June 2019 | Water Pipeline and Tank Safety Hazard Assessment

NAKASE ELEMENTARY SCHOOL

Toll Brothers

Prepared for:

Toll Brothers
Contact: Ilan P. Feingold, Sr. Project Manager
715 W. Town & Country Road, Suite 200
Orange, California 92868
714.347.1300

Prepared by:

PlaceWorks
Contact: Steve Bush, PE, Senior Engineer
1625 Shattuck Avenue, Suite 300
Berkeley, California 94709
510.848.3815
info@placeworks.com
www.placeworks.com

PLACEWORKS

PLACEWORKS

Table of Contents

1. Introduction ... 1
1.1 PURPOSE ... 1
1.2 SCHOOL SITE LOCATION ... 1
1.3 REGULATORY REQUIREMENTS ... 1
1.4 REPORT OBJECTIVES ... 2
1.5 ASSESSMENT METHODOLOGY ... 2
2. Hazard Assessment ... 3
2.1 PIPELINE IDENTIFICATION ... 3
2.2 WATER TANK LOCATION AND OPERATIONAL DATA ... 4
2.3 LAND USE AND TERRAIN ... 4
2.4 WATER TANK FAILURE RATES ... 5
3. Consequence Analysis ... 9
3.1 WATER PIPELINE FLOODING ANALYSIS ... 9
3.2 WATER TANK FLOODING ANALYSIS ... 10
4. Summary and Recommendations ... 13
4.1 SUMMARY ... 13
4.2 RECOMMENDATIONS ... 14
5. References ... 15

Table of Contents

List of Figures

Figure

Figure 1 Site Location and Pipeline Map 18

List of Tables

Table **Page**

Table 1 Water Pipelines 3
Table 2 Water Pipeline Flooding Analysis – Street Flow 9

List of Appendices

Appendix A. Agency Correspondence
Appendix B. Water Storage Tank Release Calculations

1. Introduction

1.1 PURPOSE

This report presents the results of a Water Pipeline and Water Tank Safety Hazard Assessment prepared for the proposed Nakase Elementary School. This assessment evaluates the potential risk of flooding at the school site from large volume (≥ 12 inches in diameter) water pipelines and from two existing water storage tanks located approximately 1,250 feet and 1,530 northwest of the project site.

1.2 SCHOOL SITE LOCATION

Toll Brother (the project developer) is working to gain approval for construction of an elementary school on 10-acres of the 120.83-acre Nakase Property Area Plan located at 20621 Lake Forest Drive, Lake Forest, California. The project developer will dedicate the elementary school site to the Saddleback Valley Unified School District (SVUSD) following the City of Lake Forest certification of the Nakase Property Area Plan Final Environmental Impact Report, general plan amendment, zone change, development agreement, and subject to SVUSD's environmental review and approval of the school site, California Department of Education's (CDE) final approval, as well as completion and approval of grading and infrastructure plans. The school site would accommodate up to 1,000 students from kindergarten through sixth grade. The Nakase Property Area Plan is bounded by Bake Parkway to the northwest, nursery operations and commercial/office buildings to the southwest, Serrano Creek to the southeast, and Rancho Parkway to the northeast. The proposed elementary school and play fields and active use areas (project site) are in the northeast corner of the Nakase Nursery site. Figure 1 shows the school site location, water pipeline locations within 1,500 feet of the site, and the two existing water tanks.

1.3 REGULATORY REQUIREMENTS

Under Education Code Section 17251, the California Department of Education (CDE) has authority to approve the acquisition of school sites. The District must obtain CDE approval for sites to receive state funds under the state's School Facilities Program administered by the State Allocation Board. CDE standards and regulations for this process are presented in California Code of Regulations, Title 5, Sections 14010, 14011, and 14012. Information on assessing safety hazard related to water storage tanks is discussed in Section 14010 (h):

> *The site shall not be located near an above-ground water or fuel storage tank or within 1,500 feet of the easement of an above-ground or underground pipeline that can pose a safety hazard as determined by a risk analysis study, conducted by a competent professional, which may include certification from a local public utility commission.*

No high pressure natural gas pipelines or hazardous liquid pipelines were identified within 1,500 feet of the project site (National Pipeline Mapping System, 2019). The CDE's School Site Selection and Approval Guide also contain provisions for evaluating high-pressure water pipelines:

To ensure the protection of students, faculty, and school property if the proposed school site is within 1,500 feet of the easement of an aboveground or underground pipeline that can pose a safety hazard, the school district should obtain the following information from the pipeline owner and operator:

- *Pipeline alignment, size, type of pipe, depth of cover*
- *Operating water pressures in pipelines near the proposed school site*
- *Estimated volume of water that might be released from the pipeline should a rupture occur on the site*
- *Owner's assessment of the structural condition of the pipeline.*

1.4 REPORT OBJECTIVES

To meet the requirements of CCR Title 5 Sections 14010 (d) and (h) and CDE's policy on pipelines, this report is designed to meet the following objectives:

- Identify all high pressure/large volume water pipelines within 1,500 feet of the proposed school site and evaluate the potential for flooding
- Identify all nearby large volume water tanks that have the potential for releases to impact the school site and evaluate the potential for flooding
- Where appropriate, identify and develop mitigation measures to reduce flooding impacts to acceptable levels.

1.5 ASSESSMENT METHODOLOGY

The CDE also has developed risk analysis procedures for evaluating flooding associated with releases from large diameter water pipelines, as described in CDE's *Guidance Protocol for School Site Pipeline Risk Analysis* (CDE, 2007). A safety issue associated with large diameter water pipelines is the potential for flooding. Also, releases from underground water pipelines can cause subterranean erosion of saturated soil, leading to subsidence or formation of a sinkhole. The most likely cause of failure is a large magnitude earthquake and associated strong ground shaking. Although no specific criteria have been established by the CDE as a threshold of significance for flooding at a school site, a water depth of 12 inches or greater is a trigger that could warrant further evaluation (CDE, 2007).

The CDE has not yet developed a protocol for evaluating safety hazards associated with releases from water storage tanks or reservoirs. Therefore, the procedures described in CDE's *Guidance Protocol for School Site Pipeline Risk Analysis* were used to evaluate flooding associated with releases from the water storage tanks (CDE, 2007). A potential safety issue associated with the siting of a new school down-gradient from a dam, reservoir, or water storage tank is the potential for flood inundation of the school site due to failure of these structures. The most probable cause of failure is a large magnitude earthquake and associated strong ground shaking, which can cause structural damage and a release of impounded water. The analysis will evaluate the potential for flooding and estimated depth of water at the school site if the identified tanks were to catastrophically fail.

2. Hazard Assessment

2.1 PIPELINE IDENTIFICATION

Based on plans provided from the Irvine Ranch Water District (IRWD), there are 16 high volume (≥12 inch diameter) water pipelines within 1,500 feet of the project site. The pipeline locations are shown on Figure 1 and summarized in Table 1.

There are two additional water pipelines within the 1,500-foot radius. There is a 12-inch water pipeline that originates at the IRWD reclaimed water tank and connects to the 12-inch reclaimed water main along Rancho Parkway South. In addition, there is an 18-inch overflow pipeline from the IRWD potable water tank that discharges into a drainage area south of the tank. These additional water pipelines are discussed in further detail in Sections 2.2 and 3.2.

Table 1 Water Pipelines

Pipeline Diameter	Pipeline Location	Material of Construction	Type
24-inch	Bake Parkway	Cement Mortar Lined & Coated (CML&C)	Domestic Main
18-inch	Bake Parkway, west of Rancho Parkway South	Polyvinyl Chloride (PVC)	Domestic Main
16-inch	Bake Parkway, between Rancho Parkway South and Rancho Parkway	PVC	Domestic Main
12-inch	Bake Parkway, between Rancho Parkway South and Rancho Parkway	PVC	Domestic Main
12-inch	Orchard Road	PVC	Domestic Main
18-inch	Rancho Parkway South	PVC	Domestic Main
16-inch	Rancho Parkway South	PVC	Domestic Main
16-inch	Rancho Parkway	PVC	Domestic Main
12-inch	Rancho Parkway	PVC	Domestic Main
12-inch	Lake Forest Drive	PVC	Domestic Main
12-inch	Towne Centre Drive	PVC	Domestic Main
12-inch	Bake Parkway	PVC	Recycled Water
12-inch	Orchard Road	PVC	Recycled Water
12-inch	Rancho Parkway South	PVC	Recycled Water
12-inch	Rancho Parkway	PVC	Recycled Water
12-inch	Lake Forest Drive	PVC	Recycled Water

2.2 WATER TANK LOCATION AND OPERATIONAL DATA

The IRWD owns and operates two 7.8-million-gallon aboveground water storage tanks located approximately 1,250 feet and 1,530 feet northwest of the proposed school site. The tank locations and school site are shown on Figure 1. These tanks provide potable water and recycled water to IRWD customers within Central Orange County. Water tank information was provided by Mr. Eric Akiyoshi, P.E., Principal Engineer (IRWD, 2019). Agency correspondence is provided in Appendix A.

The Lake Forest Zone "II" West Reservoir storage tank was installed in 1978 and is constructed of welded steel with a diameter of 200 feet and a height of 35 feet. The Zone "II" West Reservoir tank stores domestic water with a maximum high water level of 33 feet (IRWD, 2019). The Lake Forest Zone "B" West Reservoir storage tank is approximately 80 feet southeast of the Zone "II" West Reservoir tank. The Zone "B" West Reservoir storage tank was installed in 1984 and is also constructed of welded steel with a diameter of 200 feet and a height of 35 feet. The Zone "B" West Reservoir tank stores recycled water with a maximum high water level of 33 feet (IRWD, 2019).

The IRWD have owned and operated the tanks since January 2001. The tanks are inspected weekly by on-site personnel and are monitored continuously with automated supervisory control and data acquisition (SCADA) computer system. Additionally, the tanks are inspected approximately every 2 years via underwater camera and SCUBA inspections. The IRWD reports the tanks have not had any leaks during the time IRWD has owned the tanks (i.e., since 2001), and there is no reported history of leakage prior to IRWD's acquisition of the tanks (IRWD, 2019).

The inlet/outlet piping to the Zone "II" West Reservoir tank is 24 inches in diameter. The inlet/outlet piping to the Zone "B" West Reservoir tank is 12 inches in diameter and has a flexible pipe coupling to resist the stress produced by ground motion from large earthquakes. Therefore, the worst-case catastrophic release scenario for this analysis is assumed to be a break in the tank's inlet/outlet pipe during a maximum credible earthquake as a result of differential movement. This would result in a 24-inch diameter hole where the inlet/outlet piping connects to the side of the Zone "II" West Reservoir tank and a 12-inch diameter hole where the inlet or outlet piping connects to the side of the Zone "B" West Reservoir tank. It is assumed that a break in the inlet/outlet connection to the tank would result in the release of the entire contents of the tank and the tank would be at its maximum volume.

2.3 LAND USE AND TERRAIN

Although a nursery currently exists on the property, the proposed school will not be in operation concurrently with the nursery. The current plans call for mainly residential land uses to be constructed around the future school. Commercial uses are located north of Bake Parkway and east of Rancho Parkway. The project site terrain is relatively flat with a gradual slope toward the southwest although the area to the north is relatively hilly.

The Zone "B" West Reservoir tank facility is bermed on the south, west, and east sides, with an access driveway to the tank facilities, east of the Zone "II" West Reservoir tank. The tanks are situated atop an

elevated knoll, as shown in the topographic map in Appendix B. According to the tank as-built drawings provided in Appendix B, the bermed areas along the south side of the tanks range from 5 to 20 feet above the tank ground level. If a release were to occur at the tank facility, the water would drain to the east towards the access driveway and towards Rancho Parkway South, drain to the north towards Baker Ranch Community Park, and drain to the southwest. Commercial and industrial land uses are located between the tank facilities and the proposed school site. A more detailed analysis is presented in Section 3.2.

2.4 WATER TANK FAILURE RATES

Large water storage tanks typically do not fail catastrophically, even when subject to very strong ground shaking associated with an earthquake. But failure of these tanks could have consequences in terms of flooding at downstream locations. The most likely failure scenario is a piping break at the connection to the tanks. The following section reviews how steel storage tanks have fared during California earthquakes and potential failure modes.

Failure Modes for Steel Storage Tanks

Potential failure modes specific to steel storage tanks include:

Shell Buckling Mode – One of the most common causes of damage in steel tanks, this involves the outward buckling of the bottom shell course, a phenomenon known as "elephant foot". This has occasionally resulted in the loss of tank contents and, in some cases, total collapse of the tank.

Anchorage Failure – Many steel tanks have hold-down bolts, straps, or chairs that may result in anchor pullout, stretching, or failure during an earthquake. However, failure of an anchor does not necessarily lead to loss of tank contents.

Hydrostatic Pressure Failure – Tensile hoop stresses can increase due to shaking-induced pressures between the fluid and the tank, leading to splitting and leakage. Although no welded steel tanks have actually ruptured, large tensile hoop stresses can contribute to the likelihood of elephant foot buckling near the base of the tank.

Roof and Miscellaneous Steel Damage – A sloshing motion of the tank contents during an earthquake (known as a seiche) can cause upward pressure on the roof for full or nearly full tanks. New seismic codes that require a significant amount of freeboard reduce this potential impact. In past earthquakes, damage has occurred to the joints between the walls and the cone foots, with spillage of tank contents over the top of the wall. Lateral movement and rotation from ground shaking can also result in broken guides, ladders, or other appurtenances attached between the roof and the bottom plate. However, roof damage or broken appurtenances usually do not lead to a loss of more than one third of the tank's contents.

Foundation Failure – Soil failure due to liquefaction, slope instability, or excessive differential settlement as a result of an earthquake can cause severe distortion, cracking, or leakage at the tank bottom or foundation.

Connecting Pipe Failure – One of the more common causes of loss of tank contents during earthquakes is the fracture of piping at connections to the tank. This generally results from large vertical displacements of

the tank caused by tank buckling, wall uplift, or foundation failure, but can also occur with horizontal displacement of the tanks. Piping failure can also lead to extensive scour of the foundation materials. The recent seismic requirement for flexible piping connections reduces this potential impact.

Failure Rates of Tanks During Earthquakes

American Lifelines Alliance (ALA, 2001) evaluated the seismic performance of 424 tanks during the following earthquakes:

- 1933 Long Beach
- 1952 Kern County
- 1964 Alaska
- 1971 San Fernando
- 1979 Imperial Valley
- 1983 Coalinga
- 1989 Loma Prieta
- 1992 Landers
- 1994 Northridge

Each tank was assigned one of five damage states:

- Damage State 1: No damage
- Damage State 2: Slight damage – damage to roof, minor loss of content, minor shell damage, damage to attached pipes, no elephant foot failure
- Damage State 3: Moderate damage – elephant foot buckling with no leak or minor loss of contents
- Damage State 4: Extensive damage – elephant foot buckling with major loss of contents, severe damage
- Damage State 5: Complete (collapse) damage – total failure, tank collapse

The peak ground acceleration (PGA) for each earthquake also was reported and fragility curves were developed, which relate PGA to the probability of reaching or exceeding a particular damage state. For this analysis, a damage state of 4 or 5 was considered to be relevant for the catastrophic release scenario, because damage states of 1 through 3 would result in leakage that would be released slowly without causing significant flooding.

According to the United States Geological Survey Interactive Aggregation Website (2019), the maximum credible earthquake (i.e., 2% exceedance probability in 50 years) at the site was determined to have a peak ground acceleration (PGA) of 0.53g. This corresponds with an earthquake that has the potential to cause severe damage to water facilities (PGA$\geq$0.5g). The site is not located in an Alquist Priolo fault rupture hazard zone. The nearest known active earthquake fault is the San Joaquin Hills Thrust Fault, which is approximately 3.9 miles southwest of the school site.

For a PGA value of 0.53g, the ALA damage matrix showed that for 53 steel water tanks exposed to this level of ground shaking, only 5 tanks showed a Damage State of 4 or 5 (extensive damage or complete failure). However, it should be noted that most of the storage tanks in the database were old and not anchored or

designed to current earthquake standards. Anchoring of the foundations and retrofitting to meet current seismic standards would reduce this risk.

A site-specific water tank failure assessment was also conducted for these tanks. Assuming an upper-bound earthquake at the site has a return period of 2,475 years, or a 2% chance of exceedance in 50 years, this is equivalent to a 4.0×10^{-4} probability of occurring in a given year. According to the ALA's study of tank damage during earthquakes, steel water tanks exposed to a PGA associated with the upper-bound earthquake at the site (0.53g) could result in severe damage (Damage State 4) or total failure (Damage State 5). Conservatively assuming that severe damage would result in the loss of the entire contents of the water tank and there is a 9.4% probability of this occurring with an upper-bound earthquake (i.e., 5 out of 53 tanks in the database exhibited severe damage), the probability that the water tank would catastrophically fail given the upper-bound earthquake occurs at the site is predicted to be $4.0 \times 10^{-4} \times 0.094 = 3.8 \times 10^{-5}$. This is equivalent to once every 26,300 years. It should again be noted that the ALA's database includes tanks that are older and not subject to recent AWWA and seismic standards; therefore, the probability of a maximum credible earthquake resulting in a release of water at the tank site should be much lower than this estimate.

2. Hazard Assessment

This page intentionally left blank.

3. Consequence Analysis

3.1 WATER PIPELINE FLOODING ANALYSIS

The CDE requires that the risk of releases from high volume (≥12 inches) water pipelines be evaluated. The CDE Guidance Protocol for School Pipeline Risk Analysis provides a methodology for evaluating the potential for flooding. A probability analysis is not required. Because all of the identified water pipelines in Table 1 are located beneath streets, a pipeline flooding analysis was conducted for these pipelines to determine the depth and location of water flow within the street in the event of a pipeline leak or rupture. For this worst-case analysis, it was conservatively assumed that all of the water flowing through the pipelines at their maximum capacity would reach the surface. In addition, no credit was taken for the presence of storm drains along these streets.

