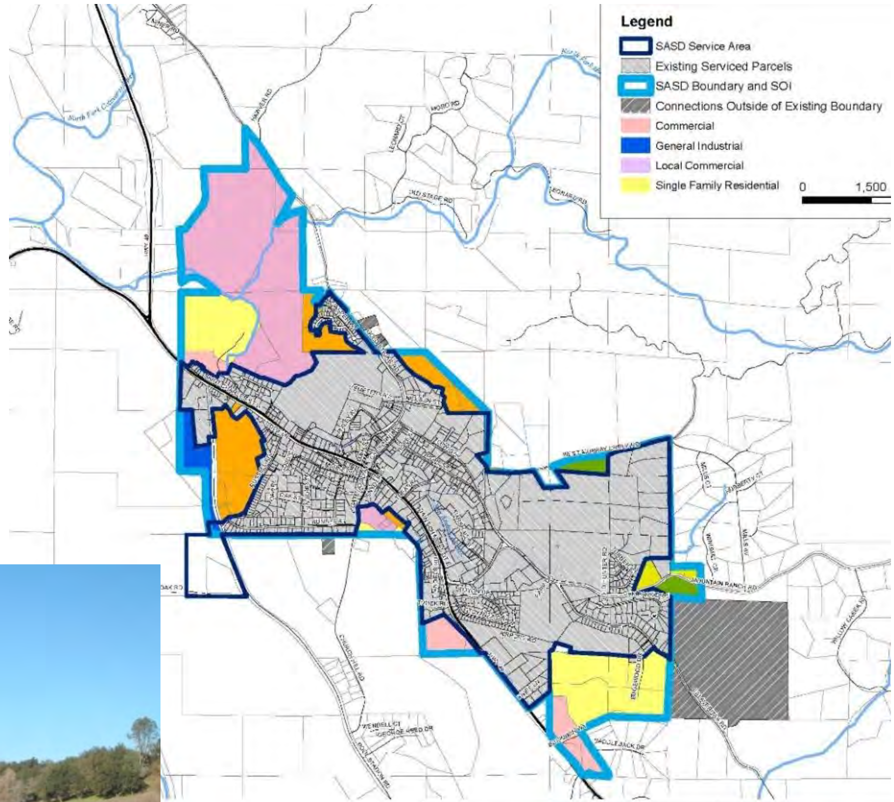

San Andreas Sanitary District Collection System Master Plan

March 14, 2016

KJELDSEN SINNOCK NEUDECK INC.
Civil Engineers and Land Surveyors

KSN
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0277-1300
05-001

March 14, 2016

San Andreas Sanitary District
Mr. Hugh Logan, General Manager
675 Gold Oak Road
San Andreas, CA 95249

Re: San Andreas Sanitary District Collection System Master Plan

Dear Mr. Logan;

Kjeldsen, Sinnock & Neudeck, Inc. (KSN) is pleased to submit this Collection System Master Plan for the San Andreas Sanitary District. Pursuant to our approved Scope of Services, this Plan includes the following:

1. Analysis of existing and future potential land uses and projections of wastewater flows and project phasing;
2. A plan for improvement and expansion of the collection system to address current and future capacity needs;
3. Review of alternatives for effluent storage and disposal; and
4. A recommended Capital Improvement Plan (CIP) for the District's collection system and effluent storage and disposal systems.

This Plan has been prepared in coordination with the District's preparation of the updated Wastewater Facilities Plan prepared by Stantec.

If you have any questions regarding this document, please do not hesitate to contact us. Thank you for engaging KSN for these important engineering services.

Sincerely,
KJELDSEN, SINNOCK & NEUDECK, INC.

Stephen K. Sinnock, RCE 32192
Principal Engineer

Neal T. Colwell, RCE 59437
Principal Engineer/Project Manager

REGISTERED PROFESSIONAL ENGINEER
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KSN KJELDSEN SINNOCK NEUDECK INC.
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0277-1300

EXECUTIVE SUMMARY

March 14, 2016

To: Hugh Logan - SASD General Manager

Subject: Executive Summary

Project: San Andreas Sanitary District – Collection System Master Plan

Prepared By: Neal Colwell, P.E.

This Collection System Master Plan has been prepared by Kjeldsen, Sinnock & Neudeck, Inc. (KSN) pursuant to the Scope of Services approved by the San Andreas Sanitary District (District) and under planning grant funding provided by the State Water Resources Control Board. This Collection System Master Plan includes this executive summary and the detailed analysis and exhibits contained in the following Technical Memoranda, which constitute the chapters of this Plan:

Technical Memorandum No. 1	-	Future Land Use and Flow
Technical Memorandum No. 2	-	Collection System Expansion Plan
Technical Memorandum No. 3	-	Effluent Storage and Disposal

These documents have been prepared in coordination with the Wastewater Facilities Planning performed for the District by Stantec.

ES.1 FUTURE LAND USE AND FLOW

As a means to characterize exiting and anticipated future land uses, sanitary sewer flows, and connections, Technical Memorandum No. 1 documents existing land uses and flows and provides a basis for projection. This characterization is to support the analysis conducted in subsequent memoranda under this Collection System Master Plan, but also as a means to relate wastewater flows as detailed in the Wastewater Facilities Master Plan (WFMP), prepared by Stantec, to approved land uses within the District's existing sewer service area and the Sphere of Influence (SOI).

ES.1.1 EXISTING AND FUTURE LAND USE AND FLOWS

Existing information, including Calaveras County GIS shape file land use data mapping, Draft 2014 Calaveras County General Plan (General Plan), land use designations, and existing and recent historical flows and population characteristics were obtained and evaluated. This information supported development of flow characteristics for exiting users and a population/land-use basis for phasing of future capacity related improvements.

Considering recent historical influent flows and varying residential vacancy rates in San Andreas, the existing level of development is anticipated to have the potential to produce an average dry weather flow of 0.28 Mgal/d. This is the expected potential wastewater generation that could result from existing connections as of 2013; however, the District has an existing commitment to the County Jail at an average flow of 24,850 gallons per day. Including this commitment, the existing facilities have a planned capacity commitment at 0.30 Mgal/d on an average dry weather flow basis.

Future connections could occur through development on currently unoccupied parcels within the District's sewer service area or from new development that could occur on parcels located outside of the existing service area but within the District Boundary. Most, but not all, future connections would be subject to additional land use approvals, such as approval of land subdivisions or more involved special use permitting. Within the current District Boundary, the District has a potential to expand the service area up to an approximate total of 1,319 acres, or an addition of approximately 523 acres.

ES.1.2 PROPOSED FUTURE WASTEWATER GENERATION RATES

Future wastewater generation has been defined in terms of the number of Equivalent Dwelling Units (EDU) for each parcel or future development area. An EDU is a unit of measure that normalizes all land use types (commercial, industrial, residential, etc.) to the level of flow created by one single-family housing unit. Likewise an EDU can equate wastewater flows associated with future populations, including residential and non-residential wastewater sources. In terms of wastewater generation, one EDU is equivalent to the average wastewater flow from an average San Andreas single-family detached household.

The 2007 WFMP established a recommended flow per EDU of 280 gallons per day for planning of future facilities. The basis of that recommendation included a per-capita wastewater generation rate of 80 gallons per capita per day and an assumed average single family dwelling unit occupancy of 3.5 people per household (EDU). Although recent data indicates that average residential occupancy and flow per capita is different from the 2007 planning value, the resultant flow per EDU for planning purposes is still supported and it is recommended that 280 gallons per day per EDU continue to be used for planning of future facilities.

For future development, an increase in infiltration and inflow (I/I) over and above the rates experienced in the existing system by the District are not expected as a result of improved construction methods and anticipated improvements to the District's existing system, therefore no additional I/I factor has been added to the flow per EDU.

Based on a logical sequence of development in San Andreas, three broad levels of development were considered with flows based on existing conditions or future conditions based on General Plan Land uses, including:

1. Existing capacity commitments as described above;
2. Near-term development potential based on new connections resulting from development of undeveloped land within the existing sewer service area; and
3. All other future development beyond the near-term development consistent with an estimated buildout of the General Plan within the District's boundary and SOI.

The future residential EDUs, associated future population, and resultant incremental and total average dry weather flow basis are summarized in Table ES-1 for these three levels of development.

Table ES-1
Land Based Potential Dry Weather Flow

Condition	Future Residential EDU(a)	Residential Population	ADWF (Mgal/d)	Cumulative Total (Mgal/d)
Existing Capacity Commitment[a]		2,643	0.30	0.30
Near-Term Development Potential[b]	555	4,585	0.26	0.56
Future Development	1,845	11,042	0.52	0.98
Total				

[a] Existing estimated capacity commitments including allocation to the County Jail.

[b] Incremental flow increase based on average wastewater generation rate of 1,300 gal/acre-day

Development within the District's existing service area is expected to result in an increase in population of approximately 1,942 and have a resulting increase in average sewer flow of 0.26 Mgal/d, resulting in a total near-term development based flow of 0.56 Mgal/d. Buildout within the District boundary consistent with the General Plan is expected to result in a total population of 11,042 and a resulting average flow of 0.98 Mgal/d

The actual timing of development is not known and will depend on local and regional economic factors.

ES.1.3 WFMP Phasing Consistency with the Land Based Flow Projections

The 2007 WFMP and the current 2015 update relate facilities upgrades to three phases of development: Phase A, Phase B and Phase C. Technical Memorandum No. 1 relates these phases to projected wastewater generation as a result of development of existing approved land uses within the District boundary. Table ES-2 summarizes the 2007 WFMP phases with respect to EDUs and ADWF.

Table ES-2
2007 WFMP Phased Facility Upgrades

Condition	EDU(a)	Incremental ADWF (Mgal/d)(b)	Cumulative Total
Existing		0.30	0.30
Phase A Upgrades	80	0.022	0.32
Phase B Upgrades	800	0.23	0.55
Phase C Upgrades	2,400	0.67	1.22
Total	5,120	1.22	-

[a] Approximate EDU basis for flow increment.

[b] 2007 Wastewater Facilities Master Plan and the 2015 update.

Overall the WFMP is consistent with EDUs and projected population-based wastewater generation anticipated to occur as a result of development within the District boundary according to the General

Plan. Relating the Table ES-2 phases of the WFMP to land use based projected flows, these phases can be characterized as follows:

Phase A: All of the Near-term potential development, which may occur approximately within the 8 years, will be accommodated by the Phase A improvements.

Phase B: Improvements associated with the Phase B upgrades are expected to accommodate nearly all of the expected development within the near-term potential development group. Based on population projections, Phase B development would occur within the next 20 to 35 years, which encompasses the planning horizon of this report.

Phase C: The future upgrades for Phase C are predominantly associated with new development occurring outside of the exiting service area but within the within the Existing District Boundary.

ES.2 COLLECTION SYSTEM EXPANSION PLAN

Technical Memorandum No. 2 evaluates and presents recommendations for the District's collection system Capital Improvement Plan (CIP). These recommendations are based on results of a hydraulic analysis of the existing collection system and a plan for trunk sewer system improvements needed to serve future development.

ES.2.1 BACKGROUND INFORMATION

The hydraulic analysis that forms the basis of Technical Memorandum No. 2 was developed as detailed in KSN's November 6, 2012 collection system modeling technical memorandum. This Collection System Master Plan analysis of the collection system included evaluating the system for existing deficiencies, then projecting system improvements to increase capacity to serve anticipated new development within the broad levels of development described above.

Existing and future sewers were evaluated with respect to their capacity to convey ADWF and a peak wet weather design storm infiltration and inflow (I/I), based on a 10-year 6 hour design storm. The rainfall-dependent inflow and infiltration (RDII) was calculated for each individual sewershed, based on the area of the sewershed and the design storm.

ES.2.2 EXISTING FACILITIES AND AVAILABLE CAPACITY

The hydraulic model indicated that some existing facilities have flow depths that exceed the minimum new sewer design criteria, but with a hydraulic grade line that meets the minimum existing sewer performance criteria and does not indicate that the sewer is surcharged. These sewers are recommended for improvement prior to any new connections being installed that are tributary to these sewers, although they do not require improvement under existing conditions.

These sewers do not require immediate improvement to convey peak flows under existing sewer performance criteria, but should be considered the highest priority sewers for improvement when any new connections are considered that will be tributary to these sewers. Before any new connections are authorized, it is recommended that the following sewer segments be improved:

1. From manhole E-1180 to E-1100;
2. From manhole E-1000 to E-0900; and
3. From manhole E-0900 to E-0800/

ES.2.3 Results of Capacity Assessment

The sewers identified above are recommended for improvement prior to or concurrent with connection of any potential near-term or future new development. Based on the hydraulic analysis two additional sewers were found to have velocities below the District's minimum allowable design velocity of 2 feet per second when flowing full. Since 2 feet per second is considered the minimum velocity for a sewer to be self-cleansing, these sewers are recommended for improvement as funding allows.

Considering the expected points of connection to the existing system as identified in Technical Memorandum No. 2, sewer system improvements recommended to serve future development are listed in Table ES-3. Additional in-development sewer improvements are expected to be necessary and will depend on the final characteristics of the development project.

In addition to the segments identified for improvement, the District is aware of additional existing sewer segments that are considered "flat" or otherwise do not meet the District's design velocity requirements, or have diameters smaller than 6". The District is compiling a summary of the segments identified as potential concerns within this District. This summary will be used to identify potential improvements to these segments, and will consider this summary in addition to the recommendations of this report when planning improvements.

In addition to capacity-related improvements, rehabilitation of existing sewers may be necessary due to the condition or operational characteristics of the sewer. The need for such improvements can be identified through various inspection methods, such as closed circuit television (CCTV) inspection or smoke testing. Improvements to sewers identified by these methods could result in system-wide benefits, such as lower RDII, which could lessen the flow in sewers downstream of the improved segment.

ES.2.4 Recommended Sewer System Capital Improvement Program

Table ES-3 summarizes the recommended capacity-related improvements needed to provide sewer service within the District's existing boundary, based on current General Plan land uses. The prioritization of each sewer segment in Table ES-3 is based on multiple factors, including:

- The number of sewers included in the segment,
- The number of sewers within the segment at capacity under both existing and future conditions,
- The number of sewersheds served by the upstream end of the segment,
- The proximity of the segment to San Andreas Creek, and
- Whether the segment includes a creek crossing.

Table ES-3
Recommended Capacity-Related Improvements to Existing Facilities – Future Peak Wet Weather Flows

Priority No.	Upstream Manhole ID	Downstream Manhole ID	Recommended Minimum Diameter (inches)	Approximate Capital Cost of Recommended Improvement	Development Phase Triggering Improvements
1	E-1210	E-0700	10	$ 1,054,000	Near-Term
2	E-0200	B-0800B	14	$ 992,000	Near-Term
3	F-0200	E-1200	10	$ 598,000	Near-Term
4	B-0650	B-0300	14	$ 556,000	Near-Term
5	B-0800B	B-0650	14	$ 314,000	Near-Term
6	F-0307	F-0306	10	$ 41,000	Near-Term
7	F-0306	F-0200	10	$ 535,000	Buildout
8	F-0308	F-0307	10	$ 30,000	Buildout
9	I-0100	H-0200	8	$ 28,000	Buildout
10	E-0700	E-0300	12	$ 687,000	Buildout
		Total Recommended CIP Cost:		**$ 4,835,000**	

In addition to the capacity related improvements to serve future users, Technical Memorandum No. 2 recommends the following on going system evaluation and rehabilitation efforts:

1. Conducting Closed Circuit Television (CCTV) inspection at a rate such that the entire system is inspected in a 5-year cycle, estimated at an annual cost of $18,000;
2. Smoke testing such that the entire system is inspected in a 5-year cycle, estimated at an annual cost of $5,000;
3. Budgeting for system rehabilitation and replacement at a minimum level of approximately $150,000 per year, with funds to be directed to high-priority sewer segments.

As a result of the CCTV inspection and smoke testing, effective use of rehabilitation funds will be assured. Through this program, the District will also be able to assess the need for rehabilitation of sewer segments indicated to have low slopes and low design velocities.

ES.3 EFFLUENT STORAGE AND DISPOSAL

Technical Memorandum No. 3 contains an evaluation of the District's effluent storage and disposal facilities. Capacity and operational characteristics of existing facilities are summarized based on historical information and options and alternatives identified for expanding capacity to meet future needs. The key facilities components evaluated under this technical memorandum include:

- Dedicated land disposal areas;
- Discharge to North Fork Calaveras River;
- Effluent storage; and
- Effluent pumping and conveyance.

ES.3.1 Existing and Historical Facilities

The District has historically used a combination of facilities for storing and disposing of treated effluent. The District's wastewater facilities historically included four unlined ponds, Ponds A through D, constructed for a variety of purposes. Historically Ponds A through C were used for effluent polishing before discharge to land or Pond D for operational/seasonal storage. Pond D remains as the District's single effluent storage facility.

Effluent disposal is accomplished by discharge to surface water during winter months and to land during summer months.

The District's existing effluent storage and disposal facilities consist of:

4. Pond D, which provides the District with operational, emergency, and very limited seasonal storage of effluent with a permitted capacity of 4.3 Mgal;
5. The Dedicated Land Disposal Area (DLDA), designed strictly for effluent disposal, includes approximately 19 acres of spray disposal area active on the WWTP site and approximately 11 acres of area developed on the District' site called the Nielsen Property (located to the north of the WWTP site and on the north side of Murray Creek); and
6. The existing surface water disposal facilities including approximately 5,900 linear feet of 12 inch diameter effluent pipeline from the WWTP to the North Fork Calaveras River. At approximately 2,800 feet upstream of where Highway 12 crosses the North Fork Calaveras River, an existing diffuser is constructed in the river immediately upstream of the confluence with Murray Creek. The diffuser is constructed with two 12 inch diameter perforated PVC diffusers installed in the bed of the North Fork Calaveras River;

On the WWTP site, the District historically used disposal trenches as the means of land disposal, however these trenches were filled in 2013 to reduce the overall land disposal operation labor effort, reduce the risk of uncontrolled discharges due to downslope leaks caused by rodents, and to switch to surface application (via sprinklers) as part of a process to reduce the potential for groundwater quality concerns.

ES.3.2 Storage and Disposal Operational Strategies

The District's NPDES permit contains certain constraints on effluent discharge to the North Fork Calaveras River and to the DLDA. In addition to water quality-based limitations, the constraints generally include the following:

1. Discharges to the North Fork Calaveras River are generally constrained to the following:
   a. Discharge is allowed from November 1 through April 30;
   b. Discharge cannot exceed 1/20th of the river flow (as a daily average); and
   c. The average daily discharge cannot exceed 1.5 Mgal/d.
2. Discharge to the DLDA is generally constrained to the following:
   d. Application to the DLDA is to be at reasonable irrigation rates designed to minimize runoff; and

e. Land application is prohibited 24 hours before a forecasted precipitation event, during precipitation, and within 24 hours after any measurable precipitation or when the ground is saturated.

During the winter months of November through April, discharge to the North Fork Calaveras River is the preferred disposal method. Winter influent average flows typically range in the order of 0.23 Mgal/d to 0.30 Mgal/d, with higher influent flows during and immediately following rain events. The District's current operation is to discharge only when at least a 20:1 dilution can be achieved in the North Fork Calaveras River, e.g., when the river is flowing at 20 times or more the influent flow.

During land disposal months, May through October, effluent is directed to Pond D and the DLDA. If discharge to the DLDA is prohibited due to precipitation or saturated soil conditions, effluent is discharge to Pond D and stored until DLDA discharge operations can resume.

The District's DLDA operation relies substantially on evapotranspiration and percolation disposal, in particular percolation disposal when winter-month land application has to occur due to insufficient or no flow in the North Fork Calaveras River and evapotranspiration potential is low. The District's effluent storage does not have sufficient capacity to provide seasonal storage

ES.3.3 RECENT HYDROLOGIC CONDITIONS

The District's effluent disposal operations are highly dependent on hydrologic conditions. Technical Memorandum No. 3 evaluates and summarizes recent, since 2005, hydrologic conditions in San Andreas and the inter-operation of the District's surface water discharge, DLDA discharge, and Pond D. During the mid-summer or mid-winter discharge seasons, sufficient conditions normally exist to readily discharge effluent and maintain a relatively low Pond D level. However when seasons change requiring the District to convert from one disposal method to the other, temporary storage of effluent can be necessary. Both disposal methods being unavailable to the District can occur under the following conditions:

1. During early winter when insufficient precipitation has occurred for the North Fork Calaveras River to have appreciable flow but application to the DLDA is prohibited due to precipitation;
2. When flows in the North Fork Calaveras River have decreased in late spring but rain events prohibit the District from using the DLDA; and
3. When a late winter occurs with heavy rainfall past April 30, when the District is prohibited from discharging to the North Fork Calaveras River but discharge to the DLDA may be prohibited.

Under condition 1) effluent has to be stored until flows in the North Fork Calaveras River increase or rain events cease allowing discharge to the DLDA. Under condition 2) effluent has to be stored until rain events have ceased or if there is a late-season increase in the North Fork Calaveras River to allow surface water discharge. Under condition 3) effluent has to be sorted until rain events subside to allow discharge to the DLDA.

Historical data and interviews with current staff indicated that December 2014 resulted in condition 1) occurring, and along with other factors, which resulted in filling of Pond D and a need to conduct emergency discharges to surface water in violation of the District's NPDES permit. Although not strictly a design condition, the December 2014 hydrologic conditions have been evaluated as indicative of the type of event that the District's effluent storage and disposal facilities should reasonably be capable of containing.

ES.3.4 Summary of Storage and Disposal Alternatives

As a key focus of Technical Memorandum No. 3, identification and evaluation of alternative approaches for expanding effluent storage and disposal was performed. Considering the constraints of the District's existing facilities, the following alternatives were identified and evaluated either at a screening level or further refined as recommended approaches:

1. Reconstruction of historically used disposal trenches;
2. Expansion of effluent storage either on the Nielsen property or by expanding Pond D;
3. Future effluent storage off-site;
4. Expansion of DLDA on existing District lands; and
5. Modification of NPDES permit dilution requirements and season.

Because of several negative factors and a relatively high cost of construction, reinstituting the disposal trenches was been eliminated from further consideration at this time.

Five steps for improving Pond D were considered, with the objective of increasing useable volume. Each of the below alternatives were included in a program of maximizing effective use of Pond D and/or increasing Pond D storage volume to the extent practicable:

Raise Weir Structure Elevation by 1 Foot: The existing overflow structure weir is located approximately 3 feet below the lowest elevation of the top of the dam. Conceptually, if supported by an engineering analyses, this improvement consists of raising the height of the existing overflow by 1.0 foot. This improvement is estimated to increase the permitted volume in Pond D by approximately 800,000 gallons.

Obtain Revised Permit Conditions Allowing Minimum 1 foot of Freeboard: The District's current NPDES permit prohibits the water level in Pond D to be less than 2 feet from the lowest point of outlet. If supported by an engineering analysis, a permit revision to allow no less than 1 foot of freeboard is estimated to increase the permitted volume of Pond D by approximately 1.0 Mgal.

Excavate Within Pond D: Pond D is underlain by soil and soil/rock. Assuming that an average depth of about 3 feet could be excavated within Pond D, a volume gain of approximately 1.1 Mgal is estimated by this improvement.

Raise Pond D Dam Crown by Approximately 7 feet: A likely alternative to increasing the volume of Pond D is to raise the existing dam. Based on an evaluation of site topography and assuming maintaining similar dam geometry to what exists, it is estimated that the maximum practical increase in Pond D height is 7 feet. This improvement is estimated to result in a maximum potential Pond D permitted volume of approximately 14.8 Mgal. This improvement would likely trigger permitting by the Department of Water Resources Division of Safety of Dams (DSOD).

Improve Drainage: A portion of the slope above Pond D to the north currently drains into the pond. Improvements upslope of Pond D could be made to capture and route surface storm water runoff from this area abound Pond D.

Alternatives for constructing new storage on the Nielson site were not considered at this time based on the results of prior studies.

Beyond Phase B, additional effluent storage, and disposal, would need to be constructed. Such effluent storage and disposal, or possibly recycled water use sites, would likely be on a site (or sites) separate from the District's existing WWTP site and the Nielsen property. Identification and evaluation of such future sites is beyond the scope of this study.

Based on prior studies prepared by KSN, a maximum potential expansion of spray disposal of up to 65 acres is possible on the District's existing DLDA. Existing land disposal is accomplished by sprinkler application using large bore (Big Gun) high volume sprinkler heads. On the Nielsen Property, it is recommended that the Big Gun type of sprinkler system be phased out and all new and replacement land application systems be based on a lower intensity sprinkler system. Any new land application area would have to be accompanied by runoff control systems to allow capture and re-application of effluent runoff back to the land application area or to Pond D (if on the WWTP site).

In addition to effluent storage and DLDA expansion options, capacity improvements resulting from potential modifications to the District's NPDES permit were also evaluated. Options included reducing the permit-required dilution ratio from 20:1 to 10:1 or 1:1 and modifying the disposal season to include May.

ES.3.5 System Expansion and Capacity Limiting Components

A series of water balance calculations were conducted to assess storage and disposal needs and benefits of the identified alternatives. The water balance calculations included traditional annual water balance calculations based on monthly changes and a short-duration (daily) calculation based on the critical transition period hydrologic conditions. With each calculation method, select alternatives were tested to assess expected system operation under the conditions assumed. Key factors evaluated included disposal capacity to the DLDA and/or surface water discharge and effluent storage use and/or need.

The annual water balance calculations were prepared based on 1-in-100 year annual precipitation season conditions and assuming:

1. Expand Pond D to a total volume of 6.1 Mgal considering:
    a. Existing DLDA area of 30 acres;
    b. Expansion of the DLDA to 47 acres (based on prime disposal lands identified on the WWTP site and Nielsen Property); and
    c. Expansion up to the estimated maximum of 65 acres.
2. Expand Pond D to 7.2 Mgal considering;
    a. Existing DLDA area of 30 acres;
    b. Expansion of the DLDA to 47 acres; and

   c. Expansion up to the estimated maximum of 65 acres.

3. Expand Pond D to the maximum potential volume of 14.8 considering:

   a. Existing DLDA area of 30 acres;

   b. Expansion of the DLDA to 47 acres; and

   c. Expansion up to the estimated maximum of 65 acres.

Based on this analysis, it was concluded that even with expanding to the full anticipated potential DLDA area of 65 acres, that expansion of Pond D beyond 7.2 Mgal would be needed. Taking a maximized Pond D volume of 14.8 Mgal, it is estimated that the District would have to expand the DLDA by approximately 23 acres to result in a total of 53 acres of dedicated land disposal to meet the Phase B storage and disposal needs.

Annual water balance calculations based on a monthly calculation of inflows, outflows, and changes in storage do not adequately predict system performance and capacity needs associated with early winter/early spring hydrologic conditions. Therefore, a daily water balance calculation methodology was employed and compared to the critical December 2014 conditions. Using these hydrologic and influent flow characteristics, the following conditions were modeled to estimate the volume of required storage including:

1. Under current (2014) average influent flow characteristics of 0.23 Mgal/d, considering:

   a. Assuming the District is not prohibited from discharging to the DLDA 24 hours prior to a predicted rain event; and

   b. Under current the current NPDES permit 1.5 Mgal/d maximum discharge and varying dilution ratios as follows:

      i. Existing 20:1 dilution;

      ii. Reduced dilution ratio to 10:1; and

      iii. Reduced dilution ratio to 1:1.

2. At existing flow commitment average of 0.30 Mgal/d, considering:

   a. Assuming the District is not prohibited from discharging to the DLDA 24 hours prior to a predicted rain event; and

   b. Under current the current NPDES permit 1.5 Mgal/d maximum discharge and varying dilution ratios as follows:

      i. Existing 20:1 dilution;

      ii. Reduced dilution ratio to 10:1; and

      iii. Reduced dilution ratio to 1:1.

3. Phase A average influent flow of 0.32 Mgal/d, considering:

a. Assuming the District is not prohibited from discharging to the DLDA 24 hours prior to a predicted rain event; and

b. Under current the current NPDES permit 1.5 Mgal/d maximum discharge and varying dilution ratios as follows:

   i. Existing 20:1 dilution;

   ii. Reduced dilution ratio to 10:1; and

   iii. Reduced dilution ratio to 1:1.

This analysis indicates that reduced dilution can have a significant reduction on the storage needed for the time that the District transitions between disposal methods; however expansion of effluent storage is needed regardless. It is recommended that the District continue to assess and evaluate potential changes in the dilution requirements in future permits, in particular within the context of effluent quality constraints and treatment requirements. At this time, it appears that through modest improvements to Pond D, to at least 6.1 Mgal, that the existing system can function within the constraints of the 20:1 dilution requirements under current flow commitments to 0.30 Mgal/d.

The District's existing effluent pumping has limited capacity and capabilities to adequately supply effluent to the DLDA or to divert stored effluent from Pond D to the WWTP headworks. As improvements are made to the DLDA and Pond D, the following phased improvements to effluent pumping are recommended:

1. Improve irrigation pumping capabilities to the DLDA when the first expansion of these facilities is contemplated. The Phase I of DLDA pumping is estimated to require a reliable pumping capacity of 1,000 gpm;

2. Improve pumping capabilities to return secondary effluent from Pond D to the WWTP, at an estimated pumping rate of 900 gpm; and

3. With expansion of the DLDA up to a maximum potential area of 65 acres, phase pumping improvements in increments of 600 to 800 gpm to match the acres of DLDA constructed.

The existing effluent pumping facilities electrical equipment, including the existing Motor Control Center (MCC) were constructed as part of the 1982 improvements. These existing electrical systems are expected to be undersized for the ultimate electrical system needs for effluent pumping and the District has reported that due to age and condition that these facilities should be replaced near-term.

Expansion of Dedicated Land Disposal Area

Under previous studies conducted by KSN for the District, expansion of the District's DLDA appears to be limited to a total of 65 acres. This area is limited based on permit-required and/or recommended setbacks to property boundaries and surface water course and based on practical limitations in steep slope areas. Expansion of the DLDA, by improvements to the Nielsen site, to obtain at least 53 acres total are recommended to accommodate increased flows up to Phase B.

Modifications to North Fork Calaveras River Discharge Requirements and Management

Modifications to the way the District manages its discharge to the North Fork Calaveras River to maximize surface water discharge when flows exist in the North Fork Calaveras River are recommended:

1. Changes to normal operational procedures are recommended when early winter storms occur and when flows are varying in the North Fork Calaveras River. Changes in procedures are recommended to allow monitoring of river flows on at least an hourly basis and to provide for surface water discharge adjustment such that the surface water discharge tracks with the river flow.

2. Because of the potential for late winter/early spring conditions to remain wet into May, it is plausible that the District would be prohibited from discharging to the DLDA but also prohibited from making a surface water discharge. It is recommended that the District request modification of the NPDES permit to allow discharge through May 31, in particular during wet years.

Technical Memorandum No. 3 recommends a series of effluent storage and disposal improvements to address existing needs and to provide for capacity for future development. Table ES-4 summarizes the recommended effluent storage and disposal plan with a planning level opinion of probable capital cost for each. Table ES-4 lists several improvements which are needed to address capacity requirements to serve the current level of commitments up to 0.30 Mgal/d, therefore with a cost to existing users. Assuming that up to 50% of that cost can be covered by grant funds, the assumed cost burden to existing is presented. The overall effluent storage and disposal improvement program is summarized as follows:

As a means of meeting near-term flow commitments, it is recommended that the following improvements be completed:

1. Pond D useable capacity should be increased to at least 6.1 Mgal by:

    a. Raising the weir structure overflow by 1 foot;

    b. Obtaining revised permit conditions allowing a reduction in the minimum freeboard from 2 to 1 feet; and

    c. Constructing improved drainage control within the catchment of Pond D.

2. Replace the existing irrigation system MCC and necessary power supply for reliability purposes.

In order to provide capacity for the planned Phase A level of development within the District, the following improvement should be constructed:

1. Improve Pond D return pumping to the WWTP with a minimum reliable capacity of 900 gpm;

2. Improve DLDA pumping to a minimum of 1,000 gpm reliable capacity (coordinated with return pumping to the WWTP); and

3. Expanding Pond D useable capacity to 7.2 Mgal by excavating within Pond D.

To meet capacity demands for Phase B, effluent storage and disposal improvements should include the following:

1. Expanding Pond D volume to 14.8 Mgal by raising the Pond D dam by approximately 7 feet;

2. Expanding the DLDA to a minimum total of 53 acres by improving and expanding the existing sprinkler application area on the Nielsen property and expanding application areas on the WWTP site as needed; and

3. Expanding DLDA pumping to approximately 2,400 gpm.

Table ES-4
Reconnaissance Cost of
Alternative Storage and Disposal Improvement Components

Improvement Phase and Component	Capital Cost[(a)]	Cost Burden to Existing Users [(b)]
Near-Term Effluent Storage, Pumping, and Disposal Improvements		
Expand Pond D to min. 6.1 Mgal	$80,000	$40,000
Improve Pond D Drainage Catchment	$165,000	$82,500
Effluent Pumping MCC Replacement	$220,000	$110,000
Phase Total	$465,000	$232,500
Improvements to Match Phase A Upgrades		
Expand Pond D to min. 7.2 Mgal	$110,000	-
Pond D to WWTP Return Pumping	$400,000	-
Improve DLDA Pumping	$520,000	-
Phase Total	$1,030,000	-
Improvement to Match Phase B Upgrades		
Expand Pond D to min. 14.8 Mgal	$2,100,000	-
Expand DLDA to min. 53 acres	$1,060,000	-
Improve DLDA Pumping	$440,000	-
Phase Total	$3,600,000	-
Total Planned Improvements	$5,095,000	$232,500

(a) Average dry weather flow basis or system planning level capacity.
(b) Potential Improvement Cost Burden to Existing Users assuming 50% grant funding of improvement.

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0277-1300

TECHNICAL MEMORANDUM NO. 1

February 25, 2016

To: Hugh Logan - SASD General Manager

Subject: Future Land Use and Flow

Project: San Andreas Sanitary District – Collection System Master Plan

Prepared By: Jacob Bejarano, P.E.

Reviewed By: Neal Colwell, P.E.

REGISTERED PROFESSIONAL ENGINEER
NEAL T. COLWELL
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STATE OF CALIFORNIA

1.1 PURPOSE

The purpose of this technical memorandum is to characterize existing San Andreas Sanitary District (District) sanitary sewer connections, potential new connections adjacent to existing sewer facilities, and anticipated future development outside of the area that can be served by the existing sewer system. This characterization is in support of the Collection System Master Plan and as a means to relate wastewater flows as detailed in the Wastewater Facilities Master Plan (WFMP), prepared by Stantec, to approved land uses within the District's existing sewer service area and the Sphere of Influence (SOI). Land uses designations from the San Andreas Community Plan (Community Plan) and unit wastewater flow rates, as developed in prior Master Plan studies, have been used as the basis for projecting future wastewater flows for sewer system planning.

This Technical Memorandum is organized into three major sections:

- Existing and Future Land Use and Flows
- Proposed Future Wastewater Generation Rates
- WFMP Phasing Consistency with the Land Based flow Projections

1.2 EXISTING AND FUTURE LAND USE AND FLOWS

The purpose of this section is to characterize existing and future land uses and wastewater flows within the District's existing sewer service area and within the District SOI that will be basis for estimating wastewater flows. Existing developed land uses were compiled based on recent Calaveras County GIS shape file land use data mapped to show existing zoning and land use inventory. The land use inventory is current as of April 2009 and is assumed be to representative of current conditions. Future potential development is based on land use designations contained in the Draft 2014 Calaveras County General Plan (General Plan).

Existing and recent historical flows and population characteristics have been developed based on information from the District's records and available published US Census Data for the San Andreas area.

1.2.1 HISTORICAL FLOW AND POPULATION CHARACTERISTICS

Since 1980 the community of San Andreas has experienced a slow but steady rate of growth. Based on compiled population and housing data published from the 2000 census[1], the population in the San Andreas census designated place (CDP) has grown from 1,912 in 1980 to 2,615 in 2000 (an average growth rate of approximately 1.8% per year), with a commensurate increase in housing units of 825 to 1,167. For the period of 2000 to 2010, the population grew by approximately 0.64% per year, or by a total of 168. Table 1-1 presents historical population, housing count, and recent occupied housing occupancy. The San Andreas census designated place is based on a geographic area that encompasses the San Andreas Sanitary District, but includes rural areas outside of the District. Because of the relatively sparse density of development outside of the District, the San Andreas census designated place is expected to only slightly over estimate population within the District.

Table 1-1
San Andreas
Recent Historical Population and Housing Characteristics

Year	San Andreas CDP Characteristics			
	Population (a)	Housing Count (a)	Avg. Occupancy (b)	Vacancy Rate (a)
			People/occupied residence	
1980	1,912	825	N/A	N/A
1990	2,115	985	N/A	N/A
2000	2,615	1,167	2.38	6.0
2010	2,783	1,311	2.43	12.6

(a) By census designated place, San Andreas.
(b) Average number of residents per occupied housing unit.

During the period from 2000 to 2010, vacancy rates increased from 6.0% to 12.6%, with the percentage vacancy being relatively equal. Assuming that no more than 95% of the CDP population is within the San Andreas Sanitary District boundary, the 2000 and 2010 estimated populations served by the District are 2,484 in 2000 and 2,643 in 2010.

Table 1-2 presents the District's recent (2005 through 2012 and 2014) influent flow characteristics.

[1] 2000 Census of Population and Housing, California: 2000 Population and Housing Unit Counts, August 2003.

Table 1-2
San Andreas
Recent Historical Influent Flow Characteristics

Year	San Andreas WWTP Influent Flow Characteristics				
	Annual Average	Avg. Dry Weather [(a)]	Max Day	Estimated Service Population	Estimated Avg. Flow Per Capita
	(Mgal/d)	(Mgal/d)	(Mgal/d)		(Gal/cap-day)
2005	0.40	0.29	0.95	2,564	113
2006	0.40	0.29	1.21	2,579	112
2007	0.33	0.29	0.93	2,595	112
2008	0.32	0.27	1.09	2,611	103
2009	0.30	0.25	0.90	2,627	95
2010[(b)]	0.42	0.46	1.24	2,643	N/A
2011	0.38	0.28	1.59	2,643	106
2012	0.32	0.26	1.22	2,643	98
2013	0.28	0.26	0.59	2,643	98
2014	0.29	0.23	2.07[(c)]	2,643	87
2015	0.27	0.23	1.30	2,643	87

(a) Average of July, August, and September.
(b) Summer 2010 influent flows known to be not representative due to suspected flow meter error.
(c) Peak day influent flow for 2014 occurred on December 11, 2014 and is the highest recent peak day influent flow of record.

Recent historical influent flow data indicate and estimated average per capita wastewater production rate of 103 gallons per capita per day (gpcd), with the most recent (2012) average dry weather flow supporting a per capita wastewater production rate of 100 gpcd. These per-capita wastewater generation rates are inclusive of existing commercial, the limited industrial in San Andreas, and public facilities flows. As such, actual wastewater generation rates from residential connections will be less. These per-capita wastewater generation rates are associated with average dry weather flows of 0.23 to 0.29 Mgal/d for the existing population in San Andreas during this period. Based on an average occupancy of 2.43 people per occupied residence, the average flow per dwelling unit is approximately 240 gallons per day, again inclusive of flows associated with commercial, limited industrial, and public facilities in San Andreas.

According to 2000 and 2010 census data, the vacancy rate in San Andreas has increased from approximately 6.0% to 12.6%, or 6.2 percentage points. It is reasonable to consider that economic conditions in 2000 represent typical housing condition, where transient vacancy occurs from sale and rental of homes and seasonal occupancy, therefore the current level of development in San Andreas is anticipated to develop an average dry weather flow of 0.28 Mgal/d (based on median average dry weather flow from 2006 through 2012 and adjusting recent (2009, 2011, and 2012) average dry weather flow upward by 6.2%. It is expected that such an increase in housing occupancy would result in a commensurate increase in commercial and public facilities flows. It is proposed that this average flow basis represent the potential average dry weather flow commitment to existing connections within the District.

Recent, 2014, influent flow data suggests a decrease in average dry weather flow, and assuming a relatively constant resident population a decrease in the estimated average wastewater generation rate per capita. It is expected that this reduction in flow, and apparent reduction in per-capita wastewater generation rate, is largely due to water us restrictions and State mandated water use reductions for 2014 and 2015 due to the ongoing drought. It is not expected that such reduced water use and wastewater generation rates will continue at this level, therefore basing current hydraulic capacity on wastewater generation prior to 2014 is recommended.

1.2.2 Existing Development and Connections

As described above, the existing level of development is anticipated to have the potential to produce an average dry weather flow of 0.28 Mgal/d. This is the expected potential wastewater generation that could result from existing connections as of 2013, however, the District has an existing commitment to the County Jail at an average flow of 24,850 gallons per day. Including this commitment, the existing facilities have a planned capacity commitment at 0.30 Mgal/d on an average dry weather flow basis. This assumes that existing developed land uses and connections do not change in the future with the exception of minor incidental densification and changes in occupancy of existing structures.

1.2.3 Near-term Potential and Future Connections

Beyond the current planned capacity commitment of 0.30 Mgal/d, future connections are expected to increase demand on the Districts wastewater systems. For planning purposes, two general groups of development have been identified based on expected timing of such development:

1) Near-term potential connections within the existing service area; and

2) Future connections within the envelope between the existing service area and the District Boundary.

The existing service area is defined as the geographical extent of parcels that are connected to or could be served by the existing sewer system, through construction of a sewer lateral. The area outside of the existing service area but within the District Boundary, coterminous with the District's Sphere of Influence, as depicted in the Figure 1-1, represents the area where new development could occur increasing the demand for wastewater service.

Near-term, there is the potential that new connections could result from development on existing parcels within the existing service area. Such near-term new connections could be characterized as development that does not require land use approvals other than a building permit to construct on an existing sub-divided parcel or issuance of a Special Use Permit for a commercial, public, or dry-industry use consistent with current land use zoning. These types of connections are assumed to occur first due to existing land use entitlements and since fewer obstacles exist for such development.

Future connections are considered to be development that could occur on all other parcels located outside of the existing service area but within the District Boundary. Future connections would be subject to additional land use approvals, such as approval of land subdivisions or more involved special use permitting. For those future connections outside of the existing service area, additional sewer facilities would be necessary to extend service to the new development. It is assumed that these areas would develop towards the end of development of the group of near-term potential connections, within the existing service area.

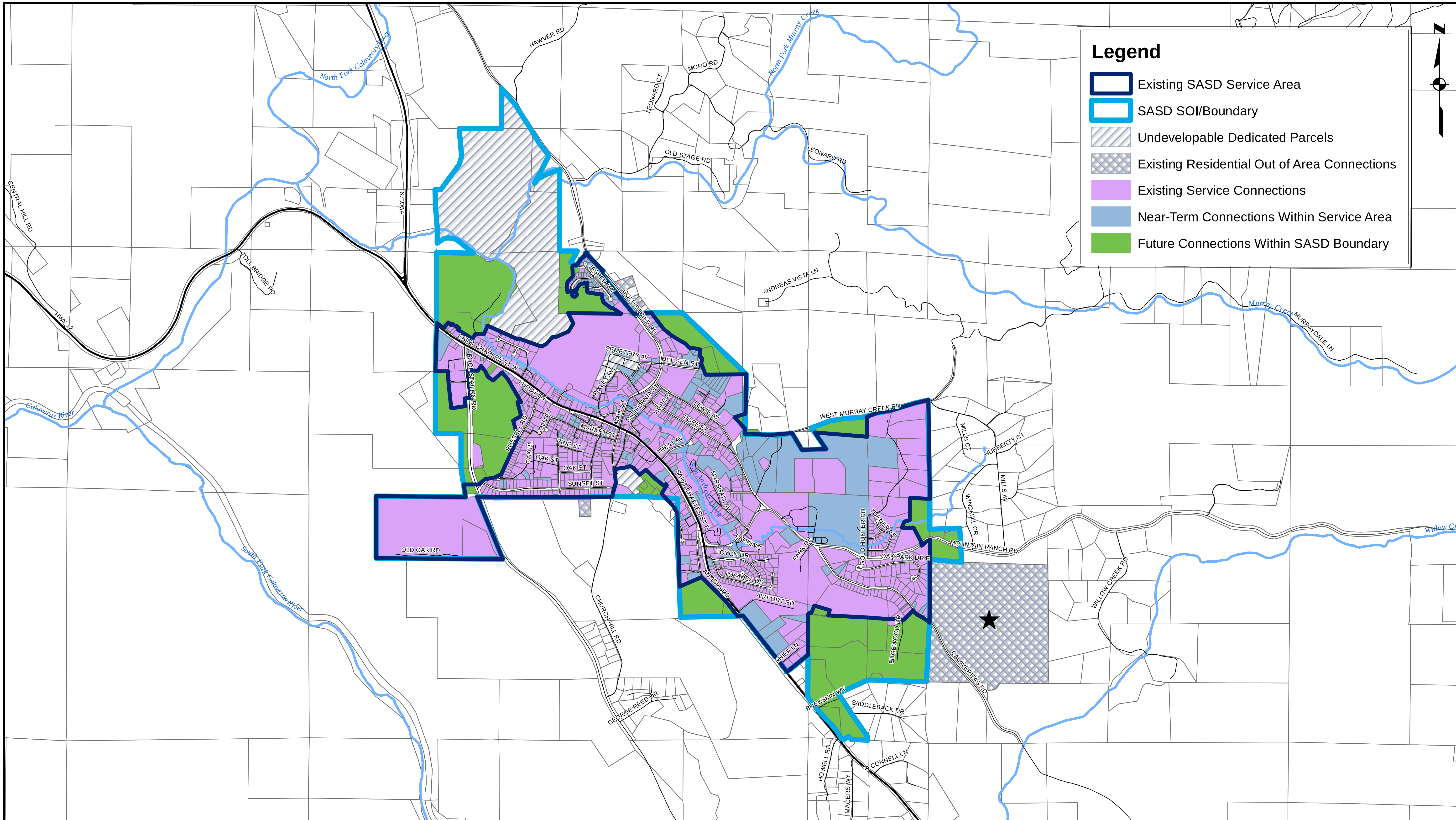
1.2.4 LAND USE SUMMARY

Table 1-3 summarizes existing land uses within the District boundary according to the San Andreas Community Plan land use designations. These areas are presented according to the total area by land use developed and within the existing sewer service area, potentially developable but not developed within the District service area, and the total area within the District boundary and sphere of influence. Figure 1-2 depicts current and future land use designations based on the 2008 Community Plan as the basis of developing future growth areas in Table 1-3.

Table 1-3
San Andreas
Existing and Future Growth Land Use Summary

Land Use	Master Plan Development Phases			
	Existing Acres [(a)]	Near-term Acres	Future Acres	Total Acres
Commercial				
General Commercial	80.6	26.6	47.7	154.9
Local Commercial	11.2	0.2	–	11.4
Professional Office	31.7	2.5	–	34.3
Recreational	3.0	–	–	3.0
Public Services	133.6	83.5	7.2	224.4
Industrial				
Light Industrial	17.8	4.4	1.4	23.5
General Industrial	6.4	–	20.0	26.4
Residential				
Rural Residential	61.7	9.6	12.3	83.6
Single Family Residential	187.1	31.1	131.1	349.4
Two Family Residential	37.4	18.7	–	56.1
Multi-Family Residential	70.5	23.0	87.6	181.1
Agriculture	154.8	–	15.6	170.4
Unclassified	0.3	0.2	–	0.5
Total	**796**	**199.8**	**322.9**	**1,319**

(a) Based on net area for currently developed land area within the District Sphere of Influence, existing District Sewer Service Area and additional 9 existing service connections outside the SOI.



★ Note: *This parcel is an agricultural preserve with one existing out of area connection.*

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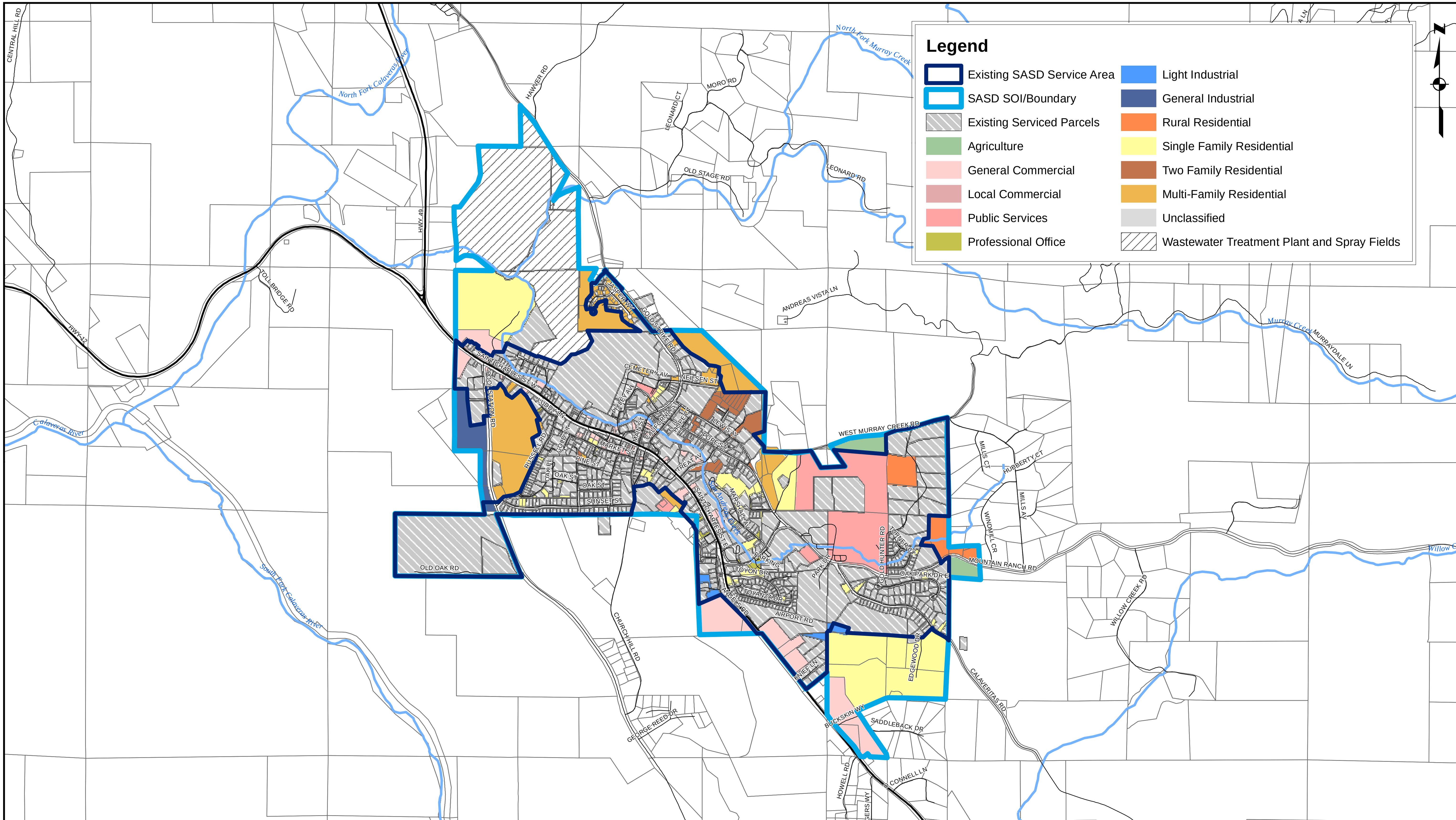
Scale
1 " = 2,000 '

Original Drawing Scale
0 1/4" 1/2"

San Andreas Sanitary District
Development Phasing

FIGURE
1-1



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Scale
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Original Drawing Scale
0 1/4" 1/2"

San Andreas Sanitary District
Future Growth Land Use

FIGURE
1-2

Based on Table 1-3, the existing District service area envelops approximately 796 acres of developed land. Within the current District Boundary, the District has a potential to expand the service area up to an approximate total of 1,319 acres, or an addition of approximately 523 acres.

1.3 PROPOSED FUTURE WASTEWATER GENERATION RATES

The purpose of this section is to present the basis of estimated wastewater generation rates for new service connections resulting from near-term development and development within the District's current District boundary. Wastewater generation rates are used to develop estimates of future wastewater flows associated with the near-term development and future development based on planned land uses as summarized in Table 1-3. Wastewater service demand and sizing of new facilities are compared on this basis for the phases of future development contemplated.

1.3.1 EQUIVALENT DWELLING UNIT

Future wastewater generation is defined in terms of the number of Equivalent Dwelling Units (EDU) for each parcel or future development area. An EDU is a unit of measure that normalizes all land use types (commercial, industrial, residential, etc.) to the level of flow created by one single-family housing unit. In terms of wastewater generation, one EDU is equivalent to the average wastewater flow from an average San Andreas single-family detached household. For example, a one-acre commercial land use parcel designated to produce ten EDUs, would have the equivalent wastewater generation of ten average single-family detached dwelling units.

The 2007 WFMP established a recommended flow per EDU of 280 gallons per day for planning of future facilities. Table 1-4 summarizes the basis of that recommendation, which includes a per-capita wastewater generation rate was based on 80 gallons per capita per day and an assumed average single family dwelling unit occupancy of 3.5 people per household (EDU).

Table 1-4
San Andreas Equivalent Dwelling Unit (EDU)
Definition for New Development[a]

Parameter	Planning Unit
Flow Per Capita (gal/person-day)	80
EDU Occupancy (person/EDU)	3.5
EDU Flow (gal/day-EDU)	280

[a] Per 2007 Wastewater Facilities Master Plan

Recent (2000 and 2010) census data suggest that the average occupancy of occupied residential units is on the order of 2.40 people per unit, and based on 2005 to 2012 influent flow data that per-capita wastewater generation rates for existing users is approximately 100 gpcd. Considering both per-capita wastewater generation rates and per unit occupancy, it is recommended that the 2007 flow basis for planning continue to be used. This is justified by the expectation that per-capita wastewater generation rates are expected to decrease due to the trend for decreasing indoor water use, including all new buildings having to meet current low-flow fixture requirements. This is expected to be off-set, however, by new development likely having higher occupancy, e.g., new residential buildings tending to be larger with more bedrooms and attracting families with 3 to 4 occupants per household.

The wastewater generation rates used in this, and prior, study is based on a community wastewater generation as calculated on a resident population basis. As such, typical commercial and institutional wastewater flow rates characteristic of the community are included in the per-capita wastewater generation rate. Actual residential and per person wastewater generation would be less, however on a whole the total flow of residential, commercial, limited San Andreas industrial, and public facilities would be equivalent to the resident population times the per-capita wastewater generation rate. Based on the future proportion of commercial, public facilities, and industrial land use projected for San Andreas as detailed in Table 1-3, the characteristics of the community with respect to wastewater generation associated with non-residential land uses is not expected to change. If, in the future, significant changes to land use are proposed, or if significant commercial, industrial, or public facility developments are proposed, project-specific wastewater generation characterization should be completed.

1.3.2 LAND USE BASED WASTEWATER GENERATION

This section relates the WFMP future flows to future population based on land use as a means of characterizing the potential level of development that would result in Phase A, B, or C of treatment facilities upgrades as described in the 2007 WFMP and as presented in the 2015 update prepared by Stantec.

As a means to compare the 2007 WFPM/2015 update phases flows to wastewater generated from population increases associated planned land uses in the District boundary, and therefore provide a land-use based tie between facilities and future development, estimated wastewater generation is calculated by defining Dwelling Unit densities to the 2014 Draft General Plan (General Plan) land use types, according to the following process. According to the General Plan, each land use designation is planned to fall within a range of development density, dependent on the vicinity of public utilities, among other factors. For instance, R1 can be classified as either Rural Residential on septic and well with a density of 1 dwelling unit per acre, or Medium Density Residential with public sewer and water service with a density of 6 dwelling units per acre. Parcels within the District Boundary are assumed to ultimately be served by both public sewer and water, and therefore have the expected potential to develop to the higher range of General Plan identified density. In such a case, the higher end land use density of this type of land use is used to estimating future wastewater flows. A summary of the General Plan dwelling unit density assignments for residential land uses is listed in Table 1-5. As discussed previously, wastewater generation from commercial, industrial, and public facilities is included in the flow per capita basis.

Table 1-5
San Andreas
General Plan Residential Land Use EDU Density Definitions

Land Use	General Plan Density (DU/acre or FAR) [a]	EDU Density for San Andreas Master Plan (EDUs/acre)
Rural Residential	1.0 DU/acre	1
Single Family Residential	6.0 DU/acre	6
Two Family Residential	12.0 DU/acre	12
Multi-Family Residential	12.0 DU/acre	12

[a] EDUs = Equivalent Dwelling Units based on General Plan Dwelling Units (DUs).

