APPENDIX G – URBAN SERVICE AREA AMENDMENT - EIR PHASE

• Engineering Geology
• Coastal Geology
• Hydrogeology

Nolan, Zinn, and Associates

January 21, 2002 Job #01070-SLC

Ms. Alison Imamura
Denise Duffy and Associates
947 Cass Street, Suite 5
Monterey, California 93940

Re: Geologic and Geotechnical Services
Urban Service Area Amendment - EIR Phase
APN 790-17-001 (*USA 00-01*)
APN's 790-17-010, 790-09-009, 790-09-010 & 790-09-011 (*USA 00-02*)
APN's 841-17-067 & 841-17-081 (*USA 00-03*)
APN's 841-15-007, 841-15-008, 841-150-009, 841-15-010 & 841-15-058 (*USA 00-04*)
City of Gilroy, Santa Clara County, California

Dear Ms. Imamura:

At your request, we have reviewed the geologic and hydrologic information for the above referenced properties. The purpose of this investigation was to provide an evaluation of geologic, geotechnical, and hydrologic impacts relevant to the proposed annexation of these residentially and industrially zoned parcels to the City of Gilroy's urban services area.

This report summarizes the geologic and hydrologic settings of the parcels and discusses potential geologic, geotechnical, and hydrologic impacts of the proposed annexation.

Scope of Services

1. Review of existing literature describing the geology, hydrology, and groundwater resources of pertinent portions of the Gilroy area and Santa Clara County.

2. Review of 2 sets of stereo-pair aerial photographs depicting the sites.

3. Geologic and hydrologic reconnaissance of the project site.

4. Preparation of this report summarizing our findings and conclusions.

Introduction

Based on our review of the project description, it is our understanding that the City of Gilroy is considering four amendments to the Urban Service Area, comprising two residentially zoned parcels and two industrially zoned parcels, totaling approximately 213.5 acres. The first amendment consists of approximately 5.5 acres of land located on Kern Avenue, just south of Tatum Avenue (*USA 00-01*, Figure 1; Topographic Index Map). This land is designated for residential use and is currently being used by the Gilroy Union High School for student use as a farming site. The second amendment consists of approximately 32 acres of land bounded on the east by Wren Avenue and on the north by Vickery Avenue (*USA 00-02*, Figure 1). This land is also designated for residential use and is currently used for agriculture and rural residence. The third and fourth amendments consist of a total of approximately 176 acres of vacant industrial zoned land south of Highway 152 and east of Rossi Avenue (*USA 00-03 & USA 00-04*, Figure 1). All four amendments are located adjacent to the City of Gilroy, Santa Clara County, California.

Geologic Setting

The subject sites are rectangular to semi-rectangular parcels situated in the southern portion of the Santa Clara Valley at elevations between 170 and 280 feet above sea level. The Santa Clara Valley is a broad depositional trough bounded by the Santa Cruz Mountains to the southwest and the Diablo mountain range to the northeast.

The valley is filled with alluvial and fluvial sediments of Plio-Pliestocene to Holocene age. These sediments range from 500 to more than 1,000 feet thick. The lower portion of the valley-fill sedimentary section includes fluvial and alluvial sediments assigned to the Santa Clara Formation, a Plio-Pleistocene unit that occurs along the length of the Santa Clara Valley, extending northward along the San Francisco Peninsula, where is it well exposed at the surface. The Santa Clara Formation includes deposits of an ancient river system flowing roughly along the axis of the Santa Clara Valley. Overlying the Santa Clara Formation are younger alluvial sediments, shed principally from the valley margins.

Regional geology is dominated by the San Andreas fault system, which results in the pronounced northwest/southeast structural alignment of geologic features (Figure 2, Regional Geologic Map). Other significant faults in the project area include the Calaveras and Sargent faults, which pass to the northeast and southwest of the subject site, respectively (Figure 2).

Earth materials underlying *USA 00-01* and *USA 00-02* have been mapped as alluvium of an undetermined depth (Qa, Figure 3, Local Geologic Map for *USA 00-01 and USA 00-02*). These alluvial deposits are made up of gravel, sand, silt and clay.

Earth materials underlying *USA 00-03* and *USA 00-04* have been mapped as alluvium and clay and silt deposits (Qa and Qc, Figure 4, Local Geologic Map for *USA 00-03* and *USA 00-04*).

Materials encountered in geotechnical borings in the vicinity of the study areas were consistent with these descriptions (Earth System Consultants, 2001; Harza Consulting Engineers and Scientists, 1994; Terrasearch, Inc., 1998).

Soils

The agricultural soil survey for Santa Clara County (SCS, 1974) shows soil types mapped on the subject parcels. The distribution of soil types on the subject parcels is depicted on Figures 5 and 6, Soil Survey Maps. Table 1 summarizes the characteristics of the various soil units. The soils tend to be clay rich.

Table 1: Soil Unit Characteristics

Soil Series	Hydrologic Soil Group	Seasonal High Water Table (feet below ground surface)	Permeability (inches/hour)	Shrink/Swell Potential
Ca- Campbell silty clay loam	C	none	0.2-0.63	Moderate
Ce-Campbell silty clay, muck substratum	D	yes (2.5-3.5)	0.06-0.2	High
Cg-Clear Lake clay	D	yes (2.5-6.0)	0.06-0.2	High
PpA-Pleasanton gravelly loam, 0 to 2% slopes	B	none	0.2-0.63	Moderate
SdA-San Ysidro loam, 0 to 2% slopes	D	none	<0.06	High
Su-Sunnyvale silty clay	C	yes (2.5-5.0)	0.06-0.2	High

Seismic Setting

Major faults and associated earthquake epicenters for the project region are depicted on Figure 7, Regional Seismicity Map. The dominant faults in the area trend northwest-southeast, sub-parallel to the Santa Clara Valley. The Calaveras Fault passes 4.2 miles to the northeast of the subject sites. The Calaveras fault is highly active and has been associated with several historic earthquakes in the magnitude range of 6 to 6.5. Petersen et al (1996) assign a maximum earthquake magnitude of about 6.2 to this portion of the Calaveras fault.

The Sargent fault passes approximately 3.6 miles to the southwest of the subject parcels. Geologic investigations indicate that the Sargent fault is capable of a magnitude 6.8 earthquake every 1200 years, on average (Petersen et al., 1996).

The main trace of the San Andreas fault is located approximately 7.0 miles to the southwest of the subject site. This fault is highly active and has the potential to generate magnitude 7.9 earthquakes (Petersen et al, 1996).

