EAST BAY MUNICIPAL UTILITY DISTRICT

September 22, 2020

ADDENDUM 1

TO PROSPECTIVE BIDDERS UNDER REQUEST FOR PROPOSAL 790-20-01, Water Treatment Effluent Meters, Large Customer Meters, Rate Control Stations, and Regulators Improvements Design Project.

Notice is hereby given that RFP 790-20-01 of the East Bay Municipal Utility District has been revised as follows:

1. SECTION II – CALENDAR OF EVENTS

   A. On Page 22, replace the information in Row 3 in its entirety with the following information:

Project Briefing via MS Teams	September 30, 2020 1:30 – 3:00 p.m. Join Microsoft Teams Meeting Learn more about Teams | Meeting options Meeting shall be held on Microsoft Teams, please use the link above to join or email andrew.richardson@ebmud.com for a direct meeting invitation.

2. EXHIBIT E – METERING IMPROVEMENTS PLAN

   A. On page 74, insert PDF attachment "Draft Metering Improvements Plan"

ADDRESS ANY QUESTIONS REGARDING THIS ADDENDUM TO THE PROJECT WEBSITE AT https://www.ebmud.com/business-center/requests-proposal-rfps/wtp-effluent-lcm-rcs-reg/ .

ANDREW E. RICHARDSON
JUNIOR ENGINEER
OPERATIONS AND MAINTENANCE SUPPORT DEPARTMENT

East Bay Municipal District

Metering Improvements Plan

DRAFT | September 22, 2020

M.E. SIMPSON Co., Inc.

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Project Overview

The East Bay Municipal Utility District (EBMUD or District) has identified eight meters at the District's water treatment plants (WTP) and seven large customer meters as being critical to measuring the annual volumetric balance in the District's distribution system. The eight WTP meters represent the volumetric source input into the distribution system and the seven customer meters represent the highest consumption (output) meters in the distribution system. Improving the accuracy and reliability for the measured data for these meters is the first step in assessing the District's water loss and meeting regulatory requirements.

The District has been assessing its water losses since 2003. The Metering Improvements Plan (MIP) will improve the District's annual water loss auditing by assessing the current condition, recommending meter and facility improvements, and testing the accuracy of the 15 critical meters. In general, the MIP will result in recommendations for meter testing facilities, proper meter design and install, preparation of testing and maintenance procedures, annual testing, and support during the design and construction phases.

California Senate Bill (SB 555), enacted in 2015, requires utilities to perform annual water loss audits and meet water loss performance standards in 2028 and 2035. In the future, the State Water Resources Control Board will use the validated annual water loss audit information to determine utilities' compliance with SB 555 performance standard.

Production and Customer Meters

This report contains a detailed assessment for each of the meters, along with recommendations for improvements covering nearly every aspect of the meters' performance and functionality. Below is a list of the meters that were evaluated for this project. *Chevron No. 1 and CH Sugar were inaccessible and were not inspected as of the writing of this report.*

	Meter Name	Meter Size	Date Installed	Type	Location
System - Input					
1	Lafayette	48"	1954	Venturi	Lafayette WTP
2	Sobrante - MPP	42"	1964	Venturi	Maloney Pumping Station
3	Sobrante - GPP	24"	1964	Venturi	Maloney Pumping Station
4	Sobrante - La Honda	84"	1964	Venturi	Maloney Pumping Station
5	Walnut Creek	96"	2006	Ultrasonic	Walnut Creek WTP
6	Orinda 1	48"	2017	Magmeter	Orinda WTP
7	Orinda 2	54"	2017	Ultrasonic	Orinda WTP
8	USL	54"	1959	Dall Flow Tube	USL WTP
System – Output					
9	Chevron No. 1	8"	2014	Magmeter	Richmond
10	Chevron No. 2	12"	2020	Dall Flow Tube	Richmond
11	Chevron No. 3	20"	2020	Magmeter	Richmond
12	Chevron No. 4	20"	2020	Magmeter	Richmond
13	Chevron No. 5 (Reclaim)	18"	2020	Venturi	Richmond
14	Phillips 66	16"	1954	Venturi	Rodeo
15	CH Sugar	10"	2000	Magmeter	Crockett

Project Approach

Recommendations of the 15 critical meters began with a review of current practices. In order to prepare a recommendation for meter improvements, a thorough investigation of current preventive maintenance procedures and work orders, as they relate to calibration and reliability of the meters, were reviewed. Following the review of background information, site investigations at each meter were conducted to identify site restraints and an assessment of current configurations. The review of current site practices, drawings, and site-specific configurations were, in part, the basis for the development of improvements and recommendations.

Assessment and Evaluation Criteria

Accurately measuring volumetric flow requires that each meter be properly installed, operated, tested, and maintained. All of the production and customer meters listed, were inspected and evaluated based on a series of pre-determined criteria, per AWWA best-practice guidelines.

Meter Testing Methodologies – Pitot Testing

Wholesale / Production metering accuracy is critical for a variety of reasons such as determining the total volume of water input into a distribution system, controlling chemical feed rates, wholesale billing, calculating water loss in the distribution system, and validating a utilities Water Audit. Unfortunately, these meters are prone to failure due to age, corrosion, mineral buildup, and mis-use.

Because of their size and function, it is not usually possible or cost effective to remove these meters and send them to a testing facility for calibration. Also, the piping and proximity of obstructions (like valves, strainers, elbows, etc…) can have a tremendous impact on a meters' accuracy. By testing them on-site, in their "natural" setting, valuable information can be obtained regarding the meters' performance, providing guidance to the utility for corrections and improvements. This can be accomplished using a portable **Pitot flow-meter**, performing a **reservoir draw-down test**, or using a portable **ultrasonic flow-meter** to independently establish the flow rate.

Of these three testing methodologies, Pitot Testing is the most accurate, with an expected accuracy envelope of +/- 2% (from AWWA M33).

Standard Testing Procedure - Polcon® Pitot Testing Methodology

Pitot flow-measurement is a testing method in which the meter is operated under normal conditions, while monitoring the flow-rate with an inserted Pitot rod and flow-recorder acting as a test-meter (*see Figure 1)*. The performance of both the test-meter and meter are compared at various flow-rates, spanning the range of the meter. From this comparison, the meters' accuracy is calculated at each flow-rate, and its' performance is documented. Meters which "fail", or fall outside of the accuracy range (as per the AWWA M6), should be repaired or replaced by the utility.

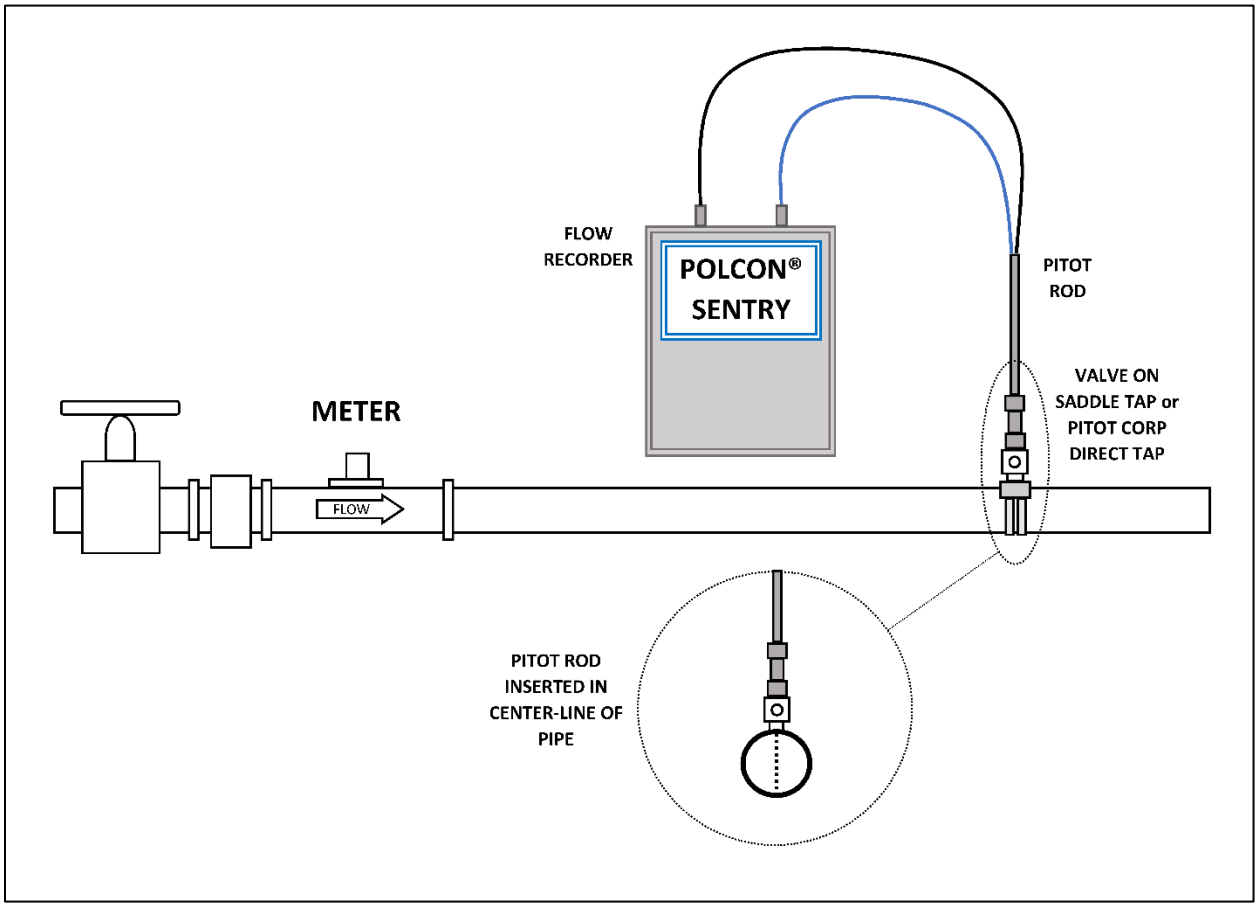


Figure 1. Polcon® Pitot Test Schematic

In order to conduct a Pitot test, there are certain hydraulic requirements. Ideally the selected test site would have twenty pipe-diameters upstream and ten pipe-diameters downstream of any obstruction, which includes elbows, butterfly valves, strainers, meters, pumps, and flow-straighteners (*see Figure 2*). Realistically, ten diameters upstream and five downstream is acceptable.