For future development, an increase in infiltration and inflow (I/I) over and above the rates experienced in the existing system by the District are not expected as a result of improved construction methods and anticipated improvements to the District's existing system, therefore no additional I/I factor has been added to the flow per EDU.

1.3.3 Potential Near-Term and Future Wastewater Flows

Identified near-term development could occur on approximately 200 acres as identified in Table 1-3, and would consist of a mix of commercial, public service, industrial and residential development. The majority of near-term development potential development is expected to be from residential development, followed by commercial and public service. Based on the Table 1-5 EDU allocations and the planning flow per EDU of 280 gallons per day, development of this nearly 83 acres of potential residential designated lands is expected to result in an increase in population equivalent to ADWF of approximately 0.16 Mgal/d, or to result in future ADWF of 0.46 Mgal/d. This additional wastewater flow includes the potential infill development, and potential connections that result in parcel sub-division and densification within the current SASD service area. Table 1-6 below summarizes the basis of projected near-term increase in ADWF.

Table 1-6
San Andreas
Estimated Potential Near-Term Connections
and Flows within SASD Service Area

Land Use	Acres	Residential EDUs	Additional Population	ADWF (Mgal/d)(a)
Residential	82.4	555	1,942	0.16

[a] Based on 280 gpd/EDU.

Future connections which develop beyond the near-term could occur through subdivision and new development within the existing District Boundary on approximately 307.4 acres (of which approximately 231 acres are designated for residential development). As detailed in Table 1-7, development within this area has the potential to increase the resident population by approximately 6,460 people and increase the ADWF by approximately 0.52 Mgal/d, or resulting in a total ADWF influent flow basis of 0.98 Mgal/d. Potential future wastewater generation is expected to be as a result of a combination of development within the District boundary, including residential, industrial, commercial, and public facilities. Projecting future flows is done on the basis of wastewater flow per residential EDU and associated population, where increases in population will result in increased in development of other land uses and associated wastewater generation.

Table 1-7
San Andreas
Estimated Future Connections and Flows within SASD Boundary

Land Use	Acres	Residential EDUs	Additional Population	ADWF (Mgal/d)[a]
Residential	231.1	1,845	6,457	0.52

[a] Based on 280 gpd/EDU.

Table 1-8 summarizes the estimated cumulative flows for existing, Near-Term potential, and Future Development to the District's Boundary for use in comparing to the project phases as presented in the 2007 WFMP and the 2015 update.

Table 1-8
San Andreas
Land Based Potential Dry Weather Flow

Condition	Future Residential EDUs	Residential Population	ADWF (Mgal/d)	Cumulative Total (Mgal/d)
Existing Capacity Commitment[a]		2,643	0.30	0.30
Near-Term Development Potential[b]	555	4,585	0.26	0.56
Future Development	1,845	11,042	0.52	0.98
Total	5,129		0.98	

[a] Existing estimated capacity commitment including allocation to the County Jail.
[b] Incremental flow increase based on average wastewater generation rate of 1,300 gallons per acre/day.

Based on land use-based ADWF estimates summarized in Table 1-8, it is expected that the District's influent flows have the potential to increase to 0.56 Mgal/d through full occupancy and Near-term potential development and to 0.98 Mgal/d through development of lands within the District boundary consistent with the General Plan. The actual timing of development is not known and will depend on local and regional economic factors, however Figure 1-3 projects the potential range of population increase from 2015 assuming a range of annual growth of 1.35% per year to 2.36% per year (based respectively on average annual growth in San Andreas since 1980 and a high growth potential as indicated by the period of 1990 to 2000). Depending on the proportion of non-residential to residential development at future points in time, the actual wastewater generation rates will vary. However, based on these population projections, Phase B (see below) is not expected to be fully developed until approximately the year 2040 or 2060, however capacity for that level of development would have to be in place prior to that time.

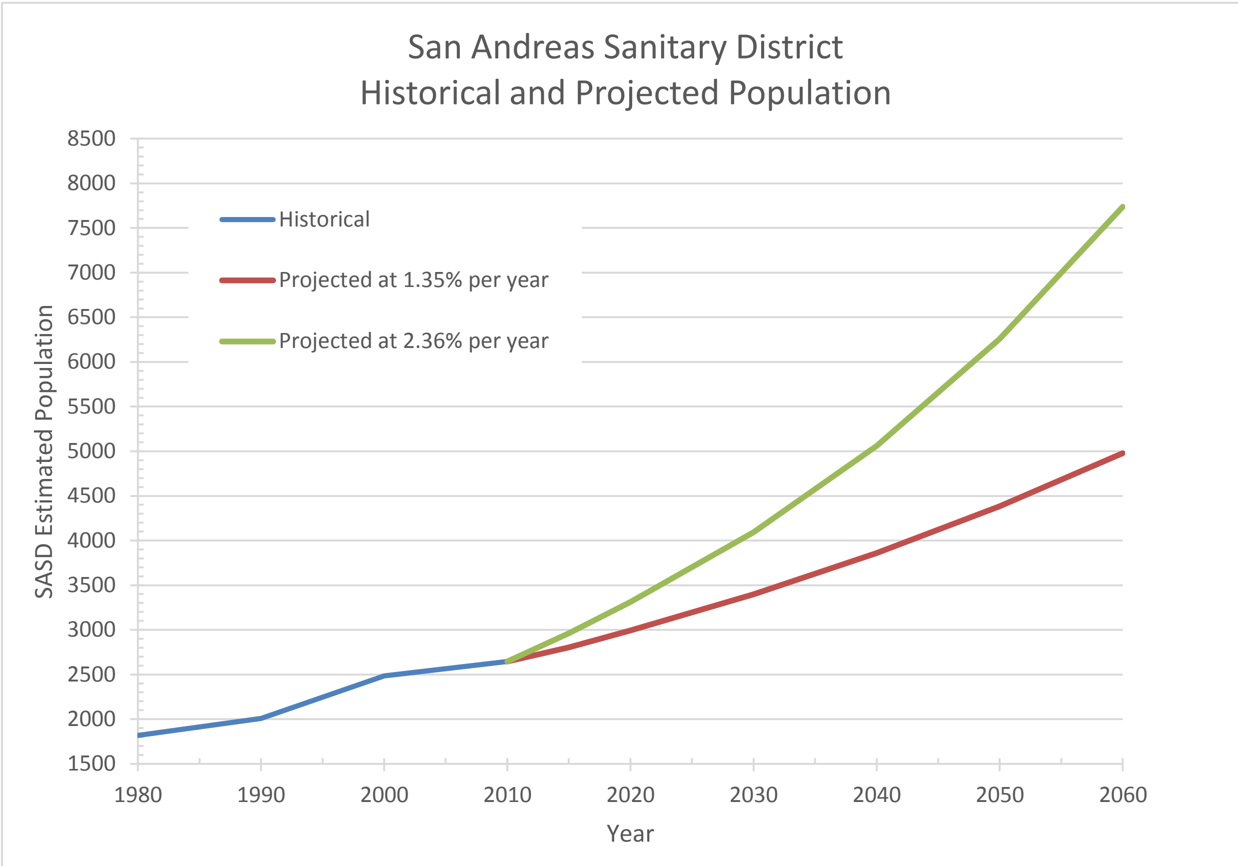

Figure 1-3
San Andreas
Projected Future Population

1.4 WFMP PHASING CONSISTENCY WITH THE LAND BASED FLOW PROJECTIONS

The 2007 WFMP and the current 2015 update relate facilities upgrades to three phases of development: Phase A, Phase B and Phase C. This section relates these phases to projected wastewater generation as a result of development of existing approved land uses within the District boundary. Table 1-9 summarizes the 2007 WFMP phases with respect to EDUs and ADWF.

Based on the 2007 WFMP, the Phases were based on an additional 80 EDU (Phase A) to serve commitments identified in 2007, then additional phased improvements in increments of 800 EDU's (Phase B) thereafter to the total of 5,120 EDU (Phase C).

Table 1-9
San Andreas
2007 WFMP Phased Facility Upgrades

Condition	EDU[a]	Incremental ADWF (Mgal/d)[b]	Cumulative Total
Existing		0.30	0.30
Phase A Upgrades	80	0.022	0.32
Phase B Upgrades	800	0.23	0.55
Phase C Upgrades	2,400	0.67	1.22
Total	5,120	1.22	-

[a] Approximate EDU basis for flow increment.
[b] 2007 Wastewater Facilities Master Plan and the 2015 update.

We understand that the WFMP phases relate to economical increments of capacity in the wastewater treatment facilities, with some consideration for potential phases of development. Overall the WFMP is consistent with EDUs and projected population based wastewater generation anticipated to occur as a result of development within the District boundary according to the General Plan. Relating the Table 1-9 phases of the WFMP to land use based projected flows, these phases can be characterized as follows:

Phase A: All of the Near-term potential development, which may occur approximately within the 8 years, will be accommodated by the Phase A improvements.

Phase B: Improvements associated with the Phase B upgrades are expected to accommodate nearly all of the expected development within the near-term potential development group. Based on population projections, Phase B development would occur within the next 20 to 35 years, which encompasses the planning horizon of this report.

Phase C: The future upgrades for Phase C are predominantly associated with new development occurring outside of the exiting service area but within the within the Existing District Boundary.

Exhibits

Exhibit 1-A: Land Use Inventory

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Civil Engineers and Land Surveyors

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Christopher H. Neudeck, P.E.
Neal T. Colwell, P.E.
Barry O'Regan, P.E.

0277-1300

TECHNICAL MEMORANDUM NO. 2

March 2, 2016

To: Hugh Logan - SASD General Manager

Subject: Collection System Expansion Plan

Project: San Andreas Sanitary District – Collection System Master Plan

Prepared By: Elizabeth Schlegel, P.E.

Reviewed By: Neal Colwell, P.E.

REGISTERED PROFESSIONAL ENGINEER
ELIZABETH R. SCHLEGEL
Exp. 06/30/2017
No. 73999
3-10-2016
CIVIL
STATE OF CALIFORNIA

2.1 PURPOSE

This memorandum presents the recommendations for a San Andreas Sanitary District (District) Collection System Capital Improvement Plan (CIP), resulting from hydraulic analysis of the existing collection system and enabling the District to plan for future service requirements. The purpose of this expansion plan is to propose capital improvements to improve certain segments of the collection system. These segments have been identified as having insufficient hydraulic capacity to convey current, near-term, and future peak wastewater flows within the District's sewer design criteria, and are therefore proposed to be included in a new Capital Improvement Plan (CIP). Based on available system construction and maintenance information, a recommended program of system inspection and replacement is proposed.

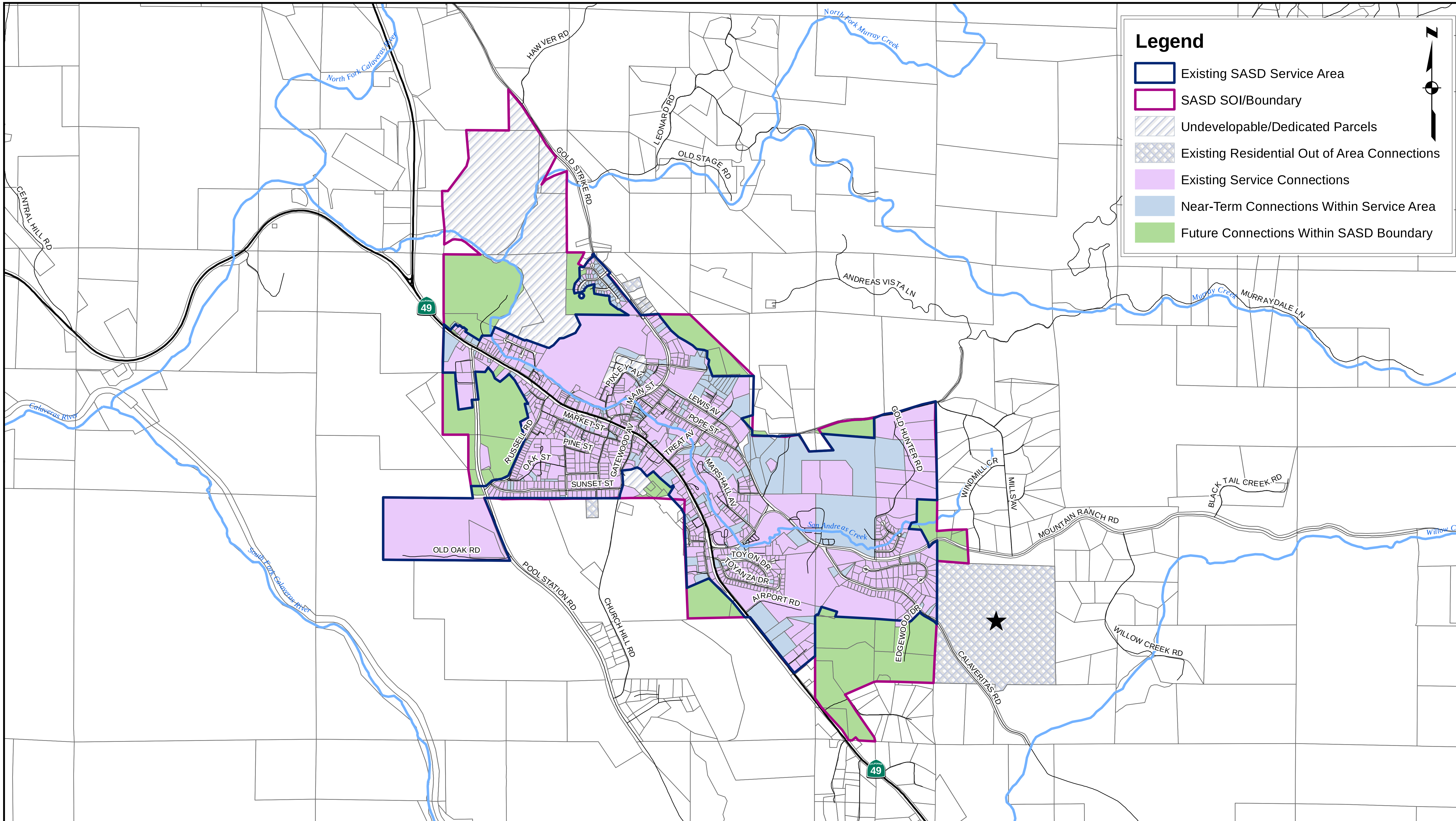
2.2 BACKGROUND INFORMATION

The hydraulic analysis that forms the basis of this memorandum was performed using a computer model of the existing collection system. The development, calibration, and validation of the model are presented in KSN's November 6, 2012 Technical Memorandum. In that memorandum, flows from existing District sewer connections were been analyzed, modeled, calibrated, and validated based on flow measurements collected at strategic locations within the District in 2012.

2.2.1 EXISTING AND FUTURE LAND USE AND FLOWS

Technical Memorandum No. 1 (TM No. 1) characterized existing District sanitary sewer connections, potential new connections adjacent to existing sewer facilities and within the District's existing service area, and anticipated future development outside of the existing sewer service area but within the District boundary/sphere of influence (SOI). The District boundary and phases of development proposed within the District are shown in Figure 2-1 and are based on the anticipated order of development growth within the District.

Future connections associated with planned land uses are anticipated to contribute to the current and future dry weather flows described in Technical Memorandum No. 1. The flow increases are based on a planning flow per equivalent dwelling unit (EDU) of 280 gallons per day, resulting in a total ADWF increase of 0.68 Mgal/day due to new development, summarized in Table 2-1.



★ Note: *This parcel is an agricultural preserve with one existing out of area connection.*

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San Andreas Sanitary District
Development Phasing

FIGURE
2-1

Table 2-1
Flow Increases Associated with Development Within District

Development Period	Development Area (acres)	ADWF Increase (Mgal/day)
Near-Term (1)	199.8	0.16
Future	322.9	0.52
Overall Potential	522.7	0.68

(1) Includes increase in occupancy as outlined in TM No. 1

2.2.2 LAND USE-BASED SEWER GENERATION FLOW BASIS

The average dry weather flow (ADWF) for the near-term and future development periods were developed based on a sewer generation rate per acre for new development within the existing District boundary, based on the criteria developed in TM No. 1.

In performing the hydraulic analysis on modeled sewers, the zoning and land use information for individual properties were considered, rather than using a residential development-based flow basis applied across all properties. In order to determine the flow basis for analysis of the District sewer network, the ADWF increase developed in TM No. 1 was distributed between the various land use types anticipated to be developed within the District boundary, as shown in Table 2-2. The expected increase in ADWF presented in Table 2-2 includes the expected increase in flow from current levels to an ADWF of 0.30 Mgal/day based on changes in occupancy and existing service commitments. This increase is included here is to assess the need, if any, for system improvements to meet that existing commitment.

Table 2-2
Land Use-Based Flow Basis for Planning of New Sewer Facilities

Land Use Classification	Near-Term Develop-ment, Acres	Future Develop-ment, Acres	Total Develop-ment, Acres	EDU Density, EDUs/ Acre	Collection Units, Total EDUs	Flow Basis for Land Use Type, gal/acre-day	Total Flow For Land Use Type, gal/day
General Commercial	26.6	47.7	74.3	7.7	572.11	1305	96,998.5
Local Commercial	0.2	0	0.2	7.7	1.54	1305	261.1
Professional Office	2.5	0	2.5	7.7	19.25	1305	3,263.7
Subtotal, Commercial	**29.3**	**47.7**	**77**		**592.9**		**100,523.3**
Recreational	3	0	3	7.7	23.1	1305	3,916.5
Public Services	83.5	7.2	90.7	7.7	698.39	1305	118,408.7
Light Industrial	4.4	1.4	5.8	5.8	33.64	983	5,703.5
General Industrial	0	20	20	5.8	116	983	19,667.2
Subtotal, Industrial	**4.4**	**21.4**	**25.8**		**149.64**		**25,370.7**
Rural Residential	9.6	12.3	21.9	1	21.9	170	3,713.0
Single-Family Residential	31.1	131.1	162.2	6	973.2	1017	165,001.4
2-Family Residential	18.7	0	18.7	12	224.4	2035	38,045.9
Multi-Family Residential	23	87.6	110.6	12	1327.2	2035	225,020.4
Subtotal, Residential	**82.4**	**231**	**313.4**		**2546.7**		**431,780.7**
Total	**202.6**	**307.3**	**509.9**		**4010.73**		**680,000.0**

The flow basis for a given land use classification has been applied to each property expected to be developed within the existing District boundary, providing a representative basis to model flows within the District sewer network under existing, near-term development, and future development conditions.

2.3 MODEL INPUT

The existing District boundary encompasses approximately 796 acres of developed land (TM No. 1), with an existing measured ADWF of 0.28 Mgal/day conveyed to the District's wastewater treatment plant through the existing sewer network. This network of existing sewers serves all connections within the District boundary, and currently must convey all committed flows within the District boundary. These committed flows are consistent with the recent historical influent flow characteristics discussed in TM No. 1, and include flows from existing connections that are currently unoccupied or not in service, such as residences currently using a septic system. The committed flows also include new single-source flows that the District has made an agreement to convey, such as the 24,850 gal/day wastewater flow from the Calaveras County Jail, for a total committed ADWF of 0.30 Mgal/day. In addition to the ADWF, the District sewer network also conveys wet period flows including approximately 0.10 Mgal/day of non-rainflow dependent infiltration during the winter months.

2.3.1 EVALUATION CRITERIA

Since the District must convey all committed flows, the existing sewer network should have the capacity to convey these flows to the District's wastewater treatment plant without violating minimum performance criteria recommended for existing sewers, as summarized in Table 2-3 below. Where the hydraulic analyses, discussed below, indicate that existing District sewers do not meet the criteria in Table 2-3 or Table 2-4, they have been identified for future improvement.

Table 2-3
Minimum Existing Sewer Performance Criteria

Sewer Performance Criteria	Recommended Performance Value
Peak Wet Weather Flow Depth (Design Flow)	Hydraulic Grade Line < or = Crown of Pipe

Existing facilities are compared with the performance criteria as outlined in Table 2-3 for improvement under the current flow commitments, however where new connections due to development will contribute additional flows, the design criteria as summarized in Table 2-4 are used to assess the existing sewers.

Table 2-4
Minimum New Sewer Design Criteria

Sewer Design Criteria	Minimum Acceptable Design Value
Peak Wet Weather Flow Depth (Design Flow)	Normal Depth = 0.75 * Sewer Diameter
Minimum Sewer Size	6 inches, inside diameter
Minimum Velocity	2 feet per second

2.3.2 PEAK WET WEATHER FLOWS

Existing and future sewers were evaluated with respect to their capacity to convey ADWF and a peak wet weather design storm infiltration and inflow (I/I), based on a 10-year 6 hour design storm. The rainfall-dependent inflow and infiltration (RDII) was calculated for each individual sewershed, based on the area of the sewershed and the design storm. The peak wet weather flow rate in the influent channel to the wastewater treatment plant is 3.23 Mgal/day according to the calibrated hydraulic model, resulting in an effective wet weather peaking factor of approximately 10.8 relative to the ADWF of 0.30 Mgal/day.

2.4 EXISTING FACILITIES AND AVAILABLE CAPACITY

The hydraulic model shows that some existing facilities have flow depths that exceed the criteria in Table 2-4, but with a hydraulic grade line that meets the criteria in Table 2-3 and does not indicate that the sewer is surcharged. These sewers are recommended for improvement prior to any new connections being installed that are tributary to these sewers, although they do not require improvement under existing conditions. Recommended improvements to these facilities should also account for near-term and future development flows. This holistic approach to improving the District's existing sewer network will allow the District to plan its capital improvements so that each sewer segment will be replaced only once, and providing the District with confidence that the replacement sewer will adequately serve both the existing and future anticipated development.

2.4.1 EXISTING FACILITIES CURRENTLY AT CAPACITY

According to the criteria in Table 2-4, where the existing peak wet weather flow depth is greater than 75% of the sewer diameter, the sewer will benefit from improvement concurrent with any new connections being installed that are tributary to these sewers. Table 2-5 identifies those modeled sewer segments with predicted flow depths greater than 75% of the sewer diameter during existing peak wet weather flows. This condition is acceptable for existing sewers serving the existing committed flows, but will require improvement to convey any new flows.

Table 2-5
Existing Facilities Currently at Capacity – Existing Peak Wet Weather Flows

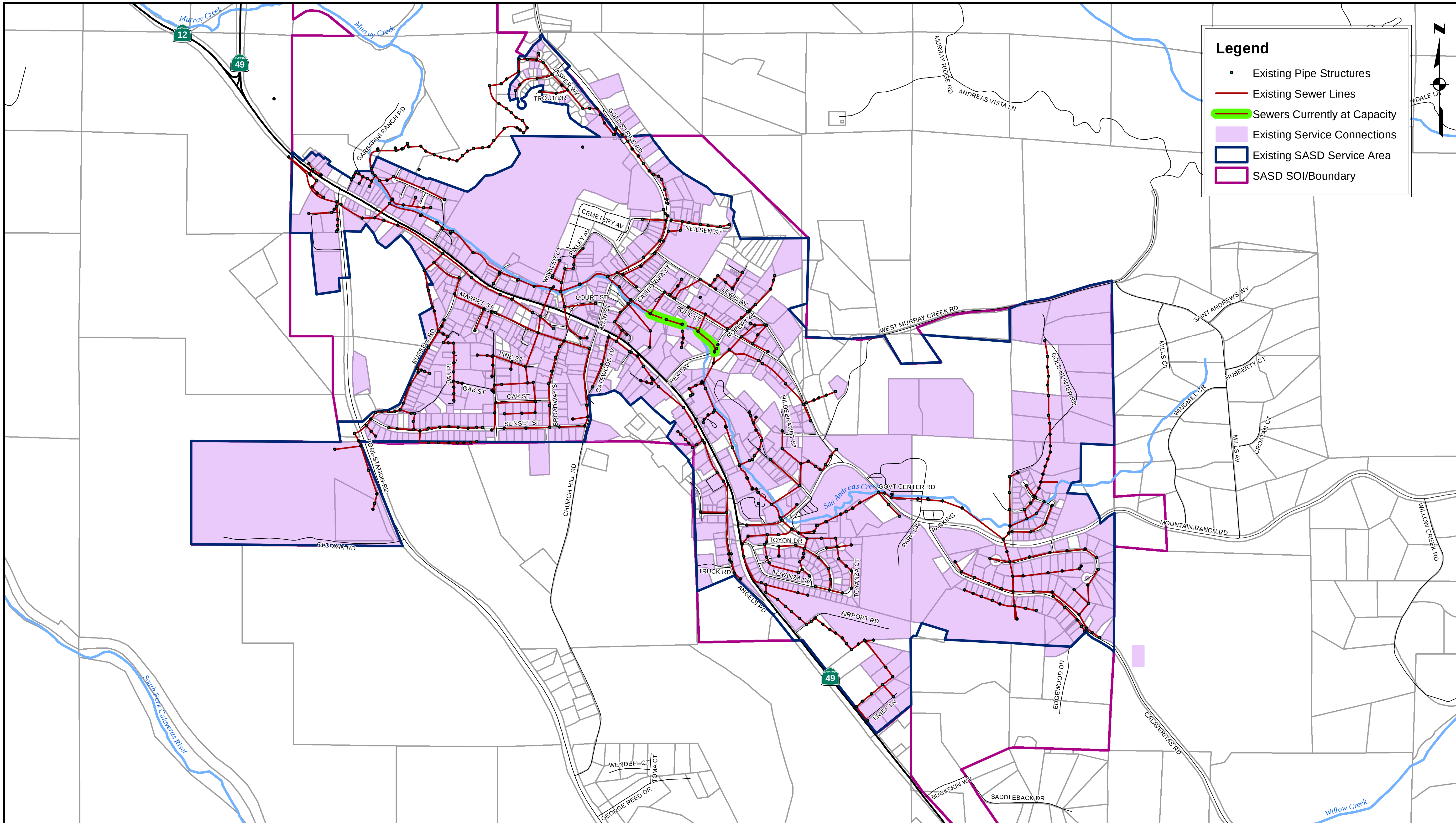
Upstream District Manhole ID	Downstream District Manhole ID	Existing Diameter (inches)	Length of Sewer Segment (feet)	% Full, Existing Peak Wet Weather Flows
E-1180	E-1100	8	343	82
E-1000	E-0900	8	219	83
E-0900	E-0800	8	223	87

Figure 2-2 identifies the location of the sewers currently at capacity under existing peak wet weather flow conditions.

These sewers do not require immediate improvement to convey peak flows under existing sewer performance criteria, but should be considered the highest priority sewers for improvement when any new connections are considered that will be tributary to these sewers.

2.5 RESULTS OF CAPACITY ASSESSMENT

The land use-based flow basis discussed in Section 2.2.2 was applied to the model of the existing District sewer network for near-term and future development scenarios in order to identify sewer improvements necessary to serve future connections under the criteria identified in Table 2-4. The Near-Term and Future Development scenarios were each simulated in the model under peak wet weather flow



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San Andreas Sanitary District
Existing Sewers Currently at Capacity
Under Existing Peak Wet Weather Flows

FIGURE
2-2

conditions, and the predicted flows from the model were used to determine which sewers are anticipated to require capacity improvements at each phase of the District's anticipated development.

2.5.1 Improvement Recommendations to Accommodate Near-Term Development

The sewer segments identified in Table 2-6 are anticipated to require improvement to convey the peak wet weather flows after near-term development occurs.

Table 2-6
Recommended Improvements to Existing Facilities – Near-Term Peak Wet Weather Flows

Upstream District Manhole ID	Downstream District Manhole ID	Existing Diameter (inches)	Length of Sewer Segment (feet)	% Full, Existing Peak Wet Weather Flows	Recommended Minimum Diameter (inches)
F-0307	F-0306	8	58	86	10
F-0200	F-0100	8	283	88	10
F-0100	E-1310	8	400	100	10
E-1310	E-1200	8	321	100	10
E-1210	E-1200	8	257	100	10
E-1200	E-1180	8	119	100	10
E-1180*	E-1100	8	343	100	10
E-1100	E-1000	8	229	100	10
E-1000*	E-0900	8	219	100	10
E-0900*	E-0800	8	223	95	10
E-0800	E-0700	8	314	89	10
E-0200	E-0100	12	221	82	14
E-0100	B-1000A	12	229	88	14
B-1000A	B-1000	12	262	77	14
B-0800B	B-0800	12	136	85	14
B-0650	B-0600	10	441	76	14

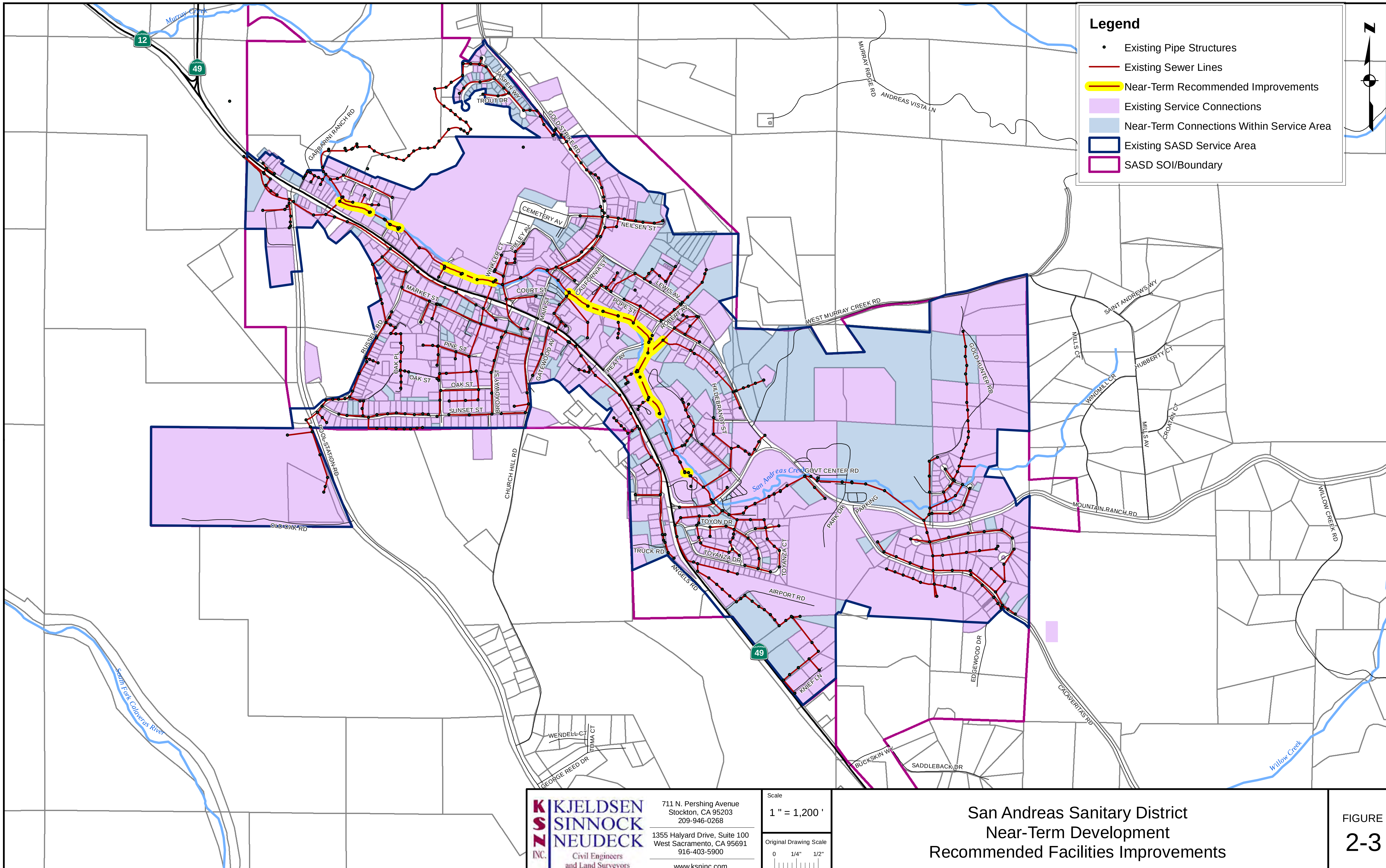
* Sewer is identified as an existing sewer currently at capacity in Table 2-5.

The locations of these sewer segments are shown in Figure 2-3.

The sewers identified in both Table 2-5 and Table 2-6 are recommended for improvement prior to or concurrent with any potential near-term or future development.

The recommended minimum improved sewer diameter is identified for each sewer included in Table 2-6. The recommended diameters have been sized to accommodate existing, committed, near-term, and future flows, so that each sewer is improved to its recommended buildout diameter within one capital improvement project.

The District may choose to install a sewer with a greater diameter than the recommended minimum improved sewer diameter at the time that the CIP project is under construction, but consideration must be made at that time to the existing and recommended sewer diameters downstream of the project so that the sewer diameter consistently increases as flows travel downstream. The final installed diameter of



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San Andreas Sanitary District
Near-Term Development
Recommended Facilities Improvements

FIGURE
2-3

each sewer may therefore be a policy-driven decision on the part of the District, to be made at the time that each capital improvement project is designed.

2.5.2 IMPROVEMENT RECOMMENDATIONS TO ACCOMMODATE FUTURE DEVELOPMENT

The sewer segments identified in Table 2-7 are anticipated to require improvement to convey the peak wet weather flows after both near-term and future development occurs.

Table 2-7
Recommended Improvements to Existing Facilities – Future Peak Wet Weather Flows

Upstream District Manhole ID	Downstream District Manhole ID	Existing Diameter (inches)	Length of Sewer Segment (feet)	% Full, Existing Peak Wet Weather Flows	Recommended Minimum Diameter (inches)
I-0100	H-0200	6	37	76	8
F-0308	F-0307	8	39	86	10
F-0306	F-0305	8	163	83	10
F-0250	F-0200	8	287	93	10
E-0700	E-0600	10	222	73*	12
E-0600	E-0500	10	211	72*	12

*This improvement is recommended because if all other recommended improvements are made, this sewer no longer meets the criteria in Table 2-4 due to various factors throughout the sewer network affecting its peak flow rate.

The locations of these sewer segments are shown in Figure 2-4.

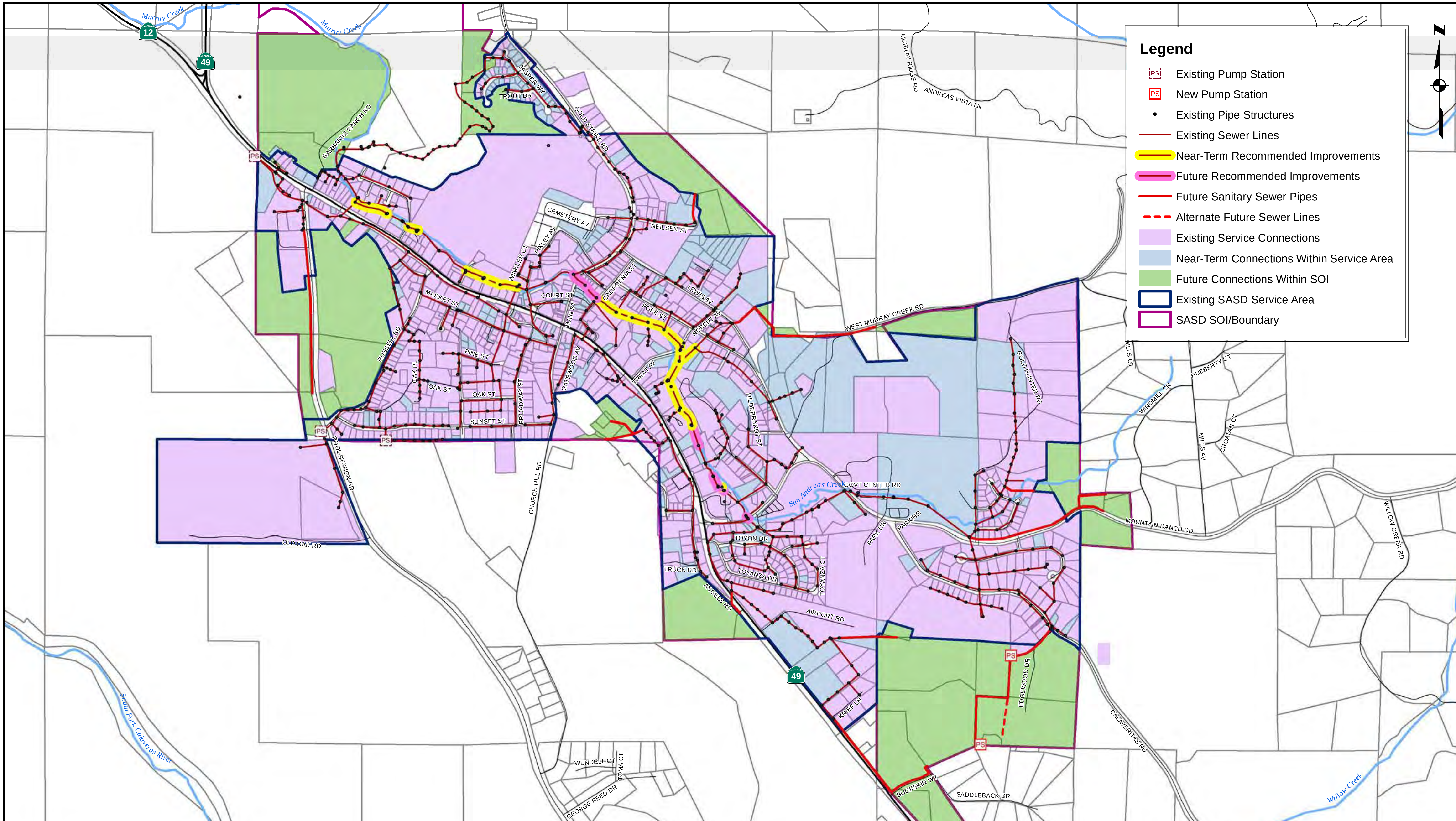
The sewers identified for improvement in Table 2-7 will require improvement only after the near-term development is complete and future development is underway, making the improvement of these sewers a lesser priority than those sewers identified in Table 2-6.

Figure 2-4 also identifies the proposed path and connection location of future sewers to serve properties within the District boundary proposed to be developed. These future sewers are suggested paths based on the information known at the time this memorandum is being developed, and should be considered to be one of many possible alternatives at the time of development of a property. If a different connection location or sewer alignment is selected at the time of development, a capacity analysis should be performed on the District sewer network to assess whether the change results in revised improvement recommendations.

The recommended sewer paths and connection locations have been assessed to determine whether the sewer can flow via gravity into the existing sewer network. Where this is not feasible, a location for a new pump station has been identified in Figure 2-4.

2.5.3 IMPROVEMENT RECOMMENDATIONS TO ADDITIONAL DISTRICT SEWERS

In addition to the improvements recommended above, several sewers downstream of the recommended improvements will have smaller diameters than those recommended for the sewers in Table 2-6 and Table 2-7. These smaller downstream sewers should also be recommended for diameter upsizing for consistency. These recommended diameter increases are development-driven and are triggered by the capacity-related improvements identified above.



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San Andreas Sanitary District
Future Development
Recommended Facilities Improvements

FIGURE
2-4

Table 2-8
Recommended Improvements to Existing Facilities – Recommended Sewer Network Diameter Improvements

Upstream District Manhole ID	Downstream District Manhole ID	Existing Diameter (inches)	Length of Sewer Segment (feet)	Recommended Minimum Diameter (inches)	Approximate Capital Cost of Recommended Improvement	Cost Burden to Existing Users
F-0305	F-0300	8	196	10	$ 120,000	-
F-0300	F-0250	8	235	10	$ 142,000	-
E-0500	E-0400	10	415	12	$ 253,000	-
E-0400	E-0300	10	261	12	$ 162,000	-
B-1000	B-0900	12	432	14	$ 276,000	-
B-0900	B-0800B	12	390	14	$ 250,000	-
B-0800	B-0700	12	95	14	$ 67,000	-
B-0700	B-0650	10	236	14	$ 154,000	-
B-0600	B-0500	12	67	14	$ 74,000	-
B-0500	B-0400	12	62	14	$ 47,000	-
B-0400	B-0300	12	236	14	$ 154,000	-

Additionally, analyses of each sewer with known upstream and downstream invert elevations were performed to assess the velocity in each sewer. Of the 141 sewers modeled, 53 sewers were analyzed to determine the velocity of flows in the pipe when flowing full. Of the sewers analyzed, 2 sewers were found to have velocities below the District's minimum allowable design velocity of 2 feet per second when flowing full. These sewers are identified in Table 2-9. Since 2 feet per second is considered the minimum velocity for a sewer to be self-cleansing, these sewers are recommended for improvement as funding allows.

Table 2-9
Recommended Improvements to Existing Facilities – Recommended Sewer Network Velocity Improvements

Upstream District Manhole ID	Downstream District Manhole ID	Existing Diameter (inches)	Length of Sewer Segment (feet)	Existing Slope (ft/ft)	Recommended Minimum Slope (ft/ft)	Approximate Capital Cost of Recommended Improvement	Cost Burden to Existing Users
N-0125	N-0100	6	161	0.0029	0.0049	$322,000	$322,000
N-0100	I-1310	6	427	0.0702	0.0049	-	-
A-0500	A-0475	8	103	0.0012	0.0034	$124,000	$124,000
A-0475	A-0450	8	95	0.0358	0.0034	-	-

The sewer segments identified in Tables 2-8 and 2-9 are also shown in Figure 2-5.

Review of the sewer downstream of each of the sewers identified in Table 2-9 below indicate that the downstream segment of each of these sewers has a slope that would allow modification of the slope of both segments so that each segment meets the design velocity when flowing full without changing the pipe diameter. This design approach should be assessed for feasibility prior to design, since the slopes may have been determined in the field due to prohibitive construction conditions, such as solid rock in the intended sewer trench. The approximate costs identified in Table 2-9 are based on this approach to improvement, and include the costs for improving both the segment with an insufficient velocity and the segment immediately downstream. Since these velocities are calculated for a full pipe under existing conditions, the cost burden for these improvements falls upon the existing users. As such, these improvements should be considered for improvement under the District's annual sewer system replacement budget.

In addition to the segments identified for improvement in this memorandum, the District is aware of additional existing sewer segments that are considered "flat" or otherwise do not meet the District's design velocity requirements, or have diameters smaller than 6". The District is compiling a summary of the segments they have identified as potential concerns within this District. This summary will be used to identify potential improvements to these segments, and will consider this summary in addition to the recommendations of this report when planning improvements.

2.5.4 Recommendations for Future Studies

The recommended improvements presented in this memorandum are based primarily on capacity-related improvements needed to serve new development anticipated to occur within the District boundary. In addition to capacity-related improvements, rehabilitation of existing sewers may be necessary due to the condition of the sewer, or operational characteristics. These sewers can be identified through various inspection methods, such as closed circuit television (CCTV) inspection or smoke testing. Improvements to sewers identified by these methods could result in system-wide benefits, such as lower RDII, which could lessen the flow in sewers downstream of the improved segment.

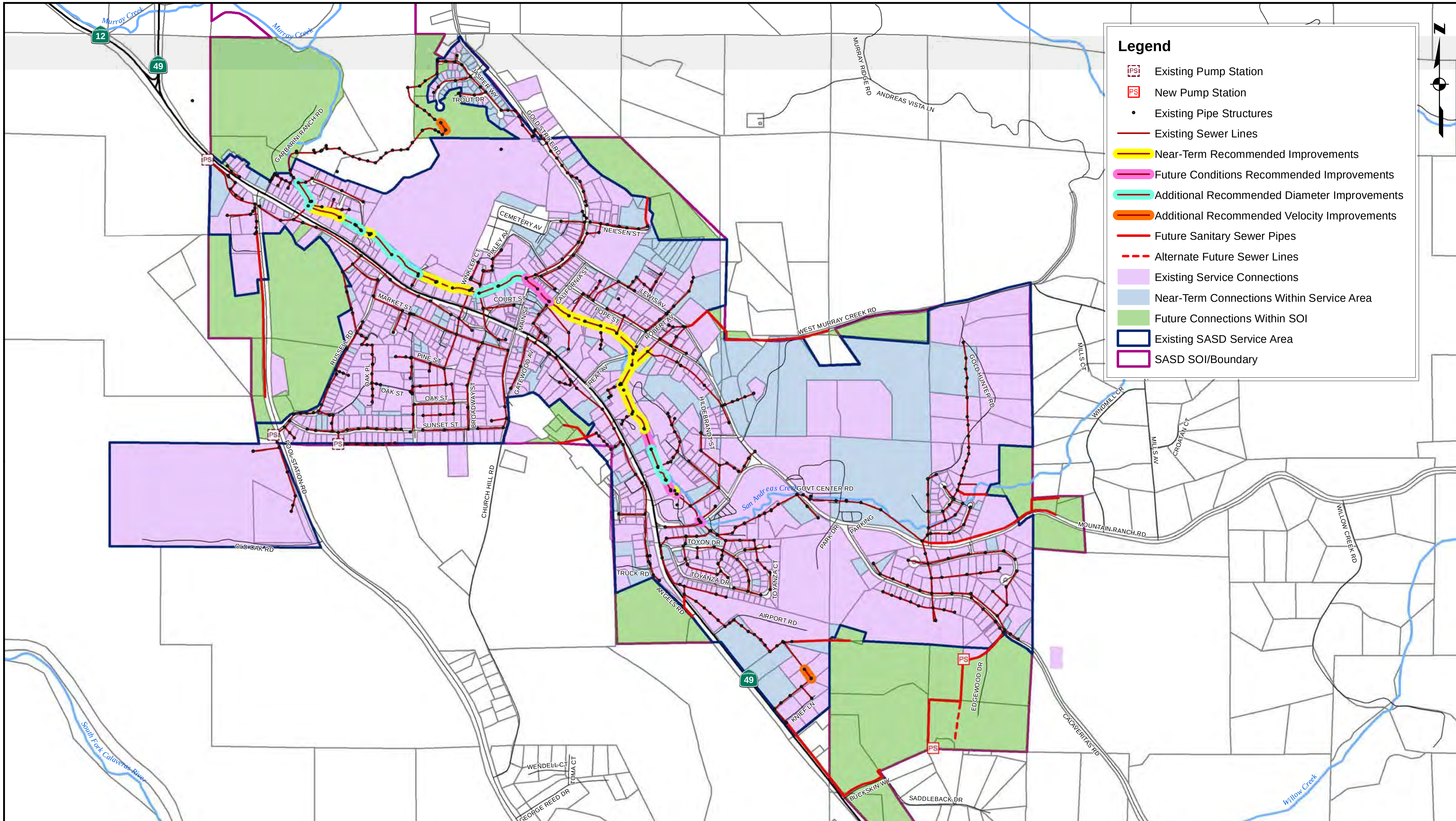
The recommendations presented in this memorandum are planning-level recommendations, and are relatively accurate within the limitations of the information available to support planning-level efforts. At the time that a sewer will be improved, design level surveys and other confirmation of the basis of these recommendations should be performed to support the design of each specific improvement project.

2.6 RECOMMENDED SEWER SYSTEM CAPITAL IMPROVEMENT PROGRAM

All recommended improvements identified in this memorandum are recommended due to development, and therefore are not associated with a cost burden to the existing users. The District may consider these recommendations when planning maintenance projects, but may be better served by improving segments with other known deficiencies found during smoke testing or CCTV inspection.

2.6.1 Existing System Capital Costs

The existing sewer collection system and wastewater treatment plant facilities require ongoing inspection, maintenance, and improvement. These costs are attributable to existing users, since the facilities require these services regardless of development activities. Table 2-10 identifies annual costs associated with the sanitary sewer collection system, as well as one-time costs for needed wastewater treatment plant facility improvements.



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San Andreas Sanitary District
Additional
Recommended Facilities Improvements

FIGURE
2-5

Table 2-10
Existing System Capital Costs

Sanitary Sewer Collection System - Annual Costs				
Item No.	**Description**	**Capital Cost**	**Cost Burden to Existing Users**	**Project Fiscal Year**
1	Closed Circuit Television (CCTV) Inspection (1)	$ 18,000	$ 18,000	Annual
2	Smoke Testing (2)	$ 5,000	$ 5,000	Annual
3	Annual Sewer System Replacement (3)	$ 150,000	$ 150,000	Annual
	Total Annual Costs	$ 173,000	$ 173,000	-

(1) CCTV of Entire System on 5-year Cycle
(2) Smoke Testing of Entire System on 5-year Cycle
(3) Annual sewer system replacement cost based on minimum recommended project cost to capture economies of scale for design and construction of improvements.

The improvements associated with these costs will allow the District to continue to serve existing users at the District's current level of service or better. The District's recommended annual sewer system replacement cost of $150,000 is a recommended minimum cost to design and construct a single improvement project, allowing the District to capture economies of scale on various costs associated with the project. The District has the flexibility to set an annual sewer system replacement budget according to the annual funding available, which may be less or more than $150,000 per year; the District's final annual budget will be policy-driven.

The District has the flexibility to construct a single project within a several year period using an amount accrued from this budget item over several years in order to complete a multi-segment project and take advantage of economies of scale available for larger construction efforts. If the District were to plan to replace the entire District sewer network in a 60-year period, the annual cost of this replacement schedule would be approximately $300,000 per year. This approximate cost over time should be accounted for when prioritizing and planning improvements to the existing District facilities.

2.6.2 Future Improvement Prioritization and Triggers

The recommended improvements included in Section 2.5 consist primarily of consecutive sewer segments recommended for improvement due to either capacity limitations at various stages of development or triggered by upstream facilities. Since the sewers recommended for improvement can be grouped into an upstream segment requiring improvement due to capacity and downstream segments recommended for improvement for either lesser capacity concerns or consistency, these groupings are identified and prioritized in Table 2-11.

Table 2-11
Recommended Capacity-Related Improvements to Existing Facilities – Future Peak Wet Weather Flows

Priority No.	Upstream Manhole ID	Downstream Manhole ID	Approximate Capital Cost of Recommended Improvement	Cost Burden to Existing Users	Development Phase Triggering Improvements
1	E-1210	E-0700	$ 1,054,000	-	Near-Term
2	E-0200	B-0800B	$ 992,000	-	Near-Term
3	F-0200	E-1200	$ 598,000	-	Near-Term
4	B-0650	B-0300	$ 556,000	-	Near-Term
5	B-0800B	B-0650	$ 314,000	-	Near-Term
6	F-0307	F-0306	$ 41,000	-	Near-Term
7	F-0306	F-0200	$ 535,000	-	Buildout
8	F-0308	F-0307	$ 30,000	-	Buildout
9	I-0100	H-0200	$ 28,000	-	Buildout
10	E-0700	E-0300	$ 687,000	-	Buildout
		Total Recommended CIP Cost:	**$ 4,835,000**	**-**	

The locations of these sewer segments are shown in Figure 2-6, along with the priority number assigned in Table 2-11.

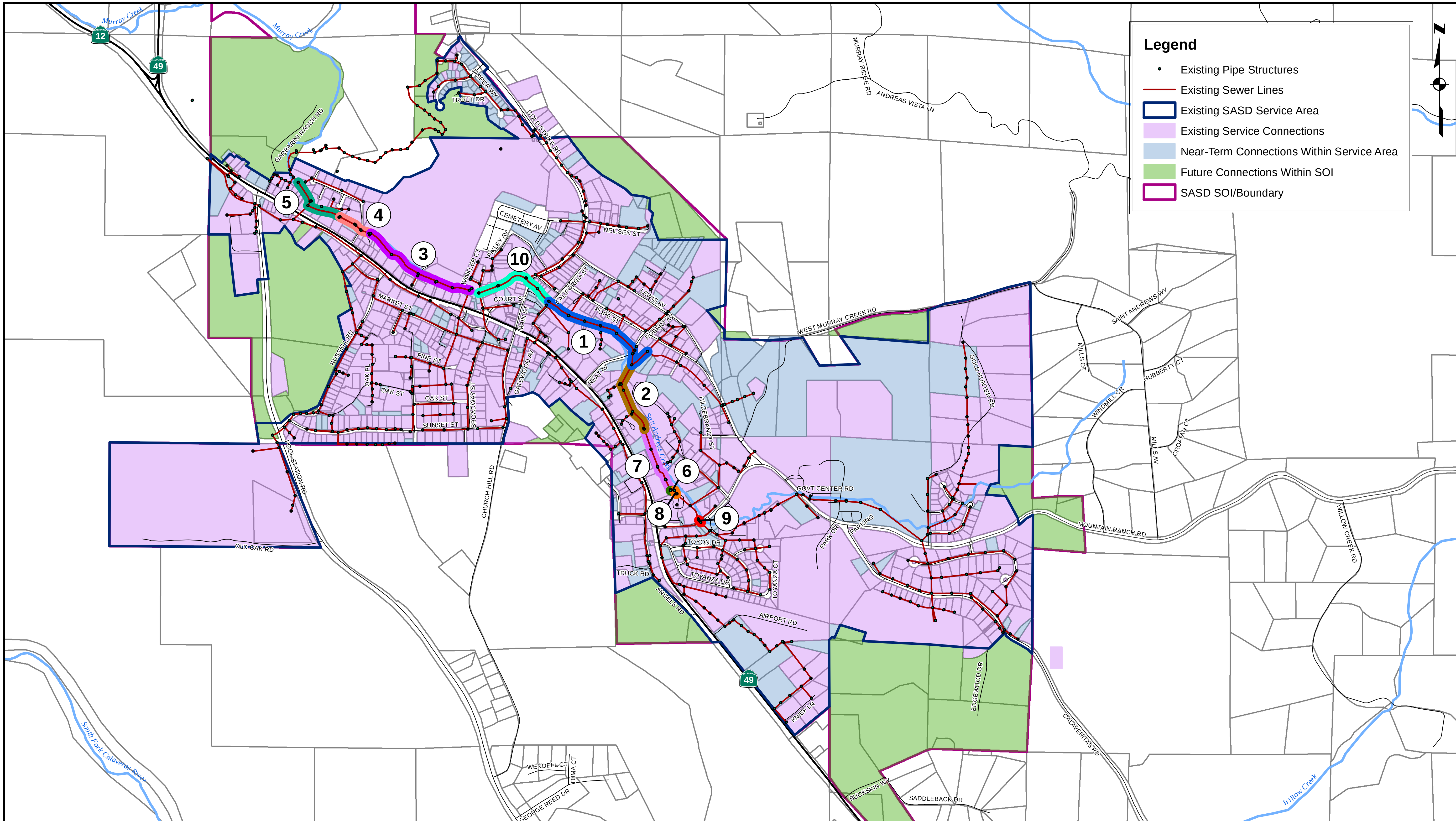
The prioritization of each sewer segment in Table 2-11 is based on multiple factors, including:

- The number of sewers included in the segment,
- The number of sewers within the segment at capacity under both existing and future conditions,
- The number of sewersheds served by the upstream end of the segment,
- The proximity of the segment to San Andreas Creek, and
- Whether the segment includes a creek crossing.

These key features of each segment contribute to how critical the segment is to District operations, the cost and complexity of designing and constructing the improvements, and the importance of maintaining continuous service through the segment.

2.7 CONCLUSIONS

The existing District sewer network has sufficient capacity to convey all existing and committed flows, but should be inspected regularly to identify potential improvements and a program of system replacement implemented to address condition deficiencies. At the time that any proposed development occurs, the development will be responsible for the recommended capacity-related capital improvements to allow the District facilities to continue to serve existing and new users at or above the current level of service.



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San Andreas Sanitary District
CIP Prioritization

FIGURE
2-6

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Stephen K. Sinnock, P.E.
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Neal T. Colwell, P.E.
Barry O'Regan, P.E.

0277-1300

TECHNICAL MEMORANDUM NO. 3

March 11, 2016

To: Hugh Logan - SASD General Manager

Subject: Effluent Storage and Disposal

Project: San Andreas Sanitary District – Collection System Master Plan

Prepared By: Neal Colwell, P.E.

REGISTERED PROFESSIONAL ENGINEER NEAL T. COLWELL No. C 59437 CIVIL STATE OF CALIFORNIA

3.1 PURPOSE

This technical memorandum contains an evaluation of the San Andreas Sanitary District's (District) effluent storage and disposal facilities. Capacity and operational characteristics of existing facilities are summarized based on historical information and options and alternatives identified for expanding capacity to meet future needs. The key facilities components evaluated under this memorandum include:

- Dedicated land disposal areas;
- Discharge to North Fork Calaveras River;
- Effluent storage; and
- Effluent pumping and conveyance.

