Viejas Hotel South Tower Project Draft TEIR

Appendix E

Supporting Water Supply Assessment

Prepared by Environmental Navigation Services, Inc.

April 14, 2014

SUPPORTING WATER SUPPLY EVALUATION:
VIEJAS SOUTH TOWER TEIR

Prepared for:
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1.0 INTRODUCTION

The purpose of this Report is to update and revise water supply information provided in a Tribal Environmental Impact Report for the Viejas Hotel Project prepared for by BRG Consulting dated March 2012 (BRG, 2012) in support of a similar TEIR being produced in 2014. Relevant new data have been collected by the Viejas Public Works Department in 2012 and 2013 as further described in this Report.

Water volumes in this report are expressed in gallons and in acre-feet (Acft). One Acft is the amount of water that will cover one acre (43,560 ft^2) to a depth of one foot, approximately 326,000 gallons.

2.0 PROJECT DESCRIPTION

The project is understood to be a 128 room, multi-story hotel, located adjacent to the existing Viejas Casino (NOP, 2014). The expansion would demolish the existing office space on the southeastern portion of the casino and replace it with a second hotel tower very similar in construction to an existing 128 room hotel completed March 2013. The existing hotel is referred to herein as the north tower hotel, and the proposed new hotel as the south tower hotel.

The south tower hotel is being proposed to be built at the southeast corner of the existing Casino, due south of the existing north tower. No new infrastructure would be required, or is proposed, for the Viejas South Tower Hotel. The construction footprint is in an area that was previously developed and/or paved. From a groundwater hydrology perspective there is currently little to no natural recharge and storm water runoff patterns will not be materially affected. As a result there would be no significant change in surface conditions and thus no significant interference with ground water recharge related to the construction footprint.

With construction of the north tower hotel, the Casino gaming area was reduced by approximately 20,000 sf. The proposed project would add approximately 16,500 sf of gaming area in the new development. The 2012 TEIR (BRG, 2012) did not account for any changes in water uses associated with the reduction in gaming area. As there is no net gain in gaming area, it is understood that the south tower hotel TEIR will not require an analysis of changes in water use related to gaming area because of the net decrease in gaming activities and area.

3.0 UPDATED WATER PRODUCTION AND WATER USE DATA

3.1 North Tower Hotel Water Use, 2013

It is understood that the type and style of hotel rooms proposed for the south tower hotel are very similar to those of the north tower. Water use measurements have been made by Viejas for the north tower hotel and will be used here to project water demand for the south tower hotel.

The north tower hotel opened for business March 21, 2013. For the 10-month period of March to December 2013, the north tower hotel water use was measured to be 4,446,577 gallons (13.7 Acft) (Viejas DPW, 2014). It is conservatively assumed that the water use is for a 9 month period, equivalent to an annual water demand of 18.2 Acft for the 128 room hotel.

The south tower hotel is proposed to include 128 rooms. It is assumed that the water demand will be similar on a per room basis because it is understood that the room design and plumbing from a water use perspective will be the same as the current north tower room design. The projected annual water demand is thus estimated to be 18.2 Acft.

Effectively all of the water demand is for interior use with minimal water loss. 95% of the water demand (17.3 Acft) is assumed to be returned to Viejas' wastewater treatment plant where is treated and reclaimed. Reclaimed water is used for irrigation, with excess water sent to an infiltration basin and allowed to percolate into the ground.

3.2 Viejas Reservation-wide Groundwater Production, 2012- 2013

Viejas operates a series of production wells located across the Reservation to provide potable water for commercial, tribal, and residential use. Seven production wells are currently in use. The wells produce water at rates of 40 to 130 gallons per minute (gpm), depending on the well capacity and pumps installed in the wells. The well locations are distributed across the Reservation- specific locations are not shown in this report due to security concerns.

All of the wells are operated at the same time and used to fill a series of storage tanks. Pumping ceases in all wells when the tanks are full. As a result the wells are cyclically operated, with an average operation time ranging from approximately 25 to 50% depending on seasonal demands.

Water and wastewater production and use data were compiled from Viejas' Department of Public Works reports and records. A summary is presented in **Table 1**. Review of the data shows that groundwater pumping rates were fairly constant in 2012 and 2013 (DPW, 2014). For reference the north tower hotel opened March 21, 2013.

Table 1. VIEJAS WATER USE SUMMARY, 2012 and 2013		
	2012	2013
Total Groundwater Pumping	322	323
Treated Water Produced (Reclaimed)	144	158
Reclaim Irrigation	54	74
Percent of Reclaim Use	38%	47%
Excess Discharged to Percolation Basin	90	84
Annual Evaporation, Perc Basin	0.74	0.74
Net Recharge	89	83
as percent of water production	28%	26%
Net Pumping	233	240
Units: Acft		
Notes:		
(a) 2011 Production was 311 Acft		
(b) Evaporation Loss assumes 55 inches/yr (CIMIS Zone 9)		
from a 7,000 ft^2 basin.		

3.3 Reclaimed Water Production and Use, 2012- 2013

All of the commercial operations, all of the Tribal offices buildings, and nearly all of the residences on the Reservation are supported by a wastewater treatment system operated by the Viejas Department of Public Works (DPW). The wastewater is treated in a closed membrane filtration treatment system that minimizes water loss. Following treatment the reclaimed water becomes available for non-potable, irrigation uses. Wastewater production and use rates for 2012 and 2013 are summarized in **Table 1**. Viejas' wastewater system treated and used more water in 2013 than 2012, reflecting an ongoing successful program to reclaim wastewater.

A large portion of the treated wastewater is discharged to a percolation basin where it us allowed to infiltrate. Evaporative losses are included in **Table 1**, conservatively assuming that the basin is full of water all year and that evaporation occurs across the entire basin.

Discussions with Viejas DPW staff indicate that the use of reclaimed water for irrigation has been maximized to supply existing demands. As a result they believe that most of south tower hotel reclaimed water will be excess and discharged to the percolation basin (recharged). For purposes of the TEIR discussion it is conservatively assumed that 50% of the south tower hotel reclaimed water will be used for irrigation.

3.4 Summary

The projected net annual groundwater demand for the south tower is conservatively estimated to be 9.45 Acft (in Acft: 18.2 inflow, 17.3 return flow, 8.75 recharged, 9.45 net use) based on the return flow and recharge assumptions described in **Section 3.3**, above.

The north tower hotel was operated for 9 months in 2013 with no observed increase in groundwater pumping versus 2012. Thus the assumed change in groundwater demand for the proposed south tower is judged to be conservative because it is not supported by the pumping data reported for 2012 and 2013 (**Table 1**).

4.0 REVIEW OF GROUNDWATER RECHARGE, STORAGE, AND SUSTAINABLE YIELD ESTIMATES

4.1 Viejas Creek Watershed

The 1,600 acre Viejas Indian Reservation (Viejas) is centrally located within the 5,750 acre Viejas Creek Watershed as shown in **Figure 1**. Viejas is surrounded by publicly and privately-owned properties. Viejas Creek is centered in Viejas Valley, drains to the west, and exits the western side of the Reservation. A series of tributary drainages that flow into Viejas Valley provide seasonal flows that accumulate within central portion of the valley. The watershed is defined by the western boundary of the Reservation (**Figure 1**).

A larger 7,391 Viejas Creek Watershed is described in a hydrologic evaluation included in EIR analysis for the County of San Diego General Plan Update (PDS Appendix D, 2010). The area and shown in **Figure 2** is larger in area than the watershed described in this report because it encompasses areas downstream and west of the Reservation.