Release impacts were calculated based on the procedures specified in the CDE manual. The release rate was determined by multiplying the pipe area by an assumed velocity of 5 feet per second (fps). Then the release rate was compared to the carrying capacity of the street, taking into account longitudinal slope, to determine if the water would be contained within the confines of the street curbing (Jeffers & Associates, 2006). The results are provided in Table 2.

Table 2 Water Pipeline Flooding Analysis – Street Flow

Pipeline Diameter (inches)	Pipeline Location	Type	Release Rate (cfs)	Street Width (ft)	Depth of Flow in Street (in)	Curb Height (inches)	Exceeds Street Carrying Capacity?
24-inch	Bake Parkway	Domestic Main (DM)	15.71	78	4.8	8	No
18-inch	Bake Parkway	DM	8.84	78	3.9	8	No
16-inch	Bake Parkway	DM	6.98	78	3.6	8	No
12-inch	Bake Parkway	DM	3.93	78	3.0	8	No
12-inch	Orchard Road	DM	3.93	40	2.1	8	No
18-inch	Rancho Parkway South	DM	8.84	78	2.7	8	No
16-inch	Rancho Parkway South	DM	6.98	78	2.5	8	No
16-inch	Rancho Parkway	DM	6.98	88	4.2	8	No
12-inch	Rancho Parkway	DM	3.93	88	3.5	8	No
12-inch	Lake Forest Drive	DM	3.93	78	2.6	8	No
12-inch	Towne Centre Drive	DM	3.93	60	2.6	8	No
12-inch	Bake Parkway	Recycled Water (RW)	3.93	78	3.0	8	No
12-inch	Orchard Road	RW	3.93	40	2.1	8	No
12-inch	Rancho Parkway South	RW	3.93	78	2.1	8	No
12-inch	Rancho Parkway	RW	3.93	88	3.5	8	No
12-inch	Lake Forest Drive	RW	3.93	78	2.6	8	No

Assuming a standard 8-inch curb for arterial streets, the water released from a full-flow rupture of the water pipelines would be entirely contained within the confines of the street curbing and would not result in flooding at the school site. For this worst-case analysis, it was conservatively assumed that all of the water flowing through the pipeline at its maximum capacity would reach the surface. In addition, no credit was taken for the existing surface topography nor that only a portion of the water released from the pipeline would reach the surface, given the pipelines are buried at least 3 feet below ground surface.

3.2 WATER TANK FLOODING ANALYSIS

In the unlikely event that either of the 7.8-million-gallon aboveground water storage tanks experience a release during the maximum credible earthquake, an important question to be answered is where the water would flow that is released from the tanks. A flooding analysis was conducted to answer this question and to determine if students and staff at the school site would be impacted.

For this worst-case analysis, it was assumed that the 7.8-million-gallon IRWD storage tanks would catastrophically fail as the result of an earthquake. It was assumed that either of the tanks would be full at the time and all of the water in the tank would be released immediately from the bottom of the tank via either the 24-inch inlet/outlet piping (i.e., 2-foot diameter hole) for the Zone "II' West Reservoir tank and via the 12-inch inlet/outlet piping (i.e., 1-foot diameter hole) for the Zone "B' West Reservoir tank. This worst-case analysis is conservative because a catastrophic failure of the storage tank is highly unlikely. The analysis provided in Section 2.4 shows that the ground shaking that occurs with the maximum credible earthquake in the vicinity of the water tank site would most likely not result in catastrophic tank failure. The water release impacts were modeled, using the methodology and calculations described in detail in Appendix B. For the modeling analysis, it was conservatively assumed that the inlet/outlet piping to the tank would break and release all the water from the tank. Based on the location of the tanks on top of a knoll with a berm to the south (see Elevation Gradient in Appendix B), the majority of released water would not flow directly toward the school site but would flow to the east towards the access driveway and onto Rancho Parkway South, to the north and northwest toward Baker Ranch Community Park, and to the south/southwest along the drainage channel just north and east of the cul-de-sac at Mariposa.

For the domestic water tank (Zone "II" West Reservoir tank), the release rate varies over time as the water level in the tank decreases, with a maximum flow rate of 97.0 cubic feet per second (cfs). The tank would be completely emptied in approximately 6 hours. However, IRWD personnel would respond quickly and most likely would be able to stop flow from the tank before it is completely emptied. Similarly, for the reclaimed water tank (Zone "B" West Reservoir tank), the maximum released water flow rate was calculated to be 24.3 cfs. Due to the smaller inlet/outlet piping size for the reclaimed water tank, the reclaimed water tank would take longer to empty (i.e., 24 hours and 10 minutes), compared to the domestic water tank. The results of the analysis are provided in Appendix B.

To determine if a catastrophic failure of either tank would result in a release of water that would adversely impact the school site, it was conservatively assumed that all of the water from the Zone "II" tank would flow at the maximum rate of 97 cfs onto Rancho Parkway South. The released water would most likely flow in multiple directions to the east, north, and south/southwest and the flow rate from the Zone "B" tank

3. Consequence Analysis

would be significantly less (i.e., 24 cfs) than the flow rate from the Zone "II" tank. A street flow analysis for Rancho Parkway South was conducted to determine if the released water would be confined within the street curbing. The results provided in Appendix B show that the maximum depth in the street would be 8.1 inches. The curb height of the street is 8 inches. Therefore, it is possible that 0.1 inches of water would overflow the curb. This assumes that the released water did not turn and flow southwest on Bake Parkway but continued straight over the curb. At this location (i.e., the intersection of Rancho Parkway South and Bake Parkway), if the water flowed straight over the curb, it would mainly impact the land just west of the school site. Conservatively assuming that some released water would reach the western boundary of the school site, a water depth of 0.1 inches is much less than CDE's water depth level of concern of 12 inches.

There also are two large volume water pipelines connected with the two tanks that are within the 1,500-foot radius: 1) a 12-inch reclaimed water line that connects from the Zone "B" reservoir to the 12-inch reclaimed water main beneath Rancho Parkway South and 2) a 18-inch overflow water pipeline connected to the Zone "II" tank that drains into a natural drainage channel. A break in the 12-inch reclaimed water main would follow the flow path presented above for the tank failure scenario and flow onto Rancho Parkway South. Since it has a flow rate significantly less than the 97 cfs analyzed in the tank failure scenario (3.93 cfs), a release from this pipeline would be completely contained within the street curbing of Rancho Parkway South and would not impact the school site. A break in the 18-inch overflow water pipeline from the Zone "II" tank would result in released water draining into the natural channel south of the two tanks and would not reach the school site.

Based on these results, there should be no significant flooding at the school site in the unlikely event that any the water storage tanks to the northwest or connected water pipelines were to fail due to a maximum credible earthquake.

3. Consequence Analysis

This page intentionally left blank.

4. Summary and Recommendations

4.1 SUMMARY

- Irvine Ranch Water District (IRWD) owns and operates 16 high volume water pipelines (domestic and recycled water) within 1,500 feet of the school site and two 7.8-million-gallon aboveground water storage tanks in close proximity to the school site.

- Based on the worst-case analysis for the water pipelines, the water released from a full-flow rupture of any of the water pipelines would be entirely contained within the confines of the street curbing and would not result in flooding at the school site.

- Both tanks are constructed of welded steel and are 200 feet in diameter, 35 feet in height, and operate with a high water level of 33 feet in each tank. The Lake Forest Zone "II" West Reservoir tank stores domestic water and the Lake Forest Zone "B" West Reservoir tank stores recycled water.

- The school site and water tank site are not located in an Alquist Priolo fault rupture hazard zone; the upper-bound earthquake for the water tank site was predicted to have a peak ground acceleration (PGA) of 0.53g.

- The probability that the tank would catastrophically fail due to ground shaking from the upper-bound earthquake was conservatively estimated to be 3.8×10^{-5}, or approximately once every 26,300 years.

- A worst-case analysis was conducted, assuming that the inlet/outlet connections to the water tanks ruptured during a maximum credible earthquake and all the water in each tank was released when the tank was at its maximum storage capacity.

- Based on the model results provided in Appendix B, the released water would flow to the east, north, and south/southwest, and away from the proposed school site to the southeast.

- Based on a worst-case analysis assuming all of the released water at a maximum rate of 97 cfs flowed down Rancho Parkway South, the maximum water depth in the street would be 8.1 inches, as compared to a curb height of 8 inches. Therefore, the street curbing overflow would be only 0.1 inches and there would be no significant flooding at the school site.

- The results of this analysis show that a release from the IRWD storage tanks due to a maximum credible earthquake would not result in a safety hazard to students and staff at the proposed Nakase Elementary School.

4.2 RECOMMENDATIONS

- Although it is highly unlikely that any released water from a catastrophic failure of IRWD water pipelines or storage tanks could reach the school site, the school's emergency response and evacuation plan could address the possibility of water releases from this storage tank and identify potential evacuation routes (i.e., to the south). The following recommendations, though not required, could be implemented:
    - Maintain contact names for the water agency (Irvine Ranch Water District) with the emergency response plan in case the school needs to report leakage or malfunctions of the storage tank.
    - Keep a copy of this report with the school's emergency response plan so that potential flow paths and evacuation routes can be determined in the unlikely event of accidental releases from this tank.

5. References

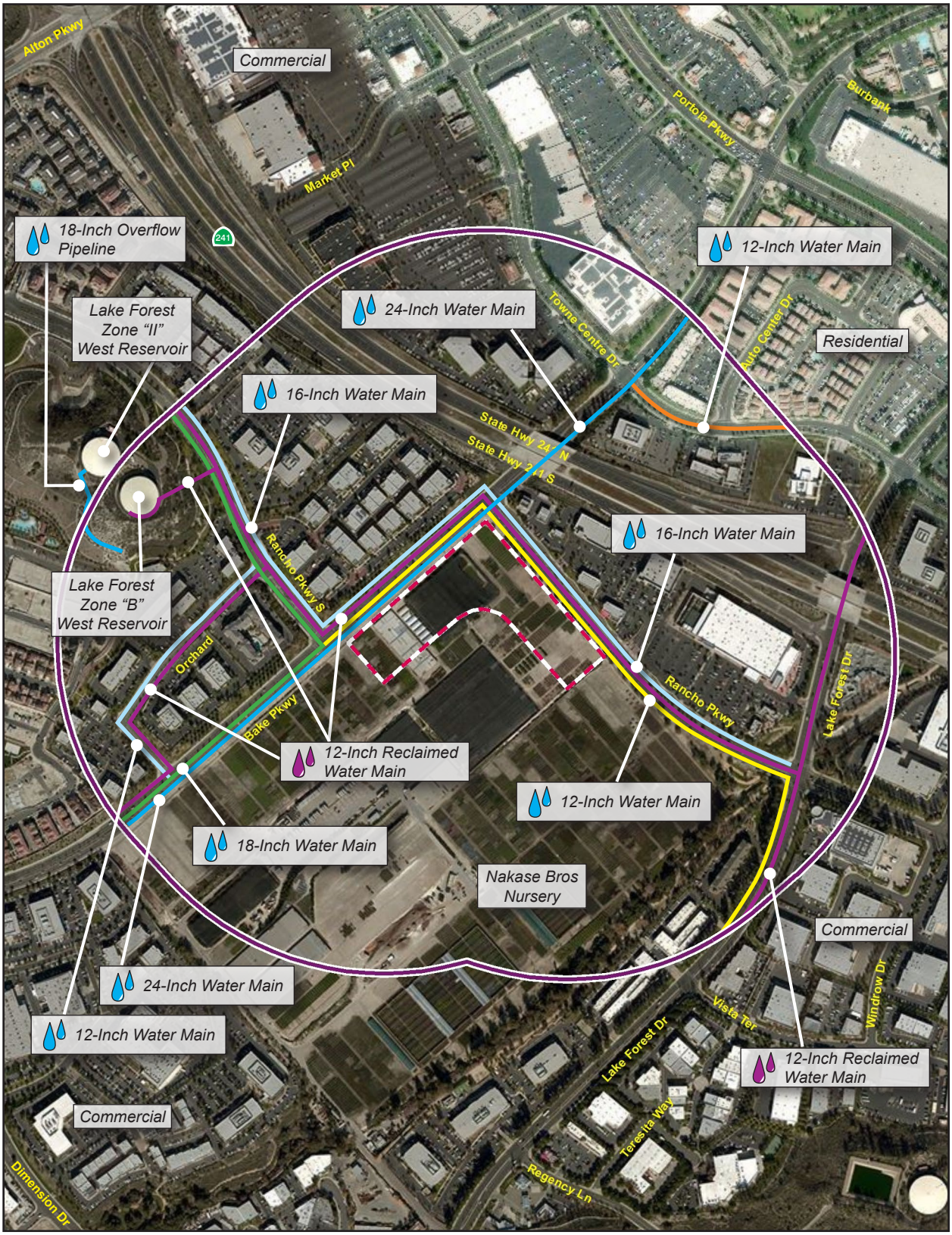
1. American Lifelines Alliance (ALA), 2001. *Seismic Fragility Formulations for Water Systems, Part 1 – Guideline.* April 2001.
2. California Department of Education (CDE), 2000. Resources for School Facilities Planning, School Selection and Approval Guide. Prepared by School Facilities Planning Division, CDE, Sacramento, CA.
3. CDE, 2007. Guidance Protocol for School Site Pipeline Risk Analysis, Prepared by URS Corporation. February, 2007.
4. Irvine Ranch Water District (IRWD), 2019. Water pipeline and tank information provided by Mr. Eric Akiyoshi, PE, Principal Engineer for IRWD to Ms. Danielle Clendening, Intern, for PlaceWorks. Dated January 29, 2019 and March 12, 2019.
5. Jeffers & Associates, 2006. Modified Manning's Equation Solver. Version 3.0.
6. National Pipeline Mapping System (NPMS), 2019. Gas Transmissions and Hazardous Liquids Pipeline Map produced by the NPMS Public Viewer at https://pvnpms.phmsa.dot.gov/PublicViewer/. Accessed on January 28, 2019.
7. PlaceWorks, 2018. *Water Pipeline Safety Hazard Assessment for Helen Keller Elementary School.* Dated January 2018.
8. United States Geological Survey, 2019. Unified Hazards Tool. Website accessed March 11, 2019 at https://earthquake.usgs.gov/hazards/interactive/.

5. References

This page intentionally left blank.

Figures

Figure 1 - Site Location and Pipeline Map



School Boundary

1,500-ft Radius

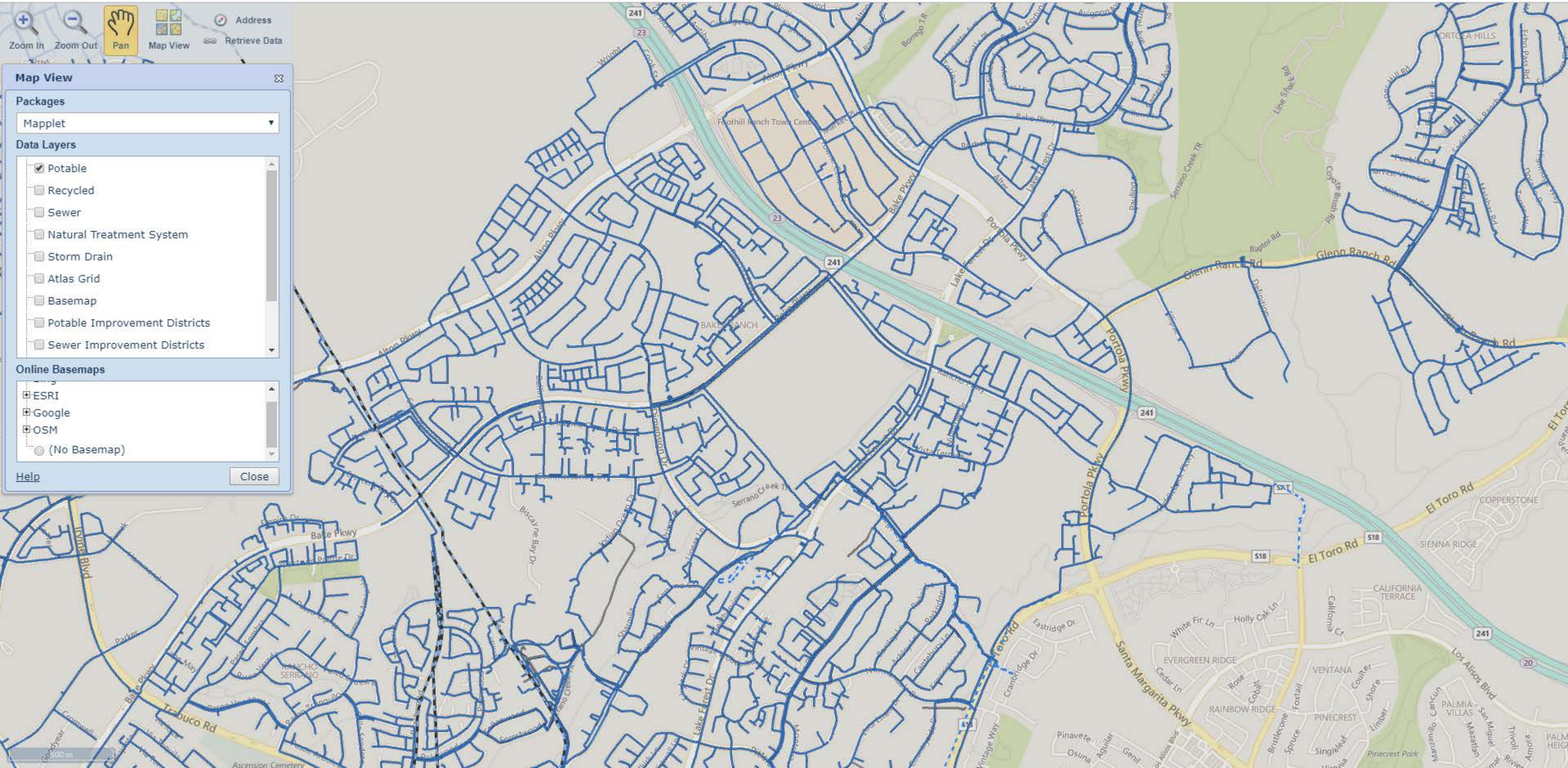
0 700
Scale (Feet)

