CUPERTINO SANITARY DISTRICT
SANITARY BOARD MEETING
WEDNESDAY, AUGUST 07, 2019

A_G_E_N_D_A

Meeting to be held at **7:00 p.m.** in the **Stevens Creek Office Center, Suite 100, 20863 Stevens Creek Boulevard**, Cupertino, California.

1. ROLL CALL:

2. MINUTES:

A. APPROVAL OF THE MINUTES OF JULY 17, 2019

B. APPROVED MINUTES OF JULY 3, 2019

3. PERSONAL PRESENTATIONS:

THIS PORTION OF THE MEETING IS RESERVED FOR PERSONS DESIRING TO ADDRESS THE BOARD ON ANY MATTER NOT ON THE AGENDA. SPEAKERS ARE LIMITED TO THREE (3) MINUTES.

ALL STATEMENTS REQUIRING A RESPONSE WILL BE REFERRED TO STAFF FOR FURTHER ACTION. IN MOST CASES, STATE LAW WILL PROHIBIT THE BOARD FROM MAKING ANY DECISIONS WITH RESPECT TO A MATTER NOT LISTED ON THE AGENDA.

4. CORRESPONDENCE:

NONE

5. MEETINGS:

A. REGULAR MEETING OF THE SAN JOSE/SANTA CLARA TREATMENT PLANT ADVISORY COMMITTEE (TPAC) TO BE HELD AUGUST 8, 2019 (CANCELLED)

B. CASA CONFERENCE TO BE HELD AUGUST 21-23, 2019

6. REPORTS:

A. REGULAR MEETING OF THE SAN JOSE/SANTA CLARA TREATMENT PLANT TECHNICAL ADVISORY COMMITTEE (TAC) TO BE HELD AUGUST 6, 2019 (CANCELLED)

7. UNFINISHED BUSINESS:

A. LOAN DOCUMENTS & FEDERAL TAX LAW REQUIREMENTS

8. NEW BUSINESS:

A. TAX ROLL FILING WITH THE COUNTY

9. STAFF REPORT:

A. PROSPECT PUMP STATION

B. SMART BALL FORCE MAIN CONDITION ASSESSMENT

C. VALLCO/SANTA CLARA

D. CUPERTINO VILLAGE

10. CLOSED SESSION:

A. CONFERENCE WITH LEGAL COUNSEL – EXISTING LITIGATION
in accordance with government code section Paragraph (1) of Subdivision (d) of Section 54956.9, existing litigation. Name of Case: County Sanitation District 2-3, West Valley Sanitation District, Cupertino Sanitary District, Burbank Sanitary District and the City of Milpitas v. The City of San Jose, The City of Santa Clara and Does 1 through 50 inclusive.

12. NEXT MEETING:

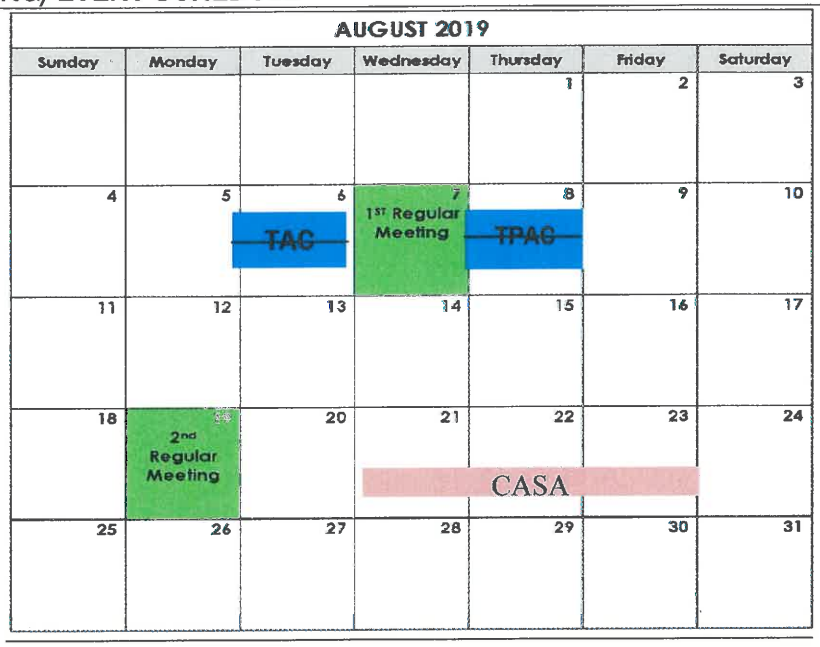
A. NEXT REGULAR DISTRICT BOARD MEETING IS SCHEDULED TO BE HELD ON MONDAY, AUGUST 19, 2019

13. ADJOURNMENT:

CUPERTINO SANITARY DISTRICT
MEETING/EVENT SCHEDULE

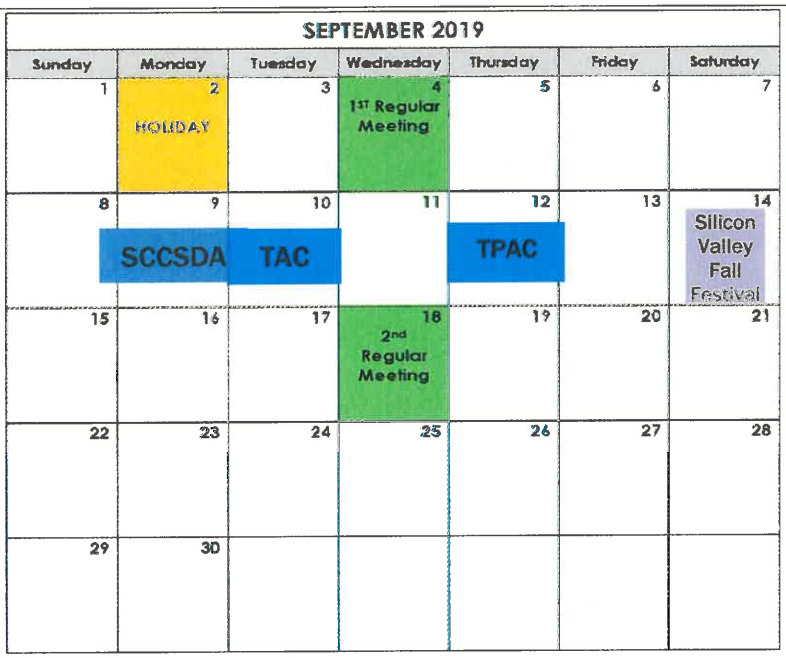
AUGUST 2019

08/05: TAC - Cancelled
08/07: 1st Regular Meeting *(Kwok excused)*
08/08: TPAC - Cancelled
08/19: 2nd Regular Meeting
08/21-23: CASA Conference



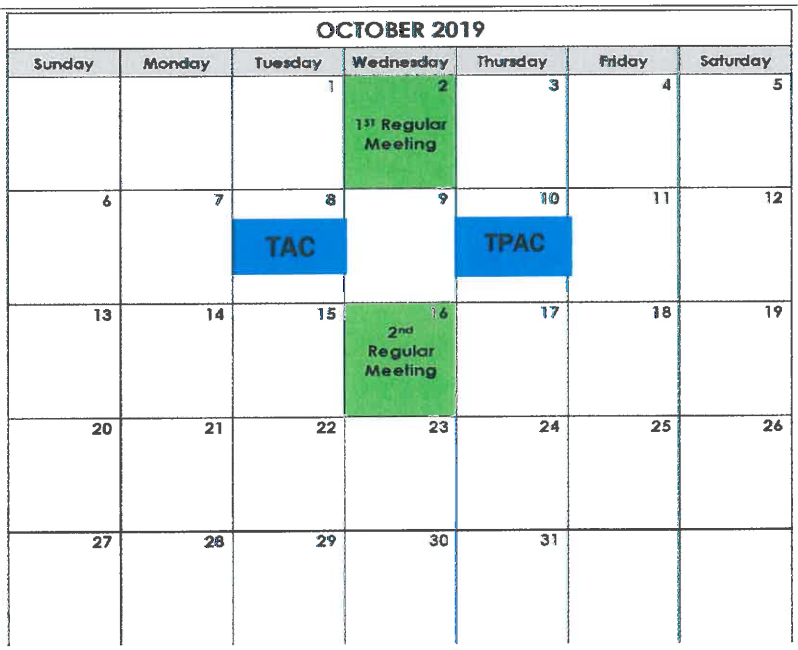
SEPTEMBER 2019

09/02: Holiday – Office Closed
09/04: 1st Regular Meeting
09/09: SCCSDA Regular Meeting
09/10: TAC
09/12: TPAC
09/14: Silicon Valley Fall Festival
09/18: 2nd Regular Meeting



OCTOBER 2019

10/02: 1st Regular Meeting
10/08: TAC
10/10: TPAC
10/16: 2nd Regular Meeting



CUPERTINO SANITARY DISTRICT BOARD MEETING
WEDNESDAY, JULY 17, 2019

The Sanitary Board of the Cupertino Sanitary District convened this date at 7:00 p.m. in the Stevens Creek Office Center, 20863 Stevens Creek Boulevard, Suite 100, Cupertino, California.

1. ROLL CALL:

President Kwok called the meeting to order and the following proceedings were had to wit: Roll call was taken, with the following members in attendance:

Directors present: Angela S. Chen, Patrick S. Kwok, Taghi S. Saadati, John M. Gatto, and William A. Bosworth.

Staff present: District Manager Benjamin Porter, District Advisor Richard K. Tanaka, and Counsel Marc Hynes.

Guests present: Garrett Chan and Mike Rohde from Main Street, Kitty Moore, Resident, Eric Brewer, Resident, and Sasha Dansky, Mark Thomas Principal.

2. MINUTES & BILLS:

A. On a motion by Director Gatto, seconded by Director Bosworth, by a vote of 5-0-0, the minutes of Wednesday, July 3, 2019 were approved as written.

B. By consensus, the Minutes of Wednesday, June 19, 2019 are to be Noted & Filed.

C. The Board reviewed the June financials for payment. On a motion by Director Gatto, seconded by President Kwok, by a vote of 5-0-0, payment of bills was approved as written.

D. The Directors submitted their June 2019 timesheets to Staff.

3. PERSONAL PRESENTATIONS:

There were none.

4. PUBLIC HEARINGS:

A. The Board conducted a public hearing on amendment to Ordinance No. 123, pertaining to "permits and fee charges." Manager Porter made a staff presentation. President Kwok opened the public hearing at 7:30 p.m. and public comments were provided by guests Garrett Chan, Mike Rohde, Eric Brewer, and Kitty Moore. President Kwok closed the public hearing at 7:40 p.m. and the Board discussed the proposed amendments. On a motion by Director Gatto, seconded by Director Bosworth, by a vote of 5-0-0, Ordinance No. 125, Amending Ordinance No. 123 relating to Permits and Development Fee Charges was approved.

