared and submitted to the Santa Ana Regional Water Quality 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) must be completed 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 will 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 other 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 11Mulching – 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 should 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 it 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 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 will 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 will 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 will provide a sediment trap.

ESC 54 Storm Drain Inlet Protection – Devises 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.

4.5 Groundwater Impacts

5.0 CONCLUSION

The development of Moon Camp Tract # 16136 will have less than significant impacts to Hydrology and Water Quality following the implementation of all mitigation described in Section 4.0.

Table No. 9 – Project Impact Evaluation

Description of Impact Would the Project:	Without Mitigation Impact	With Mitigation Impact?
1. Violate any water quality standards or waste discharge requirements?	Potentially Significant Unless Mitigated	Less Than Significant Impact
2. Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted?	Less Than Significant Impact	Less Than Significant Impact
3. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of stream or river, in a manner, which would result in substantial erosion or siltation on- or off-site?	Potentially Significant Unless Mitigated	Less Than Significant Impact
4. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner, which would result in flooding on- or off-site?	Potentially Significant Unless Mitigated	Less Than Significant Impact
5. Create or contribute runoff water, which would exceed the capacity of existing or planned storm water drainage systems or provide substantial additional sources of polluted runoff?	Potentially Significant Unless Mitigated	Less Than Significant Impact
6. Otherwise substantially degrade water quality?	Potentially Significant Unless Mitigated	Less Than Significant Impact
7. Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or flood Insurance Rate Map or other flood hazard delineation map?	No Impact	No Impact
8. Place within a 100-year flood hazard area structures, which would impede or redirect flood flows?	No Impact	No Impact

Table No. 9 – Project Impact Evaluation		
Description of Impact Would the Project:	**Without Mitigation Impact**	**With Mitigation Impact?**
9. Exposed people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	No Impact	No Impact
10. Inundation by seiche, tsunami, or mudflow?	Potentially Significant Unless Mitigated	Less Than Significant Impact
11. Change in absorption rate?	Less Than Significant Impact	Less Than Significant Impact
12. Change in the amount of surface water in any water body?	Less Than Significant Impact	Less Than Significant Impact
13. Change in the current, or course of direction of water movement?	Potentially Significant Unless Mitigated	Less Than Significant Impact
14. Altered direction or rate of flow of ground water?	Less Than Significant Impact	Less Than Significant Impact
15. Storm water discharges that would significantly impair the beneficial uses of receiving waters or areas that provide water quality benefits (e.g., riparian corridors, wetlands, etc.)?	Potentially Significant Unless Mitigated	Less Than Significant Impact
16. Harm to the biological integrity of drainage system and water bodies?	Potentially Significant Unless Mitigated	Less Than Significant Impact

The following discussion briefly explains the reasoning behind the impact evaluation in Table 9.

1. The project has the potential to violate water quality standards due to an increase in the level of activity on Moon Camp Tract # 16136. Without mitigation, Moon Camp would be expected to increase pollutant loadings, including hydrocarbons, fertilizers, and pesticides. The mitigation described in Section 4.0 includes a comprehensive Water Quality Management Plan (WQMP) for Urban Runoff, including both Structural and Non-Structural BMPs, which complies with the requirements made by the Santa Ana Regional Water Quality Control Board. This mitigation will reduce the potential impacts to a less than significant impact level.

2. The project site slightly decreases the pervious surface, however the groundwater table would not likely experience significant impacts due to the clayey soils onsite. In addition, by adding the water quality basin or infiltration trench the underground aquifers may have some recharge.

3. The proposed project will alter drainage areas and percent pervious areas on the Moon Camp site, which could be considered potentially significant to siltation and erosion potential unless mitigated. The proposed project includes storm drains, catch basins and cross culverts, which will reduce erosion. By placing inline filtration devices and water quality basins the suspended solids being deposited into Big Bear Lake will be reduces to a less then significant level.

4. The proposed project alters the drainage patterns on-site and slightly increases the amount of runoff leaving the site. Since the flow leaving the site will be contained in appropriately sized cross culverts and storm drain systems, there is no flooding on or off site.

5. The project creates runoff that has the potential to produce additional sources of polluted runoff as described in 1, above. The suggested water quality BMP's will reduce the impacts to a less than significant level.

6. The project has the potential to significantly impact water quality unless it is mitigated. See discussion in 1, above. Mitigation can reduce the impacts to a less than significant level.

7. There is no existing mapped flood hazard on-site. Therefore, there is no impact.

8. There is no existing mapped flood hazard on-site. Therefore, construction of the project would not place structures in a 100-year flood hazard area.