The test tap can be placed either up, or downstream of the meter, so long as there is continuity in the connective piping. Any connections between the meter and the test site must be isolated, to ensure that no flow is being added or subtracted from what is being measured.

It is helpful to think of most meters as “obstructions”. The placement of the test tap, in relation to the meter, follows the same up and downstream requirements, as for any other type of obstruction. Open body Magnetic and Strap-On Ultrasonic style meters are an exception to this, as they have an “open” internal design, and do not generate much, if any, flow disturbance. For these meter types, the tap can be placed within 1 to 3 pipe diameters of the meter. However, when in doubt, follow the 10 up / 5 down rule.

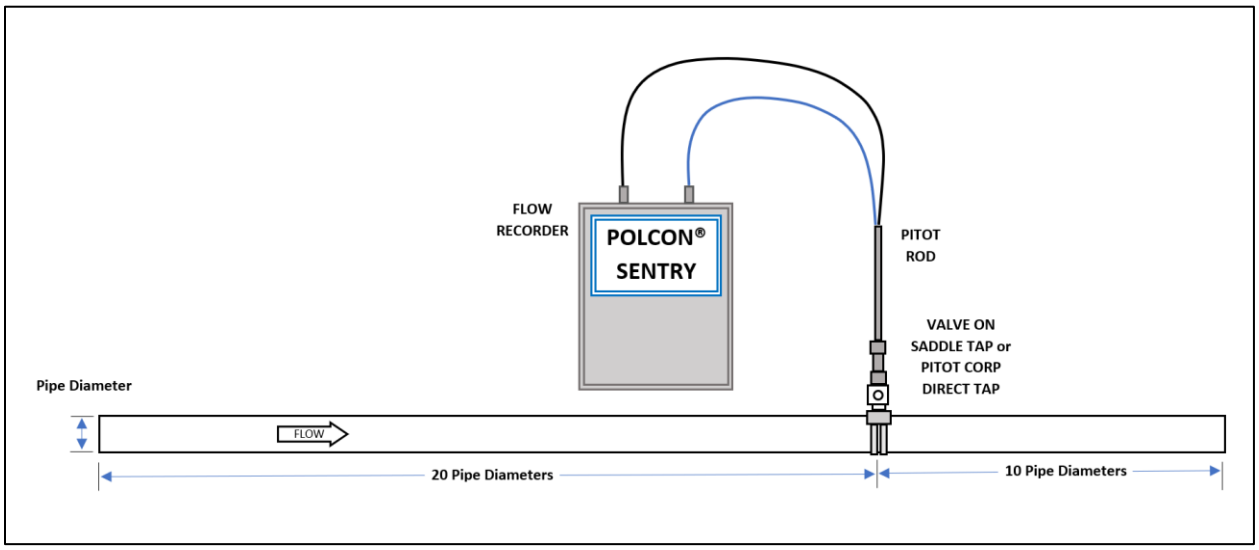


Figure 2. Ideal Pitot Test Tap Location

The test corps can be installed directly, or on “Saddle-taps”. For direct taps, a 1” corp is recommended.

Tests can be conducted on taps up to 2”. It is possible to conduct tests on taps larger than 2”, but it won’t be possible to measure the internal pipe diameter, leading to higher uncertainty in the test results.

NOTE: For a saddle-tap, we recommend a 1.5” tap. The tap hole must be at least 1.5” in diameter, MEASURED, with a 1.5” standard pipe-thread ball valve.

RECOMMENDED 1” PITOT CORPS FOR DIRECT TAPS

Mueller:	Mueller *Pitot* Tap	H-9991N
Ford:	Part Number:	F800-4NL
A Y McDonald:	Part Number:	73120 1”

Equipment Used

Pitot testing is conducted using Polcon® Pressure and Flow Monitoring equipment which is designed and manufactured by M.E. Simpson Company, Inc.

The **Polcon® Pitot Rod** is a constructed with high-grade brass to ensure a device that is durable as well as accurate. Its' primary function is to convert the velocity of the fluid flowing past it into a differential pressure, which is measured by a differential pressure sensor. The "O" ring packing and a locking device assures that all Polcon® Pitot Rods will provide a safe and leak proof installation. The solid orifice plate assures the upstream and downstream orifices remain in the same plane and directly opposite one another assuring an accurate measurement of the velocity in the pipe. A **Polcon® Pipe Caliper** is used to accurately measure the inside pipe diameter.

The **Polcon® Sentry Recorder** is a solid-state microprocessor type pressure-sensor and recorder that senses, gathers, stores, and processes differential pressure from the Pitot rod. The Sentry generates a 4-20mA signal using a Rosemount differential pressure transducer and stores this value using a Telog® ILR-31 or comparable data-logger.

Each data-logger can be set to collect data at an interval as short as one second, or as long as eight hours, and can continuously record data from *seven hours* up to *twenty-three years* depending on the recording frequency (although the internal battery is only rated for three to five years).

The Sentry is self-contained, has its own power pack, weighs less than 30 lbs., and fits into the standard 20.25" manhole entrance. Data is downloaded, using a laptop computer, for further analysis. All data is permanently stored on a computer hard drive, and backed up off-site. The data is exported to a Microsoft Excel® so that it can be analyzed and used to generate a test report.

Polcon® Pitot Testing Procedure

M.E. Simpson Co., Inc. employs the use of a Polcon® Pitot rod to accurately measure the velocity of flow within the pipe for determining the accuracy a flow meter. This consists of an insertion Pitot tube that is placed through the cross section of the pipe (*as shown in Figure 1*), in the exact center, to measure the average mean flow velocity**,** $\mathbf{V_{avg}}$. Measurements are taken at multiple points within the pipe, to calculate the average velocity in the center. These measurements are called the "velocity profile", and are used to calculate a correction coefficient known as a "pipe factor" (*as shown in Figure 3*). A Polcon® Pipe Caliper is used to accurately measure the inside pipe diameter, and from this, the pipe area, $\mathbf{A_{pipe}}$**,** is calculated. Both of these values are multiplied together to determine $\mathbf{Q_{Pitot}}$**,** the flow rate, using the following basic relationship.

$$Q_{Pitot} = A_{pipe} * V_{avg} \left\{\frac{ft^3}{s}\right\}$$

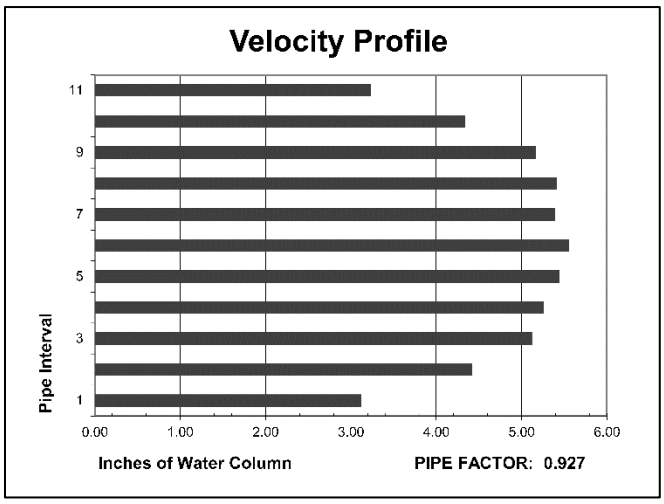


Figure 3. Velocity Profile and Pipe Factor

The results are compared to the readings of the flow meter being tested for the same time period and the accuracy is calculated for the flow meter. According to the AWWA M33 manual, "*Flow Meters in Water Supply*" Pitot testing can produce results of ± 2% of full scale with a "Repeatability" of 0.5 % (*see Figure 4. And "POLCON – Statement of Accuracy" in appendix*).

Table 6-1 Summary of in situ flowmeter testing methods

Field Testing Methodology	Accuracy Range of Test	Variables That Affect Test Accuracy
Reservoir drawdown testing	±3%	• Measurement device accuracy. The method used to measure the level in the reservoir and the corresponding precision and accuracy of the measurement device • Time length of the test. Longer tests yield more consistent and accurate test results. • Isolation-valve leakage can dramatically affect test accuracy; 24-hour tank isolation verification can reduce or eliminate this variable.
Pitot testing	±2%	• Measurement device accuracy. Accuracy and precision of the differential sensor or manometer. • The precision of the measured pipe diameter. • Test methodology. Rod biasing, order of operations, and measurement validation. • Time length of test. Longer tests yield more consistent and accurate test results. • Velocity profile and pipe factor. This is critical to accurate Pitot testing and is measured as part of the testing methodology. • Length of unobstructed upstream straight pipe.
Ultrasonic transit time	±5%	• Measurement device accuracy. The accuracy, precision, and placement of the velocity sensors. • The precision of the measured pipe diameter. This is often difficult to obtain without breaching the pipe wall. Thickness gauges can be used along with circumference measurements to calculate the inside diameter. • Test methodology. Sensor validation and biasing, order of operations, proper sensor orientation, and measurement validation. • Time length of test. Longer tests yield more consistent and accurate test results. • Velocity profile and pipe factor. Often this information is unavailable unless the test site is ideally situated. • Length of unobstructed upstream straight pipe. This variable is critical in ultrasonic testing. The sensors must be installed following good flowmetering practices including upstream and downstream distances from obstruction.