Other active faults in the region include the Paicines, Tres Pinos and Quien Sabe faults. These faults are considered to be less active than the San Andreas or Calaveras faults, but may also produce damaging earthquakes.

Hydrologic Setting

The Santa Clara Valley has a climate typical of Central Coastal California inland valleys, receiving the majority of its rainfall in the winter season, from October to April. Average annual rainfall ranges from a high of about 20 inches per year along the margins of the basin to about 17 inches per year towards the center of the basin (Rantz, 1971). Average annual rainfall in the City of Gilroy, located along the western margin of the basin, is about 19 inches per year (Rantz, 1971).

The principal drainage system in the project area is Llagas Creek and its tributaries. The tributary drainages are mostly ephemeral, flowing during and for a short time after the winter rain season. The West Branch Llagas Creek runs just east of *USA 00-01* and *USA 00-02*, and *USA 00-02* is crossed by Lions Creek (Figure 1). Lions Creek has been channelized for flood control and presently crosses the property in an artificial channel that runs parallel to and just north of Tatum Avenue. This channel is about 14 feet deep and is bounded by four-foot high levees. Llagas Creek runs just east of *USA 00-03* and *USA 00-04* and *USA 00-03* is bounded to the east by a channelized portion of Miller Slough that feeds into Llagas Creek (Figure 1).

Runoff from *USA 00-01 and 00-02* formerly took place by overland flow into nearby ephemeral drainages, including Lions Creek. Lions Creek is presently is bounded by levees, preventing runoff from entering the channel directly. Runoff from these properties therefore appears to flow overland until it enters the storm drain system associated with Kern and Wren Avenues.

Past agricultural use of *USA 00-03 and 00-04* has resulted in a system of agricultural ditches that drain runoff generally west and south towards Llagas Creek and Miller Slough.

Groundwater

The subject properties are located in the Llagas Groundwater Basin. The Llagas Basin consists of a deep, alluvial valley-fill aquifer that occupies the southeastern end of the Santa Clara Valley, Santa Clara County, California. The basin extends southeasterly from the southern end of the Coyote Valley to the Pajaro River, located along the Santa Clara-San Benito County line, a distance of about 17 miles. The valley ranges between two and five miles wide. The City of Gilroy is located in the west-central portion of the basin.

The valley is filled with 500 to a 1,000 feet of Quaternary age sediments consisting of fluvial deposits of an ancient river system overlain by alluvium shed from the adjacent mountain ranges. The aquifer is separated into confined and unconfined zones. The unconfined zone, known as the Forebay area, includes the northern half of the basin and the elevated valley margins in the southern portion of the basin. Sediments in this area consist of interstratified, discontinuous layers of gravel, sand, silt and clay. Surface waters in this area percolate directly to a shallow ground water table. Within the confined zone, constituting the southern half of the basin, a regionally continuous aquitard exists at a depth of 20 to 100 feet that separates the aquifer into an upper, unconfined aquifer and a lower, semi-confined to confined aquifer. Depths to groundwater in the confined zone are generally shallow.

Historically, groundwater levels in the valley have dropped somewhat following the onset of groundwater pumping for agricultural and urban development in this century. However, the Santa Clara Valley Water District conducts groundwater recharge at several sites in the groundwater basin using imported Central Valley water. Because of the recharge program, existing groundwater usage in the valley is considered sustainable (Hoose, Santa Clara Valley Water District, personal communication, 2001). Development of the subject parcels is consistent with planned growth in water supply for the basin (Santa Clara Valley Water District, 2000).

Groundwater quality in the basin has been compromised by agricultural and urban development. Elevated nitrate levels are found in most of the wells drilled in the basin, with levels commonly exceeding maximum contaminant levels established by state and federal drinking water standards (Santa Clara Valley Water District, 1993). Since all communities in the basin rely on groundwater for their water supply, the nitrate contamination has posed a significant water supply problem. Past mitigation of water quality problems has included abandonment of wells or blending of water from different sources to reduce the average nitrate concentration. The City of Gilroy has developed a secondary sewage treatment system that reduces the nitrate concentration of septic effluent from the city to less that significant levels before it is percolated back into ground water. The denitrification of the septic effluent is expected to help improve the overall quality of groundwater in the basin.

GEOLOGIC, GEOTECHNICAL, AND HYDROLOGIC IMPACTS AND POTENTIAL MITIGATIONS FOR THE PROPOSED PROJECT

Significance Criteria

CEQA guidelines indicate that a project may be considered to have a significant hydrologic impact if it: 1) substantially degrades water quality, 2) substantially degrades or depletes groundwater resources or interferes with groundwater recharge, or 3) significantly alters local drainage systems or runoff amounts, leading to an increase in the hazards of erosion or flooding.

With respect to geologic and geotechnical impacts, a significant impact is: 1) one that will expose people or structures to major geologic hazards, such that injury to persons or major economic loss due to structural damage will occur, or 2) one that will result in significant degradation of the natural environment due to interruption of natural landscape processes or the introduction of hazardous substances. These factors include processes that would:

- destroy a substantial portion of any unique soil type or geologic feature;
- cause a substantial change in topography or ground surface relief features;
- accelerate wind or water erosion, especially where such erosion leads to a loss of soil productivity, revegetation potential, or siltation of receiving waters;
- expose people or property to elevated geologic hazards such a seismic shaking or landsliding;

Basis for Imact Assessment

The proposed project calls for an Urban Service Area amendment for the City of Gilroy which includes approximately 205.5 acres or residential and industrial land. We have analyzed the potential impacts and prospective mitigations in accordance with this proposed amendment.

Our impacts analysis is based on a comparison between likely, permitted development on the properties assuming they are annexed to the Urban Service Area versus likely, permitted development without annexation. For *USA 00-01 and 00-02,* under present conditions, residential development on these parcels would require that homes be developed with private wells to provide water and with individual, in-ground septic systems. Based on regulatory setbacks that are required between wells and septic leachfields and the required area for development of leach fields, it is our opinion that a residential density of about one unit per acre is likely under present conditions. With annexation of these two properties into the Urban Service Area, we anticipate development according to the specification of Low Density Residential in the City of Gilroy general plan, 3 to 7.25 dwelling units per acre. For the purposes of this evaluation, we will assume 6 units per acre. The areas for *USA 00-01 and 00-02* are 5.5 and 32 acres, respectively. These areas therefore correspond to 5 and 32 residential units under a non-annexation scenario and 33 and 192 units with annexation.