The strongly-eroded Viejas stream channel was rehabilitated by Viejas in the 1980s and 1990s to facilitate groundwater management, riparian habitat restoration, and accommodate commercial development. A series of check dams/retention basins were constructed to manage stormwater flows, to reduce erosion, support the riparian habitat restoration, and to enhance groundwater recharge. The rehabilitation was very successful and the lower (western-most) portion of the channel contains perennial water and a thriving riparian habitat. **Figure 1** shows the check dam structures and associated retention basins.

Existing ground water conditions for the Viejas watershed were described in a July 2001 report by Brown & Caldwell Engineers entitled, “Viejas Indian Reservation Water and Wastewater Master Plan”. Brown & Caldwell determined that the watershed basin encompassed approximately 5,750 acres, ranging from Viejas Mountain in the west, to Chiquito Peak on the east, from Poser Mountain in the north, to the hills south of I-8 in the south. The basin boundaries are shown in **Figure 1**. Viejas Band has subsequently conducted additional private studies of local groundwater conditions that provide site-specific data obtained since 2001. The results of these additional studies generally support the findings of the July 2001 study. A summary description follows.

The overall groundwater system is comprised of an unconfined aquifer system within alluvium and decomposed granite overlying granitic bedrock. The hillsides are comprised of granitic rock with a thin veneer of soils. The bedrock in the area is described as Mesozoic age granitic rock (between 65 to 248 million years old). The eastern portion of the watershed contains gabbroic rock. (CA Division of Mines and Geology, 2000). Granite and gabbro are crystalline igneous rocks that have visible mineral grains in the rock.

The soils within the Viejas Valley reflect the infilling of the valley by soils and alluvium derived from the hillside drainages. A description of the soils various soils mapped in the valley has been obtained from the US Department of Agriculture (USDA). **Figure 3**, developed from the US Department of Agriculture Natural Resource Conservation Service on-line database (http://websoilsurvey.nrcs.usda.gov/app/), shows the various soils mapped in the valley.

Table 2 summarizes the various soils mapped within the Reservation.

Table 2. SOILS IDENTIFIED IN FIGURE 2		
	Map Unit Symbol	**Map Unit Name**
	AyE	Auld stony clay, 9 to 30 percent slopes
	CmE2	Cieneba rocky coarse sandy loam, 9 to 30 percent slopes , eroded
	CnE2	Cieneba-Fallbrook rocky sandy loams, 9 to 30 percent slopes, eroded
	CnG2	Cieneba-Fallbrook rocky sandy loams, 30 to 65 percent slopes, eroded
	FaD2	Fallbrook sandy loam, 9 to 15 percent slopes, eroded
	FeE	Fallbrook rocky sandy loam, 9 to 30 percent slopes
	LrE	Las Posas stony fine sandy loam, 9 to 30 percent slopes
	LrG	Las Posas stony fine sandy loam, 30 to 65 percent slopes
	PfC	Placentia sandy loam, thick surface, 2 to 9 percent slopes
	RaB	Ramona sandy loam, 2 to 5 percent slopes
	RaC	Ramona sandy loam, 5 to 9 percent slopes
	RcD	Ramona gravelly sandy loam, 9 to 15 percent slopes
	RcE	Ramona gravelly sandy loam, 15 to 30 percent slopes
	RkA	Reiff fine sandy loam, 0 to 2 percent slopes
	StG	Steep gullied land
	TuB	Tujunga sand, 0 to 5 percent slopes
	VaB	Visalia sandy loam, 2 to 5 percent slopes
	VaC	Visalia sandy loam, 5 to 9 percent slopes
	VaD	Visalia sandy loam, 9 to 15 percent slopes
	VvD	Vista rocky coarse sandy loam, 5 to 15 percent slopes
	WmB	Wyman loam, 2 to 5 percent slopes

Alluvium occurs within the central portion of the main channel of Viejas Creek and deepens to the west. The channel to the north of the commercial center was a deeply eroded channel prior to restoration. Following check dam construction the eroded channel filled with water, soil, and alluvium. Groundwater levels within the western portion of Viejas Creek are maintained by the perennial stream and occur close to the ground surface as evidenced by the extent of vegetation that now occurs within the creek channel (**Figure 1**).

Underlying the soil and alluvium within the Valley is weathered bedrock, referred to as decomposed granite or DG. A supporting map depicting information available to the County Planning and Development Services (PDS) Department was included in Appendix D of the GP EIR, Figure 3-7 (PDS, 2010). The PDS map supports that both alluvium and DG occur within the Viejas Valley. The amount of water contained in saturated DG is proportional to the degree of weathering and typically ranges from 2 to 8 percent by volume. Alluvium can store significantly more water, on the order of 10 to 20 percent by volume**.**

The extent of weathering decreases with depth and the granitic rock becomes harder, so the primary porosity of the rock occurs as a result of fracturing. A depth of 500 feet is typically assumed. Water production wells on the Reservation are completed within moderately fractured bedrock and produce water from depths of approximately 400 to 1000 feet.

4.2 Groundwater Recharge Rate

Recharge is water that goes through the soil and replenishes the aquifer system. The recharge rate depends on the amount and rate of rainfall, the residence time of the water at the ground surface, evaporation and plant transpiration losses (evapotranspiration), and the ability of the soil to retain and transmit water to the aquifer.

Various methods can be used to estimate recharge. For example, the County of San Diego PDS (formerly DPLU) prepared generalized basin-by-basin calculations for ground water-dependent areas in the General Plan Update (PDS, 2010; Appendix D). The PDS recharge analysis uses a minimum 30-year monthly rainfall data series (1971 to 2005) to examine changes in rainfall based on a soil moisture balance methodology. In essence recharge is evaluated based on whether enough rainfall occurs in a month period to sufficiently wet the soil, cause the soil to exceed its soil moisture capacity, and to allow water to flow through the soil column to the underlying aquifer system.

A large percentage of the rainfall is assumed to not be available for recharge because it is either lost as evapotranspiration or as run-off. The soil moisture balance approach does not consider surface water retention as a source of recharge. Viejas has constructed a series of check dams/retention basins along Viejas Creek to manage stormwater flows, to reduce erosion, enhance groundwater recharge, and support the riparian habitat restoration. A soil moisture balance recharge calculation methodology will underestimate recharge for the Viejas Reservation because it cannot account for reduced runoff, surface water storage, and associated enhanced recharge along Viejas Creek.

Brown & Caldwell (2001) estimated that ground water recharge of the basin would be 0.12 Acft/acre per year for the Viejas watershed during a year with average annual rainfall. This recharge estimate is compared to the screening-level recharge calculations conducted by the DPS for the Viejas watershed and four adjacent watersheds that include Conejos Creek, Descanso, Japatul, and Loveland (**Figure 2)**. The intent of the comparison is to examine the 0.12 Acft/acre recharge rate relative to values determined for nearby watersheds in similar terrain and climatic conditions. **Table 3** shows that the average annual recharge rates for the four basins ranged from 0.14 to 0.33 acre-feet/acre- all greater than the 0.12 Acft/acre estimate used by Brown and Caldwell (2001).

