
APPENDIX 3.6-3

PIPELINE SAFETY HAZARD ASSESSMENT



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November 2025 | Pipeline Safety Hazard Assessment

PAUL ECKE CENTRAL ELEMENTARY SCHOOL REBUILD PROJECT

Encinitas Union School District

Prepared for:

Encinitas Union School District

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Project Number EUSD-03.0



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1. Introduction

1.1 PURPOSE

This report presents the results of a Pipeline Safety Hazard Assessment (PSHA) prepared for the Encinitas Union School District (District), which proposes to rebuild the existing Paul Ecke Central Elementary School campus. The PSHA evaluates potential exposure and fatality risk to staff and students from underground or at-grade natural gas or hazardous liquid pipeline releases and the potential for flooding from large volume water pipelines.

1.2 SCHOOL SITE LOCATION

The project site is the existing Paul Ecke Central Elementary School at 185 Union Street in the City of Encinitas, San Diego County, California. The school site (Assessor's Parcel Number [APN] 256-301-0100) is surrounded by residential uses to the north and south, Orpheus Park and residences to the east, and commercial uses to the west across N. Vulcan Avenue and the North County Transit District (NCTD) railroad track. The proposed reconstruction project would modernize the existing campus and includes improved pedestrian and vehicular circulation, new outdoor educational amenities (e.g., garden and greenhouse), and upgrades to existing facilities to meet current accessibility and safety standards. Figure 1 shows the school site and local vicinity.

1.3 REGULATORY REQUIREMENTS

Under Education Code Section 17251, the California Department of Education (CDE) has authority to approve the acquisition of proposed school sites. The school 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 (CCR), Title 5, Sections 14010, 14011, and 14012. Information on assessing safety hazard related to pipelines 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.

However, for districts that are undergoing a modernization project on an existing school site, the CDE requirement is that the project would not create any new significant health and safety hazards or exacerbate any existing health and safety hazards. According to the conceptual site plan (Figure 2), new construction on the school site would not place school uses closer to the pipelines than existing conditions and therefore would not exacerbate any safety hazards. To be conservative, this report has been prepared to address all

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potential risks from the pipelines for the entire school site and has been prepared in accordance with CDE requirements as if it were a new school site.

By CDE policy,

any pipeline that has a maximum operating capacity of at least 80 pounds per square inch (psi), including but not limited to those that carry natural gas, liquid petroleum, fuels or hazardous chemicals, shall be included in a pipeline survey, regardless if the pipeline is classified as a transmission or distribution line. Pipelines located within a railroad or other easement or those pipelines serving gas and oil well sites and fields shall also be included.

Additional information on pipelines is contained in CDE's School Site Selection and Approval Guide. This document states that CDE will not approve a proposed school site if the site "contains one or more pipelines, situated underground or aboveground, which carries hazardous substances, acutely hazardous materials, or hazardous wastes, unless the pipeline is a natural gas line which is used only to supply natural gas to that school or neighborhood" (CDE 2000).

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 natural gas and hazardous liquid pipelines located within 1,500 feet of proposed or existing school sites.
- Complete a Stage 1, Stage 2, or Stage 3 risk analysis, as appropriate, for each identified pipeline to predict fatality risk.
- If appropriate, identify and develop mitigation measures to reduce predicted fatality risk to a level below the established significance threshold of one in one million.
- Identify all high-pressure/large-volume water pipelines within 1,500 feet of the proposed school site and evaluate the potential for flooding.
- If appropriate, identify and develop mitigation measures to reduce flooding impacts to acceptable levels.

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1.5 ASSESSMENT METHODOLOGY

The CDE has developed and published guidance procedures for evaluating safety hazards associated with natural gas and hazardous liquid releases from underground and aboveground pipelines. A detailed description of the procedures is provided in the Guidance Protocol for School Site Pipeline Risk Analysis (CDE 2007). These procedures were used in conducting the PSHA.

The PSHA process is composed of two steps. The first step (Stage 1) is a risk screening analysis (RSA), based on the distance of the pipeline(s) from the school site and operating characteristics of the pipeline(s). If the screening criteria are met, the level of risk is not significant and no further analysis is required.

If the screening criteria are not met, then the second step of the PSHA process is completion of a Stage 2 quantitative risk analysis (QRA). The Stage 2 risk analysis considers pipeline accident rates, school dimensions, conditional probabilities for ignition, school attendance time, and fatality probabilities for different exposure scenarios (jet fire, flash fire, and explosion) to estimate individual risk (IR). Pipelines within 50 feet of a school site are also subject to a more comprehensive Stage 3 analysis to verify the results of the Stage 2 evaluation.

The total individual risk (TIR) is compared to the significance threshold level of one in one million (1.0×10^{-6}) per year (also defined as the individual risk criterion or IRC). If the estimated risk is less than one in one million, then no significant safety hazard exists at the school site. If the estimated risk is greater than one in one million, mitigation measures are required to reduce risk to within acceptable limits or a more detailed Stage 3 risk analysis can be conducted to determine the risk more precisely.

In addition to TIR, an estimate of the potential risk for the population present at the school site is determined by calculating the TIR indicator ratio and the population risk indicator. These parameters add an additional perspective by accounting for the site configuration and school population. There is no significance threshold established by the CDE for this evaluation, and this does not replace the TIR estimate, which is the primary decision criteria for evaluating risk at the school site. However, it does provide additional information regarding the magnitude of risk at the school.

