4.6 HYDROLOGY AND WATER QUALITY

This section describes the existing and future hydrological conditions on and around the proposed project site, and presents an evaluation of potential impacts of the project on water quality. It is based on a report completed by Questa Engineering and on calculations by A.C.K. Engineering, which are included as Appendices F and G of this EIR, respectively.

A. Existing Setting

1. Regulatory Framework

a. NPDES General Construction Activities Stormwater Permit Requirements

The Clean Water Act (CWA) has nationally regulated the discharge of pollutants to waters of the United States from any point source since 1972. In 1987, amendments to the CWA added section 402(p), which established a framework for regulating non point source (NPS) storm water discharges under the National Pollutant Discharge Elimination System (NPDES). The Phase I NPDES storm water program regulates storm water discharges from major industrial facilities, large and medium-sized municipal separate storm sewer systems (those serving more than 100,000 persons), and construction sites that disturb five or more acres of land.

In California, the NPDES General Construction Activities Stormwater Program is administered by the California Regional Water Quality Control Boards. Pursuant to the NPDES Stormwater Phase II Final Rule, dated December 8, 1999, discharges of storm water associated with construction activities that result in the disturbance of equal to or greater than one acre of land must apply for coverage under the statewide General Construction Activities Stormwater Permit (General Permit). Construction activity includes, but is not limited to: clearing, grading, demolition, excavation, construction of new structures, and reconstruction of existing facilities involving removal and replacement that results in soil disturbance. It is the responsibility of the owner of the land where the construction activity is to occur to obtain a permit prior to site construction.

b. Alameda Countywide Clean Water Program (ACCWP)

The ACCWP is a group of agencies within Alameda County that discharge storm water to the San Francisco Bay. The ACCWP is required by the San Francisco RWQCB to obtain a NPDES permit for storm water discharges under the Phase I NPDES storm water program. As part of the NPDES permit, the ACCWP has developed a storm water management plan to reduce pollution in storm water discharges throughout the County. The City of Oakland is a member of the ACCWP.

c. City of Oakland Stormwater Ordinance

In 1993, water quality BMPs described in the ACCWP storm water management program were implemented into City of Oakland Stormwater Ordinance. The ordinance aims to reduce pollutants in storm water by regulating grading, excavation, and filling activities. The ordinance requires that all projects develop a site map, grading plan, and drainage plan prior to approval. The City of Oakland's Stormwater Ordinance was revised in 1997 to provide new and stronger provisions to safeguard and manage creeks. The ordinance, now called the "Creek Protection, Stormwater Management, and Discharge Control Ordinance," includes permitting guidelines for development and construction projects taking place on a creekside property.

2. Physical and Environmental Setting

a. Climate

The climate of the Oakland Hills is characterized as Mediterranean with cool, wet winters and dry, hot summers. Average annual rainfall in the vicinity of the project site is approximately 24 inches. The region's rainy season extends from November to April, with relatively dry conditions for the majority of the year.[1] Average temperatures generally range from 45 degrees Fahrenheit in winter months to 75 degrees Fahrenheit in summer months.[2]

[1] Alameda County Flood Control (ACFCD), 1989. Hydrology and Hydraulics Criteria Summary, Western Alameda County.

[2] Western Regional Climate Center, 2001. Climate Summary for Oakland Museum, California.

b. Geology and Soils

The project site lies along the northwest-trending Oakland Hills of the Coast Range Geomorphic Province of California. The bedrock geology of the project site consists of young volcanics. These volcanics have been labeled as Leona Rhyolite. Colluvium and numerous landslides have been mapped on adjacent hillsides and swales.[3]

The permeability and texture of on-site soils influence drainage patterns at the project sites. Soil permeability is the rate at which water is absorbed under saturated conditions and is related to the hydraulic conductivity of the soil. Site soils at the project site have been labeled as Xerorthents-Millsholm Loam complex. Xerorthents consist of soil material resulting from cutting or filling for urban development. Xerorthents generally have moderate permeability, rapid to very rapid runoff, and a high to very high risk of erosion. Millsholm Loam soils are formed from weathered shale or fine-grained sandstone. Millsholm Loams generally have moderate permeability, rapid runoff, and a high hazard of erosion.[4]

c. Site Drainage and Regional Storm Drainage System

The project site is located in the Arroyo Viejo watershed. The Arroyo Viejo watershed has its headwaters in the foothills of East Oakland, east of I-580. Arroyo Viejo generally travels west, draining urban development west of I-580. The creek discharges to San Leandro Bay at the northern boundary of the Oakland Coliseum. The lowermost reaches of the creek are tidally influenced.