Figure 4. Expected Accuracy of Pitot Tests (from AWWA M33)

Summary of Recommended Improvements

The recommendations were based on the following evaluation criteria; (1) current site operations (2) available drawings and historic information, (3) testability and constructability, (4) AWWA standards (5) and engineering judgment.

The recommended improvements were separated into two phases, phase 1(short term) and phase 2 (long term) improvements. Some Phase 2 improvements will be included as part of future improvement work at the District's water treatment plants.

Table 2 – Summary of Recommended Improvements

Location	Recommended Improvements	
	Phase 1	*Phase 2*
Lafayette Water Treatment Plant	Install new flow verification vault, permanent meter, and test tap as indicated.	N/A
Sobrante Water Treatment Plant	Install new flow verification vault, permanent meter, and test tap as indicated.	N/A
Walnut Creek Water Treatment Plant	Remove temperature probe and install test valve for testing access.	TBD
Orinda Effluent 1	Install test tap on pipe as indicated.	Install new ultrasonic meter and test tap in new flow verification vault, near Lime Building.
Orinda Effluent 2	Install test tap on pipe as indicated.	Install test tap and flow verification vault
USL	Test from existing tap, if tap is usable, or install new tap adjacent to existing tap.	Install new ultrasonic meter, test tap and, flow verification vault
Chevron 1	TBD	TBD
Chevron 2	Install test tap on pipe as indicated.	N/A
Chevron 3	Install test tap on pipe as indicated.	Install test tap and vault on common line to test CH 3 & CH 4 from single test site.
Chevron 4	Install test tap on pipe as indicated.	Install test tap and vault on common line to test CH 3 & CH 4 from single test site.
Chevron 5 (Reclaim)	Test from existing tap.	N/A
Phillips 66	Install new flow verification vault, permanent meter, and test tap as indicated.	

CH Sugar	Pending	Pending

Lafayette Water Treatment Plant Effluent Meter – Site Overview

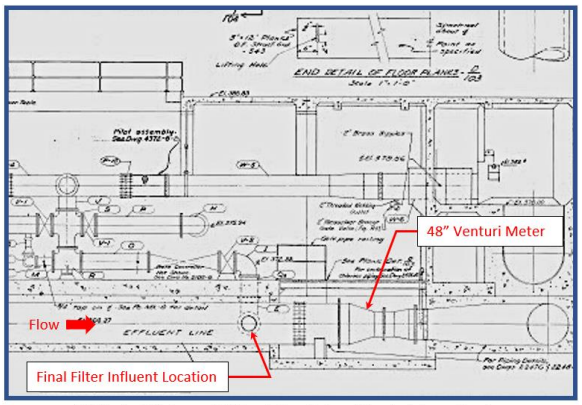
Meter Details and Background

Meter Type: 48” Venturi
Sensor: Foxboro DP
Installed: 1954
Flow Range: 0 to 50 MGD
Average Flow: 30 MGD
Location: End of filter effluent in pipe gallery building, below grating
Address: 3848 Mt. Diablo Blvd. - Lafayette, CA 94549

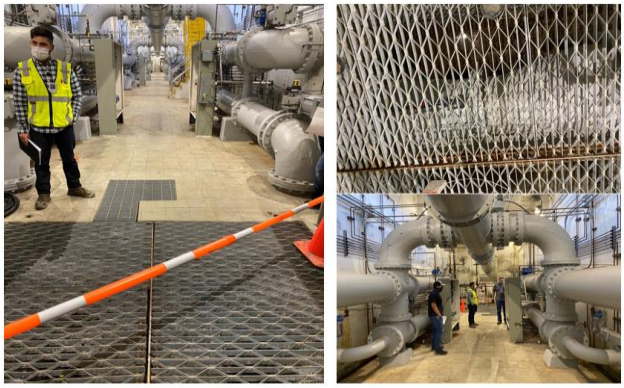
Site Assessment

Pipeline Layout and Configuration
The physical meter location and associated piping match the as-built drawings. The final 2 discharge lines connect into the effluent line, 8 feet upstream of the meter (as shown in as-built below). This close proximity of the discharge lines to the meter may potentially cause inaccurate flow measurement.

Meter Location / Setting
The 48” Plant Effluent Venturi meter is installed in a location which does not provide unobstructed upstream pipeline diameter distances from the location of the final filter effluent connections. The possibility of inaccurate meter readings resulting from this setting should be considered. An accurate volumetric flow test (Pitot flow test) will serve to confirm the meter’s accuracy, and the effect the Final Filter Discharge Influent lines have on the meters’ accuracy, if any.



48” Venturi Meter and Effluent Line (below filter / piping gallery)

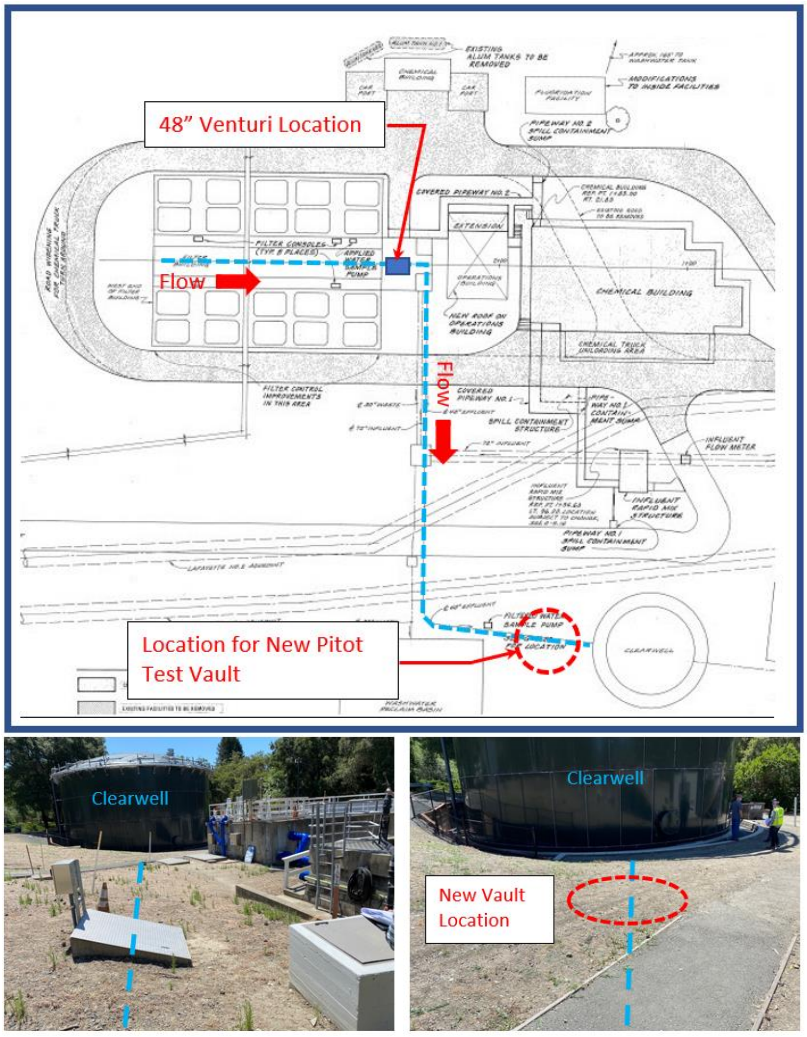

Meter location (below grating) in bottom of Filter / Piping Gallery

Recommendations

Proposed Test Site and New Meter Location

After conducting a physical site inspection, and carefully reviewing the drawings, we recommend that an access vault and Pitot test tap be installed upstream of the clear well as indicated in the schematic and photos below. This site location would allow for adequate up and downstream piping, per AWWA recommendations, and would eliminate any possible inaccuracy issues due to hydraulic disturbances.

A Mag or Ultrasonic meter should be installed in the same (new) vault as the Pitot test tap. A Mag or Ultrasonic meters would not generate any hydraulic disturbance, and could be placed in relatively close proximity to the Pitot test tap.



Effluent Line Location and New Pitot Test Vault Location

Sobrante Water Treatment Plant Effluent Meters – Site Overview

There are 3 effluent meters located at the Sobrante Water Treatment Plant. After thoroughly investigating, it was concluded that all 3 meters could be tested from a single test location.