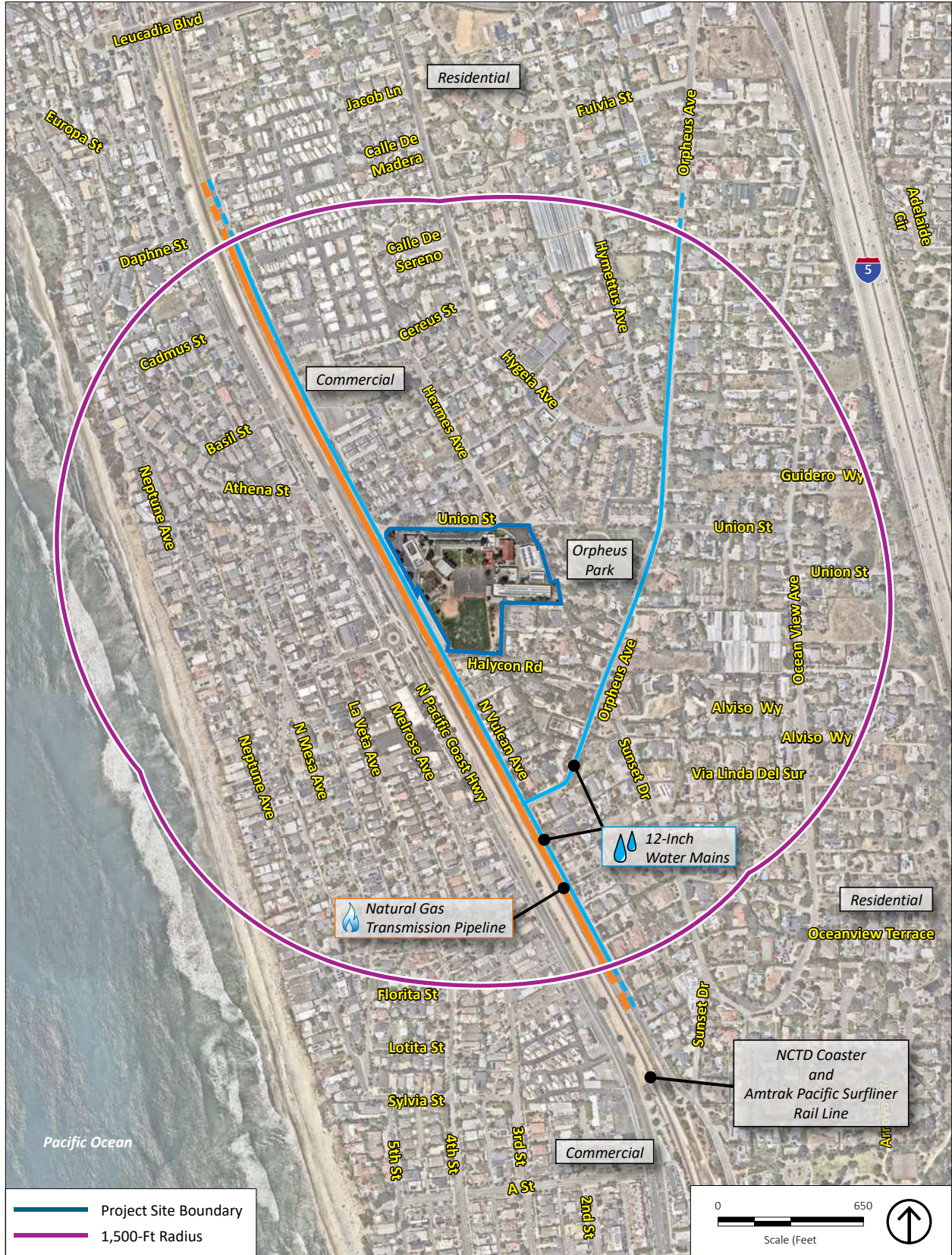
The CDE also has developed risk analysis procedures for evaluating flooding associated with releases from large volume water pipelines, as described in CDE's *Guidance Protocol for School Site Pipeline Risk Analysis* (CDE 2007). Releases from underground water pipelines can cause subterranean erosion 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 previous version of the CDE methodology assumes a water depth of 12 inches or greater could be potentially hazardous if flowing swiftly.

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PIPELINE SAFETY HAZARD ASSESSMENT
 PAUL ECKE CENTRAL ELEMENTARY SCHOOL REBUILD PROJECT
 ENCINITAS UNION SCHOOL DISTRICT



Source: Nearmap 2025.

Figure 1
 Site Location and Pipeline Map



Source: DLR Group 2025.

Figure 2
 Conceptual Site Plan

2. Hazard Assessment

2.1 PIPELINE LOCATION AND OPERATIONAL DATA

There is one high-pressure natural gas transmission pipeline within 1,500 feet of the school site. No hazardous liquid pipelines no other high-pressure natural gas pipelines were identified within the 1,500-foot radius (NPMS 2025). The location of the natural gas pipeline is shown on Figure 1.

The Southern California Gas Company (SCG) confirmed there is a high-pressure natural gas transmission pipeline approximately 35 feet west from the school site along the sidewalk area west of N. Vulcan Avenue (SCG 2025). The identified transmission pipeline is generally oriented northwest-southeast parallel to N. Vulcan Avenue and to the western boundary of the existing school site. SCG provided regarding the distance between the nearest upstream and downstream shutoff valves for the identified high-pressure pipeline but did not provide pipeline diameter nor maximum allowable operating pressure (MAOP), per a new company policy and concern for releasing sensitive information (SCG 2025). Additionally, SCG requests that consultants do not disclose pipeline details such as pipeline diameter and MAOP in their reports. The pipeline distance between the nearest shutoff valves was used in the analysis and risk calculations, but only the risk assessment methodology and results are presented in this report. Assumptions were made regarding the pipeline diameter and MAOP based on a previous evaluation of the same pipeline for a school site in the Cardiff community (PlaceWorks 2018).

SCG operates and maintains its pipeline facilities in compliance with the Department of Transportation, Title 49 of the Code of Federal Regulations, Part 192 (49 CFR 192) and State (CPUC General Order 112-E) regulations. In the event of loss of pressure, leak detection, or significant deviations from normal operating parameters, emergency procedures would be activated, including contact with the local fire department and emergency personnel. Under Federal and State regulations, the class designation of a pipeline is based on the types of buildings, population density, and level of human activity near the segment of pipeline and is used to determine the pipeline's MAOP. Pipelines are rated from Class 1 to Class 4, based on increasing levels of population. The pipelines within 1,500 feet of the school site are currently categorized as Class 3, which indicates the pipeline is within 100 yards of a building or well-defined outside area that is occupied by 20 or more people at least 5 days a week for 10 weeks in any 12-month period. The pipeline is surveyed annually to look for pipeline leaks, construction activity, and other factors that may threaten the pipeline. Also, the external and internal corrosion systems and valves are monitored annually.

The San Dieguito Water District (SDWD) was contacted to determine if any large volume water pipelines are within 1,500 feet of the site.¹ The SDWD responded that there are two large volume (\geq 12-inch diameter) water pipelines within 1,500 feet of the project site, as summarized in Table 1 (SDWD 2025).

¹ CDE defines large/high volume pipelines as pipelines 12-inches in diameter or greater (CDE 2007).

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Table 1 Water Pipelines

Pipeline Diameter	Pipeline Location	Distance from School
12-inch	N. Vulcan Avenue	25 feet west
12-inch	Orpheus Avenue	375 feet east

The water pipeline locations are shown on Figure 1, and an evaluation of flooding potential with respect to the school site is provided in Section 2.4.

2.2 LAND USE AND TERRAIN

The existing school site is generally flat with gentle slopes toward the west. There are no intervening buildings and/or structures between the school site and the high-pressure natural gas pipeline that could partially block or buffer vapor releases or jet fires if an incident were to occur involving the natural gas pipeline beneath N. Vulcan Avenue to the west. Potential ignition sources may include motor vehicles traveling along the adjacent streets, overhead high voltage electrical lines, and/or mechanical/electrical equipment.

