

**APPENDIX 4.8**

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**Hydrology and Water Quality**

## **HYDROLOGY**

Hydrology is that branch of physical geography which is concerned with the origin, distribution and properties of the waters on earth. Engineering hydrology are those segments pertinent to the design and operation of engineering projects for the control and use of water.

The hydrologic cycle (see Exhibit A) is a useful concept to begin the study of hydrology. The cycle serves to emphasize the four basic phases of interest in hydrology analysis i.e. precipitation, evaporation and transportation, surface runoff and groundwater.

Hydrology is used in engineering mainly in connection with data collection and methods of analysis and application. It is necessary to start with a mass of observed data, analyze these data and establish the systematic pattern that governs these events. Generally, each hydrologic problem is unique in that it deals with a distinct set of physical conditions within a specific watershed or basin. Hence, the quantitative conclusions of one analysis often is not directly transferable to another problem. However, the general solution for most problems can be developed from the application of a few relatively standard procedures.

### **Rational Equation<sup>(1)</sup>**

The rational equation has been widely accepted in Ventura County for use in the design of flood protection measures. When used with adequate input parameters on small drainage areas, it provides reasonable results for use in project design. The basic equation is as follows:

$$Q=CIA$$

Where Q = Peak discharge in cubic feet per second (cfs)

C = Coefficient of runoff (dimensionless)

I = Average rainfall intensity for a duration equal to the time of concentration of the watershed (inches/hour)

A = Drainage area of the watershed (acres)

The rational equation represents the peak rate of runoff (Q) at the point of concentration of flow generated from the most hydrologically remote part of the drainage area.

### **Coefficient of Runoff<sup>(1)</sup>**

Runoff coefficients used in the equation represent the ratio of runoff to rainfall. It is the percentage of rainfall on a watershed that runs off with values from zero for very porous soils to 1.0 for impervious surfaces, and includes the composite effect of such watershed variables as

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<sup>1</sup> Ventura County Hydrology Manual

infiltration, ground slope, ground cover, surface and depression storage, antecedent precipitation and soil moisture, and shape of the watershed or basin. Runoff is not a constant percentage of rainfall, but is the residual of rainfall remaining after losses. The ratio of runoff to rainfall increases as storm intensity increases, hence the runoff coefficient is becomes a function of intensity.

### **Rainfall Intensity Duration<sup>(1)</sup>**

Most precipitation in the Ventura County area results from general winter storms associated with extra tropical cyclones that develop in the North Pacific during the months of November through April. Precipitation during these storms may occur over large areas and major storms normally last four days or more. The first several days of the storm normally contain light, persistent rainfall of moderate intensities. Rainfall during this period satisfies the soil moisture deficiency. The latter portion of the storm is characterized by short periods of extremely high intensities falling on saturated soils.

Utilizing techniques proposed by the California Department of Water Resources, intensity-duration-frequency relationships were computed for all long-term recording rain gage data in Ventura County.

### **Time of Concentration<sup>(1)</sup>**

Time of concentration is the time required for runoff to travel from the hydraulically most distant point of a watershed to its outlet or point of concentration. It is a summation of the travel times associated with overland flow and concentrated flow in streets, pipes and stream channels.

To determine time of concentration, the watershed is divided into contributing sub-areas using topographic barriers as well as streets, known improvement plans, and projected ultimate development.

Travel times are based on normal flow velocities associated with overland flow and flow in various watershed conveyance facilities modified by wave velocity considerations. Overland flow on a canyon side slope or undeveloped hillside is dependent upon slope, topography, cover conditions, and travel distance.

### **Rational Equation for Hydrograph Synthesis<sup>(1)</sup>**

The rational equation computes an instantaneous flow rate based upon an average rainfall intensity over a period equal to the time of concentration of a watershed. When the intensity is the maximum for a given storm, the associated flow rate represents the peak for that storm. When storm intensities less than the peak period intensity are used in the rational equation, resulting flow rates represent some point on the storm hydrograph.

(1) Ditto

Every design storm is made up of a series of intensities that change more or less uniformly throughout. A mass curve of rainfall represents a cumulation of storm totals at any point in a storm and its slope at any point represents the rainfall intensity at that point. By determining an intensity at representative times through a design storm, a runoff hydrograph can be computed using the ration equation.

Each of the intensity-duration curves have an associated mass curve. The mass curves are used to define intensities for all hydrographs.

### **Westside Community Plan**

The Westside Community Development Plan and Westside Redevelopment Area Plan are a part of the Ventura River Watershed and include the following sub-watershed areas.

- 1) Lower Ventura River at Highway 101
- 2) Dent Drain
- 3) Canada de San Joaquin
- 4) Lower Ventura River above Canada de San Joaquin
- 5) Manuel Canyon
- 6) Ventura River above Weldon Canyon
- 7) Weedon Canyon
- 8) Canada Larga Canyon at Ventura Ave.
- 9) Canada de Aliso
- 10) Leon Canyon
- 11) Canada Larga Canyon above Coche Canyon
- 12) Coche Canyon

These sub-watersheds are shown on Exhibit "B" West Ventura EIR sub-watersheds.

Field review was conducted to verify existence of most of the storm drains and their associated catch basins. This information is include on Exhibit "C".

In 1971 Koebig and Koebig prepared a "Master Drainage Plan" for the City of San Buenaventura. The plan provided the hydrology and associated proposed storm drains based on a 10-year and 50-year frequency storms. Said plan included the Westside area extending from West Point Row Avenue northward to Canada de San Joaquin with listing and maps of existing and proposed storm drain facilities in the Westside area.