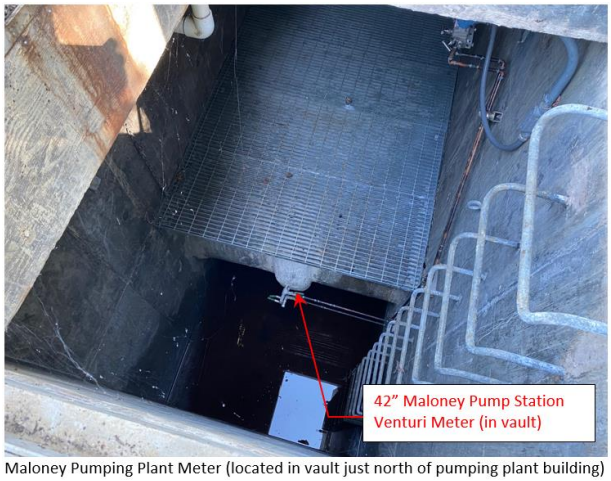
Maloney Pumping Plant (MPP) Effluent – Meter Details and Background

Meter Type: 42" Venturi
Sensor: Rosemount DP
Installed: 1964
Flow Range: 10 to 40 MGD
Average Flow: 30 MGD
Location: In vault, next to pumping plant building
Address: 5500 Amend Road, El Sobrante, CA 94803

Site Assessment

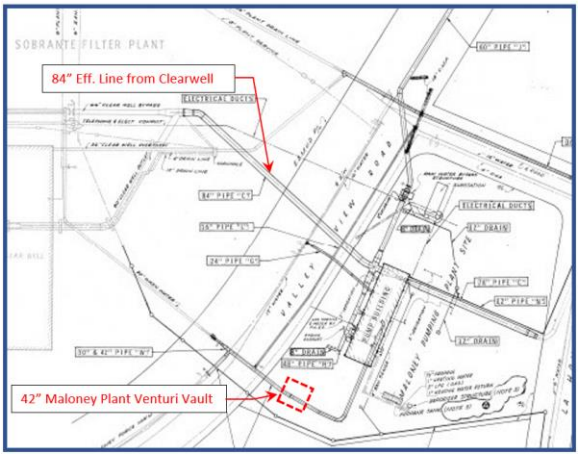
Pipeline Layout and Configuration
The physical meter location and associated piping match the as-built drawings. The meter is located in a vault on the North end of the pump building, on the 42" pumped effluent line served from the pumps located inside the pumping plant. The influent supply to the pump comes from a supply pipe manifold tied to the 84" Sobrante Water Plant effluent pipeline.

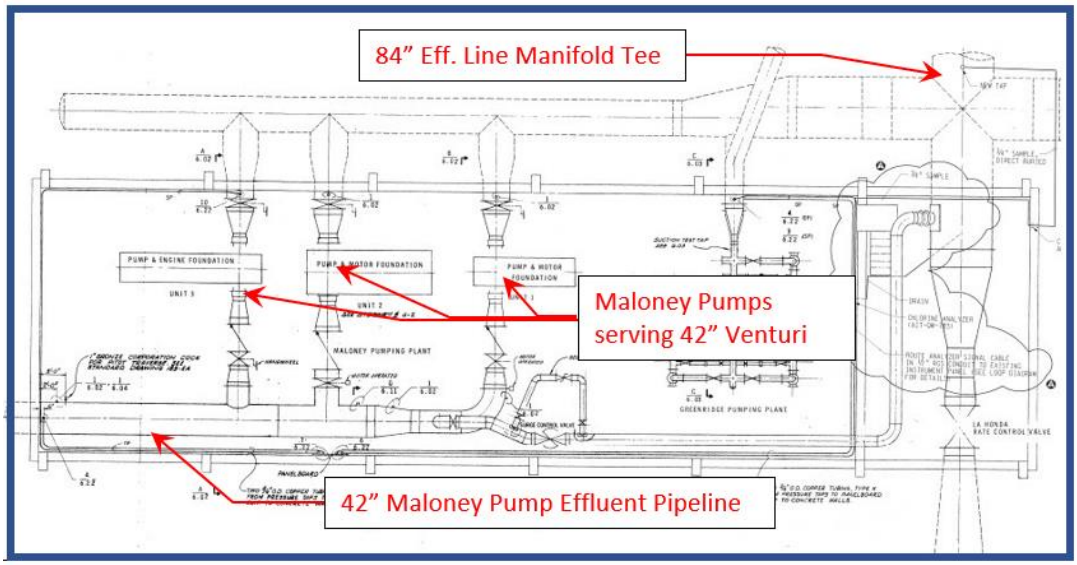
Meter Location / Setting
The length of unobstructed straight-pipe both up and downstream of the meter is sufficient to ensure that the meter is functioning properly, free of hydraulic disturbances.



Maloney Pumping Plant Meter (located in vault just north of pumping plant building)

Sobrante WTP 84" Effluent Pipeline and 42" Maloney Pumping Plant Meter




84” Eff. Line Manifold Tee
Maloney Pumps serving 42” Venturi
42” Maloney Pump Effluent Pipeline
PUMP & ENGINE FOUNDATION
PUMP & MOTOR FOUNDATION
PUMP & MOTOR FOUNDATION
MALONEY PUMPING PLANT
GREENRIDGE PUMPING PLANT

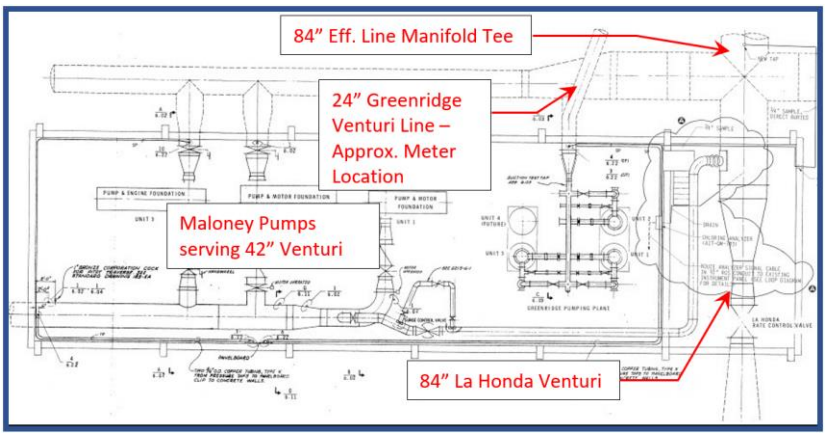
Greenridge Pumping Plant (GPP) Effluent – Meter Details and Background

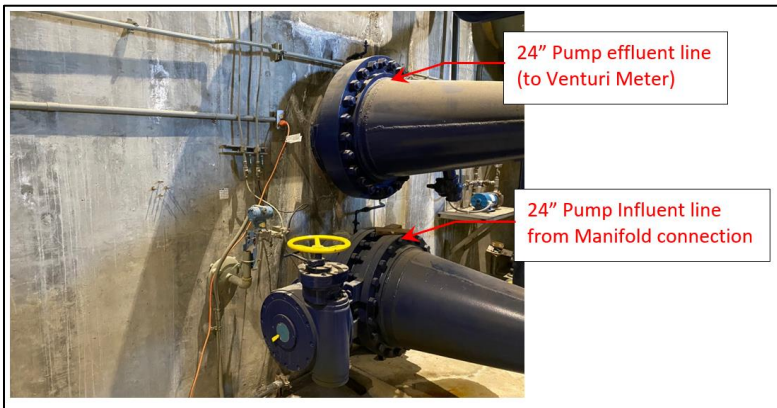
Meter Type: 24" Venturi
Sensor: Rosemount DP
Installed: 1964
Flow Range: 5 to 10 MGD
Average Flow: 5 MGD
Location: Outside of building, buried
Address: 5500 Amend Road, El Sobrante, CA 94803

Site Assessment

Pipeline Layout and Configuration
The exact physical meter location is not known. It is believed to be buried outside of the plant, per District personnel, as shown in the schematic below.

Meter Location / Setting
As the exact location of the meter is unknown, it is currently not possible to determine the quality of the meters' setting, or the nature and impact of any possible hydraulic disturbances.





Greenridge Pumping Plant influent and effluent pipelines (Inside of Maloney Pump building)

La Honda Rate Control Station Effluent – Meter Details and Background

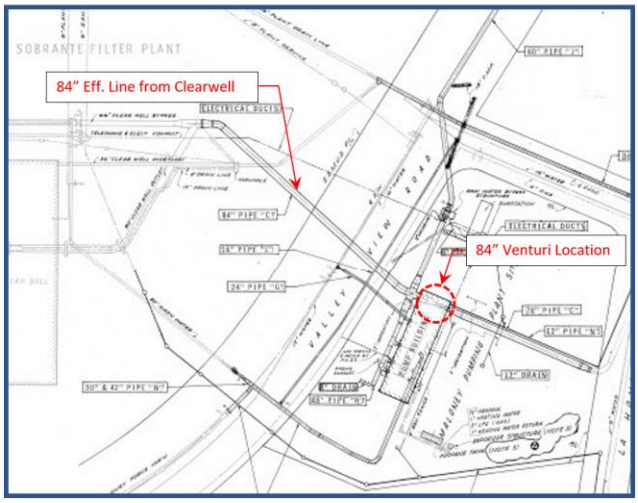
Meter Type: 84” Venturi
Sensor: Rosemount DP
Installed: 1964
Flow Range: 10 to 50 MGD
Average Flow: 50 MGD
Location: In MPP, south end of building
Address: 5500 Amend Road, El Sobrante, CA 94803

Site Assessment

Pipeline Layout and Configuration
The physical meter location and associated piping match the as-built drawings. This meter is located at the South end of the Maloney Pumping Plant. It is served by the 84” WTP effluent pipeline which comes from the plant clear-well located up the hill and to the east of the pumping plant.

Meter Location / Setting
The meter is located 1-2 pipe diameters downstream of a cross, which may impact the accuracy of the meter. As shown in the schematic and photos, the meter is installed just downstream of a manifold tee, which may cause hydraulic disruptions in the meter, leading to the potential for inaccurate flow measurements. The extent of any inaccuracy due to pipeline and setting issues, if any, would not be known until meter is tested.