2.3 NATURAL GAS PIPELINE ANALYSIS

In accordance with the CDE Guidance Protocol, two conservative release scenarios were evaluated: 1) a rupture or large-volume release equal to the pipeline’s diameter, and 2) a leak or small-volume release from a 1-inch diameter hole. Three potential consequences were evaluated for each release scenario: 1) jet flame, 2) flash fire, and 3) explosion. Results from the ALOHA computer analyses indicate that unconfined vapor cloud explosions would not occur in an open environment, such as the area around the school site, and this scenario was not subject to further analysis (USEPA 2016).

2.3.1 Stage 2 Risk Analysis and Results

The criteria for a Stage 1 screening analysis were not met because the identified high-pressure pipeline is within 600 feet of the school site. Therefore, a Stage 2 risk analysis was conducted to determine the potential risks to students and staff at the proposed school.

The results are summarized in Table 2, and the calculations are provided in Appendix A. The total individual risk from the high pressure natural gas pipeline is 1.3×10^{-7} , which is less than the TIR criterion of one in a million (1.0×10^{-6}). Therefore, the risk is less than significant.

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Table 2 Total Individual Risk (TIR) Analysis

Pipeline	TIR	TIR/IRC Ratio	TIR Indicator Ratio	Population Risk Indicator
Natural Gas Transmission Pipeline	1.3×10^{-7}	0.13	0.25	31

As part of the Stage 2 analysis, TIR/IRC ratios and TIR indicator ratios were also determined for the school configuration shown in Figure 2, based on the protocol presented in the CDE manual. The school site was divided into three zones of equal length based on the width of the school site that is perpendicular to the pipeline being analyzed (Zones 1, 2 and 3). The TIR was calculated for each zone and compared to the TIR calculated for the nearest property boundary to the pipeline (i.e., TIR Indicator Ratio). The population risk indicator can only be estimated when the hazard footprint for a pipeline rupture and jet flame release reaches the school site. The total population of the school site was estimated to be 750 students and 80 teachers & administration staff, and it was assumed that students and staff would be outside 30 percent of the time, as per the CDE default assumption.

There are no significance thresholds established by CDE for the TIR/IRC ratio, TIR indicator ratio, or population risk indicator. These values are simply used by CDE reviewers as guidelines to determine the relative potential risk at a school site.

2.3.2 Stage 3 Risk Analysis and Results

A Stage 3 analysis was conducted for this pipeline because the SCG pipeline to the west of the school site is located less than 50 feet from the school property boundary. As per CDE guidance, the additional analysis was used to verify and validate the Stage 2 results, using different calculation methods. The CDE manual states that near-field modeling may not accurately apply within 50 feet and that “additional modeling should be applied, with checks by more than one estimation method”.

From a literature review on pipeline risk assessments and consequence modeling, it appears that ALOHA results from modeling natural gas releases within 50 feet of a receptor would be conservative for the following reasons:

- ALOHA underestimates concentrations at distances of 200 meters or more and overestimates concentrations closer in, resulting in conservative results for near field analyses.
- ALOHA is used extensively by local fire departments and hazmat teams to model immediate *near field* impacts of hazardous material releases.
- ALOHA ignores initial plume or puff rise, resulting in conservative results for modeling natural gas (methane) releases.
- ALOHA does not model initial momentum of release, which is conservative and results in higher ground level concentrations than with an elevated release.
- ALOHA does not account for buoyancy due to heat, resulting in conservative results when modeling natural gas releases resulting from a jet fire or flash fire.
- ALOHA treats released methane as being neutrally buoyant, when it is actually lighter than ambient air, resulting in conservative results.

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- Los Angeles Unified School District's (LAUSD's) pipeline risk assessment protocol uses ALOHA and other models without any distance restriction on model results for pipelines located within 50 feet of a school's property boundary.

Based on the reasons listed above, using ALOHA to model releases from natural gas pipeline segments within 50 feet of a school site would result in conservative results. Nevertheless, a Stage 3 analysis, using alternative calculation methods, was conducted for this report.

For the Stage 3 analysis, the methodology developed by LAUSD was used to evaluate natural gas pipeline risk (LAUSD 2009). The LAUSD methodology typically has higher calculated risk values and is more conservative than the CDE methodology, based on the following:

- The LAUSD methodology used in this analysis assumes a school attendance time of 8 hours per day for 180 days per calendar year and assumes that all students and staff are outdoors during the attendance time for a total exposure probability of 16 percent. The CDE protocol uses an attendance time of 8 hours per day for 180 days and assumes that students and staff are outdoors 25 percent of the time, for a total exposure probability of 4 percent.

The LAUSD methodology also uses the ALOHA model to determine jet flame radiant heat levels and flammable vapor cloud (FVC) impacts for natural gas rupture and leak scenarios. However, the LAUSD methodology also calculates impacts due to the width of the jet flame, which is estimated to be 25 percent of its length/height. The release scenarios are the same as those used in the CDE methodology: 1) a rupture equal to the pipeline's diameter, and 2) a leak from a 1-inch diameter hole. For this alternative analysis, two potential consequences were evaluated: 1) jet flame/radiant heat flux, and 2) flammable vapor cloud impacts.

The LAUSD methodology also includes wind direction and frequency data for the nearest meteorological station that is representative of school site. The San Diego County Air Pollution Control District (SDAPCD) provided meteorological data for the Camp Pendleton station, while 11.5 miles northwest of site was determined to be representative of wind patterns west of I-5 (SDAPCD 2019-2021). The monitoring station wind rose diagram for school attendance hours (8:00 AM to 4:00 PM) and Stability Classes B through F is provided in Appendix A. The predominant wind direction is to the east during school hours. Any wind directed from NNW to SSE including the east vectors was assumed to be able to direct a release from the natural gas pipeline segment beneath N. Vulcan Avenue toward the school site. For Stability Classes B through D, which is representative of conditions during school hours, the wind for all vectors from NNW to SSE blows toward the site 26 percent of the time.

The fatality probabilities for the radiant heat and UVCE footprints were adjusted from the LAUSD default values of 0.1, based on the site-specific school configuration and per the instructions in the *Pipeline Safety Hazard Assessment User Manual*. The results of the alternative Stage 3 analysis are provided in Appendix A, and the results are summarized herein:

- LAUSD Methodology –Natural Gas Transmission Pipeline, N. Vulcan Avenue – 1.1×10^{-7}

The Stage 3 results using the LAUSD methodology has a slightly lower risk TIR of 1.1×10^{-7} than was calculated by the CDE methodology (i.e., 1.3×10^{-7}), but is still less than the TIR criterion of one in a million

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(1.0×10^{-6}). Therefore, the results of the alternate Stage 3 analysis verify that in the unlikely event of a rupture or leak in the high-pressure natural gas pipeline within 1,500 ft of the school site, the risk to students and staff at the school site would be less than significant, according to the CDE assessment criteria.