The City has implemented many of the 1971 studies. However, increased development coupled with changing regulatory requirements resulted in additional drainage deficiencies since completion of the 1971 plan. In 2003 the City completed a "Master Drainage Needs Assessment Study" that evaluated, and prioritized needed improvements for areas with frequent flooding or

damaged from storm runoff. Drainage deficiencies identified within the Westside Communities area are as follows:

- Wall Street Storm Drain (Sediment & Debris)
- Barnett and Cavier Street Storm Drain (Sediment & Debris)
- Vince and Lewis Street Debris Basin Project (Debris Basin Project)
- Sunnyway Drive (Street Flooding)
- James Drive (Street Flooding)
- Stanley Avenue (Street Flooding)
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In February 2010, Ventura County Watershed Protection District (VCWPD) completed the Ventura River Watershed Storm Modeling final report which included the latest data and technical procedures for estimating hydrological runoffs, storm drain design and floodplain analysis, which included the Westside area watershed. The 2010 hydrology increases the estimated peak runoffs by a significant amount – in some cases by factor of two (2). Exhibit “B” lists the peak flows for these sub-watersheds.

In view of the fact that the 1971 peak flows are superceded by the current hydrology due to the many larger storms that have occurred and were recorded since 1971, this would indicate that the existing drainage facilities proposed and subsequently constructed from Koebig and Koebig study are conceivably under capacity under present conditions, and would be further over-taxed with additional development and/or re-development. Following are examples of increase in pipe sizes with peak flows increased by a factor of two.

<b>Koebig &amp; Koebig 1971 Study</b>		<b>Current Hydrology (with Q<sub>10</sub> Doubled)</b>	
<b>Pipe Size (Diameter)</b>	<b>Estimated Capacity (Q<sub>10</sub>)</b>	<b>Q<sub>10</sub> x 2 (New Q's)</b>	<b>Estimated Required Pipe Size (Ref ITTE)</b>
24"	27 cfs	54 cfs	36"
30"	36 cfs	72 cfs	42"
36"	46 cfs	92 cfs	54"
48"	61 cfs	122 cfs	60"
78"	250 cfs	500 cfs	96"

Implementing the latest National Pollution Discharge Elimination Standards (NPDES) requirements of onsite detention for all new development along with upgrading the existing storm drain systems could help to mitigate the increased runoff and storm drain deficiency. The

Technical Guidance Manual for Stormwater Quality Measures as required by NPDES are covered in the following Water Quality Section.

The Ventura River Levee which extends along Freeway 101 upstream to about Potawatomi Street is determined to be “uncertified” under Federal Emergency Management Agency (FEMA) current criteria. This determination is presently under investigation. In any case, should FEMA determine that this “uncertified designation” is to be conclusive, the entire southerly portion of the Westside area would be subject to major flooding. This would be a significant impact to the existing, new and redevelopment of the Westside area.

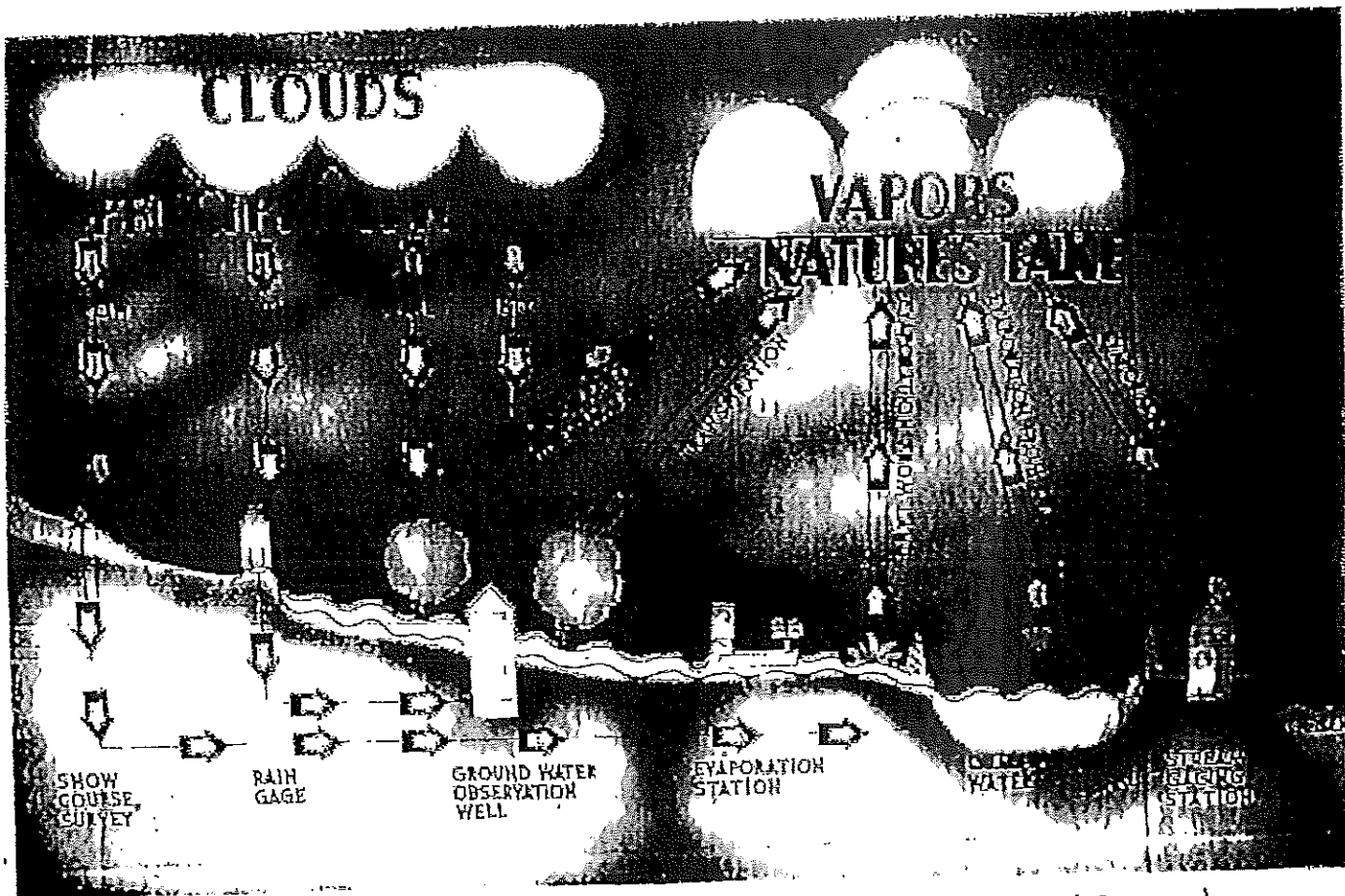


FIG. 1-1. The hydrologic cycle. (Courtesy of U.S. Geological Survey.)

