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Admin. Law Judge	:	Amin Nojan
Public Advocates witness	:	Daphne Goldberg

PUBLIC ADVOCATES OFFICE

CALIFORNIA PUBLIC UTILITIES COMMISSION

REPORT ON PIPELINE REPLACEMENTS

Los Angeles, California

February 27, 2024

MEMORANDUM

The Public Advocates Office at the California Public Utilities Commission ("Cal Advocates") examined requests and data presented by Golden State Water Company ("GSWC") in Application ("A.") 23-08-010 ("Application") to provide the California Public Utilities Commission ("Commission") with recommendations that represent the interests of ratepayers for safe and reliable service at the lowest cost. This Report is prepared by Daphne Goldberg. Mehboob Aslam is Cal Advocates' project lead for this proceeding. Victor Chan is the oversight supervisor and Brett Palmer and Crystal Yu are legal counsels.

Although every effort was made to comprehensively review, analyze, and provide the Commission with recommendations on each ratemaking and policy aspect of the requests presented in the Application, the absence from Cal Advocates' testimony of any particular issue does not constitute its endorsement or acceptance of the underlying request, or of the methodology or policy position supporting the request.

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CHAPTER 1 PIPELINE REPLACEMENTS

I. INTRODUCTION

This chapter presents an analysis and recommendation regarding GSWC's proposed pipeline replacement budgets, which should be based on its actual 2018-2022 pipeline replacement costs, by Region. GSWC's proposed budgets are inflated when compared to its five-year average (2018-2022) of completed pipeline cost per foot and actual costs for completed pipeline projects compared to Commission authorized budgets, by Region.[1] In addition, GSWC is not applying industry best practices to develop its proposed pipeline budgets, as it still relies on an age-based approach to determine its annual pipeline replacement rates. Instead, GSWC should use a condition-based assessment approach in which GSWC would determine the actual physical condition of a pipeline to determine pipeline replacement rates, as discussed below.

II. SUMMARY OF RECOMMENDATIONS

The Commission should authorize the following GSWC annual recommended pipeline budgets, by Region:

[1] GSWC states that for years 2021 and 2022, its Proposed Budgets and Authorized Budgets are the same based on the Commission's 2023 Decision, which authorized a total capital program budget. Attachment 1-5: GSWC's response to Public Advocates Office data request DG-01, Attachment 1, A.20-07-012, Attachment E, pp. 59-60, and D.23-06-024, p.10.

Table 1-1 Recommended 2024-2026 Pipeline Budgets Compared With GSWC Proposed Pipeline Budgets, By Region[2,3,4]

Region	Recommended 2024 Budget[5]	GSWC Proposed[6] 2024 Budget	Recommended 2025 Budget[7]	GSWC Proposed[8] 2025 Budget	Recommended 2026 Budget[9]	GSWC Proposed 2026[10] Budget
Region I	$929,593	$5,382,400	$1,015,171	$5,996,400	$3,838,625	$23,411,400
Region II	$4,522,895	$18,991,700	$5,480,362	$22,963,600	$7,524,402	$26,587,200
Region III	$5,214,203	$18,170,100	$6,784,811	$19,813,400	$5,255,981	$14,714,100
Total	$10,666,691	$42,544,200	$13,280,344	$48,773,400	$16,622,008	$64,712,700

The Commission should adjust GSWC's proposed pipeline budget in all three of its Regions to account for the following six reasons:

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[2] Region I includes Arden, Cordova, Bay Point, Clearlake, Robbins, Los Osos, Edna Road, Orcutt, Tanglewood, Sisquoc, Lake Marie, Nipomo, Cypress Ridge, and Simi Valley. *See* GSWC's A.23-08-010 Vol.2. testimony, Attachment H, pp.74-75.

[3] Region II includes Artesia, Norwalk, Bell-Bell Gardens, Florence-Graham, Hollydale, Willowbrook, Culver City, and Southwest. *See* GSWC's A.23-08-010 Vol.2. testimony, Attachment H, pp.74-75.

[4] Region III includes West Orange County, Cowan Heights, Placentia-Yorba Linda, Claremont, San Dimas, South Arcadia, South San Gabriel, Barstow, Calipatria-Niland, Morongo Del Norte, Morongo Del Sur, Apple Valley South, Desert View, Apple Valley North, Lucerne Valley, and Wrightwood. *See* GSWC's A.23-08-010 Vol.2. testimony, Attachment H, pp.74-75.

[5] The recommended 2024 budgets represent an 83% reduction of GSWC's Region I proposed budget, 76% reduction to GSWC's Region II proposed budget, and a 71% reduction to GSWC's Region III proposed pipeline replacement budget. *See* Attachment 1-4 for the Recommended 2024 Budget Calculation. *See* GSWC's A.23-08-010 Vol.2. testimony, Attachment H, pp.74-75 for GSWC's Proposed Budgets; *See also* Public Advocates Report On Capital Project Cost Estimates and Cost Adders and Region III Capital Projects Forecast, Early Retirements, and RO Model.

[6] A.23-08-010 Testimony Volume 2, Attachment H. at 74-75.

[7] The recommended 2025 budgets represent an 83% reduction to GSWC's Region I proposed pipeline budget, a 76% reduction to GSWC's Region II proposed pipeline budget, and a 66% reduction to GSWC's Region III proposed pipeline replacement budget. *See* Attachment 1-4 for the Recommended 2024 Budget Calculation. *See* GSWC's A.23-08-010 Vol.2. testimony, Attachment H, pp.74-75 for GSWC's Proposed Budgets; *See also* Public Advocates Report On Capital Project Cost Estimates and Cost Adders and Region III Capital Projects Forecast, Early Retirements, and RO Model.

[8] A.23-08-010 Testimony Volume 2, Attachment H. at 74-75.

[9] The recommended 2026 budgets, represent an 84% reduction to GSWC's Region I proposed pipeline budget, 72% reduction to GSWC's Region II proposed pipeline budget, and a 64% reduction to GSWC's Region III proposed pipeline replacement budget. *See* Attachment 1-4 for the Recommended 2024 Budget Calculation. *See* GSWC's A.23-08-010 Vol.2. testimony, Attachment H, pp.74-75 for GSWC's Proposed Budgets; *See also* Public Advocates Report On Capital Project Cost Estimates and Cost Adders and Region III Capital Projects Forecast, Early Retirements, and RO Model.

[10] A.23-08-010 Testimony Volume 2, Attachment H. at 74-75.

1) The lack of a condition-based pipeline assessment to determine GSWC's annual pipeline replacement rate. GSWC's reliance on an age-based approach to determine its annual pipeline replacement rate likely results in unnecessary pipeline investments and causes an undue burden on ratepayers.

2) GSWC has not completed its investigation of software applications that account for a pipeline's condition. As part of its settlement with Cal Advocates during its 2020 General Rate Case (GRC), GSWC agreed to investigate software applications that account for pipe condition.[11]

3) GSWC's 2024-2026 inflated cost per foot amounts compared with its 2018-2022 average recorded replacement cost per foot by Region.

4) GSWC's proposed inflated annual pipeline investment budgets when compared to its 2018-2022 completed pipeline miles and recorded costs.

5) For the years 2018-2022, GSWC's completed pipeline replacement miles and rates do not comply with the Commission authorized pipeline replacement miles and rates.

6) GSWC's proposed pipeline replacement rates are inconsistent with the results of its 2021 AWWA water audits.

The Commission should adjust GSWC's annual proposed pipeline replacement budgets in all three of its Regions as follows: 1) the budgets should be consistent with the actual five-year average (2018-2022) recorded per-foot pipeline costs per Region. GSWC's requested pipeline budgets are unreasonable because the budgets include pipeline cost per foot which are 156% to 219% greater than its 2018-2022 recorded average cost per foot of pipeline; and 2) the recommended annual budgets should be based on GSWC's five-year (2018-2022) percentage of actual costs for completed pipeline projects compared to the Commission's authorized budgets. For the years 2018-2022, GSWC spent, on average, for completed pipeline replacement projects, 43% of

[11] D.23-06-024, Settlement Agreement, p. 18.

Region I's, 64% of Region II's, and 83% of Region III's corresponding authorized pipeline replacements budgets.[12]

Prior to receiving full funding of its proposed budget in subsequent General Rate Cases (GRC), GSWC should produce its next GRC's pipeline replacement budget using software application tools that account for a pipeline's condition.

III. ANALYSIS

A. GSWC's Reliance On An Age-Based Approach To Determine Its Pipeline Replacement Rate Results in Unnecessary Pipeline Investments

To demonstrate the prudency and reasonableness of its proposed budget, GSWC should develop its annual pipeline replacement rate using pipeline condition-based assessment tools. GSWC's reliance on an age-based approach to determine its annual pipeline replacement rate likely results in unnecessary pipeline investments and causes an undue burden on ratepayers. GSWC uses KANEW software, which is based on estimated pipeline lifetimes, to determine its annual pipeline replacement lengths, and risk reduction, leak and break frequency, material and age, and hydraulic deficiencies data analysis to calculate a benefit score used to prioritize proposed pipeline replacement projects and corresponding funding.[13,14,15] KANEW recommends the total annual amount of pipeline replacements for each water system based on pipeline vintage cohorts and survival functions that include service life estimates.[16] KANEW does not consider factors that impact a pipeline's service life, such as the pipeline's actual physical condition, soil conditions, corrosivity of the soil, pipeline lining, pipeline pressure, maintenance frequency, and water quality.[17,18] Therefore, GSWC should propose its

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[12] GSWC states that for years 2021 and 2022, its Proposed Budgets and Authorized Budgets are the same based on the Commission's 2023 Decision, which authorized a total capital program budget. GSWC's response to Public Advocates Office data request DG-01, Attachment 1, Attachment 1-5, and A.20-07-012, Attachment E, pp. 59-60, and D.23-06-024, p.10.

[13] A.23-08-010, Volume 2 Testimony, Attachment H., p.43.

[14] A.2308010 Testimony Volume 2, Attachment H. pp. 60-62.

[15] A.23-08-010, Volume 2 Testimony, Attachment H., p.43.

[16] A.23-08-010, Volume 2 Testimony, Attachment H., p.43.

[17] A.23-08-010, Volume 2 Testimony, Attachment H., p.43.

[18] A.23-08-010, Volume 2 Testimony, Attachment H, pp. 59-60.

annual pipeline replacement rate in subsequent GRCs using pipeline condition-based assessment results.

B. GSWC Is Not Applying Industry Best Practices To Develop Its Proposed Pipeline Replacements Budgets

Prior to fully funding a proposed replacement budget, GSWC should produce its next GRC's pipeline replacement budget using software application tools that account for a pipeline's condition. As part of its settlement with Cal Advocates during its 2020 GRC, GSWC agreed to investigate software application tools that account for a pipeline's condition to determine its annual pipeline replacement lengths and rates.[19] However, it has not yet completed its investigation of the software application tools.[20] According to the American Water Works Association (AWWA), condition-based assessment is the "identification of the likelihood that an asset will continue to perform its required function."[21] Condition assessment includes collecting data through various methods to determine the "physical characteristics of the pipe and how they may impact the pipeline's likelihood that it will leak, break, or otherwise fail to perform."[22] Some examples of condition based assessment tools include machine learning and artificial intelligence software to determine likelihood and consequences of failure and field testing methods such as internal remote visual inspections, acoustic velocity testing, and electromagnetic testing.[23]

Condition-based assessment tools save water utilities, and therefore ratepayers, the costs of replacing pipelines unnecessarily or prematurely. Recent articles on the topic concluded the following: 1) "condition assessments are needed to identify high risk pipes and also avoid replacing the 40 to 70 percent of good pipes condemned by age-based

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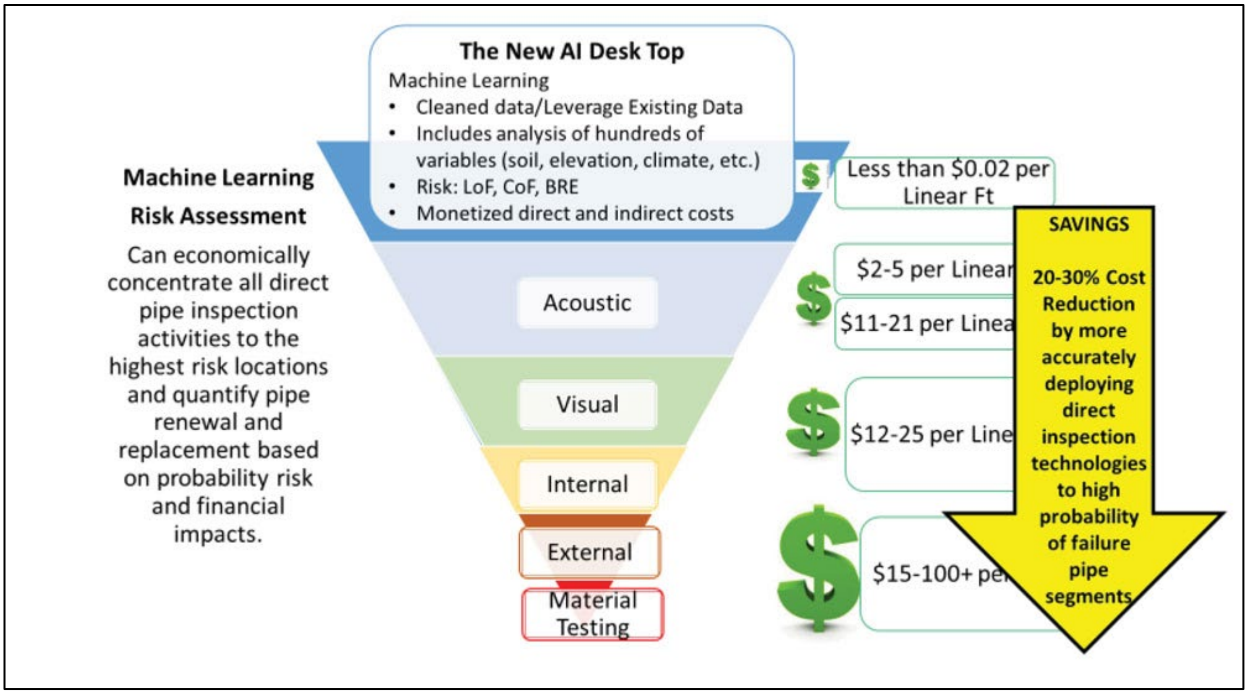
[19] A.20-07-002 Decision and Settlement, p.18.
[20] GSWC response to Public Advocates Office data request DG-07, Q.4., Attachment 1-6 and A.23-08-010, Volume 2 Testimony, Attachment H, pp.69-72.
[21] American Water Works Association Manual M77, p. 2., Attachment 1-9.
[22] American Water Works Association Manual M77, p. 2., Attachment 1-9.
[23] American Water Works Association Manual M77, CH 8, CH 10, and CH 11. Note: for presentation purposes, each chapter's first page is included in attachments., Attachment 1-9.

planning assumptions."[24]; and 2) if a water utility is not including artificial intelligence or machine learning in its asset management program for pipelines, the utility is not following best practices and will pay more for replacements over time.[25] Specifically, traditional desktop applications (i.e., age-based models) use "arbitrary assumptions and weightings and utilize a small number of factors relating to the performance of the pipe…translate into a high error rate which means good pipes could be identified as high risk and face premature replacement."[26] In comparison, a machine learning model accounts for the water utility's data and thousands of other variables used to calculate the probability of a pipe failure, which results in cost savings to the utility and ratepayers, as shown in Figure 1-1 below. [27]

Figure 1-1: Cost Savings Of Available Pipe Condition Assessment Inspection Technologies

[24] How much Should I Spend on Condition Assessments?, By Greg Baird, October 11, 2021, https://waterfm.com/how-much-should-spend-pipe-condition-assessments/, Attachment 1-2.
[25] How much Should I Spend on Condition Assessments?, By Greg Baird, October 11, 2021, https://waterfm.com/how-much-should-spend-pipe-condition-assessments/, Attachment 1-2.
[26] Capturing Condition Assessment Cost Savings, by Greg Baird, July 8, 2019, https://waterfm.com/capturing-condition-assessment-cost-savings/, Attachment 1-2.
[27] Capturing Condition Assessment Cost Savings, by Greg Baird, July 8, 2019, https://waterfm.com/capturing-condition-assessment-cost-savings/, Attachment 1-2.



The figure shows a total of 20-30% cost reduction to pipeline replacements by focusing condition-based assessment field technologies (shown in the inverted triangle) on a utility's high probability of failure pipe segments, generated from the machine learning application (shown in the top rectangle). The pipeline replacement cost savings increase with the application of additional tools. For example, the results of a recent case study of a large water utility (with 3,395 miles of pipeline) using a machine learning condition-based assessment application resulted in 56 miles less of proposed pipeline replacements compared with the age-based model, saving the water utility $56 million ($1,000,000 per mile replaced).[28]

A specific example from Mesa Water[29] District's study (Mesa Study),[30] demonstrated the cost savings of a condition-based assessment of its pipelines. Based on the Mesa Study results, Mesa Water concluded that an estimated $231 million of the

[28] Capturing Condition Assessment Cost Savings, by Greg Baird, July 8, 2019, https://waterfm.com/capturing-condition-assessment-cost-savings/., Attachment 1-2.
[29] Mesa Water serves approximately 110,000 customers in Orange County, California. Mesa Water's water distribution system includes 317 miles of water main pipelines. https://www.mesawater.org/.
[30] Mesa Study; Pipeline Integrity Testing to Assess the Useful Life of Pipeline Infrastructure (Mesa Study) AWWA Journal September 2019 Vol. 111 No.9. The Mesa Study was done in collaboration with the Water Research Foundation., Attachment 1-3.

$300 million needed for pipeline replacement was unnecessary for pipeline replacements based solely on an age-based approach (for example, the KANEW model). The Mesa Study had three goals: 1) to estimate the remaining useful life (RUL) of pipelines by measuring a pipeline's remaining wall thickness using the acoustic velocity method[31] and Point testing using X-ray spectroscopy. Testing a pipeline's wall thickness provides the current condition and the RUL of a pipeline, since the pipeline needs to have a minimum wall thickness to support the water distribution system; 2) to establish pipeline replacements decisions based on the completed condition assessments; and 3) to optimize and refine the testing procedures to maximize value to ratepayers. Prior to the Mesa Study, Mesa Water District estimated that, based on the average age of its pipelines, it would need to spend $300 million in pipeline replacements over 30 years.[32]

GSWC unreasonably concluded that the software applications it considered so far that account for a pipeline's condition were too costly and not efficient. GSWC considered the FRACTA application,[33] but decided it was too costly (approximately $150,000 to $300,000 annually) and did not conduct a pilot of the program.[34] GSWC's conclusion is unreasonable considering GSWC proposes in this GRC approximately $50 million in Test Year 2025 for its proposed pipeline replacements.[35] Even if the annual cost of the FRACTA application was $300,000, it would only be 0.6% of GSWC's proposed Test Year 2025 pipeline replacement budget. Implementing the software to aid in condition-based assessment at an annual cost of $150,000 to $300,000 per year would result in ratepayer savings. GSWC also considered the Innovyze application[36] and did complete a pilot, but states that it was time-consuming and less efficient than its current evaluation process of using its KANEW model.[37] However, GSWC's inefficiency claim is unsupported as GSWC states that its recorded employee hours dedicated to the

[31] Acoustic Velocity testing can estimate the remaining wall thickness for pipeline.
[32] Mesa Study p. 14., Attachment 1-3.
[33] A.23-08-010, Volume 2 Testimony, Attachment H, p. 70.
[34] GSWC response to Public Advocates Office data request DG-07, Q.3., Attachment 1-6.
[35] A.23-08-010, Volume 2 Testimony, Attachment H, pp. 74-75.
[36] A.23-08-010, Volume 2 Testimony, Attachment H, p. 70.
[37] GSWC response to Public Advocates Office data request DG-07, Q.1.b., Attachment 1-6.

Innovyze application "would have been charged to Engineering Overhead and cannot be differentiated on historical timesheet records."[38]

In addition, GSWC does not have pipeline condition documentation for pipelines that it states are in poor condition. For example, GSWC states that field reports for ten of its proposed pipeline projects identify the pipeline as "poor condition."[39] However, GSWC does not have documented field reports for seven out of these ten proposed projects. Upon further inquiry by Cal Advocates, GSWC stated that the field report was a "verbal statement" by GSWC field staff to GSWC's engineering staff without any supporting documentation justifying the "poor condition."[40] Since GSWC states that it is "critical that GSWC continues to identify pipelines in poor condition", GSWC should use a software application that accounts for a pipeline's condition and have documented field reports for those pipelines to support its pipeline condition assessment.[41]

GSWC identifies the implementation of condition-based assessment tools as an improvement it could make to its pipeline management program.[42] However, GSWC has not yet completed its investigation of software application tools even though it had three years to do so.[43] Therefore, prior to receiving full funding of its proposed budget in subsequent GRC's, GSWC should produce its next GRC's pipeline replacement budget using software application tools that account for a pipeline's condition.

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[38] GSWC response to Public Advocates Office data request DG-07, Q.1.b., Attachment 1-6.
[39] A.23-08-010, *See* GSWC's individual pipeline project "Project Cost Estimates" for: Singingwood, Lincoln Street, Oak Crest, Valley Avenue, Eaton Road, Niland, Butte Road, Azores Circle Area Main, Primavera Lane, and Llanto Road Main Replacement; *See also* GSWC response to Public Advocates Office data request DG-05, Q.6., Attachment 1-7.
[40] GSWC does not have field reports for its Singingwood, Lincoln Street, Oak Crest, Valley Avenue, Eaton Road, Niland, and Butte Road proposed pipeline projects. GSWC had field reports for its proposed Azores Circle Area Main, Primavera Lane, and Llanto Road Main Replacement. GSWC response to Public Advocates Office data request DG-05, Q.6., Attachment 1-7.
[41] A.23-08-010, Volume 2 Testimony, Attachment H, p. 37.
[42] A.23-08-010, Volume 2 testimony, Attachment H, pp.69-70.
[43] GSWC response to Public Advocates Office data request DG-07, Q.4. and A.23-08-010, Volume 2 Testimony, Attachment H, p.72., Attachment 1-6.

C. <u>For A Foot of Pipeline Replacement Proposed In This GRC, GSWC's Costs Are an Unreasonable 156% to 219% Greater Than GSWC's Average of 2018-2022 Cost Per Foot of Pipeline Replaced</u>

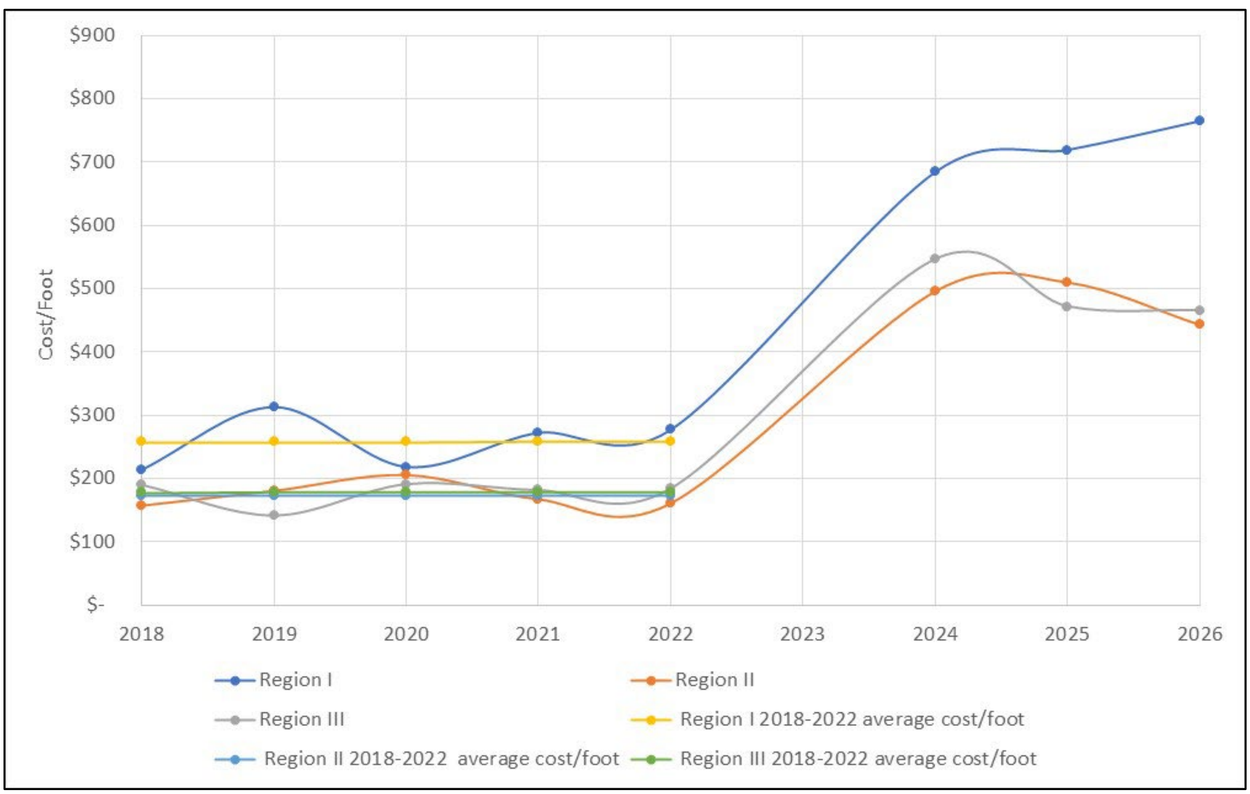
The Commission should adjust GSWC's proposed pipeline replacement budget in all three of its Regions to reflect the recorded five-year average (2018-2022) per-foot pipeline costs per Region. Using the most recent, available, five-year period (2018-2022) of per-foot pipeline cost per Region is reasonable because it includes pre-COVID and COVID years.[44] GSWC's 2024-2026 annual costs per foot of pipeline are unreasonable as the costs are between 156% and 219% greater than the average 2018-2022 cost per foot of pipeline, as shown in Table 1-2 and Figure 1-2 below.

[44] Governor Gavin Newsom declared a State of Emergency on March 4, 2020: https://www.gov.ca.gov/2020/03/04/governor-newsom-declares-state-of-emergency-to-help-state-prepare-for-broader-spread-of-covid-19/.

Table 1-2: GSWC's Recorded and Forecasted Cost Per Foot of Pipeline[45]

Year	Region I	Region II	Region III
2018	$214	$157	$190
2019	$313	$180	$142
2020	$218	$205	$191
2021	$272	$167	$182
2022	$277	$160	$184
2018-2022 Average	$259	$174	$178
GSWC's 2024-2026 Annual Unit Prices			
2024	$684	$496	$546
2025	$719	$510	$471
2026	$764	$443	$465

Figure 1-2: GSWC's 2018-2022 Recorded and 2024-2026 Forecasted Cost Per Foot of Pipeline[46]



As shown in the Table 1-2 and Figure 1-2, GSWC forecasts its 2025 Region I cost/foot of pipeline at approximately 177% more than its 5-year average (2018-2022) recorded ($719 compared with $259) and 160% more than its Test Year 2022 recorded ($719 compared with $277). For Region II, GSWC forecasts a 2025 cost/foot of pipeline of approximately 193% more than its 5-year average (2018-2022) recorded ($510 compared with $174) and 219% more than its Test Year 2022 recorded ($510 compared with $160). For Region III, GSWC forecasts a 2025 cost/foot of pipeline of approximately 165% more than its 5-year average (2018-2022) recorded ($471 compared with $178) and 156% more than its Test Year 2022 recorded ($471 compared with $184).

GSWC states that its planned project costs are subject to unpredictable major economic shifts, such as the COVID-19 pandemic, high inflation, and supply chain disruptions.[47] However, a statistical analysis of GSWC's recorded 2018-2022 pipeline cost/foot in Table 1-2 demonstrates that 73% of GSWC's cost/foot amounts are within one standard deviation of the mean of $203/foot during the years 2018-2022. Therefore, it is reasonable to conclude that the impact on cost of "unpredictable major economic shifts" did not impact GSWC's pipeline costs. Therefore, the Commission should adjust GSWC's proposed pipeline replacement budget in all three of its Regions to reflect the actual five-year average (2018-2022) recorded cost per-foot of pipeline per Region.

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[45] Region I includes Arden, Cordova, Bay Point, Clearlake, Los Osos, Edna Road, Orcutt, Tanglewood, Sisquoc, Lake Marie, Nipomo, Cypress Ridge, and Simi Valley. The Regional cost/foot is based on GSWC's recorded 2018-2022 miles replaced and pipeline costs. Note: GSWC acquired the Robbins System in 2022, therefore, the Robbins 2018-2022 pipeline cost/foot is not included. *See* GSWC Advice Letter 1878; *See also* Attachment 1-4 for cost/foot calculation; *See also* GSWC's response to Public Advocates Office data request DG-01. The 2024-2026 cost/foot is calculated from GSWC's A.23-08-010 Pipeline Management Program, Vol. 2 Testimony, Attachment H pp 66-67 and 74-75.

[46] Region I includes Arden, Cordova, Bay Point, Clearlake, Los Osos, Edna Road, Orcutt, Tanglewood, Sisquoc, Lake Marie, Nipomo, Cypress Ridge, and Simi Valley. The Regional cost/foot is based on GSWC's recorded 2018-2022 miles replaced and pipeline costs. Note: GSWC acquired the Robbins System in 2022, therefore, the Robbins 2018-2022 pipeline cost/foot is not included. *See* GSWC Advice Letter 1878; *See also* Attachment 1-4 for cost/foot calculation; *See also* GSWC's response to Public Advocates Office data request DG-01. The 2024-2026 cost/foot is calculated from GSWC's A.23-08-010 Pipeline Management Program, Vol. 2 Testimony, Attachment H pp 66-67 and 74-75.

[47] A.23-08-010 Volume I Capital testimony, pp. 23-24.

D. GSWC's Proposed Pipeline Budgets Should Be Based On GSWC's 2018-2022 Costs Of Completed Pipeline Replacement Projects Compared With The Corresponding Commission Authorized Amounts, per Region

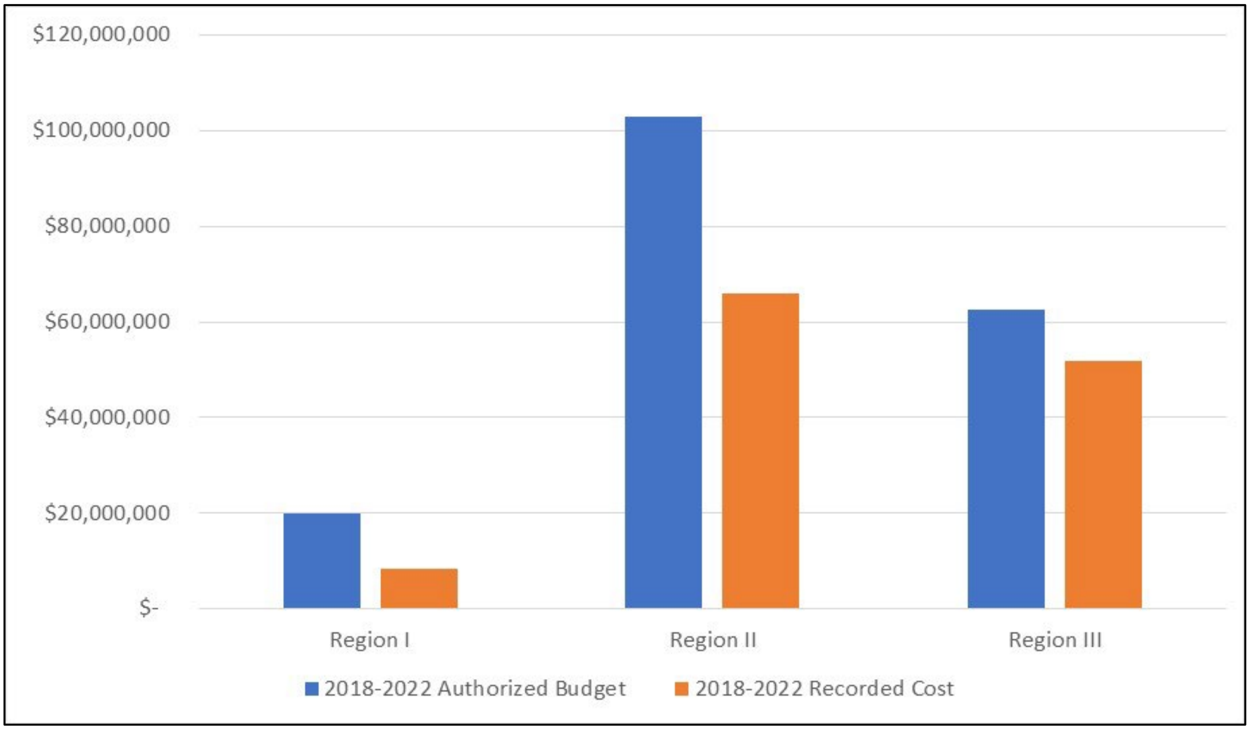
In addition to GSWC's unreasonable proposed cost per foot of pipeline, GSWC's proposed annual pipeline investment budgets are inflated when compared with GSWC's actual 2018-2022 pipeline replacement costs. Using the most recent, available, five-year period (2018-2022) of per-foot pipeline cost per Region is reasonable because it includes pre-COVID and COVID years.[48] For the years 2018-2022, GSWC's Region I completed pipeline replacement cost was 43% of the Commission's total authorized budget, for Region II, 64% of the Commission's total authorized budget, and for Region III, 83% of the Commission's total authorized budget, as shown in Figure 1-3, below.[49,50]

[48] Governor Gavin Newsom declared a State of Emergency on March 4, 2020: https://www.gov.ca.gov/2020/03/04/governor-newsom-declares-state-of-emergency-to-help-state-prepare-for-broader-spread-of-covid-19/.

[49] GSWC provided annual 2013-2022 Proposed Budgets, Authorized Budgets and Recorded Costs for each system included in each Region. The sum of the 2018-2022 Authorized Budgets and Recorded Cost were calculated from the provided data. For the 2018-2022 period, the Region I Authorized Budget was $19,793,300 compared with $8,442,340, or 43%; For Region II, the Authorized Budget was $102,914,300 compared with $65,965,649, or 64%; For Region III, the Authorized Budget was $62,504,185 compared with $51,951,162, or 83%. GSWC's response to Public Advocates Office data request DG-01, Attachment 1., Attachment 1-5.

[50] GSWC states that for years 2021 and 2022, its Proposed Budgets and Authorized Budgets are the same based on the Commission's 2023 Decision, which authorized a total capital program budget. GSWC's response to Public Advocates Office data request DG-01, Attachment 1., Attachment 1-5 and A.20-07-012, Attachment E, pp. 59-60, and D.23-06-024, p.10.

Figure 1-3: Comparison Of GSWC's 2018-2022 Recorded Costs And Authorized Budgets By Region[51]

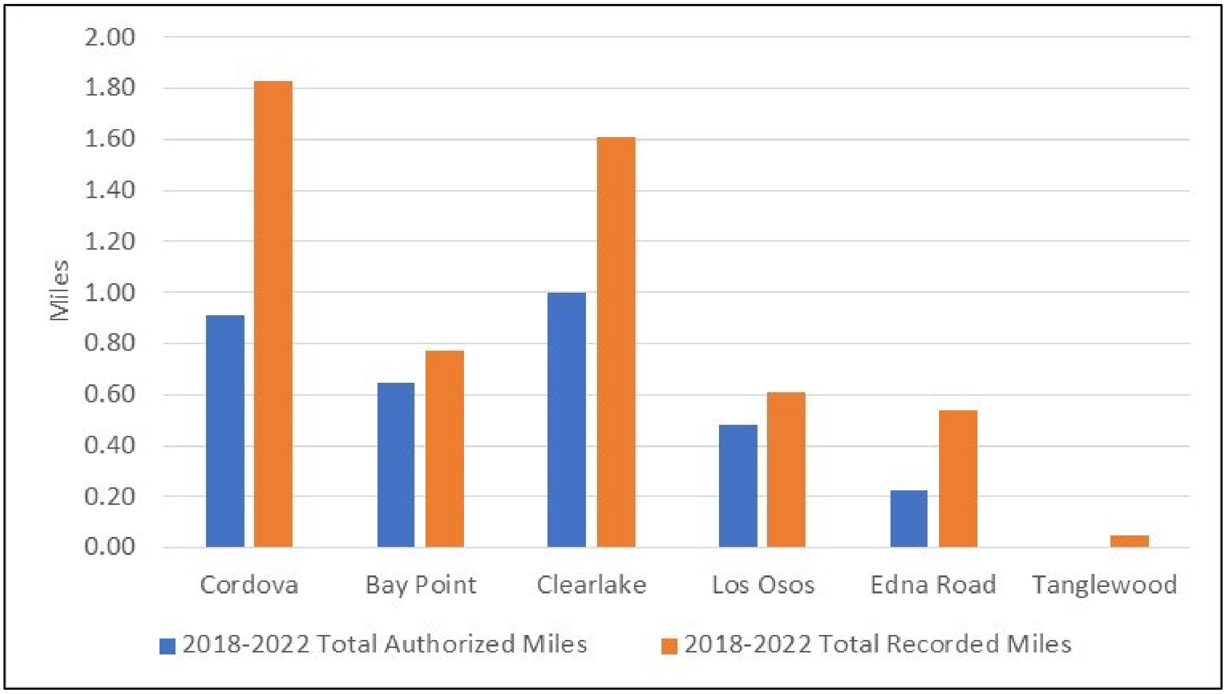


During the same years, 2018-2022, in most cases, GSWC exceeded the Commission's total authorized pipeline replacement miles for the following systems, by Region: a total of 2.14 miles, or 40%, of Region I's Cordova, Bay Point, Clearlake, Los

[51] Region I includes Arden, Cordova, Bay Point, Clearlake, Los Osos, Edna Road, Orcutt, Tanglewood, Sisquoc, Lake Marie, Nipomo, Cypress Ridge, and Simi Valley. GSWC's response to Public Advocates Office data request DG-01., Attachment 1-5.

Osos, Edna Road, and Tanglewood;[52] in Region II, by twenty miles, or 34% and in Region III, 14 miles, or 37%, as shown in Figure 1-4, and Figure 1-5 below.[53, 54]

Figure 1-4: Comparison Of GSWC's Region I Cordova, Bay Point, Clearlake, Los Osos, Edna Road, And Tanglewood 2018-2022 Total Pipeline Miles Recorded And Authorized

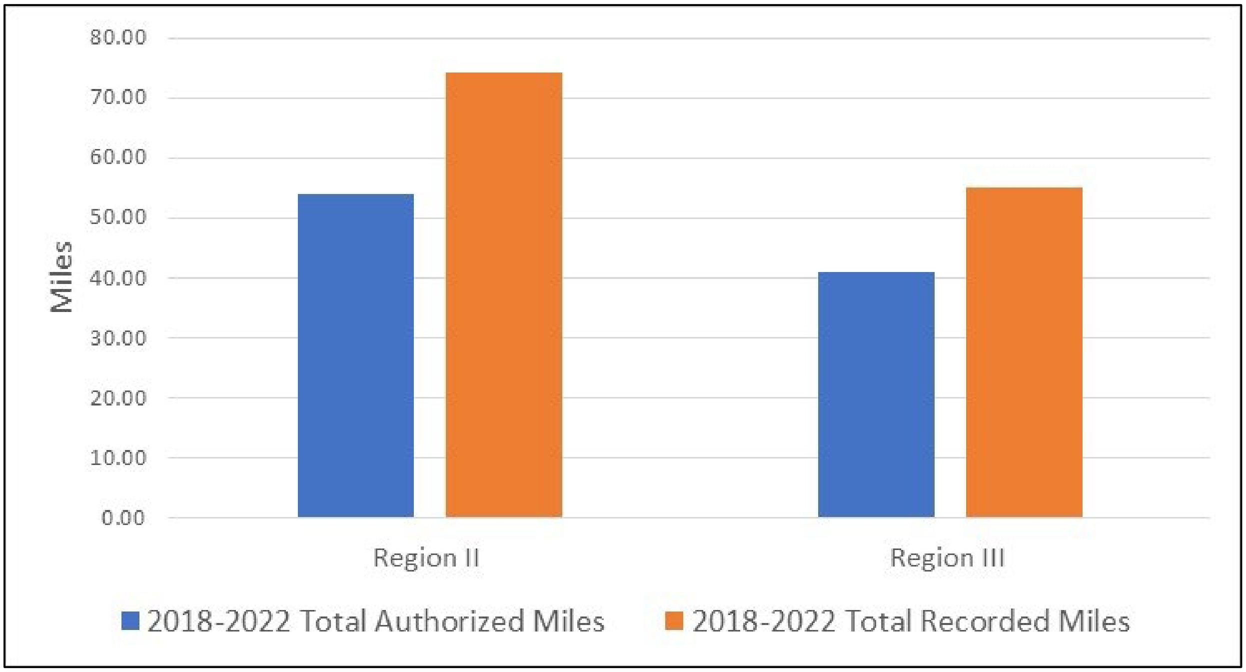


[52] GSWC provided annual 2013-2022 Proposed Pipeline Replacement Miles, Authorized Pipeline Replacement Miles, and Recorded Pipeline Replacement Miles for each system included in each Region. The sum of the 2018-2022 Authorized Pipeline Replacement Miles and Recorded Pipeline Replacement Miles was calculated from the provided data. Region I 2018-2022 total Authorized Pipeline Replacement Miles for Cordova, Bay Point, Clearlake, Los Osos, Edna Road, and Tanglewood was 3.27 compared to 5.41 Recorded Pipeline Replacement Miles. Region I also includes, Arden, Lake Marie, Orcutt, Sisquoc, Nipomo, Cypress Ridge, and Simi Valley. Between 2018 and 2022, the Commission did not authorize pipeline replacement budgets in Nipomo, Sisquoc, and Cyprus Ridge nor did GSWC record pipeline costs for those systems during the same period either. GSWC's response to Public Advocates Office data request DG-01., Attachment 1-5.

[53] GSWC provided annual 2013-2022 Proposed Pipeline Replacement Miles, Authorized Pipeline Replacement Miles, and Recorded Pipeline Replacement Miles for each system included in each Region. For GSWC's Region II: 54 miles of Authorized Pipeline Replacements compared to 74 miles Recorded Pipeline Replacement Miles; and Region III: 41 miles Authorized Pipeline Replacements compared to 55 Recorded Pipeline Replacement Miles. GSWC's response to Public Advocates Office data request DG-01., Attachment 1-5.

[54] GSWC states that for years 2021 and 2022, its Proposed Budgets and Authorized Budgets are the same based on the Commission's 2023 Decision, which authorized a total capital program budget. GSWC's response to Public Advocates Office data request DG-01, Attachment 1, Attachment 1-5, and A.20-07-012, Attachment E, pp. 59-60, and D.23-06-024, p.10.

Figure 1-5: Comparison Of GSWC's Region II and Region III 2018-2022 Total Pipeline Miles Recorded And Authorized[55,56]



As shown in Figure 1-4 and 1-5, GSWC replaced more pipeline miles than the Commission's authorized miles, while at the same time, GSWC's actual costs for the corresponding pipeline replacement miles are less than the Commission's authorized budget. For example, between 2018 and 2022, for Region I's Arden-Cordova ratemaking area, GSWC completed two miles of pipeline projects while spending 57% of the Commission's authorized budget for the same two miles of pipeline;[57] for Region II,

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[55] GSWC provided annual 2013-2022 Proposed Pipeline Replacement Miles, Authorized Pipeline Replacement Miles, and Recorded Pipeline Replacement Miles for each system included in each Region For GSWC's Region II: 54 miles of Authorized Pipeline Replacements compared to 74 miles Recorded Pipeline Replacement Miles; and Region III: 41 miles Authorized Pipeline Replacements compared to 55 Recorded Pipeline Replacement Miles. GSWC's response to Public Advocates Office data request DG-01., Attachment 1-5.

[56] GSWC states that for years 2021 and 2022, its Proposed Budgets and Authorized Budgets are the same based on the Commission's 2023 Decision, which authorized a total capital program budget. GSWC's response to Public Advocates Office data request DG-01, Attachment 1., Attachment 1-5 and A.20-07-012, Attachment E, pp. 59-60, and D.23-06-024, p.10.

[57] GSWC provided annual 2013-2022 Proposed Pipeline Replacement Miles, Authorized Pipeline Replacement Miles, and Recorded Pipeline Replacement Miles for each system included in each Region. GSWC also provided annual 2013-2022 Proposed Budgets, Authorized Budgets and Recorded Costs for each system included in each Region. The sum of the Arden-Cordova system's 2018-2022 Authorized Budgets and Recorded Cost were calculated from the provided data. The sum of the 2018-2022

GSWC completed 74 miles of pipeline projects while spending 64% of the Commission's authorized budget for 54 authorized miles.[58] Therefore, the Commission should adjust GSWC's proposed pipeline replacement budget in all three of its Regions, as described below.

E. GSWC Should Improve Its Methodology For Determination Of Its Proposed Pipeline Projects In Its Next GRC Application To Comply With Commission Authorized Pipeline Replacement Miles And Rates

In addition to the comparison of GSWC's recorded costs and miles replaced to Commission authorized amounts, the following four examples also demonstrate that GSWC should improve its methodology for determining its proposed pipeline projects in its next GRC application. Example 1) GSWC exceeded the Commission authorized

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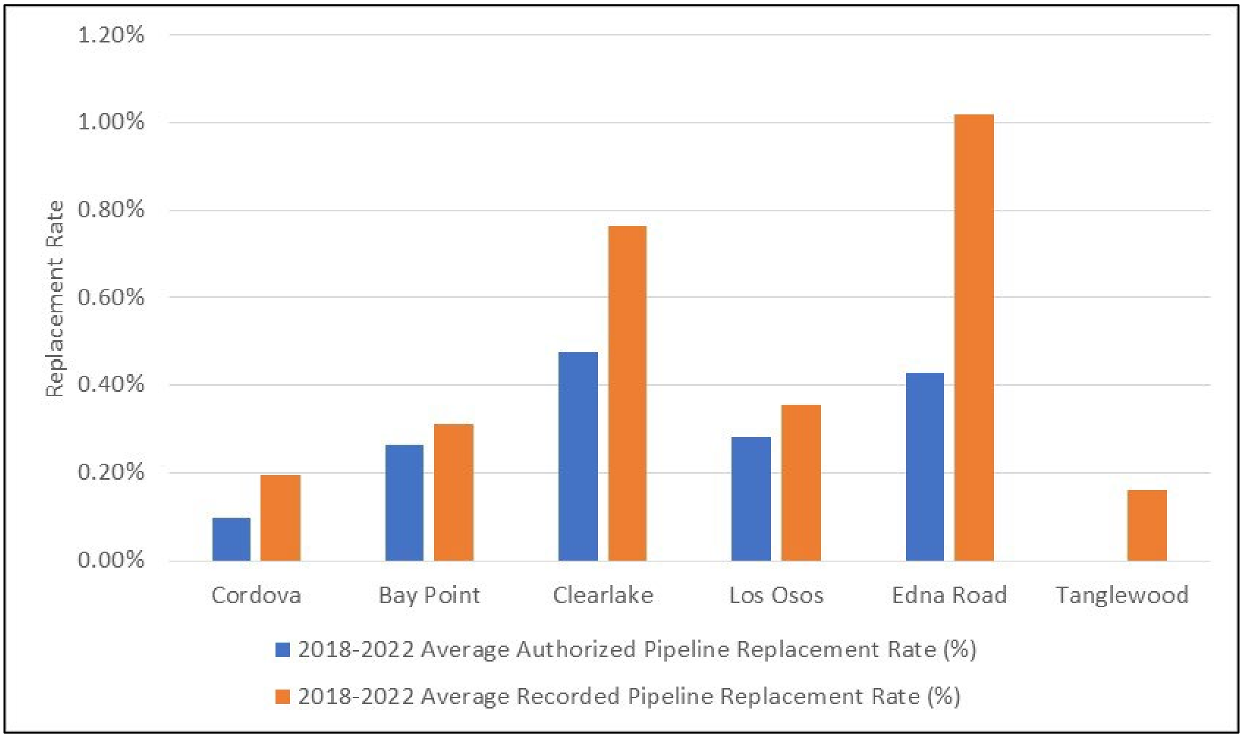
Authorized Pipeline Replacement Miles and Recorded Pipeline Replacement Miles were calculated from the provided data. For the period 2018-2022, for the Arden-Cordova system, GSWC completed 2 miles of pipeline replacements at a recorded cost of $2,825,353 compared with the Commission's Authorized Pipeline Replacement Budget of $4,916,200 for 2.01 miles Authorized Pipeline Replacement Miles. GSWC's response to Public Advocates Office data request DG-01, Attachment 1., Attachment 1-5.