2.4 WATER PIPELINE FLOODING ANALYSIS

In addition to natural gas and hazardous liquid pipelines, the CDE requires that the risk of releases from large 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.

A pipeline flooding analysis was conducted 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 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, accounting for 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 3.

Table 3 Water Pipeline Flooding Analysis – Street Flow

Pipeline Diameter (in)	Pipeline Location	Release Rate (cfs)	Street Width (ft)	Depth of Flow in Street (in)	Exceeds Street Carrying Capacity?
12-inch	N. Vulcan Avenue	3.93	28	3.2	No
12-inch	Orpheus Avenue	3.93	34	2.6	No

Assuming standard 6-inch curb for residential or collector streets.

Assuming a standard 6-inch curb for residential and collector streets, the water released from a full-flow rupture of any of the identified water mains would be entirely contained within the confines of the curbing and would not result in flooding at the school site.

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3. Summary and Recommendations

The results of the CDE pipeline protocol analysis indicate a total individual risk of 1.3×10^{-7} for the SCG high pressure natural gas transmission pipeline, which is less than the CDE significance threshold of one in a million (1.0×10^{-6}). The results from the Stage 3 analysis for the natural gas pipeline beneath N. Vulcan Avenue, which is within 50 feet from the school site, confirm that the pipeline do not pose a risk to students and staff at the school site. Therefore, the pipeline would not pose a risk to students or staff at the proposed school site and no mitigation measures are required. If a rupture or leak should occur in any of the water pipelines within 1,500 feet of the school site, the results of the flooding analysis indicate that the released water would not result in water depths at the school site that would pose a significant risk to students and staff.

The risk of pipeline failures is expected to decrease in the future with recent changes to federal and state pipeline safety regulations (i.e., PIPES Act of 2020) and evolving industry standards (PHMSA 2021). The Office of Pipeline Safety (OPS) and the California Public Utilities Commission (CPUC) are charged with responsibility for pipeline safety and conduct regular inspections to ensure that the pipeline operators are complying with regulatory standards.

Although the operation and management of each pipeline ultimately resides with the pipeline operator, there are certain measures that the District can take to further protect the students and staff at the school site:

- Have SCG contact the Encinitas Union School District if there are maintenance activities planned for the pipeline segments in close proximity to the school site (i.e., within N. Vulcan Avenue).
- Use non-flammable fencing along the western school property, where feasible.
- Include the possibility of a pipeline release as a scenario in the school's emergency preparedness planning and response plans, including potential evacuation routes or shelter-in-place, awareness of pipeline locations, contact information, and actions to follow in the event of a pipeline release.
- Encinitas Union School District should immediately notify SCG if there are any odors or evidence of gas leakage from the pipeline or activities that involve excavation near the pipeline.
- SCG personnel are trained to respond to a release or threatened release by immediate notification to various agencies, including 911, the California Office of Emergency Services (OES), National Response Center (NRC), Consolidated Unified Program Agency (CUPA), and local agencies, as required by special agreement. If necessary, the Encinitas Union School District could coordinate with CUPA or the local agency to ensure that they are notified if there is a release or threatened release in the vicinity of the school site.

3. Summary and Recommendations

Steps to be taken in the event of a pipeline failure include:

- Immediately notify Encinitas Fire and Marine Safety Department and Southern California Gas Company.
- If natural gas is leaking but not burning, avoid doing anything that may ignite it. Eliminate ignition sources, such as vehicles, cell phones, switches, flashlights, static electricity, and cigarettes.
- Evacuation (i.e., away from the pipeline to the east) or shelter in place procedures may be necessary.

Any additional measures to ensure the safety of school students and staff and maintain the integrity of the pipelines can be discussed between representatives of SCG and Encinitas Union School District personnel, as deemed necessary. A map of the pipeline locations and emergency contact information should be kept with the school's emergency response plan.

4. References

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4. References

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Appendix A. CDE Risk Analysis Summary Forms and Calculations

Appendix A: CDE Risk Analysis Summary Forms and Calculations

Local Educational Agency	
Date:	November 11, 2025
Local Educational Agency	Encinitas Union School District
Contact	Eric Smith, Director of Facilities, Maintenance, Operations and Grounds
Telephone Number	760.944.4300
E-mail address	Eric.Smith@eusd.net
Street Address	101 S. Rancho Santa Fe Road
Department or Mail Drop	
City	Encinitas
County	San Diego County
Zip Code	92024


School Campus Site	
Name	Paul Ecke Central Elementary School Rebuild Project
Location Description	185 Union Street, Encinitas, CA
Pipelines of Interest	High pressure natural gas transmission pipeline
Operator/Owner	Southern California Gas Company
Product Transported	Natural Gas
Pipeline Diameter (inches)	Diameter = Not provided by SCG; assumption made based on previously evaluated risk study of the same pipeline from 2018; not disclosed in report per agency agreements
Operating Pressure (psig)	MAOP = Not provided by SCG; assumption made based on previously evaluated risk study of the same pipeline from 2018; not disclosed in report per agency agreements
Closest Approach to Property Line	35 feet

Individual Risk Estimate Result							
Type of Analysis (Check One)	Stage 1	<input type="checkbox"/>	Stage 2	<input checked="" type="checkbox"/>	Stage 3	<input checked="" type="checkbox"/>	
Individual Risk Estimate Value	1.3E-07						
Individual Risk Criterion	1.0E-06 (0.000001)						
IR Significance (check one)	Significant	<input type="checkbox"/>					
	Insignificant	<input checked="" type="checkbox"/>					

Certification and Signatures of Risk Analyst(s)

This analysis was conducted according to the 2007 CDE Protocol except as noted. All modifications within the Stage 2 framework, and exceptions to the data and processes established in the 2007 CDE Protocol, if any, were based upon my professional opinion and in a manner consistent with the standards of care and skill ordinarily exercised by professionals working on similar projects.

I certify that the estimated risk levels were derived based upon the 2007 CDE Protocol, unless otherwise noted, and that these levels demonstrate, with reasonable expectations of uncertainties for such estimates, that the estimated Individual Risk for the school site, as the site was planned at the time of this analysis, including mitigation measures, if any, meets the Individual Risk Criterion stated in the 2007 CDE Protocol, based on the information provided to me.

Printed Name	Signature	Position or Title
Steven J. Bush, P.E.		Senior Engineer

Notice: In the event that the Individual Risk Criterion could not be met, at the option of the LEA, CDE will still accept a report for review and consultation with the LEA.