9. The proposed project contains adequate storm drain system to convey flows to the lake; therefore, no structures are expected to be affected by flooding. Also, no flooding hazard currently exist onsite resulting in no impacts.

10. The project is located in an area that has a potential to be affected by mudflows, in the natural areas with slopes greater then 33%. See discussion in Section 4 on "Burning and Bulking" . Mitigation can reduce the impacts to a less than significant level.

11. The absorption rate will not significantly change from existing to proposed condition due to the clayey content of onsite soils.

12. For the overall watershed there is an increase on 8.7 cfs in the 10-year storm and 9.5 cfs in a 100-year storm event. There is minimal change to the amount of surface water entering the lake. The additional flow is only two percent greater in the proposed condition than in the existing condition.

13. The direction of flow will alter due to proposed grading and changes in land uses. In the proposed project storm drains, catch basins and cross culverts are proposed providing less than significant level of impact.

14. There will be less then significant impacts to groundwater flow due to minor changes in impervious areas as discussed in 13, above.

15. The project is proposed in areas that will potentially contain riparian habitat. The area also discharges into Big Bear Lake, which is listed on the 303(d) list. Per the 303(d) list, the water body is impaired for various metals, noxious aquatic plants, nutrients, siltation and sedimentation. The Santa Ana Regional Board is currently developing TMDL standards for Big Bear Lake. It is anticipated that the Moon Camp project will have to conform to these future TMDLs by appropriate use of structural BMPs as outlined in Section 4.0. Mitigation associated with permit processing and development of the WQMP will reduce the impact to a less then significant level.

16. If the concentrated flows were not properly controlled and treated, the project would have the potential to harm biological integrity of the water body. The proposed storm drain and suggested treatment BMPs will reduce this impact to a less then significant level, see discussion in 15, above.

6.0 REFERENCES

Camp Dresser & McKee, et al., 1993. California Storm Water Best Management Practice Handbooks - Construction Activity. March 1993.

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Hicks & Hartwick, Inc. Moon Camp Tentative Tract No. 16136 Preliminary Drainage Study Hydrology and Hydraulics Summary Report. April 2002.

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San Bernardino County Department of Public Works, The County of San Bernardino, and Incorporated Cities of San Bernardino County within the Santa Ana Region. California Regional Water Quality Control Board Santa Ana Region National Pollutant Discharge Elimination System (NPDES) Permit and Water Discharge Requirements. Draft April 9, 2002.

San Bernardino County Stormwater Program. Guidelines for New Developments and Redevelopments. June 2000.

Moon Camp Tentative Tract 16136

APPENDIX A

Modified Rational Method - Existing Condition
10 year and 100 year

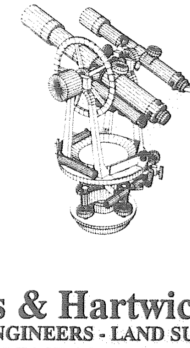
FAWNSKIN, CALIFORNIA
MOON CAMP
Tentative Tract 16136

PRELIMINARY DRAINAGE STUDY
HYDROLOGY AND HYDRAULICS
SUMMARY REPORT

APRIL 2002

EXHIBIT A
EXISTING HYDROLOGY

10-YEAR RUNOFF



Hicks & Hartwick, Inc.
CIVIL ENGINEERS - LAND SURVEYORS
37 EAST OLIVE AVENUE
REDLANDS, CALIFORNIA 92373
909.793.2257 or FAX 909.792.3763

TRACT No. 16136 MOON CAMP (JN 9373)
EXISTING HYDROLOGY
AREA A

[SAN BERNARDINO COUNTY]

FILE NAME:9373HEAH.DAT
TIME/DATE OF STUDY: 11:20 4/11/2002
100.0-YEAR STORM RATIONAL METHOD STUDY (AMC III LOSSES)

