Lessons Learned from Utilization of Stakeholders in Piloted Water Loss Programs with the City of Sacramento

By:

Jessica Parrish

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Abstract

Water loss control for water distribution piping infrastructure is an important issue that all municipalities must address. With climate change affecting water resources in California, innovative programs for water loss control have been an important next step in mitigation to reduce water and energy use. In 2013 the City of Sacramento, Department of Utilities (DOU) adopted a "5-year Strategic Plan calling for intensifying the City's system-wide leak detection program and reducing water losses to help achieve water use reduction goals mandated by the 2009 Water Conservation Act" (City of Sacramento, 2015). With this strategic goal in mind DOU approached City Council and received approval to apply for a California Department of Water Resources (DWR) Water and Energy Grant. In 2015 the $2.5 Million DWR Grant was awarded to DOU which was utilized to fund the creation of two programs: the District Metered Area (DMA) and the Leak Free Sacramento (LFS) Programs. The DMA program is a pilot intended to set up hydrologically discrete zones in Disadvantaged Area Communities (DACs) for analysis of water flow data in the City's water distribution system while the LFS program was a free plumbing program for single family homeowners located in DACs. This report will document the "Lessons Learned" from each program and how stakeholder engagement plays a part in program creation, development and implementation. Part of this process included the development of a survey distributed to stakeholders and a compilation of the feedback regarding the implementation of the programs. From the study, communication was determined to be the most important aspect of a successful program.

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Introduction

The City of Sacramento is the State Capital of California, has a Mediterranean climate and is located at the confluence of two rivers the American and the Sacramento Rivers. With a total of almost 500,000 constituents living within the City limits, the City of Sacramento, Department of Utilities (DOU) continues to assess ways to reduce its water use to meet state standards and to continue being good stewards of natural resources. Water loss control and management is a long-term concern in municipality water distribution system infrastructure. Complete elimination of water loss is not economically feasible for utilities, however significant reduction can be achieved with targeted programs to residential, commercial customers and the water utility for overall reduction of water and energy loss. The State of California Department of Water Resources (DWR) provided the opportunity for DOU to create two water loss programs via a Water and Energy Grant that addressed water and energy loss or leaks within the infrastructure on both the City and customer side. The first, larger budgeted program was the creation of District Metered Areas or DMAs aimed to assist the City with its water loss with a budget of approximately $2 Million (City of Sacramento, 2018). The DMAs are defined as "hydrologically discrete zones consisting of known points of inflows and outflows" (WSO and WSP, 2018). In this Pilot Program, the DMAs were monitored remotely for review of water losses for DOU leak detection crews to be deployed if water losses pass a cost-efficient threshold. Repairs were done by the City and were reimbursed by the grant for repairs to about $2 Million (City of Sacramento, 2018). Five DMAs were created: Bell Avenue, Brookfield Drive (BR), Lower Pocket (LP) and Norwood Marysville Robla North and South (NMRN & NMRS) (WSO and WSP, 2018). An additional part of the DWR grant was funding for DOU staff to repair leaks in its infrastructure in Disadvantaged Area Communities (DACs).

The second program aimed to assist DOU customers with their water loss. The Leak Free Sacramento (LFS) Program was a free plumbing program for single family homeowners located in DACs with a budget of $500,000 from the DWR Grant. Its creation was based on an ongoing program in San Antonio, Texas named "Plumbers to People." With stakeholder input, LFS was created to serve the Sacramento residential community. Understanding the processes behind

both pilot programs and the lessons learned from each is important because it will assist the City and other municipalities in future pilot projects.

Evaluation

The intention of a pilot program is to do a small-scale test of a project, in this case two pilots were realized with the DWR support. Pilot studies are vital to government agencies to cost-efficiently determine the feasibility of new, innovative, scientifically based strategies for management of resources. Understanding different types of pilot study planning and the successes along with lessons learned from different approaches is necessary to create effective policies. Both the DMA and LFS programs were impactful in different ways and their approaches were respective to the type of pilot programs they were.

Since inception, the DMA program process was made public, whereas the LFS program was not until all strategic processes were formed and planned out. This may be a key difference that affected the outcome of stakeholder involvement, and the development and acceptance of the programs. The DMA program was a larger construction pilot program and needed stakeholder engagement early on, thus it was made public at inception. The LFS was a smaller scale pilot that did not require as much stakeholder engagement in the early stages but needed vast oversight and support to keep the program running efficiently. Both approaches are valid but should be considered with an understanding of the benefits, and drawbacks each approach can have on a pilot study. It is important to note that stakeholders are a valuable resource for creating effective programs when they are selected with care, as having input from a multitude of perspectives is essential to creating effective programs. However, if a stakeholder panel is not selected with care it can derail projects and sabotage cooperation among parties, and the goal of creating an effective project that assists the community may not be realized. The same can be said for program managers. For a pilot project to have the greatest impact and the opportunity to be implemented, having stakeholders with very different perspectives that are heard with respect is vital for the contribution of useful knowledge. Without this type of open

representation in a group of stakeholders, projects cannot be successful. It is a program manager's duty to understand and manage their stakeholders and utilize their stakeholder input as a tool for successful implementation. For a program manager to successfully work with and manage a stakeholder group, clear communication and understanding of the stakeholders and the program manager's role in the program is essential.

The public sector would benefit greatly from the application of stakeholder theory, which has a longstanding tradition of being applied to the private sector almost exclusively. Stakeholder theory is the concept that individuals that devote their time and money into a business have a duty to actively participate in managing their investment. By having a stake in the company, the outcome of any business venture that a company may partake in will directly affect them economically (Scholl, 2001). This active participation can be enacted by doing so themselves or hiring someone to do so, which is an action of them exerting their "natural right to own their private property" (Scholl, 2001). It is important to note that despite having stakeholders actively participate in the running of a company within this theory that most company executives hold the most power in company decisions (Scholl, 2001). Which is sensible as they have the most stake in company decisions. Applying this concept to the public sector could increase accountability and could be improved with the inclusion of public input as they are a stakeholder in their government. It could also create buy in from stakeholders within the government organization. Part of this process includes the selection of credible, insightful stakeholders that have a great deal of experience in their fields which is essential to have for successful programs.

A good representation of this type of strategic approach to selecting stakeholders is from the report for *Strategies for Assessing and Managing Organizational Stakeholders*. The authors of this report review the strategies of what managers should utilize when selecting stakeholders that can contribute vital knowledge to a study. "By assessing each stakeholder's potential to threaten or to cooperate with the organization, managers' may identify supportive, mixed blessing, nonsupportive, and marginal stakeholders" (Whitehead and Blair, 1991). By

understanding what each stakeholder can contribute or take away from a project, managers can make more informed choices about who would be an asset to a stakeholder panel for their program. It also can assist managers in understanding how to create bridges and better relationships with potential stakeholders that may not initially fall within a supportive category. Figure 1 below is a visual example of understanding stakeholder's potential helpfulness on a project. Even supportive type stakeholders should be actively included because sometimes they are not, and they can be the greatest asset to a team (Whitehead and Blair, 1991).

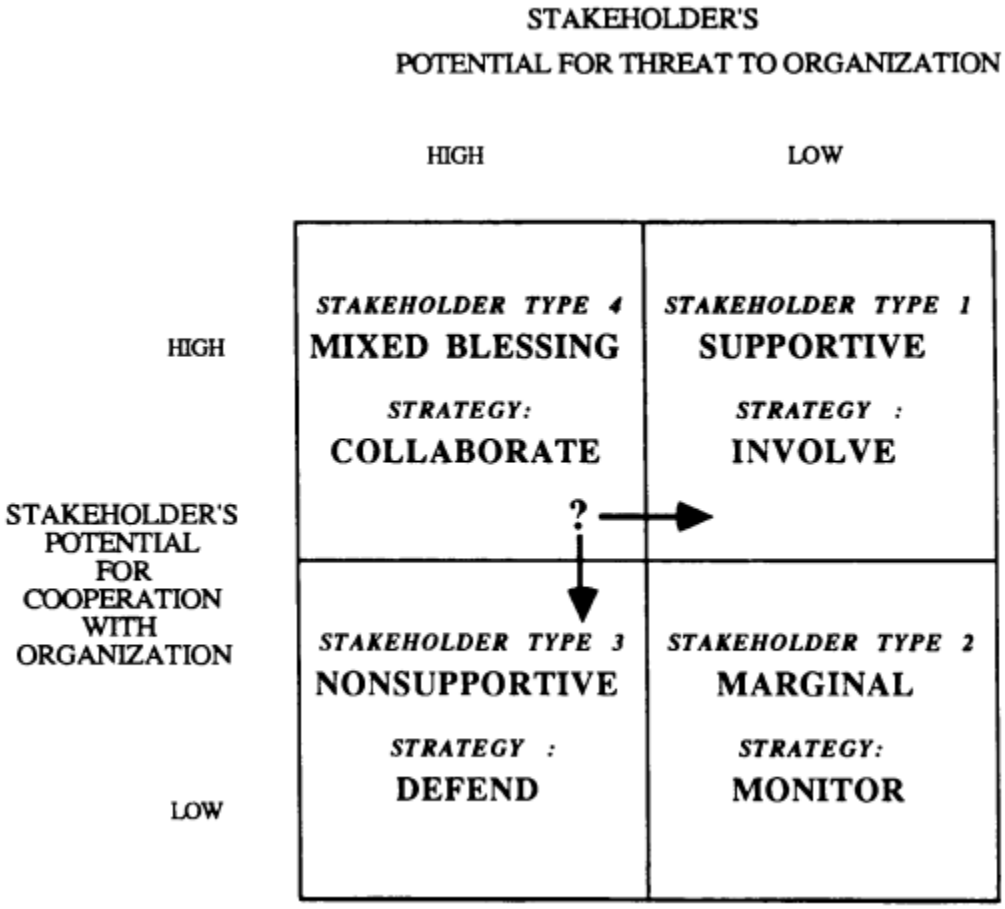

Figure 1: Taken from *Strategies for Assessing and Managing Organizational Stakeholders* (Whitehead and Blair 1991) it shows the four stakeholder categories. It can be utilized to assist in determining strategies for working with each type of stakeholder and to create strategies in working better with them.

Nonsupportive stakeholders in Whitehead and Blair's report are viewed as stakeholders outside of the organization such as business rivals, but this can apply in other organizations as well, such as the public sector. The report recommends making strategic steps to improve

relationships with these types of stakeholders to strengthen the overall outcome of a program or in this case an organization (Whitehead and Blair, 1991). Involving stakeholders that will contribute and collaborate with other stakeholders and the project manager can create a forum for successful programs to take place. Part of this strategic approach of creating better relationships among stakeholders can be to incorporate the reminder that all the stakeholders and the program managers are working toward the same goal of serving their community and without their different perspectives that will enhance the pilot program the community is the one that loses.

Another method for obtaining more involvement from participants in planning and designing processes is with a system called Stakeholder Engagement Wheel Framework from the *Explore, Synthesize, and Repeat: Unraveling Complex Water Management Issues through the Stakeholder Engagement Wheel.* The report addresses some of the reasons why getting buy in is so difficult including the main issues like water resource management intricacy, short timelines for projects, barriers or obstacles that make it hard to encourage commitment from stakeholders from a variety of fields, and the absence of approaches that focus on making participants feel heard, in a respectful, inclusive environment. The report addresses the three most important issues as individual project managers will have to work with their own project timelines (Mott et. al, 2016). Figure 3 below is a visual example of working through these problems with the utilization of "social learning" (Mott et. al, 2016). The wheel has several moving parts to it including the main circle with each subsequent step. Along with the individual smaller circles that include the process of data collection and analysis that can assist in resolving the complex issues of water management (Mott et. al, 2016). The focus is to have a "convener (Bridging Organization)" that ensures the program continues to meet timelines and the "steering committee" that assists with the inclusion of stakeholders input (Mott et. al, 2016).

Using an engagement strategy like the stakeholder wheel below can assist program managers in keeping projects on track while utilizing important input from professionals with different

perspectives. In addition, having a third-party organization that does not have stake in the outcome of the project but that can assist in adding their input is an additional resource that program managers should utilize. The stakeholder wheel has a steering committee as well as a bridging organization, which is an interesting aspect as one panel could perform both duties of keeping the project on track and including stakeholders' inputs. Especially in circumstances when less people are available to participate as a stakeholder. Keeping these roles separate would provide a great benefit when circumstances allow.

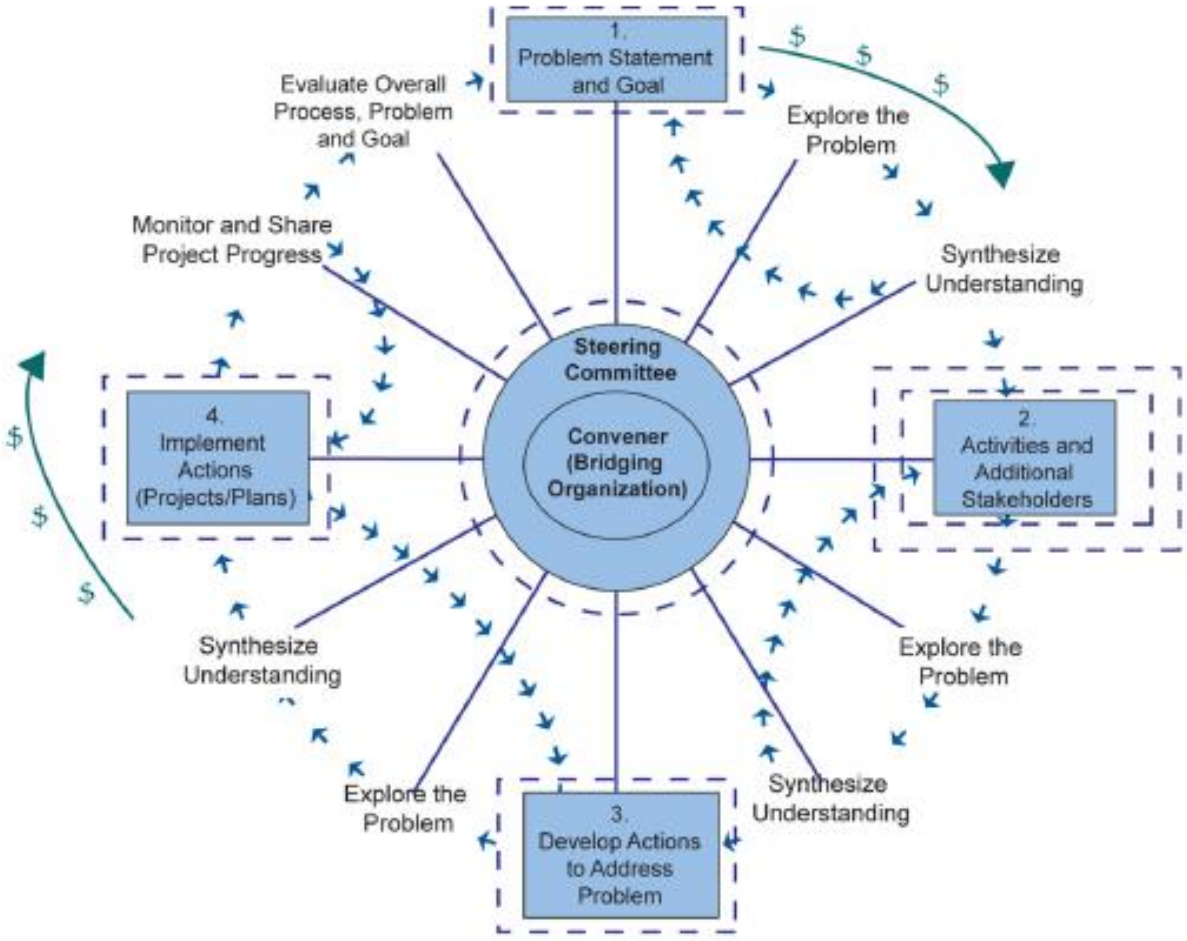

Figure 2: From the report *Explore, Synthesize, and Repeat: Unraveling Complex Water Management Issues through the Stakeholder Engagement Wheel* (Mott et. al, 2016) it shows a visual of the Stakeholder Engagement Wheel.

In addition to these approaches, the American Water Works Association (AWWA) in their *Water Conservation Programs A Planning Manual Second Edition* suggests "supporting an engaged stakeholder process" (AWWA, 2017) in four steps. "Identify target audiences, address inequities in terms of range of viewpoints, select forums for consensus building, leverage tools for consensus among stakeholders and conduct a successful process" (AWWA, 2017). Figure 2 below is a visual representation of how to incorporate and keep momentum going within a project for continual improvement. It can serve as a reminder to everyone participating on a project, whether it be stakeholders or the managers themselves, that through each step of the process they should step in and check with each other to ensure their pilot project stays on track.

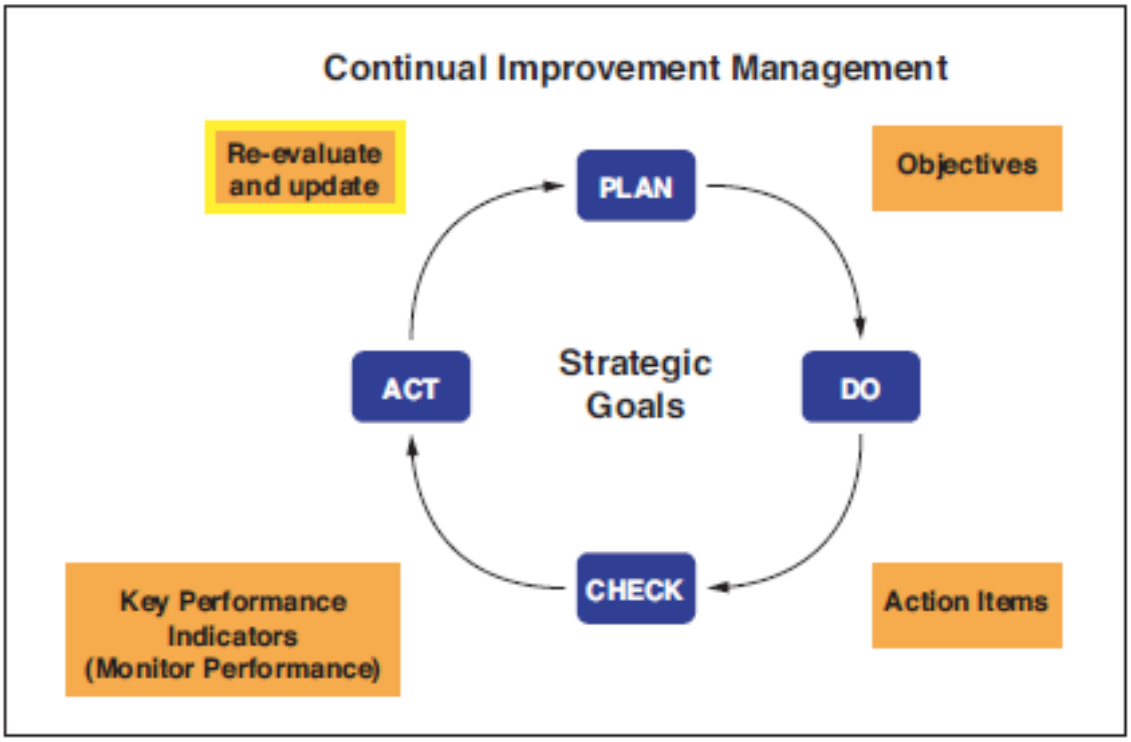

Figure 3: From the City of Sacramento Department of Utilities, 2015 utilized in the *American Water Works Association (AWWA) Water Conservation Programs A Planning Manual Second Edition* (AWWA, 2017) shows a visual of continuous improvement through management plans.

Managers of pilot programs must take all of this into consideration when they are designing and implementing their programs. However, implementation and "balancing of stakeholder's interests" is a difficult task, especially in highly political programs. Each manager must make an

individual decision on how to utilize stakeholders and how much weight to give their stakeholder's input (Reynolds et. al, 2006). Keeping these strategies in mind as well as sticking to strategic goals throughout a pilot program can be part of the reason a program is successful or not.

The DMA Program used stakeholder engagement from the beginning. Including the incorporation of public opinion and City council opinion throughout the process when the pilot program was presented in public City Council reports; first to obtain permission and public comment on applying for the DWR Water and Energy Grant, then for accepting the awarded grant and finally to extend the timeline to complete the program. It started in 2013 when the Water Conservation Plan was adopted by City Council. Stakeholders of the Water Conservation Plan recommended intensifying leak detection to reduce water loss within the City Water Distribution infrastructure. In concurrence with this plan the Operations and Maintenance Division (O&M) started a survey and leak repair program that assisted the City in reducing water loss by specifically focusing on older water mains in downtown Sacramento. They were successful in their effort and saved approximately two million gallons of water within a six-month time frame. Empowered from this effort the City expanded its O&M crew by two service workers for a total of four service workers assisting on the project in 2014. During this same year, the DMA program came to fruition, and DOU applied for grant funding and received it from Sacramento Municipal Utility District (SMUD) Customer Advanced Technologies Program and Regional Water and Energy Assessment Program with a match provided by DOU. A request for qualifications was advertised and Water Systems Optimization, Inc. (WSO) was chosen by a panel/team of stakeholders and contracted to begin DMA design and installation of a Pilot DMA System with stakeholder oversight and input (City of Sacramento, 2014).

During 2015, the City of Sacramento pursued the $2.5 Million Department of Water Resources' (DWR) Water and Energy grant which was awarded to the City in 2015. A part of the DWR Grant was to fund the Leak Free Sacramento Program, which was a free residential homeowner plumbing program to address water loss from the customer-side and will be discussed later in

the evaluation section of this report. From 2016 through 2017, planning of the expansion of the DMA program began, and data from the existing DMAs was used to supplement leak detection and repair efforts. (See Appendix 1 for example weekly review of DMA data). During this effort, a committee of stakeholders was utilized in the beginning stages of the planning, design and implementation phases. As the program developed, issues arose with equipment design incompatibility, and unmetered accounts affecting data analyses; the larger stakeholder committee update meetings were not made a priority, as focus was on resolving arising issues in the construction/implementation phase. In addition, some stakeholders had expressed that they could not commit as much time to involvement as well.

Installation of Phase 2 of the DMA program went into effect in 2018 with a completion of 12 percent distribution system coverage. In 2018 it was determined that the selected insertion meters, Hydreka's Hydrins 2 EO Insertion Meter configured with the City Badger endpoints that were on Advanced Metering Infrastructure (AMI) and read through Badger's Beacon software, were not compatible. The stakeholders learned from the implementation efforts that the insertion meters "cannot provide the required data for the City DMA Program and that the configuration cannot report reverse direction flow now in excess of positive direction flow necessary for the project's study" (City of Sacramento, Department of Utilities, 2019). Due to this issue the City and Matchpoint, the distributor for Hydreka (the insertion meter manufacturer) and all stakeholders created an agreement, which was approved by City Council in the City's Change Order 4. Per this agreement, Hydreka supplied 28 Data Telemetry Units (DTUs), 23 for the DMAs funded from the DWR Water and Energy grant and five for the Lower Pocket DMA which is covered under the Water Division's funding (City of Sacramento, Office of the City Clerk, 2018). At the end of the grant period in June of 2018, the DMAs "saved 30.5 MG water, 30,500 kWh energy, 7,200 kg CO_2e greenhouse gas emissions in their first year due to leaks identified by the DMA methodology" (City of Sacramento, 2018).

In 2019, full usage of the DMAs was realized and the agreement for a three-month trial period of the updated Hydreka Hydrins 2.1 AMI insertion meter was implemented with the Badger endpoint. At the end of the three-month trial period it was determined that the update for utilizing Hydreka's insertion meter with Badger Beacon software for AMI implementation was not successful, data was not accurate, and the test Hydreka Hydrins 2.1 AMI insertion meter was returned to Matchpoint and Hydreka. The original Hydreka Hydrins 2 EO was reinstalled with a DTU. At the end of June 2019, a final Post-Performance report was submitted to DWR with the next steps and recommendation by stakeholders. (See Appendix 4 for full Post-Performance report). The recommendation from DOU stakeholders was for the full completion of the pilot project and a hold to be placed on the program until the City is fully metered and has a chance to reevaluate if the DMA program best serves the Sacramento community for a viable, proactive leak detection program (City of Sacramento, Department of Utilities, 2019).

The concept for Leak Free Sacramento was included in the grant application for the $2.5 Million DWR Water and Energy grant by the subconsulting firm to WSO, WSP Parsons-Brinkerhoff. Initial development and design started from intensive research on different types of plumbing programs that other municipalities, including San Francisco and Los Angeles County were doing. Direct install programs were found to be the most common type of plumbing and water loss reduction program that municipalities were implementing and were slightly different from the vision of what the City DOU stakeholders wanted to implement. As direct install programs are done in multi-family homes with just the installation of low water use fixtures and toilets, no leak repairs are conducted, and single-family homes are not typically served. During this process staff found a longtime running program in San Antonio, Texas called "Plumbers to People," which became the basis for the Leak Free Sacramento Program. Program research and planning timeline took the program staff a year to develop with periodic meetings with pertinent stakeholders in the City's Operations and Maintenance (O&M), Grant and Logistics Divisions. After discovering and obtaining input from City of San Antonio, DOU staff worked on creating the program protocol, forms, outreach materials, applications and Request for Qualifications (RFQ) for a plumbing contractor. (See Appendix 6 – 13 for LFS outreach materials,

application, forms and RFQ). After review of the statement of qualifications received, the O&M and Logistics stakeholder team members awarded the contract to the plumbing company SouthWest Environmental (SWE) to implement the pilot program.

Leak Free Sacramento was "live" from September 2016 to October 2017. Initial public outreach was determined by stakeholders to utilize program postcards that were sent to potential customers within the targeted DACs. (See Appendix 5 for LFS postcard). After the first wave of postcards was sent to customers in fall of 2016, it was determined by the stakeholders (including the City's Public Information Office team) that a letter and flyers distributed instead of a postcard may be a better approach to get residential homeowner's interest and participation in the program as the postcard had not produced effective results. An outreach letter was sent in January of 2017 to approximately 17,622 potential customers. From this effort, at least two percent responded, and 297 customers were served with having leak repairs fixed inside and outside of their homes with a total maximum budget per home of $4,000. A key part of the management of the project throughout its lifetime was the staff and contractor maintenance of a customer database with tracking of customers through the process, including the type of repairs and or replacements in each home. In addition, a weekly summary update was kept to periodically update the City of Sacramento stakeholders and included the DOU Executive Team and management staff on the progress of the program. This was also utilized in weekly meetings with the plumbing contractor SWE to compare data and sort out any discrepancies weekly. "Implementation of this program saved 22.8 MG water, 22,800 kWh energy, 5,400 kg CO_2e greenhouse gas emissions annually" (City of Sacramento, 2018). At the close of the program, LFS was accepted by the stakeholders to transition from a pilot to a permanent program and management of the program was transferred from the O&M team to management oversight by the Water Conservation Office within DOU.

For an in depth understanding of program processes and the potential impact of stakeholders on each program an email survey was developed and conducted along with a reminder

telephone call to stakeholders to ask them to participate. A total of 37 stakeholders were contacted, 32 stakeholders for the DMA pilot and five for the LFS program. An email was sent out to stakeholders on June 17, 2019 requesting a response by June 24, 2019 with a word document attached consisting of the following questions.

City of Sacramento, Department of Utilities

Leak Free Sacramento and District Metered Area Program Survey Questions

Please utilize N/A if you were not a stakeholder of one of the projects.
Please respond by 6/24/2019.

1. In your opinion, what is one vital step that should be taken in the implementation of a pilot program to make it successful?

2. Do you believe stakeholder input or lack of it can affect the outcome of a pilot project?

3. On a scale of 1 to 10, one being low, as a stakeholder of the Leak Free Sacramento Program how would you rate the impact of the program?

    a. Comments:

4. On a scale of 1 to 10, one being low, how effective was outreach for the Leak Free Sacramento Program?

    a. Comments:

5. On a scale of 1 to 10, one being low, as a stakeholder of the District Metered Area (DMA) Program how would you rate the impact of the program?

    a. Comments:

6. On a scale of 1 to 10, one being low, how effective was outreach for the District Metered Area Program?

    a. Comments:

7. What steps can program managers take to improve the effectiveness of a pilot program such as these?

Figure 4: Survey questions to stakeholders utilized to get an overarching idea of their perspective on the successes and improvements needed in both the DMA and LFS pilot programs. (See Appendix 14 and 15 for results).

Results

Stakeholders weighed in on the impact, outreach and lessons learned of both the LFS and DMA programs, with a total of nine responses in a one-week timeframe equating to a 24 percent response rate. The following is a summary of the survey responses on average from stakeholders. It is important to note that all four questions regarding impact and outreach were not answered by all nine stakeholders that participated. In some instances, they either did not complete these questions, responded "Not Applicable or N/A" as requested if they weren't a stakeholder on one program or in some cases stakeholders did not understand that the LFS and DMA programs were separate and provided answers for the DMA program under LFS questions as well. For those specific responses, comments were kept as they still contained pertinent information for the DMA program, but scaled numbers were excluded as they were not about the LFS program.

An overall theme in the survey responses for both question one and two was that stakeholder input throughout the entire project is a vital part of any program. Stakeholders acknowledged that a successful program needs active participants for vendor selection, materials and design, and that constructive discussion is necessary for a successful project. In addition to this, participants also noted that meeting frequently throughout the pilot program process was needed if it was in informative, constructive meetings. Otherwise input from team members could delay or put a pilot program off track.

For questions three through six responses varied depending on the program. However, it is important to note that as stated above, not all nine stakeholders participated in answering each question. The number of responses per question is mentioned below, averages were calculated based on these numbers and percentages should be reviewed with a margin of error.

> The DMA program impact on average from the six responses to this question was 47 percent.

The DMA program outreach on average from the four responses to this question was 25 percent.

The LFS program impact on average from the three responses to this question was 83 percent.

The LFS program outreach on average from the two responses to this question was 77.5 percent.

Responses to the last question regarding additional steps that project managers can take to utilize stakeholders in the most efficient way possible for a successful, effective pilot program include an overarching theme that continues from the previous questions one and two. Creating a group of stakeholders in the beginning of a pilot project, getting buy in from your selected stakeholders, identify goals that the pilot program needs to achieve to succeed, and ensure the stakeholders that are a part of the committee have committed their full support for the program and include stakeholders from a variety of fields.

Discussion

One large barrier to the DMA and LFS programs was communication issues with stakeholders, vendors or with customers. For pilot programs to be successful clear communication throughout the project is needed. Stakeholders that participated in both programs were from both the public sector (City of Sacramento Department of Utilities' staff, managers and other agencies) and private sector (consultants, contractors and manufacturers/distributors).

With the DMA program communication with stakeholders was a large part of the project but ended up not being a continuous process on a larger scale throughout the program. This was for several reasons, one of which included lack of stakeholder buy in. This created difficulties in addressing technical program issues that arose. Some feedback from stakeholders was the wish

for more inclusion at the beginning of the program and due to this lack of inclusion they felt that it was harder to be engaged later in the process. Other stakeholders expressed at the end of the program that they were not able to participate as much in the beginning when asked, due to lack of resources to finish the other tasks they needed to work on. They expressed that being a part of this project became overwhelming for them, so they pulled back. Towards the end of the DMA program more effort was made to actively include presentations, an Assessment Report, input and assistance for stakeholders to be more involved. (See Appendix 2 for Assessment Report and Appendix 3 for AWWA presentation). This seemed to greatly improve the relationships with stakeholders and the program itself and is a great reminder for the importance of communication.

As discussed previously, balancing stakeholder's input is not an easy process. In the DMA program there was a breakdown in communication that seemed to start even from the beginning of the project. Everyone that participates in any project has their own goals and input that they bring to a project. This is based on an individual's background and history, and their personal and work force experiences. The inclusion of participants with greater differences in their field of expertise and personal experiences is a better representation of the communities they serve. However, this can increase conflicts within program planning, design and implementation, but if managed correctly can create a better program that serves the community. Conflict is needed to create successful programs and learning to create better relationships with stakeholders and understanding their viewpoint can create better programs.

Ultimately the DMA program was a successful pilot program in that it did what it was supposed to do, which was to be a small-scale pilot project that showed how this sort of project would work or not work for the City DOU. It showed the difficulties of implementing DMAs in a City infrastructure that is over 100 years old. Redesigning a fixed system into discrete zones is not an easy task and selecting new technology to assist with this can come with its own difficulties, which was discovered in the program design process. However, without the government

striving for new innovative programs and technology to address issues for water loss control, no improvement will be made to better serve communities. The largest take away of this program is the importance of continued communication throughout projects, whether they are pilot ones or not. The City of Sacramento, DOU has determined to hold the DMA program until the City has all of its customers fully metered to re-evaluates its suitability for serving the community and finding water loss within its system. One recommendation when the City reevaluates, is to review potential utilization of a different technology such as electromagnetic flow meters that report in Supervisory Control and Data Acquisition (SCADA) data. Originally, in 2014 during the creation of the pilot program, this was not a concept that could have been implemented due to the high cost of electromagnetic flow meters and the large amount of work that would be needed for implementation. However, going forward it could be a viable option for the City.

The LFS program although a successful endeavor, experienced some challenges and some lessons that can be utilized for future projects. Stakeholder input was not as impactful on the outcome of the program, due to the type of project. However, clear communication was needed throughout the project with internal staff, contractor and consultant staff. Toward the middle and end of the project it was determined that utilizing weekly meetings with all staff was needed to keep the program on track and stakeholders engaged as there was too many little moving parts that could easily set the program off track.

Feedback from stakeholders in the survey was low regarding the LFS program. Even though the responses for this program were positive, there were few of them. A good portion of stakeholders did not understand that it was a separate project from the DMA program. They either added additional comments for the DMA program in the LFS section or they thought it was a part of the O&M leak detection section. As it was a part of the same DWR Water and Energy grant program stakeholders were briefly updated a few times at DMA committee

meetings. However, clearly from the feedback received, additional outreach internally was needed to stakeholders and other departments within the City.

The Water Conservation department revamped and updated the LFS program to include several changes. A more targeted approach to outreach for participants with higher leaks, and an increase in per home budget was deemed necessary to better assist customers. The Water Conservation team is currently putting the program out to bid again to utilize not only plumbers, but irrigation specialists to address outdoor leaks for a better price. With these changes to the program, it shows the usefulness of a pilot program. Having the basics of a program created via the pilot, the City of Sacramento, DOU can now create program changes based on previous impacts of the first program to assist the community better. With increased budgets available per homeowner, very serious problems can be fixed for customers providing even more value to the customer and City. This was a barrier that the initial grant funded program encountered with some customers only having part of their overall leak problems addressed due to the budget limitations.

Conclusions

Continual program outreach and communication is a vital part of water loss programs, whether they are pilots or not. In the case of the District Metered Areas (DMA) and Leak Free Sacramento (LFS) programs more active communication was needed. For the DMA program, continual communication throughout the program was needed to understand the barriers to the project. For the LFS program, communication was not done in the initial design and planning, but throughout the “live” part of the project. However, the audience for that communication was too small. Expanded and continual correspondence about projects even to stakeholders not initially thought of in the beginning of the process; or who may not immediately come to mind, can assist towards the creation of a successful pilot program.

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Appendices

Appendix 1

City of SACRAMENTO
Department of Utilities

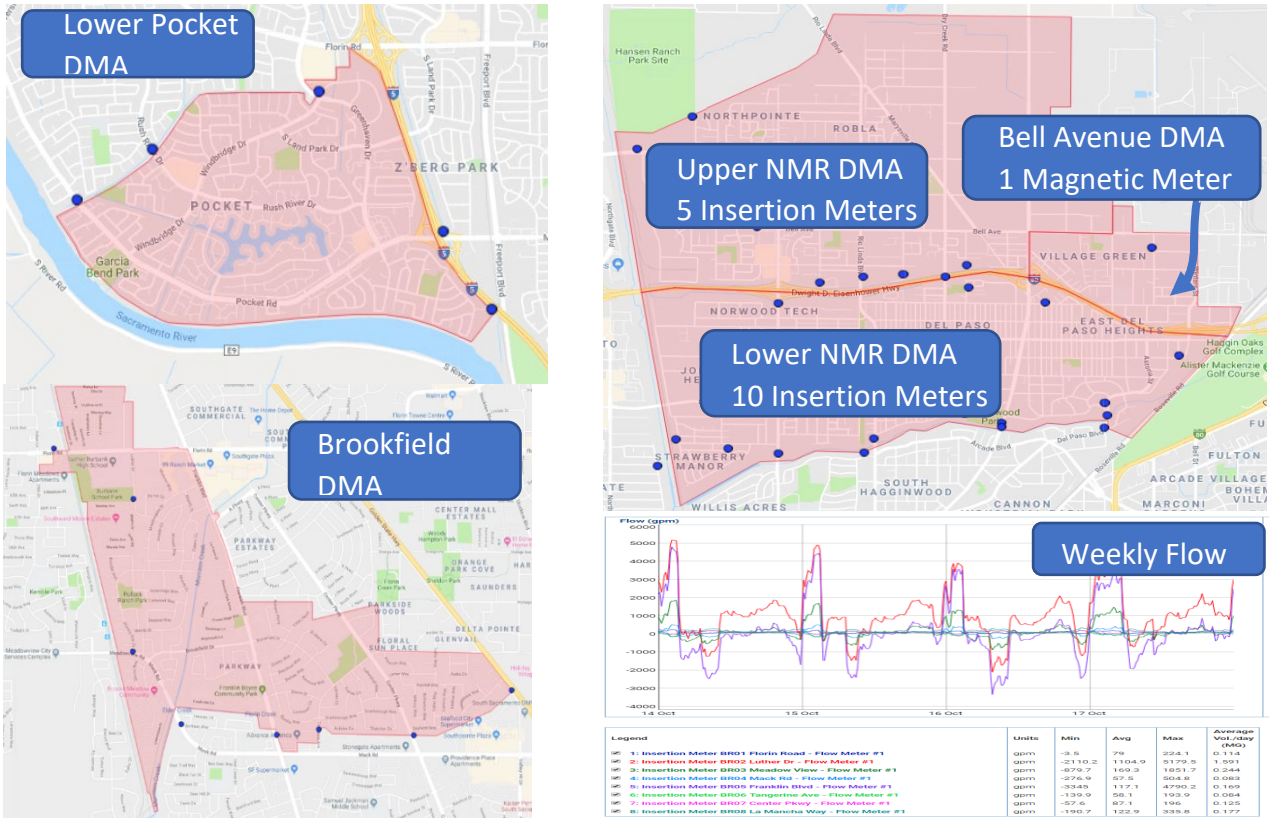
District Metered Area (DMA) Update

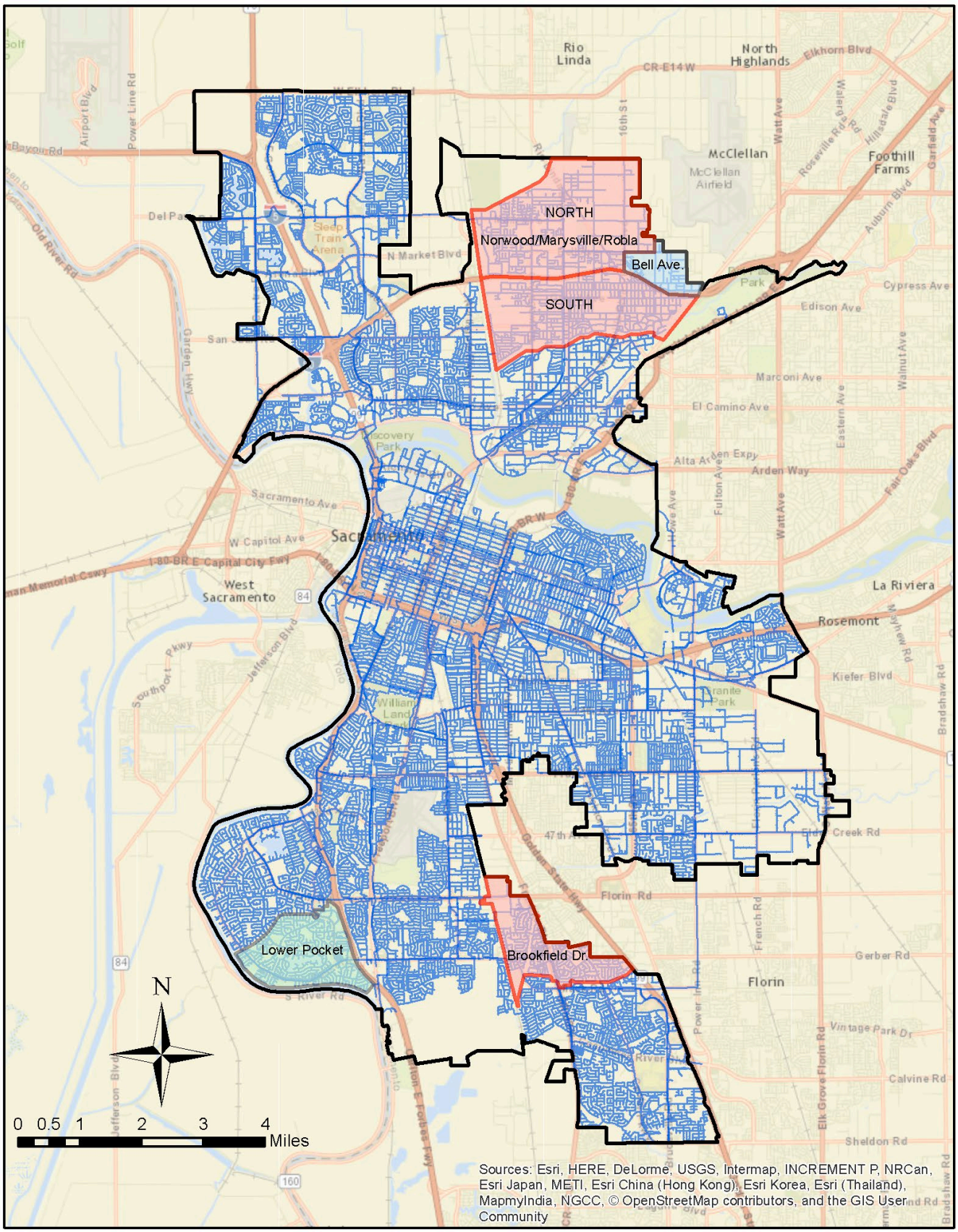
The City of Sacramento Department of Utilities (DOU) embarked on a pilot program to establish District Metered Areas (DMAs). The program was funded through grants from DWR and SMUD. A DMA is a hydraulically discrete zone consisting of known points of inflows and outflows. By monitoring inflows, outflows and consumption in the zone, DOU can assess water losses. The DMAs are being monitored and utilized to strategically deploy leak detection resources only when water loss levels indicate intervention is cost effective. Thus, the program augments the DOU Leak Detection Program efforts. Currently, the DOU Water Division and consulting teams are providing daily monitoring and evaluation of five DMAs. The teams have developed and utilize an online dashboard, the NRWManager. Weekly activities and locations are presented below.