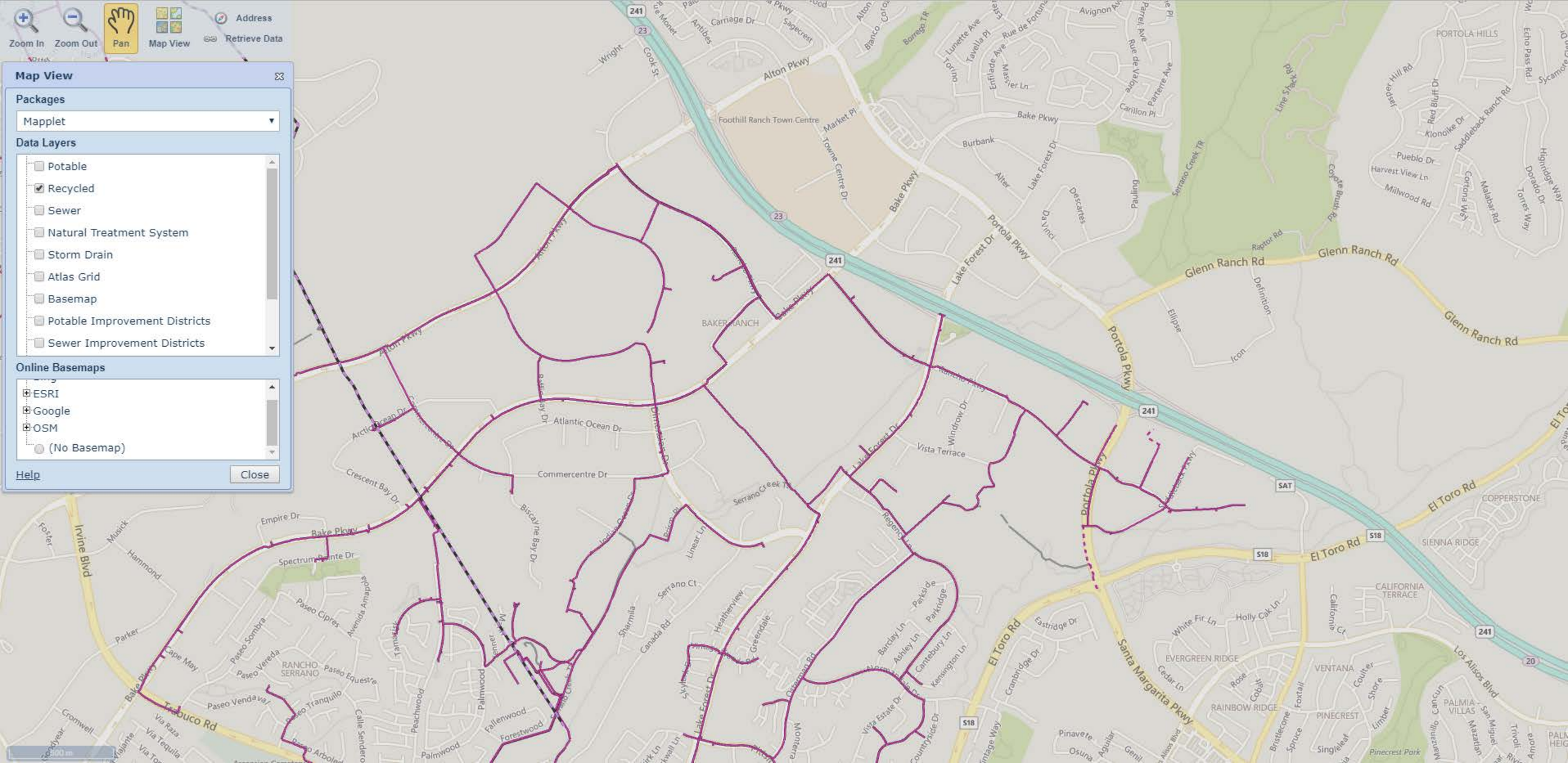
Source: ESRI, 2019

Appendix A. Agency Correspondence

Appendix

This page intentionally left blank.


Zoom In
Zoom Out
Pan
Map View
Address
Retrieve Data
Map View
Packages
Mapplet
Data Layers
Potable
Recycled
Sewer
Natural Treatment System
Storm Drain
Atlas Grid
Basemap
Potable Improvement Districts
Sewer Improvement Districts
Online Basemaps
ESRI
Google
OSM
(No Basemap)
Help
Close
Alton Pkwy
Bake Pkwy
Portola Pkwy
Glenn Ranch Rd
El Toro Rd
Santa Margarita Pkwy
Los Alisos Blvd
Trabuco Rd
Irvine Blvd
Lake Forest Dr
Serrano Creek Tr
Foothill Ranch Town Center
BAKE RANCH
PORTOLA HILLS
COPPERSTONE
SIENNA RIDGE
CALIFORNIA TERRACE
EVERGREEN RIDGE
VENTANA
RAINBOW RIDGE
PINECREST
PALMIA VILLAS
Pinecrest Park
RANCHO SERRANO
Ascension Cemetery
241
23
20
S18

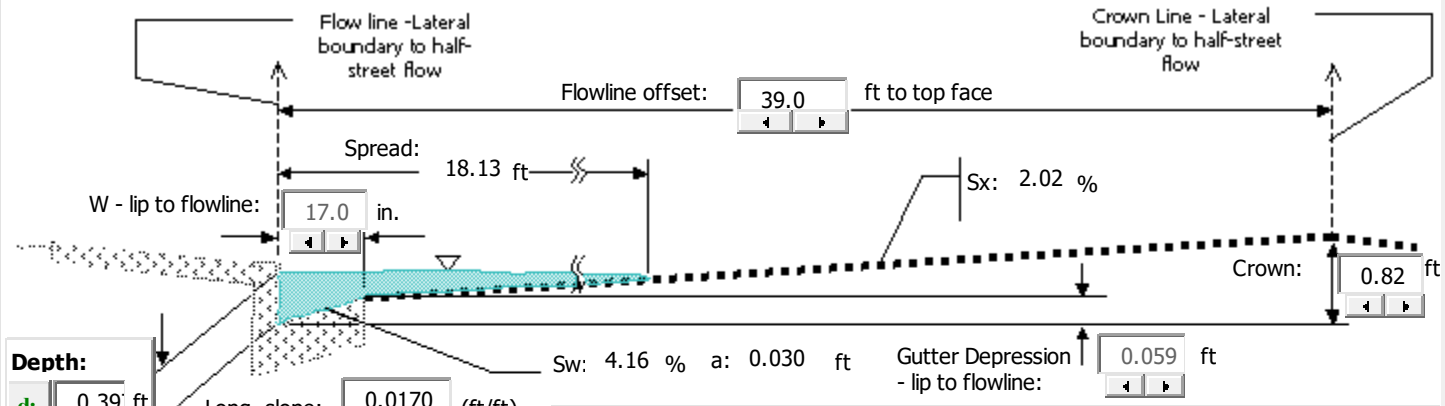

Zoom In
Zoom Out
Pan
Map View
Address
Retrieve Data
Map View
Packages
Mapplet
Data Layers
Potable
Recycled
Sewer
Natural Treatment System
Storm Drain
Atlas Grid
Basemap
Potable Improvement Districts
Sewer Improvement Districts
Online Basemaps
ESRI
Google
OSM
(No Basemap)
Help
Close
Alton Pkwy
Foothill Ranch Town Centre
Bake Pkwy
Portola Pkwy
Lake Forest Dr
Glenn Ranch Rd
El Toro Rd
Santa Margarita Pkwy
Los Alisos Blvd
Irvine Blvd
Trabuco Rd
Atlantic Ocean Dr
Commercentre Dr
Serrano Creek TR
Vista Terrace
BAKER RANCH
PORTOLA HILLS
COPPERSTONE
SIENNA RIDGE
CALIFORNIA TERRACE
EVERGREEN RIDGE
VENTANA
RAINBOW RIDGE
PINECREST
RANCHO SERRANO
PALMIA - VILLAS
Pinecrest Park
241
23
SAT
S18
20

Modified Manning's Equation Solver
Version: 3.0<>3/5/2019 3:46:39 PM

© 2006 Jeffers & Associates, PLLC. All Rights Reserved

Print | Save | Quit

Parameters | Composite Triangular Sections | Head - Discharge Table | Assumptions | Inlet Geometry | Disclaimer



Depth:
d: 0.39 ft
4.8 in.

Long. slope: 0.0170 (ft/ft)
N value: 0.016

Local Parameters:
Local inlet flow line depression: 2.0 in.

Curb Opening Parameters:
C-O Apron wider than gutter: 0 in.
S'w 13.9 % Se: 4.90 %
Length of curb opening inlet: 12.0 ft
Lt: 41.05 ft
80 % Clear Efficiency 38.1 %
Curb opening flowby: 9.73 cfs

P-1-7/8-4
Print Chart 7

Grate Parameters:
Apron wider than grate: 2 in.
Length: 48 in. Width: 22 in.
% Factor 50 % Factor 50
Splash-over Vel: 7.41 ft/s Vel over grate: 6.28 ft/s
Eo: 46.40 %
Rs: 3.95 % Rf: 100.00 %
Side flow captured: 0.29 cfs Frontal captured: 2.26 cfs
Total combined CB flowby: 7.17 cfs

Street Parameters:
Q: 15.71 cfs
K: 120.5
Vel: 4.69 ft/s
Eo: 20.6 %
W/T: 0.0782

Standard Manning's:
Q: 12.96 cfs
K: 99.4
Vel: 3.87 ft/s
Rh: 0.18 ft
Area: 3.35 sf

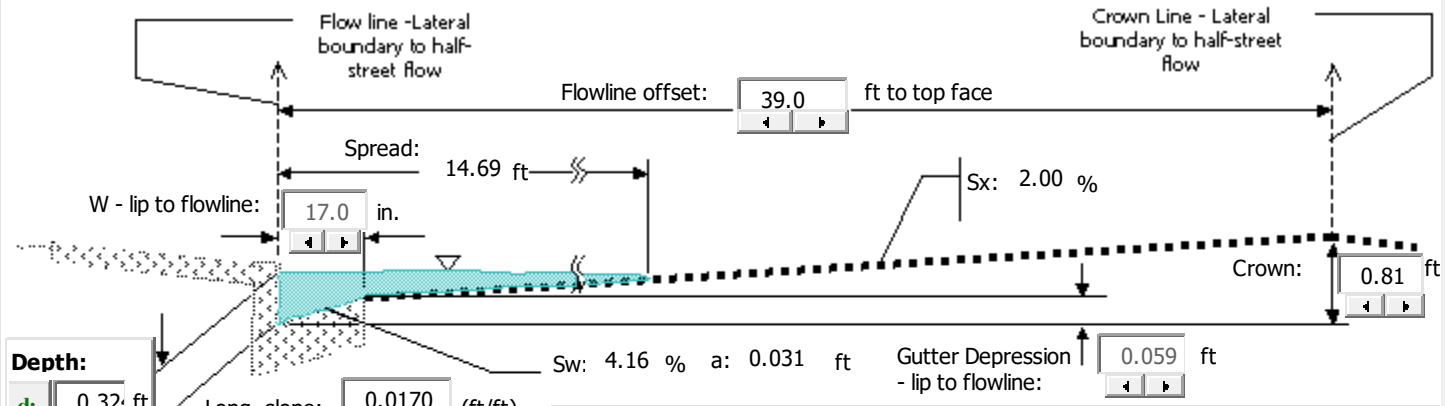
Street Flow - 24-Inch Domestic Water Pipeline
Bake Parkway

Modified Manning's Equation Solver
Version: 3.0<>5/10/2017 1:56:55 PM

© 2006 Jeffers & Associates, PLLC. All Rights Reserved

Print | Save | Quit

Parameters | Composite Triangular Sections | Head - Discharge Table | Assumptions | Inlet Geometry | Disclaimer



Depth:
d: 0.32 ft
3.9 in.

Long. slope: 0.0170 (ft/ft)
N value: 0.016

Local Parameters:
Local inlet flow line depression: 2.0 in.

Curb Opening Parameters:
C-O Apron wider than gutter: 0 in.
S'w 13.9 % Se: 5.53 %
Length of curb opening inlet: 12.0 ft
Lt: 29.96 ft
80 % Clear Efficiency 50.1 %
Curb opening flowby: 4.41 cfs

P-1-7/8-4
Print Chart 7

Grate Parameters:
Apron wider than grate: 2 in.
Length: 48 in. Width: 22 in.
% Factor 50 % Factor 50
Splash-over Vel: 7.41 ft/s Vel over grate: 5.27 ft/s
Eo: 64.72 %
Rs: 4.85 % Rf: 100.00 %
Side flow captured: 0.14 cfs Frontal captured: 1.43 cfs
Total combined CB flowby: 2.84 cfs

Street Parameters:
Q: 8.84 cfs
K: 67.8
Vel: 4.06 ft/s
Eo: 25.4 %
W/T: 0.0965

Standard Manning's:
Q: 7.28 cfs
K: 55.8
Vel: 3.34 ft/s
Rh: 0.15 ft
Area: 2.18 sf

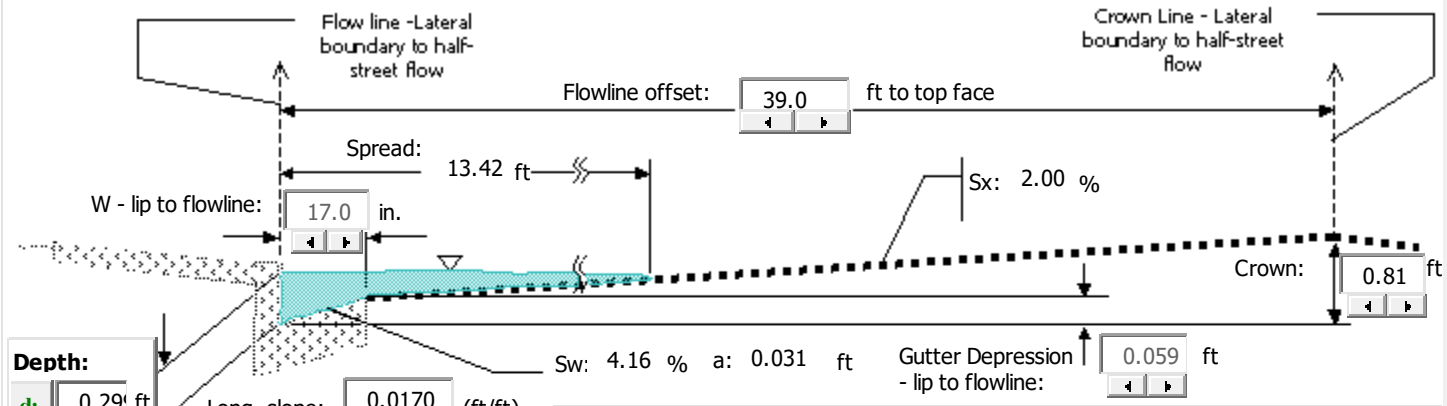
Street Flow - 18-Inch Domestic Water Pipeline
Bake Parkway, between Orchard Drive and
Rancho Parkway South

Modified Manning's Equation Solver
Version: 3.0<>5/10/2017 1:56:55 PM

© 2006 Jeffers & Associates, PLLC. All Rights Reserved

Print | Save | Quit

Parameters | Composite Triangular Sections | Head - Discharge Table | Assumptions | Inlet Geometry | Disclaimer



Depth:
d: 0.29 ft
3.6 in.

Long. slope: 0.0170 (ft/ft)
N value: 0.016

Local Parameters:
Local inlet flow line depression: 2.0 in.

