Attachment E

Willows Road Study Area
Water and Sewer Feasibility Study

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Mr. Bob Citrano
County of San Diego
Department of Planning and Land Use
5201 Ruffin Road, Suite B
San Diego, CA 92123

Re: Willows Road Study Area Water and Sewer Feasibility Study

Dear Mr. Citrano:

PURPOSE

The purpose of this report is to explore the feasibility of contemplated land uses in an approximate 255-acre study area in the county of San Diego, along the south and north side of Willows Road, just east of the Viejas Casino, and prepare order of magnitude costs for providing water and sewer service under varying land use scenarios.

The primary goal is to provide local property owners and the County of San Diego Planning and Land Use Department a range of potential costs to develop adequate water and sewer infrastructure to support various levels of development. This feasibility study would assist in evaluating land use scenarios to economically support some level of development. It is recommended that a more detailed engineering and cost analysis be prepared to further refine costs and infrastructure needs based on preferred land uses. A summary of our findings is presented in the following section.

EXECUTIVE SUMMARY

The Willows Road Study Area consists of 255 acres, of which 60 acres are owned by private land holders and 195 acres are owned by the Viejas Band of Indians No portion of the study area is currently included in the Tribe's Reservation Land Trust. The Willows Road Study Area was previously designated as Forest Conservation Initiative (FCI) land, which expired on December 31, 2010. The County plans to review the possibility of a General Plan Amendment for this area potentially converting the existing land use to commercial and / or higher density residential land uses.

The Feasibility Study includes engineering and financial evaluations of the following potential development scenarios:

1. 60 acres of low water use commercial development or single family at 2 units per acre
2. 255 acres of all commercial development
3. 255 acres of all residential use with densities ranging from 4 -8 units per acre
4. 255 acres of a mixed use residential and commercial development

Based on the study findings as summarized below, the County may chose to evaluate other land use scenarios and magnitude of developable area. This initial study is intended to lay the foundation for future refinement of a land use plan.

Water Supply Constraints Analysis

The lack of ready access to a public water supply or ample groundwater supply, in addition to the absence of a sanitary sewer collection and disposal system, will constrain the area from cost effectively developing at various densities and acreages. A new connection to the Padre Dam Municipal Water District (PDMWD) offers the greatest potential to support development in the area but must overcome two major obstacles. First, the study area must annex into the San Diego County Water Authority (SDCWA) and PDMWD, either as a non-contiguous service area or as part of a larger contiguous area extending from the existing PDMWD boundary eastward along the Interstate 8 corridor to the study area. Second, the project would likely need to offset potable water demands to comply with the PDMWD's 2010 Urban Water Management Plan, since their allocation of imported water did not include this area. The local groundwater supply is limited and may only support an extremely low density concept, with extreme water conservation measures. For development of higher land use densities annexation and connection to the PDMWD water supply will be essential.

Due to the water supply constraints listed above, two distinct density concepts emerge as the most economically feasible: a high density concept supplied by imported water and a very low density concept utilizing local groundwater supply.

High Density Residential/Commercial Development

Due to the high costs of a PDMWD connection and associated annexation fees, the most cost effective development scenarios are at the higher densities to better spread infrastructure costs. The maximum density evaluated as part of this study was a Commercial Floor Area Ratio (FAR) = 3.2 and/or Residential Density = 8 Dwelling Units per Acre (DU/AC), and was determined to be the most economically feasible concept.

Typical combined water and sewer capacity fees to obtain service in San Diego County range from $10,000 to $20,000 per EDU. A range of commercial and residential development scenarios were evaluated for 60 acres and 255 acres of development in the study area and combined costs per equivalent dwelling unit (EDU) ranged from approximately $17,000 to $53,000 per EDU. The higher density scenarios considered both onsite wastewater disposal and offsite disposal to the San Diego County Sanitation District (SDCSD) Alpine Sewer Service

Area, in conjunction with a PDMWD water supply. The relatively high range of capacity fee and capital costs for on-site water and sewer infrastructure reflects the high cost to obtain imported water and disposal of wastewater in an undeveloped area like Willows Road,

Low Density Residential/Commercial Development

Groundwater is inadequate to satisfy normal water demands for a standard low density residential/commercial development. However, if landscape irrigation is eliminated and the non-consumptive use component of the indoor demand is returned to the local groundwater regime, the groundwater allocation may potentially become viable. For the low density concepts (Commercial FAR = 0.8 and/or Residential Density = 2 DU/AC) the most cost effective water supply may be local groundwater augmented with treated effluent from a new local wastewater treatment plant. For the local groundwater supply, a comprehensive groundwater investigation, including test wells, would be needed to ascertain actual quantity and quality of water which could be developed from on-site wells. A possible development scenario may include limited commercial retail development, no hotels or other intensive water uses, with extreme water conservation.