Summary of Weekly Activities: Week of 7/13/19 - 7/19/19

- Matchpoint is investigating BR01 to determine why it has not been transmitting to the City's FTP site.
- Site NMRS10 will be going offline due to an Army Corps of Engineers project with the nearby levy. As a result, WSO will not be able to calculate a Mass Balance report due to incomplete data.
- Field Visit to site NMRN21 on 7/17/19 revealed that the batteries at site 21 were dead.
- Matchpoint will be shipping batteries for sites NMRN19, NMRS11, NMRS14, NMRS16, and NMRN21. Shipping details to be obtained.

DMA Boundaries and Meter Locations





District Metered Areas

City of SACRAMENTO
Department of Utilities

Weekly Transmission Summary

(7/13/19 - 7/19/19)

Site	Sat (7/13)	Sun (7/14)	Mon (7/15)	Tues (7/16)	Wed (7/17)	Thurs (7/18)	Fri (7/19)	Notes
Lower Pocket								
LP1	No	No	No	Yes	Yes	Yes	Yes	Backlogged Data received.
LP2	No	No	No	Yes	Yes	Yes	Yes	Backlogged Data received.
LP3	No	No	No	Yes	Yes	Yes	Yes	Backlogged Data received.
LP4	No	No	No	Yes	Yes	Yes	Yes	Backlogged Data received.
LP5	No	No	No	Yes	Yes	Yes	Yes	Backlogged Data received.
Brookfield								
BR01	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Matchpoint confirmed that site is calling into Webfluid. Not calling into ftp site yet.
BR02	No	No	No	Yes	Yes	Yes	Yes	Backlogged Data received.
BR03	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Data manually downloaded 7/17/19.
BR04	No	No	No	Yes	Yes	Yes	Yes	Backlogged Data received.
BR05	No	No	No	Yes	Yes	Yes	Yes	Backlogged Data received.
BR06	No	No	No	Yes	Yes	Yes	Yes	Backlogged Data received.
BR07	No	No	No	Yes	Yes	Yes	Yes	Backlogged Data received.
BR08	No	No	No	Yes	Yes	Yes	Yes	Backlogged Data received.
NMR North								
NMRN09	No	No	No	Yes	Yes	Yes	Yes	Backlogged Data received.
NMRN19	No	No	No	No	No	No	No	Dead batteries in DTU.
NMRN20	No	No	No	Yes	No	No	No	Backlogged Data received.
NMRN21	No	No	No	No	No	No	No	Dead batteries in DTU.
NMRN23	No	No	No	Yes	Yes	Yes	Yes	Backlogged Data received.
NMR South								
NMRS10	No	No	No	Yes	Yes	Yes	Yes	Backlogged Data received.
NMRS11	No	No	No	No	No	No	No	Dead batteries in DTU.
NMRS12	No	No	No	Yes	Yes	Yes	Yes	Backlogged Data received.
NMRS13	No	No	No	Yes	Yes	Yes	Yes	Backlogged Data received.
NMRS14	No	No	No	No	No	No	No	Dead batteries in DTU.
NMRS15	No	No	No	Yes	Yes	Yes	Yes	Backlogged Data received.
NMRS16	No	No	No	No	No	No	No	Dead batteries in DTU.
NMRS17	No	No	No	Yes	Yes	Yes	Yes	Backlogged Data received.
NMRS18	No	No	No	Yes	Yes	Yes	Yes	Backlogged Data received.
NMRS22	No	No	No	Yes	Yes	Yes	Yes	Backlogged Data received.

Not in operation

No Data Received

City of SACRAMENTO
Department of Utilities

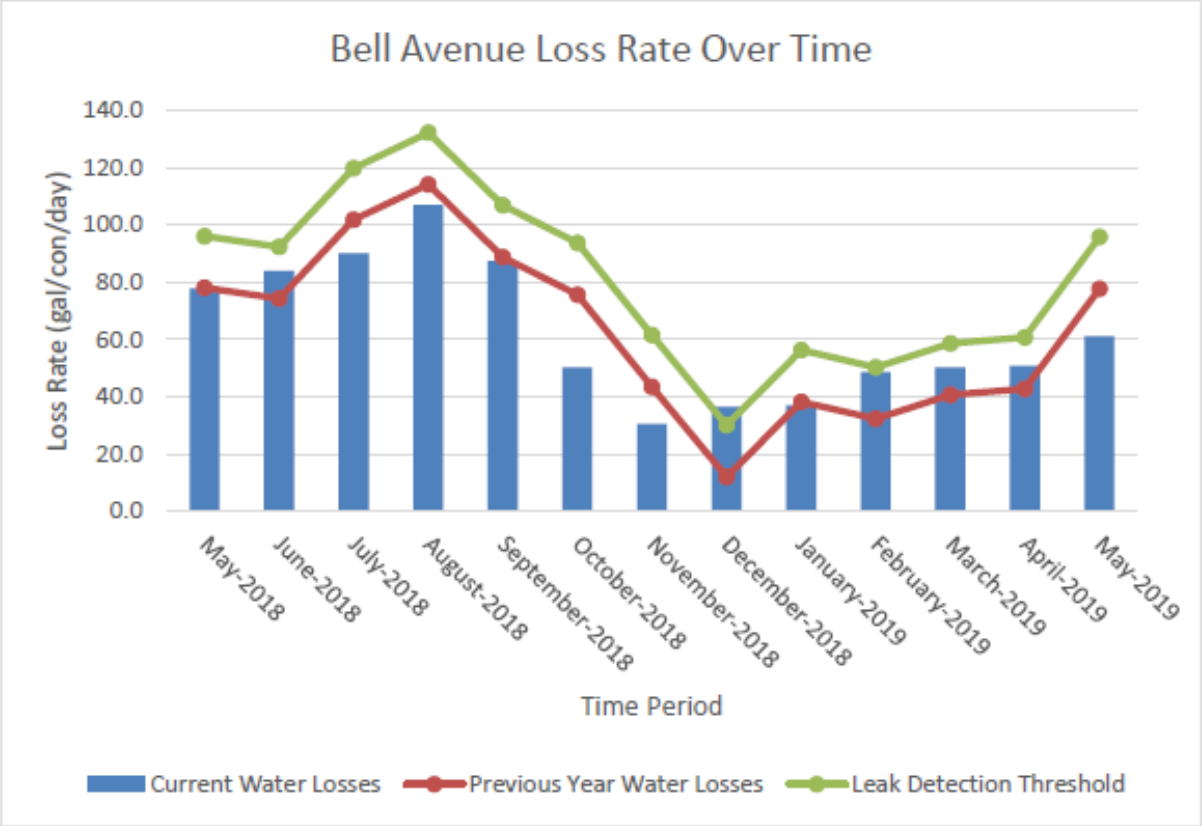
District Metered Area (DMA) Program

DMA Weekly Flow Summary and Monthly Mass Balance

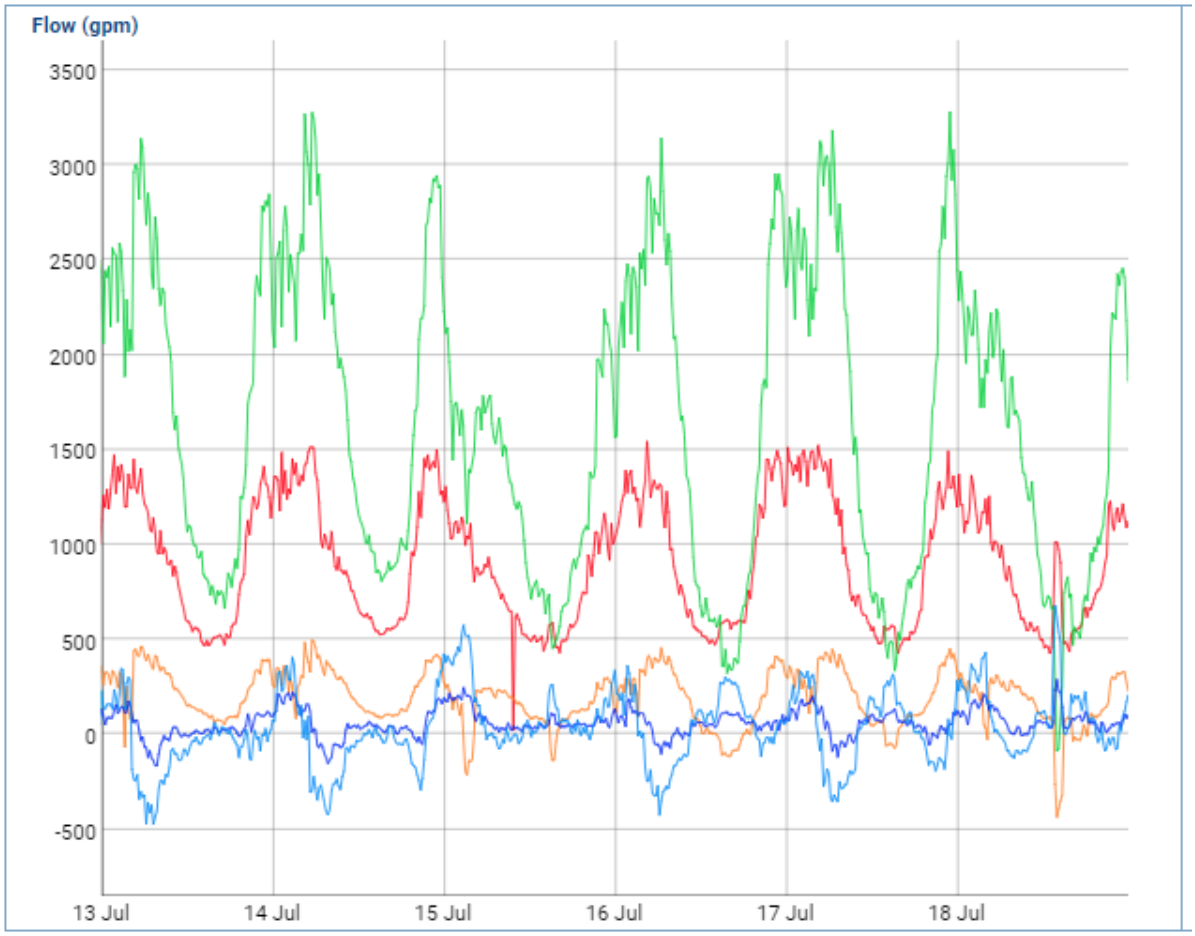
July 19, 2019

Bell Avenue DMA Mass Balance Report: May 2019

Water Loss Calculation for Monitoring Period (05/01/2019 - 05/31/2019)		
Duration of Monitoring Period	31	days
Service Connections in DMA	613	# of service connections
Total Inflow (gal)	9,364,449	gal
Total Consumption (gal)	8,203,065	gal
Operational Used (gal)	0	gal
Total Losses (gal)	1,161,384	gal
May 2019 Water Losses	61	gal/con/day
May 2018 Water Losses	78	gal/con/day
Results		
Water Loss trend over previous period: <18 gpcd increase from last year. Therefore leak detection is not warranted		
Deploy Leak Detection Team:	No	



Lower Pocket DMA Flow Summary



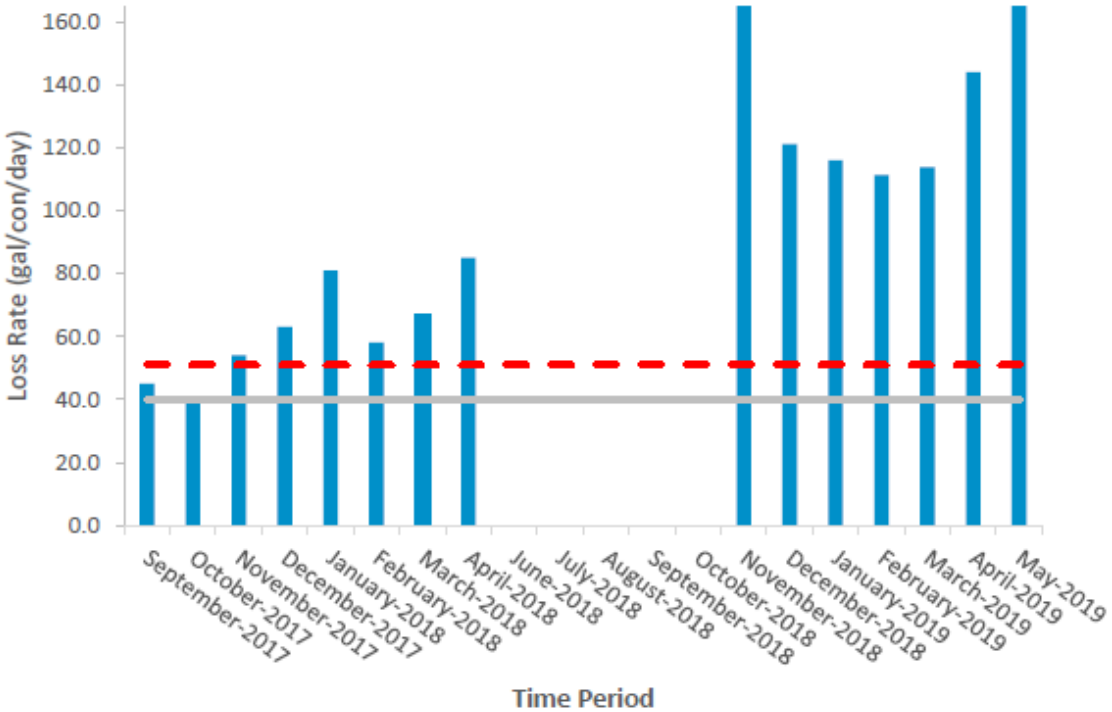
Legend	Units	Min	Avg	Max	Average Vol./day (MG)
1: Lower Pocket DMA MP - Site LP01 - Flow Meter #1	gpm	20.2	917	1545.9	1.32
2: Lower Pocket DMA MP - Site LP02 - Flow Meter #1	gpm	-436.7	195.8	497.7	0.282
3: Lower Pocket DMA MP - Site LP03 - Flow Meter #1	gpm	-86.3	1651.8	3282.6	2.379
4: Lower Pocket DMA MP - Site LP04 - Flow Meter #1	gpm	-165.8	60.1	289.3	0.087
5: Lower Pocket DMA MP - Site LP05 - Flow Meter #1	gpm	-474.7	34.8	680.3	0.05

Lower Pocket DMA Mass Balance Report - May 2019

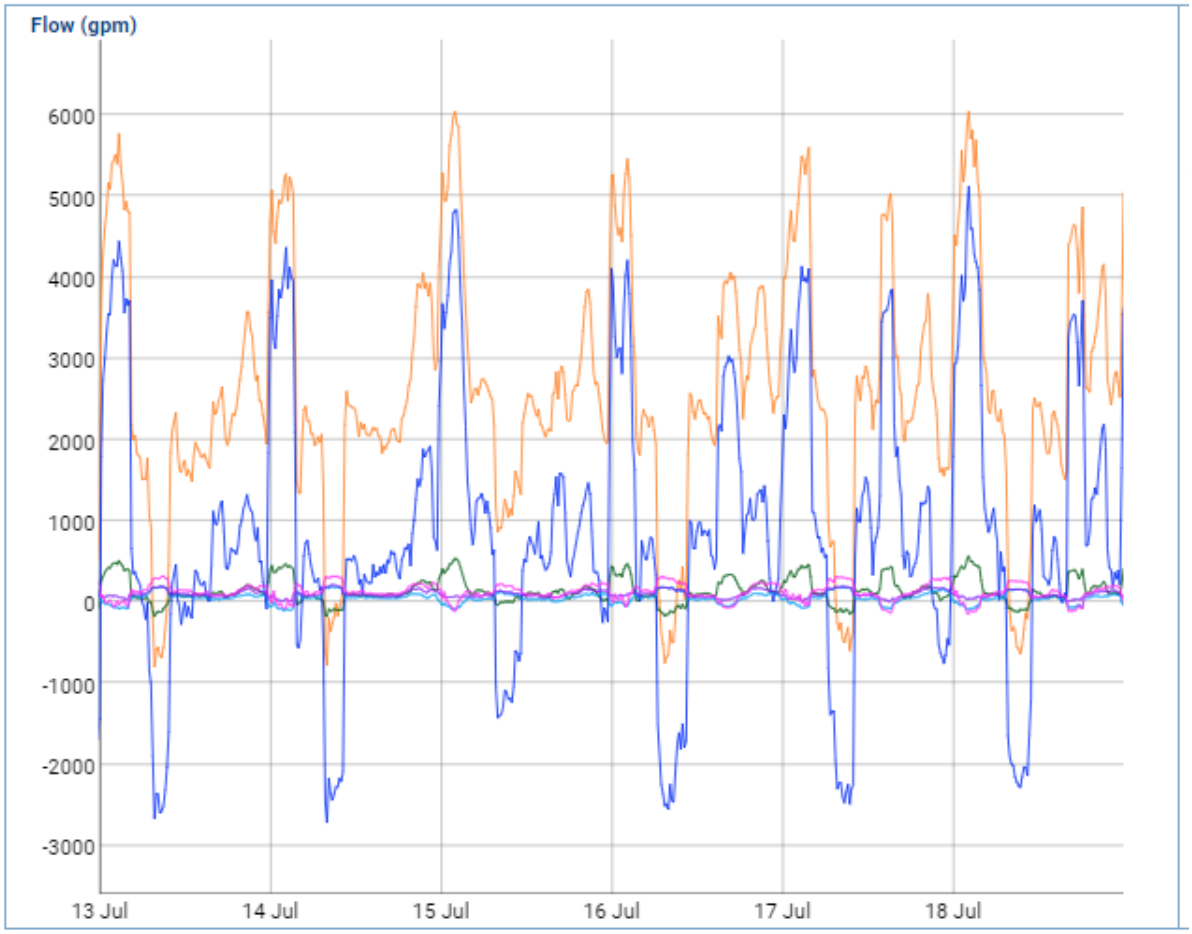
Water Loss Calculation for Monitoring Period (05/01/2019- 05/31/2019)		
Duration of Monitoring Period	31	days
Service Connections in DMA	4013	# of service connections
Total Inflow (gal)	89,308,086	gal
Total Consumption (gal)	65,614,817	gal
Operational Used (gal)	0	gal
Total Losses (gal)	23,693,269	gal
Water Losses (gal/connection/day)	190	gal/con/day
Water Losses (GPM)	531	gpm
Deploy Leak Detection Team:	**No**	

Note: Mass Balances may be incorrect due to incomplete flow data for Site 5 from May 1-May 7. Therefore, leak detection is not recommended for Lower Pocket DMA at this time.

Lower Pocket Monthly Loss Rate



Brookfield Dr DMA Flow Summary



Legend	Units	Min	Avg	Max	Average Vol./day (MG)
1: Insertion Meter BR01 Florin Road - Flow Meter #1	gpm	0	NaN	0	NaN
2: Insertion Meter BR02 Luther Dr - Flow Meter #1	gpm	-795.2	2632.7	6050.9	3.791
3: Insertion Meter BR03 Meadow View - Flow Meter #1	gpm	0	NaN	0	NaN
4: Insertion Meter BR04 Mack Rd - Flow Meter #1	gpm	-178.6	143	567	0.206
5: Insertion Meter BR05 Franklin Blvd - Flow Meter #1	gpm	-2719.5	910.6	5123.7	1.311
6: Insertion Meter BR06 Tangerine Ave - Flow Meter #1	gpm	-108.7	51.9	196.5	0.075
7: Insertion Meter BR07 Center Pkwy - Flow Meter #1	gpm	4.8	99	212.8	0.143
8: Insertion Meter BR08 La Mancha Way - Flow Meter #1	gpm	-145.5	124.7	321.1	0.18

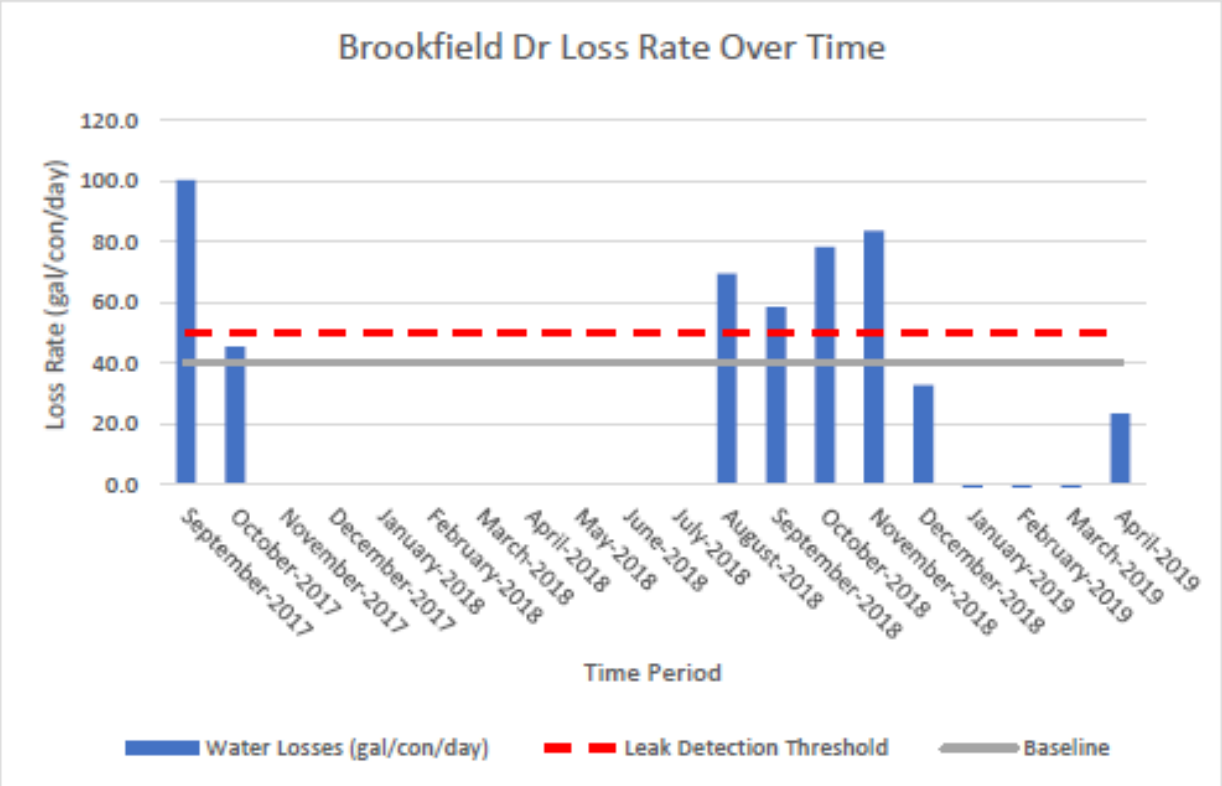
Brookfield Dr DMA Mass Balance Report

Water Loss Calculation for Monitoring Period (04/01/2019 - 04/30/2019)		
Duration of Monitoring Period	30	days
Service Connections in DMA	3648	# of service connections
Total Inflow (gal)	44,705,689	gal
Total Consumption (gal)	42,082,900	gal
Operational Used (gal)	0	gal
Total Losses (gal)	2,622,789	gal
Water Losses (gal/connection/day)	24	gal/con/day
Water Losses (GPM)	59	gpm

Results

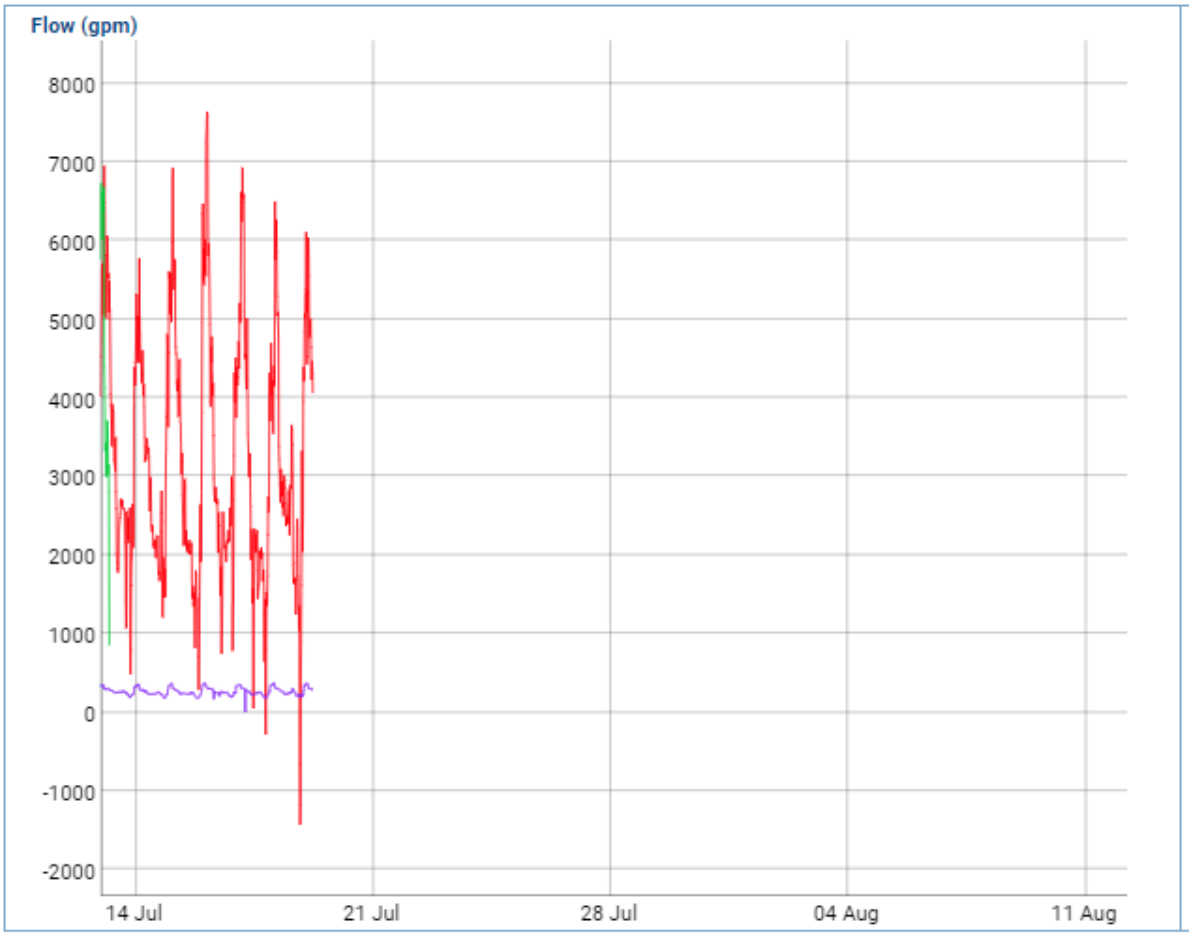
Water Losses are below leak detection requirement. Therefore, leak detection is not recommended for Brookfield Dr. DMA at this time.

Deploy Leak Detection Team:	**No**



No mass balance was completed for Brookfield Dr. in May due to malfunctioning insertion meter at BR01.

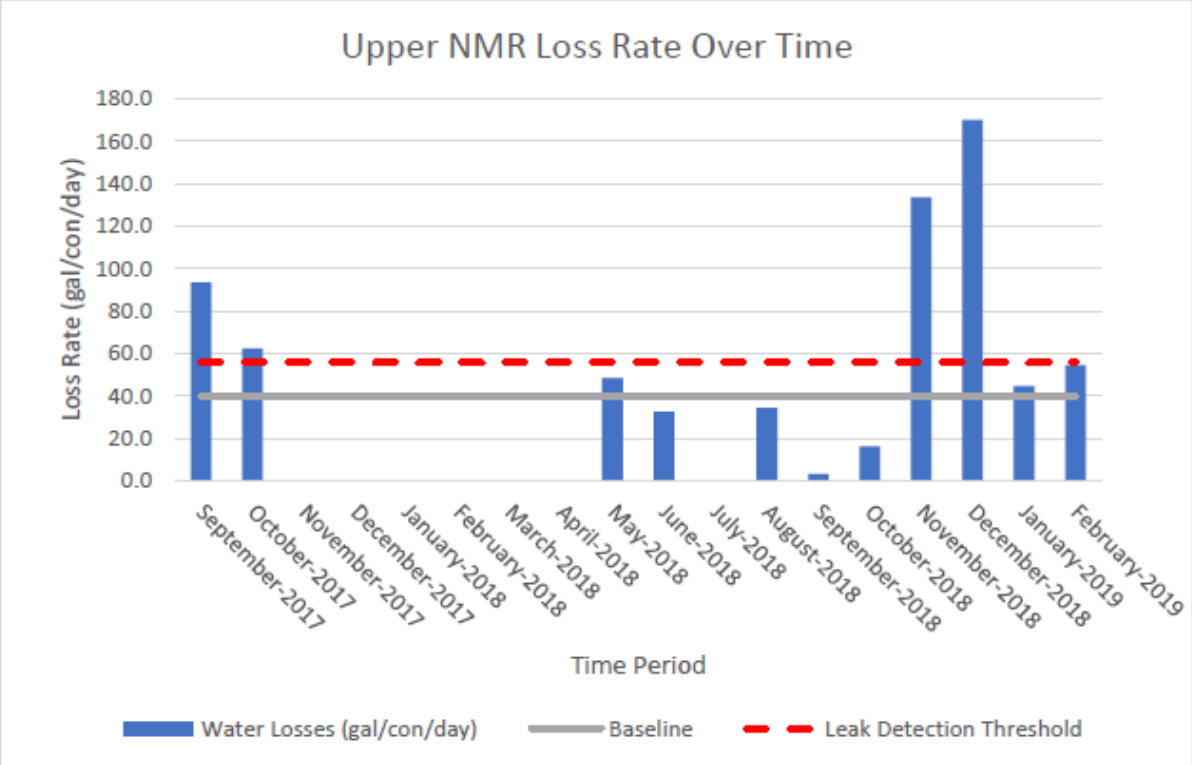
Upper Norwood-Marysville-Robla DMA Flow Summary



Legend	Units	Min	Avg	Max	Average Vol./day (MG)
1: Insertion Meter NMRN09 Del Paso - Flow Meter #1	gpm	-1431.9	3265	7638	4.702
2: Insertion Meter NMRN19 Taylor Street - Flow Meter #1	gpm	0	NaN	0	NaN
3: Insertion meter NMRN20 Rio Linda Blvd - Flow Meter #1	gpm	851.2	4501.3	6718.7	6.482
4: Insertion Meter NMRN21 May St - Flow Meter #1	gpm	0	NaN	0	NaN
5: Insertion Meter NMRN23 Fell St - Flow Meter #1	gpm	10	262	377.1	0.377

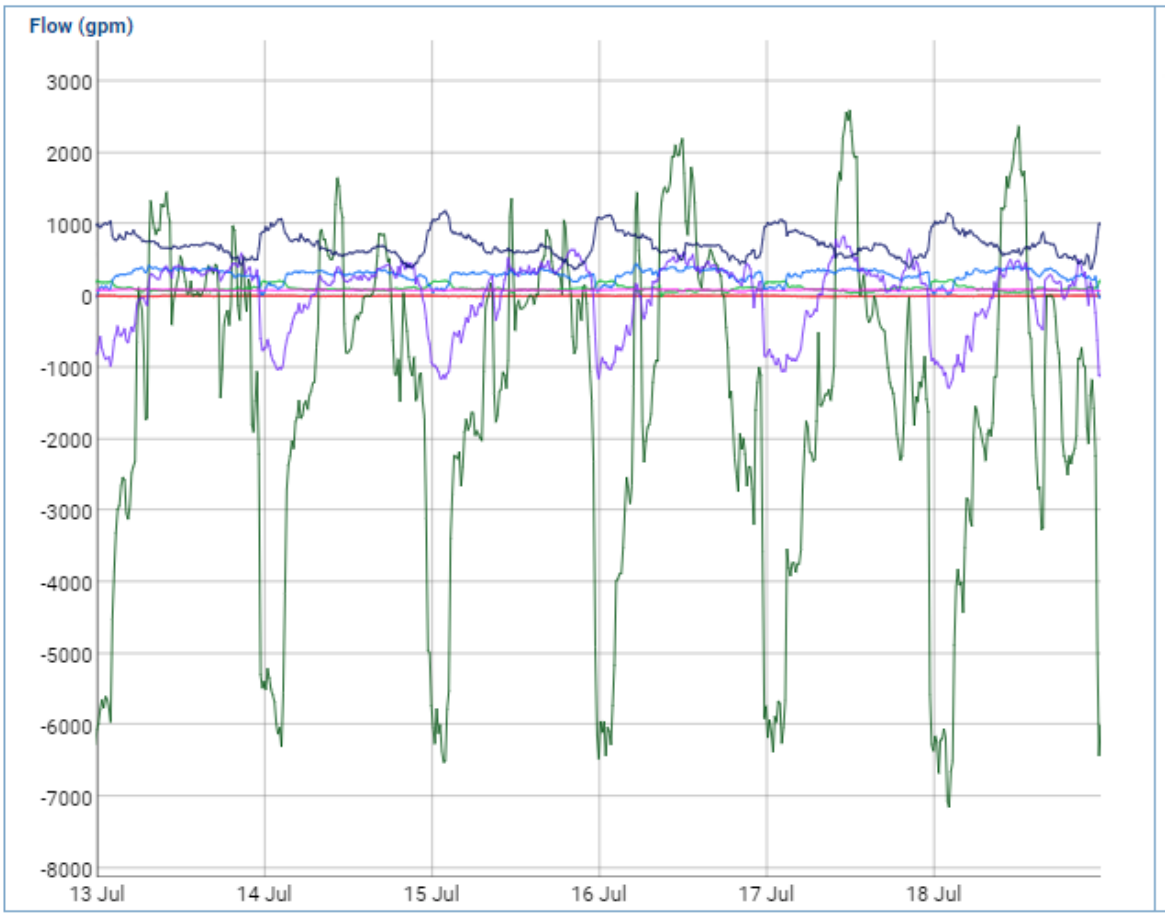
Upper Norwood-Marysville-Robla DMA Mass Balance Report

Water Loss Calculation for Monitoring Period (02/01/2019 - 02/28/2019)		
Duration of Monitoring Period	28	days
Service Connections in DMA	4,170	# of service connections
Total Inflow (gal)	41,058,108	gal
Total Consumption (gal)	34,671,560	gal
Operational Used (gal)	0	gal
Total Losses (gal)	6,386,548	gal
Water Losses (gal/connection/day)	55	gal/con/day
Water Losses (GPM)	158	gpm
Results		
Water losses are inconsistent. WSO recommends relying on combined mass balance results for NMR DMA.		
Deploy Leak Detection Team:	**No**	



No mass balance was completed for NMRN in March, April and May due to dead batteries at NMRN09 and other site call in issues.