For *USA 00-03 and 00-04,* we anticipate that the parcels will remain agricultural unless annexed to the Urban Service Area. Provided that annexation takes place, we anticipate development according to the guidelines established in the City general plan for the General Industrial designation. We assume that industrial development will entail coverage of about 90% of the land with pavement or buildings.

Hydrologic Impacts

Discussion

Development based on the proposed Urban Service Area amendments may have several impacts on surface and groundwater resources: 1) the increase in impermeable surface area due to paving and buildings could result in higher erosion or flooding potential due to concentration and increased velocity of the runoff; 2) development of the properties could cause a reduction in surface water quality due to contaminants carried in surface water runoff, and 3) there may be an increased sediment load in runoff due to grading and site development, leading to siltation of local waterways.

Calculations for Impermeable Area Associated With Development of USA 00-01 and 00-02:

Impermeable area associated with a typical Single family residence:

roof area	*1800 sq.ft.*
driveway area (20ftx20ft)	*400 sq.ft.*
patios, sidewalks, etc.	*300 sq.ft.*
Total Impermeable Area per unit	*2,500 sq.ft.*

Access roadway coverage associated with each single family residence

½ average road width (including sidewalks)	*25 ft.*
X	
approximate frontage length along each lot	*100 ft.*
Total Impermeable Road Area per unit	*2500 sq. ft.*
Total Impermeable Area per Residential Unit	***5000 sq. ft.***

1) Prospective impermeable area without annexation, USA 00-01:

5 units x 5000 sq. ft. impermeable area per unit = 25,000 sq. ft.
= 0.57 acres

2) Prospective impermeable area with annexation, USA 00-01

33 units x 5000 sq. ft. impermeable area per unit =165,000 sq. ft.
=3.79 acres

Net Change in Impermeable Area, USA 00-01 =+3.22 acres

3) Prospective impermeable area without annexation, USA 00-02:

32 units x 5000 sq. ft. impermeable area per unit = 160,000 sq. ft.
= 3.67 acres

4) Prospective impermeable area with annexation, USA 00-02

192 units x 5000 sq. ft. impermeable area per unit =960,000 sq. ft.
=22 acres

Net Change in Impermeable Area, USA 00-02 =18.37 acres

Based on these calculations, we expect an increase in prospective impermeable area of about 21.5 acres under the annexation scenario.

Calculation of expected change in runoff amounts with annexation, USA 00-01 and 00-02

The amount of precipitation falling on the ground surface that ends up as runoff depends on slope, soil type, vegetative cover, and the pattern (timing and amounts) of rainfall. For the purposes of this evaluation, we estimate that 90% of water falling on impermeable surfaces is carried off site by storm drains, in comparison to about 30% of precipitation under existing conditions, based on local soil types and Soil Conservation Service methods (SCS, 1974; McCuen, 1982). The balance of the precipitation in each case is lost to evo-transpiration or percolates to groundwater. Using these assumptions, and using an annual average rainfall of 19 inches, we calculate that the increase in impermeable area will result in additional runoff volume of about 3.06 and 17.4 acre-feet annually from *USA 00-01 and 00-02, respectively.*

1) Without annexation, USA 00-01

0.57 acres impermeable area x 19" precip. annually x 90% = 0.81 acre-feet
4.93 remaining acres x 19" precip. annually x 30% = 2.34 acre-feet
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Total anticipated annual runoff without annexation = 3.15 acre-feet

2) With annexation, USA 00-01

3.79 acres impermeable area x 19" precip. annually x 90% =	*5.4 acre-feet*
1.71 remaining acres x 19" precip. annually x 30% =	*0.81 acre-feet*
Total anticipated annual runoff with annexation =	***6.21 acre-feet***
Net Change with annexation	***+3.06 acre-feet***

3) Without annexation, USA 00-02

3.67 acres impermeable area x 19" precip. annually x 90% =	*5.23 acre-feet*
28.33 remaining acres x 19" precip. annually x 30% =	*13.46 acre-feet*
Total anticipated annual runoff without annexation =	***18.69 acre-feet***

4) With annexation, USA 00-02

22 acres impermeable area x 19" precip. annually x 90% =	*31.35 acre-feet*
10 remaining acres x 19" precip. annually x 30% =	*4.75 acre-feet*
Total anticipated annual runoff with annexation =	***36.1 acre-feet***
Net Change with annexation	***+17.4 acre-feet***

Based on these calculations, we expect development under the annexation scenario to result in an annual increase in runoff from precipitation of about 20.5 acre-feet.

Calculation of expected change in runoff amounts associated with development of USA 00-03 and 00-04:

Impermeable area associated with industrial development is expected to be 90% of available land due to building coverage, parking lots, and roadways. We expect 90% of precipitation falling on paved areas to run off. Without annexation, we expect the parcels to remain agricultural, with negligible impermeable area. Runoff from undeveloped agricultural land is expected to be 30% of annual precipitation.

Without annexation, annual runoff volume is expected to be:

176 acres x 19" annual precip. x 30% runoff = *83.6 acre-feet*

With annexation, runoff is expected to be:

90% of 176 acres = 158.4 acres x 19" annual precip. x 90% runoff = 225.7 acre-feet
10% of 176 acres = 17.6 acres x 19" annual precip. x 30% runoff = 8.4 acre-feet

Total runoff with annexation ***234.1 acre-feet***

Net Change with annexation ***+150.5 acre-feet***

Based on these calculations, we expect development under the annexation scenario to result in an annual increase in runoff from precipitation of about 150.5 acre-feet.

Impacts of Increased Runoff Volume and Runoff Velocity, USA 00-01: In our opinion, the anticipated increase in runoff volumes for the proposed change in development densities is potentially significant and has the potential to increase the hazard of soil erosion and flooding in downstream areas and to tax the capacities of local drainage systems. These impacts may be mitigated with appropriate engineering design. It should be noted that our analysis is based on reasonable figures for runoff quantities and impervious surface associated with different types of development. These estimates should therefore be considered approximate. Specific development plans may alter actual calculated volumes, although it is unlikely that such variations will significantly alter our conclusions.

Impacts of Increased Runoff Volume and Runoff Velocity, USA 00-02: In our opinion, the anticipated increase in runoff volumes for the proposed change in development densities is potentially significant and has the potential to increase the hazard of soil erosion and flooding in downstream areas and to tax the capacities of local drainage systems. These impacts may be mitigated with appropriate engineering design. It should be noted that our analysis is based on reasonable figures for runoff quantities and impervious surface associated with different types of development. These estimates should therefore be considered approximate. Specific development plans may alter actual calculated volumes, although it is unlikely that such variations will significantly alter our conclusions.