Summary of Costs

- In summary, proposed development cost are included below for a range of development scenarios. The two density concepts with the lowest estimated fee and capital costs are shown in bold in Table ES-1. The high density concept (Commercial FAR = 3.2 and/or Residential Density = 8 DU/AC, or greater) will require a connection and annexation to PDMWD water supply and likely on-site treatment and reuse.
- The low density concept (Commercial FAR = 0.8 and/or Residential Density = 2 DU/AC), may be feasible if a sustainable groundwater supply including recharge from captured rainwater as well as highly treated wastewater can be developed. While this concept is estimated to have lower unit costs, it possesses greater uncertainty because the local groundwater supply yield and storage are unknown.

Table ES-1 Summary of Estimated Cost per EDU

Scenario	Sewer EDUs*	Local Supply & Metro Disposal	Local Supply & Local Disposal	Imported Supply & Metro Disposal	Imported Supply & Local Disposal
60 acres of Commercial (or 2 DU/AC)	125	$24,800	$ 25,600	$44,000	$52,800
255 acres of Commercial	531	N/A	**$ 16,760**	$30,300	$32,600
255 acres of Residential (4 DU/AC)	1,020	N/A	N/A	$42,100	$22,900
255 acres of Residential (8 DU/AC)	2,040	N/A	N/A	$31,300	**$18,400**
255 acres of Mixed Use	1,286	N/A	N/A	$45,300	$24,600

* 1 Sewer EDU = 240 gpd (Sewer) and 480 gpd (Water)

The remaining sections of the report present the assumption and calculations to develop the range of water and sewer capacity fees. Additional engineering studies will be necessary in conjunction with land use concepts to refine the above costs and assess land development feasibility.

BACKGROUND

The Willows Road study area was previously designated as Forest Conservation Initiative (FCI) land, which expired on December 31, 2010. Existing land uses along East and West Willows Roads are predominantly low density residential uses. The County plans to review the possibility of a General Plan Amendment for this area potentially converting the existing land use to a commercial or higher density residential development plan. The Willows Road Study Area consists of 255 acres, of which 60 acres are owned by private land holders and 195 acres are owned by the Viejas Band of Indians, but is not included in the Tribe's Reservation Land Trust.

CONTEMPLATED LAND USE ALTERNATIVES

The County has requested Atkins to evaluate the following contemplated land use alternatives for the feasibility of water and wastewater service:

- 60 acres of commercial use
- 255 acres of commercial use
- 255 acres or residential use at 4 DU/AC
- 255 acres or residential use at 8 DU/AC
- 255 acres of mixed use (50% high density residential and 50% commercial)

WATER SUPPLY OPTIONS

The two options to supply water to the Willows Road Study Area include development of the local groundwater supply or introduction of imported water through annexation into PDMWD.

Imported Supply from PDMWD

Imported water from PDMWD would not be available unless the properties are annexed into the District. Since PDMWD receives imported water from the SDCWA, which in turn is supplied by the Metropolitan Water District of Southern California (MWD), annexation to the SDCWA would also be necessary. A major hurdle in annexation is that the subject property is not contiguous to the SDCWA service area. The SDCWA Board of Directors in 2006 enacted a policy to discourage annexation of "islands" (non-contiguous properties). Even if the intervening properties could also be annexed, the annexation process would have to be initiated by a PDMWD request and would involve an exhaustive evaluation of the implications. The base fee for annexation to SDCWA, which also includes the MWD annexation fee, is currently about $6,000 per acre (Dana Friehauf, SDCWA, 1/27/2011). Another major obstacle is that a Water

Supply Assessment (WSA) would need to be prepared to determine the future availability of water supply to serve the development. The PDMWD allocation of imported water (currently being identified in its 2011 Urban Water Management Plan Update) will not increase so the District would have to find means to offset the increased demands. The subject annexation and connection fees are summarized in Table 1 below. In addition to these costs, construction of a booster pump station, pipeline and reservoir would be needed to serve the area from the PDMWD water system.

Table 1 Annexation, Connection, and Offset Unit Costs

Annexation to CWA (MWD)	$ 6,000 / acre
Annexation to PDMWD	$ 1,000 / acre
Connection to CWA	$ 5,000 / EDU
Connection to PDMWD	$ 9,000 / EDU
Water Offset Costs*	$2,500 / EDU

* Preliminary estimated allowance

Local Groundwater

The local groundwater supply is situated in the upper Sweetwater Watershed, which encompasses 230 square miles and empties into the San Diego Bay. The watershed is heavily urbanized in the western portions, with a population of about 350,000. Groundwater resources are limited. The shallow alluvial basin is the most permeable formation but is very limited in scope, with storage capacity estimates ranging from 13,000 AF (SDCWA 1997) to 20,000 AF (DWR 1986). In general, the alluvial formation groundwater is fully utilized. The much older San Diego Formation, underlying the western portion of the watershed is a confined basin much larger in size but with low well yields and poor water quality. Based on input from a local USGS representative, wells within the project site would essentially be “bedrock wells” taping the underlying fractured rock complex. Bedrock wells are very unpredictable in terms of yields and water quality and are generally limited to sustainable yields of no greater than 40 gpm, or 57,600 gpd.

Local groundwater as the sole source of supply for the project is thus seen to be quite limited from a physical availability standpoint. A comprehensive groundwater investigation including test wells would be needed to ascertain actual quantity and quality of water which could be developed from on-site wells.