Table 3. COMPARISON OF AVERAGE AQUIFER RECHARGE AND STORAGE

	Conejos	**Descanso**	**Japatul**	**Loveland**	**Viejas**	**Viejas**			
GP EIR Table No.:	C-16	C-20	C-40	C-46	C-80	C-80mod	mods	TEIR-est	B&C (2001)
Area, acres	33,581	13,413	1,486	22,717	5,791	7,391	1,600	5,750	5,750
Recharge, Acft/yr	7,183	4,441	206	4,044	816	1,173	357	920	690
acft/acre recharge	0.21	0.33	0.14	0.18	0.14	0.16			
Storage, Acft	5,807	4,256	749	6,287	2,224	3,319	1,095	2,582	not est
Acft/acre storage	0.17	0.32	0.50	0.28	0.38	0.45			

Notes:
(a) Recharge rate based on average annual rainfall
(b) Table C-80 modifications:
increase watershed by 1600 acres to include the Viejas Reservation
recharge in the reservation conservatively estimated using 700 acres @0.33 Acft/acre and 900 acres @0.14 Acft/acre
storage in the reservation estimated as 700 acres with 20 ft DG (5%) and 500 ft mod frx bedrock (0.1%),
and 900 acres w/ 500 ft slightly fractured rock (0.01%)
(c) The 5,750 acre watershed (TEIR-est) calculation uses a recharge rate of 0.16 and storage of 0.45

Since the Reservation is a sovereign entity, and not subject to County regulations, the PDS analysis “white-holed” the 1,600 acre Reservation and addressed only the watershed area of Viejas Creek basin area outside Viejas Reservation (i.e. the 5,791 acre area excludes the Reservation). The exclusion of the Viejas Reservation from the groundwater analysis leads to an underestimation of the amount of groundwater recharge shown in **Table 3**. Also shown in the Table is a revised estimate (C-80mod) that includes the 1,600 acre reservation. It assumes a high-range recharge rate of 0.33 acre-feet/acre for the 700 acre valley and a low-range recharge rate of 0.14 acre-feet/acre for the surrounding hillsides and upper stream valleys. This recalculation results in an average annual recharge rate of 0.16 acre-feet/acre (920 Acft/year versus 690 Acft/year). This value is conservative and less than observed in three of the four adjacent watersheds (**Table 3**). Also note that a significant portion of the Los Conejos watershed was also “white-holed”.

The soil moisture balance methods used in the PDS methodology do not explicitly evaluate surface water-groundwater interactions and will underestimate recharge related to surface water. While the soil moisture balance method provides for conservative recharge estimates when applied to the Viejas watershed, a different methodology is required to allow for the positive effect of the check dams and retention basins, especially when the basins are empty and ready to retain water.

The “TEIR-est” recharge rate shown in **Table 3** is considered to be a conservative estimate to be used for screening-level purposes. It is subject to revision- actual recharge rates are expected to be significantly higher within the Reservation as result of Viejas’ stream channel modifications and riparian habitat management program that benefit on- and off-Reservation water resources. The results of ongoing measurements by the Viejas Band supports that the check dams and riparian habitat management practices are highly effective, have raised groundwater levels, and provide drought-period benefits both on-Reservation and to adjacent off-Reservation properties.

4.3 Groundwater Storage Estimates

Groundwater is a renewable resource- rainfall recharges the aquifer system and replaces the water pumped out of the ground. During drought periods, the aquifer system provides for storage of groundwater in the absence of recharge. The amount of groundwater in subsurface storage depends on the ability of subsurface materials to hold water. Groundwater in subsurface storage is estimated based on a generally-accepted 10% storage coefficient for alluvium, a 5% storage coefficient for DG (weathered bedrock), and a storage coefficient of 0.1% for moderately fracture bedrock.

Brown & Caldwell (2001) did not provide an estimate of groundwater storage. **Table 3** examines the storage calculations in a manner similar to the analysis done in the previous section for recharge. Calculated storage values range from 0.17 to 0.50 Acft/acre.

The exclusion of the Viejas Reservation from the PDS groundwater analysis leads to an underestimation of the amount of groundwater in storage because data obtained by the Viejas Band, consistent with data presented in Figure 3-7 of PDS (2010), demonstrate that the portion of the watershed along Viejas Creek within the Reservation contains saturated alluvium and deeply weathered granitic rock (decomposed granite, or DG). Because these materials contain more water per volume than the adjacent hillsides, the Viejas basin calculations were modified by conservatively assuming the approximately 700 acre valley contains 20 feet of saturated DG (at 5%) and 500 feet of moderately fractured rock (at 0.1%). The modification conservatively excludes the storage capacity of the alluvium known to occur within the Reservation. Surrounding hillsides were assumed to be composed of slightly fractured rock (500 feet at 0.01%). The result is an average of 0.45 Acft/acre storage over the watershed, or 2,582 acre-feet of storage in the 5,750 acre watershed.

4.4 Sustainable Yield

According to Brown & Caldwell (2001), "The unit recharge rate was developed from precipitation data collected over many years. Therefore, the 690 AFY [value] should be considered a long-term average recharge rate." "[F]or planning purposes, the safe yield is nominally taken as being equal to the recharge rate for a particular year." Therefore, based on the foregoing definition, the average safe yield for the Viejas basin would be approximately 690 Acft/yr. Brown & Caldwell provided a minimum basin safe yield of 450 Acft/yr for the entire 5,750 acre watershed. For comparison, this is equivalent to approximately half of the "TEIR-est" annual average recharge value of 920 Acft/yr (**Table 3**).

An alternative definition of safe yield is based on the maximum sustainable pumping rate that will not cause the aquifer to have less than 50% of its total capacity at any time. The long-term available water supply is evaluated by using the historical rainfall record to calculate annual groundwater recharge rates. The critical periods occur during prolonged drought periods and typically end with "El Nino"-type (above average) rainfall when the rainfall recharge replaces the groundwater that is used by pumping. In this case, the long-term maximum pumping rate of 450 Acft/yr is compared to an aquifer with a total storage capacity of 2,582 Acft. The aquifer capacity would need to drop to 1,214 Acft (50% of total). This would theoretically occur after nearly three years of pumping at 450 Acft/yr in the absence of recharge. Additional discussion of this approach is included in **Section 5.2**.

5.0 COMPARISON OF PROJECT GROUNDWATER DEMAND WITH COUNTY DPS CEQA SIGNIFICANCE CRITERIA

Exhibit A of the Viejas-State Compact utilizes the following guidelines for determination of significance related to potential ground water use impacts.

- *Would the project substantially deplete off-reservation groundwater supplies or interfere substantially with groundwater recharge such that there should be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?*

PDS comments on the NOP (NOP 2014) dated February 21, 2014 state that "[T]the County bases sustainable groundwater yield through usage of the County Groundwater Ordinance as well as the California Environmental Quality Act (CEQA). The County Guidelines for Determining Significance- Groundwater Resource (http://www.sdcounty.ca.gov/pds/docs/GRWTR-Guidelines.pdf) provide measurable standards for determining when an impact would be considered significant to groundwater resources pursuant to CEQA."

While acknowledging that County Department of Planning and Development Services (PDS) regulations do not apply on Tribal trust lands, the approach presented herein generally addresses the two criteria described by the County of San Diego PDS:

1. Evaluate water level decline resulting from groundwater pumping. "As an initial screening tool, off site well interference will be considered a significant impact if, after a five year projection of drawdown, the results indicate a decrease of 20 feet or more in the offsite wells. If site-specific data indicates water bearing fractures exist which substantiate an interval of more than 400 feet between the static water level in each offsite well and the deepest major water bearing fracture in the well(s), a decrease in saturated thickness of 5% or more in the offsite wells would be considered a significant impact. "

2. "Determine if extraction is in excess of sustained yield, which is defined in the County Guidelines as cumulative depletion of storage of greater than 50 percent capacity of the given basin."

These are further described in the next two sections.

5.1 Water Level Decline Resulting from Groundwater Pumping

The change in water level (drawdown) that occurs within an aquifer associated with pumping at a given well decreases with distance away from the well. At the well, a small increase in the pumping rate will give rise to a proportional decrease in water level- here expected to be less than five percent. With distance the drawdown decreases rapidly (exponentially) and forms what is referred to as the cone of depression (Freeze and Cherry, 1979).

The water production wells are used to supply a single water supply system that serves private and commercial users on the Reservation. The proposed hotel will be included in the Viejas water and wastewater system. Water from the all of the supply wells is combined, and the Project water demand will thus be spread across all of the wells.