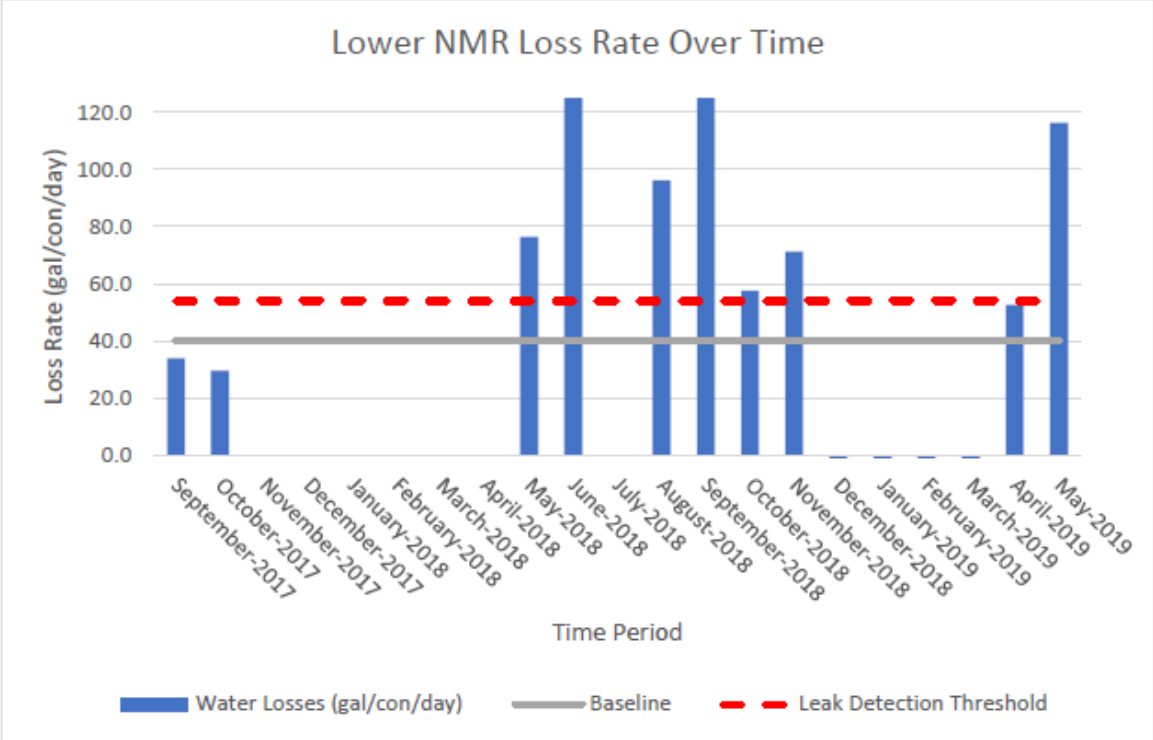
Lower Norwood-Marysville-Robla DMA Flow Summary



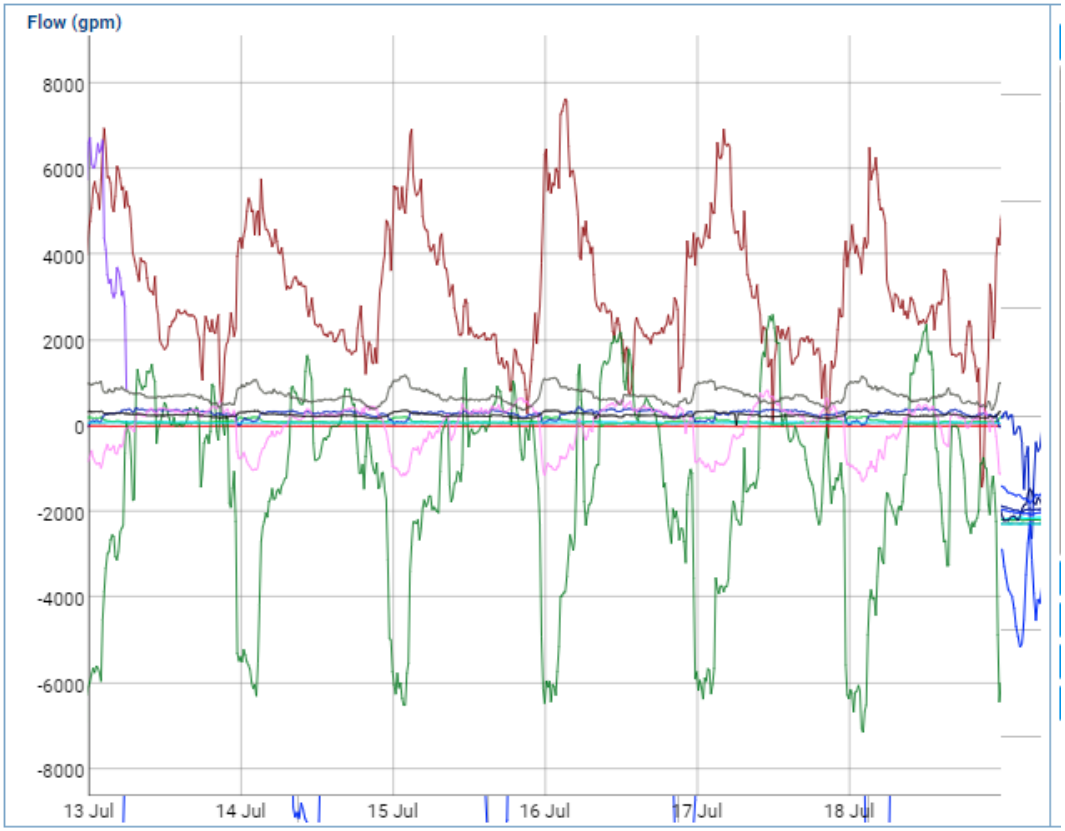
Legend	Units	Min	Avg	Max	Average Vol./day (MG)
1: Insertion Meter NMRS10 Steelhead Creek - Flow Meter #1	gpm	-13.7	-4.3	0.3	-0.006
2: Insertion Meter NMRS11 Norwood Ave - Flow Meter #1	gpm	0	NaN	0	NaN
3: Insertion Meter NMRS12 Rio Linda Blvd - Flow Meter #1	gpm	-7149.5	-1438.5	2596.6	-2.071
4: Insertion Meter NMRS13 Rio Linda Blvd - Flow Meter #1	gpm	-15	104.4	223	0.15
5: Insertion Meter NMRS14 Marrysville Blvd - Flow Meter #1	gpm	0	NaN	0	NaN
6: Insertion Meter NMRS15 Marrysville Blvd - Flow Meter #1	gpm	-28	291.3	442	0.419
7: Insertion Meter NMRS16 Del Paso Blvd - Flow Meter #1	gpm	0	NaN	0	NaN
8: Insertion Meter NMRS17 Del Paso Blvd - Flow Meter #1	gpm	57.5	79.9	101.6	0.115
9: Insertion Meter NMRS18 Norwood Ave - Flow Meter #1	gpm	-1290	-9.8	828.5	-0.014
10: Insertion Meter NMRS22 Dry Creek Rd - Flow Meter #1	gpm	368.6	712	1188.1	1.025

Lower Norwood-Marysville-Robla DMA Mass Balance Report

Water Loss Calculation for Monitoring Period (05/01/2019 - 05/31/2019)		
Duration of Monitoring Period	31	days
Service Connections in DMA	4993	# of service connections
Total Inflow (gal)	82,689,307	gal
Total Consumption (gal)	64,704,812	gal
Operational Used (gal)	0	gal
Total Losses (gal)	17,984,495	gal
Water Losses (gal/connection/day)	116	gal/con/day
Water Losses (GPM)	403	gpm
Results		
Water losses are inconsistent. WSO recommends relying on combined mass balance results for NMR DMA.		
Deploy Leak Detection Team:	**No**	



Full Norwood-Marysville-Robla DMA Flow Summary



Legend	Units	Min	Avg	Max	Average Vol./day (MG)
1: Insertion Meter NMRN09 Del Paso - Flow Meter #1	gpm	-1431.9	3194.2	7638	4.6
2: Insertion Meter NMRS10 Steelhead Creek - Flow Meter #1	gpm	-13.7	-4.3	0.3	-0.006
3: Insertion Meter NMRS11 Norwood Ave - Flow Meter #1	gpm	0	NaN	0	NaN
4: Insertion Meter NMRS12 Rio Linda Blvd - Flow Meter #1	gpm	-7149.5	-1438.5	2596.6	-2.071
5: Insertion Meter NMRS13 Rio Linda Blvd - Flow Meter #1	gpm	-15	104.4	223	0.15
6: Insertion Meter NMRS14 Marrysville Blvd - Flow Meter #1	gpm	0	NaN	0	NaN
7: Insertion Meter NMRS15 Marrysville Blvd - Flow Meter #1	gpm	-28	291.3	442	0.419
8: Insertion Meter NMRS16 Del Paso Blvd - Flow Meter #1	gpm	0	NaN	0	NaN
9: Insertion Meter NMRS17 Del Paso Blvd - Flow Meter #1	gpm	57.5	79.9	101.6	0.115
10: Insertion Meter NMRS18 Norwood Ave - Flow Meter #1	gpm	-1290	-9.8	828.5	-0.014
11: Insertion Meter NMRN19 Taylor Street - Flow Meter #1	gpm	0	NaN	0	NaN
12: Insertion meter NMRN20 Rio Linda Blvd - Flow Meter #1	gpm	851.2	4501.3	6718.7	6.482
13: Insertion Meter NMRN21 May St - Flow Meter #1	gpm	0	NaN	0	NaN
14: Insertion Meter NMRS22 Dry Creek Rd - Flow Meter #1	gpm	368.6	712	1188.1	1.025
15: Insertion Meter NMRN23 Fell St - Flow Meter #1	gpm	10	259.6	377.1	0.374

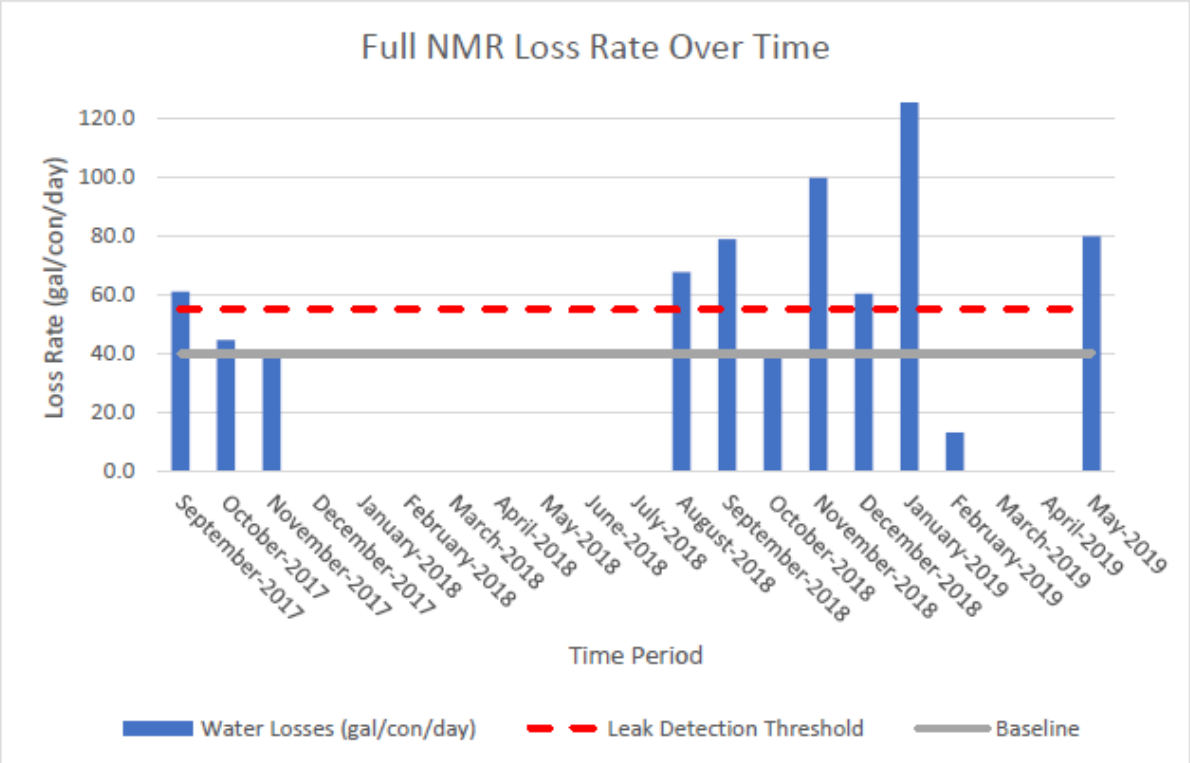
Full Norwood-Marysville-Robla DMA Mass Balance Report

Water Loss Calculation for Monitoring Period (05/01/2019 - 05/31/2019)		
Duration of Monitoring Period	31	days
Service Connections in DMA	9163	# of service connections
Total Inflow (gal)	155,306,218	gal
Total Consumption (gal)	132,653,619	gal
Operational Used (gal)	0	gal
Total Losses (gal)	22,652,599	gal
Water Losses (gal/connection/day)	80	gal/con/day
Water Losses (GPM)	507	gpm

Results

Water Losses have now surpassed the leak detection limit. However WSO suggets performing a confirmatory mass balance in June before deploying leak detection to this DMA.

Deploy Leak Detection Team:	No



Appendix 2

Assessment of Pilot District Metered Areas: Benefits, Challenges, and Business Case with Findings and Recommendations

March 2018

WSO

WSP | PARSONS BRINCKERHOFF

Executive Summary

The City of Sacramento Department of Utilities (DOU) has embarked on a pilot program to establish District Metered Areas (DMAs) in the water distribution system. The program was funded through a grant from the Department of Water Resources.

A DMA is a hydraulically discrete zone consisting of known points of inflows and outflows. By monitoring inflows and outflows, it is possible to assess Water Losses in the DMA. Generally speaking DMAs allow for ongoing monitoring to strategically deploy leak detection resources only when Water Loss levels indicate intervention is cost effective.

The primary benefits that DOU realizes through the implementation of these pilot DMAs can be summarized as follows:

- The DMAs enable DOU to monitor more of its network than possible with one leak detection crew.
- The DMAs allow for ongoing and automated monitoring of water losses in specific zones throughout the distribution system and deployment of leak detection crews in DMAs only when the level of recoverable leakage is economical.
- The DMAs provide the ability to set thresholds for leak detection in each DMA based on cost/benefit of intervention.
- The DMAs provide for ongoing detailed data analytics of consumption and DMA relevant system hydraulics data.
- The DMA results provide field validation of annual system wide audit results.
- DMAs are a proactive tool to aid with increasing regulatory pressures on water loss management and reduction.
- Through the implementation and operation of these pilot DMAs, DOU continues to exhibit industry leadership.

The primary challenges for a broader implementation of DMAs in DOUs distribution network can be summarized as follows:

- When valuing real losses at DOUs variable production cost there is no business case for DOU to do more than just the annual survey (FY2017) of about 18% of the system.
- Even when the DMAs are financed through grants it takes a significant amount of effort and work on the side of DOU to implement a DMA.
- The way DMAs need to be designed and implemented in DOUs system requires a significant number of supply metering locations making the implementation of a DMA quite costly and more complicated than what is typically seen.

- Until all customers are fully metered the unmetered accounts introduce a certain level of error in the water loss calculations for each DMA depending on the percentage of unmetered accounts.

Findings and Recommendations:

The evaluation of the benefits, the challenges and the general business case leads to the conclusion that **it does not appear to be in the interest of DOU to expand** its implementation of DMAs beyond the five pilot DMAs.

Considering the regulatory pressures (some of the outcomes/targets are not clear at this point), future droughts, and public pressure to demonstrate proactive management of water losses it would appear to be reasonable to value real losses at the cost of conservation measures. By doing so **the continuation of the pilot DMAs provides a benefit to DOU** by not having to randomly survey the areas covered by the DMAs and therefore helping DOU to meet more aggressive leak detection survey targets. The annual costs for the data plans and the online DMA water loss monitoring dashboard (nrwmanager) are less than the cost to achieve the required leak survey coverage on the areas covered by the DMAs.

If DOU considers expanding its DMA coverage in the future due to changing external pressures or different economic incentives it is recommended to wait until 100% of DOU customers are metered.

Table of Contents

1 Background

The City of Sacramento Department of Utilities (DOU) has embarked on the implementation of five pilot District Metered Areas (DMAs) (Bell Avenue, Lower Pocket, Brookfield Drive, Upper Norwood Marysville Robla and Lower Norwood Marysville Robla) to evaluate this innovative approach to water loss management. DMAs are discrete regions within the water system that feature metered points of inflow and outflow. Water Losses within the zone can be calculated as the simple difference between metered supply and authorized consumption.

The key principle behind DMA management is the use of flow to determine the level of leakage within a defined area of the water network. The establishment of DMAs allows one to determine the current levels of leakage in a given DMA and prioritize the leakage detection and location activities. By monitoring flows in the DMAs it will be possible to identify the presence of new leaks and breaks so that leakage can be maintained at the optimum level[1].

DMAs are an advanced water loss management tool currently not widely utilized throughout the United States. However, the 2018 North American Water Loss Conference in San Diego highlighted that more and more utilities in the US are starting to implement pilot DMAs or are working towards system wide DMA implementation.

The goal of this technical memorandum is to review if and how DMAs, as a water loss management tool, can aid DOU's overall water loss control program. Simple cost benefit analyses are not feasible for the evaluation of DMA implementation since the benefits materialize over time through targeted deployment of resources and not necessarily simply through leakage savings during the pilot period.

[1] Adapted from: IWA Water Loss Task Force: District Metered Area Guidance Notes, 2007

1.1 DMA Selection

Before implementing pilot DMAs within DOU's water distribution system, the project team (DOU and consultant team) identified ideal DMA locations. This was done by evaluating possible DMAs based on specific criteria. The criteria used to identify the best possible DMAs are as follows:

1. **Limited Number of Inflow/Outflow Metering Points**. Typically, a DMA limits the number of feeds into the DMA by closing boundary valves, which then minimizes the level of compounded error associated with input meters, as well as ensures adequate flows throughout. However, due to low pressure and water quality concerns expressed by DOU staff, closing boundary valves was not considered a viable option. Therefore, the Project Team attempted to use natural occurring boundaries to limit the number of inflow/outflow metering points. This is especially evident in the Lower Pocket DMA.

2. **DWR grant funded DMAs required to cover disadvantaged communities**. The DMAs covered by the DWR grant (Bell Avenue, Brookfield Drive, and Norwood Marysville Robla) were carefully selected to ensure they included disadvantaged community areas, as stipulated by the grant requirements.

3. **Limited number of unmetered accounts within DMA boundary.** The boundaries of the DMAs were selected to minimize the number of unmetered accounts within the DMA. By reducing the number of unmetered accounts within the DMA, the accuracy of the monthly consumption calculation will improve. Ideally, the DMAs would not include any unmetered accounts. However, due to criteria 1 and 2 listed above, some of the DMAs implemented still contained a significant amount of unmetered accounts. The project team has recommended DOU prioritize metering the unmetered accounts that occur within the implemented DMAs.

4. **Number of Service connections.** Finally, the number of service connections that occurred within the DMA was used to evaluate DMA boundaries. If a DMA has too many service connections, it becomes difficult to identify small increases in leakage. If a DMA has too few service connections, small inaccuracies (such as meter inaccuracy, theft, or inaccurate estimate of unmetered accounts) could disproportionately affect the calculation of water losses. Ideally, the number of service connections would be between 1,000 and 5,000, but because of the other limiting criteria (specifically criteria #1 and #2), some of the DMAs contain more (Norwood Marysville Robla) or less (Bell Avenue) connections then recommended. However at this point the number of unmetered accounts has a much bigger impact on the accuracy of monitoring water losses in DOUs DMAs than the number of service connections in a DMA.

The project team performed an in-depth investigation, which identified a variety of possible DMA boundaries. Each DMA was assessed using the four criteria listed above. Based on those criteria, Bell Avenue DMA, Lower Pocket DMA (funded through a Sacramento Municipal Utility District Grant not the DWR Grant), Brookfield Drive DMA, and Norwood Marysville Robla were implemented. Specific details regarding the DMA selection are outlined in Tech Memos *DWR-5 Hydraulics Memo, Pilot-1 City of Sacramento DMA Pilot Project*, and *Pilot-2 DMA Hydraulics Memo*.

1.2 DMA Implementation

After the DOU project team approved the selection of DMA locations based off the criteria identified, the selected DMAs were implemented. Implementing the DMAs required considerable effort from a variety of DOU staff and contractors. The following sections identify the major steps involved in implementing the DMAs and the key lessons learned.

1.2.1 Flow Meter Selection

Selecting an appropriate flow meter that would accurately measure and transmit all flows entering and exiting the DMAs was a major implementation step. The most suitable flow meter was selected by weighing the options against the following criteria:

- **NSF61 certification** – the flow meter must be NSF61 certified. This certification sets health effects criteria for water system components.
- **Low Flow Accuracy** – Given that no boundary valves could be closed many of the DMAs' inflow locations were identified during hydraulic modeling as having low flows (< 0.3 ft/s). Selecting a flow meter that can accurately measure low flow rates was key to ensure accurate water loss calculations.
- **Battery Powered** – Battery Powered flow meters were considered essential in order to reduce permanent electrical installation costs for remote flow meter locations.
- **Insertion Meter** – Many of the DMA inflow locations were on large diameter pipes (>30 inches). Purchasing a full-bore meter for these large diameter pipes would have been very costly. Furthermore, installing these meters would have temporarily interrupted service for some customers and the overall installation cost for chamber construction, re-piping and meter installations would have been significantly more expensive than the installation of insertion meters. Insertion meters were considered the optimal choice in order to reduce cost and maintain customer service.
- **Compatible with Badger AMI –** DOU requested the flow meters be able to transfer and store data in DOU's Badger AMI database.

The flow meter criteria listed above eliminated all but one type of insertion meter – the Hydreka Hydrins Encoded Output meter. This insertion meter was NS61 certified,

battery powered, accurate at low flows and was according to Hydreka's equipment specifications compatible with Badger's AMI system. With approval from DOUs project team the Hydreka Hydrins Encoded Output flow meter was selected for the DMA project.

1.2.2 Flow Meter Installation

For the initial flow meter installations in the Lower Pocket DMA, DOU designed the meter vaults and performed the installation of the meters in conjunction with the meter vendor and input from the project team. DOU designed the meters to be installed on the pipeline via a tap and contained within a manhole for belowground locations and directly on pipelines on bridge crossings for aboveground locations. Transmitters for the belowground installations were installed below the manhole lid. Transmitters for the aboveground locations were located adjacent to the bridge abutments. The meters and transmitters originally used were a cellular-based system that relied on 2G cellular network service. On 01/02/2017 AT&T discontinued 2G cellular service within the Sacramento area and the transmitters were unable to function. At this time, it was decided to switch to a different Hydrins data logger and transmitter system (Hydrins Encoded Output meter) that was thought to be compatible with DOU's existing Badger meter infrastructure and reporting software according to Hydreka's equipment specifications.

For the DWR-funded flow meter installations, the original DOU design was used with slight modification and constructed by an outside contractor. Below ground locations were classified as either high- or low-traffic, with high-traffic locations having the data logger and transmitter located outside of the traveled way in a meter box adjacent to the manhole. Aboveground meter installations were given additional protection with the addition of a steel mesh cage surrounding the meter.

During construction of these flow meter installations, several challenges were encountered. Record drawings and existing utility information was not available to the design team, which lead to several construction conflicts resulting in several meter locations being moved. Several large diameter pipelines were shallower than originally thought, leading to meter probes being swapped with other sites due to height constraints.

During construction of the DWR-funded phase, the meter vendor was working on resolving a communication issue with one meter in the Lower Pocket DMA. From this troubleshooting effort, it was determined that the Encoded Output meters were not fully compatible with Badger's system. The technical side of this issue is discussed in more detail below. After some negotiation with the meter manufacturer (Hydreka) and the equipment supplier (Matchpoint), it was agreed that the equipment supplier (Matchpoint) would pay for the transmitters to be swapped out with new data loggers

(DTU II) able to send complete data via a 3G cellular network. These new data loggers are provided on loan from Hydreka for 15 months at which point they would become the property of the City if no acceptable fix is provided for the Encoded Output transmitters before then.

In addition to the construction challenges, some operational challenges have been encountered. Some belowground vaults are prone to filling with ground or stormwater necessitating them to be pumped out for access. Aboveground installations may be vandalism targets due their proximity to walkways and transient populations.

1.2.3 Flow Meter Communication Issues

A compatibility issue was noticed between the Hydreka Insertion meter and Badger's AMI system after installing insertion meters. Specifically, Badger's AMI endpoints were unable to read and transmit Hydreka's insertion meter reads when they became negative. This caused incomplete and erroneous flow data to be stored in Badger's AMI database, which affected the Project Team's ability to monitor water losses within the DMAs. To correct this issue, the Hydreka insertion meters are being equipped with data loggers (DTU II). This will allow the flow data to be transmitted through cell towers to an ftp site and from there directly into the nrwmanager dashboard (an online program developed to monitor water losses with DMAs).

1.2.4 Customer Locations

Customer locations were identified to ensure all consumption occurring within the DMA was accounted for. Mapbooks, GIS Maps and billing databases were crosschecked to verify all customer locations. This investigation highlighted discrepancies between sources of information. The Project Team recommended the Mapbooks be updated to reflect the GIS Maps and several accounts were further verified through field investigations. The final list of customer locations was used to assess consumption occurring within the DMA.

1.2.5 Consumption Data

The Project Team attempted to collect accurate consumption data for every customer within the DMAs. For metered customers, DOU collects two forms of consumption data:

1) hourly AMI reads which is stored in the Beacon database and
2) monthly AMR reads which is stored in the billing database.

The Project Team has developed an automated process, which exports consumption data from the AMR database to the nrwmanager dashboard. AMI consumption data is

currently being uploaded manually, once a week, to the nrwmanager dashboard. DOU is working with Badger to develop an API coding process that will allow the AMI consumption data to be uploaded to the nrwmanager automatically. Once this is complete all metered consumption data will be uploaded automatically to the nrwmanager dashboard.

After consumption data is uploaded to the nrwmanager, automatic QA/QC checks are performed. These QA/QC checks have identified issues with anomalous consumption reads, mislabeled meter information, incorrect GIS coordinates, in both the AMI and the AMR databases and reported to DOU for investigation and follow up action. A more complete list of these issues is identified in the Benefits section described further on in this report (see section 4.3).

1.3 Implementation Cost:

Table 1 highlights the total implementation costs for the five pilot DMAs. Based on these numbers the average cost for designing and implementing a pilot DMA was around $374,000.

The DMA pilot project ran into a variety of issues during the implementation process. This affected the amount of time and money required to establish the pilot DMAs. If in the future DOU wishes to expand this program and implement new DMAs, the process is expected to be more efficient.

Pilot DMA Implementation Cost	
Item	**Cost**
City Labor	$298,900.55
Professional Services	$599,164.01
Construction Cost	$974,034.87
Total	$1,872,099.43

Table 1: Pilot DMA Implementation Cost Estimate

1.4 Monitoring Costs

Table 1 provides the annual cost for the automated data transfer and monitoring of DMA data.

DMA Monitoring Costs		
Item	Cost ($ / Year)	Notes
Cellular Costs	$3,861	Cellular Data costs to transmit data from 28 Dataloggers @ $137.88 /year /site
nrwmanager Fee	$15,000	Ongoing Maintenance Fee for nrwmanager/year
Total	$18,861	

Table 2: Pilot DMA Annual Monitoring Costs

2 DMA Monitoring

After establishing the DMA boundary and collecting the necessary consumption (AMI/AMR records) and flow data (hourly insertion meter reads), the project team initiated monitoring water losses within the DMAs.

Monitoring leakage losses within a DMA is typically conducted in two primary ways:

1. **Minimum Night Flow (MNF):** By analyzing daily trends in inflow, one can identify periods of lowest inflow into the DMA. These time periods are typically late at night because the minimum night flow rate should remain relatively constant day-to-day in the absence of summer night-time irrigation and water use. An increase in the Minimum Night Flow rate that is not attributed to authorized nighttime use can indicate an increase in Water Losses. However, the DOU pilot project has shown that this methodology is not reliable when conducted during the summer months due to seasonal trends in irrigation (see Figure 1).

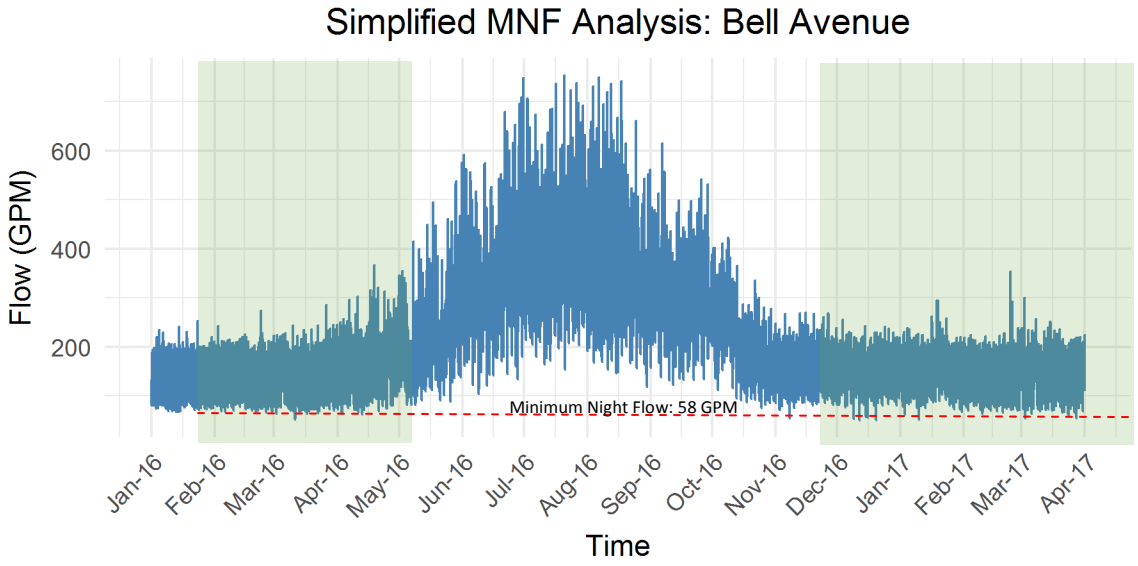


Figure 1: Minimum Night Flow Analysis Overview

2. **Mass Balance**: By adding the total volume of inflow into the zone and subtracting the total volume of water used in a specific time period, DOU can calculate the volume of Water Loss (see Figure 2). While conceptually simple, this approach is complicated by multiple sources of consumption data (estimated unmetered accounts, AMI data, and AMR data) for each DMA. However, The Project team has implemented an online dashboard (the nrwmanager) that automates this calculation as well as provides an easy to navigate tool that can track water loss and DMA performance throughout DOUs water distribution system.

Lower Pocket DMA Mass Balance Report - Dec. 2017

Water Loss Calculation for Monitoring Period (12/01/2017 - 12/31/2017)		
Duration of Monitoring Period	31	days
Service Connections in DMA	4143	# of service connections
Total Inflow (gal)	47,449,831	gal
Total Consumption (gal)	41,551,491	gal
Operational Used (gal)	0	gal
Total Losses (gal)	5,898,340	gal
Water Losses (gal/connection/day)	46	gal/con/day
Water Losses (gal/mile/day)	4,506	gal/miles/day
Water Losses (GPM)	132	gpm
Deploy Leak Detection Team:	**No**	

Note: Inflow data for Site 5 insertion meter was unavailable for May-17 Mass Balance. Therefore, the Water Loss assessment for this month is considered inaccurate

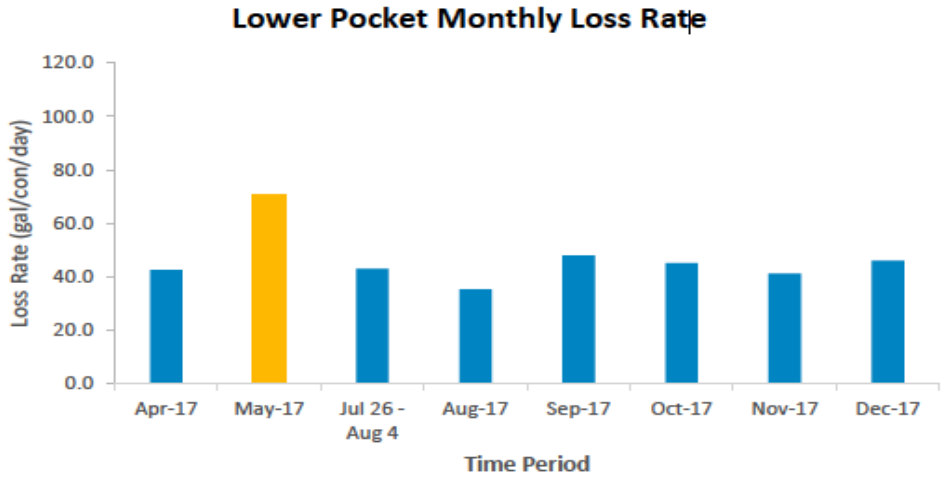


Figure 2: Example Monthly Mass Balance Report for Lower Pocket DMA

The monitoring of DMA data has shown that due to summer irrigation the minimum night flow analysis is unreliable during periods of irrigation. As a result, the Project Team relied on the Mass Balance Results to monitor water losses within each DMA.

2.1 Baseline Calculation and Leak Detection Threshold

The Water Loss values calculated from the Mass Balance approach (net inflow minus total consumption within the DMA) includes all forms of water loss; background leakage, apparent losses, and real/recoverable leakage. The Project Team performed an

initial leak detection survey on all DWR funded DMAs[2] in order to calculate each DMAs' minimum Water Loss level. The minimum Water Loss level, or baseline, only includes water losses that are not recoverable through leak detection, such as small seeps or drips undetectable through standard leak detection surveys. Therefore, any significant increase in Water Losses above the DMA's baseline is considered recoverable through leak detection.

After establishing a baseline Water Loss assessment, the economic leak detection threshold can be calculated. The economic leak detection threshold is the point when the cost of recoverable leakage is greater than the cost of leak detection for that DMA. Table 3 highlights how the leak detection threshold is calculated for the Bell Ave DMA. The same approach is used for the other DMAs.

Required Level of Recoverable Leakage - Bell Ave			
A	Average Cost of Leak Detection	$ 574.93	$ / mile of main
B	Miles of Main	9.78	miles
C=A * B	Total Cost of Leak Detection	$ 5,622.79	$
D	Alternative Cost to Save Water (Conservation Plan)	462	$ / AF
E= C / D	Required Vol of Recoverable Leakage	12.17	AF
F= E * 325,851 / 613 / 365	Required rate of Recoverable Leakage	17.72	gal/con/day

Table 3: Calculating Leak Detection Threshold for Bell Avenue DMA

It is important to note that the recoverable leakage cost was evaluated at the lowest cost to save an acre-foot of water, as evaluated by The City of Sacramento's 2013 Water Conservation Plan. This value reflects the costs required for the City to reach its target water use rate of 233 gallons per connection per day. If DOU decides to evaluate the cost of leakage at a different rate, the leak detection threshold would need to be updated.

2.2 Issues Experienced During DMA Monitoring

During the monitoring phase, the project team encountered several issues. First, the mass balance analysis showed inconsistent water losses occurring within the Bell Avenue DMA. The inconsistent water losses prompted an in-depth investigation into what may be causing this issue. The project team performed a pressure survey and identified that check valves, which were believed to only allow inflow into the DMA in case of a significant pressure drop in the DMA, were in fact opening and allowing water to exit the DMA unmetered. Without having an intact boundary, where all flows into

[2] No leak detection survey was conducted in the Lower Pocket DMA since the water loss levels remain low and grant funding for leak detection was not provided for this DMA

and out of the DMA are measured, the Project Team is unable to accurately calculate water losses in the Bell Avenue DMA. The findings from this investigation are also important in understanding the distribution system hydraulics. It is recommended that this latest information be used to update the hydraulic model for this area.

Second, during the monitoring phase, the project team identified that contrary to what the Hydreka equipment specifications claimed the Hydreka insertion meters were not fully compatible with the Badger endpoints/beacon system. This incompatibility issue resulted in incomplete and erroneous flow data being reported to the nrwmanager. With incomplete/erroneous flow data the Project Team is unable to calculate water losses occurring within the DMAs. In order to solve this issue, dataloggers are being installed at each insertion meter location. The dataloggers will collect the flow data directly from the Hydreka insertion meter and upload it to the nrwmanager. After the dataloggers are installed, the project team will be able to monitor water losses in the DMAs.

Furthermore, many of the display units on the Hydreka insertion meters have recently become cracked, effecting the ability to perform manual reads. With installation of dataloggers, manual reads should no longer be necessary. During the datalogger installation, the Hydreka display units will be replaced with compatible datalogger units. This will ensure the meters remain water resistant but manual reads will require a computer connection.

Lastly, the nrwmanager continues to identify data anomalies occurring within the AMI database. These data anomalies are infrequent but can have a substantial impact in water loss assessment. A procedure has been put in place to identify the largest data anomalies within each DMA but the root cause for these anomalies remains unknown. Badger is continuing to work with DOU in creating a more effective data transfer process, and this may solve the majority of these issues.

3 DMA Monitoring Results

Incomplete flow data has affected the ability to accurately calculate and track water losses for each DMA on a consistent basis. However, the additional information obtained from this project has provided a greater understanding of non-revenue water within DOU's distribution system. Specifically, there is a stronger understanding of: leak detection survey results, leak detection thresholds, and intermittent water loss calculations. This information provides a broader understanding to the non-revenue water issues within DOU's distribution system.

3.1 Leak Detection Survey Results

The primary objective of monitoring DMAs is to identify when water losses reach a level that economically justifies leak detection. In order to perform this recommendation, the baseline water loss level[3] must be determined first. To calculate the baseline water loss level, a comprehensive leak detection survey was performed in all of the DWR Grant funded DMAs.[4] The results from the initial leak detection survey are outlined in Table 4 below.

Initial Leak Detection Results by DMA			
DMA	# of Customer Side Leaks Located	# of Distribution side leaks located	Estimated Distribution side leakage identified (GPM)
Brookfield Dr.	1	3	11 GPM
Lower NMR	0	0	0 GPM
Upper NMR	1	4	26 GPM
Bell Ave.	5	3	21 GPM
Total	7	10	58 GPM

Table 4: Initial Leak Detection Results

By repairing the distribution-side leaks identified during the initial DMA surveys, our best estimate is that DOU can expect to annually recover 30.5 MG gal per year.

Overall the results of the leak detection survey in the DWR Grant funded DMAs indicate that these DMAs are experiencing relatively low levels of leakage.

3.2 Leak Detection Thresholds

After establishing a baseline water loss assessment, the economic intervention threshold can be calculated. The economic intervention threshold is the point at which the volume of water expected to be recovered through leak detection is worth more than the cost of leak detection. When water losses exceed the economic intervention threshold, leak detection becomes cost effective and should be deployed.

Due to the issues discussed earlier (unmetered flow entering/exiting the Bell Ave DMA through check valves, and incomplete / erroneous flow data due to Hydreka/Beacon

[3] That is, the volume of water losses that cannot be recovered through a traditional leak detection survey.

[4] No leak detection survey was conducted in the Lower Pocket DMA since the water loss levels remain low and grant funding for leak detection was not provided for this DMA.

incompatibility) the Project Team has been unable to identify an accurate baseline assessment. The economic intervention threshold per DMA, outlined in Table 5, highlights the volume of water losses above the baseline, which would justify leak detection. Once complete inflow data is available, the project team will be able to calculate the baseline values and provide specific leak detection thresholds for each DMA. For calculating the intervention thresholds leakage (real losses) was valued at the minimum cost to save water through other water conservation methods (assumed to be $462/AF, adopted from Program C1 of The City of Sacramento's 2013 Water Conservation Plan.

Economic Intervention Threshold - Volume of Water Losses Above Baseline				
DMA	# of Miles	# of Connections	Cost of Leak Detection	Required Rate of Recoverable Leakage (gal/con/day)
Brookfield Dr.	34	3,597	$19,275	**10**
Lower NMR	62	5,044	$35,414	**14**
Upper NMR	59	4,132	$34,133	**16**
Bell Ave.	10	613	$5,726	**18**
Lower Pocket	42	4,143	$24,278	**11**

Table 5: Economic Intervention Threshold Above Baseline

3.3 Understanding DOU's Water Losses

In several DMAs the DMA monitoring results are limited due to incomplete flow data. However, the data that is made available through the DMA program still provides valuable insight into DOU's Non-Revenue Water. Specifically, investigations into customer meter inaccuracy, the preliminary results of water losses for each DMA and leak detection results all help illustrate the different forms of water losses that are occurring throughout DOU's water distribution system.

Understanding the types of water losses occurring within the water distribution system allows DOU to refine the approach to managing non-revenue water.

3.3.1 Customer Meter Inaccuracy

To assess DOU's customer meter accuracy, the Project Team tested a representative sample of small customer meters (53 meters with sizes of 1.5 inches or less) within the Lower Pocket DMA.

The Project Team followed the AWWA meter testing guidelines by testing a variety of flow rates for each meter. To assess the overall accuracy of meters, the accuracy at each

flow rate that was tested was weighted according to the volume of water that passes through the meter at these flow rates.

Following this procedure, the overall accuracy of small customer meters can be assessed. Figure 3 depicts the meter accuracy results by meter type and flow rate.

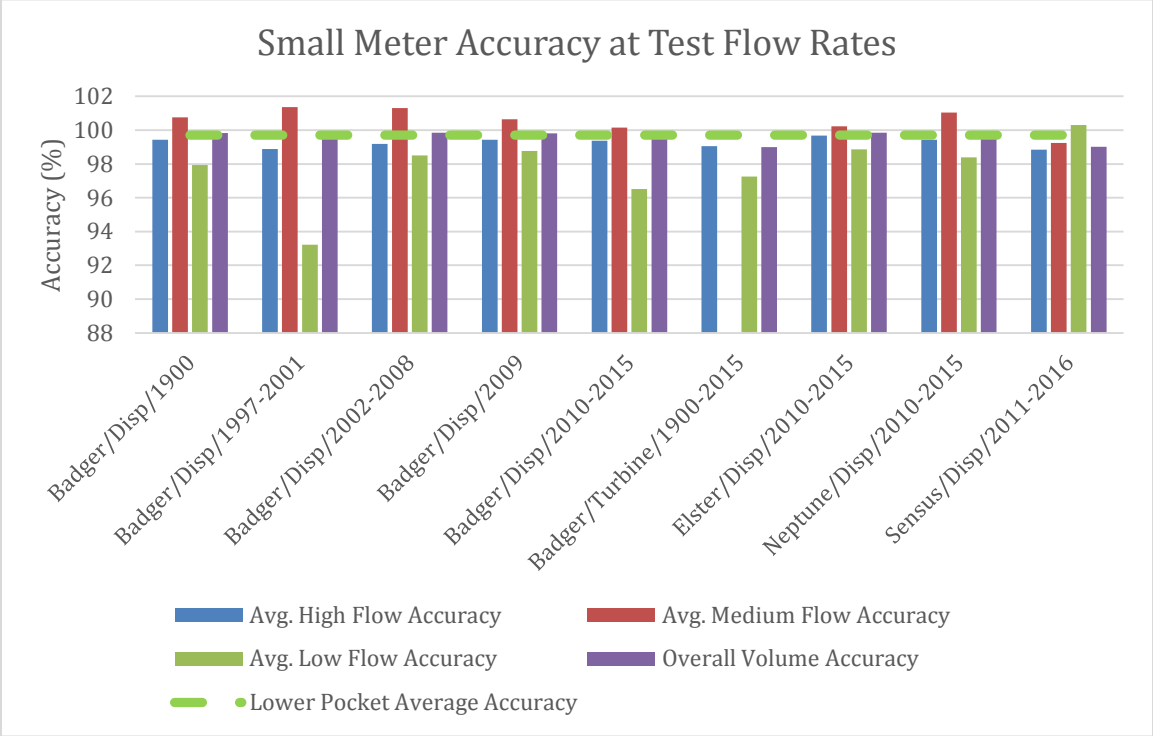


Figure 3: Small Meter Accuracy Test Results

The meter test results from Lower Pocket DMA suggest the small meter population to be very accurate (with an overall accuracy of 99.7%). If these results are indicative of all customer meters within DOU's water distribution system, then non-revenue water losses due to meter inaccuracy would be minimal. A bigger data set of randomly tested small meters from DOUs distribution network would ultimately be needed to confirm that the test results from the Lower Pocket DMA can be extrapolated.

However, given the relatively young age of DOUs small meter population it is reasonable to assume that the meter test results from Lower Pocket are fairly representative of DOU small meter population.

3.3.2 Preliminary DMA Baseline results and Asset Management

As discussed earlier, the DMA water loss control methodology calculates the baseline level of losses for each DMA and establishes leak detection thresholds. The DMAs'

baseline excludes all leakage that is detectable through acoustic leak detection surveys. Therefore, the baseline assessment for each DMA characterizes the level water losses where in DOUs case the majority is due to background leakage (undetectable seeps and drips) plus a minor component of customer meter under-registration (confirmed through meter tests to be low) and potentially theft.

Background losses can only be reduced through pressure reduction and/or pipe rehabilitation/replacement. Therefore, characterizing the background losses on a DMA basis is a useful tool when considering pipe replacement strategies.

At this point, it is important to note that the baseline levels are preliminary due to at times incomplete flow data. Therefore it's not feasible to try to assess correlations between pipe age and baseline levels or pipe material and baseline levels. Once accurate baseline levels are assessed for all DMAs the project team will run such an analysis.

Generally speaking the levels of background leakage estimated for each of the DMAs is relatively moderate. So background leakage does not appear to be a significant factor in deciding mains replacement strategies for these five DMAs.

3.3.3 Refinement of Non-Revenue Water Assessment

The DMA based water loss assessment and monitoring together with DMA field investigations and DMA leak detection results provides DOU with additional data to better inform overall non-revenue water assessment.

Specifically, DOU calculates their system-wide non-revenue water losses using a yearly, top-down water audit (as mandated by the State of California). This water audit performs a mass balance for the entire distribution system to estimate overall non-revenue water losses per year. Given that a significant portion of DOUs authorized consumption needs to be estimated the results of the water audit will naturally have a wide range of error.