These facilities have been evaluated under the influent flow characteristics projected in the Future Land Use and Flow analysis of this master planning effort, which includes the District's current commitment to serve existing development and considers incremental capacity improvements to serve future connections. Alternatives for expanding existing effluent storage and disposal facilities are primarily constrained by the physical limits of existing land, but logical and cost efficient incremental improvements are presented and compared to the future flow phasing described in the Future Land Use and Flow analysis and the wastewater treatment improvements studied by Stantec in the Wastewater Facilities Master Plan.

As a result of this analysis, a proposed plan for facilities improvements and expansion is developed, though it is recommended that the plan be contemplated and constructed as needed when future development occurs. This analysis focuses on approaches to expand effluent storage and disposal based on existing site constraints; however, if other approaches or opportunities present themselves in the future, e.g., potential for developing recycled water use areas on land not currently identified for that purpose, such alternatives may be considered to either augment or replace the approached described herein.

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3.2 EXISTING AND HISTORICAL FACILITIES

The District has historically used a combination of facilities for storing and disposing of treated effluent. Effluent storage has historically been in a series of earthen ponds constructed on the wastewater treatment plant (WWTP) site, Pond D being the largest. Effluent disposal is accomplished by discharge to surface water during winter months and to land during summer months.

3.2.1 FACILITIES OVERVIEW

Characteristics of the District's existing effluent storage and disposal facilities are summarized in Table 3-1. These facilities consist of:

1) Pond D, which provides the District with operational, emergency, and very limited seasonal storage of effluent;

2) The Dedicated Land Disposal Area (DLDA) which includes approximately 19 acres of spray disposal area active on the WWTP site and approximately 11 acres of area developed on the District's site called the Nielsen Property (located to the north of the WWTP site and on the north side of Murray Creek); and

3) The existing surface water disposal facilities includes approximately 5,900 linear feet of 12 inch diameter effluent pipeline from the WWTP to the North Fork Calaveras River. At approximately 2,800 feet upstream of where Highway 12 crosses the North Fork Calaveras River, an existing diffuser exists within the river immediately upstream of the confluence with Murray Creek. The diffuser is constructed with two 12 inch diameter perforated PVC diffusers installed in the bed of the North Fork Calaveras River;

The approximate location of the District's existing DLDA, Pond D, and wastewater treatment plant are show in Figure 3-1.

Table 3-1
Existing Effluent Storage and Disposal Facilities Characteristics

Facility Component	Characteristic
Effluent Storage	
Pond D Permitted Volume[(a)]	Permitted Volume of 4.3 Mgal
Dedicated Land Disposal Area	
On WWTP Site	19 acres
On Nielson Property	11 acres
Total	30 acres
North Fork Calaveras River Discharge	
Effluent Pipeline	5,900 LF of 12" Diameter PVC C900
River Diffuser	2 – 12" Diameter Perforated PVC Diffusers

(a) At 2 feet of freeboard from overflow weir.

3.2.2 Historical Disposal Trench Use

On the WWTP site, the District historically used disposal trenches as the means of land disposal. Historically, these trenches occupied approximately 32 acres of the WWTP site and consisted of a total of approximately 13,000 linear feet of trench[1]. Through 2013, land disposal was accomplished by pumping secondary effluent to these ditches where percolation and downslope irrigation and evapotranspiration were the primary mechanisms for disposal. The disposal trenches followed the contours of the DLDA land and were constructed such that percolation disposal into the seams of the underlying bedrock was enhanced. These trenches historically provided both disposal capacity and limited storage during both winter and non-winter months.

In 2013 these disposal trenches were replaced with sprinkler applicationand the majority of the trenches werebackfilled. We understand that the primary purpose for replacing the disposal trenches was to reduce the overall land disposal operation labor effort, as the trenches required significant attention and constant repairs; these repairs were required to maintain capacity and prevent uncontrolled discharges due to downslope leaks caused by rodent burrow activity. We also understand that the existing land disposal process switched to surface application (via sprinklers) as part of a process to reduce the potential for groundwater quality concerns related to application of secondary effluent to fracture bedrock with very little soil treatment.

3.2.3 Effluent Storage

The District's wastewater facilities historically included four unlined ponds, Ponds A through D, constructed for a variety of purposes. Historically Ponds A through C were used for effluent

[1] San Andreas Sanitary District 2008 WWTP Upgraded Preliminary Design Report, December 2007, ECO:LOGIC Engineering.

polishing before discharge to land or Pond D for operational/seasonal storage The area occupied by Pond A was used to construct a part of the 2007 wastewater treatment plant improvements and the remaining Pond B and Pond C are used for site stormwater control or other process purposes. Pond D remains as the District's single effluent storage facility. As listed in Table 3-1, Pond D has a storage volume of approximately 4.3 Mgal, as authorized by the District's current NPDES permit which stipulates that:

> *"Freeboard shall never be less than 2 feet (measured vertically to the lowest point of overflow)"*[2]

The lowest point of overflow in Pond D is the spillway box, constructed at an elevation of approximately three feet below the crown of the Pond D dam. The dam spillway is a concrete box weir with a 48 inch corrugated metal pipe running through the dam. Pond D is an earthen dam formed using low permeable material core and constructed to a total height of approximately 25 feet.

Pond D was constructed in the early 1980s with a planned total volume of almost 5 Mgal, up to the spillway box. Based on site topographic information collected in 2012 and supplemented in 2015, the volume of Pond D to an elevation 2 feet below the spillway (the current lowest point of overflow) has been confirmed at an estimated 4.3 Mgal.

Because the existing dam does not exceed a total height of 25 feet while storing less than 50 acre-feet of water, it is not subject to the permitting authority and design requirements administered by the California Department of Water Resources Division of Safety of Dams (DSOD).

Upslope of Pond D, approximately 1,400 lineal feet of ditch catches surface water runoff that can originate from areas south and west of the pond. This runoff is diverted around Pond D and discharged to San Andreas Creek as stormwater. The area upslope of Pond D to the north is captured in a depression above the high water level of Pond D; however this water has the potential to percolate into Pond D.

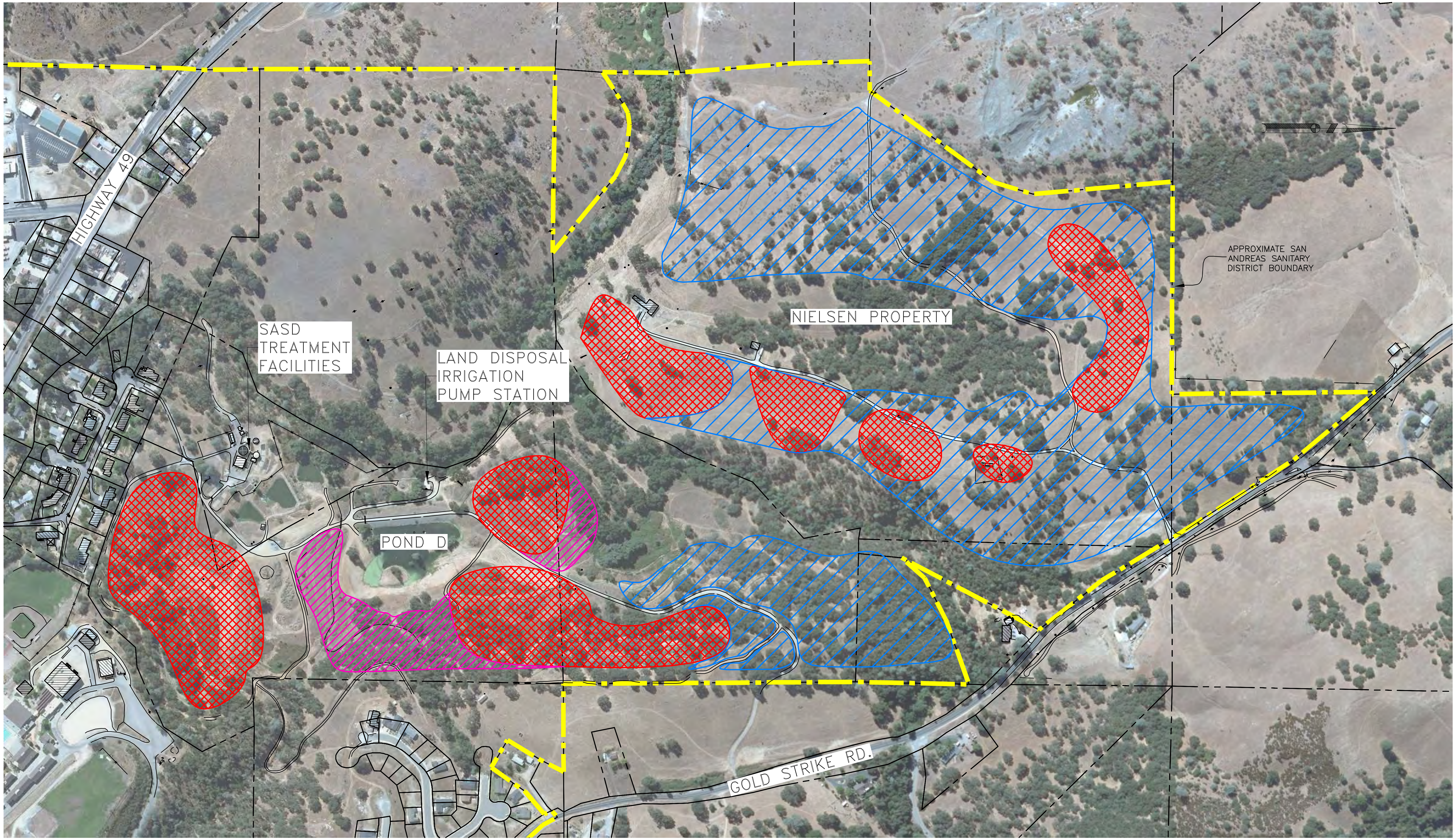
3.2.4 DEDICATED LAND DISPOSAL AREAS

The District's existing developed DLDA is shown in Figure 3-1 as the existing individual land disposal area. On the WWTP site, approximately 19 acres of the historical trench disposal area was converted to sprinkler disposal. Piping historically used to convey effluent to the disposal trenches was retrofit to supply existing large-bore impact sprinklers called Big-Gun sprinklers; Big-Gunsprinklers are manufactured by Nelson Irrigation. The sprinkler application system on the WWTP site is fixed and has been constructed where the District could provide sufficient application area runoff control, with application-season runoff being diverted to Pond D.

In 2011/2012, the District started a pilot test of sprinkler application on the Nielsen Property. This pilot test includes installation of a single small centrifugal pump at the effluent pump station, a pipeline connecting to the Nielsen Property, and both portable Big-Gun and fixed Big-Gun sprinklers. The pilot test led to the development of an 11 acre of dedicated land disposal area.

---

[2] Construction, Operation and Maintenance Specification No. 4.a.iv and 4.a.v of Order No. R5-2014-0104



EXISTING INDIVIDUAL LAND DISPOSAL AREA

PROPOSED NEAR TERM EXPANSION OF LAND DISPOSAL AREA

FUTURE EXPANSION OF LAND DISPOSAL AREA

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Scale
1" = 200'
Original Drawing Scale
0 ½" 1"

SAN ANDREAS SANITARY DISTRICT
COLLECTION SYSTEM MASTER PLAN
EXISTING WASTEWATER TREATMENT, STORAGE, AND DISPOSAL SITE

FIGURE 3-1

PAGE 1

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3.2.5 EFFLUENT CONVEYANCE CAPABILITIES

Effluent conveyance for existing DLDA is provided by four split case pumps constructed as part of the 1981 Land Disposal System improvements. The pumping system was set up to allow for constant speed pumping to the disposal trenches with design static lift ranging from 40 feet to 145 feet, discharging to the trenches with no necessary residual pressure. Historically the effluent pumping system was connected to the surface water discharge pipeline to San Andreas and Murray Creeks. To accommodate this large range in pumping head, the pump system piping and valving allowed for pumping in parallel and series.

The existing effluent pump system provides limited capacity to convey effluent back to the WWTP headworks. Effluent conveyance to the existing DLDA from the WWTP site is through an existing 6 inch diameter Class 150 PVC pipe.

As part of the Nielsen Property pilot study for land disposal, a single small end-suction centrifugal pump was installed adjacent to the existing effluent pump station. Piping from the centrifugal pump was installed to supply effluent to the Nielson Property.

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Scale
1" = 50'
Original Drawing Scale
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SAN ANDREAS SANITARY DISTRICT
COLLECTION SYSTEM MASTER PLAN

POND D EXISTING FEATURES

FIGURE 3-2

PAGE 1

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3.3 STORAGE AND DISPOSAL OPERATIONAL STRATEGIES

The District's NPDES permit contains certain constraints on effluent discharge to the North Fork Calaveras River and to the DLDA. In addition to water quality-based limitations, the constraints generally include the following:

1) Discharges to the North Fork Calaveras River are generally constrained to the following:
    a. Discharge is allowed from November 1 through April 30;
    b. Discharge cannot exceed 1/20th of the river flow (as a daily average); and
    c. The average daily discharge cannot exceed 1.5 Mgal/d.
2) Discharge to the DLDA is generally constrained to the following:
    a. Application to the DLDA is to be at reasonable irrigation rates designed to minimize runoff; and
    b. Land application is prohibited 24 hours before a forecasted precipitation event, during precipitation, and within 24 hours after any measurable precipitation or when the ground is saturated.

Considering the above discharge constraints, volume and freeboard constraints of Pond D, and effluent quality and conveyance constraints, the District manages its discharge to the DLDA, Pond D, and the North Fork Calaveras River based on daily and seasonal variations in influent flows.

3.3.1 LAND DISPOSAL AND NORTH FORK CALAVERAS RIVER DISCHARGE

During the winter months of November through April, discharge to the North Fork Calaveras River is the preferred disposal method. This discharge is contingent on sufficient influent flow in the North Fork Calaveras River to provide at least 20:1 dilution with the daily influent. Generally, the District establishes its winter-time discharge to the North Fork Calaveras based on the influent flow rate. Diversion to Pond D is only used when, or if, effluent is not in compliance with permit criteria and/or if both surface water discharge and land discharge are not permitted.

Winter influent average flows typically range between 0.23 Mgal/d to 0.30 Mgal/d, with higher influent flows during and immediately following rain events. The District's current operation is to discharge only when at least a 20:1 dilution can be achieved in the North Fork Calaveras River, e.g., when the river is flowing at 20 times the influent flow. When the North Fork Calaveras River is flowing such that less than 20:1 dilution would be achieved based on the influent flow rate, effluent is diverted to Pond D and/or discharged to the DLDA (when allowed under the constraints listed in Section 3.3).

At those times when the North Fork Calaveras River is flowing higher than the minimum to achieve 20:1 dilution based on influent flow alone, a higher dilution rate is actually achieved in the river. Normally, effluent from Pond D is not returned through the WWTP for discharge to the North Fork

Calaveras River unless Pond D levels are high and discharge to the DLDA is prohibited by permit constraints.

During land disposal months (normally May through October), effluent is directed to Pond D and the DLDA. If discharge to the DLDA is prohibited due to precipitation or saturated soil conditions, effluent is discharge to Pond D and stored until DLDA discharge operations can resume.

Whether effluent is discharged to DLDA or the North Fork Calaveras River, Pond D is maintained at as low a level as possible to accommodate emergency storage requirements.

3.3.2 LAND DISPOSAL AND PERCOLATION

The District's land disposal operations are not intended to provide a beneficial reuse of effluent; these operations are designed strictly for effluent disposal. The District's permitted DLDA Operating Requirements include limits for irrigation application rates based solely on minimizing runoff. If runoff does occur, such runoff needs to be captured and reapplied to the DLDA or returned to the facility. In addition to this requirement, the District's permit Groundwater Limitations require that the discharge (from any portion of the facility) does not cause groundwater to exhibit the following:

1) Exceed waste constituent concentrations statistically greater than background groundwater quality;

2) Exceed a total coliform organism level of 2.2 MPN/100ml;

3) pH less than 6.5 or greater than 8.4; and

4) Any taste or odor-producing, toxic, or nuisance constituents that affect beneficial uses.

Based on these requirements, the District has operated its DLDA to dispose effluent through evapotranspiration and percolation into the underlying or adjacent soils. Evapotranspiration occurs as a result of evaporation off of water surfaces or directly from the surface of moist soils and from the transpiration of vegetation. Any effluent that percolates into the soil that is not evapotranspired moves into the underlying soil and comingles with groundwater. The District's DLDA operation relies substantially on percolation disposal, particularly when winter-month land application has to occur due to insufficient or no flow in the North Fork Calaveras River and evapotranspiration potential is low. The District's effluent storage does not have sufficient capacity to provide seasonal storage necessary for such conditions.

3.4 RECENT HYDROLOGIC CONDITIONS

The District's effluent disposal operations are highly dependent on hydrologic conditions (primarily precipitation), as it affects the District's ability to apply effluent to the DLDA and discharge to the river due to the runoff response of the North Fork Calaveras River. Evapotranspiration rates are also a significant factor when considering the fraction of applied effluent to the DLDA lost to the atmosphere.

This section summarizes recent hydrologic conditions (2005 to present) in San Andreas including recent historical North Fork Calaveras River Flows, precipitation, and evapotranspiration potential.

3.4.1 North Fork Calaveras River Flows

Since November 2004, the District has maintained a record of the measured flow in the North Fork Calaveras River as measured at an existing weir located approximately 1,700 feet upstream of the crossing of Highway 12 (or about 1,100 feet downstream of the District's diffuser and the confluence with Murry Creek). Table 3-2 presents the monthly total North Fork Calaveras River flows for Water Year (WY, from September through August for this study) 2005 through WY 2015.

Table 3-2
Recent North Fork Calaveras River Flows[a]

Water Year Month[b]	2005	2006	2007	2008	2009	2010	2011	2012	2015	Avg.
	Mgal	Mgal	Mgal	Mgal	Mgal	Mgal	Mgal	Mgal	Mgal	Mgal
September	-	-	-	-	-	-	-	-	-	-
October	-	-	-	-	-	-	-	-	-	-
November	150	76	185	57	7	2	704	196	0	153
December	495	811	328	234	146	293	1385	162	580	493
January	1428	1356	415	868	340	820	1073	472	145	769
February	1095	918	818	1177	153	854	1048	399	556	780
March	1435	1804	849	624	915	1016	1893	958	177	1,075
April	1111	2221	469	217	393	1188	1142	1104	146	888
May	950	973	228	59	295	921	962	326	53	530
June	165	559	22	0	0	306	700	71	1	203
July	-	50	-	-	-	-	-	-	-	-
August	-	-	-	-	-	-	-	-	-	-
WY Annual	6829	8768	3314	3236	2849	5400	8907	3628	1658	4,954

(a) Recorded North Fork Calaveras River flows below Murray Creek, minus SASD recorded discharge where available.
(b) North Fork Calaveras River flows not normally recorded during the months of July through October.

The District currently records flows only during the disposal season from November through April, but regularly does include May and June. As can be seen in Table 3-2, the average annual WY flow in the North Fork Calaveras River has been 4,954 million gallons, with 2011 being the recent highest WY discharge of 8,907 Mgal. Recent history indicates WY 2015 as the lowest annual discharge at 1,658 Mgal. Monthly totals for WY 2013 and 2014 are not shown due to incomplete available data.

3.4.2 San Andreas Precipitation

Recent San Andreas precipitation has been estimated based on the New Hogan Reservoir precipitation measurements collected by the US Army Corps of Engineers and available through the California Department of Water Resources. Table 3-3 summarizes estimated San Andreas monthly precipitation through WY 2012.

Table 3-3
Recent Estimated San Andreas Precipitation[(a)]

Water Year Month	2005	2006	2007	2008	2009	2010	2011	2012	Avg.
	In.	In.	In.	In.	In.	In.	In.	In.	In.
September	0.0	0.6	0.0	0.4	0.0	0.1	0.0	0.0	0.2
October	6.7	0.3	0.6	1.4	1.0	1.8	3.2	1.2	2.0
November	2.8	0.8	1.6	1	2.0	1.1	5.9	1.2	2.1
December	8.3	10.2	5.4	5.8	3.1	5.5	8.3	0.0	5.8
January	6.6	6	0.8	9.9	4.9	9.4	1.7	3.5	5.4
February	3.2	2.3	7.9	3.0	6.3	4.9	1.8	2.6	4.0
March	9.5	10.4	1.0	0.1	3.3	3.8	8.9	7.5	5.6
April	1.5	9.6	2.3	0.1	1.4	6.4	0.9	6.1	3.5
May	2.6	1.3	0.3	0.0	0.5	2.8	2.6	0.1	1.3
June	1.5	0.0	0.0	0.0	0.1	0.1	2.0	0.6	0.5
July	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
August	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WY Annual	42.7	41.5	19.9	21.7	22.6	35.9	35.3	23.0	30.3

(a) Estimated precipitation for San Andreas based on adjusted precipitation totals from New Hogan Reservoir, DWR Station NHG.

For the purpose of preparing monthly water balance calculations, long-term historical estimated precipitation and evapotranspiration potential was compiled by ECO:LOGIC Engineering as presented in Table 3-4. These long term averages are used in the water balance calculations presented in this report.

Although based on different data sets and different time periods, the precipitation depth averages presented in Table 3-3 compare reasonably well with the long term averages as presented in Table 3-4.

Table 3-4
Long Term Historical San Andreas Precipitation[a] and Evapotranspiration Potential

Water Year Month	Average	1-in-100 Year Annual Precipitation[b]	Average Year Reference Evapotranspiration[c]
	In.	In.	In.
September	0.53	0.96	5.45
October	1.72	3.11	3.81
November	3.82	6.91	1.83
December	5.02	9.09	1.04
January	5.63	10.19	1.02
February	4.74	8.58	1.66
March	4.77	8.63	3.00
April	2.63	4.76	4.54
May	1.20	2.17	5.85
June	0.35	0.63	7.11
July	0.08	0.14	8.19
August	0.11	0.20	7.36
WY Annual	30.6	55.4	50.9

(a) From historical data as compiled and used in the 2007 facilities plan water balance prepared by ECO:LOGIC Engineering.
(b) Based on a 1-in-100 year to average year precipitation factor of 1.81 as supported by DWR Station No. B20 7702 00 long-duration depth-duration-frequency calculations.
(c) Grass reference evapotranspiration as recorded at the DWR CIMIS Station Plymouth #227.

3.4.3 Early Winter and Early Spring Hydrologic Conditions

As describe above in Section 3.3, the District's surface water discharge, DLDA discharge, and Pond D operate in combination to contain and allow for controlled discharge of treated effluent under the various applicable permit constraints. During the mid-summer or mid-winter discharge seasons, sufficient conditions normally exist to readily discharge effluent and maintain a relatively low Pond D level. However when seasons change requiring the District to convert from one disposal method to the other, e.g., going from discharge to the North Fork Calaveras River to only the DLDA, temporary storage of effluent may be necessary. Under these conditions it is necessary to store effluent when both disposal methods are limited or not available to the District. The following conditions can render the District unable to use both disposal methods:

1) During early winter when insufficient precipitation has occurred for the North Fork Calaveras River to have appreciable flow but application to the DLDA is prohibited due to precipitation;

2) When flows in the North Fork Calaveras River have decreased in late spring but rain events prohibit the District from using the DLDA; and

3) When a late winter occurs with heavy rainfall past April 30, when the District is prohibited from discharging to the North Fork Calaveras River but discharge to the DLDA may be prohibited.

Under condition 1) effluent has to be stored until flows in the North Fork Calaveras River increase or rain events cease, allowing discharge to the DLDA. Under condition 2) effluent has to be stored until rain events have ceased or if there is a late-season increase in the North Fork Calaveras River to allow surface water discharge. Under condition 3) effluent has to be sorted until rain events subside to allow discharge to the DLDA.

Based on a review of historical data and interviews with current staff, conditions 2) and 3) have not recently occurred. However, in December 2014, condition 1) occurred in conjunction with dechlorination system failures that resulted in filling of Pond D and a need to conduct emergency discharges to surface water in violation of the District's NPDES permit. Although not strictly a design condition, the December 2014 hydrologic conditions have been evaluated as indicative of the type of event that the District's effluent storage and disposal facilities should reasonably be capable of containing. This event, and the antecedent hydrologic conditions, are evaluated below with respect to existing facilities having sufficient capacity to contain influent flows and allow for a controlled discharge in conformance with applicable permit conditions.

On December 11, 2014 San Andreas experienced a heavy winter storm. This storm was recorded with a total precipitation of 4.5 inches at the District's WWTP site on December 11, 2014 and can be characterized as nearly a 1-in-50 year 24 hour precipitation event. Prior to this storm, a few smaller storm events were recorded from November 28 through December 5, as depicted in Figure 3-3. Prior to these storms, little rain had fallen during the Fall of 2014.

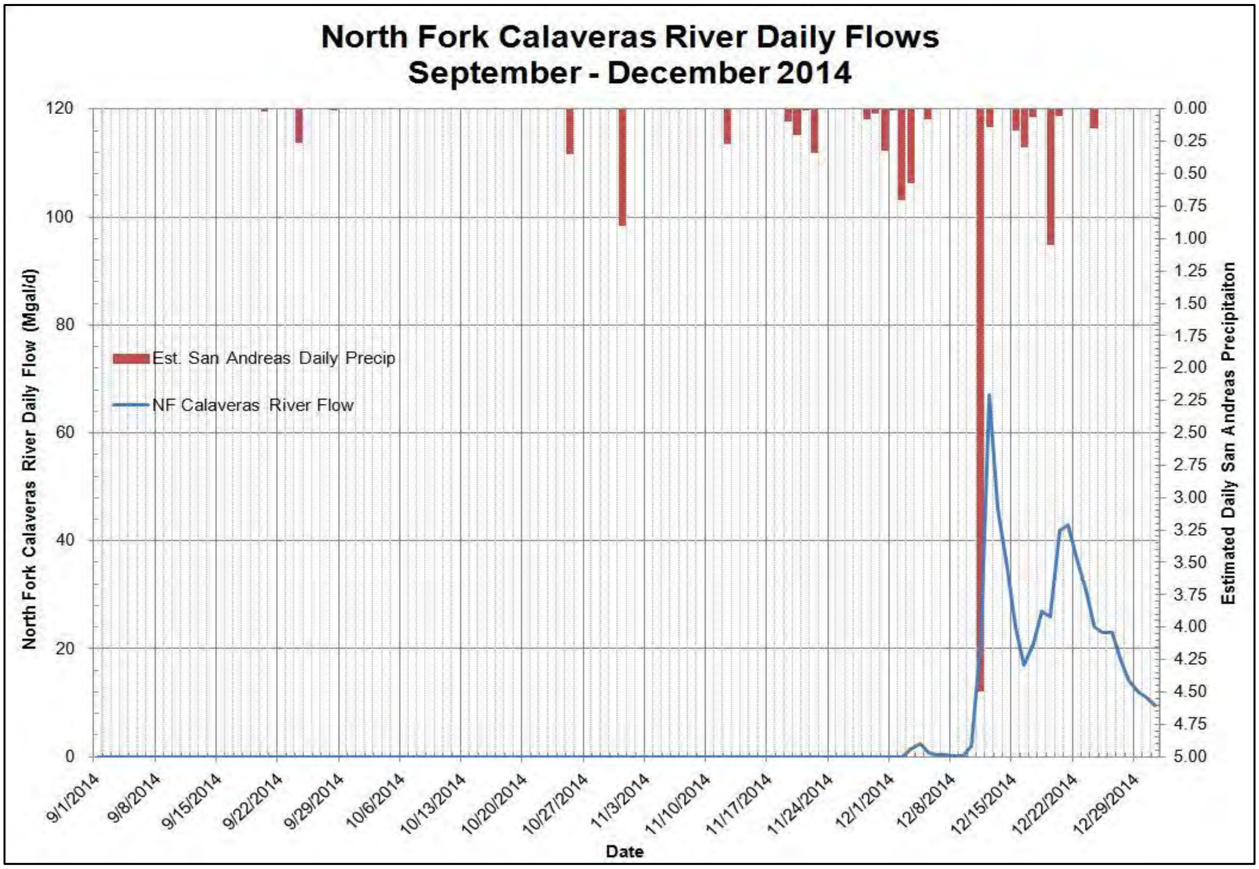


Figure 3-3
San Andreas
Representative Early Winter Precipitation River Flow Response

Prior to December 11, 2014 the District's average influent flow was approximately 0.23 Mgal/d. However, as a result of the rain event influent flow increased to nearly 2.1 Mgal/d during and immediately following the heavy precipitation.

A key observation that can be made from Figure 3-3 is that no significant North Fork Calaveras River flow occurred in late 2014 until more than approximately 6 inches of precipitation occurred in the watershed. Late 2014 is indicative of a very dry summer followed by a relatively dry early winter. It is expected that when precipitation occurred in September, October, and November, that soil moisture levels were very low and that virtually all rainfall that occurred prior to approximately December 11, 2014 was retained as soil moisture. It can be expected that under similar hydrologic conditions the District may need to temporarily store effluent when land disposal is not permitted and flows in the North Fork Calaveras River have not increased to allow surface water discharge.

3.5 SUMMARY OF STORAGE AND DISPOSAL ALTERNATIVES

The primary focus of this section is to identify and evaluate alternative effluent storage and disposal approaches for the District to pursue. Since these processes are co-dependent, alternatives have to simultaneously address both elements. The approach taken below is based on identifying reasonably available alternatives based on the District's existing facilities, existing land constraints, and conformance with existing permit conditions or minor permit modifications that could be supported by provisions known to exist in Waste Discharge Requirements adopted for similar agencies by the Central Valley Regional Water Quality Control Board (CVRWQCB). Based on this approach, the following alternatives were identified and evaluated either at a reconnaissance level or further refined as recommended approaches:

1. Review of historical use of disposal trenches and their potential re-construction;
2. Expansion of effluent storage either on the Nielsen property or by expanding Pond D;
3. Future effluent storage off-site;
4. Expansion of DLDA on existing District lands; and
5. Modification of NPDES permit dilution requirements and season.

3.5.1 Reconstruction of Disposal Trenches

From the early 1980s through 2013, the District has relied on land disposal through a series of disposal trenches constructed on the WWTP site to supplement surface water discharge or to serve as the primary means of effluent disposal during months when there is no flow in local streams. Effluent discharged to the disposal trenches had historically been secondary disinfected effluent. These disposal trenches provided multiple benefits to the District's objective of containing and disposing of effluent including:

A. Allowing for both dry and wet period disposal;
B. Providing a degree of effluent storage based on filling of the trenches; and
C. Allowing for a virtually constant effluent flow to this disposal method when local streams did not provide for surface water discharge.

Capacity associated with the disposal trenches was estimated at 0.24 to 0.52 Mgal/d for summer time months. During winter months when evapotranspiration rates are low, it is expected that a substantial portion of this disposal capacity is still effective through subsurface lateral flow and percolation.

In 2013 the District filled in the disposal trenches due to the high cost and effort of maintaining the ditches and in anticipation of likely increased regulatory scrutiny over their use. Although the disposal trenches likely allowed the District to avoid spills such as occurred in December 2014, (in consultation with Stantec) it is KSN's opinion that the District would likely be limited to discharging tertiary disinfected effluent into the Disposal trenches if they were reinstituted. This would require significant additional operational expense and modification of other facilities such as Pond D and likely construction of additional, separate emergency storage reservoirs. Because of these factors and a relatively high cost of construction, reinstituting the disposal trenches has been eliminated from further consideration at this time.

3.5.2 Options for Expanding Pond D

Pond D was constructed within the sloping terrain of the WWTP site by construction of an earthen dam as depicted in Figure 3-2. The original volume of Pond D was based on a maximum operating level at the spillway, which is located approximately 3 feet below the top of the dam. Pond D is currently not lined. Conceptually, there are two ways in which Pond D can be expanded:

1. By increasing the height of the existing dam; or
2. By excavating within the footprint of the pond.

In addition to these two methods, the useable volume of the existing structure can be increased by increasing the elevation of the spillway such that the permitted volume with two feet of freeboard is increased and/or negotiating revised permit conditions to allow minimum freeboard to be less than 2 feet. Each of these options have been evaluated in this technical memorandum as follows. The reconnaissance capital cost of these alternative improvements is summarized in Table 3-5.

Raise Weir Structure Elevation by 1 Foot

The existing overflow structure weir is located approximately 3 feet below the lowest elevation of the top of the dam. Including the current permit requirement to maintain at least two feet of freeboard from the lowest point of outlet, the maximum permitted water surface elevation could be increased by 1 foot. This is based on maintaining a minimum elevation difference from the overflow structure weir to the lowest elevation point on the top of the dam of at least 2.0 feet. Conceptually, this improvement could be limited to minor structural modifications to the overflow structure. Such improvements could be as simple as installing a steel weir plate with an elevation 1.0 feet above the current overflow. It is recommended that this improvement be contemplated with an engineering analyses of the pond and dam system to evaluate if any additional system risks, e.g., increased seepage rates, can be identified. If found to be practicable, this improvement is estimated to increase the permitted volume in Pond D by approximately 800,000 gallons, or to a total of 5.1 Mgal.

Obtain Revised Permit Conditions Allowing Minimum 1 foot of Freeboard

The District's current NPDES permit prohibits the water level in Pond D to be less than 2 feet from the lowest point of outlet. This permit condition is consistent with requirements in most permits issued by the CVRWQB, however many recent permits allow for the agency to evaluate if a lesser minimum freeboard can be practiced. Sample permit language allowing for a discharger to evaluate alternative freeboard level is as follows:

> *"The Discharger shall operate and maintain all ponds sufficiently to protect the integrity of containment dams and berms and prevent overtopping and/or structural failure. Unless a California-registered civil engineer certifies (based on design, construction, and conditions of operation and maintenance) that less freeboard is adequate, the operating freeboard in any pond shall never be less than two feet (measured vertically from the lowest possible point of overflow). As a means of management and to discern compliance*

> *with this requirement, the Discharger shall install and maintain in each pond a permanent staff gauge with calibration marks that clearly show the water level at design capacity and enable determination of available operational freeboard."*[3]

Under this alternative, it is possible for the District to evaluate the condition, design, construction, and operating conditions of Pond D to assess whether a lesser freeboard can be accommodated. If supported by an engineering analysis (likely including an evaluation of wave run-up under a set of design conditions), this alternative assumes that the freeboard requirement can be reduced to 1.0 feet. If this is supported with a 1 foot increase in the elevation of the overflow structure weir, it is estimated that the permitted volume of Pond D could be increased by approximately 1.0 Mgal, or to a total Pond D volume of 6.1 Mgal.

If the District were to be successful in documenting and negotiating a lesser permit minimum freeboard, we would expect that both permanent staff gauge and electronic level sensing equipment would have to be installed. The electronic level sensing equipment would likely have to be set up to provide alarms to District staff if the water level in Pond D exceeded the elevation associated with the revised minimum freeboard level.

Excavate Within Pond D

Pond D is underlain by soil and soil/rock as characterized by Crawford & Associates, Inc. in their April 13, 2015 Geotechnical Report (see Exhibit 3-A). The depth of the excavatable soil is from 1 ½ to 3 feet below the land surface. Based on seismic refraction surveys, as correlated to test pit surveys, Crawford & Associates estimates that excavation of the soil and underlying weathered rock with typical grading equipment would be limited to 2 ½ to 6 feet below the existing ground surface. Assuming that an average depth of about 3 feet could be excavated within Pond D, the estimated volume increase from this activity could be approximately 1.1 Mgal. Assuming that the raising of Pond D overflow weir structure elevation and reduction of minimum permitted freeboard can be done as described above, this could result in a total permitted volume of Pond D of 7.2 Mgal. Excavation of Pond D would have to be performed with care, such that sufficient soil layer remains on the bottom of Pond D to not result in water quality concerns for underlying groundwater as a result of increased mobilization of effluent biological constituents.

Raise Pond D Dam Crown by Approximately 7 feet

A reasonable alternative to increasing the volume of Pond D is to raise the existing dam. Based on an evaluation of site topography and assuming maintaining similar dam geometry to what exists, it is estimated that the maximum practical increase in Pond D height is 7 feet. Raising the height to this level is then constrained by down-slope site features and improvements. Conceptually, increasing the top elevation of the Pond D dam would be done with maintaining

[3] Discharge Specification D.10 of Order R5-2013-0114, R5-2014-0144, R5-2013-0009, R5-2014-0098, R5-2014-0149, and Construction, Operation, and Maintenance Specification 4.c.v of R5-2015-0031.

the relative distance from the new top of the dam to the point of overflow. This improvement is estimated to result in a maximum potential Pond D permitted volume of approximately 14.8 Mgal, or an estimated increase of 8.6 Mgal over what would be gained by excavating within Pond D and raising the overflow structure weir by 1 foot.

Based on the existing dam configuration, it is expected that any increase in height of the Pond D dam would be subject to permitting by the DSOD, including compliance with applicable DSOD design requirements. Lesser increments of increasing Pond D height could be considered but at a much higher cost per unit of capacity.

Improve Drainage

A portion of the slope above Pond D to the north currently drains into the pond. Improvements upslope of Pond D could be made to capture and route surface storm water runoff from this area abound Pond D. Such improvements could include construction of a drainage ditch, installation of a portable drainage pumping system, and improvements to divert drainage around Pond D to San Andreas Creek. These improvements would have to be constructed such that during land application any irrigation water runoff is diverted back to Pond D. By improving the diversion of surface water runoff from the area north of Pond D, it is estimated that under December 2014-type conditions that approximately 300,000 to 600,000 gallons of useable storage in Pond D could be maintained. Conceptual layout of these drainage improvements are shown in Figure 3-2.

Table 3-5
Pond D Expansion Options

Improvement Step	Estimated Volume Gain (Mgal)	Resulting Permitted Storage Volume (Mgal)	Approximate Improvement Step Capital Cost
None	0.0	4.3	-
Raise Weir Structure Elevation by 1 foot	+0.8	5.1	$30,000
Obtain Revised Permit Allowing Min. 1 foot Freeboard	+1.0	6.1	$50,000
Excavate Within Pond D	+1.1	7.2	$110,000
Raise Pond D Dam Crown by Approximately 7 feet[(a)]	+8.6	14.8	$2,100,000

(a) Volume already includes approx. 0.8 Mgal gain by raising overflow weir by 1.0 foot before raising of dam.

3.5.3 STORAGE ON NIELSON PROPERTY SITE

Prior studies evaluated the potential for constructing additional storage on the Neilson property site. The most recent and thorough evaluation of this potential alternative is contained in the Nielson Property Hydrologic Evaluation and Land Disposal Assessment Report dated December 2007 prepared by ECO:LOGIC Engineering. This report estimated that a total of 8.5 Mgal of storage could be constructed on the Nielson site in two separate ponds, but at cost of occupying significant useable land disposal area on the site. Based on the preliminary dam characteristics described in that report, it is estimated that the capital cost of the two dams would be in excess of $4.3M. Because of the high cost of improvements, relatively small volume gain, and loss of valuable effluent disposal land, construction of effluent storage on the Nielsen property site is not recommended at this time.

3.5.4 Future Effluent Storage

It is expected that if the District is to serve development beyond Phase B, that additional effluent storage and disposal would need to be constructed. Such effluent storage and disposal, or recycled water use sites, would likely be on a site (or sites) separate from the District's existing WWTP site and the Nielsen property. Identification and evaluation of such future sites is beyond the scope of this study.

3.5.5 Expansion of Dedicated Land Disposal Areas

Based on prior studies prepared by KSN, a maximum potential expansion of spray disposal of up to 65 acres is possible on the District's existing DLDA. Figure 3-4 shows existing and potential land disposal expansion areas. Existing land disposal is accomplished by sprinkler application using large bore (Big Gun) high volume sprinkler heads. District staff has reported that these systems work adequately on the existing WWTP site, but on the Nielsen property site, that ponding on the soil surface and potential runoff can readily occur if these sprinklers are operated too long.

Because of the District's recent investment in sprinkler application for the DLDA and its proven success on the WWTP site, expansion of land disposal using similar sprinkler application is recommended for that area. This land application method is also currently compatible with secondary disinfected quality of effluent.

On the Nielsen Property, it is recommended that the Big Gun type of sprinkler system be phased out and all new and replacement land application systems be based on a lower intensity sprinkler system. Based on KSN's experience with a site with very similar shallow and low permeability soils, we recommend that any future Nielsen Property land application improvements be according to the following preliminary design concepts:

a. Control valving for each zone including: shutoff valve(s), pressure reducing/control valve.

b. Flow meter for each zone.

c. In-field main piping consisting of Certa-Set or PIP PVC DR 14.

d. Irrigation sprinkler assemblies including Nelson R2000WF rotator, Green WF14 Plate, Green #14 (7/64) Nozzle, spaced at 40' along lateral.

e. Sprinkler assembly appurtenances such as shut off valves, air release valves, tees, and risers.

f. Tail water management consisting of downslope v-ditch, 12-24" deep with 2:1 side slopes.

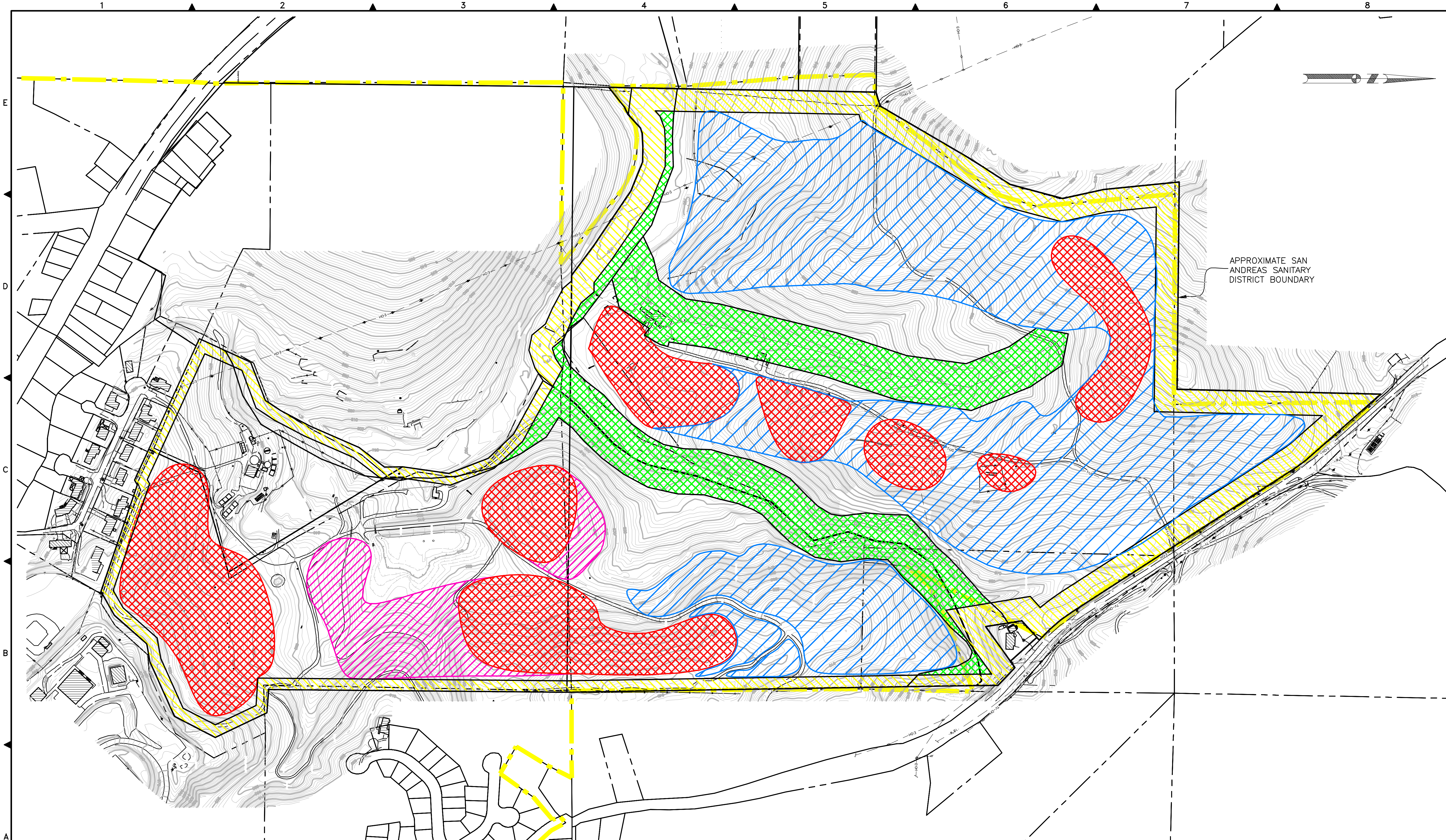
Any land application area improvements would have to be accompanied by runoff control systems to allow capture and re-application of effluent runoff back to the land application area or to Pond D (if on the WWTP site). Effluent delivered to the Nielsen Property with the recommended Nelson R2000WF-type spray heads would have to be screened though strainers equipped with maximum 0.015" wedge-wire baskets.

Improved evapotranspiration disposal could also be accomplished by seeding the DLDA with the following seed mixture by increasing transpiration of the surrounding vegetation:

a. No till drill planting of a grass seed mix applied at 50 lbs/acre.
b. Seed Mix: Horse pasture mix:
    i. 35% Tet. Perennial Ryegrass
    ii. 35% Potomac Orchard grass
    iii. 20% Tet. Annual Ryegrass
    iv. 10% Spring Green Fest.

3.5.6 MODIFICATION OF DILUTION REQUIREMENT AND PEAK DISCHARGE FOR NORTH FORK CALAVERAS RIVER DISCHARGE

In addition to effluent storage and DLDA expansion options, capacity improvements resulting from potential modifications to the District's NPDES permit were also evaluated. This includes the potential for reducing the permit-required dilution ratio from 20:1 to 10:1 or 1:1. Modifying the disposal season to include May was also considered in the context of late surface water disposal season conditions and the potential need to maintain surface water discharge while late spring rain excluding application to the DLDA.



SETBACK FROM PROPERTY LINE (50–100')

SETBACK FROM NATURAL OR MANMADE SURFACE WATER DRAINAGE COURSE OR SPRING (50')

EXISTING INDIVIDUAL LAND DISPOSAL AREA

PROPOSED NEAR-TERM EXPANSION OF LAND DISPOSAL AREA

FUTURE EXPANSION OF LAND DISPOSAL AREA

PROPOSED DRAINAGE COLLECTION AND CONVEYANCE DITCHES

KSN
KJELDSEN SINNOCK NEUDECK INC.
Civil Engineers and Land Surveyors
711 N. Pershing Avenue
Stockton, CA 95203–2152
Office: (209) 946–0268
Faxes: (209) 946–0296
E-mail: KSN@ksninc.com

Scale
1" = 200'
Original Drawing Scale
0 ½" 1"

SAN ANDREAS SANITARY DISTRICT
COLLECTION SYSTEM MASTER PLAN
PRACTICAL LIMIT OF DLDA
DEVELOPMENT ON DISTRICT LANDS

FIGURE
3–4
PAGE 1

FILE SPEC: P:\0277 SASD\1300_Collection_System_Master_Plan\05_Civil\CAD\SHT\Civil\Exhibits\140627-Exh-3-4-Spray_Field_Layout.dwg
PLOT DATE: Mar 11, 2016 – 5:46pm

3.6 SYSTEM EXPANSION AND CAPACITY LIMITING COMPONENTS

A series of water balance calculations, including and the traditional annual water balance calculation based on a monthly basis and a short-duration daily water balance calculation, were conducted to assess storage and disposal needs and benefits of identified alternatives. The water balance calculations are the foundation for evaluating benefits as a result of the identified alternative effluent disposal and storage modifications or improvements. The traditional annual water balance calculation addresses permit-requirements for containing and disposing of effluent under 1-in-100 year annual precipitation season. The short duration water balance calculation evaluates expected system operation under critical disposal transition from the DLDA to surface water, or vice versa, under critical hydrologic conditions.

3.6.1 SUMMARY OF WATER BALANCE CALCULATIONS METHODOLOGY

As described above, two types of water balance calculations were prepared, annual based on monthly calculations, and short-duration daily calculations. The basis of data and assumptions used in these calculations are summarized below.

Annual Water Balance under Average and 1-in-100 Year Precipitation Season

The annual average and 1-in-100 year annual precipitation season water balance calculations prepared by KSN were primarily based on methodologies and source data used by ECO:LOGIC Engineering in the prior facilities master plans. Detailed information regarding the sources of data and basis are contained in the December 2007 San Andreas Sanitary District 2008 WWTP Upgrades Preliminary Design Report and the 1-in-100 Year Season Waterbalance Calculations Technical Memorandum for the Disposal Capacity Assessment, dated April 9, 2014, prepared by KSN. Source information used in the annual water balance calculations includes:

1. Influent flow characteristics, including infiltration and inflow rates, based on historical influent flow records, as adjusted as described in technical memorandum No. 1;
2. Storage reservoir and DLDA percolation potential based on prior estimated average fractured bedrock percolation rates of 0.175 in/day[4];
3. Site characteristics as mapped by KSN, including Pond D and existing and potential future DLDA acreages;
4. Average monthly precipitation and as summarized in the 2008 WWTP Upgrades Preliminary Design Report;
5. Evapotranspiration potential based on the California Irrigation Management Information System (CIMIS) site in Plymouth, California;
6. Discharge limitations as based on the District's existing NPDES permit

[4] Based on estimated percolation rate for fractured bedrock as described in the November 1991 Facilities Plan for Wastewater Treatment and Disposal Facilities prepared by Dewante and Stowell.

7. North Fork Calaveras River flows based on average monthly totals as measured by the District since 2005; and

8. Long duration depth-duration-frequency statistics from the Department of Water Resources from San Andreas Station No. B20 7702 00.

The annual water balance calculation sheets are contained in Exhibit 3-B and include an evaluation of storage and disposal characteristics under a variety of scenarios. For the annual water balance scenario, design conditions associated with the 1-in-100 year annual precipitation season were evaluated under the storage and disposal options expected to be available to the District as described in this technical memorandum. Key assumptions with the water balance calculations include Pond D not being lined and that application to the DLDA is not constrained to agronomic application rates. The starting point for assessing what capacity gains could be made, using the water balance calculations as the primary analysis tool, was to evaluate the expected increase in average dry weather flow (ADWF) capacity that could be accommodated under a series of improvements. The following combination of improvements, assuming existing NPDES permit conditions remain, were evaluated as summarized in Table 3-6:

1. Expand Pond D to a total volume of 6.1 Mgal considering the following incremental improvements:
    a. No expansion of the existing DLDA area of 30 acres;
    b. Expansion of the DLDA to 47 acres (based on prime disposal lands identified on the WWTP site and Nielsen Property); and
    c. Expansion up to the estimated maximum of 65 acres.
2. Expand Pond D to 7.2 Mgal considering the following incremental improvements;
    a. No expansion of the existing DLDA area of 30 acres;
    b. Expansion of the DLDA to 47 acres; and
    c. Expansion up to the estimated maximum of 65 acres.
3. Expand Pond D to the maximum potential volume of 14.8 considering the following incremental improvements:
    a. No expansion of the existing DLDA area of 30 acres;
    b. Expansion of the DLDA to 47 acres; and
    c. Expansion up to the estimated maximum of 65 acres.

The capacity gains were compared to the project Phasing as described in Technical Memorandum No. 1, particularly a capacity target of approximately 0.55 Mgal/d associated with Phase B. Based on this analysis, it was concluded that even with expanding to the full anticipated potential DLDA area of 65 acres, that expansion of Pond D beyond 7.2 Mgal would be needed. Therefore, it appears that expansion of Pond D to the maximum potential is triggered in order to serve anticipated flows from Phase B. Taking this maximized Pond D volume, it is estimated that the District would have to expand the DLDA by approximately 23 acres to result in a total of 53 acres of dedicated land disposal.

Table 3-6
Annual Water Balance Analysis of 1-in-100 Year Conditions under Varying Land Disposal/Storage Improvements at 20:1 Dilution

Land Disposal Area/Pond D Storage	6.1 Mgal	7.2 Mgal	14.8 Mgal
ADWF Limit (1-in-100)			
Existing (30) acres DLDA	0.31	0.32	0.41
47 Acres DLDA (+17 acres)	0.39	0.41	0.52
65 Acres DLDA (+36 acres)	0.46	0.48	0.61
Phase B 53 Acres DLDA (+23 acres)			0.55

The results in Table 3-6 suggest that there are several ways for the District to develop additional capacity towards the identified Phase B need of 14.8 Mgal of storage and total of 53 acres of DLDA. Expansion of Pond D to at least 6.1 Mgal appears to be necessary to accommodate near-term commitments. Additional storage and/or disposal improvements would be necessary to accommodate Phase A flows at 0.32 Mgal/d. Based on the projected capacity gains summarized in Table 3-6, effluent storage and disposal capacity for Phase A could be developed by expanding Pond D to approximately 6.1 Mgal and adding about 10 acres of additional DLDA or by only expanding Pond D to 7.2 Mgal. Table 3-7 compares the reconnaissance cost of these two alternative approaches, excluding likely necessary effluent pumping requirements. Based on estimated capital cost, expansion of Pond D to 7.2 Mgal appears to be the lower cost approach. If either of the steps towards expanding Pond D to 7.2 Mgal is not successful, improvements to serve Phase A would need to include additions to the DLDA.

Table 3-7
Cost Comparison for Near-Term Effluent Storage and Land Disposal Improvement Alternatives

Improvement Alternative and Component	Alternative Total Capital Cost[a]
Expand Storage to 6.1 Mgal w/10 acre improvement to land disposal	
Pond D Improvements to 6.1 Mgal	$80,000
Add 10 Acres of DLDA	$200,000
Alternative Total	$280,000
Expand Storage to 7.2 Mgal w/No improvement to land disposal	
Pond D Improvements to 7.2 Mgal	$190,000
Improvements to Land Disposal	$0
Alternative Total	$190,000

(a) Excludes cost for improved drainage catchment and return or DLDA pumping.

Water Balance Calculation for Early Winter/Early Spring Hydrologic Conditions

Annual water balance calculations based on a monthly calculation of inflows, outflows, and changes in storage do not adequately predict system performance and capacity needs associated with early winter/early spring hydrologic conditions where the District is transitioning from one disposal method to the next. A recent example of how this period is critical is the December 2014 conditions. Although challenges with other system components occurred during that time, the insight gained from those conditions is useful in assessing the potential benefit of alternative improvements to provide the capacity necessary to contain effluent and incidental precipitation during similar conditions.

Exhibit 3-C contains daily water balance calculations based primarily on the hydrologic conditions that occurred in December 2014. This includes precipitation, North Fork Calaveras River Flow, and the response of the District's collection system to rain induced infiltration and inflow. Using these hydrologic and influent flow characteristics, the following conditions were modeled to estimate the volume of required storage including:

1. Under current (2014) average influent flow characteristics of 0.23 Mgal/d, considering:
    a. Assuming the District is not prohibited from discharging to the DLDA 24 hours prior to a predicted rain event; and
    b. Under the current NPDES permit 1.5 Mgal/d maximum discharge and varying dilution ratios as follows:
        i. Existing 20:1 dilution;
        ii. Reduced dilution ratio to 10:1; and
        iii. Reduced dilution ratio to 1:1.
2. At existing flow commitment average of 0.30 Mgal/d, considering:
    a. Assuming the District is not prohibited from discharging to the DLDA 24 hours prior to a predicted rain event; and
    b. Under the current NPDES permit 1.5 Mgal/d maximum discharge and varying dilution ratios as follows:
        i. Existing 20:1 dilution;
        ii. Reduced dilution ratio to 10:1; and
        iii. Reduced dilution ratio to 1:1.
3. Phase A average influent flow of 0.32 Mgal/d, considering:
    a. Assuming the District is not prohibited from discharging to the DLDA 24 hours prior to a predicted rain event; and

b. Under the current NPDES permit 1.5 Mgal/d maximum discharge and varying dilution ratios as follows:

   i. Existing 20:1 dilution;

   ii. Reduced dilution ratio to 10:1; and

   iii. Reduced dilution ratio to 1:1.

The results of these analysis are summarized in Table 3-8. A critical element of this analysis is that the District was able to discharge to the DLDA approximately 20,000 gallons per day per acre over a short period in December 2014. Assuming that DLDA application can occur at a minimum of 17,000 gallons per acre per day over short periods based on that experience, the resultant required storage for each of the above scenarios is presented in Table 3-8.