A five percent (or more) long-term decrease in water levels and hence long-term pumping rates is judged to be significant. The on-Reservation pumping rate was 323 Acft/yr in 2013 and 322 Acft/yr in 2012, and increase of 0.3%. A 5% increase from 2013 pumping levels would be 16.1 Acft/yr. If spread evenly across the seven production wells this corresponds to an increase of approximately 1.4 gpm (24 hours per day).

The projected annual Project water demand is estimated to be 18.2 Acft, with a wastewater reclamation rate of 95%. Review of current reclaimed water use supports that approximately 50% of the water will be recharged, so the net groundwater demand is conservatively estimated to be approximately 9.45 Acft/yr (**Section 3.4**). Given the net increase in groundwater use associated with the hotel is 2.9% over 2013 pumping rates, it is unlikely that water levels in off-Reservation wells will experience significant water level impacts due to the Project.

The presence of the perennial portion of Viejas Creek sustained by the groundwater management and riparian habitat restoration work provides hydraulic conditions that reduce the potential effect of off-Reservation water level changes. In simple terms Viejas' production wells preferentially draw water from the on-Reservation portion of the aquifer being recharged by the creek. This effect, known as a boundary condition, will significantly reduce the potential for off-Reservation wells to be impacted by on-Reservation pumping.

Finally it should be noted that there was minimal observed change in groundwater pumping rates from 2012 to 2013 subsequent to the operation of the north tower hotel that opened March 2013.

5.2 Aquifer Depletion Relative to Groundwater Extraction Rates

A cumulative depletion of water in subsurface storage of greater than 50% of the aquifer capacity is judged to be a significant impact. Here 50% of storage is estimated for purposes of the TEIR to be 1,291 Acft (**Section 4.3**). A sustainable long-term pumping rate of 450 Acft/yr is assumed based on Brown & Caldwell, 2001.

A cumulative depletion calculation is done by examining the change in the amount of groundwater in the aquifer over time. Water is extracted from the aquifer at a hypothetical constant rate. Historical rainfall data are used to support calculations of the potential change in groundwater recharge that offset groundwater withdrawal. Water extraction is judged to be significant per the PDS Guidelines if the amount of water in the aquifer decreases by more than 50%.

The analysis was conducted as follows:

- The 50% significance criterion occurs when only 1,291 Acft of water remains in the aquifer.
- The historical rainfall record was obtained from the nearby Alpine weather station (WRCC, 2014). The Alpine rainfall measurements are from a location that has lower

rainfall than expected to occur in the Viejas Creek Watershed. The monthly data are shown in **Table 4**. Rainfall rates in the Viejas watershed are expected to be higher- the Alpine data are used as a proxy to approximate groundwater recharge rates.

Review of the historical rainfall record shows that rainfall rates significantly vary over time. Rainfall variability occurs, in part, due to recognized climatic cycles such as the El Nino/ La Nina (http://www.elnino.noaa.gov/) and the Pacific Decadal Oscillation (PDO) (http://www.ncdc.noaa.gov/teleconnections/pdo.php). The data are shown in **Figure 4**. A July to June 'rain year' is used to present the data because area precipitation occurs primarily from November to April.

The rainfall record for Alpine is incomplete as noted by the letter codes shown in **Table 4**, especially so for the period of 2005 to 2008. Review of nearby weather station data shows that rainfall rates at Lakeside 2E station (#044710) are comparable, and that the station has a more complete record for this period. The Lakeside data are substituted for this period to better approximate the historical rainfall record.

- Average annual recharge for the 5,750 acre watershed is conservatively estimated to be 920 Acft/yr (**Section 4.2**).

- Recharge is calculated as a function of rainfall. If rainfall is less than half of the annual average, no recharge is assumed to occur. Recharge is assumed to be one third of the average annual rainfall for rainfall rates ranging up to the annual average. Recharge is held constant at the average annual value for above-average rainfall.

  These assumptions are based on review of other soil moisture balance recharge calculations, intended to be conservative, and to be used only for screening-level purposes. The calculations do not reflect the dry season effectiveness of the check dams along Viejas Creek to retain and recharge stormwater, and are not intended to simulate changes in water levels that may occur at any specific locations within the watershed.

- The calculations are done on an annual basis (**Table 5**) for a 'bucket' aquifer using the available rainfall record. Water is withdrawn at a constant annual rate of 450 Acft/yr. Recharge is calculated based on the annual rainfall rate. The aquifer starts 'full' and the cumulative change is tracked on an annual basis. The aquifer volume as described by the screening-level calculations generally remains fairly full under sustained pumping except for the period of 2006 to 2009 where there are two consecutive low rainfall years.

In summary, the calculations show that the sustainable yield estimate of 450 Acft/yr is reasonable for purposes of the TEIR because the aquifer does not drop below the 50% criterion in the cumulative demand calculations under a sustained pumping rate of 450 Acft/year based on the foregoing calculations.