Impacts of Increased Runoff Volume and Runoff Velocity, USA 00-03 and 00-04: *In our opinion, the anticipated increase in runoff volumes for the proposed change in development densities is potentially significant and has the potential to increase the hazard of soil erosion and flooding in downstream areas and to tax the capacities of local drainage systems. These impacts may be mitigated with appropriate engineering design. It should be noted that our analysis is based on reasonable figures for runoff quantities and impervious surface associated with different types of development. These estimates should therefore be considered approximate. Specific development plans may alter actual calculated volumes, although it is unlikely that such variations will significantly alter our conclusions.*

Mitigation of Increased Runoff Volume and Runoff Velocity Impacts: *To mitigate potential hazards associated with runoff from developed surfaces, we recommend: 1) development of an engineered drainage system to capture runoff and divert it to safe discharge points, protecting exposed soils from erosion and 2) detention and metering of site runoff to pre-development flows. 3) drainage design that is specifically directed toward reducing the amount of runoff from paved surfaces. Runoff volumes can be reduced by site design that limits paved areas, employs permeable paving designs, and/or incorporates drainage design that disperses runoff into areas designed to slow runoff and encourage percolation into soils.*

Potential Impacts on Groundwater Quantity

Discussion

Groundwater quantity impacts result from several different aspects of development, including 1) reduction in groundwater recharge due to creation of impermeable surface, and changes in the amount of groundwater consumption due to a change in use. These two sources of impacts will be considered separately, below.

Reduction in recharge:

The project area overlies the Llagas Groundwater Basin. A portion of the precipitation falling on the project area percolates into the ground and contributes to groundwater recharge in the basin. In addition to increasing runoff volumes, paving and building will result in a decrease of natural recharge to groundwater due to the creation of impermeable surface. Precipitation runoff from parking lots and roofs is typically collected and directed into a storm drain system where it runs off site into local stream channels.

Groundwater recharge by rainfall depends on the annual amount of rainfall, temporal distribution of rainfall during the year, vegetation, and climatic factors such as temperature and wind. Ones means of estimating how much precipitation percolates to groundwater is a soil moisture balance calculation.

We did not perform a moisture balance for this project. However, we have looked at the results of moisture balance and numerical modeling results for local areas to help estimate precipitation recharge. A soil moisture balance was prepared for the University of California at Santa Cruz by Johnson (1988). This site consists of grasslands and mixed forest with an average annual precipitation of 38 inches per year. That study found that 6 inches of precipitation, or 16% of the total, was available for groundwater recharge. Nolan Associates (1995) prepared a soil moisture balance for a site in Salinas Valley. The site is range land vegetated by grasses and sparse trees. Average annual rainfall is 12 inches per year. Out of 12 inches of precipitation, it was found that 1.8 inches per year (15%) are available for recharge. Montgomery Watson (1994) estimated an average annual recharge from rainfall for undeveloped land in the Salinas Valley of 1.7 inches per year. This figure was estimated from calibration of the integrated surface and groundwater model for the Salinas Valley. Average annual rainfall for most of the valley ranges from 12 to 14 inches per year. Recharge is therefore equivalent to 12 to 14% of rainfall.

The present subject sites are almost flat lying and are underlain by well to very well drained soils. Consequently, we are of the opinion that recharge to ground water will be somewhat higher than the 12% to 16% range found in the studies cited above. For this evaluation, we assume that 20% of precipitation falling on the subject properties will percolate to groundwater.

USA 00-01

Given an average annual rainfall of 19 inches, and an increase in impermeable area at this site of 3.22 acres, we estimate that the increase in impermeable area will result in a loss of 1.02 acre feet of recharge to groundwater.

3.22 acres x 19" annual precip. x 20% recharge = 1.02 acre-feet per year

USA 00-02

Given an average annual rainfall of 19 inches, and an increase in impermeable area at this site of 18.37 acres, we estimate that the increase in impermeable area will result in a loss of 5.82 acre-feet of recharge to groundwater.

18.37 acres x 19" annual precip. x 20% recharge = 5.82 acre-feet per year

USA 00-03 AND 00-04

Given an average annual rainfall of 19 inches, and an increase in impermeable area at these sites of 158.4 acres, we estimate that the increase in impermeable area will result in a loss of 50.2 acre feet of recharge to groundwater.

158.4 acres x 19" annual precip. x 20% recharge = 50.2 acre-feet per year

In our opinion, these estimates are conservative, since not all runoff from roofs and paved areas will be captured by storm drains and carried offsite. Some of the runoff will be discharged onto native soil and will result in some recharge to groundwater. In addition, mitigation measures recommended for reducing runoff may also serve to induce groundwater recharge.

Project water use:

A change in land use can impact local water supply resources by changing the amount of water used on the parcels. Private water supplies for residential and agricultural use and municipal water supplies are both drawn from ground water. Consequently, impacts will be a function of changes in consumptive use of water, rather than a change of water source.

Change in Water Use USA 00-01:

Parcel USA 00-01 is in use as a student farm site by the Gilroy Union High School. The present amount of water used at this site is unknown. For the purposes of evaluating changes in water use for environmental analysis, we will assume residential development of this parcel at a density of one unit per acre without annexation and six units per acre with annexation.

Estimated Water Use:

We have prepared calculations that estimate the amount of water used by individual residential units. Reference sources for the various water use statistics used in the calculations are included in foot notes.

Residential water use:

daily use, per residence	*= 400 gallons per day**
	= 0.45 acre-ft per year

** City of Hollister, Department of Public Works*

Assuming that the proposed increase in residential density with annexation results in an increase in the number of residential units from 5 to 33 (net increase of 28 units), this project would result in an increased annual water demand of:

28 units x 0.45 acre-ft per unit per year = 12.6 acre feet per year

Of the total amount of water used per household, approximately 50% is typically used for irrigation of landscaping (outdoor use), and 50% is used for drinking, bathing, cooking, laundry, dishes, etc. (indoor use). Of these amounts, about 20% of the water used outdoors percolates back into the groundwater regime and about 80% of the water used indoors is returned to groundwater, either through individual septic systems or through the municipal waste treatment system for the City of Gilroy. Therefore, approximately half of the water used by a typical household is returned to groundwater, and half constitutes consumptive use, resulting in a net annual consumption per household of approximately 0.225 acre-feet per year. The net increase in the consumptive use of groundwater by the proposed annexation for USA 00-01 and 00-02 is therefore approximately 42.3 acre-feet per year.