Sobrante WTP 84” Effluent Pipeline and La Honda Rate Control Station Meter

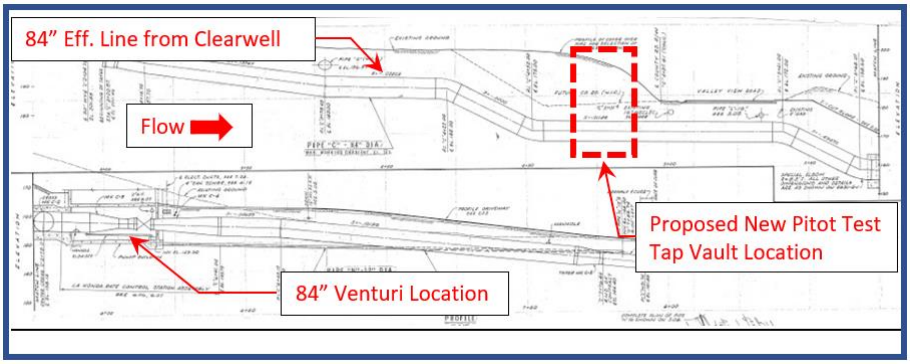


84” La Honda Venturi Meter located inside South end of Maloney Pumping Plant

Recommendations – For all Sobrante Meters

Proposed Test Site

An access vault and Pitot test tap should be installed as indicated in the schematic and photos below. This site location would allow for adequate up and downstream piping, per AWWA recommendations. All 3 of the Sobrante WTP Effluent meters would be tested from this site. This would require isolating each meter during each test.



Note: Pipeline location and proposed new Pitot Test vault location are shown approximate

Proposed potential new Pitot Test tap vault – Looking East from Maloney Pumping Plant

Walnut Creek Water Treatment Plant Effluent Meter – Site Overview

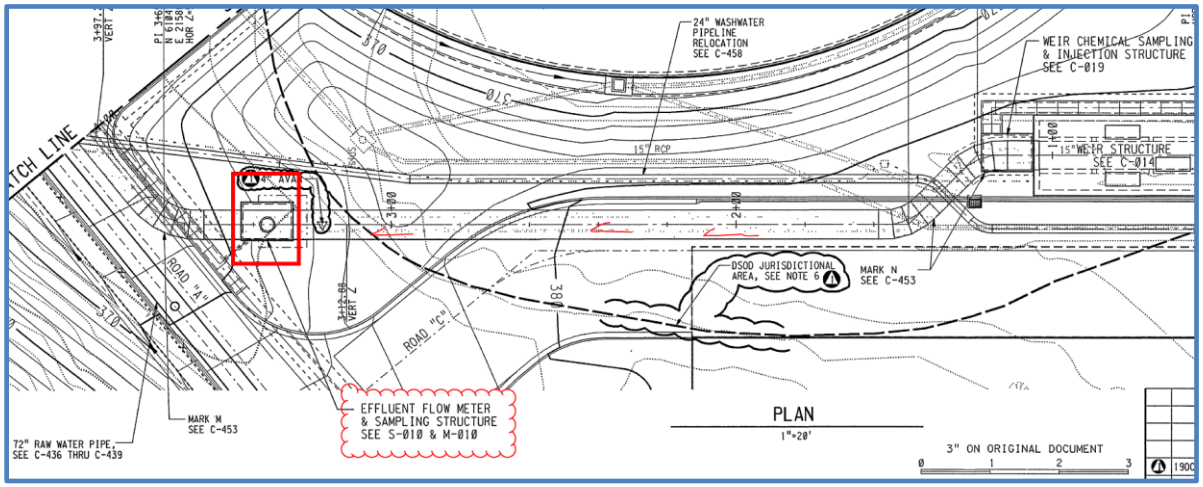
Meter Details and Background

Meter Type: 96” Ultrasonic, 4-path
Brand: Accusonic 7510+
Installed: 2006
Flow Range: 0 to 180 MGD
Average Flow: 75 MGD
Location: 96” Pipeline between CI2 contact tank and clearwell
Address: 2201 Larkey Lane, Walnut Creek, CA 94597

Site Assessment

Pipeline Layout and Configuration
The physical meter location and associated piping match the as-built drawings. It is installed within the 96” pipeline which runs between the Chlorine Contact Tank and the Plant Clearwell. The 96” pipeline is not exposed at any location within the pipe run where the meter is mounted. The meter is located in the pipe beneath the Effluent Meter Vault and the meter transducer cables serving the meter sensor / display unit come up through a flange in the bottom of the vault.

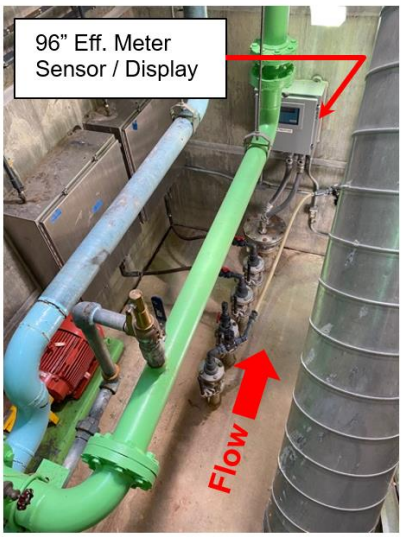
Meter Location / Setting
The meter is located 1 pipe diameter upstream 45-degree bend, which may impact the accuracy of the meter. The extent of any inaccuracy due to pipeline and setting issues, if any, would not be known until meter is tested.



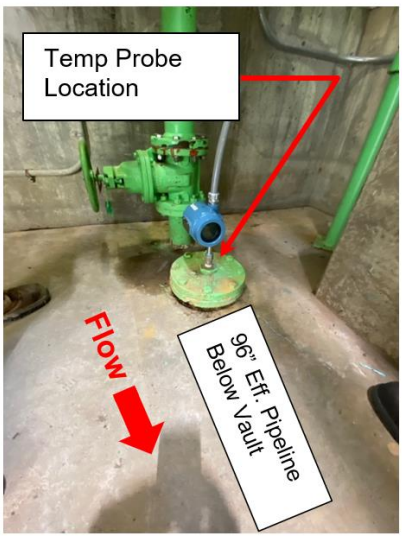
Recommendations

Proposed Test Site

This meter can be tested by removing the temperature probe and installing a test valve on the existing 6” vertical flange, as shown in the photo below. This would require depressurizing the pipeline to remove the temperature probe.



Bottom of Effluent Meter Vault



Pitot Test Location

Orinda Water Treatment Plant Effluent 1 Meter – Site Overview

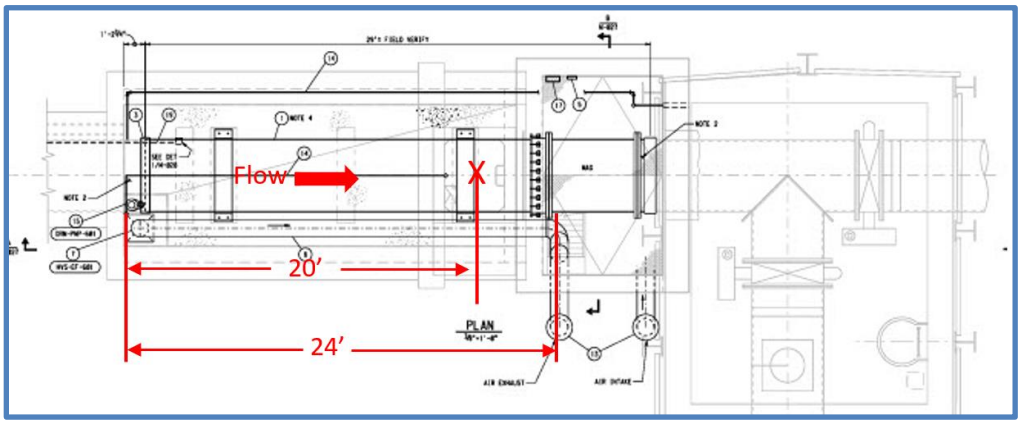
Meter Details and Background

Meter Type: 48” Magmeter
Brand: Rosemount, 8712
Installed: 2017
Flow Range: 10 to 50 MGD
Average Flow: 50 MGD
Location: Effluent No. 1 pipeline from Southeast end of filter gallery, in “Horseshoe Vault”
Address: 209 Camino Pablo, Orinda

Site Assessment

Pipeline Layout and Configuration
The physical meter location and associated piping match the as-built drawings. The effluent No. 1 pipeline is accessible in a vault which houses a 48” Mag Meter which measures the totalized effluent No. 1 flow from the facility. The meter in the vault is easily accessible and there also exists 24’ linear feet of exposed pipeline in what is referred to as the “horseshoe vault”, upstream of the meter. The pipeline in the vault appears to be double-walled steel. In evaluating the mag meter placement on site and in reviewing the record drawings provided, it appears that the meter is installed in a suitable location with at least 5 pipe diameters of clear straight pipeline upstream of the meter at least one straight pipe diameter downstream of the mag meter.