[58] For Region II: GSWC recorded $8,245,706 of pipeline replacement cost between 2018 and 2022 compared with the corresponding $12,864,288 Authorized Pipeline Replacement Budget. GSWC provided annual 2013-2022 Proposed Pipeline Replacement Miles, Authorized Pipeline Replacement Miles, and Recorded Pipeline Replacement Miles for each system included in each Region. GSWC also provided annual 2013-2022 Proposed Budgets, Authorized Budgets and Recorded Costs for each system included in each Region. The sum of the Region II's 2018-2022 Authorized Budgets and Recorded Cost were calculated from the provided data. GSWC's response to Public Advocates Office data request DG-01, Attachment 1., Attachment 1-5.

average 2018-2022 replacement rate for five of its thirteen[59] Region I systems, as shown in Figure 1-6, below:[60, 61]

Figure 1-6: Comparison Of GSWC's Region I 2018-2022 Recorded Average And Authorized Replacement Rates For Six Systems[62]



[59] GSWC provided annual 2013-2022 Authorized Pipeline Replacement Rates and Recorded Pipeline Replacement Rates for each system included in each Region. The 2018-2022 total and average replacement rates were calculated from GSWC's data. The Region I systems in which GSWC exceeded the 2018-2022 average authorized replacement rates include: Cordova (0.20% recorded compared to 0.10% authorized), Bay Point (0.31% recorded compared to 0.26% authorized), Clearlake (0.76% recorded compared to 0.48% authorized), Los Osos (0.36% recorded compared to 0.36% authorized), Edna Road (1.02% recorded compared to 0.43% authorized), and Tanglewood (0.16% compared to 0%). Attachment 1-8: GSWC's response to Public Advocates Office data request DG-08, Attachment 1.

[60] GSWC provided annual 2013-2022 Authorized Pipeline Replacement Rates and Recorded Pipeline Replacement Rates for each system included in each Region. The 2018-2022 total and average replacement rates were calculated from GSWC's data. Region III systems in which GSWC exceeded the 2018-2022 average authorized replacement rate include: Wrightwood, Lucerne Valley, Apple Valley South, South San Gabriel, South Arcadia, San Dimas, and West Orange County. GSWC's response to Public Advocates Office data request DG-08, Attachment 1., Attachment 1-8.

[61] GSWC states that for years 2021 and 2022, its Proposed Budgets and Authorized Budgets are the same based on the Commission's 2023 Decision which authorized a total capital program budget. GSWC's response to Public Advocates Office data request DG-01, Attachment 1, Attachment 1-5, and A.20-07-012, Attachment E, pp. 59-60, and D.23-06-024, p.10

[62] GSWC provided annual 2013-2022 Proposed Budgets, Authorized Budgets and Recorded Costs for each system included in each Region. GSWC also provided annual 2013-2022 Proposed Pipeline

Example 2) Specifically, between 2018 and 2022, for GSWC's Region I Orcutt system, GSWC spent $491,641 and replaced 0.3 miles compared with the Commission authorized amount of $6,577,300 for GSWC's authorized 5.5 miles of pipeline between 2018 and 2022.[63],[64] Example 3) For Region II, GSWC exceeded the Commission's authorized replacement rate in five of its eight[65] systems, or 63%, as shown in Figure 1-7; below.[66]

Replacement Miles and Rates, Authorized Pipeline Replacement Miles and Rates, and Recorded Pipeline Replacement Miles and Rates for each system included in each Region. The 2018-2022 Authorized Budgets and Recorded Costs, and Average Authorized and Recorded Pipeline Replacement Rate were calculated from the provided data. GSWC's 2018-2022 Annual Recorded Pipeline Replacement Cost exceeded its Authorized Pipeline Replacement Budget for each of the systems shown in Figure 1-6. Region I includes Arden, Cordova, Bay Point, Clearlake, Los Osos, Edna Road, Orcutt, Tanglewood, Sisquoc, Lake Marie, Nipomo, Cypress Ridge, and Simi Valley. GSWC's response to Public Advocates Office data request DG-01., Attachment 1-5. The 2024-2026 cost/foot is calculated from GSWC's A.23-08-010 Pipeline Management Program, Vol. 2 Testimony, Attachment H, pp. 66-67 and 74-75.

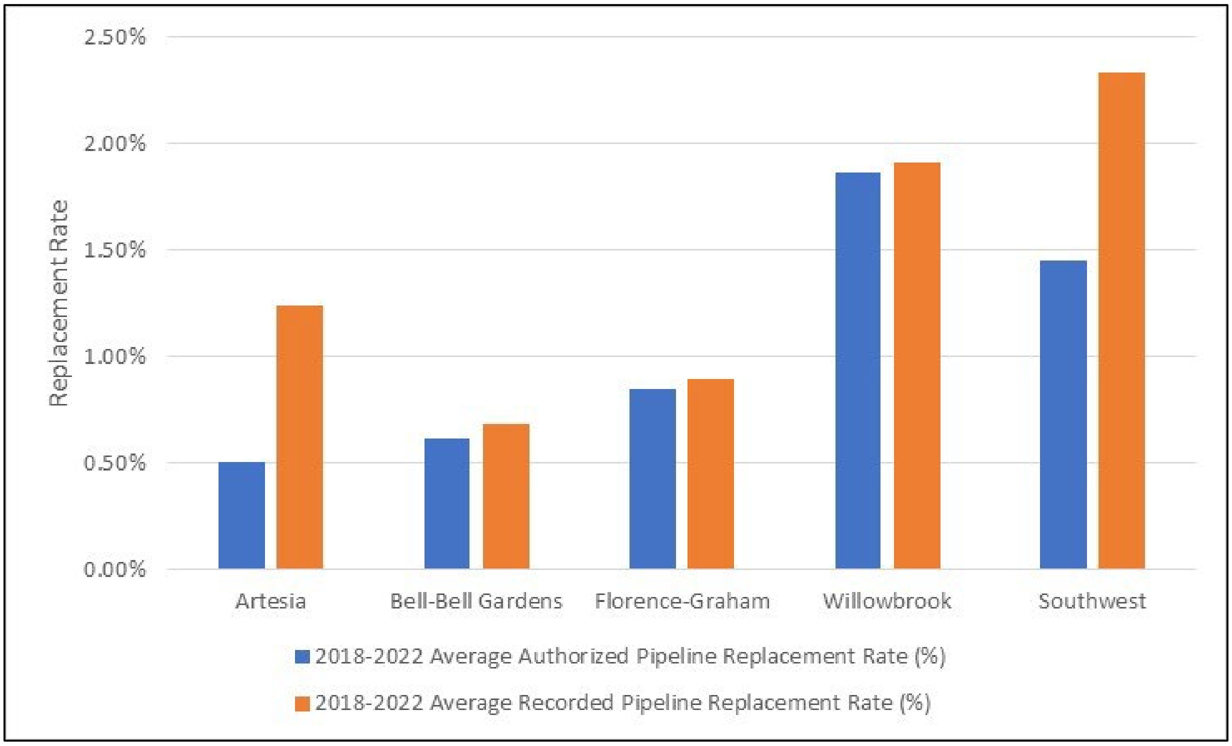
[63] GSWC provided annual 2013-2022 Proposed Budgets, Authorized Budgets and Recorded Costs for each system included in each Region. GSWC also provided annual 2013-2022 Proposed Pipeline Replacement Miles and Rates, Authorized Pipeline Replacement Miles and Rates, and Recorded Pipeline Replacement Miles and Rates for each system included in each Region. The 2018-2022 total Orcutt Authorized and Recorded Pipeline Replacement Cost and Authorized and Recorded Replacement Miles was calculated from GSWC's data. Between 2018 and 2020, the Commission authorized a total of $1,673,900 and GSWC spent $20,915. GSWC's response to Public Advocates Office data request DG-01, Attachment 1., Attachment 1-5.

[64] GSWC states that for years 2021 and 2022, its Proposed Budgets and Authorized Budgets are the same based on the Commission's 2023 Decision, which authorized a total capital program budget. GSWC's response to Public Advocates Office data request DG-01, Attachment 1, Attachment 1-5, and A.20-07-012, Attachment E, pp. 59-60, and D.23-06-024, p.10.

[65] GSWC provided annual 2013-2022 Authorized Pipeline Replacement Rates and Recorded Pipeline Replacement Rates for each system included in each Region. The 2018-2022 total and average replacement rates were calculated from GSWC's data. Region II ratemaking areas in which GSWC exceeded the 2018-2022 average authorized replacement rate include: Southwest (2.33% recorded compared to 1.45% authorized), Willowbrook (1.91% recorded compared to 1.86% authorized), Florence-Graham (0.89% recorded compared to 0.85% authorized), Bell-Bell Gardens (0.68% recorded compared to 0.61% authorized), and Artesia (1.24% recorded compared to 0.51% authorized). GSWC's response to Public Advocates Office data request DG-08, Attachment 1., Attachment 1-8.

[66] GSWC provided annual 2013-2022 Authorized Pipeline Replacement Rates and Recorded Pipeline Replacement Rates for each system included in each Region. The 2018-2022 total and average replacement rates were calculated from GSWC's data. Region III ratemaking areas in which GSWC exceeded the 2018-2022 average authorized replacement rate include: Wrightwood (4.31% recorded compared to 0% authorized), Lucerne Valley (4.33% recorded compared to 1.95% authorized), Apple Valley South (3.05% recorded compared to 1.98% authorized), South San Gabriel (2.09% recorded compared to 0.53%), South Arcadia (3.04% recorded compared to 2.58% authorized), San Dimas (0.45% recorded compared to 0.30% authorized), and West Orange County (0.40% recorded compared to 0.31% authorized). GSWC's response to Public Advocates Office data request DG-08, Attachment 1., Attachment 1-8.

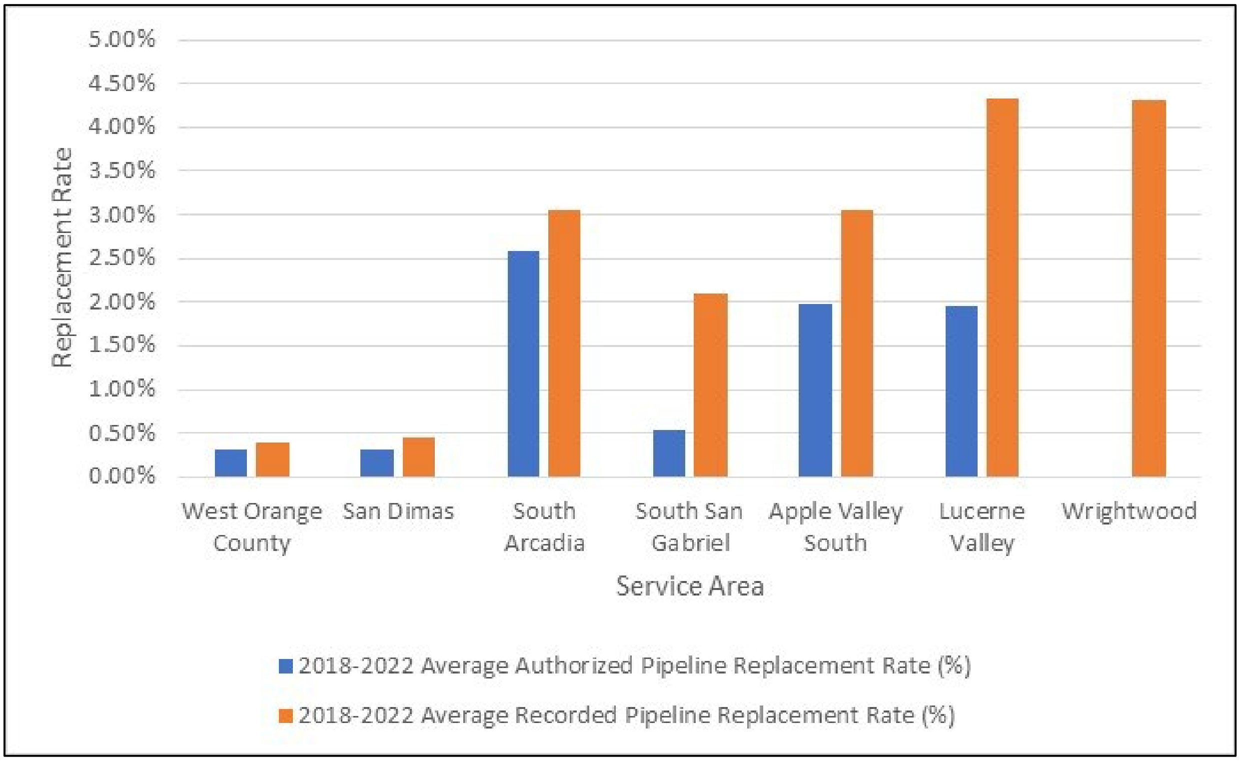
Figure 1-7: Comparison Of GSWC's Region II 2018-2022 Recorded Average And Authorized Replacement Rates For Five Systems



Example 4) GSWC exceeded the Commission's authorized replacement rate in seven of its sixteen Region III, systems, or 44%, as shown in the Figure 1-8, below.[67]

[67] GSWC provided annual 2013-2022 Authorized Pipeline Replacement Rates and Recorded Pipeline Replacement Rates for each system included in each Region. The 2018-2022 total and average replacement rates were calculated from GSWC's data. Region III ratemaking areas in which GSWC exceeded the 2018-2022 average authorized replacement rate include: Wrightwood, Lucerne Valley, Apple Valley South, South San Gabriel, South Arcadia, San Dimas, and West Orange County. GSWC's response to Public Advocates Office data request DG-08, Attachment 1., Attachment 1-8.

Figure 1-8: Comparison Of GSWC's Region III 2018-2022 Recorded Average And Authorized Replacement Rates For Seven Systems



GSWC's should improve its methodology to determine proposed pipeline replacement projects in its next GRC to comply with the Commission's authorized pipeline miles and budget.

F. Results of GSWC's 2021 American Water Works Association Water Audit Are Inconsistent With Its 2024-2026 Pipeline Replacement Rates

GSWC's proposed pipeline replacement rates are inconsistent with the results of its 2021 American Water Works Association (AWWA) Water Audits provided by GSWC in its application.[68] The AWWA Water Audit's results are used by the industry to "guide a program for cost-effective water loss control and revenue recovery."[69] A metric provided in the AWWA Water Audit is the Infrastructure Leakage Score (ILI).[70] The ILI provides a "highly effective" performance indicator for benchmarking a utility's

[68] GSWC's MDR II.E.03.
[69] https://www.awwa.org/Resources-Tools/Resource-Topics/Water-Loss-Control.
[70] AWWA Free Water Audit Software v5.0 Definitions p. 33.

performance in management of real water losses. Each ILI Score range includes specific financial, operational, and water resources considerations, as described in Figure 1-9. The 2021 average ILI score for GSWC's Regions are: Region I[71]: 3.83; Region II[72]: 1.08, and Region III[73]: 1.43, as shown in Table 1-3. These scores place GSWC's infrastructure in leakage control for Region II and Region III at a high level, indicating a healthy system.[74] An ILI of 3.0 to 5.0 is appropriate when water resources are enough to meet water needs. Figure 1-9 Target ILI Ranges, shows the definitions and criteria for the ILI scores shown in Table 1-3, below.

[71] The Region I average ILI score was calculated from GSWC's data in MDR II.E.03. The Region I average ILI score calculation includes Cordova, Bay Point, Clearlake, Los Osos, Orcutt, and Simi Valley.
[72] The Region II average ILI score was calculated from GSWC's data MDR II.E.03. The average ILI score includes Artesia, Norwalk, Bell-Bell Gardens, Florence-Graham, Culver City, and Southwest.
[73] The Region III average ILI score was calculated from GSWC's data MDR II.E.03. The average ILI score includes West Orange County, Cowan Heights, Placentia-Yorba Linda, Claremont, San Dimas, South Arcadia, South San Gabriel, Barstow, Apple Valley South, and Wrightwood.
[74] GSWC's Region I exceptions are: Clearlake with an ILI of 6.9 and Cordova with an ILI of 10.4. *See* GSWC's 2021 AWWA Water Audits for Clearlake and Cordova.

Table 1-3: GSWC's 2021 ILI SCORES[75,76]

Region	2021 Average ILI
Region I[77]	3.83
Region II[78]	1.08
Region III[79]	1.43

Figure 1-9 Target ILI Ranges[80]

General Guidelines for Setting a Target ILI (without doing a full economic analysis of leakage control options)			
Target ILI Range	**Financial Considerations**	**Operational Considerations**	**Water Resources Considerations**
1.0 - 3.0	Water resources are costly to develop or purchase; ability to increase revenues via water rates is greatly limited because of regulation or low ratepayer affordability.	Operating with system leakage above this level would require expansion of existing infrastructure and/or additional water resources to meet the demand.	Available resources are greatly limited and are very difficult and/or environmentally unsound to develop.
>3.0 -5.0	Water resources can be developed or purchased at reasonable expense; periodic water rate increases can be feasibly imposed and are tolerated by the customer population.	Existing water supply infrastructure capability is sufficient to meet long-term demand as long as reasonable leakage management controls are in place.	Water resources are believed to be sufficient to meet long-term needs, but demand management interventions (leakage management, water conservation) are included in the long-term
>5.0 - 8.0	Cost to purchase or obtain/treat water is low, as are rates charged to customers.	Superior reliability, capacity and integrity of the water supply infrastructure make it relatively immune to supply shortages.	Water resources are plentiful, reliable, and easily extracted.
Greater than 8.0	Although operational and financial considerations may allow a long-term ILI greater than 8.0, such a level of leakage is not an effective utilization of water as a resource. Setting a target level greater than 8.0 - other than as an incremental goal to a smaller long-term target - is discouraged.		
Less than 1.0	If the calculated Infrastructure Leakage Index (ILI) value for your system is 1.0 or less, two possibilities exist. a) you are maintaining your leakage at low levels in a class with the top worldwide performers in leakage control. b) A portion of your data may be flawed, causing your losses to be greatly understated. This is likely if you calculate a low ILI value but do not employ extensive leakage control practices in your operations. In such cases it is beneficial to validate the data by performing field measurements to confirm the accuracy of production and customer meters, or to identify any other potential sources of error in the data.		

GSWC's 2024-2026 pipeline projects are inconsistent with its ILI scores and non-revenue water as a percentage of water supplied. For example, Region I's weighted average ILI score of 3.8 is high because it includes the Cordova system with an ILI score of 10.4 and the Clearlake system with an ILI score of 6.9. Both Cordova and Clearlake

[75] GSWC's MDR II.E.03.
[76] Note: ILI does not apply to small systems with less than 32 service connections/mile of pipeline.
[77] The Region I average ILI score calculation includes Cordova, Bay Point, Clearlake, Los Osos, Orcutt, and Simi Valley.
[78] The Region II average ILI score calculation includes Artesia, Norwalk, Bell-Bell Gardens, Florence-Graham, Culver City, and Southwest.
[79] The Region III average ILI score includes West Orange County, Cowan Heights, Placentia-Yorba Linda, Claremont, San Dimas, South Arcadia, South San Gabriel, Barstow, Apple Valley South, and Wrightwood.
[80] AWWA Free Water Audit Software v5.0, Loss Control Planning p. 38.

have high non-revenue water as a percentage of water supplied, 18.3% and 55.6%,[81] respectively. In this GRC, GSWC includes 0.7%[82] of Cordova's total pipelines and 1.7%[83] of Clearlake's total pipelines for replacement. Both replacement rates are lower than GSWC's Simi Valley pipelines replacement rate of 2.4%.[84] Simi Valley also has a non-revenue water as a percentage of water supplied of 3.8%,[85] as shown in Figure 1-10 below.

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[81] GSWC's Clearlake system 2021 Annual Cost of Real Losses is $128,772. GSWC's Clearlake AWWA Water Audit 2021.

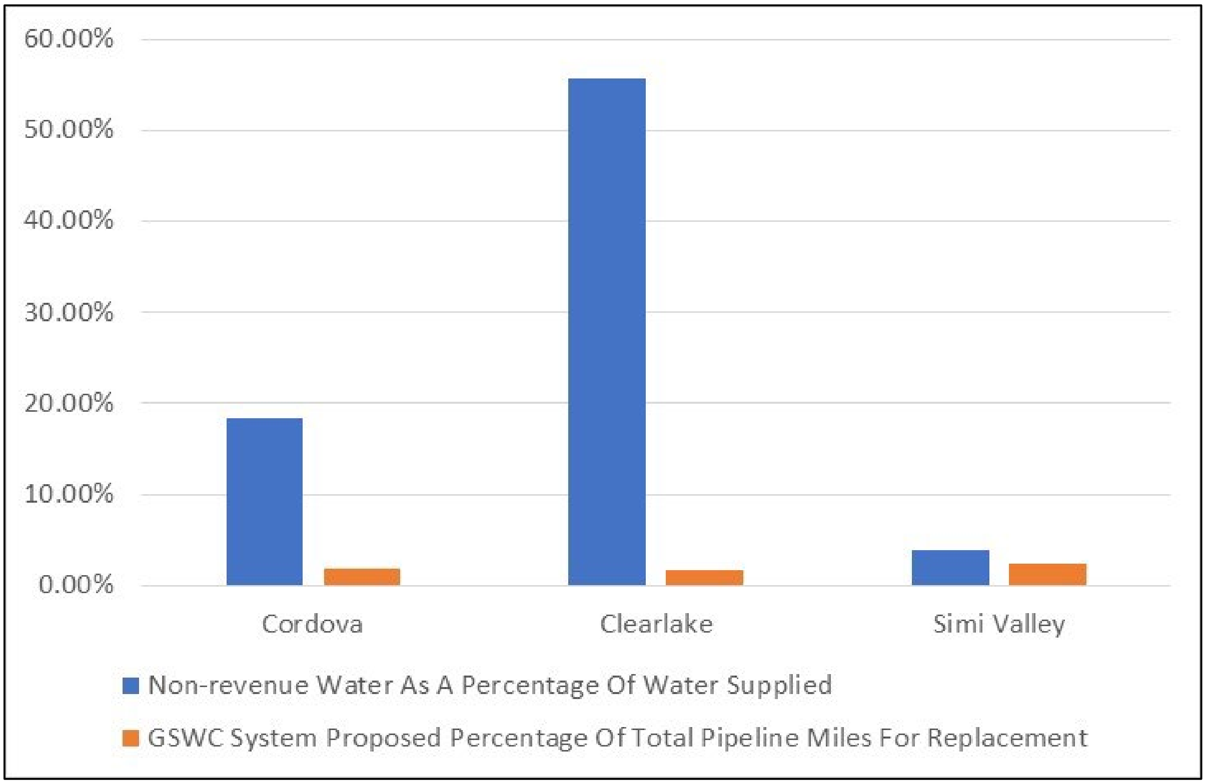
[82] The Cordova system has 186.9 pipeline miles and GSWC proposes to replace 1.33 miles, or 0.71%. A.23-08-010 Volume 2 testimony, Attachment H, p. 67-68; and GSWC's response to Public Advocates Office data request DG-08, Attachment 1., Attachment 1-8.

[83] The Clearlake system has 42.1 pipeline miles and GSWC proposes to replace 0.74 miles, or 1.7%. A.23-08-010 Volume 2 testimony, Attachment H, p. 67-68; and GSWC's response to Public Advocates Office data request DG-08, Attachment 1., Attachment 1-8.

[84] The Simi Valley system has 138.8 pipeline miles and GSWC' 2024-2026 total pipeline replacement equals 3.37 miles, or 2.4%. A.23-08-010 Volume 2 testimony, Attachment H, p. 67-68; and GSWC's response to Public Advocates Office data request DG-08, Attachment 1., Attachment 1-8.

[85] *See* GSWC's 2021 AWWA Water Audits for Simi Valley, tab Performance Indicators.

Figure 1-10: Comparison Of GSWC's Cordova, Clearlake, and Simi Valley Proposed Pipeline Replacement Rates And AWWA Water Audit Non-Revenue Water As A Percentage Of Water Supplied



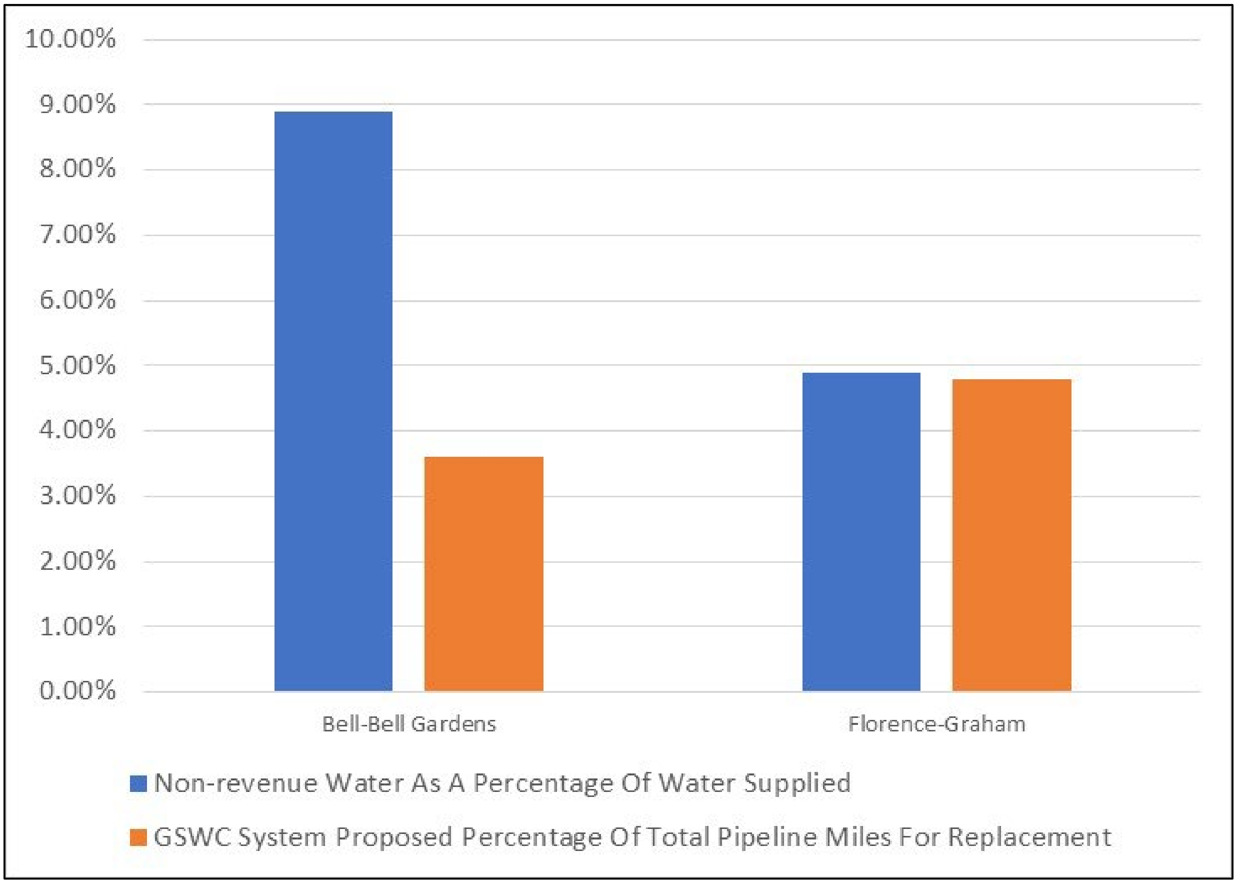
Although Clearlake's non-revenue water as a percentage of water supplied of 55.6% is greater than Simi Valley's at 3.8%, GSWC's GRC application includes 1.7% of Clearlake's total pipeline miles for replacement compared to Simi Valley's 2.4%. For Region II, GSWC's GRC application includes 2.9%[86] of Bell-Bell Gardens' total pipelines for replacement and 4%[87] of Florence-Graham's pipelines for replacement. However, Florence-Graham has both a lower ILI score and non-revenue water as a percentage of water supplied than Bell-Bell Gardens, (0.89 ILI and 4.9% non-revenue

[86] The Bell-Bell Gardens system has 66.2 pipeline miles and GSWC' 2024-2026 total pipeline replacement equals 1.93 miles, or 2.9%. A.23-08-010 Volume 2 testimony, Attachment H, p. 67-68; and GSWC's response to Public Advocates Office data request DG-08., Attachment 1-8.

[87] The Florence-Graham system has 85.8 pipeline miles and GSWC' 2024-2026 total pipeline replacement equals 3.47 miles, or 4%. A.23-08-010 Volume 2 testimony, Attachment H, p. 67-68; and GSWC's response to Public Advocates Office data request DG-08., Attachment 1-8.

water ratio compared to 2.76 ILI and 8.9% non-revenue water ratio),[88] for which the ratios are shown in Figure 1-11.

Figure 1-11: Comparison Of GSWC's Bell-Bell Gardens and Florence Graham Proposed Pipeline Replacement And AWWA Water Audit Non-Revenue Water As A Percentage Of Water Supplied



Although Bell-Bell Gardens non-revenue water as a percentage of water supplied is greater than Florence-Graham's percentage, GSWC's GRC application includes 2.9% of Bell-Bell Gardens total pipeline miles for replacement compared to Florence-Graham's 4%.

Therefore, the Commission should adjust GSWC's proposed pipeline budget in all three of its Regions to account for 1) The lack of a condition-based pipeline assessment to determine GSWC's pipeline replacement rate, 2) GSWC's incomplete investigation of

[88] *See* GSWC's 2021 AWWA Water Audits for Florence-Graham and Bell-Bell Gardens, tab Performance Indicators.

software applications that account for a pipeline's condition,[89] 3) GSWC's 2024-2026 inflated cost per foot amounts compared to its 2018-2022 average recorded replacement cost per foot by Region, 4) GSWC's proposed inflated annual pipeline investment budgets when compared to its 2018-2022 completed pipeline miles and recorded costs, 5) for the years 2018-2022, GSWC's completed pipeline replacement miles and rates that do not comply with the Commission authorized pipeline replacement miles and rates, and 6) GSWC's proposed pipeline replacement rates are inconsistent with the results of its 2021 AWWA water audits.

The recommended pipeline budgets should be calculated according to the method below.

G. Example of Recommended Annual Pipeline Budget Calculation

For each Region, GSWC's forecasted 2025[90] budgets, should be calculated as follows using GSWC's 2018-2022 actual pipeline replacement costs. Using the most recent, available, five-year period (2018-2022) of pipeline replacement data is reasonable because it includes pre-COVID and COVID years.[91] Region I:[92] for the years 2018-2022, GSWC spent, on average, 43% of the Commission's authorized pipeline replacements budget; Region II:[93] for the years 2018-2022, GSWC spent, on average, 64% of the Commission's authorized pipeline replacements budget; and Region III: [94] for the years

[89] D.23-06-024, Settlement Agreement, p. 18.
[90] The recommended 2024 and 2026 budget calculations are included in Attachment 1-4.
[91] Governor Gavin Newsom declared a State of Emergency on March 4, 2020: https://www.gov.ca.gov/2020/03/04/governor-newsom-declares-state-of-emergency-to-help-state-prepare-for-broader-spread-of-covid-19/.
[92] Region I includes Arden, Cordova, Bay Point, Clearlake, Robbins, Los Osos, Edna Road, Orcutt, Tanglewood, Sisquoc, Lake Marie, Nipomo, Cypress Ridge, and Simi Valley. See GSWC's A.23-08-010 Vol.2. testimony, Attachment H, pp.74-75.
[93] Region II includes Artesia, Norwalk, Bell-Bell Gardens, Florence-Graham, Hollydale, Willowbrook, Culver City, and Southwest. See GSWC's A.23-08-010 Vol.2. testimony, Attachment H, pp.74-75.
[94] Region III includes West Orange County, Cowan Heights, Placentia-Yorba Linda, Claremont, San Dimas, South Arcadia, South San Gabriel, Barstow, Calipatria-Niland, Morongo Del Norte, Morongo Del Sur, Apple Valley South, Desert View, Apple Valley North, Lucerne Valley, and Wrightwood. See GSWC's A.23-08-010 Vol.2. testimony, Attachment H, pp.74-75.

2018-2022, GSWC spent, on average, 83% of the Commission's 2018-2022 authorized pipeline replacements budget.[95]

Applying both the 2018-2022 average cost per foot and the average percentage GSWC spent of the Commission authorized budgets to GSWC's proposed budgets results in the following recommended budgets:[96]

Step 1: Calculate the total proposed 2025 budget using the 2018-2022 Average Cost/Foot of Pipeline for each Region and an assumed 3% annual escalation:

Table 1-4: Recommended Total 2025 Proposed Pipeline Budget Using 2018-2022 Average Cost Per Foot, By Region[97,98]

Region	Recommended 2018-2022 Average Cost/Foot of Pipeline	3-Year Escalation (2022-2025)	Escalated Cost/Foot to 2025 dollars (multiply Cost/Foot of Pipeline by 1.0927)	GSWC 2025 Proposed Pipeline Feet By Region	Recommended Total 2025 Proposed Pipeline Budget With 2018-2022 Average Cost/Foot (multiply escalated Cost/Foot by feet)
	(A)	(B)	(C)	(D)	(E)
			[A x (1+B)]		[C x D]
Region I	$259	9.27%	$283	8,342	$2,360,864
Region II	$174	9.27%	$190	45,038	$8,563,066
Region III	$178	9.27%	$195	42,028	$8,174,471

95 GSWC states that for years 2021 and 2022, its Proposed Budgets and Authorized Budgets are the same based on the Commission's 2023 Decision, which authorized a total capital program budget. GSWC's response to Public Advocates Office data request DG-01, Attachment 1, Attachment 1-5, and A.20-07-012, Attachment E, pp. 59-60, and D.23-06-024, p.10.

96 Includes an assumed annual 3% escalation rate between 2022 and 2025.

97 *See* Attachment 1-4 for calculation of the Recommended 2018-2022 Average Cost/Foot of Pipeline by Region.

98 GSWC's proposed 2025 pipeline miles by Region is included A.23-08-010 Volume 2 Testimony, Attachment H, pp.66-67. The miles to feet conversions are not included in GSWC's testimony.

<u>Step 2</u>: Calculate the 2018-2022 average percentage GSWC spent on pipeline replacement cost of the Commission's total authorized 2018-2022 budget for each Region:

<u>Table 1-5: 2018-2022 Recorded Pipeline Replacement Cost As A Percentage Of The Commission's Authorized Budgets</u>[99]

Region	2018-2022 Average Authorized Pipeline Replacement Budget	2018-2022 Average Recorded Pipeline Replacement Cost	2018-2022 Average Recorded Pipeline Replacement Cost/2018-2022 Average Authorized Pipeline Replacement Budget
	(A)	(B)	(C)
			[B/A]
Region I	$1,522,562	$649,411	43%
Region II	$12,864,288	$8,245,706	64%
Region III	$3,906,512	$3,246,948	83%

<u>Step 3</u>: Calculate the 2025 recommended budget using the 2018-2022 recorded pipeline replacement cost as a percentage of the Commission's authorized 2018-2022 budgets for each Region:

[99] GSWC's 2018-2022 annual authorized budgets and costs by Region are included in GSWC's response to Public Advocates Office data request DG-01. The 2018-2022 average authorized pipeline replacement budget, by Region and 2018-2022 average recorded pipeline replacement cost, by Region, was calculated from GSWC's data provided in its response to Public Advocates Office data request DG-01. *See* Attachment 1-4 for calculations of the Recommended 2018-2022 Average Cost/Foot of Pipeline by Region and the 2018-2022 average authorized pipeline replacement budget and 2018-2022 average recorded pipeline replacement cost.

Table 1-6: The Recommended Test Year 2025 Pipeline Budget

Region	Recommended 2025 Revised Proposed Pipeline Budget (from Step 1)	2018-2022 Average Recorded Pipeline Replacement Cost/2018-2022 Average Authorized Pipeline Replacement Budget	Recommended Test Year 2025 Pipeline Budget
	(A)	(B)	(C)
			[AxB]
Region I	$2,360,864	43%	$1,015,171
Region II	$8,563,066	64%	$5,480,362
Region III	$8,174,471	83%	$6,784,811

Therefore, the Commission should authorize pipeline replacement budget for Test Year 2025 as follows: $1,015,171 for Region I, $5,480,362 for Region II, and $6,784,811 for Region III.[100]

IV. CONCLUSION

The Commission should authorize the following GSWC annual recommended pipeline budgets, by Region:

[100] *See* Attachment 1-4 for the calculations of the recommended 2024 and 2026 annual pipeline budgets.

Table 1-7: Recommended 2024-2026 Pipeline Budgets Compared With GSWC Proposed Pipeline Budgets, By Region[101,102,103]

Region	Recommended 2024 Budget[104]	GSWC Proposed[105] 2024 Budget	Recommended 2025 Budget[106]	GSWC Proposed[107] 2025 Budget	Recommended 2026 Budget[108]	GSWC Proposed 2026[109] Budget
Region I	$929,593	$5,382,400	$1,015,171	$5,996,400	$3,838,625	$23,411,400
Region II	$4,522,895	$18,991,700	$5,480,362	$22,963,600	$7,524,402	$26,587,200
Region III	$5,214,203	$18,170,100	$6,784,811	$19,813,400	$5,255,981	$14,714,100
Total	$10,666,691	$42,544,200	$13,280,344	$48,773,400	$16,622,008	$64,712,700

The Commission should adjust GSWC's proposed pipeline budget in all three of its Regions to account for the following six reasons:

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[101] Region I includes Arden, Cordova, Bay Point, Clearlake, Robbins, Los Osos, Edna Road, Orcutt, Tanglewood, Sisquoc, Lake Marie, Nipomo, Cypress Ridge, and Simi Valley. *See* GSWC's A.23-08-010 Vol.2. testimony, Attachment H, pp.74-75.

[102] Region II includes Artesia, Norwalk, Bell-Bell Gardens, Florence-Graham, Hollydale, Willowbrook, Culver City, and Southwest. *See* GSWC's A.23-08-010 Vol.2. testimony, Attachment H, pp.74-75.

[103] Region III includes West Orange County, Cowan Heights, Placentia-Yorba Linda, Claremont, San Dimas, South Arcadia, South San Gabriel, Barstow, Calipatria-Niland, Morongo Del Norte, Morongo Del Sur, Apple Valley South, Desert View, Apple Valley North, Lucerne Valley, and Wrightwood. *See* GSWC's A.23-08-010 Vol.2. testimony, Attachment H, pp.74-75.

[104] The recommended 2024 budgets represent an 83% reduction of GSWC's Region I proposed budget, 76% reduction to GSWC's Region II proposed budget, and a 71% reduction to GSWC's Region III proposed pipeline replacement budget. For the Recommended 2024 Budget Calculation, see Attachment 1-4. For GSWC's Proposed Budgets, see GSWC's A.23-08-010 Vol.2. testimony, Attachment H, pp.74-75. *See also* Public Advocates Report and Recommendations on Capital Project Cost Estimates and Cost Adders and Region III Capital Projects Forecast and Early Retirements.

[105] A.23-08-010 Testimony Volume 2, Attachment H. at 74-75.

[106] The recommended 2025 budgets, represent an 83% reduction to GSWC's Region I proposed pipeline budget, 76% reduction to GSWC's Region II proposed pipeline budget, and a 66% reduction to GSWC's Region III proposed pipeline replacement budget. For the Recommended 2024 Budget Calculation, see Attachment 1-4. For GSWC's Proposed Budgets, see GSWC's A.23-08-010 Vol.2. testimony, Attachment H, pp.74-75. Also *see* Public Advocates Report and Recommendations on Capital Project Cost Estimates and Cost Adders and Region III Capital Projects Forecast and Early Retirements.

[107] A.23-08-010 Testimony Volume 2, Attachment H. at 74-75.

[108] The recommended 2026 budgets, represent an 84% reduction to GSWC's Region I proposed pipeline budget, 72% reduction to GSWC's Region II proposed pipeline budget, and a 64% reduction to GSWC's Region III proposed pipeline replacement budget. For the Recommended 2024 Budget Calculation, see Attachment 1-4. For GSWC's Proposed Budgets, see GSWC's A.23-08-010 Vol.2. testimony, Attachment H, pp.74-75. Also *see* Public Advocates Report and Recommendations on Capital Project Cost Estimates and Cost Adders and Region III Capital Projects Forecast and Early Retirements.

[109] A.23-08-010 Testimony Volume 2, Attachment H. at 74-75.

1) The lack of a condition-based pipeline assessment to determine GSWC's annual pipeline replacement rate. GSWC's reliance on an age-based approach to determine its annual pipeline replacement rate likely results in unnecessary pipeline investments and causes an undue burden on ratepayers.

2) GSWC has not completed its investigation of software applications that account for a pipeline's condition. As part of its settlement with Cal Advocates during its 2020 General Rate Case (GRC), GSWC agreed to investigate software applications that account for pipe condition.[110]

3) GSWC's 2024-2026 inflated cost per foot amounts compared with its 2018-2022 average recorded replacement cost per foot by Region.

4) GSWC's proposed inflated annual pipeline investment budgets when compared to its 2018-2022 completed pipeline miles and recorded costs.

5) For the years 2018-2022, GSWC's completed pipeline replacement miles and rates do not comply with the Commission authorized pipeline replacement miles and rates.

6) GSWC's proposed pipeline replacement rates are inconsistent with the results of its 2021 AWWA water audits.

The Commission should adjust GSWC's annual proposed pipeline replacement budgets in all three of its Regions as follows: 1) the budgets should be consistent with the actual five-year average (2018-2022) recorded per-foot pipeline costs per Region. GSWC's requested pipeline budgets are unreasonable because the budgets include pipeline cost per foot which are 156% to 219% greater than its 2018-2022 recorded average cost per foot of pipeline; and 2) the recommended annual budgets should be based on GSWC's five-year (2018-2022) percentage of actual costs for completed pipeline projects compared to the Commission's authorized budgets. For the years 2018-2022, GSWC spent, on average, for completed pipeline replacement projects, 43% of

[110] D.23-06-024, Settlement Agreement, p. 18.

Region I's, 64% of Region II's, and 83% of Region III's corresponding authorized pipeline replacements budgets. [111]

Prior to receiving full funding of its proposed budget in subsequent General Rate Cases (GRC), GSWC should produce its next GRC's pipeline replacement budget using software application tools that account for a pipeline's condition.

[111] GSWC states that for years 2021 and 2022, its Proposed Budgets and Authorized Budgets are the same based on the Commission's 2023 Decision, which authorized a total capital program budget. GSWC's response to Public Advocates Office data request DG-01, Attachment 1, Attachment 1-5, A.20-07-012, Attachment E, pp. 59-60, and D.23-06-024, p.10.

CHAPTER 2 EXTRAORDINARY PIPELINE RETIREMENTS

I. INTRODUCTION

Ratepayers should not be responsible for assets that were retired significantly earlier than their reasonably estimated useful life. Early retirement of assets creates a disadvantage for ratepayers as the entire cost of the asset is removed (by crediting) from the Utility Plant In Service (UPIS) account. However, rather than removing (by debiting) the actual accumulated depreciated amount of the assets from depreciation reserve account, an amount equal to the full cost of the retired asset is removed. Therefore, the extra accumulated depreciation amount above and beyond the actual accumulated depreciation amount unduly increases the rate base. In a competitive market such early retirements create capital loss as only the actual accumulated depreciation amount is removed from the depreciation reserve account. Allowing GSWC to profit from extraordinary retirements is inconsistent with the Commission's role as a replacement for competition. During this GRC, GSWC's retired pipelines were reviewed to determine if the retirement was extraordinary and justified.[112]

II. SUMMARY OF RECOMMENDATIONS

For each pipeline retired early without justification the Commission should reduce GSWC's rate base by increasing the depreciation reserve (by crediting), for each ratemaking area, to account for the cost of extraordinary early retirements. During this GRC, GSWC's retired pipelines were reviewed. However, due to limited information provided by GSWC, the review was limited to a small sample of 71 pipeline segments out of 678 initially marked for sampling purposes. At this time, there are no significant issues related to early retirements of GSWC's pipelines, however, a review of GSWC's pipeline retirements will continue in future GRCs.

[112] GSWC's response to Public Advocates Office data request DG-09, Q.1., Attachment 1., Attachment 2-1

III. ANALYSIS

A. Pipeline Early Retirement Review

GSWC provided a list of 6,034 pipelines retired between 2017 and 2023.[113] However, for 1,292 of the pipelines, GSWC stated that it did not have a record of the original costs nor the year the pipeline was installed.[114] Of the remaining 4,742 pipelines with year in service data, GSWC's data showed that it retired 678 pipelines at age twenty years or less.[115] In response to a follow-up discovery request regarding these 678 pipelines, GSWC provided additional details only for 71 of the pipelines by the discovery due date. GSWC found 1) Twenty-five pipelines were inadvertently marked as "abandoned" and should not have been included in the list, and 2) GSWC previously presented forty-six of the remaining pipelines to the Commission in a prior proceeding.[116] Therefore, there are no significant issues with the small sample of 71 pipelines at this time. However, a review of GSWC's pipeline retirements will continue in future GRCs to determine whether retirement was justified.

IV. CONCLUSION

During this GRC, a review of GSWC's retired pipelines results in no significant issues with the small sample for which GSWC provided timely information. However, a review of GSWC's pipeline retirements will continue in future GRCs.

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[113] GSWC provided a list of 6,034 pipelines it abandoned between 2017 and 2023. Of the total, GSWC has a record of the year the pipeline was placed in service for 4,742 pipelines. GSWC assumes 80 years of useful life for pipelines for accounting purposes. GSWC's response to Public Advocates Office data request DG-09, Q.1., Attachment 2-1.

[114] GSWC's response to Public Advocates Office data request DG-09, Q.1. Attachment 2-1.

[115] GSWC's response to Public Advocates Office data request DG-11, Q.1., Attachment 2-2

[116] GSWC's response to Public Advocates Office data request DG-11, Q.1., Attachment 2-2

ATTACHMENTS

ATTACHMENT 1-1: STATEMENT OF QUALIFICATIONS

STATEMENT OF QUALIFICATIONS – DAPHNE GOLDBERG

Q1. Please state your name, business address, and position with the California Public Utilities Commission ("Commission").

A1. My name is Daphne Goldberg and my business address is 505 Van Ness Avenue, San Francisco, California 94102. I am a Utilities Engineer in the Water Branch of the Public Advocates Office.

Q2. Please summarize your educational background and professional experience.

A2. I received a Bachelor of Science Degree in Civil Engineering from Santa Clara University, a Master of Business Administration Degree from San Francisco State University, and a Master's in Civil/Environmental Engineering from University of California, Davis. I received my Engineer-in-Training Certification in the State of California, Certificate #141820. My professional experience in my role as a Utilities Engineer includes work on several General Rate Cases, water system acquisitions, review of Advice Letters, and review and analysis of water quality regulations. Prior to joining the Public Advocates Office, my professional experience includes work as a Staff Engineer at URS Corporation in the Civil Engineering Group where I assisted the civil engineers and planners in infrastructure design projects, development of project schedules and budgets and preparation of new project proposals; and a position as a Design Trainee at the San Francisco Public Utilities Commission where I worked on the Water System Improvement Program in the Project Management Bureau on performance reporting documents related to water resources planning, scheduling, risk management and operations.

Q3. What is your responsibility in this proceeding Golden State Water Company GRC A.23-08-010?

A3. I am responsible for the preparation of the Report and Recommendations on Pipeline Replacements for the Golden State Water Company General Rate Case Test Year 2025.

Q4. Does this conclude your prepared direct testimony?

A4. Yes, it does.