Table 4. Monthly Precipitation Data, Alpine, 1952 to 2013

YEAR	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC		Rain Year, RF (in.) Alpine	Lakeside
1952	0.00	z	0.00	z	0.00	z	0.00	z	0.00	z	0.00	z	0.00	z	0.00	z	0.00	z	0.00		0.00	z	3.02			
1953	1.13		1.50		1.98		1.25		0.91		0.00		0.04		0.00		0.00		0.00		0.96		0.24		9.79	
1954	5.40		1.95		7.66		0.18		0.19		0.09		0.30		0.00		0.00		0.00		0.46		0.94		16.71	
1955	4.29	c	1.96		0.80		0.47		2.52		0.00		0.11		0.16		0.00		0.03		1.07	d	0.43	c	11.74	
1956	3.19		1.19		0.00		2.88		0.12		0.00		0.06		0.00		0.00		0.39		0.00		0.44		9.18	
1957	7.18		0.82		1.46		1.59		2.13		0.43		0.00		0.02		0.00		3.86		0.91		1.72		14.50	
1958	1.33		3.89		7.23		4.27		0.36		0.00		0.00		0.15		0.33		0.05	a	0.50		0.07		23.59	
1959	0.35		6.39		0.03		0.47		0.02		0.00		0.00		0.00		0.00		0.34		0.07		2.60		8.36	
1960	3.58		4.14		0.66		2.01		0.89		0.00		0.06		0.00		0.02		0.20		2.22		0.00		14.29	
1961	1.03		0.22		2.35		0.00		0.00		0.02		0.00		0.36		0.03		0.62		0.97		2.22		6.12	
1962	3.45		5.33		1.93		0.00		1.39		0.15		0.00		0.00		0.08		0.05		0.00		0.60		16.45	
1963	0.72		2.90		1.98		1.63		0.00		0.10		0.00		0.09		2.50		0.67		2.24		0.31		8.06	
1964	2.34		1.05		3.69		1.28		1.02		0.03		0.00		0.00		0.02		0.35		2.50		2.34		15.22	
1965	0.58		1.70		1.42		6.77		0.04		0.06		0.08		0.00		0.60		0.00		7.76		4.01		15.78	
1966	1.63		2.08		1.31		0.02		0.15		0.00		0.00		0.00		0.19		0.84		1.93		8.64		17.64	
1967	2.43		0.00		1.87		4.11		0.21		0.24		0.15		0.01		0.15		0.00		3.75		3.31		20.46	
1968	0.74		0.50		1.32		0.93		0.61		0.04		0.09		0.00		0.00		0.10		0.65		1.19		11.51	10.00
1969	8.80		6.76		2.91		0.33		0.51		0.06		0.00	z	0.00		0.01		0.06		1.54		0.36		21.40	19.61
1970	0.89		1.25		4.08		0.70		0.08		0.09		0.01		0.19		0.00		0.32		1.46		2.94		9.06	8.44
1971	1.24		1.68		0.40		1.41		2.38		0.00		0.00		0.00	z	0.05		1.59		0.22		5.55		12.03	12.72
1972	0.03		0.30		0.00		0.32		0.46		2.20		0.00		0.02		0.57		1.73		0.00	z	2.87		10.72	9.23
1973	3.42		3.15		5.59		0.34		0.21		0.13		0.00	z	0.02		0.00		0.00		2.27		0.22		18.03	17.95
1974	7.07		0.12		1.73		0.77		0.00		0.00		0.32		0.00		0.22		3.94		0.23		1.48		12.20	10.25
1975	0.38		1.47		4.94		3.41		0.28		0.24		0.00		0.00		0.28		0.08		1.40		0.59		16.91	16.50
1976	0.00		6.06		2.84		2.58		0.07		0.00		0.62		0.00		4.36		2.05		1.17		1.94		13.90	12.66
1977	3.06		0.49		1.85		0.15		2.45		0.06		0.03		3.09		0.01		0.90		0.42		3.49		18.20	12.79
1978	7.37		7.31		9.68		1.92		0.38		0.00		0.00		0.00		0.36		0.02		4.13		3.56		34.60	30.61
1979	7.99		2.88		5.31		0.14		0.35		0.05		0.00		0.12		0.00		1.52		0.43		0.41		24.79	24.75
1980	8.99		9.71		4.39		2.24		0.62		0.00		0.00		0.00		0.00		0.83		0.00		0.00	a	28.43	26.30
1981	0.65	b	2.63		4.55		1.12		0.22		0.00		0.00		0.00		0.00		0.27		1.31		1.03		10.00	11.40
1982	5.01		0.00	z	7.02		1.14		0.40		0.36		0.00		0.13		0.87		0.18		5.91		2.66		16.54	17.00
1983	3.27		6.04		10.92		2.56		0.30		0.00		0.00		1.66		0.29		0.33		3.59		3.50		32.84	28.53
1984	0.45		0.05		0.00	z	0.43		0.00		0.16		1.86		0.86		0.11		0.49		2.08		5.42		10.46	7.62
1985	1.38		1.68		2.09		0.67		0.07		0.07		0.05		0.00		0.46		0.49		7.41		1.73		16.78	13.33
1986	0.28		4.59		5.37		0.58		0.00		0.00		0.08		0.00		1.14		1.66		0.82		1.78		20.96	19.42
1987	1.89		2.30		2.27		0.68		0.38		0.00		0.00		0.10		0.38		2.94		3.97		2.52	a	13.00	12.68
1988	3.00		0.99		1.04		3.60		0.22		0.00		0.00		0.00		0.10		0.00		1.42		2.66		18.76	17.28
1989	0.72		2.04		1.56		0.12		0.46		0.00		0.00		0.00		0.47		0.38		0.08		0.10		9.08	6.08
1990	3.87		1.68		1.56		1.02		0.48		0.84		0.62		0.15		0.00		0.00	z	1.05		1.71		10.48	8.99
1991	0.98		3.18		12.69		0.20		0.02		0.00		0.35		0.00		0.00	z	1.51		0.00		2.68		20.60	16.94
1992	2.61		3.97		0.00	z	0.35		0.14		0.00	z	0.13		1.23		0.00		1.30	a	0.00	z	4.69		11.61	18.06
1993	15.24		5.94	a	0.83	a	0.00		0.09		0.00	z	0.08		0.00		0.03		0.10		2.39		1.30		29.45	26.98
1994	1.47		4.54		4.04		2.27		0.58		0.00		0.25		0.00	z	0.00		0.00	z	1.53		1.26		16.80	15.20
1995	9.55		3.82		8.68		2.05		1.76		0.56		0.00		0.00		0.15		0.20	a	0.26		0.29		29.46	25.46
1996	1.87		3.28		2.78		0.77		0.03		0.00		0.36		0.00		0.11		0.00	z	2.12		2.37		9.63	11.17
1997	5.82		2.37		0.00	z	0.00	z	0.08	a	0.09		0.00		0.00		1.57		0.09		2.69		2.38		13.32	11.86
1998	0.00	z	12.96		5.08		0.00	z	0.00	z	0.59		0.00	z	0.00		0.00	z	0.00	z	0.00	z	0.00	z	25.36	18.68
1999	2.44		0.97		0.94		3.10		0.04		0.70		0.11		0.00		0.34		0.00		0.00	z	0.61		8.19	9.78
2000	0.68	a	5.08		1.49		1.01		0.24	a	0.01		0.00		0.53	a	0.24		1.17		1.07		0.00		9.57	8.40
2001	3.39	b	3.78		0.97		1.68		0.00		0.00		0.05		0.00		0.00		0.00		0.16		1.70	a	12.83	12.58
2002	0.50		0.16		1.59		0.61	b	0.00		0.00		0.11		0.00		0.45		0.01		3.22		1.27	b	4.77	4.53
2003	0.14		5.14		2.42		1.89		0.70		0.15	a	0.09		0.15		0.05		0.00		1.54	a	0.00	z	15.50	15.83
2004	0.21		4.44		0.04		1.46		0.00		0.00		0.00		0.00		0.00		4.96	e	0.65		2.95	b	7.98	9.75
2005	4.73	b	5.27	c	1.77	d	0.00	z	0.29	a	0.00		0.28	y	0.00		0.00		0.00	z	0.00	z	0.02		20.62	28.87
2006	0.30		0.00	z	0.00	z	0.00	z	0.42	a	0.00		0.27	d	0.00		0.00		0.75	c	0.10	j	0.00		1.02	7.00
2007	0.82	o	2.10	d	0.00		0.00		0.08		0.00	o	0.00		0.00		0.05	b	0.00		0.00		1.45	b	4.12	7.03
2008	4.44	d	2.13	u	0.18		0.00	v	0.57	c	0.00		0.00		0.17		0.00		0.00	z	1.20	g	4.94	c	8.82	15.08
2009	0.14		4.47		0.18		0.44		0.00		0.00		0.00		0.00		0.00		0.08		0.93		2.43		11.54	13.31
2010	3.74		4.38		0.96		2.61		0.05		0.00		0.08		0.00		0.58		2.80		1.88		7.74		15.18	18.95
2011	0.74		4.74		2.52		0.78		0.72		0.28		0.11		0.00		0.20		0.55		5.00		1.37		22.86	22.09
2012	0.81		1.97		3.51		2.77		0.00		0.00		0.00		0.18		0.18		0.32		0.48		2.73		16.29	12.53
2013	1.96		1.29		1.59		0.01	z	0.00	z	0.00	z	0.00	z	0.00	z	0.00	z	0.00	z	0.00	z	0.23	z	8.74	7.47
avg monthly	2.86		3.08		2.76		1.24		0.45		0.13		0.11		0.16		0.29		0.69		1.55		1.95		annual avg (1968 on)	
% by month	19%		20%		18%		8%		3%		1%		1%		1%		2%		5%		10%		13%		15.54	15.04
																									average, all data	
																									15.13	