CALCULATED BY: R.CLARK
CHECKED BY: R.CLARK
PAGE NUMBER 1 OF 2

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CONCENTRATION POINT NUMBER	AREA (ACRES) SUBAREA	SUM	SOIL TYPE	DEV. TYPE	Tt MIN.	Tc MIN.	I in/h	Fm	Fm (Avg)	Q SUM	PATH (ft)	SLOPE ft/ft	V FPS.	HYDRAULICS AND NOTES
2.00	3.0	3.0	D	Nat	..	16.6	4.60	.14	.140	12.2	779	.3440	..	INITIAL SUBAREA
5.0ft-GUTTER FLOW TO PT.# 3.00	9.4	12.5	D	Nat	.8	17.4	4.45	.14	.140	48.4	730	.1603	15.1	Qest.= 30.2cfs XFALL= .20000 n=.0300 D= 1.2
5.0ft-GUTTER FLOW TO PT.# 7.00	17.2	29.7	D	Nat	.9	18.3	4.29	.14	.140	111.0	869	.1438	17.1	Qest.= 80.5cfs XFALL= .20000 n=.0300 D= 1.4
7.00		29.7				18.3	4.29			111.0				FOR CONFLUENCE
5.00	4.7	4.7	D	Nat	..	18.4	4.29	.14	.140	17.4	890	.2719	..	INITIAL SUBAREA
5.0ft-GUTTER FLOW TO PT.# 6.00	12.6	17.3	D	Nat	.9	19.2	4.15	.14	.140	62.5	719	.1405	14.6	Qest.= 40.2cfs XFALL= .20000 n=.0300 D= 1.2
5.0ft-GUTTER FLOW TO PT.# 7.00	8.8	26.1	D	Nat	.8	20.0	4.04	.14	.140	91.6	719	.1293	15.8	Qest.= 77.9cfs XFALL= .20000 n=.0300 D= 1.4

CONFLUENCE ANALYSIS FOR POINT# 7.00

PEAK FLOW RATE(CFS) = 200.5
TIME OF CONCENTRATION(MIN.) = 18.3
MEAN VALUES: Fp(IN/HR) = .140; Ap = 1.000; Fm(IN/HR) = .140
EFFECTIVE AREA(ACRES) = 53.66 TOTAL AREA(ACRES) = 55.85

Q(cfs)	Tc(min)	Fp(avg)	Ap(avg)	Fm(avg)	I(in/hr)	Ae(acres)	NODE
200.47	18.32	.140	1.00	.140	4.29	53.66	1.0
195.84	19.99	.140	1.00	.140	4.04	55.85	4.0

LARGEST CONFLUENCE Q= 200.5

TRACT No. 16136 MOON CAMP (JN 9373)
EXISTING HYDROLOGY
AREA A

[SAN BERNARDINO COUNTY]

FILE NAME: 9373HEAH.DAT
TIME/DATE OF STUDY: 11:20 4/11/2002
100.0-YEAR STORM RATIONAL METHOD STUDY (AMC III LOSSES)

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CONCENTRATION POINT NUMBER	AREA (ACRES) SUBAREA	SUM	SOIL TYPE	DEV. TYPE	Tt MIN.	Tc MIN.	I in/h	Fm	Fm (Avg)	Q SUM	PATH (ft)	SLOPE ft/ft	V FPS.	HYDRAULICS AND NOTES
5.0ft-GUTTER FLOW TO PT.# 8.00	24.9	78.5	C	Nat	1.3	19.6	4.09	.22	.165	277.3	1261	.0896	16.4	Qest.= 243.7cfs XFALL= .20000 n=.0300 D= 2.3
5.0ft-GUTTER FLOW TO PT.# 9.00	16.8	95.4	C	Nat	1.6	21.2	3.87	.22	.174	317.3	1233	.0487	13.1	Qest.= 305.0cfs XFALL= .20000 n=.0300 D= 2.7
9.00		95.4			----	21.2				317.3	----	-----	----	STREAM SUMMARY

EFFECTIVE AREA(ACRES) = 95.36 TOTAL AREA(ACRES) = 97.55 PEAK FLOW RATE(CFS) = 317.33
TIME OF CONCENTRATION(MIN.) = 21.22 MEAN VALUES: Fp(IN/HR) = .174; Ap = 1.000; Fm(IN/HR) = .174

PEAK FLOW RATE TABLE

Q(cfs)	Tc(min)	Fp(avg)	Ap(avg)	Fm(avg)	I(in/hr)	Ae(acres)	NODE
317.34	21.22	.174	1.00	.174	3.87	95.36	1.0
306.92	22.91	.173	1.00	.173	3.67	97.55	4.0

TRACT No. 16136 MOON CAMP (JN 9373)
EXISTING HYDROLOGY
AREA B

[SAN BERNARDINO COUNTY]

FILE NAME:9373HEBH.DAT
TIME/DATE OF STUDY: 11:22 4/11/2002
100.0-YEAR STORM RATIONAL METHOD STUDY (AMC III LOSSES)