ATTACHMENT 1-2: “CAPTURING CONDITION ASSESSMENT COST SAVINGS” ARTICLE AND “HOW MUCH SHOULD I SPEND ON PIPE CONDITION ASSESSMENTS” ARTICLE

Capturing Condition Assessment Cost Savings

Contributing Author

Can Machine Learning Really Provide A Cost-Effective Desktop Analysis?

By Greg Baird

Artificial Intelligence, specifically machine learning, is poised to make a significant impact in underground water infrastructure asset management. Not only does machine learning drive performance optimization, it also increases efficiencies in business processes and planning. In the water utility industry, due to the multitude of data and variables involved, water main condition assessment is an ideal use case for this technology.

Desktop Analysis

The traditional desktop study includes collecting all of the pipe attributes, location and repair and break history, and developing a preliminary risk matrix.

Desktop analysis or computational approaches are by far the most cost effective and least invasive, but many of these methods are based on arbitrary assumptions and weightings and utilize a small number of factors relating to the performance of the pipe. These issues translate into a high error rate which means good pipes could be identified as high risk and face premature replacement.

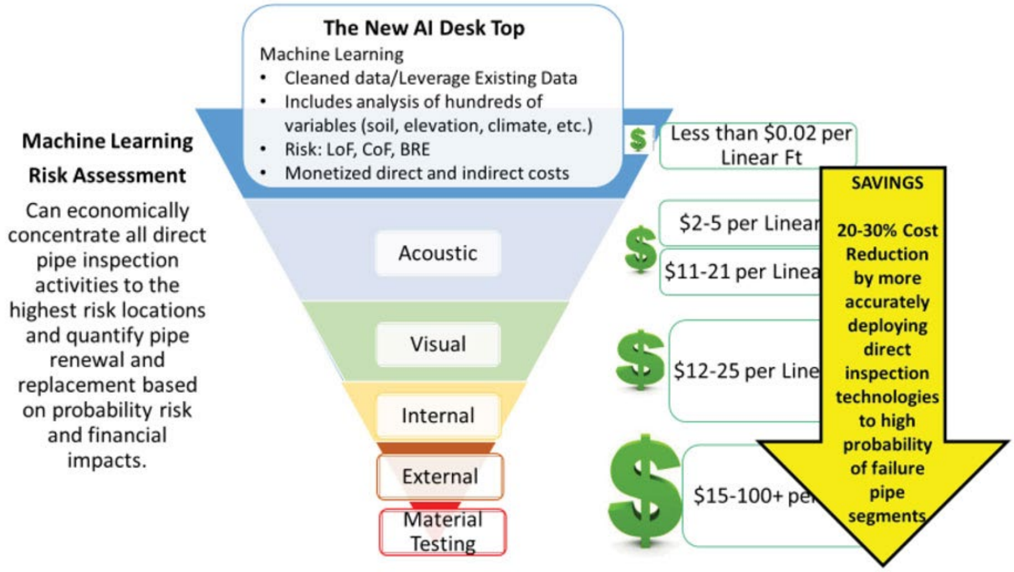
The industry has adopted a number of different approaches ranging from a simple weighted score approach on an excel spreadsheet, to Cohort Analysis, LEYP, Kanew forecasting and Weibull modeling. More advanced statistical modeling may help decipher differences between variables, although many of these approaches may not have the ability to consider the importance of the spacial proximity, elevation or pipe material characteristics which can distort the overall accuracy.

Machine Learning Vs. Age-Based Models

One of the first steps in evaluating this new machine leaning technology for cost effectiveness and accuracy for the water industry is to compare the traditional age-based methodology of determining water pipe asset life and water main breaks with a machine learning risk assessment model.

The Challenge

As the water industry continues to collect large amounts of data, the old-school methodologies of analyzing that data have only provided a portion of the data's real value. Age-based or straight-line depreciation methodologies have a very high rate of inaccuracy which have translated into thousands of miles of good pipe being replaced simply because it was "at the end of its aged-based service life." AI/machine learning leverages a water utility's collected data and combines more than 1,000 other variables to provide a more accurate predictive model. This model is created for calculating the probability of a water pipe segment failing. Comparing these two types of models reveals very different results as explained in the case study analysis for a large and medium sized utility.



Comparison of pipe condition assessment inspections technologies.

Case Study: Large-Sized Water Utility

Five years of water main break data from a large utility with 3,395 miles of pipe was used to compare how each model would predict the actual pipe's failures. To do this, part of the data set was withheld from the machine learning model to demonstrate the accuracy of its predictability.

The machine learning model captured 26.2 percent of the historical pipe breaks as part of its analysis of the highest risk or worst 5 percent of pipes that are predicted to fail. This 5 percent of the 3,395 miles of pipe identifies 139.5 miles of pipe as the highest risk pipes that are predicted to fail.

The age-based model captured 26.2 percent of the historical pipe breaks by identifying the worst 7 percent of the pipes. This 7 percent of the 3,395 miles of pipe suggests that 195.4 miles of pipe would need to be replaced to avoid the historical breaks.

In comparing the two models, the machine learning model was 28.5 percent (2 percent/7 percent) more effective in identifying pipe breaks over the age-based model.

The machine learning model calls for 139.5 miles of pipe to be replaced

The age-based model calls for 195.4 miles of pipe to be replaced

The replacement difference is 56 miles of pipes

If the replacement cost for 1 mile of pipe was $1,000,000 then the age-based model would have spent $56,000,000 more than the machine learning model to prevent the pipe failures.

In order to further test the machine learning model against an age-based model, a new main break data set was used from a medium sized utility following the same comparison methodology as the large utility.

Case Study: Medium-Sized Water Utility

Five years of water main break data from a medium sized utility with 847 miles of pipe was used to compare how each model would predict the actual pipe's failures. To do this, part of the data set was withheld from the machine learning model to demonstrate the accuracy of its predictability.

The machine learning model captured 10.9 percent of the historical pipe breaks as part of its analysis of the highest risk or worst 1.9 percent of pipes that are predicted to fail. This 1.9 percent of the 847 miles of pipe identifies 14.8 miles of pipe as the highest risk pipes that are predicted to fail.

The age-based model captured 10.9 percent of the historical pipe breaks by identifying the worst 2.4 percent of the pipes. This 2.4 percent of the 847 miles of pipe suggests that 18.7 miles of pipe would need to be replaced to avoid the historical breaks.

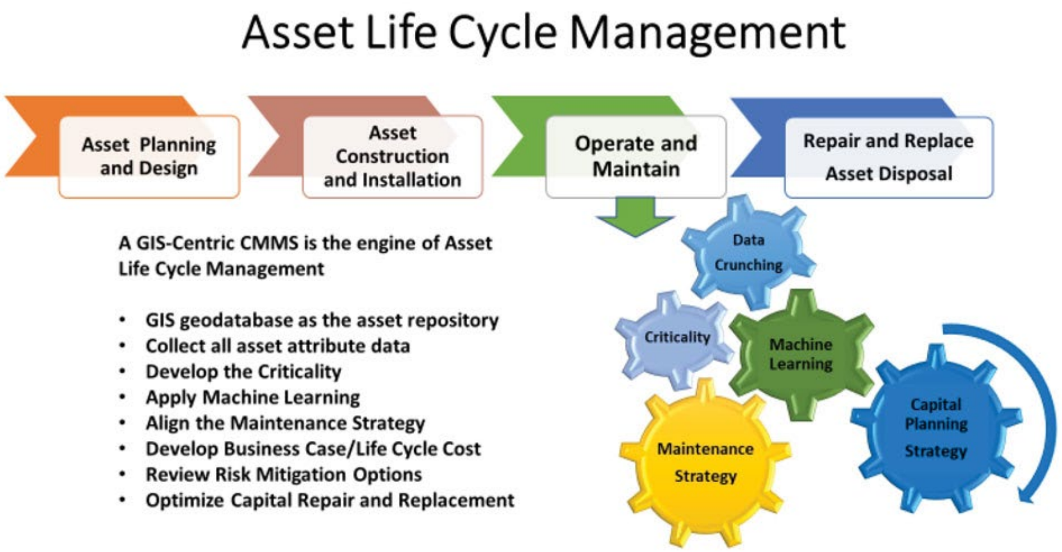
In comparing the two models, the machine learning model was 21 percent (1.9 percent/2.4 percent) more effective in identifying pipe breaks over the age-based model.

The machine learning model calls for 14.8 miles of pipe to be replaced

The age-based model calls for 18.7 miles of pipe to be replaced

The replacement difference is 4 miles of pipes

If the replacement cost for 1 mile of pipe was $1,000,000 then the age-based model would have spent $4,000,000 more than the machine learning model to prevent the pipe failures.



The Water Pipe Condition Assessment Program and Costs

The accuracy and cost effectiveness of the machine learning provides benefits to the entire pipe condition assessment program by focusing more expensive and time-consuming inspection actives to the high-risk pipes for further investigation. Machine learning can be 20 to 30 percent more accurate and provide the same of level of cost efficiencies in identifying the highest-risk pipes. This 20 to 30 percent cost savings can also be passed down to reduce the individual unit costs of direct inspections by only focusing on the pipes and pipe segments as determined by the Machine Learning Pipe Risk Assessment.

Asset management is maintaining a desired level of service at the lowest life cycle cost.

A condition assessment as a fundamental part of asset management is based on the assumption that materials or infrastructure components deteriorate, with the goal of gathering information to predict the need for repair, rehabilitation, or replacement. The nine main steps of machine learning asset management condition assessment process are:

Develop an up-to-date inventory of assets. With water main pipes, a geographic information system (GIS) mobile app can be used to collect the pipe data.

Apply machine learning likelihood of failure as a solution to clean and verify the data and identify the probability of each pipe's failure using hundreds of variables with a 20 to 30 percent improvement over an age-based model.

Produce a monetized criticality rating for each pipe segment and conduct risk mitigation efforts.

Select and cost effectively deploy direct inspection condition assessment technologies to the high-risk pipes to further determine the internal pipe condition, pipe wall condition, pipe environment condition or leakage.

Update the planned maintenance activities in the CMMS.

Revise pipe repair and replacement capital plans and re-evaluate water rate increases and future debt needs.

Provide high risk pipe locations with GIS maps on mobile devices for field crews.

Update results in the water asset management plan.

Systematically repeat by updating the machine learning model with new data.

Asset management is maintaining a desired level of service at the lowest life cycle cost. Lowest life cycle cost includes the cost efficiencies gain through machine learning over age-based methodologies. The cost benefits of machine learning extend to additional direct inspection condition assessments, pipe rehabilitation, repair and replacement activities. Asset management is implemented through an asset management program and typically includes a written asset management plan. Sound financial decisions and developing an effective long-term funding strategy are critical to the implementation of an asset management program.

Greg Baird is president of the Water Finance Research Foundation. He specializes in long-term utility planning, infrastructure asset management and capital funding strategies for municipal utilities in the United States. He has served as a municipal finance officer in California with rate design and implementation experience and as the CFO of Colorado's third-largest utility.

https://waterfm.com/how-much-should-spend-pipe-condition-assessments/

How Much Should I Spend on Pipe Condition Assessments?

Contributing Author

By Greg Baird

In asking the question, "How much should I spend on pipe condition assessments?" one must first ask about the design, construction, installation and inspection of the pipeline.

Pipe Installation Considerations

If you did not install pipes correctly, you are already, on average, losing 20 to 50 percent of the pipe's service life. If you did not inspect the pipe during installation, then you may be only foregoing 10 to 30 percent of the potential service life for that pipe segment. When it comes to long term underground infrastructure which can last 50 to 300 years doing things correctly has huge dividends or on the other hand – high costs and risks from decision making errors. Essentially, with all of the variables influencing pipe service life – condition assessments are needed to identify high risk pipes and also avoid replacing the 40 to 70 percent of good pipes condemned by age-based planning assumptions.

Pipe Material Considerations

Pipe material selection needs to be appropriate for its location, dealing with many variables such as environmental issues and operating conditions. Specifications should be open to allow for the engineering review and analysis. 91 percent of all the installed water mains in the United States utilized a combination of cast iron at 28 percent, ductile iron at 28 percent, PVC pipe at 22 percent, and asbestos cement at 13 percent. Which is interesting considering only two materials ductile iron and PVC remain as options for new installations and replacement. The remaining 9 percent of pipes used are represented by HDPE, steel, concrete steel cylinder and other materials. Each pipe material has different pipe characteristics meaning that the installed environment and operational/environmental factors act differently on each pipe material and can be different for each pipe segment.

Lesson learned from recent studies point out that 75 percent of all utilities have some corrosive soils. Utilities with a higher percentage of iron pipe may experience a higher percentage of corrosion related breaks. Analysis of soil corrosivity shows that traditionally, the thickness of the iron pipe wall provided the additional corrosion protection. Cast iron pipes manufactured after World War II have significantly higher failure rates as a result. Cast iron pipe in highly corrosive soil is expected to have over 20 times the break rate of cast iron pipe in low corrosive soils. Corrosion is an important failure mode for cast iron and is the predominant failure mode for ductile iron pipe. Cast iron and ductile iron pipe corrode at about the same rate. Ductile iron pipe in highly corrosive soils has over 10 times the break rate, than a ductile iron pipe in low corrosive soil. The many types of corrosion can also be combined with other environmental conditions, all contributing to water main failures because of the wall thickness of metallic pipes has decreased overtime.

Pipe Diameter Considerations

In the total inventory of water pipes, 85 percent of water mains are less than 12 inches in diameter. 67 percent of all water mains are 8 in. or less in diameter. Eighteen percent of water mains are 10 to 12 in. and 9 percent are 14 to 24 in. in diameter. A national metric of the replacement rate of water mains is 0.8 percent, which equates to a pipe replacement cycle of 125 years with the average pipe break occurring at 50 years. Typical water pipe planning for replacements ranges between 1.0 and 1.6 percent equivalent to a 100 year and 60-year replacement cycle. A water distribution system as defined by most water utilities considers pipe sizes less than 16 or 24 in. in diameter and anything larger as a transmission pipeline. Pipe diameter matters, as an example overall ductile iron pipe has a break rate of 5.5 breaks per 100 miles of pipe for all sizes, but studies also show a 15.1 break rate for ductile pipe pipes less than 12 in. in diameter.

As a general rule of thumb, larger diameter pipes are more expensive, have less breaks therefore a lower likelihood of failure, but if a break does occur the consequence of failure is more severe. As an example, a 16-in. diameter pipe break could cost $100,000, a 36-in. diameter pipe $800,000 and an 84-in. diameter pipe over $1.5 million just in direct costs, not including water loss and other indirect and societal costs which can average between 50 and 66 percent of a utilities direct costs with the repair. For these larger diameter transmission lines for raw water or treated water the cost is too high and the loss of water delivery to a community too disruptive to allow for failures. As a result, condition assessments for these perpetual lifelines should occur every 10 years and even more frequently if there are known issues. There is also a business case for continuous monitoring for understanding any change in the condition of these pipes or building redundancy into the system to prevent or mitigate catastrophic failures costing millions of dollars.

Engage the Defect Radar! Space Age AI Technology in Our Underground Sewer Networks

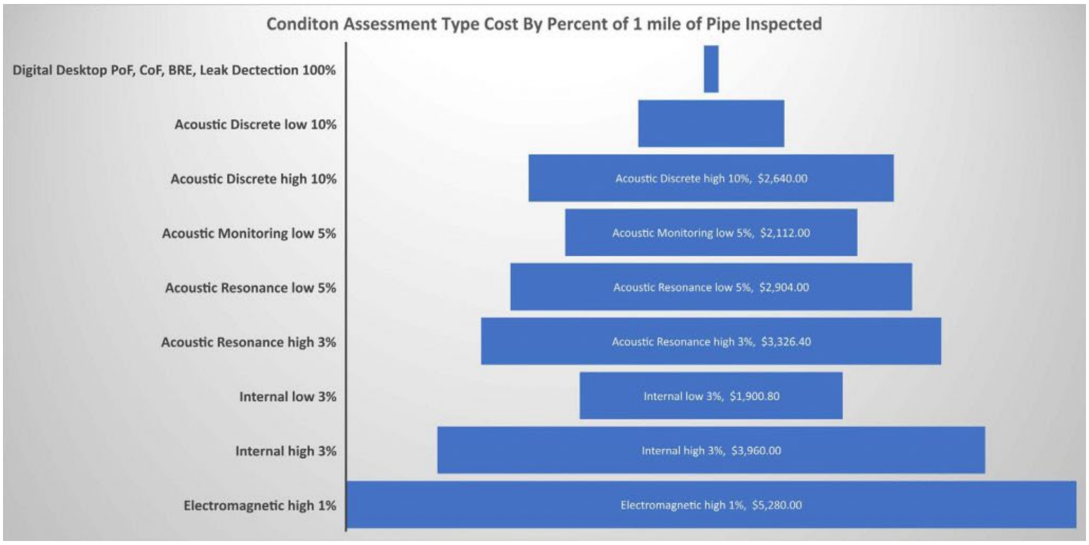
Asset Management Programs

The first basic steps of an infrastructure asset management program are to know what assets you own, where they are located and in what condition they are in. At this point of condition awareness, risk mitigation steps combined with funding scenarios play out to develop the rest of the asset management plan.

One definition or major goal of asset management is to achieve the *longest useful life* of each asset at the *lowest cost* while delivering the expected *level of service*. If we unpack this generalized statement, *longest useful life* would entail pipe material selection, proper design and installation and inspections optimized for the installed environment with periodic pipe condition assessments and analysis to direct changes to maintenance strategies, timely repairs, the use of trenchless technologies and rehabilitation methodologies and open cut replacement considering that a simple aged-based planned intervention will always be wrong considering all of the ongoing and changing variables that can influence the useful life of a pipe. Even the best decay curves with historical data change over time.

The useful life of the pipe also assumes the entire pipe network and every pipe segment. The "lowest cost" approach with pipe condition assessments for the entire distribution system traditionally held by engineering firms as a desktop statistical analysis has now been replaced with a more cost effective and more accurate AI/machine leaning algorithms and cloud platforms using a non-bias approach of hundreds of variables to apply a percentage-based risk of failure (Likelihood of Failure LoF) to every pipe segment for about $0.02 per linear foot. More importantly, identifying good pipes to avoid asset and financial loss through decision errors is also critical. The more break data and bigger the database, the more accurate predictions can be made for LoF algorithms, and also cleaning data and correcting for missing data. Once a LoF can be established for every unique pipe segment a more accurate, yet subjective consequence of failure (CoF) can be calculated by quantifying in dollars the direct repair costs and indirect societal costs of every pipe segment. This monetized risk or total risk assessment provides a methodology of understanding the carrying risk in dollars which can then be prioritized. As an example, the criticality of a pipe segment failure near a hospital could carry a risk value of $5 million while the risk mitigation cost could only be $500,000.

Too many utilities do not understand the actual risk they are carrying and too many financial mangers have asked, "if we make this capital investment what risk amount will it buy down?" Mapping these pipe segment risk values provides a means of grouping together or bundling projects for capital planning efforts while also providing the additional benefit of coordinating with road repair projects and other underground utility right-of-way planning efforts.



Business Process

Asset management requires continual business process improvement and the use of new technologies and methodologies to strive for an overall lower life cycle cost for each asset.

Home-grown or in-house pipe risk analysis models should be tested against AI/machine leaning databases to help verify capital plans to prevent the financial decision error of replacing good pipes while also sharpening the accuracy of identifying high-risk pipe segment clusters.

An AI digital desktop pipe condition assessment solution with LoF and CoF with a monetized total risk value can more efficiently direct maintenance and work order strategies for Computer Maintenance Management Systems (CMMS), while identifying targeted pipe segments for more in depth and traditional condition assessment technologies ranging from leak detection and acoustics monitoring to in pipe wall thickness condition assessments and surveys. Traditional and even innovative pipe leak detection and pipe condition assessments are not cost effective to be used on the entire water distribution system. AI can better focus the other needed condition assessment activities reducing the overall cost of identifying risks and "defects to linear foot spend." There is also a workforce benefit of AI in water and sewer operations addressing knowledge loss, retention, labor hours, training and recruiting.

AI enablement benefits many asset management and software planning tools which can also provide CoF evaluations and capital repair and replacement plans with financial investment and funding scenarios.

Asset Management Planning

Underground infrastructure asset management planning is complex with changing variables and levels of uncertainty.

Asset management practitioners need the support of all tools which can help determine and extend the life of a pipe segment in a cost-effective manner while meeting expected service levels. Asset managers are faced with the challenge of balancing risk, cost and levels of service while also taking into consideration pipe planning efforts and failure modes.

Assets have four basic failure modes. Capacity (pipes need to be replaced because of a planned increase in water demand due to growth); Physical Mortality (actual pipe break and loss of service); Financial Efficiency or Economic Failure (when it is more cost effective to replace an asset due to high operational or maintenance costs and potentially even the risky burden of very high consequence of failure); and Level of Service (which could consider water quality or rust in the water degrading the chlorine effect; social disruption and the number of water main breaks; non-revenue water loss; poor pressure resulting in public safety/firefighting/insurance issues; public health contaminations; and water boil notices).

Conclusion

Financial accounting may suggest a 1-2 percent amount annually of the entire pipe network valuation as a total cost of condition assessment and risk mitigation activities. Engineering firms may suggest a threshold cost of a condition assessment program (statistical desktop review, onsite visits, selection of condition assessment products based on material and diameter, risk analysis and recommendations) at 20 percent of the replacement value of a pipe segment. The introduction and adoption of AI/machine learning for pipe condition assessments and leak detection reduces the overall costs of traditional condition assessment programs and can accelerate the development of water asset management plans. While AI cannot address every failure mode or complexity, if you are NOT including AI/ machine leaning in your infrastructure asset management program for underground pipes you are NOT following the best practices and core principles of asset management and in one way or another over time you will be paying more.

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This post has been updated to reflect the author's current job title.

<u>ATTACHMENT 1-3: MESA STUDY</u>

Pipeline Integrity Testing to Assess the Useful Life of Pipeline Infrastructure

Karyn Igar, Phil Lauri, Paul Shoenberger, David Spencer, Dan Ellison, and Amy Omae

Key Takeaways

Mesa Water District found that a condition- based program was a better option than age- based estimates to determine the remaining useful life of its pipelines.

Asbestos–cement pipe was the primary focus of the testing program.

Mesa Water estimates that it will avoid spending $231 million in unnecessary pipe replacement over the next 30 years.

Mesa Water District provides potable water service to approximately 110,000 people through 317 miles of water main pipelines in Orange County, Calif. While some of its active pipelines were installed as early as 1926, the vast majority of Mesa Water's pipeline infrastructure is asbestos–cement pipe (ACP) that was installed after 1950.

Mesa Water is governed by a five-member elected board of directors that has adopted a "perpetual agency" philosophy, focusing on cost-effectively sustaining long-term service levels. As the distribution system continues to age and deteriorate, investments will be made to maintain desired levels of service. To better understand the cost implications, Mesa Water developed an age-based renewal estimate in 2013. Using local unit cost and industry average-age-based useful-life assumptions grouped by pipeline material, Mesa Water estimated that it would need $300 million of renewal work over the next 30 years. Historically, Mesa Water pipelines have performed well, with a break rate of 4.5 breaks per 100 miles per year (approximately three times better than the AWWA recommended service level). Therefore, it was believed that substantial portions of the system still had significant remaining useful life (RUL). Implementing an age-based renewal program was neither affordable nor a prudent alternative. So, in 2014, Mesa Water adopted a policy to develop a pipeline testing program to maximize the useful life of its existing pipeline infrastructure. This program seeks to

- estimate the RUL of Mesa Water's pipelines on the basis of measured pipeline properties rather than an age-based estimate,
- identify specific pipes that require replacement, and
- continuously refine the testing program to maximize value to ratepayers.

After several years of investigation and testing, the initial goals of this program were accomplished. Because 74% of the system was ACP, it was the initial focus of the Pipeline Integrity Program and is the focus of this article. The Pipeline Integrity Program included extensive system analysis, nondestructive and destructive testing, and data analysis to better understand the system's pipe deterioration rates and mechanisms. This information would help Mesa Water estimate RUL, make near-term renewal decisions, and develop more prudent long-term infrastructure investment budgets.

Through this program it was found that, on average, Mesa Water ACP will last approximately 140 years, which is twice as long as industry average useful-life tables indicate. (According to AWWA's Buried No Longer report, average useful life for ACP is 65–105 years.) By evolving from an age-based approach to a condition-based program that allows older pipe in good condition to continue to operate, it is estimated that $231 million of unnecessary pipe replacement will be avoided over the next 30 years. This will allow Mesa Water to cost-effectively sustain long-term service levels and avoid unneeded rate increases.

Through this program it was found that, on average, Mesa Water ACP will last approximately 140 years, which is twice as long as industry average useful-life tables indicate.

Path to Achieving Goals of the Pipeline Integrity Study

Before it developed the Pipeline Integrity Program, Mesa Water had pilot-tested the Echologics e-Pulse method for pipeline condition assessment and found it was a good screening tool for ACP. As shown in Figure 1, the acoustic velocity method uses a sound wave traveling through a known material for a known distance to measure the structural thickness of the material. The original and existing wall thicknesses are used to estimate the percent of the original wall thickness remaining and the RUL.

Pipes were prioritized for testing on the basis of break history and age. Ninety pipe segments were tested. More than one-third of the pipes tested had an RUL of 10 years or less. This did not align well with institutional knowledge and the performance of ACP at Mesa Water. There are known limitations to applying this technology when a repair has been performed or the original wall thickness is not known. Therefore, Mesa Water committed to a destructive testing program to verify the condition of the ACP compared with the acoustic test results.

Between 2013 and 2017, Mesa Water used its pipe integrity data to identify and test 29 destructive samples on 23 pipelines. To perform the destructive testing, ACP samples of pipe, approximately 8 ft long, were collected as part of a planned shutdown. Locations for destructive testing were identified and prioritized on the basis of acoustic test results and potential impact on the community.

Mesa Water was surprised by the crush test and hydrostatic test results. Even though the acoustic test results showed significant wall loss and limited useful life, crush testing showed that all of the segments tested would meet new pipe criteria for crush strength. The hydrostatic failure test showed that for 14 of the 17 samples tested, the segments were capable of withstanding greater than 450 psi, or three times the design pressure for Pressure Class 150 water pipe.

To better understand these results, Mesa Water collaborated with the research team that had recently published Water Research Foundation (WRF) Project 4480, *Development of an Effective Management Strategy for Asbestos Cement Pipe,* because the team had encountered similar findings. Mesa Water found that crush tests and hydrostatic tests don't necessarily measure the most common failure trigger in ACP (bending due to ground movement). For this failure mechanism, the effective structural remaining wall thickness is the key measurement. To accurately measure this, it's important to understand how ACP corrodes.

Corrosion of Asbestos–Cement Pipe

The corrosion of ACP follows a two-step process, documented in WRF Project 4480:

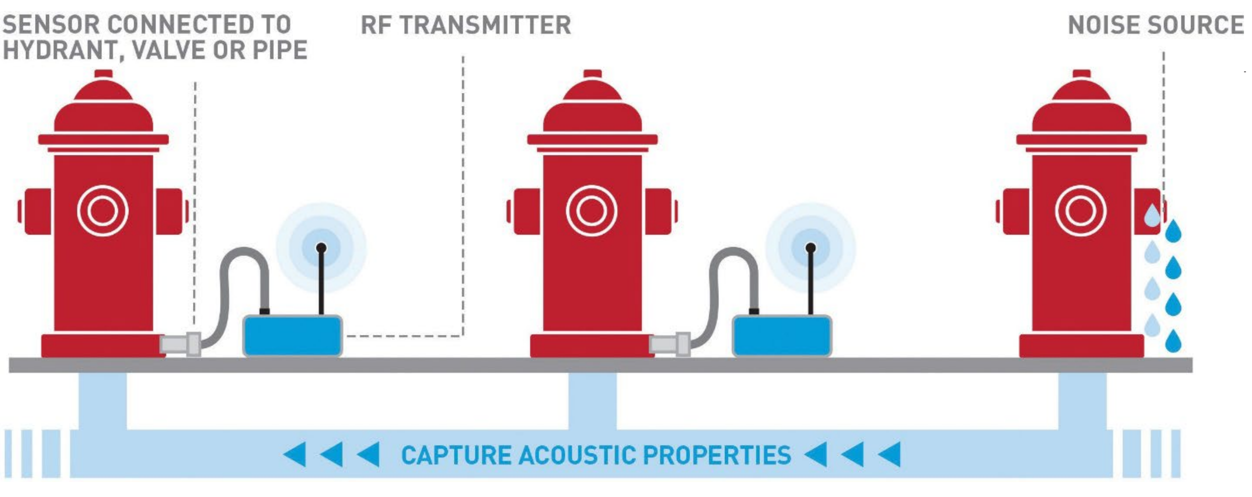
- Step 1—conversion of free lime ($Ca(OH)_2$) to calcium carbonate ($CaCO_3$)
- Step 2—calcium dissolution and transport

The first step involves the conversion of free lime to calcium carbonate. This step can be measured by spraying phenolphthalein stain (i.e., conducting a stain test) on a freshly exposed cross section of the pipe wall. The portion of the pipe wall that turns purple is uncarbonated, while the portion that is unstained is carbonated. The image (top) in Figure 2 shows a pipe that has been recently tested, where the left side is the inner portion of the pipe wall and the right side is the outer portion of the pipe wall.

Carbonation starts at the inner and outer wall surfaces. Over time it progresses toward the center of the pipe wall, which is typically uncarbonated. In ACP and other nonreinforced concrete applications, carbonation itself does not weaken the pipe. In fact, studies (such as *Study on Effect of Carbonation on the Properties of Concrete* by Bhunia et al. 2013) in nonreinforced concrete actually show a minor strengthening effect after carbonation. However, carbonation in ACP is a precursor to corrosion.

In step two of the ACP corrosion process, if the environment allows for calcium carbonate to be dissolved and carried away; calcium then leaches from the calcium–silicate–hydrate and other cement products in the concrete

Pipe Integrity Acoustic Test Setup



Source: Echologics®. Used with permission. RF—radio frequency

Figure 1

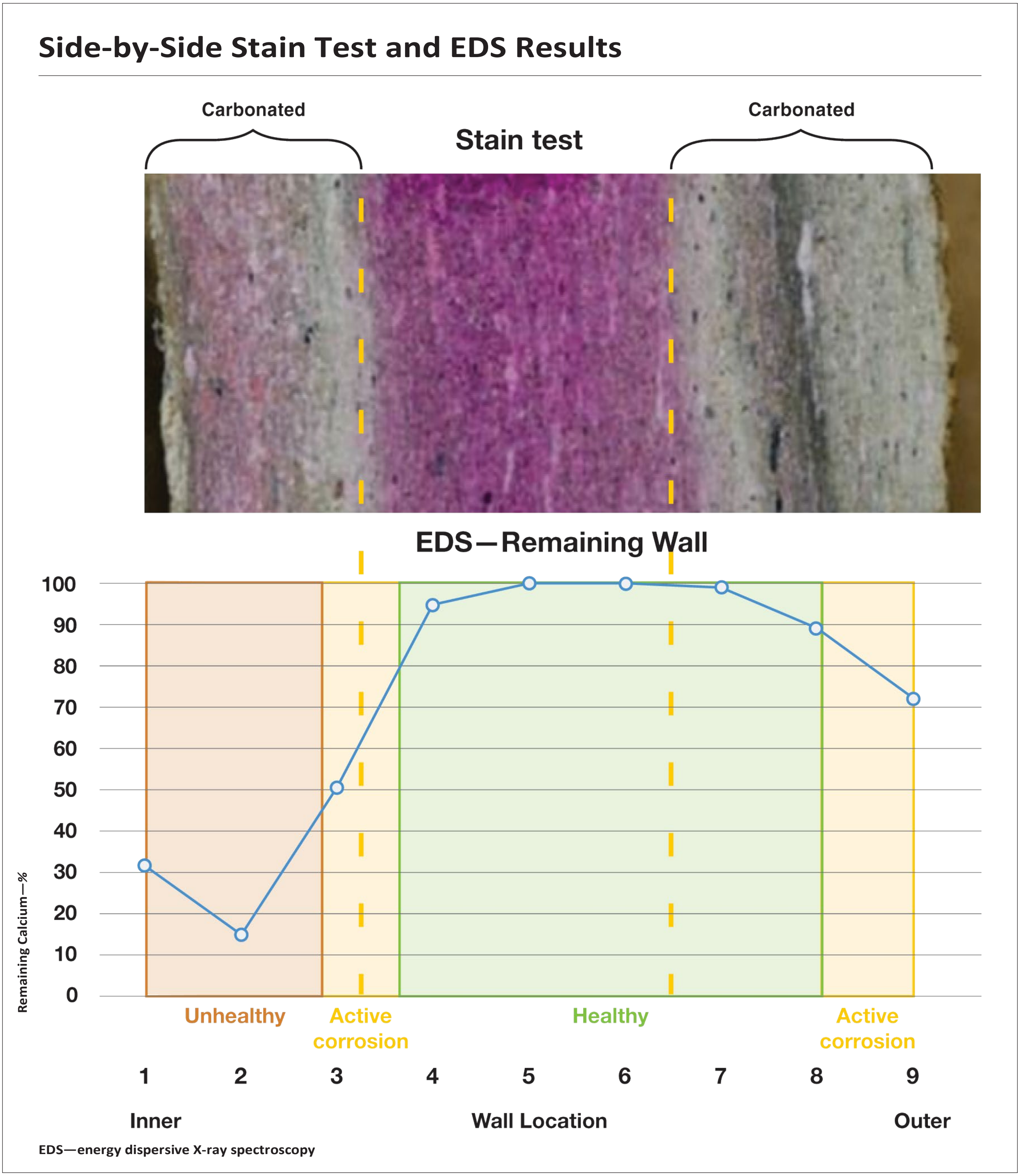

Side-by-Side Stain Test and EDS Results
Carbonated
Stain test
Carbonated
EDS—Remaining Wall
100
90
80
70
60
50
40
30
20
10
0
Remaining Calcium—%
Unhealthy
Active corrosion
Healthy
Active corrosion
1
2
3
4
5
6
7
8
9
Inner
Wall Location
Outer
EDS—energy dispersive X-ray spectroscopy

Figure 2

matrix, strength is lost, and the pipe becomes more susceptible to failure.

The extent of this degradation process can be measured by assessing the remaining calcium (Ca) content using an energy dispersive X-ray spectroscopy (EDS) test. The graph (bottom) in Figure 2 shows the EDS test results for the same sample shown in the image. In this test, calcium content is measured at multiple points (i.e., wall locations) along the thickness of the pipe. At installation, calcium content was relatively uniform across the pipe wall thickness. As the ACP wall corrodes from the inner and outer wall surfaces toward the center of the wall, the calcium content will be significantly lower than the calcium content at the center of the pipe wall.

The remaining calcium content at each wall location is reported as a percentage and calculated as the calcium content at that location divided by the maximum calcium content measured at all locations along the wall. Where the remaining calcium content is high, the pipe should be stronger and less likely to break. Where the remaining calcium content is relatively low, the pipe is weaker and more likely to break. Typically, active corrosion is occurring over a relatively narrow portion of the pipe wall.

Figure 2 orients both tests for a single sample to each other to correlate the results. On the inner portion of the pipe wall, the freshwater conveyed by the pipe is an ideal medium to dissolve and carry away calcium carbonate (step 2 of the corrosion process). As a result, shortly after each layer carbonates (step 1), the pipe corrodes (step 2). This means that stain and EDS tests typically correlate very well to each other on the inner pipe wall. However, on the outer pipe wall, there is not a consistent medium to dissolve and carry away the calcium carbonate. Therefore, carbonation can often penetrate deep into the pipe, but the pipe may not corrode nor lose strength. External carbonation occurs merely from exposure to atmospheric carbon dioxide.

Correlating Acoustic and EDS Test Results

Both the acoustic velocity and EDS test results provide measures of remaining structural wall thickness. Showing test results on 18 different pipes in Mesa Water's system, Figure 3 summarizes the test results and shows reasonable correlation (R^2) for all samples (6–12 inches). However, when three 12-inch samples are excluded in Figure 3, part A, versus part B, the correlation drops significantly.

Research has shown that the condition of ACP varies around the circumference and length of a pipe. Therefore, a perfect correlation should not be expected because EDS measures the condition of a pipe at one location and acoustic tests measure the average condition over the entire segment inspected (typically 300–600 feet). Therefore,

> The first goal of the Pipeline Integrity Testing Program was to estimate the remaining useful life of Mesa Water's pipelines on the basis of measured pipeline properties rather than an age-based approach.

EDS testing should be used to estimate useful life and more precisely to measure structural wall thickness at a particular location, while acoustic tests should be used to identify macro-level changes in the relative condition of the pipe over several hundred feet.

Pipeline Integrity Study Goals

Goal 1: Estimate Remaining Useful Life

The first goal of the Pipeline Integrity Testing Program was to estimate the RUL of Mesa Water's pipelines on the basis of measured pipeline properties rather than an age-based approach. The destructive testing program for ACP (see the sidebar on page 19) was developed to solve the Schlick failure criterion for critical wall thickness. The critical thickness is the minimum wall thickness required to support the internal and external loads on the ACP. The Schlick failure criterion for ACP is as follows:

$$\frac{F_{SL} * w}{\pi \sigma_r t_{ud}^2 \;/\; 3(d+t)^2} + \frac{F_{SP} P}{2\sigma_t \, t_{ud}/d} = 1$$

where F_{SL} = factor of safety for external loading; w = total exterior loading; σ_r = residual rupture modulus; t_{ud} = undegraded portion of pipe wall thickness (critical thickness); d = inside diameter; t = total pipe wall thickness; F_{SP} = factor of safety for internal pressure; P = internal pressure, in pounds per square inch (kilopascals), that the pipe will withstand when no external load exists; and σ_t = residual tensile strength.

The left side of the equation represents the external loading from traffic and soil loads. The right side of the equation represents the internal forces from static and surge pressures. The residual rupture modulus σ_r is measured from crush tests performed on each sample. The residual tensile strength σ_t is measured from burst tests performed on each sample. The diameter and thickness of each sample were also measured. A safety factor of 1.3 was applied. On the basis of this information, the critical thickness for each sample was calculated by solving the

Schlick failure criterion for t_{ud}, which is the undegraded thickness of the pipe wall necessary to support the internal and external loads. The RUL for each sample was estimated on the basis of the following:

- The original remaining wall thickness at installation, assumed to be the measured wall thickness from each sample
- The measured remaining wall thickness and age at the time of the sample based on EDS testing
- The critical remaining wall thickness (t_{ud}) at failure as calculated using the Schlick failure criterion

For each sample, these three inputs were plotted on a graph of age versus remaining wall thickness. A conservative linear deterioration trend was fit between the original wall

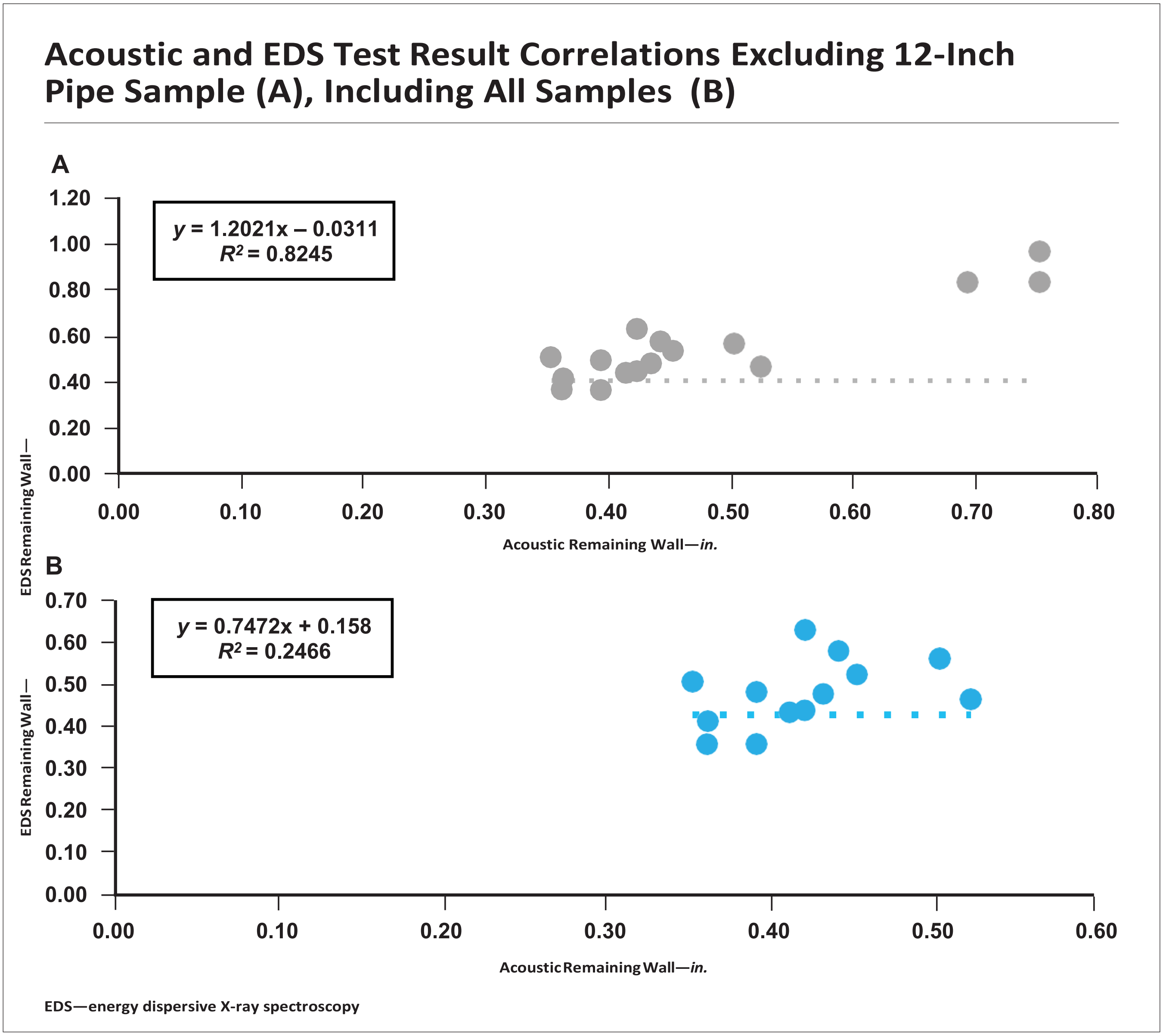
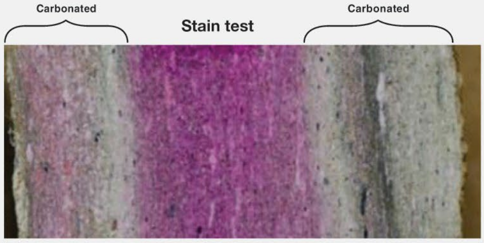


Figure 3

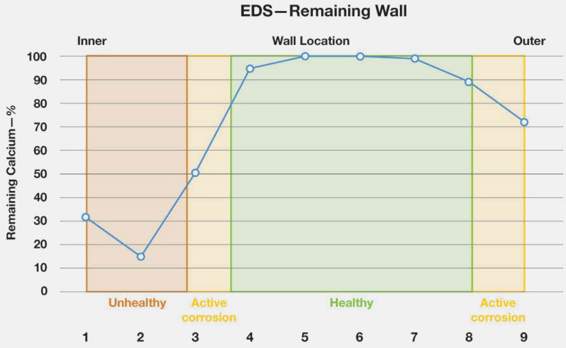
and the measured remaining wall thickness at the time of the sample. The deterioration trend was then extrapolated to the critical wall thickness, as shown in Figure 4. The RUL was estimated as the number of years it would take the deterioration trend to cross the critical wall thickness, shown as the dashed line in Figure 4.

Destructive Tests Initially Performed

Phenolphthalein stain test. This test applies a phenolphthalein solution to a polished asbestos–cement pipe (ACP) wall cross section. The pipe wall that has remaining calcium hydroxide (lime) will turn bright pink, while the degraded wall without calcium hydroxide will not change color.



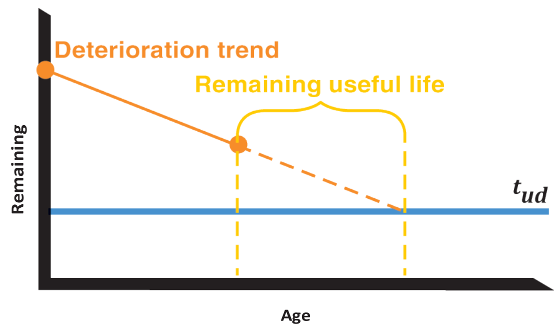
Scanning electron microscopy/energy dispersive X-ray spectroscopy (EDS). EDS uses a focused beam of electrons on a polished pipe wall cross-section sample to assess the chemical composition at several points along the cross section.



Hydrostatic failure test. The hydrostatic failure test is used to assess the pipe's ability to withstand increasing levels of internal pressure until failure occurs.

Crush test. The crush test is used to assess the pipe's ability to withstand increasing levels of external stress (e.g., soil and traffic loading) until failure occurs.

Use of EDS to Estimate Deterioration Trend and Remaining Useful Life



EDS—energy dispersive X-ray spectroscopy

Table 1 summarizes Mesa Water's estimated RUL for its survey. On the basis of the methodology described in the previous section, the average age of the pipes sampled was 57 years. The average estimated RUL was 85 years. Therefore, the average condition-based useful life of the pipes tested at this time was 142 years. This is almost twice as long as the age-based useful life originally estimated in 2013, which estimated that $300 million of pipeline replacement would be needed over the next 30 years. This study helps explain why Mesa Water pipes are still performing relatively well compared with industry average break rates.

While a rapid ramp-up of replacement is not needed in the near future, particular pipes may last significantly shorter or longer than their estimated average useful life. This finding, supported by industry experience, may be due to a variety of factors, including manufacturing quality, installation practices, the aggressiveness of the water conveyed, and variations in loading and stresses.

There are several important limitations to note of the Schlick failure criterion as it's applied to ACP. First, when the pipe is in operation, the internal and external pipe forces counter each other, with the water pressure in the pipe supporting some of the external loads and the compacted soils around the pipe helping the pipe wall hold the internal pressure. Second, neither hydrostatic failure nor external crushing is a typical failure mode for ACP under normal operating conditions. Analysis performed at East Bay Municipal Water District and documented in WRF

Estimated Remaining Useful Life for Survey

Sample Number	Age When Sampled *Years*	Estimated Remaining Useful Life *Years*
1	36	64
2	36	52
3	39	52
4	39	148
7	68	71
8	68	79
9	65	68
10	63	77
11	63	90
13	65	-12
14	42	58
15	60	45
183	64	139
184	64	101
185	64	65
186	64	99
187	66	194
188	62	143
Average	**57**	**85**

Table 1

Project 4480 shows that ACP failures are most likely in areas where the ACP, a brittle material, is forced to flex with soil movement. Finally, in theory, ACP corrosion is believed to slow over time, rather than degrade at a constant rate as it ages. Over the next several years, Mesa Water will address these limitations as it refines its approach for estimating useful life.

Goal 2: Condition-Based ACP Renewal Decisions Utilities commonly use run-to-failure models that leverage historic break data and other risk factors to make pipe-specif- ic renewal decisions. However, since breaks in its system are rare, Mesa Water sought to develop condition-based renewal decision-making criteria to drive its investment decisions. Of the 18 samples, 17 tested as having significant RUL. However, one sample (sample 13) was tested as being beyond its RUL. The Schlick failure criterion is useful for planning-level RUL estimates, but because of its limitations described in the previous section, the estimated RUL was used as one input in a more holistic decision-making strategy, albeit one with significant weight. Additional data that were considered included break history, external factors, and acoustic test data. Figure 5 illustrates Mesa Water's current renewal decision-making process.

For pipes with significant external factors (e.g., high consequence of failure or an opportunity construction project exists in the area), pipe replacement is typically recommended if the pipe has a break rate higher than 10 per 100 miles per year or no RUL. For pipes without significant external factors, replacement is only recommended if the pipe has both a break rate higher than 10 and no RUL.