a = 1 day missing, b = 2 days missing, c = 3 days, ..etc..,

z = 26 or more days missing, A = Accumulations present

Incomplete rainfall record for Alpine, subsituted by Lakeside data

Monthly Data from WRCC Station 40136

Table 5. Cumulative Water Balance,
5750 acre watershed

Rain Year ending June	Rainfall, inches	Cumulative Aquifer Volume	Recharge minus pumping	Annual Recharge
		1291		
1953	9.79	1148	-143	307
1954	16.71	1291	470	920
1955	11.74	1148	-143	307
1956	9.18	1004	-143	307
1957	14.50	861	-143	307
1958	23.59	1291	470	920
1959	8.36	1148	-143	307
1960	14.29	1004	-143	307
1961	6.12	554	-450	0
1962	16.45	1024	470	920
1963	8.06	881	-143	307
1964	15.22	1291	470	920
1965	15.78	1291	470	920
1966	17.64	1291	470	920
1967	20.46	1291	470	920
1968	11.51	1148	-143	307
1969	21.40	1291	470	920
1970	9.06	1148	-143	307
1971	12.03	1004	-143	307
1972	10.72	861	-143	307
1973	18.03	1291	470	920
1974	12.20	1148	-143	307
1975	16.91	1291	470	920
1976	13.90	1148	-143	307
1977	18.20	1291	470	920
1978	34.60	1291	470	920
1979	24.79	1291	470	920
1980	28.43	1291	470	920
1981	10.00	1148	-143	307
1982	16.54	1291	470	920
1983	32.84	1291	470	920
1984	10.46	1148	-143	307
1985	16.78	1291	470	920
1986	20.96	1291	470	920
1987	13.00	1148	-143	307
1988	18.76	1291	470	920
1989	9.08	1148	-143	307
1990	10.48	1004	-143	307
1991	20.60	1291	470	920
1992	11.61	1148	-143	307
1993	29.45	1291	470	920
1994	16.80	1291	470	920
1995	29.46	1291	470	920
1996	9.63	1148	-143	307
1997	13.32	1004	-143	307
1998	25.36	1291	470	920
1999	8.19	1148	-143	307
2000	9.57	1004	-143	307
2001	12.83	861	-143	307
2002	4.77	411	-450	0
2003	15.50	881	470	920
2004	7.98	738	-143	307
2005	28.87	1208	470	920
2006	7.00	758	-450	0
2007	7.03	308	-450	0
2008	15.08	164	-143	307
2009	11.54	**21**	-143	307
2010	15.18	491	470	920
2011	22.86	961	470	920
2012	16.29	1291	470	920
2013	8.74	1148	-143	307

Note: Alpine Rainfall Record underestimates rainfall because of missing data

(shaded) Rainfall from Lakeside (Table 4)

Parameters

Pumping Rate	450	Acft/yr
Recharge Rate (at annual rainfall)	920	Acft/yr
Average Rainfall (Alpine)	15.1	Inches/yr

6.0 REFERENCES

BRG, 2012. Tribal Environmental Impact Report (TEIR) for the Viejas Hotel Project prepared for The Viejas Band of Kumeyaay Indians by BRG Consulting dated March 2012.

Brown & Caldwell, 2001. Viejas Indian Reservation Water and Wastewater Master Plan. Brown & Caldwell Engineers, dated July 2001. A copy of the document was included in Appendix D of BRG, 2012 (cited above).

CA Division of Mines and Geology, 2000. State Geologic Map, DMG CD 2000-007, based on Jennings, 1977 Geologic Map of California

CIMIS, 2014. The California Irrigation Management Information System (CIMIS) is a program of the Office of Water Use Efficiency (OWUE), California Department of Water Resources (DWR) http://wwwcimis.water.ca.gov/cimis/infoEtoCropCo.jsp

DPW, 2014. Refers to confidential water supply and water treatment data provided to ENSI for this report by the Viejas Department of Public Works (DPW).

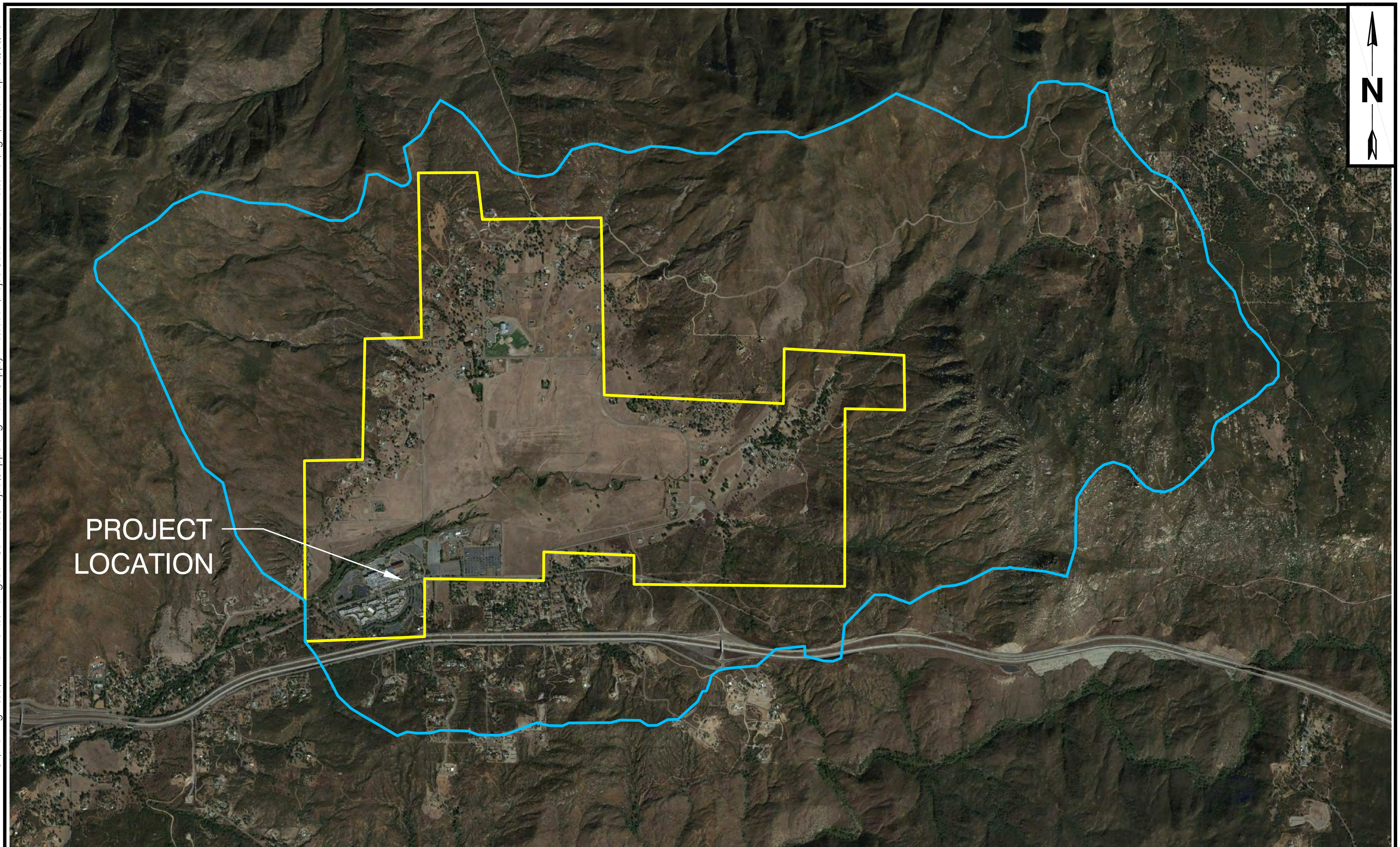
Groundwater, 1979. Textbook entitled *Groundwater*, by RA Freeze and JA Cherry, 1979, Prentice-Hall pub.

NOP, 2014. Notice of Preparation of a Draft Tribal Environmental Impact Report. Prepared by Viejas Enterprises, dated January 17, 2014.