B. The Board conducted a public hearing on Reports and Collection of Rates and Charges for Fiscal Year 2019-2020. Manager Porter made a staff presentation. President Kwok opened the public hearing at 7:43 p.m. There were no public comments. President Kwok closed the public hearing at 7:44 p.m. On a motion by Director Gatto, seconded by Director Saadati, by a vote of 5-0-0,

Resolution No. 1312, Confirming Report on Rates and Charges for FY 2019-2020 was approved. On a motion by Director Gatto, seconded by Director Saadati, by a vote of 5-0-0, Resolution No. 1313, Collection of Rates and Charges for FY 2019-2020 was approved.

5. CORRESPONDENCE:

There was none.

6. MEETINGS:

A. Manager Porter plans to attend the Regular Meeting of the San Jose/Santa Clara Treatment Plant Technical Advisory Committee (TAC) to be held August 6, 2019.

B. Director Gatto plans to attend the Regular Meeting of the San Jose/Santa Clara Treatment Plant Advisory Committee (TPAC) to be held August 8, 2019.

7. REPORTS:

There were none.

8. UNFINISHED BUSINESS:

A. The Board discussed California Special Districts Association (CSDA) membership. On a motion by Director Gatto, seconded by Director Bosworth, by a vote of 4-1-0 the Board approved membership to CSDA. President Kwok voted "No."

B. Advisor Tanaka presented an update on the loan application for the District with the plan to bring the loan approval package to the Board at August 7, 2019 meeting.

9. NEW BUSINESS:

A. The Board reviewed the Mountain Winery's request for annexation. On a motion by Director Bosworth, seconded by Director Gatto, by a vote of 5-0-0, the Board approved Resolution No. 1314, approving annexation of APN 503-46-006 and 503-46-007 parcels to the District and directed staff to work with LAFCO for the formal annexation.

10. STAFF REPORTS:

A. Manager Porter and Advisor Tanaka reported on the status of Prospect Pump Station.

B. Manager Porter reported on the status of the Silicon Valley Fall Festival to be held August 14, 2019.

C. Manager Porter reported on the monthly maintenance report.

11. CLOSED SESSION:

President Kwok adjourned the regular meeting session and opened the closed session at 8:10 p.m. in accordance with government code section Paragraph (1) of Subdivision (d) of Section 54956.9, existing

litigation. Name of Case: County Sanitation District 2-3, West Valley Sanitation District, Cupertino Sanitary District, Burbank Sanitary District, and the City of Milpitas v. The City of San Jose, The City of Santa Clara, and Does 1 through 50 inclusive.

President Kwok adjourned the closed session and the regular meeting was called to order at 8:19 p.m.

There was no reportable action.

12. ADJOURNMENT:

The next regular meeting is scheduled for Wednesday, August 7, 2019. President Kwok is excused from this meeting.

On a motion properly made and seconded, at 8:20 p.m. the meeting was adjourned.

_____ _____

Secretary of the Sanitary Board President of the Sanitary Board

Approved

CUPERTINO SANITARY DISTRICT BOARD MEETING
WEDNESDAY, JULY 3, 2019

The Sanitary Board of the Cupertino Sanitary District convened this date at 7:00 p.m. in the Stevens Creek Office Center, 20863 Stevens Creek Boulevard, Suite 100, Cupertino, California.

1. ROLL CALL:

President Kwok called the meeting to order and the following proceedings were had to wit: Roll call was taken, with the following members in attendance:

Directors present: Angela S. Chen, William A. Bosworth, Taghi S. Saadati, John M. Gatto, and Patrick S. Kwok.

Staff present: District Manager Benjamin Porter, District Advisor Richard K. Tanaka, and Counsel Marc Hynes.

Guests present: Kitty Moore, Cupertino Planning Commission (representing self), and Osking Fluang of 862 Brent Drive, Cupertino.

2. MINUTES:

A. On a motion by Director Gatto, seconded by Director Saadati, by a vote of 5-0-0, the minutes of Wednesday, June 19, 2019 were approved as written.

B. By consensus, the Minutes of Wednesday, June 5, 2019 are to be Noted & Filed.

3. PERSONAL PRESENTATIONS:

There were none.

4. PUBLIC HEARING:

Staff made a presentation on the sewer rate fees study. President Kwok opened the meeting for public comments. K. Moore addressed the Board and expressed that she would prefer to have development fees discussed alongside service fees. No other public comments were made. President Kwok closed the public hearing portion and the Board reviewed two written protests that were submitted to the District. After discussion by the Board, on motion by Director Gatto, seconded by Director Saadati, by a vote of 5-0-0, the Board approved Ordinance No. 124, Adopting Rate Increase for FY 2019-2020 with an increase of 12%.

On motion by Director Gatto, seconded by Director Chen, by a vote of 5-0-0, a public hearing to collect sewer service charges on taxroll was set for July 17, 2019.

5. CORRESPONDENCE:

There was none.

6. MEETINGS:

There were none.

7. REPORTS:

There were none.

8. UNFINISHED BUSINESS:

There was none.

9. NEW BUSINESS:

A. The Board discussed California Special Districts Association membership. Staff was instructed to clarify membership dues and length of membership and bring back to the next regular meeting.

B. The Board discussed Prospect Pump Station construction. On motion by Director Gatto, seconded by Director Bosworth, by a vote of 5-0-0, the Board authorized staff to purchase pumps and electrical components. On motion by Director Gatto, seconded by Director Saadati, by a vote of 5-0-0, the Board authorized advertising the project to receive bids once the plans and specs are complete.

10. STAFF REPORTS:

A. District Manager Porter reported on potential annexation of Mountain Winery.

11. CLOSED SESSION:

President Kwok adjourned the regular meeting session and opened the closed session at 8:15 p.m. in accordance with government code section Paragraph (1) of Subdivision (d) of Section 54956.9, existing litigation. Name of Case: County Sanitation District 2-3, West Valley Sanitation District, Cupertino Sanitary District, Burbank Sanitary District, and the City of Milpitas v. The City of San Jose, The City of Santa Clara, and Does 1 through 50 inclusive.

President Kwok adjourned the closed session and the regular meeting was called to order at 8:26 p.m.

There was no reportable action.

12. ADJOURNMENT:

President Kwok is excused from the regular meeting scheduled to be held on Wednesday, August 7, 2019.

On a motion properly made and seconded, at 8:30 p.m. the meeting was adjourned.

_____ _____

Secretary of the Sanitary Board President of the Sanitary Board

RESOLUTION NO. 1315

A RESOLUTION OF THE BOARD OF DIRECTORS OF THE CUPERTINO SANITARY DISTRICT A RESOLUTION APPROVING A DEBT MANAGEMENT POLICY FOR THE DISTRICT

RESOLVED, by the Sanitary Board of the Cupertino Sanitary District, Santa Clara County, California, that

WHEREAS, pursuant to Senate Bill 1029 ("SB 1029"), which was signed by the California Governor on September 12, 2016, California public agencies that issue debt must adopt debt management policies that meet certain criteria; and

WHEREAS, in response to SB 1029 and in order to adhere to sound financial management practices, the Cupertino Sanitary District wishes to adopt and maintain a debt management policy; and

WHEREAS, there has been presented to this meeting a proposed form of debt management policy, which is on file with this Board (the "Policy");

NOW, THEREFORE, IT IS ORDERED as follows:

1. **Approval of Policy**. This Board hereby approves and adopts the Policy as the debt management policy for the Cupertino Sanitary District.

2. **Effective Date**. This resolution shall take effect immediately upon its passage and adoption.

* * *

I hereby certify that the foregoing is a full, true and correct copy of a resolution which was duly and regularly passed and adopted by the Sanitary Board of the Cupertino Sanitary District, at a meeting thereof held on the 7th day of August 2019, by the following vote:

AYES:

NOES:

ABSTAIN:

ABSENT:

_____
Secretary, Cupertino Sanitary District

APPROVED:

_____
President, Cupertino Sanitary District

RESOLUTION NO. 1316

A RESOLUTION OF THE BOARD OF DIRECTORS OF THE CUPERTINO SANITARY DISTRICT AUTHORIZING THE EXECUTION AND DELIVERY OF A LOAN AGREEMENT BY AND BETWEEN THE DISTRICT AND ZIONS BANCORPORATION, N.A. TO FINANCE THE DISTRICT'S SHARE OF THE COSTS OF IMPROVEMENTS TO THE SAN JOSÉ-SANTA CLARA REGIONAL WASTEWATER FACILITY AND APPROVING RELATED DOCUMENTS AND ACTIONS

RESOLVED, by the Sanitary Board of the Cupertino Sanitary District, Santa Clara County, California, that

WHEREAS, the Cupertino Sanitary District (the "District") owns and operates certain facilities and property for the collection, transportation and disposal of wastewater (the "Enterprise"); and

WHEREAS, the District is a tributary agency of the San José-Santa Clara Regional Wastewater Facility (the "Plant"), and, as such, the District is served by the Plant; and

WHEREAS, the District has determined that it is in the District's best interests at this time to provide financing for the District's share of the costs of the capital improvements being undertaken for the Plant as well as other capital improvements to the Enterprise undertaken by the District (collectively, the "Project"), and in order to provide funds for that purpose the District has further determined to borrow an amount of up to $10,000,000 (the "Loan") from Zions Bancorporation, N.A., or an affiliate (the "Lender"), under a Loan Agreement between the District and the Lender (the "Loan Agreement"), to be secured by a pledge of and lien on the net revenues of the Enterprise, as set forth in the Loan Agreement; and

WHEREAS, the Loan is payable solely from the net revenues of the Enterprise, and no other funds or revenues of the District are liable for Loan repayment; and

WHEREAS, the District is authorized to borrow amounts from the Lender for the foregoing purposes, under the under the laws of the State of California, including the provisions of Section 6523.1 of the California Health and Safety Code (the "Bond Law"); and

WHEREAS, the information required to be obtained and disclosed with respect to the Loan Agreement by the Sanitary Board in accordance with Government Code Section 5852.1 is set forth on Exhibit A hereto; and

WHEREAS, the Sanitary Board approves said transaction in furtherance of the public purposes of the District, and the Sanitary Board wishes at this time to authorize all proceedings relating to the borrowing of funds from the Lender in order to finance the Project;

NOW, THEREFORE, IT IS ORDERED as follows:

1. Approval of Loan; Execution and Delivery of Loan Agreement. In order to provide financing for the Project, this Board hereby approves the borrowing of funds from the Lender in the maximum principal amount of $10,000,000 under the Loan Agreement in substantially the form on file with the Secretary of the Board, together with any changes therein or additions thereto deemed advisable by the President of the Board or the District Manager, whose execution shall be conclusive evidence of the approval of any such changes or additions. The interest on the Loan Agreement may be payable on a federally tax-exempt

basis, a federally taxable basis or a combination thereof, as determined by the District, in consultation with Jones Hall, A Professional Law Corporation, as special counsel to the District, to be required to meet federal tax law requirements, so long as the interest rate on the Loan Agreement does not exceed 5.00%. Subject to the foregoing, the Sanitary Board hereby authorizes and directs the President or the District Manager to execute, and the Secretary to attest, the final form of the Loan Agreement for and in the name of the District.