Utilization of groundwater for this project would need to be done in compliance with the “San Diego County Groundwater Ordinance” (County Code Title 6 Division 7, Chapter 7, Section 67.701), which regulates groundwater usage “…for the protection, preservation, and maintenance of this resource.” The project would be entitled to extract an annual amount of groundwater representing its proportionate share (based on acreage) of the sustainable annual yield of the watershed, considering the demands of existing and potential future development within the watershed.

The actual annual allocation for the subject 255 acre property would be determined from a groundwater investigation conducted by a geohydrologist and approved by the San Diego County Geohydrologist (Jim Bennet). Mr. Bennet (phone conversation with Mr. Eikermann on 1/18/2011) expressed his preliminary opinion that the groundwater resources in the vicinity of the proposed project would be inadequate to support the normal demands of the contemplated development.

Notwithstanding the above obstacles, should a well system be selected as the water source, a “New Community Water System” permit would be required including a technical, managerial, financial (TMF) assessment, to be approved by the County of San Diego Department of Environmental Health (DEH) and the California Department Health Services (DHS) Office of Drinking Water.

The facilities required to provide local groundwater to the contemplated development would include a system of bedrock wells pumping into a dedicated supply line to a storage reservoir. The reservoir containing operational, fire suppression, and emergency storage, would be placed at an elevation to provide adequate pressure to the development. A distribution system from the reservoir would be sized to meet peak demands and fire flows throughout. It is assumed that the internal storage and distribution systems would be similar regardless of the water source.

Supply Limitations Preclude Conventional Development

The limited availability of sustainable yields from the groundwater source and the uncertain availability and high cost of imported supply from PDMWD and SDCWA, would likely force any contemplated development to feature extreme water conservation measures to limit water consumption. Such measures would likely include very low water use fixtures and irrigation ordinances set for xeriscape native vegetation, as well as captured rainfall and recharge of treated demineralized wastewater in order to minimize the impact and render any contemplated urban land use feasible.

WASTEWATER DISPOSAL OPTIONS

The two options to dispose of wastewater generated in the Willows Road Study Area include construction of a new wastewater treatment and disposal facility or construction of a new gravity sewer pipeline connecting into the County of San Diego Sanitation District’s Alpine Sewer Service Area.

Alpine Sewer Service Area

The Alpine Sewer Service Area conveys its flows westerly to the County of San Diego Sanitation District's Lakeside Sewer Service Area, which conveys flows to the City of San Diego's Metropolitan Wastewater Department (Metro) system. The Metro system conveys flow to Point Loma for treatment and disposal. Based on a cursory review of the Alpine and Lakeside sewer system model, the following thresholds were established.

- 50,000 gpd – no major upgrades required
- 100,000 gpd – Alpine Trunk lines will need to be replaced
- 300,000 gpd – Lakeside Trunk lines will need to be replaced

Annexation and connection fees would also be associated with connecting to the County Sanitation District and Metro, as summarized in Table 2.

Table 2 Estimated Annexation and Connection Unit Costs

Annexation to County	$ 1,000 / acre
Connection to County	$ 1,500 / EDU
Connection to Metro	$ 3,000 / EDU

New Wastewater Treatment Plant/Local Disposal

On-site treatment and disposal of wastewater is technically feasible but would face significant regulatory hurdles and require innovative and costly measures to meet water quality objectives. The Basin Plan objective for Hydrologic Subarea (HSA) 9.30, in which the project lies, includes a very restrictive Total Dissolved Solids (TDS) limit of 500 mg/l. The wastewater generated from the project, regardless of the water source, would exceed the 500 mg/l salinity objective. To meet the objectives would require expensive salt removal, likely by reverse osmosis (RO) treatment, of either the source water or the treatment plant effluent. Facility and operational costs, as well as disposal of salt brine, are important considerations in RO treatment. In addition to TDS, nitrates (NO_3) would be a water quality issue since the Upper Sweetwater groundwater objective for NO_3 is 10 mg/l (nitrate as nitrogen). Iron and manganese may also be present in the groundwater but would be removed in the treatment of the water supply. The local groundwater may already exceed the TDS objective, but the RWQCB Basin Plan is not easily amended and the California non-degradation policy makes it difficult to secure a permit for a project that would contribute to degradation of local groundwater quality.

A Waste Discharge Permit (WDP) administered by the RWQCB in cooperation with the County DPW, would need to be secured for an on-site or local wastewater management project. The WDP application process is quite challenging, requiring extensive investigation and documentation, and includes public review.

The wastewater management system would feature an advanced secondary treatment plant with added tertiary treatment processes as required to meet discharge objectives. The added processes would likely include nitrate removal by extended aeration or perhaps an organic upflow filter and salinity reduction by RO if required. Note that RO treatment of the wastewater effluent would not be needed if the rainfall capture/recharge system or RO treatment of the source water can achieve the necessary salinity offset to meet the RWQCB TDS objectives.