PDS, 2010. County of San Diego Department of Planning and Land Use General Plan Update Groundwater Study. Prepared by the County of San Diego. Final dated April 2010. Included as Appendix D of the EIR for the County General Plan Update. The County of San Diego Board of Supervisors certified the Final Program Environmental Impact Report (EIR) for the General Plan Update and adopted the update to the General Plan on August 3, 2011.
(http://www.sdcounty.ca.gov/pds/gpupdate/environmental.html)
[Note: DPLU is now known as the Planning and Development Services, or PDS]

WRCC, 2014. Monthly Precipitation obtained from the Western Regional Climate Center. Per their website "The Western Regional Climate Center, inaugurated in 1986, is one of six regional climate centers in the United States. The regional climate center program is administered by the National Oceanic and Atmospheric Administration. Specific oversight is provided by the National Climatic Data Center (NCDC) of the National Environmental Satellite, Data, and Information Service (NESDIS)". http://www.wrcc.dri.edu/ The Alpine and San Diego data were obtained at http://www.wrcc.dri.edu/summary/Climsmsca.html

C:\Drawing Files\Environmental Navigation Services\Viejas\Supporting Water Supply Evaluation\Viejas South Tower Hotel Tier\Fig 1, Base Map - 03/03/2014



Environmental Navigation Services, Inc.

0 | 3,000 | 6,000 FEET

APPROXIMATE SCALE

EXPLANATION BLOCK

- Viejas Reservation Boundary
- Viejas Watershed Boundary

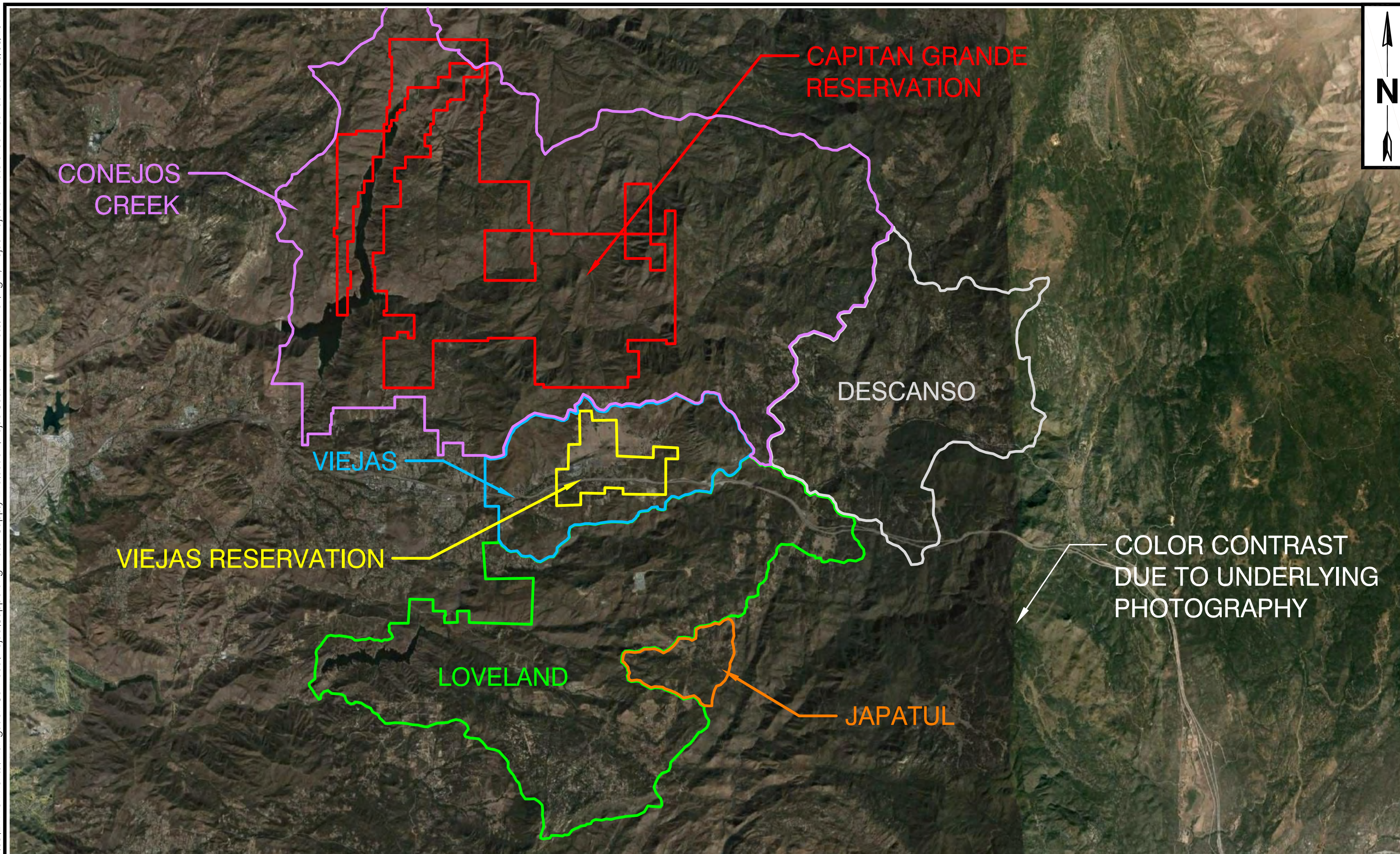
NOTE:
Base Map Sources:
Google Earth, Image Date 10/27/2012

VIEJAS WATERSHED

SUPPORTING WATER SUPPLY EVALUATION:
VIEJAS SOUTH TOWER HOTEL TIER

PE/PG	Project Number		Figure
JWJ	VIEJAS		1
Project Manager	Drafter	Date	
JWJ	CM	03/03/2014	

C:\Drawing Files\Environmental Navigation Services\Viejas\Supporting Water Supply Evaluation\Viejas South Tower Hotel Tier\Fig 2, Viejas Adjacent Watershed Boundaries - 03/03/2014



Environmental Navigation Services, Inc.

0 15,000 30,000 FEET
APPROXIMATE SCALE

EXPLANATION BLOCK

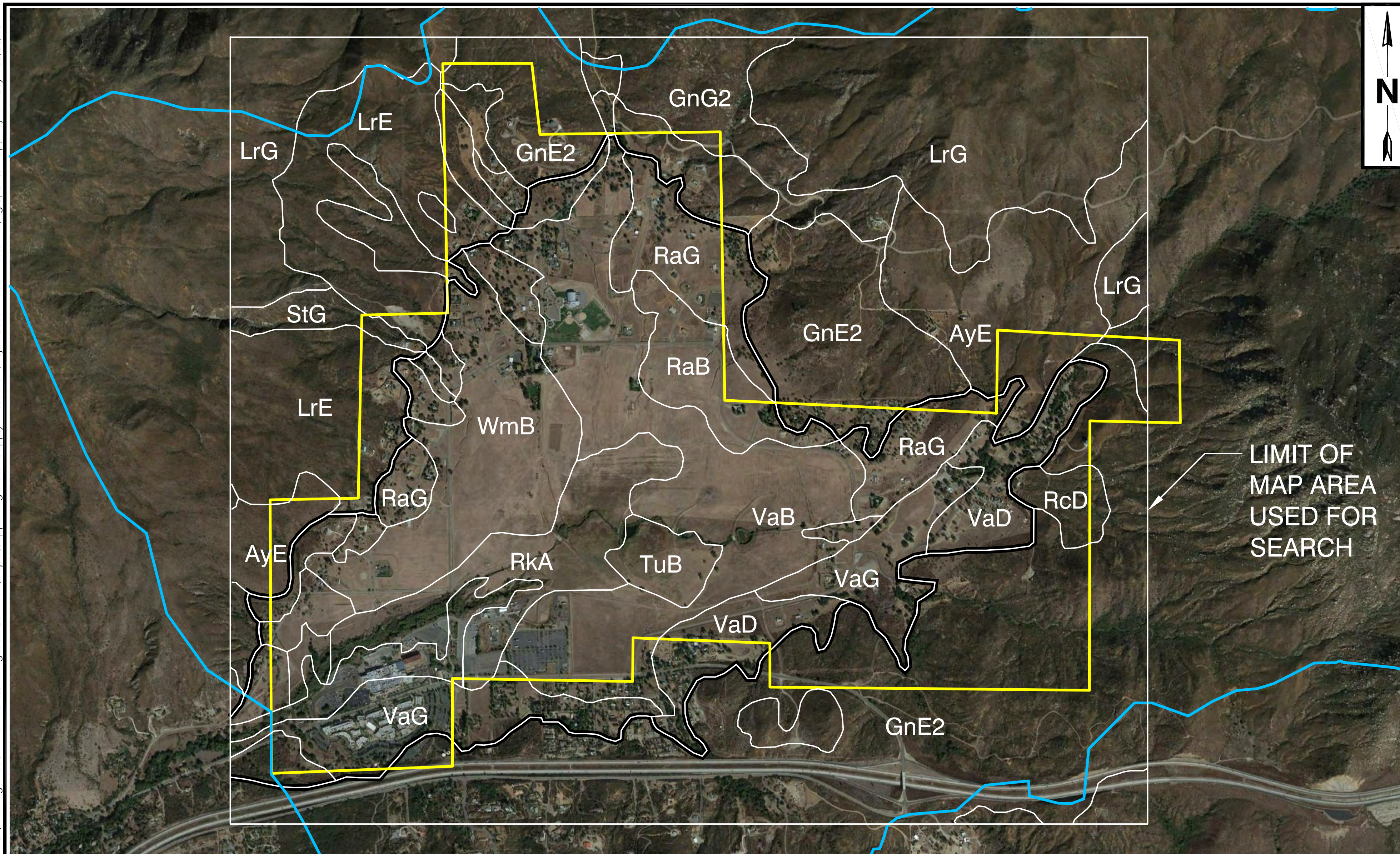
- Viejas Reservation Boundary
- Capitan Grande Reservation Boundary
- Descanso Watershed Boundary
- Japatul Watershed Boundary
- Loveland Watershed Boundary
- Conejos Creek Watershed Boundary
- Viejas Watershed Boundary