There are currently no drainage improvements on the project site. Runoff currently starts as unconcentrated overland sheet flow that quickly becomes concentrated sheet flow as it moves down the steep hillside. There are two drainage swales on the project site. These drainage swales are steep and gullied

[3] Underdahl, Gary. 2001. Geotechnical Investigation, Planned Townhouse Development, Keller Avenue, Oakland, Alameda County, California.

[4] United States Department of Agriculture (USDA), Soil Conservation Service (SCS). 1981. Alameda County Soil Survey.

in several areas. The drainage swales convey runoff to Keller Avenue. Curbs and gutters along Keller Avenue carry runoff north-northwest to two existing drop inlets, one along Keller Avenue and the other along Greenridge Drive. These drop inlets connect to an existing 18-inch pipe under Keller Avenue, which ties in to a 21-inch pipe at the intersection of Keller Avenue and Greenridge Drive.

d. Flooding

The project site is located outside of the 100-year flood zone as delineated by the Federal Emergency Management Agency (FEMA).[5] According to the City of Oakland Storm Drainage Department, there are no reported drainage/flooding problems in the vicinity of the project site.[6] The Alameda County Flood Control District l (ACFCD) reports that there are no existing flooding/drainage problems along Arroyo Viejo Creek, which is approximately 1.5 miles downstream of the project site.[7]

e. Groundwater

The California Department of Water Resources (DWR) defines state groundwater basins based on geologic and hydrogeologic conditions. According to the DWR, the project site is not located within a groundwater basin.[8]

The preparation of the geotechnical investigation for the proposed project involved three subsurface investigations to depths of 1.5 to 6 feet. The test pits were dug and sampled in June 2001, when seasonal groundwater levels are generally low. Groundwater was not encountered in any of the test pits.

[5] Federal Emergency Management Agency (FEMA), 1996. Q3 Flood Data, Alameda, CA. [ArcInfo format].

[6] Per telephone conversation with Dale Smith, City of Oakland Storm Drainage Department. December 18, 2002.

[7] Per messages left by Anderson Allen, Alameda County Flood Control District, December 18 and 20, 2002.

[8] Department of Water Resources (DWR). 1975. California's Groundwater – Bulletin 118. Updated 2002.

While depth to groundwater at the project site is unknown, it is not likely that groundwater will be found in the fill or natural soils of the project site.[9]

3. Relevant Project Characteristics

The proposed project involves the development of 32 single-family homes. Runoff within the project area will be carried via a system of curbs and gutters that will discharge runoff into the existing subterranean storm drain network. All drainage improvements will be constructed in accordance with all City of Oakland engineering requirements. Two existing drop inlets would be used to serve the project site. These inlets are located at: (1) Keller Avenue at 338 feet above mean sea level (MSL) and (2) at Greenridge Drive at 334 feet above MSL. In addition, as part of the drainage plan, the applicant is proposing a 48-inch-diameter pipe on the project site to contain peak storm water runoff. Figure 18 shows the predicted site hydrology after the proposed development.