Table 3-8
Daily Water Balance Analysis of Early Winter/Early Spring Type Hydrologic Conditions

Flow Conditions w/ Existing Land Disposal	Pond D (Mgal) Estimated Storage Requirement 20:1 Dilution	Pond D (Mgal) Storage Requirement Estimated 10:1 Dilution	Pond D (Mgal) Storage Requirement Estimated 1:1 Dilution
Current Flows (0.23 Mgal/d ADWF)	4.4	3.8	2.2
Existing Commitment Potential (0.30 Mgal/d)	5.4	4.9	2.7
Existing WWTP Flow Capacity (0.32 Mgal/d)	5.7	5.2	2.8

Conclusions that can be made from this analysis are that reduced dilution can have a significant reduction on required storage for the time that the District transitions between disposal methods. However, based on the annual water balance, expansion of effluent storage is needed regardless. It is recommended that the District continue to assess and evaluate potential changes in the dilution requirements in future permits, particularly within the context of effluent quality constraints and treatment requirements. At this time, it appears that through modest improvements to Pond D that the existing system can function within the constraints of the 20:1 dilution requirements.

Key operational elements of this analysis are:

- The District's ability to regularly monitor and adjust surface water discharges based on tracking changing river discharge rates to maximize surface water discharge under 20:1 dilution requirement; and
- A return flow capability of approximately 1.2 Mgal/d, including the ability to treat return flow at approximately this rate.

The District should consider approaching the CVRWQCB to possibly negotiate the following changes to the NPDES permit:

- Eliminate the prohibition of discharge to the DLDA 24 hours before a predicted storm event; and
- Allowing discharge to the North Fork Calaveras River in May, in particular if a late wet spring occurs.

Effluent Pumping for Land Disposal and Return to WWTP

The District's existing effluent pumping (consisting of the irrigation pump station and return pumping facilities near Pond D) have limited capacity and capabilities. The existing pump system supplying the sprinklers on the WWTP site were not designed to supply at a residual pressure to provide optimal performance of the Big-Gun sprinklers. Likewise, the pilot project pumping system for the Nielsen Property is undersized for what is needed to expand on that site. As improvements are made to the DLDA and Pond D, the following phased improvements to effluent pumping are recommended:

1. Improve irrigation pumping capabilities to the DLDA when the first expansion of these facilities is contemplated. Phase I of DLDA pumping is estimated to require a reliable pumping capacity of 1,000 gpm;

2. Improve pumping capabilities to return secondary effluent from Pond D to the WWTP, at an estimated pumping rate of 900 gpm; and

3. Expansion of the DLDA up to a maximum potential area of 65 acres and phase pumping improvements in increments of 600 to 800 gpm to match the acres of DLDA constructed.

Table 3-9 summarizes the recommended phasing of effluent pumping. A conceptual layout for the pumping component of these improvements is presented in Figure 3-5.

Table 3-9
Recommended Stored Effluent Pumping Capacity

DLDA Area	DLDA Pumping Capacity (gpm)[a]	Pond D to WWTP Return Pumping (gpm)
Existing Conditions (29 acres DLDA)	1,000	900
Expansion to 47 acres DLDA	1,800	900
Expansion to 65 acres DLDA	2,400	900

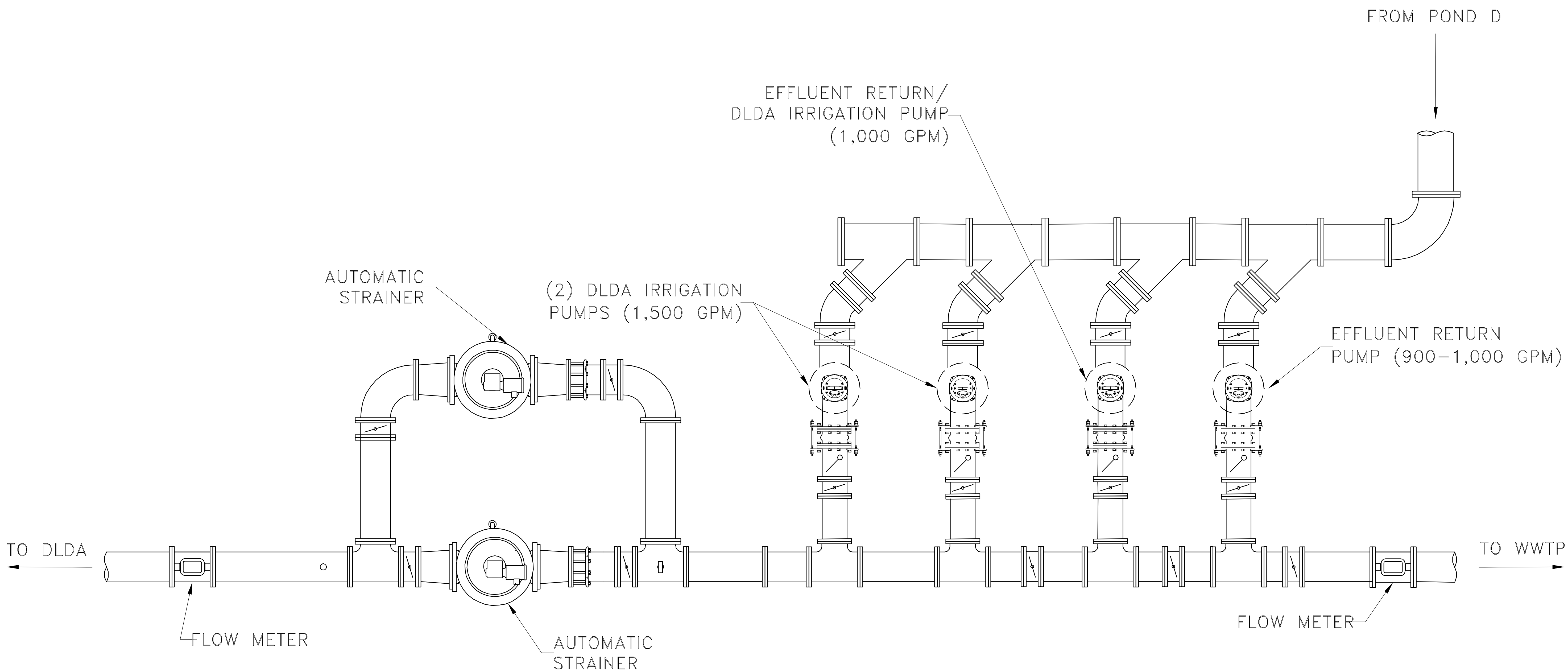
(a) Based on application of peak month land disposal over 8 hrs/day and 5 days per week.

Pumping shown in Figure 3-5 is based on vertical turbine-type pumps, which would occupy the least space. However, due to likely presence of shallow hard rock, close-coupled split case pumps may be the preferred type of equipment. Pump selection, including consideration of site rock conditions, space needs, and performance, should be evaluated during project preliminary design.

Operational elements that should be incorporated into DLDA effluent pumping include:

1. Variable frequency control of pumping to meet varying flow and pressure (head) requirements;
2. Automation to facilitate reduced labor needs and increased efficiency of system. Monitoring elements includes:
    a. Zone valves that allow for manual and automatic operation;
    b. Zone flow and pressure measurement and flow recording; and
    c. Automated screening, as described in Section 3.5.5 for the Nielson site.

The existing effluent pumping facilities electrical equipment, including the existing Motor Control Center (MCC), were constructed as part of the 1982 improvements. These existing electrical systems are expected to be undersized for the ultimate electrical system needs for effluent pumping; the District has reported that due to age and condition that these facilities should be replaced near-term. Replacement of the existing electrical systems are warranted and new facilities should consider expansion to include future pumping and system instrumentation and controls.



EFFLUENT PUMPING IMPROVEMENTS
CONCEPTUAL LAYOUT

KSN
KJELDSEN SINNOCK NEUDECK INC.
Civil Engineers and Land Surveyors
711 N Pershing Avenue
Stockton, CA 95203
209–946–0268
1355 Halyard Drive, Suite 100
West Sacramento, CA 95691
916–403–5900
www.ksninc.com

Scale
N.T.S.
Original Drawing Scale
0 ½" 1"

SAN ANDREAS SANITARY DISTRICT
COLLECTION SYSTEM MASTER PLAN
EFFLUENT PUMPING IMPROVEMENTS
CONCEPTUAL LAYOUT

FIGURE
3–5

PAGE 1

FILE SPEC: P:\0277 SASD\1300_Collection_System_Master_Plan\05_Civil\CAD\SHT\Civil\Exhibits\160215–Exh–3–5–Pumping–Improvements.dwg
PLOT DATE: Mar 11, 2016 – 5:02pm

Expansion of Dedicated Land Disposal Area

Under previous studies conducted by KSN for the District, expansion of the District's DLDA appears to be limited to a total of 65 acres. This area is limited based on permit-required and/or recommended setbacks to property boundaries and surface water course and based on practical limitations in steep slope areas. As presented above, expansion of the DLDA to at least 53 acres total will be needed to accommodate increased flows up to Phase B. This expansion could occur on the WWTP site or on the Nielsen Property. Although use of the Big Gun sprinklers on the WWTP site was reported to have adequate performance, expansion using the same type of sprinkler is recommended for ease of operation and consistent performance. For the Nielsen Property, it is recommended that the existing temporary sprinkler system be replaced and a new sprinkler system be constructed using low-impact spray heads such as the Nelson R2000WF rotator. The improvements described in Section 3.5.5 are recommended for expansion of the Nielsen Property sprinkler application system.

Modifications to North Fork Calaveras River Discharge Requirements and Management

Modifications to the way the District manages its discharge to the North Fork Calaveras River are recommended. It is also recommended that the District pursue modifications to the requirements under the NPDES permit. These modifications are intended to allow the District to maximize surface water discharge when flows exist in the North Fork Calaveras River and to facilitate permit compliance under unusual spring rain and river flow conditions. These modifications are recommended as follows:

1. System improvements and modification of normal operational procedures are recommended for surface water discharges. The District's current NPDES permit allows for discharge up to 1.5 Mgal/d as long as the dilution of effluent with receiving water is at least 20:1. Compliance with the dilution requirements are calculated on a daily basis. In cases where the North Fork Calaveras River flow is less than the influent flow or when flows are varying, the District's facilities should be modified to allow operations staff to monitor river flows on at least an hourly basis and to provide for measurement and adjustment such that the surface water discharge tracks with the river flow. Operational strategy improvements that allow for this degree of river flow monitoring and allowing for measured changing of the surface water discharge valving and flow.

2. Because of the potential for late winter/early spring conditions to remain wet into May, it is plausible that the District would be prohibited from discharging to the DLDA but also prohibited from making a surface water discharge. It is recommended that the District request modification of the NPDES permit to allow discharge through May 31, in particular during wet years.

3.6.2 SUMMARY OF RECOMMENDED IMPROVEMENTS

In this technical memorandum is a series of recommended effluent storage and disposal improvements to address existing needs and to provide capacity for future development. Table 3-10 summarizes the recommended effluent storage and disposal plan.

Table 3-10
Summary of Recommended Effluent Storage and Disposal Improvements

Improvement Phase and Component	Flow Capacity Basis[a]
Near-Term Effluent Storage, Pumping, and Disposal Improvements	0.30 Mgal/d
Expand Pond D to min. 6.1 Mgal	
Improve Pond D Drainage Catchment	-
Effluent Pumping MCC Replacement	
Improvements to Match Phase A Upgrades	0.32 Mgal/d
Pond D to WWTP Return Pumping	900 gpm
Improve DLDA Pumping	1,000 gpm
Expand Pond D to min. 7.2 Mgal	
Improvement to Match Phase B Upgrades	0.55 Mgal/d
Expand Pond D to min. 14.8 Mgal	
Expand DLDA to min. 53 acres	
Improve DLDA Pumping	2,400 gpm

(a) Average dry weather flow basis or system planning level capacity.

As a means of meeting near-term flow commitments, it is recommended that the following improvements be completed:

1. Pond D useable capacity should be increased to at least 6.1 Mgal by:

    a. Raising the weir structure overflow by 1 foot;

    b. Obtaining revised permit conditions allowing a reduction in the minimum freeboard from 2 to 1 feet; and

    c. Constructing improved drainage control within the catchment of Pond D.

2. Replace the existing irrigation system MCC and necessary power supply for reliability purposes.

In order to provide capacity for the planned Phase A level of development within the District, the following improvement should be constructed:

1. Improve Pond D return pumping to the WWTP with a minimum reliable capacity of 900 gpm;

2. Improve DLDA pumping to a minimum of 1,000 gpm reliable capacity (coordinated with return pumping to the WWTP); and

3. Expand Pond D useable capacity to 7.2 Mgal by excavating within Pond D.

To meet capacity demands for Phase B, effluent storage and disposal improvements should include the following:

1. Expand Pond D volume to 14.8 Mgal by raising the Pond D dam by approximately 7 feet;

2. Expand the DLDA to a minimum total of 53 acres by improving and expanding the existing sprinkler application area on the Nielsen property and expanding application areas on the WWTP site as needed; and

3. Expand DLDA pumping to approximately 2,400 gpm.

3.7 OPINION OF PROBABLE FACILITIES COST

Planning level opinions or probable capital cost for the recommended improvements described above are listed in Table 3-11. Cost details for the recommended improvements are contained in Exhibit 3-E. For those improvements that have been identified to address existing deficiencies and/or replace existing systems, an approximate cost burden to existing uses is identified assuming that up to 50% of the cost of these improvements could be eligible for grant funding. If grant funding cannot be obtained for these facilities, then the majority of the cost for these improvements would likely have to be borne by existing users. Each of the improvements needed to serve near-term users are also likely to provide benefit to future users, therefore the cost of these improvements should be considered in calculation of future capacity charges on a rational benefit basis, including applicable interest payments that existing users are required to cover.

Facilities identified for Phase A and Phase B development would all benefit future users and should be uses as part of the basis of calculating updated capacity charges.

Table 3-11
Reconnaissance Cost of
Alternative Improvement Components

Improvement Phase and Component	Capital Cost[(a)]	Cost Burden to Existing Users [(b)]
Near-Term Effluent Storage, Pumping, and Disposal Improvements		
Expand Pond D to min. 6.1 Mgal	$80,000	$40,000
Improve Pond D Drainage Catchment	$165,000	$82,500
Effluent Pumping MCC Replacement	$220,000	$110,000
Phase Total	$465,000	$232,500
Improvements to Match Phase A Upgrades		
Expand Pond D to min. 7.2 Mgal	$110,000	-
Pond D to WWTP Return Pumping	$400,000	-
Improve DLDA Pumping	$520,000	-
Phase Total	$1,030,000	-
Improvement to Match Phase B Upgrades		
Expand Pond D to min. 14.8 Mgal	$2,100,000	-
Expand DLDA to min. 53 acres	$1,060,000	-
Improve DLDA Pumping	$440,000	-
Phase Total	$3,600,000	-
Total Planned Improvements	$5,095,000	$232,500

(a) Average dry weather flow basis or system planning level capacity.
(b) Potential Improvement Cost Burden to Existing Users assuming 50% grant funding of improvement.

Exhibits

Exhibit 3-A: Pond D Geotechnical Site Investigation
Exhibit 3-B: Annual Water Balance Calculation Sheets
Exhibit 3-C: Early Winter Daily Water Balance Calculation
Exhibit 3-D: Improvement Cost Detail

Exhibit 1-A

Land Use Inventory

San Andreas Sanitary District
Sewer Master Plan Land Use Inventory

APN	ACERAGE	PHASE	Zone
42006027	0.34	Existing Service Connections	Commercial
42009025	0.74	Existing Service Connections	Commercial
42016008	0.14	Existing Service Connections	Commercial
42016014	0.20	Existing Service Connections	Commercial
42021034	0.26	Existing Service Connections	Commercial
42029025	0.45	Existing Service Connections	Commercial
42035012	0.14	Existing Service Connections	Commercial
42035016	0.25	Existing Service Connections	Commercial
42010002	2.55	Existing Service Connections	Commercial
42021002	0.12	Existing Service Connections	Commercial
42043011	1.54	Existing Service Connections	Commercial
42010001	0.35	Existing Service Connections	Public Service
42011001	57.61	Existing Service Connections	Public Service
42015013	0.48	Existing Service Connections	Public Service
42018013	0.18	Existing Service Connections	Public Service
42043001	2.56	Existing Service Connections	Public Service
44012005	4.68	Existing Service Connections	Residential
42031028	1.96	Existing Service Connections	Residential
44002043	0.06	Existing Service Connections	Residential
44002069	0.62	Existing Service Connections	Residential
44004015	0.18	Existing Service Connections	Residential
44028009	0.38	Existing Service Connections	Residential
42045001	0.02	Existing Service Connections	Residential
42045002	0.02	Existing Service Connections	Residential
42045003	0.02	Existing Service Connections	Residential
42045004	0.03	Existing Service Connections	Residential
44009019	154.80	Existing Service Connections	Agriculture
42002010	0.22	Existing Service Connections	Commercial
42002012	0.27	Existing Service Connections	Commercial
42002013	0.30	Existing Service Connections	Commercial
42002014	0.62	Existing Service Connections	Commercial
42002015	0.31	Existing Service Connections	Commercial
42002016	0.23	Existing Service Connections	Commercial
42002017	0.16	Existing Service Connections	Commercial
42002018	0.37	Existing Service Connections	Commercial
42002023	0.51	Existing Service Connections	Commercial
42002024	0.23	Existing Service Connections	Commercial
42003002	0.36	Existing Service Connections	Commercial
42003005	0.17	Existing Service Connections	Commercial
42003009	4.84	Existing Service Connections	Commercial
42003010	1.24	Existing Service Connections	Commercial
42004007	0.50	Existing Service Connections	Commercial
42004009	0.99	Existing Service Connections	Commercial
42004017	0.22	Existing Service Connections	Commercial
42004018	0.30	Existing Service Connections	Commercial
42004019	0.93	Existing Service Connections	Commercial

42005002	0.17	Existing Service Connections	Commercial
42005003	0.18	Existing Service Connections	Commercial
42005007	0.74	Existing Service Connections	Commercial
42005008	0.14	Existing Service Connections	Commercial
42005013	0.77	Existing Service Connections	Commercial
42005014	1.40	Existing Service Connections	Commercial
42006028	0.79	Existing Service Connections	Commercial
42006035	0.38	Existing Service Connections	Commercial
42006036	0.37	Existing Service Connections	Commercial
42006037	0.71	Existing Service Connections	Commercial
42006039	0.57	Existing Service Connections	Commercial
42007002	0.00	Existing Service Connections	Commercial
42007003	0.13	Existing Service Connections	Commercial
42007004	0.16	Existing Service Connections	Commercial
42007006	0.19	Existing Service Connections	Commercial
42007007	0.17	Existing Service Connections	Commercial
42007008	0.73	Existing Service Connections	Commercial
42007009	0.99	Existing Service Connections	Commercial
42007010	0.55	Existing Service Connections	Commercial
42007011	0.12	Existing Service Connections	Commercial
42007012	0.33	Existing Service Connections	Commercial
42007016	0.14	Existing Service Connections	Commercial
42007018	0.14	Existing Service Connections	Commercial
42007025	0.04	Existing Service Connections	Commercial
42008001	0.15	Existing Service Connections	Commercial
42008002	0.25	Existing Service Connections	Commercial
42008003	0.20	Existing Service Connections	Commercial
42008004	0.25	Existing Service Connections	Commercial
42009011	1.23	Existing Service Connections	Commercial
42009013	0.34	Existing Service Connections	Commercial
42009018	0.38	Existing Service Connections	Commercial
42009019	0.29	Existing Service Connections	Commercial
42009026	0.02	Existing Service Connections	Commercial
42009035	0.50	Existing Service Connections	Commercial
42009036	0.68	Existing Service Connections	Commercial
42009039	0.40	Existing Service Connections	Commercial
42010006	0.16	Existing Service Connections	Commercial
42010007	0.68	Existing Service Connections	Commercial
42010008	0.52	Existing Service Connections	Commercial
42010009	0.47	Existing Service Connections	Commercial
42010016	0.58	Existing Service Connections	Commercial
42010018	0.16	Existing Service Connections	Commercial
42010021	0.34	Existing Service Connections	Commercial
42010024	0.12	Existing Service Connections	Commercial
42015008	0.14	Existing Service Connections	Commercial
42015009	0.02	Existing Service Connections	Commercial
42015010	0.04	Existing Service Connections	Commercial

42015014	0.08	Existing Service Connections	Commercial
42015016	0.09	Existing Service Connections	Commercial
42015017	0.13	Existing Service Connections	Commercial
42015027	0.16	Existing Service Connections	Commercial
42015031	0.04	Existing Service Connections	Commercial
42015032	0.30	Existing Service Connections	Commercial
42016001	0.11	Existing Service Connections	Commercial
42016004	0.09	Existing Service Connections	Commercial
42016005	0.04	Existing Service Connections	Commercial
42016006	0.05	Existing Service Connections	Commercial
42016009	0.04	Existing Service Connections	Commercial
42016010	0.24	Existing Service Connections	Commercial
42016013	0.60	Existing Service Connections	Commercial
42017004	0.54	Existing Service Connections	Commercial
42017005	0.20	Existing Service Connections	Commercial
42017006	0.17	Existing Service Connections	Commercial
42017007	0.67	Existing Service Connections	Commercial
42017008	0.20	Existing Service Connections	Commercial
42017011	0.60	Existing Service Connections	Commercial
42017012	0.48	Existing Service Connections	Commercial
42018002	0.11	Existing Service Connections	Commercial
42018003	0.07	Existing Service Connections	Commercial
42018004	0.32	Existing Service Connections	Commercial
42018005	0.25	Existing Service Connections	Commercial
42018006	0.14	Existing Service Connections	Commercial
42018011	0.30	Existing Service Connections	Commercial
42018018	0.26	Existing Service Connections	Commercial
42018019	0.02	Existing Service Connections	Commercial
42021023	0.05	Existing Service Connections	Commercial
42021024	0.08	Existing Service Connections	Commercial
42021025	0.06	Existing Service Connections	Commercial
42021029	0.53	Existing Service Connections	Commercial
42021033	0.20	Existing Service Connections	Commercial
42021042	0.09	Existing Service Connections	Commercial
42021043	0.23	Existing Service Connections	Commercial
42022004	1.50	Existing Service Connections	Commercial
42022007	0.16	Existing Service Connections	Commercial
42022008	0.09	Existing Service Connections	Commercial
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42022011	0.05	Existing Service Connections	Commercial
42022014	0.50	Existing Service Connections	Commercial
42022015	0.42	Existing Service Connections	Commercial
42022016	2.43	Existing Service Connections	Commercial
42022017	0.06	Existing Service Connections	Commercial
42029001	1.50	Existing Service Connections	Commercial
42029002	1.15	Existing Service Connections	Commercial
42029010	0.09	Existing Service Connections	Commercial

42029026	1.17	Existing Service Connections	Commercial
42030001	0.57	Existing Service Connections	Commercial
42030004	0.61	Existing Service Connections	Commercial
42030005	0.69	Existing Service Connections	Commercial
42030007	0.48	Existing Service Connections	Commercial
42030008	0.75	Existing Service Connections	Commercial
42030015	1.72	Existing Service Connections	Commercial
42031023	0.49	Existing Service Connections	Commercial
42031024	0.34	Existing Service Connections	Commercial
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42035014	0.32	Existing Service Connections	Commercial
42035015	0.60	Existing Service Connections	Commercial
42039001	3.06	Existing Service Connections	Commercial
42039002	0.08	Existing Service Connections	Commercial
42039003	0.15	Existing Service Connections	Commercial
42039007	0.25	Existing Service Connections	Commercial
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42040006	0.47	Existing Service Connections	Commercial
42040008	0.12	Existing Service Connections	Commercial
42040009	0.05	Existing Service Connections	Commercial
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42040015	0.52	Existing Service Connections	Commercial
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44006002	0.28	Existing Service Connections	Commercial
44006013	0.41	Existing Service Connections	Commercial
44006014	0.39	Existing Service Connections	Commercial
44006015	0.61	Existing Service Connections	Commercial
44006024	0.05	Existing Service Connections	Commercial
44006025	0.02	Existing Service Connections	Commercial
44007004	1.16	Existing Service Connections	Commercial
44007005	1.04	Existing Service Connections	Commercial
44007006	0.96	Existing Service Connections	Commercial
44007014	0.70	Existing Service Connections	Commercial
44007016	1.44	Existing Service Connections	Commercial
44007017	1.04	Existing Service Connections	Commercial
44007018	0.79	Existing Service Connections	Commercial
44007019	2.66	Existing Service Connections	Commercial
44007020	2.70	Existing Service Connections	Commercial
42004002	2.11	Existing Service Connections	Industrial
42004003	4.27	Existing Service Connections	Industrial
44006028	15.59	Existing Service Connections	Industrial
44006038	1.01	Existing Service Connections	Industrial
44006039	1.16	Existing Service Connections	Industrial
42007013	0.17	Existing Service Connections	Commercial
42007014	0.16	Existing Service Connections	Commercial
42007015	0.15	Existing Service Connections	Commercial

42009034	0.16	Existing Service Connections	Commercial
42009037	0.14	Existing Service Connections	Commercial
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42010004	0.19	Existing Service Connections	Commercial
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42018016	0.64	Existing Service Connections	Commercial
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42020016	0.26	Existing Service Connections	Commercial
42020019	0.95	Existing Service Connections	Commercial
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42008006	0.30	Existing Service Connections	Residential
42008008	0.45	Existing Service Connections	Residential
42008009	0.22	Existing Service Connections	Residential
42008010	0.39	Existing Service Connections	Residential
42008013	0.25	Existing Service Connections	Residential
42008016	0.46	Existing Service Connections	Residential
42008017	0.47	Existing Service Connections	Residential
42009007	0.15	Existing Service Connections	Residential
42009008	0.18	Existing Service Connections	Residential
42009042	0.39	Existing Service Connections	Residential
42009043	0.96	Existing Service Connections	Residential
42011012	4.51	Existing Service Connections	Residential
42012018	1.35	Existing Service Connections	Residential
42012020	0.26	Existing Service Connections	Residential
42012021	0.29	Existing Service Connections	Residential
42012022	0.77	Existing Service Connections	Residential
42013005	0.62	Existing Service Connections	Residential
42013007	0.25	Existing Service Connections	Residential
42013008	0.28	Existing Service Connections	Residential
42013009	0.31	Existing Service Connections	Residential
42013012	0.96	Existing Service Connections	Residential
42013019	0.57	Existing Service Connections	Residential
42013020	0.29	Existing Service Connections	Residential
42014001	0.26	Existing Service Connections	Residential
42014002	0.21	Existing Service Connections	Residential
42014003	0.19	Existing Service Connections	Residential
42014004	0.23	Existing Service Connections	Residential
42014005	0.28	Existing Service Connections	Residential
42014006	0.35	Existing Service Connections	Residential
42014007	0.32	Existing Service Connections	Residential
42014008	0.21	Existing Service Connections	Residential
42014009	0.26	Existing Service Connections	Residential

42015001	0.12	Existing Service Connections	Residential
42015002	0.10	Existing Service Connections	Residential
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42015018	0.09	Existing Service Connections	Residential
42015020	0.09	Existing Service Connections	Residential
42015022	0.26	Existing Service Connections	Residential
42015029	0.02	Existing Service Connections	Residential
42019026	0.29	Existing Service Connections	Residential
42023001	0.33	Existing Service Connections	Residential
42023002	0.18	Existing Service Connections	Residential
42023003	0.14	Existing Service Connections	Residential
42023004	0.29	Existing Service Connections	Residential
42023005	0.44	Existing Service Connections	Residential
42024018	1.21	Existing Service Connections	Residential
42024022	0.22	Existing Service Connections	Residential
42024024	0.12	Existing Service Connections	Residential
42024027	0.18	Existing Service Connections	Residential
42025042	2.72	Existing Service Connections	Residential
42026003	0.29	Existing Service Connections	Residential
42026004	0.35	Existing Service Connections	Residential
42026006	0.60	Existing Service Connections	Residential
42026008	0.69	Existing Service Connections	Residential
42026009	1.17	Existing Service Connections	Residential
42026011	0.83	Existing Service Connections	Residential
42026018	0.38	Existing Service Connections	Residential
42026023	0.34	Existing Service Connections	Residential
42026024	0.42	Existing Service Connections	Residential
42026025	0.10	Existing Service Connections	Residential
42026027	0.25	Existing Service Connections	Residential
42026028	0.14	Existing Service Connections	Residential
42026030	0.09	Existing Service Connections	Residential
42026031	0.96	Existing Service Connections	Residential
42026034	0.74	Existing Service Connections	Residential
42026036	0.34	Existing Service Connections	Residential
42026037	0.24	Existing Service Connections	Residential
42026038	0.37	Existing Service Connections	Residential
42026039	0.27	Existing Service Connections	Residential
42026040	2.21	Existing Service Connections	Residential
42031025	1.79	Existing Service Connections	Residential
42035004	2.94	Existing Service Connections	Residential
42044001	0.25	Existing Service Connections	Residential
42044003	0.24	Existing Service Connections	Residential
42044004	0.36	Existing Service Connections	Residential
42044005	0.38	Existing Service Connections	Residential
42044006	0.26	Existing Service Connections	Residential
42044007	0.23	Existing Service Connections	Residential
42044008	0.27	Existing Service Connections	Residential

42044010	0.07	Existing Service Connections	Residential
42044011	0.10	Existing Service Connections	Residential
42044012	0.16	Existing Service Connections	Residential
42044013	0.06	Existing Service Connections	Residential
44002022	1.07	Existing Service Connections	Residential
44002044	1.27	Existing Service Connections	Residential
44012015	18.25	Existing Service Connections	Residential
44030001	0.23	Existing Service Connections	Residential
44030002	0.17	Existing Service Connections	Residential
44030003	0.23	Existing Service Connections	Residential
44030008	0.14	Existing Service Connections	Residential
44030009	0.13	Existing Service Connections	Residential
44030012	0.13	Existing Service Connections	Residential
44030015	0.16	Existing Service Connections	Residential
44030018	0.23	Existing Service Connections	Residential
44030019	0.26	Existing Service Connections	Residential
44030020	0.17	Existing Service Connections	Residential
44030026	0.13	Existing Service Connections	Residential
44031009	0.27	Existing Service Connections	Residential
44031014	0.17	Existing Service Connections	Residential
44031015	0.14	Existing Service Connections	Residential
44031018	0.12	Existing Service Connections	Residential
44031022	0.50	Existing Service Connections	Residential
42007019	0.22	Existing Service Connections	Commercial
42007026	0.12	Existing Service Connections	Commercial
42031035	0.77	Existing Service Connections	Commercial
42031040	0.01	Existing Service Connections	Commercial
42032006	0.79	Existing Service Connections	Commercial
42032013	0.23	Existing Service Connections	Commercial
42032014	0.19	Existing Service Connections	Commercial
42032015	0.26	Existing Service Connections	Commercial
42032023	0.72	Existing Service Connections	Commercial
42032026	0.45	Existing Service Connections	Commercial
42033002	0.27	Existing Service Connections	Commercial
42033006	0.18	Existing Service Connections	Commercial
42033007	0.21	Existing Service Connections	Commercial
42033008	0.40	Existing Service Connections	Commercial
42033010	0.25	Existing Service Connections	Commercial
42034003	0.26	Existing Service Connections	Commercial
42034004	0.44	Existing Service Connections	Commercial
42034005	0.23	Existing Service Connections	Commercial
42034009	0.25	Existing Service Connections	Commercial
42034012	1.67	Existing Service Connections	Commercial
42043002	1.71	Existing Service Connections	Commercial
42043013	2.54	Existing Service Connections	Commercial
42043014	1.16	Existing Service Connections	Commercial
42043015	0.79	Existing Service Connections	Commercial

44005023	0.47	Existing Service Connections	Commercial
44006017	0.40	Existing Service Connections	Commercial
44006018	0.35	Existing Service Connections	Commercial
44006019	0.48	Existing Service Connections	Commercial
44012008	4.07	Existing Service Connections	Commercial
42015033	0.06	Existing Service Connections	Public Service
42015034	0.09	Existing Service Connections	Public Service
42029023	1.96	Existing Service Connections	Public Service
44006027	16.12	Existing Service Connections	Public Service
44011064	7.05	Existing Service Connections	Public Service
44011068	11.80	Existing Service Connections	Public Service
44012027	9.44	Existing Service Connections	Public Service
44012036	2.51	Existing Service Connections	Commercial
44012037	0.46	Existing Service Connections	Commercial
44011023	5.08	Existing Service Connections	Residential
44011025	6.06	Existing Service Connections	Residential
44011026	7.62	Existing Service Connections	Residential
44011027	5.83	Existing Service Connections	Residential
44011028	5.09	Existing Service Connections	Residential
44011029	4.79	Existing Service Connections	Residential
44011030	4.88	Existing Service Connections	Residential
44011034	4.33	Existing Service Connections	Residential
44011035	5.16	Existing Service Connections	Residential
44021001	4.94	Existing Service Connections	Residential
44021002	3.24	Existing Service Connections	Residential
44026006	0.19	Existing Service Connections	Residential
42002002	0.36	Existing Service Connections	Residential
42002003	0.24	Existing Service Connections	Residential
42002005	0.31	Existing Service Connections	Residential
42002025	0.22	Existing Service Connections	Residential
42006001	0.99	Existing Service Connections	Residential
42006002	0.56	Existing Service Connections	Residential
42006003	0.36	Existing Service Connections	Residential
42006004	0.44	Existing Service Connections	Residential
42006005	0.30	Existing Service Connections	Residential
42006006	0.35	Existing Service Connections	Residential
42006007	0.32	Existing Service Connections	Residential
42006008	0.32	Existing Service Connections	Residential
42006009	0.31	Existing Service Connections	Residential
42006010	0.21	Existing Service Connections	Residential
42006011	0.41	Existing Service Connections	Residential
42006012	0.70	Existing Service Connections	Residential
42006013	0.68	Existing Service Connections	Residential
42006014	0.23	Existing Service Connections	Residential
42006015	0.33	Existing Service Connections	Residential
42006020	0.04	Existing Service Connections	Residential
42006022	0.84	Existing Service Connections	Residential

42006023	0.42	Existing Service Connections	Residential
42006024	0.45	Existing Service Connections	Residential
42006025	0.36	Existing Service Connections	Residential
42006026	0.32	Existing Service Connections	Residential
42006029	0.09	Existing Service Connections	Residential
42006033	0.51	Existing Service Connections	Residential
42006034	0.40	Existing Service Connections	Residential
42007027	0.33	Existing Service Connections	Residential
42009001	0.34	Existing Service Connections	Residential
42009002	0.61	Existing Service Connections	Residential
42009003	0.18	Existing Service Connections	Residential
42009004	0.19	Existing Service Connections	Residential
42009005	0.20	Existing Service Connections	Residential
42009033	0.32	Existing Service Connections	Residential
42011002	0.03	Existing Service Connections	Residential
42011005	0.52	Existing Service Connections	Residential
42011008	0.02	Existing Service Connections	Residential
42012003	0.45	Existing Service Connections	Residential
42012005	0.47	Existing Service Connections	Residential
42012011	0.47	Existing Service Connections	Residential
42012012	0.27	Existing Service Connections	Residential
42012013	0.26	Existing Service Connections	Residential
42012014	0.29	Existing Service Connections	Residential
42012017	1.58	Existing Service Connections	Residential
42012026	0.31	Existing Service Connections	Residential
42012027	0.23	Existing Service Connections	Residential
42012029	0.34	Existing Service Connections	Residential
42012030	0.38	Existing Service Connections	Residential
42012031	0.31	Existing Service Connections	Residential
42012032	0.88	Existing Service Connections	Residential
42013013	0.14	Existing Service Connections	Residential
42013014	0.14	Existing Service Connections	Residential
42013015	0.20	Existing Service Connections	Residential
42019003	0.41	Existing Service Connections	Residential
42019004	0.21	Existing Service Connections	Residential
42019005	0.15	Existing Service Connections	Residential
42019006	0.20	Existing Service Connections	Residential
42019013	0.40	Existing Service Connections	Residential
42019014	0.55	Existing Service Connections	Residential
42019015	0.30	Existing Service Connections	Residential
42019016	0.70	Existing Service Connections	Residential
42019017	0.32	Existing Service Connections	Residential
42019018	0.43	Existing Service Connections	Residential
42019019	0.18	Existing Service Connections	Residential
42019020	0.02	Existing Service Connections	Residential
42019021	0.12	Existing Service Connections	Residential
42019024	0.32	Existing Service Connections	Residential

42019025	0.15	Existing Service Connections	Residential
42019028	0.42	Existing Service Connections	Residential
42019029	0.31	Existing Service Connections	Residential
42019035	0.16	Existing Service Connections	Residential
42019036	0.10	Existing Service Connections	Residential
42019037	0.14	Existing Service Connections	Residential
42019038	0.35	Existing Service Connections	Residential
42019039	0.21	Existing Service Connections	Residential
42019040	0.36	Existing Service Connections	Residential
42020001	0.23	Existing Service Connections	Residential
42020002	0.17	Existing Service Connections	Residential
42020007	0.20	Existing Service Connections	Residential
42020008	0.17	Existing Service Connections	Residential
42020011	0.24	Existing Service Connections	Residential
42020012	0.17	Existing Service Connections	Residential
42020013	0.63	Existing Service Connections	Residential
42020017	1.36	Existing Service Connections	Residential
42020018	0.23	Existing Service Connections	Residential
42021004	0.36	Existing Service Connections	Residential
42021005	0.29	Existing Service Connections	Residential
42021006	0.29	Existing Service Connections	Residential
42021011	0.29	Existing Service Connections	Residential
42021016	0.38	Existing Service Connections	Residential
42021018	0.06	Existing Service Connections	Residential
42021019	0.22	Existing Service Connections	Residential
42021032	0.16	Existing Service Connections	Residential
42021036	0.48	Existing Service Connections	Residential
42021037	0.00	Existing Service Connections	Residential
42021038	0.61	Existing Service Connections	Residential
42021040	0.17	Existing Service Connections	Residential
42021041	0.19	Existing Service Connections	Residential
42021044	0.41	Existing Service Connections	Residential
42030002	0.77	Existing Service Connections	Residential
42030010	0.82	Existing Service Connections	Residential
42030011	0.78	Existing Service Connections	Residential
42032012	0.31	Existing Service Connections	Residential
42032017	0.13	Existing Service Connections	Residential
42032019	0.10	Existing Service Connections	Residential
42032024	0.32	Existing Service Connections	Residential
42032027	0.24	Existing Service Connections	Residential
42032028	0.18	Existing Service Connections	Residential
42032029	0.21	Existing Service Connections	Residential
42032030	0.13	Existing Service Connections	Residential
42032031	0.14	Existing Service Connections	Residential
42032032	0.04	Existing Service Connections	Residential
42032033	0.19	Existing Service Connections	Residential
42032034	0.13	Existing Service Connections	Residential

42033001	1.92	Existing Service Connections	Residential
42035010	0.38	Existing Service Connections	Residential
42035011	0.21	Existing Service Connections	Residential
42036001	0.15	Existing Service Connections	Residential
42036002	0.19	Existing Service Connections	Residential
42036003	0.43	Existing Service Connections	Residential
42036004	0.25	Existing Service Connections	Residential
42036006	0.27	Existing Service Connections	Residential
42036007	0.19	Existing Service Connections	Residential
42036008	0.09	Existing Service Connections	Residential
42037002	1.45	Existing Service Connections	Residential
42037003	0.17	Existing Service Connections	Residential
42037005	0.37	Existing Service Connections	Residential
42037007	0.28	Existing Service Connections	Residential
42037008	0.32	Existing Service Connections	Residential
42037009	0.24	Existing Service Connections	Residential
42037010	0.25	Existing Service Connections	Residential
42037011	0.25	Existing Service Connections	Residential
42037016	0.42	Existing Service Connections	Residential
42037017	0.79	Existing Service Connections	Residential
42037018	1.00	Existing Service Connections	Residential
42037019	0.34	Existing Service Connections	Residential
42037020	0.30	Existing Service Connections	Residential
42038003	0.27	Existing Service Connections	Residential
42038004	0.33	Existing Service Connections	Residential
42038006	0.18	Existing Service Connections	Residential
42038007	0.38	Existing Service Connections	Residential
42038008	0.07	Existing Service Connections	Residential
42038009	0.11	Existing Service Connections	Residential
42038010	0.43	Existing Service Connections	Residential
42038011	0.28	Existing Service Connections	Residential
42038012	0.42	Existing Service Connections	Residential
42038013	0.03	Existing Service Connections	Residential
42038014	0.01	Existing Service Connections	Residential
42038015	0.50	Existing Service Connections	Residential
42038016	0.23	Existing Service Connections	Residential
42038019	0.01	Existing Service Connections	Residential
42038020	0.69	Existing Service Connections	Residential
42039010	0.63	Existing Service Connections	Residential
42039011	0.34	Existing Service Connections	Residential
42039013	3.32	Existing Service Connections	Residential
42040016	1.04	Existing Service Connections	Residential
42040017	1.02	Existing Service Connections	Residential
42041001	0.46	Existing Service Connections	Residential
42041002	0.46	Existing Service Connections	Residential
42041003	0.48	Existing Service Connections	Residential
42041004	0.49	Existing Service Connections	Residential

42041005	0.49	Existing Service Connections	Residential
42041006	0.39	Existing Service Connections	Residential
42041007	0.38	Existing Service Connections	Residential
42041008	0.29	Existing Service Connections	Residential
42041009	0.30	Existing Service Connections	Residential
42041010	0.34	Existing Service Connections	Residential
42041011	0.34	Existing Service Connections	Residential
42041012	0.33	Existing Service Connections	Residential
42041013	0.34	Existing Service Connections	Residential
42041014	0.30	Existing Service Connections	Residential
42041015	0.35	Existing Service Connections	Residential
42041016	0.36	Existing Service Connections	Residential
42041017	0.35	Existing Service Connections	Residential
42041018	0.39	Existing Service Connections	Residential
42041019	0.38	Existing Service Connections	Residential
42041020	0.33	Existing Service Connections	Residential
42041021	0.31	Existing Service Connections	Residential
42041022	0.46	Existing Service Connections	Residential
42041023	0.44	Existing Service Connections	Residential
42041024	0.45	Existing Service Connections	Residential
42041025	0.35	Existing Service Connections	Residential
42041026	0.35	Existing Service Connections	Residential
42041027	0.36	Existing Service Connections	Residential
42041028	2.23	Existing Service Connections	Residential
42041029	0.39	Existing Service Connections	Residential
42041030	0.38	Existing Service Connections	Residential
42041031	0.39	Existing Service Connections	Residential
42041032	0.37	Existing Service Connections	Residential
42041033	0.37	Existing Service Connections	Residential
42041034	0.37	Existing Service Connections	Residential
42041035	0.39	Existing Service Connections	Residential
42041036	0.43	Existing Service Connections	Residential
42041037	0.39	Existing Service Connections	Residential
42041038	0.39	Existing Service Connections	Residential
42041039	0.39	Existing Service Connections	Residential
42042003	0.46	Existing Service Connections	Residential
42042005	0.73	Existing Service Connections	Residential
42042006	0.61	Existing Service Connections	Residential
42042007	0.54	Existing Service Connections	Residential
42042008	0.62	Existing Service Connections	Residential
42042009	0.44	Existing Service Connections	Residential
42042010	0.48	Existing Service Connections	Residential
42042011	0.45	Existing Service Connections	Residential
42042012	0.19	Existing Service Connections	Residential
42042013	0.20	Existing Service Connections	Residential
42042018	0.27	Existing Service Connections	Residential
42042019	0.58	Existing Service Connections	Residential

42042020	0.20	Existing Service Connections	Residential
42042021	0.21	Existing Service Connections	Residential
44001007	2.51	Existing Service Connections	Residential
44002005	1.27	Existing Service Connections	Residential
44002006	0.26	Existing Service Connections	Residential
44002010	0.28	Existing Service Connections	Residential
44002028	0.49	Existing Service Connections	Residential
44002032	0.22	Existing Service Connections	Residential
44002035	0.37	Existing Service Connections	Residential
44002037	0.23	Existing Service Connections	Residential
44002040	0.53	Existing Service Connections	Residential
44002041	0.21	Existing Service Connections	Residential
44002045	0.02	Existing Service Connections	Residential
44002050	0.42	Existing Service Connections	Residential
44002054	0.43	Existing Service Connections	Residential
44002057	0.34	Existing Service Connections	Residential
44002064	1.11	Existing Service Connections	Residential
44002065	0.29	Existing Service Connections	Residential
44002068	0.56	Existing Service Connections	Residential
44002070	2.20	Existing Service Connections	Residential
44002071	1.66	Existing Service Connections	Residential
44002072	1.73	Existing Service Connections	Residential
44002074	0.50	Existing Service Connections	Residential
44002076	0.53	Existing Service Connections	Residential
44002077	1.76	Existing Service Connections	Residential
44003001	0.31	Existing Service Connections	Residential
44003002	0.31	Existing Service Connections	Residential
44003003	0.34	Existing Service Connections	Residential
44003004	0.29	Existing Service Connections	Residential
44003006	0.27	Existing Service Connections	Residential
44003007	0.24	Existing Service Connections	Residential
44003008	0.25	Existing Service Connections	Residential
44003009	0.44	Existing Service Connections	Residential
44003011	0.32	Existing Service Connections	Residential
44003012	0.32	Existing Service Connections	Residential
44003013	0.43	Existing Service Connections	Residential
44003014	0.46	Existing Service Connections	Residential
44003015	0.32	Existing Service Connections	Residential
44003016	0.31	Existing Service Connections	Residential
44003017	0.27	Existing Service Connections	Residential
44003020	0.34	Existing Service Connections	Residential
44003022	0.29	Existing Service Connections	Residential
44003023	0.56	Existing Service Connections	Residential
44003024	0.29	Existing Service Connections	Residential
44003025	0.27	Existing Service Connections	Residential
44003028	0.34	Existing Service Connections	Residential
44003029	0.40	Existing Service Connections	Residential

44003030	0.38	Existing Service Connections	Residential
44003031	0.32	Existing Service Connections	Residential
44003034	0.28	Existing Service Connections	Residential
44003035	0.29	Existing Service Connections	Residential
44003036	0.28	Existing Service Connections	Residential
44003037	0.27	Existing Service Connections	Residential
44003038	0.29	Existing Service Connections	Residential
44003039	0.23	Existing Service Connections	Residential
44003040	0.24	Existing Service Connections	Residential
44003041	0.29	Existing Service Connections	Residential
44003042	0.34	Existing Service Connections	Residential
44004001	0.19	Existing Service Connections	Residential
44004002	0.18	Existing Service Connections	Residential
44004003	0.19	Existing Service Connections	Residential
44004004	0.20	Existing Service Connections	Residential
44004005	0.20	Existing Service Connections	Residential
44004006	0.20	Existing Service Connections	Residential
44004007	0.19	Existing Service Connections	Residential
44004008	0.20	Existing Service Connections	Residential
44004009	0.21	Existing Service Connections	Residential
44004010	0.18	Existing Service Connections	Residential
44004013	0.16	Existing Service Connections	Residential
44004014	0.19	Existing Service Connections	Residential
44004016	0.18	Existing Service Connections	Residential
44004017	0.17	Existing Service Connections	Residential
44005002	0.19	Existing Service Connections	Residential
44005003	0.24	Existing Service Connections	Residential
44005004	0.19	Existing Service Connections	Residential
44005005	0.22	Existing Service Connections	Residential
44005006	0.17	Existing Service Connections	Residential
44005007	0.16	Existing Service Connections	Residential
44005008	0.14	Existing Service Connections	Residential
44005009	0.15	Existing Service Connections	Residential
44005010	0.13	Existing Service Connections	Residential
44005011	0.15	Existing Service Connections	Residential
44005012	0.14	Existing Service Connections	Residential
44005013	0.15	Existing Service Connections	Residential
44005014	0.19	Existing Service Connections	Residential
44005015	0.17	Existing Service Connections	Residential
44005016	0.18	Existing Service Connections	Residential
44005017	0.17	Existing Service Connections	Residential
44005018	0.16	Existing Service Connections	Residential
44005019	0.17	Existing Service Connections	Residential
44005020	0.20	Existing Service Connections	Residential
44005021	0.16	Existing Service Connections	Residential
44010005	0.51	Existing Service Connections	Residential
44010006	0.63	Existing Service Connections	Residential

44010007	0.70	Existing Service Connections	Residential
44010016	2.08	Existing Service Connections	Residential
44012011	0.85	Existing Service Connections	Residential
44013001	0.74	Existing Service Connections	Residential
44013005	0.57	Existing Service Connections	Residential
44013008	0.55	Existing Service Connections	Residential
44013009	0.53	Existing Service Connections	Residential
44013010	0.54	Existing Service Connections	Residential
44013011	0.53	Existing Service Connections	Residential
44013012	0.57	Existing Service Connections	Residential
44013013	0.61	Existing Service Connections	Residential
44013014	0.58	Existing Service Connections	Residential
44013015	0.56	Existing Service Connections	Residential
44013016	0.52	Existing Service Connections	Residential
44013017	0.72	Existing Service Connections	Residential
44013018	0.56	Existing Service Connections	Residential
44013019	0.58	Existing Service Connections	Residential
44013021	0.69	Existing Service Connections	Residential
44013022	0.65	Existing Service Connections	Residential
44013023	0.64	Existing Service Connections	Residential
44013024	0.58	Existing Service Connections	Residential
44013025	0.56	Existing Service Connections	Residential
44013026	0.49	Existing Service Connections	Residential
44013027	0.57	Existing Service Connections	Residential
44013028	0.56	Existing Service Connections	Residential
44013030	0.50	Existing Service Connections	Residential
44013031	0.59	Existing Service Connections	Residential
44013032	0.84	Existing Service Connections	Residential
44013033	0.54	Existing Service Connections	Residential
44013034	0.49	Existing Service Connections	Residential
44013035	0.62	Existing Service Connections	Residential
44013036	0.73	Existing Service Connections	Residential
44013037	1.07	Existing Service Connections	Residential
44013038	0.79	Existing Service Connections	Residential
44013039	0.56	Existing Service Connections	Residential
44013040	0.68	Existing Service Connections	Residential
44013041	0.68	Existing Service Connections	Residential
44013044	0.49	Existing Service Connections	Residential
44013045	0.50	Existing Service Connections	Residential
44013046	0.51	Existing Service Connections	Residential
44013047	0.61	Existing Service Connections	Residential
44013048	0.62	Existing Service Connections	Residential
44013051	0.48	Existing Service Connections	Residential
44013052	0.71	Existing Service Connections	Residential
44013053	0.04	Existing Service Connections	Residential
44013054	0.04	Existing Service Connections	Residential
44013055	0.57	Existing Service Connections	Residential

44013056	0.60	Existing Service Connections	Residential
44013059	0.59	Existing Service Connections	Residential
44013060	0.59	Existing Service Connections	Residential
44013061	0.51	Existing Service Connections	Residential
44013062	0.56	Existing Service Connections	Residential
44013064	1.71	Existing Service Connections	Residential
44013066	0.03	Existing Service Connections	Residential
44020002	0.32	Existing Service Connections	Residential
44020003	0.29	Existing Service Connections	Residential
44020004	0.23	Existing Service Connections	Residential
44020005	0.28	Existing Service Connections	Residential
44020006	0.26	Existing Service Connections	Residential
44020007	0.23	Existing Service Connections	Residential
44020008	0.23	Existing Service Connections	Residential
44020009	0.23	Existing Service Connections	Residential
44020010	0.23	Existing Service Connections	Residential
44020011	0.24	Existing Service Connections	Residential
44020012	0.24	Existing Service Connections	Residential
44020013	0.32	Existing Service Connections	Residential
44020015	0.59	Existing Service Connections	Residential
44026001	0.26	Existing Service Connections	Residential
44026002	0.25	Existing Service Connections	Residential
44026003	0.29	Existing Service Connections	Residential
44026004	0.20	Existing Service Connections	Residential
44026005	0.28	Existing Service Connections	Residential
44026007	0.25	Existing Service Connections	Residential
44026008	0.32	Existing Service Connections	Residential
44026009	0.24	Existing Service Connections	Residential
44026010	0.20	Existing Service Connections	Residential
44026011	0.18	Existing Service Connections	Residential
44026012	0.17	Existing Service Connections	Residential
44026013	0.18	Existing Service Connections	Residential
44026014	0.18	Existing Service Connections	Residential
44026015	0.17	Existing Service Connections	Residential
44026016	0.20	Existing Service Connections	Residential
44026017	0.19	Existing Service Connections	Residential
44026018	0.19	Existing Service Connections	Residential
44026019	0.19	Existing Service Connections	Residential
44026020	0.17	Existing Service Connections	Residential
44026021	0.20	Existing Service Connections	Residential
44026022	0.46	Existing Service Connections	Residential
44026023	0.28	Existing Service Connections	Residential
44026024	0.28	Existing Service Connections	Residential
44026025	0.25	Existing Service Connections	Residential
44026026	0.20	Existing Service Connections	Residential
44026027	0.23	Existing Service Connections	Residential
44026028	0.16	Existing Service Connections	Residential

44026029	0.17	Existing Service Connections	Residential
44026030	0.17	Existing Service Connections	Residential
44026031	0.17	Existing Service Connections	Residential
44026032	0.18	Existing Service Connections	Residential
44026033	0.16	Existing Service Connections	Residential
44027001	0.16	Existing Service Connections	Residential
44027002	0.17	Existing Service Connections	Residential
44027003	0.18	Existing Service Connections	Residential
44027004	0.29	Existing Service Connections	Residential
44027005	0.26	Existing Service Connections	Residential
44027006	0.16	Existing Service Connections	Residential
44027007	0.16	Existing Service Connections	Residential
44027008	0.15	Existing Service Connections	Residential
44027009	0.17	Existing Service Connections	Residential
44027010	0.26	Existing Service Connections	Residential
44027011	0.31	Existing Service Connections	Residential
44027012	0.36	Existing Service Connections	Residential
44027013	0.19	Existing Service Connections	Residential
44027014	0.16	Existing Service Connections	Residential
44027015	0.16	Existing Service Connections	Residential
44027016	0.18	Existing Service Connections	Residential
44027018	0.20	Existing Service Connections	Residential
44027019	0.19	Existing Service Connections	Residential
44027020	0.15	Existing Service Connections	Residential
44027021	0.16	Existing Service Connections	Residential
44027022	0.18	Existing Service Connections	Residential
44027023	0.17	Existing Service Connections	Residential
44027024	0.24	Existing Service Connections	Residential
44027025	0.45	Existing Service Connections	Residential
44027026	0.80	Existing Service Connections	Residential
44027027	0.34	Existing Service Connections	Residential
44027028	0.20	Existing Service Connections	Residential
44027029	0.18	Existing Service Connections	Residential
44027030	0.20	Existing Service Connections	Residential
44027031	0.23	Existing Service Connections	Residential
44028004	1.50	Existing Service Connections	Residential
44028005	0.69	Existing Service Connections	Residential
44028006	0.61	Existing Service Connections	Residential
44028007	0.44	Existing Service Connections	Residential
44028008	0.50	Existing Service Connections	Residential
44028010	0.56	Existing Service Connections	Residential
44028012	1.86	Existing Service Connections	Residential
44029001	0.31	Existing Service Connections	Residential
44029009	0.16	Existing Service Connections	Residential
44029010	0.18	Existing Service Connections	Residential
44029011	0.26	Existing Service Connections	Residential
44029012	0.12	Existing Service Connections	Residential

44029013	0.22	Existing Service Connections	Residential
44029014	0.20	Existing Service Connections	Residential
44029015	0.19	Existing Service Connections	Residential
44029016	0.18	Existing Service Connections	Residential
44029017	0.17	Existing Service Connections	Residential
44029018	0.27	Existing Service Connections	Residential
44029019	0.33	Existing Service Connections	Residential
44029022	0.25	Existing Service Connections	Residential
44029023	0.23	Existing Service Connections	Residential
44029024	0.17	Existing Service Connections	Residential
44029025	0.22	Existing Service Connections	Residential
44029026	0.21	Existing Service Connections	Residential
44029027	0.14	Existing Service Connections	Residential
44029028	0.22	Existing Service Connections	Residential
44029029	0.22	Existing Service Connections	Residential
44029030	0.27	Existing Service Connections	Residential
44029031	0.29	Existing Service Connections	Residential
44029032	0.25	Existing Service Connections	Residential
44029033	0.23	Existing Service Connections	Residential
44029035	0.22	Existing Service Connections	Residential
44029036	0.22	Existing Service Connections	Residential
44029037	0.23	Existing Service Connections	Residential
44029038	0.24	Existing Service Connections	Residential
44029039	0.29	Existing Service Connections	Residential
44029040	0.21	Existing Service Connections	Residential
44029041	0.19	Existing Service Connections	Residential
44029042	0.19	Existing Service Connections	Residential
44029043	0.20	Existing Service Connections	Residential
44029044	0.17	Existing Service Connections	Residential
44029047	0.21	Existing Service Connections	Residential
44029048	0.20	Existing Service Connections	Residential
44029049	0.19	Existing Service Connections	Residential
44029050	0.16	Existing Service Connections	Residential
42007020	0.14	Existing Service Connections	Residential
42007021	0.30	Existing Service Connections	Residential
42021031	0.17	Existing Service Connections	Residential
42023006	1.72	Existing Service Connections	Residential
42023007	0.22	Existing Service Connections	Residential
42023009	0.22	Existing Service Connections	Residential
42023010	0.13	Existing Service Connections	Residential
42023012	0.57	Existing Service Connections	Residential
42023013	0.31	Existing Service Connections	Residential
42023014	0.36	Existing Service Connections	Residential
42023015	0.18	Existing Service Connections	Residential
42023017	0.22	Existing Service Connections	Residential
42023018	0.18	Existing Service Connections	Residential
42024005	0.29	Existing Service Connections	Residential