XSEG Calculations														
Pipe Size, Pressure, and Hazard Type			Front Property Line - Begin Zone 1			Begin Zone 2			Begin Zone 3			End Zone 3 -Back Property Line		
Pipe Size	Press.	Hazard X	RX (1%)	R0	XSEG	RX (1%)	R0	XSEG	RX (1%)	R0	XSEG	RX (1%)	R0	XSEG
(in)	(psig)		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
NDA	NDA	LJF	33	35	0	33	262	0	33	488	0	33	715	0
NDA	NDA	RJF	156	35	1530	156	262	0	156	488	0	156	715	0
NDA	NDA	LFF	120	35	1536	120	262	0	120	488	0	120	715	0
NDA	NDA	RFF	603	35	2360	603	262	1737	603	488	1358	603	715	0
NDA	NDA	LEX	0	35	0	0	262	0	0	488	0	0	715	0
NDA	NDA	REX	0	35	0	0	262	0	0	488	0	0	715	0

NATURAL GAS TRANSMISSION PIPELINE

Input Data		
Product	natural gas	
Diameter	NDA	inches
Pressure	NDA	psig
R0	35	ft

XSEG	RX(1%)	Units
XSEG(LJF)	0	ft
XSEG(RJF)	1530	ft
XSEG(LFF)	1536	ft
XSEG(RFF)	2360	ft
XSEG(LEX)	0	ft
XSEG(REX)	0	ft

Base and Conditional Probability Calculations							
	Base	Leak		Rupture		Exposure	
F0	1.2E-04	PC(L)	0.80	PC(R)	0.20	PC(OCC)	0.16
P0	1.2E-04	PC(LIG)	0.30	PC(RIG)	0.45	PC(OUT)	0.25
PAF	1.0	PC(FIG)	0.99	PC(FIG)	0.99		
PA	1.2E-04	PC(JF)	0.98	PC(JF)	0.98		
		PC(FF)	0.01	PC(FF)	0.01		
		PC(EIG)	0.01	PC(EIG)	0.01		
Calculated Values:							
PA(LJF)	0.0E+00	PCI(LJF)	0.233	PCI(RJF)	0.087		
PA(RJF)	3.5E-05	PCI(LFF)	0.002	PCI(RFF)	0.001		
PA(LFF)	3.5E-05	PCI(LEX)	0.002	PCI(REX)	0.001	PC(EXPO)	0.04
PA(RFF)	5.4E-05						
PA(LEX)	0.0E+00						
PA(REX)	0.0E+00						

Impact Probability Calculations							
Probability Term				Values			
PC(LJF) =	PA(LJF) x	PCI(LJF) x	PC(EXPO) =	0.0E+00	0.23	0.040	0.0E+00
PC(RJF) =	PA(RJF) x	PCI(RJF) x	PC(EXPO) =	3.5E-05	0.09	0.040	1.2E-07
PC(LFF) =	PA(LFF) x	PCI(LFF) x	PC(EXPO) =	3.5E-05	0.002	0.040	3.3E-09
PC(RFF) =	PA(RFF) x	PCI(RFF) x	PC(EXPO) =	5.4E-05	0.001	0.040	1.9E-09
PC(LEX) =	PA(LEX) x	PCI(LEX) x	PC(EXPO) =	0.0E+00	0.002	0.040	0.0E+00
PC(REX) =	PA(REX) x	PCI(REX) x	PC(EXPO) =	0.0E+00	0.001	0.040	0.0E+00

Based on data from impact distance figures in Section 4.6 and mortality figures in Section 4.5, enter the maximum impact probability at receptor location for each hazard in MAX PF(X) column.

IR Calculation				
	MAX PF(X)		PC(X)	IR(X)
IR(LJF) =	1.00		0.0E+00	0.00E+00
IR(RJF) =	1.00		1.2E-07	1.21E-07
IR(LFF) =	1.00		3.3E-09	3.32E-09
IR(RFF) =	1.00		1.9E-09	1.91E-09
IR(LEX) =	0.00		0.0E+00	0.00E+00
IR(REX) =	0.00		0.0E+00	0.00E+00
TOTAL INDIVIDUAL RISK, TIR				1.3E-07
CDE INDIVIDUAL RISK CRITERION, IRC				1.0E-06
TIR/IRC RATIO				0.13
PROTOCOL TIR INDICATOR RATIO				0.25

NATURAL GAS PIPELINE

POPULATION RISK INDICATOR

Zone	Distance from Pipeline (ft)		Zone Boundary Mortality (RJF) (%)		Average Zone Mortality RJF (%)	Zone Population	Population Risk Indicator
	Begin	End	Begin	End			
1	35	262	100	0	50	63	31
2	262	488	0	0	0	125	0
3	488	715	0	0	0	63	0
Population Risk Indicator						250	31

**Natural Gas Pipeline
Pipeline Safety Hazard Assessment - Fatality Risk
LAUSD Methodology**

Natural Gas Pipeline: N Vulcan Avenue
School Hours - 8 am to 4 pm - Atmospheric Stability Class D

Accident Scenario	Footprint Length (ft)	Pipeline Segment ¹ (ft)	Pipeline Accident Rate (per mile-yr)	Adjusted Accident Rate ² (per year)	Leak or Rupture Probability	Probability of Initial Ignition or No Ignition	Stability Class/Flow Vector Percent	Probability of Flash Fire or UVCE at School	Probability of HF Reaching School	Annual ³ Student Attendance Percent	Probability of Student/Staff Exposure	Probability of Fatality	Fatality Risk
Leak - jet flame width *	1.5	0	3.80E-05	0.00E+00	0.80	0.10			0.00E+00	0.164	0.00E+00	1.0	0.00E+00
Leak - radiant heat	33	0	3.80E-05	0.00E+00	0.80	0.10			0.00E+00	0.164	0.00E+00	0.00	0.00E+00
Leak - FVC	120	880	3.80E-05	6.33E-06	0.80	0.90	0.26	0.30	3.56E-07	0.164	5.83E-08	1.0	5.83E-08
Leak - FVC & UVCE	0	0	3.80E-05	0.00E+00	0.80	0.90	0.26	0.10	0.00E+00	0.164	0.00E+00	0.1	0.00E+00
Total Leak									3.56E-07		5.83E-08		5.83E-08
Rupture - jet flame width*	26	0	3.80E-05	0.00E+00	0.20	0.25			0.00E+00	0.164	0.00E+00	1.0	0.00E+00
Rupture - radiant heat	198	1,040	3.80E-05	7.48E-06	0.20	0.25			3.74E-07	0.164	6.14E-08	0.33	2.05E-08
Rupture - FVC	603	1,854	3.80E-05	1.33E-05	0.20	0.75	0.26	0.38	1.95E-07	0.164	3.20E-08	1.0	3.20E-08
Rupture - FVC & UVCE	0	0	3.80E-05	0.00E+00	0.20	0.75	0.26	0.13	0.00E+00	0.164	0.00E+00	0.1	0.00E+00
Total Rupture									5.69E-07		9.34E-08		5.25E-08
TOTAL													1.1E-07