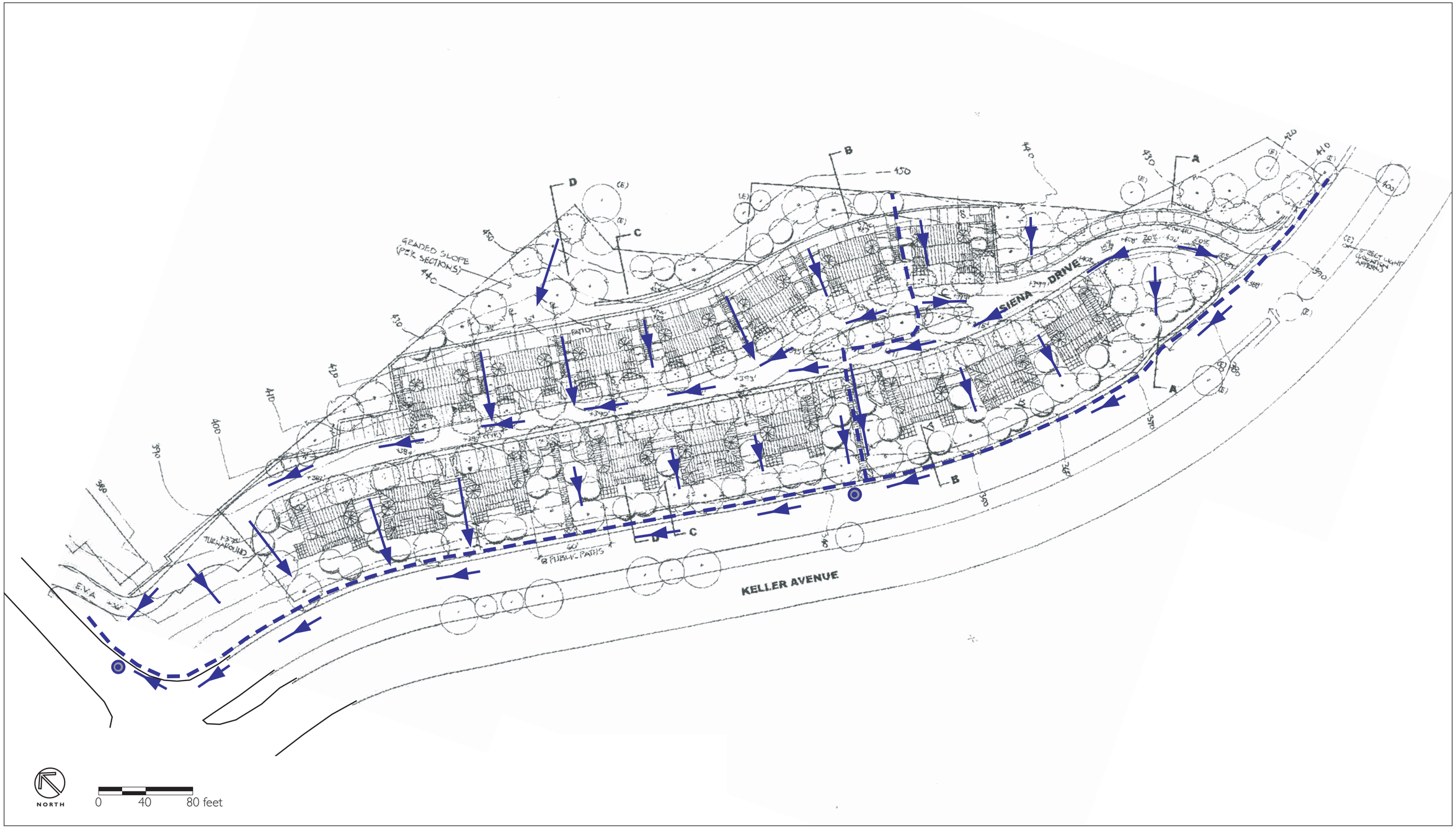
B. Standards of Significance

The project would have a significant impact on the environment if it would:

- Violate any water quality standards or waste discharge requirements;
- 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 proposed uses for which permits have been granted);
- Result in substantial erosion or siltation on- or off-site that would affect the quality of receiving waters;
- Result in substantial flooding on- or off-site;

[9] Underdahl, Gary. 2001. Geotechnical Investigation, Planned Townhouse Development, Keller Avenue, Oakland, Alameda County, California.

- Create or contribute substantial runoff which would exceed the capacity of existing or planned storm water drainage systems;
- Create or contribute substantial runoff which would be an additional source of polluted runoff;
- Otherwise substantially degrade water quality;
- 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, that would impede or redirect flood flows;
- Place within a 100-year flood hazard area structures which would impede or redirect flood flows;
- Expose people or structures to a substantial risk of loss, injury or death involving flooding;
- Result in inundation by seiche, tsunami, or mudflow;
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course, or increasing the rate or amount of flow, of a Creek, river or stream in a manner that would result in substantial erosion, siltation, or flooding, both on- or off-site; or
  Fundamentally conflict with elements of the City of Oakland Creek Protection (OMC Chapter 13.16) ordinance intended to protect hydrologic resources. Although there are no specific, numeric/quantitative criteria to assess impacts, factors to be considered in determining significance include whether there is substantial degradation of water quality through (a) discharging a substantial amount of pollutants into a creek; (b) significantly modifying the natural flow of the water or capacity; (c) depositing substantial amounts of new material into a creek or causing substantial bank erosion or instability; or (d) substantially endangering public or private property or threatening public health or safety.