Curb Opening Parameters:
C-O Apron wider than gutter: 0 in.
S'w 13.9 % Se: 5.85 %
Length of curb opening inlet: 12.0 ft
Lt: 26.23 ft
80 % Clear Efficiency 56.0 %
Curb opening flowby: 3.07 cfs

P-1-7/8-4
Print Chart 7

Grate Parameters:
Apron wider than grate: 2 in.
Length: 48 in. Width: 22 in.
% Factor 50 % Factor 50
Splash-over Vel: 7.41 ft/s Vel over grate: 4.86 ft/s
Eo: 74.63 %
Rs: 5.23 % Rf: 100.00 %
Side flow captured: 0.10 cfs Frontal captured: 1.15 cfs
Total combined CB flowby: 1.83 cfs

Street Parameters:
Q: 6.98 cfs
K: 53.5
Vel: 3.83 ft/s
Eo: 27.7 %
W/T: 0.1056

Standard Manning's:
Q: 5.74 cfs
K: 44.0
Vel: 3.15 ft/s
Rh: 0.13 ft
Area: 1.82 sf

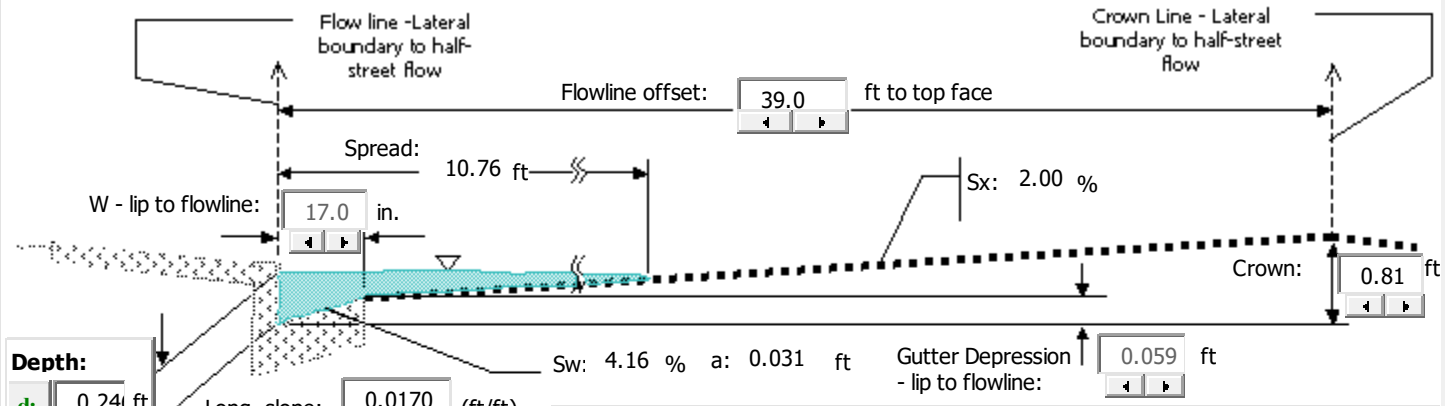
Street Flow - 16-Inch Domestic Water Pipeline
Bake Parkway, between Rancho Parkway South
and Rancho Parkway

Modified Manning's Equation Solver
Version: 3.0<>3/5/2019 3:46:39 PM

© 2006 Jeffers & Associates, PLLC. All Rights Reserved

Print | Save | Quit

Parameters | Composite Triangular Sections | Head - Discharge Table | Assumptions | Inlet Geometry | Disclaimer



Depth:
d: 0.24 ft
3.0 in.

Long. slope: 0.0170 (ft/ft)
N value: 0.016

Street Parameters:

Q:	3.93	cfs
K:	30.1	
Vel:	3.33	ft/s
Eo:	34.1	%
W/T:	0.1316	

Standard Manning's:

Q:	3.22	cfs
K:	24.7	
Vel:	2.73	ft/s
Rh:	0.11	ft
Area:	1.18	sf

Local Parameters:
Local inlet flow line depression: 2.0 in.

Curb Opening Parameters:
C-O Apron wider than gutter: 0 in.
S'w 13.9 % Se: 6.75 %
Length of curb opening inlet: 12.0 ft
Lt: 18.91 ft
80 % Clear Efficiency 72.1 %
Curb opening flowby: 1.10 cfs

P-1-7/8-4
Print Chart 7

Grate Parameters:
Apron wider than grate: 2 in.
Length: 48 in. Width: 22 in.
% Factor 50 % Factor 50
Splash-over Vel: 7.41 ft/s Vel over grate: 3.76 ft/s
Eo: 98.73 %
Rs: 5.93 % Rf: 100.00 %
Side flow captured: 0.03 cfs Frontal captured: 0.54 cfs
Total combined CB flowby: 0.52 cfs

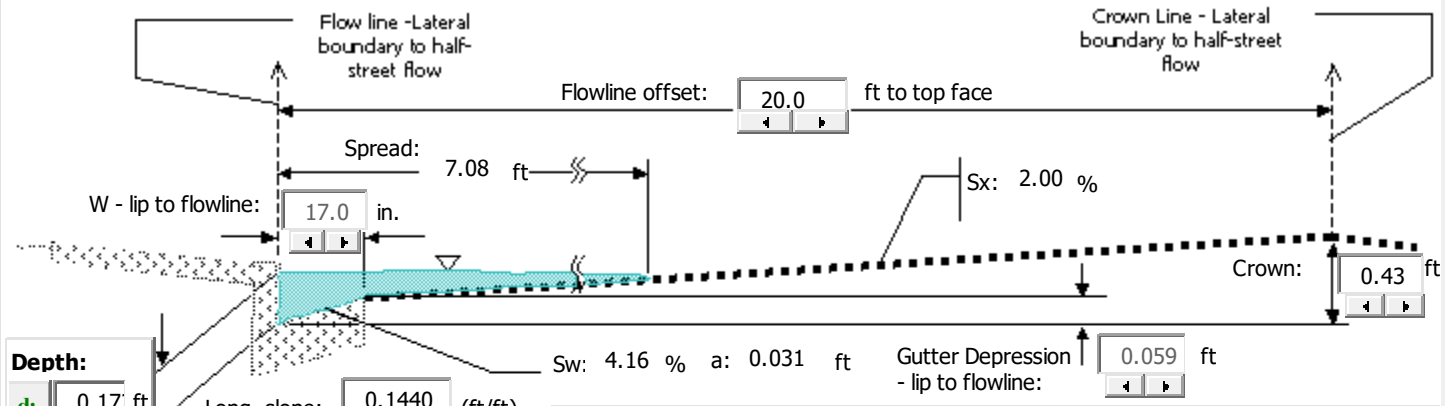
Street Flow - 12-Inch Domestic Water Pipeline
Bake Parkway, between Rancho Parkway South and Rancho Parkway
12-Inch Recycled Water Pipeline
Bake Parkway west of Orchard Road and between Rancho Parkway South and Rancho Parkway

Modified Manning's Equation Solver
Version: 3.0<>3/5/2019 4:46:39 PM

© 2006 Jeffers & Associates, PLLC. All Rights Reserved

Print | Save | Quit

Parameters | Composite Triangular Sections | Head - Discharge Table | Assumptions | Inlet Geometry | Disclaimer



Depth:
d: 0.17 ft
2.1 in.

Long. slope: 0.1440 (ft/ft)

N value: 0.016

Local Parameters:
Local inlet flow line depression: 2.0 in.

Curb Opening Parameters:
C-O Apron wider than gutter: 0 in.

S'w 13.9 % Se: 8.93 %

Length of curb opening inlet: 12.0 ft

Lt: 30.37 ft

80 % Clear Efficiency 49.5 %

Curb opening flowby: 1.98 cfs

P-1-7/8-4

Print Chart 7

Grate Parameters:
Apron wider than grate: 2 in.

Length: 48 in. Width: 22 in.

% Factor 50 % Factor 50

Splash-over Vel: 7.41 ft/s Vel over grate: 9.66 ft/s

Eo: 100.00 %

Rs: 0.93 % Rf: 79.79 %

Side flow captured: 0.01 cfs Frontal captured: 0.79 cfs

Total combined CB flowby: 1.18 cfs

Street Parameters:

Q:	3.93	cfs
K:	10.4	
Vel:	7.54	ft/s
Eo:	49.8	%
W/T:	0.2002	

Standard Manning's:

Q:	3.18	cfs
K:	8.4	
Vel:	6.10	ft/s
Rh:	0.07	ft
Area:	0.52	sf

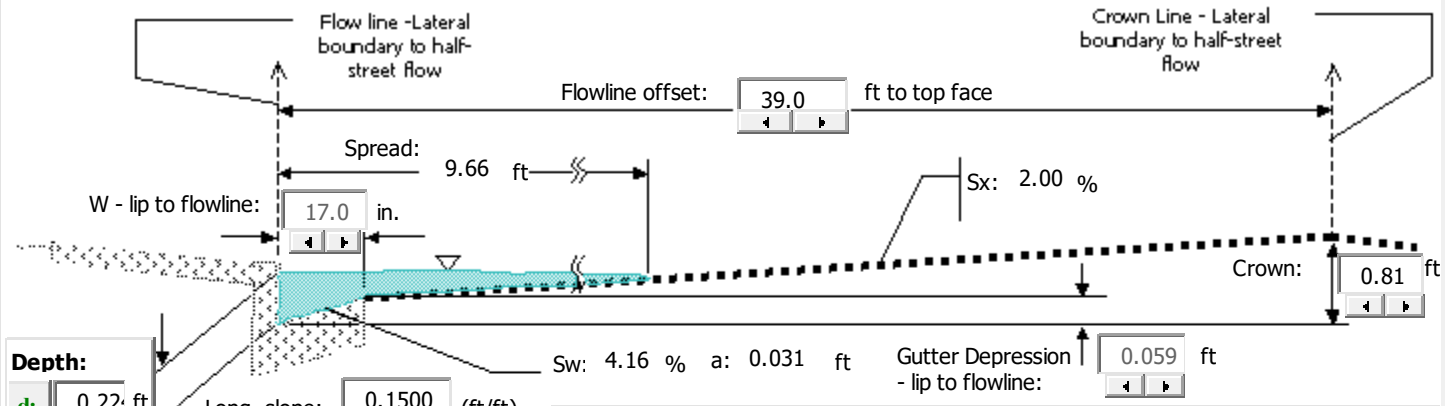
Street Flow - 12-Inch Domestic Water and Recycled Water Pipelines
Orchard Road

Modified Manning's Equation Solver
Version: 3.0<>3/5/2019 4:46:39 PM

© 2006 Jeffers & Associates, PLLC. All Rights Reserved

Print | Save | Quit

Parameters | Composite Triangular Sections | Head - Discharge Table | Assumptions | Inlet Geometry | Disclaimer



Depth:
d: 0.22 ft
2.7 in.

Long. slope: 0.1500 (ft/ft)
N value: 0.016

Local Parameters:
Local inlet flow line depression: 2.0 in.

Curb Opening Parameters:
C-O Apron wider than gutter: 0 in.
S'w 13.9 % Se: 7.25 %
Length of curb opening inlet: 12.0 ft
Lt: 48.95 ft
80 % Clear Efficiency 32.5 %
Curb opening flowby: 5.97 cfs

P-1-7/8-4
Print Chart 7

Grate Parameters:
Apron wider than grate: 2 in.
Length: 48 in. Width: 22 in.
% Factor 50 % Factor 50
Splash-over Vel: 7.41 ft/s Vel over grate: 13.05 ft/s
Eo: 86.47 %
Rs: 0.81 % Rf: 69.98 %
Side flow captured: 0.03 cfs Frontal captured: 1.81 cfs
Total combined CB flowby: 4.13 cfs

Street Parameters:
Q: 8.84 cfs
K: 22.8
Vel: 9.26 ft/s
Eo: 37.7 %
W/T: 0.1466

Standard Manning's:
Q: 7.22 cfs
K: 18.7
Vel: 7.57 ft/s
Rh: 0.10 ft
Area: 0.95 sf

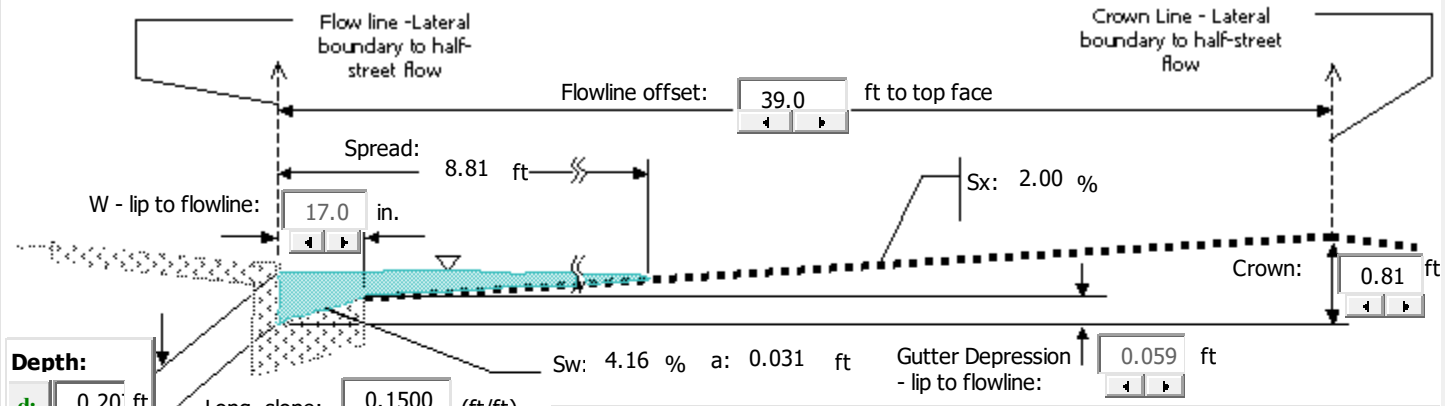
Street Flow - 18-Inch Domestic Water Pipeline
Rancho Parkway South

Modified Manning's Equation Solver
Version: 3.0<>3/5/2019 4:46:39 PM

© 2006 Jeffers & Associates, PLLC. All Rights Reserved

Print | Save | Quit

Parameters | Composite Triangular Sections | Head - Discharge Table | Assumptions | Inlet Geometry | Disclaimer



Depth:
d: 0.20 ft
2.5 in.

Long. slope: 0.1500 (ft/ft)
N value: 0.016

Local Parameters:
Local inlet flow line depression: 2.0 in.

Curb Opening Parameters:
C-O Apron wider than gutter: 0 in.
S'w 13.9 % Se: 7.71 %
Length of curb opening inlet: 12.0 ft
Lt: 42.71 ft
80 % Clear Efficiency 36.8 %
Curb opening flowby: 4.41 cfs

P-1-7/8-4
Print Chart 7

Grate Parameters:
Apron wider than grate: 2 in.
Length: 48 in. Width: 22 in.
% Factor 50 % Factor 50
Splash-over Vel: 7.41 ft/s Vel over grate: 12.10 ft/s
Eo: 93.82 %
Rs: 0.84 % Rf: 70.46 %
Side flow captured: 0.02 cfs Frontal captured: 1.46 cfs
Total combined CB flowby: 2.93 cfs

Street Parameters:
Q: 6.98 cfs
K: 18.0
Vel: 8.76 ft/s
Eo: 41.0 %
W/T: 0.1608

Standard Manning's:
Q: 5.69 cfs
K: 14.7
Vel: 7.14 ft/s
Rh: 0.09 ft
Area: 0.80 sf

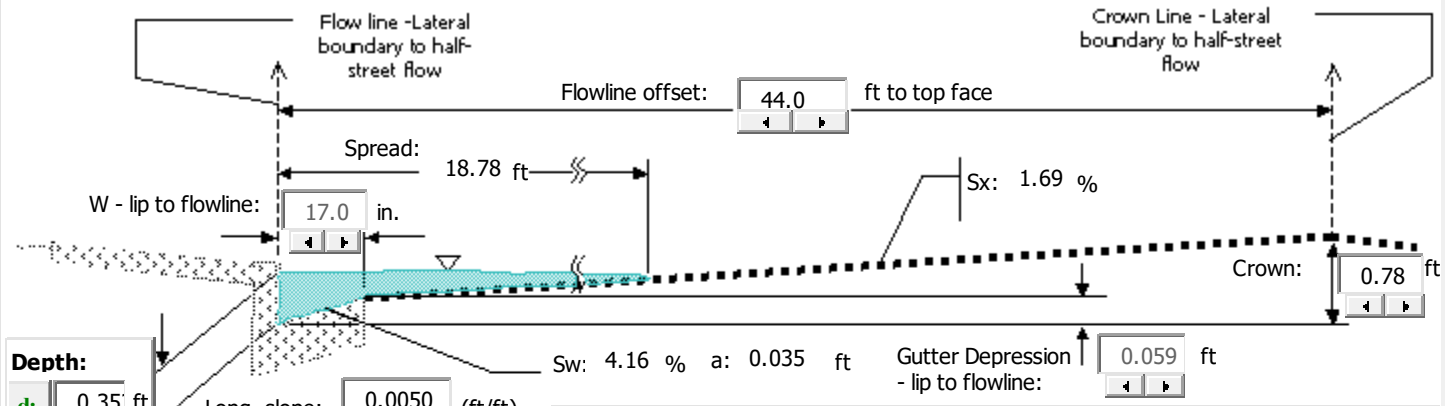
Street Flow - 16-Inch Domestic Water Pipeline
Rancho Parkway South

Modified Manning's Equation Solver
Version: 3.0<>3/5/2019 4:46:39 PM

© 2006 Jeffers & Associates, PLLC. All Rights Reserved

Print | Save | Quit

Parameters | Composite Triangular Sections | Head - Discharge Table | Assumptions | Inlet Geometry | Disclaimer



Depth:
d: 0.35 ft
4.2 in.

Long. slope: 0.0050 (ft/ft)
N value: 0.016

Local Parameters:
Local inlet flow line depression: 2.0 in.