The DMA results provide data and insight allowing DOU to use the DMA's average water loss results to compare against and confirm the system wide annual audit results. The DMA results provide a bottom-up water loss assessment (field measurements through the DMA approach) to compare/confirm the results of the top-down system-wide water audit results.

For example, DOU's FY2017 water audit estimated non-revenue water losses of around 40 gal/con/day. The DMAs' preliminary water loss results suggest a weighted average of 45 gal/con/day. The slightly higher DMA water loss results are well within DOU's water

audit's margin of error. Indicating that the system wide audit results fall within a range of water loss that is also seen in the field through the DMA monitoring.

Further refinement to DOUs non-revenue water assessment came through the customer meter test work, DMA leak detection and DMA monitoring. A clearer picture of DOU's water loss profile emerges than what the system-wide annual water audit provides. The main refinements are:

- Apparent Losses due to customer meter inaccuracies appear to be low and DOUs small customer meters seem to perform very accurately.
- Recoverable leakage through leak detection is moderate and supports the system wide water audit results.
- Like in most systems, background losses compose a noteworthy portion of DOUs total real losses – around 34% of total real losses based on the results of a real loss component analysis modelling exercise (see section 4.1).
- The DMA monitoring indicates that the build up of new leakage is slow in the areas covered by DMAs.
- The areas covered by the pilot DMAs do not seem to represent priority areas for active leakage recovery or infrastructure replacement based on the leakage levels observed.

4 Business Case Review

Simple cost benefit analyses are not feasible for the evaluation of DMA implementation since the benefits materialize over time through targeted deployment of resources and not necessarily simply through leakage savings during the pilot period.

To evaluate how DOUs pilot DMAs may fit or may not fit in with DOUs leakage management strategy the following approach was taken:

- First a Real Loss Component Analysis (RLCA) modelling exercise was conducted for FY2017 using DOUs FY2017 water audit results and the leak repair data (from reported leaks and unreported leaks).
- Second the results of the RLCA model were then used to assess the economic frequency of intervention (economic optimum frequency for proactive leak detection) using two ways of valuing DOU's real losses. One model valued real losses at the FY2017 variable production cost of $121.82/AF and the other model used a higher valuation of real losses at the minimum cost to save water through

other water conservation methods (assumed to be $462/AF, adopted from Program C1 of The City of Sacramento's 2013 Water Conservation Plan).

- The results of the economic frequency of intervention were compared to DOUs actual leak detection frequency in FY2017.
- The project team also assessed the avoided cost of not having to do leak detection in the pilot DMAs since the monitoring allows deployment of resources only when the leakage levels are at a point where deployment of DOUs leak detection team is cost effective.

4.1 Results of the Real Loss Component Analysis Model

Break and Background Estimate (BABE) Component Analysis, a systematic approach to modeling Real Losses, was developed during the UK National Leakage Initiative between 1991 and 1993. The model recognizes that the annual volume of real losses consists of individual leakage events where the volume lost to each leak is a function of that leak's flow rate and duration before repair. In addition, a Real Losses Component Analysis (RCLA) recognizes that distinct forms and magnitudes of leakage are best addressed through distinct interventions. **It is important to highlight that a RLCA is a modelling exercise and it should be seen as such.**

A RLCA model divides leakage into three categories: Reported Leakage, Unreported Leakage, and Background Leakage. Each of these categories is defined by typical characteristics outlined in the Table 6 and Figure 4 below.

TYPE	DISCOVERY	FLOW RATE	DURATION	INTERVENTION
Reported	reported to utility by customers and staff; usually surfaces	varied, but generally high flow rates	relatively short duration function of leak repair practices	shorter repair times pressure optimization
Unreported	unsurfaced; discovered through proactive leak detection	varied but sufficient to be acoustically detectable; generally mid-range flow rates	duration is a function of proactive leak detection policy	proactive leak detection and repair pressure optimization
Background	undetectable	acoustically undetectable, low flow rates (e.g. seeps and drips at joints and fittings)	ongoing	pressure optimization infrastructure replacement

Table 6 Categories of Leakage

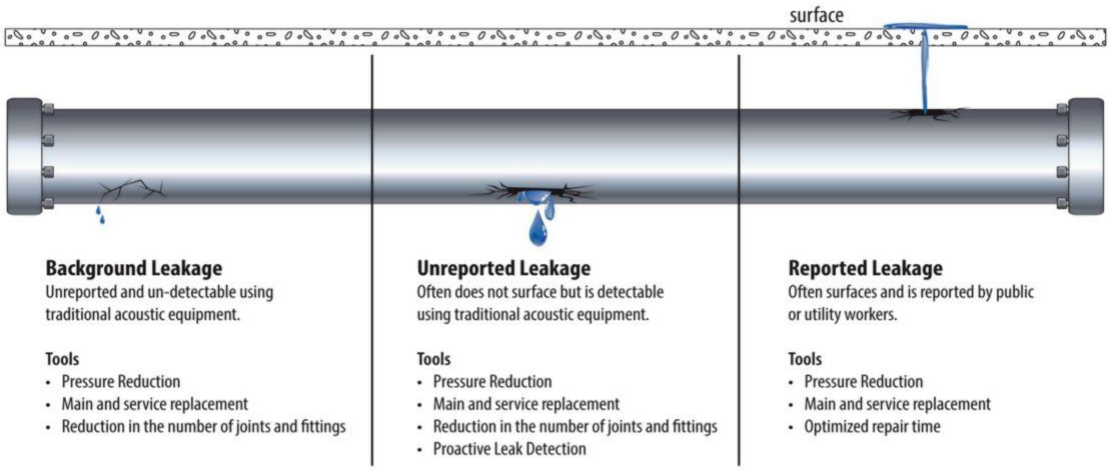


Figure 4 Components of Real Losses and Tools to Intervene

As these definitions indicate, leakage is categorized by how DOU interacts with it. DOU is made aware of reported leakage by both customers and utility personnel during standard operations. In contrast, unreported leakage is *only* discovered through proactive acoustic leak detection. Background leakage cannot be acoustically detected and is best managed through pressure optimization.

Following the AWWA M36 recommended approach and based on the leak repair data for both reported and unreported leaks received from DOU and an assumption that background leakage in DOUs system is two-times the technical minimum the RLCA model provided the following results.

FY2017 Leakage Volume

CATEGORY	VOLUME (AF)	% OF TOTAL
Reported	96	1.8%
Unreported	90	1.7%
Background	1,786	33.6%
Hidden	3,350	62.9%
TOTAL	**5,322**	**100%**

Its important to acknowledge that the RLCA is a modelling exercise and that there is uncertainty associated to the results of the RLCA due to:

- accuracy of FY2017 Water Audit results
- accuracy of leak repair reports and estimated leak flow rate and runtime
- estimation of background leakage

With these considerations in mind, the RLCA model results indicate that DOU's real losses are mainly made up by Hidden Losses, leaks running in the system that could be detected through proactive leak detection. Generally speaking this is a typical picture among California water utilities. Leakage losses from reported and unreported leaks are relatively small in the case of DOU indicating good response times to leaks that DOU is aware of.

4.2 Current DOU Proactive Leak Detection Strategy

DOU surveyed 18% of its distribution network in FY2017, 18% in FY2016 and in FY2015 it surveyed about 10% of the system. DOU conducts proactive leak detection with a dedicated 2-man crew.

For FY2017 the internal cost of proactively surveying the distribution network was $575/mile surveyed. A total of 304 miles were surveyed for leaks by the DOU leak detection team in FY2017 resulting in a total survey cost of $175,000. This survey expense is the primary cost used in leak detection cost-benefit analysis that balances the costs of intervention with expected water savings.

The costs of leak repair are generally *not* included in leak detection intervention frequency analysis, since leak detection does not actually introduce the cost of repair. Once a leak develops, DOU will likely repair it at some point, with the date and nature of the repair dependent on when the leak is discovered (quickly through proactive leak detection or eventually when the leak surfaces).

The leak detection cost-benefit analysis presented in this report is conservative because it does not include benefits that are difficult to quantify, including:

- Reduced staff overtime for repairs as a result of planned repair instead of reactive leak repair
- Lower leak flow rates and corresponding minimized damage resulting from earlier detection of leaks
- Reduced environmental impacts of unattended leakage
- Infrastructure condition monitoring from periodic survey

Periodic and proactive leak detection combats the accumulation of new leakage in a distribution system. The figure below illustrates the accumulation of new leakage in the absence of proactive intervention.

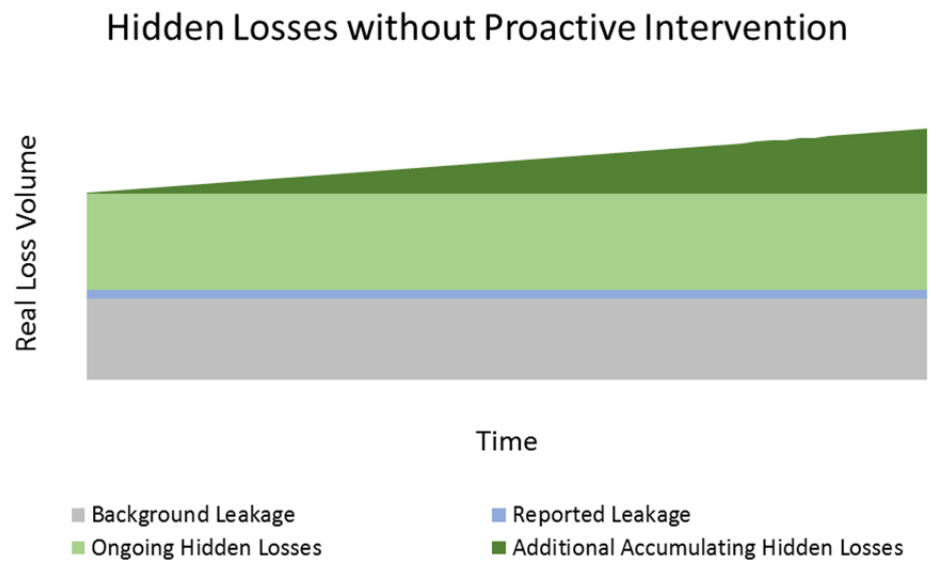


Figure 5 Accumulation of Hidden Losses without Proactive Leak Detection

Conversely, when proactive leak detection periodically attends to a utility's Hidden Losses, the utility's experience of leakage will mirror that depicted in the figure below, where leakage accumulates between surveys and is episodically eliminated through proactive detection and repair. The longer the period between surveys the more leakage can accumulate.

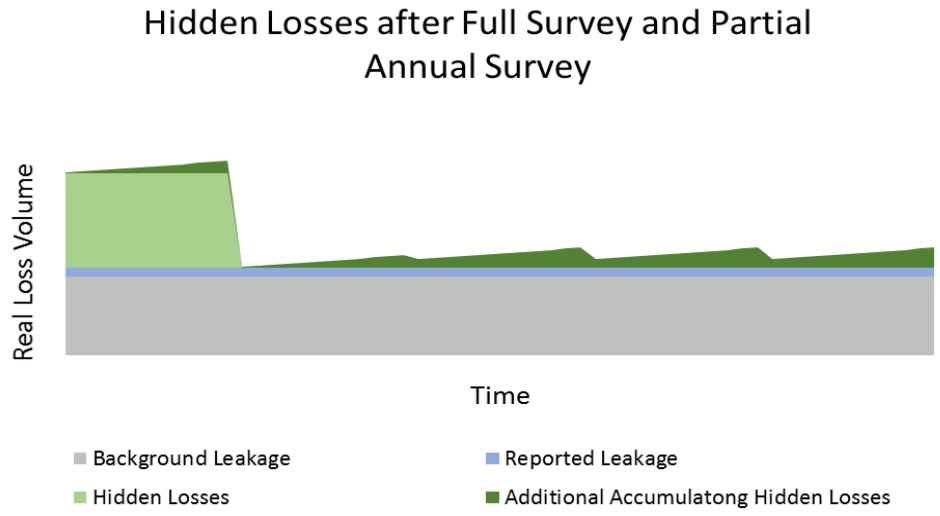


Figure 6 Hidden Losses after Full Survey and Partial Annual Survey

Because DOU surveys its entire distribution network approximately once every 5.5 years using the survey rate of FY2017 (18% of system), the volume of Hidden Losses experienced in any given year consists of leaks developed during that year and the backlog of leakage that builds up between surveys. To assess whether the current pace of survey is appropriate the economic intervention frequency for proactive leak detection was calculated.

Following the AWWA M36 recommended approach, the economic intervention frequency (EIF) is calculated using the rate of rise method. In this method, the economic intervention frequency is defined as the rate of intervention at which the cost of active leakage control equals the cost of leaking water. Three parameters need to be assessed to use this method:

- Average rate of rise of unreported leakage (RR)
- The cost of leak detection survey intervention (CI)
- The cost of Real Losses (CV)

Once these three parameters are known it is possible to assess EIF for any size system or subsystem. It is important to begin the calculation of EIF with units in mind. The unit of time incorporated in the Rate of Rise input will be the unit of time in which EIF is returned.

- The economic frequency of intervention (EIF) to find unreported leaks

$$EIF = \sqrt{\frac{2 \times CI}{CV \times RR}}$$

- The economic percentage (EP) of the system that should be inspected each year (with EIF inputted in months)

$$EP_{\%} = 100 \times 12 \div EIF_{months}$$

- The appropriate annual budget for intervention (ABI) (excluding leak repair cost)

$$ABI_{\$} = EP \times CI$$

- The economic annual volume of unreported real losses (EURL), corresponding to the EIF.

$$EURL = ABI \div CV$$

The rate of rise of leakage is defined as the development of new leakage that occurs with time in all systems. The rate of rise of unreported leakage can be estimated using the International Water Association (IWA) and AWWA approach if other data is not available. IWA/AWWA sets forth standard estimates for the annual occurrence of unreported leaks. These estimates are based on international data collected after leaks have been located and repaired in District Metered Areas (DMAs).

Without active leak detection, new unreported leaks would continue to run undetected each year. Therefore, each year the total volume of unreported leakage would increase by the amount predicted by the IWA/AWWA Unavoidable Annual Real Losses (UARL) formula.

Table 7 shows the calculation for the predicted rate of rise of unreported leakage for DOU using the UARL constants (a conservative approach assuming that new leakage develops at the minimum rate established by the UARL constants).

Based on the UARL formula, and the DOU's system characteristics, the average rate of rise for unreported leakage is 0.16 kgal/mile of main/day.

DOU System Characteristics			
A	Miles Mains	1,686.00	Miles
B	Number of Service Connections	154,049	Count
C	Length of Service Connections: Curb to Meter	0	Miles
D	Average Pressure	45	PSI

Accumulating Unreported Leakage from UARL Formula			
	Infrastructure Component	UARL Unreported Leaks*	UARL Unreported Leaks (gal/day)
E = **0.77***A*D	Mains	0.77 gal/mile of main/day/psi	58,420
F = **0.03***B*D	Service Connection: Mains to Curb Stop	0.03 gal/conn/day/psi	207,966
G = **2.12***C*D	Service Connection: Curb Stop to Meter	2.21 gal/mile of servconn/day/psi	0
H = E + F + G	Annual Unreported Leak Volume		266,386
= H/A/1000	**Average Rate of Rise of Unreported Leakage (kgal/mile of main/day): 0.16**		

* Constants based on international data collected on the rate of rise of leakage for different infrastructure components by the International Water Association (IWA) and adopted by AWWA.

Table 7: Accumulating Unreported Leakage - Rate of Rise

4.2.1 Economic Intervention Frequency at Variable Production Cost Valuation

When real losses are valued at the FY2017 Variable Production Cost ($121.82/AF), the least cost point for DOU occurs when the leak survey interval is 88 months (survey the entire system once every 88months or 7.3 years) with an average runtime for unreported leaks of 44 months.

Using the FY2017 cost of $575/mile of detailed leak survey, the optimal annual budget for leak detection would be about $133,000/year to survey approximately 14% of the system annually.

- **Annual Budget for Intervention (ABI):** $133,000/year
- **Economic Percentage of System for Annual Survey (EP):** 14% / 1,686 miles
- **Economic Annual Volume of Unreported Real Losses (EURL):** 1090 AF/year

Economic Intervention Approach to Combat RR	Output	Units
Economic Intervention Frequency (EIF)	88	Months
Average Leak Run Time	1333	Days
Economic % of System Surveyed per Year	14%	
Economic Mileage of Survey per Year	231	Miles
Average Annual Budget for Intervention (ABI)	$132,742.80	
Economic Unreported Real Losses (EURL)	355,068	kgal/year
Economic Unreported Real Losses (EURL)	1090	AF/year

At this valuation (Variable Production Cost) of real losses the economic intervention frequency for proactive leak detection is less than the mileage (304 miles) DOU surveyed in FY2017. Meaning that at this valuation the current survey frequency is above what the model would predict as economically optimized.

Under this scenario there is no financial incentive for DOU to cover more mileage with proactive leak detection than the current 304 miles.

This would also mean that the additional portion of the network covered by the DMAs is beyond what is needed or cost effective for DOU. **Under this scenario the DMAs would not add additional value to DOUs leakage management strategy.**

4.2.2 Economic Intervention Frequency at Conservation Cost Valuation

When real losses are valued at the minimum cost to save water through other water conservation methods (assumed to be $462/AF, adopted from Program C1 of The City of Sacramento's 2013 Water Conservation Plan) the least cost point for DOU occurs when the leak survey interval is 45 months (survey the entire system once every 45months or 3.75 years) with an average runtime for unreported leaks of 22.5 months.

Using the FY2017 cost of $575/mile of detailed leak survey, the optimal annual budget for leak detection would be about $259,000/year to survey approximately 27% of the system annually.

- **Annual Budget for Intervention (ABI):** $259,000/year
- **Economic Percentage of System for Annual Survey (EP):** 27% / 1,686 miles
- **Economic Annual Volume of Unreported Real Losses (EURL):** 560 AF/year

Economic Intervention Approach to Combat RR	Output	Units
Economic Intervention Frequency (EIF)	45	Months
Average Leak Run Time	684	Days
Economic % of System Surveyed per Year	27%	
Economic Mileage of Survey per Year	450	Miles
Average Annual Budget for Intervention (ABI)	$258,507.20	
Economic Unreported Real Losses (EURL)	182,326	kgal/year
Economic Unreported Real Losses (EURL)	560	AF/year

At this valuation (conservation cost) of real losses the economic intervention frequency for proactive leak detection is almost double the mileage DOU surveyed in FY2017. To achieve this goal DOU would probably need to dedicate/hire a second two-man leak detection crew.

The pilot DMAs established by DOU over the past three years cover about 12% (207miles) of the DOU distribution network. So when combining DOUs proactive leak detection efforts (18% of system covered each year) and the portion of the system that is covered by DMAs (12% of distribution system) DOU has an annual coverage of the system of 30%.

Given that the miles covered by the DMAs (207 miles) will not need to be surveyed by random leak detection, DOU has to cover 1,479 miles (1,686 miles – 207 miles) in 3.75 years under this valuation of real losses. This means that the DOU leak detection team would need to cover 395miles per year (1,479 miles / 395 miles/yr = 3.75years) to achieve the economic intervention frequency. **Under this scenario the DMAs provide benefit to the DOU leakage management strategy by reducing the mileage that needs to be randomly surveyed, potentially allowing DOU to achieve this survey target with only one leak detection team.**

4.2.3 Cost to Conduct Leak Detection in Areas Covered by Pilot DMAs

At 2017 costs for internal resources it costs about $119,000 to survey all pilot DMAs covering about 207 miles of mains. By not having to survey the DMAs unless the DMA monitoring indicates economically recoverable leakage DOU avoids that cost.

Currently DOU surveys 18% of the system each year. For evaluation purposes we assume that 18% of the DMA mileage would be covered each year without the DMAs in place. So the cost for leak detection efforts directed towards the DMA covered areas would be $21,400/year.

The savings per year of not having to do any leak detection in the DMAs under the current leak detection strategy would be $21K/ year and would accumulate over the years. These simple savings would cover the monitoring cost (sim-card data plan costs = $3,861/year) and the cost for the ongoing maintenance of the nrwmanager ($15,000/year).

4.3 Additional Benefits to DOU:

Through the implementation of the pilot DMAs a significant amount of time went into detailed analysis of DMA relevant data and a refinement in understanding the system hydraulics. The additional benefits, which are hard to financially evaluate can be grouped by:

Data Management

A rigorous and ongoing analysis of billing data on a DMA by DMA basis has resulted in:

- Improved understanding of DOUs AMI and AMR consumption data.
- Analyses have uncovered misalignment between the two data sources (AMR and AMI data base) in both the Bell Avenue and Lower Pocket DMAs.
- DOU was able to identify and resolve an issue causing AMI consumption data to go missing in the Bell Avenue DMA.
- DOU was able to identify and investigate AMI meters with a high percentage of estimated reads.
- DOU was made aware of scaling issues with the meter readings from several locations within the Lower Pocket DMA.
- DOU was informed that the billing database is not recording consumption for several metered accounts in the Lower Pocket DMA.
- DOU was made aware of inconsistencies between customer data stored in GIS and what is recorded on paper map books.

System Hydraulics

- Improved insight about system hydraulics including pressure and flow dynamics in each of the DMAs.
- Pressure Recording - Indicates appropriate pressure for Lower Pocket and Bell Avenue (Not too high and therefore wasting energy and decreasing remaining service life of infrastructure, and not too low as to cause issues for customers).
- DOU was able to identify pressure transients that occurred in the Bell Avenue DMA in November of 2016.
- Bell Ave DMA check valves allow flow out of DMA into adjacent areas.

Customer Meter Accuracy

- DOU, through random meter testing, has validated that small customer meters are performing accurately within Lower Pocket. This indicates that Apparent Losses from meter inaccuracy is relatively low, and therefore DOU's focus should remain on real losses (leaks).

Regulatory Pressure and Industry Leadership:
There are several regulatory drivers for DOUs water loss control program.

- **SBX7-7** requires the reduction DOUs per capita water consumption by 20% by 2020. It is a major goal for DOU to meet or exceed a 20% GPCD reduction by 2020. DOU is meeting and exceeding the GPCD required targets. In FY2017 DOU was at 156 GPCD. An ongoing focus on water loss control efforts will help DOU maintain the low PPCD levels.

- On April 7, 2017, the State of California released the "Making Water Conservation a California Way of Life, Implementing **Executive Order B-37-16**" Final Framework Report[5] (State Framework Report). The State Framework Report, which builds upon Governor Brown's call for new long-term water use efficiency requirements in Executive Order (EO) B-37-16, provides the State's proposed approach for implementing new long-term water conservation requirements. A key element of the report is proposed new water use targets for urban water suppliers that go beyond existing Senate Bill X7-7 (SB X7-7) requirements[6] and are based on strengthened standards for indoor residential

[5] California Department of Water Resources, et al. *Making Water Conservation a California Way of Life, Implementing Executive Order B-37-16*, April 2017. Online: http://www.water.ca.gov/wateruseefficiency/conservation/docs/20170407_EO_B-37-16_Final_Report.pdf

[6] SB X7-7, also known as the Water Conservation Act of 2009, was a significant amendment introduced after the drought of 2007-2009 and because of the California governor's call for a statewide 20% reduction in urban water use by the

per capita use; outdoor irrigation; commercial, industrial, and institutional (CII) water use; and water loss. Water Loss is a key component of this executive order and DOUs water loss control efforts will be crucial in making sure that the targets can be met once the (EO) B-37-16 goes into effect.

- In October of 2015, the Governor of California signed **SB 555** into law to improve water system auditing throughout the state. SB 555 requires all California urban retail water suppliers to submit a completed and validated water loss audit annually to the Department of Water Resources (DWR).[7] SB555 requires that urban retail water suppliers:
    - submit an audit annually and to report to DWR
    - to report on measures taken to improve the validity of the water audit data and measures taken to reduce water losses in the system

  The State Water Resources Control Board is tasked to adopt rules requiring urban retail water suppliers to meet performance standards for the volume of water losses.

Given these regulatory pressures it benefits DOU to be able to demonstrate proactive activities for water loss control that are at the cutting edge of water loss control methodology. By implementing and operating five pilot DMAs DOU is among a handful of utilities in California utilizing DMAs as an advanced water loss control strategy.

Considering these regulatory pressures it is more likely that the appropriate valuation of DOUs real losses should be based on the cost to conserve water rather than variable production cost. As seen in the economic evaluation under this scenario DMAs add value to DOUs water loss control strategy.

5 Challenges for Implementing DMAs in DOU

The main challenges that DOU faces when considering implementing DMAs from an operational aspect and from a cost benefit aspect are outlined below:

- When valuing real losses at DOUs variable production cost it is hard to justify any additional real loss recovery activities beyond the roughly 18% of system DOU surveys each year.

---

year 2020. See the California Department of Water Resources website for more information: http://www.water.ca.gov/wateruseefficiency/sb7/

[7] An Urban Water Suppler defined in California Water Code is a water system that serves more than 3,000 service connections or produces more than 3,000 acre-feet (AF) of water.

- The fact that DMAs can not be created by closing valves and isolating one or two inflow points to a given DMA means that DMA installation costs are higher than what is typically seen.
- DOU is in the process of metering 100% of its customers by 2020. As of now the unmetered accounts introduce uncertainty in the calculation of water losses when monitoring DMAs.

6 Analysis and Recommendations

DMAs, like all well designed non-revenue water loss programs, require input and assistance from all sectors of the water utility. This was especially obvious during DMA implementation. The implementation of DOUs pilot DMAs was a challenging process for all parties involved and DOU had to provide significant support to complete the project.

6.1 Primary Benefits

The primary benefits that DOU realizes through the implementation of these pilot DMAs are:

- Enables DOU to monitor more of its network than possible with one leak detection crew.
- Ongoing and automated monitoring of Water Losses in specific zones throughout the distribution system.
- Deployment of leak detection crews in DMAs only when the level of recoverable leakage is economical.
- Ability to set threshold for leak detection in each DMA based on cost benefit of intervention.
- Ongoing detailed data analytics of consumption and DMA relevant system hydraulics data.
- DMAs provide field validation of annual system wide audit results.
- DMAs are a proactive tool to aid with increasing regulatory pressures on water loss management and reduction.
- Through the implementation and operation of these pilot DMAs DOU continues to exhibit industry leadership.

6.2 Primary Challenges

The primary challenges for a broader implementation of DMAs in DOUs distribution network are:

- When valuing real losses at DOUs variable production cost there is no business case for DOU to do more than just the annual survey of about 18% of the system.
- The way DMAs need to be designed and implemented in DOUs system requires a significant number of supply metering locations making the implementation of a DMA quite costly.
- Until all customers are fully metered the unmetered accounts introduce a certain level of error in the water loss calculations for each DMA depending on the percentage of unmetered accounts.

6.3 Recommendations:

The evaluation of the benefits, the challenges and the general business case leads to the conclusion that **it does not appear to be in the interest of DOU to expand** its implementation of DMAs beyond the five DMAs.

Considering the regulatory pressures (some of the outcomes/targets are not even clear at this point), future droughts, and public pressure to demonstrate proactive management of water losses it would appear to be reasonable to value real losses at the cost of conservation measures. By doing so **the continuation of the pilot DMAs provides a benefit to DOU** by not having to randomly survey the areas covered by the DMAs and therefore helping DOU to meet more aggressive leak detection survey targets. The annual costs for the data plans and the online DMA water loss monitoring dashboard (nrwmanager) are less that the cost to achieve the required survey portion on the areas covered by the DMAs.

If DOU considers to expand its DMA coverage in future due to changing external pressures or different economic incentives it is recommended to wait until 100% of DOU customers are metered.

Appendix 3

American Water Works Association California-Nevada Section

#CANVSC2019
SPRING CONFERENCE
CONFLUENCE 2019
Where Policy, Operations and Management Converge

March 25-28, 2019 • Sheraton Grand & Convention Center • Sacramento, CA

Lessons Learned in Sacramento on District Metered Area (DMA) Implementation

March 27, 2019

Julie Friedman, Environmental Services Manager

DEPARTMENT OF WATER RESOURCES • STATE OF CALIFORNIA

City of SACRAMENTO Department of Utilities

WSO

CALIFORNIA CLIMATE INVESTMENTS
Cap and Trade Dollars at Work

Overview, Sacramento's DMA Program

- Background
- Engagement of Stakeholders and Investments Made
- Regulatory Drivers, Goals and Targets
- Design and Implementation, Phase 1
- Alternative implementation strategies, Phase 2
- Challenges, Benefits, and Lessons Learned
- Business Case Findings and Recommendations

City of Sacramento

- Almost one-half million customers in 100 square miles
  - *Located at confluence of 2 rivers*
- Deliver ~37 billion gallons potable/year
- Surface and groundwater sources
  - *2 Water Treatment Plants; 33 Wells;*
  - *1,727 Miles of Pipeline; 15 Reservoirs*
- 139,238 Water Service Accounts
  - ~85% metered to date (100% by 2020)

Collaborative Process

- Grants: DWR , California Climate Investments, RWA/SMUD
- DOU Management Teams: BSD, GIS, Grants, IT Engineering, O&M, Quality, Construction
- Consulting Teams: WSO, WSP, Dokken, Matchpoint/Hydreka, Cavanaugh, Badger
- Water Loss Technical Assistance Program (TAP)
- AWWA, NAWL, WTA and CA Agencies

Accomplished in 5 years

Pilot Design, implementation, stakeholder input (2014 - present)

Ongoing automated monitoring of Water Losses

- *In specific zones of the distribution system*
- *Developed and utilize online dashboard: The NRWManager*

Monitor more of the distribution network (2017 - present)

- *Assists leak detection crews; help meet performance targets*

Deploy crews only when economical (2017 - 2018)

- *Only deploy crews when level of recoverable leakage is economical. Threshold based on cost benefit of intervention*

Provide field validation of system wide audit results (2017-present)

Accomplished in 5 Years: DMAs Phase 1 and 2

2013

Water Conservation Plan Adopted - Recommended intensifying Leak Detection Program.

2014

Augmented Water Loss Program with DMAs as long-term strategy. Received local grant funding. Began design of Pilot Program.

2015

Awarded DWR Water-Energy grant to continue and augment Pilot in Disadvantaged Area Communities.

2016

Phase 1 Implemented and completed: 3% System Coverage.

2017

Using DMA Data to Supplement Leak Detection Efforts.

2018

Phase 2 implemented and completed: 12% of System Coverage.

2019

Full functionality of DMAs; used to manage work flow.

Regulatory Drivers and BMPs

SB 555: Requires validated water audit annually to DWR (2017)

SB1420 and AB2067 requires UWMPs include analyses and SWRCB adopt performance standards for water losses

SB 606 and AB 1668: Interrelated bills that amend existing law

- **Long-term water use efficiency/conservation**

- Better prepare CA for droughts and climate change

- Based on Governor Brown's Executive Order B-37-16 (Signed by Governor on May 31, 2018) directs the SWRCB and DWR to minimize water waste through system leaks

Best Management Practices: AWWA M36 recommends DMAs

DWR and SWRCB: Four Goals, SB 606 & AB1668

1. Use Water More Wisely
2. **Eliminate Water Waste**
   - **Setting urban retail supplier water loss standard, methodology, reporting and enforcement (in coordination with SB555 requirements, 2015**)
3. Strengthen Local Drought Resilience
4. Improve Agricultural Water Use Efficiency & Drought Planning

Calculating Water Targets

To create each water provider's unique target, the following standards will be calculated and added together:

INDOOR USE

The standard for indoor residential water use is 55 gallons per person per day multiplied by the population of the service area.

+

OUTDOOR USE

The standard for outdoor residential water use is based upon a community's climate and the amount of landscape area and is still to be determined.

+

WATER LOSS

The standard for water loss due to leaks in the water system pipes is still to be determined.

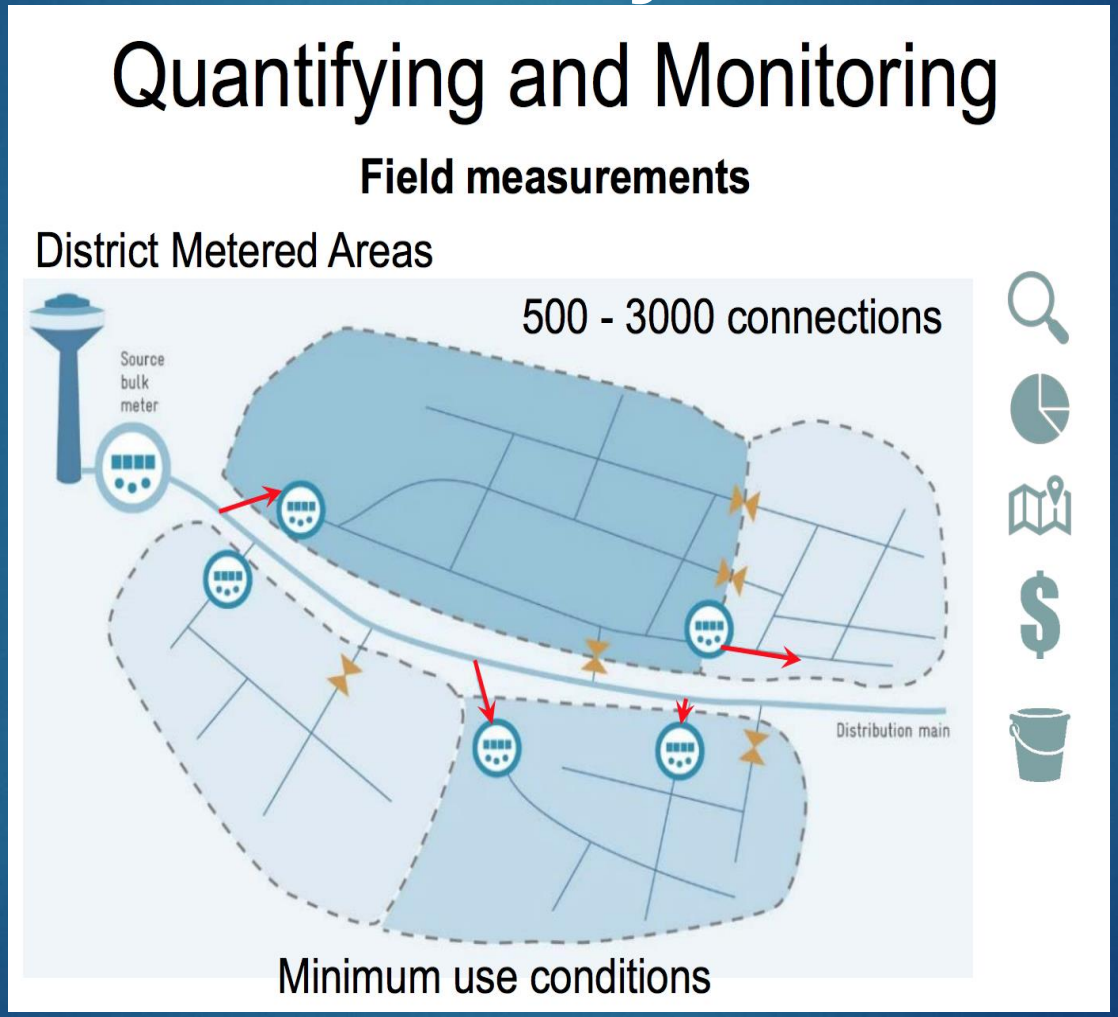
+

CII LANDSCAPE

The standard for outdoor CII water use for accounts with dedicated irrigation meters is still to be determined.

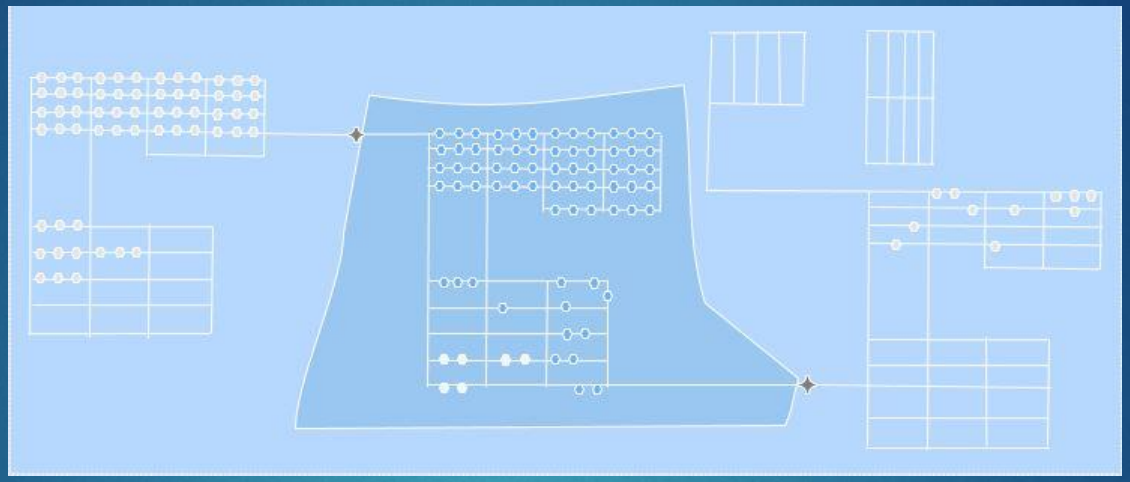
Source: Alliance for Water Efficiency and California Water Efficiently Partnership

Water Loss Monitoring Technologies Featured by SWRCB



Source: SWRCB meeting Public Stakeholder Workgroup Meeting #2 June 1, 2018 at East Bay Municipal Utility District, Oakland

District Metered Areas (DMAs)



- All flows into and out of the zone are measured.
- User consumption is recorded and analyzed.
- Difference between the volume of water entering the zone and volume of water consumed by users within the zone represents the total volume of water loss.

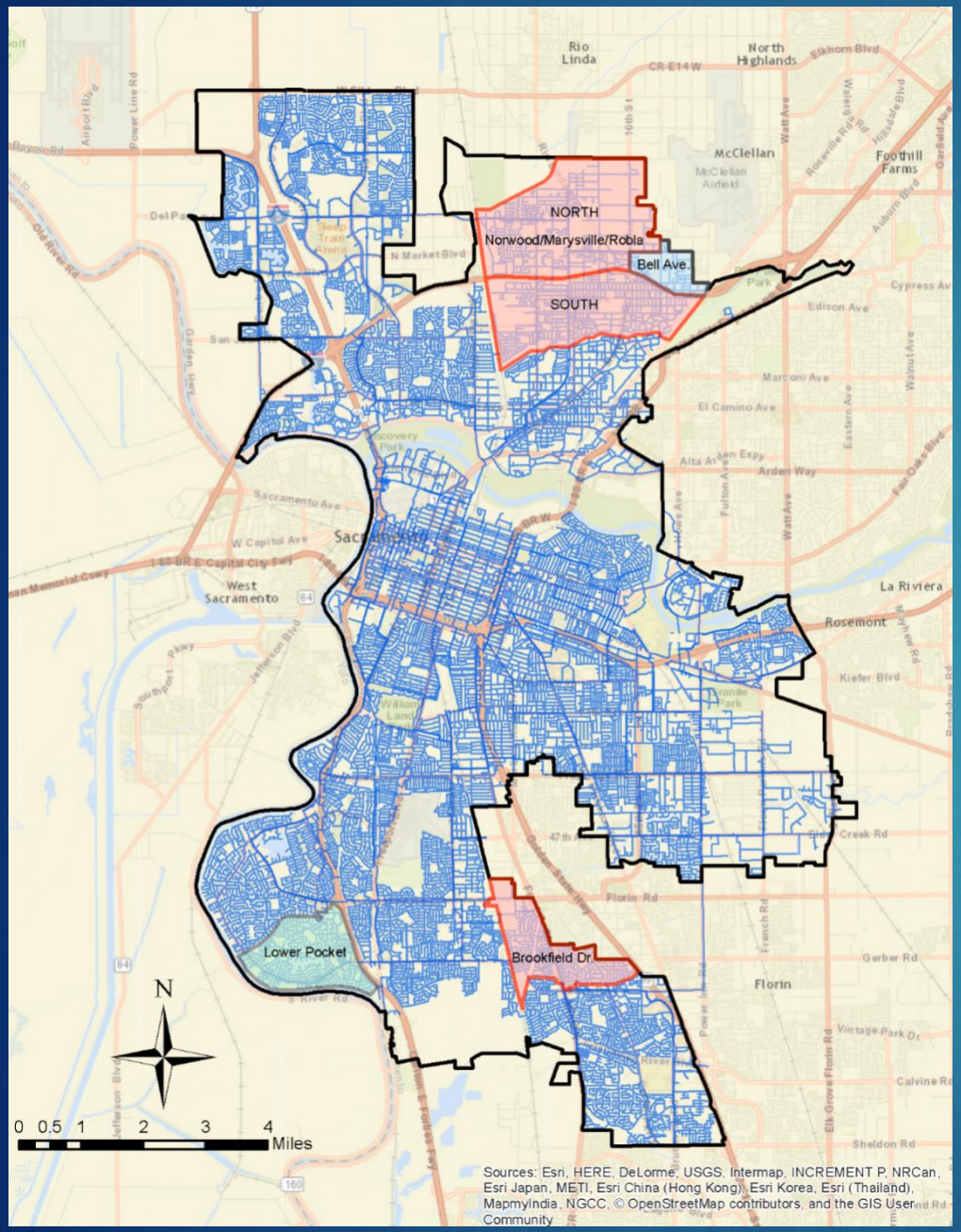
DMA Pilot Design & Implementation

Areas recommended for implementation:

- Minimal changes to hydraulics & water quality
- Ease and low cost of implementation
- Percent metered
- Within Disadvantage Area Community as defined by the EPA

Meter Criteria:

- Register at low flow velocities
- Accuracy profile
- Record bi-directional flow
- Ability to record & transfer flow data
- Cost



Designed, Implemented Five DMAs

SMUD/RWA/DOU Pilot (2014):

Lower Pocket 4143 con., metered

Bell Av 613 con., 2 unmetered

DWR Pilot (2015):

Brookfield: 3597 con.,472 unmetered

NMR

No. NMR: 4,132 con., 92 unmetered

So. NMR: 5,044 con., 101 unmetered

Challenges:
Meters installed under or next to bridges

…in areas with vandalism and high traffic concerns

Overcoming Challenges: Configuration of Meter with Endpoint

For Hydreka EO Meter to be integrated with Badger BEACON, Hydreka needed to update their firmware to allow the totalizer values to be reported (between 0 and 99999999 (with an 8 meter register)).