Existing drop inlet

Flow direction

Sub basin Boundry

FIGURE 18

SITE HYDROLOGY

C. Impacts and Mitigation Measures

The project site does not contain, and is not adjacent to, any creeks or other watercourses. Therefore, the project would not conflict with any elements of the City of Oakland Creek Protection Ordinance.

1. Groundwater

The project site is not located within a groundwater recharge area as defined by the California DWR. The project site would be served by East Bay Municipal Utility District (EBMUD) and would not rely upon local groundwater. Therefore, no impacts to groundwater supplies and/or groundwater recharge are anticipated to result from the proposed project.

2. Erosion

IMPACT HYDRO-1: Increased erosion caused by the grading of the project site during construction of the project could result in the degradation of downstream waterways. (Potentially Significant)

The project site is located on very steep slopes. The proposed development would require extensive grading activities for roadways and building pads. Existing vegetative cover, predominantly grass, which helps to stabilize site soils, would be removed from most areas. Construction operations associated with the proposed project would present a threat of soil erosion from soil disturbance by subjecting unprotected bare soil areas to the erosional forces of runoff. Increased erosion could result in the degradation of downstream waterways. Construction-related erosion impacts are considered to be potentially significant.

Mitigation Measure HYDRO- 1: The project applicant shall prepare a storm water pollution prevention plan (SWPPP) prior to construction activities, as required by the statewide General Permit for Construction Activities. Implementation of the plan shall start with the commencement of construction and shall continue though the completion of the

project. Upon completion of the project, the sponsor must submit a Notice of Termination to the San Francisco RWQCB to indicate that construction is completed.

At a minimum, the SWPPP shall include the following requirements:

- Excavation and grading activities will be scheduled for the dry season only (April 15 to October 15), to the extent possible. This will reduce the chance of severe erosion from intense rainfall and surface runoff, as well as the potential for soil saturation in swale areas.
- If excavation occurs during the rainy season, storm runoff from the construction area will be regulated through a storm water management/erosion control plan that may include temporary onsite silt traps and/or basins with multiple discharge points to natural drainages and energy dissipaters. Stockpiles of loose material will be covered and runoff diverted away from exposed soil material. If work is stopped due to rain, a positive grading away from slopes will be provided to carry the surface runoff to areas where flow can be controlled, such as the temporary silt basins. Sediment basin/traps will be located and operated to minimize the amount of off site sediment transport. Any trapped sediment will be removed from the basin or trap and placed at a suitable location onsite, away from concentrated flows, or removed to an approved disposal site.
- Temporary erosion control measures will be provided until perennial revegetation or landscaping is established and can minimize discharge of sediment into nearby waterways. For construction within 500 feet of a water body, straw bales will be placed upstream adjacent to the water body.
- After completion of grading, erosion protection will be provided on all cut-and-fill slopes. Revegetation will be facilitated by mulching, hydroseeding, or other methods and should be initiated as soon as possible after completion of grading and prior to the onset of the rainy season (by November 1).

- Permanent revegetation/landscaping will emphasize drought-tolerant perennial ground coverings, shrubs, and trees to improve the probability of slope and soil stabilization without adverse impacts to slope stability due to irrigation infiltration and long-term root development.
- BMPs selected and implemented for the project will be in place and operational prior to the onset of major earthwork on the site. The construction-phase facilities will be maintained regularly and cleared of accumulated sediment as necessary.
- Hazardous materials such as fuels and solvents used on the construction sites will be stored in covered containers and protected from rainfall, runoff, and vandalism. A stockpile of spill cleanup materials will be readily available at all construction sites. Employees will be trained in spill prevention and cleanup, and individuals will be designated as responsible for prevention and cleanup activities.

Significance After Mitigation: Less than Significant.

IMPACT HYDRO-2: Increased erosion caused by the increase in impervious surfaces and changes in drainage patterns after construction of the project could result in the degradation of downstream waterways. (Potentially Significant)

Mitigation Measure HYDRO-2a: The proposed project must be developed in accordance with the Phase II NPDES permit program. Under the program, the applicant shall comply with Phase II NPDES General Construction Activities Stormwater Permit Requirements established by the CWA.

Mitigation Measure HYDRO-2b: The City of Oakland's Municipal Code requires that the project applicant prepare a grading plan for the proposed project.