2. Engagement of Professional Services. The Sanitary Board hereby approves the engagement of Jones Hall, A Professional Law Corporation, as bond counsel in connection with the execution and delivery of the Loan Agreement under the terms of the Agreement for Legal Services on file with the Secretary of the Board. The Sanitary Board hereby authorizes and directs the District Manager of the Board to execute such agreement for and in the name of the District, and ratifies the prior execution by the District Manager of such Agreement for Legal Services

3. Official Actions. The President, the District Manager, the Secretary and all other officers of the District are each authorized and directed in the name and on behalf of the District to make any and all assignments, certificates, requisitions, agreements, notices, consents, instruments of conveyance, warrants and other documents, which they or any of them might deem necessary or appropriate in order to consummate any of the transactions contemplated by the agreements and documents approved under this Resolution. Whenever in this resolution any officer of the District is authorized to execute or countersign any document or take any action, such execution, countersigning or action may be taken on behalf of such officer by any person designated by such officer.

4. Effective Date. This Resolution shall take effect from and after the date of its passage and adoption.

* * *

I hereby certify that the foregoing is a full, true and correct copy of a resolution which was duly and regularly passed and adopted by the Sanitary Board of the Cupertino Sanitary District, at a meeting thereof held on the 7th day of August 2019, by the following vote:

AYES:

NOES:

ABSTAIN:

ABSENT:

_____
Secretary, Cupertino Sanitary District

APPROVED:

_____
President, Cupertino Sanitary District

EXHIBIT A
GOOD-FAITH ESTIMATES

In accordance with Government Code Section 5852.1, the following information has been obtained and disclosed to the Sanitary Board in connection with the approval of the Loan Agreement:

(i) the estimated true interest cost of the Loan Agreement (being the rate necessary to discount the amounts payable on the respective principal and interest payment dates to the purchase price received for the Loan Agreement) is 2.50%,

(ii) the estimated finance charge of the Loan Agreement (being the sum of all fees and charges paid to third parties) is $30,000.00,

(iii) the estimated proceeds of the Loan Agreement expected to be received, net of proceeds for finance charges in (ii) above to paid from the principal amount of the Loan Agreement and any reserves or capitalized interest paid or funded with Loan Agreement is $9,970,000.00, and

(iv) the estimated total payment amount of the Loan Agreement (being the sum total of all payments the District will make to pay amounts under the Loan Agreement, plus any financing costs not paid from proceeds of the Loan Agreement) to the final maturity thereof is $11,436,062.50.

Cupertino Sanitary District

Memo

Item 8A

To: **Board of Directors**

From: **Benjamin Porter, District Manager-Engineer**

Date: **August 7, 2019**

Re: **COUNTY TAX ROLL**

Background:

At the July 17, 2019 Board Meeting, the Board adopted Resolution No. 1312, Confirming Report on Rates and Charges for FY 2019-2020 and Resolution No. 1313, Collection of Rates and Charges for FY 2019-2020. The Tax Roll Report was submitted to the Santa Clara County as was accepted.

Analysis:

A summary of the tax roll and hand-billing charges are provided in the table below.

Net Revenue to CuSD	2019-2020 Service Charge Revenue
From Tax Roll	$17,464,028.60
Hand-billing	$438,006.30
Total	**$17,902,034.90**

Recommendation:

No action by the Board is necessary. These changes will be reflected in the updated revenue budget.

Attached:

1) CuSD Revenue Report for FY 2019-2020.

CUPERTINO SANITARY DISTRICT REVENUE FOR FY 2019-2020

Date: 8/1/2019

Type	FY 2019-2020	Delta (FY 2019-2020 - FY 2018-19)	Percent Differences (FY 2018-19 and FY 2017-18)	FY 2018-2019	Percent Differences (FY 2018-19 and FY 2017-18)	FY 2017-2018	Percent Differences (2017-18 and 2016-17)	FY 2016-2017	Percent Differences (FY2015-16 and 2016-17)	FY 2015-2016
Residential	**$12,383,379.90**	**$1,339,294.18**	**12.13%**	$11,044,085.72	8.04%	$10,222,164.18	8.10%	$9,456,519.94	8.77%	$8,691,409.19
Retail/Office	**$2,004,667.30**	**$272,198.49**	**15.71%**	$1,732,468.81	36.14%	$1,272,598.72	15.72%	$1,099,748.14	-5.20%	$1,178,954.06
Laundry	**$12,510.90**	**$4,238.94**	**51.24%**	$8,271.96	-5.68%	$8,769.71	12.68%	$7,782.79	15.06%	$6,080.73
Restaurants	**$2,454,862.80**	**$270,685.70**	**12.39%**	$2,184,177.10	9.20%	$2,000,098.41	26.28%	$1,583,883.91	3.06%	$1,286,963.68
Gas Stations/Repair	**$31,255.00**	**$6,575.84**	**26.65%**	$24,679.16	-10.66%	$27,624.51	9.02%	$25,338.84	8.76%	$29,784.52
Hotel	**$277,988.90**	**$86,786.31**	**45.39%**	$191,202.59	22.24%	$156,419.64	7.25%	$145,839.58	3.42%	$139,860.02
Private School Uses	**$15,232.20**	**$239.61**	**1.60%**	$14,992.59	18.33%	$12,670.59	-1.38%	$12,847.59	-8.23%	$18,710.27
Health Care	**$254,446.40**	**$8,095.60**	**3.29%**	$246,350.80	-4.02%	$256,659.79	3.34%	$248,364.16	12.96%	$230,170.40
Misc	**$29,685.20**	**$16,247.77**	**120.91%**	$13,437.43	-4.23%	$14,030.46	-1.63%	$14,262.82	3.61%	$18,637.80
Hand-Billing	**$438,006.30**	**$24,004.02**	**5.80%**	$414,002.28	19.53%	$390,171.60	-0.47%	$392,000.00	-9.86%	$418,500.54
Total	**$17,902,034.90**	**$2,028,366.45**	**12.74%**	$15,926,032.70	12.04%	$14,361,207.62	10.58%	$12,994,664.16	6.53%	$12,019,071.21

From Taxroll:

Residential	$12,383,379.90
Commercial:	$5,080,648.70
TOTAL	**$17,464,028.60**

Item 9B

pure TECHNOLOGIES
a xylem brand

SmartBall®
Inspection Report

Prospect Road Lift Station 10-Inch Force Main

Homestead Road Lift Station 8-Inch Force Main

Report Prepared for:

Mark Thomas and Co. Inc.

MARK THOMAS

On behalf of:

CUPERTINO SANITARY DISTRICT
ESTABLISHED 1956

By:

Pure Technologies, A Xylem Brand
July 16, 2019

Dallas, TX | 2310 McDaniel Dr | Carrolton, TX 75006 | Tel: +1 (214) 377-5300 | puretechltd.com

pure TECHNOLOGIES
a xylem brand

SmartBall® Inspection Report of the

Prospect Road Lift Station 10-Inch Force Main

Homestead Road Lift Station 8-Inch Force Main

Prepared for

Mark Thomas and Co. Inc.

On behalf of:

Cupertino Sanitary District

Prepared by

Pure Technologies, A Xylem Brand

July 16, 2019

Quality Assurance and Quality Control Statement

By my signature I attest that this report has been prepared and reviewed in accordance with the Pure Technologies, A Xylem Brand. Quality Assurance and Quality Control procedures:

July 16, 2019

Cesar Moran, E.I,T, Project Manager — Date

NOTICE

pure TECHNOLOGIES
a xylem brand

Contents

1. Executive Summary

Cupertino Sanitary District retained the services of Pure Technologies, A Xylem Brand (Pure Technologies) to perform a SmartBall® inspection of the Prospect Road lift station 10-Inch force main and Homestead Road lift station 8-inch force main on June 17 and 18, 2019 respectively. The purpose of the SmartBall inspections was to identify and locate leaks and pockets of trapped air along the pipeline. Acoustic and sensor data was collected and recorded as the SmartBall tool traversed the pipelines. This data was evaluated to identify acoustic events associated with leaks and pockets of trapped gas. Pure Technologies detected zero (0) acoustic events characteristic of leaks and zero (0) acoustic events characteristic of pockets of trapped gas in Prospect Lift Station; zero (0) acoustic events characteristic of leaks and three (3) acoustic events characteristic of migratory air/entrained air in Homestead Lift Station. The results of the inspection are summarized in Tables 1.1 to 1.4.

Table 1.1: SmartBall Inspection Details Prospect Lift Station	
Total Length Inspected:	3,476 ft
Pipe Material:	Cast Iron (CI)
Diameter of Pipe:	10 inches
Product:	Wastewater
Duration of the Inspection:	25 minutes
Average SmartBall Tool Velocity:	2.3 ft/s

Table 1.2: SmartBall Inspection Results Prospect Lift Station	
Total Number of Leaks:	0
Joint Leaks	0
Barrel Leaks	0
Feature-Related Leaks	0
Total Number of Static Air/Trapped Gas Events:	0
Total Number of Gas Slugs:	0
Total Number of Migratory Air/Entrained Air Events:	0

Table 1.3: SmartBall Inspection Details Homestead Lift Station	
Total Length Inspected:	556 ft
Pipe Material:	Cast Iron (CI)
Diameter of Pipe:	8 inches
Product:	Wastewater

Table 1.3: SmartBall Inspection Details Homestead Lift Station	
Duration of the Inspection:	3 minutes
Average SmartBall Tool Velocity:	3.0 ft/s
Table 1.4: SmartBall Inspection Results Homestead Lift Station	
Total Number of Leaks:	0
Joint Leaks	0
Barrel Leaks	0
Feature-Related Leaks	0
Total Number of Static Air/Trapped Gas Events:	0
Total Number of Gas Slugs:	0
Total Number of Migratory Air/Entrained Air Events:	3

2. Project Background

Cupertino Sanitary District (CuSD) and Mark Thomas and Co. Inc retained the services of Pure Technologies to perform a SmartBall inspection of the Prospect and Homestead lift stations 10 and 8-inch force mains on June 17 and 18, 2019, respectively. Cupertino Sanitary District engaged in an inspection to determine if the force mains exhibit any leaks or air pockets for the first time to assess their condition in light of future modifications to Prospect Road and Homestead Road lift stations.

2.1 Description of the Subject Pipelines

Cupertino Sanitary District (CuSD) operates and manages seventeen (17) lift station that provide sewer service to over 23,000 customers within the communities of Cupertino, portions of Saratoga, Sunnyvale, Los Altos and unincorporated areas within Santa Clara County. Prospect Road and Homestead Road cast iron (CI) force mains are comprised of approximately 3,476 and 556 feet respectively and were constructed between 1968 and 1970.

The approximate pipeline locations are shown in Figures 2.1 and 2.2.

Figure 2.1: General Layout of Prospect Lift Station Force Main.