Curb Opening Parameters:
C-O Apron wider than gutter: 0 in.
S'w 14.2 % Se: 4.59 %
Length of curb opening inlet: 12.0 ft
Lt: 21.02 ft
80 % Clear Efficiency 66.6 %
Curb opening flowby: 2.33 cfs

P-1-7/8-4
Print Chart 7

Grate Parameters:
Apron wider than grate: 2 in.
Length: 48 in. Width: 22 in.
% Factor 50 % Factor 50
Splash-over Vel: 7.41 ft/s Vel over grate: 2.80 ft/s
Eo: 63.06 %
Rs: 12.40 % Rf: 100.00 %
Side flow captured: 0.20 cfs Frontal captured: 0.73 cfs
Total combined CB flowby: 1.40 cfs

Street Parameters:
Q: 6.98 cfs
K: 98.7
Vel: 2.32 ft/s
Eo: 20.4 %
W/T: 0.0754

Standard Manning's:
Q: 5.76 cfs
K: 81.5
Vel: 1.91 ft/s
Rh: 0.16 ft
Area: 3.01 sf

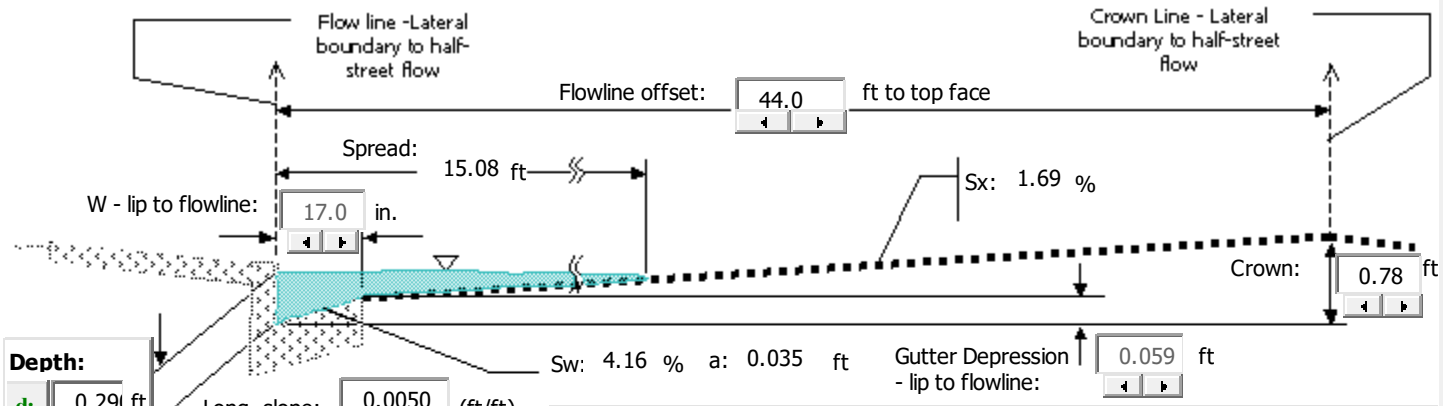
Street Flow - 16-Inch Domestic Water Pipeline
Rancho Parkway

Modified Manning's Equation Solver
Version: 3.0<>3/5/2019 4:46:39 PM

© 2006 Jeffers & Associates, PLLC. All Rights Reserved

Print | Save | Quit

Parameters | Composite Triangular Sections | Head - Discharge Table | Assumptions | Inlet Geometry | Disclaimer



Depth:
d: 0.29 ft
3.5 in.

Long. slope: 0.0050 (ft/ft)
N value: 0.016

Street Parameters:

Q:	3.93	cfs
K:	55.6	
Vel:	2.01	ft/s
Eo:	25.3	%
W/T:	0.0939	

Standard Manning's:

Q:	3.24	cfs
K:	45.8	
Vel:	1.66	ft/s
Rh:	0.13	ft
Area:	1.95	sf

Local Parameters:
Local inlet flow line depression: 2.0 in.

Curb Opening Parameters:
C-O Apron wider than gutter: 0 in.
S'w 14.2 % Se: 5.29 %
Length of curb opening inlet: 12.0 ft
Lt: 15.16 ft
80 % Clear Efficiency 83.5 %
Curb opening flowby: 0.65 cfs

P-1-7/8-4
Print Chart 7

Grate Parameters:
Apron wider than grate: 2 in.
Length: 48 in. Width: 22 in.
% Factor 50 % Factor 50
Splash-over Vel: 7.41 ft/s Vel over grate: 2.08 ft/s
Eo: 97.25 %
Rs: 14.59 % Rf: 100.00 %
Side flow captured: 0.05 cfs Frontal captured: 0.31 cfs
Total combined CB flowby: 0.28 cfs

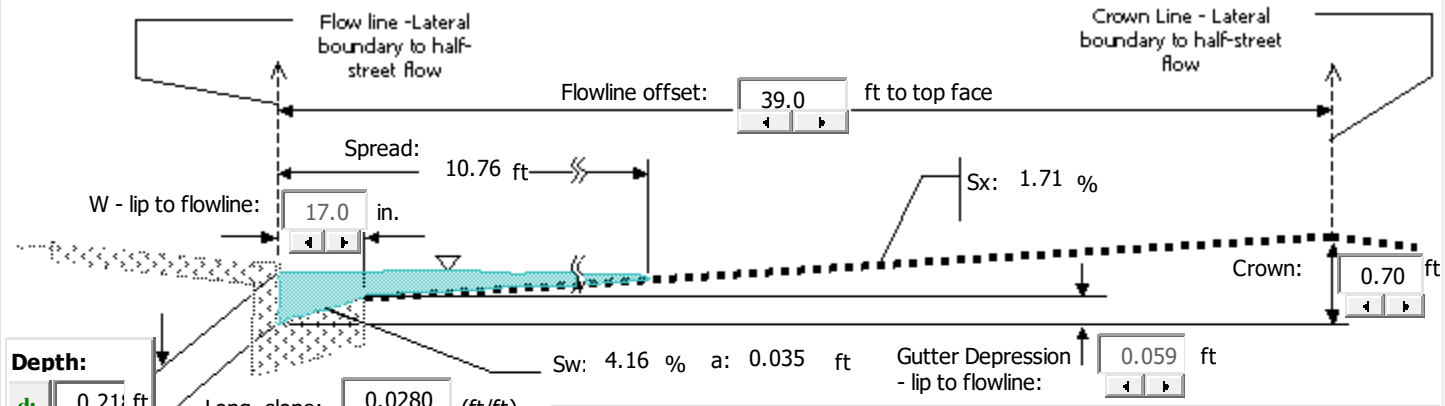
Street Flow - 12-Inch Domestic Water and Recycled Water Pipelines
Rancho Parkway

Modified Manning's Equation Solver
Version: 3.0<>5/10/2017 1:56:55 PM

© 2006 Jeffers & Associates, PLLC. All Rights Reserved

Print | Save | Quit

Parameters | Composite Triangular Sections | Head - Discharge Table | Assumptions | Inlet Geometry | Disclaimer



Depth:
d: 0.218 ft
2.6 in.

Long. slope: 0.0280 (ft/ft)
N value: 0.016

Street Parameters:

Q:	3.93	cfs
K:	23.5	
Vel:	3.88	ft/s
Eo:	35.0	%
W/T:	0.1316	

Standard Manning's:

Q:	3.21	cfs
K:	19.2	
Vel:	3.17	ft/s
Rh:	0.09	ft
Area:	1.01	sf

Local Parameters:
Local inlet flow line depression: 2.0 in.

Curb Opening Parameters:
C-O Apron wider than gutter: 0 in.
S'w 14.2 % Se: 6.69 %
Length of curb opening inlet: 12.0 ft
Lt: 22.10 ft
80 % Clear Efficiency 64.1 %
Curb opening flowby: 1.41 cfs

P-1-7/8-4
Print Chart 7

Grate Parameters:
Apron wider than grate: 2 in.
Length: 48 in. Width: 22 in.
% Factor 50 % Factor 50
Splash-over Vel: 7.41 ft/s Vel over grate: 4.81 ft/s
Eo: 98.43 %
Rs: 3.53 % Rf: 100.00 %
Side flow captured: 0.03 cfs Frontal captured: 0.69 cfs
Total combined CB flowby: 0.69 cfs

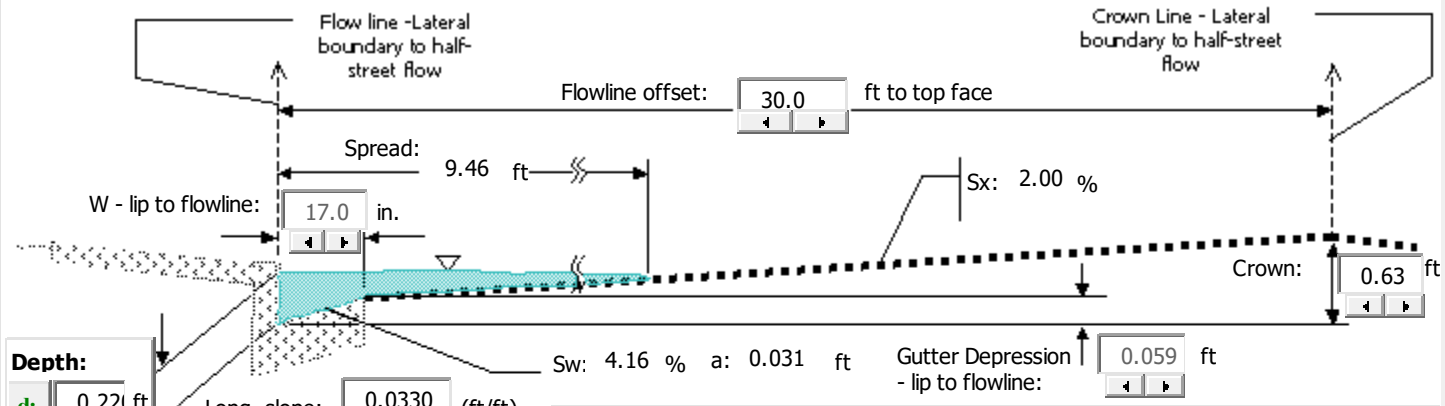
Street Flow - 12-Inch Domestic Water and Recycled Water Pipelines
Lake Forest Drive

Modified Manning's Equation Solver
Version: 3.0<>3/5/2019 4:46:39 PM

© 2006 Jeffers & Associates, PLLC. All Rights Reserved

Print | Save | Quit

Parameters | Composite Triangular Sections | Head - Discharge Table | Assumptions | Inlet Geometry | Disclaimer



Depth:
d: 0.22(ft
2.6 in.

Long. slope: 0.0330 (ft/ft)

N value: 0.016

Local Parameters:
Local inlet flow line depression: 2.0 in.

Curb Opening Parameters:
C-O Apron wider than gutter: 0 in.

S'w 13.9 % Se: 7.35 %

Length of curb opening inlet: 12.0 ft

Lt: 21.93 ft

80 % Clear Efficiency 64.5 %

Curb opening flowby: 1.39 cfs

P-1-7/8-4
Print Chart 7

Grate Parameters:
Apron wider than grate: 2 in.

Length: 48 in. Width: 22 in.

% Factor 50 % Factor 50

Splash-over Vel: 7.41 ft/s Vel over grate: 5.10 ft/s

Eo: 99.50 %

Rs: 3.37 % Rf: 100.00 %

Side flow captured: 0.02 cfs Frontal captured: 0.69 cfs

Total combined CB flowby: 0.68 cfs

Street Parameters:

Q:	3.93	cfs
K:	21.6	
Vel:	4.29	ft/s
Eo:	38.4	%
W/T:	0.1497	

Standard Manning's:

Q:	3.21	cfs
K:	17.7	
Vel:	3.50	ft/s
Rh:	0.09	ft
Area:	0.92	sf

Street Flow - 12-Inch Domestic Water Pipeline
Towne Center Drive

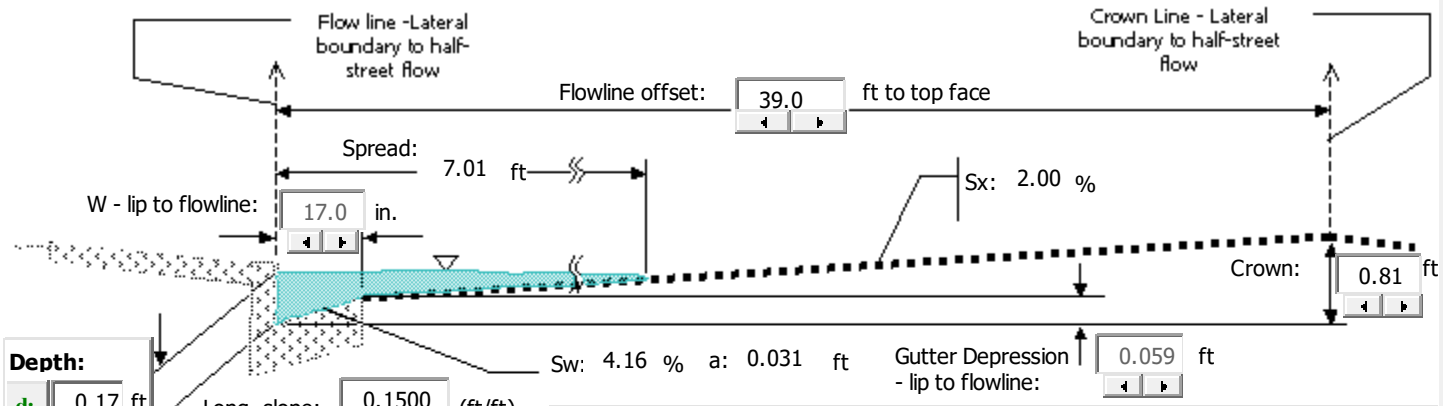
Modified Manning's Equation Solver

Version: 3.0<>3/5/2019 4:46:39 PM

© 2006 Jeffers & Associates, PLLC. All Rights Reserved

Print | Save | Quit

Parameters | Composite Triangular Sections | Head - Discharge Table | Assumptions | Inlet Geometry | Disclaimer



Depth:
d: 0.17 ft
2.1 in.

Long. slope: 0.1500 (ft/ft)

N value: 0.016

Local Parameters:

Local inlet flow line depression: 2.0 in.

Curb Opening Parameters:

C-O Apron wider than gutter: 0 in.

S'w 13.9 % Se: 8.98 %

Length of curb opening inlet: 12.0 ft

Lt: 30.63 ft

80 % Clear Efficiency 49.2 %

Curb opening flowby: 2.00 cfs

P-1-7/8-4

Print Chart 7

Grate Parameters:

Apron wider than grate: 2 in.

Length: 48 in. Width: 22 in.

% Factor 50 % Factor 50

Splash-over Vel: 7.41 ft/s Vel over grate: 9.82 ft/s

Eo: 100.00 %

Rs: 0.89 % Rf: 78.31 %

Side flow captured: 0.01 cfs Frontal captured: 0.78 cfs

Total combined CB flowby: 1.20 cfs

Street Parameters:

Q:	3.93	cfs
K:	10.1	
Vel:	7.66	ft/s
Eo:	50.1	%
W/T:	0.2020	

Standard Manning's:

Q:	3.18	cfs
K:	8.2	
Vel:	6.19	ft/s
Rh:	0.07	ft
Area:	0.51	sf

Street Flow - 12-Inch Recycled Water Pipeline
Rancho Parkway South

From: Eric Akiyoshi
To: Danielle Clendening
Subject: Re: Fwd: Pipeline Information Request for Proposed School Site in Lake Forest, CA
Date: Tuesday, January 29, 2019 11:35:19 AM

Danielle

Thank you for your e-mail. With regards to your facilities request. You can do the research on IRWD's online GIS Map and Records tool located here:
https://www.irwd.com/doing-business/gis-map-and-records

Regarding the two tanks you identified, items 1-6 have been filled in. Items 6-9 will need to be researched and we anticipate getting back to you within 5-7 business days.

Lake Forest Zone "II" West Reservoir

1. Tank Capacity: 7.8 million gallons

<!--[if !supportLists]-->2. ID: Lake Forest Zone "II" West Reservoir

<!--[if !supportLists]-->3. Height: approximately 35 ft

<!--[if !supportLists]-->4. Material: Steel

<!--[if !supportLists]-->5. Year of Construction: 1978

<!--[if !supportLists]-->6. Water Level of the Tank: High Water Level = 883 ft

<!--[if !supportLists]-->

Lake Forest Zone "B" West Reservoir

1. Tank Capacity: 7.8 million gallons

<!--[if !supportLists]-->2. ID: Lake Forest Zone "B" West Reservoir

<!--[if !supportLists]-->3. Height: approximately 35 ft

<!--[if !supportLists]-->4. Material: Steel

<!--[if !supportLists]-->5. Year of Construction: 1984

<!--[if !supportLists]-->6. Water Level of the Tank: High Water Level = 867 ft

<!--[if !supportLists]-->

If you have questions, feel free to contact me.

Eric Akiyoshi, P.E.
Principal Engineer
Planning and Technical Services
Irvine Ranch Water District
15600 Sand Canyon Avenue, Irvine, California 92618
Mailing: PO Box 57000, Irvine, California 92619-7000
(949) 453-5552 office (714) 222-5149 cell
Email: akiyoshi@irwd.com

>>> Danielle Clendening <dbclendening@placeworks.com> 1/28/2019 3:36 PM >>>
Good afternoon,

Saddleback Valley Unified School District, in compliance with CCR Title V Section 14010 (h), has contracted the services of PlaceWorks to conduct a safety hazard assessment related to water pipelines that are 12-inches in diameter or greater and pressurized sewer lines located within a 1,500-foot radius of a proposed elementary school site in Lake Forest, Orange County, CA. The proposed school site is located in the northeast corner of the intersection of Bake Parkway and Rancho Parkway. I have attached a pdf of a map showing the exact location of the site outlined in

yellow and an approximately 1,500-foot radius marked around the site in red.

This email is requesting information about any water pipelines 12-inches in diameter or greater and any pressurized sewer pipelines operated by Irvine Ranch Water District located within a 1,500-foot radius of the site. If there are no water or sewer lines that meet those specifications within the radius of the site, could I get a response stating such for the school district's safety hazard report.

Additionally, there appear to be two aboveground water storage tanks within 1,500 feet of the proposed school site. For the purposes of the District's safety hazard assessment we require the following information for each tank:

<!--[if !supportLists]-->1. Tank Capacity:
<!--[if !supportLists]-->2. ID:
<!--[if !supportLists]-->3. Height:
<!--[if !supportLists]-->4. Material:
<!--[if !supportLists]-->5. Year of Construction:
<!--[if !supportLists]-->6. Water Level of the Tank:
<!--[if !supportLists]-->7. Leak History:
<!--[if !supportLists]-->8. Inspection Frequency:
<!--[if !supportLists]-->9. Is there a seismic shutoff valve:

If this not the correct email to be sending such a request, could you please help direct this inquiry to the proper division.