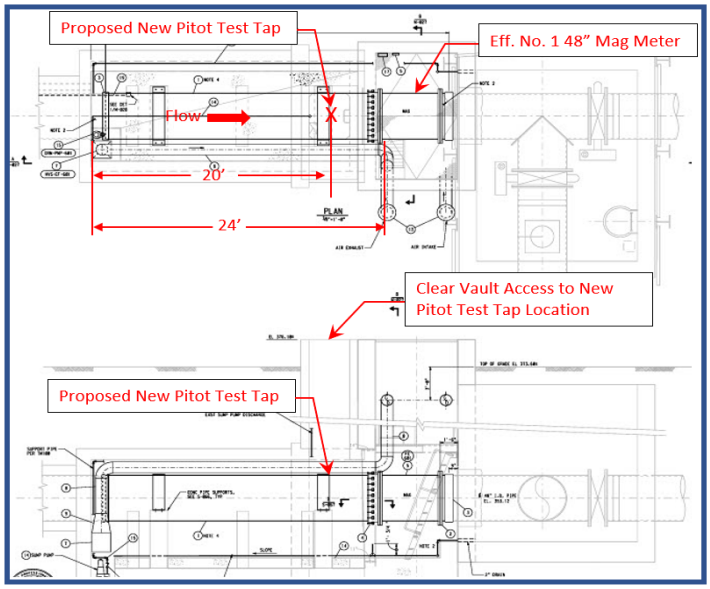
Meter Location / Setting
There are 5 unobstructed pipe diameters upstream and 1 unobstructed pipe diameter downstream, before and after the meter, which is sufficient for accurate flow measurement.



Recommendations – Phase 1

Proposed Test Site

A Pitot tap should be installed as shown in the schematic and photos below. This site location would allow for adequate up and downstream piping, per AWWA recommendations.



New Phase 1 Pitot Test Tap Location – 4' upstream of existing Mag Meter (proposed)

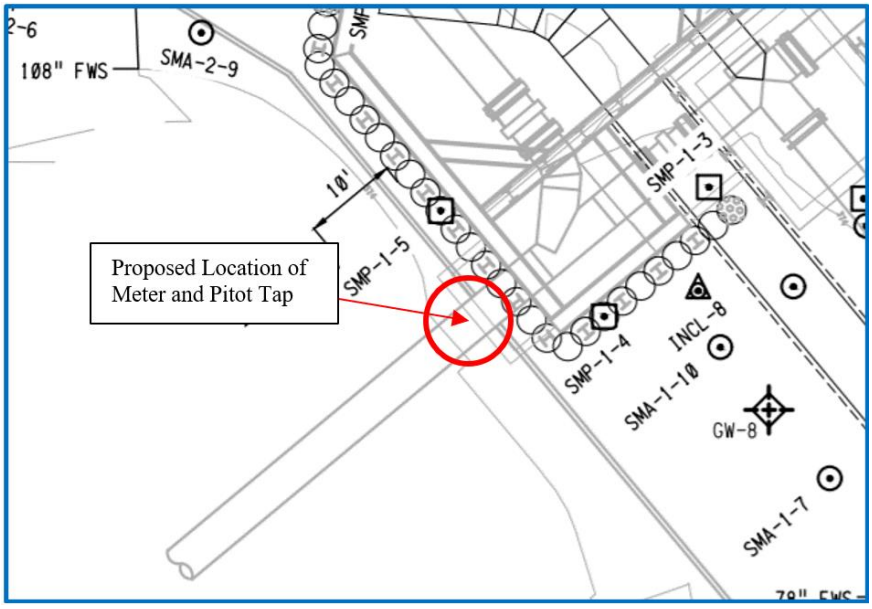
48" Effluent No. 1 Mag Meter

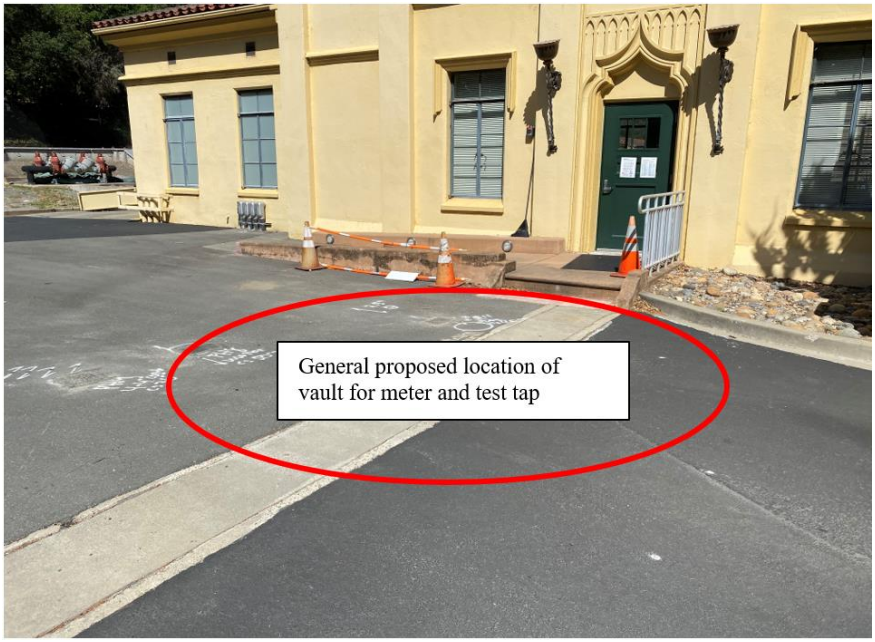
48" Effluent Pipeline upstream from Mag Meter

Recommendations – Phase 2

Proposed Test Site and New Meter Location

We recommend that the proposed meter site be moved further upstream to avoid hydraulic disturbances caused by the flow changing directions at the "Y", and that a Pitot test tap be installed upstream of the proposed meter location, as shown in the schematic below. This would require that an additional vault be installed in the driveway, between the Lime Tower building and the location of the proposed, second new vault. Due to the close proximity of the proposed second new vault to the Lime Tower building, further review by geotechnical engineers would be required to determine feasibility.





Orinda Water Treatment Plant Effluent 2 Meter – Site Overview

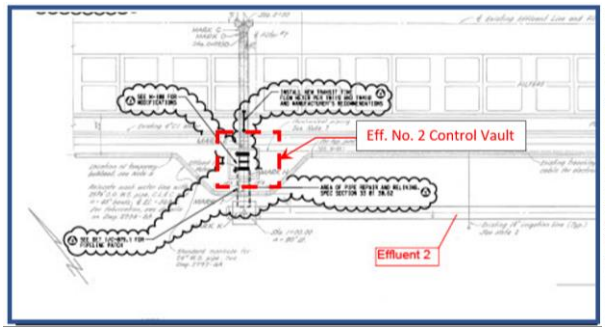
Meter Details and Background

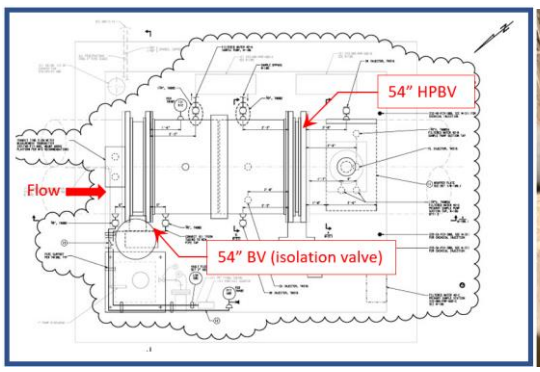
Meter Type: 54" Ultrasonic, Multi-path
Brand: Accusonic, 8510
Installed: 2017
Flow Range: 10 to 50 MGD
Average Flow: 50 MGD
Location: Effluent No. 2 pipeline from filter gallery – vault with HPBV
Address: 209 Camino Pablo, Orinda

Site Assessment

Pipeline Layout and Configuration
The physical meter location and associated piping match the as-built drawings. The Effluent 2 discharge from the Orinda Water Treatment Plant currently flows perpendicularly from under the filter gallery in a 54" diameter pipeline and into a flow control vault before turning 90^0 and flowing through a 78" effluent pipeline toward the Claremont Tunnel.

Meter Location / Setting
Based on the drawings, there appears to be adequate up and downstream piping, per AWWA recommendations, to ensure meter accuracy. The flow control vault currently houses two 54" butterfly valves – one without actuation control and used only for isolation purposes (normally kept in the 100% open position), and one as a high-performance actuated butterfly valve which is actively modulated for flow control from the plant.

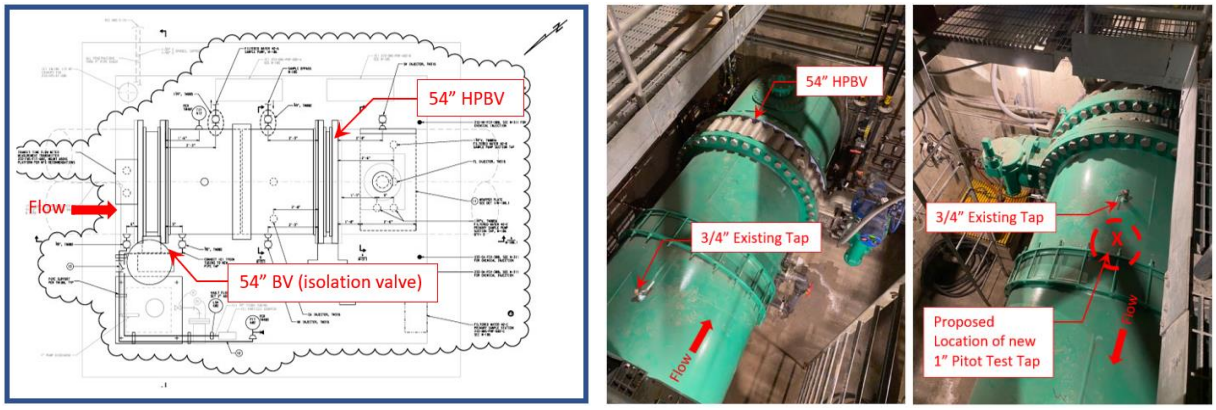




Recommendations – Phase 1

Proposed Test Site

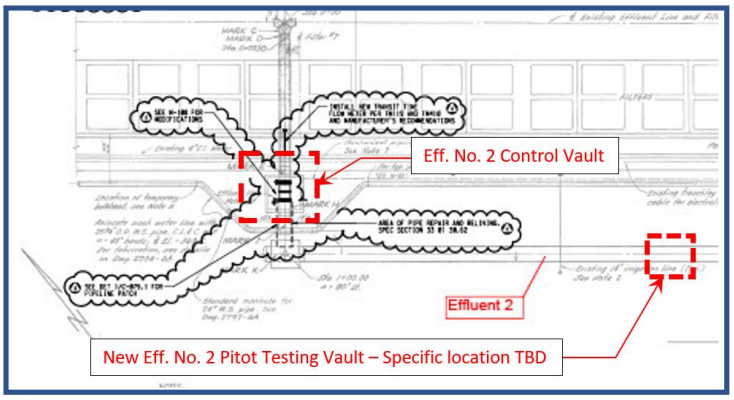
A Pitot tap should be installed as shown in the schematic and photos below. This tap site is not ideal and does not benefit from adequate up and downstream piping, but is the only available option, and will provide value for Phase 1 evaluation purposes.