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PAGE NUMBER 1 OF 1

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CONCENTRATION POINT NUMBER	AREA (ACRES) SUBAREA	SUM	SOIL TYPE	DEV. TYPE	Tt MIN.	Tc MIN.	I in/h	Fm	Fm (Avg)	Q SUM	PATH (ft)	SLOPE ft/ft	V FPS.	HYDRAULICS AND NOTES
2.00	8.5	8.5	C	1D/AC	..	10.3	6.43	.22	.218	47.3	997	.1956	..	INITIAL SUBAREA
3.00					.0						34	.0588	12.1	Qpipe= 47.3cfs n=.0240 D= 1.9 30.0"-PIPE
3.00		8.5				10.3				47.3				STREAM SUMMARY

EFFECTIVE AREA(ACRES)= 8.46 TOTAL AREA(ACRES)= 8.46 PEAK FLOW RATE(CFS)= 47.26
TIME OF CONCENTRATION(MIN.)= 10.34 MEAN VALUES: Fp(IN/HR) = .272; Ap = .800; Fm(IN/HR) = .218

TRACT No. 16136 MOON CAMP (JN 9373)
EXISTING HYDROLOGY
AREA C

[SAN BERNARDINO COUNTY]

FILE NAME:9373HECH.DAT
TIME/DATE OF STUDY: 11:24 4/11/2002
100.0-YEAR STORM RATIONAL METHOD STUDY (AMC III LOSSES)
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PAGE NUMBER 1 OF 1

CONCENTRATION POINT NUMBER	AREA (ACRES) SUBAREA	SUM	SOIL TYPE	DEV. TYPE	Tt MIN.	Tc MIN.	I in/h	Fm	Fm (Avg)	Q SUM	PATH (ft)	SLOPE ft/ft	V FPS.	HYDRAULICS AND NOTES
2.00	3.0	3.0	C	2.5AC	..	9.4	6.85	.24	.245	17.9	794	.2355	..	INITIAL SUBAREA
2.00		3.0				9.4				17.9				STREAM SUMMARY

EFFECTIVE AREA(ACRES) = 3.01 TOTAL AREA(ACRES) = 3.01 PEAK FLOW RATE(CFS) = 17.88
TIME OF CONCENTRATION(MIN.) = 9.40 MEAN VALUES: Fp(IN/HR) = .272; Ap = .900; Fm(IN/HR) = .245

TRACT No. 16136 MOON CAMP (JN 9373)
EXISTING HYDROLOGY
AREA D

[SAN BERNARDINO COUNTY]

FILE NAME:9373HEDH.DAT
TIME/DATE OF STUDY: 11:25 4/11/2002
100.0-YEAR STORM RATIONAL METHOD STUDY (AMC III LOSSES)

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PAGE NUMBER 1 OF 1

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CONCENTRATION POINT NUMBER	AREA (ACRES) SUBAREA	SUM	SOIL TYPE	DEV. TYPE	Tt MIN.	Tc MIN.	I in/h	Fm	Fm (Avg)	Q SUM	PATH (ft)	SLOPE ft/ft	V FPS.	HYDRAULICS AND NOTES
2.00	2.3	2.3	C	2.5AC	..	10.0	6.53	.24	.245	12.8	774	.1602	..	INITIAL SUBAREA
2.00		2.3				10.0				12.8				STREAM SUMMARY

EFFECTIVE AREA(ACRES) = 2.26 TOTAL AREA(ACRES) = 2.26 PEAK FLOW RATE(CFS) = 12.79
TIME OF CONCENTRATION(MIN.) = 10.05 MEAN VALUES: Fp(IN/HR) = .272; Ap = .900; Fm(IN/HR) = .245

TRACT No. 16136 MOON CAMP (JN 9373)
EXISTING HYDROLOGY
AREA E

[SAN BERNARDINO COUNTY]

FILE NAME:9373HEEH.DAT
TIME/DATE OF STUDY: 11:26 4/11/2002
100.0-YEAR STORM RATIONAL METHOD STUDY (AMC III LOSSES)

CALCULATED BY: R.CLARK
CHECKED BY: R.CLARK
PAGE NUMBER 1 OF 1

CONCENTRATION POINT NUMBER	AREA (ACRES) SUBAREA	SUM	SOIL TYPE	DEV. TYPE	Tt MIN.	Tc MIN.	I in/h	Fm	Fm (Avg)	Q SUM	PATH (ft)	SLOPE ft/ft	V FPS.	HYDRAULICS AND NOTES
2.00	1.5	1.5	C	Nat	..	19.9	4.05	.22	.218	5.0	683	.1069	..	INITIAL SUBAREA
2.00		1.5				19.9				5.0				STREAM SUMMARY

EFFECTIVE AREA(ACRES)= 1.45 TOTAL AREA(ACRES)= 1.45 PEAK FLOW RATE(CFS)= 5.00
TIME OF CONCENTRATION(MIN.)= 19.90 MEAN VALUES: Fp(IN/HR) = .218; Ap = 1.000; Fm(IN/HR) = .218