42024009	0.84	Existing Service Connections	Residential
42024010	0.41	Existing Service Connections	Residential
42024011	0.18	Existing Service Connections	Residential
42024017	0.37	Existing Service Connections	Residential
42024021	0.38	Existing Service Connections	Residential
42024026	0.84	Existing Service Connections	Residential
42024030	0.17	Existing Service Connections	Residential
42024032	0.21	Existing Service Connections	Residential
42024034	0.26	Existing Service Connections	Residential
42024036	0.31	Existing Service Connections	Residential
42024037	0.20	Existing Service Connections	Residential
42024038	0.19	Existing Service Connections	Residential
42025005	0.62	Existing Service Connections	Residential
42025006	0.61	Existing Service Connections	Residential
42025007	1.15	Existing Service Connections	Residential
42025010	3.50	Existing Service Connections	Residential
42025013	0.21	Existing Service Connections	Residential
42025014	0.20	Existing Service Connections	Residential
42025028	0.41	Existing Service Connections	Residential
42025029	0.42	Existing Service Connections	Residential
42025030	0.43	Existing Service Connections	Residential
42025032	0.01	Existing Service Connections	Residential
42025033	0.35	Existing Service Connections	Residential
42025035	0.71	Existing Service Connections	Residential
42025036	0.30	Existing Service Connections	Residential
42025044	1.83	Existing Service Connections	Residential
42025045	0.72	Existing Service Connections	Residential
42027004	0.07	Existing Service Connections	Residential
42027005	0.07	Existing Service Connections	Residential
42027006	0.13	Existing Service Connections	Residential
42027007	0.11	Existing Service Connections	Residential
42027008	0.04	Existing Service Connections	Residential
42027009	0.22	Existing Service Connections	Residential
42027012	0.58	Existing Service Connections	Residential
42027013	0.28	Existing Service Connections	Residential
42027014	0.10	Existing Service Connections	Residential
42027018	0.78	Existing Service Connections	Residential
42027021	0.14	Existing Service Connections	Residential
42027022	0.15	Existing Service Connections	Residential
42027023	0.18	Existing Service Connections	Residential
42027024	0.19	Existing Service Connections	Residential
42027025	0.43	Existing Service Connections	Residential
42027026	0.34	Existing Service Connections	Residential
42027028	0.51	Existing Service Connections	Residential
42027030	0.19	Existing Service Connections	Residential
42027031	0.38	Existing Service Connections	Residential
42028002	0.25	Existing Service Connections	Residential

42028013	0.44	Existing Service Connections	Residential
42028014	0.31	Existing Service Connections	Residential
42028017	0.40	Existing Service Connections	Residential
42028019	1.10	Existing Service Connections	Residential
42028022	0.20	Existing Service Connections	Residential
42028023	0.45	Existing Service Connections	Residential
42028024	0.31	Existing Service Connections	Residential
42028025	0.16	Existing Service Connections	Residential
42028026	0.22	Existing Service Connections	Residential
42028027	0.96	Existing Service Connections	Residential
42028030	0.65	Existing Service Connections	Residential
42028031	0.38	Existing Service Connections	Residential
42028032	0.21	Existing Service Connections	Residential
42028035	1.23	Existing Service Connections	Residential
42028036	0.34	Existing Service Connections	Residential
42028038	0.29	Existing Service Connections	Residential
42028040	0.59	Existing Service Connections	Residential
42035009	2.15	Existing Service Connections	Residential
44011012	0.98	Existing Service Connections	Residential
42018017	0.09	Existing Service Connections	Unclassified
42023016	0.17	Existing Service Connections	Unclassified
44006029	0.01	Existing Service Connections	Unclassified
42009014	0.38	Existing Service Connections	Commercial
42010020	0.44	Existing Service Connections	Commercial
44002053	2.24	Existing Service Connections	Residential
42043012	10.26	Existing Service Connections	Commercial
42011003	0.57	Existing Service Connections	Public Service
42025001	8.15	Existing Service Connections	Public Service
42043005	14.61	Existing Service Connections	Public Service
42043007	2.57	Existing Service Connections	Public Service
44009020	5.89	Future Connections Within SOI	Agriculture
44011061	7.78	Future Connections Within SOI	Agriculture
44012004	1.91	Future Connections Within SOI	Agriculture
44012033	0.10	Future Connections Within SOI	Industrial
44031019	0.12	Future Connections Within SOI	Residential
44012002	0.68	Future Connections Within SOI	Residential
44021005	7.91	Future Connections Within SOI	Residential
44023022	2.13	Future Connections Within SOI	Residential
44023023	1.24	Future Connections Within SOI	Residential
44023027	0.37	Future Connections Within SOI	Residential
42031012	0.14	Future Connections Within SOI	Residential
44014025	0.11	Future Connections Within SOI	Residential
42026033	0.14	Future Connections Within SOI	Residential
44002059	0.16	Future Connections Within SOI	Residential
42031005	0.53	Future Connections Within SOI	Residential
44001073	0.46	Future Connections Within SOI	Residential
42031004	0.46	Future Connections Within SOI	Public Service

44014022	0.82	Future Connections Within SOI	Residential
42025043	0.72	Future Connections Within SOI	Residential
44012032	1.31	Future Connections Within SOI	Industrial
44011045	0.89	Future Connections Within SOI	Residential
42031003	1.38	Future Connections Within SOI	Public Service
44006032	1.41	Future Connections Within SOI	Commercial
44002060	1.44	Future Connections Within SOI	Residential
44001018	2.55	Future Connections Within SOI	Industrial
44001050	2.59	Future Connections Within SOI	Industrial
42031017	2.34	Future Connections Within SOI	Residential
44014007	3.83	Future Connections Within SOI	Commercial
44014011	6.95	Future Connections Within SOI	Residential
42026016	4.69	Future Connections Within SOI	Residential
42031001	5.41	Future Connections Within SOI	Public Service
44010019	5.44	Future Connections Within SOI	Residential
42002006	8.49	Future Connections Within SOI	Commercial
44006031	15.24	Future Connections Within SOI	Commercial
44014014	18.77	Future Connections Within SOI	Commercial
42004004	14.87	Future Connections Within SOI	Industrial
44028013	15.13	Future Connections Within SOI	Residential
44014023	18.27	Future Connections Within SOI	Residential
44014024	19.17	Future Connections Within SOI	Residential
44014016	21.10	Future Connections Within SOI	Residential
44010020	12.19	Future Connections Within SOI	Residential
44002058	12.26	Future Connections Within SOI	Residential
42026013	16.32	Future Connections Within SOI	Residential
42001005	48.44	Future Connections Within SOI	Residential
42004015	30.94	Future Connections Within SOI	Residential
44006003	0.04	Potential New Connections Within Service Area	Commercial
42016002	0.06	Potential New Connections Within Service Area	Commercial
42018001	0.09	Potential New Connections Within Service Area	Commercial
42008014	0.03	Potential New Connections Within Service Area	Residential
42012023	0.18	Potential New Connections Within Service Area	Residential
42024001	0.21	Potential New Connections Within Service Area	Residential
44011056	0.11	Potential New Connections Within Service Area	Residential
44030004	0.14	Potential New Connections Within Service Area	Residential
44030005	0.24	Potential New Connections Within Service Area	Residential
44030007	0.19	Potential New Connections Within Service Area	Residential
44030010	0.13	Potential New Connections Within Service Area	Residential
44030011	0.19	Potential New Connections Within Service Area	Residential
44030013	0.11	Potential New Connections Within Service Area	Residential
44030014	0.15	Potential New Connections Within Service Area	Residential
44030016	0.15	Potential New Connections Within Service Area	Residential
44030017	0.14	Potential New Connections Within Service Area	Residential
44030021	0.12	Potential New Connections Within Service Area	Residential
44030022	0.11	Potential New Connections Within Service Area	Residential
44030023	0.10	Potential New Connections Within Service Area	Residential

44030024	0.13	Potential New Connections Within Service Area	Residential
44030025	0.14	Potential New Connections Within Service Area	Residential
44030027	0.12	Potential New Connections Within Service Area	Residential
44030028	0.14	Potential New Connections Within Service Area	Residential
44030029	0.14	Potential New Connections Within Service Area	Residential
44031002	0.15	Potential New Connections Within Service Area	Residential
44031003	0.15	Potential New Connections Within Service Area	Residential
44031004	0.15	Potential New Connections Within Service Area	Residential
44031005	0.14	Potential New Connections Within Service Area	Residential
44031006	0.14	Potential New Connections Within Service Area	Residential
44031007	0.13	Potential New Connections Within Service Area	Residential
44031008	0.23	Potential New Connections Within Service Area	Residential
44031013	0.16	Potential New Connections Within Service Area	Residential
44031016	0.14	Potential New Connections Within Service Area	Residential
44031017	0.12	Potential New Connections Within Service Area	Residential
44031021	0.13	Potential New Connections Within Service Area	Residential
42011006	4.15	Potential New Connections Within Service Area	Public Service
42011007	3.29	Potential New Connections Within Service Area	Public Service
44011020	9.59	Potential New Connections Within Service Area	Residential
44002038	0.19	Potential New Connections Within Service Area	Residential
42002001	0.24	Potential New Connections Within Service Area	Residential
42009032	0.25	Potential New Connections Within Service Area	Residential
42013003	0.13	Potential New Connections Within Service Area	Residential
42013017	0.24	Potential New Connections Within Service Area	Residential
42019032	0.18	Potential New Connections Within Service Area	Residential
42035006	0.25	Potential New Connections Within Service Area	Residential
42037022	0.18	Potential New Connections Within Service Area	Residential
42038017	0.05	Potential New Connections Within Service Area	Residential
42038018	0.06	Potential New Connections Within Service Area	Residential
42039012	0.21	Potential New Connections Within Service Area	Residential
44002046	0.12	Potential New Connections Within Service Area	Residential
44002066	0.11	Potential New Connections Within Service Area	Residential
44002073	0.11	Potential New Connections Within Service Area	Residential
44004018	0.18	Potential New Connections Within Service Area	Residential
44005022	0.18	Potential New Connections Within Service Area	Residential
44013065	0.24	Potential New Connections Within Service Area	Residential
44027017	0.22	Potential New Connections Within Service Area	Residential
44029002	0.17	Potential New Connections Within Service Area	Residential
44029034	0.24	Potential New Connections Within Service Area	Residential
42018007	0.10	Potential New Connections Within Service Area	Commercial
42021028	0.16	Potential New Connections Within Service Area	Unclassified
42018010	0.13	Potential New Connections Within Service Area	Commercial
42005006	0.13	Potential New Connections Within Service Area	Commercial
42005012	0.13	Potential New Connections Within Service Area	Commercial
42010023	0.14	Potential New Connections Within Service Area	Commercial
42010017	0.14	Potential New Connections Within Service Area	Commercial
42021035	0.15	Potential New Connections Within Service Area	Commercial

42034007	0.15	Potential New Connections Within Service Area	Commercial
42033009	0.16	Potential New Connections Within Service Area	Commercial
42009040	0.16	Potential New Connections Within Service Area	Commercial
42008012	0.17	Potential New Connections Within Service Area	Commercial
42009041	0.17	Potential New Connections Within Service Area	Commercial
42026014	0.28	Potential New Connections Within Service Area	Residential
42026032	0.27	Potential New Connections Within Service Area	Residential
42042016	0.31	Potential New Connections Within Service Area	Residential
44030006	0.25	Potential New Connections Within Service Area	Residential
44031010	0.25	Potential New Connections Within Service Area	Residential
44031011	0.39	Potential New Connections Within Service Area	Residential
44031012	0.28	Potential New Connections Within Service Area	Residential
44031020	0.26	Potential New Connections Within Service Area	Residential
42009031	0.32	Potential New Connections Within Service Area	Residential
42013016	0.34	Potential New Connections Within Service Area	Residential
42013018	0.39	Potential New Connections Within Service Area	Residential
42032004	0.33	Potential New Connections Within Service Area	Residential
42032009	0.34	Potential New Connections Within Service Area	Residential
44002067	0.39	Potential New Connections Within Service Area	Residential
44003032	0.31	Potential New Connections Within Service Area	Residential
44003033	0.34	Potential New Connections Within Service Area	Residential
42042014	0.20	Potential New Connections Within Service Area	Residential
42042015	0.19	Potential New Connections Within Service Area	Residential
42010022	0.19	Potential New Connections Within Service Area	Commercial
42022006	0.20	Potential New Connections Within Service Area	Commercial
42015011	0.21	Potential New Connections Within Service Area	Commercial
42015026	0.21	Potential New Connections Within Service Area	Commercial
42009030	0.21	Potential New Connections Within Service Area	Commercial
42037021	0.22	Potential New Connections Within Service Area	Commercial
42009038	0.22	Potential New Connections Within Service Area	Commercial
42033016	0.23	Potential New Connections Within Service Area	Commercial
42015028	0.24	Potential New Connections Within Service Area	Commercial
42010019	0.24	Potential New Connections Within Service Area	Commercial
42009029	0.26	Potential New Connections Within Service Area	Commercial
42015025	0.26	Potential New Connections Within Service Area	Commercial
42031037	0.27	Potential New Connections Within Service Area	Commercial
42004020	0.48	Potential New Connections Within Service Area	Residential
42011013	0.43	Potential New Connections Within Service Area	Residential
42026017	0.55	Potential New Connections Within Service Area	Residential
42021046	0.43	Potential New Connections Within Service Area	Residential
44002075	0.50	Potential New Connections Within Service Area	Residential
44005001	0.46	Potential New Connections Within Service Area	Residential
44013029	0.55	Potential New Connections Within Service Area	Residential
44013063	0.47	Potential New Connections Within Service Area	Residential
42024031	0.21	Potential New Connections Within Service Area	Residential
42027015	0.29	Potential New Connections Within Service Area	Residential
42017003	0.29	Potential New Connections Within Service Area	Commercial

42004006	0.29	Potential New Connections Within Service Area	Commercial
42040002	0.32	Potential New Connections Within Service Area	Commercial
44012028	0.46	Potential New Connections Within Service Area	Industrial
42026035	0.75	Potential New Connections Within Service Area	Residential
44031001	0.70	Potential New Connections Within Service Area	Residential
42037001	0.62	Potential New Connections Within Service Area	Residential
42038005	0.68	Potential New Connections Within Service Area	Residential
44012010	0.68	Potential New Connections Within Service Area	Residential
44013020	0.66	Potential New Connections Within Service Area	Residential
42046003	0.36	Potential New Connections Within Service Area	Residential
42046004	0.37	Potential New Connections Within Service Area	Residential
42023011	0.36	Potential New Connections Within Service Area	Residential
42024006	0.32	Potential New Connections Within Service Area	Residential
42024033	0.34	Potential New Connections Within Service Area	Residential
42025031	0.36	Potential New Connections Within Service Area	Residential
42045005	0.34	Potential New Connections Within Service Area	Residential
42015024	0.39	Potential New Connections Within Service Area	Commercial
42029024	0.41	Potential New Connections Within Service Area	Commercial
42032020	0.47	Potential New Connections Within Service Area	Commercial
42002007	0.47	Potential New Connections Within Service Area	Commercial
42021047	0.85	Potential New Connections Within Service Area	Residential
42018014	0.48	Potential New Connections Within Service Area	Public Service
42029027	0.49	Potential New Connections Within Service Area	Commercial
42002008	0.51	Potential New Connections Within Service Area	Commercial
44011054	1.01	Potential New Connections Within Service Area	Residential
42046001	0.53	Potential New Connections Within Service Area	Residential
42046005	0.46	Potential New Connections Within Service Area	Residential
42006038	0.62	Potential New Connections Within Service Area	Commercial
42035001	0.64	Potential New Connections Within Service Area	Commercial
42046006	0.56	Potential New Connections Within Service Area	Residential
42028029	0.55	Potential New Connections Within Service Area	Residential
44011053	1.35	Potential New Connections Within Service Area	Residential
42034002	1.33	Potential New Connections Within Service Area	Residential
44006004	1.33	Potential New Connections Within Service Area	Residential
42046007	0.63	Potential New Connections Within Service Area	Residential
42046008	0.68	Potential New Connections Within Service Area	Residential
42046011	0.64	Potential New Connections Within Service Area	Residential
44006040	1.10	Potential New Connections Within Service Area	Industrial
42035003	0.87	Potential New Connections Within Service Area	Commercial
42033015	0.89	Potential New Connections Within Service Area	Commercial
42011009	1.61	Potential New Connections Within Service Area	Residential
42046002	0.81	Potential New Connections Within Service Area	Residential
44006030	1.36	Potential New Connections Within Service Area	Industrial
42046009	0.93	Potential New Connections Within Service Area	Residential
42046010	0.91	Potential New Connections Within Service Area	Residential
42029013	0.95	Potential New Connections Within Service Area	Residential
44006037	1.44	Potential New Connections Within Service Area	Industrial

42026041	2.22	Potential New Connections Within Service Area	Residential
42028037	1.19	Potential New Connections Within Service Area	Residential
42013001	1.42	Potential New Connections Within Service Area	Public Service
42030014	1.54	Potential New Connections Within Service Area	Commercial
44011046	3.36	Potential New Connections Within Service Area	Residential
44011055	3.59	Potential New Connections Within Service Area	Residential
42043006	2.16	Potential New Connections Within Service Area	Public Service
42025015	2.06	Potential New Connections Within Service Area	Residential
42038021	5.29	Potential New Connections Within Service Area	Residential
44007001	3.12	Potential New Connections Within Service Area	Commercial
42003007	3.29	Potential New Connections Within Service Area	Commercial
44007012	3.94	Potential New Connections Within Service Area	Commercial
42025039	4.49	Potential New Connections Within Service Area	Residential
44006026	5.94	Potential New Connections Within Service Area	Commercial
44011043	11.00	Potential New Connections Within Service Area	Residential
44011069	36.94	Potential New Connections Within Service Area	Public Service
44012007	35.09	Potential New Connections Within Service Area	Public Service
42001002	11.56	Wastewater Treatment PLant and Spray Fields	Public Service
40012039	100.92	Wastewater Treatment PLant and Spray Fields	Industrial
40012042	5.53	Wastewater Treatment PLant and Spray Fields	Residential
40012011	29.12	Wastewater Treatment PLant and Spray Fields	Residential
40012014	4.77	Wastewater Treatment PLant and Spray Fields	Residential
42001004	42.75	Wastewater Treatment PLant and Spray Fields	Residential
42001006	1.32	Wastewater Treatment PLant and Spray Fields	Residential
40011009	6.89	Wastewater Treatment PLant and Spray Fields	Unclassified

Exhibit 2-A

SASD Existing and Future Flows

SAN ANDREAS SANITARY DISTRICT
EXISTING AND POTENTIAL FLOWS

ADWF	0.28	Mgal/day
Known Winter Infiltration Rate, Non-RDII	0.100	Mgal/day

Catchment	Existing ADWF (Mgal/day)	Non-Rainflow Dependent Infiltration (Mgal/day)	Additional Committed Flows (Mgal/day)	Existing ADWF, Committed Flows, and Non-Rainflow Dependent Infiltration (Mgal/day)	Estimated Additional Flow from Near-Term Development (gpd)	Estimated DWF after Near-Term Development (Mgal/day)	Estimated Additional Flow from Future Development (gpd)	Estimated DWF after Future Development (Mgal/day)
A-100_01	0.002	0.001		0.003	0	0.003	49263	0.052
A-100_02	0.010	0.004		0.014	0	0.014	0	0.014
A-100_03	0.004	0.001		0.005	1253	0.007	0	0.007
A-100_04	0.013	0.004		0.017	75231	0.092	0	0.092
A-100_05	0.016	0.006		0.021	11282	0.033	0	0.033
A-100_06	0.003	0.001		0.004	893	0.005	0	0.005
A-100_07	0.028	0.010		0.037	904	0.038	468	0.039
A-100_08	0.009	0.003		0.012	938	0.013	0	0.013
A-100_09	0.013	0.004		0.017	195	0.017	0	0.017
A-100_10	0.021	0.008		0.029	24228	0.053	20787	0.074
A-130_01	0.007	0.003		0.010	13686	0.023	11305	0.035
A-130_02	0.005	0.002		0.006	1773	0.008	0	0.008
B-600_01	0.005	0.002		0.006	6755	0.013	68896	0.082
B-600_02	0.006	0.002		0.007	2404	0.010	0	0.010
B-600_03	0.005	0.002		0.006	1737	0.008	0	0.008
B-600_04	0.002	0.001		0.002	367	0.003	0	0.003
B-600_05	0.007	0.003		0.010	11133	0.021	27058	0.048
E-700-E_01	0.006	0.002		0.007	4025	0.011	0	0.011
E-700-E_02	0.008	0.003		0.011	5056	0.016	0	0.016
E-700-E_03	0.007	0.003	0.025	0.034	103573	0.138	712	0.139
E-700-E_04	0.003	0.001		0.004	484	0.005	0	0.005
E-700-S_01	0.003	0.001		0.004	1161	0.005	0	0.005
E-700-S_02	0.003	0.001		0.004	2199	0.006	0	0.006
E-700-S_03	0.002	0.001		0.003	2015	0.005	5420	0.011
E-700-S_04	0.007	0.003		0.010	4816	0.014	21726	0.036
F-300_01	0.005	0.002		0.006	3657	0.010	0	0.010
F-300_02	0.009	0.003		0.013	5199	0.018	0	0.018
F-300_03	0.003	0.001		0.004	1560	0.006	0	0.006
F-300_04	0.009	0.003		0.013	61966	0.075	0	0.075
F-300_05	0.009	0.003		0.012	1567	0.013	0	0.013
F-300_06	0.002	0.001		0.003	179	0.003	0	0.003
F-300_07	0.002	0.001		0.003	468	0.004	0	0.004
F-300_08	0.003	0.001		0.004	18385	0.023	52360	0.075
F-300_09	0.007	0.003		0.010	46479	0.056	0	0.056
F-300_10	0.037	0.013		0.050	2785	0.053	55527	0.108
	0.28	0.10		0.40		0.82		1.14

Exhibit 3-A

Pond D Geotechnical Site Investigation

GEOTECHNICAL REPORT

San Andreas WWTP Pond D Expansion

San Andreas, CA

Prepared by:

Crawford & Associates, Inc.
4030 S. Land Park Drive, Suite C
Sacramento, CA 95822

Date: April 13, 2015

Prepared for:

KSN
711 N. Pershing Avenue
Stockton, CA 95203

CAInc File No. 15-195.1
April 13, 2015

Neal Colwell
Kjeldsen, Sinnock & Neudeck, Inc.
711 N Pershing Avenue
Stockton, CA 95203

Subject: **Geotechnical Report**
San Andreas WWTP Pond D Expansion
San Andreas, CA

Dear Mr. Colwell,

Crawford & Associates, Inc (CAInc) prepared this Geotechnical Report for the proposed San Andreas Wastewater Treatment Plant (WWTP) Pond D Expansion project in accordance with our January 14, 2015 agreement.

Thank you for the opportunity to provide geotechnical services for this project. Please call if you have any questions.

Sincerely,

Crawford & Associates, Inc,

Reviewed by

Adam J. Killinger, P.E.
Project Manager

REGISTERED PROFESSIONAL ENGINEER
ADAM JAMES KILLINGER
No. 72364
CIVIL
STATE OF CALIFORNIA

Benjamin D. Crawford, P.E., G.E.
Principal

REGISTERED PROFESSIONAL ENGINEER
BENJAMIN D. CRAWFORD
No. GE 2861
GEOTECHNICAL
STATE OF CALIFORNIA

Geotechnical Report
San Andreas Sanitary District WWTP Pond D Expansion
San Andreas, California

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Test Pit Logs
Laboratory Test Results

1 INTRODUCTION

1.1 Purpose

This report presents a summary of surface/subsurface conditions and conclusions regarding the proposed Pond D Expansion project. We prepared this report for Kjeldsen, Sinnock & Neudeck, Inc (KSN) – the project design engineers. Do not use or rely upon this report for different locations or improvements without the written consent of CAInc.

1.2 Scope of Services

To prepare this report, CAInc:

1. Discussed the proposed Pond D expansion project with KSN;
2. Reviewed geotechnical report (Blackburn Consulting, May 20, 2008) from the previous Pond D expansion;
3. Reviewed published geologic maps of the site;
4. Performed four sets of seismic refraction lines on February 2, 2015;
5. Observed, logged, and sampled seven exploratory test pits on February 12, 2015 to depths of about 3 to 6½ ft below ground surface (bgs);
6. Performed laboratory testing on test pit samples using an outside laboratory; and
7. Performed engineering analysis.

1.3 Project and Site Description

We understand the San Andreas Sanitary District needs to expand Pond D again to accommodate future wastewater treatment service. The additional storage capacity will be achieved through excavating soil/rock from the land immediately east of existing Pond D.

The site is located in the foothills of the Sierra Nevada mountain range. The site exhibits moderate topographic relief within the area of improvement (as much as 20 to 30 ft). Terrain steepens significantly east of the improvement area.

Figure 1 shows site vicinity and exploration locations.

2 GEOLOGIC SETTING

Our site work and published geologic literature (Wagner, D.L., et al., 1981) indicate that the property is underlain by the Calaveras Complex of the Paleozoic Era. The Calaveras Complex consists of metasedimentary and volcanic rock. We show the regional site geology on Figure 2.

3 SUBSURFACE CONDITIONS

To characterize the subsurface conditions at the site, CAInc observed and logged seven exploratory test pits and four sets of seismic refraction lines.

3.1 Soil Conditions

Based on our test pit data, near surface soils appear reasonably consistent within the proposed improvement area. The subsurface soil/rock can be characterized as low- to medium-plastic, silt, silty clay, and clay to depths of about 1½ to 3 ft bgs underlain by intensely- to moderately-weathered, soft to moderately soft metamorphic rock to depths of about 2½ to 6 ft bgs. The intensely- to moderately-weathered rock is underlain by slightly-weathered, very-hard metamorphic rock to the depths explored (3 to 6½ ft bgs). We encountered digging refusal in each test pit using a John Deere 310J backhoe equipped with 24 in bucket.

Refer to the test pit logs in the appendix for more specific soil descriptions.

3.2 Seismic Refraction Survey

We performed a seismic refraction survey is to obtain shear wave velocities (SWV) and corresponding rippability of subsurface materials. We performed three 100-foot long seismic refraction line sets (SA1 through SA6) and one 90-foot seismic refraction line set (SA7 and SA8). We used a seistronix RS-100 RadioSeis Wireless Seismic System with a 24 bit high resolution, single channel refraction seismograph. The energy source was by means of hand-actuated sledgehammer blows. Geophone spacing was 10 feet.

After analyzing our data, we combine SWV into three groups for the *majority* of the site; they are:

- SWV of **950** to **1,300 ft/s** from **ground surface to 3-4 ft** bgs;
- SWV of **2,500** to **3,000 ft/s** from **3-4 to 7-11 ft** bgs; and
- SWV of **5,000** to **6,750 ft/s** from **7-11 to 30-33 ft.**

Seismic line set SA3 and SA4 indicated a noticeably different subsurface SWV profile southeast of the existing pond. We model the profile as:

- SWV of **1,300 ft/s** from **ground surface to 4 ft** bgs;
- SWV of **3,800 ft/s** from **4 to 9-19 ft** bgs; and
- SWV of **9,000 ft/s** from **9-19 to 33 ft**.

The data we obtained from the SA3 and SA4 seismic line set indicates ripping may require more effort southeast of the pond compared to other surveyed locations.

Our seismic velocities correlate well with typical values published in Figure 12.1 of "Engineering Geology, Second Edition" by Perry H. Rahn published in 1996. The reference indicates typical seismic velocities for topsoil range from about 350 to 3,000 ft./sec., typical values for weathered rock ranges from about 4,000 to 9,000ft/sec, and typical values for hard rock from about 10,000 to 17,000ft/sec.

The formulas used to determine layer depths and seismic velocities assume horizontal soil/rock layers along the refraction line and consistent, increasing rock hardness with depth. However, layer interfaces in almost all cases are not horizontal, and due to weathering and differing rock types, softer rock may underlie harder rock. Therefore, layer depths and seismic velocities described above should only be considered rough estimates.

Use the above information only as a general guide. Rippability/excavatability of rock depends on many other factors including jointing and fracture patterns of the rock, experience of the equipment operator, and equipment and excavation methods selected.

4 LABORATORY TESTS

We completed the following laboratory tests on representative soil samples obtained from the exploratory borings:

- Particle Size Analysis (ASTM D422)
- Atterberg Limits (ASTM D4318)

We used laboratory test results to modify our soil classifications and test pit logs. Laboratory test results are presented in the appendix.

5 CONCLUSIONS

Based on our review of the Blackburn Consulting report, preliminary exploration, laboratory testing, and analysis, the proposed Pond D expansion is feasible. We include the following to be used for preliminary reservoir design and planning.

Based on the data collected during our exploration, the near surface alluvium and moderately to intensely weathered rock encountered to depths ranging from 2½ to 6 ft bgs, should be excavatable with typical grading equipment such as backhoes, excavators, and scrapers. The underlying slightly weathered rock we encountered refusal in will likely require ripping with a relatively large dozer such as a Caterpillar D9 (or larger) with a single shank ripper.

A pneumatic hammer may be required to remove slightly weathered to fresh rock underlying the moderate to slightly weathered rock and hard outcrops.

Construct excavated ponds slopes no steeper to 3:1 (horizontal to vertical).

6 LIMITATIONS

CAInc based this report on the current site conditions and our experience at the site. We assume the soil and rock conditions encountered in our test pits and seismic lines are representative of the subsurface conditions on the site. Actual conditions between the trenches and seismic refraction lines could be different. Our experience at the site shows that fresh rock out rocks may be encountered during construction and may alter the ultimate pond dimensions.

APPENDIX

Figure 1: Vicinity and Exploration Location Map

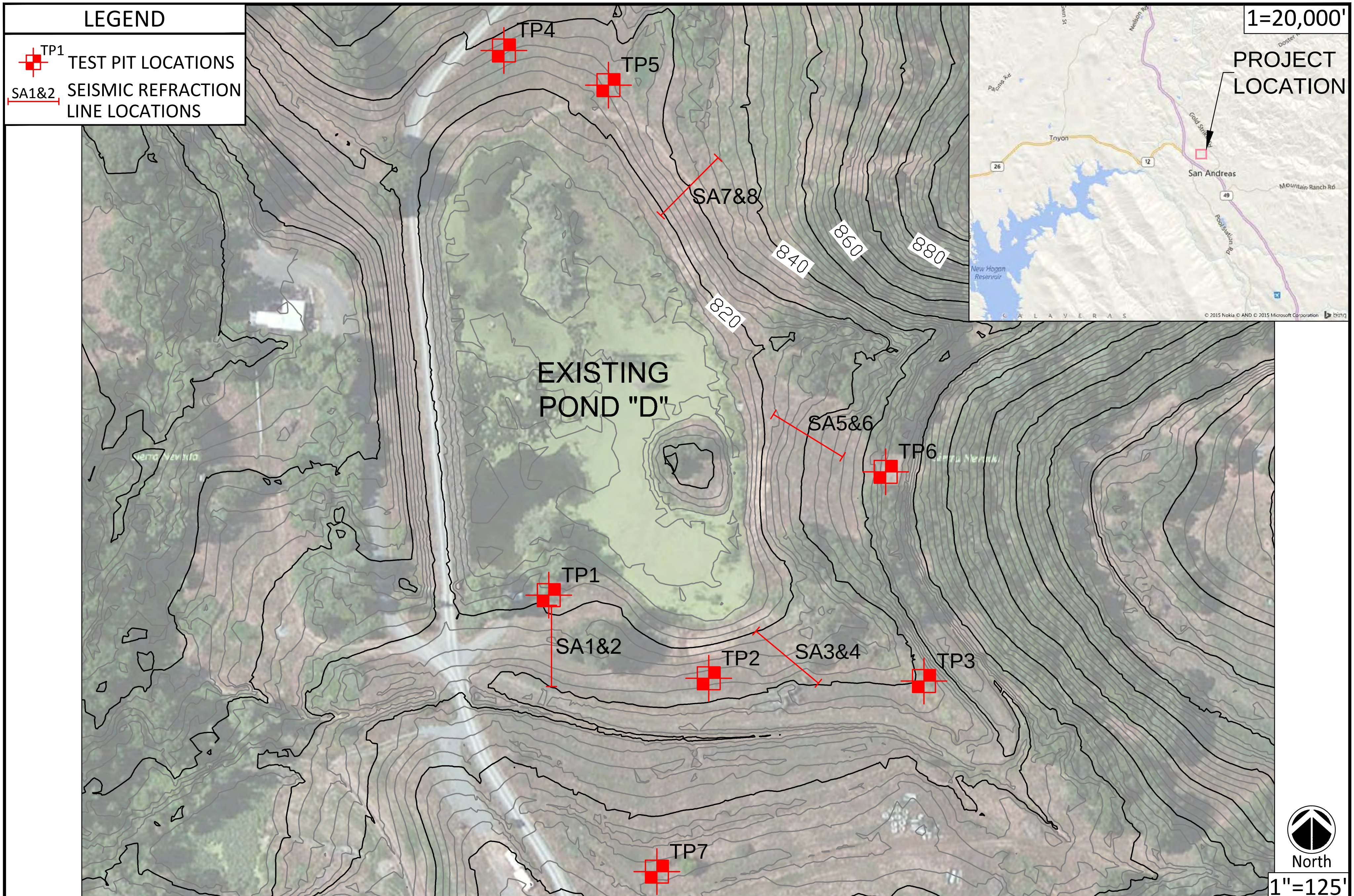
Figure 2: Geologic Map

Test Pit Notes

Test Pit Log Legend

Test Pit Logs

Laboratory Test Results



Project Mgr.	DPC	4/6/15
Project Eng.		
Designer		
Checked By	BDC	
Drawn By	RRH	4/6/15
	By	Date

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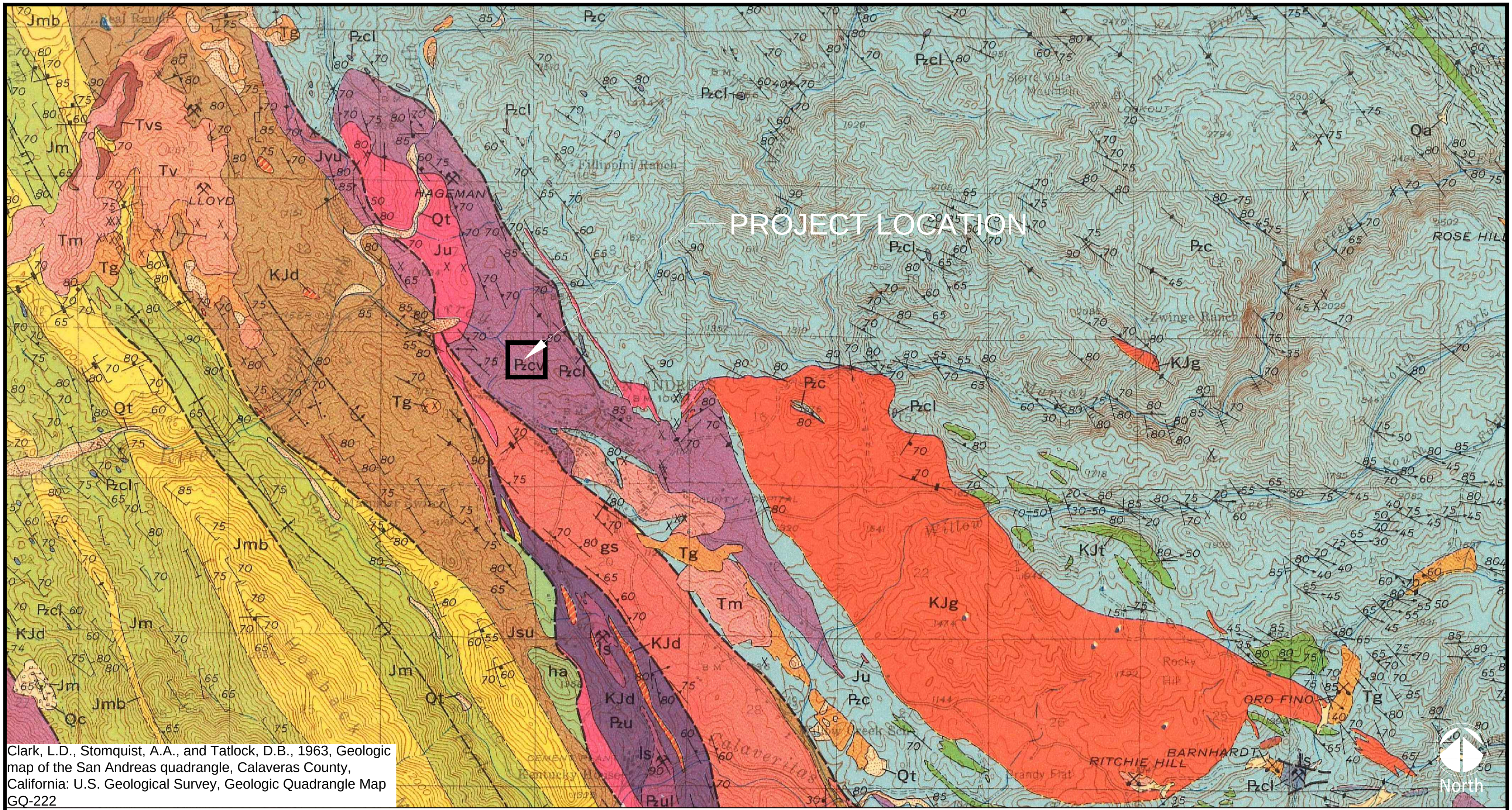
San Andreas WWTP Pond D
Calaveras County, CA

Figure 1
Vicinity and Exploration Location Map

Project No.	15-195.1
Scale	See Above
Date	4/6/15



Clark, L.D., Stomquist, A.A., and Tatlock, D.B., 1963, Geologic map of the San Andreas quadrangle, Calaveras County, California: U.S. Geological Survey, Geologic Quadrangle Map GQ-222

LEGEND

gs | ha

Green schist and related rocks

gs, *green schist derived from basaltic and andesitic breccia and tuff, consists largely of saussuritized feldspar and actinolite with some epidote, clinozoisite, chlorite, and sericite; possibly in part equivalent to volcanic rocks of the Calaveras Formation.*

ha, *porphyritic flows and flow breccias; contains minor hornblende dacite*

Pzc | Pzcl | Pzcv

Calaveras Formation

Pzc, *mostly interbedded chert and graphitic phyllite and schist but includes lenticular basaltic or andesitic volcanic rocks, and, possibly minor orthoquartzite; probably in part of Permian age.*

Pzcl, *recrystallized limestone and dolomitic limestone.*

Pzcv, *pyroclastic rocks, commonly bedded, having mineralogy similar to that of the green schist*

KJg | KJd

Felsic plutonic rocks

Igneous rocks variable in texture and composition, particularly near their margins, where they locally grade into more mafic rocks.

KJg, *granodioritic rocks.*

KJd, *dioritic rocks*

Ultramafic rocks

Mostly serpentine, but includes some dunite. Some bodies contain narrow chrysotile veinlets and pods or diffuse layers of chromite. Some serpentine is included with KJt in northeastern part of quadrangle

Project Mgr.	DPC	4/6/15
Project Eng.		
Designer		
Checked By	BDC	
Drawn By	RRH	4/6/15
	By	Date

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San Andreas WWTP Pond D
Calaveras County, CA

Figure 2
Geologic Map

Project No.	15-195.1
Scale	1"=5,000'
Date	4/6/15

Test Pit Notes

The lines designating the interface between soil/rock types on the following logs are approximate. The transition between soil types may be abrupt or gradual. Our recommendations are based on the final logs, which represent our interpretation of the field logs, laboratory testing results, and general knowledge of the site and geological conditions.

The test pits were backfilled with soil and rock removed from the trench. The backfill is not adequate for embankment construction and should be removed and recompacted unless it is removed during embankment base preparation.

UNIFIED SOIL CLASSIFICATION (ASTM D 2487-06)

MATERIAL TYPES	CRITERIA FOR ASSIGNING SOIL GROUP NAMES			GROUP SYMBOL	SOIL GROUP NAMES
COARSE-GRAINED SOILS >50% RETAINED ON NO. 200 SIEVE	GRAVELS >50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS <5% FINES	$Cu \geq 4$ AND $1 \leq Cc \leq 3$	GW	WELL-GRADED GRAVEL
			Cu < 4 AND/OR 1 > Cc > 3	GP	POORLY-GRADED GRAVEL
		GRAVELS WITH FINES >12% FINES	FINES CLASSIFY AS ML OR MH	GM	SILTY GRAVEL
			FINES CLASSIFY AS CL OR CH	GC	CLAYEY GRAVEL
	SANDS <50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN SANDS <5% FINES	$Cu \geq 6$ AND $1 \leq Cc \leq 3$	SW	WELL-GRADED SAND
			Cu < 6 AND/OR 1 > Cc > 3	SP	POORLY-GRADED SAND
		SANDS WITH FINES >12% FINES	FINES CLASSIFY AS ML OR MH	SM	SILTY SAND
			FINES CLASSIFY AS CL OR CH	SC	CLAYEY SAND
FINE-GRAINED SOILS >50% PASSING NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT <50	INORGANIC	PI>7 AND PLOTS ON OR ABOVE "A" LINE	CL	LEAN CLAY
			PI>4 AND PLOTS BELOW "A" LINE	ML	SILT
		ORGANIC	LL (oven dried)<0.75/LL (not dried)	OL	ORGANIC CLAY OR SILT
	SILTS AND CLAYS LIQUID LIMIT >50	INORGANIC	PI PLOTS ON OR ABOVE "A" LINE	CH	FAT CLAY
			PI PLOTS BELOW "A" LINE	MH	ELASTIC SILT
		ORGANIC	LL (oven dried)<0.75/LL (not dried)	OH	ORGANIC CLAY OR SILT
HIGHLY ORGANIC SOILS		PRIMARILY ORGANIC MATTER, DARK COLOR, ORGANIC ODOR		PT	PEAT

NOTE: $Cu = D_{60} / D_{10}$

$Cc = (D_{30})^2 / D_{10} \times D_{60}$

BLOW COUNT

The number of blows of a 140-lb. hammer falling 30-inches required to drive the sampler the last 12-inches of an 18-inch drive. The notation 50/4 indicates 4-inches of penetration achieved in 50 blows.

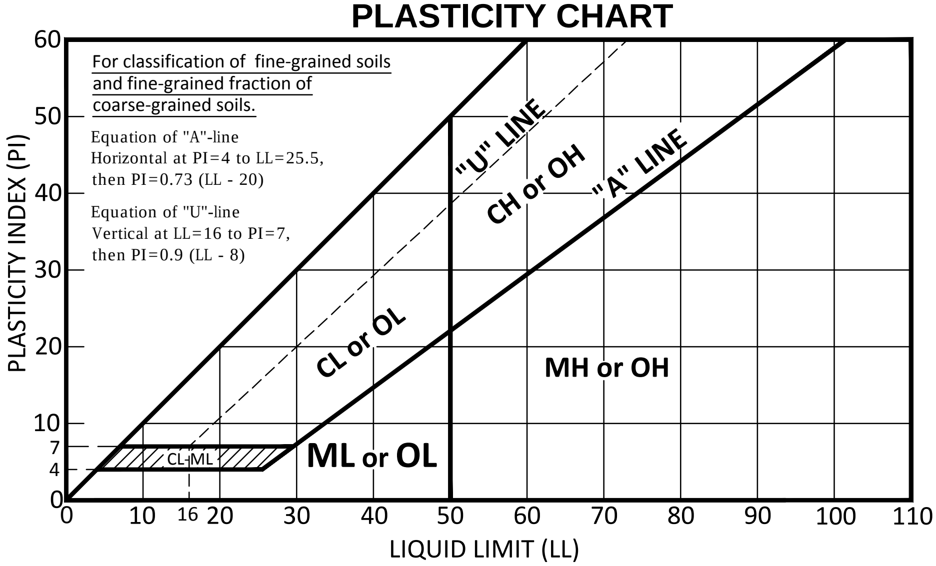
SAMPLE TYPES

- Auger or backhoe cuttings
- Modified California (2.0")
- Shelby tube
- Standard California (2.5")
- Standard Penetration (SPT)
- Rock core

ADDITIONAL TESTS

- C - Consolidation
- CP - Compaction Curve
- CR - Corrosivity Testing
- CU - Consolidated Undrained Triaxial
- DS - Direct Shear
- EI - Expansion Index
- P - Permeability
- PA - Partical Size Analysis
- PI - Plasticity Index
- PP - Pocket Penetrometer
- R - R-Value
- SE - Sand Equivalent
- SG - Specific Gravity
- SL - Shrinkage Limit
- SW - Swell Potential
- TV - Pocket Torvane Shear Test
- UC - Unconfined Compression
- UU - Unconsolidated Undrained Triaxial

PLASTICITY CHART



GROUND WATER LEVELS

- Later water level after drilling
- Water level at time of drilling

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TEST PIT LOG LEGEND

LOG OF TEST PIT TP1

PROJECT NO: 15-195.1
PROJECT: San Andreas Pond D
LOCATION: Calaveras County
CLIENT: KSN
LOGGED BY: DPC
DEPTH OF TEST PIT: 5.5(ft)

BEGIN DATE: 2/12/15
COMPLETION DATE: 2/12/15
SURFACE ELEVATION: (ft)
SURFACE CONDITION: Soil
WATER DEPTH: Not encountered
READING TAKEN: 2/2/15
HAMMER EFFICIENCY: N/A

DRILLING CONTRACTOR: Davis-Shubert
DRILLING METHOD: Backhoe
DRILL RIG: John Deere 310J Backhoe
HAMMER TYPE: N/A
SAMPLER TYPE & SIZE: BULK
BOREHOLE DIAMETER: N/A
BACKFILL METHOD: Cuttings

FIELD									LABORATORY						
ELEVATION (ft)	DEPTH (ft)	SAMPLE	SAMPLE NO	BLOWS PER 6 IN.	BLOWS PER FOOT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	RECOVERY(%)	PLASTIC LIMIT	LIQUID LIMIT	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200 SIEVE	REMARKS
	0–2	Bulk	1					SILTY CLAY (CL-ML); soft to medium stiff; reddish brown; moist; about 5% fine SAND; medium plasticity, medium to high toughness fines.							
	2–5							METAMORPHIC ROCK, Volcanic, dark olive brown, intensely to moderately weathered, soft to moderately soft.							
	5–5.5							METAMORPHIC ROCK, Volcanic, dark olive brown, slightly weathered, very hard.							Refusal with John Deere 310J Backhoe

Bottom of borehole at 5.5 ft bgs

No groundwater encountered

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(916) 455 4225

LOG OF TEST PIT TP2

PROJECT NO: 15-195.1
PROJECT: San Andreas Pond D
LOCATION: Calaveras County
CLIENT: KSN
LOGGED BY: DPC
DEPTH OF TEST PIT: 3(ft)

BEGIN DATE: 2/12/15
COMPLETION DATE: 2/12/15
SURFACE ELEVATION: (ft)
SURFACE CONDITION: Soil
WATER DEPTH: Not encountered
READING TAKEN: 2/2/15
HAMMER EFFICIENCY: N/A

DRILLING CONTRACTOR: Davis-Shubert
DRILLING METHOD: Backhoe
DRILL RIG: John Deere 310J Backhoe
HAMMER TYPE: N/A
SAMPLER TYPE & SIZE: BULK
BOREHOLE DIAMETER: N/A
BACKFILL METHOD: Cuttings

FIELD						GRAPHIC LOG	DESCRIPTION	RECOVERY(%)	LABORATORY					REMARKS
ELEVATION (ft)	DEPTH (ft)	SAMPLE	SAMPLE NO	BLOWS PER 6 IN.	BLOWS PER FOOT	POCKET PEN. (TSF)			PLASTIC LIMIT	LIQUID LIMIT	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200 SIEVE	
	0–1.5						SILTY CLAY (CL-ML); soft to medium stiff; reddish brown; moist; about 5% fine SAND; medium to high plasticity, medium to high toughness fines.							
	1.5–2.5						METAMORPHIC ROCK, Volcanic, dark olive brown, intensely to moderately weathered, soft to moderately soft.							
	2.5–3						METAMORPHIC ROCK, Volcanic, dark olive brown, slightly weathered, very hard.							Refusal with John Deere 310J Backhoe

Bottom of borehole at 3.0 ft bgs

No groundwater encountered

Depth scale (ft): 1, 2, 3, 4, 5, 6, 7

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(916) 455 4225

PROJECT NUMBER: 15-195.1
PROJECT: San Andreas Pond D
BORING: TP2
ENTRY BY: DPC
CHECKED BY: AJK

LOG OF TEST PIT TP3

PROJECT NO: 15-195.1	BEGIN DATE: 2/12/15	DRILLING CONTRACTOR: Davis-Shubert
PROJECT: San Andreas Pond D	COMPLETION DATE: 2/12/15	DRILLING METHOD: Backhoe
LOCATION: Calaveras County	SURFACE ELEVATION: (ft)	DRILL RIG: John Deere 310J Backhoe
CLIENT: KSN	SURFACE CONDITION: Soil	HAMMER TYPE: N/A
LOGGED BY: DPC	WATER DEPTH: Not encountered	SAMPLER TYPE & SIZE: BULK
DEPTH OF TEST PIT: 5(ft)	READING TAKEN: 2/2/15	BOREHOLE DIAMETER: N/A
	HAMMER EFFICIENCY: N/A	BACKFILL METHOD: Cuttings

FIELD										LABORATORY						
ELEVATION (ft)	DEPTH (ft)	SAMPLE	SAMPLE NO	BLOWS PER 6 IN.	BLOWS PER FOOT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	RECOVERY(%)	PLASTIC LIMIT	LIQUID LIMIT	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200 SIEVE	REMARKS
	0–3							SILTY CLAY (CL-ML); soft to medium stiff; reddish brown; moist; about 5% fine SAND; medium to high plasticity, medium to high toughness fines.							
	3–4.5							METAMORPHIC ROCK, Volcanic, dark olive brown, intensely to moderately weathered, soft to moderately soft.							
	4.5–5							METAMORPHIC ROCK, Volcanic, dark olive brown, slightly weathered, very hard.							Refusal with John Deere 310J Backhoe

Bottom of borehole at 5.0 ft bgs

No groundwater encountered

LOG OF TEST PIT TP4

PROJECT NO: 15-195.1
PROJECT: San Andreas Pond D
LOCATION: Calaveras County
CLIENT: KSN
LOGGED BY: DPC
DEPTH OF TEST PIT: 3.5(ft)

BEGIN DATE: 2/12/15
COMPLETION DATE: 2/12/15
SURFACE ELEVATION: (ft)
SURFACE CONDITION: Soil
WATER DEPTH: Not encountered
READING TAKEN: 2/2/15
HAMMER EFFICIENCY: N/A

DRILLING CONTRACTOR: Davis-Shubert
DRILLING METHOD: Backhoe
DRILL RIG: John Deere 310J Backhoe
HAMMER TYPE: N/A
SAMPLER TYPE & SIZE: BULK
BOREHOLE DIAMETER: N/A
BACKFILL METHOD: Cuttings

FIELD									LABORATORY						
ELEVATION (ft)	DEPTH (ft)	SAMPLE	SAMPLE NO	BLOWS PER 6 IN.	BLOWS PER FOOT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	RECOVERY(%)	PLASTIC LIMIT	LIQUID LIMIT	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200 SIEVE	REMARKS
	0–2	BULK	1					SILT with SAND (ML); soft to medium stiff; reddish brown; moist; about 4% GRAVEL; about 15% fine SAND; about 81% low plasticity, medium toughness fines.		23	28			80.9	PI
	2–3							METAMORPHIC ROCK, Volcanic, dark olive brown, intensely to moderately weathered, soft to moderately soft.							
	3–3.5							METAMORPHIC ROCK, Volcanic, dark olive brown, slightly weathered, very hard.							Refusal with John Deere 310J Backhoe

Bottom of borehole at 3.5 ft bgs

No groundwater encountered

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(916) 455 4225

PROJECT NUMBER: 15-195.1
PROJECT: San Andreas Pond D
BORING: TP4
ENTRY BY: DPC
CHECKED BY: AJK

LOG OF TEST PIT TP5

PROJECT NO: 15-195.1	BEGIN DATE: 2/12/15	DRILLING CONTRACTOR: Davis-Shubert
PROJECT: San Andreas Pond D	COMPLETION DATE: 2/12/15	DRILLING METHOD: Backhoe
LOCATION: Calaveras County	SURFACE ELEVATION: (ft)	DRILL RIG: John Deere 310J Backhoe
CLIENT: KSN	SURFACE CONDITION: Soil	HAMMER TYPE: N/A
LOGGED BY: DPC	WATER DEPTH: Not encountered	SAMPLER TYPE & SIZE: BULK
DEPTH OF TEST PIT: 4.2(ft)	READING TAKEN: 2/2/15	BOREHOLE DIAMETER: N/A
	HAMMER EFFICIENCY: N/A	BACKFILL METHOD: Cuttings

FIELD										LABORATORY					
ELEVATION (ft)	DEPTH (ft)	SAMPLE	SAMPLE NO	BLOWS PER 6 IN.	BLOWS PER FOOT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	RECOVERY(%)	PLASTIC LIMIT	LIQUID LIMIT	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200 SIEVE	REMARKS
	0–1.5							SILTY CLAY (CL-ML); soft to medium stiff; reddish brown; moist; about 5% fine SAND; medium to high plasticity, medium to high toughness fines.							
	1.5–3.7							METAMORPHIC ROCK, Volcanic, dark olive brown, intensely to moderately weathered, soft to moderately soft.							
	3.7–4.2							METAMORPHIC ROCK, Volcanic, dark olive brown, slightly weathered, very hard.							Refusal with John Deere 310J Backhoe

Bottom of borehole at 4.2 ft bgs

No groundwater encountered

LOG OF TEST PIT TP6

PROJECT NO: 15-195.1	BEGIN DATE: 2/12/15	DRILLING CONTRACTOR: Davis-Shubert
PROJECT: San Andreas Pond D	COMPLETION DATE: 2/12/15	DRILLING METHOD: Backhoe
LOCATION: Calaveras County	SURFACE ELEVATION: (ft)	DRILL RIG: John Deere 310J Backhoe
CLIENT: KSN	SURFACE CONDITION: Soil	HAMMER TYPE: N/A
LOGGED BY: DPC	WATER DEPTH: Not encountered	SAMPLER TYPE & SIZE: BULK
DEPTH OF TEST PIT: 4(ft)	READING TAKEN: 2/2/15	BOREHOLE DIAMETER: N/A
	HAMMER EFFICIENCY: N/A	BACKFILL METHOD: Cuttings

FIELD							GRAPHIC LOG	DESCRIPTION	RECOVERY(%)	LABORATORY					REMARKS
ELEVATION (ft)	DEPTH (ft)	SAMPLE	SAMPLE NO	BLOWS PER 6 IN.	BLOWS PER FOOT	POCKET PEN. (TSF)				PLASTIC LIMIT	LIQUID LIMIT	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200 SIEVE	
	0–2							SILTY CLAY (CL-ML); soft to medium stiff; reddish brown; moist; about 5% fine SAND; medium to high plasticity, medium to high toughness fines.							
	2–3.5							METAMORPHIC ROCK, Volcanic, dark olive brown, intensely to moderately weathered, soft to moderately soft.							
	3.5–4							METAMORPHIC ROCK, Volcanic, dark olive brown, slightly weathered, very hard.							Refusal with John Deere 310J Backhoe

Bottom of borehole at 4.0 ft bgs

No groundwater encountered

Depth scale: 1, 2, 3, 4, 5, 6, 7

LOG OF TEST PIT TP7

PROJECT NO: 15-195.1
PROJECT: San Andreas Pond D
LOCATION: Calaveras County
CLIENT: KSN
LOGGED BY: DPC
DEPTH OF TEST PIT: 6.5(ft)