Recommendations – Phase 2

Proposed Test Site and New Meter Location

We recommend that a vault and Pitot test tap be installed as shown in the schematic below. The precise location is not fixed and could be moved based on necessity, so long as there is adequate up and downstream piping. Currently this pipe is not full, and has an air gap at the top. Control measures would need to be taken to ensure that there are no air gaps, and the pipe is flowing full.



New Potential Flow Testing Vault Location on 78" Effluent Pipeline – Phase 2

Upper San Leandro (USL) Water Treatment Plant Effluent Meter – Site Overview

Meter Details and Background

Meter Type: 54" Dall Flow Tube
Brand:
Installed: 1959
Flow Range: 10 to 30 MGD
Average Flow: 20 to 25 MGD
Location: In vault, East of filter basins
Address: 7700 Greenly Drive, Oakland, CA, 94605

Site Assessment

Pipeline Layout and Configuration
The current 54" existing effluent pipeline travels from the filter gallery of the treatment plant to the vault which houses the existing 54" Dall Flow Tube meter. The configuration of the effluent pipeline currently turns 90 degrees just before entering the existing meter vault. Beyond the existing meter vault (and meter), the pipeline run has approximately 9 clear pipe diameters of clear, straight piping before turning again 90 degrees. The upstream piping configuration ahead of the meter does not provide the recommended straight pipeline diameters as per recommended manufacturer specifications for this type of meter.

Meter Location / Setting
As stated above, the current 54" Dall Flow Tube meter location is compromised due to pipeline configuration upstream of the meter. It is M.E. Simpson's experience that this type of meter installed as this meter is will likely result in meter inaccuracies. It is our understanding that current plans exist to replace this effluent meter with an Accusonic Multi-Path in-pipe transducer meter. We support this course of action.

54" Effluent Pipeline Vault – Dall Flow Tube Meter Location

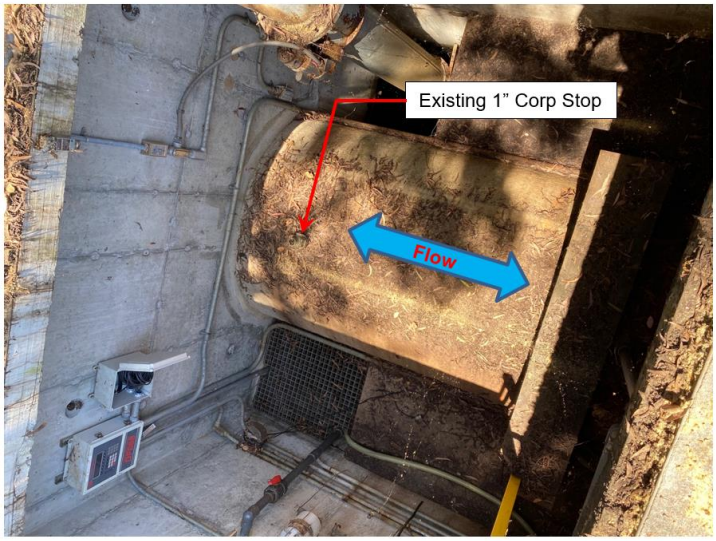
Recommendations

Existing / Proposed Test Site

There is an existing 1” test tap as shown in the photo below. The inside diameter of the test tap would have to be verified to determine if the testing equipment could be inserted through it. Testing from this location would require controlling the flow direction, as both influent and effluent move through this location.

If the test tap is not usable, another test tap could be placed in the same vault, adjacent to existing tap, or by replacing the existing tap.

Exposed 54” pipeline in vault located southeast of clearwell. Note: it was reported that there is an Accusonic meter installed in the pipeline at this location but it has been non-operational for many years. The sending unit for this non-operational meter still exists in the vault.



Chevron No. 2 Meter – Richmond Refinery – Site Overview

Meter Details and Background

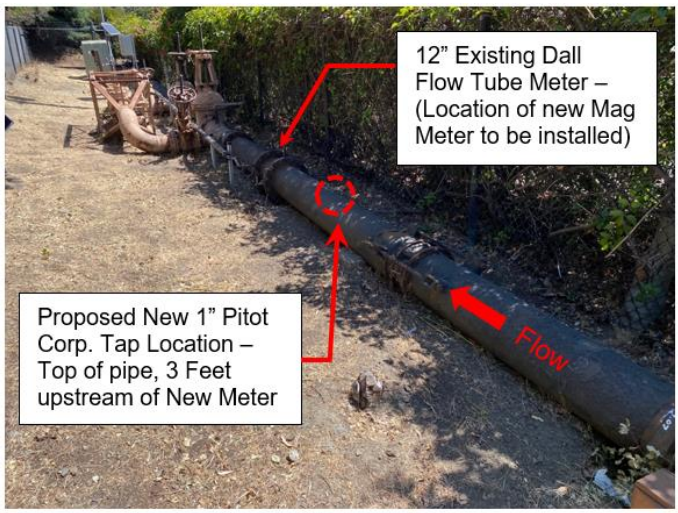
Meter Type: 12” Magmeter
Brand:
Installed: 2020
Flow Range: 0 to 3 MGD
Average Flow: 1.5 MGD
Location: Fenced site, adjacent to refinery
Address: Richmond Refinery, Richmond, CA

Site Assessment

Pipeline Layout, Configuration, and Meter Location / Setting
The meter is situated above ground with sufficient unobstructed piping, before and after the meter.

Recommendations

Proposed Test Site
The recommended location for the new Pitot Test Tap (1” Corp stop) is 3’ upstream of the new Mag Meter. This will place the test tap 12 feet (10 pipe diameters) downstream of the 12” strainer and 3 feet (3 pipe diameters) upstream of the new Mag Meter.



Chevron refinery Recycled Water facility Meter No 2. The existing meter at time of inspection is a 12” Dall Flow Tube type located 15 feet downstream of a 12” diameter strainer. This meter is to be replaced within the coming weeks after inspection with a new 12” Mag Meter located in the same place as the existing meter. The upstream strainer is also scheduled to remain. A new Pitot Test Tap corp is recommended to be installed on the new pipeline 3 feet upstream of the new Mag Meter. – see photo left -

Chevron No. 3 & 4 Meters – Richmond Refinery – Site Overview

Meter Details and Background

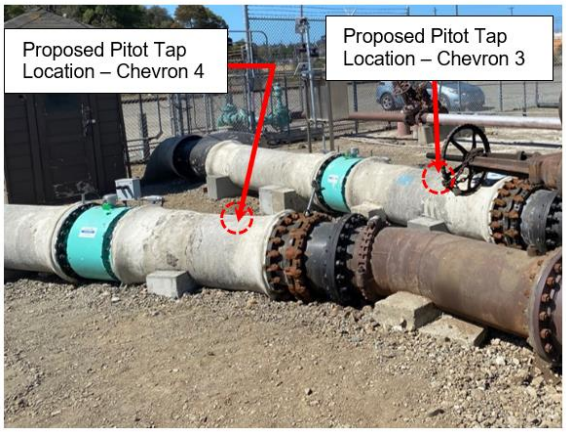
Meter Type: 20" Magmeters
Brand: McCrometer
Installed: 2009
Flow Ranges: 0 to 4 MGD
Average Flow: 2.8 MGD
Location: Fenced site
Address: Richmond Refinery, Richmond, CA

Site Assessment

Pipeline Layout, Configuration, and Meter Location / Setting
The meters are situated above ground with sufficient unobstructed piping, before and after the meter.

Recommendations

Proposed Test Sites
Test taps need to be installed on the top crown of each pipe. It should be noted that there are 20" Y-Type flow strainers installed on the influent side of each meter. As shown in the photos below, the recommended Pitot Test Tap location is approximately 3' to 4' downstream of each meter.



Chevron refinery customer meters No. 3 and 4. The 20" Ultra Mag Meters are easily accessible for volumetric Pitot flow testing. The location for the recommended Pitot Test Taps are shown for both meters – (approx. 3-4 feet downstream of each meter).

Chevron No. 5 Meter (Reclaim) – Richmond Refinery – Site Overview

Meter Details and Background

Meter Type: 18” Magmeter
Brand: McCrometer
Installed: 2020
Flow Range: 0 to 4 MGD
Average Flow: 2 MGD
Location: Fenced site
Address: Richmond Refinery, Richmond, CA

Site Assessment

Pipeline Layout, Configuration, and Meter Location / Setting
The meter is situated above ground with sufficient unobstructed piping, before and after the meter. This meter collects flow data for the recycled water supply. The meter is a newly installed 18” McCrometer Ultra Mag type.