TRACT No. 16136 MOON CAMP (JN 9373)
EXISTING HYDROLOGY
AREA F

[SAN BERNARDINO COUNTY]

FILE NAME:9373HEFH.DAT
TIME/DATE OF STUDY: 11:27 4/11/2002
100.0-YEAR STORM RATIONAL METHOD STUDY (AMC III LOSSES)

CALCULATED BY: R.CLARK
CHECKED BY: R.CLARK
PAGE NUMBER 1 OF 1

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CONCENTRATION POINT NUMBER	AREA (ACRES) SUBAREA	SUM	SOIL TYPE	DEV. TYPE	Tt MIN.	Tc MIN.	I in/h	Fm	Fm (Avg)	Q SUM	PATH (ft)	SLOPE ft/ft	V FPS.	HYDRAULICS AND NOTES
2.00	4.1	4.1	C	Nat	..	20.0	4.03	.22	.218	14.1	848	.1592	..	INITIAL SUBAREA
5.0ft-GUTTER FLOW TO PT.# 3.00	18.7	22.8	C	Nat	1.1	21.1	3.89	.22	.218	75.2	1044	.1935	17.3	Qest.= 44.4cfs XFALL= .20000 n=.0300 D= 1.2
5.0ft-GUTTER FLOW TO PT.# 4.00	22.1	44.9	C	Nat	1.5	22.5	3.71	.22	.218	141.1	1109	.0712	13.3	Qest.= 110.0cfs XFALL= .20000 n=.0300 D= 1.8
5.00					.1						51	.0588	15.9	Qpipe= 141.1cfs n=.0240 D= 2.8 45.0"-PIPE
5.00		44.9				22.6				141.1				STREAM SUMMARY

EFFECTIVE AREA(ACRES)= 44.88 TOTAL AREA(ACRES)= 44.88 PEAK FLOW RATE(CFS)= 141.09
TIME OF CONCENTRATION(MIN.)= 22.59 MEAN VALUES: Fp(IN/HR) = .218; Ap = 1.000; Fm(IN/HR) = .218

TRACT No. 16136 MOON CAMP (JN 9373)
EXISTING HYDROLOGY
AREA G

[SAN BERNARDINO COUNTY]

FILE NAME:9373HEGH.DAT
TIME/DATE OF STUDY: 11:28 4/11/2002
100.0-YEAR STORM RATIONAL METHOD STUDY (AMC III LOSSES)

CALCULATED BY: R.CLARK
CHECKED BY: R.CLARK

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CONCENTRATION POINT NUMBER	AREA (ACRES) SUBAREA	SUM	SOIL TYPE	DEV. TYPE	Tt MIN.	Tc MIN.	I in/h	Fm	Fm (Avg)	Q SUM	PATH (ft)	SLOPE ft/ft	V FPS.	HYDRAULICS AND NOTES
2.00	3.0	3.0	C	Nat	..	18.1	4.32	.22	.218	10.9	781	.2228	..	INITIAL SUBAREA
2.00		3.0				18.1				10.9				STREAM SUMMARY

EFFECTIVE AREA(ACRES)= 2.96 TOTAL AREA(ACRES)= 2.96 PEAK FLOW RATE(CFS)= 10.93
TIME OF CONCENTRATION(MIN.)= 18.13 MEAN VALUES: Fp(IN/HR) = .218; Ap = 1.000; Fm(IN/HR) = .218

TRACT No. 16136 MOON CAMP (JN 9373)
EXISTING HYDROLOGY
AREA H

[SAN BERNARDINO COUNTY]

FILE NAME:9373HEHH.DAT
TIME/DATE OF STUDY: 11:29 4/11/2002
100.0-YEAR STORM RATIONAL METHOD STUDY (AMC III LOSSES)
[(c) 1983-1994 ADVANCED ENGINEERING SOFTWARE]

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PAGE NUMBER 1 OF 1

CONCENTRATION POINT NUMBER	AREA (ACRES) SUBAREA	SUM	SOIL TYPE	DEV. TYPE	Tt MIN.	Tc MIN.	I in/h	Fm	Fm (Avg)	Q SUM	PATH (ft)	SLOPE ft/ft	V FPS.	HYDRAULICS AND NOTES
2.00	9.4	9.4	C	2.5AC	..	9.6	6.72	.24	.245	54.6	833	.2281	..	INITIAL SUBAREA
2.00		9.4				9.6				54.6				STREAM SUMMARY