Thank you so much for your help, please contact me if you have any questions or need more information!

DANIELLE CLENDENING
Intern

PLACEWORKS <!--[if !vml]-->

2850 Inland Empire Boulevard, Suite B | Ontario, California 91764
909.989.4449 | dbclendening@placeworks.com | placeworks.com

From: Eric Akiyoshi
To: Danielle Clendening
Subject: RE: Fwd: Pipeline Information Request for Proposed School Site in Lake Forest, CA
Date: Monday, March 11, 2019 3:55:21 PM

Danielle

Thank you for checking back. Here are some thoughts on the remaining questions.

Leak History - IRWD has owned and operating these tanks since January 2001. Neither the Lake Forest Zone "II" West, nor the Zone "B" West tanks have had any leaks during this time frame. Additionally, IRWD is not aware of any leaks prior to taking responsibility for the tanks.
Inspection Frequency - IRWD inspects its facilities on a weekly basis and monitors continuously with automated data acquisition. Tanks are typically inspected via underwater camera and SCUBA inspections approximately every 2 years.
Is there a seismic shutoff valve - IRWD has automated data acquisition and manual isolation valves for each of these tanks.

Regards

Eric Akiyoshi, P.E.
Principal Engineer
Planning and Technical Services
Irvine Ranch Water District
15600 Sand Canyon Avenue, Irvine, California 92618
Mailing: PO Box 57000, Irvine, California 92619-7000
(949) 453-5552 office (714) 222-5149 cell
Email: akiyoshi@irwd.com

>>> Danielle Clendening <dbclendening@placeworks.com> 10:53 AM 3/11/2019 >>>
Hi Eric,

Is there any update about questions 6-9 regarding the two water tanks?

Thank you for your assistance,

Danielle

From: Eric Akiyoshi <AKIYOSHI@irwd.com>
Sent: Tuesday, January 29, 2019 11:35 AM
To: Danielle Clendening <dbclendening@placeworks.com>
Subject: Re: Fwd: Pipeline Information Request for Proposed School Site in Lake Forest, CA

Danielle

Thank you for your e-mail. With regards to your facilities request. You can do the research on IRWD's online GIS Map and Records tool located here:
https://www.irwd.com/doing-business/gis-map-and-records

Regarding the two tanks you identified, items 1-6 have been filled in. Items 6-9 will need to be researched and we anticipate getting back to you within 5-7 business days.

Lake Forest Zone "II" West Reservoir
Tank Capacity: 7.8 million gallons
ID: Lake Forest Zone "II" West Reservoir

Height: approximately 35 ft
Material: Steel
Year of Construction: 1978
Water Level of the Tank: High Water Level = 883 ft

Lake Forest Zone "B" West Reservoir
Tank Capacity: 7.8 million gallons
ID: Lake Forest Zone "B" West Reservoir
Height: approximately 35 ft
Material: Steel
Year of Construction: 1984
Water Level of the Tank: High Water Level = 867 ft

If you have questions, feel free to contact me.

Eric Akiyoshi, P.E.
Principal Engineer
Planning and Technical Services
Irvine Ranch Water District
15600 Sand Canyon Avenue, Irvine, California 92618
Mailing: PO Box 57000, Irvine, California 92619-7000
(949) 453-5552 office (714) 222-5149 cell
Email: akiyoshi@irwd.com

>>> Danielle Clendening <dbclendening@placeworks.com> 1/28/2019 3:36 PM >>>
Good afternoon,

Saddleback Valley Unified School District, in compliance with CCR Title V Section 14010 (h), has contracted the services of PlaceWorks to conduct a safety hazard assessment related to water pipelines that are 12-inches in diameter or greater and pressurized sewer lines located within a 1,500-foot radius of a proposed elementary school site in Lake Forest, Orange County, CA. The proposed school site is located in the northeast corner of the intersection of Bake Parkway and Rancho Parkway. I have attached a pdf of a map showing the exact location of the site outlined in yellow and an approximately 1,500-foot radius marked around the site in red.

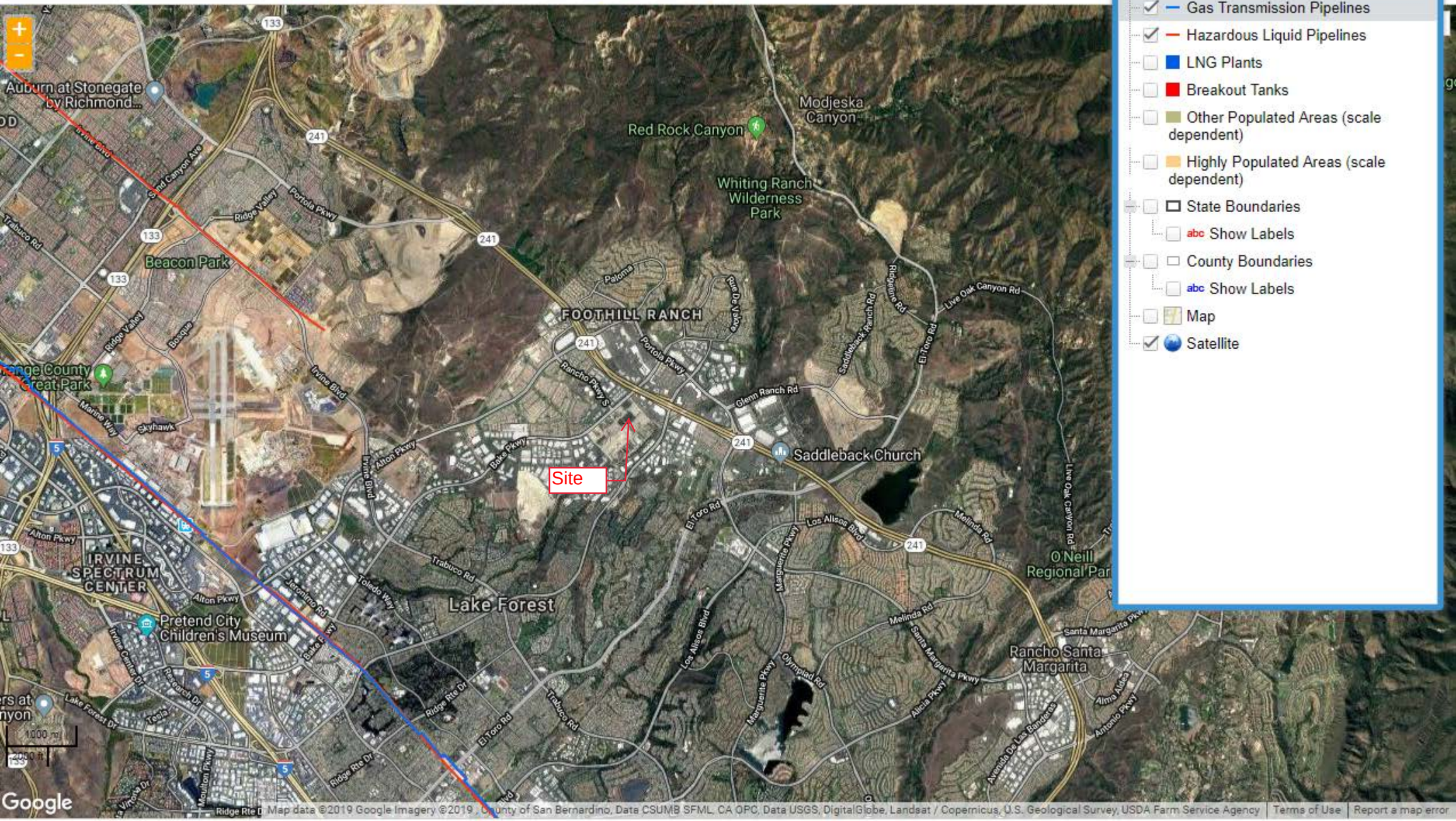
This email is requesting information about any water pipelines 12-inches in diameter or greater and any pressurized sewer pipelines operated by Irvine Ranch Water District located within a 1,500-foot radius of the site. If there are no water or sewer lines that meet those specifications within the radius of the site, could I get a response stating such for the school district's safety hazard report.

Additionally, there appear to be two aboveground water storage tanks within 1,500 feet of the proposed school site. For the purposes of the District's safety hazard assessment we require the following information for each tank:

1. Tank Capacity:
2. ID:
3. Height:
4. Material:

Public Viewer

Map Layers | Query Tools



Map Layers

- Accidents (Liquid)
- Incidents (Gas)
- Gas Transmission Pipelines
- Hazardous Liquid Pipelines
- LNG Plants
- Breakout Tanks
- Other Populated Areas (scale dependent)
- Highly Populated Areas (scale dependent)
- State Boundaries
  - Show Labels
- County Boundaries
  - Show Labels
- Map
- Satellite

Ready | Zoom Level: 13 of 19 (1:54,168) | 33.666642, -117.758893 | COUNTY : Orange, CA

©USDOT PHMSA. All rights reserved.

Appendix

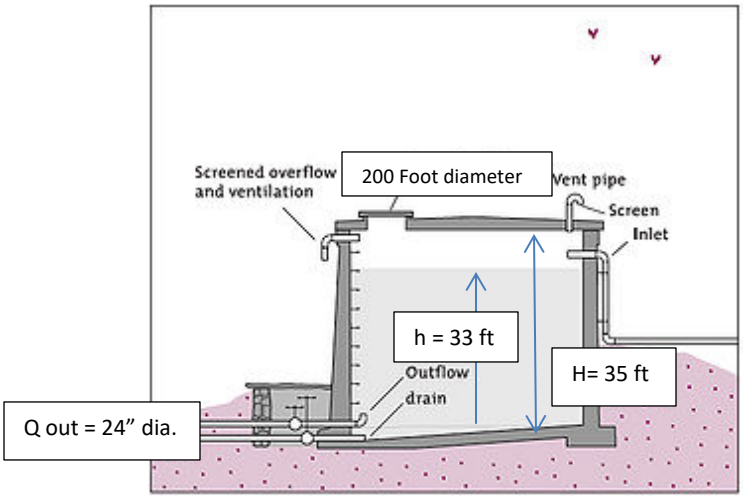
This page intentionally left blank.

Appendix B. Water Storage Tank Release Calculations

Appendix

This page intentionally left blank.

FLOW RATE FROM WATER TANK – Zone "II" West Reservoir



Water Tank Cross Section: $A_R = 1/4\pi D^2 = 1/4\pi(200)^2 = 31{,}416\ ft^2$

Piping Outlet Cross Section: $A_P = 1/4\pi D^2 = 1/4\pi(2)^2 = 3.14\ ft^2$

Flow Rate Equation from Piping Rupture:

$$Q = CA\sqrt{2gh}$$

Where Q = flow rate (cfs)

C = orifice coefficient (0.67)

A = area of opening (ft^2)

G = gravitational acceleration (32.2 ft/s^2)

h = water height above opening (ft)

$$dh = -\frac{Qdt}{A_R} = \frac{CA_P\sqrt{2gh}}{A_R}\,dt$$

$$\frac{A_R dh}{CA_P\sqrt{2gh}} = \frac{-31{,}416\ dh}{(0.67)(3.14)\sqrt{(2)(32.2)h}} = dt$$

$$-1{,}860\ h^{-1/2}\ dh = dt$$

$$-1{,}860 \int_H^h h^{-1/2}\ dh = \int_0^t dt$$

$$-1{,}860 \left(\frac{h^{1/2}}{-1/2H}\right) = t$$

$$-3{,}720\ (h^{\frac{1}{2}} - H^{\frac{1}{2}})\ ) = t$$

$$h = \left(H^{\frac{1}{2}} - (\frac{t}{3720}\right)^2$$

H = 33 feet

Then h = $(33^{(1/2)} – 2.7E\text{-}04t)^2$

$$Q = (0.67)(3.14)\sqrt{(2)(32.2)}\,[33^{\left(\frac{1}{2}\right)} - 2.7^{-04}(t)] = 97.0 - 0.0045t$$

Then peak flow = 97.0 cfs at t = 0

RUNOFF FROM SITE

Runoff from site is based on the following:

Outflow from storage tank: Q = 97.0 – 0.0045t (cfs)

The results are provided in the following spreadsheet.

OUTFLOW FROM TANK - Zone "II" West Reservoir

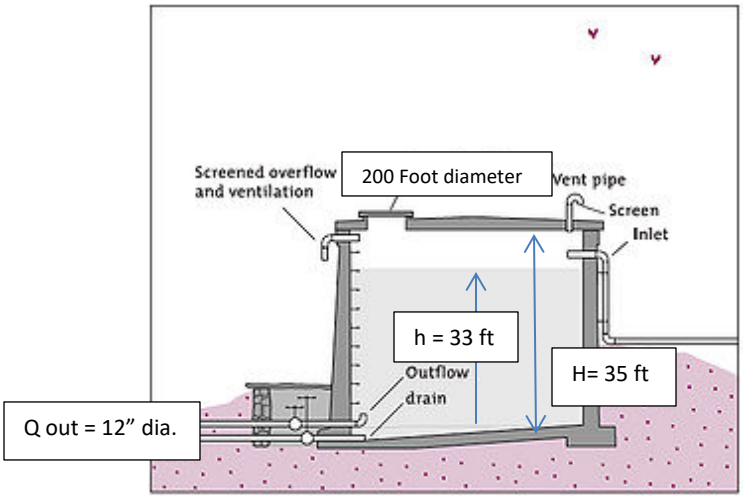
Time (min)	Outflow (cfs)
0	97.0
5	95.7
10	94.3
15	93.0
20	91.6
25	90.3
30	88.9
35	87.6
40	86.2
45	84.9
50	83.5
55	82.2
65	79.5
70	78.1
75	76.8
80	75.4
85	74.1
90	72.7
95	71.4
100	70.0
105	68.7
110	67.3
115	66.0
120	64.6

Time (min)	Outflow (cfs)
125	63.3
130	61.9
135	60.6
140	59.2
145	57.9
150	56.5
155	55.2
160	53.8
165	52.5
170	51.1
175	49.8
180	48.4
185	47.1
190	45.7
195	44.4
200	43.0
205	41.7
210	40.3
215	39.0
220	37.6
225	36.3
230	34.9
235	33.6
240	32.2

Time (min)	Outflow (cfs)
245	30.9
250	29.5
255	28.2
260	26.8
265	25.5
270	24.1
275	22.8
280	21.4
285	20.1
290	18.7
295	17.4
300	16.0
305	14.7
310	13.3
315	12.0
320	10.6
325	9.3
330	7.9
335	6.6
340	5.2
345	3.8
350	2.5
355	1.2
360	-0.2

Time to empty tank - 6 hours

FLOW RATE FROM WATER TANK – Zone "B" West Reservoir



Water Tank Cross Section: $A_R = 1/4\pi D^2 = 1/4\pi(200)^2 = 31{,}416\ ft^2$

Piping Outlet Cross Section: $A_P = 1/4\pi D^2 = 1/4\pi(1)^2 = 0.79\ ft^2$

Flow Rate Equation from Piping Rupture:

$$Q = CA\sqrt{2gh}$$

Where Q = flow rate (cfs)

C = orifice coefficient (0.67)

A = area of opening (ft^2)

G = gravitational acceleration (32.2 ft/s^2)

h = water height above opening (ft)

$$dh = -\frac{Qdt}{A_R} = \frac{CA_P\sqrt{2gh}}{A_R}\,dt$$

$$\frac{A_R dh}{CA_P\sqrt{2gh}} = \frac{-31{,}416\ dh}{(0.67)(0.79)\sqrt{(2)(32.2)h}} = dt$$

$$-7{,}439\ h^{-1/2}\ dh = dt$$

$$-7{,}439 \int_H^h h^{-1/2}\ dh = \int_0^t dt$$

$$-7{,}439 \left(\frac{h^{1/2}}{-1/2H}\right) = t$$

$$-14{,}879\ (h^{\frac{1}{2}} - H^{\frac{1}{2}})\ ) = t$$

$$h = \left(H^{\frac{1}{2}} - (\frac{t}{14879}\right)^2$$

H = 33 feet

Then h = $(33^{(1/2)} – 6.7E\text{-}05t)^2$

$$Q = (0.67)(0.79)\sqrt{(2)(32.2)}\,[33^{\left(\frac{1}{2}\right)} - 6.7^{-05}(t)] = 24.3 - 0.00028t$$

Then peak flow = 24.3 cfs at t = 0

RUNOFF FROM SITE

Runoff from site is based on the following:

Outflow from storage tank: Q = 24.3 – 0.00028t (cfs)

The results are provided in the following spreadsheet.