If a pipe does not meet these criteria, Mesa Water will continue to operate the pipe and collect EDS data to validate the condition of the pipe whenever it is exposed (e.g., pipe tap, break response, valve replacement); this process is called an opportunity assessment. As it is obtained, new data help determine whether the pipe is still in good condition.

If pipe replacement is recommended, the next step is to determine the boundaries of the replacement project. Delineation of replacement project boundaries incorporate a number of factors:

- Surface features
- Isolation valve locations
- Traffic control
- Appropriate project size to obtain a reasonable unit price
- Customer impacts
- Street-pavement moratoriums
- Pipe condition

Determining the pipe condition along potential replacement project extents can be difficult because EDS testing measures corrosion at a specific point and does not specify how that condition varies along the pipeline. Therefore, Mesa Water is using the acoustic velocity method to estimate the average remaining wall thickness over pipe lengths ranging from 200 to 600 feet in length to support identification of the appropriate replacement project extents.

Goal 3: Program Optimization

The third goal of this study was to continuously refine the testing program to maximize value to ratepayers. The acoustic technology is noninvasive, relatively inexpensive, and not disruptive to customers. Mesa Water tested 3 miles of pipe within a work week, at a cost of $90,000, which includes consultants and Mesa Water staff time.

Direct condition assessment of ACP can disrupt customers and is more expensive because the pipe must be isolated and exposed. However, when a pipe is exposed for another reason (e.g., service tap, break, valve replacement, pipe replacement), it provides an opportunity to cost-effectively gather EDS data, since roughly 90% of the cost of testing is in accessing the pipe. When incorporated as part of an opportunity condition assessment program, EDS testing is not disruptive and becomes much less expensive (approximately $500–$1,500 per sample).

EDS and acoustic tests are mutually beneficial. The physical wall thickness (measured during EDS testing) can be used to calibrate acoustic test results and more accurately estimate wall loss.

Conversely, isolated opportunity EDS tests are difficult to extrapolate to surrounding pipes to identify the extents of a project. Therefore, Mesa Water will continue to collect and evaluate acoustic testing and EDS test data to support prudent ACP decision-making. By moving away from proactive crush and hydrostatic burst testing and toward noninvasive and cost-effective EDS and acoustic

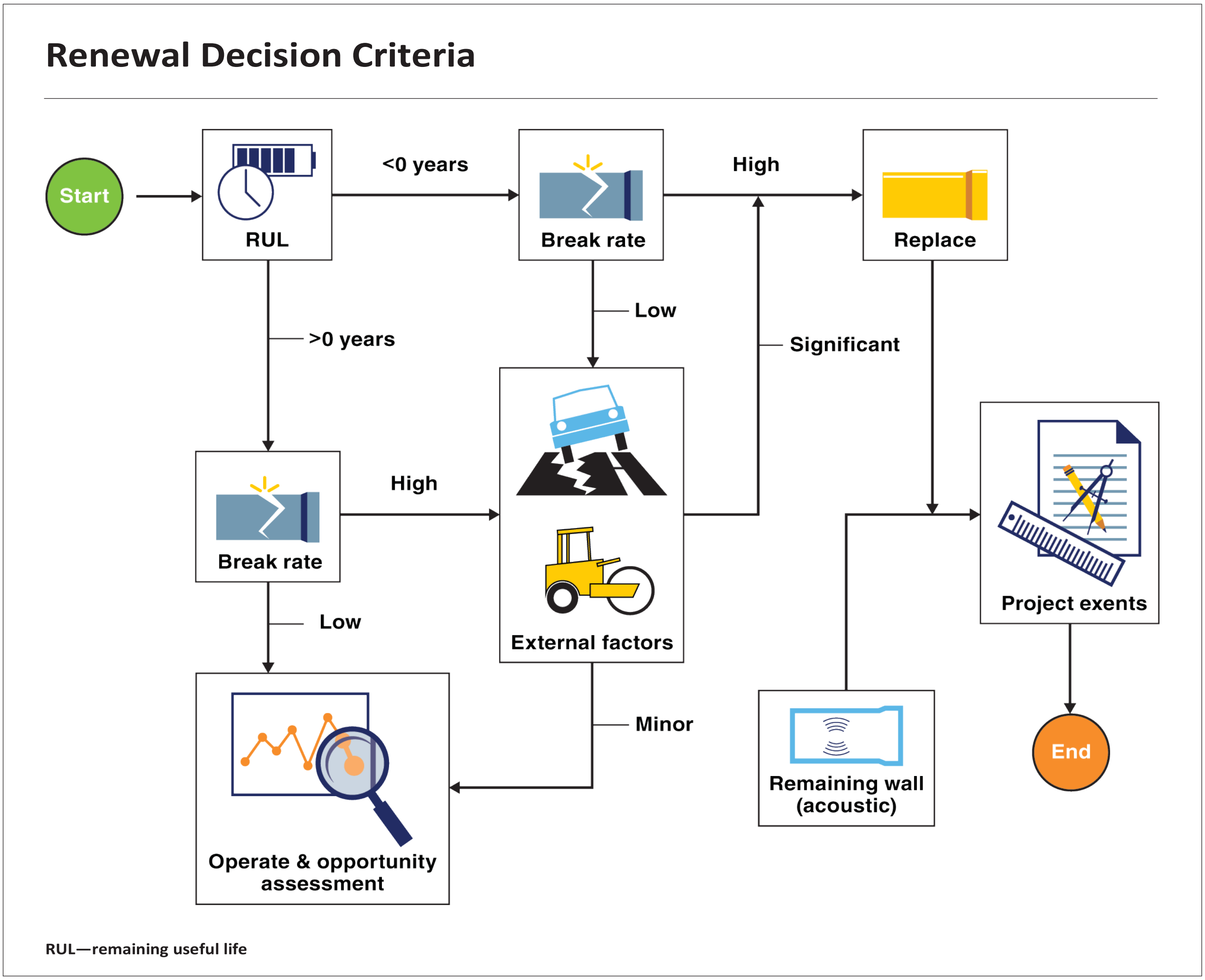


Figure 5

testing, Mesa Water estimates it will save approximately $100,000 per year.

Mesa Water is also supporting neighboring water agencies by sharing data and lessons learned. It is envisioned that this may result in the development of a multiagency database of testing results that will accelerate continuous improvement of the data collection and interpretation process. Additional risk factors are being evaluated. Following the findings of WRF Project 4480, Mesa Water is evaluating the effect of ground movement resulting from small earthquakes and soil shrink–swell potential.

While the initial focus of the Pipeline Integrity Program has been on ACP, the 44 miles of ferrous material pipe in Mesa Water transmission and distribution system cannot be ignored. While a much smaller fraction by length of the pipeline system, the ferrous material pipelines are the large-diameter transmission backbone of the pipeline system. Nondestructive testing methods for these pipes are being evaluated.

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ATTACHMENT 1-4: RECOMMENDED ANNUAL 2024, 2025, AND 2026 PIPELINE BUDGET CALCULATIONS

Description of Methodology used to calculate 2024-2026 Annual Recommended Budgets, by Region:

Step 1:

1. Calculated sum of annual pipeline miles, by Region using GSWC's 2018-2022 recorded annual pipeline miles, which are included in GSWC's response to Public Advocates Office data request DG-01.
2. Calculated pipeline miles to pipeline feet conversion which are shown in tables below.
3. Calculated sum of annual pipeline costs, by Region using GSWC's 2018-2022 recorded annual pipeline costs are included in GSWC's response to Public Advocates Office data request DG-01.
4. Divided Regional pipeline cost by recorded pipeline feet, per year, which results in the Cost/Foot, by Region (rounded).
5. To calculate GSWC's proposed annual 2024-2026 Cost/Foot: Used GSWC's A.23-08-010, proposed annual budgets, by Region and proposed annual miles, by Region. See Volume 2 testimony, Attachment H, pp.66-67 and 74-75 (see tables below).
6. Converted annual miles to feet, by Region and divided Proposed Budget by Proposed Feet.

Calculations of Cost/Foot using GSWC's response to data request DG-01:

Region I Annual Miles	Authorized	Recorded
2018	0.10	1.04
2019	2.10	2.33
2020	2.55	1.13
2021	1.77	0.67
2022	4.31	0.79

Region II Annual Miles	Authorized	Recorded
2018	9.32	26.39
2019	13.34	28.88
2020	15.06	2.09
2021	3.38	9.58
2022	12.81	7.18

Region II Annual Miles	Authorized	Recorded
2018	4.55	18.65
2019	9.70	11.17
2020	16.62	10.81
2021	2.68	4.76
2022	7.44	9.65

Region I	Authorized	Recorded
2018	$ 333,000	$ 1,173,687
2019	$ 3,320,500	$ 3,847,664
2020	$ 6,389,700	$ 1,302,750
2021	$ 3,298,300	$ 962,700
2022	$ 6,451,800	$ 1,155,539

Region II	Authorized	Recorded
2018	$ 18,272,200	$ 21,816,405
2019	$ 24,052,400	$ 27,384,109
2020	$ 24,787,100	$ 2,262,164
2021	$ 7,430,300	$ 8,427,684
2022	$ 28,372,300	$ 6,075,287

Region III Costs	Authorized	Recorded
2018	$ 5,540,625	$ 18,721,635
2019	$ 13,871,215	$ 8,358,225
2020	$ 21,883,845	$ 10,905,107
2021	$ 3,283,100	$ 4,570,608
2022	$ 17,925,400	$ 9,395,587

Region I	**Year**			**Region I**	**Year**	
Recorded	**2018**	**2019**	**2020**	**Recorded**	**2021**	**2022**
Miles	1.04	2.33	1.13	Miles	0.67	0.79
Cost	$ 1,173,687	$ 3,847,664	$ 1,302,750	Cost	$ 962,700	$ 1,155,539
Feet	5,491	12,302	5,966	Feet	3,538	4,171
Cost/Foot	**$ 214**	**$ 313**	**$ 218**	**Cost/Foot**	**$ 272**	**$ 277**

Region I	**Year**		
A2308010 Proposed	**2024**	**2025**	**2026**
Miles	1.49	1.58	5.8
Budget	$ 5,382,400	$ 5,996,400	$ 23,411,400
Feet	7,867	8,342	30,624
Cost/Foot	**$ 684**	**$ 719**	**$ 764**

Region II	**Year**			**Region II**	**Year**	
Recorded	**2018**	**2019**	**2020**	**Recorded**	**2021**	**2022**
Miles	26.39	28.88	2.09	Miles	9.58	7.18
Cost	$ 21,816,405	$ 27,384,109	$ 2,262,164	Cost	$ 8,427,684	$ 6,075,287
Feet	139,339	152,486	11,035	Feet	50582.4	37910.4
Cost/Foot	**$ 157**	**$ 180**	**$ 205**	**Cost/Foot**	**$ 167**	**$ 160**

Region II	**Year**		
A2308010 Proposed	**2024**	**2025**	**2026**
Miles	7.25	8.53	11.37
Budget	$ 18,991,700	$ 22,963,600	$ 26,587,200
Feet	38,280	45,038	60,034
Cost/Foot	**$ 496**	**$ 510**	**$ 443**

Region III	Year			Region III	Year	
Recorded	**2018**	**2019**	**2020**	**Recorded**	**2021**	**2022**
Miles	18.65	11.17	10.81	Miles	4.76	9.65
Cost	$ 18,721,635	$ 8,358,225	$ 10,905,107	Cost	$ 4,570,608	$ 9,395,587
Feet	98,472	58,978	57,077	Feet	25132	50952
Cost/Foot	**$ 190**	**$ 142**	**$ 191**	**Cost/Foot**	**$ 182**	**$ 184**

Region III	Year		
A2308010 Proposed	**2024**	**2025**	**2026**
Miles	6.3	7.96	5.99
Budget	$ 18,170,100	$ 19,813,400	$ 14,714,100
Feet	33,264	42,029	31,627
Cost/Foot	**$ 546**	**$ 471**	**$ 465**

A.23-08-010 GSWC Volume 2 Testimony, Attachment H. Proposed Pipeline Data

TABLE 3.7 GSWC REGION 1 - PROPOSED PIPELINE INSTALLATIONS

	Proposed Installation (miles)			
Distribution System	**2024**	**2025**	**2026**	**Total**
ARDEN	1.27	-	-	1.27
CORDOVA	-	-	1.33	1.33
ROBBINS	-	-	0.15	0.15
BAY POINT	-	0.27	0.14	0.41
CLEARLAKE	-	-	0.74	0.74
LOS OSOS	-	0.17	0.06	0.23
EDNA RD	-	0.23	-	0.23
LAKE MARIE	-	-	-	-
ORCUTT	-	0.28	0.51	0.80
SISQUOC	-	0.07	-	0.07
TANGLEWOOD	-	-	-	-
NIPOMO	0.22	-	0.07	0.28
CYPRESS RIDGE	-	-	-	-
SIMI VALLEY	-	0.57	2.80	3.37
Total	**1.49**	**1.58**	**5.80**	**8.87**

TABLE 3.8 GSWC REGION 2 - PROPOSED PIPELINE INSTALLATIONS

	Proposed Installation (miles)			
Distribution System	**2024**	**2025**	**2026**	**Total**
ARTESIA	0.59	0.80	0.89	2.27
NORWALK	-	1.86	0.49	2.35
BELL-BELL GARDENS	0.12	-	1.81	1.93
FLORENCE-GRAHAM	0.08	2.43	0.96	3.47
HOLLYDALE	-	-	0.71	0.71
WILLOWBROOK	-	0.08	0.13	0.20
CULVER CITY	0.44	1.29	0.50	2.23
SOUTHWEST	6.03	2.08	5.88	14.00
Total	**7.25**	**8.53**	**11.37**	**27.15**

TABLE 3.9 GSWC REGION 3 - PROPOSED PIPELINE INSTALLATIONS

	Proposed Installation (miles)			
Distribution System	**2024**	**2025**	**2026**	**Total**
WEST ORANGE COUNTY	1.27	-	0.12	1.39
COWAN HEIGHTS	0.09	0.29	0.05	0.43
PLACENTIA-YORBA LINDA	1.80	-	0.13	1.93
CLAREMONT	0.80	0.52	0.73	2.05
SAN DIMAS	1.75	3.35	0.51	5.62
SOUTH ARCADIA	0.11	0.23	-	0.34
SOUTH SAN GABRIEL	0.40	0.52	0.34	1.26
BARSTOW	-	0.61	1.99	2.60
CALIPATRIA-NILAND	-	0.48	0.36	0.84
MORONGO DEL NORTE	-	-	-	-
MORONGO DEL SUR	-	0.27	0.23	0.50
APPLE VALLEY SOUTH	-	-	0.93	0.93
DESERT VIEW	-	0.38	-	0.38
APPLE VALLEY NORTH	-	0.38	-	0.38
LUCERNE VALLEY	-	0.93	-	0.93
WRIGHTWOOD	0.08	-	0.60	0.68
Total	**6.30**	**7.96**	**5.99**	**20.25**

TABLE 4.1 GSWC REGION 1 - COST PER YEAR FOR PROPOSED PIPELINE INSTALLATIONS

	Estimated Cost[a] ($)			
Distribution System	**2024**	**2025**	**2026**	**Total**
ARDEN	$4,385,000	$0	$244,300	$4,629,300
CORDOVA	$0	$327,800	$6,490,200	$6,818,000
ROBBINS	$23,300	$0	$571,600	$594,900
BAY POINT	$0	$1,177,000	$2,148,900	$3,325,900
CLEARLAKE	$0	$240,100	$2,479,500	$2,719,600
LOS OSOS	$51,600	$393,200	$237,800	$682,600
EDNA RD	$64,700	$466,400	$0	$531,100
LAKE MARIE	$0	$0	$97,900	$97,900
ORCUTT	$88,500	$878,800	$1,552,000	$2,519,300
SISQUOC	$34,800	$250,900	$0	$285,700
TANGLEWOOD	$0	$0	$228,400	$228,400
NIPOMO	$637,300	$35,400	$673,800	$1,346,500
CYPRESS RIDGE	$0	$0	$0	$0
SIMI VALLEY	$97,200	$2,226,800	$8,687,000	$11,011,000
Total	**$5,382,400**	**$5,996,400**	**$23,411,400**	**$34,790,200**

[a] Pipeline unit costs are detailed in GSWC's Master Cost Cross-Reference spreadsheet and for each pipeline PCE.

TABLE 4.2 GSWC REGION 2 - COST PER YEAR FOR PROPOSED PIPELINE INSTALLATIONS

	Estimated Cost[a] ($)			
Distribution System	**2024**	**2025**	**2026**	**Total**
ARTESIA	$2,241,000	$1,797,400	$1,911,600	$5,950,000
NORWALK	$241,700	$4,418,100	$1,019,600	$5,679,400
BELL-BELL GARDENS	$287,300	$218,900	$4,106,900	$4,613,100
FLORENCE-GRAHAM	$613,200	$5,695,800	$2,108,100	$8,417,100
HOLLYDALE	$0	$97,300	$1,739,000	$1,836,300
WILLOWBROOK	$9,300	$215,100	$298,900	$523,300
CULVER CITY	$2,010,700	$5,506,900	$1,918,500	$9,436,100
SOUTHWEST	$13,588,500	$5,014,100	$13,484,600	$32,087,200
Total	**$18,991,700**	**$22,963,600**	**$26,587,200**	**$68,542,500**

[a] Pipeline unit costs are detailed in GSWC's Master Cost Cross-Reference spreadsheet and for each pipeline PCE.

TABLE 4.3 GSWC REGION 3 - COST PER YEAR FOR PROPOSED PIPELINE INSTALLATIONS

	Estimated Cost[a] ($)			
Distribution System	**2024**	**2025**	**2026**	**Total**
WEST ORANGE COUNTY	$2,712,500	$0	$511,900	$3,224,400
COWAN HEIGHTS	$463,600	$1,276,300	$279,800	$2,019,700
PLACENTIA-YORBA LINDA	$6,940,700	$0	$391,800	$7,332,500
CLAREMONT	$2,251,300	$1,926,400	$2,106,900	$6,284,600
SAN DIMAS	$3,722,800	$7,240,300	$1,079,800	$12,042,900
SOUTH ARCADIA	$696,500	$475,300	$0	$1,171,800
SOUTH SAN GABRIEL	$855,400	$1,125,300	$825,400	$2,806,100
BARSTOW	$0	$2,674,500	$4,726,900	$7,401,400
CALIPATRIA-NILAND	$0	$2,538,800	$1,226,300	$3,765,100
MORONGO DEL NORTE	$119,600	$0	$0	$119,600
MORONGO DEL SUR	$0	$463,200	$506,800	$970,000
APPLE VALLEY SOUTH	$64,800	$0	$1,205,200	$1,270,000
DESERT VIEW	$0	$409,200	$0	$409,200
APPLE VALLEY NORTH	$0	$537,600	$0	$537,600
LUCERNE VALLEY	$0	$1,042,800	$0	$1,042,800
WRIGHTWOOD	$342,900	$103,700	$1,853,300	$2,299,900
Total	**$18,170,100**	**$19,813,400**	**$14,714,100**	**$52,697,600**

[a] Pipeline unit costs are detailed in GSWC's Master Cost Cross-Reference spreadsheet and for each pipeline PCE.

<u>Step 2</u>, using GSWC's response to Public Advocates Office data request DG-01:

1. Calculated 2018-2022 Average Authorized Pipeline Cost, By Region.
2. Calculated 2018-2022 Average Recorded Pipeline Cost, By Region.
3. Calculated 2018-2022 Average Recorded Pipeline Cost Divided By 2018-2022 Average Authorized Pipeline Cost, By Region to obtain percentage.

Region I	Authorized 2018-2022	Recorded 2018-2022
Arden	$ 3,113,000	$ 302,863
Cordova	$ 1,803,200	$ 2,522,490
Bay Point	$ 1,041,300	$ 1,578,480
Clearlake	$ 1,352,400	$ 1,780,197
Los Osos	$ 675,300	$ 779,598
Edna Road	$ 270,400	$ 469,909
Lake Marie	$ 269,700	$ -
Orcutt	$ 6,577,300	$ 491,641
Sisquoc	$ -	$ -
Tanglewood	$ 31,600	$ 56,145
Nipomo	$ 84,900	$ -
Cypress Ridge	$ 2,434,100	$ -
Simi Valley	$ 2,140,100	$ 461,017
Total	$ 19,793,300	$ 8,442,340
Recorded/Authorized		43%
Average	$ 1,522,562	$ 649,411
		43%

Region II	Authorized 2018-2022	Recorded 2018-2022
Artesia	$ 5,027,600	$ 4,566,652
Norwalk	$ 2,166,900	$ 198,570
Bell-Bell Gardens	$ 4,689,900	$ 1,434,996
Florence-Graham	$ 7,332,000	$ 3,433,456
Hollydale	$ 2,638,200	$ 911,026
Willobrook	$ 2,171,700	$ 958,912
Culver City	$ 18,260,700	$ 6,701,588
Southwest	$ 60,627,300	$ 47,760,449
Total	$ 102,914,300	$ 65,965,649
Recorded/Authorized		64%
Average	$ 12,864,288	$ 8,245,706
		64%

Region III	Authorized 2018-2022	Recorded 2018-2022
West Orange County	$ 9,218,000	$ 5,522,799
Cowan Heights	$ 2,445,800	$ 1,266,687
Placentia Yorba Linda	$ 1,514,400	$ -
Claremont	$ 15,656,100	$ 10,445,375
San Dimas	$ 4,459,500	$ 4,568,320
South Arcadia	$ 11,083,485	$ 7,997,596
South San Gabriel	$ 2,062,900	$ 3,807,526
Barstow	$ 4,717,500	$ 1,961,318
Calipatria-Niland	$ 2,303,900	$ 505,791
Morongo Del Sur	$ 1,316,100	$ 597,417
Morongo Del Norte	$ 486,700	$ -
Apple Valley South	$ 3,765,800	$ 2,852,011
Desert View	$ 427,900	$ 185,999
Apple Valley North	$ 1,844,100	$ 914,335
Lucerne Valley	$ 1,202,000	$ 1,367,816
Wrightwood	$ -	$ 9,958,173
Total	$ 62,504,185	$ 51,951,162
Recorded/Authorized		83%
Average	$ 3,906,512	$ 3,246,948
		83%

Step 3: calculation included in table below.

Recommended 2024 Pipeline Budget Calculation Methodology

Review GSWC recorded data: GSWC's Recorded and Forecasted Cost Per Foot of Pipeline[117, 118]

Year	Region I	Region II	Region III
2018	$214	$157	$190
2019	$313	$180	$142
2020	$218	$205	$191
2021	$272	$167	$182
2022	$277	$160	$184
2018-2022 Average	$259	$174	$178
GSWC's 2024-2026 Annual Unit Prices			
2024	$684	$496	$546
2025	$719	$510	$471
2026	$764	$443	$465

117 Note: GSWC states that 2023 data is not available.

118 Region I includes Arden, Cordova, Bay Point, Clearlake, Los Osos, Edna Road, Orcutt, Tanglewood, Sisquoc, Lake Marie, Nipomo, Cypress Ridge, and Simi Valley. The Regional cost/foot is based on GSWC's recorded 2018-2022 miles replaced and pipeline costs. Note: GSWC acquired the Robbins System in 2022, therefore, the Robbins 2018-2022 pipeline cost/foot is not included. See GSWC Advice Letter 1878. *See* GSWC's response to Public Advocates Office data request DG-01. The 2024-2026 annual cost/foot is calculated from GSWC's A.23-08-010 Pipeline Management Program, Vol. 2 Testimony, Attachment H pp 66-67 and 74-75.

Step 1: Calculate the total proposed 2024 budget using the 2018-2022 Average Cost/Foot of Pipeline for each Region and an assumed 3% annual escalation:

Region	Recommended 2018-2022 Average Cost/Foot of Pipeline	2-Year Escalation (2022-2024)	Escalated Cost/Foot to 2024 dollars (multiply Cost/Foot of Pipeline by 1.0610)	GSWC 2024 Proposed Pipeline Feet By Region	Recommended Total 2024 Proposed Pipeline Budget With 2018-2022 Average Cost/Foot (multiply escalated Cost/Foot by feet)
	(A)	(B)	(C)	(D)	(E)
			[A x (1+B)]		[C x D]
Region I	$259	6.10%	$275	7,867	$2,161,844
Region II	$174	6.10%	$185	38,280	$7,067,024
Region III	$178	6.10%	$189	33,264	$6,282,173

Step 2: Calculate the 2018-2022 average percentage GSWC spent on pipeline replacement cost of the Commission's total authorized 2018-2022 budget for each Region:

Region	2018-2022 Average Authorized Pipeline Replacement Budget	2018-2022 Average Recorded Pipeline Replacement Cost	2018-2022 Average Recorded Pipeline Replacement Cost/2018-2022 Average Authorized Pipeline Replacement Budget
	(A)	(B)	(C)
			[B/A]
Region I	$1,522,562	$649,411	43%
Region II	$12,864,288	$8,245,706	64%
Region III	$3,906,512	$3,246,948	83%

Step 3: Calculate the 2024 recommended budget using the 2018-2022 recorded pipeline replacement cost as a percentage of the Commission's authorized 2018-2022 budgets for each Region:

Region	Recommended 2024 Revised Proposed Pipeline Budget (from Step 1)	2018-2022 Average Recorded Pipeline Replacement Cost/2018-2022 Average Authorized Pipeline Replacement Budget	Recommended Test Year 2024 Pipeline Budget
	(A)	(B)	(C)
			[AxB]
Region I	$2,161,844	43%	$929,593
Region II	$7,067,024	64%	$4,522,895
Region III	$6,282,173	83%	$5,214,203

Therefore, the Commission should authorize for 2024: $929,593 for Region I, $4,522,895 for Region II and $5,214,203 for Region III.

Recommended 2026 Pipeline Budget Calculation Methodology

Review GSWC recorded data: GSWC's Recorded and Forecasted Cost Per Foot of Pipeline[119, 120]

Year	Region I	Region II	Region III
2018	$214	$157	$190
2019	$313	$180	$142
2020	$218	$205	$191
2021	$272	$167	$182
2022	$277	$160	$184
2018-2022 Average	$259	$174	$178
GSWC's 2024-2026 Annual Unit Prices			
2024	$684	$496	$546
2025	$719	$510	$471
2026	$764	$443	$465

Step 1: Calculate the total proposed 2026 budget using the 2018-2022 Average Cost/Foot of Pipeline for each Region and an assumed 3% annual escalation:

Region	Recommended 2018-2022 Average Cost/Foot of Pipeline	4-Year Escalation (2022-2026)	Escalated Cost/Foot to 2026 dollars (multiply Cost/Foot of Pipeline by 1.1255)	GSWC 2026 Proposed Pipeline Feet By Region	Recommended Total 2026 Proposed Pipeline Budget With 2018-2022 Average Cost/Foot (multiply escalated Cost/Foot by feet)
	(A)	(B)	(C)	(D)	(E)
			[A x (1+B)]		[C x D]
Region I	$259	12.55%	$292	30,624	$8,927,034
Region II	$174	12.55%	$196	60,034	$11,756,878
Region III	$178	12.55%	$200	31,627	$6,336,122

Step 2: Calculate the 2018-2022 average percentage GSWC spent on pipeline replacement cost of the Commission's total authorized 2018-2022 budget for each Region:

Region	2018-2022 Average Authorized Pipeline Replacement Budget	2018-2022 Average Recorded Pipeline Replacement Cost	2018-2022 Average Recorded Pipeline Replacement Cost/2018-2022 Average Authorized Pipeline Replacement Budget
	(A)	(B)	(C)
			[B/A]
Region I	$1,522,562	$649,411	43%
Region II	$12,864,288	$8,245,706	64%
Region III	$3,906,512	$3,246,948	83%

[119] Note: GSWC states that 2023 data is not available.

[120] Region I includes Arden, Cordova, Bay Point, Clearlake, Los Osos, Edna Road, Orcutt, Tanglewood, Sisquoc, Lake Marie, Nipomo, Cypress Ridge, and Simi Valley. The Regional cost/foot is based on GSWC's recorded 2018-2022 miles replaced and pipeline costs. Note: GSWC acquired the Robbins System in 2022, therefore, the Robbins 2018-2022 pipeline cost/foot is not included. See GSWC Advice Letter 1878. *See* GSWC's response to Public Advocates Office data request DG-01. The 2024-2026 annual cost/foot is calculated from GSWC's A.23-08-010 Pipeline Management Program, Vol. 2 Testimony, Attachment H pp 66-67 and 74-75.

Step 3: Calculate the 2026 recommended budget using the 2018-2022 recorded pipeline replacement cost as a percentage of the Commission's authorized 2018-2022 budgets for each Region:

Region	Recommended 2026 Revised Proposed Pipeline Budget (from Step 1)	2018-2022 Average Recorded Pipeline Replacement Cost/2018-2022 Average Authorized Pipeline Replacement Budget	Recommended Test Year 2026 Pipeline Budget
	(A)	(B)	(C) [AxB]
Region I	$8,927,034	43%	$3,838,625
Region II	$11,756,878	64%	$7,524,402
Region III	$6,336,122	83%	$5,258,981

Therefore, the Commission should authorize for 2026: $3,838,625 for Region I, $7,524,402 for Region II and $5,258,981 for Region III.

ATTACHMENT 1-5: GSWC'S RESPONSE TO PUBLIC ADVOCATES OFFICE DG-01, ATTACHMENT 1

Region I

Arden

Main Replacement Miles	Proposed	Adopted	Recorded
2013	0.00	0.00	0.00
2014	0.00	0.00	0.00
2015	0.00	0.00	0.00
2016	0.00	0.00	0.00
2017	0.78	0.77	0.99
2018	0.00	0.00	0.00
2019	0.00	0.00	0.17
2020	0.16	0.16	0.00
2021	0.01	0.01	0.00
2022	0.93	0.93	0.00

Cordova

Main Replacement Miles	Proposed	Adopted	Recorded
2013	0.78	0.34	0.34
2014	0.47	0.91	0.80
2015	0.44	0.44	0.15
2016	0.16	0.13	0.46
2017	0.34	0.34	1.63
2018	0.00	0.00	0.47
2019	0.83	0.32	0.89
2020	1.63	0.51	0.00
2021	0.08	0.08	0.00
2022	0.00	0.00	0.47

Baypoint

Main Replacement Miles	Proposed	Adopted	Recorded
2013	0.15	0.15	0.00
2014	0.28	0.00	0.00
2015	0.00	0.00	0.00
2016	0.19	0.19	0.61
2017	0.27	0.27	0.00
2018	0.03	0.03	0.00
2019	0.35	0.35	0.43
2020	0.27	0.27	0.03
2021	0.00	0.00	0.31
2022	0.00	0.00	0.00

Clearlake

Main Replacement Miles	Proposed	Adopted	Recorded
2013	0.06	0.06	0.50
2014	0.19	0.19	0.28
2015	0.23	0.22	0.21
2016	0.30	0.30	0.56
2017	0.15	0.15	0.30
2018	0.00	0.00	0.41
2019	0.74	0.85	0.29
2020	0.15	0.15	0.55
2021	0.00	0.00	0.36
2022	0.00	0.00	0.00

Los Osos

Main Replacement Miles	Proposed	Adopted	Recorded
2013	0.15	0.15	0.10
2014	0.09	0.09	0.55
2015	0.00	0.00	0.00
2016	0.00	0.00	0.00
2017	0.00	0.00	0.01
2018	0.01	0.01	0.06
2019	0.05	0.05	0.00
2020	0.07	0.07	0.55
2021	0.35	0.35	0.00
2022	0.00	0.00	0.00

Region II

Artesia

Main Replacement Miles	Proposed	Adopted	Recorded
2013	0.93	0.00	0.00
2014	0.31	0.81	1.43
2015	0.00	0.00	0.00
2016	1.70	0.08	1.64
2017	0.69	0.40	0.44
2018	0.00	0.00	2.11
2019	0.89	0.89	0.00
2020	0.00	0.00	0.00
2021	1.13	1.13	0.21
2022	0.32	0.32	3.42

Norwalk

Main Replacement Miles	Proposed	Adopted	Recorded
2013	1.73	0.00	3.13
2014	0.00	1.74	2.26
2015	1.13	1.13	0.25
2016	1.07	1.07	1.96
2017	0.00	0.00	0.00
2018	0.00	0.00	0.00
2019	0.27	0.27	0.00
2020	0.00	0.00	0.00
2021	0.17	0.17	0.35
2022	0.67	0.67	0.00

Bell-Bell Gardens

Main Replacement Miles	Proposed	Adopted	Recorded
2013	0.97	0.97	1.07
2014	0.63	0.63	0.00
2015	0.49	0.49	0.50
2016	0.00	0.00	1.38
2017	1.32	1.32	3.28
2018	0.00	0.00	0.00
2019	0.00	0.00	0.00
2020	0.00	0.00	0.00
2021	0.00	0.00	0.94
2022	2.03	2.03	1.32

Florence-Graham

Main Replacement Miles	Proposed	Adopted	Recorded
2013	1.25	0.00	2.93
2014	0.78	1.23	0.85
2015	0.76	0.76	0.68
2016	1.21	1.21	1.64
2017	0.16	0.16	0.42
2018	0.00	0.00	2.57
2019	1.29	1.29	1.26
2020	0.00	0.00	0.00
2021	0.00	0.00	0.00
2022	2.36	2.36	0.00

Hollydale

Main Replacement Miles	Proposed	Adopted	Recorded
2013	0.17	0.15	0.00
2014	0.06	0.08	0.00
2015	0.00	0.00	0.00
2016	0.00	0.00	0.26
2017	0.23	0.23	0.00
2018	0.00	0.00	0.00
2019	1.46	0.51	0.00
2020	0.00	0.00	0.00
2021	0.00	0.00	0.00
2022	0.89	0.89	0.00

Region III

West Orange County

Main Replacement Miles	Proposed	Adopted	Recorded
2013	0.45	0.36	0.06
2014	0.00	0.00	0.42
2015	0.00	0.00	0.00
2016	0.00	0.00	0.13
2017	0.81	0.58	0.34
2018	0.00	0.00	1.17
2019	0.72	0.72	0.21
2020	2.42	2.42	1.47
2021	0.00	0.00	0.40
2022	0.94	0.94	1.94

Cowan Heights

Main Replacement Miles	Proposed	Adopted	Recorded
2013	0.23	0.23	0.22
2014	0.00	0.00	0.00
2015	0.00	0.00	0.00
2016	0.00	0.00	0.00
2017	0.29	0.29	0.32
2018	0.00	0.00	0.68
2019	0.38	0.38	0.00
2020	0.38	0.38	0.00
2021	0.00	0.00	0.00
2022	0.42	0.42	0.00

Placentia-Yorba Linda

Main Replacement Miles	Proposed	Adopted	Recorded
2013	0.00	0.00	0.00
2014	0.00	0.00	0.00
2015	0.00	0.00	0.00
2016	0.19	0.19	0.33
2017	0.00	0.00	0.23
2018	0.00	0.00	0.00
2019	0.75	0.75	0.00
2020	0.00	0.00	0.00
2021	0.09	0.09	0.00
2022	0.00	0.00	0.00

Claremont

Main Replacement Miles	Proposed	Adopted	Recorded
2013	1.52	1.06	1.16
2014	0.72	0.00	0.35
2015	2.71	2.62	1.36
2016	0.00	0.00	0.79
2017	0.19	0.19	0.16
2018	0.08	0.08	1.80
2019	1.21	1.21	1.84
2020	3.56	3.56	3.09
2021	0.00	0.00	0.42
2022	3.54	3.54	1.23

San Dimas

Main Replacement Miles	Proposed	Adopted	Recorded
2013	1.17	0.27	0.58
2014	0.49	0.49	0.44
2015	0.15	0.13	0.38
2016	0.00	0.00	2.56
2017	0.68	0.68	1.69
2018	0.00	0.00	0.29
2019	1.93	1.93	2.29
2020	1.02	1.02	1.43
2021	0.00	0.00	0.32
2022	0.00	0.00	0.00

Edna Road

Main Replacement Miles	Proposed	Adopted	Recorded
2013	0.00	0.00	0.00
2014	0.28	0.25	0.00
2015	0.00	0.00	0.32
2016	0.00	0.00	0.47
2017	0.04	0.00	0.00
2018	0.00	0.00	0.05
2019	0.23	0.23	0.49
2020	0.00	0.00	0.00
2021	0.00	0.00	0.00
2022	0.00	0.00	0.00

Willowbrook

Main Replacement Miles	Proposed	Adopted	Recorded
2013	0.00	0.00	0.52
2014	0.43	0.42	0.41
2015	0.00	0.00	0.00
2016	0.72	0.72	0.00
2017	0.00	0.00	0.74
2018	0.00	0.00	0.00
2019	1.23	1.23	0.00
2020	0.00	0.00	0.00
2021	0.00	0.00	1.26
2022	0.00	0.00	0.00

South Arcadia

Main Replacement Miles	Proposed	Adopted	Recorded
2013	2.42	1.46	1.29
2014	2.96	1.44	3.54
2015	0.36	0.36	0.00
2016	2.23	2.23	4.95
2017	0.51	0.51	2.73
2018	3.35	3.35	3.93
2019	0.81	0.81	2.73
2020	3.45	3.45	1.63
2021	0.00	0.00	1.43
2022	0.64	0.64	0.00

Lake Marie

Main Replacement Miles	Proposed	Adopted	Recorded
2013	0.00	0.00	0.00
2014	0.00	0.00	0.00
2015	0.00	0.00	0.06
2016	0.00	0.00	0.00
2017	0.04	0.04	0.00
2018	0.00	0.00	0.00
2019	0.00	0.00	0.00
2020	0.22	0.22	0.00
2021	0.00	0.00	0.00
2022	0.00	0.00	0.00

Culver City

Main Replacement Miles	Proposed	Adopted	Recorded
2013	1.30	0.34	0.90
2014	1.14	0.95	0.84
2015	2.16	1.46	1.13
2016	1.22	1.43	0.27
2017	0.80	0.30	1.13
2018	0.00	0.00	1.62
2019	1.67	1.67	2.66
2020	0.00	0.00	0.00
2021	0.02	0.02	1.80
2022	6.54	6.54	0.14

South San Gabriel

Main Replacement Miles	Proposed	Adopted	Recorded
2013	0.59	0.27	0.63
2014	0.44	0.32	0.33
2015	0.00	0.00	0.00
2016	0.00	0.00	0.00
2017	0.17	0.17	0.17
2018	0.87	0.45	0.74
2019	0.51	0.29	0.93
2020	0.23	0.23	0.14
2021	0.00	0.00	0.60
2022	0.00	0.00	1.44

Orcutt

Main Replacement Miles	Proposed	Adopted	Recorded
2013	0.44	0.44	0.83
2014	0.00	1.02	0.00
2015	0.00	0.00	0.78
2016	0.00	0.00	0.00
2017	0.78	0.78	0.00
2018	0.08	0.06	0.00
2019	0.21	0.21	0.03
2020	0.96	0.96	0.00
2021	1.33	1.33	0.00
2022	2.94	2.94	0.27

Southwest

Main Replacement Miles	Proposed	Adopted	Recorded
2013	2.95	5.23	2.99
2014	8.15	0.23	4.42
2015	9.89	10.20	11.23
2016	6.74	6.74	12.25
2017	5.61	5.63	15.01
2018	9.32	9.32	20.09
2019	7.48	7.48	24.96
2020	15.06	15.06	2.09
2021	2.06	2.06	5.02
2022	0.00	0.00	2.30

Barstow

Main Replacement Miles	Proposed	Adopted	Recorded
2013	0.83	0.83	0.37
2014	1.73	0.45	3.67
2015	0.00	0.00	0.24
2016	0.09	0.00	3.00
2017	0.67	0.09	5.62
2018	0.00	0.67	0.65
2019	0.00	0.00	0.00
2020	3.49	3.49	1.11
2021	0.00	0.00	0.00
2022	0.13	0.13	0.00

Sisquoc

Main Replacement Miles

	Proposed	Adopted	Recorded
2013	0.00	0.00	0.00
2014	0.00	0.00	0.00
2015	0.00	0.00	0.00
2016	0.00	0.00	0.00
2017	0.00	0.00	0.00
2018	0.00	0.00	0.00
2019	0.00	0.00	0.00
2020	0.00	0.00	0.00
2021	0.00	0.00	0.00
2022	0.00	0.00	0.00

Tanglewood

Main Replacement Miles

	Proposed	Adopted	Recorded
2013	0.00	0.00	0.69
2014	0.62	0.55	0.00
2015	0.00	0.00	0.00
2016	0.00	0.00	1.62
2017	0.00	0.00	0.00
2018	0.00	0.00	0.05
2019	0.00	0.00	0.00
2020	0.00	0.00	0.00
2021	0.00	0.00	0.00
2022	0.00	0.00	0.00

Nipomo

Main Replacement Miles

	Proposed	Adopted	Recorded
2013	0.00	0.00	0.00
2014	0.00	0.00	0.00
2015	0.00	0.00	0.00
2016	0.00	0.00	0.00
2017	0.00	0.00	0.00
2018	0.00	0.00	0.00
2019	0.05	0.05	0.00
2020	0.00	0.00	0.00
2021	0.00	0.00	0.00
2022	0.00	0.00	0.00

Cypress Ridge

Main Replacement Miles

	Proposed	Adopted	Recorded
2013	0.00	0.00	0.00
2014	0.00	0.00	0.00
2015	0.00	0.00	0.00
2016	0.00	0.00	0.00
2017	0.00	0.00	0.00
2018	2.08	0.00	0.00
2019	0.85	0.00	0.00
2020	0.00	0.00	0.00
2021	0.00	0.00	0.00
2022	0.00	0.00	0.00

Simi Valley

Main Replacement Miles

	Proposed	Adopted	Recorded
2013	0.32	0.00	0.19
2014	0.00	1.29	0.00
2015	0.76	0.00	0.00
2016	0.00	0.76	1.56
2017	0.32	0.32	0.00
2018	0.00	0.00	0.00
2019	0.06	0.04	0.03
2020	0.21	0.21	0.00
2021	0.00	0.00	0.00
2022	0.44	0.44	0.05

Calipatria-Niland

Main Replacement Miles

	Proposed	Adopted	Recorded
2013	0.00	0.00	0.00
2014	0.00	0.00	0.00
2015	0.00	0.00	0.00
2016	0.00	0.00	0.00
2017	0.00	0.00	0.00
2018	0.00	0.00	0.00
2019	0.15	0.15	0.00
2020	0.00	0.00	0.22
2021	0.14	0.14	0.00
2022	0.68	0.68	0.16

Morongo Del Norte

Main Replacement Miles

	Proposed	Adopted	Recorded
2013	0.00	0.00	0.00
2014	0.00	0.00	0.00
2015	0.00	0.00	0.00
2016	0.00	0.00	0.00
2017	0.00	0.00	0.00
2018	0.00	0.00	0.00
2019	0.19	0.19	0.00
2020	0.00	0.00	0.00
2021	0.13	0.13	0.00
2022	0.00	0.00	0.00

Morongo Del Sur

Main Replacement Miles

	Proposed	Adopted	Recorded
2013	0.00	0.00	0.48
2014	0.27	0.21	0.00
2015	0.00	0.00	0.00
2016	0.00	0.00	0.16
2017	0.00	0.00	0.00
2018	0.00	0.00	0.25
2019	0.76	0.76	0.00
2020	0.00	0.00	0.27
2021	0.08	0.08	0.00
2022	0.12	0.12	0.13

Apple Valley South

Main Replacement Miles

	Proposed	Adopted	Recorded
2013	0.85	0.98	1.65
2014	0.09	0.09	0.32
2015	0.36	0.36	0.00
2016	0.00	0.00	4.37
2017	0.00	0.00	0.00
2018	0.00	0.00	1.63
2019	1.57	1.57	1.49
2020	1.33	1.33	0.00
2021	0.08	0.08	0.00
2022	0.97	0.97	2.97

Desert View

Main Replacement Miles

	Proposed	Adopted	Recorded
2013	0.00	0.00	0.00
2014	0.00	0.00	0.00
2015	0.00	0.00	0.00
2016	0.00	0.00	0.80
2017	1.14	1.14	0.00
2018	0.00	0.00	0.00
2019	0.00	0.00	0.00
2020	0.00	0.00	0.00
2021	0.51	0.51	0.51
2022	0.00	0.00	0.00

Apple Valley North

Main Replacement Miles

	Proposed	Adopted	Recorded
2013	0.00	0.00	0.16
2014	0.17	0.17	0.00
2015	0.63	0.63	1.13
2016	0.00	0.00	3.46
2017	0.00	0.00	0.00
2018	0.00	0.00	0.00
2019	0.93	0.93	0.91
2020	0.00	0.00	0.00
2021	1.14	1.14	0.00
2022	0.00	0.00	1.13

Lucerne Valley

Main Replacement Miles

2013	0.00	0.00	0.28
2014	0.00	0.00	0.00
2015	0.00	0.00	0.00
2016	0.00	0.00	1.02
2017	0.00	0.00	0.00
2018	0.00	0.00	0.00
2019	0.00	0.00	0.77
2020	0.74	0.74	1.45
2021	0.51	0.51	0.00
2022	0.00	0.00	0.55

Wrightwood

Main Replacement Miles

	Proposed	Adopted	Recorded
2013	0.97	0.97	1.59
2014	0.42	0.00	2.04
2015	1.07	1.05	0.00
2016	0.00	0.00	1.74
2017	1.31	1.40	0.00
2018	0.00	0.00	7.51
2019	0.00	0.00	0.00
2020	0.00	0.00	0.00
2021	0.00	0.00	1.08
2022	0.00	0.00	0.10

Note:

For Years 2021 and 2022
The Proposed and Adopted are listed as the same dollar amount since the Decision adopted a total dollar amount for all Capital Projects and did not identify any projects as being dis-allowed.
D.23-06-024, at page 10 states:
The $45,792,057 reduction in GSW's original $450,627,889 represents a nearly 10 percent reduction. We find that it will allow GSW to recover a reasonable amount of the costs needed to ensure safe and reliable water service to its customers, while promoting operational efficiency and prudent infrastructure development and keeping rates as low as reasonably practicable. We base this on GSW's and Cal Advocates' representation in this record [7] that the funding for GSW's capital improvement program, as settled, is reasonable and designed to align with regulatory mandates. …
GSW is not obligated to construct any individual project included in the $404,835,832 settled capital budget. This term will allow GSW leeway to address emergencies and unforeseen events. However, the CPUC expects that with this flexibility, GSW will manage the timing of construction projects to maximize efficiency and will put the approved budget to its highest priorities and best uses first.
[7] Joint Motion, at 3.