28 units x 0.225 acre-feet/year = 6.3 acre-ft per year.

Change in Water Use USA 00-02:

Parcel USA 00-02 is presently empty. For the purposes of evaluating changes in water use for environmental analysis, we will assume residential development of this parcel at a density of one unit per acre without annexation and six units per acre with annexation.

Estimated Water Use:

We have prepared calculations that estimate the amount of water used by individual residential units. Reference sources for the various water use statistics used in the calculations are included in foot notes.

Residential water use:

daily use, per residence	*= 400 gallons per day**
	= 0.45 acre-ft per year

* *City of Hollister, Department of Public Works*

Assuming that the proposed increase in residential density with annexation results in an increase in the number of residential units from 32 to 192 (a net change of 160 units), this project would result in an increased annual water demand of:

160 units x 0.45 acre-ft per unit per year = 72 acre feet per year

Of the total amount of water used per household, approximately 50% is typically used for irrigation of landscaping (outdoor use), and 50% is used for drinking, bathing, cooking, laundry, dishes, etc. (indoor use). Of these amounts, about 20% of the water used outdoors percolates back into the groundwater regime and about 80% of the water used indoors is returned to groundwater, either through individual septic systems or through the municipal waste treatment system for the City of Gilroy. Therefore, approximately half of the water used by a typical household is returned to groundwater, and half constitutes consumptive use, resulting in a net annual consumption per household of approximately 0.225 acre-feet per year. The net increase in the consumptive use of groundwater by the proposed annexation for USA 00-01 and 00-02 is therefore approximately 42.3 acre-feet per year.

160 units x 0.225 acre-feet/year = 36 acre-ft per year

Change in Water Use USA 00-03 and 00-04:

Parcels USA 00-03 and 00-04 are presently being used for agriculture. Water consumption by agriculture is highly variable, depending on the type of crop, the number of crops per year, and the amount of rainfall in a particular year. Typical consumptive use of water (evotranspiration of applied water) in the Gilroy area ranges from about one to three acre-feet per acre (per crop), depending on the type of crop (DWR, 1975). The balance of applied water percolates back to ground water. Commercial and industrial water use is highly variable and cannot be reliably estimated without specific information about planned commercial/industrial operations.

Without specific plans for commercial/industrial development on USA 00-03 and 00-04, it is difficult to ascertain specific impacts. Prospective agricultural water use for the 176 acres on these two parcels could range from 176 acre-feet per year, assuming one low water use crop per year, to over 1000 acre-feet per year with multiple high water consumption crops per year. This range of water consumption would be comparable to water use by a wide range of commercial/industrial operations, although there area some commercial processes, such as food processing, that could result in increased water use.

<u>Groundwater Quantity Impacts USA 00-01</u>: *In our opinion, the project specific impacts on groundwater quantity are likely to be less than significant. The reduction of ground water recharge and changes in consumptive water use suggested by the above analysis are not likely to significantly impact local ground water supplies. However, cumulative impacts on groundwater quantity due to continued residential and commercial development in the Gilroy area could be significant and can only be mitigated by area wide resource planning.*

<u>Groundwater Quantity Impacts, USA 00-02</u>: *In our opinion, the project specific impacts on groundwater quantity are likely to be less than significant. The reduction of ground water recharge and changes in consumptive water use suggested by the above analysis are not likely to significantly impact local ground water supplies. However, cumulative impacts on groundwater quantity due to continued residential and commercial development in the Gilroy area could be significant and can only be mitigated by area wide resource planning.*

Groundwater Quantity Impacts, USA 00-03 and 00-04: In our opinion, the project specific impacts on groundwater quantity are likely to be less than significant. The reduction of ground water recharge and changes in consumptive water use suggested by the above analysis are not likely to significantly impact local ground water supplies. Commonly, conversion from agricultural uses to other uses results in little net change in water consumption. However, cumulative impacts on groundwater quantity due to continued residential and commercial development in the Gilroy area could be significant and can only be mitigated by area wide resource planning.

Mitigation of Project Specific Groundwater Quantity Impacts: Although the project specific impacts are judged to be less than significant, there are a number of things that can be done to reduce water consumption. Potential mitigations include construction of facilities to encourage groundwater recharge as part of development plans, incorporation of water conservation measures in any site development (including use of native drought resistant vegetation for landscaping), and minimizing the use of impervious ground covering materials, as discussed below:

1. *Artificial recharge can be separated into onsite and offsite recharge projects. Onsite artificial recharge can include percolation ponds (these can be used simultaneously as detention ponds) or underground recharge systems such as dry wells or horizontal drains. It should be noted, however, that runoff from parking areas and roads exposed to vehicular traffic may not be of sufficient quality to be used for recharge projects.*

   Offsite artificial recharge can be through direct participation by developers in offsite recharge projects, or by contribution to recharge project funds administrated by public agencies.

2. *Water Conservation Typical water conservation measures include use of drought tolerant landscaping and low flow plumbing fixtures.*

   Since the sewage treatment facility for Gilroy produces reclaimed water, the proposed projects may be designed to utilize reclaimed water for irrigation and other non-potable water uses.

3 *<u>Limitation of Impermeable Surface</u> The amount of impermeable surface associated with a development can be minimized through project design. Such mitigation can include clustering of development to minimize road areas and design of buildings to minimize the foot print area of the structure.*

Water Quality Impacts

<u>Discussion</u>

The proposed annexation has the potential to impact water quality though two means:

1) the generation of contaminated or hazardous effluent on site that has a potential to enter the groundwater system via sewage treatment systems, or;

2) the generation of surficial contaminants, such as oil, grease, or silt, and the application of pesticides or fertilizers to landscaping that can be carried offsite in surface runoff.

Groundwater Quality

The principal groundwater quality issue in the the Llagas groundwater basin is the occurrence of elevated nitrate levels. Nitrate concentrations in well water in the basin are commonlynear or above established maximum contaminant levels (Santa Clara Valley Water District, 1993). Recognized sources of the nitrate contamination in ground water include sewage disposal systems, feed lots, and application of nitrate bearing fertilizers in agriculture. All three sources are present in the Llagas basin.

The sewage treatment system used by the City of Gilroy incorporates a secondary treatment system that recharges treated effluent to ground water in percolation ponds (some effluent is discharged directly to the Pajaro River as needed during the winter season) and a reclaimed water project that recycles waste water for commercial and agricultural uses. The treated effluent and reclaimed water is denitrified and discharged with nitrate levels well below that of effluent typically discharged from on-site septic systems. The sewage treatment program is expected to improve overall quality of groundwater by reducing nitrate concentrations in effluent percolating to groundwater.