Recommendations

Existing / Proposed Test Site
This meter can be tested from an existing test site, as shown in the photo below.
This site location would allow for adequate up and downstream piping, per AWWA recommendations.

Chevron refinery Recycled Water facility Meter No 5. The 18” Ultra Mag Meter is newly installed and easily accessible for volumetric Pitot flow testing. There exists two new 1-½” ball valves – each of which can be utilized as a viable Pitot test access location. The upstream location shown in the photo to the left is recommended.

Phillips 66 – Refinery Meter – Site Overview

Meter Details and Background

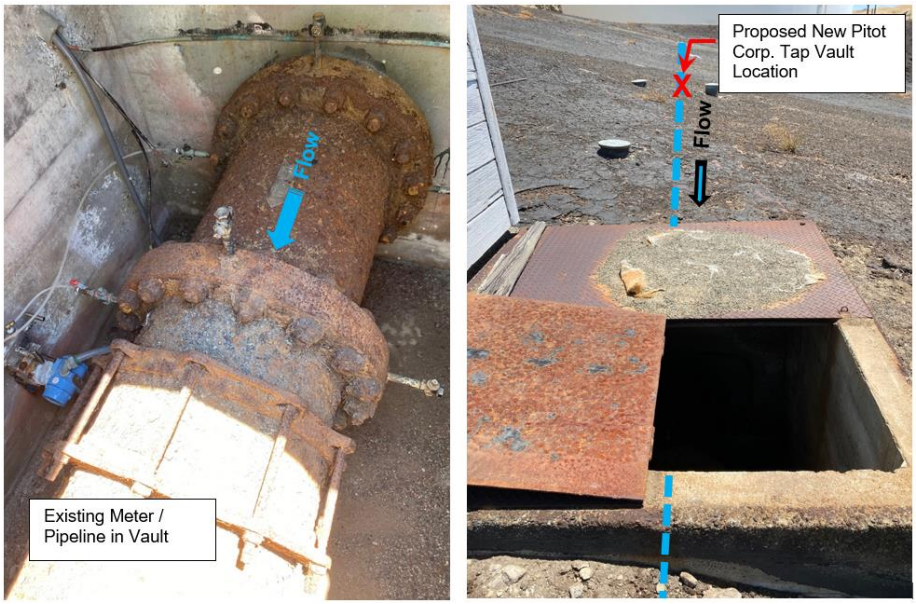
Meter Type: 16” Venturi
Brand:
Installed: 1954
Flow Range: 0 to 5 MGD
Average Flow: 3 MGD
Location: On refinery property, next to meter telemetry building
Address: 1290 San Pablo Ave, Rodeo, CA 94572

Site Assessment

Pipeline Layout, Configuration, and Meter Location / Setting
The meter is a 16” Venturi type meter installed in 1954. The meter is located well within the refinery property.

Recommendations

Proposed Test Site
Install a vault and test tap 20 feet upstream of the existing meter vault, as shown in the photo below. This site location would allow for adequate up and downstream piping, per AWWA recommendations.



Site Inspection Report Drawing Reference List

Orinda Water Treatment Plant – Meter Survey and Inspection Report: Effluent No. 1, Phase 1

Page 1: Reference Dwg. No. 510.20-M-027 (portion of drawing used)
Drawing Title: Orinda Water Treatment Plant, Effluent No. 1 Flow Meter Vault – Mechanical, Plan and Sections

Orinda Water Treatment Plant – Meter Survey and Inspection Report: Effluent No. 2, Phase 1

Page 1: Reference Dwg. No. 510.00-C-079 (portion of drawing used)
Drawing Title: Orinda Water Treatment Plant, Effluent No. 2, Civil, Plan and Profile

Page 2: Reference Dwg. No. 510.00-M-108 (portion of drawing used)
Drawing Title: Orinda Water Treatment Plant, Effluent No. 2 Vault, Mechanical, Plan

Orinda Water Treatment Plant – Meter Survey and Inspection Report: Effluent No. 2, Phase 2

Page 1: Reference Dwg. No. 510.00-C-079 (portion of drawing used)
Drawing Title: Orinda Water Treatment Plant, Effluent No. 2, Civil, Plan and Profile

Page 2: Reference Dwg. No. 510.00-C-079 (portion of drawing used)
Drawing Title: Orinda Water Treatment Plant, Effluent No. 2, Civil, Plan and Profile

Sobrante Water Treatment Plant – Meter Survey and Inspection Report: 24" Greenbridge Meter

Page 1: Reference Dwg. No. 4740-G-5.01 (portion of drawing used)
Drawing Title: Maloney Pumping Plant and Appurtenances, Underground Piping, LAYOUT

Page 2: Reference Dwg. No. 4740-G-6.01 (portion of drawing used)
Drawing Title: Maloney Pumping Plant and Appurtenances, Pumps and Piping, LAYOUT

Page 3: Reference Dwg. No. 4740-G-5.02 (portion of drawing used)
Drawing Title: Maloney Pumping Plant and Appurtenances, Underground Piping:
Pipe "C" – 84" and 78" Clearwell Outlet Extension
Pipe "N" – 12" Drain Line, Sect. 1

Sobrante Water Treatment Plant – Meter Survey and Inspection Report: Maloney Pumping Plant - 42" Venturi Meter

Page 1: Reference Dwg. No. 4740-G-5.01 (portion of drawing used)
Drawing Title: Maloney Pumping Plant and Appurtenances, Underground Piping, LAYOUT

Page 2: Reference Dwg. No. 4740-G-6.01 (portion of drawing used)
Drawing Title: Maloney Pumping Plant and Appurtenances, Pumps and Piping, LAYOUT

Page 3: Reference Dwg. No. 4740-G-5.02 (portion of drawing used)
Drawing Title: Maloney Pumping Plant and Appurtenances, Underground Piping:
Pipe "C" – 84" and 78" Clearwell Outlet Extension
Pipe "N" – 12" Drain Line, Sect. 1

Sobrante Water Treatment Plant – Meter Survey and Inspection Report: La Honda Rate Control Station - 84" Venturi Meter

Page 1: Reference Dwg. No. 4740-G-5.01 (portion of drawing used)
Drawing Title: Maloney Pumping Plant and Appurtenances, Underground Piping, LAYOUT

Page 2: Reference Dwg. No. 4740-G-6.01 (portion of drawing used)
Drawing Title: Maloney Pumping Plant and Appurtenances, Pumps and Piping, LAYOUT

Page 3: Reference Dwg. No. 4740-G-5.02 (portion of drawing used)
Drawing Title: Maloney Pumping Plant and Appurtenances, Underground Piping:
Pipe "C" – 84" and 78" Clearwell Outlet Extension
Pipe "N" – 12" Drain Line, Sect. 1

Lafayette Water Treatment Plant – Meter Survey and Inspection Report: Lafayette Water Treatment Plant: 48" Production Venturi Meter

Page 1: Reference Dwg. No. 9254-G-1.05 (portion of drawing used)
Drawing Title: Lafayette Filter Plant, Chemical Systems and Filter Controls Project, Site Plan - General

Page 2: Reference Dwg. No. 2103-G (portion of drawing used)
Drawing Title: Lafayette Filter Plant, Pipe Gallery Plan & Elevation

Page 3: Reference Dwg. No. 9254-G-1.05 (portion of drawing used)
Drawing Title: Lafayette Filter Plant, Chemical Systems and Filter Controls Project, Site Plan - General

Site Investigation Field Reports

STATEMENT OF ACCURACY - POLCON® PITOT EQUIPMENT

M.E. Simpson Co., Inc. makes the statement of accuracy of Polcon® Pitot testing equipment to be +/- 2.0%. This is based on the analysis of potential error propagation during the testing process, and historical precedent. By following a strict methodology, most, if not all errors can be mitigated. There are three major areas where error can be introduced; the ***differential pressure sensor***, the measurement of the ***pipe diameter***, and the measurement / calculation of the ***pipe factor***.

The first area of potential error is the ***differential pressure sensor***. M.E. Simpson Company, Inc. utilizes Rosemount 3051-CD differential pressure transducers, which are accurate to +/- 0.15% of the sensor span. These smart pressure transducers are calibrated twice a year using a Meriam Meri-Cal pressure calibrator, which is accurate to +/- 0.10% of the pressure reading. The Meri-Cal's accuracy includes the combined effects of linearity, hysteresis, repeatability and temperature over the calibrated range.

The second area of potential error is in the measurement of the ***pipe diameter***. M.E. Simpson Company, Inc. technicians follow a strict field protocol when measuring the pipe diameter. Measurements are taken to the nearest 1/16 of an inch (and to the nearest 1/32 of an inch as needed).

The third area of potential error is in the measurement of the ***pipe factor***. The pipe factor is determined by measuring the flow velocity at 11 equidistant points across the pipe's traverse. These velocity measurements are used to generate the pipe factor, which is then used to convert the center line velocity into the average mean velocity. Multiple pipe factors are measured and compared for consistency, which eliminates random errors.

By following a strict field-testing procedure, the introduction of error is reduced significantly.

Pitot flow testing has a rich history dating back over 100 years and is well documented as being one of the most reliable and accurate methods used to measure flow in a closed conduit.

According to the **AWWA M33 manual, "*Flow Meters in Water Supply*"** pitot testing can produce results of +/- 2.0% under non-laboratory conditions.