Region I

Arden

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ -	$ -	$ -
2014	$ -	$ -	$ -
2015	$ -	$ -	$ -
2016	$ 181,300	$ 177,300	$ -
2017	$ 1,572,100	$ 1,537,300	$ 1,273,690
2018	$ -		$ (104)
2019	$ 12,700	$ 13,000	$ 302,967
2020	$ 251,000	$ 256,600	$ -
2021	$ 280,700	$ 280,700	$ -
2022	$ 2,562,700	$ 2,562,700	$ -

Cordova

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ 1,236,400	$ 780,400	$ 340,138
2014	$ 966,800	$ 1,099,500	$ 774,295
2015	$ 936,600	$ 849,600	$ 186,842
2016	$ 552,500	$ 429,900	$ 505,469
2017	$ 1,288,500	$ 1,259,900	$ 2,013,580
2018	$ 76,600	$ 25,700	$ 509,663
2019	$ 1,537,400	$ 512,100	$ 1,474,178
2020	$ 3,086,700	$ 1,050,700	$ -
2021	$ 214,700	$ 214,700	$ -
2022	$ -	$ -	$ 538,649
		$ 1,803,200	$ 2,522,490
			139.89%

Baypoint

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ 301,800	$ 221,500	$ -
2014	$ 465,600	$ 119,400	$ -
2015	$ 68,600	$ 67,100	$ -
2016	$ 409,100	$ 400,100	$ 1,014,573
2017	$ 572,800	$ 560,100	$ 3,707
2018	$ 83,400	$ 85,200	$ -
2019	$ 514,900	$ 526,400	$ 952,480
2020	$ 420,300	$ 429,700	$ 38,080
2021	$ -	$ -	$ 587,920
2022	$ -	$ -	$ -

Clearlake

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ 125,900	$ 125,100	$ 431,834
2014	$ 251,700	$ 250,400	$ 162,772
2015	$ 302,600	$ 295,800	$ 165,872
2016	$ 456,600	$ 446,400	$ 451,563
2017	$ 433,600	$ 424,000	$ 247,408
2018	$ 51,300	$ 52,400	$ 375,594
2019	$ 1,035,200	$ 1,058,300	$ 445,968
2020	$ 236,400	$ 241,700	$ 583,855
2021	$ -	$ -	$ 374,780
2022	$ -	$ -	$ -

Region II

Artesia

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ 2,476,000	$ -	$ -
2014	$ 815,200	$ 1,461,214	$ 1,164,242
2015	$ 358,100	$ 311,100	$ 28,576
2016	$ 3,562,700	$ 3,101,000	$ 1,254,527
2017	$ 1,933,300	$ 1,675,100	$ 783,887
2018	$ -	$ -	$ 1,306,688
2019	$ 1,297,100	$ 1,326,000	$ -
2020	$ -	$ -	$ -
2021	$ 2,438,000	$ 2,438,000	$ 194,509
2022	$ 1,263,600	$ 1,263,600	$ 3,065,455

Norwalk

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ 4,159,300	$ 416,136	$ 2,327,664
2014	$ 193,800	$ 4,456,300	$ 1,175,843
2015	$ 2,433,700	$ 2,140,300	$ 234,381
2016	$ 2,189,300	$ 1,915,200	$ 2,635,350
2017	$ -		$ -
2018	$ -	$ -	$ -
2019	$ 391,100	$ 399,800	$ -
2020	$ -	$ -	$ -
2021	$ 391,100	$ 391,100	$ 198,570
2022	$ 1,376,000	$ 1,376,000	$ -

Bell-Bell Gardens

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ 1,913,400	$ 1,900,600	$ 705,272
2014	$ 1,269,200	$ 1,262,800	$ -
2015	$ 1,149,900	$ 1,016,800	$ 451,798
2016	$ 274,800	$ 241,000	$ 1,109,706
2017	$ 2,382,800	$ 2,089,900	$ 2,624,868
2018	$ -	$ -	$ -
2019	$ -	$ -	$ -
2020	$ -	$ -	$ -
2021	$ -	$ -	$ 565,659
2022	$ 4,689,900	$ 4,689,900	$ 869,337

Florence-Graham

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ 2,412,900	$ 349,700	$ 2,356,540
2014	$ 1,547,900	$ 2,482,300	$ 954,671
2015	$ 2,232,800	$ 1,983,200	$ 667,988
2016	$ 2,702,900	$ 2,394,500	$ 1,560,055
2017	$ 643,800	$ 553,800	$ 505,795
2018	$ -	$ -	$ 2,389,358
2019	$ 2,580,300	$ 2,637,800	$ 1,044,337
2020	$ -	$ -	$ -
2021	$ -	$ -	$ (239)
2022	$ 4,694,200	$ 4,694,200	$ -

Region III

West Orange County

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ 551,700	$ 548,000	$ 103,680
2014	$ -	$ -	$ 211,852
2015	$ -	$ -	$ -
2016	$ 160,100	$ 156,500	$ 168,209
2017	$ 1,420,500	$ 1,389,100	$ 1,589,183
2018	$ -	$ -	$ 1,579,052
2019	$ 1,435,300	$ 1,467,200	$ 218,777
2020	$ 4,000,600	$ 4,089,700	$ 1,105,742
2021	$ -	$ -	$ 445,011
2022	$ 3,661,100	$ 3,661,100	$ 2,174,217

Cowan Heights

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ 273,400	$ 271,600	$ 256,715
2014	$ -	$ -	$ -
2015	$ -	$ -	$ -
2016	$ 42,000	$ 41,100	$ -
2017	$ 528,000	$ 516,400	$ 460,420
2018	$ -		$ 1,266,687
2019	$ 671,800	$ 686,700	$ -
2020	$ 566,200	$ 578,900	$ -
2021	$ -	$ -	$ -
2022	$ 1,180,200	$ 1,180,200	$ -

Placentia-Yorba Linda

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ -	$ -	$ -
2014	$ -	$ -	$ -
2015	$ -	$ -	$ -
2016	$ 329,900	$ 322,600	$ 414,476
2017	$ 41,300	$ 40,400	$ 207,402
2018	$ -		$ -
2019	$ 1,159,800	$ 1,185,600	$ -
2020	$ -	$ -	$ -
2021	$ 328,800	$ 328,800	$ -
2022	$ -	$ -	$ -

Claremont

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ 2,152,600	$ 1,034,200	$ 830,792
2014	$ 1,617,000	$ 1,285,000	$ 531,346
2015	$ 3,261,800	$ 3,189,500	$ 1,207,360
2016	$ -	$ -	$ 728,590
2017	$ 293,000	$ 286,500	$ 145,856
2018	$ 112,100	$ 114,500	$ 1,976,397
2019	$ 1,877,500	$ 1,919,500	$ 1,982,531
2020	$ 4,964,300	$ 5,075,000	$ 3,584,946
2021	$ 82,100	$ 82,100	$ 660,458
2022	$ 8,465,000	$ 8,465,000	$ 2,241,042

Los Osos

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ 165,400	$ 154,500	$ 111,790
2014	$ 304,000	$ 196,200	$ 233,693
2015	$ -	$ -	$ -
2016	$ -	$ -	$ -
2017	$ -	$ -	$ 9,289
2018	$ 22,200	$ 22,800	$ 98,783
2019	$ 56,800	$ 58,000	$ -
2020	$ 89,000	$ 90,900	$ 680,815
2021	$ 503,600	$ 503,600	$ -
2022	$ -	$ -	$ -

Edna Road

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ 25,400	$ 25,200	$ -
2014	$ 274,000	$ 272,600	$ -
2015	$ -	$ -	$ 218,112
2016	$ 12,600	$ 12,300	$ 282,165
2017	$ 247,600	$ 242,100	$ -
2018	$ 12,600	$ 12,900	$ 133,607
2019	$ 251,900	$ 257,500	$ 336,303
2020	$ -	$ -	$ -
2021	$ -	$ -	$ -
2022	$ -	$ -	$ -

Lake Marie

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ -	$ -	$ -
2014	$ -	$ -	$ -
2015	$ -	$ -	$ 57,609
2016	$ 10,100	$ 9,900	$ -
2017	$ 104,700	$ 102,400	$ -
2018	$ -	$ -	$ -
2019	$ 12,800	$ 13,000	$ -
2020	$ 251,000	$ 256,700	$ -
2021	$ -	$ -	$ -
2022	$ -	$ -	$ -

Orcutt

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ 582,900	$ 579,000	$ 527,735
2014	$ 483,900	$ 353,000	$ -
2015	$ -	$ -	$ 846,107
2016	$ -	$ -	$ -
2017	$ 1,487,300	$ 1,454,400	$ -
2018	$ 110,100	$ 112,500	$ -
2019	$ 340,100	$ 347,700	$ 20,915
2020	$ 1,187,300	$ 1,213,700	$ -
2021	$ 2,238,000	$ 2,238,000	$ -
2022	$ 2,665,400	$ 2,665,400	$ 470,726

Hollydale

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ 315,900	$ 313,800	$ -
2014	$ 130,000	$ 129,300	$ -
2015	$ -	$ -	$ -
2016	$ -	$ -	$ 275,452
2017	$ 537,100	$ 475,700	$ -
2018	$ -	$ -	$ -
2019	$ 2,785,500	$ 1,075,100	$ -
2020	$ -	$ -	$ 879,875
2021	$ -	$ -	$ 31,152
2022	$ 1,563,100	$ 1,563,100	$ -

Willowbrook

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ 197,400	$ 130,700	$ 387,688
2014	$ 710,500	$ 706,900	$ 444,422
2015	$ 232,600	$ 205,200	$ -
2016	$ 2,034,000	$ 1,795,200	$ -
2017	$ -	$ -	$ 518,133
2018	$ -	$ -	$ -
2019	$ 2,117,800	$ 2,165,200	$ -
2020	$ 6,400	$ 6,500	$ -
2021	$ -	$ -	$ 958,912
2022	$ -	$ -	$ -

Culver City

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ 2,726,500	$ 893,100	$ 697,851
2014	$ 2,712,800	$ 2,022,800	$ 1,250,119
2015	$ 4,959,800	$ 4,374,200	$ 1,107,537
2016	$ 2,529,400	$ 2,194,200	$ 391,410
2017	$ 1,834,000	$ 1,595,600	$ 1,005,797
2018	$ 196,300	$ 200,700	$ 1,372,405
2019	$ 3,075,500	$ 3,144,100	$ 2,760,150
2020	$ -	$ -	$ 1,108
2021	$ 273,800	$ 273,800	$ 2,654,145
2022	$ 14,642,100	$ 14,642,100	$ (86,221)

Southwest

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ 10,163,900	$ 11,217,484	$ 3,291,138
2014	$ 15,108,800	$ 1,865,116	$ 5,045,369
2015	$ 22,646,200	$ 19,803,800	$ 11,933,660
2016	$ 14,784,300	$ 12,841,200	$ 11,639,219
2017	$ 14,618,700	$ 12,694,900	$ 13,478,162
2018	$ 17,677,300	$ 18,071,500	$ 16,747,954
2019	$ 13,014,100	$ 13,304,400	$ 23,579,622
2020	$ 29,913,300	$ 24,780,600	$ 1,381,181
2021	$ 4,327,400	$ 4,327,400	$ 3,824,976
2022	$ 143,400	$ 143,400	$ 2,226,715

San Dimas

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ 1,691,800	$ 412,700	$ 408,623
2014	$ 1,076,600	$ 1,256,800	$ 634,505
2015	$ 294,800	$ 288,300	$ 424,339
2016	$ 106,600	$ 104,200	$ 1,788,475
2017	$ 1,096,300	$ 1,072,000	$ 1,534,199
2018	$ -	$ -	$ 272,450
2019	$ 2,856,600	$ 2,920,200	$ 2,129,679
2020	$ 1,505,700	$ 1,539,300	$ 1,860,232
2021	$ -	$ -	$ 305,959
2022	$ -	$ -	$ -

South Arcadia

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ 3,805,100	$ 2,213,200	$ 717,617
2014	$ 4,037,900	$ 2,398,500	$ 2,240,961
2015	$ 676,100	$ 661,100	$ -
2016	$ 2,929,300	$ 2,864,400	$ 3,087,605
2017	$ 762,100	$ 745,200	$ 1,539,852
2018	$ 5,061,600	$ 4,398,325	$ 2,869,797
2019	$ 1,656,900	$ 1,439,815	$ 1,897,953
2020	$ 4,824,100	$ 4,191,945	$ 2,016,900
2021	$ -	$ -	$ 1,212,946
2022	$ 1,053,400	$ 1,053,400	$ -

South San Gabriel

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ 792,200	$ 363,900	$ 398,030
2014	$ 509,400	$ 477,100	$ 299,701
2015	$ -	$ -	$ -
2016	$ 28,000	$ 27,400	$ -
2017	$ 292,100	$ 285,600	$ 147,266
2018	$ 1,655,200	$ 1,021,100	$ 654,111
2019	$ 795,800	$ 583,700	$ 1,013,411
2020	$ 448,100	$ 458,100	$ 126,189
2021	$ -	$ -	$ 737,286
2022	$ -	$ -	$ 1,276,529

Barstow

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ 1,056,500	$ 802,100	$ 249,728
2014	$ 1,766,400	$ 482,200	$ 2,609,516
2015	$ -	$ -	$ 234,292
2016	$ 291,300	$ 284,900	$ 1,024,086
2017	$ 1,129,900	$ 1,104,900	$ 2,264,964
2018	$ -	$ -	$ 742,050
2019	$ 93,100	$ 95,100	$ -
2020	$ 3,844,700	$ 3,930,500	$ 1,219,268
2021	$ -	$ -	$ -
2022	$ 691,900	$ 691,900	$ -

Sisquoc

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ -	$ -	$ -
2014	$ -	$ -	$ -
2015	$ -	$ -	$ -
2016	$ -	$ -	$ -
2017	$ -	$ -	$ -
2018	$ -	$ -	$ -
2019	$ -	$ -	$ -
2020	$ -	$ -	$ -
2021	$ -	$ -	$ -
2022	$ -	$ -	$ -

Tanglewood

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ 349,800	$ 254,800	$ 598,993
2014	$ 1,260,200	$ 1,253,800	$ -
2015	$ -	$ -	$ -
2016	$ -	$ -	$ 1,384,881
2017	$ 329,900	$ 322,600	$ -
2018	$ -	$ -	$ 56,145
2019	$ -	$ -	$ -
2020	$ -	$ -	$ -
2021	$ -	$ -	$ -
2022	$ 31,600	$ 31,600	$ -

Nipomo

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ -	$ -	$ -
2014	$ -	$ -	$ -
2015	$ -	$ -	$ -
2016	$ -	$ -	$ -
2017	$ -	$ -	$ -
2018	$ -	$ -	$ -
2019	$ 83,000	$ 84,900	$ -
2020	$ -	$ -	$ -
2021	$ -	$ -	$ -
2022	$ -	$ -	$ -
		$ 84,900	$ -
			0.00%

Cypress Ridge

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ -	$ -	$ -
2014	$ -	$ -	$ -
2015	$ -	$ -	$ -
2016	$ -	$ -	$ -
2017	$ -	$ -	$ -
2018	$ 2,308,300	$ -	$ -
2019	$ 888,000	$ -	$ -
2020	$ -	$ 2,434,100	$ -
2021	$ -	$ -	$ -
2022	$ -	$ -	$ -
		$ 2,434,100	$ -
			0.00%

Simi Valley

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ 681,900	$ 129,100	$ 191,864
2014	$ 195,100	$ 893,100	$ -
2015	$ 851,600	$ 832,800	$ -
2016	$ 984,000	$ 962,200	$ 2,450,638
2017	$ 1,006,100	$ 983,800	$ (2,076)
2018	$ 21,000	$ 21,500	$ -
2019	$ 439,700	$ 449,600	$ 314,853
2020	$ 406,500	$ 415,600	$ -
2021	$ 61,300	$ 61,300	$ -
2022	$ 1,192,100	$ 1,192,100	$ 146,163

Calipatria-Niland

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ -	$ -	$ -
2014	$ -	$ -	$ -
2015	$ -	$ -	$ -
2016	$ -	$ -	$ -
2017	$ -	$ -	$ -
2018	$ -	$ -	$ -
2019	$ 158,800	$ 162,300	$ -
2020	$ -	$ -	$ 209,715
2021	$ 376,400	$ 376,400	$ -
2022	$ 1,765,200	$ 1,765,200	$ 296,076

Morongo Del Sur

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ 31,100	$ 30,900	$ 310,044
2014	$ 349,500	$ 347,700	$ -
2015	$ -	$ -	$ -
2016	$ -	$ -	$ 239,736
2017	$ -	$ -	$ -
2018	$ 6,600	$ 6,700	$ 266,131
2019	$ 709,100	$ 725,100	$ -
2020	$ -	$ -	$ 153,121
2021	$ 273,300	$ 273,300	$ -
2022	$ 311,000	$ 311,000	$ 178,165

Morongo Del Norte

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ -	$ -	$ -
2014	$ -	$ -	$ -
2015	$ -	$ -	$ -
2016	$ -	$ -	$ -
2017	$ -	$ -	$ -
2018	$ -	$ -	$ -
2019	$ 183,000	$ 187,100	$ -
2020	$ -	$ -	$ -
2021	$ 299,600	$ 299,600	$ -
2022	$ -	$ -	$ -

Apple Valley South

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ 850,600	$ 987,000	$ 697,219
2014	$ 122,400	$ 121,800	$ 151,333
2015	$ 389,100	$ 380,400	$ -
2016	$ -	$ -	$ 1,752,139
2017	$ 236,500	$ 231,300	$ (900)
2018	$ -		$ 488,083
2019	$ 1,524,200	$ 1,558,100	$ 421,248
2020	$ 1,264,700	$ 1,293,000	$ -
2021	$ 117,100	$ 117,100	$ -
2022	$ 797,600	$ 797,600	$ 1,942,681

Desert View

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ -	$ -	$ -
2014	$ -	$ -	$ -
2015	$ -	$ -	$ -
2016	$ 98,300	$ 96,100	$ 298,771
2017	$ 851,600	$ 832,800	$ -
2018	$ -	$ -	$ -
2019	$ -	$ -	$ -
2020	$ -	$ -	$ -
2021	$ 427,900	$ 427,900	$ 185,999
2022	$ -	$ -	$ -

Apple Valley North

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ 15,300	$ 15,200	$ 67,269
2014	$ 227,300	$ 226,100	$ -
2015	$ 551,300	$ 539,200	$ 531,468
2016	$ -	$ -	$ 953,540
2017	$ 93,100	$ 91,000	$ -
2018	$ -	$ -	$ -
2019	$ 920,200	$ 940,800	$ 320,399
2020	$ -	$ -	$ -
2021	$ 903,300	$ 903,300	$ -
2022	$ -	$ -	$ 593,936

Lucerne Valley

Main Replacement Budgets

2013	$ -	$ -	$ 104,938
2014	$ -	$ -	$ -
2015	$ -	$ -	$ -
2016	$ -	$ -	$ 618,462
2017	$ -	$ -	$ -
2018	$ -	$ -	$ -
2019	$ -	$ -	$ 374,226
2020	$ 711,600	$ 727,400	$ 628,995
2021	$ 474,600	$ 474,600	$ -
2022	$ -	$ -	$ 364,594

Wrightwood

Main Replacement Budgets

	Proposed	Adopted	Recorded
2013	$ 879,100	$ 809,400	$ 848,490
2014	$ 752,100	$ 124,200	$ 1,434,897
2015	$ 1,673,600	$ 1,636,600	$ -
2016	$ 116,800	$ 114,200	$ 1,612,703
2017	$ 2,614,700	$ 2,438,100	$ (768)
2018	$ -	$ -	$ 8,606,876
2019	$ -	$ -	$ -
2020	$ -	$ -	$ -
2021	$ -	$ -	$ 1,022,949
2022	$ -	$ -	$ 328,348

Note:
For Years 2021 and 2022
The Proposed and Adopted are listed as the same dollar amount since the Decision adopted a total dollar amount for all Capital Projects and did not identify any projects as being dis-allowed.
D.23-06-024, at page 10 states:
The $45,792,057 reduction in GSW's original $450,627,889 represents a nearly 10 percent reduction. We find that it will allow GSW to recover a reasonable amount of the costs needed to ensure safe and reliable water service to its customers, while promoting operational efficiency and prudent infrastructure development and keeping rates as low as reasonably practicable. We base this on GSW's and Cal Advocates' representation in this record [7] that the funding for GSW's capital improvement program, as settled, is reasonable and designed to align with regulatory mandates. …
GSW is not obligated to construct any individual project included in the $404,835,832 settled capital budget. This term will allow GSW leeway to address emergencies and unforeseen events. However, the CPUC expects that with this flexibility, GSW will manage the timing of construction projects to maximize efficiency and will put the approved budget to its highest priorities and best uses first.
[7] Joint Motion, at 3.

ATTACHMENT 1-6: GSWC'S RESPONSE TO PUBLIC ADVOCATES OFFICE DG-07

Golden State
Water Company
A Subsidiary of American States Water Company

September 13, 2023

To: Daphne Goldberg, Public Advocates Office
CALIFORNIA PUBLIC UTILITIES COMMISSION
505 Van Ness Avenue
San Francisco, CA 94102

Subject: Data Request DG-07 (A.23-08-010)
(Pipeline Condition Based Assessment)
Due Date (Revised): September 18, 2023

Dear Daphne Goldberg,

In response to the above referenced data request number, we are pleased to submit the following responses:

Question 1:
Please respond to the following questions regarding A.23-08-010, Attachment H, pp. 3-35. which states:
"GSWC previously piloted Innovyze's InfoAsset Planner (formerly known as InfoMaster). InfoAsset Planner resulted in recommendations for multiple short sections of pipelines that required additional manual evaluation by GSWC staff to form realistic and practical pipeline replacement projects. The process proved to be time-consuming, and ultimately less efficient compared to GSWC's current procedure of evaluating and prioritizing pipeline replacement projects based on GIS data and hydraulic model results (i.e., pipeline velocity/head loss, junction pressure)."

a. State the complete date range in which GSWC piloted the Innovyze InfoAsset Planner program.
b. Provide all documents produced as a result of the Innovyze InfoAsset Planner pilot, including all conclusion and recommendation documents. Include specific project costs.
c. Provide all documents associated with and developed through the "manual evaluation" referenced in the quote above that GSWC staff performed to form "realistic and practical pipeline replacement projects."

d. During the Innovyze InfoAsset Planner pilot, provide a timesheet log of all hours GSWC staff worked on the manual evaluation described in Q.1.c.
e. During the same Innovyze InfoAsset Planner Pilot time period, provide a timesheet log of all hours GSWC staff worked on "current procedure of evaluating and prioritizing pipeline replacement projects based on GIS data and hydraulic model results."

Response 1:

a. Based on available records, GSWC initiated conversations with Innovyze regarding InfoMaster (now named InfoAsset Planner) in March 2017, and concluded the pilot project in August 2019.
b. See attached "Q1b response-InfoMaster deliverable", "Q1b response-Model Update Manual", and "Q1b response-Project Summary" produced as a result of the Innovyze InfoMaster pilot. Some of the files provided require special software to view, which GSWC no longer has the ability to use. The total project cost of $40,000 is shown in attached "Q1b response-Innovyze invoices".
c. 'Manual evaluation' by GSWC staff occurred within the InfoMaster software and during discussions/demonstration sessions with Innovyze throughout the pilot project timeframe. The attached "Q1c response-Norwalk InfoMaster Risk Grades" document is an example of the work compiled by GSWC staff to form "realistic and practical pipeline replacement projects".
d. All hours worked by GSWC staff on the InfoMaster pilot would have been charged to Engineering Overhead and cannot be differentiated on historical timesheet records.
e. See response to Questions 1.d.

Question 2:

Please respond to the following questions regarding A.23-08-010, Attachment H, pp. 3-35. which states:

"In 2021, GSWC representatives met with FRACTA, which has developed a machine learning model to assess the condition of potable water distribution pipelines. The goal of the FRACTA software is to assist water utilities to avoid costly breaks, service interruptions, and to save money. However, GSWC was informed that the recurring annual maintenance fee for FRACTA would be $50-$100 per mile of pipeline. As GSWC has approximately 3,000 miles of pipeline, the annual expense for FRACTA to maintain GSWC's pipeline models would range from $150k to $300k. This equates to an expense of $450k to $900k for each GRC cycle (as compared to $6,480 for 36 months of KANEW software maintenance)."

a. State all date(s) that GSWC staff meet with FRACTA staff?
b. Provide all notes from the meeting(s) of GSWC's staff with FRACTA staff.
c. If GSWC received any FRACTA vendor quote, please provide all quotes.
d. Provide a vendor quote for FRACTA's annual maintenance fee of "$50-$100 per mile of pipeline."

e. Provide a vendor quote to support the amount of "$6,480 for 36 months of KANEW".
f. Explain if GSWC piloted the FRACTA software and explain why or why not.
g. If GSWC piloted the FRACTA software, provide the pilot results.

Response 2:

a. 4/8/2021 & 6/28/2021
b. See attached file titled "Q2b response - Meeting Notes FRACTA".
c. Vendor quote provided during meeting(s) of GSWC's staff with FRACTA staff (see meeting notes).
d. Vendor quote provided during meeting(s) of GSWC's staff with FRACTA staff (see meeting notes).
e. See attached file titled "Q2e response – KANEW quote".
f. GSWC did not pilot the FRACTA software; according to the meeting notes, FRACTA did not offer the option of a pilot study when requested by GSWC.
g. N/A

Question 3:

Please respond to the following questions regarding A.23-08-010, Attachment H, pp. 3-36. which states:

"Prior to the 2026 GRC, GSWC plans to investigate Aquanuity AquaTwin Asset software, once GSWC is fully utilizing ArcGIS Pro and the ESRI Utility Network (GSWC will need to be fully converted to ArcGIS Pro before it can assess how the Aquanuity software may enhance the current pipeline replacement rate process)."

a. Explain if GSWC has started to "investigate Aquanuity AquaTwin Asset software."
b. If GSWC has started to investigate Aquanuity AquaTwin Asset software, provide all documentation produced as a result of this investigation to date.
c. Explain why GSWC "will need to be fully converted to ArcGIS Pro before it can assess how the Aquanuity software may enhance the current pipeline replacement rate process."
d. Provide the timeline for GSWC to "be fully converted to ArcGIS Pro and the ESRI Utility Network".

Response 3:

a. GSWC has not further investigated Aquaninity AquaTwin software since the filing of A.23-08-010, Attachment H.
b. N/A
c. Aquanuity software runs on the Esri Utility Network via ArcGIS Pro, not on the geometric network/ArcMap, which is currently used for hydraulic modeling by

GSWC. The Aquanuity website includes the following in its description of the software user environment:

- 64 bit ArcGIS Pro extension application.
- Full support of ArcGIS Pro Pipeline Referencing and Utility Network.
- Compatible with ArcGIS Pro 3.x.

d. GSWC plans to start the conversion to the Esri Utility Network in 2024, with an estimated end date of July 2025.

Question 4:
Please respond to the following questions regarding A.23-08-010, Attachment H, pp. 3-36. which states:
"Coupon Sampling - An opportunity to assess physical condition of a pipeline is during repairs or service taps when the pipeline is exposed. Coupon sampling and testing can be an effective, non-evasive way to determine the condition of an asbestos concrete pipeline. AC pipeline will typically have uniform deterioration, unlike with ductile iron or steel. Testing one coupon of AC pipeline can provide insight to the condition of the entire pipeline segment. By testing the coupon, AC pipeline in poor condition can be identified and recommended for replacement. This can be particularly effective for the GSWC water systems, since a large portion of the pipelines are AC. Prior to the 2026 GRC, GSWC plans to explore the feasibility of coupon sampling, particularly for AC pipelines, which may provide additional support for the pipeline project prioritization process."

a. Explain if GSWC has started exploring the "feasibility of coupon sampling, particularly for AC pipelines…"
b. If GSWC has started exploring the feasibility of coupon sampling, provide all documentation produced to date as a result of this exploration.
c. If GSWC has not started exploring the feasibility of coupon sampling, provide an estimated start date.

Response 4:
a. GSWC has not further explored the feasibility of coupon sampling since the filing of A.23-08-010, Attachment H.
b. N/A
c. GSWC plans to start exploring the feasibility of coupon sampling in 2024, after the conclusion of Engineering Planning responsibilities associated with A.23-08-010.

END OF RESPONSE

Meeting Notes 20210408 Fracta

4/8/2021 11:00 am
Attendees: Beth, Blair Forcet, Sayali Lokare, Warren Wong, Treia Martin

Blair
Challenges: construction related, budget transfers, we justify mains for replacement, decrease in break rate in SW showed pipeline replacement plan

Home screen and application suite
Over 100+ utilities, machine learning model, 120K LF of mains and many breaks.
Cloud based, no set-up or IT costs

Data, Assets, Cost of Failure, likelihood of failure, business risk exposure, job planner

Justify why we need miles of replacement, EBMUD, data driven third party tool, can also do leak detection to reduce water loss by as much as 20%

Pipe LOF (prioritization)

EBMUD looking to go from 10 miles to 20 miles of replacement. Fracta predicted pipe in a two year span and was 80% accurate.

What data is input into system to improve accuracy of water model?

20 utilities, 9 current

SGVWD - working with them on access to full subscription to LOF, pipeline failure, how long have they been a customer - since June 2018

Sayali
Machine learning - been around for a long time so predictions are more accurate.

Data (from GSWC)
  a. age & break
Data from database (already collected and in Fracta system for US)
  a. soil (37 attributes including pH, depth to water table, etc.)

b. population
c. material
d. climate
e. Terrain

Model improvement - from all customers, model improves, customers see accuracy improvements and sign up again because of this. LOF scores.

Blair - model demo
5 hours to set-up
3 hours to update data (every 6 months or other frequency)
Data upload (shape, geojson, csv)

<u>Likelihood of Failure:</u>
Looked at model, lots of filters, predict which pipes will break that have not yet broken.

<u>Consequence of Failure (cost)</u> - indirect and direct costs. Considers: roads, hospitals, police stations, water outages to customers, etc.

Can incorporate data from hydraulic model and soon can input data from valve model. How will the valve model be used - valve model is used to target critical facilities and people that will be out of water.

<u>Total Risk:</u> assessed and monetized, can toggle on and off break data.

<u>Job Planner:</u> converts analyses into jobs, use a smart query tool to look for projects. Can look at map, select red pipes, based on LOF or Total Risk, clusters segments into min and max project size. Total Risk is cost to avoid and budget is cost to install, C/B analysis.

Concerned about the time and effort to get data in the format needed to upload. They now have data reconstruction algorithm. Missing data can be estimated based on age of installation or nearest neighbor analysis (size and materials). All techniques are used to reconstruct data.

Can we manually add segments of pipe to a projects? Yes, added this feature recently.

Cost of services, FH, and valves or just LF prices in system. Feature is being added (in the next year or so) to add services, FHs, and valves costs. Replacement, rehab, or repair.

Separate systems - can we separate them? They can develop a model for each service area and then group them. Separate data sets and one that includes all data sets. Fracta can build in custom features is needed. Custom features can be added if all 7 districts would be included

Cost of system:
$60 per mile of pipe, quoted around $25 per miles annually ($70,000).

Other costs - no standard implementation fees. They will pull data in from GIS included in costs of subscription. See some value in job planner, costs and scope drawings.

Job Planner currently does not have the export features. For each demo project we be able to export Shape files to GIS (LOF, COF, attributes), data in CSV file, and a jpeg image of project.

Randy Rouden - Cal Water, Fracta is doing a presentation for them in May. CalWater said they make decision like this every three years and their fiscal year starts in July (?).

I can send a cost estimate template and scope drawing.

Meeting Notes 20210628 Fracta

6/28/2021 11:00 am
Attendees: Beth, Ernie, and Dane, Blair Forcet, Tom Wojcik, Treia Martin, and Sayali Lokare

Ernie shared the Kanew model and how we currently create the main replacement program. Average is around 1% replacement rate, sustainable and higher than most.

Presentation by **Blair** - same as last presentation.

Recommended replacement rate - remaining useful life feature will be incorporated into the application this fall. The client can determine what level of breaks we will accept and then the application provides the pipes to replace.

Sayali
Can we assign a criticality to each pipe segment (EAG)? Yes, the application - captures different factors:

1. People without water
2. Traffic disruptions
3. Critical facilities
4. Property damage
5. Environmental

Application also indicates which valves to turn-off to replace pipes. We currently use an internal system. Tom likes this because it can be used very quickly by engineers (1 hour to analyze all pipes in the system.

Fracta is more accurate as other utility data is uploaded into machine algorithm.

How is information added to the system? The data would be provided to Fracta every 6 months (maintenance and leaks data) as an upload (about 2 hours). Fracta is building a mobile app (no extra costs) and field crews can add data directly into data base, by-passing the engineers. Also, this can be updated to GIS without typing information in manually, this should be running by the end of 2021. Fracta uses our GIS when we give it to them to update the pipe and break information, roughly every 6 months.

Still building in the ability to update the pipe once replaced into the model.

Reporting functionality for Job Planner - they can work with us on this but the data can be exported into Excel or CSV. Reporting can be easily automated, at no extra costs as long as it is from the data in the database.

General feedback and next steps.

EAG questions:

1. restricted by users or open to everyone? No limit on users.
2. LOF - use case studies, Arlington use leaks versus LOF and more accurate than internal model.
3. 37 systems. EAG said we would want to get planning, GIS, and FTS folks to see presentation. EAG would like to do a pilot study on one system. Fracta doesn't do pilot study any longer - we can reduce subscription rate is duration is longer, if we include all our systems.

Cost - $50 - $100 per mile, larger areas are lower for entire system. Can set low escalation to pricing for 10 years or so. Historically, for all current clients there were no big price hikes. 3 - year minimum. GSWC is on the calendar year, need to work with P&A to make sure it is capitalized, they can call this an asset.

EAG will talk to VP of AM and see if he would like to take a look at and moved forward with. Blair will send data sheet, we know SGVGD. Can follow-up with EAG next Thursday at 10 am, 30 minute meeting.

Blair is in Austin, Texas
Sayali is in Florida

INFOMASTER WATER MODEL IMPLEMENTATION
MODEL UPDATE MANUAL

GOLDEN STATE WATER COMPANY

Prepared By:

Innovyze®

370 Interlocken Blvd., Suite 520
Broomfield, CO 80021

July 29, 2019

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1.0 SUMMARY

The purpose of this document is to enable quick and reliable InfoMaster project database updates. This document provides Golden State Water Company (GSWC) staff step-by-step instructions on how to keep the InfoMaster project up-to-date with new and updated data.

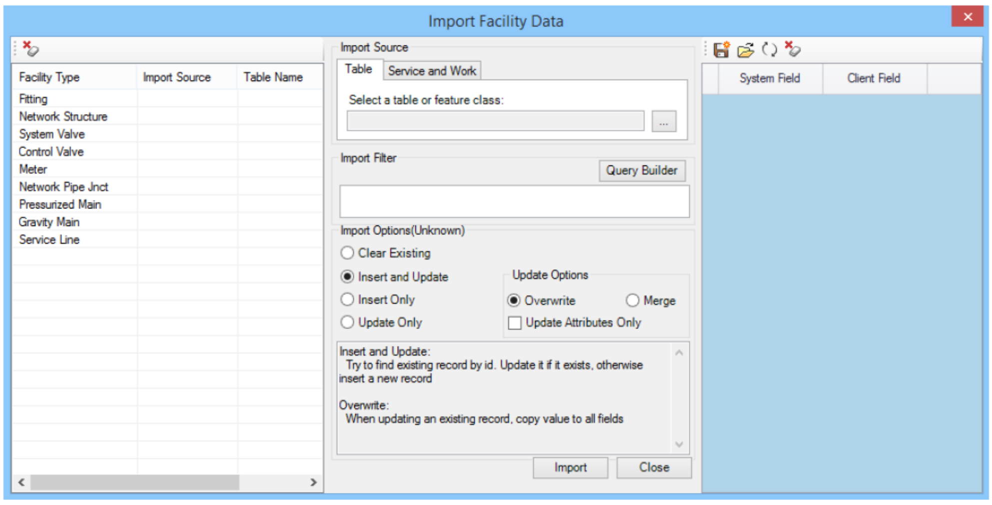
2.0 IMPORTING FACILITY DATA

Facility data in InfoMaster originates from feature classes within the project database. To update this facility data, GSWC can update the GIS feature classes within the project database via the Import Facility Data tool or overwriting the facility feature classes within the project database.

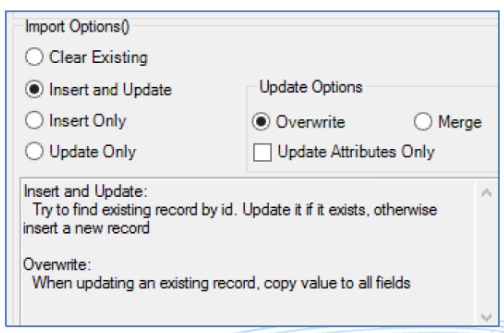
Option #1: InfoMaster Import Facility Data Tool

This method allows for InfoMaster to read directly from their ArcSDE connection, or the source GIS database. Generally, this import option is best applied when using a local InfoMaster project database.

1. Open the InfoMaster.mxd and login to the InfoMaster project requiring an update.
    - Default user name: Admin
    - Default password: Admin
2. Click the InfoMaster dropdown menu InfoMaster▾ and click on the “Import Facility Data” option.
3. Click “Next” on the first window to access the main Import Facility Data window.



4. Select the Import and Update Options based on the user's preference. Update options affect whether the latest mapping overwrites existing fields and whether the geometry is updated.
    - "Clear Existing" will completely replace the model with the new GIS data.
    - "Insert and Update" will add new records based on Facility ID and will update fields in existing records to match the latest field mapping.
    - "Insert Only" will only add new records and will not change existing records.
    - No new records based on Facility ID will be imported if the user selects the "Update Only" radio button. Instead only matching records will have their fields updated to the latest data.



5. In the left pane, select the InfoMaster Facility Type requiring an update (e.g. pressurized mains).

6. In the middle pane under "Import Source", select the table or feature class which will be used to update the Facility Type.
    - Note: This table or feature class can be in almost any tabular format. SQL format cannot be imported. Users must export this data to a GIS table/feature class or an Access database before they can import with this tool.
7. By utilizing the query builder under "Import Filter", users can create queries based on fields to select specific features to import.
8. Map the fields the user wishes to include in the import. Client Fields are fields within the Import Source table selected while System Fields are native to the InfoMaster Facility Type.
    - Note: For GSWC, Client Fields and System Fields should automatically match up for a majority of the listed Facility Types and fields. This is because the Facility Types were provided by GSWC to Innovyze within an InfoMaster Project Database and the custom information fields within the feature classes were setup beforehand.
9. Notice that the Facility ID system field is highlighted in red for each facility type. This field is required. InfoMaster requires a unique ID field to differentiate each object.
    - Note: If GSWC wishes to switch the unique ID field InfoMaster requires, users can change the mapping for the 'Facility ID' field within the Facility and Asset Type Manager.
10. Users can also save the field mapping as comma delimited (CSV) files for future use.

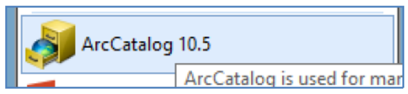
	System Field	Client Field
1	Subtype	SUBTYPE
2	Enabled	ENABLED
3	Water Type	FLOWTYPE
4	Owner	OWNER
5	Lifecycle Status	LIFECYCLESTATS
6	JOBNUM	JOBNUM
7	INSTALLDATE	INSTALLDATE

11. Repeat Steps 4 through 14 for additional facilities requiring an update (e.g. System Valves, Junctions).
12. After setting all panes for each facility that requires an update, click "Import". The Facility Type will be updated and saved within the project database. Open the appropriate attribute table or DB Editor table to confirm the successful import.

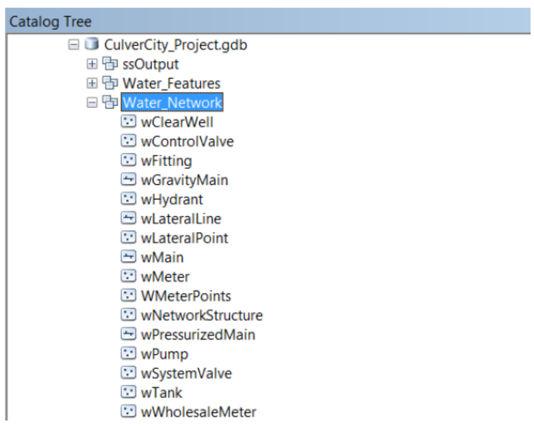
Option #2: Replace the Feature class

InfoMaster reads directly from the ArcGIS feature class within the InfoMaster project database. Because of this, users can replace the feature class to update their InfoMaster data using ArcTools/ArcCatalog. To do this, complete the following steps.

1. Open ArcCatalog.

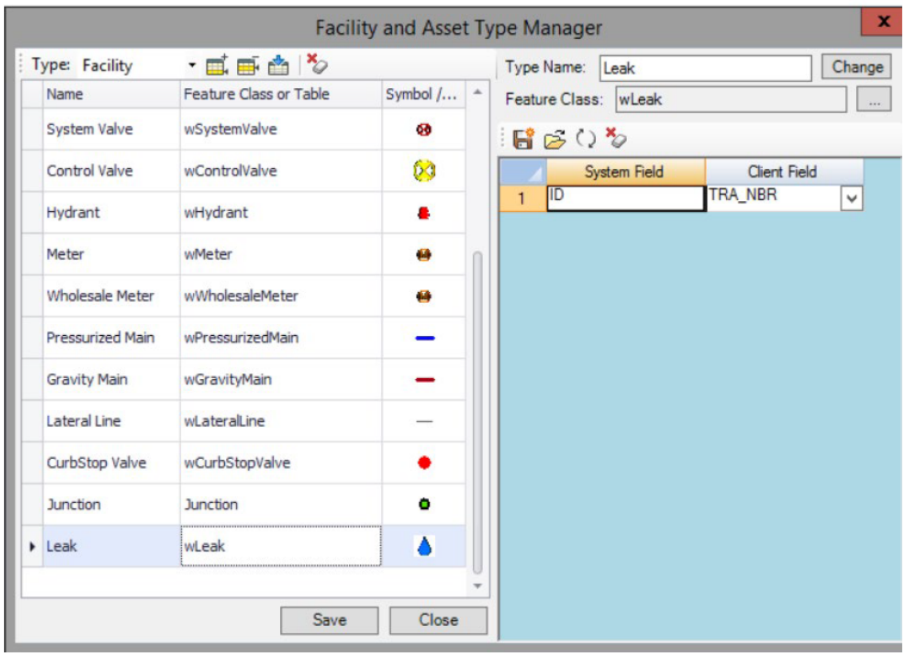


2. Locate the new feature class and the outdated feature class in the InfoMaster project database. The InfoMaster feature class will be within the Water_Distribution_Network dataset within the project database.



3. Copy and paste the replacement ArcGIS feature class within the Water_Distribution_Network dataset.
4. Delete the old feature class and rename the new feature class to match the old feature class name.
5. The model will now read the new, updated feature class for all analyses.
6. Verify that the fields are the same for both feature classes. Differences in fields and field names could disrupt some of the analyses within InfoMaster (e.g. LoF, CoF, and risk analysis).
    - It is especially important to verify that the unique Facility ID field is consistent. If the old feature class used Asset Tag as the unique Facility ID field, the new feature class should as well.
    - To verify that new facility is properly linked in the model, use the Facility and Asset Type Manager (InfoMaster→Facility and Asset Type

Manager) to map the facility to the feature class or table in the InfoMaster Model project database



3.0 INFERRING MISSING DATA

New data may be missing data required for InfoMaster functions and calculations. To correct these instances, inference tools may be utilized to estimate missing data. The fitting_connection inference created in the model:

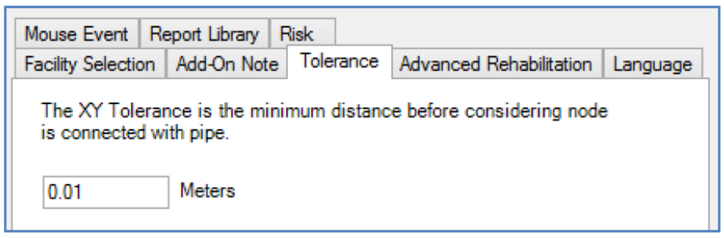
- **Fitting_Connection** – This inference searches for fittings near the upstream and downstream ends of each pipe. It adds upstream and downstream fitting IDs to the pressurized mains facility data. It does not change pressurized mains with upstream and downstream IDs already assigned. To change the search radius for this inference, go to InfoMaster > Settings… > Tolerance tab.

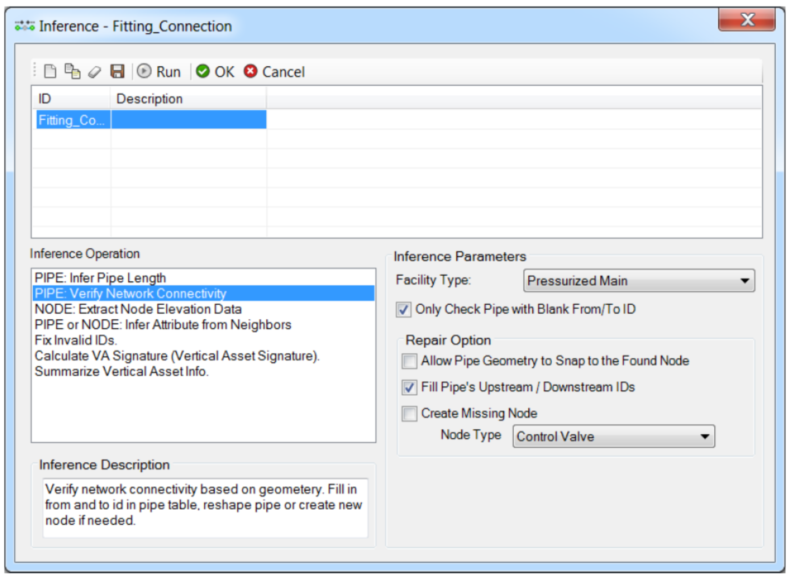
Adjust and run this inference as necessary. Users can also create their own inferences and run these as well.

1. Click the Toolbox tab Toolbox in the IM Operation Center window. This tab contains many different tools and reporting options for InfoMaster.
2. The inferences discussed above is are already in the model. Adjust and run this inferences as necessary. Users can also create and run additional

inferences.

3. Right-click on "Fitting_Connection" and select "Run"
4. To change the search radius for this inference, go to InfoMaster > Settings… > Tolerance tab. Increase the tolerance to allow fittings and pipes that are further apart to connect.



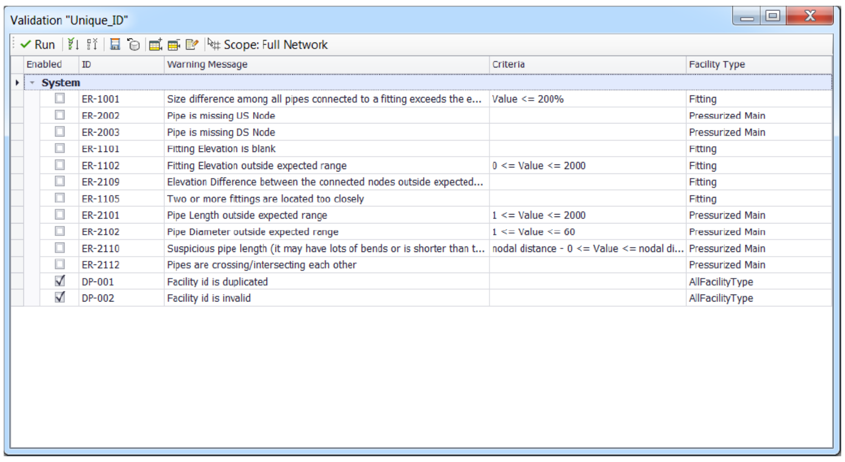


4.0 VALIDATING DATA

New data may have errors and inconsistencies between different sources. Validation tools may be utilized to identify and correct these instances. Validations highlight possible errors requiring corrections. There is one validation routine already created in the model. Validations should be run once all data edits are complete.

1. Run the "Unique_ID," validation created by Innovyze by right-clicking on it and selecting "Run".
2. Verify that the following two rules are checked: DP-001 which checks for

duplicate IDs and DP-002 which identifies invalid IDs.