**EXHIBIT A**

# **WATER QUALITY**

## **Regulatory Background**

Water quality issues began in 1948 when Federal Water Pollution Control Act was enacted for states to construct wastewater treatment facilities. In 1972 the federal government subsequently took charge of regulating the quality of the Nation's Water suppliers by amending the Federal Water Pollution Control also referred to as The Clean Water Act (CWA). CWA was passed providing financial assistance for construction of local sewage treatment plants requiring that all industrial and municipal wastewater discharges shall meet secondary treatment of wastewater (at least 85% removal of conventional wastes) to meet water quality standards. The CWA initial strategies primarily focused on controlling water pollution from industrial processed wastewater and municipal sewage known as "POINT SOURCE" water pollution, has experienced success as evidenced by clean water ways in comparison to the years preceding the 1972 amendment.

As industrial and municipal sources have abated pollution, uncontrolled "NON-POINT SOURCE" water pollution (also known as "wet-weather", "stormwater and urban runoff" pollution), "dry-weather", snow melt, surface runoffs and drainage. The EPA and state water quality authorities have identified wet weather flows as the largest remaining threat to water quality. The 1992 National Water Quality Inventory Report to Congress concluded "that stormwater runoff from . . . diffuse sources including . . . urban runoff is a leading cause of water quality impairment."

In February 1987 Congress responded to public concern that, despite much progress, significant water quality problems persist. After six years of congressional efforts, Congress overwhelmingly passed the 1987 amendment to the CWA known as the "Water Quality Act of 1987" with increasing attention to mitigate non-point sources of water pollutants. In view of the fact that remedies for non-point source pollutants are more complicated than the point source in 1990, EPA established final regulations requiring stormwater discharges shall be regulated by NPDES permits.

Ventura County Watershed Protection District, County of Ventura, and Cities of Camarillo, Fillmore, Moorpark, Ojai, Oxnard, Port Hueneme, San Buenaventura, Santa Paula, Sini Valley and Thousand Oaks have joined to form the Ventura Countywide Stormwater Quality Management Program and are named as co-permittees under a revised countywide municipal NPDES permit for stormwater discharges issued by the State Regional Water Quality Control Board in 2010 (Order R4-2010-0108). Controlling urban runoff pollution from new development/redevelopment during and after construction is critical to the success of the program.

## **Hydrology**

The Westside Community Plan area consists of existing natural drainage features, the Ventura River, hillside drainage, Canada Larga areas and existing drainage facilities in North Avenue portion of the planning area, all of which are factors in water quality analysis.

Urbanization, land use changes, development of impervious area which changes the land form and changes the runoff hydrograph. Alteration of the runoff hydrograph change the downstream hydrology since new development and/or redevelopment typically results in more runoff volume and higher rates of

runoff. BMP's such as detention basins, which detain volume and reduce peak flows, but the increased duration could cause adverse impacts including . . . "washing out habitat . . . erosions . . . and changing downstream ecosystems . . . in addition . . . it affects the downstream energy in the water and peak flow conditions." <sup>(1)</sup>

Understanding of these factors is necessary for development of storm water management plans. Ideally, the hydrograph after development would parallel the pre-development hydrograph. The "stream balance equation" can be used to make qualitative guidelines relative to channel impacts from changes in watershed runoff/sediment loads. Refer to the attached Appendix A. "Channel Impacts from Watershed Changes"<sup>(2)</sup> for the concept and equation.

To resolve the watershed stability and balance analysis is necessary through the comprehensive Drainage Master Plan. Therefore, a drainage master plan should consider a) project area location in the larger watershed, b) topography, c) soil and vegetation conditions, d) percent impervious area, e) natural and infrastructure drainage facilities/features, and f) other relevant hydrologic and environmental factors. Finally the master plan drainage report should include:

- Field reconnaissance of downstream conditions,
- Calculated rainfall and runoff characteristics such as peak flow rate, velocity, volumes, time of concentration, retention volume and capacities of existing facilities, and
- Establishment of proposed site design, source control and treatment control measures to be incorporated and maintained to address concern(s) of downstream conditions.

### **Stormwater Runoff**

Stormwater runoff is part of the hydrologic cycle. However, urbanization, agriculture and human activities can affect and alter natural drainage patterns and add pollutants to streams, rivers, lakes, coastal bays and estuaries and ultimately to the ocean. Urban runoff includes all flows from urban land use into storm water conveyance facilities and receiving waters, both dry weather non-stormwater sources, i.e. irrigation waters, etc. and wet weather storm water runoff. "Numerous studies have shown urban runoff to be significant source of water pollution, causing decline in fisheries, restriction on "water sports."<sup>(1)</sup>

Stormwater runoff naturally contains certain constituents. Urbanization and urban activities typically would increase constituent concentrations that adversely impact water quality. Stormwater pollutants consist of "...sediment, nutrients, bacteria and viruses, oil and grease, metals, organics, pesticides, and trash (floatables). ...nutrients rich storm water is an attractive medium for vector production when it accumulates and stand more than 72 hours."<sup>(1)</sup> Refer to the attached Table 1-1, "Pollutant Impacts on Water Quality"<sup>(1)</sup>

Water quality impacts from urbanization and urban activities are categorized as follows.

- a) Erosion and sedimentation and discharge of pollutants during construction, and
- b) Long Term Impacts from completed development/redevelopment associated with land uses.