Grading plans must include drainage, erosion, and sediment control plans and incorporate BMPs to minimize the amount of pollutants entering the storm

drain system, to the maximum extent possible. The project grading plan must be approved by a City Engineer. The grading plan shall include but not be limited to the following:

- A proposed schedule of grading activities, monitoring, and infrastructure milestones in chronological format;
- Identification of critical areas of high erodibility potential;
- Description of erosion control measures on streets;
- Contour and spot elevations indicating runoff patterns before and after grading;
- Filter systems at catch basins (drop inlets) along Keller Avenue and Greenridge Drive as a means of sediment control;
- Soil stabilization techniques such as short-term biodegradable erosion control blankets and hydroseeding should be utilized. Silt fences should be installed downslope of all graded slopes. Hay bales should be installed in the flow path of graded areas receiving concentrated flows, as well as around storm drain inlets; and
- The post-construction inspection of all drainage facilities for accumulated sediment, and the clearing of these drainage structures of debris and sediment.

Significance After Mitigation: Less than Significant.

3. Flooding and Mudflows

The proposed project is not located within a 100-year flood zone as mapped in FEMA FIRMs or any other flood hazard delineation map, nor does the proposed project include the placement of structures within a 100-year flood hazard area. No impacts associated with 100-year flood zones are anticipated to result from the proposed project.

The project site is not located in the vicinity of a large inland water body, along coastal waters or in the path of a potential mudflow. No impacts asso-

ciated with seiches, tsunamis, or mudflow are anticipated to result from the proposed project.

4. Storm Drainage

According to the City of Oakland Public Works Agency, there are no existing drainage problems in the vicinity of the project site.[10] Alameda County Flood Control District (ACFCD) has indicated that there are no drainage/flood problems along Arroyo Viejo Creek, downstream of the project site.[11]

Project runoff would be served by two existing drop inlets at Keller Avenue and Greenridge Drive. These drop inlets connect to an existing 18-inch pipe under Keller Avenue, which ties in to a 21-inch pipe at the intersection of Keller Avenue and Greenridge Drive. The proposed project would result in an increase in impervious surface area across the project site and lead to a reduction in the amount of ground surface which would otherwise be available for absorption and infiltration of rainfall. Consequently, the volume and rate of runoff would increase. If downstream drainage infrastructure is undersized, increased runoff volume and peak discharge rates could potentially create downstream drainage problems.

Impact HYDRO-3: If storm water runoff from the project is not adequately contained by the on-site drainage system, and exceeds existing subbasin or conveyance system capacity, a significant impact would result. (Potentially Significant)

The project site and surrounding area were divided into two separate subbasins, each subbasin discharging into one of the two drop inlets which will likely serve the project site. Subbasin 1 (4.5 acres) drains to the drop inlet at

[10] Per telephone conversation with Dale Smith, City of Oakland Public Works Agency, December 18, 2002, and memorandum from Lorraine Purcell, City of Oakland Public Works Agency, March 15, 2004.

[11] Per messages left by Anderson Allen, Alameda County Flood Control District, December 18 and 20, 2002.

Keller Avenue; Subbasin 2 (5.7 acres) drains to the drop inlet at Greenridge Drive. The Rational Method was used to estimate the change in peak discharge for each subbasin as a result of project development. The peak discharge, as computed using Western Alameda County Hydrology and Hydraulics criteria, is a function of precipitation, topography, soil characteristics, and land use within the project subbasins.

In order to determine whether the existing drainage infrastructure has sufficient capacity to handle the change in peak discharge from the project site, the capacity of the two drop inlets at Keller Avenue and Greenridge Drive was estimated using the Mannings Equation. The Mannings Equation estimates pipe capacity according to pipe slope, diameter, and the Mannings roughness coefficient. The results of the Rational Method and the Mannings Equation are presented in Table 6.

A comparison of the results from the Rational Method and Mannings Equation indicates that downstream infrastructure has sufficient capacity to handle the estimated increase in peak discharge from the proposed project during 10-year storm events, but do not have sufficient capacity available for 100-year storm events. The final drainage plan for the project has not yet been completed, but the applicant has completed preliminary plans in consultation with a hydraulic engineer and the City of Oakland Public Works Agency.

The final formal drainage plan will be required to comply with City of Oakland and ACFCD Hydrology and Hydraulics criteria. The ACFCD requires that drainage infrastructure for all proposed projects must be capable of handling flows from 10-year storm events, and that all facilities be capable of withstanding a 100-year storm event without failure. All drainage improvements must be reviewed and approved by a City Engineer to confirm that they would meet City and ACFCD standards.