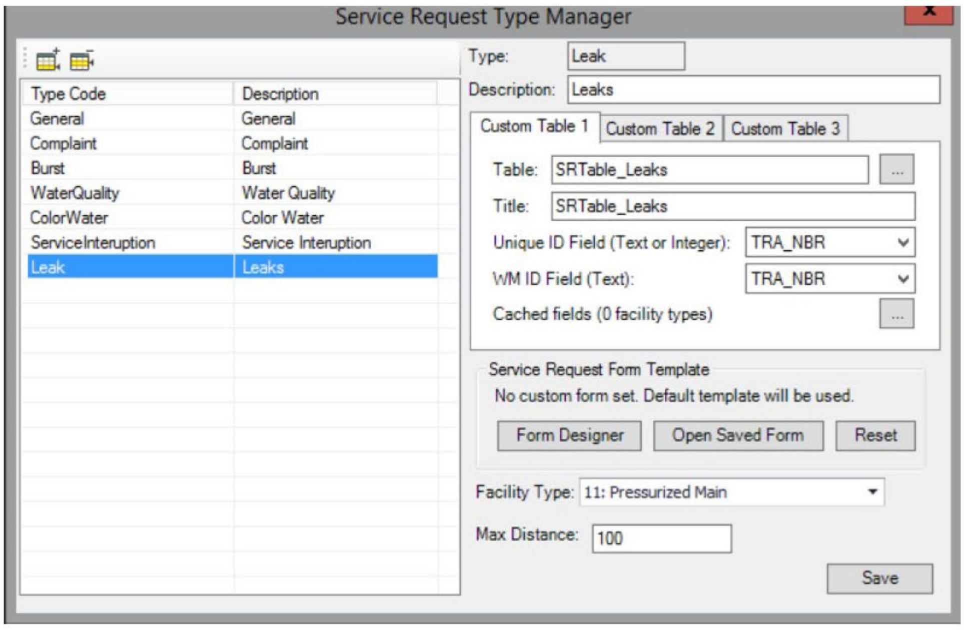
Enabled	ID	Warning Message	Criteria	Facility Type
System				
☐	ER-1001	Size difference among all pipes connected to a fitting exceeds the e...	Value <= 200%	Fitting
☐	ER-2002	Pipe is missing US Node		Pressurized Main
☐	ER-2003	Pipe is missing DS Node		Pressurized Main
☐	ER-1101	Fitting Elevation is blank		Fitting
☐	ER-1102	Fitting Elevation outside expected range	0 <= Value <= 2000	Fitting
☐	ER-2109	Elevation Difference between the connected nodes outside expected...		Fitting
☐	ER-1105	Two or more fittings are located too closely		Fitting
☐	ER-2101	Pipe Length outside expected range	1 <= Value <= 2000	Pressurized Main
☐	ER-2102	Pipe Diameter outside expected range	1 <= Value <= 60	Pressurized Main
☐	ER-2110	Suspicious pipe length (it may have lots of bends or is shorter than t...	nodal distance - 0 <= Value <= nodal di...	Pressurized Main
☐	ER-2112	Pipes are crossing/intersecting each other		Pressurized Main
☑	DP-001	Facility id is duplicated		AllFacilityType
☑	DP-002	Facility id is invalid		AllFacilityType

3. After running, check for any errors and correct as necessary. Users can also add, customize, and run additional validation rules as required.

5.0 IMPORTING SERVICE REQUESTS/LEAK DATA

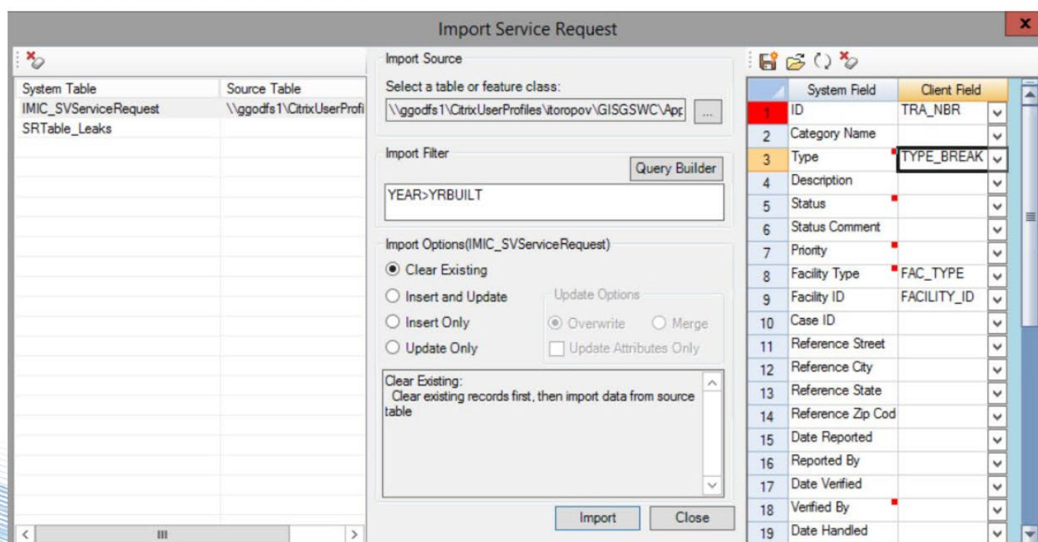
Bringing in leak data as service requests allows the InfoMaster software to auto associate this information to pipe data. The following procedure details the process of updating or re-importing service request information.

1. Through the InfoMaster Work Manager window click on the Service Request tab and click on the Type Manager button to open the Service Request Type Manager.
    - This dialog is intended to assist in classifying service requests, associate custom data tables and associate to the service request's facility type
    - The custom data table used for the GSWC Culver City project is SRTable_Leak.



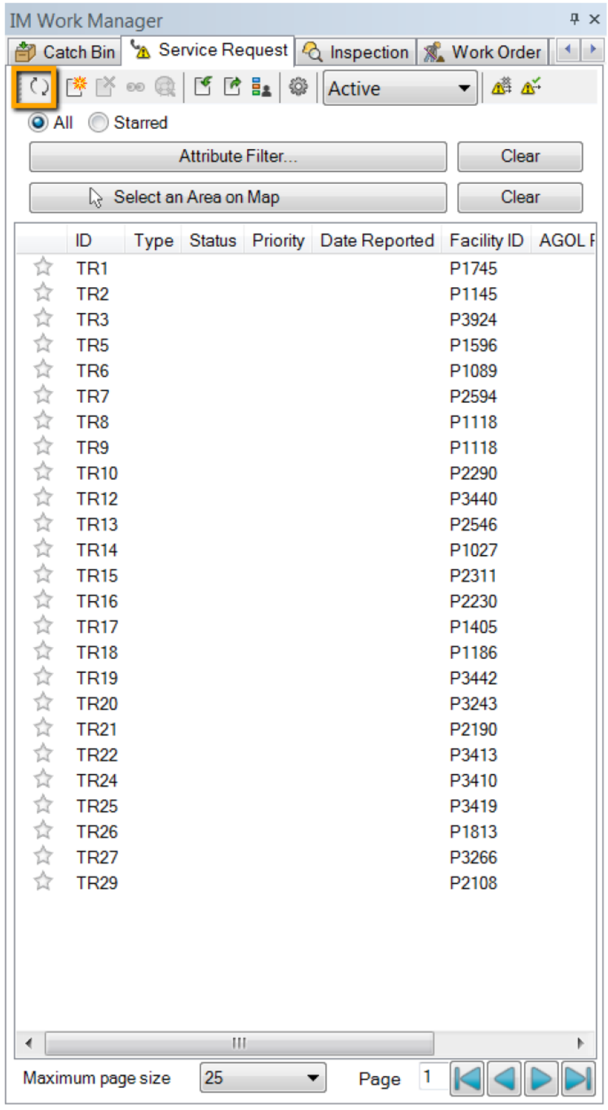
•

2. Through the InfoMaster Work Manager window click on the Service Request tab and click on the import button to open the Service Request Type Manager.
   - If a custom table is associated to service request type, as is the case with the 'Leak' Service request; service requests need to be mapped imported into both the IMIC_ServiceRequest and SRTable_Leaks system tables. Be sure to clear existing data when importing new data in order to avoid duplicate entries.



3. Click refresh when import process is complete to verify that the new service

request data has imported.

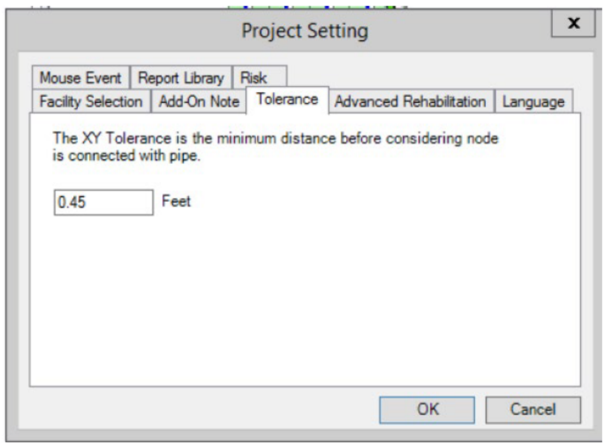


6.0 VALVE CRITICALITY

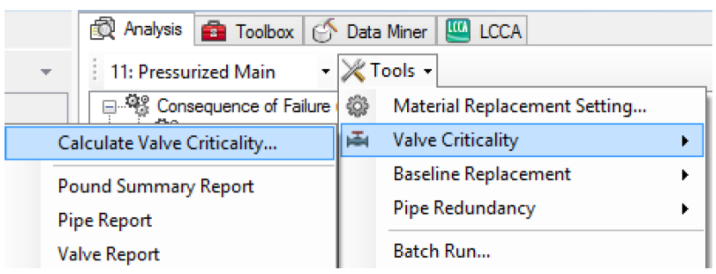
The valve criticality analysis tool creates additional data which may be included in a risk or rehab analysis or used standalone. This tabular data, however, is not updated automatically when facility data or any other data is updated or changed. Therefore, it is good practice to rerun the valve criticality tool before updating further analyses.

1. Before running the valve criticality tool, check the InfoMaster spatial tolerance settings (InfoMaster > Settings... > Tolerance tab). The spatial tolerance specified here will be used to join the system valve facility type to

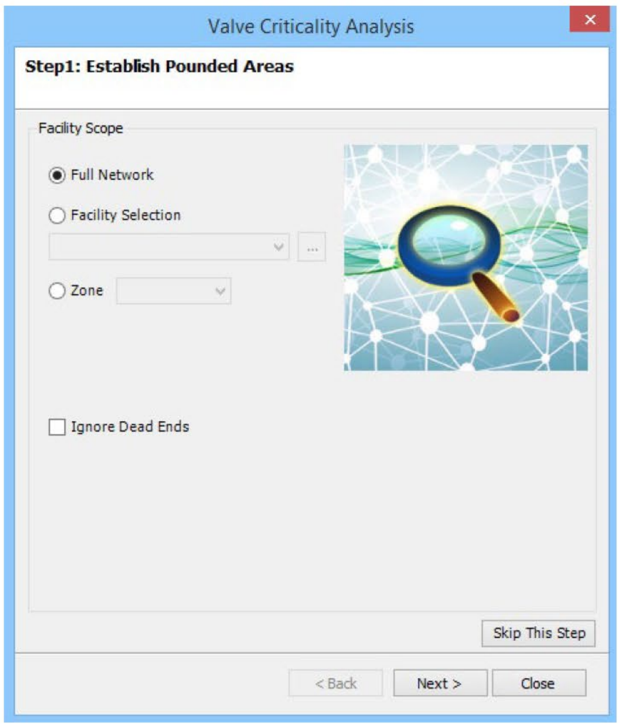
the pressurized main facility type. Joining system valves to pressurized mains is a key part in establishing pounded areas, so make sure you are comfortable with the allowable tolerance before proceeding with the analysis.



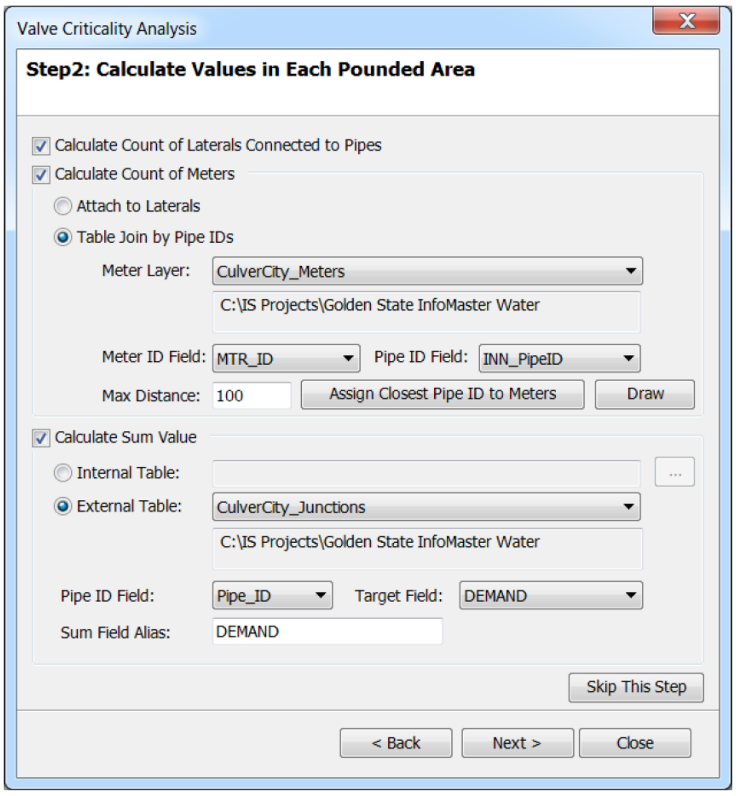
2. In the IM Operation Center in the Analysis tab with Pressurized Main selected as the facility type, click "Tools" > "Valve Criticality" > "Calculate Valve Criticality…"



3. If brought to Step 2, go back to Step 1 to re-establish pounded areas. In Step 1, choose the desired facility scope for the updated analysis and decide whether to include dead ends or not. Then click "Next" and wait for the spatial analysis to finish.
    - Note: Re-running Step 1: Establish Pounded Areas will re-evaluate the network for isolation areas based on system valve locations as they are associated to existing pipes



4. In Step 2, set the calculated values for the valve criticality analysis to calculate. InfoMaster can calculate count of laterals and/or meters associated to individual pipes and pounded areas as well as sum values such as total demand from the joined meters. The screenshot below shows how Innovyze generated the initial example for the valve criticality analysis.

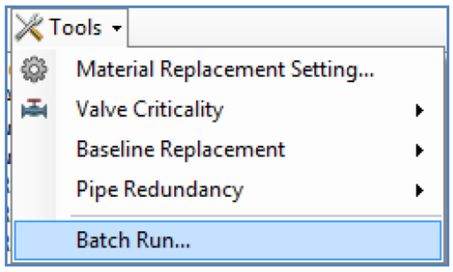


5. Once Step 2 is set, click "Next" to complete the valve criticality analysis.

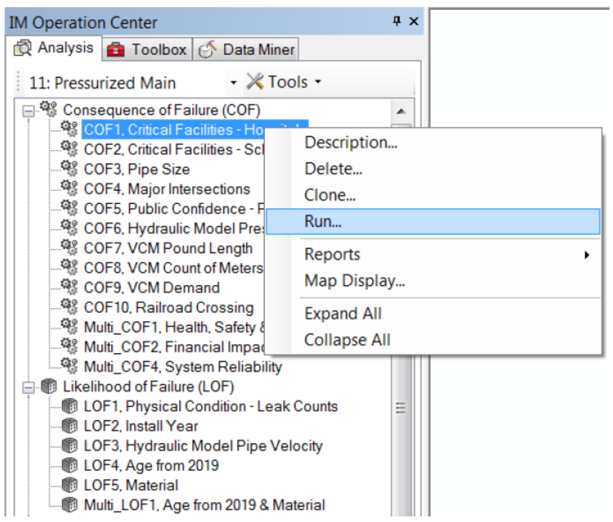
7.0 RERUN COFS AND LOFS

CoFs and LoFs are analyzed and stored in the InfoMaster attribute tables within the project database. These analyses do not automatically update when facility data, valve criticality, or any other data is updated or changed. Therefore, users must rerun these analyses when input data is updated. The following steps describe the process to update CoFs and LoFs.

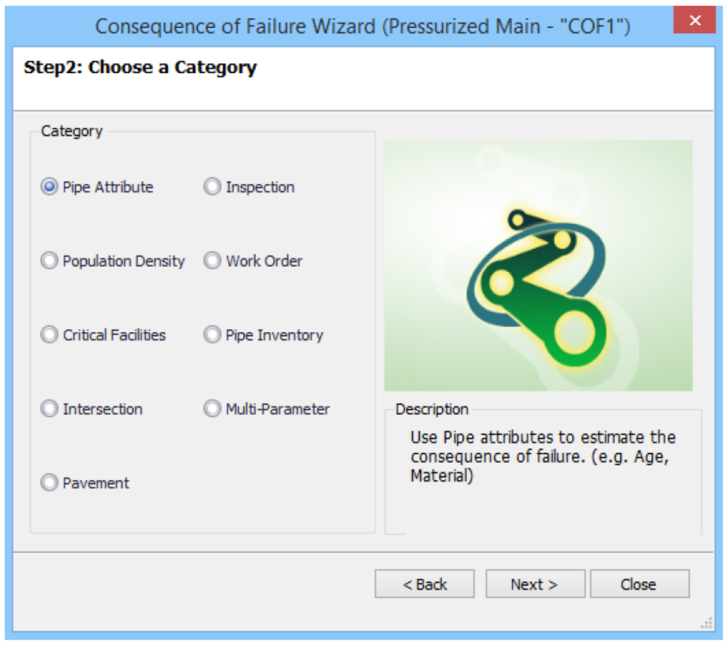
1. If no CoFs or LoFs need to be changed to reflect new conditions such as facility scope or new scoring, they can be updated in a batch run. To do this, click Tools > Batch Run. Then select the desired items to be updated from the list and allow InfoMaster to rerun its analysis.
   - Note: This Batch Run process can be done for Failure/Deterioration, Risk, and Rehabilitation analyses as well.



2. If a CoF/LoF requires updated settings, select the CoF/LoF and click "Run". Select "No" to open up the CoF/LoF wizard.



3. Navigate to the step requiring updating.
4. If you wish to edit the Facility Scope, edit in Step 1.
5. If you wish to edit the field scored, edit in Step 2 and/or 3
6. If you wish to change the scoring, edit in Step 4 and/or 5
7. After editing, click "Next" to save your changes in the desired step and close out of the CoF/LoF.
8. The new settings will be applied when all the CoFs/LoFs are rerun in a batch run process.

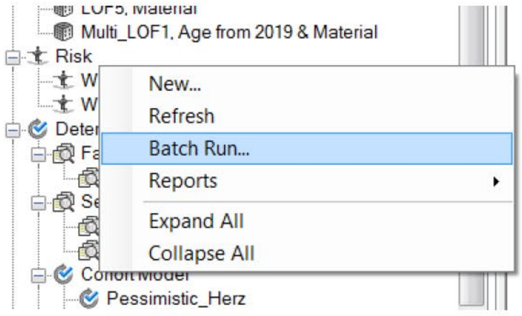


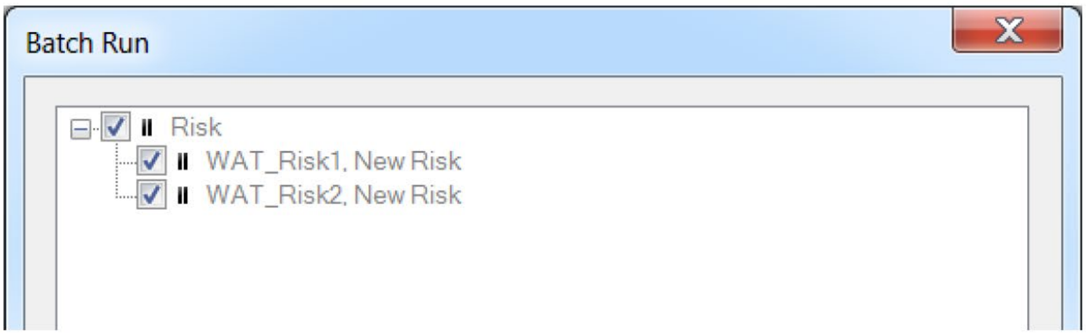
9. At this point, if you have any additional CoFs/LoFs to add, this is a good time to add them. After adding any new CoFs/LoFs, batch run all CoFs and LoFs as shown in Step 1.

8.0 RERUN RISK ANALYSES

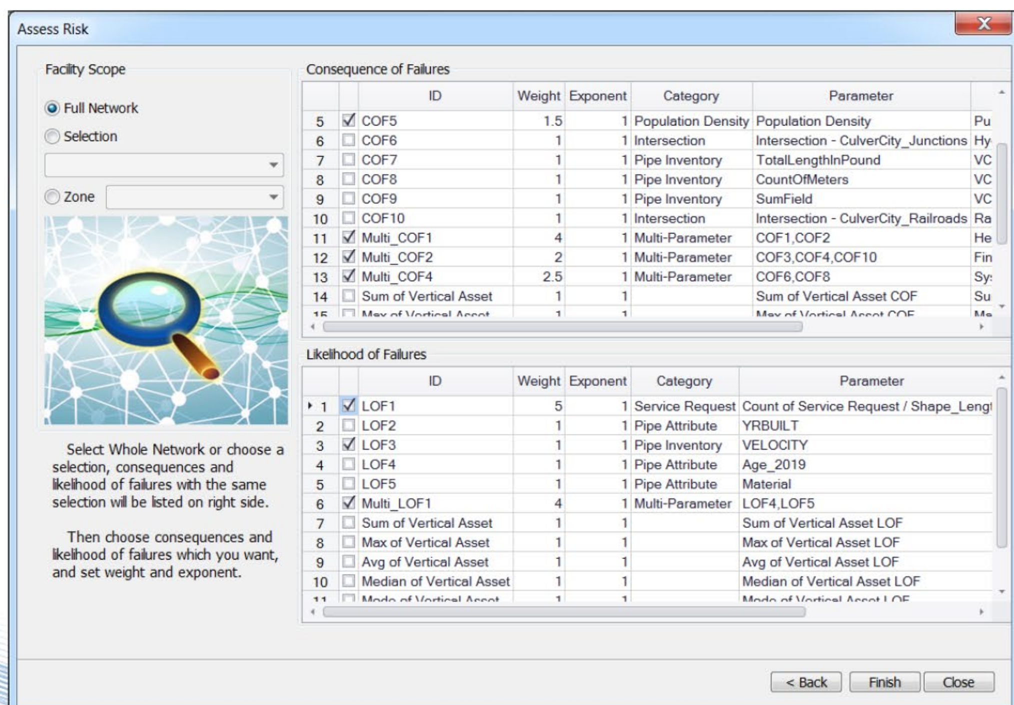
Risk analyses are analyzed and stored in the InfoMaster attribute tables within the project database. These analyses do not automatically update when facility data or other data is updated or changed. Therefore, users must rerun these analysis when the input data is updated. The following steps describe the process to update risk analyses.

1. Like CoFs/LoFs, if no risk analyses need to be edited such as normalized value, maxtrix settings, or multipliers, risk analyses can be updated in a batch run. To do this, click Tools > Batch Run. Then select the desired items to be updated from the list and allow InfoMaster to rerun its analysis.
    - You can also right-click Risk and select batch run to only view a batch run list of risk analysis. This same option is available for CoF/LoF, Failure/Deterioration, and Rehabilitation analyses.





2. If a risk analyses requires updated settings, select it and click "Run". Select "No" to open up the Risk wizard.
3. Adjust the desired setting and either rerun from the wizard by clicking "Finish" or exit the wizard and rerun as part of a batch run.

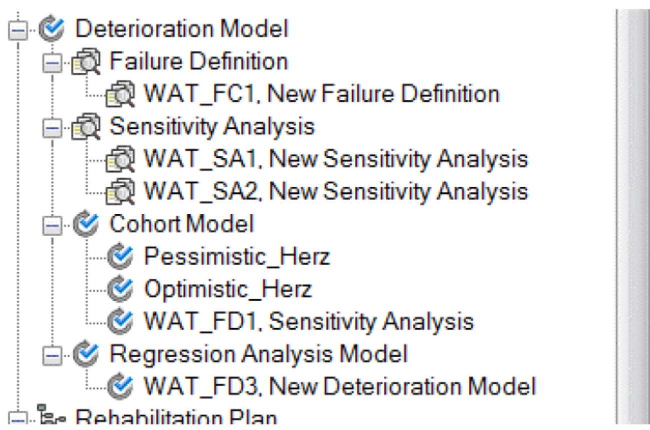


9.0 RERUN FAILURE MODELS

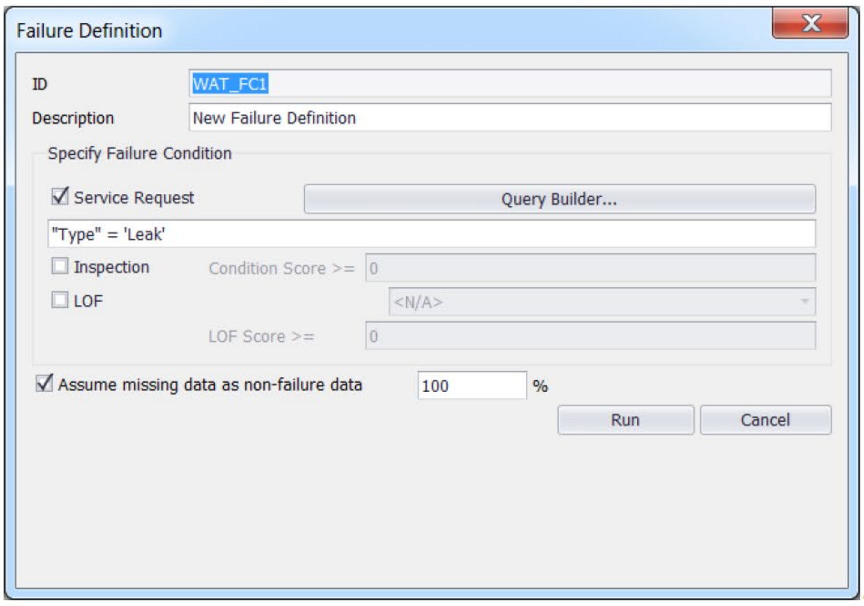
Failure models are analyzed using the attribute data, CMMS data, CoFs, LoFs, and risk analyses. Because of these dependent relationships, users must rerun these analyses to update to the latest results. It is also beneficial to review these analyses at this time. It's best to rerun these top to bottom as the failure definition forms the basis for all the other three analyses.

Like CoFs, LoFs, and Risk analyses, failure models can be rerun and updated using the Batch Run process. Only follow the steps below if one of the settings within the Failure Definition, Sensitivity Analysis, Cohort Model, or Regression Model must be changed.

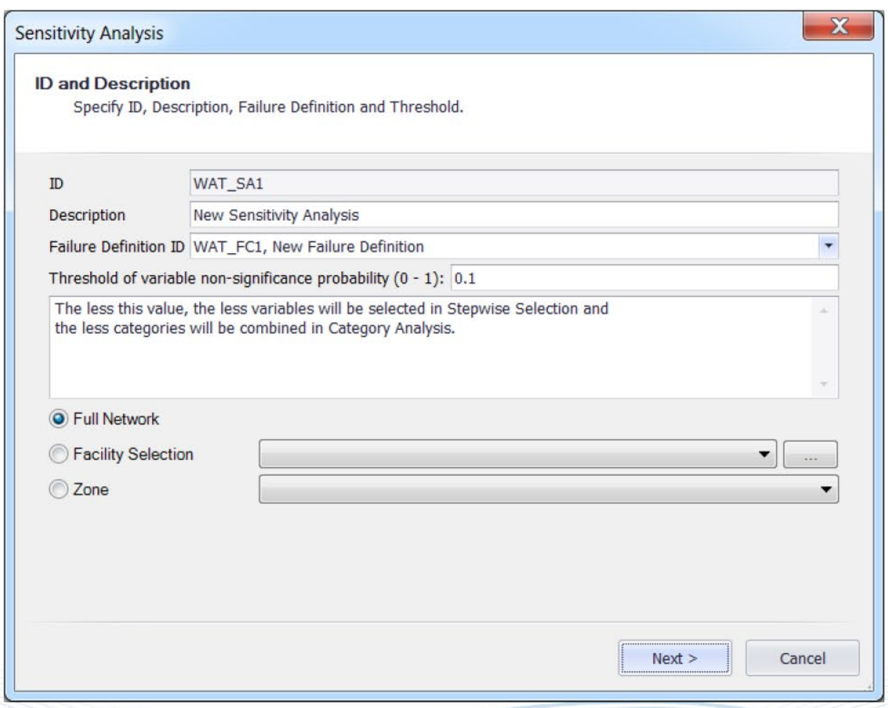
It is important to note that for this particular model the failure models were included as an added analysis but it is not utilized in the risk or rehabilitation plan, as a result the updating procedures detailed are optional.



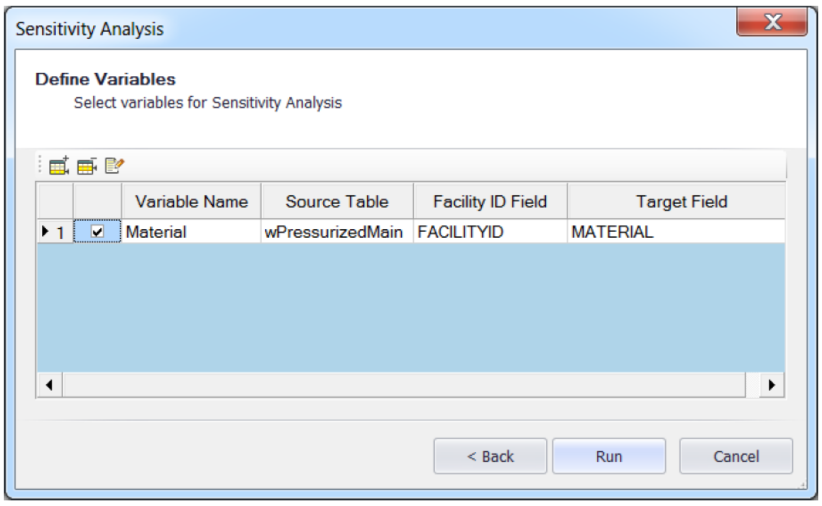
1. Right-click on an existing failure definition, click "Run", and then "No" to open the analysis settings.
2. Review the failure condition parameters and adjust as necessary. Click "Run" once the condition parameters have been reviewed.



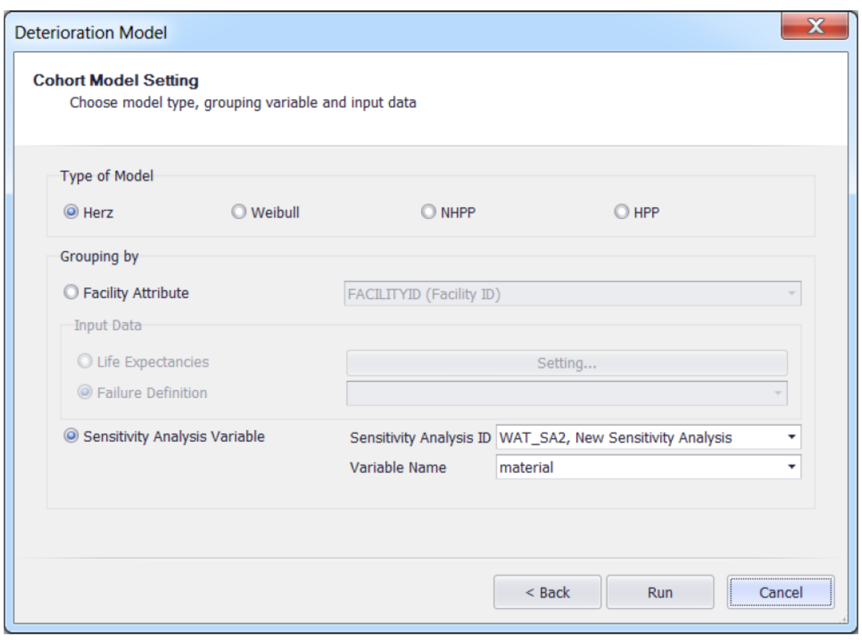
3. Right-click on an existing sensitivity analysis and click "Run" and then "No" to open the analysis settings.
4. Review the facility scope and threshold of variable non-significant probability. Adjust as necessary, then click "Next".



5. Review the variables selected in the sensitivity analysis and adjust as necessary. Click "Run" to rerun the sensitivity analysis.
6. Repeat Steps 4 through 6 for each sensitivity analysis.



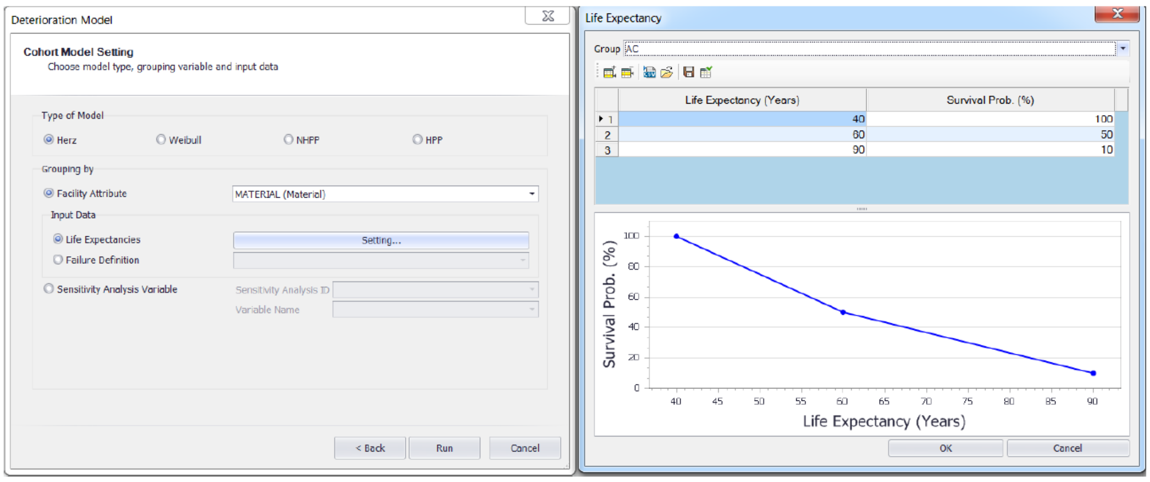
7. Right-click on an existing cohort model and click "Run" and then "No" to open the analysis settings. Review and adjust the target year and facility scope as necessary.
8. Click "Next" and review the different parameters. Click "Run" to rerun the model. View the results and rerun the model with adjusted parameters if necessary.



9. Alternatively, a cohort model can be evaluated based on defined Life Expectancies such as it was done for the Pessimistic an Optimistic cohort model examples
10. Right-click on an existing cohort model and click "Run" and then "No" to open the analysis settings. Review and adjust the target year and facility scope as

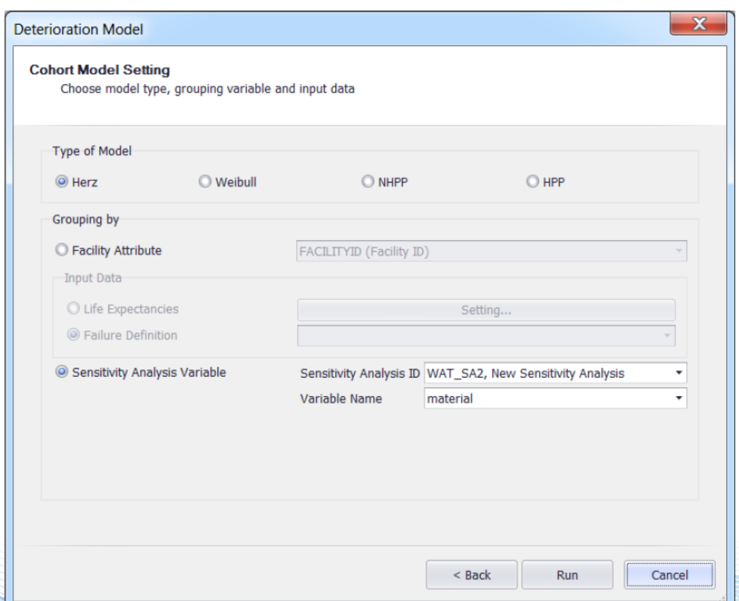
necessary.

11. Click "Next" and review the different parameters. Click "Run" to rerun the model. View the results and rerun the model with adjusted parameters if necessary.



12. Right-click on an existing regression model and click "Run" and then "No" to open the analysis settings. Review and adjust the target year and facility scope as necessary.

13. Click "Next" and review the type of model and sensitivity analysis applied. Adjust as necessary and then click "Run". View the results and rerun the model with adjusted parameters if necessary.

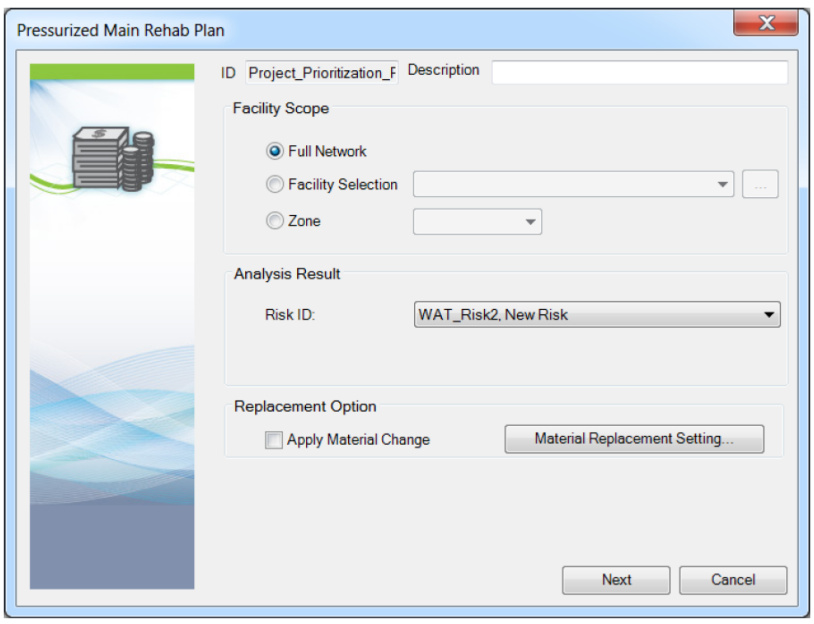


10.0 RERUN REHABILITATION ANALYSES

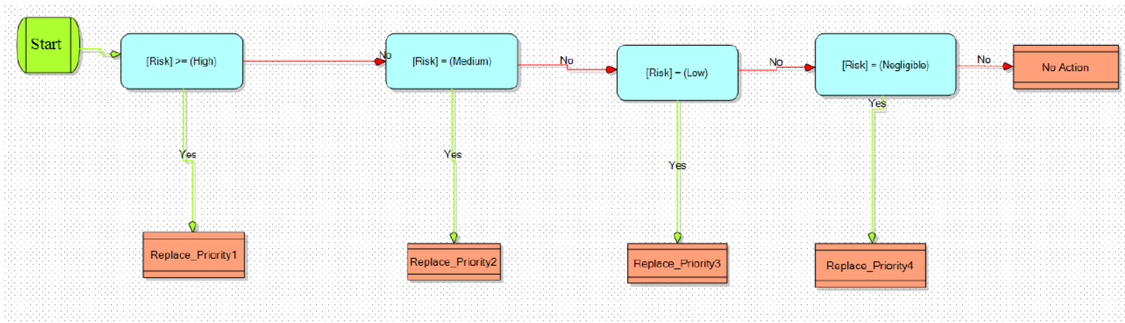
Rehabilitation analyses are analyzed using the attribute data, CMMS data, CoFs, LoFs, risk analyses, failure data, and any external data users wish to incorporate. Because of the dependent relationships between these data sources, users must rerun rehabilitation analyses to update to the latest results.

Like CoFs, LoFs, Risk, and Failure analyses, rehabilitation plans can be rerun and updated using the Batch Run tool. Only follow the steps below if it is necessary to adjust rehabilitation plan settings.

1. Right-click on the desired rehabilitation analysis and select "Run" and then "No" to open the rehabilitation plan settings.
2. Adjust Facility Scope, Analysis Result, and Replacement Option settings in the initial window as necessary. Then click "Next".



3. Adjust the flowchart as necessary. Verify that all Conditions and Ends are connected properly with the flow arrows.
    - Note that a previously saved rehabilitation flowchart may be imported by clicking "Open" in the top left corner. Users can open flowcharts saved as an XML file or from another location in the InfoMaster project database.
4. Users can also save constructed flowcharts for future reference.



5. Select "Run" at the right end of the toolbar to run the rehab analysis. Review the results.
6. Adjust and rerun the rehab plan as necessary.

11.0 DATA MINER

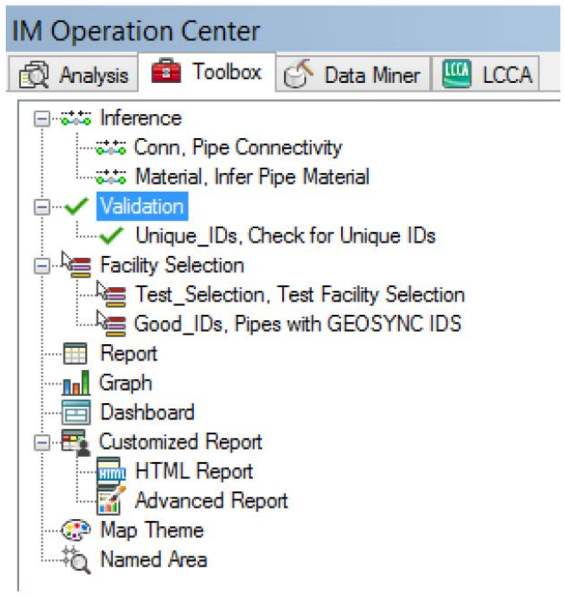
A Data Miner was created to select pipelines near high risk pipelines. This data miner need to be rerun after the Risk analysis is re-run. Follow the steps below if the risk analysis was ran.

1. Click on the Data Miner Tab
2. Right click on the "Risk 5 pipes within distance of similarly ranked pipes" data miner
3. Select "Run"

The facility set "Risk5_score_pipes" will be updated.

12.0 FINAL REVIEW

Users should check, edit, and rerun saved reports, customized reports, and map themes. To edit and rerun these, right-click on each tool and select "Edit" or "Run" similar to the steps described in previous sections. Click "Next" and/or "Back" through the different windows, review the results, and make changes to the model as necessary.


IM Operation Center
Analysis
Toolbox
Data Miner
LCCA
Inference
Conn, Pipe Connectivity
Material, Infer Pipe Material
Validation
Unique_IDs, Check for Unique IDs
Facility Selection
Test_Selection, Test Facility Selection
Good_IDs, Pipes with GEOSYNC IDS
Report
Graph
Dashboard
Customized Report
HTML Report
Advanced Report
Map Theme
Named Area

INFOMASTER WATER MODEL IMPLEMENTATION PROJECT SUMMARY REPORT

GOLDEN STATE WATER COMPANY

Prepared By:

Innovyze®

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Broomfield, CO 80021

July 29, 2019

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1.0 SUMMARY

The purpose of this document is to summarize the work completed and assumptions made by Innovyze in developing the finished InfoMaster Water project for Golden State Water Company (GSWC). The resulting model has the ability to perform risk analysis, failure/statistical modeling, and rehabilitation planning.

2.0 DATA REVIEW AND PREPROCESSING

GSWC provided GIS information at multiple points during the project for use in the creation of the InfoMaster model. The main enterprise GIS extract database included the collection system facility data for Culver City.

The water distribution system facility data included in the database was reviewed, processed, and mapped as InfoMaster facility types. Additional external data was used to develop Consequence of Failure (CoF) and Likelihood of Failure (LoF) scoring in InfoMaster.

The CulverCity_Project.gdb containing the Culver City water facilities was delivered on August 21 2018 and re-imported into an InfoMaster database (IM_CulverCity_Project.gdb). By utilizing GSWC Culver City's Water database customized structure, customized GIS fields and feature classes were able to be used in InfoMaster processes. The Water_Features dataset within the project database was the main reference for InfoMaster facility data. However, due to the issues related to spatial reference inconsistencies the water facilities dataset were reimported into a project database for work to be completed by Innovyze.

Table 1 identifies the eight GIS feature classes provided by GSWC and assigned within InfoMaster's Facility and Asset Type Manager tool. The table also shows additional notes on potentially important fields' completeness and any additional actions performed by Innovyze.

Table 1: InfoMaster Water GIS Data

From CulverCity_Project.gdb – Water_Features

Feature Class	Utilization	Notes
wHydrant	InfoMaster Hydrant	• Unique ID field = FacilityID (100%) • Important fields included: INSTALLDATE (12%), LOCDESC (99%), HYD_ID (100%), DIAMETER (100%)

Feature Class	Utilization	Notes
wControlValve	InfoMaster Control Valve	• Unique ID field = FacilityID (100%) • Important fields included: DIAMETER (100%), VALVETYPE (100%)
wSystemValve	InfoMaster System Valve	• Unique ID field = FacilityID (100%) • Important fields included: Subtype (100%), DIAMETER (100%), VALVETYPE (100%)
wNetworkStructure	InfoMaster Network Structure	• Unique ID field = FacilityID (100%) • Important fields included: LifecycleStatus (100%), MaintainedBy (100%), Name (100%)
wFitting	InfoMaster Fitting	• Unique ID field = FacilityID (95%), or GlobalID (100%)
wPump	InfoMaster Pump	• Unique ID field = FacilityID (0%) • Important fields included: LifecycleStatus (100%), InstallDate (27%), PumpType (100%)
wLateralLine	InfoMaster Lateral Line	• Unique ID field = FacilityID (100%) • Important fields included: MATERIAL (100%), LINETYPE (100%), DIAMETER (99%), Shape_Length (100%), INSTALLDATE (10%)
wPressurizedMain	InfoMaster Pressurized Main	• Unique ID field = FacilityID (100%) • Important fields included: MATERIAL (100%), DIAMETER (100%), YRBUILT (99%), ROUGHNESS (100%), Shape_Length (100%)

Within these ten feature classes, the most critical field to have fully populated is the unique facility ID field. GSWC's Facility ID fields is the preferred unique facility ID, but in its absence Global ID was used. Within the eight feature classes mapped, pressurized mains are normally the most important in an InfoMaster Water project. Within this feature class, it is especially important to have the following fields as complete as possible: material, install date, diameter, from and to node ID fields (fitting), and unique facility IDs. Out of the 2,784 fittings currently in the Culver City InfoMaster model only 130 were provided by GSWC. These fields are only relevant for the InfoMaster calculations of pipe redundancy and valve criticality.

2.1 ArcGIS Calculation

After the pipeline data is updated, the pipeline age will need to be calculated. In addition, this field will need to be recalculated on a yearly basis. The original field was calculated using the current year (2019) to calculate pipeline age (i.e. age will need to be recalculated in January 2020, January 2021, etc.). The steps to calculate this field are discussed further in the Model Update Manual. Appendix A includes documentation on calculated fields.

3.0 VALVE CRITICALITY ANALYSIS

InfoMaster's valve criticality analysis tool attempts to identify pipe network areas which can be isolated in the case of a main break. For example, this tool can show users how many and which system valves need to be closed if a main break occurs in order to preserve pressure for the rest of the system. In the final deliverable, Innovyze ran the valve criticality analysis tool with the following settings.

3.1 Step 1: Establish Pounded Areas

In this first step, the isolated or pounded areas are established by conducting a spatial join between system valves and pressurized mains. This spatial analysis was completed across the full network and the spatial tolerance (set within InfoMaster > Settings Tolerance Tab) was set to be 0.01 feet.

3.2 Step 2: Calculate Values in Each Pounded Area

In the second step, calculated values can be added to the results tables. Meters were counted and added based on the settings shown in **Figure 1** below. Meters, from the CulverCity_Meters, facility layer were joined to the closest pressurized main within 100 ft. These pipe IDs were stored in the custom field INN_PipeID, added by Innovyze to the CulverCity_Meters feature class. No Pipe ID field was created on the GSWC end in the CulverCity_Meters feature class. This additional Pipe ID field will be necessary if GSWC wishes to rerun this tool.

The CulverCity_Junction feature class was exported with demand data from the Culver City Hydraulic Model 20180731. The demand data in the external table of CulverCity_Junctions was used in the Calculate Sum Value process of the Valve Criticality Analysis.