DMA Process: Brookfield Dr. DMA

- Many issues have been resolved:
  - AMI compatibility
  - DTUs incorrectly programmed and incorrect battery set-up
  - Some sites had poor cell signal
- Leak detection threshold set, 50 gpcd.
- If water losses are above the threshold, leak detection is warranted.
- Crew notified and performed leak detection.

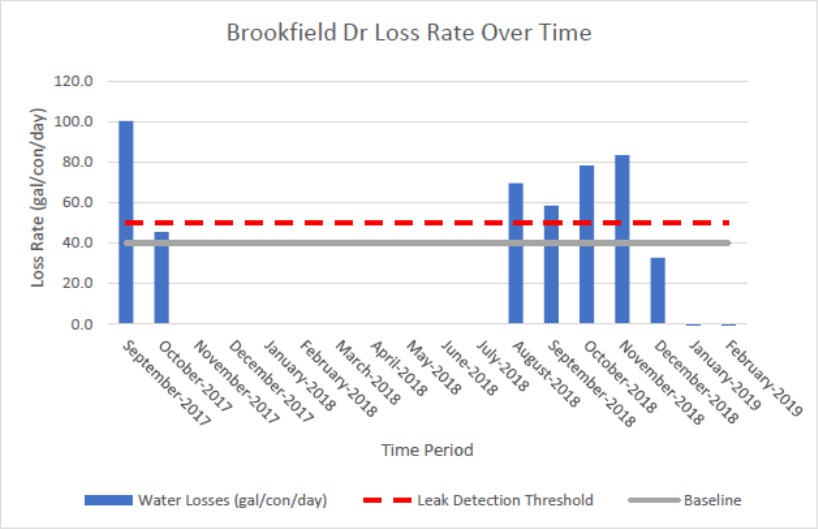
Brookfield Dr DMA Mass Balance Report

Water Loss Calculation for Monitoring Period (02/01/2019 - 02/28/2019)		
Duration of Monitoring Period	28	days
Service Connections in DMA	3648	# of service connections
Total Inflow (gal)	30,137,576	gal
Total Consumption (gal)	32,189,584	gal
Operational Used (gal)	0	gal
Total Losses (gal)	-2,052,008	gal
Water Losses (gal/connection/day)	-20	gal/con/day
Water Losses (GPM)	-51	gpm

Results

Negative water losses suggests water is entering the DMA unmetered. Before accurate mass balances can be calculated this volume of water must be accounted for.

Deploy Leak Detection Team:	No



DMA Process: Brookfield Dr. DMA

- Open valve discovered from this process in Dec.
  - Valve closed, locked and tagged
  - Reviewed the periods, before and after the valve was closed
  - Data indicate water savings are about 0.3 MG/Day (109 MG/Year)
- Jan. and Feb. show negative water losses, water entering DMA unmetered.

Brookfield Dr DMA Mass Balance Report

Water Loss Calculation for Monitoring Period (02/01/2019 - 02/28/2019)		
Duration of Monitoring Period	28	days
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Total Inflow (gal)	30,137,576	gal
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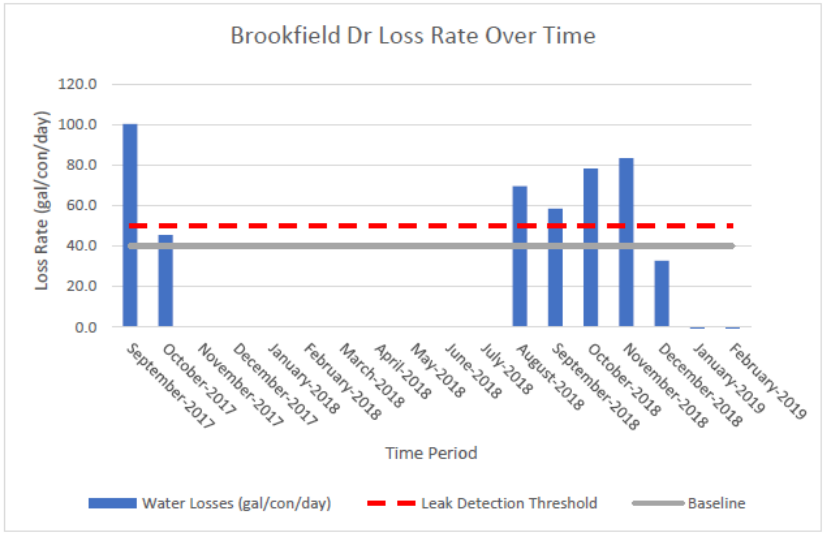
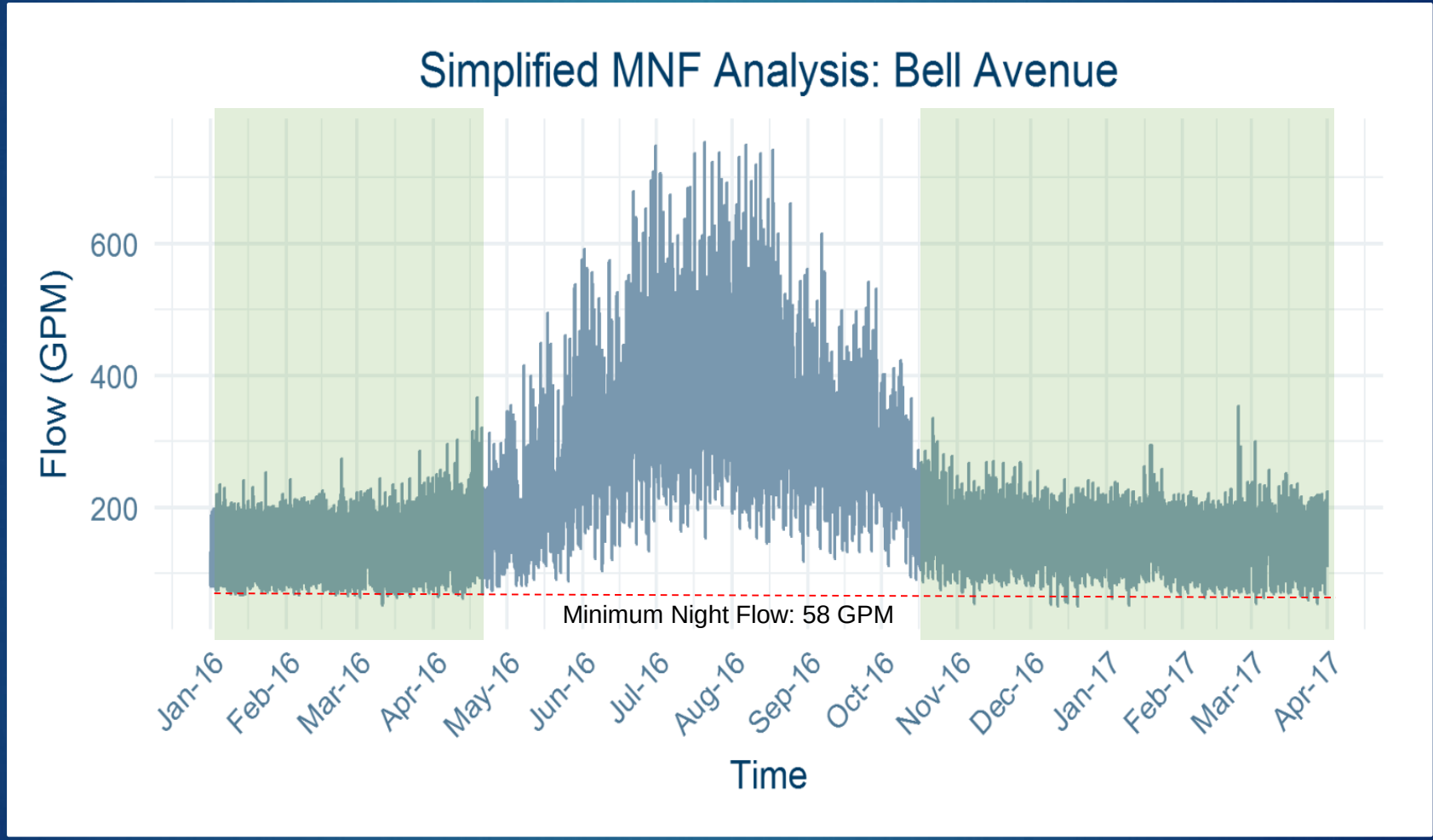
Results

Negative water losses suggests water is entering the DMA unmetered. Before accurate mass balances can be calculated this volume of water must be accounted for.

Deploy Leak Detection Team:	No



Bell Avenue MNF Analysis Baseline at 58 GPM



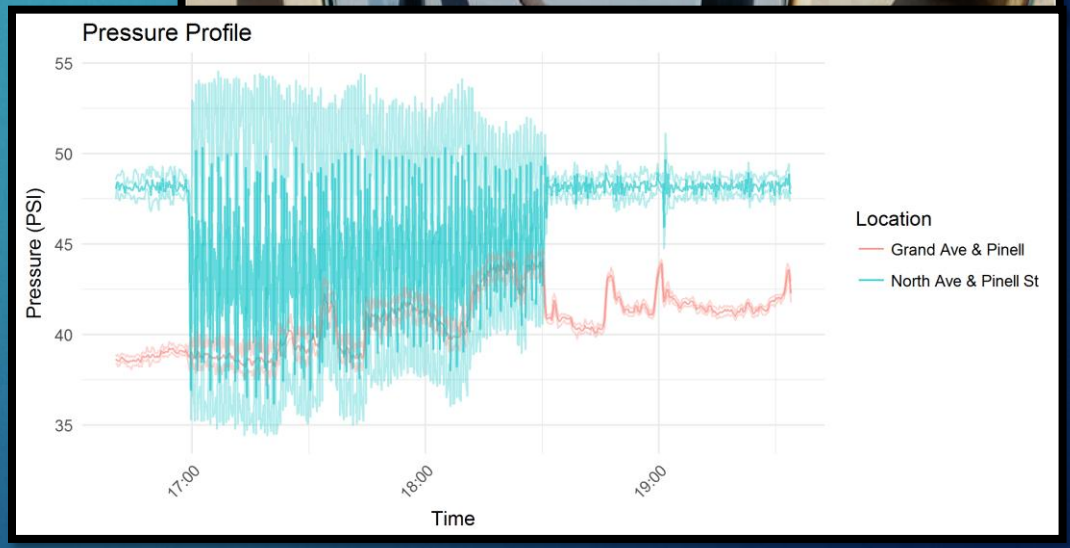
Bell Ave. DMA: Investigation into Elevated Baseline

Elevated Baseline Investigations:

- **Leak detection** confirmed no recoverable leakage is occurring within DMA.
- **Accuracy testing** and data chain analysis suggests accurate inflow meter.
- **Pressure survey** identified check valves allowing water to exit the zone unmetered.

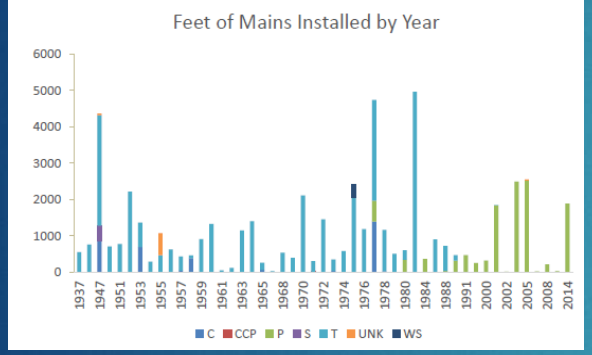
Additional Considerations:

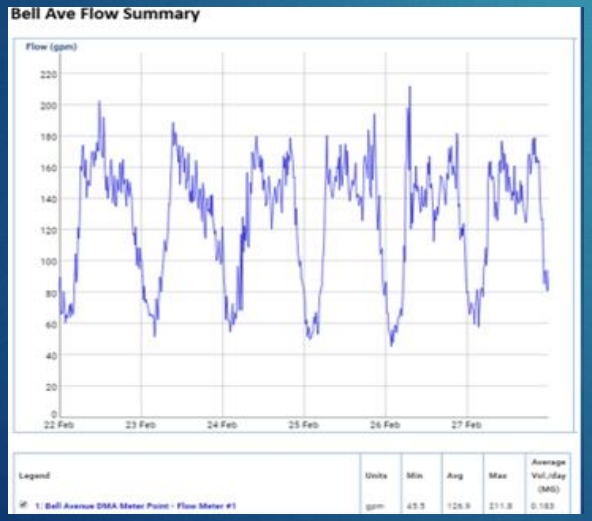
- Unauthorized Water Use / Theft.



Bell Avenue DMA Mass Balance

DMA Infrastructure Summary		
Inflow Meters	1	Meter
Metered Service Connections	611	Connections
Unmetered Service Connections	2	Connections
Total Miles of Mains	9.96	Miles
Weighted Average Install Year	1974	Weighted by Length





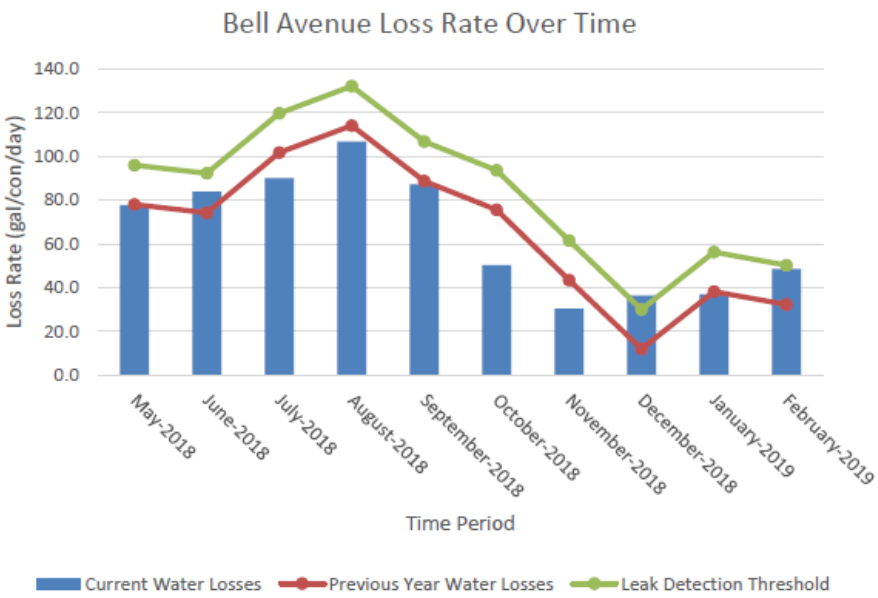
Bell Avenue DMA Mass Balance Report: February 2019

Water Loss Calculation for Monitoring Period (02/01/2019 - 02/28/2019)		
Duration of Monitoring Period	28	days
Service Connections in DMA	613	# of service connections
Total Inflow (gal)	5,203,268	gal
Total Consumption (gal)	4,370,520	gal
Operational Used (gal)	0	gal
Total Losses (gal)	832,748	gal
February 2019 Water Losses	49	gal/con/day
February 2018 Water Losses	32	gal/con/day

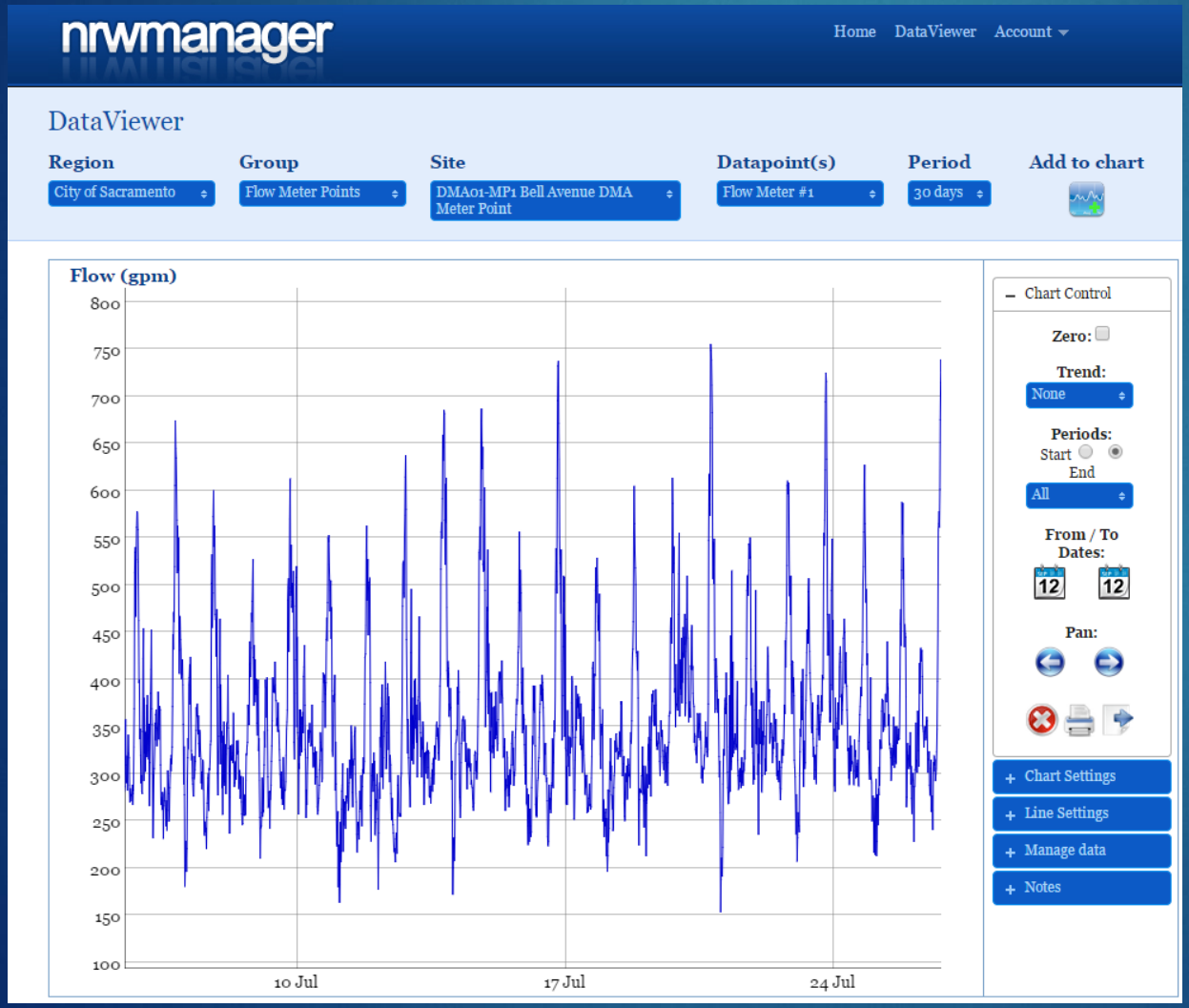
Results

Water Loss trend over previous period: <18 gpcd increase from last year.
Therefore leak detection is not warranted

Deploy Leak Detection Team: No

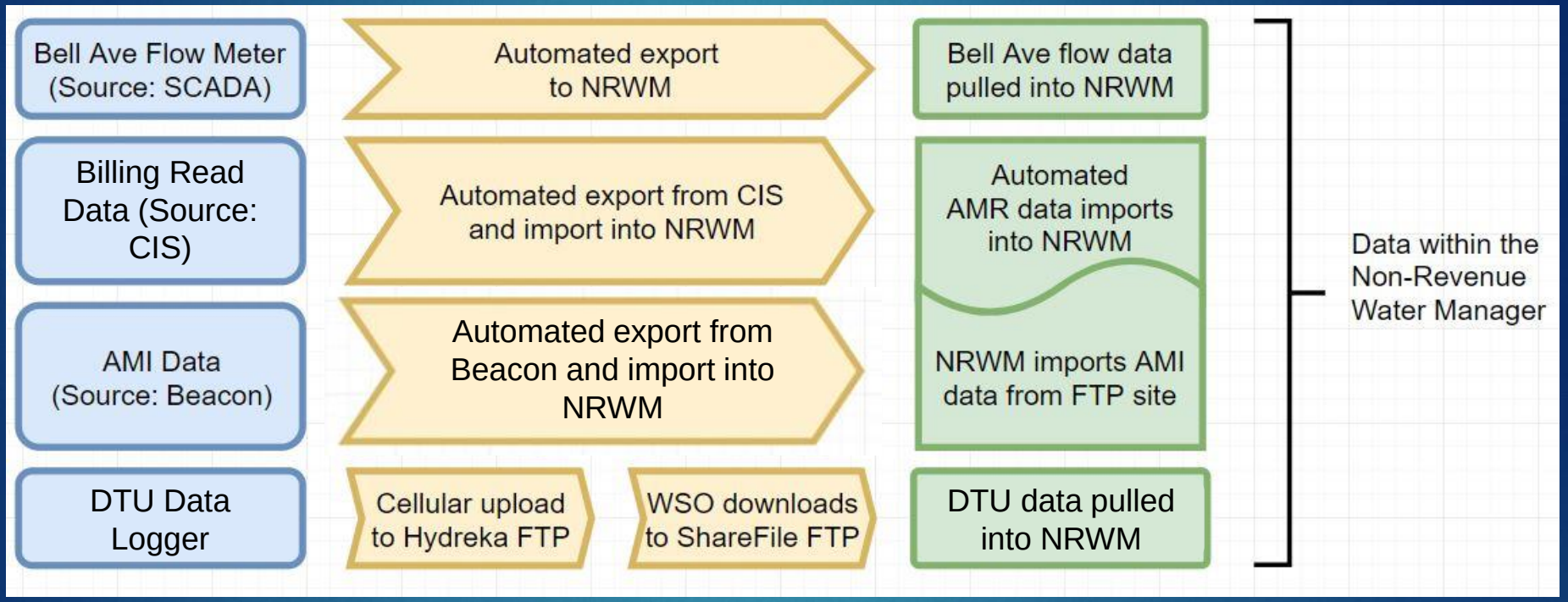


NRWMANAGER DASHBOARD MONITORING TOOL

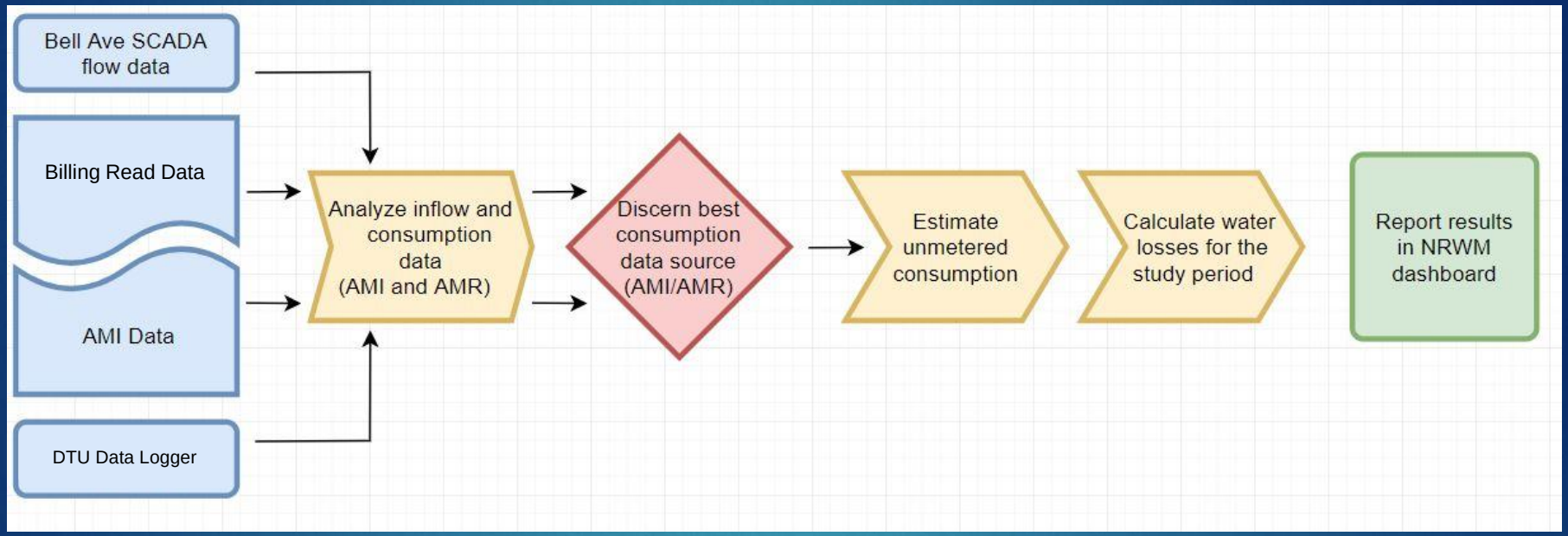


Demonstration:
https://www.nrwmanager.com

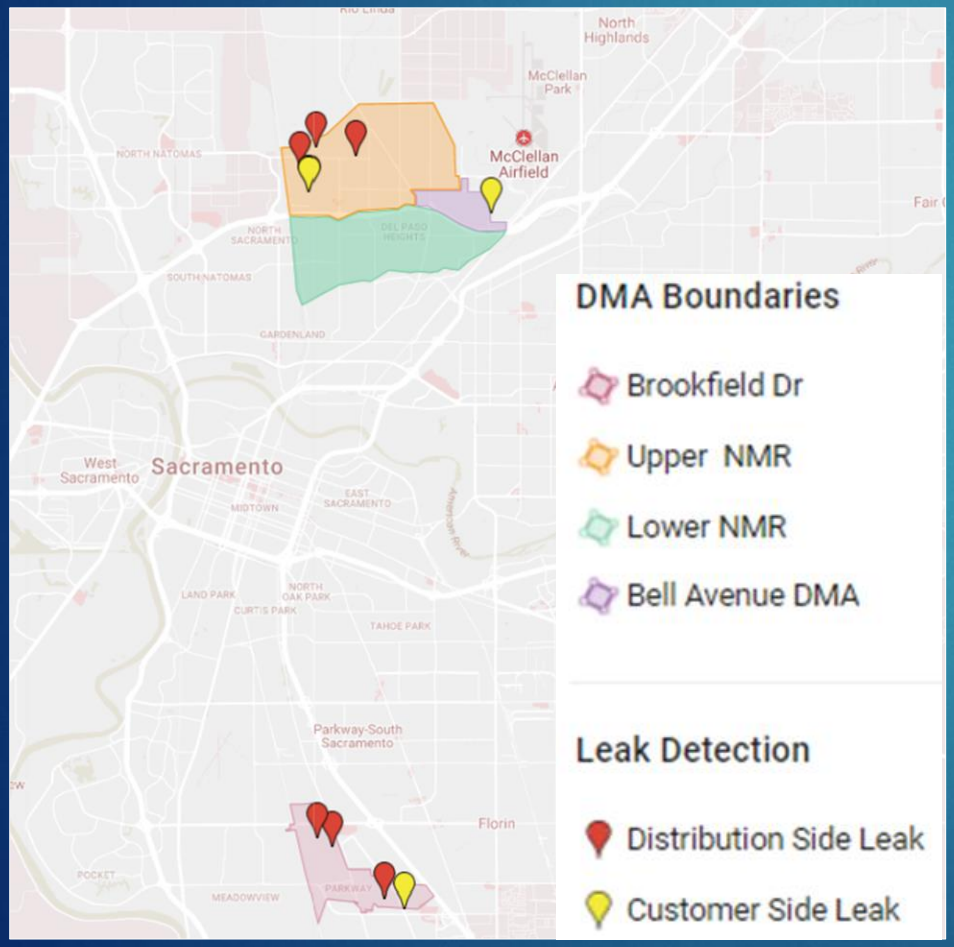
Overcame the Challenges of Managing Complex Datasets



Overcoming Challenges: DMA Mass Balance & Unmetered Consumption



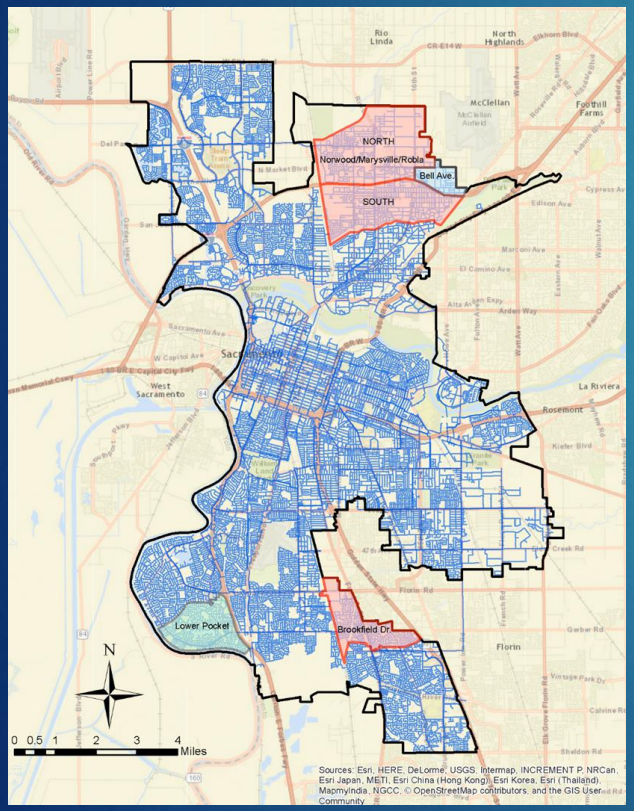
Overcoming Challenges: Financial Considerations, Water-Wise Business



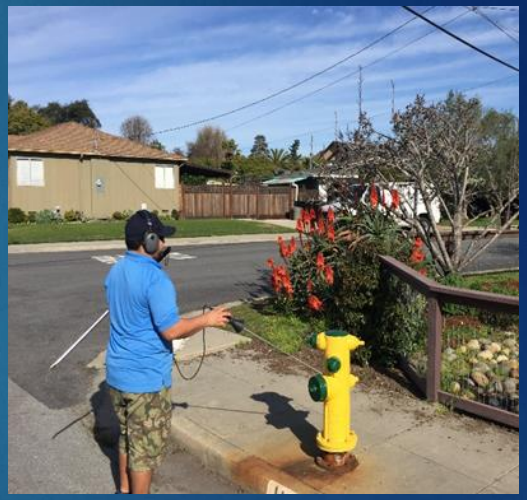
Leak Detection Oct. 2017

- Relatively low levels of real losses. 0.024 leaks per miles of mains surveyed.
- Identified 7 distribution-side leaks and 3 customer-side leaks during 165-mile survey in October.
- About 19.4 MG in annual recoverable distribution-side leakage translates to $772 in annual savings.

Benefits of DMA Program: Reducing leak detection team's survey area



- DOU systematically surveys ~18% of distribution system per year (304 miles)
- DMAs provide an area where systematic leak detection is not required (207 miles)
- Savings per year of not having to do leak detection in these DMAs = $21,400 /yr



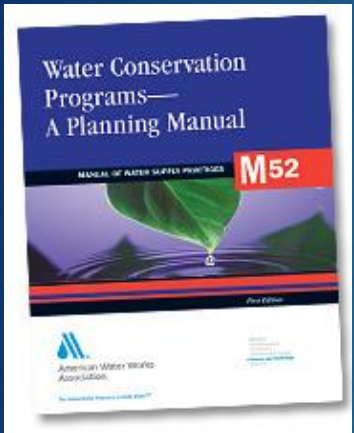
Challenges of DMAs

- When valuing real losses at DOU's variable production cost there is no business case for DOU to do more than just the annual survey (FY2017) of about 18% of the system.
- Even when the DMAs are financed through grants it takes a significant amount of effort and work on the side of DOU to implement a DMA.
- The way DMAs need to be designed and implemented in DOU's system requires a significant number of supply metering locations making the implementation quite costly and more complicated than what is typically seen.
- Until all customers are fully metered the unmetered accounts introduce a certain level of error in the water loss calculations for each DMA depending on the percentage of unmetered accounts.

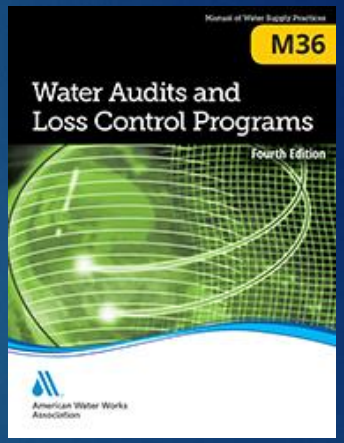
Benefits of DMAs

- Enables DOU to monitor more of the network
- Ongoing and automated monitoring in specific zones.
- Deployment of leak detection crews in DMAs only when the level of recoverable leakage is economical.
- Ability to set thresholds for leak detection in each DMA based on cost/benefit of intervention.
- Provide for ongoing detailed data analytics of consumption and DMA relevant system hydraulics data.
- Through pilot DMAs study, DOU exhibits industry leadership.

Assessment of Pilot DMAs: Benefits, Challenges, Business Case, Findings and Recommendations



- Not in DOU's best interest to expand implementation of DMAs beyond the five pilot DMAs.
- Considering regulatory pressures (unclear targets), future droughts, public pressure, reasonable to value real losses at the cost of conservation measures.
- The pilot DMAs provide a benefit to DOU by not having to survey areas covered by DMAs helping DOU to meet more aggressive leak detection survey targets. If DOU expands program in the future, recommend wait until 100% DOU customers are metered.



Program Alternative A

Alternative A	Description	Benefits	Drawbacks	Risks	Cost Per Year*
(A) Complete DMA Pilot, hold program until fully metered.	Complete DMA Pilot Test Evaluation and do not continue Program until fully metered. Revert back to prior level of 2016 leak detection activities with Crew obtaining 18% of system surveyed per year within 5-6 year period.	Will have successfully completed pilot.	Prior levels of leak detection may not be enough to meet performance standards target. Will have costs associated with meeting SB606 and AB 1668 reqts. Other CA agencies are showing 25 gpcd median real losses, and City is showing 39 gpcd in 2018. Already invested and will not be cost effectively meeting regulatory mandates.	City may not be participating at needed levels to meet performance standard target, and there are challenges associated with this.	$50K DMA Program costs were offset by grants.

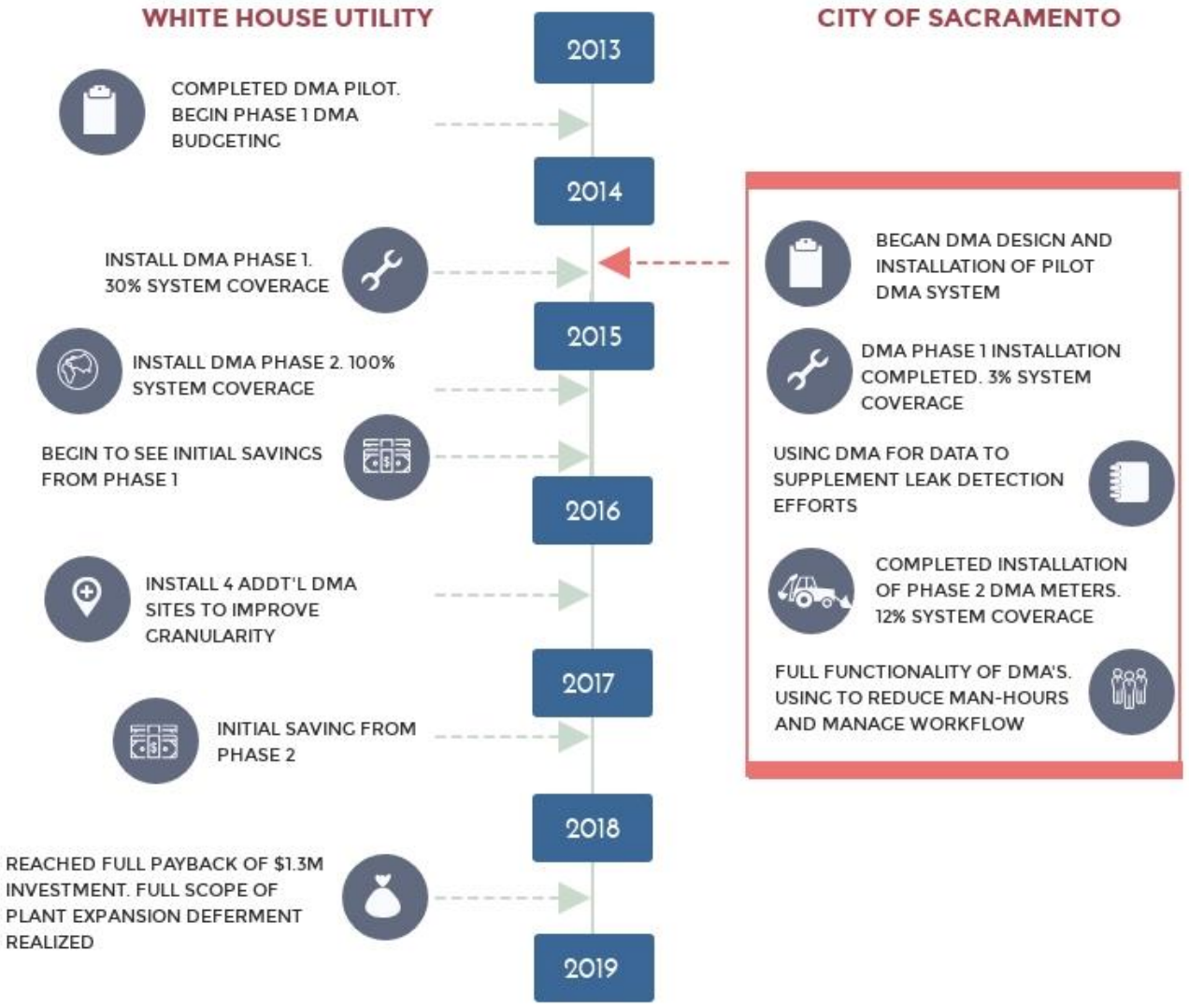
Notes:

*** The cost per year is based on NRW Manager License fee and consultant monitoring and evaluation professional services.**

Remaining Tasks

- Avoid leak detection in DMA until water loss levels surpass the established economic intervention threshold
- Test the upgraded EO meter with Badger cellular endpoint , and
- Matchpoint/Hydreka reinstall upgraded meters
- Provide Final Report to DWR by June 2019, complete DMA Pilot Evaluation and do not continue Program until fully metered.
- Share findings with Stakeholders
- Water Loss Program Business Case in
- Water Conservation Plan 2020

DMA Capabilities Timeline



Summary

- DMAs are long-term strategy
- Flexibility in implementation
- City is evaluating the usefulness for its system:
  - Fieldwork corroborates AWWA Water Audit
  - Augments leak detection
  - Updates to CIS and GIS
  - Reduces leakage, ongoing monitoring
  - Online, near real time data-viewing

Thank you!

Please Contact:

Julie Friedman, Environmental Services Manager
(916)808-7898, jfriedman@cityofsacramento.org

DEPARTMENT OF WATER RESOURCES · STATE OF CALIFORNIA

City of SACRAMENTO Department of Utilities

WSO

CALIFORNIA CLIMATE INVESTMENTS
Cap and Trade Dollars at Work

Appendix 4

City of SACRAMENTO
Department of Utilities

FINAL DRAFT

06/11/2019

Kaitlin Bushell
Department of Water Resources
Division of Integrated Regional Water Management
3374 East Shields Avenue
Fresno, CA 93726

RE: Water-Energy Grant Program, Funding Agreement No. 4600011116

Dear Ms. Bushell,

Please find enclosed the Post-Performance Report for Agreement No. 4600011116 (Funded by the Greenhouse Gas Reduction Fund, as authorized in Section 2 of the Budget Act of 2013 (Senate Bill 103, Section 11) as requested.

If you have any questions, please do not hesitate to contact me at (916) 808-6645.

Sincerely,

Dean Fujimoto
Capital Finance & Grant Manager

Enclosures

CC: Julie Friedman, Program Specialist, City of Sacramento
Alaina Jordan, Administrative Analyst, City of Sacramento
File, City of Sacramento Department of Utilities

Water-Energy Grant Program
Agreement No. 4600011116
draft PROJECT COMPLETION REPORT

Project: DMA Water Energy Grant

IMPLEMENTING AGENCY: City of Sacramento, Department of Utilities

Executive Summary

In 2015, the California Department of Water Resources (DWR) announced the grant award to the City of Sacramento. Department of Utilities (DOU) in an amount up to $2,500,000 to fund three to four District Metered Areas (DMA's) within Disadvantaged Area Communities (DACs). The focus of the grant was to help identify existing leaks within the water distribution system, and fund both City-asset and customer-side leak repairs identified during this project.