OUTFLOW FROM TANK - Zone "B" West Reservoir

Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)
0	24.3	240	20.3	480	16.2	720	12.2	960	8.2	1200	4.1
10	24.1	250	20.1	490	16.1	730	12.0	970	8.0	1210	4.0
20	24.0	260	19.9	500	15.9	740	11.9	980	7.8	1220	3.8
30	23.8	270	19.8	510	15.7	750	11.7	990	7.7	1230	3.6
40	23.6	280	19.6	520	15.6	760	11.5	1000	7.5	1240	3.5
50	23.5	290	19.4	530	15.4	770	11.4	1010	7.3	1250	3.3
60	23.3	300	19.3	540	15.2	780	11.2	1020	7.2	1260	3.1
70	23.1	310	19.1	550	15.1	790	11.0	1030	7.0	1270	3.0
80	23.0	320	18.9	560	14.9	800	10.9	1040	6.8	1280	2.8
90	22.8	330	18.8	570	14.7	810	10.7	1050	6.7	1290	2.6
100	22.6	340	18.6	580	14.6	820	10.5	1060	6.5	1300	2.5
110	22.5	350	18.4	590	14.4	830	10.4	1070	6.3	1310	2.3
120	22.3	360	18.3	600	14.2	840	10.2	1080	6.2	1320	2.1
130	22.1	370	18.1	610	14.1	850	10.0	1090	6.0	1330	2.0
140	21.9	380	17.9	620	13.9	860	9.9	1100	5.8	1340	1.8
150	21.8	390	17.7	630	13.7	870	9.7	1110	5.7	1350	1.6
160	21.6	400	17.6	640	13.5	880	9.5	1120	5.5	1360	1.5
170	21.4	410	17.4	650	13.4	890	9.3	1130	5.3	1370	1.3
180	21.3	420	17.2	660	13.2	900	9.2	1140	5.1	1380	1.1
190	21.1	430	17.1	670	13.0	910	9.0	1150	5.0	1390	0.9
200	20.9	440	16.9	680	12.9	920	8.8	1160	4.8	1400	0.8
210	20.8	450	16.7	690	12.7	930	8.7	1170	4.6	1410	0.6
220	20.6	460	16.6	700	12.5	940	8.5	1180	4.5	1420	0.4
230	20.4	470	16.4	710	12.4	950	8.3	1190	4.3	1430	0.3
										1440	0.1
										1450	-0.1

Time to empty tank - 24 hours and 10 minutes

USGS Store

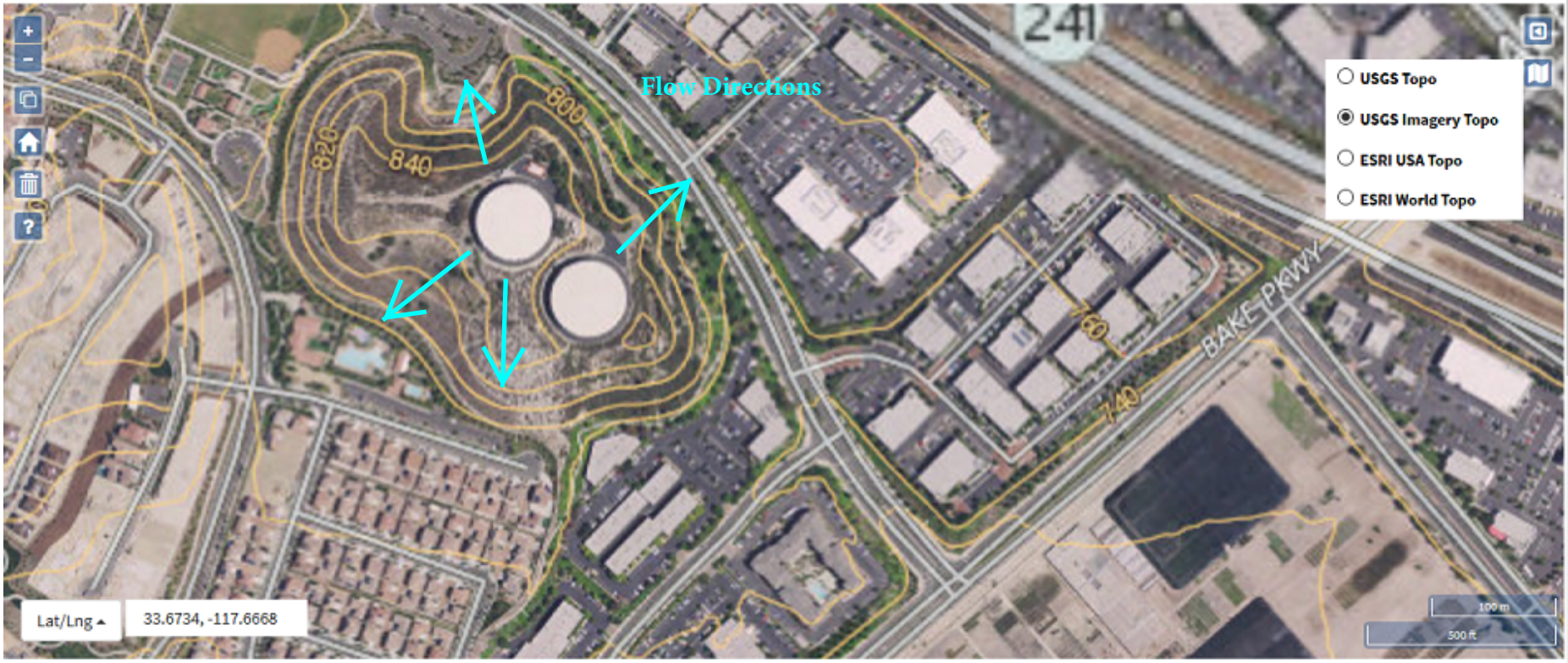
My Account |

Map Locator

Lake Forest, California

Clear

To use the map locator to find map products use the search bar or drop a pin by double clicking on the map view.

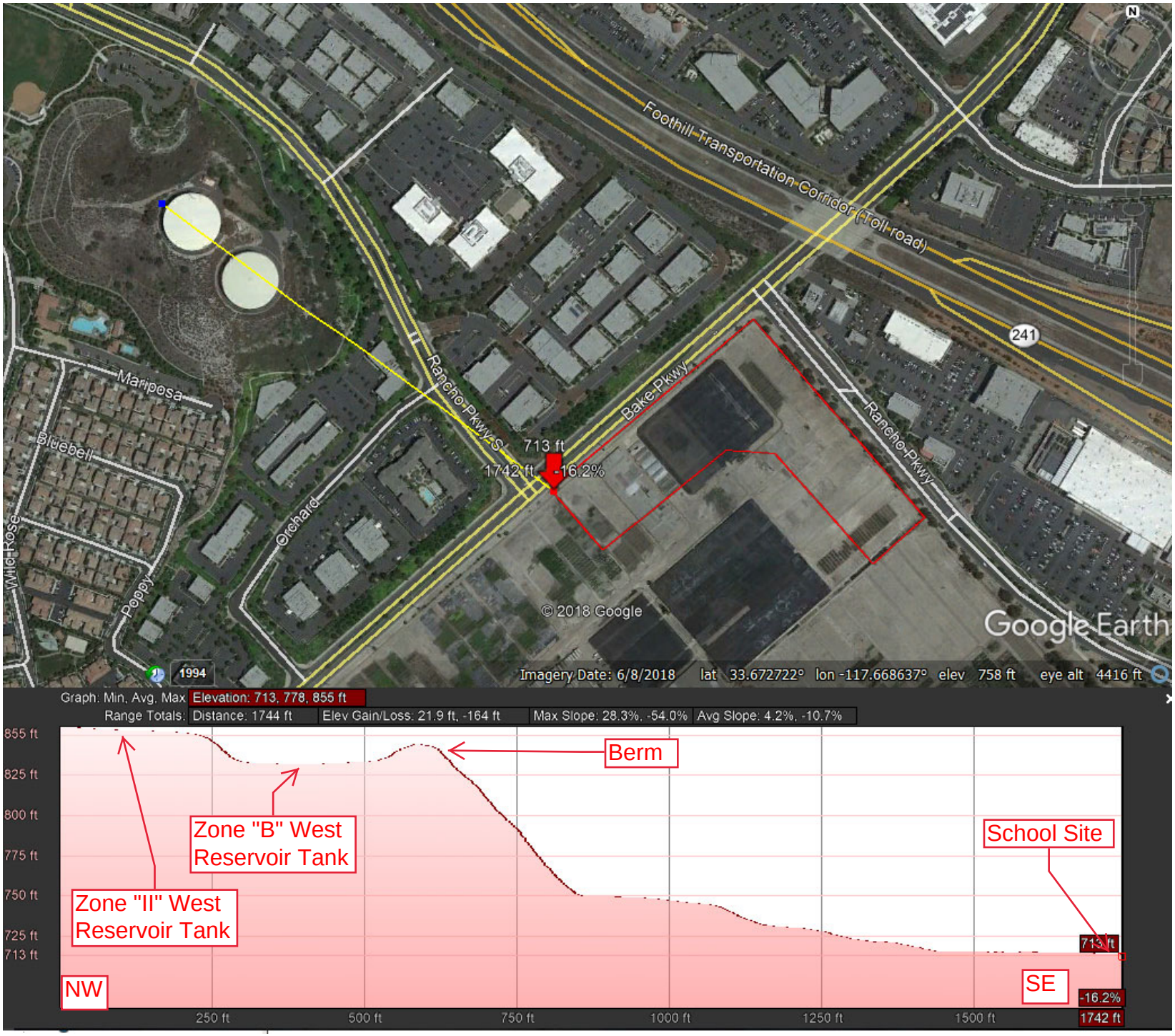


HOME

Map location pins dropped or searched for by address/place provide products within a 15 mile radius of specified location.

If you have any questions or issues please click here to email usgsstore@usgs.gov.

Elevation Gradient from Tank Site to Proposed School Site - Google Earth

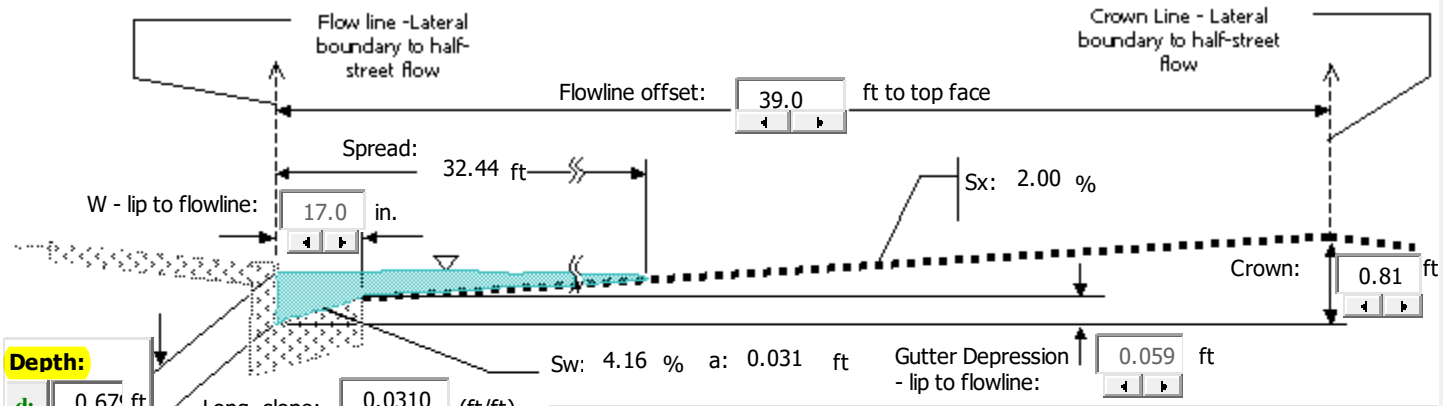


Modified Manning's Equation Solver
Version: 3.0<>3/5/2019 4:46:39 PM

© 2006 Jeffers & Associates, PLLC. All Rights Reserved

Print | Save | Quit

Parameters | Composite Triangular Sections | Head - Discharge Table | Assumptions | Inlet Geometry | Disclaimer



Depth:
d: 0.67 ft
8.1 in.

Long. slope: 0.0310 (ft/ft)
N value: 0.016

Local Parameters:
Local inlet flow line depression: 2.0 in.

Curb Opening Parameters:
C-O Apron wider than gutter: 0 in.
S'w 13.9 % Se: 3.62 %
Length of curb opening inlet: 12.0 ft
Lt: 126.59 ft
80 % Clear Efficiency 13.2 %
Curb opening flowby: 84.16 cfs

P-1-7/8-4
Print Chart 7

Grate Parameters:
Apron wider than grate: 2 in.
Length: 48 in. Width: 22 in.
% Factor 50 % Factor 50
Splash-over Vel: 7.41 ft/s Vel over grate: 12.75 ft/s
Eo: 20.49 %
Rs: 1.17 % Rf: 85.57 %
Side flow captured: 0.90 cfs Frontal captured: 7.38 cfs
Total combined CB flowby: 75.88 cfs

Street Parameters:
Q: 97.00 cfs
K: 550.9
Vel: 9.21 ft/s
Eo: 11.6 %
W/T: 0.0437

Standard Manning's:
Q: 80.26 cfs
K: 455.8
Vel: 7.62 ft/s
Rh: 0.32 ft
Area: 10.53 sf

Street Flow - Rancho Parkway South
Tank Release

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition

Dynamic: Conterminous U.S. 2014 (v4.1.1)

Spectral Period

Peak ground acceleration

Latitude

Decimal degrees

33.6719

Time Horizon

Return period in years

2475

Longitude

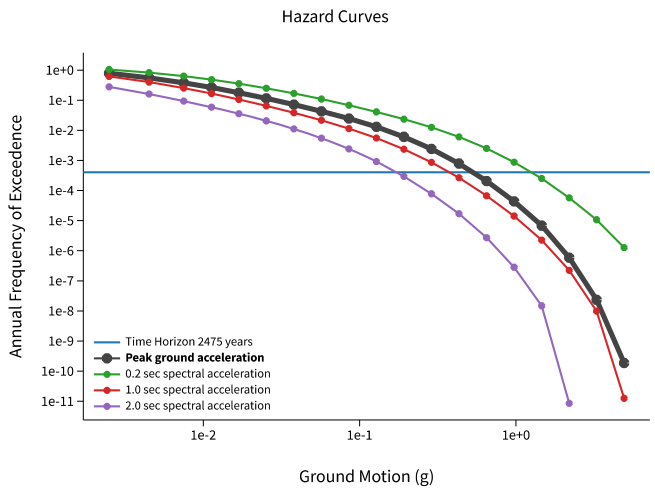
Decimal degrees, negative values for western longitudes

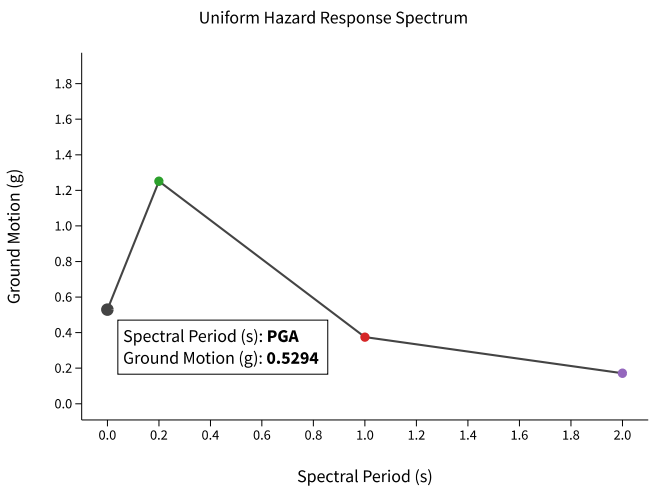
-117.667

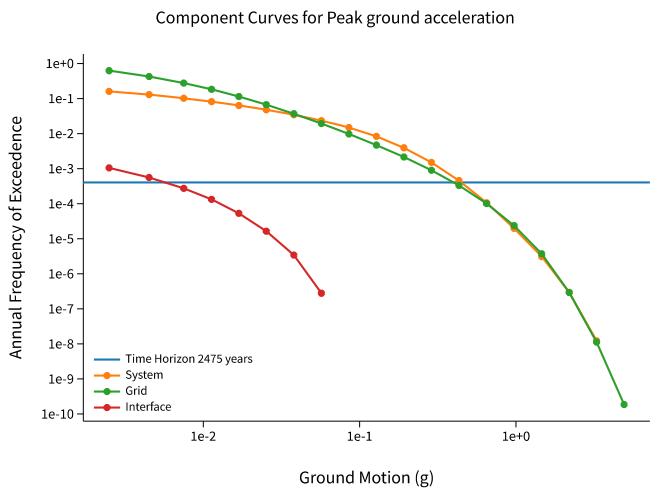
Site Class

760 m/s (B/C boundary)