TABLE 6 **PRE- AND POST-DEVELOPMENT STORM WATER DISCHARGE**

	Pipe Capacity (cfs)	Peak Discharge (cfs)		Change in Peak Discharge (cfs)	Percent Change
		Existing	Future		
Subbasin 1 (4.5 acres)					
10-year	11.40	8.90	9.63	0.73	9.1 %
100-year		12.72	13.51	1.13	9.1 %
Subbasin 2 (5.7 acres)					
10-year	30.80	11.30	12.47	1.17	8.2 %
100-year		16.12	17.78	1.79	8.2 %

Source: Hydraulic Calculations by A.C.K. Engineering, August 20, 2004.

Mitigation Measure HYDRO-3: Prior to final approval of the project, the applicant shall submit final hydrology/hydraulics calculations for the project based on final design plans. These calculations shall be reviewed and approved by a City Engineer. The calculations shall demonstrate that the existing drainage infrastructure along Keller Avenue and Greenridge Drive are capable of handling flows from the proposed development. If remedial actions must be taken to ensure that the project would not impact downstream drainage infrastructure, these actions shall be completed prior to construction of the proposed project at the sole cost and expense of the applicant, subject to City review and approval.

Significance After Mitigation: Less than Significant.

5. Water Quality and Runoff Pollution

IMPACT HYDRO-4: The proposed project could result in water-quality impacts including an increase in NPS pollutants and on- or off-site erosion and/or siltation. (Potentially Significant)

There has been no known water quality monitoring of runoff from the project site or vicinity. Given the existing suburban land use of the area, it is likely that the non-point source (NPS) pollutants currently found in runoff are oils, grease, metals, and petroleum hydrocarbons. These NPS pollutants are typical of suburban areas. Typical sources of such NPS pollutants in suburban environments include household products and home maintenance supplies, landscape chemicals, automobiles, and fuels. Because the proposed project would introduce 32 new units into the area, it is anticipated that there will be a moderate increase in oil, grease, metals, and petroleum hydrocarbons in site runoff. An increase in NPS pollutants as a result of project development is considered to be a potentially significant impact.

In addition, development of the proposed project could result in changes to existing drainage patterns that could potentially result in increased erosion after construction. Once the project were completed, the increase in impervious surface area resulting from project development would increase the amount of runoff leaving the project site, and could potentially increase erosion on-site. The onsite runoff, which currently occurs as sheet flow and concentrated shallow flow, would be concentrated within curbs and gutters and discharged to the subterranean drainage network. Without mitigation, eroded soils from the project site would be deposited into the drainage network and be carried to downstream drainage infrastructure. Therefore, project impacts related to on- or off-site erosion and/or siltation are considered to be potentially significant.

Mitigation Measure HYDRO-4a: Filter mechanisms shall be installed at all drop inlets receiving runoff from the project site.

Filter mechanisms can reduce the amount of sediment and petroleum hydrocarbons in runoff prior to discharge to downstream drainage facilities. Fossil filters and oil/grease separators are two types of filter mechanisms commonly used at drop inlets. Both types of filter mechanisms must be regularly maintained to ensure functionality. A maintenance schedule must be prepared and approved by City staff prior to installation.

Mitigation Measure HYDRO-4b: The project applicant shall develop a long-term storm water pollution prevention plan (SWPPP) to protect storm water quality after the construction period. The SWPPP shall include the following additional BMPs to protect storm water quality:

- Proper maintenance of parking lots and other paved areas can eliminate the majority of litter and debris washing into storm drains and thus, entering local waterways. Regular sweeping is a simple and effective BMP aimed at reducing the amount of litter in storm drain inlets (to prevent clogging) and public waterways (for water quality). The project applicant shall enter into an agreement with the City of Oakland to ensure this maintenance is completed.
- Proper maintenance of filter mechanisms at drop inlets is essential to maintain functionality. The maintenance of filter mechanisms will be the responsibility of the City of Oakland's Public Works Department. The project applicant shall enter into an agreement with the City of Oakland to ensure this maintenance is completed.
- The applicant shall prepare informational literature and guidance on residential BMPs to minimize pollutant contributions from the proposed development. This information shall be distributed to all residences at the project site. At a minimum the information should cover: (1) Proper disposal of household and commercial chemicals; (2) Proper use of landscaping chemicals; (3) Clean-up and appropriate disposal of yard cuttings and leaf litter; and (4) Prohibition of any washing and dumping of materials and chemicals into storm drains.

Significance After Mitigation: Less than Significant.