BEGIN DATE: 2/12/15
COMPLETION DATE: 2/12/15
SURFACE ELEVATION: (ft)
SURFACE CONDITION: Soil
WATER DEPTH: Not encountered
READING TAKEN: 2/2/15
HAMMER EFFICIENCY: N/A

DRILLING CONTRACTOR: Davis-Shubert
DRILLING METHOD: Backhoe
DRILL RIG: John Deere 310J Backhoe
HAMMER TYPE: N/A
SAMPLER TYPE & SIZE: BULK
BOREHOLE DIAMETER: N/A
BACKFILL METHOD: Cuttings

FIELD										LABORATORY						
ELEVATION (ft)	DEPTH (ft)	SAMPLE	SAMPLE NO	BLOWS PER 6 IN.	BLOWS PER FOOT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	RECOVERY(%)	PLASTIC LIMIT	LIQUID LIMIT	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200 SIEVE	REMARKS
	0–3							Lean CLAY (CL); soft to medium stiff; reddish brown; moist; about 5% fine SAND; medium to high plasticity, medium to high toughness fines.							
	2–4	BULK	1							24	36				PI
	3–6							METAMORPHIC ROCK, Volcanic, dark olive brown, intensely to moderately weathered, soft to moderately soft.							
	6–6.5							METAMORPHIC ROCK, Volcanic, dark olive brown, slightly weathered, very hard.							Refusal with John Deere 310J Backhoe

Bottom of borehole at 6.5 ft bgs

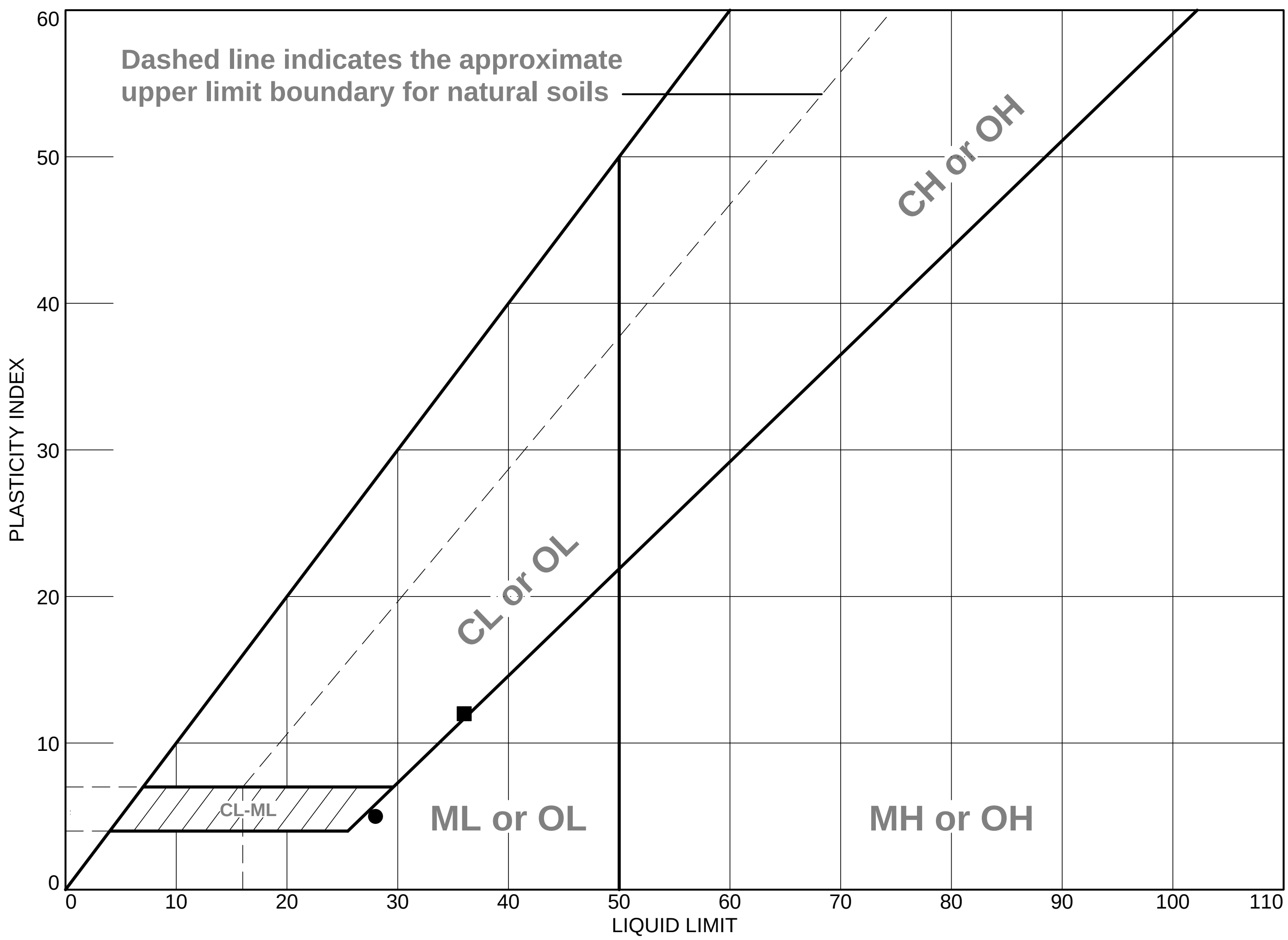
No groundwater encountered

Crawford & Associates, Inc.
Geotechnical Engineering, Design and Construction Services

Crawford & Associates, Inc.
4030 S Land Park Drive, Ste. C
Sacramento, CA 95822
(916) 455 4225

PROJECT NUMBER: 15-195.1
PROJECT: San Andreas Pond D
BORING: TP7
ENTRY BY: DPC
CHECKED BY: AJK

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	silt with sand	28	23	5	92.7	80.9	ML
■	Lean CLAY	36	24	12			

Project No. **Client:**

Project:

● **Location:** TP4 **Depth:** 0-2' **Sample Number:** TP4-1

■ **Location:** TP7 **Depth:** 2-4' **Sample Number:** TP7-1

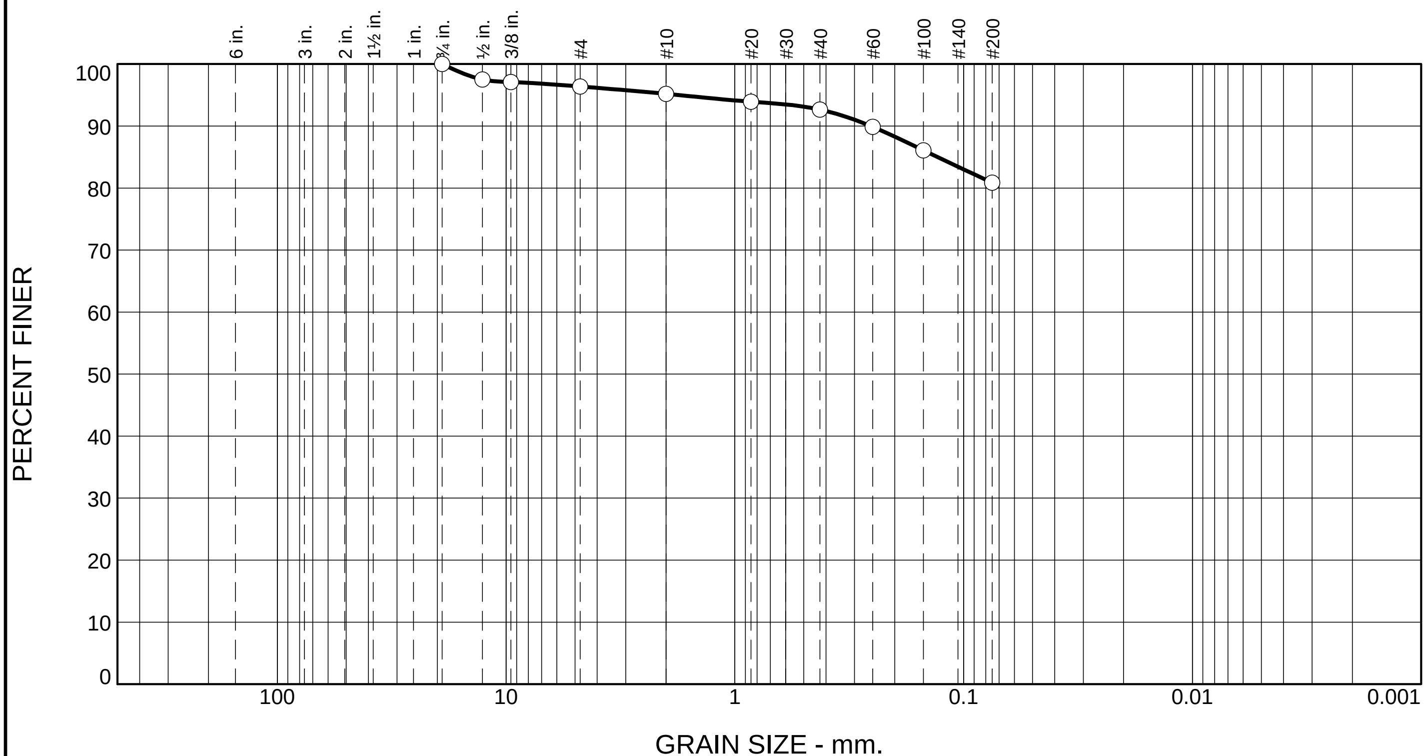
Remarks:

GEOCON CONSULTANTS, INC.

Figure

Tested By: RC **Checked By:** MR

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.6	1.2	2.5	11.8	80.9	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
.75	100.0		
.5	97.5		
.375	97.1		
#4	96.4		
#10	95.2		
#20	93.9		
#40	92.7		
#60	89.9		
#100	86.1		
#200	80.9		

* (no specification provided)

Material Description

silt with sand

Atterberg Limits (ASTM D 4318)

PL= 23 **LL=** 28 **PI=** 5

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4(3)

Coefficients

D_{90}= 0.2549 D_{85}= 0.1301 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: **Date Tested:** 2/20/15
Tested By: WS
Checked By: MR
Title: Lab Manager

Location: TP4
Sample Number: TP4-1 **Depth:** 0-2' **Date Sampled:**

GEOCON CONSULTANTS, INC.

Client:
Project:

Project No: **Figure**

Exhibit 3-B

Annual Water Balance Calculation Sheets

SAN ANDREAS SANITARY DISTRICT FILE: 0277-1290

WATER BALANCE, EXISTING FLOW POTENTIAL UNDER 1-in-100 YEAR TYPE HYDROLOGIC CONDITIONS

3/3/2016

INPUT DATA, CONSTANT

SANITARY FLOW CHARACTERISTICS	
AVERAGE DRY WEATHER FLOW (MGD)..	0.30
IRRIGATION AREA CHARACTERISTICS	
EXISTING IRRIGATION AREA (AC)..	30.0
AVERAGE DISTRIBUTION UNIFORMITY (DECIMAL FRACTION)..	0.94
EFFECTIVE STORAGE PERCOLATION RATE (IN/DAY)..	0.175

EXISTING STORAGE RESERVOIRS			
CHARACTERISTICS	POND D	FUTURE	TOTAL
CATCHMENT AREA (AC).............	8.2		
WATER SURFACE (AC)...............	2.9		
BOTTOM SURFACE (AC)............	1.3		
STORAGE AVAILABLE (MG).........	4.3		

CLIMATOLOGICAL FACTORS	
CLIMATOLOGICAL DESIGN BASIS	1-in-100 YEAR
DESIGN PRECIP/AVG PRECIP RATIO..	1.81
OCT-APR EVAP/AVG EVAP RATIO...	0.75
MAY-SEP EVAP/AVG EVAP RATIO...	1.00
IRRIGATION AREA SOIL RUNOFF COEFFICIENT	0.20
STORAGE CATCHMENT SOIL RUNOFF COEFF.	0.25

AVERAGE SOIL DEPTH (FT)	0.8
MAXIMUM AVAILABLE SOIL WATER HOLDING CAPACITY (IN)	1.7
MANAGEMENT ALLOWABLE SOIL WATER DEFICIT (%)	50%
RIVER DILUTION RATIO, 1 : ____	20
MAXIMUM RIVER DISCHARGE RATE (MGD)	1.5
MINIMUM RIVER FLOW RATE DISCHARGE THRESHOLD (MGD)	0.15
MAXIMUM ALLOWABLE LAND DISCHARGE RATE (MGD)	1.8

INPUT DATA, MONTHLY VARIABLE

MONTH	ANNUAL	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
DAYS IN MONTH	365	30	31	30	31	31	28	31	30	31	30	31	31
AVERAGE DRY WEATHER FLOW (MGD)		0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
AVG PRECIP, SAN ANDREAS (IN)	30.60	0.53	1.72	3.82	5.02	5.63	4.74	4.77	2.63	1.20	0.35	0.08	0.11
REFERENCE EVAPOTRANSPIRATION (ETo) (IN)	52.90	5.70	4.06	1.97	1.07	1.00	1.66	3.12	4.72	6.07	7.45	8.46	7.62
WATER SURFACE EVAPORATION COEFFICIENT		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
CROP COEFFICIENT (Kc), GRASS		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
CROP COEFFICIENT (Kc), TREES (OAKS)		1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
WEIGHTED CROP COEFFICIENT FOR SASD SITE		1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03
I/I VOLUME PER MGD of ADWF (MG)		0.00	0.08	0.24	0.68	0.92	0.75	1.28	0.52	0.25	0.03	0.00	0.00
AVERAGE RECENT SASD N.F. CALAVERAS RIVER FLOW (MGD)		0.00	0.00	5.23	17.79	26.30	28.23	38.28	31.63	19.01	7.35	0.20	0.00

CALCULATIONS

CALCULATIONS / MONTH	ANNUAL	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
RAIN-RELATED CALCULATIONS													
PERCENT ANNUAL RAINFALL/MONTH (%)		1.7%	5.6%	12.5%	16.4%	18.4%	15.5%	15.6%	8.6%	3.9%	1.1%	0.3%	0.4%
ESTIMATED SAN ANDREAS RAIN, 1-in-100 YEAR (IN)	55	0.96	3.11	6.91	9.08	10.19	8.58	8.63	4.76	2.17	0.63	0.14	0.20
EFFECTIVE RAIN FOR PLANTS (IN)	44	0.77	2.49	5.53	7.27	8.15	6.86	6.90	3.81	1.74	0.51	0.12	0.16
EVAPORATION-RELATED CALCULATIONS													
EVAPOTRANSPIRATION POTENTIAL (IN) (ETc) (ETo * Weighted Kc)	54	5.84	4.16	2.02	1.10	1.03	1.70	3.20	4.84	6.22	7.64	8.67	7.81
1-in-100 YEAR DESIGN ET POTENTIAL (IN) (ETc * Seasonal Evaporation Ratio)	50	5.84	3.12	1.51	0.82	0.77	1.28	2.40	3.63	6.22	7.64	8.67	7.81
STORAGE RESERVOIR EVAPORATION (IN) (Eto * Water Surface Coefficient)	53	5.70	4.06	1.97	1.07	1.00	1.66	3.12	4.72	6.07	7.45	8.46	7.62
SANITARY-RELATED CALCULATIONS													
AVERAGE DRY WEATHER FLOW VOLUME (MG)	110	9.00	9.30	9.00	9.30	9.30	8.40	9.30	9.00	9.30	9.00	9.30	9.30
AVERAGE I/I FLOW RATE (MGD)		0.00	0.02	0.07	0.20	0.28	0.22	0.38	0.16	0.07	0.01	0.00	0.00
I/I FLOW VOLUME (MG)	43	0.00	0.72	2.20	6.31	8.56	6.27	11.90	4.68	2.31	0.24	0.00	0.00
TOTAL INFLUENT FLOW RATE (MGD)		0.3	0.32	0.37	0.50	0.58	0.52	0.68	0.46	0.37	0.31	0.30	0.30
TOTAL INFLUENT FLOW VOLUME (MG)	153	9.00	10.02	11.20	15.61	17.86	14.67	21.20	13.68	11.61	9.24	9.30	9.30
DESIGN DISCHARGE TO LAND													
AVAILABLE RAIN WATER IN SOIL (IN)		0.00	0.00	1.70	1.70	1.70	1.70	1.70	0.18	0.00	0.00	0.00	0.00
RAIN WATER LOST TO PERCOLATION (IN)		0.00	0.00	1.81	6.17	7.12	5.16	3.71	0.00	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)		5.40	0.67	0.00	0.00	0.00	0.00	0.00	0.00	4.77	7.58	9.10	8.14
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	29	4.40	0.55	0.00	0.00	0.00	0.00	0.00	0.00	3.89	6.18	7.41	6.63
MAX EFFLUENT VOLUME AVAILABLE FOR LAND (MG)		9.00	10.02	15.62	20.74	18.90	15.84	22.19	14.67	12.15	12.16	9.88	9.30
AVAILABLE EFFLUENT APPLIED TO LAND (MG)	29	4.40	0.55	0.00	0.00	0.00	0.00	0.00	0.00	3.89	6.18	7.41	6.63
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.15	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.21	0.24	0.21
EFFLUENT IRRIGATION RATE (IN/MONTH)	36	5.40	0.67	0.00	0.00	0.00	0.00	0.00	0.00	4.77	7.58	9.10	8.14
EXCESS SPRAY DISPOSAL POT., LIMITED (IN) (LIMITED TO 0.175 IN/D)		5.25	5.43	3.44						5.43	5.25	5.43	5.43
EXCESS SPRAY DISPOSAL VOLUME (MG)	29	4.28	4.42	2.80						4.42	4.28	4.42	4.42
DESIGN DISCHARGE TO RIVER													
LOWER RIVER FLOW DISCHARGE THRESHOLD (MGD)				0.15	0.15	0.15	0.15	0.15	0.15				
MAX PERMITTED DISCHARGE RATE (MGD)				1.50	1.50	1.50	1.50	1.50	1.50				
MAX DISCHARGE BASED ON DILUTION (1 IN 20, MGD)				0.26	0.89	1.32	1.41	1.91	1.58				
POTENTIAL 1-in-100 YEAR EFFLUENT DISCHARGE VOLUME (MG)	207			7.84	27.57	40.77	39.53	46.50	45.00				
MAX VOLUME AVAILABLE FOR DISCHARGE AFTER LAND APPLICATION (MG)				15.62	20.74	18.90	15.84	22.19	14.67				
MAX AVAILABLE AGV. DISCHARGE RATE (MGD)				0.52	0.67	0.61	0.57	0.72	0.49				
CONDITION GOVERNING DISCHARGE RATE?				DILUTION	EFFLUENT	EFFLUENT	EFFLUENT	PERMIT	PERMIT				
ALLOWABLE RIVER DISCHARGE RATE (MGD)				0.26	0.67	0.61	0.57	0.72	0.49				
DISCHARGE VOLUME (MG)	100			7.84	20.74	18.90	15.84	22.19	14.67				
DESIGN LOSSES AND GAINS FROM STORAGE													
STORAGE AT BEGINNING OF MONTH (MG)		0.00	0.00	4.43	5.14	1.04	1.17	0.98	0.99	0.55	2.92	0.58	0.00
EFFLUENT STORAGE VOLUME GAIN/LOSS (MG)		0.33	5.06	0.55	-5.14	-1.04	-1.17	-0.98	-0.99	3.30	-1.22	-2.53	-1.75
UNADJUSTED STORAGE VOLUME (MG)		0.33	5.06	4.98	0.00	0.00	0.00	0.00	0.00	3.85	1.70	-1.95	-1.75
APPROXIMATE EFFECTIVE RESERVOIR AREA (AC)		2.90	4.14	4.13	2.90	2.90	2.90	2.90	2.90	3.93	3.47	2.90	2.90
EVAPORATIVE LOSS FROM STORAGE (MG)	2	0.45	0.46	0.22	0.00	0.00	0.00	0.00	0.00	0.65	0.70	0.00	0.00
PERCOLATION LOSS FROM STORAGE (MG)	3	0.41	0.61	0.59	0.00	0.00	0.00	0.00	0.00	0.58	0.49	0.00	0.00
RUNOFF TO STORAGE FROM RAIN CATCHMENT AREA (MG)	7	0.11	0.44	0.97	1.04	1.17	0.98	0.99	0.55	0.29	0.08	0.02	0.02
STORAGE AT END OF MONTH (MG)		0.00	4.43	5.14	1.04	1.17	0.98	0.99	0.55	2.92	0.58	0.00	0.00

MAXIMUM STORAGE REQUIRED (MG)... 5.1

TOTAL AVAILABLE STORAGE (MG).. 4.3

SUMMARY

ANNUAL INFLOW (MG)		ANNUAL OUTFLOW POTENTIAL (MG)		OVERALL BALANCE	
WASTEWATER...	110	EVAPORATION................................	2	UNUSED DISPOSAL CAPACITY (MG).....................	105
INFLOW AND INFILTRATION..................................	43	PERCOLATION................................	32	(MUST NOT BE NEGATIVE)	
PRECIPITATION INTO RESERVOIR..	7	LAND DISPOSAL............................	29	UNUSED STORAGE CAPACITY (MG).....................	-1
		SURFACE WATER DISPOSAL.....................................	100	(MUST NOT BE NEGATIVE)	
TOTAL	160	TOTAL	163		

SAN ANDREAS SANITARY DISTRICT | FILE: 0277-1290

WATER BALANCE, EXISTING FLOW POTENTIAL w/ 6.1 Mgal POND D UNDER 1-in-100 YEAR TYPE HYDROLOGIC CONDITIONS

3/3/2016

INPUT DATA, CONSTANT

SANITARY FLOW CHARACTERISTICS	
AVERAGE DRY WEATHER FLOW (MGD)........	0.30
IRRIGATION AREA CHARACTERISTICS	
EXISTING IRRIGATION AREA (AC)........	30
AVERAGE DISTRIBUTION UNIFORMITY (DECIMAL FRACTION)........	0.94
EFFECTIVE STORAGE PERCOLATION RATE (IN/DAY)........	0.175

EXISTING STORAGE RESERVOIRS			
CHARACTERISTICS	POND D	FUTURE	TOTAL
CATCHMENT AREA (AC)........	8.2		
WATER SURFACE (AC)........	2.9		
BOTTOM SURFACE (AC)........	1.3		
STORAGE AVAILABLE (MG)........	6.1		

CLIMATOLOGICAL FACTORS	
CLIMATOLOGICAL DESIGN BASIS	1-in-100 YEAR
DESIGN PRECIP/AVG PRECIP RATIO........	1.81
OCT-APR EVAP/AVG EVAP RATIO........	0.75
MAY-SEP EVAP/AVG EVAP RATIO........	1.00
IRRIGATION AREA SOIL RUNOFF COEFFICIENT	0.20
STORAGE CATCHMENT SOIL RUNOFF COEFF.	0.25

AVERAGE SOIL DEPTH (FT)	0.8
MAXIMUM AVAILABLE SOIL WATER HOLDING CAPACITY (IN)	1.7
MANAGEMENT ALLOWABLE SOIL WATER DEFICIT (%)	50%
RIVER DILUTION RATIO, 1 : ____	20
MAXIMUM RIVER DISCHARGE RATE (MGD)	1.5
MINIMUM RIVER FLOW RATE DISCHARGE THRESHOLD (MGD)	0.15
MAXIMUM ALLOWABLE LAND DISCHARGE RATE (MGD)	1.8

INPUT DATA, MONTHLY VARIABLE

MONTH	ANNUAL	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
DAYS IN MONTH	365	30	31	30	31	31	28	31	30	31	30	31	31
AVERAGE DRY WEATHER FLOW (MGD)		0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
AVG PRECIP, SAN ANDREAS (IN)	30.60	0.53	1.72	3.82	5.02	5.63	4.74	4.77	2.63	1.20	0.35	0.08	0.11
REFERENCE EVAPOTRANSPIRATION (ETo) (IN)	52.90	5.70	4.06	1.97	1.07	1.00	1.66	3.12	4.72	6.07	7.45	8.46	7.62
WATER SURFACE EVAPORATION COEFFICIENT		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
CROP COEFFICIENT (Kc), GRASS		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
CROP COEFFICIENT (Kc), TREES (OAKS)		1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
WEIGHTED CROP COEFFICIENT FOR SASD SITE		1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03
I/I VOLUME PER MGD of ADWF (MG)		0.00	0.08	0.24	0.68	0.92	0.75	1.28	0.52	0.25	0.03	0.00	0.00
AVERAGE RECENT SASD N.F. CALAVERAS RIVER FLOW (MGD)		0.00	0.00	5.23	17.79	26.30	28.23	38.28	31.63	19.01	7.35	0.20	0.00

CALCULATIONS

CALCULATIONS / MONTH	ANNUAL	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
RAIN-RELATED CALCULATIONS													
PERCENT ANNUAL RAINFALL/MONTH (%)		1.7%	5.6%	12.5%	16.4%	18.4%	15.5%	15.6%	8.6%	3.9%	1.1%	0.3%	0.4%
ESTIMATED SAN ANDREAS RAIN, 1-in-100 YEAR (IN)	55	0.96	3.11	6.91	9.08	10.19	8.58	8.63	4.76	2.17	0.63	0.14	0.20
EFFECTIVE RAIN FOR PLANTS (IN)	44	0.77	2.49	5.53	7.27	8.15	6.86	6.90	3.81	1.74	0.51	0.12	0.16
EVAPORATION-RELATED CALCULATIONS													
EVAPOTRANSPIRATION POTENTIAL (IN) (ETc) (ETo * Weighted Kc)	54	5.84	4.16	2.02	1.10	1.03	1.70	3.20	4.84	6.22	7.64	8.67	7.81
1-in-100 YEAR DESIGN ET POTENTIAL (IN) (ETc * Seasonal Evaporation Ratio)	50	5.84	3.12	1.51	0.82	0.77	1.28	2.40	3.63	6.22	7.64	8.67	7.81
STORAGE RESERVOIR EVAPORATION (IN) (Eto * Water Surface Coefficient)	53	5.70	4.06	1.97	1.07	1.00	1.66	3.12	4.72	6.07	7.45	8.46	7.62
SANITARY-RELATED CALCULATIONS													
AVERAGE DRY WEATHER FLOW VOLUME (MG)	110	9.00	9.30	9.00	9.30	9.30	8.40	9.30	9.00	9.30	9.00	9.30	9.30
AVERAGE I/I FLOW RATE (MGD)		0.00	0.02	0.07	0.20	0.28	0.22	0.38	0.16	0.07	0.01	0.00	0.00
I/I FLOW VOLUME (MG)	43	0.00	0.72	2.20	6.31	8.56	6.27	11.90	4.68	2.31	0.24	0.00	0.00
TOTAL INFLUENT FLOW RATE (MGD)		0.3	0.32	0.37	0.50	0.58	0.52	0.68	0.46	0.37	0.31	0.30	0.30
TOTAL INFLUENT FLOW VOLUME (MG)	153	9.00	10.02	11.20	15.61	17.86	14.67	21.20	13.68	11.61	9.24	9.30	9.30
DESIGN DISCHARGE TO LAND													
AVAILABLE RAIN WATER IN SOIL (IN)		0.00	0.00	1.70	1.70	1.70	1.70	1.70	0.18	0.00	0.00	0.00	0.00
RAIN WATER LOST TO PERCOLATION (IN)		0.00	0.00	1.81	6.17	7.12	5.16	3.71	0.00	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)		5.40	0.67	0.00	0.00	0.00	0.00	0.00	0.00	4.77	7.58	9.10	8.14
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	29	4.40	0.55	0.00	0.00	0.00	0.00	0.00	0.00	3.89	6.18	7.41	6.63
MAX EFFLUENT VOLUME AVAILABLE FOR LAND (MG)		9.00	10.02	15.62	20.74	18.90	15.84	22.19	14.67	12.15	12.16	9.88	9.30
AVAILABLE EFFLUENT APPLIED TO LAND (MG)	29	4.40	0.55	0.00	0.00	0.00	0.00	0.00	0.00	3.89	6.18	7.41	6.63
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.15	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.21	0.24	0.21
EFFLUENT IRRIGATION RATE (IN/MONTH)	36	5.40	0.67	0.00	0.00	0.00	0.00	0.00	0.00	4.77	7.58	9.10	8.14
EXCESS SPRAY DISPOSAL POT., LIMITED (IN) (LIMITED TO 0.175 IN/D)		5.25	5.43	3.44						5.43	5.25	5.43	5.43
EXCESS SPRAY DISPOSAL VOLUME (MG)	29	4.28	4.42	2.80						4.42	4.28	4.42	4.42
DESIGN DISCHARGE TO RIVER													
LOWER RIVER FLOW DISCHARGE THRESHOLD (MGD)				0.15	0.15	0.15	0.15	0.15	0.15				
MAX PERMITTED DISCHARGE RATE (MGD)				1.50	1.50	1.50	1.50	1.50	1.50				
MAX DISCHARGE BASED ON DILUTION (1 IN 20, MGD)				0.26	0.89	1.32	1.41	1.91	1.58				
POTENTIAL 1-in-100 YEAR EFFLUENT DISCHARGE VOLUME (MG)	207			7.84	27.57	40.77	39.53	46.50	45.00				
MAX VOLUME AVAILABLE FOR DISCHARGE AFTER LAND APPLICATION (MG)				15.62	20.74	18.90	15.84	22.19	14.67				
MAX AVAILABLE AGV. DISCHARGE RATE (MGD)				0.52	0.67	0.61	0.57	0.72	0.49				
CONDITION GOVERNING DISCHARGE RATE?				DILUTION	EFFLUENT	EFFLUENT	EFFLUENT	PERMIT	PERMIT				
ALLOWABLE RIVER DISCHARGE RATE (MGD)				0.26	0.67	0.61	0.57	0.72	0.49				
DISCHARGE VOLUME (MG)	100			7.84	20.74	18.90	15.84	22.19	14.67				
DESIGN LOSSES AND GAINS FROM STORAGE													
STORAGE AT BEGINNING OF MONTH (MG)		0.00	0.00	4.43	5.14	1.04	1.17	0.98	0.99	0.55	2.92	0.58	0.00
EFFLUENT STORAGE VOLUME GAIN/LOSS (MG)		0.33	5.06	0.55	-5.14	-1.04	-1.17	-0.98	-0.99	3.30	-1.22	-2.53	-1.75
UNADJUSTED STORAGE VOLUME (MG)		0.33	5.06	4.98	0.00	0.00	0.00	0.00	0.00	3.85	1.70	-1.95	-1.75
APPROXIMATE EFFECTIVE RESERVOIR AREA (AC)		2.90	4.14	4.13	2.90	2.90	2.90	2.90	2.90	3.93	3.47	2.90	2.90
EVAPORATIVE LOSS FROM STORAGE (MG)	2	0.45	0.46	0.22	0.00	0.00	0.00	0.00	0.00	0.65	0.70	0.00	0.00
PERCOLATION LOSS FROM STORAGE (MG)	3	0.41	0.61	0.59	0.00	0.00	0.00	0.00	0.00	0.58	0.49	0.00	0.00
RUNOFF TO STORAGE FROM RAIN CATCHMENT AREA (MG)	7	0.11	0.44	0.97	1.04	1.17	0.98	0.99	0.55	0.29	0.08	0.02	0.02
STORAGE AT END OF MONTH (MG)		0.00	4.43	5.14	1.04	1.17	0.98	0.99	0.55	2.92	0.58	0.00	0.00

MAXIMUM STORAGE REQUIRED (MG)........ 5.1

TOTAL AVAILABLE STORAGE (MG)........ 6.1

SUMMARY

ANNUAL INFLOW (MG)	
WASTEWATER........	110
INFLOW AND INFILTRATION........	43
PRECIPITATION INTO RESERVOIR........	7
TOTAL	160

ANNUAL OUTFLOW POTENTIAL (MG)	
EVAPORATION........	2
PERCOLATION........	32
LAND DISPOSAL........	29
SURFACE WATER DISPOSAL........	100
TOTAL	163

OVERALL BALANCE	
UNUSED DISPOSAL CAPACITY (MG)........	105
(MUST NOT BE NEGATIVE)	
UNUSED STORAGE CAPACITY (MG)........	1
(MUST NOT BE NEGATIVE)	

SAN ANDREAS SANITARY DISTRICT FILE: 0277-1290

WATER BALANCE, FLOW POTENTIAL w/ 6.1 Mgal POND D AND 47 acres DLDA, UNDER 1-in-100 YEAR TYPE HYDROLOGIC CONDITIONS 3/3/2016

INPUT DATA, CONSTANT

SANITARY FLOW CHARACTERISTICS	
AVERAGE DRY WEATHER FLOW (MGD)........	0.39
IRRIGATION AREA CHARACTERISTICS	
EXISTING IRRIGATION AREA (AC)........	47.0
AVERAGE DISTRIBUTION UNIFORMITY (DECIMAL FRACTION)........	0.94
EFFECTIVE STORAGE PERCOLATION RATE (IN/DAY)........	0.175

EXISTING STORAGE RESERVOIRS			
CHARACTERISTICS	POND D	FUTURE	TOTAL
CATCHMENT AREA (AC)........	8.2		
WATER SURFACE (AC)........	2.9		
BOTTOM SURFACE (AC)........	1.3		
STORAGE AVAILABLE (MG)........	6.1		

CLIMATOLOGICAL FACTORS	
CLIMATOLOGICAL DESIGN BASIS	1-in-100 YEAR
DESIGN PRECIP/AVG PRECIP RATIO........	1.81
OCT-APR EVAP/AVG EVAP RATIO........	0.75
MAY-SEP EVAP/AVG EVAP RATIO........	1.00
IRRIGATION AREA SOIL RUNOFF COEFFICIENT........	0.20
STORAGE CATCHMENT SOIL RUNOFF COEFF.	0.25

AVERAGE SOIL DEPTH (FT)	0.8
MAXIMUM AVAILABLE SOIL WATER HOLDING CAPACITY (IN)	1.7
MANAGEMENT ALLOWABLE SOIL WATER DEFICIT (%)	50%
RIVER DILUTION RATIO, 1 : ____	20
MAXIMUM RIVER DISCHARGE RATE (MGD)	1.5
MINIMUM RIVER FLOW RATE DISCHARGE THRESHOLD (MGD)	0.15
MAXIMUM ALLOWABLE LAND DISCHARGE RATE (MGD)	1.8

INPUT DATA, MONTHLY VARIABLE

MONTH	ANNUAL	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
DAYS IN MONTH	365	30	31	30	31	31	28	31	30	31	30	31	31
AVERAGE DRY WEATHER FLOW (MGD)		0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39
AVG PRECIP, SAN ANDREAS (IN)	30.60	0.53	1.72	3.82	5.02	5.63	4.74	4.77	2.63	1.20	0.35	0.08	0.11
REFERENCE EVAPOTRANSPIRATION (ETo) (IN)	52.90	5.70	4.06	1.97	1.07	1.00	1.66	3.12	4.72	6.07	7.45	8.46	7.62
WATER SURFACE EVAPORATION COEFFICIENT		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
CROP COEFFICIENT (Kc), GRASS		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
CROP COEFFICIENT (Kc), TREES (OAKS)		1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
WEIGHTED CROP COEFFICIENT FOR SASD SITE		1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03
I/I VOLUME PER MGD of ADWF (MG)		0.00	0.06	0.19	0.52	0.71	0.58	0.99	0.40	0.19	0.02	0.00	0.00
AVERAGE RECENT SASD N.F. CALAVERAS RIVER FLOW (MGD)		0.00	0.00	5.23	17.79	26.30	28.23	38.28	31.63	19.01	7.35	0.20	0.00

CALCULATIONS

CALCULATIONS / MONTH	ANNUAL	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
RAIN-RELATED CALCULATIONS													
PERCENT ANNUAL RAINFALL/MONTH (%)		1.7%	5.6%	12.5%	16.4%	18.4%	15.5%	15.6%	8.6%	3.9%	1.1%	0.3%	0.4%
ESTIMATED SAN ANDREAS RAIN, 1-in-100 YEAR (IN)	55	0.96	3.11	6.91	9.08	10.19	8.58	8.63	4.76	2.17	0.63	0.14	0.20
EFFECTIVE RAIN FOR PLANTS (IN)	44	0.77	2.49	5.53	7.27	8.15	6.86	6.90	3.81	1.74	0.51	0.12	0.16
EVAPORATION-RELATED CALCULATIONS													
EVAPOTRANSPIRATION POTENTIAL (IN) (ETc) (ETo * Weighted Kc)	54	5.84	4.16	2.02	1.10	1.03	1.70	3.20	4.84	6.22	7.64	8.67	7.81
1-in-100 YEAR DESIGN ET POTENTIAL (IN) (ETc * Seasonal Evaporation Ratio)	50	5.84	3.12	1.51	0.82	0.77	1.28	2.40	3.63	6.22	7.64	8.67	7.81
STORAGE RESERVOIR EVAPORATION (IN) (Eto * Water Surface Coefficient)	53	5.70	4.06	1.97	1.07	1.00	1.66	3.12	4.72	6.07	7.45	8.46	7.62
SANITARY-RELATED CALCULATIONS													
AVERAGE DRY WEATHER FLOW VOLUME (MG)	142	11.64	12.03	11.64	12.03	12.03	10.87	12.03	11.64	12.03	11.64	12.03	12.03
AVERAGE I/I FLOW RATE (MGD)		0.00	0.02	0.07	0.20	0.28	0.22	0.38	0.16	0.07	0.01	0.00	0.00
I/I FLOW VOLUME (MG)	43	0.00	0.72	2.20	6.31	8.56	6.27	11.90	4.68	2.31	0.24	0.00	0.00
TOTAL INFLUENT FLOW RATE (MGD)		0.4	0.41	0.46	0.59	0.66	0.61	0.77	0.54	0.46	0.40	0.39	0.39
TOTAL INFLUENT FLOW VOLUME (MG)	185	11.64	12.75	13.84	18.34	20.59	17.13	23.93	16.32	14.34	11.88	12.03	12.03
DESIGN DISCHARGE TO LAND													
AVAILABLE RAIN WATER IN SOIL (IN)		0.00	0.00	1.70	1.70	1.70	1.70	1.70	0.18	0.00	0.00	0.00	0.00
RAIN WATER LOST TO PERCOLATION (IN)		0.00	0.00	1.81	6.17	7.12	5.16	3.71	0.00	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)		5.40	0.67	0.00	0.00	0.00	0.00	0.00	0.00	4.77	7.58	9.10	8.14
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	46	6.89	0.86	0.00	0.00	0.00	0.00	0.00	0.00	6.09	9.68	11.62	10.39
MAX EFFLUENT VOLUME AVAILABLE FOR LAND (MG)		11.64	12.75	18.18	24.44	21.63	18.30	24.92	17.31	14.88	12.93	12.03	12.03
AVAILABLE EFFLUENT APPLIED TO LAND (MG)	46	6.89	0.86	0.00	0.00	0.00	0.00	0.00	0.00	6.09	9.68	11.62	10.39
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.23	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.32	0.37	0.34
EFFLUENT IRRIGATION RATE (IN/MONTH)	36	5.40	0.67	0.00	0.00	0.00	0.00	0.00	0.00	4.77	7.58	9.10	8.14
EXCESS SPRAY DISPOSAL POT., LIMITED (IN) (LIMITED TO 0.175 IN/D)		5.25	5.43	3.44						5.43	5.25	5.43	5.43
EXCESS SPRAY DISPOSAL VOLUME (MG)	45	6.70	6.92	4.39						6.92	6.70	6.92	6.92
DESIGN DISCHARGE TO RIVER													
LOWER RIVER FLOW DISCHARGE THRESHOLD (MGD)				0.15	0.15	0.15	0.15	0.15	0.15				
MAX PERMITTED DISCHARGE RATE (MGD)				1.50	1.50	1.50	1.50	1.50	1.50				
MAX DISCHARGE BASED ON DILUTION (1 IN 20, MGD)				0.26	0.89	1.32	1.41	1.91	1.58				
POTENTIAL 1-in-100 YEAR EFFLUENT DISCHARGE VOLUME (MG)	207			7.84	27.57	40.77	39.53	46.50	45.00				
MAX VOLUME AVAILABLE FOR DISCHARGE AFTER LAND APPLICATION (MG)				18.18	24.44	21.63	18.30	24.92	17.31				
MAX AVAILABLE AGV. DISCHARGE RATE (MGD)				0.61	0.79	0.70	0.65	0.80	0.58				
CONDITION GOVERNING DISCHARGE RATE?				DILUTION	EFFLUENT	EFFLUENT	EFFLUENT	PERMIT	PERMIT				
ALLOWABLE RIVER DISCHARGE RATE (MGD)				0.26	0.79	0.70	0.65	0.80	0.58				
DISCHARGE VOLUME (MG)	114			7.84	24.44	21.63	18.30	24.92	17.31				
DESIGN LOSSES AND GAINS FROM STORAGE													
STORAGE AT BEGINNING OF MONTH (MG)		0.00	0.00	4.34	6.10	1.04	1.17	0.98	0.99	0.55	1.05	0.00	0.00
EFFLUENT STORAGE VOLUME GAIN/LOSS (MG)		-1.95	4.97	1.61	-6.10	-1.04	-1.17	-0.98	-0.99	1.33	-4.50	-6.51	-5.28
UNADJUSTED STORAGE VOLUME (MG)		-1.95	4.97	5.95	0.00	0.00	0.00	0.00	0.00	1.87	-3.45	-6.51	-5.28
APPROXIMATE EFFECTIVE RESERVOIR AREA (AC)		2.90	4.13	4.27	2.90	2.90	2.90	2.90	2.90	3.51	2.90	2.90	2.90
EVAPORATIVE LOSS FROM STORAGE (MG)	1	0.00	0.45	0.23	0.00	0.00	0.00	0.00	0.00	0.58	0.00	0.00	0.00
PERCOLATION LOSS FROM STORAGE (MG)	2	0.00	0.61	0.61	0.00	0.00	0.00	0.00	0.00	0.52	0.00	0.00	0.00
RUNOFF TO STORAGE FROM RAIN CATCHMENT AREA (MG)	7	0.11	0.43	0.99	1.04	1.17	0.98	0.99	0.55	0.28	0.07	0.02	0.02
STORAGE AT END OF MONTH (MG)		0.00	4.34	6.10	1.04	1.17	0.98	0.99	0.55	1.05	0.00	0.00	0.00

MAXIMUM STORAGE REQUIRED (MG)........ 6.1

TOTAL AVAILABLE STORAGE (MG)........ 6.1

SUMMARY

ANNUAL INFLOW (MG)	
WASTEWATER........	142
INFLOW AND INFILTRATION........	43
PRECIPITATION INTO RESERVOIR........	7
TOTAL	192

ANNUAL OUTFLOW POTENTIAL (MG)	
EVAPORATION........	1
PERCOLATION........	47
LAND DISPOSAL........	46
SURFACE WATER DISPOSAL........	114
TOTAL	208

OVERALL BALANCE	
UNUSED DISPOSAL CAPACITY (MG)........	106
(MUST NOT BE NEGATIVE)	
UNUSED STORAGE CAPACITY (MG)........	0
(MUST NOT BE NEGATIVE)	

SAN ANDREAS SANITARY DISTRICT — FILE: 0277-1290

WATER BALANCE, FLOW POTENTIAL w/ 6.1 Mgal POND D AND 65 acres DLDA, UNDER 1-in-100 YEAR TYPE HYDROLOGIC CONDITIONS

3/3/2016

INPUT DATA, CONSTANT

SANITARY FLOW CHARACTERISTICS

AVERAGE DRY WEATHER FLOW (MGD)........	0.46

IRRIGATION AREA CHARACTERISTICS

EXISTING IRRIGATION AREA (AC)........	65.0
AVERAGE DISTRIBUTION UNIFORMITY (DECIMAL FRACTION)........	0.94
EFFECTIVE STORAGE PERCOLATION RATE (IN/DAY)........	0.175

EXISTING STORAGE RESERVOIRS

CHARACTERISTICS	POND D	FUTURE	TOTAL
CATCHMENT AREA (AC)........	8.2		
WATER SURFACE (AC)........	2.9		
BOTTOM SURFACE (AC)........	1.3		
STORAGE AVAILABLE (MG)........	6.1		

CLIMATOLOGICAL FACTORS

CLIMATOLOGICAL DESIGN BASIS	1-in-100 YEAR
DESIGN PRECIP/AVG PRECIP RATIO........	1.81
OCT-APR EVAP/AVG EVAP RATIO........	0.75
MAY-SEP EVAP/AVG EVAP RATIO........	1.00
IRRIGATION AREA SOIL RUNOFF COEFFICIENT........	0.20
STORAGE CATCHMENT SOIL RUNOFF COEFF.	0.25

AVERAGE SOIL DEPTH (FT)	0.8
MAXIMUM AVAILABLE SOIL WATER HOLDING CAPACITY (IN)	1.7
MANAGEMENT ALLOWABLE SOIL WATER DEFICIT (%)	50%
RIVER DILUTION RATIO, 1 : ____	20
MAXIMUM RIVER DISCHARGE RATE (MGD)	1.5
MINIMUM RIVER FLOW RATE DISCHARGE THRESHOLD (MGD)	0.15
MAXIMUM ALLOWABLE LAND DISCHARGE RATE (MGD)	1.8

INPUT DATA, MONTHLY VARIABLE

MONTH	ANNUAL	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
DAYS IN MONTH	365	30	31	30	31	31	28	31	30	31	30	31	31
AVERAGE DRY WEATHER FLOW (MGD)		0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46
AVG PRECIP, SAN ANDREAS (IN)	30.60	0.53	1.72	3.82	5.02	5.63	4.74	4.77	2.63	1.20	0.35	0.08	0.11
REFERENCE EVAPOTRANSPIRATION (ETo) (IN)	52.90	5.70	4.06	1.97	1.07	1.00	1.66	3.12	4.72	6.07	7.45	8.46	7.62
WATER SURFACE EVAPORATION COEFFICIENT		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
CROP COEFFICIENT (Kc), GRASS		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
CROP COEFFICIENT (Kc), TREES (OAKS)		1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
WEIGHTED CROP COEFFICIENT FOR SASD SITE		1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03
I/I VOLUME PER MGD of ADWF (MG)		0.00	0.05	0.16	0.44	0.59	0.48	0.83	0.34	0.16	0.02	0.00	0.00
AVERAGE RECENT SASD N.F. CALAVERAS RIVER FLOW (MGD)		0.00	0.00	5.23	17.79	26.30	28.23	38.28	31.63	19.01	7.35	0.20	0.00

CALCULATIONS

CALCULATIONS / MONTH	ANNUAL	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
RAIN-RELATED CALCULATIONS													
PERCENT ANNUAL RAINFALL/MONTH (%)		1.7%	5.6%	12.5%	16.4%	18.4%	15.5%	15.6%	8.6%	3.9%	1.1%	0.3%	0.4%
ESTIMATED SAN ANDREAS RAIN, 1-in-100 YEAR (IN)	55	0.96	3.11	6.91	9.08	10.19	8.58	8.63	4.76	2.17	0.63	0.14	0.20
EFFECTIVE RAIN FOR PLANTS (IN)	44	0.77	2.49	5.53	7.27	8.15	6.86	6.90	3.81	1.74	0.51	0.12	0.16
EVAPORATION-RELATED CALCULATIONS													
EVAPOTRANSPIRATION POTENTIAL (IN) (ETc) (ETo * Weighted Kc)	54	5.84	4.16	2.02	1.10	1.03	1.70	3.20	4.84	6.22	7.64	8.67	7.81
1-in-100 YEAR DESIGN ET POTENTIAL (IN) (ETc * Seasonal Evaporation Ratio)	50	5.84	3.12	1.51	0.82	0.77	1.28	2.40	3.63	6.22	7.64	8.67	7.81
STORAGE RESERVOIR EVAPORATION (IN) (Eto * Water Surface Coefficient)	53	5.70	4.06	1.97	1.07	1.00	1.66	3.12	4.72	6.07	7.45	8.46	7.62
SANITARY-RELATED CALCULATIONS													
AVERAGE DRY WEATHER FLOW VOLUME (MG)	169	13.92	14.39	13.92	14.39	14.39	13.00	14.39	13.92	14.39	13.92	14.39	14.39
AVERAGE I/I FLOW RATE (MGD)		0.00	0.02	0.07	0.20	0.28	0.22	0.38	0.16	0.07	0.01	0.00	0.00
I/I FLOW VOLUME (MG)	43	0.00	0.72	2.20	6.31	8.56	6.27	11.90	4.68	2.31	0.24	0.00	0.00
TOTAL INFLUENT FLOW RATE (MGD)		0.5	0.49	0.54	0.67	0.74	0.69	0.85	0.62	0.54	0.47	0.46	0.46
TOTAL INFLUENT FLOW VOLUME (MG)	213	13.92	15.11	16.12	20.70	22.95	19.26	26.29	18.61	16.70	14.16	14.39	14.39
DESIGN DISCHARGE TO LAND													
AVAILABLE RAIN WATER IN SOIL (IN)		0.00	0.00	1.70	1.70	1.70	1.70	1.70	0.18	0.00	0.00	0.00	0.00
RAIN WATER LOST TO PERCOLATION (IN)		0.00	0.00	1.81	6.17	7.12	5.16	3.71	0.00	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)		5.40	0.67	0.00	0.00	0.00	0.00	0.00	0.00	4.77	7.58	9.10	8.14
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	63	9.53	1.19	0.00	0.00	0.00	0.00	0.00	0.00	8.42	13.39	16.06	14.37
MAX EFFLUENT VOLUME AVAILABLE FOR LAND (MG)		13.92	15.11	19.87	26.80	23.99	20.43	27.28	19.60	17.24	14.16	14.39	14.39
AVAILABLE EFFLUENT APPLIED TO LAND (MG)	61	9.53	1.19	0.00	0.00	0.00	0.00	0.00	0.00	8.42	13.39	14.39	14.37
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.32	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.45	0.46	0.46
EFFLUENT IRRIGATION RATE (IN/MONTH)	35	5.40	0.67	0.00	0.00	0.00	0.00	0.00	0.00	4.77	7.58	8.15	8.14
EXCESS SPRAY DISPOSAL POT., LIMITED (IN) (LIMITED TO 0.175 IN/D)		5.25	5.43	3.44						5.43	5.25	5.43	5.43
EXCESS SPRAY DISPOSAL VOLUME (MG)	63	9.27	9.57	6.07						9.57	9.27	9.57	9.57
DESIGN DISCHARGE TO RIVER													
LOWER RIVER FLOW DISCHARGE THRESHOLD (MGD)				0.15	0.15	0.15	0.15	0.15	0.15				
MAX PERMITTED DISCHARGE RATE (MGD)				1.50	1.50	1.50	1.50	1.50	1.50				
MAX DISCHARGE BASED ON DILUTION (1 IN 20, MGD)				0.26	0.89	1.32	1.41	1.91	1.58				
POTENTIAL 1-in-100 YEAR EFFLUENT DISCHARGE VOLUME (MG)	207			7.84	27.57	40.77	39.53	46.50	45.00				
MAX VOLUME AVAILABLE FOR DISCHARGE AFTER LAND APPLICATION (MG)				19.87	26.80	23.99	20.43	27.28	19.60				
MAX AVAILABLE AGV. DISCHARGE RATE (MGD)				0.66	0.86	0.77	0.73	0.88	0.65				
CONDITION GOVERNING DISCHARGE RATE?				DILUTION	EFFLUENT	EFFLUENT	EFFLUENT	PERMIT	PERMIT				
ALLOWABLE RIVER DISCHARGE RATE (MGD)				0.26	0.86	0.77	0.73	0.88	0.65				
DISCHARGE VOLUME (MG)	126			7.84	26.80	23.99	20.43	27.28	19.60				
DESIGN LOSSES AND GAINS FROM STORAGE													
STORAGE AT BEGINNING OF MONTH (MG)		0.00	0.00	3.74	6.10	1.04	1.17	0.98	0.99	0.55	0.00	0.00	0.00
EFFLUENT STORAGE VOLUME GAIN/LOSS (MG)		-4.87	4.35	2.21	-6.10	-1.04	-1.17	-0.98	-0.99	-1.30	-8.49	-9.57	-9.55
UNADJUSTED STORAGE VOLUME (MG)		-4.87	4.35	5.95	0.00	0.00	0.00	0.00	0.00	-0.75	-8.49	-9.57	-9.55
APPROXIMATE EFFECTIVE RESERVOIR AREA (AC)		2.90	4.02	4.27	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90
EVAPORATIVE LOSS FROM STORAGE (MG)	1	0.00	0.44	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERCOLATION LOSS FROM STORAGE (MG)	1	0.00	0.59	0.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF TO STORAGE FROM RAIN CATCHMENT AREA (MG)	7	0.11	0.43	0.99	1.04	1.17	0.98	0.99	0.55	0.25	0.07	0.02	0.02
STORAGE AT END OF MONTH (MG)		0.00	3.74	6.10	1.04	1.17	0.98	0.99	0.55	0.00	0.00	0.00	0.00

MAXIMUM STORAGE REQUIRED (MG)........	6.1
TOTAL AVAILABLE STORAGE (MG)........	6.1

SUMMARY

ANNUAL INFLOW (MG)

WASTEWATER........	169
INFLOW AND INFILTRATION........	43
PRECIPITATION INTO RESERVOIR........	7
TOTAL	219

ANNUAL OUTFLOW POTENTIAL (MG)

EVAPORATION........	1
PERCOLATION........	64
LAND DISPOSAL........	61
SURFACE WATER DISPOSAL........	126
TOTAL	252

OVERALL BALANCE

UNUSED DISPOSAL CAPACITY (MG)........ (MUST NOT BE NEGATIVE)	114
UNUSED STORAGE CAPACITY (MG)........ (MUST NOT BE NEGATIVE)	0

SAN ANDREAS SANITARY DISTRICT — FILE: 0277-1290

WATER BALANCE, FLOW POTENTIAL w/ 7.2 Mgal POND D AND 29 acres DLDA, UNDER 1-in-100 YEAR TYPE HYDROLOGIC CONDITIONS

3/3/2016

INPUT DATA, CONSTANT

SANITARY FLOW CHARACTERISTICS	
AVERAGE DRY WEATHER FLOW (MGD)..	0.32
IRRIGATION AREA CHARACTERISTICS	
EXISTING IRRIGATION AREA (AC)..	29.0
AVERAGE DISTRIBUTION UNIFORMITY (DECIMAL FRACTION)........................	0.94
EFFECTIVE STORAGE PERCOLATION RATE (IN/DAY)........................	0.175

EXISTING STORAGE RESERVOIRS			
CHARACTERISTICS	POND D	FUTURE	TOTAL
CATCHMENT AREA (AC).............	8.2		
WATER SURFACE (AC)...............	2.9		
BOTTOM SURFACE (AC).............	1.3		
STORAGE AVAILABLE (MG).........	7.2		

CLIMATOLOGICAL FACTORS	
CLIMATOLOGICAL DESIGN BASIS	1-in-100 YEAR
DESIGN PRECIP/AVG PRECIP RATIO........................	1.81
OCT-APR EVAP/AVG EVAP RATIO........................	0.75
MAY-SEP EVAP/AVG EVAP RATIO........................	1.00
IRRIGATION AREA SOIL RUNOFF COEFFICIENT	0.20
STORAGE CATCHMENT SOIL RUNOFF COEFF.	0.25

AVERAGE SOIL DEPTH (FT)	0.8
MAXIMUM AVAILABLE SOIL WATER HOLDING CAPACITY (IN)	1.7
MANAGEMENT ALLOWABLE SOIL WATER DEFICIT (%)	50%
RIVER DILUTION RATIO, 1 : ____	20
MAXIMUM RIVER DISCHARGE RATE (MGD)	1.5
MINIMUM RIVER FLOW RATE DISCHARGE THRESHOLD (MGD)	0.15
MAXIMUM ALLOWABLE LAND DISCHARGE RATE (MGD)	1.8

INPUT DATA, MONTHLY VARIABLE

MONTH	ANNUAL	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
DAYS IN MONTH	365	30	31	30	31	31	28	31	30	31	30	31	31
AVERAGE DRY WEATHER FLOW (MGD)		0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32
AVG PRECIP, SAN ANDREAS (IN)	30.60	0.53	1.72	3.82	5.02	5.63	4.74	4.77	2.63	1.20	0.35	0.08	0.11
REFERENCE EVAPOTRANSPIRATION (ETo) (IN)	52.90	5.70	4.06	1.97	1.07	1.00	1.66	3.12	4.72	6.07	7.45	8.46	7.62
WATER SURFACE EVAPORATION COEFFICIENT		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
CROP COEFFICIENT (Kc), GRASS		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
CROP COEFFICIENT (Kc), TREES (OAKS)		1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
WEIGHTED CROP COEFFICIENT FOR SASD SITE		1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03
I/I VOLUME PER MGD of ADWF (MG)		0.00	0.07	0.23	0.63	0.86	0.70	1.19	0.48	0.23	0.02	0.00	0.00
AVERAGE RECENT SASD N.F. CALAVERAS RIVER FLOW (MGD)		0.00	0.00	5.23	17.79	26.30	28.23	38.28	31.63	19.01	7.35	0.20	0.00