In addition to the treatment plant, an on-site disposal system would be required. Assuming that the very low water use "alternative concept" is in place, the wastewater effluent would not be recycled for landscape irrigation but rather would be recycled to the groundwater regime by recharge through a subsurface drain field or subsurface drip dispersal system. The drain field would be similar in design to a septic system leach field, consisting of perforated pipe in gravel filled trenches. A subsurface drip dispersal system would consist of a network of small diameter low-pressure tubing with drip emitters, installed from six inches to one foot below ground surface. This system would be placed below devegetated surfaces, either xeriscape land forms or permeable parking areas. The subsurface drain field would be more efficient in recharging the groundwater basin, since a shallow drip dispersal system would encounter some water loss due to capillary up flow and evaporation from the soil. In either system, the soil depth to bedrock, permeability, depth to groundwater and subsurface transmissibilities must be proven to be sufficient to prevent mounding and surfacing of effluent.

It is thus assumed that a new wastewater treatment facility to serve this area would be required to feature advanced treatment such as RO to ensure that the groundwater water quality objectives are met and that disposal of the effluent would be through a leach-field, subsurface drip dispersal system, or a recycled water system for landscape irrigation.

POTENTIAL DEMANDS

The challenges of annexation to (or service from) an existing water/wastewater entity warrants a closer look at the possibility of an acceptable project relying on on-site or local water supply and wastewater disposal. It may be possible to develop and secure approvals for a non-conventional, very low water use concept which would sustain itself within the expected limited allocation of local groundwater or, should annexation be feasible, a restricted allocation of imported supply. Such a project relying on local groundwater would feature very little or a complete absence of irrigated landscaping, non-consumptive recycling of highly treated wastewater, and collection and recharge of rainfall runoff. The local groundwater would then possibly be adequate to supply the demands, which would consist of only the consumptive use portion of the indoor uses and perhaps a very small amount of irrigation for drought-tolerant or xeriscape landscaping.

The potential water demands from the contemplated land uses are thus, under either supply scenarios, likely to be much smaller than would be estimated in a typical project, and more closely related to wastewater demands. With this in mind, water demands are calculated by applying a 10 percent increase to unit wastewater generation rates for various land uses (resulting in a 90% return to sewer factor). Table 3 summarizes the estimated water and wastewater demands for the three contemplated land use alternatives. The mixed use alternative assumes half of the area will be 8 dwelling units per acre of residential and the other half commercial development. Water EDUs are calculated by dividing the estimated water demand by a unit water demand of 480 gpd/EDU which will be used to determine connection fees under the reduced water use concept.

Table 3 Potential Demands

Scenario	Wastewater Unit Generation Rate	Wastewater Generation	Sewer EDU*	Water Demand	Water EDUs*
60 acres of Commercial	500 gpd / acre	30,000 gpd	125	33,000 gpd	68
255 acres of Commercial	500 gpd / acre	127,500 gpd	531	140,250 gpd	292
255 acres of Residential (4 DU/AC)	960 gpd/ acre	244,800 gpd	1,020	269,680 gpd	562
255 acres of Residential (8 DU/AC)	1,920 gpd/ acre	489,600 gpd	2,040	538,560 gpd	1,122
255 acres of Mixed Use	1,210 gpd/ acre	308,550 gpd	1,286	339,405 gpd	707

* 1 Water EDU = 480 gpd (Water) for capacity fee determination
* 1 Sewer EDU = 240 gpd (Sewer)

Net Demands with Recharge of Recycled Wastewater

The amount of groundwater which might be allocated to the 255-acre property under the County's groundwater ordinance can be very roughly estimated as follows:

- Section 67.722 of the Groundwater Ordinance ("Residential Density Controls") gives the maximum number of residential units which could be supported in a given area based on mean annual precipitation. The subject site is in the 15 inch to 18 inch per year range, which has a minimum parcel size of 8 acres. Assuming the County criterion of 0.5 AFY per dwelling unit, this equates to only 0.0625 AFY per acre of allowable groundwater use.

- Another method, which results in higher but still very low allocations, is to assume that approximately 10 percent to 15 percent of precipitation on the watershed becomes groundwater recharge and thus safe yield. Assuming the watershed precipitation averages 16 inches and that approximately 12.5 percent becomes deep percolation (Wiedlin Campo Study), the groundwater allocation would be 0.16 AFY per acre. This method would require an approved groundwater investigation to estimate actual yields.

- Assume that a comprehensive groundwater investigation would conclude, and that the County Hydrogeologist would approve, a groundwater allocation midway between the above two estimates (0.06 AFY and 0.16 AFY), or 0.11 AFY per acre.

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- A groundwater allocation of 0.11 AFY per acre amounts to only 28 AFY available for the 255-acre project, compared to 486 AFY required for conventional General Commercial and General Commercial - Manufacturing development.

- Groundwater is thus grossly inadequate to satisfy normal demands for this contemplated development. However if landscape irrigation is eliminated and the non-consumptive use component of the indoor demand is returned to the local groundwater regime, the groundwater allocation would be adequate, as follows:

  - Indoor water use is estimated from wastewater generation assuming 90 percent of the indoor water use becomes wastewater (500 gpd per acre ÷ 0.90 = 555.6 gpd per acre indoor use). Thus, the consumptive use component of indoor use in 556 – 500 = 56 gpd per acre. For the 255 acre project, the consumptive use water demand is only 14,300 gpd, or 16 AFY — well within the groundwater allocation of 28 AFY.