Notes:

- Distance from pipeline to school **35 ft**
- School frontage length along pipeline **650 ft**
- HF - hazard footprint
- * Jet flame width is 25 percent of its length
- 1 Calculated using So Cal Gas provided information.
- 2 Adjusted AR = AR x (L/ 5,280 ft/mile)
- 3 8 hours/day, 180 days/year

Conditional Probability - Ignition

- Ignition of gas at pipeline - leak **0.10**
- Ignition of gas at pipeline- rupture **0.25**
- No ignition of gas at pipeline - leak **0.90**
- No ignition of gas at pipeline - rupture **0.75**
- Delayed ignition of FVC at school - leak **0.40**
- Delayed ignition at FVC school - rupture **0.50**
- Flash Fire **0.75**
- UVCE **0.25**

Delayed Ignition - Large Diameter Pipeline

- For FVC length 1,000 to 1,500 feet **0.50**
- For FVC length 1,501 to 1,700 feet **0.70**
- For FVC length > 1,700 feet **0.90**

Conditional Probability - Fatality - Leak

- Jet flame **1.0** Default
- Radiant heat **0.00** Calculated
- Flammable vapor cloud **1.0** Default
- UVCE **0.10** Default

Conditional Probability - Fatality - Rupture

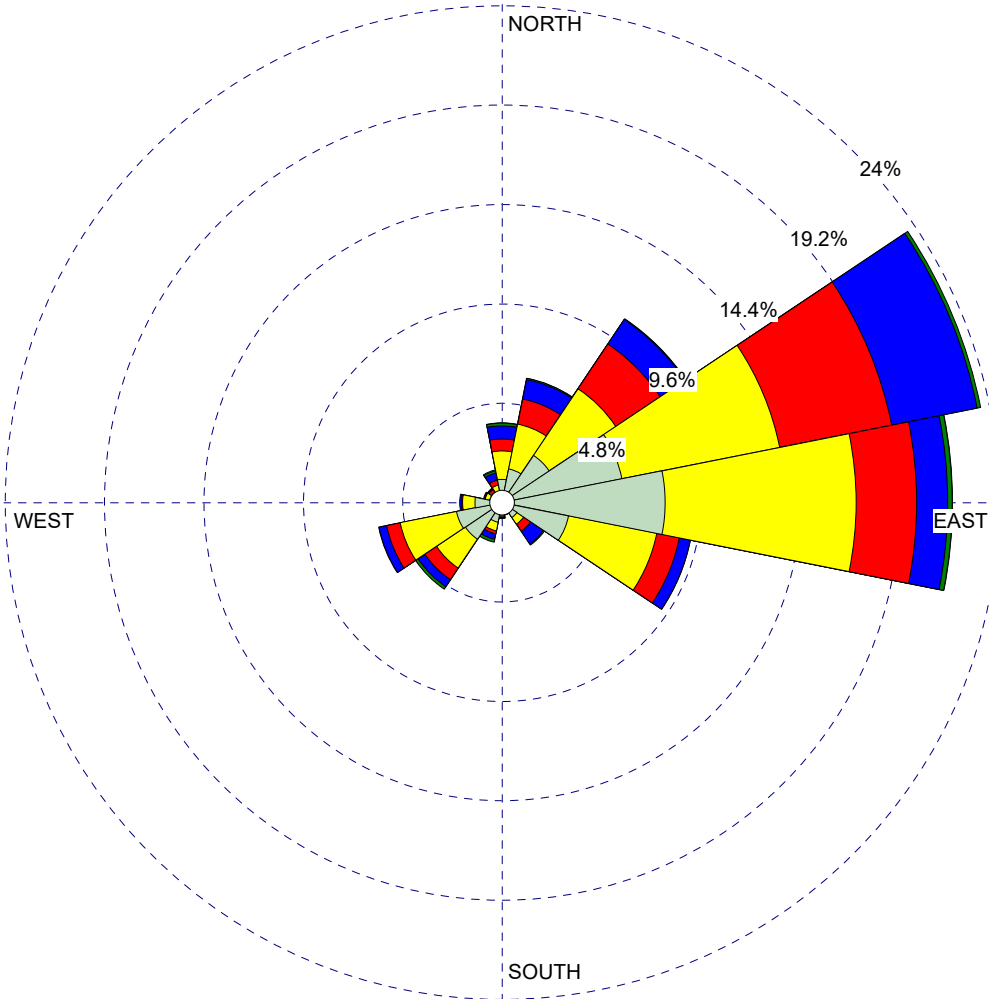
- Jet flame **1.0** Default
- Radiant heat **0.33** Calculated
- Flammable vapor cloud **1.0** Default
- UVCE **0.10** Default

WIND ROSE PLOT:

**Camp Pendleton Meteorological Station
2019-2021**

DISPLAY:

**Wind Speed
Flow Vector (blowing to)**



WIND SPEED (m/s)

- >= 11.10
- 8.80 - 11.10
- 5.70 - 8.80
- 3.60 - 5.70
- 3.00 - 3.60
- 2.10 - 3.00
- 0.50 - 2.10

Calms: 0.66%

COMMENTS:

DATA PERIOD:

**Start Date: 1/1/2019 - 08:00
End Date: 12/31/2021 - 15:00**

COMPANY NAME:

PlaceWorks

MODELER:

SB

CALM WINDS:

0.66%

TOTAL COUNT:

8595 hrs.

AVG. WIND SPEED:

2.57 m/s

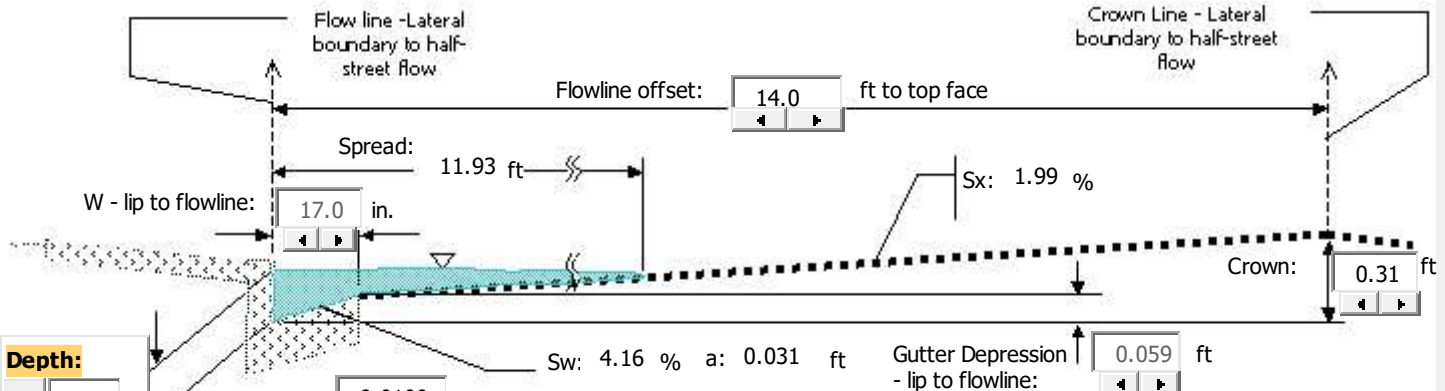
DATE:

8/1/2025

PROJECT NO.:

EUSD-02

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



Depth:
 d: 0.26 ft
 3.2 in.