CALCULATIONS

CALCULATIONS / MONTH	ANNUAL	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
RAIN-RELATED CALCULATIONS													
PERCENT ANNUAL RAINFALL/MONTH (%)		1.7%	5.6%	12.5%	16.4%	18.4%	15.5%	15.6%	8.6%	3.9%	1.1%	0.3%	0.4%
ESTIMATED SAN ANDREAS RAIN, 1-in-100 YEAR (IN)	55	0.96	3.11	6.91	9.08	10.19	8.58	8.63	4.76	2.17	0.63	0.14	0.20
EFFECTIVE RAIN FOR PLANTS (IN)	44	0.77	2.49	5.53	7.27	8.15	6.86	6.90	3.81	1.74	0.51	0.12	0.16
EVAPORATION-RELATED CALCULATIONS													
EVAPOTRANSPIRATION POTENTIAL (IN) (ETc) (ETo * Weighted Kc)	54	5.84	4.16	2.02	1.10	1.03	1.70	3.20	4.84	6.22	7.64	8.67	7.81
1-in-100 YEAR DESIGN ET POTENTIAL (IN) (ETc * Seasonal Evaporation Ratio)	50	5.84	3.12	1.51	0.82	0.77	1.28	2.40	3.63	6.22	7.64	8.67	7.81
STORAGE RESERVOIR EVAPORATION (IN) (Eto * Water Surface Coefficient)	53	5.70	4.06	1.97	1.07	1.00	1.66	3.12	4.72	6.07	7.45	8.46	7.62
SANITARY-RELATED CALCULATIONS													
AVERAGE DRY WEATHER FLOW VOLUME (MG)	118	9.66	9.98	9.66	9.98	9.98	9.02	9.98	9.66	9.98	9.66	9.98	9.98
AVERAGE I/I FLOW RATE (MGD)		0.00	0.02	0.07	0.20	0.28	0.22	0.38	0.16	0.07	0.01	0.00	0.00
I/I FLOW VOLUME (MG)	43	0.00	0.72	2.20	6.31	8.56	6.27	11.90	4.68	2.31	0.24	0.00	0.00
TOTAL INFLUENT FLOW RATE (MGD)		0.3	0.35	0.40	0.53	0.60	0.55	0.71	0.48	0.40	0.33	0.32	0.32
TOTAL INFLUENT FLOW VOLUME (MG)	161	9.66	10.70	11.86	16.29	18.54	15.28	21.89	14.34	12.29	9.90	9.98	9.98
DESIGN DISCHARGE TO LAND													
AVAILABLE RAIN WATER IN SOIL (IN)		0.00	0.00	1.70	1.70	1.70	1.70	1.70	0.18	0.00	0.00	0.00	0.00
RAIN WATER LOST TO PERCOLATION (IN)		0.00	0.00	1.81	6.17	7.12	5.16	3.71	0.00	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)		5.40	0.67	0.00	0.00	0.00	0.00	0.00	0.00	4.77	7.58	9.10	8.14
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	28	4.25	0.53	0.00	0.00	0.00	0.00	0.00	0.00	3.76	5.97	7.17	6.41
MAX EFFLUENT VOLUME AVAILABLE FOR LAND (MG)		9.66	11.23	17.61	23.49	19.58	16.45	22.87	15.33	12.84	13.73	12.35	9.98
AVAILABLE EFFLUENT APPLIED TO LAND (MG)	28	4.25	0.53	0.00	0.00	0.00	0.00	0.00	0.00	3.76	5.97	7.17	6.41
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.14	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.20	0.23	0.21
EFFLUENT IRRIGATION RATE (IN/MONTH)	36	5.40	0.67	0.00	0.00	0.00	0.00	0.00	0.00	4.77	7.58	9.10	8.14
EXCESS SPRAY DISPOSAL POT., LIMITED (IN) (LIMITED TO 0.175 IN/D)		5.25	5.43	3.44						5.43	5.25	5.43	5.43
EXCESS SPRAY DISPOSAL VOLUME (MG)	28	4.13	4.27	2.71						4.27	4.13	4.27	4.27
DESIGN DISCHARGE TO RIVER													
LOWER RIVER FLOW DISCHARGE THRESHOLD (MGD)				0.15	0.15	0.15	0.15	0.15	0.15				
MAX PERMITTED DISCHARGE RATE (MGD)				1.50	1.50	1.50	1.50	1.50	1.50				
MAX DISCHARGE BASED ON DILUTION (1 IN 20, MGD)				0.26	0.89	1.32	1.41	1.91	1.58				
POTENTIAL 1-in-100 YEAR EFFLUENT DISCHARGE VOLUME (MG)	207			7.84	27.57	40.77	39.53	46.50	45.00				
MAX VOLUME AVAILABLE FOR DISCHARGE AFTER LAND APPLICATION (MG)				17.61	23.49	19.58	16.45	22.87	15.33				
MAX AVAILABLE AGV. DISCHARGE RATE (MGD)				0.59	0.76	0.63	0.59	0.74	0.51				
CONDITION GOVERNING DISCHARGE RATE?				DILUTION	EFFLUENT	EFFLUENT	EFFLUENT	PERMIT	PERMIT				
ALLOWABLE RIVER DISCHARGE RATE (MGD)				0.26	0.76	0.63	0.59	0.74	0.51				
DISCHARGE VOLUME (MG)	106			7.84	23.49	19.58	16.45	22.87	15.33				
DESIGN LOSSES AND GAINS FROM STORAGE													
STORAGE AT BEGINNING OF MONTH (MG)		0.00	0.52	5.76	7.20	1.04	1.17	0.98	0.99	0.55	3.83	2.37	0.00
EFFLUENT STORAGE VOLUME GAIN/LOSS (MG)		1.27	5.90	1.31	-7.20	-1.04	-1.17	-0.98	-0.99	4.26	-0.21	-1.46	-0.70
UNADJUSTED STORAGE VOLUME (MG)		1.27	6.43	7.06	0.00	0.00	0.00	0.00	0.00	4.81	3.62	0.91	-0.70
APPROXIMATE EFFECTIVE RESERVOIR AREA (AC)		2.90	4.34	4.43	2.90	2.90	2.90	2.90	2.90	4.10	3.89	3.25	2.90
EVAPORATIVE LOSS FROM STORAGE (MG)	3	0.45	0.48	0.24	0.00	0.00	0.00	0.00	0.00	0.68	0.79	0.75	0.00
PERCOLATION LOSS FROM STORAGE (MG)	3	0.41	0.64	0.63	0.00	0.00	0.00	0.00	0.00	0.60	0.55	0.48	0.00
RUNOFF TO STORAGE FROM RAIN CATCHMENT AREA (MG)	7	0.11	0.45	1.01	1.04	1.17	0.98	0.99	0.55	0.30	0.09	0.02	0.02
STORAGE AT END OF MONTH (MG)		0.52	5.76	7.20	1.04	1.17	0.98	0.99	0.55	3.83	2.37	0.00	0.00

MAXIMUM STORAGE REQUIRED (MG).. 7.2

TOTAL AVAILABLE STORAGE (MG).. 7.2

SUMMARY

ANNUAL INFLOW (MG)	
WASTEWATER........................	118
INFLOW AND INFILTRATION........................	43
PRECIPITATION INTO RESERVOIR........................	7
TOTAL	168

ANNUAL OUTFLOW POTENTIAL (MG)	
EVAPORATION........................	3
PERCOLATION........................	31
LAND DISPOSAL........................	28
SURFACE WATER DISPOSAL........................	106
TOTAL	168

OVERALL BALANCE	
UNUSED DISPOSAL CAPACITY (MG)........................	95
(MUST NOT BE NEGATIVE)	
UNUSED STORAGE CAPACITY (MG)........................	0
(MUST NOT BE NEGATIVE)	

SAN ANDREAS SANITARY DISTRICT FILE: 0277-1290

WATER BALANCE, FLOW POTENTIAL w/ 7.2 Mgal POND D AND 47 acres DLDA, UNDER 1-in-100 YEAR TYPE HYDROLOGIC CONDITIONS 3/3/2016

INPUT DATA, CONSTANT

SANITARY FLOW CHARACTERISTICS		EXISTING STORAGE RESERVOIRS				CLIMATOLOGICAL FACTORS	
AVERAGE DRY WEATHER FLOW (MGD)......................................	0.41	CHARACTERISTICS	POND D	FUTURE	TOTAL	CLIMATOLOGICAL DESIGN BASIS	1-in-100 YEAR
		CATCHMENT AREA (AC).............	8.2			DESIGN PRECIP/AVG PRECIP RATIO..................	1.81
IRRIGATION AREA CHARACTERISTICS		WATER SURFACE (AC)..............	2.9			OCT-APR EVAP/AVG EVAP RATIO....................	0.75
EXISTING IRRIGATION AREA (AC)..........................	47.0	BOTTOM SURFACE (AC)............	1.3			MAY-SEP EVAP/AVG EVAP RATIO....................	1.00
AVERAGE DISTRIBUTION UNIFORMITY (DECIMAL FRACTION)..................	0.94	STORAGE AVAILABLE (MG).........	7.2			IRRIGATION AREA SOIL RUNOFF COEFFICIENT	0.20
EFFECTIVE STORAGE PERCOLATION RATE (IN/DAY)......................	0.175					STORAGE CATCHMENT SOIL RUNOFF COEFF.	0.25

AVERAGE SOIL DEPTH (FT)	0.8
MAXIMUM AVAILABLE SOIL WATER HOLDING CAPACITY (IN)	1.7
MANAGEMENT ALLOWABLE SOIL WATER DEFICIT (%)	50%
RIVER DILUTION RATIO, 1 : ____	20
MAXIMUM RIVER DISCHARGE RATE (MGD)	1.5
MINIMUM RIVER FLOW RATE DISCHARGE THRESHOLD (MGD)	0.15
MAXIMUM ALLOWABLE LAND DISCHARGE RATE (MGD)	1.8

INPUT DATA, MONTHLY VARIABLE

MONTH	ANNUAL	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
DAYS IN MONTH	365	30	31	30	31	31	28	31	30	31	30	31	31
AVERAGE DRY WEATHER FLOW (MGD)		0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41
AVG PRECIP, SAN ANDREAS (IN)	30.60	0.53	1.72	3.82	5.02	5.63	4.74	4.77	2.63	1.20	0.35	0.08	0.11
REFERENCE EVAPOTRANSPIRATION (ETo) (IN)	52.90	5.70	4.06	1.97	1.07	1.00	1.66	3.12	4.72	6.07	7.45	8.46	7.62
WATER SURFACE EVAPORATION COEFFICIENT		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
CROP COEFFICIENT (Kc), GRASS		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
CROP COEFFICIENT (Kc), TREES (OAKS)		1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
WEIGHTED CROP COEFFICIENT FOR SASD SITE		1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03
I/I VOLUME PER MGD of ADWF (MG)		0.00	0.06	0.18	0.50	0.68	0.55	0.94	0.38	0.18	0.02	0.00	0.00
AVERAGE RECENT SASD N.F. CALAVERAS RIVER FLOW (MGD)		0.00	0.00	5.23	17.79	26.30	28.23	38.28	31.63	19.01	7.35	0.20	0.00

CALCULATIONS

CALCULATIONS / MONTH	ANNUAL	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
RAIN-RELATED CALCULATIONS													
PERCENT ANNUAL RAINFALL/MONTH (%)		1.7%	5.6%	12.5%	16.4%	18.4%	15.5%	15.6%	8.6%	3.9%	1.1%	0.3%	0.4%
ESTIMATED SAN ANDREAS RAIN, 1-in-100 YEAR (IN)	55	0.96	3.11	6.91	9.08	10.19	8.58	8.63	4.76	2.17	0.63	0.14	0.20
EFFECTIVE RAIN FOR PLANTS (IN)	44	0.77	2.49	5.53	7.27	8.15	6.86	6.90	3.81	1.74	0.51	0.12	0.16
EVAPORATION-RELATED CALCULATIONS													
EVAPOTRANSPIRATION POTENTIAL (IN) (ETc) (ETo * Weighted Kc)	54	5.84	4.16	2.02	1.10	1.03	1.70	3.20	4.84	6.22	7.64	8.67	7.81
1-in-100 YEAR DESIGN ET POTENTIAL (IN) (ETc * Seasonal Evaporation Ratio)	50	5.84	3.12	1.51	0.82	0.77	1.28	2.40	3.63	6.22	7.64	8.67	7.81
STORAGE RESERVOIR EVAPORATION (IN) (Eto * Water Surface Coefficient)	53	5.70	4.06	1.97	1.07	1.00	1.66	3.12	4.72	6.07	7.45	8.46	7.62
SANITARY-RELATED CALCULATIONS													
AVERAGE DRY WEATHER FLOW VOLUME (MG)	148	12.20	12.60	12.20	12.60	12.60	11.38	12.60	12.20	12.60	12.20	12.60	12.60
AVERAGE I/I FLOW RATE (MGD)		0.00	0.02	0.07	0.20	0.28	0.22	0.38	0.16	0.07	0.01	0.00	0.00
I/I FLOW VOLUME (MG)	43	0.00	0.72	2.20	6.31	8.56	6.27	11.90	4.68	2.31	0.24	0.00	0.00
TOTAL INFLUENT FLOW RATE (MGD)		0.4	0.43	0.48	0.61	0.68	0.63	0.79	0.56	0.48	0.41	0.41	0.41
TOTAL INFLUENT FLOW VOLUME (MG)	192	12.20	13.33	14.39	18.91	21.16	17.65	24.51	16.88	14.91	12.43	12.60	12.60
DESIGN DISCHARGE TO LAND													
AVAILABLE RAIN WATER IN SOIL (IN)		0.00	0.00	1.70	1.70	1.70	1.70	1.70	0.18	0.00	0.00	0.00	0.00
RAIN WATER LOST TO PERCOLATION (IN)		0.00	0.00	1.81	6.17	7.12	5.16	3.71	0.00	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)		5.40	0.67	0.00	0.00	0.00	0.00	0.00	0.00	4.77	7.58	9.10	8.14
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	46	6.89	0.86	0.00	0.00	0.00	0.00	0.00	0.00	6.09	9.68	11.62	10.39
MAX EFFLUENT VOLUME AVAILABLE FOR LAND (MG)		12.20	13.33	19.29	26.11	22.20	18.82	25.49	17.87	15.46	14.02	12.60	12.60
AVAILABLE EFFLUENT APPLIED TO LAND (MG)	46	6.89	0.86	0.00	0.00	0.00	0.00	0.00	0.00	6.09	9.68	11.62	10.39
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.23	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.32	0.37	0.34
EFFLUENT IRRIGATION RATE (IN/MONTH)	36	5.40	0.67	0.00	0.00	0.00	0.00	0.00	0.00	4.77	7.58	9.10	8.14
EXCESS SPRAY DISPOSAL POT., LIMITED (IN) (LIMITED TO 0.175 IN/D)		5.25	5.43	3.44						5.43	5.25	5.43	5.43
EXCESS SPRAY DISPOSAL VOLUME (MG)	45	6.70	6.92	4.39						6.92	6.70	6.92	6.92
DESIGN DISCHARGE TO RIVER													
LOWER RIVER FLOW DISCHARGE THRESHOLD (MGD)				0.15	0.15	0.15	0.15	0.15	0.15				
MAX PERMITTED DISCHARGE RATE (MGD)				1.50	1.50	1.50	1.50	1.50	1.50				
MAX DISCHARGE BASED ON DILUTION (1 IN 20, MGD)				0.26	0.89	1.32	1.41	1.91	1.58				
POTENTIAL 1-in-100 YEAR EFFLUENT DISCHARGE VOLUME (MG)	207			7.84	27.57	40.77	39.53	46.50	45.00				
MAX VOLUME AVAILABLE FOR DISCHARGE AFTER LAND APPLICATION (MG)				19.29	26.11	22.20	18.82	25.49	17.87				
MAX AVAILABLE AGV. DISCHARGE RATE (MGD)				0.64	0.84	0.72	0.67	0.82	0.60				
CONDITION GOVERNING DISCHARGE RATE?				DILUTION	EFFLUENT	EFFLUENT	EFFLUENT	PERMIT	PERMIT				
ALLOWABLE RIVER DISCHARGE RATE (MGD)				0.26	0.84	0.72	0.67	0.82	0.60				
DISCHARGE VOLUME (MG)	118			7.84	26.11	22.20	18.82	25.49	17.87				
DESIGN LOSSES AND GAINS FROM STORAGE													
STORAGE AT BEGINNING OF MONTH (MG)		0.00	0.00	4.90	7.20	1.04	1.17	0.98	0.99	0.55	1.59	0.00	0.00
EFFLUENT STORAGE VOLUME GAIN/LOSS (MG)		-1.40	5.54	2.16	-7.20	-1.04	-1.17	-0.98	-0.99	1.90	-3.94	-5.94	-4.71
UNADJUSTED STORAGE VOLUME (MG)		-1.40	5.54	7.06	0.00	0.00	0.00	0.00	0.00	2.44	-2.36	-5.94	-4.71
APPROXIMATE EFFECTIVE RESERVOIR AREA (AC)		2.90	4.21	4.43	2.90	2.90	2.90	2.90	2.90	3.65	2.90	2.90	2.90
EVAPORATIVE LOSS FROM STORAGE (MG)	1	0.00	0.46	0.24	0.00	0.00	0.00	0.00	0.00	0.60	0.00	0.00	0.00
PERCOLATION LOSS FROM STORAGE (MG)	2	0.00	0.62	0.63	0.00	0.00	0.00	0.00	0.00	0.54	0.00	0.00	0.00
RUNOFF TO STORAGE FROM RAIN CATCHMENT AREA (MG)	7	0.11	0.44	1.01	1.04	1.17	0.98	0.99	0.55	0.28	0.07	0.02	0.02
STORAGE AT END OF MONTH (MG)		0.00	4.90	7.20	1.04	1.17	0.98	0.99	0.55	1.59	0.00	0.00	0.00

MAXIMUM STORAGE REQUIRED (MG)................................ 7.2

TOTAL AVAILABLE STORAGE (MG)................................ 7.2

SUMMARY

ANNUAL INFLOW (MG)		ANNUAL OUTFLOW POTENTIAL (MG)		OVERALL BALANCE	
WASTEWATER..............................	148	EVAPORATION............................	1	UNUSED DISPOSAL CAPACITY (MG)........................	100
INFLOW AND INFILTRATION..............................	43	PERCOLATION............................	47	(MUST NOT BE NEGATIVE)	
PRECIPITATION INTO RESERVOIR..............................	7	LAND DISPOSAL............................	46	UNUSED STORAGE CAPACITY (MG)........................	0
		SURFACE WATER DISPOSAL............................	118	(MUST NOT BE NEGATIVE)	
TOTAL	198	TOTAL	212		

SAN ANDREAS SANITARY DISTRICT FILE: 0277-1290

WATER BALANCE, FLOW POTENTIAL w/ 7.2 Mgal POND D AND 65 acres DLDA, UNDER 1-in-100 YEAR TYPE HYDROLOGIC CONDITIONS

3/3/2016

INPUT DATA, CONSTANT

SANITARY FLOW CHARACTERISTICS	
AVERAGE DRY WEATHER FLOW (MGD)	0.48

IRRIGATION AREA CHARACTERISTICS	
EXISTING IRRIGATION AREA (AC)	65.0
AVERAGE DISTRIBUTION UNIFORMITY (DECIMAL FRACTION)	0.94
EFFECTIVE STORAGE PERCOLATION RATE (IN/DAY)	0.175

EXISTING STORAGE RESERVOIRS			
CHARACTERISTICS	POND D	FUTURE	TOTAL
CATCHMENT AREA (AC)	8.2		
WATER SURFACE (AC)	2.9		
BOTTOM SURFACE (AC)	1.3		
STORAGE AVAILABLE (MG)	7.2		

CLIMATOLOGICAL FACTORS	
CLIMATOLOGICAL DESIGN BASIS	1-in-100 YEAR
DESIGN PRECIP/AVG PRECIP RATIO	1.81
OCT-APR EVAP/AVG EVAP RATIO	0.75
MAY-SEP EVAP/AVG EVAP RATIO	1.00
IRRIGATION AREA SOIL RUNOFF COEFFICIENT	0.20
STORAGE CATCHMENT SOIL RUNOFF COEFF.	0.25

AVERAGE SOIL DEPTH (FT)	0.8
MAXIMUM AVAILABLE SOIL WATER HOLDING CAPACITY (IN)	1.7
MANAGEMENT ALLOWABLE SOIL WATER DEFICIT (%)	50%
RIVER DILUTION RATIO, 1 : ____	20
MAXIMUM RIVER DISCHARGE RATE (MGD)	1.5
MINIMUM RIVER FLOW RATE DISCHARGE THRESHOLD (MGD)	0.15
MAXIMUM ALLOWABLE LAND DISCHARGE RATE (MGD)	1.8

INPUT DATA, MONTHLY VARIABLE

MONTH	ANNUAL	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
DAYS IN MONTH	365	30	31	30	31	31	28	31	30	31	30	31	31
AVERAGE DRY WEATHER FLOW (MGD)		0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48
AVG PRECIP, SAN ANDREAS (IN)	30.60	0.53	1.72	3.82	5.02	5.63	4.74	4.77	2.63	1.20	0.35	0.08	0.11
REFERENCE EVAPOTRANSPIRATION (ETo) (IN)	52.90	5.70	4.06	1.97	1.07	1.00	1.66	3.12	4.72	6.07	7.45	8.46	7.62
WATER SURFACE EVAPORATION COEFFICIENT		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
CROP COEFFICIENT (Kc), GRASS		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
CROP COEFFICIENT (Kc), TREES (OAKS)		1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
WEIGHTED CROP COEFFICIENT FOR SASD SITE		1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03
I/I VOLUME PER MGD of ADWF (MG)		0.00	0.05	0.15	0.42	0.57	0.46	0.80	0.32	0.15	0.02	0.00	0.00
AVERAGE RECENT SASD N.F. CALAVERAS RIVER FLOW (MGD)		0.00	0.00	5.23	17.79	26.30	28.23	38.28	31.63	19.01	7.35	0.20	0.00

CALCULATIONS

CALCULATIONS / MONTH	ANNUAL	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
RAIN-RELATED CALCULATIONS													
PERCENT ANNUAL RAINFALL/MONTH (%)		1.7%	5.6%	12.5%	16.4%	18.4%	15.5%	15.6%	8.6%	3.9%	1.1%	0.3%	0.4%
ESTIMATED SAN ANDREAS RAIN, 1-in-100 YEAR (IN)	55	0.96	3.11	6.91	9.08	10.19	8.58	8.63	4.76	2.17	0.63	0.14	0.20
EFFECTIVE RAIN FOR PLANTS (IN)	44	0.77	2.49	5.53	7.27	8.15	6.86	6.90	3.81	1.74	0.51	0.12	0.16
EVAPORATION-RELATED CALCULATIONS													
EVAPOTRANSPIRATION POTENTIAL (IN) (ETc) (ETo * Weighted Kc)	54	5.84	4.16	2.02	1.10	1.03	1.70	3.20	4.84	6.22	7.64	8.67	7.81
1-in-100 YEAR DESIGN ET POTENTIAL (IN) (ETc * Seasonal Evaporation Ratio)	50	5.84	3.12	1.51	0.82	0.77	1.28	2.40	3.63	6.22	7.64	8.67	7.81
STORAGE RESERVOIR EVAPORATION (IN) (Eto * Water Surface Coefficient)	53	5.70	4.06	1.97	1.07	1.00	1.66	3.12	4.72	6.07	7.45	8.46	7.62
SANITARY-RELATED CALCULATIONS													
AVERAGE DRY WEATHER FLOW VOLUME (MG)	176	14.48	14.96	14.48	14.96	14.96	13.51	14.96	14.48	14.96	14.48	14.96	14.96
AVERAGE I/I FLOW RATE (MGD)		0.00	0.02	0.07	0.20	0.28	0.22	0.38	0.16	0.07	0.01	0.00	0.00
I/I FLOW VOLUME (MG)	43	0.00	0.72	2.20	6.31	8.56	6.27	11.90	4.68	2.31	0.24	0.00	0.00
TOTAL INFLUENT FLOW RATE (MGD)		0.5	0.51	0.56	0.69	0.76	0.71	0.87	0.64	0.56	0.49	0.48	0.48
TOTAL INFLUENT FLOW VOLUME (MG)	219	14.48	15.68	16.68	21.27	23.52	19.78	26.87	19.16	17.27	14.72	14.96	14.96
DESIGN DISCHARGE TO LAND													
AVAILABLE RAIN WATER IN SOIL (IN)		0.00	0.00	1.70	1.70	1.70	1.70	1.70	0.18	0.00	0.00	0.00	0.00
RAIN WATER LOST TO PERCOLATION (IN)		0.00	0.00	1.81	6.17	7.12	5.16	3.71	0.00	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)		5.40	0.67	0.00	0.00	0.00	0.00	0.00	0.00	4.77	7.58	9.10	8.14
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	63	9.53	1.19	0.00	0.00	0.00	0.00	0.00	0.00	8.42	13.39	16.06	14.37
MAX EFFLUENT VOLUME AVAILABLE FOR LAND (MG)		14.48	15.68	20.97	28.47	24.94	20.95	27.85	20.15	17.82	14.79	14.96	14.96
AVAILABLE EFFLUENT APPLIED TO LAND (MG)	62	9.53	1.19	0.00	0.00	0.00	0.00	0.00	0.00	8.42	13.39	14.96	14.37
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.32	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.45	0.48	0.46
EFFLUENT IRRIGATION RATE (IN/MONTH)	35	5.40	0.67	0.00	0.00	0.00	0.00	0.00	0.00	4.77	7.58	8.48	8.14
EXCESS SPRAY DISPOSAL POT., LIMITED (IN) (LIMITED TO 0.175 IN/D)		5.25	5.43	3.44						5.43	5.25	5.43	5.43
EXCESS SPRAY DISPOSAL VOLUME (MG)	63	9.27	9.57	6.07						9.57	9.27	9.57	9.57
DESIGN DISCHARGE TO RIVER													
LOWER RIVER FLOW DISCHARGE THRESHOLD (MGD)				0.15	0.15	0.15	0.15	0.15	0.15				
MAX PERMITTED DISCHARGE RATE (MGD)				1.50	1.50	1.50	1.50	1.50	1.50				
MAX DISCHARGE BASED ON DILUTION (1 IN 20, MGD)				0.26	0.89	1.32	1.41	1.91	1.58				
POTENTIAL 1-in-100 YEAR EFFLUENT DISCHARGE VOLUME (MG)	207			7.84	27.57	40.77	39.53	46.50	45.00				
MAX VOLUME AVAILABLE FOR DISCHARGE AFTER LAND APPLICATION (MG)				20.97	28.47	24.94	20.95	27.85	20.15				
MAX AVAILABLE AGV. DISCHARGE RATE (MGD)				0.70	0.92	0.80	0.75	0.90	0.67				
CONDITION GOVERNING DISCHARGE RATE?				DILUTION	DILUTION	EFFLUENT	EFFLUENT	PERMIT	PERMIT				
ALLOWABLE RIVER DISCHARGE RATE (MGD)				0.26	0.89	0.80	0.75	0.90	0.67				
DISCHARGE VOLUME (MG)	129			7.84	27.57	24.94	20.95	27.85	20.15				
DESIGN LOSSES AND GAINS FROM STORAGE													
STORAGE AT BEGINNING OF MONTH (MG)		0.00	0.00	4.30	7.20	1.43	1.17	0.98	0.99	0.55	0.07	0.00	0.00
EFFLUENT STORAGE VOLUME GAIN/LOSS (MG)		-4.32	4.92	2.76	-6.31	-1.43	-1.17	-0.98	-0.99	-0.73	-7.93	-9.57	-8.98
UNADJUSTED STORAGE VOLUME (MG)		-4.32	4.92	7.06	0.89	0.00	0.00	0.00	0.00	-0.18	-7.86	-9.57	-8.98
APPROXIMATE EFFECTIVE RESERVOIR AREA (AC)		2.90	4.12	4.43	3.24	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90
EVAPORATIVE LOSS FROM STORAGE (MG)	1	0.00	0.45	0.24	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERCOLATION LOSS FROM STORAGE (MG)	2	0.00	0.61	0.63	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF TO STORAGE FROM RAIN CATCHMENT AREA (MG)	7	0.11	0.43	1.01	1.11	1.17	0.98	0.99	0.55	0.25	0.07	0.02	0.02
STORAGE AT END OF MONTH (MG)		0.00	4.30	7.20	1.43	1.17	0.98	0.99	0.55	0.07	0.00	0.00	0.00

MAXIMUM STORAGE REQUIRED (MG) 7.2

TOTAL AVAILABLE STORAGE (MG) 7.2

SUMMARY

ANNUAL INFLOW (MG)	
WASTEWATER	176
INFLOW AND INFILTRATION	43
PRECIPITATION INTO RESERVOIR	7
TOTAL	226

ANNUAL OUTFLOW POTENTIAL (MG)	
EVAPORATION	1
PERCOLATION	65
LAND DISPOSAL	62
SURFACE WATER DISPOSAL	129
TOTAL	257

OVERALL BALANCE	
UNUSED DISPOSAL CAPACITY (MG) (MUST NOT BE NEGATIVE)	107
UNUSED STORAGE CAPACITY (MG) (MUST NOT BE NEGATIVE)	0

SAN ANDREAS SANITARY DISTRICT FILE: 0277-1290

WATER BALANCE, FLOW POTENTIAL w/ 14.8 Mgal POND D AND 29 acres DLDA, UNDER 1-in-100 YEAR TYPE HYDROLOGIC CONDITIONS

3/3/2016

INPUT DATA, CONSTANT

SANITARY FLOW CHARACTERISTICS	
AVERAGE DRY WEATHER FLOW (MGD)..	0.41

IRRIGATION AREA CHARACTERISTICS	
EXISTING IRRIGATION AREA (AC)..	29.0
AVERAGE DISTRIBUTION UNIFORMITY (DECIMAL FRACTION)........................	0.94
EFFECTIVE STORAGE PERCOLATION RATE (IN/DAY)........................	0.175

EXISTING STORAGE RESERVOIRS			
CHARACTERISTICS	POND D	FUTURE	TOTAL
CATCHMENT AREA (AC).............	8.2		
WATER SURFACE (AC)...............	2.9		
BOTTOM SURFACE (AC)............	1.3		
STORAGE AVAILABLE (MG).........	14.8		

CLIMATOLOGICAL FACTORS	
CLIMATOLOGICAL DESIGN BASIS	1-in-100 YEAR
DESIGN PRECIP/AVG PRECIP RATIO........................	1.81
OCT-APR EVAP/AVG EVAP RATIO........................	0.75
MAY-SEP EVAP/AVG EVAP RATIO........................	1.00
IRRIGATION AREA SOIL RUNOFF COEFFICIENT	0.20
STORAGE CATCHMENT SOIL RUNOFF COEFF.	0.25

AVERAGE SOIL DEPTH (FT)	0.8
MAXIMUM AVAILABLE SOIL WATER HOLDING CAPACITY (IN)	1.7
MANAGEMENT ALLOWABLE SOIL WATER DEFICIT (%)	50%
RIVER DILUTION RATIO, 1 : ____	20
MAXIMUM RIVER DISCHARGE RATE (MGD)	1.5
MINIMUM RIVER FLOW RATE DISCHARGE THRESHOLD (MGD)	0.15
MAXIMUM ALLOWABLE LAND DISCHARGE RATE (MGD)	1.8

INPUT DATA, MONTHLY VARIABLE

MONTH	ANNUAL	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
DAYS IN MONTH	365	30	31	30	31	31	28	31	30	31	30	31	31
AVERAGE DRY WEATHER FLOW (MGD)		0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41
AVG PRECIP, SAN ANDREAS (IN)	30.60	0.53	1.72	3.82	5.02	5.63	4.74	4.77	2.63	1.20	0.35	0.08	0.11
REFERENCE EVAPOTRANSPIRATION (ETo) (IN)	52.90	5.70	4.06	1.97	1.07	1.00	1.66	3.12	4.72	6.07	7.45	8.46	7.62
WATER SURFACE EVAPORATION COEFFICIENT		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
CROP COEFFICIENT (Kc), GRASS		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
CROP COEFFICIENT (Kc), TREES (OAKS)		1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
WEIGHTED CROP COEFFICIENT FOR SASD SITE		1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03
I/I VOLUME PER MGD of ADWF (MG)		0.00	0.06	0.18	0.50	0.68	0.55	0.94	0.38	0.18	0.02	0.00	0.00
AVERAGE RECENT SASD N.F. CALAVERAS RIVER FLOW (MGD)		0.00	0.00	5.23	17.79	26.30	28.23	38.28	31.63	19.01	7.35	0.20	0.00

CALCULATIONS

CALCULATIONS / MONTH	ANNUAL	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
RAIN-RELATED CALCULATIONS													
PERCENT ANNUAL RAINFALL/MONTH (%)		1.7%	5.6%	12.5%	16.4%	18.4%	15.5%	15.6%	8.6%	3.9%	1.1%	0.3%	0.4%
ESTIMATED SAN ANDREAS RAIN, 1-in-100 YEAR (IN)	55	0.96	3.11	6.91	9.08	10.19	8.58	8.63	4.76	2.17	0.63	0.14	0.20
EFFECTIVE RAIN FOR PLANTS (IN)	44	0.77	2.49	5.53	7.27	8.15	6.86	6.90	3.81	1.74	0.51	0.12	0.16
EVAPORATION-RELATED CALCULATIONS													
EVAPOTRANSPIRATION POTENTIAL (IN) (ETc) (ETo * Weighted Kc)	54	5.84	4.16	2.02	1.10	1.03	1.70	3.20	4.84	6.22	7.64	8.67	7.81
1-in-100 YEAR DESIGN ET POTENTIAL (IN) (ETc * Seasonal Evaporation Ratio)	50	5.84	3.12	1.51	0.82	0.77	1.28	2.40	3.63	6.22	7.64	8.67	7.81
STORAGE RESERVOIR EVAPORATION (IN) (Eto * Water Surface Coefficient)	53	5.70	4.06	1.97	1.07	1.00	1.66	3.12	4.72	6.07	7.45	8.46	7.62
SANITARY-RELATED CALCULATIONS													
AVERAGE DRY WEATHER FLOW VOLUME (MG)	149	12.22	12.63	12.22	12.63	12.63	11.41	12.63	12.22	12.63	12.22	12.63	12.63
AVERAGE I/I FLOW RATE (MGD)		0.00	0.02	0.07	0.20	0.28	0.22	0.38	0.16	0.07	0.01	0.00	0.00
I/I FLOW VOLUME (MG)	43	0.00	0.72	2.20	6.31	8.56	6.27	11.90	4.68	2.31	0.24	0.00	0.00
TOTAL INFLUENT FLOW RATE (MGD)		0.4	0.43	0.48	0.61	0.68	0.63	0.79	0.56	0.48	0.42	0.41	0.41
TOTAL INFLUENT FLOW VOLUME (MG)	192	12.22	13.35	14.42	18.94	21.19	17.68	24.54	16.91	14.94	12.46	12.63	12.63
DESIGN DISCHARGE TO LAND													
AVAILABLE RAIN WATER IN SOIL (IN)		0.00	0.00	1.70	1.70	1.70	1.70	1.70	0.18	0.00	0.00	0.00	0.00
RAIN WATER LOST TO PERCOLATION (IN)		0.00	0.00	1.81	6.17	7.12	5.16	3.71	0.00	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)		5.40	0.67	0.00	0.00	0.00	0.00	0.00	0.00	4.77	7.58	9.10	8.14
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	28	4.25	0.53	0.00	0.00	0.00	0.00	0.00	0.00	3.76	5.97	7.17	6.41
MAX EFFLUENT VOLUME AVAILABLE FOR LAND (MG)		12.22	16.44	25.26	33.74	27.89	18.84	25.52	17.90	15.48	18.84	19.86	19.34
AVAILABLE EFFLUENT APPLIED TO LAND (MG)	28	4.25	0.53	0.00	0.00	0.00	0.00	0.00	0.00	3.76	5.97	7.17	6.41
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.14	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.20	0.23	0.21
EFFLUENT IRRIGATION RATE (IN/MONTH)	36	5.40	0.67	0.00	0.00	0.00	0.00	0.00	0.00	4.77	7.58	9.10	8.14
EXCESS SPRAY DISPOSAL POT., LIMITED (IN) (LIMITED TO 0.175 IN/D)		5.25	5.43	3.44						5.43	5.25	5.43	5.43
EXCESS SPRAY DISPOSAL VOLUME (MG)	28	4.13	4.27	2.71						4.27	4.13	4.27	4.27
DESIGN DISCHARGE TO RIVER													
LOWER RIVER FLOW DISCHARGE THRESHOLD (MGD)				0.15	0.15	0.15	0.15	0.15	0.15				
MAX PERMITTED DISCHARGE RATE (MGD)				1.50	1.50	1.50	1.50	1.50	1.50				
MAX DISCHARGE BASED ON DILUTION (1 IN 20, MGD)				0.26	0.89	1.32	1.41	1.91	1.58				
POTENTIAL 1-in-100 YEAR EFFLUENT DISCHARGE VOLUME (MG)	207			7.84	27.57	40.77	39.53	46.50	45.00				
MAX VOLUME AVAILABLE FOR DISCHARGE AFTER LAND APPLICATION (MG)				25.26	33.74	27.89	18.84	25.52	17.90				
MAX AVAILABLE AGV. DISCHARGE RATE (MGD)				0.84	1.09	0.90	0.67	0.82	0.60				
CONDITION GOVERNING DISCHARGE RATE?				DILUTION	DILUTION	EFFLUENT	EFFLUENT	PERMIT	PERMIT				
ALLOWABLE RIVER DISCHARGE RATE (MGD)				0.26	0.89	0.90	0.67	0.82	0.60				
DISCHARGE VOLUME (MG)	126			7.84	27.57	27.89	18.84	25.52	17.90				
DESIGN LOSSES AND GAINS FROM STORAGE													
STORAGE AT BEGINNING OF MONTH (MG)		0.00	3.09	10.84	14.80	6.70	1.17	0.98	0.99	0.55	6.38	7.23	6.71
EFFLUENT STORAGE VOLUME GAIN/LOSS (MG)		3.84	8.55	3.87	-8.64	-6.70	-1.17	-0.98	-0.99	6.91	2.36	1.19	1.95
UNADJUSTED STORAGE VOLUME (MG)		3.84	11.64	14.71	6.16	0.00	0.00	0.00	0.00	7.46	8.73	8.42	8.66
APPROXIMATE EFFECTIVE RESERVOIR AREA (AC)		2.90	4.99	5.36	4.30	2.90	2.90	2.90	2.90	4.48	4.64	4.60	4.63
EVAPORATIVE LOSS FROM STORAGE (MG)	5	0.45	0.55	0.29	0.13	0.00	0.00	0.00	0.00	0.74	0.94	1.06	0.96
PERCOLATION LOSS FROM STORAGE (MG)	5	0.41	0.74	0.76	0.63	0.00	0.00	0.00	0.00	0.66	0.66	0.68	0.68
RUNOFF TO STORAGE FROM RAIN CATCHMENT AREA (MG)	7	0.11	0.49	1.14	1.30	1.17	0.98	0.99	0.55	0.32	0.10	0.02	0.03
STORAGE AT END OF MONTH (MG)		3.09	10.84	14.80	6.70	1.17	0.98	0.99	0.55	6.38	7.23	6.71	7.04

MAXIMUM STORAGE REQUIRED (MG).. 14.8

TOTAL AVAILABLE STORAGE (MG).. 14.8

SUMMARY

ANNUAL INFLOW (MG)	
WASTEWATER..	149
INFLOW AND INFILTRATION...................................	43
PRECIPITATION INTO RESERVOIR..	7
TOTAL	199

ANNUAL OUTFLOW POTENTIAL (MG)	
EVAPORATION..	5
PERCOLATION..	33
LAND DISPOSAL..	28
SURFACE WATER DISPOSAL..	126
TOTAL	192

OVERALL BALANCE	
UNUSED DISPOSAL CAPACITY (MG)..	64
(MUST NOT BE NEGATIVE)	
UNUSED STORAGE CAPACITY (MG)..	0
(MUST NOT BE NEGATIVE)	

SAN ANDREAS SANITARY DISTRICT — FILE: 0277-1290

WATER BALANCE, FLOW POTENTIAL w/ 14.8 Mgal POND D AND 47 acres DLDA, UNDER 1-in-100 YEAR TYPE HYDROLOGIC CONDITIONS

3/3/2016

INPUT DATA, CONSTANT

SANITARY FLOW CHARACTERISTICS

AVERAGE DRY WEATHER FLOW (MGD)........	0.52

IRRIGATION AREA CHARACTERISTICS

EXISTING IRRIGATION AREA (AC)........	47.0
AVERAGE DISTRIBUTION UNIFORMITY (DECIMAL FRACTION)........	0.94
EFFECTIVE STORAGE PERCOLATION RATE (IN/DAY)........	0.175

EXISTING STORAGE RESERVOIRS

CHARACTERISTICS	POND D	FUTURE	TOTAL
CATCHMENT AREA (AC)........	8.2		
WATER SURFACE (AC)........	2.9		
BOTTOM SURFACE (AC)........	1.3		
STORAGE AVAILABLE (MG)........	14.8		

CLIMATOLOGICAL FACTORS

CLIMATOLOGICAL DESIGN BASIS	1-in-100 YEAR
DESIGN PRECIP/AVG PRECIP RATIO........	1.81
OCT-APR EVAP/AVG EVAP RATIO........	0.75
MAY-SEP EVAP/AVG EVAP RATIO........	1.00
IRRIGATION AREA SOIL RUNOFF COEFFICIENT	0.20
STORAGE CATCHMENT SOIL RUNOFF COEFF.	0.25

AVERAGE SOIL DEPTH (FT)	0.8
MAXIMUM AVAILABLE SOIL WATER HOLDING CAPACITY (IN)	1.7
MANAGEMENT ALLOWABLE SOIL WATER DEFICIT (%)	50%
RIVER DILUTION RATIO, 1 : ____	20
MAXIMUM RIVER DISCHARGE RATE (MGD)	1.5
MINIMUM RIVER FLOW RATE DISCHARGE THRESHOLD (MGD)	0.15
MAXIMUM ALLOWABLE LAND DISCHARGE RATE (MGD)	1.8

INPUT DATA, MONTHLY VARIABLE

MONTH	ANNUAL	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
DAYS IN MONTH	365	30	31	30	31	31	28	31	30	31	30	31	31
AVERAGE DRY WEATHER FLOW (MGD)		0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52
AVG PRECIP, SAN ANDREAS (IN)	30.60	0.53	1.72	3.82	5.02	5.63	4.74	4.77	2.63	1.20	0.35	0.08	0.11
REFERENCE EVAPOTRANSPIRATION (ETo) (IN)	52.90	5.70	4.06	1.97	1.07	1.00	1.66	3.12	4.72	6.07	7.45	8.46	7.62
WATER SURFACE EVAPORATION COEFFICIENT		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
CROP COEFFICIENT (Kc), GRASS		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
CROP COEFFICIENT (Kc), TREES (OAKS)		1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
WEIGHTED CROP COEFFICIENT FOR SASD SITE		1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03
I/I VOLUME PER MGD of ADWF (MG)		0.00	0.05	0.14	0.39	0.54	0.43	0.75	0.30	0.14	0.02	0.00	0.00
AVERAGE RECENT SASD N.F. CALAVERAS RIVER FLOW (MGD)		0.00	0.00	5.23	17.79	26.30	28.23	38.28	31.63	19.01	7.35	0.20	0.00

CALCULATIONS

CALCULATIONS / MONTH	ANNUAL	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
RAIN-RELATED CALCULATIONS													
PERCENT ANNUAL RAINFALL/MONTH (%)		1.7%	5.6%	12.5%	16.4%	18.4%	15.5%	15.6%	8.6%	3.9%	1.1%	0.3%	0.4%
ESTIMATED SAN ANDREAS RAIN, 1-in-100 YEAR (IN)	55	0.96	3.11	6.91	9.08	10.19	8.58	8.63	4.76	2.17	0.63	0.14	0.20
EFFECTIVE RAIN FOR PLANTS (IN)	44	0.77	2.49	5.53	7.27	8.15	6.86	6.90	3.81	1.74	0.51	0.12	0.16
EVAPORATION-RELATED CALCULATIONS													
EVAPOTRANSPIRATION POTENTIAL (IN) (ETc) (ETo * Weighted Kc)	54	5.84	4.16	2.02	1.10	1.03	1.70	3.20	4.84	6.22	7.64	8.67	7.81
1-in-100 YEAR DESIGN ET POTENTIAL (IN) (ETc * Seasonal Evaporation Ratio)	50	5.84	3.12	1.51	0.82	0.77	1.28	2.40	3.63	6.22	7.64	8.67	7.81
STORAGE RESERVOIR EVAPORATION (IN) (Eto * Water Surface Coefficient)	53	5.70	4.06	1.97	1.07	1.00	1.66	3.12	4.72	6.07	7.45	8.46	7.62
SANITARY-RELATED CALCULATIONS													
AVERAGE DRY WEATHER FLOW VOLUME (MG)	188	15.46	15.98	15.46	15.98	15.98	14.43	15.98	15.46	15.98	15.46	15.98	15.98
AVERAGE I/I FLOW RATE (MGD)		0.00	0.02	0.07	0.20	0.28	0.22	0.38	0.16	0.07	0.01	0.00	0.00
I/I FLOW VOLUME (MG)	43	0.00	0.72	2.20	6.31	8.56	6.27	11.90	4.68	2.31	0.24	0.00	0.00
TOTAL INFLUENT FLOW RATE (MGD)		0.5	0.54	0.59	0.72	0.79	0.74	0.90	0.67	0.59	0.52	0.52	0.52
TOTAL INFLUENT FLOW VOLUME (MG)	231	15.46	16.70	17.66	22.29	24.54	20.70	27.88	20.15	18.29	15.70	15.98	15.98
DESIGN DISCHARGE TO LAND													
AVAILABLE RAIN WATER IN SOIL (IN)		0.00	0.00	1.70	1.70	1.70	1.70	1.70	0.18	0.00	0.00	0.00	0.00
RAIN WATER LOST TO PERCOLATION (IN)		0.00	0.00	1.81	6.17	7.12	5.16	3.71	0.00	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)		5.40	0.67	0.00	0.00	0.00	0.00	0.00	0.00	4.77	7.58	9.10	8.14
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	46	6.89	0.86	0.00	0.00	0.00	0.00	0.00	0.00	6.09	9.68	11.62	10.39
MAX EFFLUENT VOLUME AVAILABLE FOR LAND (MG)		15.46	17.82	26.94	37.09	34.59	21.87	28.87	21.14	18.83	20.50	18.82	15.98
AVAILABLE EFFLUENT APPLIED TO LAND (MG)	46	6.89	0.86	0.00	0.00	0.00	0.00	0.00	0.00	6.09	9.68	11.62	10.39
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.23	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.32	0.37	0.34
EFFLUENT IRRIGATION RATE (IN/MONTH)	36	5.40	0.67	0.00	0.00	0.00	0.00	0.00	0.00	4.77	7.58	9.10	8.14
EXCESS SPRAY DISPOSAL POT., LIMITED (IN) (LIMITED TO 0.175 IN/D)		5.25	5.43	3.44						5.43	5.25	5.43	5.43
EXCESS SPRAY DISPOSAL VOLUME (MG)	45	6.70	6.92	4.39						6.92	6.70	6.92	6.92
DESIGN DISCHARGE TO RIVER													
LOWER RIVER FLOW DISCHARGE THRESHOLD (MGD)				0.15	0.15	0.15	0.15	0.15	0.15				
MAX PERMITTED DISCHARGE RATE (MGD)				1.50	1.50	1.50	1.50	1.50	1.50				
MAX DISCHARGE BASED ON DILUTION (1 IN 20, MGD)				0.26	0.89	1.32	1.41	1.91	1.58				
POTENTIAL 1-in-100 YEAR EFFLUENT DISCHARGE VOLUME (MG)	207			7.84	27.57	40.77	39.53	46.50	45.00				
MAX VOLUME AVAILABLE FOR DISCHARGE AFTER LAND APPLICATION (MG)				26.94	37.09	34.59	21.87	28.87	21.14				
MAX AVAILABLE AGV. DISCHARGE RATE (MGD)				0.90	1.20	1.12	0.78	0.93	0.70				
CONDITION GOVERNING DISCHARGE RATE?				DILUTION	DILUTION	EFFLUENT	EFFLUENT	PERMIT	PERMIT				
ALLOWABLE RIVER DISCHARGE RATE (MGD)				0.26	0.89	1.12	0.78	0.93	0.70				
DISCHARGE VOLUME (MG)	142			7.84	27.57	34.59	21.87	28.87	21.14				
DESIGN LOSSES AND GAINS FROM STORAGE													
STORAGE AT BEGINNING OF MONTH (MG)		0.00	1.12	9.28	14.80	10.06	1.17	0.98	0.99	0.55	4.80	2.84	0.00
EFFLUENT STORAGE VOLUME GAIN/LOSS (MG)		1.87	8.92	5.43	-5.29	-10.06	-1.17	-0.98	-0.99	5.28	-0.68	-2.56	-1.33
UNADJUSTED STORAGE VOLUME (MG)		1.87	10.04	14.71	9.51	0.00	0.00	0.00	0.00	5.82	4.13	0.28	-1.33
APPROXIMATE EFFECTIVE RESERVOIR AREA (AC)		2.90	4.80	5.36	4.74	2.90	2.90	2.90	2.90	4.25	3.98	3.05	2.90
EVAPORATIVE LOSS FROM STORAGE (MG)	4	0.45	0.53	0.29	0.14	0.00	0.00	0.00	0.00	0.70	0.81	0.70	0.00
PERCOLATION LOSS FROM STORAGE (MG)	4	0.41	0.71	0.76	0.70	0.00	0.00	0.00	0.00	0.63	0.57	0.45	0.00
RUNOFF TO STORAGE FROM RAIN CATCHMENT AREA (MG)	7	0.11	0.48	1.14	1.38	1.17	0.98	0.99	0.55	0.31	0.09	0.02	0.02
STORAGE AT END OF MONTH (MG)		1.12	9.28	14.80	10.06	1.17	0.98	0.99	0.55	4.80	2.84	0.00	0.00

MAXIMUM STORAGE REQUIRED (MG)........ 14.8

TOTAL AVAILABLE STORAGE (MG)........ 14.8

SUMMARY

ANNUAL INFLOW (MG)		ANNUAL OUTFLOW POTENTIAL (MG)		OVERALL BALANCE	
WASTEWATER........	188	EVAPORATION........	4	UNUSED DISPOSAL CAPACITY (MG)........	60
INFLOW AND INFILTRATION........	43	PERCOLATION........	49	(MUST NOT BE NEGATIVE)	
PRECIPITATION INTO RESERVOIR........	7	LAND DISPOSAL........	46	UNUSED STORAGE CAPACITY (MG)........	0
		SURFACE WATER DISPOSAL........	142	(MUST NOT BE NEGATIVE)	
TOTAL	238	TOTAL	240		

SAN ANDREAS SANITARY DISTRICT FILE: 0277-1290

WATER BALANCE, PHASE B w/ 14.8 Mgal POND D, UNDER 1-in-100 YEAR TYPE HYDROLOGIC CONDITIONS

3/3/2016

INPUT DATA, CONSTANT

SANITARY FLOW CHARACTERISTICS	
AVERAGE DRY WEATHER FLOW (MGD)..	0.55
IRRIGATION AREA CHARACTERISTICS	
EXISTING IRRIGATION AREA (AC)..	52.8
AVERAGE DISTRIBUTION UNIFORMITY (DECIMAL FRACTION)..	0.94
EFFECTIVE STORAGE PERCOLATION RATE (IN/DAY)...	0.175

EXISTING STORAGE RESERVOIRS			
CHARACTERISTICS	POND D	FUTURE	TOTAL
CATCHMENT AREA (AC).............	8.2		
WATER SURFACE (AC)...............	2.9		
BOTTOM SURFACE (AC)............	1.3		
STORAGE AVAILABLE (MG).........	14.8		

CLIMATOLOGICAL FACTORS	
CLIMATOLOGICAL DESIGN BASIS	1-in-100 YEAR
DESIGN PRECIP/AVG PRECIP RATIO...	1.81
OCT-APR EVAP/AVG EVAP RATIO..	0.75
MAY-SEP EVAP/AVG EVAP RATIO...	1.00
IRRIGATION AREA SOIL RUNOFF COEFFICIENT	0.20
STORAGE CATCHMENT SOIL RUNOFF COEFF.	0.25

AVERAGE SOIL DEPTH (FT)	0.8
MAXIMUM AVAILABLE SOIL WATER HOLDING CAPACITY (IN)	1.7
MANAGEMENT ALLOWABLE SOIL WATER DEFICIT (%)	50%
RIVER DILUTION RATIO, 1 : ____	20
MAXIMUM RIVER DISCHARGE RATE (MGD)	1.5
MINIMUM RIVER FLOW RATE DISCHARGE THRESHOLD (MGD)	0.15
MAXIMUM ALLOWABLE LAND DISCHARGE RATE (MGD)	1.8

INPUT DATA, MONTHLY VARIABLE

MONTH	ANNUAL	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
DAYS IN MONTH	365	30	31	30	31	31	28	31	30	31	30	31	31
AVERAGE DRY WEATHER FLOW (MGD)		0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
AVG PRECIP, SAN ANDREAS (IN)	30.60	0.53	1.72	3.82	5.02	5.63	4.74	4.77	2.63	1.20	0.35	0.08	0.11
REFERENCE EVAPOTRANSPIRATION (ETo) (IN)	52.90	5.70	4.06	1.97	1.07	1.00	1.66	3.12	4.72	6.07	7.45	8.46	7.62
WATER SURFACE EVAPORATION COEFFICIENT		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
CROP COEFFICIENT (Kc), GRASS		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
CROP COEFFICIENT (Kc), TREES (OAKS)		1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
WEIGHTED CROP COEFFICIENT FOR SASD SITE		1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03
I/I VOLUME PER MGD of ADWF (MG)		0.00	0.04	0.13	0.37	0.50	0.41	0.70	0.28	0.14	0.01	0.00	0.00
AVERAGE RECENT SASD N.F. CALAVERAS RIVER FLOW (MGD)		0.00	0.00	5.23	17.79	26.30	28.23	38.28	31.63	19.01	7.35	0.20	0.00