EFFECTIVE AREA(ACRES) = 9.36 TOTAL AREA(ACRES) = 9.36 PEAK FLOW RATE(CFS) = 54.58
TIME OF CONCENTRATION(MIN.) = 9.64 MEAN VALUES: Fp(IN/HR) = .272; Ap = .900; Fm(IN/HR) = .245

TRACT No. 16136 MOON CAMP (JN 9373)
EXISTING HYDROLOGY
AREA I

[SAN BERNARDINO COUNTY]

FILE NAME: 9373HEIH.DAT
TIME/DATE OF STUDY: 11:30 4/11/2002
100.0-YEAR STORM RATIONAL METHOD STUDY (AMC III LOSSES)

CALCULATED BY: R.CLARK
CHECKED BY: R.CLARK

[(c) 1983-1994 ADVANCED ENGINEERING SOFTWARE]

CONCENTRATION POINT NUMBER	AREA (ACRES) SUBAREA	SUM	SOIL TYPE	DEV. TYPE	Tt MIN.	Tc MIN.	I in/h	Fm	Fm (Avg)	Q SUM	PATH (ft)	SLOPE ft/ft	V FPS.	HYDRAULICS AND NOTES
2.00	4.3	4.3	C	4D/AC	..	9.4	6.83	.16	.163	25.7	1050	.1762	..	INITIAL SUBAREA
											705	.1730	15.9	Qpipe= 25.7cfs n=.0240 D= 1.0 24.0"-PIPE
3.00					.7									
3.00	1.8	6.1	C	2.5AC		10.2	6.48	.24	.188	34.7				ADD SUBAREA
5.0ft-GUTTER FLOW TO PT.#											292	.0514	9.2	Qest.= 48.9cfs XFALL= .20000 n=.0300 D= 1.2
4.00	5.3	11.4	C	Nat	.6	10.7	6.25	.22	.202	61.9				
											73	.0274	9.8	Qpipe= 61.9cfs n=.0240 D= 2.3 39.0"-PIPE
5.00					.1									
5.00		11.4				10.8				61.9				STREAM SUMMARY

EFFECTIVE AREA(ACRES)= 11.38 TOTAL AREA(ACRES)= 11.38 PEAK FLOW RATE(CFS)= 61.91
TIME OF CONCENTRATION(MIN.)= 10.84 MEAN VALUES: Fp(IN/HR) = .242; Ap = .833; Fm(IN/HR) = .202

FAWNSKIN, CALIFORNIA
MOON CAMP
Tentative Tract 16136

PRELIMINARY DRAINAGE STUDY
HYDROLOGY AND HYDRAULICS
SUMMARY REPORT

APRIL 2002

EXHIBIT B
EXISTING HYDROLOGY

100-YEAR RUNOFF

Hicks & Hartwick, Inc.
CIVIL ENGINEERS - LAND SURVEYORS
37 EAST OLIVE AVENUE
REDLANDS, CALIFORNIA 92373
909.793.2257 or FAX 909.792.3763

TRACT No. 16136 MOON CAMP (JN 9373)
EXISTING HYDROLOGY
AREA A

[SAN BERNARDINO COUNTY]

FILE NAME:9373HEAT.DAT
TIME/DATE OF STUDY: 11:20 4/11/2002
10.0-YEAR STORM RATIONAL METHOD STUDY (AMC II LOSSES)

CALCULATED BY: R.CLARK
CHECKED BY: R.CLARK

[(c) 1983-1994 ADVANCED ENGINEERING SOFTWARE]

CONCENTRATION POINT NUMBER	AREA (ACRES) SUBAREA	SUM	SOIL TYPE	DEV. TYPE	Tt MIN.	Tc MIN.	I in/h	Fm	Fm (Avg)	Q SUM	PATH (ft)	SLOPE ft/ft	V FPS.	HYDRAULICS AND NOTES
2.00	3.0	3.0	D	Nat	..	16.6	3.24	.40	.398	7.8	779	.3440	..	INITIAL SUBAREA
5.0ft-GUTTER FLOW TO PT.# 3.00	9.4	12.5	D	Nat	1.2	17.8	3.09	.40	.398	30.3	730	.1603	15.1	Qest.= 19.3cfs XFALL= .20000 n=.0300 D= .8
5.0ft-GUTTER FLOW TO PT.# 7.00	17.2	29.7	D	Nat	1.0	18.8	2.98	.40	.398	69.0	869	.1438	15.2	Qest.= 50.3cfs XFALL= .20000 n=.0300 D= 1.2
7.00		29.7				18.8	2.98			69.0				FOR CONFLUENCE
5.00	4.7	4.7	D	Nat	..	18.4	3.02	.40	.398	11.0	890	.2719	..	INITIAL SUBAREA
5.0ft-GUTTER FLOW TO PT.# 6.00	12.6	17.3	D	Nat	.9	19.2	2.93	.40	.398	39.4	719	.1405	14.1	Qest.= 25.2cfs XFALL= .20000 n=.0300 D= 1.2
5.0ft-GUTTER FLOW TO PT.# 7.00	8.8	26.1	D	Nat	.9	20.1	2.84	.40	.398	57.4	719	.1293	13.8	Qest.= 49.1cfs XFALL= .20000 n=.0300 D= 1.2