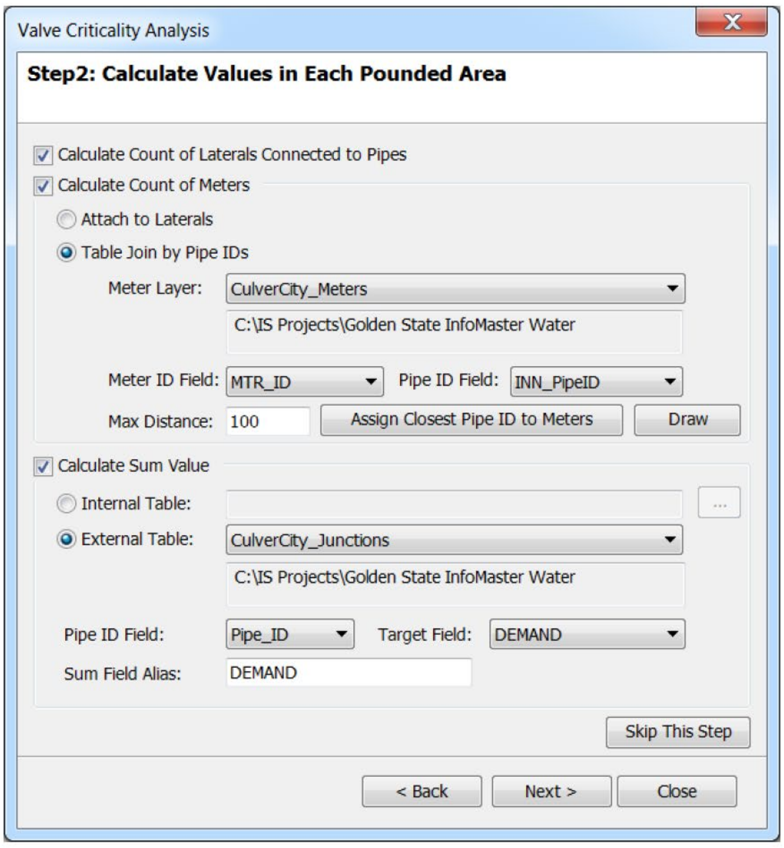


Figure 1: Valve Criticality Analysis – Step 2

Results from the valve criticality analysis can then be displayed by accessing the Pound Summary Report, Pipe Report, or Valve Report. Again, because no Pipe ID field is yet present for GSWC in the CulverCity_Meters feature class, these are a static results which require preprocessing before they can be updated based on new data.

4.0 CONSEQUENCES OF FAILURE

Consequence of failure (CoF) refers to the potential impact the failure of a pipe or other asset would have on the system. These consequences have financial, system reliability, and life safety components. Ten individual CoFs and three multi-parameter CoFs were created by Innovyze. The four CoFs utilized in the risk analysis (three multi-parameter CoFs and one individual COF) are discussed below.

4.1 Health, Safety, and Security – Multi_COF1

Health, Safety and Security (Critical Facilities) is the first of three multi-parameter CoFs within the risk assessment. Critical Facilities analyzes the distance of pipelines from Schools and Hospitals. This multi-parameter CoF is built using two building block COFs, COF1 – Hospitals and COF2 – Schools. **Table 2** shows how this multi-parameter was created and scored.

Table 2: Health, Safety and Security – 40%

Score	Criteria	Description
0	All other pipes	No Critical Facilities within 1,000 feet
1	If COF1 = 1 Or COF2 = 1	Hospital or School within 1000 to 750 feet
4	If COF1 = 4 Or COF2 = 4	Hospital or School within 750 to 500 feet
7	If COF1 = 7 Or COF2 = 7	Hospital or School within 500 to 250 feet
10	If COF1 = 10 Or COF2 = 10	Hospital or School within 250 feet

4.2 Financial Impact – Multi_COF2

Financial Impact is the second of three multi-parameter CoFs within the risk assessment. Financial Impact analyzes pipe diameter (COF3), proximity to highways (COF4), and proximity to railroads (COF10). **Table 3** shows how this multi-parameter was created and scored.

Table 3: Financial Impact – 20%

Score	Criteria	Description
1	If COF3 <= 1 and COF4 = 1 and COF10 <= 1	Pipe Diameters < 6 inches and no nearby highways or railroads
4	If COF3 =4 and COF4 = 1 and COF10 = 1	6 inches <= Pipe Diameters <= 8 inches and no nearby highways or railroads
7	If [COF3 =7 and COF4 = 1 and COF10 = 1] OR If [COF3 <=7 and COF4 = 7]	[10 inches <= Pipe Diameters <= 12 inches and no nearby highways or railroads] OR [Pipe Diameters <= 8 inches and within a 'State' highway]

10	If [COF3 =10] OR [COF4 = 10] OR [COF 10 = 10]	[Pipe Diameters > 12 inches] OR [Pipeline crosses an 'Interstate Highway' highway] OR [Pipeline crosses a 'Railroad']

4.3 Public Confidence/Population Density – COF5

Public Confidence is a COF based on population density. **Table 4** shows how this CoF was created and scored.

Table 4: Public Confidence/Population Density – 15%

Score	Criteria	Description
1	Population <= 830	Population Density <= 830
4	830 < Population <= 1140	830 < Population Density <= 1140
7	1140 < Population <= 1530	1140 < Population Density <= 1530
10	Population > 1530	Population Density > 1530

4.4 System Reliability – Multi_COF4

System Reliability is the last of three multi-parameter CoFs within the risk assessment. System Reliability analyzes the Junction Pressure (COF6) and count of meters (COF8). **Table 5** shows how this multi-parameter was created and scored.

Table 5: System Reliability – 25%

Score	Criteria	Description
1	If COF6 <= 1 and COF8 <= 1	Junction Pressure <= 40 and Count of Meters <= 5
4	If COF6 = 4 and COF8 <= 4 OR COF6 <= 4 and COF8 = 4	[40 < Junction Pressure <= 80 and Count of Meters <= 10] OR [Junction Pressure <= 80 and 5 < Count of Meters <= 10]
7	If COF6 = 7 and COF8 <= 7 OR COF6 <= 7 and COF8 = 7	[80 < Junction Pressure <= 100 and Count of Meters <= 25] OR [Junction Pressure <= 100 and 10 < Count of Meters <= 25]
10	If COF6 = 10 OR COF8 = 10	[Junction Pressure > 100] OR [Count of Meters > 25]

5.0 LIKELIHOODS OF FAILURE

Likelihood of Failure (LoF) refers to the potential impact the failure of a pipe or other asset would have on the system. Five individual LoFs and one multi-parameter LoFs were created by Innovyze based on input form GSWC. The scoring details for the individual LoFs are described in **Appendix C**. The LoFs utilized within the risk analysis are discussed below.

5.1 Physical Condition – Leak Counts

The physical condition LoF takes into account many the history of leaks along specific pipelines. InfoMaster has a build in normalization tool that normalizes the number of leaks per foot of pipeline. The city's standards were provided to Innovyze based on number of leaks per thousand feet. Innovyze converted the Cityt's standard to number of leaks per foot. **Table 6** shows how LOF1 – Physical Condition – Leak Counts was scored.

Table 6: Physical Condition – 50%

Score	Criteria	Description
1	Leak Count <= 0.002	2 or less leaks per 1000 feet of pipe
4	0.002 < Leak Count <= 0.01	More than 2 leaks per 1000 feet of pipe and 10 or less leaks per 1000 feet of pipe
7	0.01 < Leak Count <= 0.04	More than 10 leaks per 1000 feet of pipe and 40 or less leaks per 1000 feet of pipe
10	Leak Count > 0.04	40 or more leaks per 1000 feet of pipe

5.2 Hydraulic Model Pipe Velocity – 10%

The pipe velocity LoF analyzes attributes of the pipe which relate to hydraulic model results provided by GSWC. **Table 7** shows how this multi-parameter was created and scored.

Table 7: Performance – 35%

Score	Criteria	Description
0	[Blank Value]	No Pipeline velocity is associated with the pipeline
1	Velocity <= 5 ft/s	Velocity is less than 5 feet per second
4	5 ft/s < Velocity <= 10 ft/s	Veloclity is more than 5 feet per second and less than 10 feet per second
10	Velocity > 10 ft/s	Velocity is greater than 10 feet per second

5.3 Age of Pipeline and Material – Multi_LOF1

The pipe age combined with pipeline material was used for this multi-parameter LoF. The unique scoring of the pipe material LoF (LOF5) was utilized. In addition, the pipeline age was calculated using an ArcGIS editing session based on the difference between the installation year and 2019 (please note that this calculation will be required on a yearly basis – see Appendix A). A pipe age LoF (LOF4) was created to score the pipe age based on a range. **Table 8** shows how this multi-parameter was created and scored.

Table 8: Age of Pipeline and Material – 40%

Material	Pipe Age	Score
AC (LOF5 = 0),	<=49	1
	49 < age <= 79	4
	79 < age <= 119	7
	> 119	10
CI (LOF5 = 1),	<=49	1
	49 < age <= 59	4
	59 < age <= 79	7
	> 79	10
DI (LOF5 = 2),	<=49	1
	49 < age <= 89	4
	89 < age <= 119	7
	> 119	10
PVC (LOF5 = 5),	<=59	1
	59 < age <= 79	4
	79 < age <= 119	7
	> 119	10
RCP (LOF5 = 6), SS (LOF5 = 7), STLP (LOF5 = 8),	<=19	1
	19 < age <= 39	4
	39 < age <= 59	7
	> 59	10
Galv (LOF5 = 9)	<=9	1
	9 < age <= 29	4
	29 < age <= 49	7
	> 49	10
HDPE (LOF5 = 4),	<=9	1
	9 < age <= 29	4
	29 < age <= 49	7
	> 49	10
UNK (LOF5 = 9),	<=9	1
	9 < age <= 29	4
	29 < age <= 49	7
	> 49	10

6.0 CALCULATION OF RISK

Two risk models were developed for the GSWC Water Risk Model. The linear Normalization Risk model was created. In addition, a 3x3 risk matrix method was utilized to calculate risk in the InfoMaster project. This is the most commonly used InfoMaster risk analysis method. CoF and LoF scores for each asset were multiplied by the weighing factors specified by GSWC. The sum of all CoF scores was then multiplied by the sum of all LoF scores to get the total risk score. All risk scores were then normalized based on the highest scoring pipe for comparison purposes in the normalized risk field. Table 9 below shows the LoF and CoF weighting factors used for both Risk Analysis

Table 9: Risk Analysis Weighting Factors

COF	COF Category - Multi	Weight
Multi_COF1	Health, Safety & Security (Critical Facilities - schools & hospitals)	40%
Multi_COF2	Financial Impact (Pipe Size & Major Intersections, Railroads)	20%
COF5	Public Confidence (Land Use-POP12)	15%
Multi_COF3	System Reliability (Pressures from Junctions & Services Interrupted as evaluated by VCM)	25%
LOF	**LOF Category - Multi**	**Weight**
LOF1	Physical Condition (Leak count)	50%
LOF3	Performance (Pipe Velocity)	10%
Multi_LOF1	Age & materials	40%

6.1 Linear Normalization Risk Analysis Model

The linear Normalization Method was used to simulate the Kanew Results. Figure 2 below shows the setup of the linear Normalization Risk Method.

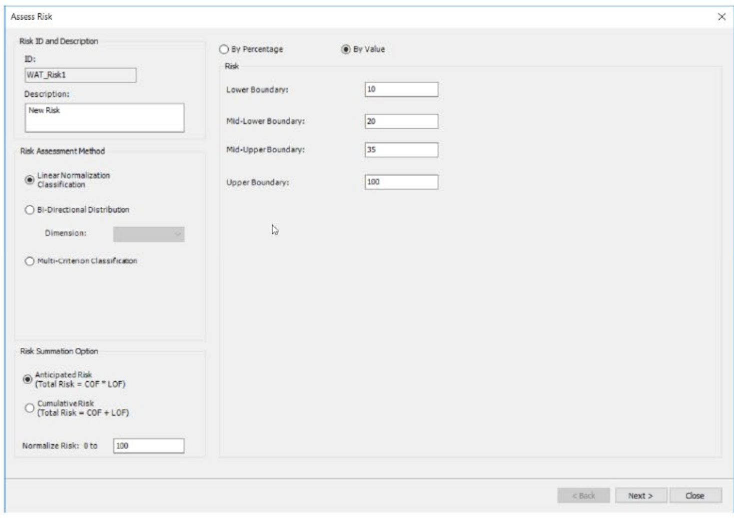


Figure 2: Linear Normalization Risk Analysis

6.2 3X3 Matrix Risk Analysis Model

A 3X3 Matrix was also utilized per GSWC direction. **Figure 2** below shows the risk matrix used in the risk analysis. This risk matrix may be altered to adjust the Risk by Grading score assigned to each pipe.

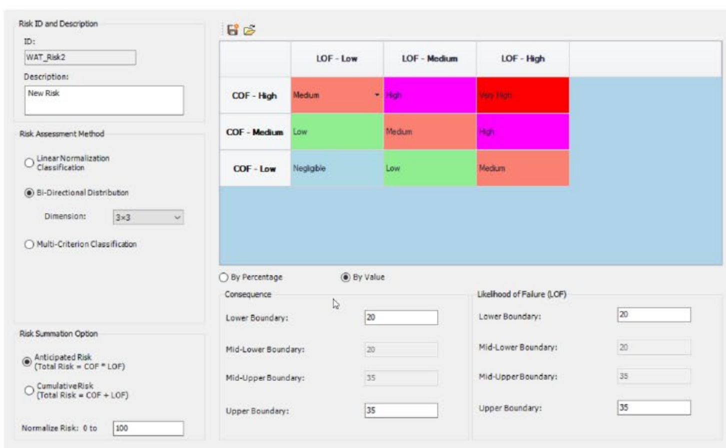


Figure 3: Risk Analysis Matrix

7.0 DATA MINER

A Data Miner was created to place all pipelines within a facility set that meet the following criteria:

- Risk score of 5

- Within 50 feet of another pipeline with a risk score of 5

The figure below presents the data miner that selects all pipelines with similar risk scores.

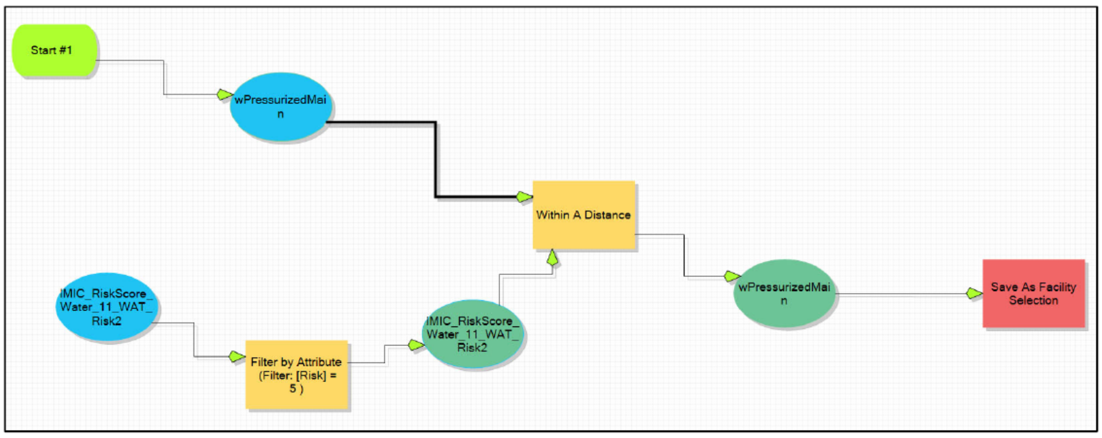


Figure 4: Data Miner

8.0 DETERIORATION ANALYSES

The Deterioration Analysis tool can be used to predict the service life of elements based on life expectancy or break criteria. There are two types of deterioration tools within InfoMaster: cohort and regression. Cohort analysis groups pipes with similar attributes and creates a deterioration model for each group. Regression analysis uses past break data to predict the service life of each type of pipe based on correlating variables.

8.1 Failure Definition

To create the cohort and regression analyses, it is first necessary to define the criteria for pipe failure. The failure definition tool allows users to define pipe failure based off of pipe survey data (only in InfoMaster Sewer), service request data, inspection data, or LoF data. In the delivered model, pipe failure is defined using imported service request data.

Data used to produce these deterioration models came from GSWC pipe failure data, specifically the Leak Service Request provided by GSWC. In total, 421 Leak records were imported.

8.2 Sensitivity Analysis

After defining failure data, sensitivity analyses can be used to evaluate pipe attributes and whether or not they are pipe failure indicators. Two example sensitivity analysis was generated in the final deliverable, WAT_SA1 and WAT_SA2.

The first sensitivity analysis evaluates material at a threshold of 0.1. The second sensitivity analysis evaluates material and diameter at a threshold of 0.1. It also only evaluates Active water mains. The screenshots below show the settings for WAT_SA1.

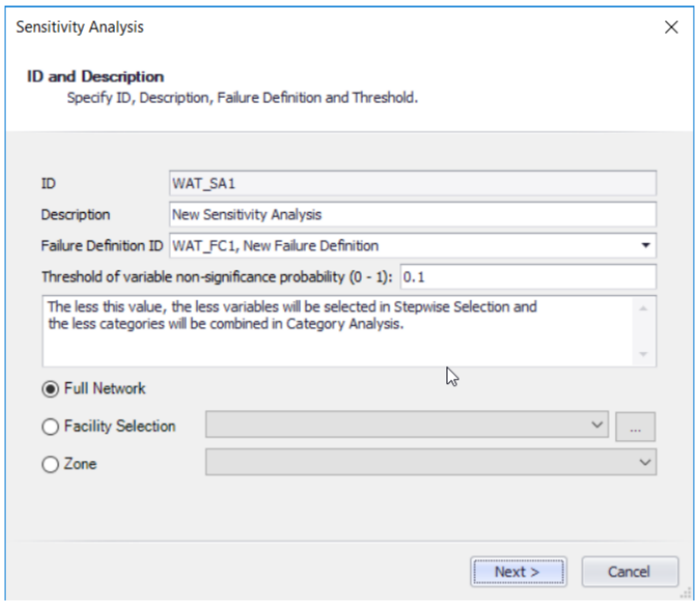


Figure 5: WAT_SA1 General Settings

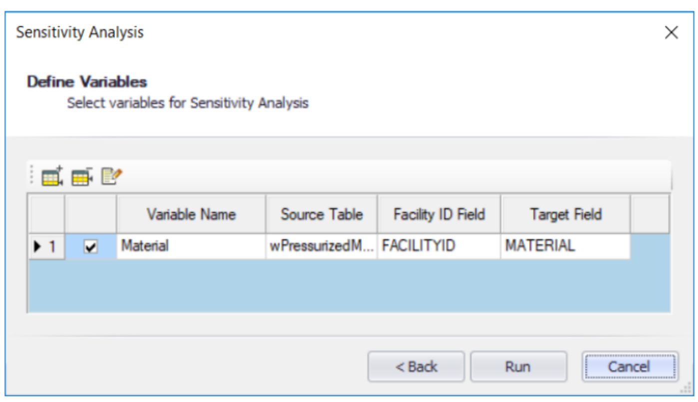


Figure 6: WAT_SA1 - Parameters Evaluated

8.3 Cohort Analyses

In the delivered model, three cohort models were provided: Optimistic Herz, Pessimistic Her, and a Herz failure model based on leak repairs (WAT_SD1). The cohort models utilized the Herz equation option and analyzed the entire Active water main network (similar to the risk analysis). Both the optimistic Herz and Pessimistic Herz models were based on the life expectancy curves provided by

GSWC. The third cohort model was generated based on an example sensitivity analysis created by Innovyze (WAT_SA1). This example sensitivity analysis created cohorts derived from the pipe material field.

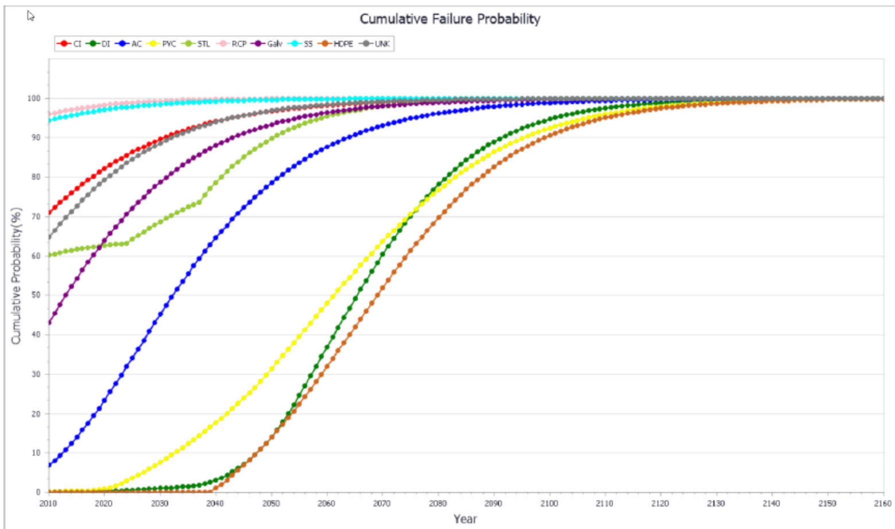


Figure 7: WAT_SA1 – Parameters Evaluated

8.4 Regression Analyses

In the delivered model, one regression model was provided. In the regression model, the sensitivity analysis WAT_SA1 was applied. In this example model, the Cox regression equation was used to generate the failure curves.

These initial statistical models were created for training/demo purposes only and are not necessarily representative of GSWC's actual linear asset life expectancies

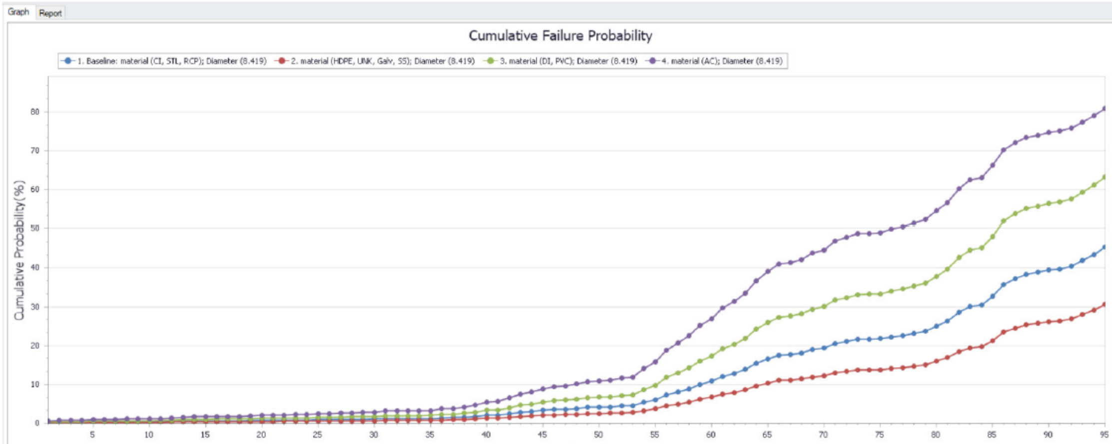


Figure 8: Example Regression Analysis Results

9.0 REHABILITATION PLAN

Rehabilitation plans use risk data, work manager data, and other data sources to make more informed rehab decisions. The plans combine all these data sources with an organization's rehab logic to determine a suggested rehab action for each pipe. The final model deliverable contains GSWC initial rehab plan. This rehab plan, called 'Project Prioritization Plan' uses the risk model as the based dataset to be used in the decision tree.

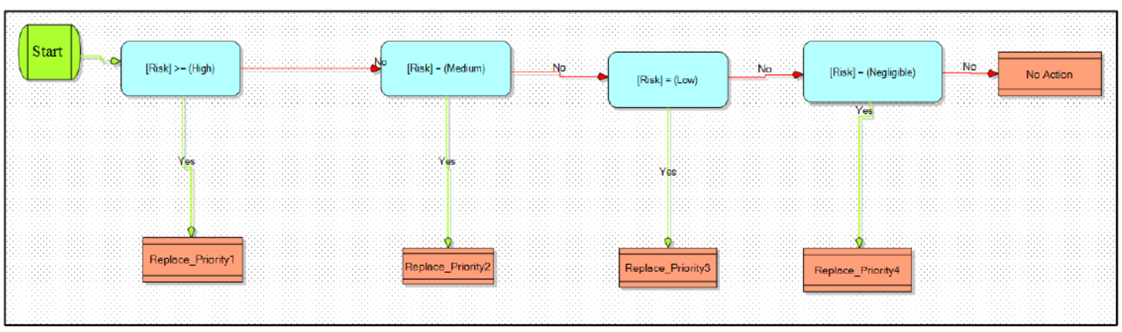


Figure 9: Project Prioritization Plan

APPENDIX A: APPENDED FIELDS

In the course of building the InfoMaster Water project, it became necessary to append additional fields to certain feature classes/tables, specifically the Pressurized Main feature class. The table below details these fields, describes their necessity, and details how they were created.

Table 10: Pressurized Mains – Appended Fields

Field Name	Reason	Creation
Pipe Age (calculated)	Used to calculate Age from 2019	Subtracted Installation year from 2019

APPENDIX B: CONSEQUENCES OF FAILURE

Many Consequences of Failure (CoFs) were created in order to accurately score the project based on input from GSWC. The following table describes these CoF building blocks.

Table 11: Consequences of Failure – Building Block List

CoF Name	Data Used	Criteria	Score
COF1, Critical Facilities Hospitals	CulverCity_Hospitals	<= 250	10
		250.01 - 500	7
		500.01 - 750	4
		750.01 - 1000	1
		[blank value]	0
COF2, Critical Facilities Schools	CulverCity_Schools	<= 250	10
		250.01 - 500	7
		500.01 - 750	4
		750.01 - 1000	1
		[blank value]	0
COF3, Diameter	Pressurized Main – Diameter field	<=4	1
		6 – 8	4
		10 – 12	7
		>=14	10
COF4, Major Intersections	CulverCity_Highways, Hwy_Class	Interstate	10
		State	7
		[blank value]	0
COF5, Population Density	CulverCity_Census, POP2012	Population > 1530	10
		1140 < Population <= 1530	7
		830 < Population <= 1140	4
		Population <= 830	1
		[blank value]	0
COF6, Hydraulic Model Pressures	Model_Junction_Results, Pressure	Pressure > 100	10
		100 < Pressure <= 80	7

CoF Name	Data Used	Criteria	Score
		80 < Pressure <= 40	4
		Pressure <= 40	1
		[blank value]	0
COF7, VCM Pound Length	Valve Criticality Pound Length	Pound Length > 1450 ft	10
		1450 ft < Pound Length <= 730 ft	7
		730 ft < Pound Length <= 360 ft	4
		Pound Length <= 360 ft	1
		[blank value]	0
COF8, VCM Count of Meters	Valve Criticality Pound Length	Count of Meters > 25	10
		25 < Count of Meters <= 10	7
		10 < Count of Meters <= 5	4
		Count of Meters <= 5	1
		[blank value]	0
COF9, VCM Demand	Valve Criticality Demands	Demand > 20 gpm	10
		20 gpm < Demand <= 6 gpm	7
		6 gpm < Demand <= 2 gpm	4
		Demand <= 2 gpm	1
		[blank value]	0
COF10, Railroad Crossing	CulverCity_Railroads	TRUE	10
		FALSE	7

APPENDIX C: LIKELIHOODS OF FAILURE

Many Likelihoods of Failure (LoFs) were created in order to accurately score the project based on the CH2M report. The following table describes these LoF building blocks.

Table 12: Likelihoods of Failure – Building Block List

LoF Name	Data Used	Criteria	Score
LOF1, Leak Count	Count of Service Request (normalized to 1 ft of pipeline length)	> 0.04	10
		0.04 - 0.01	7
		0.01 - 0.002	4
		<= 0.002	1
LOF2, Install Year (not used)	Pipeline Install Year	Year >= 1900	5
		[blank value]	0
LOF3, Hydraulic Model Pipeline Velocity	Model_Pipe_Results, Velocity	> 10 ft/s	1
		10 ft/s - 5 ft/s	2
		<=5ft/s	1
		[blank value]	0
LOF4, Pipe Age	Pipe Age (calculated)	> 119	10
		89 - 119	9
		79 - 89	8
		59 - 79	7
		49 - 59	6
		39 - 49	5
		29 - 39	4
		19 - 29	3
		19-Sep	2
		<= 9	1
		[blank value]	0
	Pipe Material	UNK	9

LoF Name	Data Used	Criteria	Score
LOF5, Pipe Material		STL	8
		SS	7
		RCP	6
		PVC	5
		HDPE	4
		Galv	3
		DI	2
		CI	1
		AC	0

APPENDIX D: LIFE EXPECTANCY CURVES

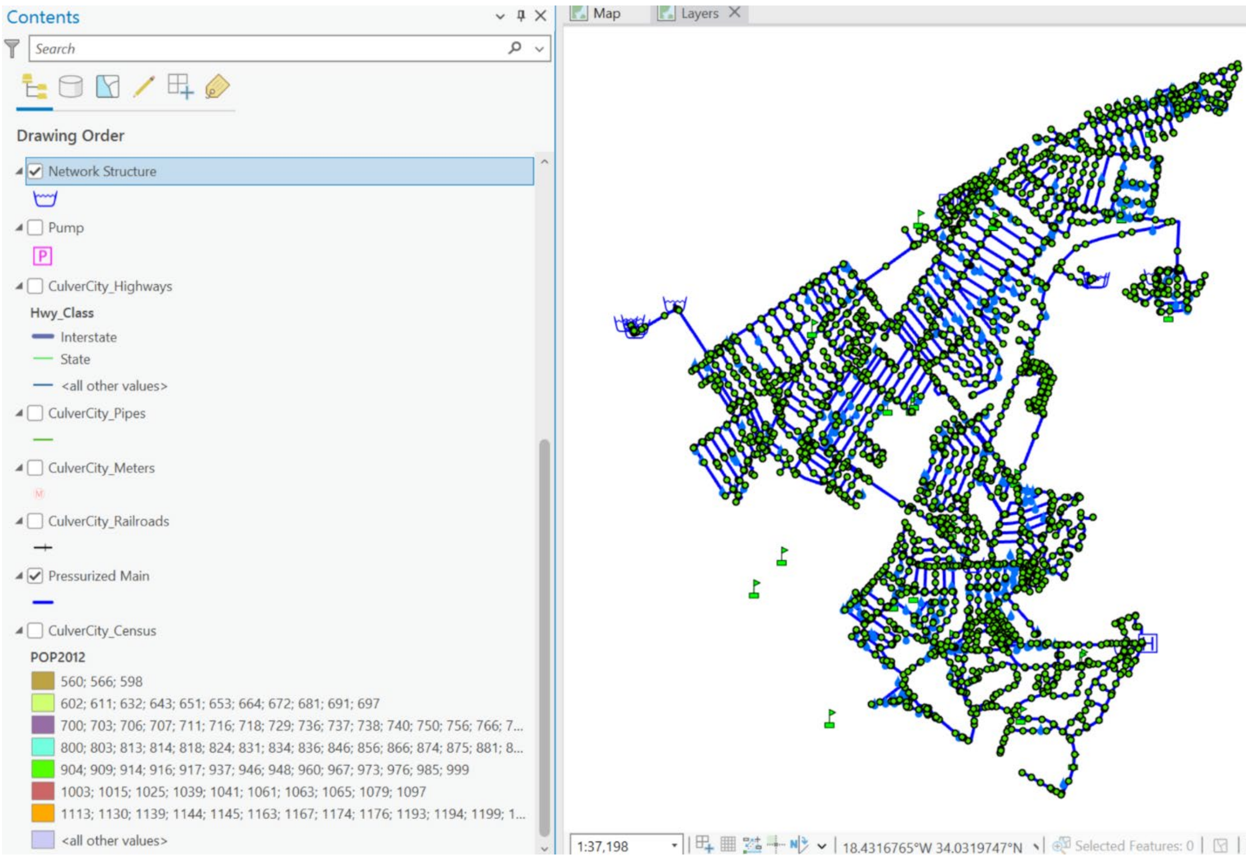
The life expectancy curves were provided by GSWC. The tables below present the curves for both the optimistic and pessimistic life expectancies of pipelines by material.

Table 13: Optimistic Life Expectancy Curves

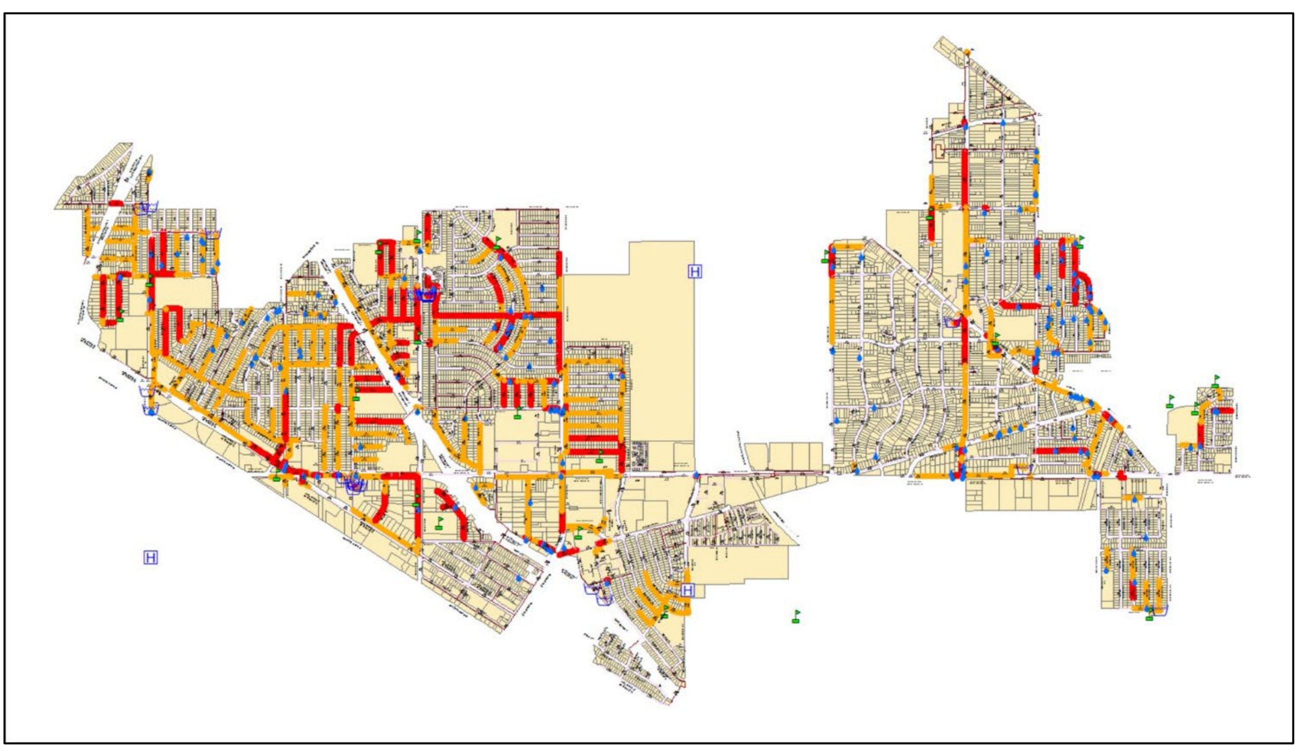
Material Group	Life Expectancy (Years)	Survival Probability (%)
[Default]	20	100
	50	50
	80	10
AC	70	100
	100	50
	140	10
CI	60	100
	80	50
	110	10
DI	70	100
	110	50
	150	10
Galv	40	100
	60	50
	90	10
HDPE	100	100
	130	50
	150	10
PVC	100	100
	130	50
	150	10
RCP	30	100
	60	50
	80	10
SS	20	100
	50	50
	80	10
STL	30	100
	60	50
	80	10

Table 14: Pessimistic Life Expectancy Curves

Material Group	Life Expectancy (Years)	Survival Probability (%)
[Default]	20	100
	50	50
	80	10
AC	40	100
	60	50
	90	10
CI	20	100
	50	50
	80	10
DI	40	100
	60	50
	85	10
Galv	40	100
	60	50
	90	10
HDPE	30	100
	60	50
	90	10
PVC	30	100
	60	50
	90	10
RCP	20	100
	30	50
	50	10
SS	20	100
	50	50
	80	10
STL	20	100
	30	50
	50	10



GSWC's Norwalk System[121]



[121] Note: for presentation purposes, only an excerpt is shown from GSWC's Norwalk system Pilot project using Innovyze software.

Innovyze®

Invoice

Invoice Number : USIN014651

Date: December 31 2018

Customer Number: CUS10845
Golden State Water Company - Anaheim, CA
1920 W Corporate Way
Anaheim, CA 92801
US

T: 916-853-3604

Customer Contact: Mark Insco
Customer Email: markinsco@gswater.com

Account Manager: Jeff Gobler

Terms: 30 Days from Invoice Date

Qty	Product	Total Amount
1	Implementation Services Project: InfoMaster Implementation Services Work completed to date: 100% Completion of Task 4 - Training. Reference: PO 7002173 - SP.	US$10,000.00
	TOTAL	US$10,000.00
	TAX	US$0.00
	TOTAL	US$10,000.00

METHOD OF PAYMENT (Choose One)

- ☐ Purchase Order No: ~~7002173 - SP~~
- ☐ Cheque No: ________ Date Mailed: ________
- ☐ Direct Transfer to bank details:

Bank: HSBC Bank
Account No.: 447004131
Name: Innovyze, Inc.
Send Remittance Advice: uscustomerbilling@innovyze.com

Swift Code: #MRMDUS33
Routing Transit Number for ACH transfer: #123006389
Routing Transit Number for wire transfer: #021001088

Please make your cheques payable to Innovyze Inc. and forward to the postal address below.
Accounts due and payable by expiry date.
Overdue accounts will attract interest at the current O/D rate on daily basis balances unless otherwise arranged.

www.innovyze.com

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Suite 150
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Mark I.

V-59169 7007805

Innovyze®

Invoice

Invoice Number : USIN015093

Date: February 28 2019

Customer Number: CUS10845
Golden State Water Company - Anaheim, CA
1920 W Corporate Way
Anaheim, CA 92801
US

T: 916-853-3604

Customer Contact: Mark Insco
Customer Email: markinsco@gswater.com

Account Manager: Jeff Gobler

Terms: 30 Days from Invoice Date

Qty	Product	Total Amount
1	Implementation Services Project: InfoMaster Implementation Services Work completed to date: 75% Completion of Task 1 - Existing Data Review. 50% completion of Task 2 InfoMaster Setup. 50% completion of Task 3 - Documentation. 100% Completion of Task 4 - Training.	US$16,750.00
	TOTAL	US$16,750.00
	TAX	US$0.00
	TOTAL	US$16,750.00

METHOD OF PAYMENT (Choose One)

- ☐ Purchase Order No: 7002173 - SP
- ☐ Cheque No: ______ Date Mailed: ______
- ☐ Direct Transfer to bank details:

Bank: HSBC Bank
Account No.: 447004131
Name: Innovyze, Inc.
Send Remittance Advice: uscustomerbilling@innovyze.com

Swift Code: #MRMDUS33
Routing Transit Number for ACH transfer: #123006389
Routing Transit Number for wire transfer: #021001088

Please make your cheques payable to Innovyze Inc. and forward to the postal address below
Accounts due and payable by expiry date.
Overdue accounts will attract interest at the current O/D rate on daily basis balances unless otherwise arranged.

www.innovyze.com

Innovyze Inc
6720 Southwest Macadam Ave
Suite 150
Portland, Oregon 97219
USA
Tel:+1 888 554 5022
Lori Abbey

Invoice

Invoice Number : USIN016281

Date: July 30 2019

Customer Number: CUS10845
Golden State Water Company - Anaheim, CA
1920 W Corporate Way
Anaheim, CA 92801
US

T: 916-853-3604

Customer Contact: Mark Insco
Customer Email: markinsco@gswater.com

Account Manager: Patrick Schreck

Terms: 30 Days from Invoice Date

Qty	Product	Total Amount
1	Implementation Services Project: InfoMaster Implementation Services Work completed to date: 100% Completion Tk1: Existing Data Review. 100% Completion Tk2: InfoMaster Setup. 100% Completion of Tk3: Documentation. 100% Completion of Tk4: Training. Ref PO7002173-SP Project Closed	US$13,250.00
	TOTAL	US$13,250.00
	TAX	US$0.00
	TOTAL	US$13,250.00

METHOD OF PAYMENT (Choose One)

☐ Purchase Order No: 7002173 - SP

☐ Cheque No: ______ Date Mailed: ______

☐ Direct Transfer to bank details:

Bank: HSBC Bank
Account No.: 447004131
Name: Innovyze, Inc.
Send Remittance Advice:

Swift Code: #MRMDUS33
Routing Transit Number for ACH transfer: #123006389
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uscustomerbilling@innovyze.com

Please make your cheques payable to Innovyze Inc. and forward to the postal address below.
Accounts due and payable by expiry date.
Overdue accounts will attract interest at the current O/D rate on daily basis balances unless otherwise arranged.

Innovyze Inc
6720 Southwest Macadam Ave
Suite 150
Portland, Oregon 97219
USA
Tel:+1 888 554 5022
Lori Abbey

3S Consult

Strömung
Struktur
Software

3S Consult GmbH • Schillerplatz 2 • 01309 Dresden • Germany

Golden State Water Company
Attn: Accounts Payable

630 E. Foothill Blvd.
San Dimas, CA 91773
United States

Date:	January 26, 2022
Your message:	
Your reference:	Mark Insco Dan Flores
Our reference:	22.111.1-GSWC-2022
Contact:	Ingo Kropp
Phone:	+49-351-48245-31

Software KANEW 3S – Prolongation of annual maintenance services

Your purchase order PO#: 7024827 – SP from 1/19/22

Our invoice number: 22.111.1

INVOICE

We are hereby invoicing you for the following items:

No.	Item	Amount	
1	Annual Maintenance for software KANEW 3S Maintenance period: 03/01/22 – 02/28/25 (36 months)	6,480.00	US$
	Sub-total (net)	6,480.00	US$
	No VAT		
	Total amount (gross)	6,480.00	US$

Payment terms: Net 30 days

The payment should be made to the following bank account:

Name of Bank:	Commerzbank Hannover
BIC-/SWIFT-Code:	DRES DE FF 250
IBAN:	DE13 2508 0020 0100 2004 00
Account number:	100200400
Account holder:	3S Consult GmbH
PAYMENT PURPOSE:	**Golden State Water Company, Invoice 22.111.1**

Büros:
Osteriede 8 - 10, 30827 Garbsen, Tel.: 05131 4980-0, Fax: 05131 4980-15
Am Harras 10, 81373 München, Tel.: 089 5404146-50, Fax: 089 5404146-97
Albtalstraße 13, 76137 Karlsruhe, Tel.: 0721 33503-360, Fax: 0721 33503-130
Schillerplatz 2, 01309 Dresden, Tel.: 0351 48245-31, Fax: 0351 48245-50

Geschäftsführer:
Dipl.-Ing. W. Micus
Sitz der Gesellschaft: Garbsen
Amtsgericht Hannover – HRB 110404
www.3sconsult.de

Bankverbindung:
Commerzbank Hannover
IBAN: DE13 2508 0020 0100 2004 00
SWIFT-BIC: DRES DE FF 250
Steuer-Nr.: 27 / 20019377
USt-IdNr.: DE115831439

<u>ATTACHMENT 1-7: GSWC'S RESPONSE TO PUBLIC ADVOCATES OFFICE DG-05, Q.6.</u>

Golden State Water Company
A Subsidiary of American States Water Company

August 25, 2023

To: Daphne Goldberg, Public Advocates Office
CALIFORNIA PUBLIC UTILITIES COMMISSION
505 Van Ness Avenue
San Francisco, CA 94102

Subject: Data Request DG-05 (A.23-08-010)
(Proposed Pipeline Project Data Follow-Up)
Due Date: August 23, 2023 Extension Due Date: August 25, 2023

Dear Daphne Goldberg,

In response to the above referenced data request number, we are pleased to submit the following responses:

Question 6:
A.23-08-010 project cost estimates for the following projects reference "Field Report(s)". Provide the "Field Report(s)":

a. Singingwood Road Area Main Replacement
b. Lincoln St Main Replacement
c. Azores Circle Area Main Replacement
d. Oak Crest Drive
e. Valley Ave AMR
f. Primavera Ln
g. Willowbrook Ave.
h. Eaton Rd Area Main Replacement
i. Niland Plant Primary Feeder Replacement
j. Llanto Rd Main Replacement
k. Butte St Area Main Replacement

Response 6:

a. The "Field Report" refers to a verbal statement provided to Engineering Planning Department (EPD) by GSWC field staff (operations and/or Capital Programs Management (CPM) inspector).
b. The "Field Report" refers to a verbal statement provided to EPD by GSWC field staff (operations and/or CPM inspector).
c. Attachment named "DG-05 6c" is the "Field Report" email from GSWC field staff (operations and/or CPM inspector). Main shown is same installation as proposed replacement.
d. The "Field Report" refers to a verbal statement provided to EPD by GSWC field staff (operations and/or CPM inspector).
e. The "Field Report" refers to a verbal statement provided to EPD by GSWC field staff (operations and/or CPM inspector).

f. Attachment named “DG-05 6f” is the “Field Report” email from GSWC field staff (operations and/or CPM inspector). This was the second time the same home was flooded. The AC main was in poor shape (pipe was “soggy” and very difficult to snap cut because it kept crumbling apart) when cut in with new pipe.
g. Per data request DG-02, Willowbrook Ave. project is updated and “Project Need” for Willowbrook Ave. project does not refer to “field report.” Attached Excel file, DG-05 Attachment 1, Column E was updated with revised project need.
h. The “Field Report” refers to a verbal statement provided to EPD by GSWC field staff (operations and/or CPM inspector).
i. The “Field Report” refers to a verbal statement provided to EPD by GSWC field staff (operations and/or CPM inspector).
j. Attachment named “DG-05 6j” is the “Field Report” email from GSWC field staff (operations and/or CPM inspector). Per Section 8 of the 2022 Master Plan, there were 23 leaks that were repaired between 2017 through 2021.
k. The “Field Report” refers to a verbal statement provided to EPD by GSWC field staff (operations and/or CPM inspector). Per Section 8 of the 2022 Master Plan, there were 23 leaks that were repaired between 2017 through 2021.

END OF RESPONSE

Flores, Daniel

From: Gonzalez, Tina M.
Sent: Wednesday, September 21, 2022 2:43 PM
To: Flores, Daniel; Schubert, Paul T.; Dees, Lawrence; Miller, Lisa; White, Dawn R.; Insco, Mark; Gisler, Ernest A.; Sinagra, Dane
Subject: RE: 2023 GRC Project Prioritization Meeting - Bay Point
Attachments: Rio Lane Leak 3.JPEG; Rio Lane Leak 1.JPEG; Rio Lane Leak 2.JPEG; Rio Lane Repair 1.JPEG; Rio Lane Repair 2.JPEG

Hi Mark & Everyone,

Attached are the pictures of the 6” AC Main Leak/Repair on Rio Lane (cross street Azores Circle) that we were talking about in the meeting. They are the leak and then the repair. The repaired picture that is black around the full circle repair clamp and pipe is 10mil plastic with 10mil tape if you were wondering. Also a 4” conduit pipe that wasn’t marked and over the 6” AC Main. Thank you Mark/Everyone and have a nice day.

Tina M. Gonzalez
Operations Superintendent
Golden State Water Company
53-B Manor Drive Bay Point, CA 94565
Phone: (925) 458-2090
email: tinagonzalez@gswater.com





Golden State Water Company
A Subsidiary of American States Water Company

Date: 11-3-22

Construction Report

Incident #: ______ Location: 960 Primavera

Contractor: Joseph Engineering Foreman: ______

Type of Incident: Main Break on 6 inch Main Time of arrival: 2:00

Condition and initial facts: AC Main blow out, 6 inch Main, Split in main was about 4 ft long

System Shutdown: Yes # Of Customers Affected/Length of Time: 10 / 4 hours

Site USA # ______ Job Site Marked: ______ Marked by: ______

DESCRIPTION OF INCIDENT

6 inch Main blow out at 960 Primavera blow out was in customers front yard, 1 valve was used to shut down main & completly and had 10 customers out of water for about 4 hours, Cut out blown main and used two compression couplings with new pipe to replace blown main.