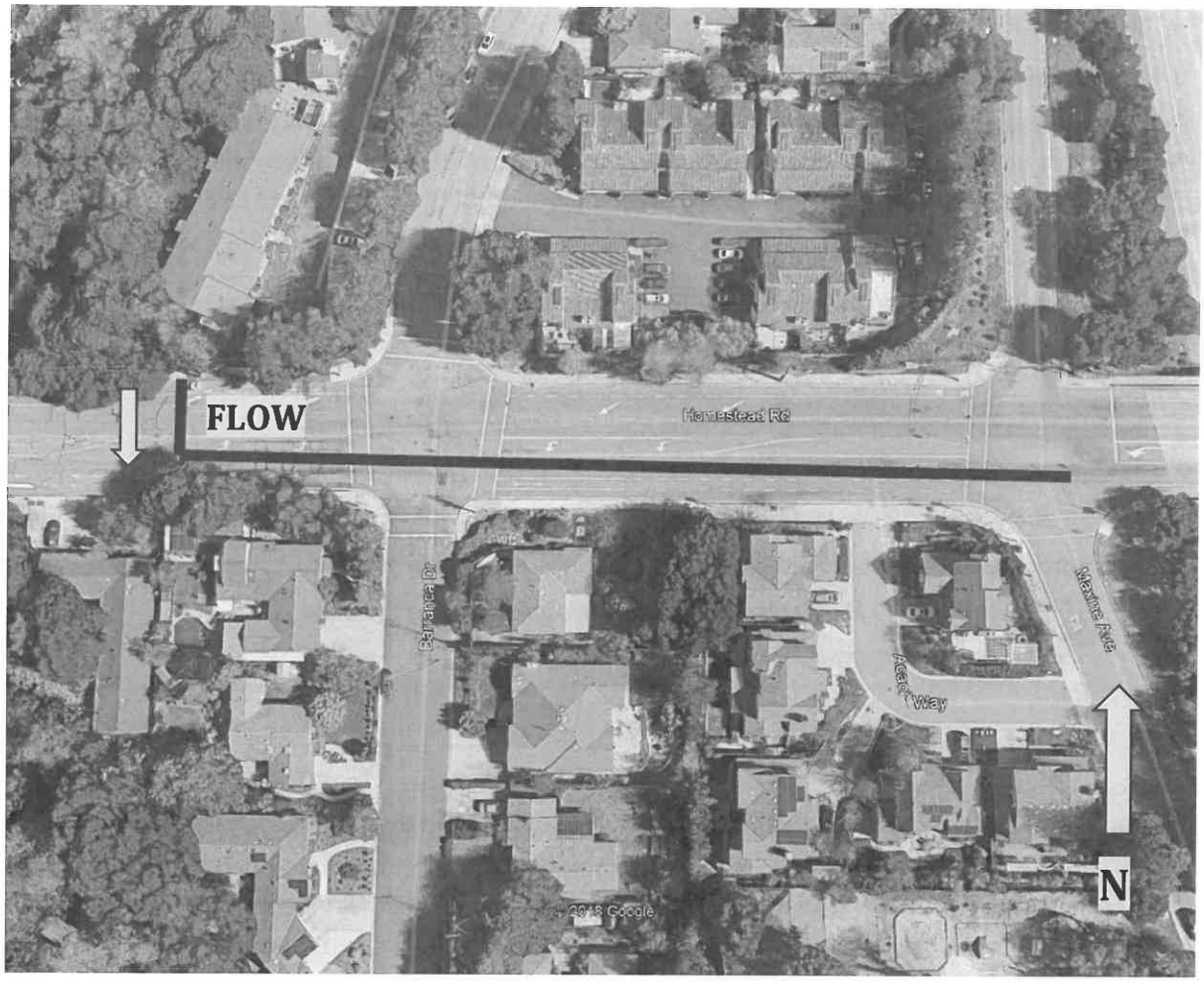


Figure 2.2: General Layout of Homestead Lift Station Force Main.

3. SmartBall Inspection Details

3.1 Planning Document & Drawing Review

Prior to the execution of the project, Pure Technologies reviewed the site and all available pipeline drawings for suitability. Following this review, a planning document that described the upcoming SmartBall inspection was generated. This planning document was submitted to the CuSD on May 14, 2019.

The drawings received and reviewed by Pure Technologies included:

- Prospect Road Lift Station Plan and Profile Sections
  - *1968-20.Prospect Rd Force Main – 10 inch reduce S1-S2*
  - *1968-20.Prospect Rd Force Main – 10 inch reduce S3-S4*
  - *1968-20.Prospect Rd Force Main – 10 inch reduce S5*
- Homestead Road Lift Station Plan and Profile Sections
  - *1970.HUD Homestead.Florence.Prospect Pump Stations*
  - *1957-6.LID2.Homestead Rd_Barranca Dr*

3.2 SmartBall Tool Insertion

The SmartBall tool was inserted into the pipeline through existing 5-inch by 8-inch and 6-inch by 8-inch check valves located at Prospect and Homestead Lift Stations respectively (Figures 3.1 and 3.2). The pipelines were isolated by CuSD and then the check valve flange was removed. The SmartBall tool was inserted by hand and the check valve flange was re-installed. The SmartBall tool was then launched from the check valve when the pumps were initiated.

Figure 3.1: Insertion Check valve at Prospect Lift Station

Figure 3.2: Insertion Check valve at Homestead Lift Station

3.3 SmartBall Tool Extraction

Once the Screening Ball and SmartBall® tool had traversed the entire length of the pipeline, they were retrieved at gravity sewers for both force mains using the bar screen to avoid the tool entering the gravity system. Figures 3.3 and 3.4 show the bar screen arrangements for both Prospect and Homestead lift stations and fluorescent dye appearing. Fluorescent dye was used to estimate the arrival of the Screening ball to extraction.

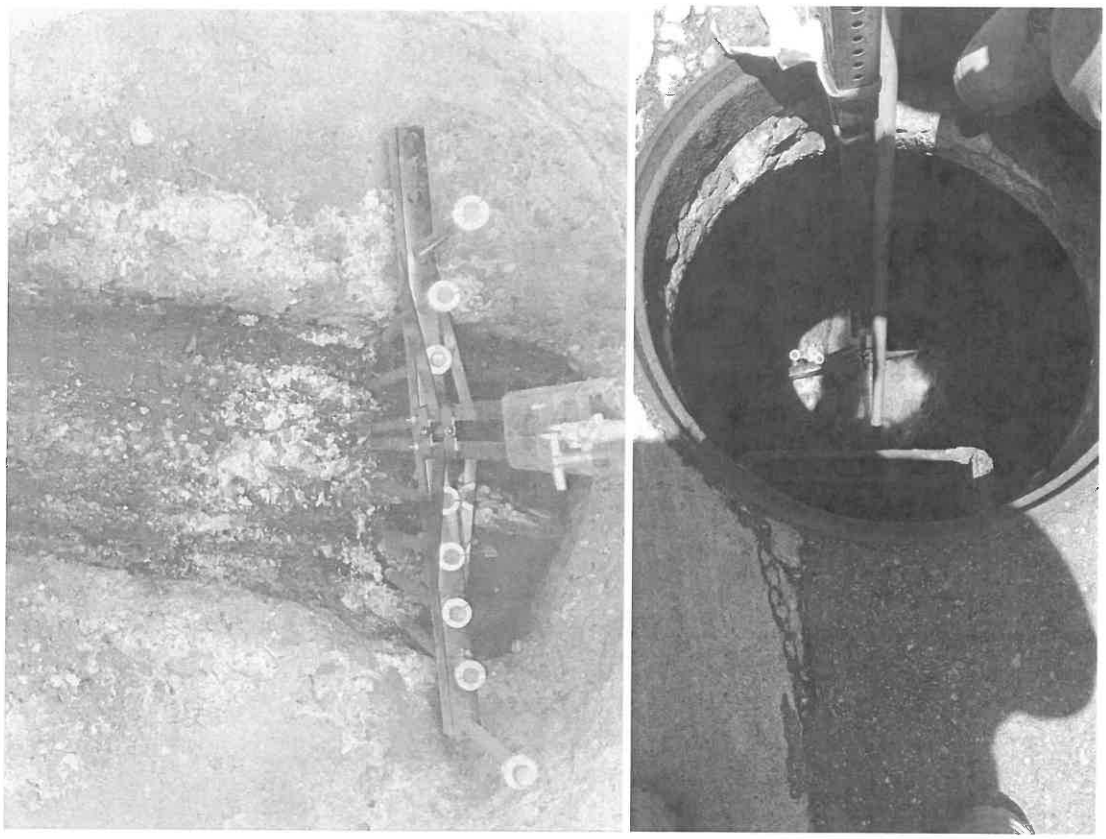


Figure 3.3: Extraction Site at Prospect Lift Station and dye showing at extraction for Screening Ball (Manhole IH-20)

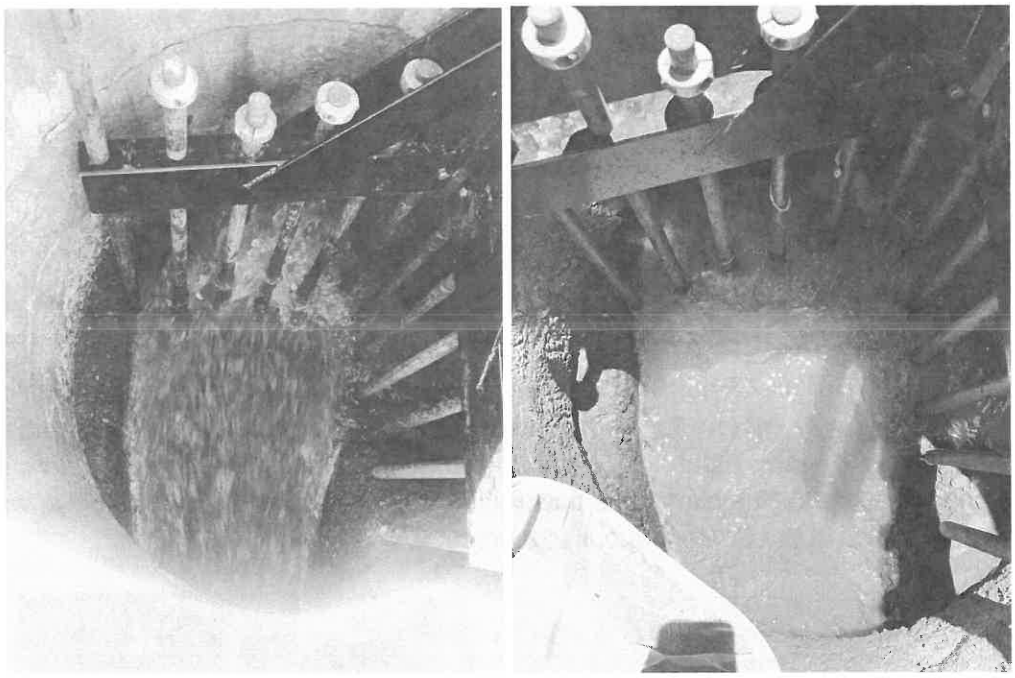


Figure 3.4: Extraction Site at Homestead Lift Station (Manhole L2-211)

4. Summary of Acoustic Events

The data collected by the SmartBall tool was internally peer reviewed to verify that all acoustic events were detected and accurately classified. There were no acoustic events resembling leaks detected during the inspection. This indicated that there were no leaks within the detection limits of the SmartBall technology present in the pipeline under the operating conditions at the time of inspection.

Figures 4.1 and 4.2 show the acoustic profile of the inspection with respect to the position of the tool within the pipeline, as detected by the SmartBall technology. The magnitude of leaks is estimated by correlating the value of the acoustic signal with historical calibration data.