1 California Stormwater BMP Handbook, January 2003, New Development and Redevelopment

2 Appendix A, "Channel Impacts from Watershed Changes" California Stormwater BMP Handbook, January 2003

Potential Water quality impacts from completed development/redevelopment can include the following.

- Urban activities can potentially generate many pollutants for dry-weather runoffs,
- Increased impervious surfaces (streets, rooftops, parking lots, etc.) could increase downstream erosion and water quality degradation,
- Urban activities and increased impervious surfaces can increase concentration and total pollutant loads in wet-weather storm runoffs.

### **Groundwater**

Exhibit D is a schematic cross section depicting the occurrence of groundwater. Near the surface, pore spaces contain both air and water (known as zone of aeration), and water in this zone is known as soil moisture. Below this zone is the "groundwater" and the surface separating these zones is the water table. Occasionally local zones of saturation exist as "perched groundwater" over a locally impervious stratum to form confined or artesian water. Confined groundwater is usually under pressure because of the weight of the overlying soil and the hydrostatic head.

Almost all groundwater derived from precipitation. Water from precipitation reaches the groundwater by the process of infiltration and percolation from streams and lakes. Direct percolation cannot yield large quantities of groundwater except where the soil is highly permeable or the water table is close to the surface.

New development/redevelopment would result in increase impervious surfaces which decrease infiltration and percolation surfaces for groundwater recharge. However, in conformance with the NPDES permit, in addition to controlling and/or treating runoff contaminant prior to discharging urban storm runoff into storm drain system as receiving waters, as well as reducing or eliminating post-project runoff is required. The latter requirement would typically utilize detention basin(s) to detain volume to reduce peak flows, and gradually release the runoff so as not to exceed the existing flow conditions. Consequently, groundwater recharge from direct percolation will be reduced by the additional impervious area. However, groundwater recharge will eventually be restored through the evapotranspiration, precipitation and infiltration and percolation from streams and lakes. In essence, the groundwater recharge will simply be delayed after the peak storm events.

### **Impacts of New Development/Redevelopment**

New development/redevelopment typically creates and/or results an increase in impervious surfaces which increases the amount of runoff and pollutants entering stormwater conveyance systems, transported directly to receiving waters but are not treated, therefore contribute to water pollution. Stormwater runoff over impervious surfaces (i.e. roadways, parking lots, rooftops), neither infiltrate nor evapotranspire, which increases runoff flow rates, velocities and accumulates pollutants and sediments, increase nutrients bacteria and other pollutant concentrations in receiving waters. Furthermore, impacts of these alterations may also include potential flooding, decreased groundwater recharge, degradation of water quality, increase stream and channel erosions, increase stream temperature due to loss of riparian vegetation, as well as water impervious surfaces, resulting in decreases in dissolved oxygen levels which adversely affecting aquatic life dependent in cooler temperature.

**Impact Mitigations**

Federal and State programs require BMP’s to be implemented by developers, property owners, and public agencies engaged in development and redevelopment activities. Site and facility planning and design for stormwater quality protection consists of multi-level strategy, which consists of

- a) Reducing or eliminating post-project runoff,
- b) Controlling sources of pollutants, and if required
- c) Treating contaminated runoff prior to discharging into the storm water system or receiving waters.

Category a) and b) are referred to as “Source controls” since they are intended to reduce or eliminate pollutants at their source. Category c) is referred to as “Treatment Control” whereby it utilizes selected treatment mechanism(s) to remove/reduce pollutants from the storm water runoff.

In reference to “California Stormwater BMP Handbook – January 2003”, Table 4-1 are BMP’s suggested for source control design.

<b>Table 4-1 Source Control BMPs for Design</b>	
<b>Design</b>	
SD-10	Site Design and Landscape Planning
SD-11	Roof Runoff Controls
SD-12	Efficient Irrigation
SD-13	Storm Drain System Signs
<b>Materials</b>	
SD-20	Pervious Pavements
SD-21	Alternative Building Materials
<b>Areas</b>	
SD-30	Fueling Areas
SD-31	Maintenance Bays and Docks
SD-32	Trash Enclosures
SD-33	Vehicle Washing Areas
SD-34	Outdoor Material Storage Areas
SD-35	Outdoor Work Areas
SD-36	Outdoor Processing Areas

and Table 5-1 for Treatment Control BMP’s Design

<b>Table 5-1 Treatment Control BMPs</b>	
<b>Public Domain</b>	<b>Manufactured (Proprietary)</b>
<b>Infiltration</b>	<b>Infiltration</b>
TC-10 Infiltration Trench	
TC-11 Infiltration Basin	
TC-12 Retention/Irrigation	
<b>Detention and Setting</b>	<b>Detention and Setting</b>
TC-20 Wet Pond	MP-20 Wetland
TC-21 Constructed Wetland	
TC-22 Extended Detention Basin	
<b>Biofiltration</b>	<b>Biofiltration</b>

TC-30 Vegetated Swale TC-31 Vegetated Buffer Strip TC-32 Bioretention	
<b>Filtration</b>	<b>Filtration</b>
TC-40 Media Filter	MP-40 Media Filter
<b>Flow Through Separation</b>	<b>Flow Through Separation</b>
TC-50 Water Quality Inlet	MP-50 Wet Vault MP-51 Vortex Separator MP-52 Drain Inserts
<b>Other</b>	<b>Other</b>
TC-60 Multiple Systems	

The planning and design phases of development or redevelopment projects may be spread over period of months or even years. Water Quality BMP's incorporated into the planning and design phases would be more cost-effective than retrofitting of BMP's.