Hazard Curve





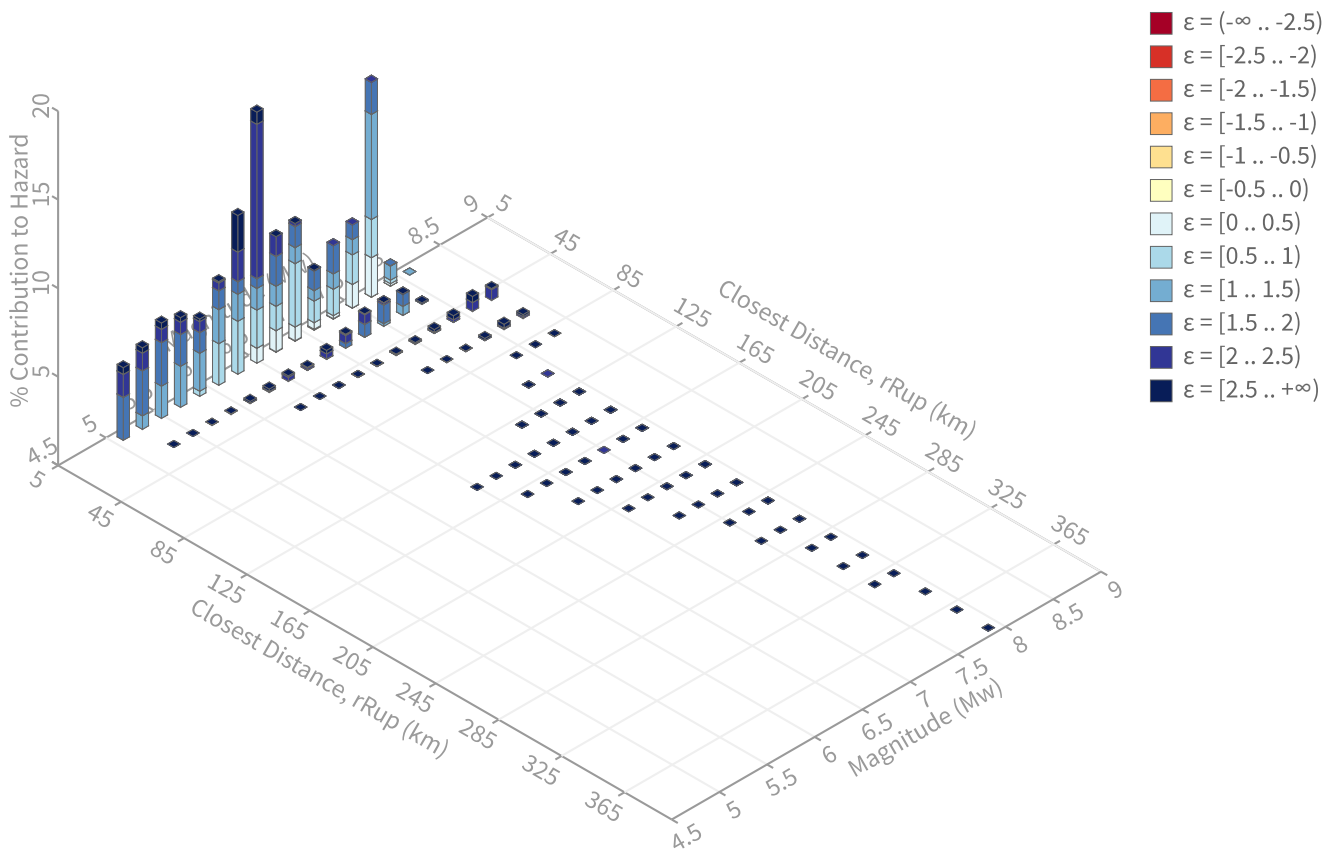


View Raw Data

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr^{-1}
PGA ground motion: 0.52942723 g

Recovered targets

Return period: 2807.7447 yrs
Exceedance rate: 0.00035615774 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.06 %

Mean (for all sources)

r: 14.16 km
m: 6.61
ε_0: 1.5 σ

Mode (largest r-m bin)

r: 15.25 km
m: 6.48
ε_0: 1.82 σ
Contribution: 14.18 %

Mode (largest ε_0 bin)

r: 18.86 km
m: 6.47
ε_0: 2.26 σ
Contribution: 8.72 %

Discretization

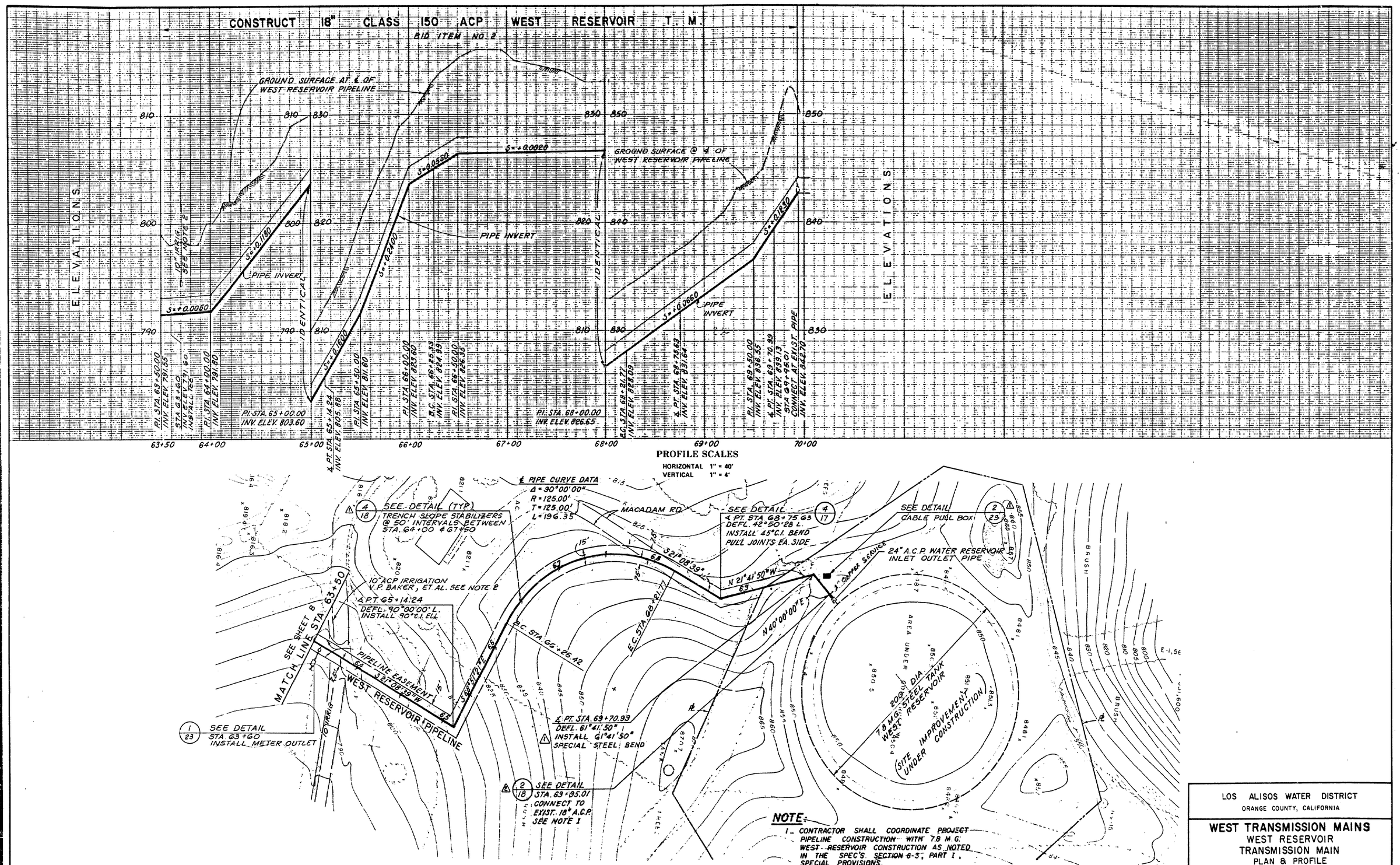
r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
UC33brAvg_FM32	System							27.48
Elsinore (Glen Ivy) rev [0]		18.88	7.04	1.87	117.581°W	33.825°N	24.97	10.89
San Joaquin Hills [2]		9.26	7.19	0.80	117.735°W	33.617°N	225.73	7.22
Chino alt 2 [3]		17.89	7.04	1.72	117.571°W	33.821°N	28.08	2.61
Newport-Inglewood (Offshore) [2]		21.80	7.45	1.75	117.821°W	33.524°N	221.08	1.35
UC33brAvg_FM31	System							25.89
Elsinore (Glen Ivy) rev [0]		18.88	7.02	1.89	117.581°W	33.825°N	24.97	10.51
San Joaquin Hills [2]		9.26	7.54	0.59	117.735°W	33.617°N	225.73	5.87
Chino alt 1 [4]		18.11	6.91	1.86	117.604°W	33.848°N	16.60	2.33
Newport-Inglewood (Offshore) [2]		21.80	7.46	1.74	117.821°W	33.524°N	221.08	1.43
Oceanside alt1 [6]		15.04	7.04	1.18	117.802°W	33.514°N	215.58	1.27
UC33brAvg_FM31 (opt)	Grid							23.44
PointSourceFinite: -117.667, 33.712		6.41	5.87	1.11	117.667°W	33.712°N	0.00	4.53
PointSourceFinite: -117.667, 33.712		6.41	5.87	1.11	117.667°W	33.712°N	0.00	4.53
PointSourceFinite: -117.667, 33.730		7.76	5.83	1.38	117.667°W	33.730°N	0.00	2.51
PointSourceFinite: -117.667, 33.730		7.76	5.83	1.38	117.667°W	33.730°N	0.00	2.51
PointSourceFinite: -117.667, 33.748		8.81	5.98	1.43	117.667°W	33.748°N	0.00	1.28
PointSourceFinite: -117.667, 33.748		8.81	5.98	1.43	117.667°W	33.748°N	0.00	1.28
PointSourceFinite: -117.667, 33.766		9.70	6.17	1.43	117.667°W	33.766°N	0.00	1.07
PointSourceFinite: -117.667, 33.766		9.70	6.17	1.43	117.667°W	33.766°N	0.00	1.07
UC33brAvg_FM32 (opt)	Grid							23.20
PointSourceFinite: -117.667, 33.712		6.41	5.87	1.11	117.667°W	33.712°N	0.00	4.52
PointSourceFinite: -117.667, 33.712		6.41	5.87	1.11	117.667°W	33.712°N	0.00	4.52
PointSourceFinite: -117.667, 33.730		7.75	5.83	1.37	117.667°W	33.730°N	0.00	2.47
PointSourceFinite: -117.667, 33.730		7.75	5.83	1.37	117.667°W	33.730°N	0.00	2.47
PointSourceFinite: -117.667, 33.748		8.82	5.97	1.43	117.667°W	33.748°N	0.00	1.27
PointSourceFinite: -117.667, 33.748		8.82	5.97	1.43	117.667°W	33.748°N	0.00	1.27
PointSourceFinite: -117.667, 33.766		9.70	6.17	1.43	117.667°W	33.766°N	0.00	1.07
PointSourceFinite: -117.667, 33.766		9.70	6.17	1.43	117.667°W	33.766°N	0.00	1.07



NOTE:

1. CONTRACTOR SHALL COORDINATE PROJECT PIPELINE CONSTRUCTION WITH 7.8 M.G. WEST RESERVOIR CONSTRUCTION AS NOTED IN THE SPEC'S. SECTION 6-3, PART I, SPECIAL PROVISIONS.
2. CONTRACTOR SHALL POTHOLE AND VERIFY EXIST. 10" IRRIG. PIPELINE LOCATION AND INVERT BEFORE CONSTRUCTION.

REV	DATE	DESCRIPTION	APP
2	11-2-79	ADDENDUM NO. 2 REVISION	R.P.K.
1	10-24-79	ADDENDUM NO. 1 REVISION	RPK

LOS ALISOS WATER DISTRICT
ORANGE COUNTY, CALIFORNIA

WEST TRANSMISSION MAINS
WEST RESERVOIR
TRANSMISSION MAIN
PLAN & PROFILE

Boyle Engineering Corporation
consulting engineers / architects

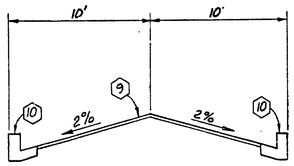
DESIGN D.M. | DRAWN J.C. | CHECKED R.P.K. | DATE AUG. '79 | # X-43 | B-L04-125-06 | D-2053

SHEET NO. 9 OF 23 SHEETS

EXCAVATION AND FILL QUANTITIES

THESE QUANTITIES ARE APPROXIMATE AND MAY VARY DEPENDING ON ACTUAL FIELD CONDITIONS.

RESERVOIR SITE EXCAVATION..... 62,000cy
FILL AREA..... 2,100cy



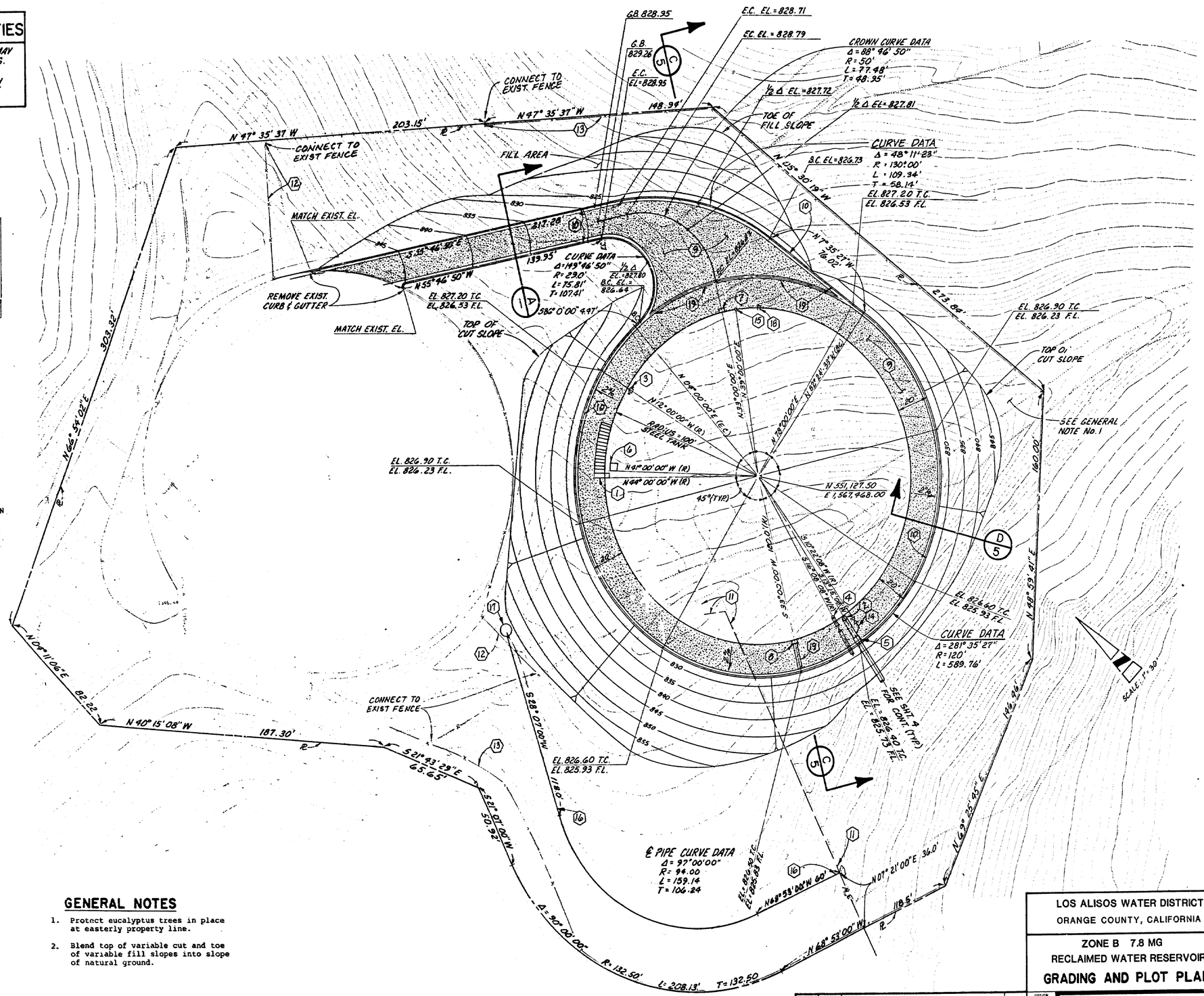
SECTION A
N.T.S.

CONSTRUCTION NOTES

1. SPIRAL STAIRS AND PLATFORM. SEE DETAILS SHEET 7
2. OVERFLOW AND DRAIN. SEE DETAIL 1 SHEET 8.
3. LIQUID LEVEL INDICATOR. SEE DETAIL 1 SHEET 7.
4. 12" DIA. INLET-OUTLET PIPE. SEE SHEET 4 FOR PLAN AND PROFILE.
5. GRATE INLET CATCH BASIN. SEE DETAIL 3 SHEET 8.
6. ROOF HATCH AND CENTERLINE OF INSIDE LADDER SEE DETAIL 2 SHEET 6.
7. 36" DIA. MANHOLE. SEE DETAIL 1 SHEET 6.
8. 24" DIA. MANHOLE. SEE DETAIL 1 SHEET 6.
9. 3" A.C. PAVEMENT OVER NATIVE.
10. CURB AND GUTTER. SEE SECTION A SHEET 5.
11. REMOVE EXISTING PVC WATER LINE AND TANK.
12. TEMPORARY 6' CHAINLINK FENCE.
13. 6' CHAINLINK FENCE.
14. 8" DIA. TANK DRAIN. SEE DETAIL 2 SHEETS.
15. CONTROL AND POTENTIAL TEST BOX AND $CuSO_4$ TEST STATIONS.
16. 4" CL. 150 PVC WATER LINE.
17. RYAN-HERCO ROUND-FLAT BOTTOM FIBERGLASS TANK SIZE NO. 7800-108 AND 7801-108 COVER SECTION. SEE B/5
18. 1" CORP STOP JONES J-50 OR APPROVED EQUAL IN OVERSIZE HALF COUPLING AND INSULATION BUSHING WELDED TO SIDE OF TANK. LOCATION OF CORP STOP TO BE DETERMINED BY DISTRICT AT TIME OF ERECTION OF TANK.
19. CROSS GUTTER. SEE DETAIL 1 SHEET 5.

GENERAL NOTES

1. Protect eucalyptus trees in place at easterly property line.
2. Blend top of variable cut and toe of variable fill slopes into slope of natural ground.



LOS ALISOS WATER DISTRICT
ORANGE COUNTY, CALIFORNIA

ZONE B 7.8 MG
RECLAIMED WATER RESERVOIR

GRADING AND PLOT PLAN

REV	DATE	DESCRIPTION	APP
1	1-87	ADDENDUM No. 1	H.R.G.

DESIGN L.G. DRAWN D.G.B. CHECKED H.U.

Boyle Engineering Corporation
consulting engineers / architects

DATE AUG. 1986 F.B. OC L04 260 12 D-2309

SHEET NO. 3 OF 10 SHEETS