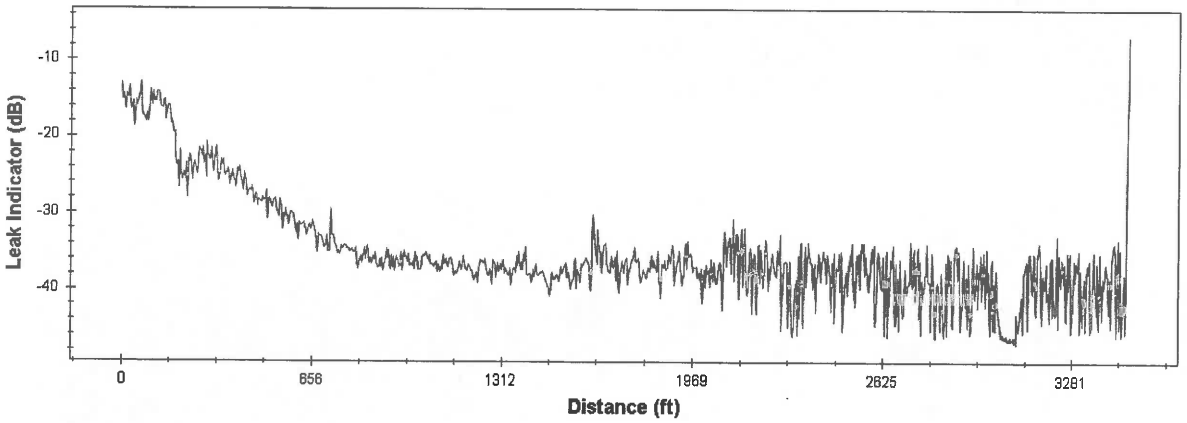


Figure 4.1: Acoustic summary of the SmartBall inspection versus Distance Traveled for the Prospect Lift Station Inspection

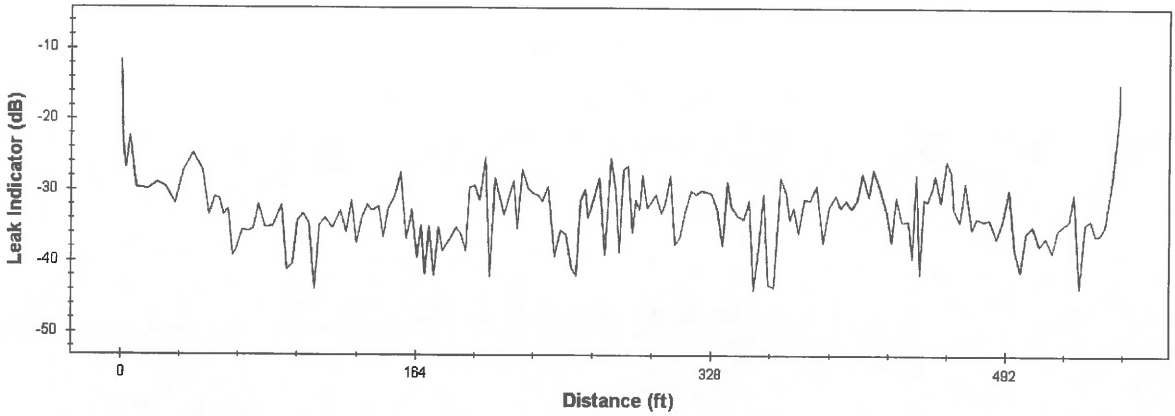


Figure 4.2: Acoustic summary of the SmartBall inspection versus Distance Traveled for the Homestead lift Station Inspection

No acoustic events of interest were found at 10-inch Prospect lift station force while three (3) acoustic events of interest were found at the 8-inch Homestead lift station force main. Details on Homestead lift station force main acoustic events detected during the SmartBall inspection are provided below:

Site of Interest #1 - Entrained Air	
Distance to Nearest feature (Start of Pocket):	40 feet after the check valve (Insertion)
Time Since Insertion (Start of Pocket):	00:00:09
Time Since Insertion (End of Pocket):	00:00:12
Time of SmartBall Tool Pass (GMT-8:00) (Start of Pocket)	11:44:59 AM
Time of SmartBall Tool Pass (GMT-8:00) (End of Pocket):	11:45:03 AM

[1] *Used by Pure Technologies to determine approximate leak size*

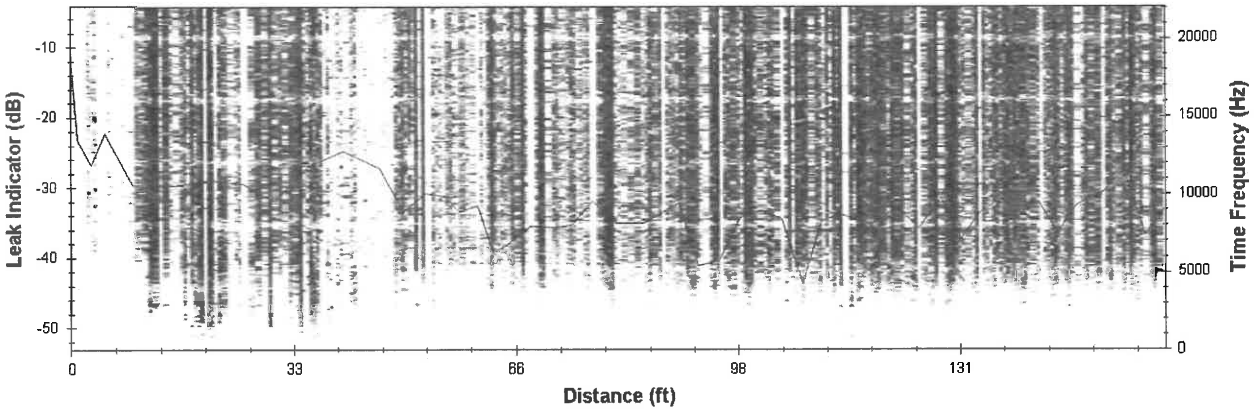


Figure 4.3: Acoustic Intensity of Event

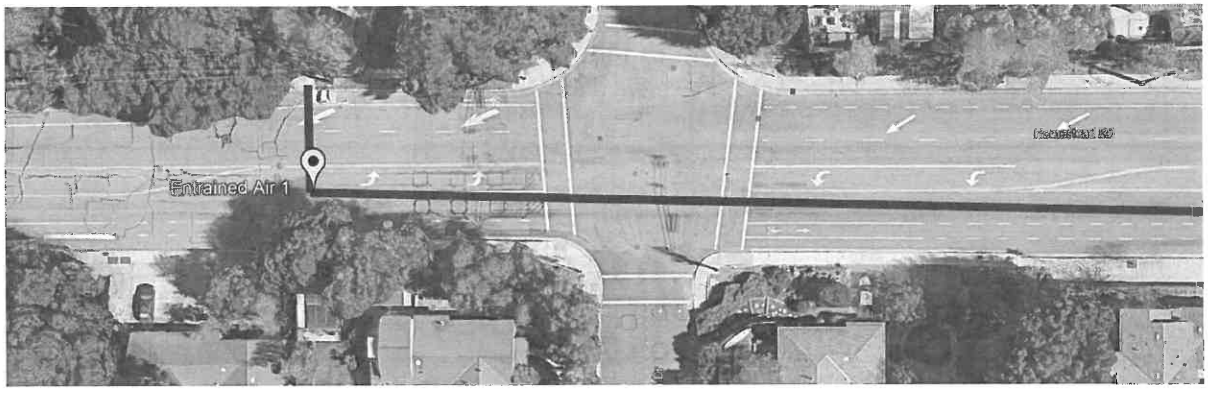


Figure 4.4: Approximate Location of Acoustic Event

Site of Interest #2 - Entrained Air	
Distance to Nearest Feature (Start of Pocket):	258 feet after the check valve (Insertion)
Time Since Insertion (Start of Pocket):	00:01:23
Time Since Insertion (End of Pocket):	00:01:37
Time of SmartBall Tool Pass (GMT-8:00) (Start of Pocket)	11:46:13 AM
Time of SmartBall Tool Pass (GMT-8:00) (End of Pocket):	11:46:27 AM

[1] *Used by Pure Technologies to determine approximate leak size*

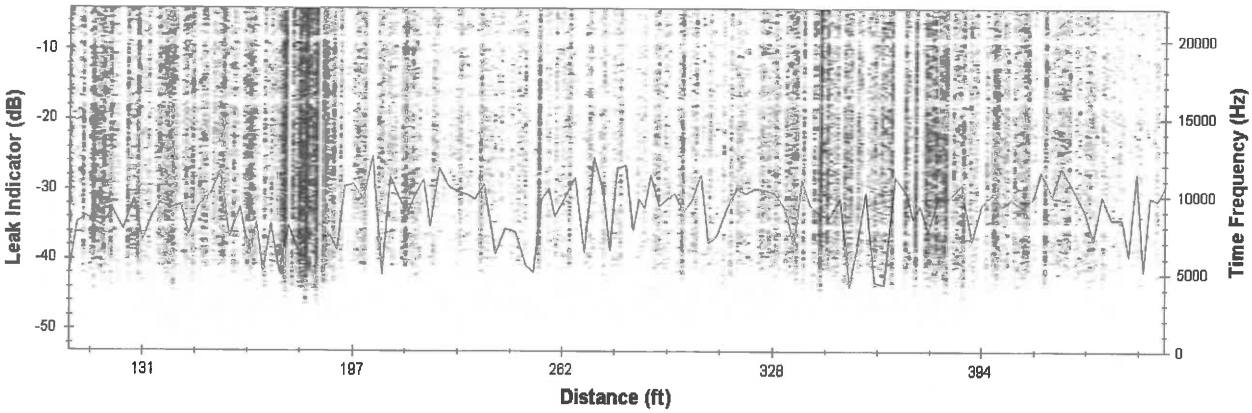


Figure 4.5: Acoustic Intensity of Event

Figure 4.6: Approximate Location of Acoustic Event

Site of Interest #3 - Entrained Air	
Distance to Nearest Feature (Start of Pocket):	144 feet before the discharge chamber (Extraction)
Time Since Insertion (Start of Pocket):	00:02:18
Time Since Insertion (End of Pocket):	00:02:18
Time of SmartBall Tool Pass (GMT-8:00) (Start of Pocket)	11:47:08 AM
Time of SmartBall Tool Pass (GMT-8:00) (End of Pocket):	11:47:09 AM

[1] *Used by Pure Technologies to determine approximate leak size*

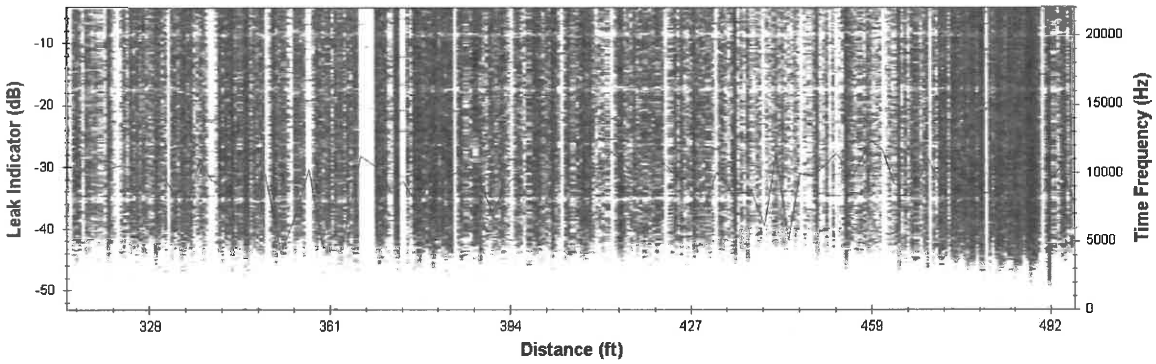


Figure 4.7: Acoustic Intensity of Event

Figure 4.8: Approximate Location of Acoustic Event

It is important to note that this overview may contain anomalous spikes in the data. These spikes may have been caused by ambient noise around the pipeline from external sources such as pumps or nearby traffic. These sources of ambient noise are easily distinguishable from leaks or

other points of interest upon analysis by trained personnel. Ambient noise generally occurs at a much lower frequency than the frequencies generated by a leak or pockets of trapped gas.