The proposed annexation will remove 176 acres from agricultural production and convert 37.5 acres of residential land from individual septic systems to city sewer. Both changes can be expected to reduce local nitrate loading of groundwater. We therefore expect the proposed annexation to have an overall net positive effect on groundwater quality with regard to nitrate contamination. Potential impacts on groundwater quality due to effluent from certain types of commercial and industrial processes cannot be specified without specific project plans. Residential use traditionally has a modest impact on groundwater quality.

> *Groundwater Quality Impacts: The proposed annexation is expected to improve overall groundwater quality with respect to nitrate contamination. Other groundwater quality impacts are expected to be small. Therefore, the prospective impacts of annexation on groundwater quality are considered to be less than significant. The principal impacts on groundwater quality other than by percolating septic effluent will be due to percolation of contaminated surface waters. Consequently, enactment of surface water quality mitigation measures will also protect groundwater quality. One potential avenue of groundwater contamination is provided by abandoned water wells, which can permit contaminated surface waters to enter deep portions of the aquifer. Consequently, any existing wells on the subject properties should be properly maintained, or abandoned according to Santa Clara Valley Water District regulations.*

> *Mitigation of Groundwater Quality Impacts: No groundwater specific mitigations are proposed based on the impacts analysis. However, any existing water wells should be properly maintained or abandoned according to Santa Clara Valley Water District regulations.*

Surface Water Quality

The primary impacts from development related to the proposed project will be due to oil, grease, and other contaminants from vehicular traffic carried in street and parking area runoff and an increase in silt load due to site grading and development. Increases in traffic related contamination will be proportional to the increase in traffic and site use. Siltation from grading will be relevant principally during site development, although some post-development siltation can occur if the project is not property designed and constructed.

Siltation commonly occurs as a result of plowing for agriculture. Therefore, conversion of use from agricultural to commercial/industrial use can result in lowering of siltation hazards, provided that development is properly planned and executed.

> *Surface Water Quality Impacts: The impacts associated with the proposed annexation in relation to surface water quality are considered to be potentially significant unless mitigated.*

Mitigation of Surface Water Quality Impacts: The quality of runoff can be improved by following a few simple procedures: 1) vacuum street sweeping will remove potential contaminants from the roadways that would otherwise be collected by runoff, 2) runoff should be directed to storm drains equipped with sediment and grease traps (it is imperative that the grease traps be maintained in good operating condition), 3) use of native vegetation for landscaping will reduce the amount of pesticide and fertilizer that might otherwise be required to maintain the landscaping, and 4) use of approved erosion control measures and landscaping can reduce sediment load in the runoff.

All construction activities should follow Best Management Practices (BMP) guidelines for construction activities as part of the Santa Clara Urban Runoff Pollution Prevention Program. BMP guidelines are summarized in the "California Storm Water Construction BMP Handbook".

Recommendations for post-construction water quality design measures are contained in "Start at the Source, Design Guidance Manual for Stormwater Quality Protection" by the Bay Area Stormwater Management Agencies Association.

Flooding Impacts

USA 00-01

USA 00-01 is shown to be partially in both Zone B and Zone D on the Flood Zone Map 1 (Figure 8). Zone B defines areas between the limits of the 100-year and 500-year floods; or certain areas subject to 100-year flooding with average depths less then 1 foot or where the contributing drainage is less then one square mile; or areas protected by levees from the base flood. Zone D defines areas with undetermined, but possible flood hazards. We are of the opinion the hazard posed by flooding on this parcel is low.

USA 00-02

USA 00-02 is shown to be partially in both Zone B and Zone D on the Flood Zone Map 1 (Figure 8). Zone B defines areas between the limits of the 100-year and 500-year floods; or certain areas subject to 100-year flooding with average depths less then 1 foot or where the contributing drainage is less then one square mile; or areas protected by levees from the base flood. Zone D defines areas with undetermined, but possible flood hazards. We are of the opinion the hazard posed by flooding on this parcel is low.

USA 00-03 and USA 00-04

USA 00-03 is shown to be partially in Zone A, Zone A3 and Zone A7 and USA 00-04 is shown to be in Zone A on the Flood Zone Map (Figure 9). Zones A, A3 and A7 all define areas of 100-year flood with base flood elevations and flood hazard factors determined. Flooding in areas designated as 100 year flood zones is a potentially significant impact.

> *<u>Flooding and Inundation Impacts, USA 00-01</u>: Flooding impacts on USA 00-01 are considered to be less than significant.*
>
> *<u>Flooding and Inundation Impacts, USA 00-02</u>: Flooding impacts on USA 00-02 are considered to be less than significant.*
>
> *<u>Flooding and Inundation Impacts, USA 00-03 and 00-04</u>: Development of areas on USA 00-03 and 00-04 may be impacted by flooding. We therefore consider flooding impacts potentially significant on these parcels without mitigation.*
>
> *<u>Mitigation of Flooding and Inundation Impacts, USA 00-03 and 00-04</u>: Mitigation of flooding impacts includes developing structures with ground floor elevations above the calculated 100-year flood water surface. FEMA regulations also require that new development in the flood plain not raise the base flood elevation significantly. It may therefore be necessary to perform a hydraulic analysis to evaluate the impacts of any proposed development on flood levels prior to permitting development.*

Seismic Shaking Hazard

<u>Discussion</u>

Strong ground shaking may occur on the subject sites during the next major earthquake on a regional fault system. Such shaking can cause severe damage to or collapse of buildings or other project facilities and may result in significant economic loss to the project and/or endanger the health and welfare of persons. Seismic shaking is therefore a potentially significant impact.

There are two methods for estimating seismic ground motions for a given area: "deterministic" and "probabilistic". A deterministic approach estimates the magnitude of the most severe shaking that can be expected at a particular site, without regard for how likely such shaking is to occur. A probabilistic analysis evaluates a range of ground motions, and specifies a probability for each level of shaking intensity. The probabilistic evaluation allows one to select a specified risk level for design which may be adequate for the structure, without having to design for a more severe, but less likely shaking intensity. While a probabilistic analysis represents a more sophisticated approach to seismic design, both approaches yield important information for evaluating risks due to seismic shaking.