The "Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures 2010" provides the following principles of Integrated Water Resource Management (IWRM) and Low Impact Development (LID) to help mitigate the impacts of development.<sup>(3)</sup>

The 2010 TGM advises to first design for the largest hydrologic controls (such as matching post development 100-year flows with pre-project 100-year flows for flood mitigation requirements), according to the appropriate City or County drainage requirements. Secondly, the 2010 TGM advises to check if flood mitigation will reduce or satisfy the stormwater management requirements. If it does not, then add more controls as necessary. Flood mitigation may provide the necessary sediment and pollution control, thereby reducing maintenance requirements for the stormwater management BMPs. A sequence of hydrologic controls should be considered such as site design, flood drainage mitigation, and Retention BMPs. Bioinfiltration BMPs and Treatment Control Measures can be considered when the use of Retention BMPs is technically infeasible. Each of these controls will have an influence on stormwater runoff from the new development or redevelopment project.

LID falls under the concept of IWRM. IWRM is a process which promotes the coordinated development and management of water, land, and related resources. IWRM links land use, water supply, wastewater treatment/reclamation, flood control/drainage, water quality, and hydro modification management into a cohesive hydrologic system that recognizes their interdependencies and minimizes their potentially negative effects on the environment. IWRM includes recharging groundwater with reclaimed wastewater to support the water supply. Combining stormwater treatment, hydromodification control, and flood control in a single regional infiltration basin that recharges groundwater, incorporates recreation, and provides habitat. TWRM also uses Smart Growth principles to help reduce the environmental footprint while still accommodating growth.

Similar to Source Control Measures, which prevent pollutant sources from contacting stormwater runoff, Retention BMPs use techniques to infiltrate, store, use and evaporate runoff onsite to mimic pre-development hydrology. The goal of LID is to increase groundwater recharge, enhance water quality, and prevent degradation of downstream natural drainage channels. This goal may be accomplished with creative site planning and incorporation of localized, naturally functioning BMPs into the project.

Implementation of Retention BMPs will reduce the size of additional Hydromodification Control Measures that may be required for a new development or redevelopment project, and, in many circumstances, may be used to satisfy all stormwater management requirements.

In reference to “Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures 2010”, New Development and Redevelopment Projects that are subject to conditioning and approval for the design and implementation of “post-construction” stormwater management control measure, prior to completion of the projects are as follows: <sup>(3)</sup>

### **New Development Projects**

- 1) All development projects equal to 1 acre or greater of disturbed area that adds more than 10,000 square feet of impervious surface area.
- 2) Industrial parks with 10,000 square feet or more of total altered surface area.
- 3) Commercial strip malls with 10,000 square feet or more of impervious surface area.
- 4) Retail gasoline outlets with 5,000 square feet or more of total altered surface area.
- 5) Restaurants (Standard Industrial Classification (SIC) of 5812) with 5,000 square feet or more of total of total altered surface area.
- 6) Parking lots with 5,000 square feet or more of impervious surface area, or with 25 or more parking spaces.
- 7) Streets, roads, highways, and freeway construction 10,000 square feet or more of impervious surface area (see Section 2 for specific requirements).
- 8) Automotive service facilities (Standard Industrial Classification (SIC) of 5013, 5014, 5511, 5541, 7532-7534 and 7536-7539) of 5,000 square feet or more of total altered surface area.
- 9) Projects located in or directly adjacent to, or discharging directly to an Environmentally Sensitive Area (ESA), where the development will:
  - a. Discharge stormwater runoff that is likely to impact a sensitive biological species or habitat; and
  - b. Create 2,500 square feet or more of impervious surface area.
- 10) Single-family hillside homes (See Section 2 for specific requirements).

(3) Ventura Countywide Technical Guidance Manual for Storm Quality Control Measures 2010

## **Redevelopment Projects**

Redevelopment projects in categories 1) through 10) above that meet the threshold identified below:

- Land-disturbing activity that results in the creation or addition or replacement of 5,000 square feet or more of impervious surface area on an already developed site.

Additionally:

- 1) Projects where redevelopment results in an alteration to more than fifty percent of impervious surfaces of a previously existing development, and the existing development was not subject to the post development stormwater quality control requirements of Board Order 00-108, shall mitigate the entire redevelopment project area.
- 2) Projects where redevelopment results in an alteration to more than fifty percent of impervious surfaces of a previously existing development, and the existing development was subject to the post development stormwater quality control requirements of Board Order 00-108, must mitigate only the altered portion of the redevelopment project area and not the entire project area.
- 3) Projects where redevelopment results in an alteration of less than fifty percent of impervious surfaces of a previously existing development must mitigate only the altered portion of the redevelopment project area and not the entire project area.

Land-disturbing activity that results in the creation or addition or replacement of less than 5,000 square feet of impervious surface area on an already developed site, or that results in a decrease in impervious area which was subject to the post-development stormwater quality control requirements of Board Order 00-108, is not subject to mitigation unless so directed by the local permitting agency.

Redevelopment does not include routine maintenance activities that are conducted to maintain the original line and grade, hydraulic capacity, or original purpose of the facility or emergency redevelopment activity required to protect public health and safety. Impervious surface replacement, such as the reconstruction of parking lots and roadways, that does not disturb additional area and maintains the original grade and alignment, is considered a routine maintenance activity. Agencies' flood control, drainage, and wet utilities projects that maintain original line and grade or hydraulic capacity are considered routine maintenance. Redevelopment also does not include the repaving of existing roads to maintain original line and grade.

Existing single-family dwelling and accessory structure projects are exempt from the redevelopment requirements unless the project creates, adds, or replaces 10,000 square feet of impervious surface area.

## **Brownfields**

There are 30 Brownfield sites within the Study Area which are identified with presence or potential presence of toxic/hazardous substance, possible contamination presence are shown in the attached Figure 2-15 and Table 2-2, courtesy of Impact Sciences, Inc.

Under California and Federal law, anyone who stores, treats or disposes waste as described in the Hazardous Waste Control Law (Health and Safety Code, Division 20, Chapter 6.5), and must obtain a permit or grant authorization from the Department of Toxic Substances Central.