5. Conclusions and Recommendations

- There were no leaks detected in any of the inspections, so no immediate action is needed to repair the inspected force mains.

- Entrained air was found in the Homestead 8-inch force main. Possible points of air being introduced into the system include the pumping station because of air becoming entrained in the sewage as it plunges into the wet well or by inefficiencies within the pump station or biochemical processes inherent to sewage mains.
- Pure Technologies recommends Cupertino Sanitary District and Mark Thomas and Co. Inc to investigate the source of the entrained air and correct it since this entrained air can convert into:
    - A fully developed gas pocket that may deteriorate the interior of the pipe.
    - The headspace created by the gas pocket may favor the accumulation of hydrogen sulfide (H_2S) that could lead to corrosion.

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APPENDIX A
Screening Ball Methodology

A.1 Screening Ball

In order to ensure that the SmartBall can traverse the high-risk configurations to be inspected, Pure will run Screening Balls. The Screening Ball is a 3D printed SmartBall replica constructed with food grade materials that will dissolve over time in case the Screening Ball cannot traverse the pipeline. Though the Screening Ball is a replica of the SmartBall, it does not include any data collection or electronic components.

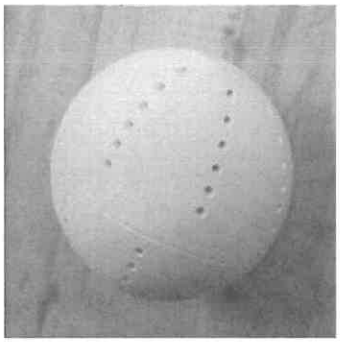
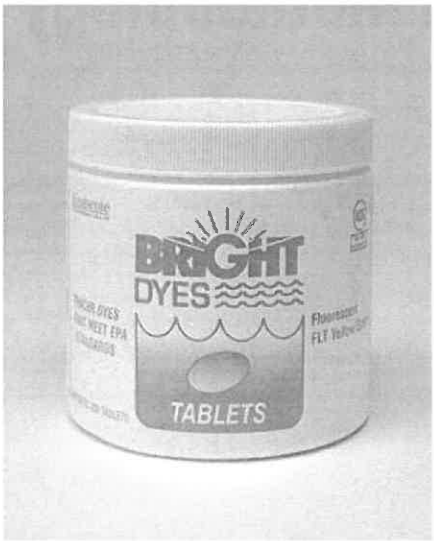


Figure A.1. Typical ScreeningBall

When either the Screening Ball or SmartBall are inserted into the pipeline, a fluorescent dye will be added in order to confirm that Screening Ball is at the extraction locations and the estimated arrival time. The dye to be used is an inert substance, thus harmless to the system and its components.



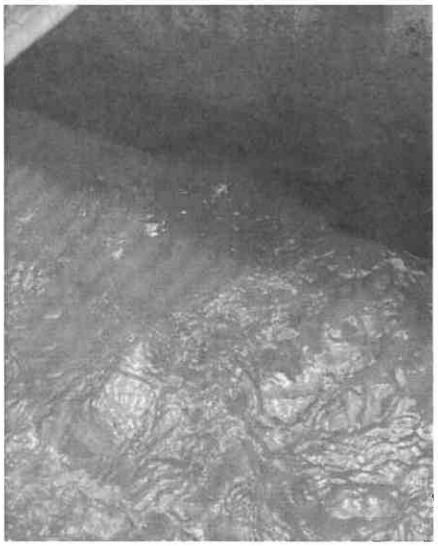


Figure A.2. Fluorescent Dye Tablets, Example of Dye in Use

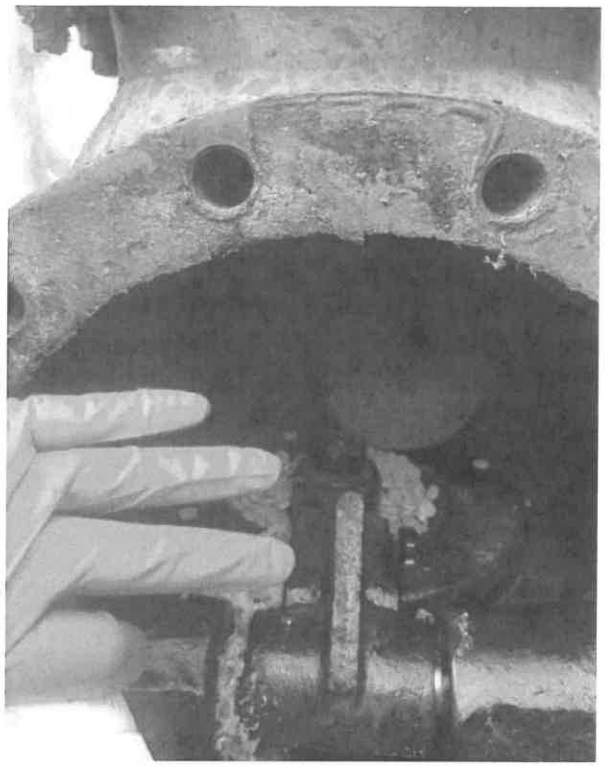


Figure A.3. ScreeningBall and Dye Tablets in Check Valve

A.1.1ScreeningBall Process

The process to be followed for Screening Ball runs and changes to be made if not recovered can be found below. These instructions may change depending on the conditions present on site. Once the Screening Ball is retrieved successfully, the SmartBall can be deployed as long as operating conditions are repeatable.

1. As a preemptive measure to decrease the risk of the Screening Ball getting stuck, the force main should be flushed in order to clear out any possible obstructions/debris prior to inserting the Screening Ball. How many times this is done prior to the first Screening Ball inspection will be determined by the subject pump station's cycle times and conditions on site.

2. Run Screening Ball and dye at standard operating conditions.

    a. If we find that the pumps are not lining up with the estimated times of arrival with the dye testing, it will be important to step back and have a discussion with the client on moving forward.

3. If the Screening Ball is not recovered successfully at the Pierce, Homestead and Prospect Pump Stations, the wet wells will be surcharged before each pump cycle during the second Screening Ball run.

4. If second Screening Ball run is unsuccessful, Cupertino Sanitary District will supplement flow for the duration of the third test with a surcharge of the wet well before each pump cycle.

5. If the third Screening Ball run is unsuccessful, the inspection will not proceed pending other possible configuration changes which must include a successful Screening Ball run.

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APPENDIX B
SmartBall Methodology

Pure Technologies' SmartBall leak and gas pocket detection system is a free-swimming, acoustic-based technology that detects acoustic activity associated with leaks or pockets of trapped gas in pressurized pipelines. The SmartBall assembly comprises a water-tight aluminum alloy core containing a power source, electronic components, and instrumentation that includes an acoustic sensor, tri-axial accelerometer, tri-axial magnetometer, GPS synchronized ultrasonic transmitter, and temperature sensor. A protective outer foam shell encapsulates the aluminum core and provides a larger surface area by which the device is pushed by the hydraulic flow of the fluid in the pipeline. The foam shell also reduces the ambient noise from the rolling action, resulting in a silent background. The SmartBall assembly is deployed into the flow of a pipeline, traverses the pipeline, and is captured and extracted at a point downstream. During the inspection, the SmartBall tool's location is tracked at known points along the alignment to correlate the inspection data with specific locations.

Figure B.1: SmartBall Core and Foam Shell a with SmartBall Receiver (SBR)

B.1 Identifying Leaks and Gas Pockets

B.1.1*Acoustic Events Representing Leaks*

A leak inside a pressurized pipeline produces a specific acoustic signal. This acoustic signal is created when the pressurized product inside the pipeline escapes into the lower pressure atmosphere outside the pipe. While the SmartBall tool traverses the pipeline, it continuously records all acoustic data in the pipeline, which is evaluated later to identify acoustic activity that may be associated with leaks along the pipeline. As the SmartBall tool rolls along the bottom of the pipeline, it will always pass within one (1) pipe diameter of a leak or pocket of trapped gas.

As the SmartBall tool approaches a leak, the acoustic signal detected by the SmartBall technology will increase. The acoustic signal will crescendo as the tool approaches the leak, peak at the point at which the SmartBall tool passes the point of the leak, and then diminish as the SmartBall tool continues away from the leak. This phenomenon is clearly evident in Figure C.2.

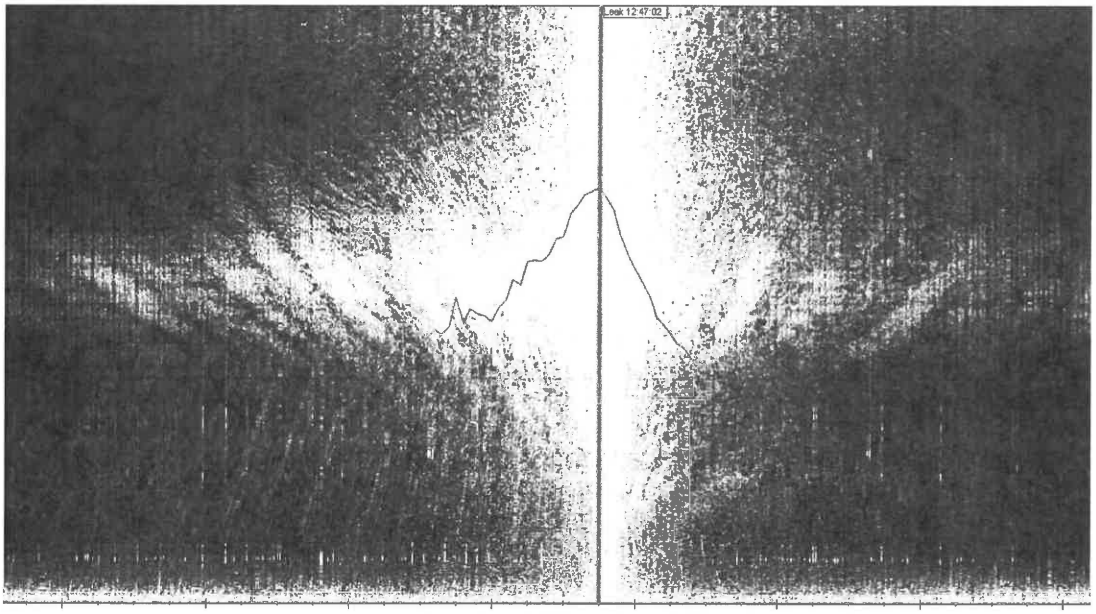

Figure B.2: Detected Leak, as shown in the SmartBall Analysis Software

In addition to detecting potential leaks and pockets of trapped gas, acoustic events are further evaluated to estimate the approximate magnitude of the leak. Pure Technologies reports leaks as being small, medium, or large. Small leaks are estimated to be in the range of 0 - 2 gallons per minute (GPM). Medium leaks are estimated to be in the range of 2 - 10 GPM and large leaks are estimated to be greater than 10 GPM.