Several challenges would confront the above low water use project. Local bedrock wells would need to have sufficient capacity to reliably extract groundwater at the maximum month demand rate plus the fire storage refill rate. Assuming the above-described alternative project maximum day water demand is twice the average day, and the fire storage recharge demand is 243 gpm the well field would need to be comprised of at least 12 wells with an average of 25 gpm capacity. Another challenge is to be able to treat the wastewater to a quality acceptable for groundwater recharge, which would likely involve desalting and nitrate removal in addition to conventional wastewater treatment processes. Groundwater recharge would likely be through shallow drain fields similar to septic system leach fields. Adequate space and permeable soils as well as adequate depth to groundwater would be a necessity for this scenario.

Another measure which could significantly increase the groundwater allocation and also be beneficial in achieving compliance with groundwater quality objectives is a rainfall capture/recharge project. Assuming a field rooftop capture system, potential "new" water could be developed in the following quantities.

- 255 acre x 20 percent rooftop area = 51 acres of rooftop surfaces
- 16 inch average annual rainfall = 1.33 feet per year
- Assume an average capture and recharge rate of 51 percent, 51 acres x 1.33 feet x 0.5 = 34 AFY average recharge.

To achieve a 50 percent capture rate, an equalization storage reservoir would need to be constructed to attenuate the peak rain fall runoff (inflow) rates, reducing the reservoir outflow rate to that which could be accommodated by the recharge drain field. To stabilize a rainfall rate of up to one-inch per 24 hour period, about 5 acre feet of equalization storage would be required. This water, recharged through a subsurface drain field system during the rainfall season, would thus result in an average of about 34 AFY of "new" groundwater recharge with very high quality (low TDS) water.

The water delivery facilities for a project of this type would likely consist of dual pipeline systems, including a very small capacity potable system to supply indoor demands, and a much larger capacity non-potable system to meet fire flow and any outdoor demands.

This alternative non-conventional project concept, which features very low water use, would be environmentally advantageous but would be scrutinized by regulatory authorities and would require significant front-end planning/engineering effort to verify feasibility and obtain permits.

COST ASSESSMENT

This section provides an assessment of the anticipated costs for each scenario under a local and regional water supply and wastewater disposal options. The costs have been provided on a per EDU basis to assist in presenting the most economically feasible options, and do not include local water distribution and sewer collection costs. Sewer EDUs were used as a cost basis because they reflect the actual EDU numbers. Table 4 provides a summary of the estimated cost per EDU for each scenario under the varying water and wastewater service alternatives. As discussed in the previous section, local water supply cannot be provided for the residential and mixed use scenarios, but can potentially be feasible for the 255 acre Commercial scenario if local disposal and capture/recharge rainfall is provided to replenish the local groundwater supply.

Table 4 Summary of Estimated Cost per EDU

Scenario	Sewer EDUs*	Option A. Local Supply & Metro Disposal	Option B. Local Supply & Local Disposal	Option C. Imported Supply & Metro Disposal	Option D. Imported Supply & Local Disposal
1. 60 acres of Commercial	125	$24,800	$ 25,600	$44,000	$52,800
2. 255 acres of Commercial	531	N/A	$ 16,760	$30,300	$32,600
3. 255 acres of Residential (4 DU/AC)	1,020	N/A	N/A	$42,100	$22,900
4. 255 acres of Residential (8 DU/AC)	2,040	N/A	N/A	$31,300	$18,400
5. 255 acres of Mixed Use	1,286	N/A	N/A	$45,300	$24,600

* 1 Sewer EDU = 240 gpd (Sewer) and 480 gpd (Water)

Provided in Appendix A is a summary of each alternatives total cost by scenario as well as the assumptions used for estimating those costs.

FINDINGS

The lack of a municipal water supply and/or adequate groundwater supply, in addition to the absence of a sanitary sewer collection and disposal system, constrains the area from cost effectively developing with typical water usage. As such, one means of cost effectively developing the study area would be to implement extreme water conservation measures, including very low water use fixtures and irrigation ordinance set for xeriscape native vegetation. In addition, use of local groundwater supply would also need to include captured rainfall and potentially recharge of treated demineralized wastewater in order to minimize the impact and render any contemplated urban land use feasible.

Typical water and sewer municipal combined costs to obtain capacity in San Diego County area range $10,000 to $20,000 per EDU. With the assumptions that any development in the study area would include extreme water conservation measures, the various commercial and residential development scenarios were evaluated for 60 acres and 255 acres of development in the study area and combined costs per EDU ranged from approximately $17,000 to $53,000. For the low density concepts (Commercial floor area ratio (FAR) = 0.8 and/or Residential Density = 2 dwelling units per acre (DU/AC)) the most cost effective water supply is from the local groundwater and augmenting that supply with treated effluent from a new local wastewater treatment plant. The local water supply can only support this low density concept and for higher densities the municipal water supply is required. Due to the high costs of municipal connection and annexation fees, the most cost effective development scenarios are at the higher densities. The highest density evaluated as part of this study was (Commercial FAR = 3.2 and/or Residential Density = 8 DU/AC). These high densities will likely prevent the study area from connecting into the Metropolitan Water District of Southern California (Metro) wastewater system due to the extensive infrastructure upgrades required to support the development.