The grant funded the development and implementation of four DMAs (Bell Avenue, Brookfield Drive, Norwood-Marysville-Robla North, and Norwood-Marysville-Robla South) to aid DOU in decreasing water loss, energy use, and greenhouse gas emissions.

The four DMAs were developed and implemented in DACs per the grant agreement. City-asset repairs and replacements were made within the DMAs, and a DAC homeowner funding repair program entitled "Leak-Free Sacramento" was developed and implemented for approximately 300 customers. By the end of June 2018, DOU had successfully submitted the Water-Energy Grant Program Completion Report to the DWR and has since entered a one-year monitoring period until the end of June 2019.

This post-performance report provides a project summary for the period of July 1, 2018 to June 30, 2019.

As a result of the ongoing water loss monitoring, DOU was able to deploy leak detection efforts only to DMAs where elevated water loss levels were identified. The Brookfield Drive DMA was the only DMA where leak detection crews were deployed pertaining to this program. During the one-year monitoring period the effort resulted in the identification of an open boundary valve to a neighboring utility, which was subsequently closed.

The DMAs are being monitored and utilized to strategically deploy leak detection resources and augments the DOU Leak Detection Program efforts. Currently, the DOU Water Division and consulting teams are providing daily monitoring and evaluation of the DMAs. The teams have developed and utilize an online dashboard, the Non-Revenue Water Manager (NRWM).

The City DOU designed and implemented the pilot DMAs and evaluated this leakage management strategy for its applicability in Sacramento's distribution network. The DMAs were designed differently from the standard DMA design to maintain consistent water quality and due to the hydraulics of the water distribution system. While the ongoing operation of DMAs provided many benefits and challenges to DOU (see benefits and challenges discussed at the end of this report), the ongoing operation of the

DMAs required a significant commitment from DOU staff to address investigations, equipment issues, data communication issues, and potential hydraulic integrity issues of DMAs.

One-Year Monitoring

The project team continued monitoring of water losses in all four DWR Water-Energy grant-funded DMAs between July 1, 2018 and June 30, 2019.

DMA Data Collection for Ongoing DMA Monitoring

The following sections provide a high-level overview of the data collection and monitoring process. Figure 1 provides an overview of the various data sources, the data export and import procedures and the subsequent integration of all relevant data into an online database for automated water loss monitoring (via the Non-Revenue Water Manager or NRWM).

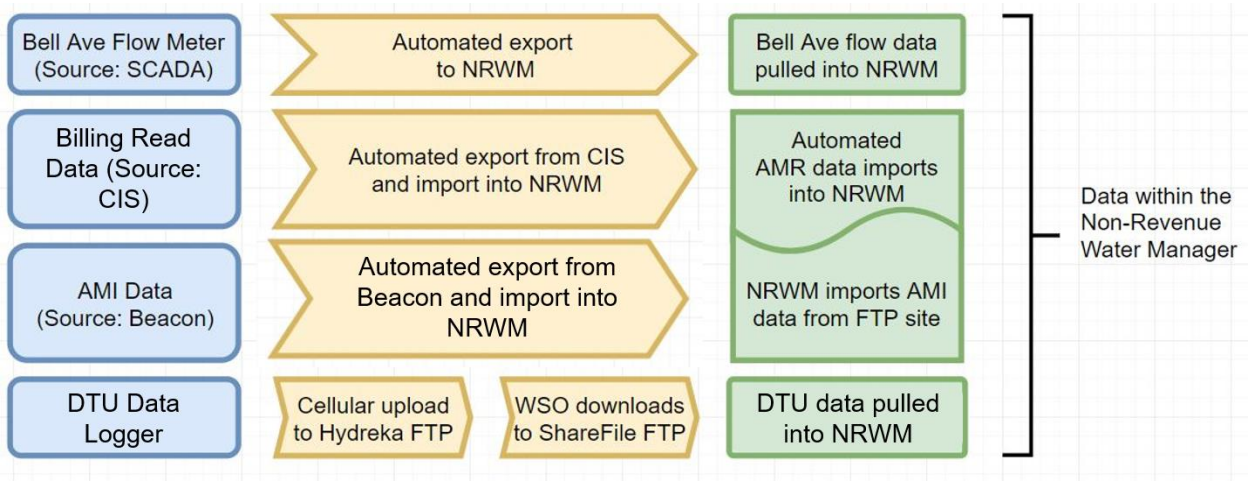


Figure 1: Supply and Consumption Data Sources for Ongoing Water Loss Monitoring

DMA Consumption Data

The project team continued to collect consumption data for every customer within the four DMAs. For metered customers, DOU collected two forms of consumption data:

1. Hourly AMI reads which is stored in the Badger Beacon database.
2. Monthly AMR reads which is stored in the billing database.

The project team continued utilizing the automated process developed during the grant implementation phase, which exported consumption data from the AMR and AMI databases to the NRWM dashboard. All metered consumption data is uploaded automatically to the NRWM dashboard.

After consumption data is uploaded to the NRWM, automatic QA/QC checks are performed. These QA/QC checks continue to identify issues with anomalous consumption reads, mislabeled meter information in both the AMI and the AMR databases are reported to DOU for investigation and follow up action.

DMA Supply Data

The project team continued to collect DMA supply data. The supply data comes from various sources and is automatically uploaded into the NRWM for processing of data and mass balance calculations. There are two sources of production data that are currently being monitored:

- Insertion flow meters and their Data Telemetry Units (DTUs); and
- Well production and reservoir levels from DOU's Supervisory Control and Data Acquisition (SCADA) system

DMA Monitoring

The project team continued to monitor water losses for all four DMAs using two primary approaches:

1. **Minimum Night Flow (MNF):** By analyzing daily trends in inflow, periods of lowest inflow into the DMA can be identified. These time periods are typically late at night because the minimum night flow rate should remain relatively constant day-to-day in the absence of summer night-time irrigation and water use. An increase in the MNF rate that is not attributed to authorized nighttime use can indicate an increase in water losses. However, DOU's DMA project has shown that this methodology is not reliable when conducted during the summer months due to seasonal trends in irrigation. (See Figure 2). The ongoing monitoring has shown that the MNF approach only provides reliable results for the Bell Avenue DMA. For the other DMAs with multiple inflow and outflow locations the results of the MNF analysis were very inconsistent. Without a reliable way of assessing minimum night demands, MNF analysis remains unreliable and not applicable to these DMAs.

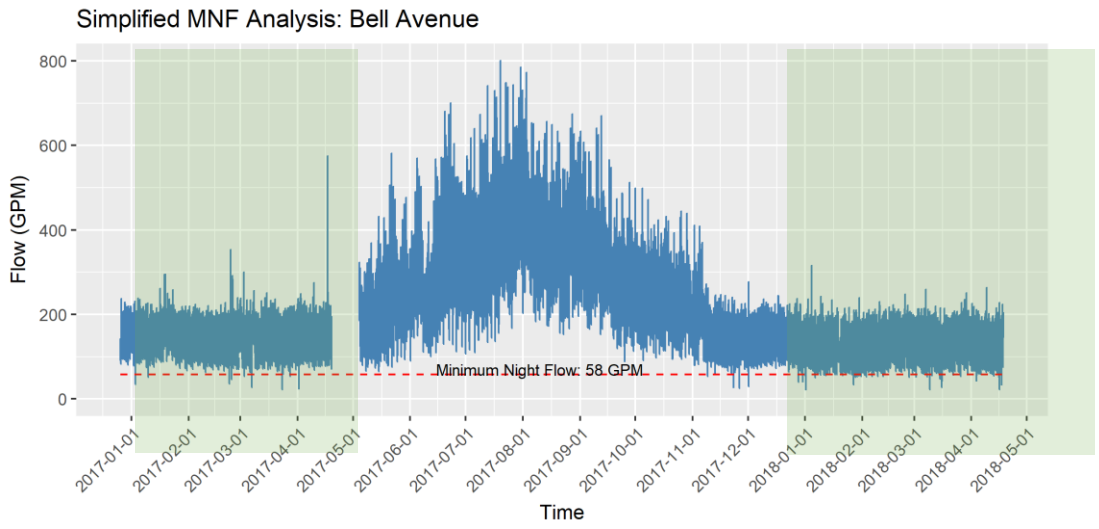


Figure 2: Minimum Night Flow Analysis Overview

Mass Balance: By adding the total volume of inflow into the zone and subtracting the total volume of water used in a specific time period, the volume of Water Loss can be calculated

2. While conceptually simple, this approach is complicated by multiple sources of consumption data (estimated unmetered accounts, SCADA data, DTU data, AMI data, and AMR data) for each DMA. The project team continued to utilize the online dashboard (the NRWM) that automates this calculation as well as provides an easy to navigate tool that can track water loss and DMA performance throughout DOU's water distribution system.

Month	Pressure (psi)	Inflow (gpd)	BMAC (gpd)	BUAC (gpd)	Revenue Water (gpd)	Non-Revenue Water (gpd)	UAC (gpd)	Water Losses (gpd)	Water Losses (gpm)	# of Conn's	Water Losses Per Connection (gpcd)
2019-05	45	312,787	0	0	0	0	0	0	0	621	0
2019-04	45	230,950	199,818	230	200,048	30,902	0	30,902	21	621	50
2019-03	45	184,509	165,192	174	165,366	19,143	0	19,143	13	576	33
2019-02	45	185,831	164,948	180	165,128	20,703	0	20,703	14	585	35
2019-01	45	184,187	163,673	179	163,852	20,335	0	20,335	14	606	34
2018-12	45	200,217	179,726	187	179,913	20,304	0	20,304	14	606	34
2018-11	45	280,195	260,662	260	260,922	19,273	0	19,273	13	605	32
2018-10	45	307,249	277,604	334	277,938	29,311	0	29,311	20	605	48
2018-09	45	415,669	363,547	383	363,930	51,739	0	51,739	36	606	85
2018-08	45	482,818	420,234	418	420,652	62,166	0	62,166	43	606	103
2018-07	45	498,047	449,108	446	449,554	48,493	0	48,493	34	607	80
2018-06	45	448,500	401,139	411	401,550	46,950	0	46,950	33	607	77

Figure 3: Example Monthly Mass Balance Report for Bell Ave DMA

DMA Monitoring Results

All four DMAs were continuously monitored, and water losses were calculated each month to evaluate if leak detection deployment is warranted in any of the DMAs. In addition to monthly evaluations, data was monitored for each DMA on a daily and weekly basis to confirm DTUs reported and to monitor for DOU team to follow-up. (See Attachment 1, Weekly Report.)

Bell Avenue DMA

Since the beginning of the one-year monitoring period in July 2018, mass balances have been calculated consistently on a monthly basis for Bell Avenue DMA. The monthly water loss assessments showed that there is no indication for increased water losses and, therefore, no leak detection resources were needed to be deployed to Bell Avenue DMA. The leak detection threshold for Bell Avenue DMA was set by the project team at 18 gallons/connection/day above the prior year's monthly water loss assessment. This constant buffer value of 18 gallons per connection per day is added to the variable monthly value based on the actual loss rate each month (See Figure 4.)

The increase in water loss observed during the summer months is consistent with the increase observed during the same period in 2017. This suggests the increase does not reflect an increase in recoverable leakage. Instead, the increase is most likely caused by check-valves operating more frequently during the summer irrigation periods, allowing water to leave the DMA unmetered.

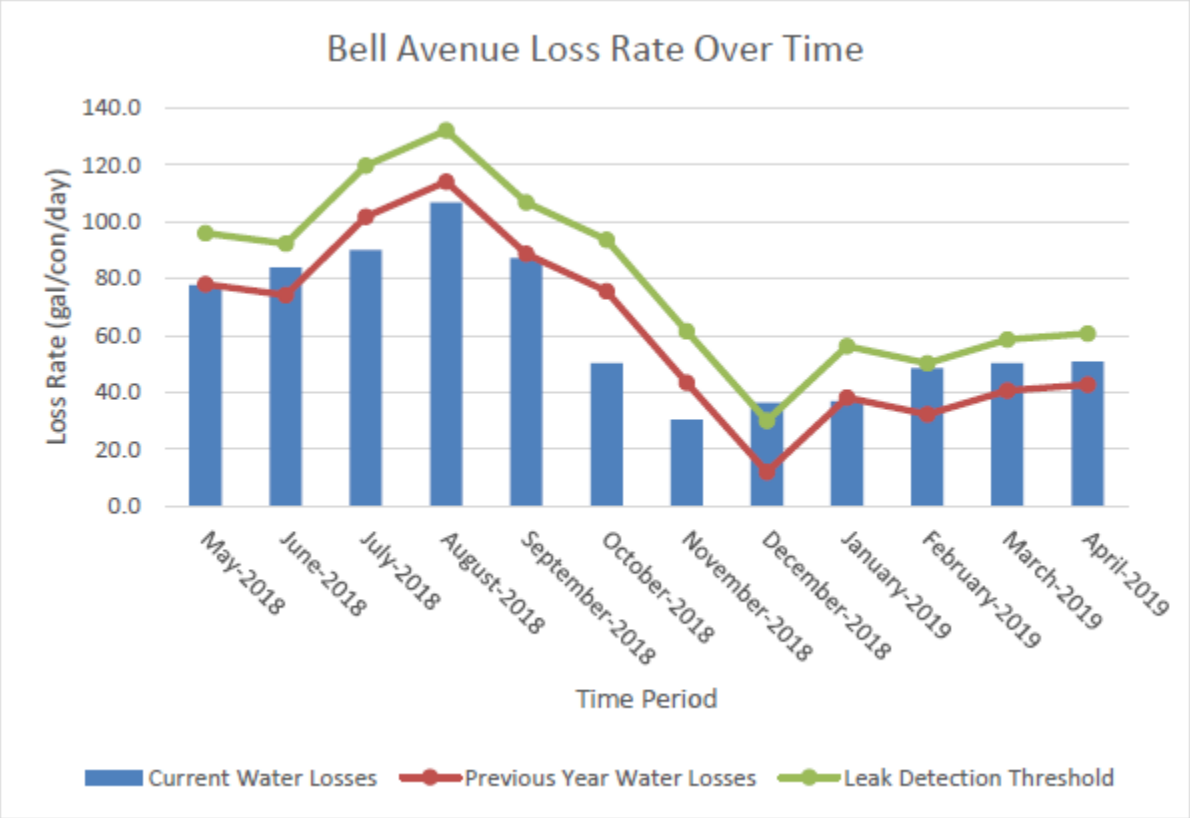


Figure 4: Bell Avenue DMA Monthly Water Loss Monitoring

Brookfield Drive DMA

Mass balances for the Brookfield Drive DMA have not been calculated consistently due to insertion meter issues. The issues included DTUs found to be incorrectly programmed and incorrect battery setup, and

poor cell signal, however, these challenges were overcome. Since August 2018, the project team has been able to calculate monthly mass balances for Brookfield Drive.

The leak detection threshold for Brookfield Drive DMA is set by the project team at 50 gallons per connection per day, which is 10 gallons per connection per day above the system-wide level of real losses (40 gallons per connection per day) based on DOU's FY 2017 water audit. Starting in August 2018, when the first mass balance was calculated since resolving the insertion meter issues, elevated water loss levels above the leak detection threshold were observed.

Given the consistently elevated water loss levels, DOU deployed a leak detection team to identify non-surfacing leaks in the Brookfield Drive DMA. As a result of the survey, DOU identified an open boundary valve that was an un-metered intertie with Fruitridge Vista Water. Subsequently the valve was closed, locked out and tagged out by a City Field Crew. The crew estimated the valve had been open for more than one year. The flow data from before and after closure of the boundary valve indicates that the resulting water savings are about 0.3 MG/D or about 109 MG annually.

Beginning in January 2019, the monthly mass balance results showed negative losses (see Figure 5), which is an indication that the hydraulic integrity of the DMA is compromised or that the consumption and supply data sources are subject to significant error. The DOU Team is continuing to investigate the negative water losses. Leak Detection Crews are currently continuing their work in this DMA.

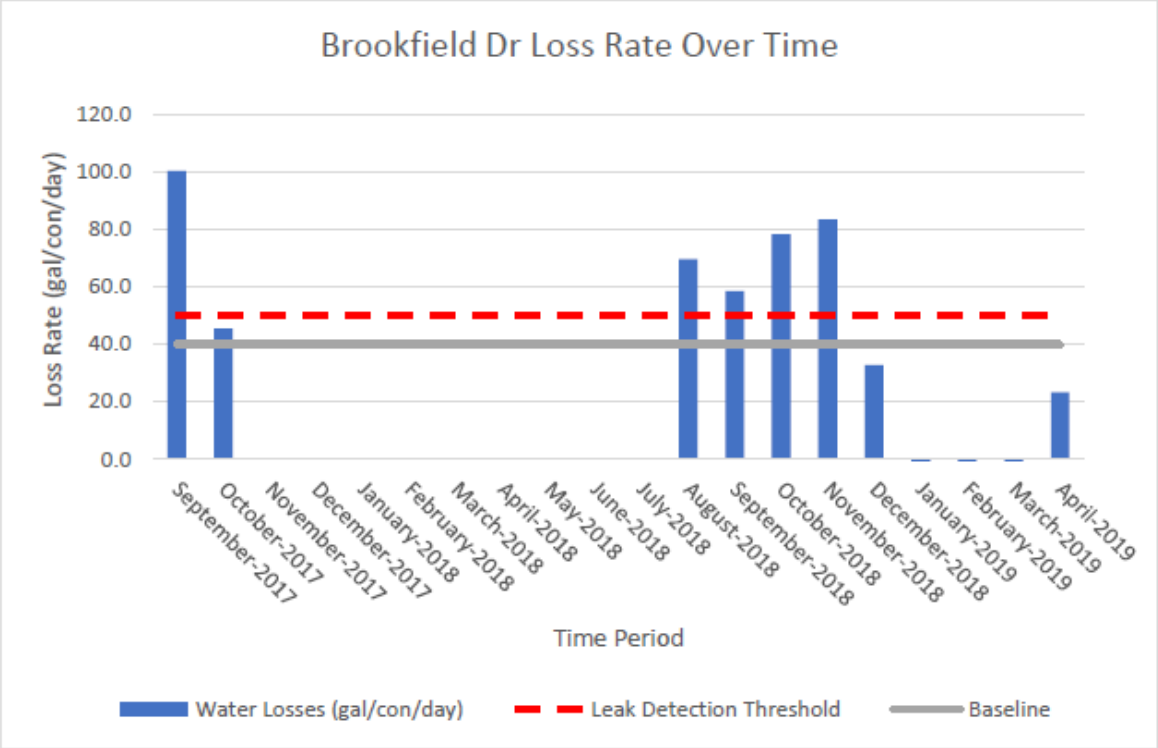


Figure 5: Brookfield Drive DMA Monthly Water Loss Monitoring

Full Norwood-Marysville-Robla DMA

The monthly mass balances for Upper Norwood-Marysville-Robla DMA and Lower Norwood-Marysville-Robla produced inconsistent and at times unrealistic results. The project team, therefore, also provided a combined Upper and Lower NMR DMA in its reports and review (see Figure 6).

The leak detection threshold for the Full NMR DMA is set at 55 gallons per connection per day by the project team, which is 15 gallons per connection per day above the system-wide level of real losses (40 gallons per connection per day) based on DOU's FY 2017 water audit.

Due to insertion meter issues the project team was not able to consistently produce monthly mass balances for the Full (combined) NMR DMA or for the individual NMR DMAs (Upper and Lower NMR).

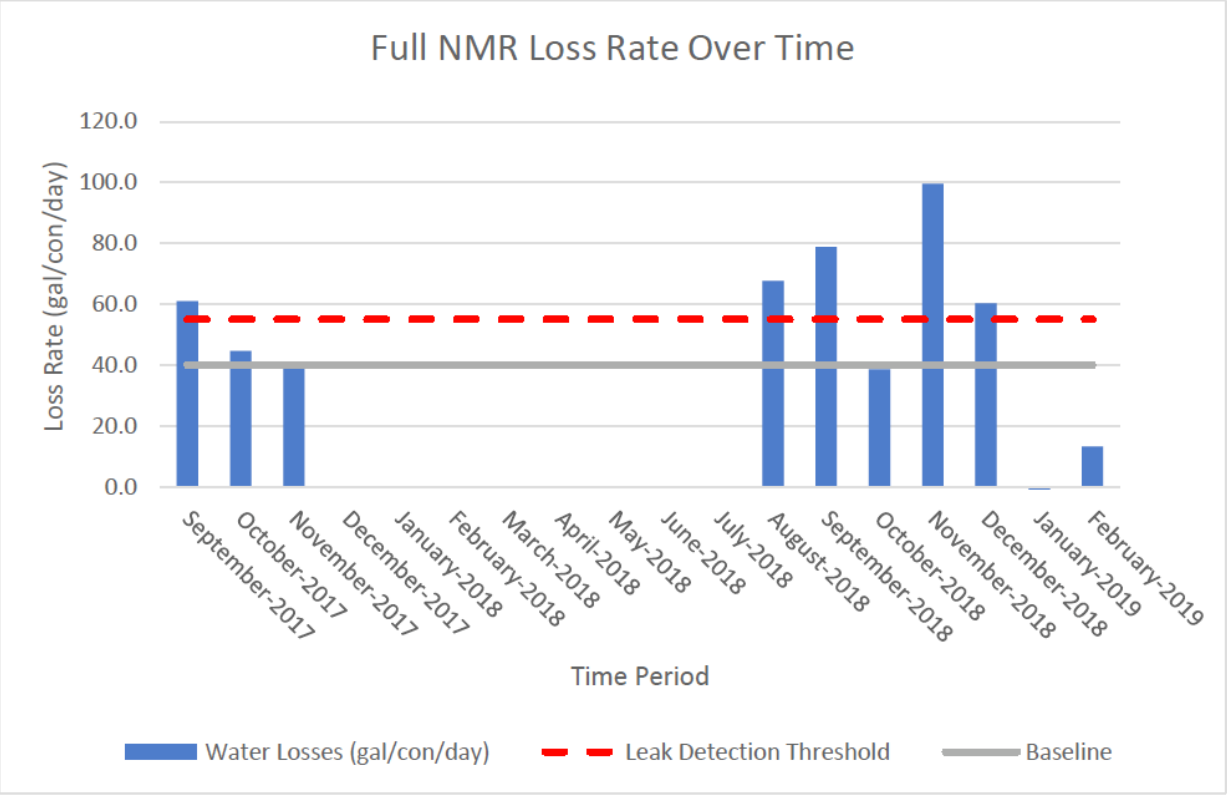


Figure 6: Full NMR DMA Monthly Water Loss Monitoring

Issues Experienced During DMA Monitoring

During the monitoring phase, the project team encountered several issues with insertion meters. Including battery configuration issues, cellular connectivity issues on one site, where an alternative antenna resolved it, and battery replacement. All of which DOU addressed together with the equipment supplier and the project team. As a result of the insertion meter malfunctions several monthly mass balances were not calculated as can be seen in the figures in the previous sections and the weekly reports. Data irregularities led to the mass balance data reporting negative losses.

DMA Leak Detection and Repair

During the one-year monitoring period leak detection resources were only deployed in the Brookfield Drive DMA where as a result an open boundary valve to a neighboring utility was identified.

Challenges, Benefits of DMA Program

The benefits and challenges were discussed with the stakeholders during the monitoring period and summarized below.

Challenges of DMAs:

- When valuing real losses at DOU's variable production cost (the cost of raw water, energy, and chemicals) there is no business case for DOU to do more than just the annual survey (FY2017) of about 18 percent of the system.
- Even when the DMAs are financed through grants it takes a significant amount of effort and work on the side of DOU to implement a DMA.
- The way DMAs need to be designed and implemented in DOU's system requires a significant number of supply metering locations making the implementation quite costly and more complicated than what is typically seen.
- Until all customers are fully metered, the unmetered accounts introduce a certain level of error in the water loss calculations for each DMA depending on the percentage of unmetered accounts.

Benefits of DMAs:

- Enables DOU to monitor more of the network.
- Ongoing and automated monitoring in specific zones.
- Deployment of leak detection crews in DMAs only when the level of recoverable leakage is economical.
- Ability to set thresholds for leak detection in each DMA based on cost/benefit of intervention.

The DOU Project Team conducted an "Assessment of Pilot DMAs: Benefits, Challenges and Business Case with Findings and Recommendations" and discussed with the DOU Teams in the Spring of 2018. (See Attachment 4, Assessment of Pilot DMAs.)

The evaluation of the benefits, the challenges and the general business case led to the conclusion that it is not in the best interest of DOU to expand its implementation of DMAs beyond the pilot DMAs. Considering the regulatory pressures (some of the outcomes/targets were not clear from the State Water Resources Control Board (SWRCB) at this time), future droughts, and public pressure to demonstrate proactive management of water losses, the Assessment reported that it is reasonable to value real losses at the cost of conservation measures. Continuation of the pilot DMAs provides a benefit to DOU by not having to manually survey the areas covered by the DMAs section by section unless it is warranted, thus assisting DOU to meet more aggressive leak detection survey targets. If DOU considers expanding its DMA

coverage in the future due to changing external pressures or different economic incentives, the Assessment report recommended to wait until 100 percent of DOU customers are metered.

During Fiscal Year2018 and 2019, the stakeholders reviewed this report and looked at three alternatives.

Alternative A –was the chosen alternative by our stakeholders as they discussed the business case and benefits drawbacks, risks and costs of holding the program until we are fully metered (Alternative A), continuing as is with current DMAs (Alternative B) or expanding the program (Alternative C). After much discussion and review, the water division manager and DOU team chose to complete DMA Pilot Test Evaluation and hold the Program until fully metered at the end of 2020.

Follow-up on issue and solution that was tested in 2019 during post-performance period

As discussed in previous reports (please see Attachment 4, Assessment of Pilot DMAs), the project team identified that contrary to what the Hydreka equipment specifications claimed, the Hydreka insertion meters were not fully compatible with the Badger endpoints and Beacon software system. This incompatibility issue resulted in incomplete and erroneous flow data being reported to the NRWM. With incomplete/erroneous flow data, the Project Team was initially unable to calculate water losses occurring within the DMAs. *In the spirit of a successful project for all, an agreement and solution was developed and put in place, and tested in 2019.*

Hydreka and Matchpoint offered a solution and an Agreement was approved by the City for Hydreka to loan DTUs to the City while Hydreka updated their firmware or developed an insertion meter that will work with the Badger Orion endpoints. The loan was at no cost to the City, and the DTUs would revert to City's ownership if Hydreka was unable to update their insertion meter at the end of 15 months (see Attachment 6, Change Order 4, Letter Agreement).

The loaned DTUs were installed at each insertion meter location. The DTUs collected the flow data directly from the Hydreka insertion meter and uploaded it to the NRWM and enabled the project team to monitor water losses in the DMAs.

By the end of the 15-month period, Hydreka was able to provide the City with the upgraded Hydrins 2.1 AMI insertion meter and it was installed in February 2019. The City tested it with Badger's cellular endpoint for a trial period of three months as outlined in the Agreement. This upgraded insertion meter was installed at Brookfield Drive DMA Site 1 and data was monitored via Badger Beacon software. On May 8, 2019 the Brookfield Drive DMA Site 1 was no longer providing data. By the end of the month and after significant investigation by the project teams, it was confirmed that the Hydrins 2.1 AMI was malfunctioning and the reason for the malfunctioning meter is still to be determined by Matchpoint and Hydreka.

Because the Hydrins 2.1 AMI had malfunctioned during the trial period, the City will return it to Matchpoint and Hydreka for their further investigation, and they will reinstall the Hydrins 2 EO unit and DTU that was at the Brookfield Dr Site 1 previously. This is planned to be completed by the end of the post- performance period (by June 2019).

As per the Agreement, all of the loaned DTUs and associated equipment will now transfer to City ownership and this will conclude the proposed solution's effort described in the Agreement.

*In summary, the issue was that the current equipment configuration (Hydreka Hydrins 2 EO meters with Badger Orion Endpoints) cannot provide the required data for the City DMA Program; that the configuration cannot report reverse direction now in excess of positive direction flows necessary for the projects study, and that a solution was needed to provide the City with the expected DMA data. The solution for the Hydreka insertion meter may have been for Hydreka to create another mode so that the totalizer can go forward and backwards. With Badger, they relayed that they can take bi-directional flow (not just positive displacement), but when it came to the way the network reports it may have only been able to take positive displacement. And, the City's desire had been to use AMI and Badger Beacon software for DMA monitoring/*evaluating of the project, and that was found to not work well for this project at this time. In the future, others can learn from the project teams work, and may look at alternative approaches, such as mag meters with SCADA as the SCADA system can be programmed to count forward and backward flow.

The remaining tasks through June 2019 is for the City to:

- Avoid leak detection in DMAs until water loss levels surpass the established economic intervention thresholds;
- Return the Hydrins 2.1 AMI Insertion Meter to Hydreka/Matchpoint for their further investigation as it malfunctioned during the 3-month trial;
- Have Matchpoint/Hydreka install the original Hydrins 2 EO unit and DTU at the test site, Brooksfield Dr DMA Site 1, before the end of the post performance period (by June 2019) (so that all DMA sites will have Hydrins 2 EO meters and DTUs by the end of this project);
- Complete DMA Site Location Final Warranty Walk;
- Complete the DMA Pilot Evaluation and do not continue the Program until the City is fully metered;
- Share findings with the DMA Team/Stakeholders.

In the future, the City plans to:

- Evaluate the Water Loss Control Program and options to consider in an updated Water Conservation Plan.

ATTACHMENTS

Attachment 1: Weekly DMA Report, May 9th

May 9th Weekly Report.pdf

Attachment 2: American Water Works Association (AWWA) Presentation

AWWA Presentation.pdf

Attachment 3: Water Technology Alliance (WTA) Workshop Presentation

WTA Workshop Presentation.pdf

Attachment 4: Assessment of Pilot District Metered Areas: Benefits, Challenges, and Business Case with Findings and Recommendations, March 2018.

Assessment of Pilot DMA.pdf

Attachment 5: White House Utility District (WHUD) Webinar

WHUD Webinar.pdf

Attachment 6: Change Order 4 approved by City Council with MOU agreement.

Change Order 4 (CO4).pdf

Appendix 5

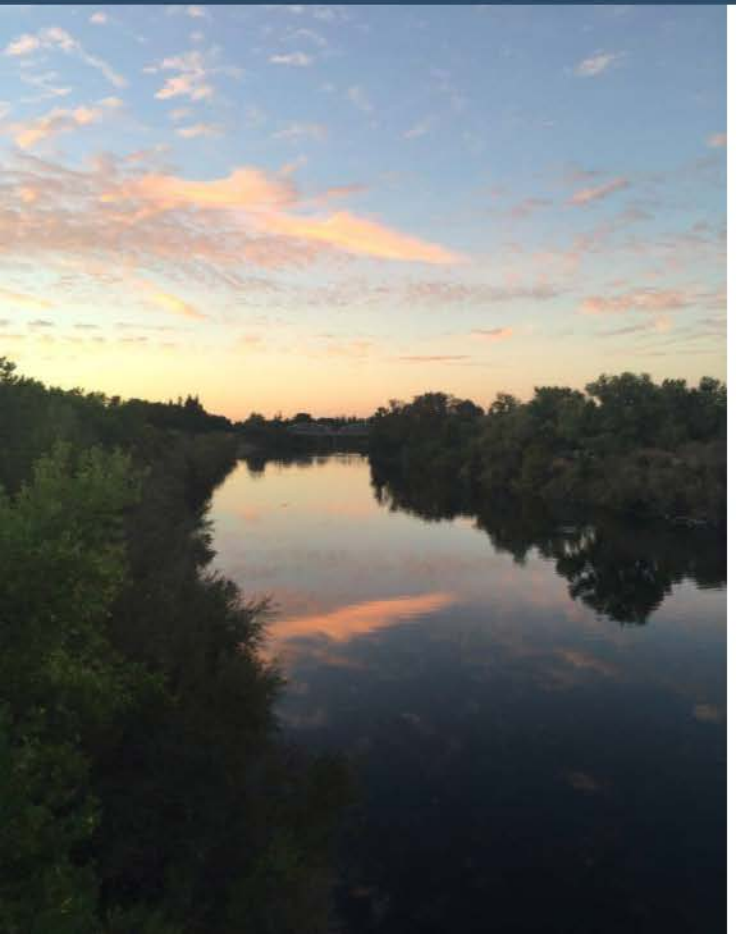
Lower your *utility bill* and *save water*!

Leak-Free Sacramento

- No cost direct install and leak repair program available to eligible single family residential customers in qualified City of Sacramento neighborhoods through September 2017.
- You may be eligible for one, free contractor house call to repair indoor and outdoor leaks and install water efficient fixtures.
  - Toilets, Faucets, Valves, Irrigation systems, etc.
- For more information and to participate (first-come, first-served basis) please contact: (916) 808-3544 or LeakFree@cityofsacramento.org; visit www.sparesacwater.org

311 Español | 中文 | Tagalog | Tiếng Việt | Hmoob | Русский

City of Sacramento
5730 24th Street Building 22
Sacramento, CA 95822



City of SACRAMENTO
Department of Utilities

CALIFORNIA CLIMATE INVESTMENTS

Customer Name

Address

Appendix 6

January 2017

Dear Department of Utilities Customer,

As a customer of the City of Sacramento Department of Utilities, you may be eligible for participation in the Leak-Free Sacramento program. This program is open to homeowners living in their own homes that meet certain eligibility requirements. Leak-Free Sacramento is a one-year program funded by the California Department of Water Resources' Water-Energy Grant. Funding is limited and applications will be accepted on a first-come, first-served basis.

Leak-Free Sacramento is designed to help you repair leaks inside and outside your home at no cost. For more information or to download an application please visit our website at: www.cityofsacramento.org/utilities/conservation/leak-free-sacramento.

Once your application is approved for eligibility, a confirmation number will be provided to you. A Leak-Free Sacramento contracted plumber will then contact you with the confirmation number to schedule a pre-inspection. The contracted plumber will visit your home to evaluate, repair or replace leaking fixtures. **Participation in this program may help to lower your water bill, save future water and energy costs.**

For any questions or to request an application be mailed to you, please call **916-808-3544** or email us at LeakFree@cityofsacramento.org. 311 Español | 中文 | Tagalog | Tiếng Việt | Hmoob | Русский

Mail completed application to:

City of Sacramento Department of Utilities
Leak-Free Sacramento Program
5730 24th Street, Building 22
Sacramento, CA, 95822

Sincerely,

The Leak-Free Sacramento Team

Appendix 7

LEAK-FREE SACRAMENTO PROGRAM

CUSTOMER APPLICATION

Dear City Customer:

Thank you for your interest in the City of Sacramento's Leak-Free Sacramento Program. We are committed to working with you to sustain and integrate water, energy and greenhouse gas emissions reduction, helping the City of Sacramento's economy and environment while ensuring social equity. The Department of Utilities (DOU) Leak-Free Sacramento program is designed to help disadvantaged area communities (DACs) single family residential homeowners with leak repairs. Through this Program, the DOU is pleased to have the support of the Department of Water Resources Water Energy Grant.

The Program offers:

Under this program, the contracted plumber may replace/repair parts with EPA WaterSense approved products when possible, and are not limited to:

- Repair Toilets
- Replace Toilets
- Replace Aerators
- Replace Kitchen Faucets
- Repair Kitchen Faucets
- Repair Disposal Leak
- Replace Lavatory Faucets
- Repair Lavatory Faucets
- Replace Tub and Shower Valves
- Repair Hot Water Heater
- Replace Hot Water Heater
- Replace Quarter-Turn Angle Valve
- Repair Supply Line
- Repair a Leak in Wall
- Repair/Reroute Slab or Home Exterior Leak
- Repair Irrigation System
- Replace Hose Bibbs

To be eligible you must:

1. Be receiving City of Sacramento Water service at the property;
2. Live within one of the DAC areas. (see attached map)
3. Own the home and the land on which the home rests (mobile homes in a mobile park that owns the land are common example of homes not eligible for assistance).
4. Be the permanent resident (s) in the home for which plumbing assistance is needed.
    a. The customer(s) must verify permanent residency by identification, current utility bill, and tax return or deed to the home.

To participate, please follow the below steps:

1. **Fill out the Application:** Complete pages 2-4 (Cover Page, Customer Agreement) and attached the appropriate verification documents of home ownership and residency. Gather your supporting information and submit to LeakFree@cityofsacramento.org or mail to:

City of Sacramento Department of Utilities
Leak-Free Sacramento Program
5730 24th Street, Building 22
Sacramento, CA, 95822

Thank you. We look forward to working with you!
Phone: (916) 808-3544
Website: www.sparesacwater.org

City Of Sacramento Department of Utilities (DOU)
Leak-Free Sacramento Program Application Cover Page

Please check below the items that apply to you and that you are submitting with your application packet.

____ Customer Agreement (Required, see pages 3)

____ Description of potential leak (if applicable, see page 4)

____ Verification documents of home ownership and residency (Required for eligibility)

Approved Program participants will complete the following steps:

1. Once your application has been approved, you will be contacted to schedule a home inspection by the City's contracted plumber. The contracted plumber will locate any leaks inside and outside of your home.
2. Then the contracted plumber determines any repairs/replacements needed in the home. As a customer you will sign and receive a copy of the Leak-Free Sacramento Work Authorization Form and Leak Detection and Repair Agreement Form (if applicable) from the Leak-Free Sacramento contracted plumber, these forms will detail which leaks were found on your property and the repairs/replacements that are needed.
3. Following the completion of the project you will sign and receive a copy of the Leak-Free Sacramento Work Completion Form from the Leak-Free Sacramento Program contracted plumber to insure that the repairs were completed.

Customer Agreement (*Signature Required*)

Please read the following contract carefully. If you have any questions on its content, call (916) 808-3544, or email LeakFree@cityofsacramento.org

Participant Information			
Name of Participant/Customer:			
Address:	City:	State:	Zip:
Water Account:	Phone:	Email Address:	

I, the participant, hereby request to participate in the City of Sacramento's Leak-Free Sacramento Repair Program. I understand and agree to the following conditions of participation:

- I understand that, as a participant, I will be required to work with a contracted plumber through the City of Sacramento's Leak-Free Program.

  I understand that I will not receive monetary reimbursement for this project; funding for my project will be transferred directly to the business indicated.

- I understand that this is a limited, first-come, first served program, and that I am eligible for one contractor site visit and they are only given for projects which have applications that are approved; the City can deny any application that does not meet program requirements.
- I understand that if I am asked for supplemental documents (proof of home ownership) to my application, I must supply them within two weeks from the time I am asked for them from program staff. If I fail to return them within this time frame, my application will be withdrawn and I must wait one month before re-applying.
- I understand the improvements to my plumbing system may not result in lower water bills.
- I understand that Plumbing assistance will **not** be rendered if such assistance will result in hazardous environmental conditions or allow an existing hazardous environmental condition to continue. If a hazardous environmental condition is found, such as mold, asbestos, lead it must be abated per the applicable regulations.
- I understand that my home must be habitable and safe for occupation to be eligible for services. Examples of circumstances that would make a home not eligible include areas open to the outside, lack of complete roofing, floors that are too unstable for toilets to be seated properly or a home settled from its original support structure in a way that makes work on it unsafe. If the contracted plumber notes concern regarding structural stability or general safety of the home, it will be assessed by the Leak-Free Program staff and referred to City of Sacramento Code Compliance as needed.

Customer Signature: _____ Date: _____

Describe the nature of any possible leaks in your home below (if applicable)

Appendix 8

LEAK-FREE SACRAMENTO

WORK AUTHORIZATION FORM

Complete BEFORE work begins

Name of Homeowner: _____
Street Address of Homeowner: _____
City, State and Zip: _____
Plumbing Company Name: _____
Plumber's Name: _____
License Number: _____
Planned Date of Work: _____ Cost Estimate: _____

WORK IDENTIFIED

Please check all that apply and indicate quantity make/model:

__ Repair Toilet(s)
__ Replace Toilet(s)
__ Replace Aerators
__ Repair Kitchen Faucet
__ Replace Kitchen Faucet
__ Repair Disposal Leak
__ Replace Bathroom Faucet(s)
__ Repair Bathroom Faucet(s)
__ Replace Tub and Shower Valves
__ Repair Hot Water Heater
__ Replace Hot Water Heater
__ Replace Quarter-Turn Angle Valve
__ Repair Supply Line
__ Repair an In-Wall Leak
__ Repair/Reroute Slab or Home Exterior Leak
__ Repair Irrigation System
__ Replace Hose Bibb
__ Other: _____

PLUMBER'S WARRANTY

Plumber warrants all of the aforementioned work performed, and materials supplied, to be free of defects for a period of six months from the date performed. Plumber hereby agrees to repair and replace during that period, at no cost to homeowner or to the City of Sacramento Department of Utilities (DOU), any defects arising from the work performed or materials supplied.

PLUMBER'S SIGNATURE: _____ DATE: _____

HOMEOWNER'S WAIVER OF DAMAGE CLAIMS

In consideration of payment for the above repairs by DOU, Homeowner agrees that s/he will hold DOU harmless and will have no recovery against DOU for any damages s/he allegedly suffers due to work performed by Plumber or any other actions of Plumber in connection with the Leak-Free Sacramento Program.

HOMEOWNER'S SIGNATURE: _____ DATE: _____

DOU AUTHORIZATION TO PROCEED - ONLY IF APPLICABLE (Repairs over $200.00 only need a phone call approval. Any repair over S1000.00 requires signature.