Any reuse as redevelopment of the Brownfield sites could pose a challenge in permitting requirements, time and mitigation costs, depending on the type of toxic/hazardous substances.

Implementing the National Pollution Discharge Elimination Standards (NPDES) along with upgrading the existing storm drain systems would help mitigate runoff and storm drain deficiencies, as well as remove/reduce pollutants from urban storm water runoffs thereby mitigating water quality degradation. New development/redevelopment would delay groundwater recharge but will have no significant impact on groundwater supplies.

Drainage master plan is designed to preserve/maintain the existing drainage tributaries within the watershed and its sub-watersheds, including their flow paths throughout its course to their tributary stream or river. With development, local flow or drainage pattern of the site area may vary from existing within the sub-watershed, except no diversion will be permitted without drainage acceptance deed.

In general, City requires building structures to be protected from a 100-year storm event without impeding or redirecting flood flows from one watershed/sub-watershed to another.

Specific development proposal will be required to perform a site-specific view, and will adhere to all the coded and regulations cited, as well as other requirements of the City, County and other State and Federal Agencies. The State CEQA Guidelines under Section IX, "Hydrology and Water Quality" Significance thresholds HYD-1 three HYD-11 will be used to evaluate project impacts related to Hydrology and Water Quality.

# Appendix A

## Channel Impacts from Watershed Changes

Channels are formed, maintained, and altered by the water and sediment they carry.

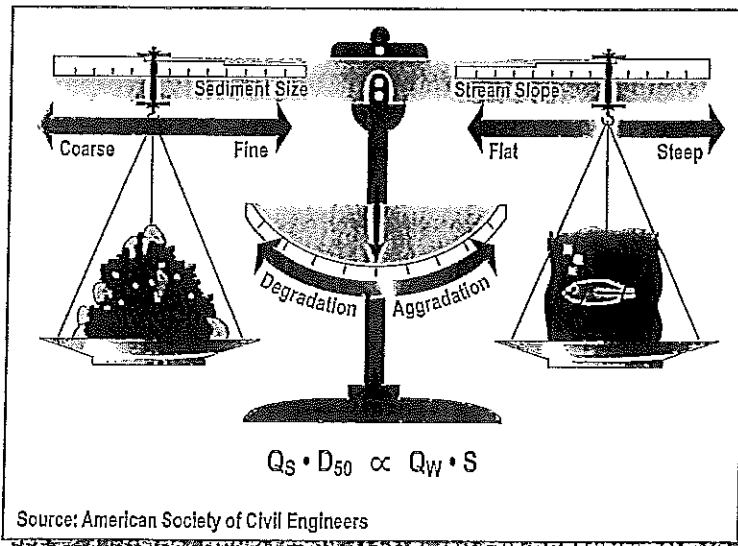
Channel equilibrium involves the interplay of four basic factors:

- Sediment discharge ( $Q_s$ )
- Sediment particle size ( $D_{50}$ )
- Streamflow ( $Q_w$ )
- Stream slope ( $S$ )

Lane (1955) showed this relationship qualitatively as:

$$Q_s \cdot D_{50} \propto Q_w \cdot S$$

This equation is shown here as a balance with sediment load on one weighing pan and streamflow on the other.



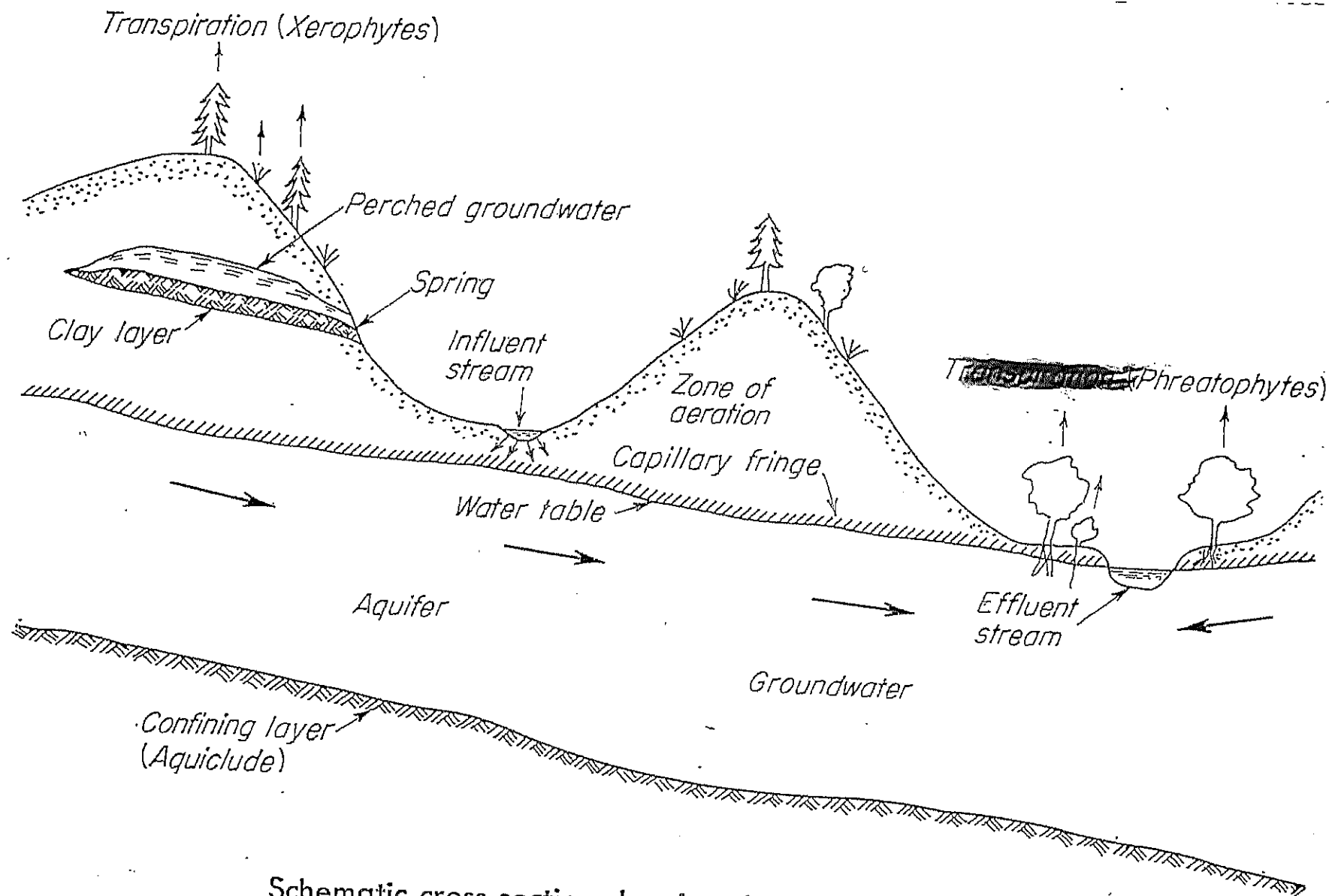
The hook holding the sediment pan can slide along the horizontal arm to adjust according to sediment size. The hook holding the streamflow side can adjust according to stream slope.