CALCULATIONS

CALCULATIONS / MONTH	ANNUAL	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
RAIN-RELATED CALCULATIONS													
PERCENT ANNUAL RAINFALL/MONTH (%)		1.7%	5.6%	12.5%	16.4%	18.4%	15.5%	15.6%	8.6%	3.9%	1.1%	0.3%	0.4%
ESTIMATED SAN ANDREAS RAIN, 1-in-100 YEAR (IN)	55	0.96	3.11	6.91	9.08	10.19	8.58	8.63	4.76	2.17	0.63	0.14	0.20
EFFECTIVE RAIN FOR PLANTS (IN)	44	0.77	2.49	5.53	7.27	8.15	6.86	6.90	3.81	1.74	0.51	0.12	0.16
EVAPORATION-RELATED CALCULATIONS													
EVAPOTRANSPIRATION POTENTIAL (IN) (ETc) (ETo * Weighted Kc)	54	5.84	4.16	2.02	1.10	1.03	1.70	3.20	4.84	6.22	7.64	8.67	7.81
1-in-100 YEAR DESIGN ET POTENTIAL (IN) (ETc * Seasonal Evaporation Ratio)	50	5.84	3.12	1.51	0.82	0.77	1.28	2.40	3.63	6.22	7.64	8.67	7.81
STORAGE RESERVOIR EVAPORATION (IN) (Eto * Water Surface Coefficient)	53	5.70	4.06	1.97	1.07	1.00	1.66	3.12	4.72	6.07	7.45	8.46	7.62
SANITARY-RELATED CALCULATIONS													
AVERAGE DRY WEATHER FLOW VOLUME (MG)	201	16.50	17.05	16.50	17.05	17.05	15.40	17.05	16.50	17.05	16.50	17.05	17.05
AVERAGE I/I FLOW RATE (MGD)		0.00	0.02	0.07	0.20	0.28	0.22	0.38	0.16	0.07	0.01	0.00	0.00
I/I FLOW VOLUME (MG)	43	0.00	0.72	2.20	6.31	8.56	6.27	11.90	4.68	2.31	0.24	0.00	0.00
TOTAL INFLUENT FLOW RATE (MGD)		0.6	0.57	0.62	0.75	0.83	0.77	0.93	0.71	0.62	0.56	0.55	0.55
TOTAL INFLUENT FLOW VOLUME (MG)	244	16.50	17.77	18.70	23.36	25.61	21.67	28.95	21.18	19.36	16.74	17.05	17.05
DESIGN DISCHARGE TO LAND													
AVAILABLE RAIN WATER IN SOIL (IN)		0.00	0.00	1.70	1.70	1.70	1.70	1.70	0.18	0.00	0.00	0.00	0.00
RAIN WATER LOST TO PERCOLATION (IN)		0.00	0.00	1.81	6.17	7.12	5.16	3.71	0.00	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)		5.40	0.67	0.00	0.00	0.00	0.00	0.00	0.00	4.77	7.58	9.10	8.14
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	51	7.73	0.96	0.00	0.00	0.00	0.00	0.00	0.00	6.83	10.87	13.04	11.66
MAX EFFLUENT VOLUME AVAILABLE FOR LAND (MG)		16.50	18.27	27.48	38.16	36.74	22.84	29.94	22.17	19.90	21.04	18.51	17.05
AVAILABLE EFFLUENT APPLIED TO LAND (MG)	51	7.73	0.96	0.00	0.00	0.00	0.00	0.00	0.00	6.83	10.87	13.04	11.66
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.26	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.36	0.42	0.38
EFFLUENT IRRIGATION RATE (IN/MONTH)	36	5.40	0.67	0.00	0.00	0.00	0.00	0.00	0.00	4.77	7.58	9.10	8.14
EXCESS SPRAY DISPOSAL POT., LIMITED (IN) (LIMITED TO 0.175 IN/D)		5.25	5.43	3.44						5.43	5.25	5.43	5.43
EXCESS SPRAY DISPOSAL VOLUME (MG)	51	7.52	7.77	4.93						7.77	7.52	7.77	7.77
DESIGN DISCHARGE TO RIVER													
LOWER RIVER FLOW DISCHARGE THRESHOLD (MGD)				0.15	0.15	0.15	0.15	0.15	0.15				
MAX PERMITTED DISCHARGE RATE (MGD)				1.50	1.50	1.50	1.50	1.50	1.50				
MAX DISCHARGE BASED ON DILUTION (1 IN 20, MGD)				0.26	0.89	1.32	1.41	1.91	1.58				
POTENTIAL 1-in-100 YEAR EFFLUENT DISCHARGE VOLUME (MG)	207			7.84	27.57	40.77	39.53	46.50	45.00				
MAX VOLUME AVAILABLE FOR DISCHARGE AFTER LAND APPLICATION (MG)				27.48	38.16	36.74	22.84	29.94	22.17				
MAX AVAILABLE AGV. DISCHARGE RATE (MGD)				0.92	1.23	1.19	0.82	0.97	0.74				
CONDITION GOVERNING DISCHARGE RATE?				DILUTION	DILUTION	EFFLUENT	EFFLUENT	PERMIT	PERMIT				
ALLOWABLE RIVER DISCHARGE RATE (MGD)				0.26	0.89	1.19	0.82	0.97	0.74				
DISCHARGE VOLUME (MG)	147			7.84	27.57	36.74	22.84	29.94	22.17				
DESIGN LOSSES AND GAINS FROM STORAGE													
STORAGE AT BEGINNING OF MONTH (MG)		0.00	0.49	8.78	14.80	11.13	1.17	0.98	0.99	0.55	4.30	1.46	0.00
EFFLUENT STORAGE VOLUME GAIN/LOSS (MG)		1.24	9.04	5.93	-4.22	-11.13	-1.17	-0.98	-0.99	4.75	-1.65	-3.76	-2.38
UNADJUSTED STORAGE VOLUME (MG)		1.24	9.53	14.71	10.58	0.00	0.00	0.00	0.00	5.30	2.65	-2.30	-2.38
APPROXIMATE EFFECTIVE RESERVOIR AREA (AC)		2.90	4.74	5.36	4.87	2.90	2.90	2.90	2.90	4.18	3.69	2.90	2.90
EVAPORATIVE LOSS FROM STORAGE (MG)	3	0.45	0.52	0.29	0.14	0.00	0.00	0.00	0.00	0.69	0.75	0.00	0.00
PERCOLATION LOSS FROM STORAGE (MG)	4	0.41	0.70	0.76	0.72	0.00	0.00	0.00	0.00	0.62	0.53	0.00	0.00
RUNOFF TO STORAGE FROM RAIN CATCHMENT AREA (MG)	7	0.11	0.47	1.14	1.41	1.17	0.98	0.99	0.55	0.31	0.08	0.02	0.02
STORAGE AT END OF MONTH (MG)		0.49	8.78	14.80	11.13	1.17	0.98	0.99	0.55	4.30	1.46	0.00	0.00

MAXIMUM STORAGE REQUIRED (MG).. 14.8

TOTAL AVAILABLE STORAGE (MG).. 14.8

SUMMARY

ANNUAL INFLOW (MG)	
WASTEWATER..	201
INFLOW AND INFILTRATION....................................	43
PRECIPITATION INTO RESERVOIR...	7
TOTAL	251

ANNUAL OUTFLOW POTENTIAL (MG)	
EVAPORATION................................	3
PERCOLATION................................	55
LAND DISPOSAL.............................	51
SURFACE WATER DISPOSAL.....................................	147
TOTAL	256

OVERALL BALANCE	
UNUSED DISPOSAL CAPACITY (MG).....................	58
(MUST NOT BE NEGATIVE)	
UNUSED STORAGE CAPACITY (MG).....................	0
(MUST NOT BE NEGATIVE)	

SAN ANDREAS SANITARY DISTRICT FILE: 0277-1290

WATER BALANCE, FLOW POTENTIAL w/ 14.8 Mgal POND D AND 65 acres DLDA, UNDER 1-in-100 YEAR TYPE HYDROLOGIC CONDITIONS

3/3/2016

INPUT DATA, CONSTANT

SANITARY FLOW CHARACTERISTICS	
AVERAGE DRY WEATHER FLOW (MGD)........	0.61

EXISTING STORAGE RESERVOIRS			
CHARACTERISTICS	POND D	FUTURE	TOTAL
CATCHMENT AREA (AC).............	8.2		
WATER SURFACE (AC)...............	2.9		
BOTTOM SURFACE (AC)............	1.3		
STORAGE AVAILABLE (MG).........	14.8		

CLIMATOLOGICAL FACTORS	
CLIMATOLOGICAL DESIGN BASIS	1-in-100 YEAR
DESIGN PRECIP/AVG PRECIP RATIO........	1.81
OCT-APR EVAP/AVG EVAP RATIO........	0.75
MAY-SEP EVAP/AVG EVAP RATIO........	1.00
IRRIGATION AREA SOIL RUNOFF COEFFICIENT	0.20
STORAGE CATCHMENT SOIL RUNOFF COEFF.	0.25

IRRIGATION AREA CHARACTERISTICS	
EXISTING IRRIGATION AREA (AC)........	65.0
AVERAGE DISTRIBUTION UNIFORMITY (DECIMAL FRACTION)........	0.94
EFFECTIVE STORAGE PERCOLATION RATE (IN/DAY)........	0.175

AVERAGE SOIL DEPTH (FT)	0.8
MAXIMUM AVAILABLE SOIL WATER HOLDING CAPACITY (IN)	1.7
MANAGEMENT ALLOWABLE SOIL WATER DEFICIT (%)	50%
RIVER DILUTION RATIO, 1 : ____	20
MAXIMUM RIVER DISCHARGE RATE (MGD)	1.5
MINIMUM RIVER FLOW RATE DISCHARGE THRESHOLD (MGD)	0.15
MAXIMUM ALLOWABLE LAND DISCHARGE RATE (MGD)	1.8

INPUT DATA, MONTHLY VARIABLE

MONTH	ANNUAL	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
DAYS IN MONTH	365	30	31	30	31	31	28	31	30	31	30	31	31
AVERAGE DRY WEATHER FLOW (MGD)		0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61
AVG PRECIP, SAN ANDREAS (IN)	30.60	0.53	1.72	3.82	5.02	5.63	4.74	4.77	2.63	1.20	0.35	0.08	0.11
REFERENCE EVAPOTRANSPIRATION (ETo) (IN)	52.90	5.70	4.06	1.97	1.07	1.00	1.66	3.12	4.72	6.07	7.45	8.46	7.62
WATER SURFACE EVAPORATION COEFFICIENT		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
CROP COEFFICIENT (Kc), GRASS		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
CROP COEFFICIENT (Kc), TREES (OAKS)		1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
WEIGHTED CROP COEFFICIENT FOR SASD SITE		1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03
I/I VOLUME PER MGD of ADWF (MG)		0.00	0.04	0.12	0.33	0.45	0.37	0.63	0.26	0.12	0.01	0.00	0.00
AVERAGE RECENT SASD N.F. CALAVERAS RIVER FLOW (MGD)		0.00	0.00	5.23	17.79	26.30	28.23	38.28	31.63	19.01	7.35	0.20	0.00

CALCULATIONS

CALCULATIONS / MONTH	ANNUAL	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
RAIN-RELATED CALCULATIONS													
PERCENT ANNUAL RAINFALL/MONTH (%)		1.7%	5.6%	12.5%	16.4%	18.4%	15.5%	15.6%	8.6%	3.9%	1.1%	0.3%	0.4%
ESTIMATED SAN ANDREAS RAIN, 1-in-100 YEAR (IN)	55	0.96	3.11	6.91	9.08	10.19	8.58	8.63	4.76	2.17	0.63	0.14	0.20
EFFECTIVE RAIN FOR PLANTS (IN)	44	0.77	2.49	5.53	7.27	8.15	6.86	6.90	3.81	1.74	0.51	0.12	0.16
EVAPORATION-RELATED CALCULATIONS													
EVAPOTRANSPIRATION POTENTIAL (IN) (ETc) (ETo * Weighted Kc)	54	5.84	4.16	2.02	1.10	1.03	1.70	3.20	4.84	6.22	7.64	8.67	7.81
1-in-100 YEAR DESIGN ET POTENTIAL (IN) (ETc * Seasonal Evaporation Ratio)	50	5.84	3.12	1.51	0.82	0.77	1.28	2.40	3.63	6.22	7.64	8.67	7.81
STORAGE RESERVOIR EVAPORATION (IN) (Eto * Water Surface Coefficient)	53	5.70	4.06	1.97	1.07	1.00	1.66	3.12	4.72	6.07	7.45	8.46	7.62
SANITARY-RELATED CALCULATIONS													
AVERAGE DRY WEATHER FLOW VOLUME (MG)	223	18.29	18.90	18.29	18.90	18.90	17.07	18.90	18.29	18.90	18.29	18.90	18.90
AVERAGE I/I FLOW RATE (MGD)		0.00	0.02	0.07	0.20	0.28	0.22	0.38	0.16	0.07	0.01	0.00	0.00
I/I FLOW VOLUME (MG)	43	0.00	0.72	2.20	6.31	8.56	6.27	11.90	4.68	2.31	0.24	0.00	0.00
TOTAL INFLUENT FLOW RATE (MGD)		0.6	0.63	0.68	0.81	0.89	0.83	0.99	0.77	0.68	0.62	0.61	0.61
TOTAL INFLUENT FLOW VOLUME (MG)	266	18.29	19.63	20.49	25.21	27.46	23.34	30.81	22.98	21.21	18.53	18.90	18.90
DESIGN DISCHARGE TO LAND													
AVAILABLE RAIN WATER IN SOIL (IN)		0.00	0.00	1.70	1.70	1.70	1.70	1.70	0.18	0.00	0.00	0.00	0.00
RAIN WATER LOST TO PERCOLATION (IN)		0.00	0.00	1.81	6.17	7.12	5.16	3.71	0.00	0.00	0.00	0.00	0.00
LAND AREA UNDER IRRIGATION (AC)		65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION RATE (IN/MONTH)		5.40	0.67	0.00	0.00	0.00	0.00	0.00	0.00	4.77	7.58	9.10	8.14
POTENTIAL 1-in-100 YEAR EFFLUENT APPLICATION VOLUME (MG)	63	9.53	1.19	0.00	0.00	0.00	0.00	0.00	0.00	8.42	13.39	16.06	14.37
MAX EFFLUENT VOLUME AVAILABLE FOR LAND (MG)		18.29	19.63	28.63	40.01	40.44	24.51	31.79	23.97	21.76	21.37	18.90	18.90
AVAILABLE EFFLUENT APPLIED TO LAND (MG)	63	9.53	1.19	0.00	0.00	0.00	0.00	0.00	0.00	8.42	13.39	16.06	14.37
AVERAGE EFFLUENT DISCHARGE RATE (MGD)		0.32	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.45	0.52	0.46
EFFLUENT IRRIGATION RATE (IN/MONTH)	36	5.40	0.67	0.00	0.00	0.00	0.00	0.00	0.00	4.77	7.58	9.10	8.14
EXCESS SPRAY DISPOSAL POT., LIMITED (IN) (LIMITED TO 0.175 IN/D)		5.25	5.43	3.44						5.43	5.25	5.43	5.43
EXCESS SPRAY DISPOSAL VOLUME (MG)	63	9.27	9.57	6.07						9.57	9.27	9.57	9.57
DESIGN DISCHARGE TO RIVER													
LOWER RIVER FLOW DISCHARGE THRESHOLD (MGD)				0.15	0.15	0.15	0.15	0.15	0.15				
MAX PERMITTED DISCHARGE RATE (MGD)				1.50	1.50	1.50	1.50	1.50	1.50				
MAX DISCHARGE BASED ON DILUTION (1 IN 20, MGD)				0.26	0.89	1.32	1.41	1.91	1.58				
POTENTIAL 1-in-100 YEAR EFFLUENT DISCHARGE VOLUME (MG)	207			7.84	27.57	40.77	39.53	46.50	45.00				
MAX VOLUME AVAILABLE FOR DISCHARGE AFTER LAND APPLICATION (MG)				28.63	40.01	40.44	24.51	31.79	23.97				
MAX AVAILABLE AGV. DISCHARGE RATE (MGD)				0.95	1.29	1.30	0.88	1.03	0.80				
CONDITION GOVERNING DISCHARGE RATE?				DILUTION	DILUTION	EFFLUENT	EFFLUENT	PERMIT	PERMIT				
ALLOWABLE RIVER DISCHARGE RATE (MGD)				0.26	0.89	1.30	0.88	1.03	0.80				
DISCHARGE VOLUME (MG)	156			7.84	27.57	40.44	24.51	31.79	23.97				
DESIGN LOSSES AND GAINS FROM STORAGE													
STORAGE AT BEGINNING OF MONTH (MG)		0.00	0.00	8.13	14.80	12.98	1.17	0.98	0.99	0.55	2.83	0.00	0.00
EFFLUENT STORAGE VOLUME GAIN/LOSS (MG)		-0.50	8.87	6.58	-2.37	-12.98	-1.17	-0.98	-0.99	3.22	-4.12	-6.74	-5.04
UNADJUSTED STORAGE VOLUME (MG)		-0.50	8.87	14.71	12.43	0.00	0.00	0.00	0.00	3.76	-1.29	-6.74	-5.04
APPROXIMATE EFFECTIVE RESERVOIR AREA (AC)		2.90	4.66	5.36	5.09	2.90	2.90	2.90	2.90	3.92	2.90	2.90	2.90
EVAPORATIVE LOSS FROM STORAGE (MG)	2	0.00	0.51	0.29	0.15	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.00
PERCOLATION LOSS FROM STORAGE (MG)	3	0.00	0.69	0.76	0.75	0.00	0.00	0.00	0.00	0.58	0.00	0.00	0.00
RUNOFF TO STORAGE FROM RAIN CATCHMENT AREA (MG)	7	0.11	0.47	1.14	1.45	1.17	0.98	0.99	0.55	0.29	0.07	0.02	0.02
STORAGE AT END OF MONTH (MG)		0.00	8.13	14.80	12.98	1.17	0.98	0.99	0.55	2.83	0.00	0.00	0.00

MAXIMUM STORAGE REQUIRED (MG)........ 14.8

TOTAL AVAILABLE STORAGE (MG)........ 14.8

SUMMARY

ANNUAL INFLOW (MG)	
WASTEWATER........	223
INFLOW AND INFILTRATION........	43
PRECIPITATION INTO RESERVOIR........	7
TOTAL	273

ANNUAL OUTFLOW POTENTIAL (MG)	
EVAPORATION........	2
PERCOLATION........	66
LAND DISPOSAL........	63
SURFACE WATER DISPOSAL........	156
TOTAL	287

OVERALL BALANCE	
UNUSED DISPOSAL CAPACITY (MG)........	60
(MUST NOT BE NEGATIVE)	
UNUSED STORAGE CAPACITY (MG)........	0
(MUST NOT BE NEGATIVE)	

Exhibit 3-C

Early Winter Daily Water Balance Calculation

San Andreas Sanitary District Water Balance Analysis of 2014 Precipitation Events, Assessment of Potential System Operational Optimization.

Additional Base Flow 0.0 Mgal.\/d **Practical Upper Limit of Discharge to NF = 0.9** **Land Disposal Area = 30 Acres**

Date	Influent Flow (Mgal/d)	Daily Precipitation (in)	Land Application (Mgal/d)	Disposal Loading Rate (Mgpd/acre)	Calculated Land Disposal (Mgal/d)	River Discharge (Mgal/d)	Max. Pot. River Discharge (Mgal/d)	Influent Limited Potential River Discharge (Mgal/d)	Practical Limit of River Discharge (at 90% of Permit Flow) (Mgal/d)	10:1 of River Discharge (at 90% of Permit Flow) (Mgal/d)	1:1 River Discharge (at 90% of Permit Flow) (Mgal/d)	Evaporation Loss (Mgal/d)	Runoff Gain (Mgal/d)	Percolation Loss (Mgal/d)	Est. Daily Storage Gain @ 20:1 (Mgal/d)	Est. Daily Storage Gain @ 10:1 (Mgal/d)	Est. Daily Storage Gain @ 1:1 (Mgal/d)	Est. Cumulative Storage Gain 20:1 (Mgal)	Est. Cumulative Storage Gain 10:1 (Mgal)	Est. Cumulative Storage Gain 1:1 (Mgal)
11/27/2014	0.23	0.00	24 hr prior				0.00	0.00	0.00	0.00	0.00	0.004	0.00	0.01	0.21	0.21	0.21	0.21	0.21	0.21
11/28/2014	0.22	0.08				0	0.00	0.00	0.00	0.00	0.00	0.004	0.01	0.01	0.21	0.21	0.21	0.43	0.43	0.43
11/29/2014	0.23	0.04				0	0.00	0.00	0.00	0.00	0.00	0.004	0.00	0.01	0.22	0.22	0.22	0.65	0.65	0.65
11/30/2014	0.30	0.32				0	0.00	0.00	0.00	0.00	0.00	0.004	0.04	0.01	0.32	0.32	0.32	0.96	0.96	0.96
12/1/2014	0.25	0.01				0	0.00	0.00	0.00	0.00	0.00	0.004	0.00	0.01	0.24	0.24	0.24	1.20	1.20	1.20
12/2/2014	0.38	0.70				0	0.00	0.00	0.00	0.00	0.00	0.004	0.08	0.01	0.44	0.44	0.44	1.64	1.64	1.64
12/3/2014	0.49	0.57				0	0.00	0.00	0.00	0.00	0.00	0.004	0.07	0.01	0.54	0.54	0.54	2.19	2.19	2.19
12/4/2014	0.35	0.00				0	0.07	0.07	0.06	0.13	1.26	0.004	0.00	0.01	0.26	0.20	-0.93	2.44	2.39	1.25
12/5/2014	0.28	0.08				0	0.12	0.12	0.11	0.22	1.50	0.004	0.01	0.01	0.15	0.05	-1.23	2.59	2.44	0.02
12/6/2014	0.25	0.00	24 hrs post			0	0.00	0.00	0.00	0.07	0.66	0.004	0.00	0.01	0.24	0.17	-0.42	2.82	2.61	-0.40
12/7/2014	0.27	0.00	0.24	0.01	0.24	0	0.00	0.00	0.00	0.04	0.41	0.004	0.00	0.01	0.00	-0.04	-0.41	2.83	2.57	-0.81
12/8/2014	0.27	0.00	0.63	0.02	0.65	0	0.00	0.00	0.00	0.04	0.38	0.004	0.00	0.01	-0.40	-0.44	-0.78	2.43	2.13	-1.59
12/9/2014	0.26	0.00	0.62	0.02	0.64	0	0.00	0.00	0.00	0.02	0.21	0.004	0.00	0.01	-0.40	-0.42	-0.61	2.03	1.71	-2.20
12/10/2014	0.26	0.00	0.50	0.02	0.52	0	0.00	0.00	0.00	0.02	0.17	0.004	0.00	0.01	-0.28	-0.29	-0.45	1.75	1.42	-2.65
12/11/2014	2.07	4.50				0	0.00	0.00	0.00	0.18	1.50	0.004	0.54	0.01	2.59	2.41	1.09	4.34	3.83	-1.56
12/12/2014	0.81	0.14				0.00	1.10	0.81	0.99	1.50	1.50	0.004	0.02	0.01	0.00	-0.69	-0.69	4.34	3.14	-2.25
12/13/2014	0.48	0.00				0.21	1.50	0.48	1.35	1.50	1.50	0.004	0.00	0.01	-0.02	-1.04	-1.04	4.32	2.10	-3.29
12/14/2014	0.37	0.00				0.00	1.50	0.37	1.35	1.50	1.50	0.004	0.00	0.01	-0.02	-1.15	-1.15	4.30	0.94	-4.44
12/15/2014	0.34	0.17				0.28	1.50	0.34	1.35	1.50	1.50	0.004	0.02	0.01	0.00	-1.16	-1.16	4.30	-0.21	-5.59
12/16/2014	0.41	0.30				0.27	1.20	0.41	1.08	1.50	1.50	0.004	0.04	0.01	0.02	-1.07	-1.07	4.32	-1.29	-6.67
12/17/2014	0.38	0.06				0.36	0.85	0.38	0.77	1.50	1.50	0.004	0.01	0.01	-0.01	-1.13	-1.13	4.31	-2.41	-7.80
12/18/2014	0.33	0.00				0.33	1.05	0.33	0.95	1.50	1.50	0.004	0.00	0.01	-0.02	-1.19	-1.19	4.29	-3.60	-8.98
12/19/2014	0.64	1.05				0.27	1.35	0.64	1.22	1.50	1.50	0.004	0.13	0.01	0.11	-0.75	-0.75	4.40	-4.35	-9.74
12/20/2014	0.73	0.05				0.58	1.30	0.73	1.17	1.50	1.50	0.004	0.01	0.01	-0.01	-0.78	-0.78	4.38	-5.13	-10.52
12/21/2014	0.48	0.00	24 hr post			0.68	1.50	0.48	1.35	1.50	1.50	0.004	0.00	0.01	-0.02	-1.04	-1.04	4.37	-6.18	-11.56
12/22/2014	0.36	0.00	0.53	0.02	0.55	0.43	1.50	0.36	1.35	1.50	1.50	0.004	0.00	0.01	-0.57	-1.71	-1.71	3.80	-7.89	-13.27
12/23/2014	0.34	0.00	0.50	0.02	0.52	0.29	1.50	0.34	1.35	1.50	1.50	0.004	0.00	0.01	-0.54	-1.70	-1.70	3.26	-9.58	-14.97
12/24/2014	0.32	0.15				0.28	1.50	0.32	1.35	1.50	1.50	0.004	0.02	0.01	0.00	-1.18	-1.18	3.26	-10.76	-16.14
12/25/2014	0.29	0.00	24 hr post			0.26	1.20	0.29	1.08	1.50	1.50	0.004	0.00	0.01	-0.02	-1.23	-1.23	3.25	-11.99	-17.38
12/26/2014	0.31	0.00	0.35	0.01	0.37	0.23	1.15	0.31	1.04	1.50	1.50	0.004	0.00	0.01	-0.39	-1.58	-1.58	2.86	-13.57	-18.95
12/27/2014	0.27	0.00	0.22	0.01	0.23	0.22	1.15	0.27	1.04	1.50	1.50	0.004	0.00	0.01	-0.24	-1.48	-1.48	2.62	-15.05	-20.43
12/28/2014	0.31	0.00	0.59	0.02	0.61	0.21	0.90	0.31	0.81	1.50	1.50	0.004	0.00	0.01	-0.63	-1.82	-1.82	1.99	-16.87	-22.25
12/29/2014	0.28	0.00	0.64	0.02	0.66	0.23	0.70	0.28	0.63	1.26	1.50	0.004	0.00	0.01	-0.68	-1.66	-1.90	1.31	-18.53	-24.15
12/30/2014	0.32	0.00	0.38	0.01	0.39	0.21	0.60	0.32	0.54	1.08	1.50	0.004	0.00	0.01	-0.41	-1.17	-1.59	0.90	-19.70	-25.74
12/31/2014	0.31	0.00	0.63	0.02	0.65	0.21	0.55	0.31	0.50	0.99	1.50	0.004	0.00	0.01	-0.67	-1.35	-1.86	0.23	-21.05	-27.60
												Maximum Accumulated Volume (Mgal)						4.4	3.8	2.2
												Existing Storage Volume Available (Mgal)						4.3	4.3	4.3
												Required Additional Storage Volume (Mgal)						0.1	-0.5	-2.1

San Andreas Sanitary District Water Balance Analysis of 2014 Precipitation Events, Assessment of Potential System Operational Optimization.

Additional Base Flow **0.07 Mgal.\/d** **Practical Upper Limit of Discharge to NF = 0.9** **Land Disposal Area =** **30** **Acres**

Date	Influent Flow (Mgal/d)	Daily Precipitation (in)	Land Application (Mgal/d)	Disposal Loading Rate (Mgpd/acre)	Calculated Land Disposal (Mgal/d)	River Discharge (Mgal/d)	Max. Pot. River Discharge (Mgal/d)	Influent Limited Potential River Discharge (Mgal/d)	Practical Limit of River Discharge (at 90% of Permit Flow) (Mgal/d)	10:1 of River Discharge (at 90% of Permit Flow) (Mgal/d)	1:1 River Discharge (at 90% of Permit Flow) (Mgal/d)	Evaporation Loss (Mgal/d)	Runoff Gain (Mgal/d)	Percolation Loss (Mgal/d)	Est. Daily Storage Gain @ 20:1 (Mgal/d)	Est. Daily Storage Gain @ 10:1 (Mgal/d)	Est. Daily Storage Gain @ 1:1 (Mgal/d)	Est. Cumulative Storage Gain 20:1 (Mgal)	Est. Cumulative Storage Gain 10:1 (Mgal)	Est. Cumulative Storage Gain 1:1 (Mgal)
11/27/2014	0.30	0.00	24 hr prior				0.00	0.00	0.00	0.00	0.00	0.004	0.00	0.01	0.28	0.28	0.28	0.28	0.28	0.28
11/28/2014	0.29	0.08				0	0.00	0.00	0.00	0.00	0.00	0.004	0.01	0.01	0.28	0.28	0.28	0.57	0.57	0.57
11/29/2014	0.30	0.04				0	0.00	0.00	0.00	0.00	0.00	0.004	0.00	0.01	0.29	0.29	0.29	0.86	0.86	0.86
11/30/2014	0.37	0.32				0	0.00	0.00	0.00	0.00	0.00	0.004	0.04	0.01	0.39	0.39	0.39	1.24	1.24	1.24
12/1/2014	0.32	0.01				0	0.00	0.00	0.00	0.00	0.00	0.004	0.00	0.01	0.31	0.31	0.31	1.55	1.55	1.55
12/2/2014	0.45	0.70				0	0.00	0.00	0.00	0.00	0.00	0.004	0.08	0.01	0.51	0.51	0.51	2.06	2.06	2.06
12/3/2014	0.56	0.57				0	0.00	0.00	0.00	0.00	0.00	0.004	0.07	0.01	0.61	0.61	0.61	2.68	2.68	2.68
12/4/2014	0.42	0.00				0	0.07	0.07	0.06	0.13	1.26	0.004	0.00	0.01	0.33	0.27	-0.86	3.00	2.95	1.81
12/5/2014	0.35	0.08				0	0.12	0.12	0.11	0.22	1.50	0.004	0.01	0.01	0.22	0.12	-1.16	3.22	3.07	0.65
12/6/2014	0.32	0.00	24 hrs post			0	0.00	0.00	0.00	0.07	0.66	0.004	0.00	0.01	0.31	0.24	-0.35	3.52	3.31	0.30
12/7/2014	0.34	0.00	0.24	0.01	0.24	0	0.00	0.00	0.00	0.04	0.41	0.004	0.00	0.01	0.07	0.03	-0.34	3.60	3.34	-0.04
12/8/2014	0.34	0.00	0.63	0.02	0.65	0	0.00	0.00	0.00	0.04	0.38	0.004	0.00	0.01	-0.33	-0.37	-0.71	3.27	2.97	-0.75
12/9/2014	0.33	0.00	0.62	0.02	0.64	0	0.00	0.00	0.00	0.02	0.21	0.004	0.00	0.01	-0.33	-0.35	-0.54	2.94	2.62	-1.29
12/10/2014	0.33	0.00	0.50	0.02	0.52	0	0.00	0.00	0.00	0.02	0.17	0.004	0.00	0.01	-0.21	-0.22	-0.38	2.73	2.40	-1.67
12/11/2014	2.14	4.50				0	0.00	0.00	0.00	0.18	1.50	0.004	0.54	0.01	2.66	2.48	1.16	5.39	4.88	-0.51
12/12/2014	0.88	0.14				0.00	1.10	0.88	0.99	1.50	1.50	0.004	0.02	0.01	0.00	-0.62	-0.62	5.39	4.26	-1.13
12/13/2014	0.55	0.00				0.21	1.50	0.55	1.35	1.50	1.50	0.004	0.00	0.01	-0.02	-0.97	-0.97	5.37	3.29	-2.10
12/14/2014	0.44	0.00				0.00	1.50	0.44	1.35	1.50	1.50	0.004	0.00	0.01	-0.02	-1.08	-1.08	5.35	2.20	-3.18
12/15/2014	0.41	0.17				0.28	1.50	0.41	1.35	1.50	1.50	0.004	0.02	0.01	0.00	-1.09	-1.09	5.35	1.12	-4.26
12/16/2014	0.48	0.30				0.27	1.20	0.48	1.08	1.50	1.50	0.004	0.04	0.01	0.02	-1.00	-1.00	5.37	0.11	-5.27
12/17/2014	0.45	0.06				0.36	0.85	0.45	0.77	1.50	1.50	0.004	0.01	0.01	-0.01	-1.06	-1.06	5.36	-0.94	-6.33
12/18/2014	0.40	0.00				0.33	1.05	0.40	0.95	1.50	1.50	0.004	0.00	0.01	-0.02	-1.12	-1.12	5.34	-2.06	-7.44
12/19/2014	0.71	1.05				0.27	1.35	0.71	1.22	1.50	1.50	0.004	0.13	0.01	0.11	-0.68	-0.68	5.45	-2.74	-8.13
12/20/2014	0.80	0.05				0.58	1.30	0.80	1.17	1.50	1.50	0.004	0.01	0.01	-0.01	-0.71	-0.71	5.43	-3.45	-8.84
12/21/2014	0.55	0.00	24 hr post			0.68	1.50	0.55	1.35	1.50	1.50	0.004	0.00	0.01	-0.02	-0.97	-0.97	5.42	-4.43	-9.81
12/22/2014	0.43	0.00	0.53	0.02	0.55	0.43	1.50	0.43	1.35	1.50	1.50	0.004	0.00	0.01	-0.57	-1.64	-1.64	4.85	-6.07	-11.45
12/23/2014	0.41	0.00	0.50	0.02	0.52	0.29	1.50	0.41	1.35	1.50	1.50	0.004	0.00	0.01	-0.54	-1.63	-1.63	4.31	-7.69	-13.08
12/24/2014	0.39	0.15				0.28	1.50	0.39	1.35	1.50	1.50	0.004	0.02	0.01	0.00	-1.11	-1.11	4.31	-8.80	-14.18
12/25/2014	0.36	0.00	24 hr post			0.26	1.20	0.36	1.08	1.50	1.50	0.004	0.00	0.01	-0.02	-1.16	-1.16	4.30	-9.96	-15.35
12/26/2014	0.38	0.00	0.35	0.01	0.37	0.23	1.15	0.38	1.04	1.50	1.50	0.004	0.00	0.01	-0.39	-1.51	-1.51	3.91	-11.47	-16.85
12/27/2014	0.34	0.00	0.22	0.01	0.23	0.22	1.15	0.34	1.04	1.50	1.50	0.004	0.00	0.01	-0.24	-1.41	-1.41	3.67	-12.88	-18.26
12/28/2014	0.38	0.00	0.59	0.02	0.61	0.21	0.90	0.38	0.81	1.50	1.50	0.004	0.00	0.01	-0.63	-1.75	-1.75	3.04	-14.63	-20.01
12/29/2014	0.35	0.00	0.64	0.02	0.66	0.23	0.70	0.35	0.63	1.26	1.50	0.004	0.00	0.01	-0.68	-1.59	-1.83	2.36	-16.22	-21.84
12/30/2014	0.39	0.00	0.38	0.01	0.39	0.21	0.60	0.39	0.54	1.08	1.50	0.004	0.00	0.01	-0.41	-1.10	-1.52	1.95	-17.32	-23.36
12/31/2014	0.38	0.00	0.63	0.02	0.65	0.21	0.55	0.38	0.50	0.99	1.50	0.004	0.00	0.01	-0.67	-1.28	-1.79	1.28	-18.60	-25.15
												Maximum Accumulated Volume (Mgal)						5.4	4.9	2.7
												Existing Storage Volume Available (Mgal)						4.3	4.3	4.3
												Required Additional Storage Volume (Mgal)						1.1	0.6	-1.6

San Andreas Sanitary District Water Balance Analysis of 2014 Precipitation Events, Assessment of Potential System Operational Optimization.

Additional Base Flow **0.09 Mgal.\/d** **Practical Upper Limit of Discharge to NF = 0.9** **Land Disposal Area =** **30** **Acres**

Date	Influent Flow (Mgal/d)	Daily Precipitation (in)	Land Application (Mgal/d)	Disposal Loading Rate (Mgpd/acre)	Calculated Land Disposal (Mgal/d)	River Discharge (Mgal/d)	Max. Pot. River Discharge (Mgal/d)	Influent Limited Potential River Discharge (Mgal/d)	Practical Limit of River Discharge (at 90% of Permit Flow) (Mgal/d)	10:1 of River Discharge (at 90% of Permit Flow) (Mgal/d)	1:1 River Discharge (at 90% of Permit Flow) (Mgal/d)	Evaporation Loss (Mgal/d)	Runoff Gain (Mgal/d)	Percolation Loss (Mgal/d)	Est. Daily Storage Gain @ 20:1 (Mgal/d)	Est. Daily Storage Gain @ 10:1 (Mgal/d)	Est. Daily Storage Gain @ 1:1 (Mgal/d)	Est. Cumulative Storage Gain 20:1 (Mgal)	Est. Cumulative Storage Gain 10:1 (Mgal)	Est. Cumulative Storage Gain 1:1 (Mgal)
11/27/2014	0.32	0.00	24 hr prior				0.00	0.00	0.00	0.00	0.00	0.004	0.00	0.01	0.30	0.30	0.30	0.30	0.30	0.30
11/28/2014	0.31	0.08				0	0.00	0.00	0.00	0.00	0.00	0.004	0.01	0.01	0.30	0.30	0.30	0.61	0.61	0.61
11/29/2014	0.32	0.04				0	0.00	0.00	0.00	0.00	0.00	0.004	0.00	0.01	0.31	0.31	0.31	0.92	0.92	0.92
11/30/2014	0.39	0.32				0	0.00	0.00	0.00	0.00	0.00	0.004	0.04	0.01	0.41	0.41	0.41	1.32	1.32	1.32
12/1/2014	0.34	0.01				0	0.00	0.00	0.00	0.00	0.00	0.004	0.00	0.01	0.33	0.33	0.33	1.65	1.65	1.65
12/2/2014	0.47	0.70				0	0.00	0.00	0.00	0.00	0.00	0.004	0.08	0.01	0.53	0.53	0.53	2.18	2.18	2.18
12/3/2014	0.58	0.57				0	0.00	0.00	0.00	0.00	0.00	0.004	0.07	0.01	0.63	0.63	0.63	2.82	2.82	2.82
12/4/2014	0.44	0.00				0	0.07	0.07	0.06	0.13	1.26	0.004	0.00	0.01	0.35	0.29	-0.84	3.16	3.11	1.97
12/5/2014	0.37	0.08				0	0.12	0.12	0.11	0.22	1.50	0.004	0.01	0.01	0.24	0.14	-1.14	3.40	3.25	0.83
12/6/2014	0.34	0.00	24 hrs post			0	0.00	0.00	0.00	0.07	0.66	0.004	0.00	0.01	0.33	0.26	-0.33	3.72	3.51	0.50
12/7/2014	0.36	0.00	0.24	0.01	0.24	0	0.00	0.00	0.00	0.04	0.41	0.004	0.00	0.01	0.09	0.05	-0.32	3.82	3.56	0.18
12/8/2014	0.36	0.00	0.63	0.02	0.65	0	0.00	0.00	0.00	0.04	0.38	0.004	0.00	0.01	-0.31	-0.35	-0.69	3.51	3.21	-0.51
12/9/2014	0.35	0.00	0.62	0.02	0.64	0	0.00	0.00	0.00	0.02	0.21	0.004	0.00	0.01	-0.31	-0.33	-0.52	3.20	2.88	-1.03
12/10/2014	0.35	0.00	0.50	0.02	0.52	0	0.00	0.00	0.00	0.02	0.17	0.004	0.00	0.01	-0.19	-0.20	-0.36	3.01	2.68	-1.39
12/11/2014	2.16	4.50				0	0.00	0.00	0.00	0.18	1.50	0.004	0.54	0.01	2.68	2.50	1.18	5.69	5.18	-0.21
12/12/2014	0.90	0.14				0.00	1.10	0.90	0.99	1.50	1.50	0.004	0.02	0.01	0.00	-0.60	-0.60	5.69	4.58	-0.81
12/13/2014	0.57	0.00				0.21	1.50	0.57	1.35	1.50	1.50	0.004	0.00	0.01	-0.02	-0.95	-0.95	5.67	3.63	-1.76
12/14/2014	0.46	0.00				0.00	1.50	0.46	1.35	1.50	1.50	0.004	0.00	0.01	-0.02	-1.06	-1.06	5.65	2.56	-2.82
12/15/2014	0.43	0.17				0.28	1.50	0.43	1.35	1.50	1.50	0.004	0.02	0.01	0.00	-1.07	-1.07	5.65	1.50	-3.88
12/16/2014	0.50	0.30				0.27	1.20	0.50	1.08	1.50	1.50	0.004	0.04	0.01	0.02	-0.98	-0.98	5.67	0.51	-4.87
12/17/2014	0.47	0.06				0.36	0.85	0.47	0.77	1.50	1.50	0.004	0.01	0.01	-0.01	-1.04	-1.04	5.66	-0.52	-5.91
12/18/2014	0.42	0.00				0.33	1.05	0.42	0.95	1.50	1.50	0.004	0.00	0.01	-0.02	-1.10	-1.10	5.64	-1.62	-7.00
12/19/2014	0.73	1.05				0.27	1.35	0.73	1.22	1.50	1.50	0.004	0.13	0.01	0.11	-0.66	-0.66	5.75	-2.28	-7.67
12/20/2014	0.82	0.05				0.58	1.30	0.82	1.17	1.50	1.50	0.004	0.01	0.01	-0.01	-0.69	-0.69	5.73	-2.97	-8.36
12/21/2014	0.57	0.00	24 hr post			0.68	1.50	0.57	1.35	1.50	1.50	0.004	0.00	0.01	-0.02	-0.95	-0.95	5.72	-3.93	-9.31
12/22/2014	0.45	0.00	0.53	0.02	0.55	0.43	1.50	0.45	1.35	1.50	1.50	0.004	0.00	0.01	-0.57	-1.62	-1.62	5.15	-5.55	-10.93
12/23/2014	0.43	0.00	0.50	0.02	0.52	0.29	1.50	0.43	1.35	1.50	1.50	0.004	0.00	0.01	-0.54	-1.61	-1.61	4.61	-7.15	-12.54
12/24/2014	0.41	0.15				0.28	1.50	0.41	1.35	1.50	1.50	0.004	0.02	0.01	0.00	-1.09	-1.09	4.61	-8.24	-13.62
12/25/2014	0.38	0.00	24 hr post			0.26	1.20	0.38	1.08	1.50	1.50	0.004	0.00	0.01	-0.02	-1.14	-1.14	4.60	-9.38	-14.77
12/26/2014	0.40	0.00	0.35	0.01	0.37	0.23	1.15	0.40	1.04	1.50	1.50	0.004	0.00	0.01	-0.39	-1.49	-1.49	4.21	-10.87	-16.25
12/27/2014	0.36	0.00	0.22	0.01	0.23	0.22	1.15	0.36	1.04	1.50	1.50	0.004	0.00	0.01	-0.24	-1.39	-1.39	3.97	-12.26	-17.64
12/28/2014	0.40	0.00	0.59	0.02	0.61	0.21	0.90	0.40	0.81	1.50	1.50	0.004	0.00	0.01	-0.63	-1.73	-1.73	3.34	-13.99	-19.37
12/29/2014	0.37	0.00	0.64	0.02	0.66	0.23	0.70	0.37	0.63	1.26	1.50	0.004	0.00	0.01	-0.68	-1.57	-1.81	2.66	-15.56	-21.18
12/30/2014	0.41	0.00	0.38	0.01	0.39	0.21	0.60	0.41	0.54	1.08	1.50	0.004	0.00	0.01	-0.41	-1.08	-1.50	2.25	-16.64	-22.68
12/31/2014	0.40	0.00	0.63	0.02	0.65	0.21	0.55	0.40	0.50	0.99	1.50	0.004	0.00	0.01	-0.67	-1.26	-1.77	1.58	-17.90	-24.45
												Maximum Accumulated Volume (Mgal)						5.7	5.2	2.8
												Existing Storage Volume Available (Mgal)						4.3	4.3	4.3
												Required Additional Storage Volume (Mgal)						1.4	0.9	-1.5

Exhibit 3-D

Improvement Cost Detail

SASD Sewer Master Plan						
0277-1300 San Andreas Sanitary District						
Effluent Pumping MCC Replacement						
Preliminary Design Opinion of Probable Cost						
Division & Item No.	**Item Description**	**Qty.**	**Unit**	**Unit Price**	**Install Adj.(1)**	**Total**
1 GENERAL REQUIREMENTS						
1.1	Mobilization and Demobilization	1.0	LS	$6,905	1.00	$6,905
2 SITE WORK						
2.1	General Site Improvements	1.0	LS	$5,000	1.00	$5,000
3 CONCRETE						
3.1	MCC Slab	3.0	CY	$700	1.00	$2,100
16 ELECTRICAL						
16.1	Supply Conduit and Conductors	1.0	LS	$25,000	1.00	$25,000
16.2	Replacement MCC	1.0	LS	$106,000	1.00	$106,000
					SUBTOTAL (ROUNDED)	$146,000
					DESIGN ENGINEERING 10%	$15,000
					PROJECT/CONSTRUCTION MANAGEMENT & LEGAL 8%	$12,000
					ENVIRONMENTAL AND PERMITTING 2%	$3,000
					CONTINGENCY 30%	$44,000
					TOTAL	**$220,000**
					POND D EXPANSION (7' Raise, Rounded) TOTAL	**$220,000**

NOTES: (1) Unit cost includes installation if value equals 1.0.

(2) At an an ENR 20-Cities CCI of 10,092, November 2015.

SASD Sewer Master Plan						
0277-1300 San Andreas Sanitary District						
Improve Pond D Drainage Catchment						
Preliminary Design Opinion of Probable Cost						
Division & Item No.	**Item Description**	**Qty.**	**Unit**	**Unit Price**	**Install Adj.(1)**	**Total**
1 GENERAL REQUIREMENTS						
1.1	Mobilization and Demobilization	1.0	LS	$4,743	1.00	$4,743
1.2	Construction Staking	1.0	LS	$5,000	1.00	$5,000
2 SITE WORK						
2.1	Trench Excavation	600.0	CY	$10	1.00	$6,000
2.2	Outlet Structure Excavation	600.0	CY	$10	1.00	$6,000
2.3	Rip Rap	75.0	TON	$50	1.00	$3,750
2.4	Levee Crown - Class 2 AB	400.0	SF	$1	1.00	$400
2.5	Finish Grading	1.0	LS	$3,000	1.00	$3,000
2.6	12-in CMP Culvert Piping	175.0	LF	$200	1.00	$35,000
2.7	Flared End Section	1.0	EA	$300	1.00	$300
3 CONCRETE						
3.1	Drainage Catch Inlet Concrete Structure	2.0	EA	$4,000	1.00	$8,000
11 EQUIPMENMT						
11.1	Portable Drainage Pump System	1.0	EA	$32,400	1.00	$32,400
					SUBTOTAL (ROUNDED)	$105,000
					DESIGN ENGINEERING 10%	$11,000
					PROJECT/CONSTRUCTION MANAGEMENT & LEGAL 8%	$9,000
					ENVIRONMENTAL AND PERMITTING 7%	$8,000
					CONTINGENCY 30%	$32,000
					TOTAL	**$165,000**
					POND D DRAINAGE CATCHMENT IMPORVEMENTS TOTAL	**$165,000**

NOTES: (1) Unit cost includes installation if value equals 1.0.

(2) At an an ENR 20-Cities CCI of 10,092, November 2015.

SASD Sewer Master Plan						
0277-1300 San Andreas Sanitary District						
Raise Pond D Crown Elevation 7'						
Preliminary Design Opinion of Probable Cost						
Division & Item No.	**Item Description**	**Qty.**	**Unit**	**Unit Price**	**Install Adj.(1)**	**Total**
1 GENERAL REQUIREMENTS						
1.1	Mobilization and Demobilization	1.0	LS	$60,705	1.00	$60,705
1.2	Construction Staking	1.0	LS	$10,000	1.00	$10,000
2 SITE WORK						
2.1	General Site Excavation	6,250.0	CY	$10	1.00	$62,500
2.2	Outlet Structure Excavation	100.0	CY	$10	1.00	$1,000
2.3	Impervious Core Material	1,600.0	CY	$50	1.00	$80,000
2.4	18" minus Rip Rap	1,200.0	TON	$45	1.00	$54,000
2.5	Levee Fill Material - "Levee Seal"	35,640.0	TON	$25	1.00	$891,000
2.6	Site Grading & New Access Road	1.0	LS	$50,000	1.00	$50,000
2.7	Levee Crown - Class 2 AB	300.0	CY	$125	1.00	$37,500
3 CONCRETE						
3.1	Concrete Spillway Structure Concrete	8.0	CY	$700	1.00	$5,600
3.2	Concrete Pedestal Foundations/Blocks	15.0	CY	$700	1.00	$10,500
15 MECHANICAL						
15.1	New 12-in RCP Spillway Outlet Piping	40.0	LF	$300	1.00	$12,000
15.2	Relocate Hand Wheel Assembly for Outlet Structure	1.0	LS	$10,000	1.00	$10,000
SUBTOTAL (ROUNDED)						$1,290,000
DESIGN ENGINEERING 10%						$130,000
PROJECT/CONSTRUCTION MANAGEMENT & LEGAL 8%						$110,000
ENVIRONMENTAL AND PERMITTING 7%						$100,000
DSOD PERMITTING 3%						$40,000
CONTINGENCY 30%						$390,000
TOTAL						**$2,060,000**
POND D EXPANSION (7' Raise, Rounded) TOTAL						**$2,100,000**

NOTES:
(1) Unit cost includes installation if value equals 1.0.
(2) At an an ENR 20-Cities CCI of 10,092, November 2015.

SASD Sewer Master Plan						
0277-1300 San Andreas Sanitary District						
Excavate Material Within Pond D						
Preliminary Design Opinion of Probable Cost						
Division & Item No.	**Item Description**	**Qty.**	**Unit**	**Unit Price**	**Install Adj.(1)**	**Total**
1 GENERAL REQUIREMENTS						
1.1	Mobilization and Demobilization	1.0	LS	$2,625	1.00	$2,625
1.2	Construction Staking	1.0	LS	$2,500	1.00	$2,500
2 SITE WORK						
2.1	General Site Excavation	5,250.0	CY	$10	1.00	$52,500
					SUBTOTAL (ROUNDED)	$60,000
					DESIGN ENGINEERING 10%	$10,000
					PROJECT/CONSTRUCTION MANAGEMENT & LEGAL 8%	$10,000
					ENVIRONMENTAL AND PERMITTING 7%	$10,000
					CONTINGENCY 30%	$20,000
					TOTAL	**$110,000**
					EXCAVATE MATERIAL WITHIN POND D TOTAL	**$110,000**

NOTES: (1) Unit cost includes installation if value equals 1.0.

(2) At an an ENR 20-Cities CCI of 10,092, November 2015.

SASD Sewer Master Plan						
0277-1300 San Andreas Sanitary District						
Pond D to WWTP Return Pumping						
Preliminary Design Opinion of Probable Cost						
Division & Item No.	**Item Description**	**Qty.**	**Unit**	**Unit Price**	**Install Adj.(1)**	**Total**
1 GENERAL REQUIREMENTS						
1.1	Mobilization and Demobilization	1.0	LS	$12,150	1.00	$12,150
2 SITE WORK						
2.1	General Site Improvements	1.0	LS	$5,000	1.00	$5,000
3 CONCRETE						
3.1	Pumping Plant Concrete	20.0	CY	$700	1.00	$14,000
9 FINISHES						
9.1	Painting and Coating	1.0	LS	$8,000	1.00	$8,000
11 EQUIPMENT						
11.1	Effluent and Return Pumps	2.0	EA	$40,000	1.50	$120,000
15 MECHANICAL						
15.1	Pump Station Piping and Valves	1.0	LS	$35,000	1.00	$35,000
15.2	Return Piping and Valves, 8" Dia.	900.0	LF	$50	1.00	$45,000
16 ELECTRICAL						
16.1	General Electrical Improvements	1.0	LS	$16,000	1.00	$16,000
SUBTOTAL (ROUNDED)						$256,000
DESIGN ENGINEERING 15%						$39,000
PROJECT/CONSTRUCTION MANAGEMENT & LEGAL 8%						$21,000
ENVIRONMENTAL AND PERMITTING 3%						$8,000
CONTINGENCY 30%						$77,000
TOTAL						**$401,000**
POND D TO WWTP RETURN PUMPING (Rounded) TOTAL						**$400,000**

NOTES: (1) Unit cost includes installation if value equals 1.0. (2) Electrical at 8% of mechanical where prior MCC Replacement Project is complete.
(3) At an an ENR 20-Cities CCI of 10,092, November 2015.

SASD Sewer Master Plan						
0277-1300 San Andreas Sanitary District						
Improve DLDA Pumping to 1,000 gpm						
Preliminary Design Opinion of Probable Cost						
Division & Item No.	**Item Description**	**Qty.**	**Unit**	**Unit Price**	**Install Adj.(1)**	**Total**
1 GENERAL REQUIREMENTS						
1.1	Mobilization and Demobilization	1.0	LS	$15,880	1.00	$15,880
2 SITE WORK						
2.1	General Site Improvements	1.0	LS	$5,000	1.00	$5,000
3 CONCRETE						
3.1	Pumping Plant Concrete	25.0	CY	$700	1.00	$17,500
9 FINISHES						
9.1	Painting and Coating	1.0	LS	$8,000	1.00	$8,000
11 EQUIPMENT						
11.1	Effluent Pumps	1.0	EA	$50,000	1.50	$75,000
11.2	Effluent Screening	2.0	EA	$35,000	1.50	$105,000
15 MECHANICAL						
15.1	Pump Station Piping and Valves	1.0	LS	$46,000	1.00	$46,000
15.2	Piping Improvements	1.0	LS	$35,000	1.00	$35,000
16 ELECTRICAL						
16.1	General Electrical Improvements	1.0	LS	$26,100	1.00	$26,100
SUBTOTAL (ROUNDED)						$334,000
DESIGN ENGINEERING 15%						$51,000
PROJECT/CONSTRUCTION MANAGEMENT & LEGAL 8%						$27,000
ENVIRONMENTAL AND PERMITTING 3%						$11,000
CONTINGENCY 30%						$101,000
TOTAL						**$524,000**
IMPROVE DLDA PUMPING (Rounded) TOTAL						**$520,000**

NOTES: (1) Unit cost includes installation if value equals 1.0. (2) Electrical at 10% of mechanical where prior MCC Replacement Project is complete.
(3) At an an ENR 20-Cities CCI of 10,092, November 2015.

SASD Sewer Master Plan						
0277-1300 San Andreas Sanitary District						
Expand DLDA to Minimum of 53 Acres						
Preliminary Design Opinion of Probable Cost						
Division & Item No.	**Item Description**	**Qty.**	**Unit**	**Unit Price**	**Install Adj.(1)**	**Total**
1 GENERAL REQUIREMENTS						
1.1	Mobilization and Demobilization	1.0	LS	$32,420	1.00	$32,420
2 SITE WORK						
2.1	DLDA Site Improvements at Nielsen Property	34	AC	$15,600	1.00	$530,400
2.2	General Site Improvements	1.0	LS	$5,000	1.00	$5,000
9 FINISHES						
9.1	Valve Station Painting and Coating	1.0	LS	$3,000	1.00	$3,000
15 MECHANICAL						
15.1	Valve Stations	1.0	LS	$50,000	1.00	$50,000
15.2	Delivery Piping Improvements	1.0	LS	$30,000	1.00	$30,000
16 ELECTRICAL						
16.1	DLDA Irrigation System Control Stations	5.0	EA	$6,000	1.00	$30,000
SUBTOTAL (ROUNDED)						$681,000
DESIGN ENGINEERING 10%						$69,000
PROJECT/CONSTRUCTION MANAGEMENT & LEGAL 8%						$55,000
ENVIRONMENTAL AND PERMITTING 7%						$48,000
CONTINGENCY 30%						$205,000
TOTAL						**$1,058,000**
EXPAND DLDA AREA (Rounded) TOTAL						**$1,060,000**

NOTES: (1) Unit cost includes installation if value equals 1.0. (2) Electrical at 10% of mechanical where prior MCC Replacement Project is complete.
(3) At an an ENR 20-Cities CCI of 10,092, November 2015.

SASD Sewer Master Plan						
0277-1300 San Andreas Sanitary District						
Improve DLDA Pumping to 2,400 gpm						
Preliminary Design Opinion of Probable Cost						
Division & Item No.	**Item Description**	**Qty.**	**Unit**	**Unit Price**	**Install Adj.(1)**	**Total**
1 GENERAL REQUIREMENTS						
1.1	Mobilization and Demobilization	1.0	LS	$13,375	1.00	$13,375
2 SITE WORK						
2.1	General Site Improvements	1.0	LS	$5,000	1.00	$5,000
3 CONCRETE						
3.1	Pumping Plant Concrete	25.0	CY	$700	1.00	$17,500
9 FINISHES						
9.1	Painting and Coating	1.0	LS	$8,000	1.00	$8,000
11 EQUIPMENT						
11.1	Effluent Pumps	1.0	EA	$50,000	1.50	$75,000
11.2	Effluent Screening	1.0	EA	$35,000	1.50	$52,500
15 MECHANICAL						
15.1	Pump Station Piping and Valves	1.0	LS	$35,000	1.00	$35,000
15.2	Piping Improvements	1.0	LS	$35,000	1.00	$35,000
16 ELECTRICAL						
16.1	General Electrical Improvements	1.0	LS	$39,500	1.00	$39,500
SUBTOTAL (ROUNDED)						$281,000
DESIGN ENGINEERING 15%						$43,000
PROJECT/CONSTRUCTION MANAGEMENT & LEGAL 8%						$23,000
ENVIRONMENTAL AND PERMITTING 3%						$9,000
CONTINGENCY 30%						$85,000
TOTAL						**$441,000**
IMPROVE DLDA PUMPING (Rounded) TOTAL						**$440,000**

NOTES: (1) Unit cost includes installation if value equals 1.0. (2) Electrical at 20% for additional MCC Section.
(3) At an an ENR 20-Cities CCI of 10,092, November 2015.