NOTE:
- Reference: County of San Diego DPS, General Plan Update Groundwater Study, Figure 3-8
- Base Map Source: Google Earth, Image Date 10/27/2012

VIEJAS ADJACENT WATERSHED BOUNDARIES

SUPPORTING WATER SUPPLY EVALUATION: VIEJAS SOUTH TOWER HOTEL TIER

PE/PG	Project Number		Figure
JWJ	VIEJAS		2
Project Manager	Drafter	Date	
JWJ	CM	03/03/2014	



C:\Drawing Files\Environmental Navigation Services\Viejas\Supporting Water Supply Evaluation\Viejas South Tower Hotel Tier\Fig 3, Soils Map, Viejas Valley - 03/03/2014

Environmental Navigation Services, Inc.

0 2,000 4,000 FEET
APPROXIMATE SCALE

EXPLANATION BLOCK
- Viejas Reservation Boundary
- Viejas Watershed Boundary

NOTE:
- Source: USDA Natural Resources Conservation Service (NRCS) Web Soil Soil Survey (WSS)
- Base Map Source: Google Earth, Image Date 10/27/2012

SOILS MAP FOR THE VIEJAS VALLEY

SUPPORTING WATER SUPPLY EVALUATION: VIEJAS SOUTH TOWER HOTEL TIER

PE/PG	Project Number		Figure
JWJ	VIEJAS		3
Project Manager	Drafter	Date	
JWJ	CM	03/03/2014	

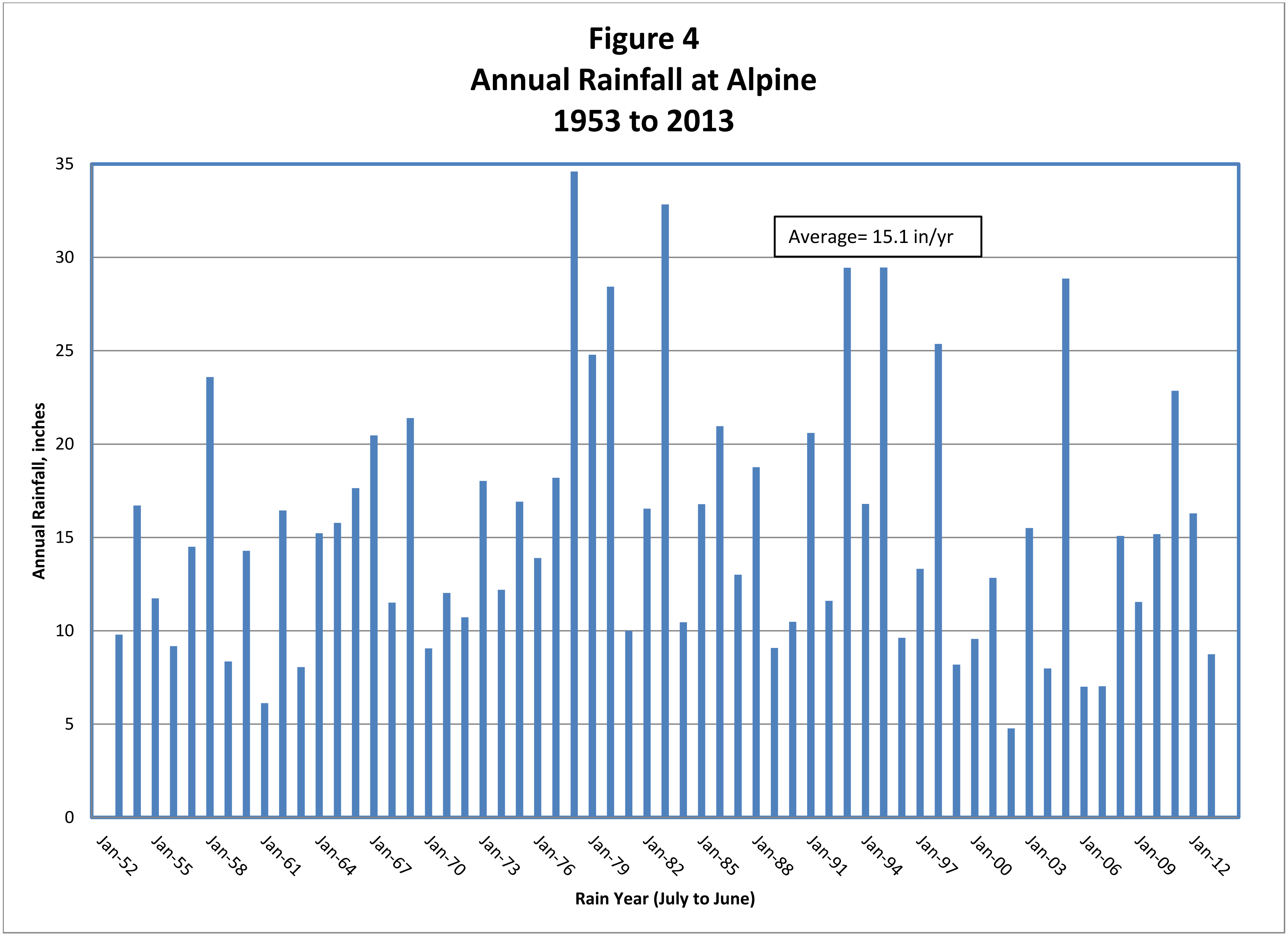


Figure 4
Annual Rainfall at Alpine
1953 to 2013
Average= 15.1 in/yr
Annual Rainfall, inches
0
5
10
15
20
25
30
35
Jan-52
Jan-55
Jan-58
Jan-61
Jan-64
Jan-67
Jan-70
Jan-73
Jan-76
Jan-79
Jan-82
Jan-85
Jan-88
Jan-91
Jan-94
Jan-97
Jan-00
Jan-03
Jan-06
Jan-09
Jan-12
Rain Year (July to June)