CONFLUENCE ANALYSIS FOR POINT# 7.00

PEAK FLOW RATE(CFS) = 125.6
TIME OF CONCENTRATION(MIN.) = 18.8
MEAN VALUES: Fp(IN/HR) = .398; Ap = 1.000; Fm(IN/HR) = .398
EFFECTIVE AREA(ACRES) = 54.15 TOTAL AREA(ACRES) = 55.85

Q(cfs)	Tc(min)	Fp(avg)	Ap(avg)	Fm(avg)	I(in/hr)	Ae(acres)	NODE
125.65	18.78	.398	1.00	.398	2.98	54.15	1.0
122.71	20.09	.398	1.00	.398	2.84	55.85	4.0

LARGEST CONFLUENCE
Q= 125.6

TRACT No. 16136 MOON CAMP (JN 9373)
EXISTING HYDROLOGY
AREA A

[SAN BERNARDINO COUNTY]

FILE NAME:9373HEAT.DAT
TIME/DATE OF STUDY: 11:20 4/11/2002
10.0-YEAR STORM RATIONAL METHOD STUDY (AMC II LOSSES)

CALCULATED BY: R.CLARK
CHECKED BY: R.CLARK

CONCENTRATION POINT NUMBER	AREA (ACRES) SUBAREA	SUM	SOIL TYPE	DEV. TYPE	Tt MIN.	Tc MIN.	I in/h	Fm	Fm (Avg)	Q SUM	PATH (ft)	SLOPE ft/ft	V FPS.	HYDRAULICS AND NOTES
5.0ft-GUTTER FLOW TO PT.# 8.00	24.9	79.0	C	Nat	1.4	20.2	2.83	.52	.436	170.1	1261	.0896	15.0	Qest.= 151.5cfs XFALL= .20000 n=.0300 D= 1.9
5.0ft-GUTTER FLOW TO PT.# 9.00	16.8	95.9	C	Nat	1.7	21.9	2.67	.52	.450	191.5	1233	.0487	11.9	Qest.= 186.4cfs XFALL= .20000 n=.0300 D= 2.3
9.00		95.9				21.9				191.5				STREAM SUMMARY

EFFECTIVE AREA(ACRES)= 95.85 TOTAL AREA(ACRES)= 97.55 PEAK FLOW RATE(CFS)= 191.46
TIME OF CONCENTRATION(MIN.)= 21.94 MEAN VALUES: Fp(IN/HR) = .450; Ap = 1.000; Fm(IN/HR) = .450

PEAK FLOW RATE TABLE

Q(cfs)	Tc(min)	Fp(avg)	Ap(avg)	Fm(avg)	I(in/hr)	Ae(acres)	NODE
191.46	21.94	.450	1.00	.450	2.67	95.85	1.0
185.53	23.26	.449	1.00	.449	2.56	97.55	4.0

TRACT No. 16136 MOON CAMP (JN 9373)
EXISTING HYDROLOGY
AREA B

[SAN BERNARDINO COUNTY]

FILE NAME:9373HEBT.DAT
TIME/DATE OF STUDY: 11:47 4/11/2002
10.0-YEAR STORM RATIONAL METHOD STUDY (AMC II LOSSES)
[(c) 1983-1994 ADVANCED ENGINEERING SOFTWARE]

CALCULATED BY: R.CLARK
CHECKED BY: R.CLARK
PAGE NUMBER 1 OF 1

CONCENTRATION POINT NUMBER	AREA (ACRES) SUBAREA	SUM	SOIL TYPE	DEV. TYPE	Tt MIN.	Tc MIN.	I in/h	Fm	Fm (Avg)	Q SUM	PATH (ft)	SLOPE ft/ft	V FPS.	HYDRAULICS AND NOTES
2.00	8.5	8.5	C	1D/AC	..	10.3	4.54	.45	.453	31.1	997	.1956	..	INITIAL SUBAREA
											34	.0588	11.0	Qpipe= 31.1cfs n=.0240 D= 1.5 27.0"-PIPE
3.00					.1									
3.00		8.5				10.3				31.1				STREAM SUMMARY