Channel equilibrium occurs when all four variables are in balance. If a change occurs, the balance will temporarily be tipped and equilibrium lost. If one variable changes, one or more of the other variables must increase or decrease proportionally if equilibrium is to be maintained. For example, if channel slope is increased (e.g., by channel straightening) and streamflow remains the same, either the sediment load or the size of the particles must also increase. Likewise, if flow is increased (e.g., by an inter-basin transfer) and the slope stays the same, sediment load or sediment particle size has to increase to maintain channel equilibrium. Under these examples' conditions, a stream seeking a new equilibrium will tend to erode more of its banks and bed, transporting larger particle sizes and a greater sediment load.

Alluvial streams that are free to adjust to changes in these four variables generally do so and re-establish new equilibrium conditions. Non-alluvial streams such as bedrock or artificial, concrete channels are unable to follow Lane's relationship because of their inability to adjust the sediment size and quantity variables.

The stream balance equation is useful for making qualitative predictions concerning channel impacts due to changes in runoff or sediment loads from the watershed. Quantitative

<b>Sediment</b>	Sediment is a common component of stormwater, and can be a pollutant. Sediment can be detrimental to aquatic life (primary producers, benthic invertebrates, and fish) by interfering with photosynthesis, respiration, growth, reproduction, and oxygen exchange in water bodies. Sediment can transport other pollutants that are attached to it including nutrients, trace metals, and hydrocarbons. Sediment is the primary component of total suspended solids (TSS), a common water quality analytical parameter.
<b>Nutrients</b>	Nutrients including nitrogen and phosphorous are the major plant nutrients used for fertilizing landscapes, and are often found in stormwater. These nutrients can result in excessive or accelerated growth of vegetation, such as algae, resulting in impaired use of water in lakes and other sources of water supply. For example, nutrients have led to a loss of water clarity in Lake Tahoe. In addition, un-ionized ammonia (one of the nitrogen forms) can be toxic to fish.
<b>Bacteria and viruses</b>	Bacteria and viruses are common contaminants of stormwater. For separate storm drain systems, sources of these contaminants include animal excrement and sanitary sewer overflow. High levels of indicator bacteria in stormwater have led to the closure of beaches, lakes, and rivers to contact recreation such as swimming.
<b>Oil and Grease</b>	Oil and grease includes a wide array of hydrocarbon compounds, some of which are toxic to aquatic organisms at low concentrations. Sources of oil and grease include leakage, spills, cleaning and sloughing associated with vehicle and equipment engines and suspensions, leaking and breaks in hydraulic systems, restaurants, and waste oil disposal.
<b>Metals</b>	Metals including lead, zinc, cadmium, copper, chromium, and nickel are commonly found in stormwater. Many of the artificial surfaces of the urban environment (e.g., galvanized metal, paint, automobiles, or preserved wood) contain metals, which enter stormwater as the surfaces corrode, flake, dissolve, decay, or leach. Over half the trace metal load carried in stormwater is associated with sediments. Metals are of concern because they are toxic to aquatic organisms, can bioaccumulate (accumulate to toxic levels in aquatic animals such as fish), and have the potential to contaminate drinking water supplies.
<b>Organics</b>	Organics may be found in stormwater in low concentrations. Often synthetic organic compounds (adhesives, cleaners, sealants, solvents, etc.) are widely applied and may be improperly stored and disposed. In addition, deliberate dumping of these chemicals into storm drains and inlets causes environmental harm to waterways.
<b>Pesticides</b>	Pesticides (including herbicides, fungicides, rodenticides, and insecticides) have been repeatedly detected in stormwater at toxic levels, even when pesticides have been applied in accordance with label instructions. As pesticide use has increased, so too have concerns about adverse effects of pesticides on the environment and human health. Accumulation of these compounds in simple aquatic organisms, such as plankton, provides an avenue for biomagnification through the food web, potentially resulting in elevated levels of toxins in organisms that feed on them, such as fish and birds.
<b>Gross Pollutants</b>	Gross Pollutants (trash, debris, and floatables) may include heavy metals, pesticides, and bacteria in stormwater. Typically resulting from an urban environment, industrial sites and construction sites, trash and floatables may create an aesthetic "eye sore" in waterways. Gross pollutants also include plant debris (such as leaves and lawn-clippings from landscape maintenance), animal excrement, street litter, and other organic matter. Such substances may harbor bacteria, viruses, vectors, and depress the dissolved oxygen levels in streams, lakes, and estuaries sometimes causing fish kills.
<b>Vector Production</b>	Vector production (e.g., mosquitoes, flies, and rodents) is frequently associated with sheltered habitats and standing water. Unless designed and maintained properly, standing water may occur in treatment control BMPs for 72 hours or more, thus providing a source for vector habitat and reproduction (Metzger, 2002).