CITY DOU PHONE APPROVAL NAME: _____ DATE: _____

CITY DOU APPROVAL SIGNATURE: _____ DATE: _____

COPIES TO:

WHITE (ORIGINAL): DOU PINK: PLUMBER YELLOW: HOMEOWNER

Appendix 9

LEAK-FREE SACRAMENTO

LEAK DETECTION AND REPAIR AGREEMENT FORM

Complete BEFORE work begins

Homeowner Agreement for Leak Detection and Repair

Account/Homeowner Name: _____

Street Address: _____

City, State and Zip: _____

Water Meter Number: _____

1. Homeowner has requested that the Leak-Free Sacramento program locate and repair a water line leak in homeowner's home at the above address.
2. Homeowner understands and acknowledges that the locating of a water line leak will require removal of homeowner's drywall or flooring near existing water fixture connections and other locations as recommended by the contracted licensed plumber.
3. Homeowner understands and acknowledges that homeowner's drywall, tile, cabinets, flooring, or other home materials may be removed or damaged in order to locate the leak and complete the necessary plumbing repairs.
4. Homeowner understands and acknowledges that the contracted licensed plumber will be able to perform minor cosmetic restorations. Anything beyond a minor restoration will be the homeowner's responsibility.
5. Homeowner understands and acknowledges that any water line leaks detected to be in the slab foundation of the homeowner's home will not be repaired, but instead will require that a new water line be routed through walls or attic space.
6. IN CONSIDERATION OF BEING ALLOWED TO PARTICIPATE IN THE LEAK-FREE SACRAMENTO PROGRAM, HOMEOWNER HEREBY RELEASES THE CITY OF SACRAMENTO, ITS OFFICERS, AND EMPLOYEES FROM ANY AND ALL CLAIMS, DEMANDS, OR OTHER LIABILITY OF ANY KIND FOR PROPERTY DAMAGE RELATING TO OR ARISING OUT OF ANY WORK PERFORMED AT THE ABOVE ADDRESS BY ANY PLUMBER OR OTHER CONTRACTOR UNDER THIS PROGRAM.

Homeowner signature and authorization are required to complete leak detection and repairs:

Homeowner Name: _____ Date: _____

Homeowner Signature: _____

COPIES TO:
WHITE (ORIGINAL): DOU PINK: PLUMBER YELLOW: HOMEOWNER

Appendix 10

LEAK-FREE SACRAMENTO

WORK COMPLETION FORM

Complete AFTER plumbing work is completed

Name of Homeowner: _____

Street Address of Homeowner: _____

City, State and Zip: _____

Plumbing Company Name: _____

Plumber's Name: _____

License Number: _____ Date Work Completed: _____

Date Work Authorized: _____

Changes to Work Authorized/ Reason Work Not Completed (If applicable):

_____

_____

_____

_____

_____

_____

I hereby confirm that the work indicated on the Leak-Free Sacramento Work Authorization Form (Dated: _____) was completed. Work not completed is described above with reason the work is not yet completed.

HOMEOWNER'S SIGNATURE: _____ DATE: _____

COPIES TO:

WHITE (ORIGINAL): DOU PINK: PLUMBER YELLOW: HOMEOWNER

Appendix 11

City of SACRAMENTO Department of Utilities

LEAK-FREE SACRAMENTO SUMMARY

29 MARCH 2018

Leak-Free Sacramento: September 2016 – October 2017. Details (to date) are below:

Metric	Measurement	Definition
Total postcards sent	Approx. 815	Total number of postcards mailed to City water customers in Disadvantaged Area Community (DAC) areas with detected leaks
Total letters sent	Approx. 17,622	Total number of letters mailed to City water customers in Disadvantaged Area Community (DAC) areas with detected leaks
Total flyers distributed	Approx. 100	Total number of flyers distributed to local community centers in Disadvantaged Area Community (DAC) areas with detected leaks
Number of calls received	663	All calls received on the Leak-Free phone line (Not all calls are from approved program applicants)
Number of approved customers (Number of customers wait listed) | Average repair cost per customer	324 (15) | $1,729	Number of approved program applicants (and wait listed) and the average estimated repair cost per customer
Number of pending pre-inspections | Number scheduled by contractor	0 | 0	Number of customers awaiting a pre-inspection from the contracted plumber and the number currently scheduled by the contractor
Number of disqualified customers	27	Customers disqualified from the program for not having any leaks or voluntarily opting out
Number of pending repairs | Total estimated repair cost	0 | $0	Number of customers pending leak repair and the total cost of repairs currently to be completed
Total customers with return work | Customers still requiring return work	13 | 0	Total number of customers requiring additional plumbing work after an invoice was submitted and the number of customers still needing return work
Number of customers with completed repairs	297	Number of customers with repaired leaks
Hourly water loss per AMI	1,884 (GPH)	Total combined hourly water loss of each approved applicant in gallons per hour (Before repairs)
Cumulative Water Savings	22,824,466 gal	Total yearly gallons of water saved from leak repair *
Projected cumulative water savings	23,043,466 gal	Projected gallons of water to be saved by all approved customers per year *
Cumulative energy savings	22,802 kWh	Total yearly kWh currently saved from leak repair *

Projected cumulative energy savings	23,020 kWh	Projected kWh saved per year by all approved customers per year *
Total amount invoiced | Number of invoices	$438,460 | 310	The total approved dollar amount invoiced, and the number of invoices approved

* Based on AMI / Beacon leak reporting, not DWR part replacement reporting

PLUMBING PARTS REPAIRED / REPLACED: OVERVIEW

EPA WATERSENSE FIXTURES INSTALLED WHERE APPLICABLE

Plumbing Part	Amount
Kitchen / Bathroom Faucets	293
Kitchen / Bathroom Aerators	63
Kitchen / Bathroom Sinks	4
Kitchen / Bathroom P-Traps	38
Kitchen / Bathroom Drainage Systems	22
Toilets Replaced	205
Toilets Repaired	42
Toilet Supply Lines	7
Shower Stems	11
Shower Valves	199
Showerheads	208
Bathtub Spouts	10
Quarter-Turn Angle Stops	159
Outside Hose Bibbs	249
Irrigation Valves	163
Water Heaters	19
Total Repaired Fixtures	530
Total Replaced Fixtures	1318

PLUMBING PARTS REPAIRED / REPLACED: IN-DEPTH

EPA WATERSENSE FIXTURES INSTALLED WHERE APPLICABLE

Kitchen

Kitchen Sink	Repair: **1**	Kitchen Faucet	Repair: **3**
	Replace: **2**		Replace: **106**
Garbage Disposal	Repair: **1**	Kitchen Drainage	Repair: **4**
	Replace: **4**		Replace: **14**
Kitchen P-Trap	Repair: **10**	Kitchen Angle Stops	Repair: **2**
	Replace: **4**		Replace: **37**
Replace Kitchen Faucet Supply: **2**		Replace Kitchen Aerator: **15**	
Replace Kitchen Hand Sprayer: **1**			

Bathroom

Bathtub Faucet	Repair: **0**	Bathroom Faucet	Repair: **10**
	Replace: **10**		Replace: **135**
Bathroom Drainage	Repair: **2**	Toilet	Repair: **42**
	Replace: **2**		Replace: **205**
Shower Valve	Repair: **180**	Toilet Supply Line	Repair: **0**
	Replace: **19**		Replace: **7**
Bathroom Sink	Repair: **0**	Bathroom P-Trap	Repair: **6**
	Replace: **1**		Replace: **13**
Bathroom Angle Stops	Repair: **1**	Replace Showerhead: **108**	
	Replace: **119**	Replace Handheld Showerhead: **100**	
Replace Shower Stem: **11**		Replace Misc Shower Parts: **21**	
Replace Bathroom Aerator: **48**			

Outdoors

Irrigation Line	Repair: **9**	Irrigation Valve	Repair: **20**
	Replace: **6**		Replace: **143**
Sprinklers:	Repair: **15**	Hose Bibb	Repair: **35**
	Replace: **80**		Replace: **214**

Miscellaneous

Water Heater	Repair: **1**	Main Shut Off Valve	Repair: **3**
	Replace: **18**		Replace: **9**
Miscellaneous Faucet	Repair: **3**	Misc P-Traps	Repair: **4**
	Replace: **26**		Replace: **1**
Repair In-Ground Leaks: **11**			
Repair In-Wall Leaks: **4**			

Appendix 12

City of SACRAMENTO
Department of Utilities

Leak-Free Sacramento Program Protocol

2016-2017

The Department of Utilities (DOU) Leak-Free Sacramento program is designed to help disadvantaged area communities (DACs) single family residential homeowners with leak repairs. Through this Program, the DOU is pleased to have the support of the Department of Water Resources Water Energy Grant to aide with sustaining and integrating water, energy and greenhouse gas emissions reduction, helping the City of Sacramento's economy and environment while ensuring social equity. The following policy sets forth all requirements to be met prior to assistance being provided.

Program Qualifications

Qualifications for participation in the Leak-Free Sacramento Program (Program) are contingent upon applicants meeting the following criteria:

- Live within the one of the DAC areas.
    - The City will only promote to targeted customers in this area with irregular water use.
- Residential Class Customer(s)
    - Single family residential dwellings.
- Customer(s) applying for plumbing assistance is considered a homeowner for purposes of this program only if they:
    - Own both the home and the land on which the home rests (mobile homes in a mobile park that owns all the land are common example of homes not eligible for assistance).
    - Are the permanent resident(s) in the home for which plumbing assistance is needed.

- Plumbing assistance will **not** be rendered if such assistance will result in hazardous environmental conditions or allow an existing hazardous environmental condition to continue. If a hazardous environmental condition is found, such as mold, asbestos, lead it must be abated per the applicable regulations.
- Home must be habitable and safe for occupation to be eligible for services. Examples of circumstances that would make a home not eligible include areas open to the outside, lack of complete roofing, floors that are too unstable for toilets to be seated properly or a home settled from its original support structure in a way that makes work on it unsafe. If the contracted plumber notes concern regarding structural stability or general safety of the

home, it will be assessed by the DOU Program staff and referred to City of Sacramento Code Compliance as needed.

- Homeowner must be qualified by living within a DAC and be a DOU water customer. The customer(s) must verify permanent residency by identification, current utility bill, and tax return or deed to the home.

Program Procedures for DOU Program Staff

Applicants are verified and approved by DOU through the following process:

1. Program participants generally learn about the Program through a postcard that the DOU will mail out to residences with leaks detected from the AMI (Advanced Metering Infrastructure) system. Upon learning about the program, the customer is referred to a hotline or email address and will contact DOU Program staff to verify that they are qualified for this program. Homeowners will provide DOU Program staff with their contact number and address, and once approved, DOU Program staff will refer them to the Leak-Free Sacramento web site to obtain an application or they will be mailed an application.

2. Once DOU Program staff receive the customer's application they will verify all documentation needed for approval:
   - Identification cards
   - Proof of residency (can be a piece of mail or electricity bill)
   - Proof of home ownership (showing client's name) (i.e. taxes or house deed)

3. Once an applicant is qualified, DOU Program staff will give the customer a confirmation number. They will enter the customer's information into a secure spreadsheet. The list will include the client’s name, address, phone number and water account number, and a description of the nature of the problem if applicable. Approval with a confirmation number does not guarantee any repairs. Repairs must be justified by the contracted plumber and final approval must be made by DOU Program staff.

4. The DOU Program staff will send the confirmation number and the customer’s information to the contracted plumber in a pdf “work order” via email.

5. The contracted plumber will contact the customer directly to schedule a service call.

Homeowner Qualification Period

Homeowners remain qualified for a 30-day period after initial approval for one service call for all repairs. After this time period has expired, and no repairs are completed, the homeowner must re-qualify through the DOU Program staff before

any services through the program will be rendered. Customers MAY NOT call the contracted plumber directly to schedule additional work even if repairs were made under the program in the past.

Customers may be disqualified from the program, if at any point during the one month period DOU learns of a change in status of any of the qualifying criteria. For example, if a customer is qualified for the Program but a month later or so rents out their house. In this case they no longer reside in the home needing assistance and are ineligible to receive service.

A customer may also be disqualified if they are non-responsive to contact efforts by DOU Program staff or by the contracted plumber to schedule an appointment for a pre-inspection and repair or replacement service. In the case where DOU Program staff and/or the contracted plumber attempted contact by phone or written letter a total of three (3) times or more, the circumstances will be reviewed on a case-by-case basis by DOU Program staff on whether or not to continue to make contact.

Scope of Services

The contracted plumber will be responsible for coordinating with DOU Program staff in obtaining the approved list of participants who qualify for the program. The list will have the participant's information along with their identified plumbing problems to be verified by the contracted plumber. The contracted plumber will be responsible for contacting participants and setting an appointment time for repairs to be made within a one-week period of receiving notice from DOU. Repairs must be made within five (5) business days of initial inspection, unless DOU Program staff approves otherwise.

Prior to commencing work at the customer's address, the contracted plumber will be responsible for obtaining a signed Leak-Free Sacramento Leak Detection and Repair Agreement form before work begins. This form must be signed by the customer/homeowner, contracted plumber and DOU Program staff. The DOU Program staff does not need to sign off on work prior to completion if the total amount of repairs is less than $200. The contracted plumber will be responsible for assessing the working situation prior to initiating work to ensure that repairs and/or retrofits can be properly accomplished. The assessment should include determining any structural weaknesses or any potential problems that will prohibit the repairs from being accomplished. In addition, if a contracted plumber deems the situation, prior to starting the repairs, as a threat to health, safety, and welfare, for the contracted plumber or the customer, the contracted plumber will be allowed to refuse to perform the services with proper notice to the DOU.

- The DOU will only address potable water leaks; drain line or other problems that take sewer water to sewer lines is not qualified.
- The contracted plumber is to make every attempt to repair a leak before replacement of a part is determined. If the contracted plumber believes that any repair of a fixture will be short-lived due to the condition of the fixture, they should consult with the DOU program staff about whether to perform a replacement service.

- Cosmetic or structural repairs may be made by the contracted plumber's sub-contractor.
- All plumbing work is scheduled and completed through a contracted plumber, and approved through the Program staff.
- Contracted Plumber must have appropriate identification showing that they are working with Leak-Free Sacramento when visiting a customer's home

Approved Plumbing Repairs

The following includes, but is not limited to, repairs that can be made through the program:

1. **Toilets –** Contracted plumber will be responsible for repairing toilets, if a repair is impossible or if a high-flow toilet (greater than 1.6 gallons per flush) is found in the client's residence, it can be replaced with a new High Efficiency Toilet. The Contracted plumber must use toilets approved by the DOU and all invoices must reflect this or they will not be compensated. The cost of replacement of all toilets will be coordinated by DOU Program staff with the Regional Water Authority and their Toilet Replacement Program.

- Contracted plumber shall provide a set price in the attached Estimated Plumbing Costs Form for the removal and retrofit of an existing high flow toilet to include **ALL labor**, foreseen or unforeseen, excluding flange repair or replacement only.
- Contracted plumber shall provide a set price in the attached Estimated Plumbing Costs Form for toilet flange replacements to include **ALL labor**, foreseen or unforeseen.
- Repair will include the removal and replacement of the fill valve, flapper, flapper stand pipe, seating area, and tank to bowl gasket with new bolts.
- High flow toilets may be replaced with High Efficiency Toilets.
- Low flow toilets (less than 1.6 gallons per flush) may not be replaced with High Efficiency Toilets.
    - If a low flow toilet already exists at the location, repairs are to be made to ensure proper working condition.
    - The only exception to this policy is if a low flow toilet is non-repairable, then a low flow toilet may be replaced with a new High Efficiency Toilet upon approval from DOU Program staff.
        - Major Cosmetic Repairs will be determined by the DOU if eligible and non-standard interior parts that must be ordered will be determined by the DOU if eligible.
        - The contracted plumber must obtain prior authorization from the DOU.
- If the homeowner has a documented need for ADA compliant toilets or is 65 years of age or older, ADA toilets can be installed as a replacement for existing high flow toilets only. Existing low flow toilets (less than 1.6 gallons per flush) are not eligible for ADA retrofit. Unless the existing low flow toilet is unrepairable, then it can be replaced with ADA retrofit. DOU Program staff must verify this.
- Toilets will not be replaced if the flooring of the lavatory or other structural problems prohibits the replacement of the toilet.

3. **Lavatory Faucets –** Contracted plumber shall provide a set price in the attached Estimated Plumbing Costs Form for the removal and replacement of an existing lavatory faucet assembly to include **ALL labor**, foreseen or unforeseen.

- New lavatory faucet assembly must include 1.0 gallon per minute aerators

4. **Kitchen Faucets –** Contracted plumber shall provide a set price in the attached Estimated Plumbing Costs Form for the removal and replacement of an existing kitchen faucet assembly to include **ALL labor**, foreseen or unforeseen.

- New kitchen faucet assembly must include 1.5 gallon per minute aerators.

5. **Shower/Tub valves-** Contracted plumber shall provide a set price in the attached Estimated Plumbing Costs Form for the removal and replacement of an existing single handle or existing two-handle Tub/Shower valve or Tub diverter valve assembly to include **ALL labor**, foreseen or unforeseen.

- New Tub/Shower valve assembly must be low-flow certified.

6. **Hose Bibbs-** Contracted plumber shall provide a set price in the attached Estimated Plumbing Costs Form for the removal and replacement of existing outside hose bibb assemblies to include **ALL labor**, foreseen or unforeseen.

7. **Other Repairs –** Contracted plumber shall provide a standard flat rate in the attached Estimated Plumbing Costs Form for all repairs outside of the aforementioned services listed in this RFQ including:

- **Water Heaters**
- **Water Service Lines**
- **Water Lines Within the Home**
    - Contracted plumber will complete limited repairs to water lines within the home. They will not break into foundations for repairs, but may assess options for rerouting water lines when feasible.
- All replacement material/fixtures **must** be approved and meet the requirements of the DOU.
- Contracted plumber must provide a purchase invoice for materials purchased for plumbing services.

8. **Aerators and Showerheads-** As part of the site visit, Contracted plumber shall be responsible for replacing all kitchen faucet aerators with 1.5 gallon per minute (GPM) aerators; all lavatory faucet aerators with 1.0 GPM aerators; and all showerheads with 1.5 GPM or 1.75 GPM flows are to be provided by the contracted plumber. Contracted plumber shall provide a set price in the attached Estimated Plumbing Costs Form for these replacements on a per unit cost basis for each fixture installed.

Contracted Plumber Work Process

The contracted plumber must contact the customer directly to schedule a service call and utilize the work process described below. The contracted plumber is required to complete the required forms before actual work begins at the property and also upon completion. The DOU reserves the right to change the contracted plumber assignments for any assigned project prior to the commencement of work at no cost to the DOU.

DOU Leak-Free Sacramento Work Authorization Form:
Prior to beginning work, the contracted plumber must:

- Document the work anticipated to be done at the property with the estimate for the total cost of the repairs or replacement, and obtain the customer's signature on the Leak-Free Sacramento Work Authorization Form.
- Provide the original to DOU Program staff.
- If the customer does not want to sign the form (which includes the Homeowner's Waiver of Damages), the contracted plumber's repairs or replacement cannot be made. The contracted plumber should ask the customer to discuss their concerns immediately with DOU Program staff if the customer is unwilling to sign.

DOU Leak-Free Sacramento Leak Detection and Repair Agreement

- Prior to any troubleshooting and leak repairs by the contracted plumber requiring removal of building materials, the contracted plumber will have the homeowner sign the Leak-Free Sacramento Leak Detection and Repair Agreement which removes DOU liability for property damage and provide a copy to DOU Program staff.

DOU Leak-Free Sacramento Work Completion Form

- Upon job completion, the contracted plumber must have the customer sign the Leak-Free Sacramento Work Completion Form. If any additional work was necessary and was not originally listed on the Leak-Free Sacramento Work Authorization Form, it is required for the contracted plumber to list the additional work on the form as long as it has been approved by Program staff.

- If the contracted plumber discovers that more work is needed, approval can be done via a phone call to DOU Program staff. The time and date of phone call approval needs to be documented along with name of staff that approved it.

The contracted plumber is required to leave a copy of the signed Leak-Free Sacramento Work Authorization Form and Leak-Free Sacramento Work Completion Form with the customer. A copy of the signed Leak-Free Sacramento Leak Detection and Repair Agreement should also be left with the customer when applicable.

It is the responsibility of the contracted plumber to complete the Leak-Free Sacramento forms. A completed and signed copy of each form with original signatures is required to be submitted to DOU Program staff with the contracted plumber's invoice. No payment from the DOU will be made to the contracted plumber prior to the receipt of these forms.

Cost Schedule for Repairs

The following is a cost schedule established for invoices submitted by the contracted plumber through the program:

- Contracted plumber will provide information one day in advance to DOU Program staff on all scheduled Leak-Free Sacramento appointments for service. This will facilitate inspection visits that DOU staff may choose to make at any time to assure high quality service and accurate assessment of repair challenges.

- Repairs under $200 – the contracted plumber is authorized to make these repairs without prior approval from the DOU, but must complete all pertinent forms (discussed above) and take photos for pre- and post-repair for documentation of work completed.

- Repairs over $200— requires prior approval from the DOU before contracted plumber can make repairs. The contracted plumber will contact the DOU Program staff to request and receive authorization of repairs and must complete all pertinent forms (discussed above) and take photos for pre- and post-repair for documentation of work completed.

- Repairs estimated over $1,000 require the contracted plumber to provide a line item cost estimate of repairs along with DOU prior approval, and photo documentation. Authorization can be given by the DOU Program staff and a DOU site visit may be required.

- Repair estimates over $2,000 or repairs/issues with unusual circumstances - the DOU Program staff will require the Administrator's advice and/or approval before work authorization is given to the contracted plumber. A DOU site visit must be completed prior to authorization given.

- Repairs may be made up to a value of $4,000, but not more.

- If a contracted plumber submits an invoice and the amount exceeds the authorized amount and prior approval was not received, then the contracted plumber will submit the invoice for the appropriate authorized amount only.

Generating Leak-Free Sacramento Work Orders

1. DOU Program staff will verify customer eligibility for the Program:
   - Customer lives in a DAC
   - Customer owns their home and lives in residence

2. DOU Program staff will check the Program database to find out if the property has ever qualified for Program assistance in the past. They will enter into the Program database:
   - First name
   - Last name
   - Street Number
   - Street Name
   - Zip Code
   - Home Phone Number

- Alternate Number, if listed

3. DOU Program staff will generate a Leak-Free Sacramento Work Order

- Customer Description—type of leaks or problems (if applicable)
- Date Received—the date the Leak-Free Sacramento application is received
- Date Assigned—the date a contracted plumber is assigned
- Contracted Plumber Assigned—name of contracted plumber
- Customer is 65 years of age or older or qualifies for ADA compliance (Toilet Replacement)

4. DOU Program staff will email the contracted plumber with a referral spreadsheet of qualified work orders for customers. These can come in during any business day of the week and include any range of Program referrals.

The homeowner name on the DOU Program staff referral spreadsheet must match the name on the Program database.

Contracted plumber contacted directly by homeowner is required to notify DOU Program staff and get approval before scheduling an appointment.

Invoicing

1. Upon receipt of contracted plumber invoice for payment, Program staff will review and approve all invoices submitted through the Leak-Free Sacramento Program. The following steps are taken to process the invoices:

- Staff reviews content of invoices to ensure proper billing. Contracted plumber is not to bill DOU for travel time to obtain standard items. If these charges are included, the invoice will not be approved and will be returned to the contracted plumber for correction.

- Once approved for payment, the invoice will be sent over to DOU's Business and Integrated Planning (BIP) division.

- DOU's BIP will give final approval and send out payment.

Processing Plumbing Invoices

The contracted plumber, upon the completion of repairs, will submit an invoice for payment. Along with the invoice the contracted plumber should include the original copy of the following:

- Leak-Free Sacramento Work Authorization Form
- Leak-Free Sacramento Work Completion Form
- Copy of Original Invoice from Plumbing Company
- Program Leak Detection and Repair Agreement (if applicable)

If a contracted plumber submits an incomplete Authorization and Completion Form, DOU will not remit payment for these repairs.

It is the responsibility of the plumbing company to complete the Work Authorization Form and Work Completion Form including customer signatures at the appointment. Failure to do so will cause a delay, and in some cases the refusal of, payment to the contracted plumbing company by DOU for the submitted invoice for Program repairs.

Once the invoice has been reviewed and approved by Program staff, the information must be updated in the Program database. Once all information is updated, the invoice is then submitted to the DOU BIP for payment processing.

The contracted plumber will receive payment from DOU within eight weeks.

Appendix 13

City of SACRAMENTO

Request for Qualifications (RFQ)

RFQ NO. Q16141071032

Project Name: **Contracted Plumbers for Leak-Free Sacramento Program**

RFQ Posted on: June 10, 2016

Questions due by: June 24, 2016 @ 2:00PM PST

RFQ Closes on: July 1, 2016 @ 2:00PM PST

Non-mandatory Pre-Proposal Meeting: June 16, 2016 @ 2:00PM

Qualifications should be delivered no later than 2:00PM on July 1, 2016 to:

Department of Utilities
5730 24th Street Building # 22, Sacramento, CA 95822
Attn: Julie Friedman, Environmental Services Manager;
Ken Swartz, Logistics Manager

Issue Date: June 10, 2016

The City of Sacramento Department of Utilities (DOU) is using Department of Water Resources Water Energy Grant funding to pay for leak detection and repair and/or fixture replacement for water service customers in disadvantaged area communities. The City is soliciting qualified plumbing contractors for the purpose of establishing a list of contracted plumbers to provide repair and installation services on private property. Interested contractors are required to maintain a State of California C36 Plumbing Contractor's license.

Submit Hard Copies of RFQ Responses to:

City of Sacramento, Department of Utilities
5730 24th Street Building #22
Sacramento, CA 95822
Attn:
Julie Friedman, Environmental Services Manager;
Ken Swartz, Logistics Manager

Submit Responses By: July 1, 2016 no later than 2:00 p.m. PST

Submit all questions via the City of Sacramento online bid portal at:
http://www.planetbids.com/portal/portal.cfm?CompanyID=15300
Written response to questions will be provided as an addendum to this RFQ.

Table of Contents

1. About the City of Sacramento

Founded in 1849, the City of Sacramento is the oldest incorporated city in California and is the capital city of California. It has a population of 469,864. Sacramento is a progressive city with great pride in its ethnic and cultural diversity, concern for environmental and social issues and emphasis on quality in the provision of governmental services. Sacramento is a charter city, which operates under the City Council Manager form of government. It has an annual budget of $951.6 million and 4,299 full-time equivalent positions.

2. Project Overview

The DOU is implementing the Department of Water Resources' Water and Energy Grant to reduce water losses, save water and energy. Leak-Free Sacramento is a 14-15 month program that will reduce water losses and aide eligible customers with leak repairs or fixture replacement. The program is for eligible single family homeowners located within the disadvantaged area communities of Sacramento and will be available during the time period: August/September 2016 through September/October 2017. Approximately 18,000 residences are located in disadvantaged area communities (DACs). These may be eligible for the program, and the DOU estimates about 900 customers may respond.

The DOU is seeking responses from firms that can:

- Coordinate with pre-qualified customers for pre-inspection of indoor and outdoor leak repair or replacement.
- Provide customer service for repair requirements, selection, and installation scheduling.
- Secure all permits and approvals for water loss repairs.
- Provide repair services with a minimum six month labor warranty.
- Provide a bonded and licensed (including C 36 license) plumber to perform interior and exterior water use surveys and retrofits.
- Properly destroy/dispose of old fixtures and pipes.
- Provide the DOU with a monthly report and invoice, and quarterly report summarizing repairs/replacements.

Typical leak repairs and/replacement are noted on page 6-7.

3. Proposed Timeline

RFQ Issued:	June 10, 2016
Non-mandatory Pre-Proposal Meeting:	June 16, 2016 @ 2:00PM
RFQ Questions Due By:	June 24, 2016 @ 2:00PM
Responses Due:	July 1, 2016 @ 2:00PM
Interviews (if necessary):	July 6, 2016 (10 am–5 pm)
Selected Firms Notified:	July 8, 2016

NOTE: The DOU reserves the right to modify the dates listed at its sole discretion. Prospective contractors will be notified of any significant schedule changes by an addendum issued via the City of Sacramento's online bid portal. The DOU shall

not accept submittals after the submission deadline specified in this RFQ and shall return the unopened responses to the respective respondents. The DOU will not consider late responses under any circumstances.

4. Scope of Services

See Attachment 6: **Leak-Free Sacramento Program Protocol.**

Contracted Plumber Availability to Customers:

The DOU staff will require the contracted plumber to be available for customer service and be able to work with up to ten customers per week. The DOU will send the contracted plumber a verified customer's confirmation number and information in a pdf "work order" via email as customers apply and are approved for the program. The contracted plumber will also establish and maintain a customer service telephone line and email address that is staffed at least four (4) hours per day, five (5) days per week; and includes an afterhours recorded message and emergency contact number. The contracted plumber shall provide information about the program and the benefits of participating including: fixture performance, selection and installation. The contracted plumber must coordinate with the DOU for assistance in communicating with multi-language households. DOU uses a language hotline: 1(888) 338-7394

Contracted Plumber Work Process

The contracted plumber must contact the customer directly to schedule a service call and utilize the work process described below. The contracted plumber is required to complete the required forms before actual work begins at the property and also upon completion. The DOU reserves the right to change the contracted plumber assignments for any assigned project prior to the commencement of work at no cost to the DOU.

DOU Leak-Free Sacramento Work Authorization Form:
Prior to beginning work, the contracted plumber must:

- Document the work anticipated to be done at the property with the estimate for the total cost of the repairs or replacement, and obtain the customer's signature on the Leak-Free Sacramento Work Authorization Form.
- Provide the original to DOU Program staff.
- If the customer does not want to sign the form (which includes the Homeowner's Waiver of Damages), the contracted plumber's repairs or replacement cannot be made. The contracted plumber should ask the customer to discuss their concerns immediately with DOU program staff if the customer is unwilling to sign.

DOU Leak-Free Sacramento Leak Detection and Repair Agreement

- Prior to any troubleshooting and leak repairs by the contracted plumber requiring removal of building materials, the contracted plumber will have the homeowner sign the Leak-Free Sacramento Leak Detection and Repair Agreement which removes DOU liability for property damage and provide a copy to DOU Program staff.

DOU Leak-Free Sacramento Work Completion Form

- Upon job completion, the contracted plumber must have the customer sign the Leak-Free Sacramento Work Completion Form. If any additional work was necessary and was not originally listed on the Leak-Free Sacramento Work Authorization Form, it is required for the contracted plumber to list the additional work on the form as long as it has been approved by Program staff.

- If the contracted plumber discovers that more work is needed, approval can be done via a phone call to DOU Program staff. The time and date of phone call approval needs to be documented along with name of staff that approved it.

The contracted plumber is required to leave a copy of the signed Leak-Free Sacramento Work Authorization Form and Leak-Free Sacramento Work Completion Form with the customer. A copy of the signed Leak-Free Sacramento Leak Detection and Repair Agreement should also be left with the customer when applicable.

It is the responsibility of the contracted plumber to complete the Leak-Free Sacramento forms. A completed and signed copy of each form with original signatures is required to be submitted to DOU Program staff with the contracted plumber's invoice. No payment from the DOU will be made to the contracted plumber prior to the receipt of these forms.

Contracted Plumber Cost Schedule for Repairs:

The following is a cost schedule established for invoices submitted by the contracted plumber:

- Contracted plumber will provide information one day in advance to DOU Program staff on all scheduled Leak-Free Sacramento appointments for service. This will facilitate inspection visits that DOU staff may choose to make at any time to assure high quality service and accurate assessment of repair challenges.

- Repairs under $200 – the contracted plumber is authorized to make these repairs without prior approval from the DOU, but must complete all pertinent forms (discussed above) and take photos for pre- and post-repair for documentation of work completed.

- Repairs over $200— requires prior approval from the DOU before contracted plumber can make repairs. The contracted plumber will contact the DOU Program staff to request and receive authorization of repairs and must complete all pertinent forms (discussed above) and take photos for pre- and post-repair for documentation of work completed.

- Repairs estimated over $1,000 require the contracted plumber to provide a line item cost estimate of repairs along with DOU prior approval, and photo documentation. Authorization can be given by the DOU Program staff and a DOU site visit may be required.

- Repair estimates over $2,000 or repairs/issues with unusual circumstances - the DOU Program staff will require the Administrator's advice and/or approval before work authorization is given to the contracted plumber. A DOU site visit must be completed prior to authorization given.

- Repairs may be made up to a value of $4,000, but not more.

- If a contracted plumber submits an invoice and the amount exceeds the authorized amount and prior approval was not received, then the contracted plumber will submit the invoice for the appropriate authorized amount only.

Contracted Plumber Project Services:

The contracted plumber shall make every reasonable effort to accommodate the customer's preference and needs in regards to scheduling and conducting repair work. This includes a pre-inspection site visit as long as it is consistent with the Leak-Free Sacramento Protocol (in Attachment 6). The contracted plumber shall secure all necessary permits, fees, and authorizations prior to starting any work. Repair scheduling and installations are to be completed in a timely manner (within a 30 day time-line without extenuating circumstances by the customer) and follow the Leak-Free Sacramento Protocol.

Permitting

The contracted plumber will pay for and secure plumbing permits, as required, from various City and County planning and building departments for each proposed installation before work begins. In addition, the contracted plumber shall schedule all final inspections, as required by City and/or County inspectors, in accordance with the permitting process outlined by the agency.

The contracted plumber shall provide a copy of the approved permit and final inspection, as necessary, with monthly invoice with the Leak-Free Sacramento Work Completion Form as documentation of completed installations. This form, along with final post inspection photos and contracted plumber's invoice will constitute successful installation and warrant compensation.

Repairs and Replacement

One goal of this program is to ensure that the retrofits and repairs properly function and remain in the housing unit through their estimated lifetime use, thus ensuring consistent and reliable water and energy savings. The DOU is seeking quality products for the best value to complete these retrofits.

Under this program, the contracted plumber may replace/repair parts with EPA WaterSense approved products when possible, and are not limited to:

- Repair Toilets
- Replace Toilets
- Replace Aerators
- Replace Kitchen Faucets
- Repair Kitchen Faucets
- Repair Disposal Leak
- Replace Lavatory Faucets
- Repair Lavatory Faucets
- Replace Tub and Shower Valves

- Repair Hot Water Heater
- Replace Hot Water Heater
- Replace Quarter-Turn Angle Valve
- Repair Supply Line
- Repair a Leak in Wall
- Repair/Reroute Slab or Home Exterior Leak
- Repair Irrigation System
- Replace Hose Bibbs

Installation Inspections

The DOU staff will conduct inspections at a number of sites. Any irregularities noticed in the course of installation review, or inaccurate or partially completed information on the forms, will result in the processing of contracted plumber's invoices to be held in abeyance until the irregularity is remedied by contracted plumber to the DOU's satisfaction.

Program Reporting and Billing

Reporting: The contracted plumber will be responsible for cumulative participating customers' pre-inspection, repair and installation information. A monthly summary will be required within (5) working days of the close of each month. Reporting will continue through the last fixture installation of the program, and then the contracted plumber will provide a follow-up quarterly report (3 months) of participants requesting or receiving warranty (parts or labor) services for fixtures installed by the contracted plumber.

Reporting data will include participating customer name, address, phone number, the number and type of fixture installations, the make and model, and installation or repair date, and a copy of the Leak-Free Sacramento program work authorization, leak detection and repair agreement, and work completion forms, photos, and all permits and approvals, as necessary, attached. The DOU will work with the contracted plumber to develop and/or modify the data requirements in an effort to improve the reporting process based on a greater understanding of program data collection needs.

Invoice Billing: On a monthly basis, the contracted plumber shall invoice the DOU for all installations completed or repairs made during that period. Charges on the invoice shall be noted on a per unit cost basis for each fixture installed, and in line with the charges quoted in the pre-inspection Work Authorization Form and in sync with the Estimated Plumbing Costs Form (Attachment 5, Leak-Free Sacramento Protocol). In addition to the invoice, the contractor shall submit a monthly report listing each customer repair/installation with supporting documents. The DOU reserves the right to withhold payment if the contractor fails to meet reporting, invoicing, or repair/installation requirements. Payment will be withheld until deficiencies are corrected to the DOU's satisfaction.

All data, documents, discussions, or other information developed or received by the contracted plumber in performance of this agreement are the property of the DOU, and not to be disclosed to any person except as authorized by the DOU, or as required by law. All reports, documents, or other materials developed or

discovered, or any other person engaged directly or indirectly by contractor to perform services, shall be and remain the property of the DOU without restriction or limitation upon their use.

5. Submittal Requirements

Each response that is submitted for consideration shall include, at a minimum, the RFQ transaction number, project name, company name, and the information as called for in the section below. To be considered, your submittal(s) shall be responsive to all of the items set forth in this RFQ.

Submit fee schedule(s), and flat rates within your submittal of qualifications using the Estimated Plumbing Costs Form provided.

Six (6) copies of the Statement of Qualifications (SOQs) including one (1) unbound copy, and one (1) electronic copy of the SOQ in both PDF and MS Word 2010 format, shall be submitted no later than **2:00 PM PST, July 1, 2016** to:

City Of Sacramento Department of Utilities
5730 24th Street Building # 22 Sacramento, CA 95822

Attn: Julie Friedman, Environmental Services Manager;
Ken Swartz, Logistics Manager

The Statement of Qualification must be limited to ten (10) single-sided pages with minimum 11-point font, not including introductory letter, resumes, and LBE forms (Attachment 2).

Transmittal Letter: The proposal should be signed by an officer authorized to bind the proposing firm. Include contact information, the state in which the firm is headquartered and whether the firm will be using any subcontractors. The transmittal letter must also acknowledge any addendums provided on the City of Sacramento's Online Bid Portal Planet Bids.

Please provide and present the following information in the order listed, in a clear and concise format:

Title Page
State the RFQ subject, name of the firm, local address and telephone number of the submitter's chief contact person, and the date of the proposal.

Table of Contents
The table of contents of the submittal should include a clear and complete identification of the materials submitted by section and page number.

Profile of Firm

Include staffing size of your firm and your firm's client base (i.e. local, regional, statewide, etc.) and the location of the office from which the work will be done and the staffing allocation for that office. Include a statement as to the firm's capability to support the proposed work.

Supervisory and Staff Qualifications and Experience, identify staff, including a point-of-contact.

Identify staff, including managers, supervisors and specialists, who would be assigned to the program. Clearly identify the program Administrator and his or her availability to manage the program between August/September 2016 and September/October 2017. Specifically discuss program administration, customer service, plumbing industry and construction experience, etc. that confirms the ability to perform the scope of work.

References

List a minimum of two and a maximum of five similar recent projects performed. Indicate the scope of work, date, customer(s), total hours, and the name and telephone number of the principal client contact. Provide no more than a one page response per project.

Conflicts of Interest

Describe any potential conflicts of interest that your firm may have regarding the project.

6. Evaluation Criteria

After the submittal deadline has passed, a selection committee comprised of City staff and a participant from another public agency or local utility or firm will review each SOQ received and make selections.

The SOQs will be evaluated and ranked based upon the criteria provided in SOQ Rating Form (Attachment 3)

A selection of the top ranked firms for the contracted plumbers for Leak-Free Sacramento Program may be made based solely on the selection committee's review and ranking of the Statement of Qualifications, without conducting any interviews.

Interviews may also be conducted with the top ranked firms determined in the selection. If interviews are held, the selection committee will select the top-ranked firms based on both the Statement of Qualification rankings and the interview results, as indicated in Attachment 3 – Statement of Qualification Rating Form.

Local Business Enterprise (LBE) participation will be considered during Statement of Qualification evaluation as indicated on the Qualification Rating Form.

The issuance of this RFQ shall not be interpreted as, and does not constitute, a representation by the City that any specific firm or firms will be retained to perform any of the services described herein, and a firm shall not acquire any

right or entitlement to be retained for such purpose by virtue of submitting a Statement of Qualification in response to this RFQ.

Firms or individuals interested in submitting Statement of Qualifications for this project should respond to this RFQ by submitting a written Statement of Qualification providing all the information requested below. The Statement of Qualification will be considered complete only if all of the items listed in this section are included in the submittal.

The City will validate and evaluate all responses received. All requirements identified in this RFQ must be satisfied in order to ensure that a submittal will qualify for consideration.

At the completion of the evaluation process, a total point value will be compiled for each submittal. The award recommendation(s), if any, will not necessarily be based on the lowest prices proposed or on the point values assigned.

LBE Five Percent Submittal Evaluation Requirement (See Attachment 2)

Rejection of Submittals:
The City of Sacramento reserves the right to reject any and all submittals received in response to this request, or to negotiate separately with any source whatsoever in any manner necessary to serve the best interests of the City. The City of Sacramento may at its discretion determine not to award a contract solely on the basis of this request for Submittals and will not pay for the information solicited or obtained.

It is recognized that each submitter may have developed unique and typical methods of service delivery. It is not the City's intention to disqualify a firm due to variations in service delivery that do not adversely affect quality and performance. Any submittal offering services equivalent to or of better quality and performance than that requested, which provides the necessary service, will receive full consideration for award.