EFFECTIVE AREA(ACRES) = 8.46 TOTAL AREA(ACRES) = 8.46 PEAK FLOW RATE(CFS) = 31.08
TIME OF CONCENTRATION(MIN.) = 10.34 MEAN VALUES: Fp(IN/HR) = .566; Ap = .800; Fm(IN/HR) = .453

TRACT No. 16136 MOON CAMP (JN 9373)
EXISTING HYDROLOGY
AREA C

[SAN BERNARDINO COUNTY]

FILE NAME:9373HECT.DAT
TIME/DATE OF STUDY: 11:48 4/11/2002
10.0-YEAR STORM RATIONAL METHOD STUDY (AMC II LOSSES)

CALCULATED BY: R.CLARK
CHECKED BY: R.CLARK

CONCENTRATION POINT NUMBER	AREA (ACRES) SUBAREA	SUM	SOIL TYPE	DEV. TYPE	Tt MIN.	Tc MIN.	I in/h	Fm	Fm (Avg)	Q SUM	PATH (ft)	SLOPE ft/ft	V FPS.	HYDRAULICS AND NOTES
2.00	3.0	3.0	C	2.5AC	..	9.4	4.83	.51	.509	11.7	794	.2355	..	INITIAL SUBAREA
2.00		3.0				9.4				11.7				STREAM SUMMARY

EFFECTIVE AREA(ACRES) = 3.01 TOTAL AREA(ACRES) = 3.01 PEAK FLOW RATE(CFS) = 11.71
TIME OF CONCENTRATION(MIN.) = 9.40 MEAN VALUES: Fp(IN/HR) = .566; Ap = .900; Fm(IN/HR) = .509

TRACT No. 16136 MOON CAMP (JN 9373)
EXISTING HYDROLOGY
AREA D

[SAN BERNARDINO COUNTY]

FILE NAME:9373HEDT.DAT
TIME/DATE OF STUDY: 11:48 4/11/2002
10.0-YEAR STORM RATIONAL METHOD STUDY (AMC II LOSSES)

CALCULATED BY: R.CLARK
CHECKED BY: R.CLARK
PAGE NUMBER 1 OF 1

[(c) 1983-1994 ADVANCED ENGINEERING SOFTWARE]

CONCENTRATION POINT NUMBER	AREA (ACRES) SUBAREA	SUM	SOIL TYPE	DEV. TYPE	Tt MIN.	Tc MIN.	I in/h	Fm	Fm (Avg)	Q SUM	PATH (ft)	SLOPE ft/ft	V FPS.	HYDRAULICS AND NOTES
2.00	2.3	2.3	C	2.5AC	..	10.0	4.61	.51	.509	8.3	774	.1602	..	INITIAL SUBAREA
2.00		2.3				10.0				8.3				STREAM SUMMARY

EFFECTIVE AREA(ACRES) = 2.26 TOTAL AREA(ACRES) = 2.26 PEAK FLOW RATE(CFS) = 8.34
TIME OF CONCENTRATION(MIN.) = 10.05 MEAN VALUES: Fp(IN/HR) = .566; Ap = .900; Fm(IN/HR) = .509

TRACT No. 16136 MOON CAMP (JN 9373)
EXISTING HYDROLOGY
AREA E

[SAN BERNARDINO COUNTY]

FILE NAME:9373HEET.DAT
TIME/DATE OF STUDY: 11:49 4/11/2002
10.0-YEAR STORM RATIONAL METHOD STUDY (AMC II LOSSES)

CALCULATED BY: R.CLARK
CHECKED BY: R.CLARK
PAGE NUMBER 1 OF 1

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CONCENTRATION POINT NUMBER	AREA (ACRES) SUBAREA	SUM	SOIL TYPE	DEV. TYPE	Tt MIN.	Tc MIN.	I in/h	Fm	Fm (Avg)	Q SUM	PATH (ft)	SLOPE ft/ft	V FPS.	HYDRAULICS AND NOTES
2.00	1.5	1.5	C	Nat	..	19.9	2.86	.52	.518	3.1	683	.1069	..	INITIAL SUBAREA
2.00		1.5				19.9				3.1				STREAM SUMMARY

EFFECTIVE AREA(ACRES)= 1.45 TOTAL AREA(ACRES)= 1.45 PEAK FLOW RATE(CFS)= 3.05
TIME OF CONCENTRATION(MIN.)= 19.90 MEAN VALUES: Fp(IN/HR) = .518; Ap = 1.000; Fm(IN/HR) = .518