Labor	Quantity	Hours
Foreman		
Operator	2	3
Laborer	6	3
Svc Truck	5	3
Dump Truck	1	3
Backhoe	1	3
Excavatoe		
Pump		
Trench Plate		

Other:

Valves Turned: 1

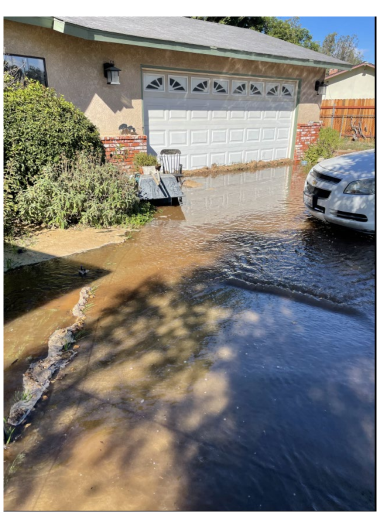
Water Loss & Hydrants/Blow Offs Flushed:

Parts From Inventory: See invoice

Materials Supplied by Contractor:

Parts & Materials Purchased: See invoice

2



ATTACHMENT 1-8: GSWC'S RESPONSE TO PUBLIC ADVOCATES OFFICE DG-08, ATTACHMENT 1

Golden State Water Company
A Subsidiary of American States Water Company

September 12, 2023

To: Daphne Goldberg, Public Advocates Office
CALIFORNIA PUBLIC UTILITIES COMMISSION
505 Van Ness Avenue
San Francisco, CA 94102

Subject: Data Request DG-08 (A.23-08-010)
(Recorded Pipeline Costs and Miles Replaced)
Due Date: September 12, 2023

Dear Daphne Goldberg,

In response to the above referenced data request number, we are pleased to submit the following responses:

Region I

Arden

Main Replacement Miles

Year	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	0.00	0.00	0.00	0.00%	0.00%
2014	0.00	0.00	0.00	0.00%	0.00%
2015	0.00	0.00	0.00	0.00%	0.00%
2016	0.00	0.00	0.00	0.00%	0.00%
2017	0.78	0.77	0.99	4.16%	5.35%
2018	0.00	0.00	0.00	0.00%	0.00%
2019	0.00	0.00	0.17	0.00%	0.92%
2020	0.16	0.16	0.00	0.86%	0.00%
2021	0.01	0.01	0.00	0.05%	0.00%
2022	0.93	0.93	0.00	5.03%	0.00%

Cordova

Main Replacement Miles

Year	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	0.78	0.34	0.34	0.18%	0.18%
2014	0.47	0.91	0.80	0.49%	0.43%
2015	0.44	0.44	0.15	0.23%	0.08%
2016	0.16	0.13	0.46	0.07%	0.25%
2017	0.34	0.34	1.63	0.18%	0.87%
2018	0.00	0.00	0.47	0.00%	0.25%
2019	0.83	0.32	0.89	0.17%	0.48%
2020	1.63	0.51	0.00	0.27%	0.00%
2021	0.08	0.08	0.00	0.04%	0.00%
2022	0.00	0.00	0.47	0.00%	0.25%

Region II

Artesia

Main Replacement Miles

Year	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	0.93	0.00	0.00	0.00%	0.00%
2014	0.31	0.81	1.43	0.88%	1.55%
2015	0.00	0.00	0.00	0.00%	0.00%
2016	1.70	0.08	1.64	0.09%	1.77%
2017	0.69	0.40	0.44	0.43%	0.48%
2018	0.00	0.00	2.11	0.00%	2.28%
2019	0.89	0.89	0.00	0.96%	0.00%
2020	0.00	0.00	0.00	0.00%	0.00%
2021	1.13	1.13	0.21	1.22%	0.23%
2022	0.32	0.32	3.42	0.35%	3.70%

Norwalk

Main Replacement Miles

Year	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	1.73	0.00	3.13	0.00%	3.75%
2014	0.00	1.74	2.26	2.09%	2.71%
2015	1.13	1.13	0.25	1.35%	0.30%
2016	1.07	1.07	1.96	1.29%	2.35%
2017	0.00	0.00	0.00	0.00%	0.00%
2018	0.00	0.00	0.00	0.00%	0.00%
2019	0.27	0.27	0.00	0.32%	0.00%
2020	0.00	0.00	0.00	0.00%	0.00%
2021	0.17	0.17	0.35	0.20%	0.42%
2022	0.67	0.67	0.00	0.80%	0.00%

Baypoint

	Main Replacement Miles				
Year	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	0.15	0.15	0.00	0.30%	0.00%
2014	0.28	0.00	0.00	0.00%	0.00%
2015	0.00	0.00	0.00	0.00%	0.00%
2016	0.19	0.19	0.61	0.39%	1.24%
2017	0.27	0.27	0.00	0.54%	0.00%
2018	0.03	0.03	0.00	0.06%	0.00%
2019	0.35	0.35	0.43	0.71%	0.87%
2020	0.27	0.27	0.03	0.55%	0.06%
2021	0.00	0.00	0.31	0.00%	0.63%
2022	0.00	0.00	0.00	0.00%	0.00%

Bell-Bell Gardens

	Main Replacement Miles				
Year	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	0.97	0.97	1.07	1.46%	1.62%
2014	0.63	0.63	0.00	0.94%	0.00%
2015	0.49	0.49	0.50	0.74%	0.76%
2016	0.00	0.00	1.38	0.00%	2.08%
2017	1.32	1.32	3.28	1.99%	4.95%
2018	0.00	0.00	0.00	0.00%	0.00%
2019	0.00	0.00	0.00	0.00%	0.00%
2020	0.00	0.00	0.00	0.00%	0.00%
2021	0.00	0.00	0.94	0.00%	1.42%
2022	2.03	2.03	1.32	3.07%	1.99%

Clearlake

	Main Replacement Miles				
Year	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	0.06	0.06	0.50	0.13%	1.19%
2014	0.19	0.19	0.28	0.45%	0.67%
2015	0.23	0.22	0.21	0.52%	0.50%
2016	0.30	0.30	0.56	0.72%	1.33%
2017	0.15	0.15	0.30	0.36%	0.71%
2018	0.00	0.00	0.41	0.00%	0.97%
2019	0.74	0.85	0.29	2.02%	0.69%
2020	0.15	0.15	0.55	0.36%	1.31%
2021	0.00	0.00	0.36	0.00%	0.86%
2022	0.00	0.00	0.00	0.00%	0.00%

Florence-Graham

	Main Replacement Miles				
Year	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	1.25	0.00	2.93	0.00%	3.41%
2014	0.78	1.23	0.85	1.43%	0.99%
2015	0.76	0.76	0.68	0.88%	0.79%
2016	1.21	1.21	1.64	1.41%	1.91%
2017	0.16	0.16	0.42	0.19%	0.49%
2018	0.00	0.00	2.57	0.00%	3.00%
2019	1.29	1.29	1.26	1.50%	1.47%
2020	0.00	0.00	0.00	0.00%	0.00%
2021	0.00	0.00	0.00	0.00%	0.00%
2022	2.36	2.36	0.00	2.75%	0.00%

Los Osos

	Main Replacement Miles				
Year	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	0.15	0.15	0.10	0.44%	0.29%
2014	0.09	0.09	0.55	0.28%	1.61%
2015	0.00	0.00	0.00	0.00%	0.00%
2016	0.00	0.00	0.00	0.00%	0.00%
2017	0.00	0.00	0.01	0.00%	0.03%
2018	0.01	0.01	0.06	0.03%	0.18%
2019	0.05	0.05	0.00	0.15%	0.00%
2020	0.07	0.07	0.55	0.20%	1.61%
2021	0.35	0.35	0.00	1.02%	0.00%
2022	0.00	0.00	0.00	0.00%	0.00%

Hollydale

	Main Replacement Miles				
Year	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	0.17	0.15	0.00	0.94%	0.00%
2014	0.06	0.08	0.00	0.47%	0.00%
2015	0.00	0.00	0.00	0.00%	0.00%
2016	0.00	0.00	0.26	0.00%	1.60%
2017	0.23	0.23	0.00	1.42%	0.00%
2018	0.00	0.00	0.00	0.00%	0.00%
2019	1.46	0.51	0.00	3.15%	0.00%
2020	0.00	0.00	0.00	0.00%	0.00%
2021	0.00	0.00	0.00	0.00%	0.00%
2022	0.89	0.89	0.00	5.49%	0.00%

Edna Road

Main Replacement Miles

Year	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	0.00	0.00	0.00	0.00%	0.00%
2014	0.28	0.25	0.00	2.32%	0.00%
2015	0.00	0.00	0.32	0.00%	3.02%
2016	0.00	0.00	0.47	0.00%	4.43%
2017	0.04	0.00	0.00	0.00%	0.00%
2018	0.00	0.00	0.05	0.00%	0.47%
2019	0.23	0.23	0.49	2.14%	4.62%
2020	0.00	0.00	0.00	0.00%	0.00%
2021	0.00	0.00	0.00	0.00%	0.00%
2022	0.00	0.00	0.00	0.00%	0.00%

Willowbrook

Main Replacement Miles

Year	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	0.00	0.00	0.52	0.00%	3.94%
2014	0.43	0.42	0.41	3.18%	3.11%
2015	0.00	0.00	0.00	0.00%	0.00%
2016	0.72	0.72	0.00	5.45%	0.00%
2017	0.00	0.00	0.74	0.00%	5.61%
2018	0.00	0.00	0.00	0.00%	0.00%
2019	1.23	1.23	0.00	9.32%	0.00%
2020	0.00	0.00	0.00	0.00%	0.00%
2021	0.00	0.00	1.26	0.00%	9.55%
2022	0.00	0.00	0.00	0.00%	0.00%

Lake Marie

Main Replacement Miles

Year	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	0.00	0.00	0.00	0.00%	0.00%
2014	0.00	0.00	0.00	0.00%	0.00%
2015	0.00	0.00	0.06	0.00%	0.75%
2016	0.00	0.00	0.00	0.00%	0.00%
2017	0.04	0.04	0.00	0.50%	0.00%
2018	0.00	0.00	0.00	0.00%	0.00%
2019	0.00	0.00	0.00	0.00%	0.00%
2020	0.22	0.22	0.00	2.75%	0.00%
2021	0.00	0.00	0.00	0.00%	0.00%
2022	0.00	0.00	0.00	0.00%	0.00%

Culver City

Main Replacement Miles

Year	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	1.30	0.34	0.90	0.36%	0.94%
2014	1.14	0.95	0.84	0.99%	0.88%
2015	2.16	1.46	1.13	1.52%	1.18%
2016	1.22	1.43	0.27	1.49%	0.28%
2017	0.80	0.30	1.13	0.32%	1.18%
2018	0.00	0.00	1.62	0.00%	1.69%
2019	1.67	1.67	2.66	1.74%	2.77%
2020	0.00	0.00	0.00	0.00%	0.00%
2021	0.02	0.02	1.80	0.02%	1.88%
2022	6.54	6.54	0.14	6.81%	0.15%

Orcutt

Main Replacement Miles

Year	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	0.44	0.44	0.83	0.30%	0.58%
2014	0.00	1.02	0.00	0.71%	0.00%
2015	0.00	0.00	0.78	0.00%	0.54%
2016	0.00	0.00	0.00	0.00%	0.00%
2017	0.78	0.78	0.00	0.54%	0.00%
2018	0.08	0.06	0.00	0.04%	0.00%
2019	0.21	0.21	0.03	0.14%	0.02%
2020	0.96	0.96	0.00	0.67%	0.00%
2021	1.33	1.33	0.00	0.92%	0.00%
2022	2.94	2.94	0.27	2.04%	0.19%

Southwest

Main Replacement Miles

Year	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	2.95	5.23	2.99	1.12%	0.64%
2014	8.15	0.23	4.42	0.05%	0.95%
2015	9.89	10.20	11.23	2.19%	2.41%
2016	6.74	6.74	12.25	1.44%	2.62%
2017	5.61	5.63	15.01	1.21%	3.22%
2018	9.32	9.32	20.09	2.00%	4.30%
2019	7.48	7.48	24.96	1.60%	5.35%
2020	15.06	15.06	2.09	3.23%	0.45%
2021	2.06	2.06	5.02	0.44%	1.08%
2022	0.00	0.00	2.30	0.00%	0.49%

Sisquoc

Main Replacement Miles

Year	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	0.00	0.00	0.00	0.00%	0.00%
2014	0.00	0.00	0.00	0.00%	0.00%
2015	0.00	0.00	0.00	0.00%	0.00%
2016	0.00	0.00	0.00	0.00%	0.00%
2017	0.00	0.00	0.00	0.00%	0.00%
2018	0.00	0.00	0.00	0.00%	0.00%
2019	0.00	0.00	0.00	0.00%	0.00%
2020	0.00	0.00	0.00	0.00%	0.00%
2021	0.00	0.00	0.00	0.00%	0.00%
2022	0.00	0.00	0.00	0.00%	0.00%

Tanglewood

Main Replacement Miles

	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	0.00	0.00	0.69	0.00%	11.13%
2014	0.62	0.55	0.00	8.86%	0.00%
2015	0.00	0.00	0.00	0.00%	0.00%
2016	0.00	0.00	1.62	0.00%	26.13%
2017	0.00	0.00	0.00	0.00%	0.00%
2018	0.00	0.00	0.05	0.00%	0.81%
2019	0.00	0.00	0.00	0.00%	0.00%
2020	0.00	0.00	0.00	0.00%	0.00%
2021	0.00	0.00	0.00	0.00%	0.00%
2022	0.00	0.00	0.00	0.00%	0.00%

Nipomo

Main Replacement Miles

	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	0.00	0.00	0.00	0.00%	0.00%
2014	0.00	0.00	0.00	0.00%	0.00%
2015	0.00	0.00	0.00	0.00%	0.00%
2016	0.00	0.00	0.00	0.00%	0.00%
2017	0.00	0.00	0.00	0.00%	0.00%
2018	0.00	0.00	0.00	0.00%	0.00%
2019	0.05	0.05	0.00	0.18%	0.00%
2020	0.00	0.00	0.00	0.00%	0.00%
2021	0.00	0.00	0.00	0.00%	0.00%
2022	0.00	0.00	0.00	0.00%	0.00%

Cypress Ridge

Main Replacement Miles

	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	0.00	0.00	0.00	0.00%	0.00%
2014	0.00	0.00	0.00	0.00%	0.00%
2015	0.00	0.00	0.00	0.00%	0.00%
2016	0.00	0.00	0.00	0.00%	0.00%
2017	0.00	0.00	0.00	0.00%	0.00%
2018	2.08	0.00	0.00	0.00%	0.00%
2019	0.85	0.00	0.00	0.00%	0.00%
2020	0.00	0.00	0.00	0.00%	0.00%
2021	0.00	0.00	0.00	0.00%	0.00%
2022	0.00	0.00	0.00	0.00%	0.00%

Simi Valley

Main Replacement Miles

	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	0.32	0.00	0.19	0.00%	0.14%
2014	0.00	1.29	0.00	0.93%	0.00%
2015	0.76	0.00	0.00	0.00%	0.00%
2016	0.00	0.76	1.56	0.55%	1.12%
2017	0.32	0.32	0.00	0.23%	0.00%
2018	0.00	0.00	0.00	0.00%	0.00%
2019	0.06	0.04	0.03	0.03%	0.02%
2020	0.21	0.21	0.00	0.15%	0.00%
2021	0.00	0.00	0.00	0.00%	0.00%
2022	0.44	0.44	0.05	0.32%	0.04%

Region III

West Orange County

	Main Replacement Miles				
Year	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	0.45	0.36	0.06	0.14%	0.02%
2014	0.00	0.00	0.42	0.00%	0.16%
2015	0.00	0.00	0.00	0.00%	0.00%
2016	0.00	0.00	0.13	0.00%	0.05%
2017	0.81	0.58	0.34	0.22%	0.13%
2018	0.00	0.00	1.17	0.00%	0.45%
2019	0.72	0.72	0.21	0.28%	0.08%
2020	2.42	2.42	1.47	0.93%	0.56%
2021	0.00	0.00	0.40	0.00%	0.15%
2022	0.94	0.94	1.94	0.36%	0.75%

Cowan Heights

	Main Replacement Miles				
Year	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	0.23	0.23	0.22	0.47%	0.45%
2014	0.00	0.00	0.00	0.00%	0.00%
2015	0.00	0.00	0.00	0.00%	0.00%
2016	0.00	0.00	0.00	0.00%	0.00%
2017	0.29	0.29	0.32	0.59%	0.65%
2018	0.00	0.00	0.68	0.00%	1.38%
2019	0.38	0.38	0.00	0.77%	0.00%
2020	0.38	0.38	0.00	0.77%	0.00%
2021	0.00	0.00	0.00	0.00%	0.00%
2022	0.42	0.42	0.00	0.85%	0.00%

Placentia-Yorba Linda

	Main Replacement Miles				
Year	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	0.00	0.00	0.00	0.00%	0.00%
2014	0.00	0.00	0.00	0.00%	0.00%
2015	0.00	0.00	0.00	0.00%	0.00%
2016	0.19	0.19	0.33	0.14%	0.25%
2017	0.00	0.00	0.23	0.00%	0.17%
2018	0.00	0.00	0.00	0.00%	0.00%
2019	0.75	0.75	0.00	0.57%	0.00%
2020	0.00	0.00	0.00	0.00%	0.00%
2021	0.09	0.09	0.00	0.07%	0.00%
2022	0.00	0.00	0.00	0.00%	0.00%

Claremont

	Main Replacement Miles				
Year	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	1.52	1.06	1.16	0.67%	0.74%
2014	0.72	0.00	0.35	0.00%	0.22%
2015	2.71	2.62	1.36	1.67%	0.87%
2016	0.00	0.00	0.79	0.00%	0.50%
2017	0.19	0.19	0.16	0.12%	0.10%
2018	0.08	0.08	1.80	0.05%	1.15%
2019	1.21	1.21	1.84	0.77%	1.17%
2020	3.56	3.56	3.09	2.26%	1.97%
2021	0.00	0.00	0.42	0.00%	0.27%
2022	3.54	3.54	1.23	2.25%	0.78%

San Dimas

Main Replacement Miles

Year	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	1.17	0.27	0.58	0.14%	0.30%
2014	0.49	0.49	0.44	0.25%	0.23%
2015	0.15	0.13	0.38	0.07%	0.20%
2016	0.00	0.00	2.56	0.00%	1.32%
2017	0.68	0.68	1.69	0.35%	0.87%
2018	0.00	0.00	0.29	0.00%	0.15%
2019	1.93	1.93	2.29	0.99%	1.18%
2020	1.02	1.02	1.43	0.52%	0.74%
2021	0.00	0.00	0.32	0.00%	0.16%
2022	0.00	0.00	0.00	0.00%	0.00%

South Arcadia

Main Replacement Miles

Year	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	2.42	1.46	1.29	2.28%	2.02%
2014	2.96	1.44	3.54	2.25%	5.54%
2015	0.36	0.36	0.00	0.56%	0.00%
2016	2.23	2.23	4.95	3.48%	7.75%
2017	0.51	0.51	2.73	0.80%	4.27%
2018	3.35	3.35	3.93	5.25%	6.15%
2019	0.81	0.81	2.73	1.27%	4.27%
2020	3.45	3.45	1.63	5.40%	2.55%
2021	0.00	0.00	1.43	0.00%	2.24%
2022	0.64	0.64	0.00	1.00%	0.00%

South San Gabriel

Main Replacement Miles

Year	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	0.59	0.27	0.63	0.72%	1.71%
2014	0.44	0.32	0.33	0.87%	0.90%
2015	0.00	0.00	0.00	0.00%	0.00%
2016	0.00	0.00	0.00	0.00%	0.00%
2017	0.17	0.17	0.17	0.46%	0.46%
2018	0.87	0.45	0.74	1.24%	2.01%
2019	0.51	0.29	0.93	0.80%	2.53%
2020	0.23	0.23	0.14	0.63%	0.38%
2021	0.00	0.00	0.60	0.00%	1.63%
2022	0.00	0.00	1.44	0.00%	3.91%

Barstow

Main Replacement Miles

Year	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	0.83	0.83	0.37	0.46%	0.20%
2014	1.73	0.45	3.67	0.25%	2.01%
2015	0.00	0.00	0.24	0.00%	0.13%
2016	0.09	0.00	3.00	0.00%	1.64%
2017	0.67	0.09	5.62	0.05%	3.07%
2018	0.00	0.67	0.65	0.37%	0.36%
2019	0.00	0.00	0.00	0.00%	0.00%
2020	3.49	3.49	1.11	1.91%	0.61%
2021	0.00	0.00	0.00	0.00%	0.00%
2022	0.13	0.13	0.00	0.07%	0.00%

Calipatria-Niland

	Main Replacement Miles				
Year	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	0.00	0.00	0.00	0.00%	0.00%
2014	0.00	0.00	0.00	0.00%	0.00%
2015	0.00	0.00	0.00	0.00%	0.00%
2016	0.00	0.00	0.00	0.00%	0.00%
2017	0.00	0.00	0.00	0.00%	0.00%
2018	0.00	0.00	0.00	0.00%	0.00%
2019	0.15	0.15	0.00	0.37%	0.00%
2020	0.00	0.00	0.22	0.00%	0.54%
2021	0.14	0.14	0.00	0.35%	0.00%
2022	0.68	0.68	0.16	1.68%	0.40%

Morongo Del Norte

	Main Replacement Miles				
Year	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	0.00	0.00	0.00	0.00%	0.00%
2014	0.00	0.00	0.00	0.00%	0.00%
2015	0.00	0.00	0.00	0.00%	0.00%
2016	0.00	0.00	0.00	0.00%	0.00%
2017	0.00	0.00	0.00	0.00%	0.00%
2018	0.00	0.00	0.00	0.00%	0.00%
2019	0.19	0.19	0.00	4.42%	0.00%
2020	0.00	0.00	0.00	0.00%	0.00%
2021	0.13	0.13	0.00	3.02%	0.00%
2022	0.00	0.00	0.00	0.00%	0.00%

Morongo Del Sur

	Main Replacement Miles				
Year	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	0.00	0.00	0.48	0.00%	2.15%
2014	0.27	0.21	0.00	0.94%	0.00%
2015	0.00	0.00	0.00	0.00%	0.00%
2016	0.00	0.00	0.16	0.00%	0.72%
2017	0.00	0.00	0.00	0.00%	0.00%
2018	0.00	0.00	0.25	0.00%	1.12%
2019	0.76	0.76	0.00	3.41%	0.00%
2020	0.00	0.00	0.27	0.00%	1.21%
2021	0.08	0.08	0.00	0.36%	0.00%
2022	0.12	0.12	0.13	0.54%	0.58%

Apple Valley South

	Main Replacement Miles				
Year	Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	0.85	0.98	1.65	2.47%	4.14%
2014	0.09	0.09	0.32	0.24%	0.80%
2015	0.36	0.36	0.00	0.90%	0.00%
2016	0.00	0.00	4.37	0.00%	10.95%
2017	0.00	0.00	0.00	0.00%	0.00%
2018	0.00	0.00	1.63	0.00%	4.09%
2019	1.57	1.57	1.49	3.93%	3.73%
2020	1.33	1.33	0.00	3.33%	0.00%
2021	0.08	0.08	0.00	0.20%	0.00%
2022	0.97	0.97	2.97	2.43%	7.44%

Desert View

Year	Main Replacement Miles Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	0.00	0.00	0.00	0.00%	0.00%
2014	0.00	0.00	0.00	0.00%	0.00%
2015	0.00	0.00	0.00	0.00%	0.00%
2016	0.00	0.00	0.80	0.00%	25.00%
2017	1.14	1.14	0.00	35.63%	0.00%
2018	0.00	0.00	0.00	0.00%	0.00%
2019	0.00	0.00	0.00	0.00%	0.00%
2020	0.00	0.00	0.00	0.00%	0.00%
2021	0.51	0.51	0.51	15.94%	15.94%
2022	0.00	0.00	0.00	0.00%	0.00%

Apple Valley North

Year	Main Replacement Miles Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	0.00	0.00	0.16	0.00%	0.80%
2014	0.17	0.17	0.00	0.85%	0.00%
2015	0.63	0.63	1.13	3.13%	5.65%
2016	0.00	0.00	3.46	0.00%	17.30%
2017	0.00	0.00	0.00	0.00%	0.00%
2018	0.00	0.00	0.00	0.00%	0.00%
2019	0.93	0.93	0.91	4.65%	4.55%
2020	0.00	0.00	0.00	0.00%	0.00%
2021	1.14	1.14	0.00	5.70%	0.00%
2022	0.00	0.00	1.13	0.00%	5.65%

Lucerne Valley

Year	Main Replacement Miles Proposed	Adopted	Recorded	Approved Pipeline Replacement Rate (%)	Recorded Pipeline Replacement Rate (%)
2013	0.00	0.00	0.28	0.00%	2.19%
2014	0.00	0.00	0.00	0.00%	0.00%
2015	0.00	0.00	0.00	0.00%	0.00%
2016	0.00	0.00	1.02	0.00%	7.97%
2017	0.00	0.00	0.00	0.00%	0.00%
2018	0.00	0.00	0.00	0.00%	0.00%
2019	0.00	0.00	0.77	0.00%	6.02%
2020	0.74	0.74	1.45	5.78%	11.33%
2021	0.51	0.51	0.00	3.98%	0.00%
2022	0.00	0.00	0.55	0.00%	4.30%

Wrightwood

	Main Replacement Miles Proposed	Adopted	Recorded		
2013	0.97	0.97	1.59	2.41%	3.95%
2014	0.42	0.00	2.04	0.00%	5.06%
2015	1.07	1.05	0.00	2.61%	0.00%
2016	0.00	0.00	1.74	0.00%	4.32%
2017	1.31	1.40	0.00	3.47%	0.00%
2018	0.00	0.00	7.51	0.00%	18.64%
2019	0.00	0.00	0.00	0.00%	0.00%
2020	0.00	0.00	0.00	0.00%	0.00%
2021	0.00	0.00	1.08	0.00%	2.68%
2022	0.00	0.00	0.10	0.00%	0.25%

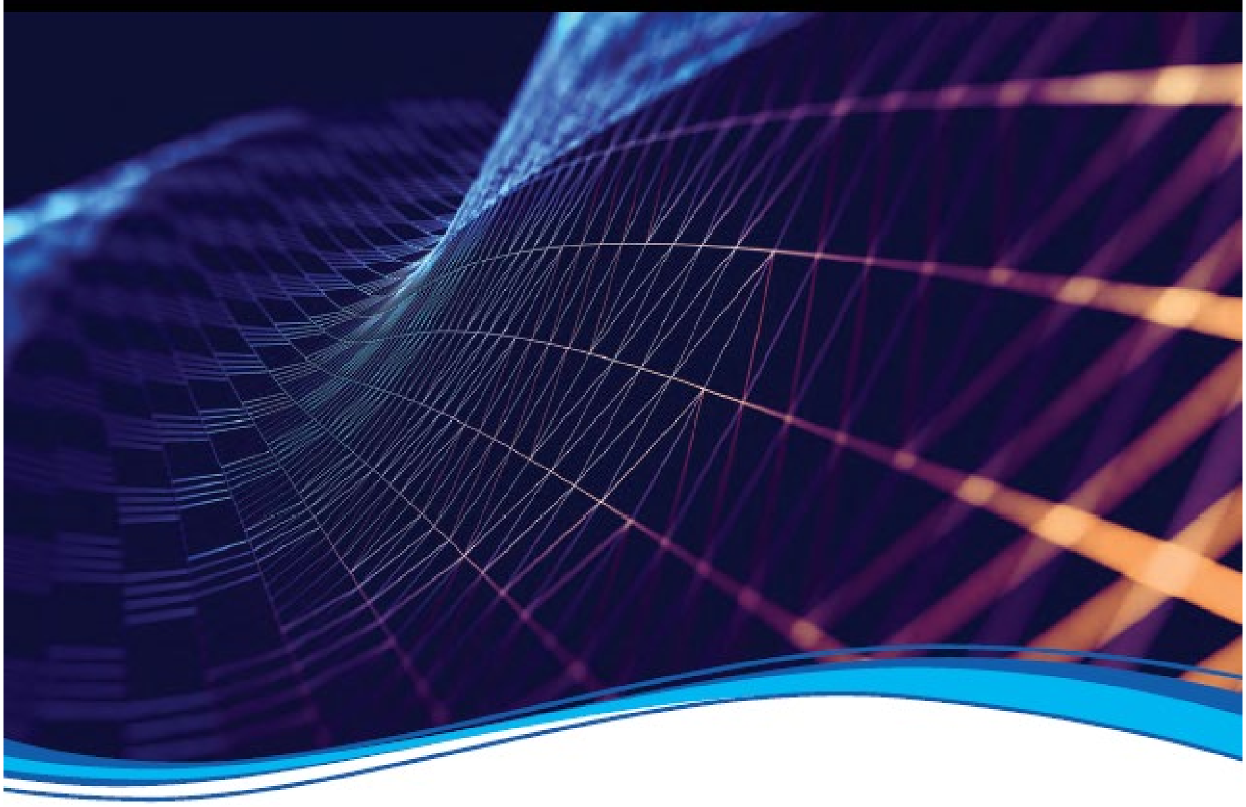
ATTACHMENT 1-9: AMERICAN WATER WORKS ASSOCIATION MANUAL M77-CONDITION ASSESSMENT OF WATER MAINS (EXCERPTS)[122]

[122] For presentation purposes, only the first page of Chapters 8,10, and 11 are included from AWWA M77. Page 2 of AWWA M77 is also included.

Manual of Water Supply Practices

M77

Condition Assessment of Water Mains



American Water Works Association

DEFINITION OF CONDITION ASSESSMENT

The emphasis of this manual is on methods of pipeline condition assessment to identify physical condition. Condition assessment may be defined as the identification of the likelihood that an asset will continue to perform its required function. As part of condition assessment, data and information are collected through direct and/or indirect methods and then analyzed to determine the physical characteristics of the pipe and how they may impact the pipeline's likelihood that it will leak, break, or otherwise fail to perform. Example characteristics include current or future structural, water quality, and hydraulic status of an individual pipe, segment, or collection of similar pipes, among other characteristics.

Condition assessment may be performed in the field, via desktop, or both. The important objective is to do it, update it, and improve upon it as needed. Field condition assessment involves direct and indirect observations of the asset and its environment to determine and document its condition. Desktop condition assessment relies more heavily on existing data and institutional knowledge to make the same determination using design documents, staff knowledge, information systems, industry experience, and other resources to determine or approximate the condition of the pipelines without viewing them physically. Beyond these efforts, condition assessments may use more advanced study and testing to more fully identify pipeline condition.

Some examples of how a condition assessment is used include

- to identify loss of integrity, and that water is leaking—water loss may be observed or detected indirectly through acoustic methods;
- to identify loss of structural competence or weakening of the pipe or that the wall thickness is diminished—wall loss may be established through a variety of methods;
- to find evidence of liner or coating failure—may be visually observed; and
- to recognize other conditions of concern, e.g., pipe is unacceptably out of round.

Condition Assessment and Monitoring as Part of a Risk-based Asset-Management Strategy for Pipes

A fundamental activity for any water utility is to determine the risks associated with asset failure. Understanding the risk of asset failure and determining an acceptable level of risk for the utility allows the balancing of conflicting goals of minimizing lifecycle costs of assets versus delivering the stipulated levels of service (LoS). Risk analysis is used to understand the cause, effect (consequence), and likelihood of events adverse to attainment of LoS; managing such risks to an acceptable level; and providing an audit trail for the management of risks.

Mathematically, risk from a failure can be expressed as the product of the consequence of the failure (CoF) and the likelihood of the failure (LoF):

$$\text{Risk} = \text{CoF} \times \text{LoF}$$

Risk analysis is used to rank assets by their risk of failure and to identify high-risk assets (i.e., assets with a risk of failure above an acceptable level of risk). In assessing risk, CoF and LoF are quantified separately, and the results can be multiplied to calculate the risk-of-failure score of a specific asset.

An asset is considered to be failing if it cannot, or does not, provide the requisite LoS. For water mains, this failure is measured by physical condition, hydraulic performance, and quality of water. Thus, when determining the LoF of a pipeline, these three factors should be assessed, with the physical condition being the most prominent one.

Chapter 8

Internal Remote Visual Inspection

Andi Corrao, Chapter Lead, infrastructureMD, Inc.
Derek Wurst, Black & Veatch Corporation
Noy Phannavong, V&A Consulting Engineers, Inc.
Kris Embry, Hibbard Inshore

Visual inspection of the inside of a water main is helpful in determining the presence or absence of lining and its general condition. Visual inspection may also detect corrosion, cracks, ovality, or other deformities that indicate pipe damage or distress. These methods are also used in determining the location and characteristics of service taps, valves, and other appurtenances.

This chapter introduces various remotely operated technologies, including digital televising, sonar imaging, and laser scanning of both small-diameter and large-diameter pipes. These technologies are deployed on various platforms, enabling inspections in both wet and dry pipes, inside operating mains, or in mains that are temporarily shut down. Direct observation through physical entry (into larger water mains) is covered in Chapter 9.

With the many options available for internal remote visual inspection, the utility professional may wish to consider a phased strategy where less costly basic methods are employed first, and more expensive and advanced methods are employed when additional qualitative and/or quantitative data are required for a more complete and accurate pipe assessment.

Chapter 10

Acoustic Velocity Testing

Frank Blaha, Chapter Lead, Water Research Foundation
Kevin Laven and Dave Johnston, Echologics, Division of Mueller
Allison Stroebele, Pure Technologies

Acoustic velocity testing for pipeline condition assessment provides information on the average pipe wall thickness loss over the measured length of the pipe. The actual pipe could be generally degraded over its entire length, or the pipe could have significant degradation at only one or two locations. The technique is often viewed as a screening technique to allow a utility to find pipes in generally poor condition. The technology is nonintrusive, noninvasive, and nondestructive in nature and can be used when the main is fully operational with all connecting valves open and all services active.

The resulting data can be used to inform

- asset management programs,
- rehabilitation and replacement decisions,
- before-and-after construction monitoring,
- evaluation of the pipe's structural adequacy,
- estimation of the pipe's useful remaining service life,
- estimation of the pipe's current and future failure rates,
- selection of mains for additional inspection and analysis, and
- asset valuation.

Chapter 11

Electromagnetic Testing Technologies

Ricardo R. Hernandez, Chapter Lead, Metropolitan Water District of Southern California
Dave Spencer, HDR
Chris Garett, PICA
Joanna Line, City of Calgary
Allison Stroebele, Pure Technologies
Martin Roubal, Rock Solid Group
Rod Jackson, CH2M Hill (now Jacobs)

Electromagnetic (EM) technology has a long history in pipeline assessment dating back several decades. EM technology can broadly be categorized as time domain electromagnetics and frequency domain electromagnetics. Both variations of EM technology are used for pipeline assessment today and are offered as broadband electromagnetics (BEM), a derivative of pulsed eddy current (PEC) and remote field testing (RFT), also referred to as remote-field eddy current (RFEC) or remote field electromagnetic technique.

EM technology can be used to assess the condition of the pipe wall by measuring the relative pipe wall thickness and identifying areas of wall loss and corrosion. The data provided by EM technology can be used to estimate remaining useful life and help inform capital planning decisions to monitor, repair, or replace existing pipelines.

Several commercially available tools have successfully used EM technology; however, there are certain limitations that should be considered before implementation.

The applicability of EM technology to water mains can be summarized as follows.

- Types of applicable materials
  - cast-iron pipe (CIP)

ATTACHMENT 2-1: GSWC'S RESPONSE TO PUBLIC ADVOCATES OFFICE DG-09 (EXCERPT)[123]

[123] GSWC's response to Public Advocates Office data request DG-09 includes an Excel file with 6,034 pipelines. For presentation purposes, the first ten rows of pipelines are shown in this attachment.

Golden State Water Company
A Subsidiary of American States Water Company

September 27, 2023

To: Daphne Goldberg, Public Advocates Office
CALIFORNIA PUBLIC UTILITIES COMMISSION
505 Van Ness Avenue
San Francisco, CA 94102

Subject: Data Request DG-08 (A.23-08-010)
(Abandoned Pipeline Projects)
Due Date: September 27, 2023

Dear Daphne Goldberg,

In response to the above referenced data request number, we are pleased to submit the following responses:

Question 1:
For each abandoned pipeline GSWC included in response to DR DG-06, Q.1.d., provide the following data in the attached spreadsheet's designated column in DR DG-09, Q.1.:

a. Customer Service Area Name
b. Pipeline Length Retired (feet)
c. Pipeline Material
d. Pipeline Diameter
e. Original Anticipated Retirement Date
f. The original recorded amount added into rate base for the asset
g. Reason for Abandonment
h. Salvage value (if not included in depreciation rate calculation)

Response 1:

a. See DG-09 Q1 AbandonedLine_GISdata_2017-2023 spreadsheet.
b. See DG-09 Q1 AbandonedLine_GISdata_2017-2023 spreadsheet.
c. See DG-09 Q1 AbandonedLine_GISdata_2017-2023 spreadsheet.
d. See DG-09 Q1 AbandonedLine_GISdata_2017-2023 spreadsheet.

	Abandoned Pipeline Name	Customer Service Area	Customer Service Area Name	Year Pipeline Placed Into Service	Pipeline Length Retired (Feet)	Pipeline Material	Pipeline Diameter	The original recorded amount added into rate base for the asset	Pipeline Age	Original Anticipated Retirement Date	Date Moved to 'Abandoned Line' Feature Class in GIS	Reason For Abandonement	Salvage Value ($)
OBJECTID	GlobalID	SYSTEM		GWO							ABANDATE		
6986	{D1C2D009-5F2B-430A-A70E-32E3D84BC72D}	326	San Dimas	1987	604	PVC	8		32		2019-04-03	new pipeline installed	
6974	{AE3F1F31-CD40-4F39-AC76-829C2B2CBD48}	326	San Dimas	1985	526	PVC	8		34		2019-04-03	new pipeline installed	
3246	{0C7E93E8-6BB2-4EA0-A3D7-6485B98CAB8E}	250	Southwest	1951	508	CI	8		67		2018-04-18	new pipeline installed	
22738	{DC1F624B-4C0B-47FE-BE36-BA3574160067}	317	Claremont		494	CI	10				2021-01-14	new pipeline installed	
101605	{46B8EB70-2C8F-4CE2-9561-5200CB3ADD44}	352	Calipatria	1980	487	AC	4		42		2022-12-05	new pipeline installed	
99191	{FBAB31E2-D886-40CA-B8AF-19C2F6515F60}	158	Santa Maria	1960	485	PVC	8		62		2022-11-16	new pipeline installed	
6529	{3FA9E4F0-59A6-4A4C-9D4E-062790D3193F}	317	Claremont		474	PVC	10				2018-08-24	new pipeline installed	
3534	{5C370B1D-DDF0-4256-8732-72D8BB86F80B}	250	Southwest	1947	470	CI	6		71		2018-09-11	new pipeline installed	
103592	{26B17A70-BA91-4C22-A710-63F1ACEFD970}	118	Arden-Cordova		464	AC	4				2022-12-07	new pipeline installed	
51147	{DBF835CC-1D6C-44BA-8399-927F624AE963}	365	Apple Valley		445	STL	3				2021-06-17	new pipeline installed	

e. GSWC's accounting practice for Account 343 Transmission & Distribution Mains considers a service life of 80 years for ratemaking and regulatory purposes. For long-term Engineering Planning purposes, as described in Section 3.3.2.3 of GSWC's Pipeline Management Program (A.23-08-010, Attachment H, p.3-14) GSWC "estimates the life span in years that 100, 50, and 10 percent of the pipelines in a given category are expected to reach without rehabilitation or replacement but assumes that some spot repairs may be necessary. The 100 percent life expectancy represents the number of years the entire length of pipeline in a particular category would be expected to last without the need for replacement. The 50 percent life expectancy represents the number of years one-half of the length of pipeline in a particular category would be expected to last without the need for replacement. Similarly, the 10 percent life expectancy represents the number of years 10 percent of the length of pipeline in a particular category would be expected to last without the need for replacement… TABLE 3.2 provides a list of life expectancies that GSWC used in the analysis." As such, the anticipated retirement dates vary by material and life expectancy from the date of installation.
f. The original recorded amount added into rate base for the asset would correspond to the closed amount when a project is closed; however, this cannot be provided for individual pipeline segments, as assets are calculated based on a group.

ATTACHMENT 2-2: GSWC'S RESPONSE TO PUBLIC ADVOCATES OFFICE DG-11 (EXCERPT)[124]

[124] GSWC's response to Public Advocates Office data request DG-11 includes an Excel file with 6,034 pipelines. For presentation purposes, a sample of rows are shown in this attachment.

Golden State
Water Company
A Subsidiary of American States Water Company

February 12, 2024

To: Daphne Goldberg, Public Advocates Office
CALIFORNIA PUBLIC UTILITIES COMMISSION
505 Van Ness Avenue
San Francisco, CA 94102

Subject: Data Request DG-11 (A.23-08-010)
(Abandoned Pipeline Follow Up REVISED) – Partial Response 1
Due Date: February 12, 2024

Dear Daphne Goldberg,

In response to the above referenced data request number, we are pleased to submit the following responses:

Question 1:
In response to Cal Advocates' DR DG-09, GSWC provided the attached list of abandoned pipelines. For each highlighted abandoned pipeline included, provide the following in the attached Excel file:

a. State if GSWC previously presented the pipeline to the Commission either as an individual pipeline replacement project request, or as part of another capital project request.
b. Provide the Commission decision number and page number for each Commission authorized pipeline project provided in response to Q.1.a..
c. For each Commission authorized pipeline replacement project provided in response to Q.1.a., state GSWC's decision criteria applied for the pipeline replacement.
d. For each Commission authorized pipeline replacement project provided in response to Q.1.a., state the reason for the pipeline replacement. Note: in response to DG-09, GSWC responded to a similar question 1.g. "Reason for Abandonement" for which GSWC responded "new pipeline installed" for each abandoned pipeline. In response to DG-11, 1.d., provide additional information as to why each old pipeline was replaced, such as poor condition, part of a relocation project, etc.

e. For each pipeline listed that was NOT previously presented to the Commission, provide GSWC's retirement policy applied to the pipeline.

Response 1:
Please see Excel file "DG-11 Attachment 1_REVISED_Partial Response 1" with responses to 71 of 678. Remaining responses will be sent as soon as they are available.

END OF RESPONSE

	GSWC's Response to DR DG-09													GSWC Response to DR DG-11								
	Abandoned Pipeline Name	Customer Service Area	Customer Service Area Name	Year Pipeline Placed into Service	Pipeline Length Retired (Feet)	Pipeline Material	Pipeline Diameter	The original recorded amount added into rate base for the asset	Pipeline Age	Original Anticipated Retirement Date	Date Moved to 'Abandoned Line' Feature Class in GIS	Reason For Abandonement	Salvage Value ($)	previously present pipeline to the Commission either as an individual pipeline replacement project request or as part of another capital project request (Yes or No)	If Column 'O' response is 'Yes', provide Commission Decision number and page number	For each Commission authorized pipeline in Column 'O' state GSWC's decision criteria applied for the pipeline replacement	For each Commission authorized pipeline in Column 'O', state the reason for the pipeline replacement	For each pipeline listed that was NOT previously presented to the Commission, provide GSWC's retirement policy applied to the pipeline	Additional comments	Cal PA Request 2/5	Response 2/12	Pending
68781	{3DD7C85F-1BAA-4E97-83D2-83FCF010848F}	364	Apple Valley	2002	173	PVC	8		19		2021-11-12	new pipeline installed		Yes	D.23-06-024 Appendix A pg. 30	see PMP	leaks			x	x	
41169	{A54A4632-42DA-4C5F-8385-6CBD0093F92D}	372	Wrightwood	2008	131	STL	2		13		2021-04-12	new pipeline installed								x		x
6086	{36E5AFED-56F0-44BA-B917-A79C4525F3B}	366	Apple Valley	1959	110	STL	4		59		2018-12-31	new pipeline installed										
82050	{6241A6F3-3A56-45BC-9F73-A6811AA0F3D1}	347	Barstow	2004	110	PVC	8		18		2022-01-28	new pipeline installed		N/A	Inadvertently included as abandoned			GIS Map projection adjustment only - no abandonment; original alignment incorrectly moved into wAbandonedLine feature class		x	x	
116777	{3E51A658-06C8-45D5-89DB-862D7C81C0F5}	347	Barstow	1956	100	CI	6		67		2023-06-20	new pipeline installed										
82040	{1227803F-829B-4741-BD86-372342DE2804}	347	Barstow	2004	100	PVC	8		18		2022-01-28	new pipeline installed		N/A	Inadvertently included as abandoned			GIS Map projection adjustment only - no abandonment; original alignment incorrectly moved into wAbandonedLine feature class		x	x	
6393	{29B25885-4FA8-4D83-BA70-9C97DF0C8277}	347	Barstow	1956	98	CI	4		62		2018-02-21	new pipeline installed										
82016	{B62E1145-0DC7-408E-A448-52B3DC0CD276}	347	Barstow	2004	98	PVC	8		18		2022-01-28	new pipeline installed		N/A	Inadvertently included as abandoned			GIS Map projection adjustment only - no abandonment; original alignment incorrectly moved into wAbandonedLine feature class		x	x	
82122	{D03BBCA8-3E7F-45EC-AC32-A51350C9430F}	347	Barstow	2004	95	PVC	8		18		2022-01-28	new pipeline installed		N/A	Inadvertently included as abandoned			GIS Map projection adjustment only - no abandonment; original alignment incorrectly moved into wAbandonedLine feature class		x	x	
82124	{F87A14B1-B8BF-4	347	Barstow	2013	91	PVC	8		9		2022-01-28	new pipeline installed		N/A	Inadvertently included as abandoned			GIS Map projection adjustment only - no abandonment; original alignment incorrectly moved into wAbandonedLine feature class		x	x	
82126	{40D75CF7-0654-4	347	Barstow	2004	91	PVC	8		18		2022-01-28	new pipeline installed		N/A	Inadvertently included as abandoned			GIS Map projection adjustment only - no abandonment; original alignment incorrectly moved into wAbandonedLine feature class		x	x	
82015	{F1B1EFFC-7824-4	347	Barstow	2004	88	PVC	8		18		2022-01-28	new pipeline installed		N/A	Inadvertently included as			GIS Map projection adjustment only - no aban		x	x	
82164	{07C7D7DB-E766-4	347	Barstow	2014	84	PVC	8		8		2022-01-28	new pipeline installed		N/A	Inadvertently			GIS Map projection adjustment only - no aban		x	x	
82035	{A326E01A-3A16-4	347	Barstow	2004	79	PVC	8		18		2022-01-28	new pipeline installed		N/A	Inadvertently			GIS Map projection adjustment only - no aban		x	x	
22726	{D0568B56-1E26-4	317	Claremont	2020	78	PVC	8		1		2021-01-14	new pipeline installed		N/A	Inadvertently included as abandoned			GIS Map projection adjustment only - no aban		x	x	
3674	{139A5663-E58D-4	250	Southwest	2013	78	DI	4		6		2019-02-26	new pipeline installed		N/A	Inadvertently included as abandoned			GIS Map projection adjustment only - no aban		x	x	
974	{0B1B3F53-632D-4	219	Central Basin E	2004	61	DI	8		14		2018-03-06	new pipeline installed		N/A	Inadvertently included as abandoned			GIS Map projection adjustment only - no aban		x	x	
82167	{E7EC0238-FC1E-4	347	Barstow	2014	58	PVC	8		8		2022-01-28	new pipeline installed		N/A	Inadvertently included as abandoned			GIS Map projection adjustment only - no aban		x	x	
82033	{E46B478F-809A-4	347	Barstow	2004	56	PVC	8		18		2022-01-28	new pipeline installed		N/A	Inadvertently included as abandoned			GIS Map projection adjustment only - no aban		x	x	
22729	{6E7760E3-254C-4	317	Claremont	2020	55	PVC	8		1		2021-01-14	new pipeline installed		N/A	Inadvertently included as abandoned			GIS Map projection adjustment only - no aban		x	x	
82034	{4482892B-30E8-4	347	Barstow	2004	54	PVC	8		18		2022-01-28	new pipeline installed		N/A	Inadvertently included as abandoned			GIS Map projection adjustment only - no aban		x	x	
82125	{C0634C5E-7DD3-4	347	Barstow	2013	51	PVC	8		9		2022-01-28	new pipeline installed		N/A	Inadvertently included as abandoned			GIS Map projection adjustment only - no aban		x	x	