Table 2 summarizes characteristics of local active faults and provides a deterministic evaluation of possible earthquake ground motions for the subject property. The ground motion intensities listed in Table 2 are termed "mean peak horizontal ground accelerations" and are expressed as a fraction of the force of gravity (g). These accelerations are based on attenuation relationships derived from the analysis of historical earthquakes. Because the historical data can be interpreted in different ways, there are a number of different attenuation relationships available. We have employed two fairly conservative attenuation relationships in deriving the acceleration values listed in Table 2. It should be noted that both sets of acceleration values listed in Table 2 are only average values. We therefore caution that the listed values are to be used only as approximations, rather than as precise predictions. Actual measured "free-field" accelerations may be larger.

For the purpose of evaluating deterministic ground motion parameters for the site, we have considered four potential seismic sources, the San Andreas, Calaveras, Sargent, and Quien Sabe faults. The recurrence intervals for potentially damaging earthquakes on these faults range from one major earthquake every 30 to 80 years on the Calaveras fault to one major earthquake about every 1200 years on the Sargent fault (Table 2). Other faults or fault zones in this region, such as the Paicines, Tres Pinos or Bradley faults, could produce earthquakes that affect the project site. There is insufficient information available for these other faults to assess potential shaking intensities at the site. Deterministic ground motions from these smaller or more distant faults, however, are expected to be lower and to occur less frequently than for the principal faults listed in Table 2.

As can be seen in Table 2, expected deterministic ground motions range up to 0.5g, corresponding to the maximum expected earthquake on the San Andreas fault.

The expected deterministic ground motion values given are only average values. Actual ground motions during an earthquake may vary due to differences in the way portions of the earths crust transmit seismic energy or because of unique site conditions, such as bedrock type or topography. The values listed in Table 2 were calculated using alluvial soil conditions reflective of those underlying the subject property. Sites on thick flood plain deposits will generally experience stronger shaking due to the tendency of soft, unconsolidated deposits to amplify ground motions that affect buildings.

Table 2: Active Local Fault Characteristics and Estimated Shaking Intensity for Maximum Credible Earthquakes

FAULT	MAXIMUM CREDIBLE EARTHQUAKE (M)	EXPECTED EARTHQUAKE (M)	FAULT TYPE ss=1;n=2;r=3	ESTIMATED RECURRENCE INTERVAL (years)	DISTANCE FROM SITE (miles)	MEAN PEAK HORIZONTAL GROUND ACCELERATION (Campbell and Bozorgnia, 1994)	MEAN PEAK HORIZONTAL GROUND ACCELERATION (Boore et al, 1994
San Andreas Fau 1906 rupture zon (multi-segment)		7.9	1	361	7	0.47	0.50
Calaveras Fault (southern segme		6.2	1	33	4.2	0.33	0.27
Quien Sabe Fault		6.4	1	647	12	0.16	0.16
Sargent		6.8	1	1200	3.6	0.43	0.39

The US Geological Survey and the California division of Mines and Geology have completed a joint effort to provide an updated "probabilistic" seismic risk assessment for the state of California (Petersen et al, 1996). The investigative team identified the principal active faults in the state and estimated the size and frequency for earthquakes likely to be produced by these faults. The results of the study are expressed as the probability that a certain shaking intensity will be exceeded at a site in a given time period. The probability level that is considered relevant to most commercial and residential development is a 10% probability of exceedance in 50 years, that is, the shaking intensity, measured in g's, that has only a 10% probability of being exceeded within 50 years. For USA 00-01 and 00-02, this ground motion value is approximately 0.66g. For USA 00-03 and 00-04, this ground motion is approximately 0.68g.

Seismic Shaking Impact: *Seismic shaking is a potentially significant impact that can be mitigated by project design*

Mitigation of Seismic Shaking Impact: *Without mitigation, strong seismic shaking in the project vicinity could produce serious damaging effects to the proposed project. The effects of ground shaking on future planned structures and other improvements can be reduced by earthquake-resistant design in accordance with the latest editions of the Uniform Building Code and the California Building Code.*

It is important that recommendations regarding seismic shaking be used in the design for any proposed development. Even with adequate design and construction, some damage to structures may occur during a great earthquake. However, the damage due to high intensity shaking may be reduced by careful placement and construction of the structure.

Past experience has shown that the quality of design and construction is far more important than the precise evaluation of ground motion parameters.

Many of the risks associated with earthquakes are not due to structural failure. Many injuries result from falling debris, overturned furniture, the disruption of utilities, and fires that occur as a result of broken utility lines, overturned gas stoves, etc. Large appliances (i.e. refrigerators, freezers, pianos, wall units, water heaters, etc.) should be firmly attached to the floor or to structural members of walls.

Ground Surface Rupture Due to Faulting

Discussion

Rupture along faults can cause offset of the ground surface along the surface trace of the fault. The offset will damage roads and buildings and can break pipes and/or other underground utilities that cross the fault. The subject sites lie at least 2.5 miles from the nearest state designated Alquist-Priolo Earthquake Fault Zone boundary. In addition, no mapped fault traces cross the subject sites and we identified no evidence for faulting on the subject sites during our aerial photo review and site reconnaissance. Therefore, we consider the potential for ground surface rupture due to faulting to be low.

Ground Suface Rupture Impacts: Potential impacts due to ground surface rupture are judged to be less than significant.

Mitigation of Ground Surface Rupture Due to Faulting Impact: No mitigation is recommended based on present knowledge.

Seismically Induced Ground Failure

Discussion

Seismically induced ground failures are secondary seismic effects related to soil, bedrock and groundwater conditions. Liquefaction, lateral spreading, and landsliding resulting from earthquakes are examples of such failures. Where these failures occur near buildings or other facilities, there is a potential for injury to persons and significant economic loss due to structural damage.

USA 00-01

Review of past geotechnical reports and boring logs performed by Harza Consulting Engineers and Scientists (1994) and Terrasearch Inc. (1998) for adjacent properties reveals that underlying earth materials are relatively dense. Groundwater was observed at depths between 12 and 14 feet on April, 30 1998 by Terrasearch Inc. and between 27 and 32 feet on March, 3 1994 by Harza Consulting. Both reports conclude that the liquefaction potential is considered to be low. Based on this information, we are of the opinion that liquefaction will not preclude development of this parcel.

USA 00-02

Review of past geotechnical reports and boring logs performed by Harza Consulting Engineers and Scientists (1994) and Terrasearch Inc. (1998) for adjacent properties reveals that underlying earth materials are relatively dense. Groundwater was observed at depths between 12 and 14 feet on April, 30 1998 by Terrasearch Inc. and between 27 and 32 feet on March, 3 1994 by Harza Consulting. Both reports conclude that the liquefaction potential is considered to be low. Based on this information, we are of the opinion that liquefaction will not preclude development of this parcel.