Long. slope: 0.0100 (ft/ft)
 N value: 0.016

Street Parameters:

Q: 3.93 cfs
 K: 39.3
 Vel: 2.73 ft/s
 Eo: 31.0 %
 W/T: 0.1187

Standard Manning's:

Q: 3.23 cfs
 K: 32.3
 Vel: 2.24 ft/s
 Rh: 0.12 ft
 Area: 1.44 sf

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

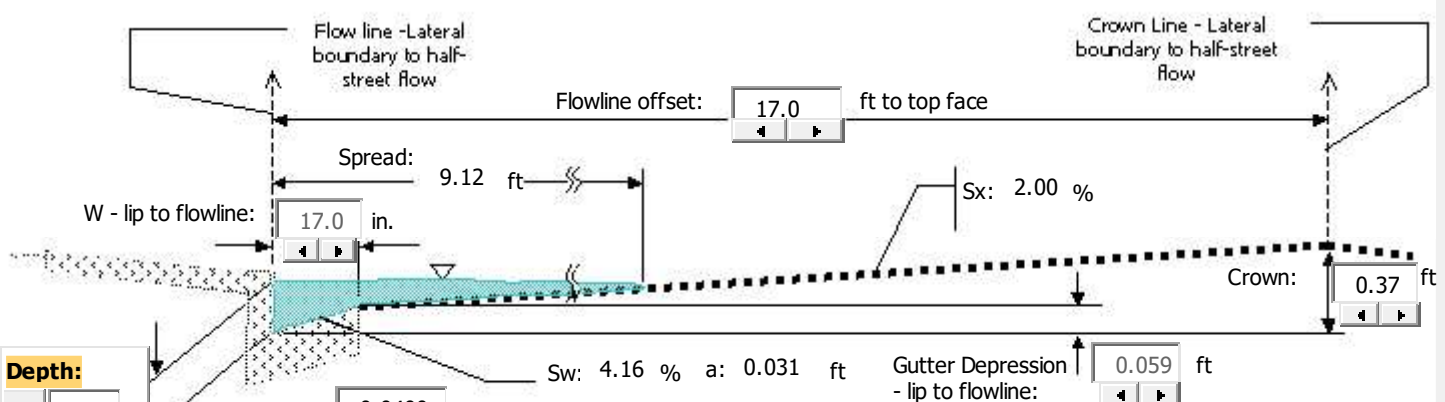
Curb Opening Parameters:
 C-O Apron wider than gutter: 0 in.
 S'w 13.9 % Se: 6.31 %
 Length of curb opening inlet: 12.0 ft
 Lt: 16.80 ft
 80 % Clear Efficiency
 Curb opening flowby: 0.86 cfs

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: 2.89 ft/s
 Eo: 98.56 %
 Rs: 9.20 % Rf: 100.00 %
 Side flow captured: 0.04 cfs Frontal captured: 0.42 cfs
 Total combined CB flowby: 0.39 cfs

Street Flow - N Vulcan Avenue
 12-Inch Water Main

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



Depth:
 d: 0.21 ft
 2.6 in.

Long. slope: 0.0400 (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: 7.54 %
 Length of curb opening inlet: 12.0 ft
 Lt: 22.89 ft
 80 % Clear Efficiency
 Curb opening flowby: 1.48 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: 5.56 ft/s
 Eo: 99.71 %
 Rs: 2.85 % Rf: 100.00 %
 Side flow captured: 0.02 cfs Frontal captured: 0.74 cfs
 Total combined CB flowby: 0.72 cfs

Street Parameters:

Q: 3.93 cfs
 K: 19.7
 Vel: 4.61 ft/s
 Eo: 39.8 %
 W/T: 0.1553

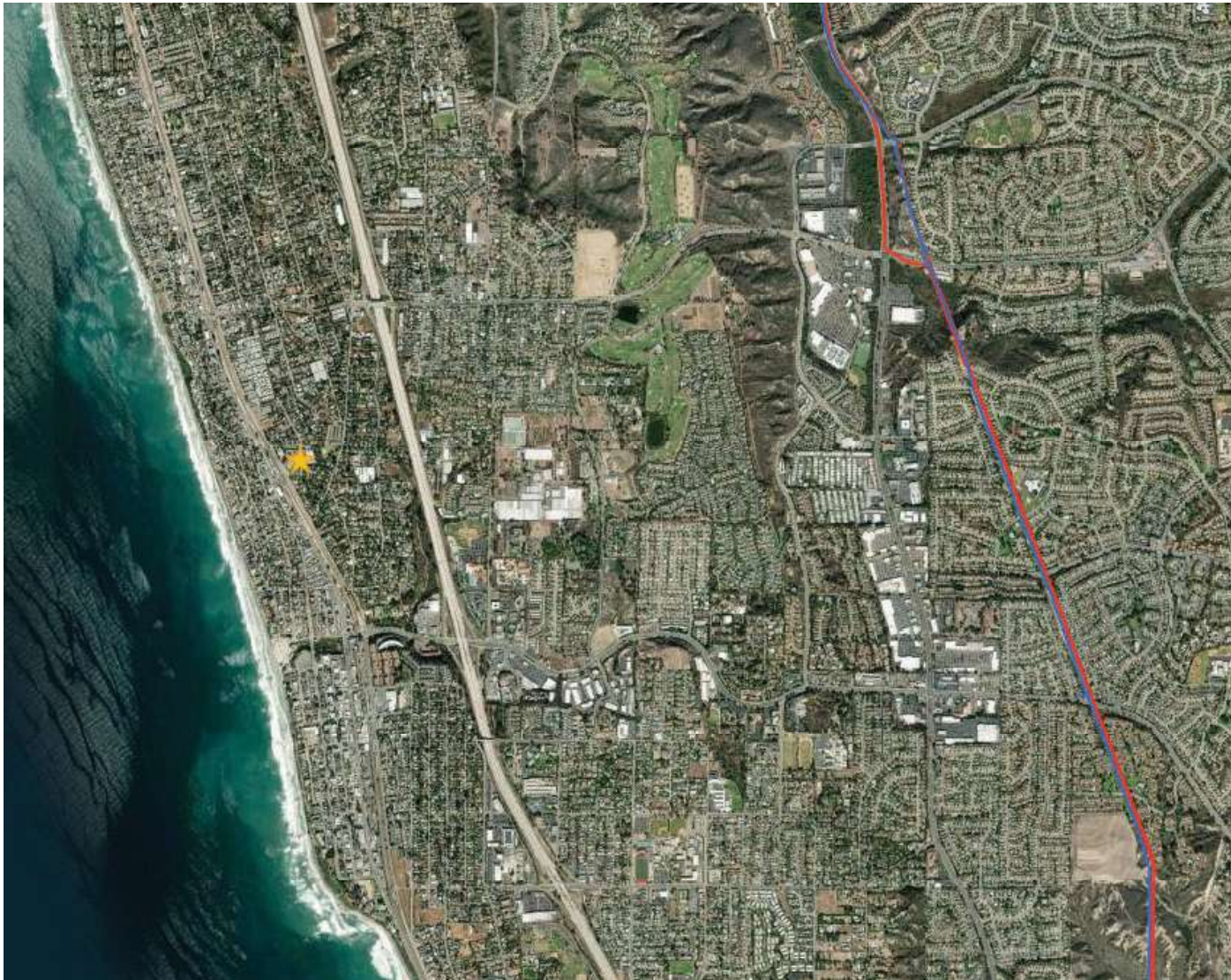
Standard Manning's:

Q: 3.21 cfs
 K: 16.0
 Vel: 3.77 ft/s
 Rh: 0.09 ft
 Area: 0.85 sf

Street Flow - Orpheus Avenue
 12-Inch Water Main

Appendix B. Agency Correspondence

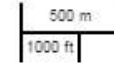
NATIONAL PIPELINE MAPPING SYSTEM



Legend

— Gas Transmission Pipelines

— Hazardous Liquid Pipelines



Pipelines depicted on this map represent gas transmission and hazardous liquid lines only. Gas gathering and gas distribution systems are not represented.

This map should never be used as a substitute for contacting a one-call center prior to excavation activities. Please call 811 before any digging occurs.

Questions regarding this map or its contents can be directed to npms@dot.gov.

Projection: Geographic

Datum: NAD83

Map produced by the Public Viewer application at www.npms.phmsa.dot.gov

World Imagery map service data is attributed to Esri, Maxar, Earthstar Geographics, and the GIS User Community.

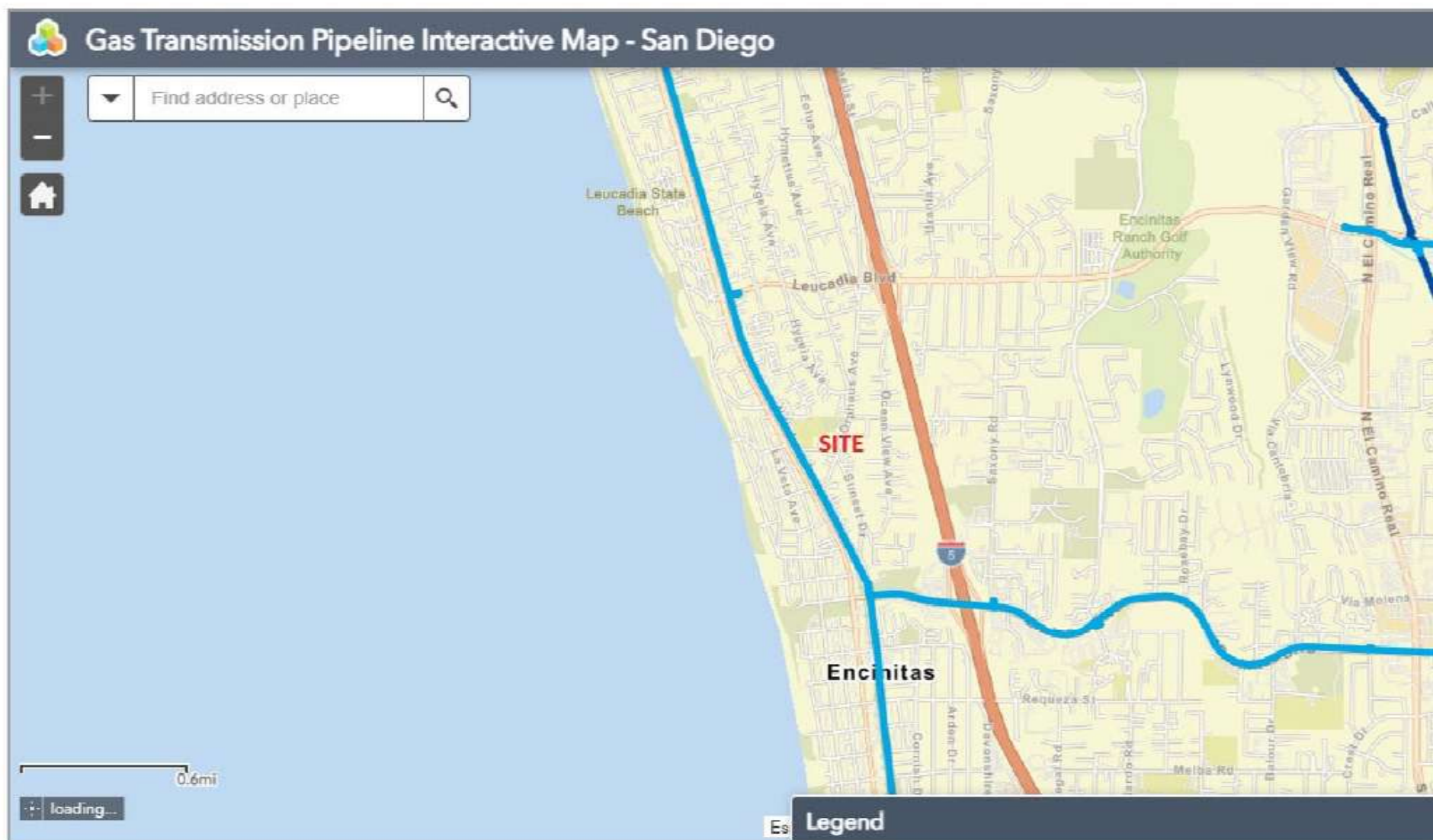
Date Printed: Mar 10, 2025



Accuracy of pipeline locations varies +/- 500 feet.

Information from this website should never be used as a substitute for calling 811 two business days before digging.

Enter your address or zip code.



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