Pure Technologies has invested heavily into identifying the characteristics of an acoustic event that is representative of a leak. The characteristics typical of a true leak as detected by the SmartBall technology include:

- The range of frequencies present increases as the tool approaches the leak
- The frequencies that appear first, grow in intensity as the SmartBall tool approaches the leak
- The frequencies that appear to indicate a leak are consistent as the SmartBall tool approaches the leak

B.1.2. Acoustic Events Representing Gas Pockets

Pockets of trapped gas inside a pipeline generate a distinct acoustic signal that is detectable using the SmartBall technology. Gas pockets in pressure pipes are typically detected at high points in the pipeline and are often the result of malfunctioning air release valves (ARVs) or a lack of ARVs. The acoustic signal is created by the liquid turbulence at the air/water interface. In full, pressurized pipes, this turbulence is not present.

Pockets of trapped gas inside a pipeline have distinct acoustic signatures that are readily identified by the SmartBall analysis software and trained technicians. Pure Technologies classifies trapped air inside a pipeline into three (3) categories:

1. Entrained Air: This classification of trapped gas is characterized by small, moving bubbles of gas within the pipeline. Entrained air is not typically static in a pipeline and frequently migrates with the flow. These moving pockets of gas can are generated in three (3) ways. They can be introduced at the pumping station because of air becoming entrained in the sewage as it plunges into the wet well or by inefficiencies within the pump station. They can be created at the tail of a hydraulic jump at the end of a fully developed gas pocket where small pockets of gas diffuse into the liquid phase and are carried downstream with the flow. Finally, entrained air may be created by the biochemical processes inherent to sewage mains.

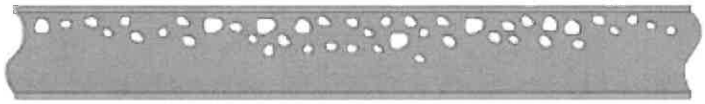

Figure B.3: Entrained Air (Pothof, 2011)

2. Slug or Developing Gas Pockets: This classification can be characterized as small pockets of trapped gas that often develop because of an amalgamation of entrained air. Gas slugs can also be introduced via ARVs. Slugs can be either static or migratory. If they are detected at a localized high point, they are likely static; if not, they are likely migrating towards a high point.

Figure B.4: Gas Slugs (Pothof, 2011)

3. Fully Developed Gas Pockets: Fully developed gas pockets are usually located at localized high points along a pipeline. These develop because of slugs that have accumulated at a high point to the magnitude that they extend into the downward slope of the pipe. A fully developed gas pocket typically has a hydraulic jump prior to the re-submergence of the pipe, creating an area of turbulent flow and gas dissolution into the liquid phase. Due to the turbulent nature of the hydraulic jump and frequent wet/dry cycles at these locations from changes in flow condition, these areas are at a higher risk of failure than other portions of the gas pocket.

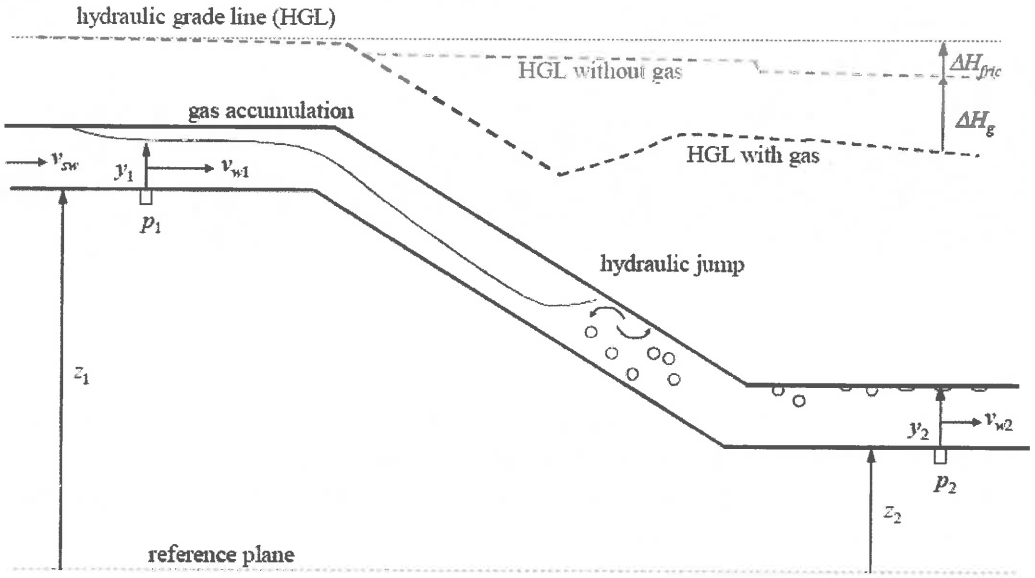

Figure B.5: Diagram of a Fully Developed Gas Pocket (Pothof, 2011)

An example of the acoustic signature generated by a pocket of trapped gas is shown in Figure C.6.

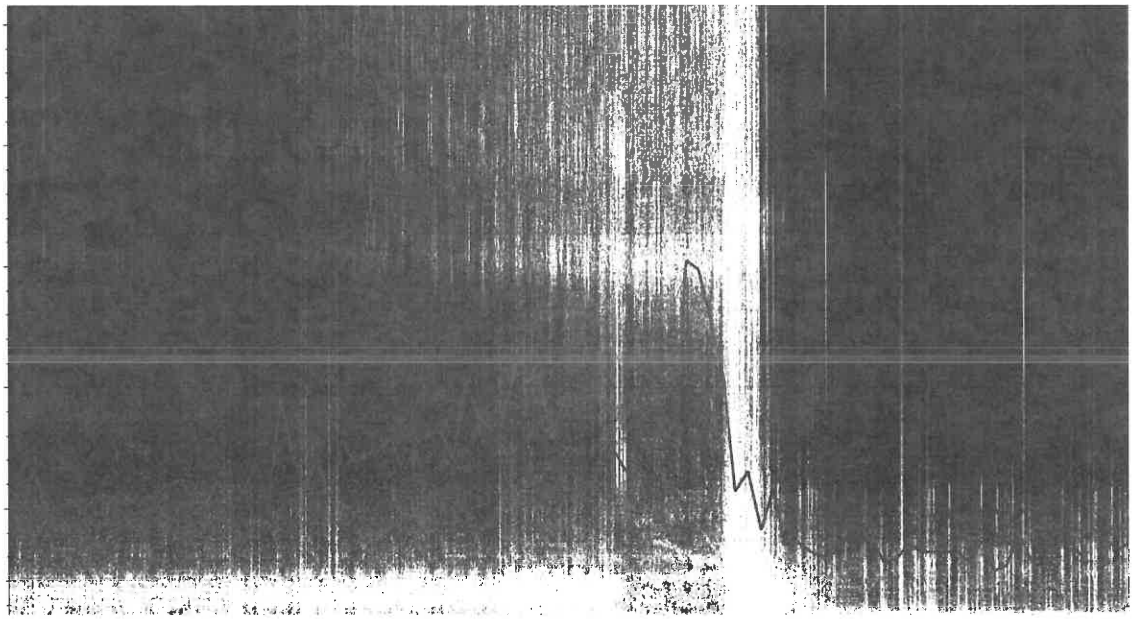

Figure B.6: Detected Gas Pocket, as shown in the SmartBall Analysis Software

Event Locating

*****Important*** - Verifications should take place with the pipeline in question being operated under the same conditions that were present during the inspection, the key factor being pressure. If the pressure is lower than it was during the inspection some leaks can be smaller or non-existent.**

Leak locating should be approached in phases. Below you will find a procedure broken down into 5 Steps which eventually lead to excavating the located leak. **While the excavation of the leak is the end goal, the pipe locating, and above ground measurement steps can be tackled early on in the process before mobilizing and scheduling hydrovacing trucks or excavators.** In addition, taking measurements early on in the process, allows both the client and Pure Technologies to assess any discrepancies noted in the field before using up costly time with machinery onsite.

Before heading out to verify a leak one should review and be familiar with the following details:

- Review the *SmartBall Verification Document* which accompanies the *SmartBall Inspection Report*.
    - o Review the size of leak(s) being targeted, a smaller leak will generate a different signal than a large leak when listened to through a ground mic.
    - o Review distance to nearest feature. Both upstream and downstream.
    - o Review if any other features were used for analysis.

- Orient yourself with the suspected location of the leak.

- The *SmartBall Verification Document* provided includes an overhead map image which shows the general location of the leak. While this image is only provided for reference and should not be used for excavation, it can be used to plan things like access to location, equipment needed, etc.

• Contact your Pure Technologies representative to notify them of your intentions to locate the leak. **We're here to help.**

Leak locating can be broken down into 5 simple steps, with the final step being the full excavation and repair of the pipeline.

1. Locate Pipeline
2. Determine above ground location of leak
3. Expose top of pipe using hydrovac truck
4. Adjust location if needed based on hydrovacing result
5. Excavate fully and repair as needed

If the repairs are completed internally and no excavation is proposed, the same procedure applies, but with the verifications and measurements being completed inside of the pipe. To ensure accurate verifications take place, a line locate should be performed on the pipeline that was inspected. This will ensure that the measurements taken in the field are along the proper alignment, while also removing any error caused by inaccurate pipeline location information. Depending on the material of the pipeline different line locating methods can be used. Note the "Warning on Excavations" sections. Some One Call services will be able to locate your pipeline in addition to other utilities.

Pure Technologies SmartBall Reports will include a leak location referenced by the distance to the closest sensor used while tracking the SmartBall during the inspection. This distance is used as a reference point as it is guaranteed to be from an accessible above ground point. This is important so that a measurement can be taken from this point to the leak location. If available a distance to the closest tracking point on the opposite side of the leak in question can also be included in the Locating notes section of the *SmartBall Verification Document.* While reviewing the inspection data, the SmartBall analysts may use other pipeline indicators or references to refine the location of the leak. These types of references can include inline valves, bends in the pipeline, other known leaks, etc. These are not typically reported as a measurable features as it is not generally known if the points are accessible to take field measurements from. Upon request Pure Technologies can provide additional measurement points that may be closer to the leak in question. This may require additional line locating to be performed but it will also increase the location accuracy of the field measurements to the leak point. A measurement should be taken from the closest reference point along the line to the indicated leak location. The easiest way to do this is to use a measurement wheel along the ground surface.