In summary, proposed development in the study area can be cost effectively developed if extreme water conservation measures are established and local wastewater treatment and disposal is provided under two distinct development scenarios.

- The low density concept (Commercial FAR = 0.8 and/or Residential Density = 2 DU/AC), which will require the development of a sustainable groundwater supply including recharge from captured rainwater as well as highly treated wastewater.

- The high density concept (Commercial FAR = 3.2 and/or Residential Density = 8 DU/AC, or greater), which will require connection to the municipal water supply and likely on-site treatment and reuse.

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Both of these concepts have significant challenges and will need to be studied further. For the local groundwater supply, a comprehensive groundwater investigation, including test wells, would be needed to ascertain actual quantity and quality of water which could be developed from on-site wells. The connection to the municipal supply must overcome two major obstacles. First, the study area must either gain approval from the SDCWA to annex as an "island," or annex the properties along Interstate 8 to develop a contiguous service border. Second, the project would likely need to assist PDMWD in offsetting existing potable water demands to comply with their 2010 Urban Water Management Plan, since their allocation of imported water will not increase.

If you have any questions regarding this report, please do not hesitate to call me at 858.514.1042 or Kyle McCarty at 858.514.1020.

Sincerely,

Mark B. Elliott, PE
Project Manager

c: Daniel Brogadir
Kyle McCarty
Gary Eickermann

Appendix A

Table A-1 Summary of Estimated Costs

Scenario	Option A. Local Supply & Metro Disposal	Option B. Local Supply & Local Disposal	Option C. Imported Supply & Metro Disposal	Option D. Imported Supply & Local Disposal
1. 60 acres of Commercial	$3.1 M	$3.2 M	$5.5 M	$6.6 M
2. 255 acres of Commercial	N/A	$8.9 M	$16.1 M	$17.3 M
3. 255 acres of Residential (4 DU/AC)	N/A	N/A	$42.9 M	$23.3 M
4. 255 acres of Residential (8 DU/AC)	N/A	N/A	$63.7 M	$37.4 M
5. 255 acres of Mixed Use	N/A	N/A	$58.3 M	$31.6 M

Option A. Local Supply / Metro Disposal

- Option A – Scenario 1: 60 Acres of Commercial – ($3.1 M)
  - $100,000 for Comprehensive groundwater investigation
  - $500,000 for a new 25 gpm well with limited wellhead treatment
  - $100,000 for a new 50 gpm pumping station
    - Max Day Peaking Factor = 2
    - Assumes $1.40 / gpd
  - $200,000 for a new conveyance pipeline
    - 0.25 miles 12-inch pipeline ($12 per foot per inch-diameter)
  - $250,000 new 250,000 gallon reservoir
    - sized at max day plus fire (1,500 gpm x 2 hours)
    - Assumes $1/gallon
  - $60,000 for annexation to Alpine
  - $188,000 for connection to Alpine
  - $375,000 for connection to Metro
  - $1,300,000 for new gravity sewer
    - 2.0 miles 10-inch pipeline ($12 per foot per inch-diameter)

Option B. Local Supply / Local Disposal

- Option B – Scenario 1: 60 Acres of Commercial – ($3.2 M)
  - $100,000 for Comprehensive groundwater investigation
  - $500,000 for a new 25 gpm well with limited wellhead treatment
  - $100,000 for a new 50 gpm pumping station

- Max Day Peaking Factor = 2
- Assumes $1.40 / gpd
- $200,000 for a new conveyance pipeline
  - 0.25 miles 12-inch pipeline ($12 per foot per inch-diameter)
- $250,000 new 250,000 gallon reservoir
  - sized at max day plus fire (1,500 gpm x 2 hours)
  - Assumes $1/gallon
- $2,000,000 for new wastewater treatment plant
  - $33/gallon – TDS between 500 – 750

- Option B – Scenario 2: 255 Acres of Commercial – ($8.9 M)
  - $100,000 for Comprehensive groundwater investigation
  - $900,000 for 12 each 25 gpm wells with limited wellhead treatment
  - $400,000 for a new 200 gpm pumping station
    - Max Day Peaking Factor = 2
    - Assumes $1.40 / gpd
  - $200,000 for a new conveyance pipeline
    - 0.25 miles 12-inch pipeline ($12 per foot per inch-diameter)
  - $500,000 new 500,000 gallon reservoir
    - sized at max day plus fire (1,500 gpm x 2 hours)
    - Assumes $1/gallon
  - $4,000,000 for new advanced wastewater treatment plant
    - $30/gallon
  - $2,800,000 for new groundwater recharge and rain harvesting systems
    - $1/gallon for low-head 500 gpm recharge pumping station = $500,000
    - 1,500,000 for RO tertiary treatment/brine disposal
    - 200,000 for effluent recharge leach field
    - 500,000 for rainfall collection system and storage
    - 100,000 for rainfall recharge drain field