During our site reconnaissance and aerial photo review we noted the channelized portion of Lions Creek that runs east-west through USA 00-02. The channel is approximately 14 feet deep with side slopes of approximately 65% slope gradient. Levies associated with the channel are approximately 4 feet high. We noted approximately 1 foot of water in the bottom of the channel. Should sediments adjacent to the channel liquefy, there is a potential for seismically induced lateral spreading to occur in the area adjacent to the channel.

USA 00-03 and USA 00-04

In a qualitative assessment of soils from borings performed at sites on Luchessa Avenue, Rossi Lane and Southside Avenue, Earth Systems Consultants (2001) concluded that the potential for liquefaction is low. Groundwater was observed at a depth of 18 feet on October 20, 2000 in borings along Southside Avenue. Based on this limited information, we are of the opinion that the potential for liquefaction will not preclude development on the subject parcels.

During our site reconnaissance and aerial photo review we noted that the channelized portion of Miller Slough bounds the eastern side of USA 00-03. The canal is up to 25 feet deep and contained a few feet of running water at the time of our site visit (November 30, 2001). If site soils were to liquefy during an earthquake, there is a potential for seismically induced lateral spreading to occur adjacent to the channel. Because of the gentle slopes in the area, there is no potential for landsliding on the subject parcels.

Seismically Induced Ground Failure Impact, USA 00-01: We judge liquefaction hazard to be potentially significant at the subject parcel unless mitigated. Landsliding hazards are not significant.

Seismically Induced Ground Failure Impact, USA 00-02: We judge liquefaction and lateral spreading hazards to be potentially significant at the subject parcel unless mitigated. Landsliding hazards are not significant.

Seismically Induced Ground Failure Impact, USA 00-03 and 00-04: We judge liquefaction and lateral spreading hazards to be potentially significant at the subject parcels without mitigation. Landsliding hazards are not significant.

Mitigation of Seismically Induced Ground Failure Impact: Liquefaction and lateral spreading impacts are not expected to preclude development of the subject parcels. However, the potential for liquefaction and lateral spreading should be evaluated by a geotechnical engineer on a site specific basis prior to development. Any identified liquefaction for lateral spreading hazards should be mitigated based on the recommendations of the geotechnical engineer.

Soil Erosion Impacts

Development on the subject sites would disrupt the surficial soil horizon in areas where soils are susceptible to erosion by wind and/or water. Removal of soils by wind or water can undermine buildings, roads, and other developments, resulting in significant economic loss. This could occur with both short-term construction impacts and long term erosion where vegetative cover is not re-established.

Soil Erosion Impact, USA 00-01: Project impacts due to soil erosion are considered to be potentially significant unless mitigated.

Soil Erosion Impact, USA 00-02: Project impacts due to soil erosion are considered to be potentially significant unless mitigated.

Soil Erosion Impact, USA 00-03 and 00-04: Project impacts due to soil erosion are considered to be potentially significant unless mitigated.

Mitigation of Soil Erosion Impacts: Mitigation measures for soil erosion are generally considered necessary both during construction and after development is complete. All lots should be graded to direct surficial water away from steep slopes and into gutters and/or lined ditches which flow into properly designed catchment structures. During construction, efforts should be made to keep soil disturbance to a minimum. This objective can be accomplished by keeping machinery off of established vegetation as much as possible. Specific access routes should be established during planning phases of the project. Areas of disturbed soils should be protected from erosion by ground cover. Runoff from exposed soil should be slowed by silt fencing, temporary settling ponds, or other detention measures. After construction, loose soils are still vulnerable to erosion, particularly immediately after project completion. Immediate revegetation, including the use of temporary stabilizing sprays have proven the most effective means of keeping soil movement to a minimum.

Expansive Soil Impacts

Discussion

Expansive soils can cause damage to buildings and paved areas, a potentially significant impact. Seasonal shrinking and swelling of expansive clay soils can crack paving and foundations and throw buildings out of level. A shown in Table 1, the soils underlying the subject properties have moderate to high shrink/swell potential.

Expansive Soil Impacts, USA 00-01: Impacts due to expansive soils are considered to be potentially significant unless mitigated.

Expansive Soil Impacts, USA 00-02: Impacts due to expansive soils are considered to be potentially significant unless mitigated.

Expansive Soil Impacts USA 00-03 and 00-04: Impacts due to expansive soils are considered to be potentially significant unless mitigated.

Mitigation of Expansive Soil Impacts: The expansion potential for any clayey materials encountered should be determined on a project specific basis per ASTM D- 4829, Standard Test Method for the Expansion Index of Soils. Numerous engineering measures *are available for mitigation of soils with high expansion potential should they be encountered. Such mitigation measures include over-excavation and recompaction of near surface soils, chemical treatment of expansive soils, or support of structures on mat or pier and grade beam foundations. All of these mitigation measures are considered ordinary and should present no significant barriers to development.*

Development of the subject areas should be guided by the recommendations of a project specific geotechnical investigation to ensure that shrink-swell or low strength soils are recognized and properly mitigated.

This concludes our report. Please let us know if you have any questions.

Sincerely,
NOLAN, ZINN AND ASSOCIATES, INC.

Yogesh I. Shapiro
Staff Geologist

Jeffrey M. Nolan
Principal Geologist
C. E. G. #2247

ATTACHMENTS:

FIGURE 1	Topographic Index Map
FIGURE 2	Regional Geologic Map
FIGURE 3	Local Geologic Map, USA 00-01 and 00-02
FIGURE 4	Local Geologic Map, USA 00-01 and 00-02
FIGURE 5	Soil Survey Map, USA 00-01 and 00-02
FIGURE 6	Soil Survey Map, USA 00-03 and 00-04
FIGURE 7	Regional Seismicity Map
FIGURE 8	Flood Zone Map, USA 00-01 and 00-02
FIGURE 9	Flood Zone Map, USA 00-03 and 00-04

REFERENCES

AERIAL PHOTOGRAPHS

DATE	FLIGHT LINE	PHOTO NUMBERS	SCALE
1968	GS-VBZK	3-98, -99 & -100	1:15,000
1997	WAC-97CA	16-110, -111 & -112	1:24,000

Photos are available for viewing at the Map Library in the McHenry Library at the University of California, Santa Cruz.

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