If available a measurement should also be taken from the opposite side of the leak to the next closest reference point.

The simplified guidelines for this step are:

a. Take measurement 1 – Closest reference point to leak locatio
b. If applicable take measurement 2 – next closest reference point on opposite side of leak to leak location
c. Compare measurements
d. Ground microphone identified location

NOTE - Typically a measurement will be provided from the nearest upstream and downstream reference point in relation to the leak in question. This is done so that measurements can be taken from both directions to increase confidence in the pipeline data provided by the client and obtained through GPS collection. There may be times when measuring from both the upstream and downstream appurtenances is not reasonable or feasible due to geography, obstructions or distance. In these circumstances the measurement from the closest most reasonable point should be used. NOTE - If the resulting locations of the measurements are not within +/- 5 meters or +/- 15 feet of each other, and using a ground microphone does not clarify the situations then stop and contact your Pure Technologies representative

B.1.3. SmartBall Tool Tracking

The SBR is a device that is used to track the position of the SmartBall tool as it traverses the pipeline. The SBR comprises a GPS receiver, and a processing computer. Both the SmartBall tool and the SBR are synchronized to standard GPS time.

Surface mounted sensors (SMS) are mounted to the pipeline at planned locations and are connected to an SBR via coaxial cable. The SBR and SMS combination detects ultrasonic pulses emitted from the SmartBall tool. The SBR determines the time taken for the pulse to travel from the SmartBall tool to the SBR and calculates the location of the SmartBall tool at any given time. Figure C.7 shows an SMS, which is typically mounted to the pipeline itself or pipeline appurtenance.

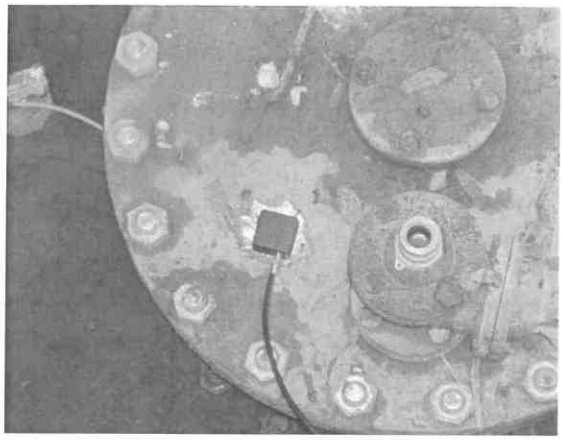

Figure B.7: SMS Adhered to a Flange

This locational data is paralleled with the data extracted from the SmartBall tool. This combination is then used to identify the locations of leaks and pockets of trapped gas.

B.1.4. Advantages and Limitations of the SmartBall Technology

The SmartBall technology acquires high quality acoustic data that is evaluated to identify leaks and pockets of trapped gas. While other leak detection techniques such as noise loggers and correlators may identify a single leak or gas pocket between each sensor, they cannot accurately locate the limits of an event nor identify multiple events. The SmartBall tool travels directly past each acoustic event of interest and thus significant advantages are recognized:

- Medium and Large Diameter Pipes: SmartBall technology has successfully inspected and detected leaks on a wide range of medium and large diameter pipelines (12 to 96 inches in diameter) . Many conventional leak detection technologies (e.g., correlators) have limitations that preclude their use on medium and large diameter pipes.
- Pipe Material: The SmartBall tool's leak detection ability is not affected by pipe material. Because the tool passes by the point at which the acoustic event is being created, the pipe wall is not relied on to transmit the acoustic event through the line to a sensor located far away from the actual event of interest. This greatly increases the SmartBall tool's sensitivity and ability to distinguish between separate acoustic events.
- Sensitivity: The sensitivity of all leak detection technologies is a function of several variables and as a result, no resolute thresholds can be established. However, the acoustic sensor inside the SmartBall tool always passes within one (1) pipe diameter of an acoustic event; therefore, it can be used to identify very small leaks due to the proximity of the SmartBall tool to the leak. It should be noted that the SmartBall technology cannot differentiate between a true leak, a simulated leak, and the potential noise of a pressure reducing valve. As such, acoustic events corresponding to features on a main should be investigated further in the field.
- Length of Survey: SmartBall technology has the ability to record acoustic data for over 18 hours. Depending on flow rates, the tool can inspect long pipelines during a single

deployment. The longest single recording within a water pipeline with a single deployment had the SmartBall tool recorded acoustic data for a length of pipeline exceeding 30 miles.

All non-destructive testing technologies have unique capabilities and limitations that affect the accuracy and efficacy of the technology. The SmartBall tool has the following limitations:

- Minimum Pressure: The acoustic activity associated with a leak is derived from the pressure differential across the pipe wall. With little to no pressure differential, the SmartBall tool will not detect leakage as there will be no associated acoustic activity. Pure Technologies recommends a minimum pressure of 15 pounds per square inch (psi) for leak detection inspections; however, under ideal conditions leaks have been detected in pipelines with pressures as low as 5 psi . There is no minimum pressure recommendation for the detection of areas of trapped gas.
- Ambient Noise: The SmartBall technology detects and reports events that have acoustic characteristics similar to leaks on pressurized pipelines. However, other forms of ambient noise may be identified during the data analysis. For medium and large leaks, there is very little that can match these acoustic characteristics; therefore, these events are reported with a high degree of certainty. For small leaks, there may be other forms of ambient noise with similar acoustic signatures, making these signals more difficult to evaluate. Pure Technologies has invested significant resources into characterizing acoustic events and consequently asserts that leaks described in this report are leaks, unless otherwise noted. However, unknown pressure reducing valves, cracked valves in close proximity to the subject pipeline, interconnected pipelines that have not been completely isolated, and leaks in pipelines immediately adjacent to the subject pipeline can contain a similar acoustic signature and could be reported as leaks. Cars, pumps, boat traffic, and other forms of common ambient noise should not be reported as leaks as they generate different acoustic signatures.

  Reported Locations: The event locations in this report are based on project experience and the limitations of the technologies used to calculate location. There are also several other factors that could decrease the accuracy of locating leaks and gas pockets. Accuracy rankings for each event are included in each event overview.

B.1.5. Overview of a SmartBall Inspection

Figure B.8 shows an overview of a typical SmartBall inspection.

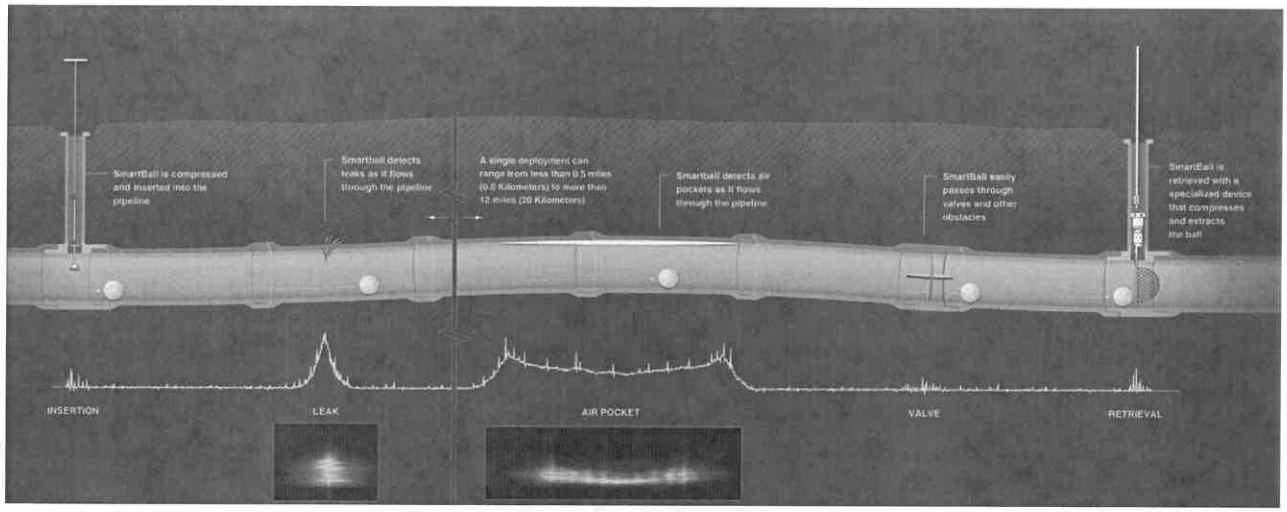

Figure B.8 – Overview of a SmartBall Inspection

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APPENDIX C
How Pipes Leak

Understanding how pipelines leak can be a valuable skill when heading out to locate a leak point on a pipeline. By understanding the cause of leaks, one can limit the amount of excavating required to locate a given leak.

Cast/Ductile Iron Pipe
Cast and Ductile iron pipes mostly consist of bell and spigot type connections. Many leaks found on this type of pipeline will be located at a joint which can be caused by improper gasket installation or soil shift. In addition to joint leaks cast and ductile iron pipes can also leak from cracks and/or through hold penetrations in the pipe barrel. The cause for these defects can be wide ranging. This types of defects will not immediately affect the pipeline itself but should be viewed as more serious than a joint leak as the structural integrity of the given pipe section has already been compromised. Barrel leaks should be addressed as soon as possible and Pure Technologies will generally be able to identify whether a leak is on the joint or barrel of a pipe section for these types of pipe.

Steel Pipe
Steel pipelines are typically welded together to form a long continuous pipe with few gasket joints. Leaks on this type of pipeline can occur at joints or along the barrel both by way of cracking or through hole penetrations.

Plastic and other pipe materials
Typical plastic pipe types include Polyvinyl Chloride (PVC) and High-density polyethylene (HDPE). Some other pipe types may include Glass Reinforced Pipe (GRP) that act and fail in similar ways to plastic pipes.

Generally speaking, leaks on these types of pipes will occur at the joints between two pipe sections. Usually this can be attributed to improper installation of the joint gasket or ground shifting leading to misalignment at the joint. A leak normally won't be located on the barrel of a plastic pipe as a simple crack or through hole penetration would likely cause the line to completely fail vs just leak.

Knowing that more leaks occur at joints you can focus your efforts on joints of the line vs digging linearly upstream or downstream when trying to locate a leak.

Concrete/Prestressed Pipe
Concrete Pressure pipe is always constructed from bell and spigot type pipe sections. Like other bell and spigot style pipe, these pipe types will generally leak from faulty or misaligned joints. Though it should be noted that other forms of failure like cracking or through hole penetration have also been seen to be the cause of leaks, though it is less likely.

On some classes of concrete pressure pipe Pure Technologies will be able to identify if a leak is on the joint or the barrel of a pipe section. This knowledge can help when locating leaks. Knowing that more leaks occur at joints you can focus your efforts on joints of the line vs digging linearly upstream or downstream when trying to locate a leak. Additionally, if a leak is located in the barrel

of a concrete pressure pipe its verification should be escalated as it is most likely indicating some form of severe structural degradation.