Option C. Imported Supply / Metro Disposal

- Option C – Scenario 1: 60 Acres of Commercial – ($5.5 M)
  - $360,000 for annexation to SDCWA
  - $60,000 for annexation to PDMWD
  - $345,000 for connection to SDCWA
  - $621,000 for connection to PDMWD
  - $172,500 for water offsets

- $100,000 for a new 50 gpm pumping station
  - Max Day Peaking Factor = 2
  - Assumes $1.40 / gpd
- $1,700,000 for a new conveyance pipeline
  - 2.25 miles 12-inch pipeline ($12 per foot per inch-diameter)
- $250,000 new 250,000 gallon reservoir
  - sized at max day plus fire (1,500 gpm x 2 hours)
  - Assumes $1/gallon
- $60,000 for annexation to Alpine
- $188,000 for connection to Alpine
- $375,000 for connection to Metro
- $1,300,000 for new gravity sewer
  - 2.0 miles 10-inch pipeline ($12 per foot per inch-diameter)

- Option C – Scenario 2: 255 Acres of Commercial – ($16.1 M)
  - $1,530,000 for annexation to SDCWA
  - $255,000 for annexation to PDMWD
  - $1,469,000 for connection to SDCWA
  - $2,628,000 for connection to PDMWD
  - $730,000 for water offsets
  - $400,000 for a new 200 gpm pumping station
    - Max Day Peaking Factor = 2
    - Assumes $1.40 / gpd
  - $1,700,000 for a new conveyance pipeline
  - 2.25 miles 12-inch pipeline ($12 per foot per inch-diameter)
  - $500,000 new 500,000 gallon reservoir
    - sized at max day plus fire (1,500 gpm x 2 hours)
    - Assumes $1/gallon
  - $255,000 for annexation to Alpine
  - $797,000 for connection to Alpine
  - $1,593,000 for connection to Metro
  - $1,300,000 for new gravity sewer
    - 2.0 miles 10-inch pipeline ($12 per foot per inch-diameter)
  - $2,900,000 for new Alpine trunk sewer
    - 3.0 miles of 15-inch pipeline ($12 per foot per inch-diameter)

- Option C – Scenario 3: 255 Acres of Residential at 4 DU/Ac – ($42.9 M)
  - $1,530,000 for annexation to SDCWA
  - $255,000 for annexation to PDMWD
  - $2,810,000 for connection to SDCWA
  - $5,058,000 for connection to PDMWD
  - $1,405,000 for water offsets
  - $700,000 for a new 400 gpm pumping station
    - Max Day Peaking Factor = 2
    - Assumes $1.20 / gpd
  - $1,700,000 for a new conveyance pipeline
  - 2.25 miles 12-inch pipeline ($12 per foot per inch-diameter)
  - $750,000 new 750,000 gallon reservoir
    - sized at max day plus fire (1,500 gpm x 2 hours)
    - Assumes $1/gallon
  - $255,000 for annexation to Alpine
  - $1,530,000 for connection to Alpine
  - $3,060,000 for connection to Metro
  - $1,300,000 for new gravity sewer
    - 2.0 miles 10-inch pipeline ($12 per foot per inch-diameter)
  - $22,500,000 for new Alpine and Lakeside trunk sewers
    - 3.0 miles of 18-inch pipeline ($12 per foot per inch-diameter)
    - 10.0 miles of 30-inch pipeline ($12 per foot per inch-diameter)

- Option C – Scenario 4: 255 Acres of Residential at 8 DU/Ac – ($63.7 M)
  - $1,530,000 for annexation to SDCWA
  - $255,000 for annexation to PDMWD
  - $5,610,000 for connection to SDCWA
  - $10,098,000 for connection to PDMWD
  - $2,805,000 for water offsets
  - $1,300,000 for a new 800 gpm pumping station
    - Max Day Peaking Factor = 2
    - Assumes $1.10 / gpd
  - $2,300,000 for a new conveyance pipeline
    - 2.25 miles 16-inch pipeline ($12 per foot per inch-diameter)
  - $1,400,000 new 1.4 million gallon reservoir
    - sized at max day plus fire (2,500 gpm x 2 hours)
    - Assumes $1/gallon

  - $255,000 for annexation to Alpine
  - $3,060,000 for connection to Alpine
  - $6,120,000 for connection to Metro
  - $1,520,000 for new gravity sewer
    - 2.0 miles 12-inch pipeline ($12 per foot per inch-diameter)
  - $27,400,000 for new Alpine and Lakeside trunk sewers
    - 3.0 miles of 24-inch pipeline ($12 per foot per inch-diameter)
    - 10.0 miles of 36-inch pipeline ($12 per foot per inch-diameter)