Schematic cross section showing the occurrence of groundwater.

**EXHIBIT D**

## BROWNFIELDS

Within the Study Area there are 30 brownfield sites. They are scattered throughout the Westside and North Avenue areas. Figure 2-15 shows the location of brownfields within the Study Area. Brownfields through the EPA are defined as "real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant." Not all brownfield sites in the Study Area have been identified or labeled as brownfields because of the EPA's strict restrictions on funding for brownfields containing petroleum. For example, old gas stations have been left out of the Westside Brownfield Project. These brownfield sites pose a big hindrance to the revitalization of the project area.

Figure 2-15:  
Brownfield  
Locations within the  
Study Area

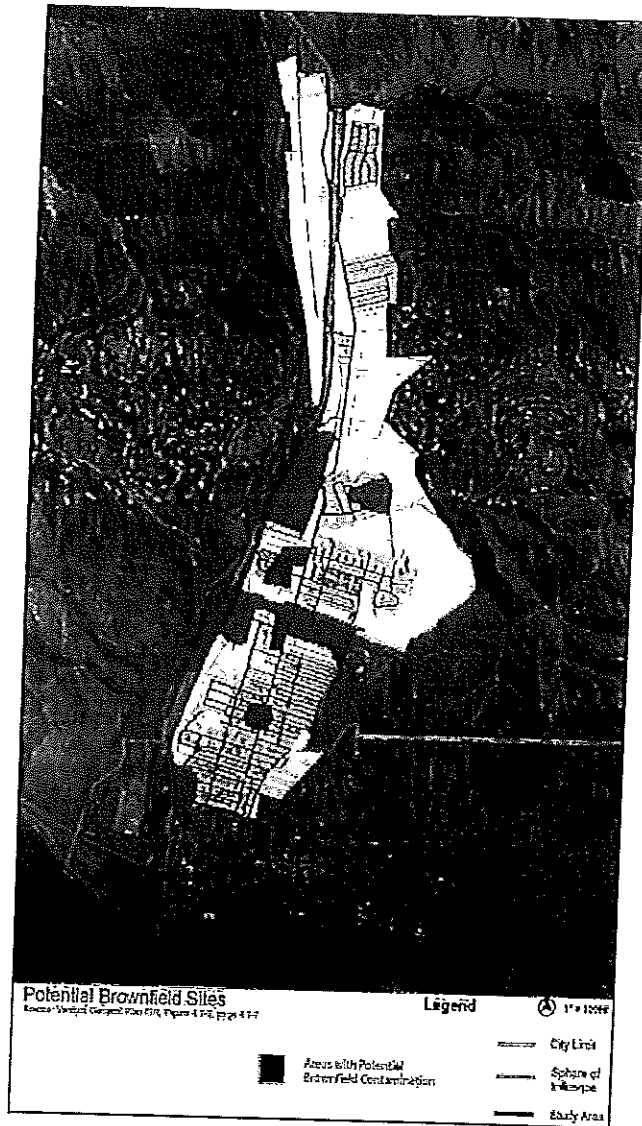


Table 2-2: Possible Contaminates by Industry Site

Industry Type	Potential Contaminants	Typical Operations
Oilfield and Oilfield Services	Toxic metals, petroleum solvents, chlorinated solvents, semivolatle hydrocarbons, polychlorinated biphenyls (PCBs)	Oil production and handling, oil tool, welding, and machine shops, vacuum truck services, equipment storage yards, waste disposal, wireline, perforation
Scrap Metal and Salvage Yards	Toxic metals, petroleum solvents, chlorinated solvents, semivolatle hydrocarbons, PCBs)	Meal recycling, equipment scrapping, waste disposal, auto salvage, vehicle scrapping
Chemical Facilities	Toxic metals, petroleum solvents, chlorinated solvents, semivolatle hydrocarbons, caustics & acids, PCBs.	Chemical supply, refineries, natural gas processing/compression plants, bulk fuel storage/sales.
Quarry Sites	Toxic metals, petroleum solvents, chlorinated solvents, semivolatle hydrocarbons, explosive charges.	Rock quarries, mining, processing, mixing

From the Sanborn Fire Insurance maps, the city has been able to conclude which areas would be most likely to contain brownfield sites. These areas have been identified as locating:

- Along the north and south side of Stanley Avenue
- Along Ventura Ave. at various location and near the inter section of Franklin Ln.
- West of Ventura Avenue north of Barry Lane
- On both sides of Rocklite Road
- Between Olive Street and Highway 33, north of West Lewis Street
- North of Main Street along Julian and Peking Streets
- Along West Park Row and Dubbers Street
- Along Olive Street immediately north and south of Main Street
- Along Ventura Ave, north of Thompson Boulevard

**EXHIBIT "B"**

**WATERSHEDS AND HSPF DISCHARGES  
FROM  
VENTURA RIVER WATERSHED DESIGN STORM MODELING  
FEBRUARY 2010**

<b><u>WATERSHED NAME</u></b>	<b><u>Q 10</u></b>	<b><u>Q 50</u></b>	<b><u>Q 100</u></b>	<b><u>MODEL NUMBER</u></b>
Ventura River at Highway 101	15,720	52,500	78,600	876
Dent Drain	105	350	527	877
Canada de San Juaquin	480	1,600	2,420	874
Ventura River above Canada de San Juaquin	15,600	52,100	78,100	875
Manuel Canyon	390	1,300	1,970	873
Ventura River above Weldon Canyon	14,180	47,270	70,900	962
Weldon Canyon	No Data	No Data	No Data	961
Canada Larga at Ventura Avenue	4,100	13,670	20,500	288
Canada de Aliso	630	2,100	3,150	286
Leon Canyon	642	2,140	3,210	287
Canada Larga above Coche Canyon	2,560	8,530	12,800	284
Coche Canyon	1,340	4,470	6,700	285