- Option C – Scenario 5: 255 Acres of Mixed Use – ($58.3 M)
  - $1,530,000 for annexation to SDCWA
  - $255,000 for annexation to PDMWD
  - $3,535,000 for connection to SDCWA
  - $6,363,000 for connection to PDMWD
  - $1,767,500 for water offsets
  - $700,000 for a new 450 gpm pumping station
    - Max Day Peaking Factor = 2
    - Assumes $1.05 / gpd
  - $2,300,000 for a new conveyance pipeline
  - 2.25 miles 16-inch pipeline ($12 per foot per inch-diameter)
  - $1,000,000 new 1.0 million gallon reservoir
    - sized at max day plus fire (3,000 gpm x 4 hours)
    - Assumes $1/gallon
  - $255,000 for annexation to Alpine
  - $3,857,000 for connection to Alpine
  - $7,713,000 for connection to Metro
  - $1,520,000 for new gravity sewer
    - 2.0 miles 12-inch pipeline ($12 per foot per inch-diameter)
  - $27,400,000 for new Alpine and Lakeside trunk sewers
    - 3.0 miles of 24-inch pipeline ($12 per foot per inch-diameter)
    - 10.0 miles of 36-inch pipeline ($12 per foot per inch-diameter)

Option D. Imported Supply / Local Disposal

- Option D – Scenario 1: 60 Acres of Commercial – ($6.6 M)
  - $360,000 for annexation to SDCWA
  - $60,000 for annexation to PDMWD
  - $345,000 for connection to SDCWA

- $621,000 for connection to PDMWD
- $172,500 for water offsets
- $100,000 for a new 50 gpm pumping station
  - Max Day Peaking Factor = 2
  - Assumes $1.40 / gpd
- $1,700,000 for a new conveyance pipeline
  - 2.25 miles 12-inch pipeline ($12 per foot per inch-diameter)
- $250,000 new 250,000 gallon reservoir
  - sized at max day plus fire (1,500 gpm x 2 hours)
  - Assumes $1/gallon
- $3,000,000 for a new WWTP & Disposal
  - 50,000 gpd at $60/gallon

- Option D – Scenario 2: 255 Acres of Commercial – ($17.3 M)
  - $1,530,000 for annexation to SDCWA
  - $255,000 for annexation to PDMWD
  - $1,460,000 for connection to SDCWA
  - $2,628,000 for connection to PDMWD
  - $730,000 for water offsets
  - $400,000 for a new 200 gpm pumping station
    - Max Day Peaking Factor = 2
    - Assumes $1.40 / gpd
  - $1,700,000 for a new conveyance pipeline
    - 2.25 miles 12-inch pipeline ($12 per foot per inch-diameter)
  - $500,000 new 500,000 gallon reservoir
    - sized at max day plus fire (1,500 gpm x 2 hours)
    - Assumes $1/gallon
  - $8,000,000 for a new WWTP & Disposal
    - 0.2 mgd at $40/gallon

- Option D: Scenario 3 - 255 Acres of Residential at 4 DU/Ac – ($23.3 M)
  - $1,530,000 for annexation to SDCWA
  - $255,000 for annexation to PDMWD
  - $2,810,000 for connection to SDCWA
  - $5,058,000 for connection to PDMWD
  - $1,405,000 for water offsets
  - $700,000 for a new 400 gpm pumping station

    - Max Day Peaking Factor = 2
    - Assumes $1.20 / gpd
  - $1,700,000 for a new conveyance pipeline
    - 2.25 miles 12-inch pipeline ($12 per foot per inch-diameter)
  - $750,000 new 750,000 gallon reservoir
    - sized at max day plus fire (1,500 gpm x 2 hours)
    - Assumes $1/gallon
  - $9,000,000 for a new WWTP & Disposal
    - 0.3 mgd at $30/gallon

- Option D – Scenario 4: 255 Acres of Residential at 8 DU/Ac – ($37.4 M)
  - $1,530,000 for annexation to SDCWA
  - $255,000 for annexation to PDMWD
  - $5,610,000 for connection to SDCWA
  - $10,098,000 for connection to PDMWD
  - $2,805,000 for water offsets
  - $1,300,000 for a new 800 gpm pumping station
    - Max Day Peaking Factor = 2
    - Assumes $1.10 / gpd
  - $2,300,000 for a new conveyance pipeline
    - 2.25 miles 16-inch pipeline ($12 per foot per inch-diameter)
  - $1,400,000 new 1.4 million gallon reservoir
    - sized at max day plus fire (2,500 gpm x 2 hours)
    - Assumes $1/gallon
  - $12,000,000 for a new WWTP & Disposal
    - 0.6 mgd at $20/gallon

- Option D – Scenario 5: 255 Acres of Mixed Use – ($31.6 M)
  - $1,530,000 for annexation to SDCWA
  - $255,000 for annexation to PDMWD
  - $3,535,000 for connection to SDCWA
  - $6,363,000 for connection to PDMWD
  - $1,767,500 for water offsets
  - $700,000 for a new 450 gpm pumping station
    - Max Day Peaking Factor = 2
    - Assumes $1.05 / gpd
  - $2,300,000 for a new conveyance pipeline

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  - 2.25 miles 16-inch pipeline ($12 per foot per inch-diameter)
- $1,000,000 new 1.0 million gallon reservoir
  - sized at max day plus fire (3,000 gpm x 4 hours)
  - Assumes $1/gallon
- $14,000,000 for a new WWTP & Disposal
  - 0.8 mgd at $17.50/gallon