Withdrawal of Submittals:
Unauthorized conditions, limitations, or provisions attached to a submittal may be cause for its rejection. No oral, telegraphic or telephonic Submittals or modifications will be considered. The submittal may be withdrawn upon request by the submitter without prejudice to the submitter prior to, but not after the time fixed for opening of qualification submittals, provided that the request for withdrawal is in writing, has been executed by the submitter or the firm's duly authorized representative, and has been filed with the City.

Contract Negotiations
Contract negotiations may be undertaken simultaneously during the evaluation of submittals with the finalist(s) as determined by the City. The City will not accept any changes to the standard maintenance agreement.

7. Acceptance of Submittal

The contents of the submittal of the successful contractor will become contractual obligations to be contained in a formal written agreement. Failure of successful submitter to accept these obligations in a formal agreement may result in cancellation of the award.

Addenda and Supplements to RFQ
If it becomes necessary to revise any part of the RFQ, an addendum to the RFQ will be provided to all known prospective Submitters via the City of Sacramento's online bid portal PlanetBids.

http://www.planetbids.com/portal/portal.cfm?CompanyID=15300

It is the responsibility of the Submitter to verify addenda and supplements up to the RFQ submission date and time.

Contractor Responsibilities
Service shall be the best of its respective kind. All plumbers shall be skilled, knowledgeable, and successfully experienced in all aspects of providing the required services.

Licenses
The contractor shall be required to obtain any necessary licenses and shall comply with all Federal, State and local laws, codes and ordinances without cost to the City. (State of California C36 Plumbing Contractor's license is required.)

Business Operations Tax Certificate
Chapter 3.08 of the Sacramento City Code requires that anyone conducting business in the City of Sacramento obtain a Business Operations Tax Certificate and pay the applicable tax if necessary. The successful contractor, and any subcontractors, will be required to show compliance with this requirement prior to award of the contract.

Information about the Business Operations Tax Certificate may be obtained from the City of Sacramento, Revenue Division, 915 I Street, New City Hall First Floor, Sacramento, CA 95814, or by telephone at (916) 808-8500.

Contractual Obligations

Non Professional Services Agreement. A service of a non-professional character of any type, description or variety such as: tree trimming services, janitorial services, appliance repair, pest control, window washing, canvas awning repairs, street/parking lot sweepers, pressure washing, carpet cleaning, repair services for office machines and equipment or automotive vehicles, landscape maintenance services, and work performed by a licensed contractor that does not constitute "public project" work under City Code Chapter 3.60, such as sidewalk maintenance and repair.

The submitter(s) recommended for this award will be required to sign the Non Professional Services Agreement found at the following URL:

http://portal.cityofsacramento.org/~/media/Corporate/Files/Finance/Procurement/standard-agreements/NPSA_Over_$25k.pdf

Bidders are responsible for reading and understanding the attached Non Professional Services Agreement's requirements, terms and conditions prior to submitting their bids.

Deductions for Non Performance

A. The value of a deduction for non-performance of work shall be determined solely by the DOU. In the event of non-performance, the DOU may seek remedy by taking the following steps:

i. Notify the contracted plumber of the non-performance, and have the contractor commence correction of the problem.
ii. Cause the incorrect work to be corrected by DOU staff.

B. Cause the incorrect work to be corrected by utilization of another contractor at the expense of the original contractor.

C. The parties agree that if, after thirty days if no work is completed to the satisfaction of the DOU, the contracted plumber will be notified of non-performance and the contractor does not commence correction of the non-performance, the Contractor will then reimburse the DOU for their cost of correcting the non- performance, and an equal amount will be deducted from contractor compensation.

D. The smallest value of a deduction for non-performance where the contractor has failed to completely render the services acceptable by performing all scheduled routine work tasks shall be determined in accordance with the following formula:

i. If corrective measures are not taken by the contractor, and the non-performance of work is not corrected, then 10 percent of the total project cost per occurrence will be deducted.
ii. The deduction for non-performance shall be subtracted from any of the monthly invoices

8. General Information

Submittals may be withdrawn or modified before the due date of submission for Submittals by delivering a written and signed request by the due date. A request for modification of the proposal after the due date will not be considered, including a representation that the Submitter was not fully informed regarding any information pertinent to the proposal or the offer. The City shall not be responsible for or bound by any oral instructions, interpretations or information provided by the City or its employees other than the RFQ contract.

The City reserves the right to reject any or all RFQ responses submitted, correct any technical errors in the RFQ process, waive any irregularities in any proposal, negotiate with any of the submitting contractors, or enter into a subsequent agreement with another Submitter if the originally selected Submitter fails to execute its agreement with the City.

Any agreement shall not be binding unless it is executed by authorized representatives of the City and the selected Submitter. Proposing firms are solely responsible for any expenses incurred in preparing their Submittals in response to this RFQ.

Submittals should be prepared simply and economically, providing straightforward, concise delineation of the firm's capabilities to satisfy the requirements of this RFQ. The emphasis should be on completeness and clarity of content. To expedite proposal evaluations, it is essential that specifications and instructions contained in the proposal instructions are followed as outlined.

Submittals received are public records that will be disclosed upon request. All material submitted that has not been clearly designated in the response itself as proprietary information becomes the property of the City. RFQ Responses submitted become the property of the City and may be reviewed and evaluated by any persons at the discretion of the City.

Responses to this RFQ become a matter of public record and shall be regarded as public records and will be disclosed upon receipt of a request for public disclosure pursuant to the California Public Records Act; provided, however, that if any information or elements of the response is set apart and clearly marked as "Trade Secret" or "Proprietary" when it is provided to the City, the City will give notice to the Submitter of the request for disclosure to allow the Submitter to seek judicial protection from disclosure.

Failure by the Submitter to take timely steps to seek judicial protection from disclosure shall constitute a complete waiver by the Submitter of any rights regarding the information designated as "Trade Secret" or "Proprietary" and such information may be disclosed by the City pursuant to applicable procedures under the California Public Records Act. Under no circumstances will the City have any obligations to seek judicial protection from disclosure for any responses or other materials submitted in response to this RFQ.

The City has no liability for any disclosure, unless such disclosure is made in violation of a court order obtained by a Submitter or pertains to materials marked as "Trade Secret" or "Proprietary" for which the City failed to give the above notice.

Any/all respondents responding to this RFQ do so entirely at their expense. There is no expressed or implied obligation by the City to reimburse any individual or firm for any costs incurred in preparing or submitting responses, for providing additional information when requested by the City or for participating in any selection demonstrations or interviews, including pre-contract negotiations and contract negotiations.

ATTACHMENT 1

SUBMITTAL SIGNATURE

All FIRMS must complete and sign this section. Failure to complete and sign this section may result in rejection of the submittal.

Name of Firm: _____

Business Address: _____
(Street) (City) (State) (Zip Code)

Telephone: _____ **Fax:** _____

Type of Business:

□ Corporation
□ Partnership
□ Individual doing business under own name
□ Individual doing business using a firm name
□ Joint Venture (Attach Joint Venture Agreement)

Federal Tax I.D. Number: _____

City of Sacramento Business Operations Tax Number: _____
*Mandatory only if recommended for contract award.

Signature: _____ **Date Signed:** _____

Name & Title: _____

ATTACHMENT 2

Local Business Enterprise Program Forms

LOCAL BUSINESS ENTERPRISE (LBE) PARTICIPATION PROGRAM

NOTE: Submitters must provide responses to the following items. Failure to provide a response to each of the items in this section may be grounds for rejection of the response.

1. LBE FIVE PERCENT (5%) PARTICIPATION

On April 3, 2012, the Sacramento City Council adopted a Local Business Enterprise (LBE) Preference Program to provide enhanced opportunities for the participation of local business enterprises (LBEs) in the City's contracting and procurement activities. On November 19, 2013, City Council increased the LBE preference and authorized City departments to require minimum LBE Participation levels in individual contracts. Under City Code Section 3.60.270, when the bid specifications for a City contract establish a minimum participation level for LBEs, no bidder on the contract shall be considered responsive unless its bid meets the minimum LBE participation level required by the bid specifications.

The City has established a minimum 5% participation level for LBEs on this contract. Pursuant to City Code Section 3.60.270, no bidder on this contract shall be considered responsive unless its bid meets or exceeds this minimum participation level.

Local Business Enterprise means a business enterprise, including but not limited to, a sole proprietorship, partnership, limited liability company, corporation, or other business entity that has a legitimate business presence in the city or unincorporated county of Sacramento. Evidence of legitimate business presence in the city or unincorporated county of Sacramento shall include:

1. Having a current City of Sacramento Business Operation Tax or County of Sacramento Business License for at least twelve (12) consecutive months prior to submission of bid; and
2. Having either of the following types of offices or workspace operating legally within the city or unincorporated county of Sacramento for at least twelve (12) consecutive months prior to submission of bid:
    a. The LBE's principle business office or workspace; or
    b. The LBE's regional, branch or satellite office with at least one full time employee located in the city or unincorporated county of Sacramento.

A. LOCAL BUSINESS ENTERPRISE (LBE)

Is the firm submitting the bid qualified as a local business enterprise? Check the appropriate box below:

☐ **YES** - the firm submitting the bid is qualified as a local business enterprise.

☐ **NO** - the firm submitting the bid is not qualified as a local business enterprise.

If the response to the above is YES, provide the City of Sacramento Business Operations Tax Certificate Number and/or County of Sacramento Business License Number:

_____

If the response to the above is YES, provide a current copy of the City of Sacramento Business Operations Tax Certificate and/or County of Sacramento Business License.

If the response to the above is YES, provide business office or workspace address*:

_____

_____

_____

*Address must be a physical address for the basis of location, this excludes P.O. Box addresses.

City of SACRAMENTO

Local Business Enterprise (LBE)
Participation Verification Form
Professional and Nonprofessional Service Agreements of $100,000

THIS FORM MUST BE SUBMITTED WITH THE PROPOSAL OR BID
IF A SEPARATE SEALED COST ESTIMATE IS REQUIRED, THIS FORM MUST BE INCLUDED WITH THE SEALED COST ESTIMATE

To be eligible for this agreement, the Submitter or bidder shall list below all the business entities used to attain the 5% LBE participation requirement. Estimated dollar values shall be provided for all work / services listed. The failure to attain the 5% LBE participation or the inclusion of false information or the omission of required information will render the proposal or bid non-responsive.

Submitter/Bidder Name: _____
Proposal/Bid Amount: _____
Is the Submitter/Bidder a LBE ? _____Yes _____ No

LBE Business Entity Name and Address (subject to verification)	Description of Work or Services to be provided	Estimated Dollar Value of Work or Services

The Submitter/Bidder hereby certifies that each business entity listed on this LBE Participation Verification Form has been notified that it has been listed and has consented in writing to its name being submitted for this proposal or bid. The Submitter/Bidder also certifies that it will notify each business entity listed on this Form in writing if the agreement is awarded to the Submitter/Bidder, and will make all documentation relevant to the listed business entities and LBE participation available to the City of Sacramento upon request. The Submitter/Bidder further certifies that all of the information contained in this Form is true and correct and acknowledges that the City will rely on the accuracy of this information in awarding the agreement.
Form Revised 2/3/2014
COPY AND ATTACH ADDITIONAL SHEETS AS NECESSARY Page _____ of _____

LOCAL BUSINESS ENTERPRISE (LBE)
PARTICIPATION REQUIREMENTS
(For City Contracts, without Federal Funds)

I. LBE PARTICIPATION REQUIREMENT

On April 3, 2012, the Sacramento City Council adopted a Local Business Enterprise (LBE) Preference Program to provide enhanced opportunities for the participation of LBEs in the City's contracting and procurement activities. On November 19, 2013, City Council increased the LBE preference percentage from 2% to 5% and authorized City departments to require minimum LBE participation levels in specific contracts. Under City Code section 3.60.270, when the bid specifications for a City contract establish a minimum participation level for LBEs, no bidder on the contract shall be considered responsive unless its bid meets the minimum LBE participation level required by the bid specifications.

The City has established **a minimum 5% participation level for LBEs on certain contracts of $100,000 or more as illustrated below.**

When Does the LBE Program Apply?

	Contracts Under $100,000			**Contracts $100,000 or More**			
	Supplies/ Non-Professional	**Professional**	**Public Projects**	**Supplies**	**Non-Professional**	**Professional**	**Public Projects**
5% LBE Preference Applies to Bid Evaluation?	Yes	Yes	Yes	No	No	Yes	No
5% Minimum Participation Requirement?*	No	No	No	No	Yes	Yes	Yes

*Requirement may be waived by the City Manager or the City Manager's designee (e.g. Department Directors)

II. LBE QUALIFICATION

A. To meet the LBE participation requirement, bidders must meet the requirements for an LBE prior to the deadline for submission of bids.

B. Local Business Enterprise means a business enterprise, including but not limited to, a sole proprietorship, partnership, limited liability company, corporation, or other business entity that has a legitimate business

presence in the City or unincorporated areas of Sacramento County. Proof of legitimate business presence in the City or unincorporated areas of Sacramento County shall include:

1. Be an established business entity operating in the City or unincorporated County of Sacramento for at least twelve (12) consecutive months prior to submission of bid; and;
2. Having either:
   a. a principal business office or workspace; or
   b. regional, branch, or satellite office with at least one full-time employee located and operating legally in the city or unincorporated county of Sacramento.

III. LBE PARTICIPATION LEVEL REQUIREMENTS

A. LBE Participation: The percentage of LBE participation is determined based on the dollar value of the work to be performed. LBE credit may be obtained by utilizing LBE qualified subcontractors or suppliers as outlined below.

B. Participation Credit: To receive credit for participation: (1) an LBE subcontractor must be responsible for the execution of a distinct element of the work, must possess any license or certification required for the work, and must actually perform, manage, or supervise the work without subcontracting or otherwise shifting any portion of the work to another subcontractor; and (2) an LBE supplier must furnish materials or equipment that the supplier sells as a recurring, although not necessarily primary, part of its business, and that are necessary for performance of the work.

C. Suppliers: Credit for an LBE supplier of materials or equipment is counted as 100% of the amount paid to the supplier for the materials or equipment. To receive this credit, LBE suppliers must be listed on the bidder's Subcontractor and LBE Participation Verification Form.

D. Subcontractors (including truckers): To receive credit for an LBE subcontractor, the subcontractor must be listed on the bidder's Subcontractor and LBE Participation Verification Form.
   - Truckers: Credit for an LBE trucker is counted as 100% of the amount paid to the trucker for trucking services, not including any amount paid to the trucker for the cost of any materials or equipment being transported by the trucker.

IV. LBE REQUIREMENTS FOR CONTRACTOR

A. LBE RECORDS - The contractor shall maintain records of all subcontracts with verified LBE subcontractors and records of materials purchased from verified LBE suppliers for one year after receiving final payment from the City. Such records shall show the name and business address of each LBE subcontractor or supplier and the total dollar amount actually paid to each LBE subcontractor or supplier.

No later than 30 days after completion of the work performed under the contract, a summary of these records shall be prepared, certified correct by the contractor's authorized representative and furnished to the City. The contractor shall provide such other information, records, reports, certifications or other documents as may be required by the City, to determine compliance with any provision of the LBE program or these specifications.

B. Performance of LBE Subcontractors and Suppliers: The LBEs listed by the contractor shall perform the work and supply the materials or equipment for which they are listed, unless the contractor has received prior written authorization from the City to perform the work with other forces or to obtain the materials or equipment from other sources. Reasons for requesting such authorization would include:

1. The listed LBE fails to execute a written contract based upon the general terms, conditions, plans, and specifications for the project.

2. The listed LBE becomes bankrupt or insolvent.

3. The listed LBE subcontractor fails to meet the bond requirements of the contractor.

4. The work performed or the materials or equipment provided by the listed LBE are unsatisfactory or are not in accordance with the plans and specifications, or the listed LBE fails to perform its contractual obligations.

5. It would be in the best interest of the City.

C. Subcontractor Substitution: No substitution of an LBE subcontractor shall be made at any time without compliance with the Subletting and Subcontracting Fair Practices Act. If an LBE subcontractor is unable to perform successfully and is to be replaced, the contractor shall make reasonable efforts to replace the original LBE subcontractor with another verified LBE subcontractor. The new LBE subcontractor must be verified at the time of substitution.

D. Reporting and Utilization Requirements and Sanctions: Failure to provide specific information, records, reports, certifications, or any other documents required for compliance with these specifications, or failure to utilize one or more LBEs in substantial compliance with the LBE utilization indicated in the contractor’s bid (unless otherwise authorized by the City as provided herein, or when such failure results from changes to the work approved by the City), shall be considered a breach of the contract. A deduction may be made from the contract amount and the deduction shall be not more than 10% of the value of the work or materials or equipment that the subject LBE(s) were listed to perform or provide in the contractor’s bid, and shall also be deducted from any payment due to the contractor. This is in addition to any deduction that may be made under any other provision of the contract, the Sacramento City Code, or State law.

E. Hearing and Review of Division Manager Decision: Prior to making a deduction pursuant to Section IV (D), above, the City shall provide written notice of the proposed deduction to the contractor. The contractor may, no later than five working days after receiving such notice, provide a written request to the City for a hearing to contest the proposed deduction. Upon receipt of a timely written request from the contractor, the City shall schedule a hearing before the Division Manager (as defined in the City's Standard Specifications for Public Construction), and written notice of the date, time and location of the hearing shall be provided to the contractor not less than five working days prior to the date of the hearing. The hearing shall be conducted in the manner specified in Section 4-8 of the Standard Specifications, and the Division Manager shall prepare and forward to the contractor a written decision as soon as practicable after the hearing. The Division Manager's decision shall be subject to review in accordance with the provisions of Section 4-9 of the Standard Specifications. Failure to request such review in compliance with the requirements set forth in Section 4-9 shall constitute acceptance of the Division Manager's decision by the contractor.

The written notices and requests described above shall be provided by registered or certified mail (return receipt requested), by facsimile, by personal delivery, or by any other method that provides reliable evidence of the date of receipt. Written notice provided by facsimile shall be deemed received on the date that it is transmitted and transmission is confirmed by the transmitting machine. Written notice provided by personal delivery shall be deemed received on the date of delivery.

V. DEFINITIONS

A. Local Business Enterprise (LBE): A business enterprise, including but not limited to, a sole proprietorship, partnership, limited liability company, corporation, or any other business entity that has a legitimate business presence in the city or unincorporated county of Sacramento.

B. Contractor: The sole proprietorship, partnership, Limited Liability Company, corporation, or any other business entity entering into a contract with the City of Sacramento.

C. Subcontractor: The sole proprietorship, partnership, Limited Liability Company, corporation, or other business entity entering into a contract with the prime contractor to perform a portion of the work.

D. Supplier: The sole proprietorship, partnership, Limited Liability Company, corporation, or other business entity to provide materials, equipment, or supplies necessary for performance of the work.

E. Proposal: Any response to a City solicitation for Qualifications.

F. Bid: Any response to a City solicitation for bids

G. Waiver: Request to department director to waive or reduce LBE participation requirement

ATTACHMENT 3

Statement of Qualification Rating Form

Proposal Rating Form:
Contracted Plumbers for Leak-Free Sacramento Program

Submitter:_____ Selection Committee Member: _____

Date of Review:_____ Signature: _____

Selection Criteria:
A. The Firms Profile
B. Expertise and Qualifications
C. Experience and References
D. Estimated Plumbing Costs Form in Attachment 6

Selection Criteria	Scoring	Wt*	Computed Scores
A		0.2	
B		0.3	
C		0.3	
D		0.2	
Subtotal		1.0	
LBE 5%		0.25 total pts	
Total			

* Weighing Factor

** Add 0.25 point if firm submitting proposal is City certified LBE when Submittals are due.

Please evaluate the Submittals using the following cumulative point system (maximum of 5.00 points):

Outstanding	=	5
Very Good	=	4
Good	=	3
Average	=	2
Poor	=	1
Not Addressed or not acceptable	=	0

Additional review factors include:

- Interviews - if the Selection Committee determines to include interviews in the selection process.

Attachment 4

License Verification and Reference Form

Firm Name:_____

Type of Service:_____

All information requested below must be completed and submitted in order for firm to be considered. Provide a list of your qualifications as it relates to the type of service you are submitting for. Include your experience in performing the types of work listed in the Scope of Work and the Qualifications sections of this document, including repairs of all related plumbing systems.

1. Contractor's License: Provide a copy of your Contractors License C/D_____.

2. Labor Rates: Provide pricing sheet of labor rates.

3. References: Provide information for three customers for whom you have performed plumbing repair work that we may contact.

1. Company Name:_____

Project: _____

Description:_____

_____

_____

Contact person: _____Phone:_____

2. Company Name:_____

Project: _____

Description:_____

_____

_____

Contact person: _____Phone:_____

3. Company Name:_____

Project: _____

Description:_____

_____

_____

Contact person: _____Phone:_____

Attachment 5

Leak-Free Sacramento Program Protocol

2016-2017

The Department of Utilities (DOU) Leak-Free Sacramento program is designed to help disadvantaged area communities (DACs) single family residential homeowners with leak repairs. Through this Program, the DOU is pleased to have the support of the Department of Water Resources Water Energy Grant to aide with sustaining and integrating water, energy and greenhouse gas emissions reduction, helping the City of Sacramento's economy and environment while ensuring social equity. The following policy sets forth all requirements to be met prior to assistance being provided.

Program Qualifications

Qualifications for participation in the Leak-Free Sacramento Program (Program) are contingent upon applicants meeting the following criteria:

- Live within the one of the DAC areas.
    - The City will only promote to targeted customers in this area with irregular water use.
- Residential Class Customer(s)
    - Single family residential dwellings.
- Customer(s) applying for plumbing assistance is considered a homeowner for purposes of this program only if they:
    - Own both the home and the land on which the home rests (mobile homes in a mobile park that owns all the land are common example of homes not eligible for assistance).
    - Are the permanent resident(s) in the home for which plumbing assistance is needed.

- Plumbing assistance will **not** be rendered if such assistance will result in hazardous environmental conditions or allow an existing hazardous environmental condition to continue. If a hazardous environmental condition is found, such as mold, asbestos, lead it must be abated per the applicable regulations.
- Home must be habitable and safe for occupation to be eligible for services. Examples of circumstances that would make a home not eligible include areas open to the outside, lack of complete roofing, floors that are too unstable for toilets to be seated properly or a home settled from its original support structure in a way that makes work on it unsafe. If the contracted plumber notes concern regarding structural stability or general safety of the home, it will be assessed by the DOU Program staff and referred to City of Sacramento Code Compliance as needed.
- Homeowner must be qualified by living within a DAC and be a DOU water customer. The customer(s) must verify permanent residency by identification, current utility bill, and tax return or deed to the home.

Program Procedures for DOU Program Staff

Applicants are verified and approved by DOU through the following process:

1. Program participants generally learn about the Program through a postcard that the DOU will mail out to residences with leaks detected from the AMI (Advanced Metering Infrastructure) system. Upon learning about the program, the customer is referred to a hotline or email address and will contact DOU Program staff to verify that they are qualified for this program. Homeowners will provide DOU Program staff with their contact number and address, and once approved, DOU Program staff will refer them to the Leak-Free Sacramento web site to obtain an application or they will be mailed an application.

2. Once DOU Program staff receive the customer's application they will verify all documentation needed for approval:
   - Identification cards
   - Proof of residency (can be a piece of mail or electricity bill)
   - Proof of home ownership (showing client's name) (i.e. taxes or house deed)

3. Once an applicant is qualified, DOU Program staff will give the customer a confirmation number. They will enter the customer's information into a secure spreadsheet. The list will include the client's name, address, phone number and water account number, and a description of the nature of the problem if applicable. Approval with a confirmation number does not guarantee any repairs. Repairs must be justified by the contracted plumber and final approval must be made by DOU Program staff.

4. The DOU Program staff will send the confirmation number and the customer's information to the contracted plumber in a pdf "work order" via email.

5. The contracted plumber will contact the customer directly to schedule a service call.

Homeowner Qualification Period

Homeowners remain qualified for a 30 day period after initial approval for one service call for all repairs. After this time period has expired, and no repairs are completed, the homeowner must re-qualify through the DOU Program staff before any services through the program will be rendered. Customers MAY NOT call the contracted plumber directly to schedule additional work even if repairs were made under the program in the past.

Customers may be disqualified from the program, if at any point during the one month period DOU learns of a change in status of any of the qualifying criteria. For example, if a customer is qualified for the Program but a month later or so rents out their house. In this case they no longer reside in the home needing assistance and are ineligible to receive service.

A customer may also be disqualified if they are non-responsive to contact efforts by DOU Program staff or by the contracted plumber to schedule an appointment for a pre-inspection and repair or replacement service. In the case where DOU Program staff

and/or the contracted plumber attempted contact by phone or written letter a total of three (3) times or more, the circumstances will be reviewed on a case-by-case basis by DOU Program staff on whether or not to continue to make contact.

Scope of Services

The contracted plumber will be responsible for coordinating with DOU Program staff in obtaining the approved list of participants who qualify for the program. The list will have the participant's information along with their identified plumbing problems to be verified by the contracted plumber. The contracted plumber will be responsible for contacting participants and setting an appointment time for repairs to be made within a one-week period of receiving notice from DOU. Repairs must be made within five (5) business days of initial inspection, unless DOU Program staff approves otherwise.

Prior to commencing work at the customer's address, the contracted plumber will be responsible for obtaining a signed Leak-Free Sacramento Leak Detection and Repair Agreement form before work begins. This form must be signed by the customer/homeowner, contracted plumber and DOU Program staff. The DOU Program staff does not need to sign off on work prior to completion if the total amount of repairs is less than $200. The contracted plumber will be responsible for assessing the working situation prior to initiating work to ensure that repairs and/or retrofits can be properly accomplished. The assessment should include determining any structural weaknesses or any potential problems that will prohibit the repairs from being accomplished. In addition, if a contracted plumber deems the situation, prior to starting the repairs, as a threat to health, safety, and welfare, for the contracted plumber or the customer, the contracted plumber will be allowed to refuse to perform the services with proper notice to the DOU.

- The DOU will only address potable water leaks; drain line or other problems that take sewer water to sewer lines is not qualified.
- The contracted plumber is to make every attempt to repair a leak before replacement of a part is determined. If the contracted plumber believes that any repair of a fixture will be short-lived due to the condition of the fixture, they should consult with the DOU program staff about whether to perform a replacement service.
- Cosmetic or structural repairs may be made by the contracted plumber's sub-contractor.
- All plumbing work is scheduled and completed through a contracted plumber, and approved through the Program staff.
- Contracted Plumber must have appropriate identification showing that they are working with Leak-Free Sacramento when visiting a customer's home

Approved Plumbing Repairs

The following includes, but is not limited to, repairs that can be made through the program:

1. **Toilets –** Contracted plumber will be responsible for repairing toilets, if a repair is impossible or if a high-flow toilet (greater than 1.6 gallons per flush) is found in the client's residence, it can be replaced with a new High Efficiency Toilet. The Contracted plumber must use toilets approved by the DOU and all invoices must

reflect this or they will not be compensated. The cost of replacement of all toilets will be coordinated by DOU Program staff with the Regional Water Authority and their Toilet Replacement Program.

- Contracted plumber shall provide a set price in the attached Estimated Plumbing Costs Form for the removal and retrofit of an existing high flow toilet to include **ALL labor**, foreseen or unforeseen, excluding flange repair or replacement only.
- Contracted plumber shall provide a set price in the attached Estimated Plumbing Costs Form for toilet flange replacements to include **ALL labor**, foreseen or unforeseen.
- Repair will include the removal and replacement of the fill valve, flapper, flapper stand pipe, seating area, and tank to bowl gasket with new bolts.
- High flow toilets may be replaced with High Efficiency Toilets.
- Low flow toilets (less than 1.6 gallons per flush) may not be replaced with High Efficiency Toilets.
    - If a low flow toilet already exists at the location, repairs are to be made to ensure proper working condition.
    - The only exception to this policy is if a low flow toilet is non-repairable, then a low flow toilet may be replaced with a new High Efficiency Toilet upon approval from DOU Program staff.
        - Major Cosmetic Repairs will be determined by the DOU if eligible and non-standard interior parts that must be ordered will be determined by the DOU if eligible.
        - The contracted plumber must obtain prior authorization from the DOU.
- If the homeowner has a documented need for ADA compliant toilets or is 65 years of age or older, ADA toilets can be installed as a replacement for existing high flow toilets only. Existing low flow toilets (less than 1.6 gallons per flush) are not eligible for ADA retrofit. Unless the existing low flow toilet is unrepairable, then it can be replaced with ADA retrofit. DOU Program staff must verify this.
- Toilets will not be replaced if the flooring of the lavatory or other structural problems prohibits the replacement of the toilet.

3. **Lavatory Faucets –** Contracted plumber shall provide a set price in the attached Estimated Plumbing Costs Form for the removal and replacement of an existing lavatory faucet assembly to include **ALL labor**, foreseen or unforeseen.

- New lavatory faucet assembly must include 1.0 gallon per minute aerators

4. **Kitchen Faucets –** Contracted plumber shall provide a set price in the attached Estimated Plumbing Costs Form for the removal and replacement of an existing kitchen faucet assembly to include **ALL labor**, foreseen or unforeseen.

- New kitchen faucet assembly must include 1.5 gallon per minute aerators.

5. **Shower/Tub valves-** Contracted plumber shall provide a set price in the attached Estimated Plumbing Costs Form for the removal and replacement of an existing single handle or existing two-handle Tub/Shower valve or Tub diverter valve assembly to include **ALL labor**, foreseen or unforeseen.

- New Tub/Shower valve assembly must be low-flow certified.

6. **Hose Bibbs-** Contracted plumber shall provide a set price in the attached Estimated Plumbing Costs Form for the removal and replacement of existing outside hose bibb assemblies to include **ALL labor**, foreseen or unforeseen.

7. **Other Repairs –** Contracted plumber shall provide a standard flat rate in the attached Estimated Plumbing Costs Form for all repairs outside of the aforementioned services listed in this RFQ including:

- **Water Heaters**
- **Water Service Lines**
- **Water Lines Within the Home**
    - Contracted plumber will complete limited repairs to water lines within the home. They will not break into foundations for repairs, but may assess options for rerouting water lines when feasible.
- All replacement material/fixtures **must** be approved and meet the requirements of the DOU.
- Contracted plumber must provide a purchase invoice for materials purchased for plumbing services.

8. **Aerators and Showerheads-** As part of the site visit, Contracted plumber shall be responsible for replacing all kitchen faucet aerators with 1.5 gallon per minute (GPM) aerators; all lavatory faucet aerators with 1.0 GPM aerators; and all showerheads with 1.5 GPM or 1.75 GPM flows are to be provided by the contracted plumber. Contracted plumber shall provide a set price in the attached Estimated Plumbing Costs Form for these replacements on a per unit cost basis for each fixture installed.

Contracted Plumber Work Process

The contracted plumber must contact the customer directly to schedule a service call and utilize the work process described below. The contracted plumber is required to complete the required forms before actual work begins at the property and also upon completion. The DOU reserves the right to change the contracted plumber assignments for any assigned project prior to the commencement of work at no cost to the DOU.

DOU Leak-Free Sacramento Work Authorization Form:
Prior to beginning work, the contracted plumber must:

- Document the work anticipated to be done at the property with the estimate for the total cost of the repairs or replacement, and obtain the customer's signature on the Leak-Free Sacramento Work Authorization Form.
- Provide the original to DOU Program staff.
- If the customer does not want to sign the form (which includes the Homeowner's Waiver of Damages), the contracted plumber's repairs or replacement cannot be made. The contracted plumber should ask the customer to discuss their concerns immediately with DOU Program staff if the customer is unwilling to sign.

DOU Leak-Free Sacramento Leak Detection and Repair Agreement

- Prior to any troubleshooting and leak repairs by the contracted plumber requiring removal of building materials, the contracted plumber will have the homeowner sign the Leak-Free Sacramento Leak Detection and Repair Agreement which removes DOU liability for property damage and provide a copy to DOU Program staff.

DOU Leak-Free Sacramento Work Completion Form

- Upon job completion, the contracted plumber must have the customer sign the Leak-Free Sacramento Work Completion Form. If any additional work was necessary and was not originally listed on the Leak-Free Sacramento Work

Authorization Form, it is required for the contracted plumber to list the additional work on the form as long as it has been approved by Program staff.

- If the contracted plumber discovers that more work is needed, approval can be done via a phone call to DOU Program staff. The time and date of phone call approval needs to be documented along with name of staff that approved it.

The contracted plumber is required to leave a copy of the signed Leak-Free Sacramento Work Authorization Form and Leak-Free Sacramento Work Completion Form with the customer. A copy of the signed Leak-Free Sacramento Leak Detection and Repair Agreement should also be left with the customer when applicable.

It is the responsibility of the contracted plumber to complete the Leak-Free Sacramento forms. A completed and signed copy of each form with original signatures is required to be submitted to DOU Program staff with the contracted plumber's invoice. No payment from the DOU will be made to the contracted plumber prior to the receipt of these forms.

Cost Schedule for Repairs

The following is a cost schedule established for invoices submitted by the contracted plumber through the program:

- Contracted plumber will provide information one day in advance to DOU Program staff on all scheduled Leak-Free Sacramento appointments for service. This will facilitate inspection visits that DOU staff may choose to make at any time to assure high quality service and accurate assessment of repair challenges.

- Repairs under $200 – the contracted plumber is authorized to make these repairs without prior approval from the DOU, but must complete all pertinent forms (discussed above) and take photos for pre- and post-repair for documentation of work completed.

- Repairs over $200— requires prior approval from the DOU before contracted plumber can make repairs. The contracted plumber will contact the DOU Program staff to request and receive authorization of repairs and must complete all pertinent forms (discussed above) and take photos for pre- and post-repair for documentation of work completed.

- Repairs estimated over $1,000 require the contracted plumber to provide a line item cost estimate of repairs along with DOU prior approval, and photo documentation. Authorization can be given by the DOU Program staff and a DOU site visit may be required.

- Repair estimates over $2,000 or repairs/issues with unusual circumstances - the DOU Program staff will require the Administrator's advice and/or approval before work authorization is given to the contracted plumber. A DOU site visit must be completed prior to authorization given.

- Repairs may be made up to a value of $4,000, but not more.

- If a contracted plumber submits an invoice and the amount exceeds the authorized amount and prior approval was not received, then the contracted plumber will submit the invoice for the appropriate authorized amount only.

Generating Leak-Free Sacramento Work Orders

1. DOU Program staff will verify customer eligibility for the Program:
   - Customer lives in a DAC
   - Customer owns their home and lives in residence

2. DOU Program staff will check the Program database to find out if the property has ever qualified for Program assistance in the past. They will enter into the Program database:
   - First name
   - Last name
   - Street Number
   - Street Name
   - Zip Code
   - Home Phone Number
   - Alternate Number, if listed

3. DOU Program staff will generate a Leak-Free Sacramento Work Order

   - Customer Description—type of leaks or problems (if applicable)
   - Date Received—the date the Leak-Free Sacramento application is received
   - Date Assigned—the date a contracted plumber is assigned
   - Contracted Plumber Assigned—name of contracted plumber
   - Customer is 65 years of age or older or qualifies for ADA compliance (Toilet Replacement)

4. DOU Program staff will email the contracted plumber with a referral spreadsheet of qualified work orders for customers. These can come in during any business day of the week and include any range of Program referrals.

The homeowner name on the DOU Program staff referral spreadsheet must match the name on the Program database.

Contracted plumber contacted directly by homeowner is required to notify DOU Program staff and get approval before scheduling an appointment.

Invoicing

1. Upon receipt of contracted plumber invoice for payment, Program staff will review and approve all invoices submitted through the Leak-Free Sacramento Program. The following steps are taken to process the invoices:

   - Staff reviews content of invoices to ensure proper billing. Contracted plumber is not to bill DOU for travel time to obtain standard items. If these charges are included, the invoice will not be approved and will be returned to the contracted plumber for correction.

- Once approved for payment, the invoice will be sent over to DOU's Business and Integrated Planning (BIP) division.

- DOU's BIP will give final approval and send out payment.

Processing Plumbing Invoices

The contracted plumber, upon the completion of repairs, will submit an invoice for payment. Along with the invoice the contracted plumber should include the original copy of the following:

- Leak-Free Sacramento Work Authorization Form
- Leak-Free Sacramento Work Completion Form
- Copy of Original Invoice from Plumbing Company
- Program Leak Detection and Repair Agreement (if applicable)

If a contracted plumber submits an incomplete Authorization and Completion Form, DOU will not remit payment for these repairs.

It is the responsibility of the plumbing company to complete the Work Authorization Form and Work Completion Form including customer signatures at the appointment. Failure to do so will cause a delay, and in some cases the refusal of, payment to the contracted plumbing company by DOU for the submitted invoice for Program repairs.

Once the invoice has been reviewed and approved by Program staff, the information must be updated in the Program database. Once all information is updated, the invoice is then submitted to the DOU BIP for payment processing.

The contracted plumber will receive payment from DOU within eight weeks.

Leak Free Sacramento: Estimated Plumbing Costs Form

(WS) WaterSense approved products (currently EPA approved WaterSense products are limited to bathroom faucets, showerheads and toilets)

		Repair	Replace	Reroute
Kitchen	Sinks	$	$	
	Faucets	$	$	
	Aerators	$	$	
	Disposal Leak	$	$	
Lavatory	Bathtubs	$	$	
	Shower Heads (WS)	$	$	
	Sink Faucets (WS)	$	$	
	Bathtub Faucets	$	$	
	Toilets (WS)	$	$	
	Sinks	$	$	
	Tub and Shower Valves	$	$	
Large Parts	Water Heaters (Gas)	$	$	
	Water Heaters (Elec)	$	$	
Small Parts	Hose Bibbs		$	
	Quarter-Turn Angle Valves		$	
Miscellaneous	Supply Line	$		
	Leak in Wall	$		
	Slab or Home Exterior Leak	$		$
	Irrigation System	$		

Appendix 14

City of Sacramento, Department of Utilities

Leak Free Sacramento and District Metered Area Program Survey Questions

Please utilize N/A if you were not a stakeholder of one of the projects.
Please respond by 6/24/2019.

1. In your opinion, what is one vital step that should be taken in the implementation of a pilot program to make it successful?

   All relevant internal stakeholders have to be committed to supporting the project and providing information needed to other stakeholders.

2. Do you believe stakeholder input or lack of it can affect the outcome of a pilot project?

   Yes, see response to above question.

3. On a scale of 1 to 10, one being low, as a stakeholder of the Leak Free Sacramento Program how would you rate the impact of the program? 9

   a. Comments: I think the program was a great resource that met the needs of the intended target demographic. Additional funding would have made a greater impact if more people could have been served.

4. On a scale of 1 to 10, one being low, how effective was outreach for the Leak Free Sacramento Program? 9

   a. Comments: I think the outreach via multiple sources was well done.

5. On a scale of 1 to 10, one being low, as a stakeholder of the District Metered Area (DMA) Program how would you rate the impact of the program? 5

   a. Comments: I think the program had limited impact due to a variety of reasons including lack of internal support for the project, limitations on data analysis and results, complicated analysis, and cost to fully implement. The project did provide some valuable information and provided an insight into how the water system actually functions versus theoretical modeling.

6. On a scale of 1 to 10, one being low, how effective was outreach for the District Metered Area Program? 1

   a. Comments: I do not recall external outreach being performed for the DMA project.

7. What steps can program managers take to improve the effectiveness of a pilot program such as these?

   Have strong, committed support from all managers providing support staff for the project. Make sure all appropriate information is shared with all involved parties. Understand the costs, capital and O&M and resources needed before implementing.

City of Sacramento, Department of Utilities

Leak Free Sacramento and District Metered Area Program Survey Questions

Please utilize N/A if you were not a stakeholder of one of the projects.
Please respond by 6/24/2019.

1. In your opinion, what is one vital step that should be taken in the implementation of a pilot program to make it successful?

***All parties that are involved with pilot / project, be involved from the very beginning to include selection of vendor and material / manufacture*.**

2. Do you believe stakeholder input or lack of it can affect the outcome of a pilot project?

Not having stakeholder input from very beginning will have a negative outcome for the project. Hard to get staff involved when their input wasn't important (or perceived as not important) from the beginning of the project especially when it is determined they are the subject matter experts.

3. On a scale of 1 to 10, one being low, as a stakeholder of the Leak Free Sacramento Program how would you rate the impact of the program?

I was not a part of or work with Leak Free Sacramento

   a. Comments:

4. On a scale of 1 to 10, one being low, how effective was outreach for the Leak Free Sacramento Program?

I was not a part of or work with Leak Free Sacramento

   a. Comments:

5. On a scale of 1 to 10, one being low, as a stakeholder of the District Metered Area (DMA) Program how would you rate the impact of the program?

4

   a. Comments: ***My involvement started well after the project was underway. I believe my input would have helped design a much better program.***

6. On a scale of 1 to 10, one being low, how effective was outreach for the District Metered Area Program?

3

   a. Comments: ***The DMA team did a great job with outreach after the project was well underway. Not having stakeholders involved earlier effected the success of the program.***

7. What steps can program managers take to improve the effectiveness of a pilot program such as these?

Create a committee to help with program development and technology / vendor selection. Quarterly meetings with stake holders (that were involved from beginning) to review progress and concerns with the program.

City of Sacramento, Department of Utilities

Leak Free Sacramento and District Metered Area Program Survey Questions

Please utilize N/A if you were not a stakeholder of one of the projects.
Please respond by 6/24/2019.

1. In your opinion, what is one vital step that should be taken in the implementation of a pilot program to make it successful?

   Make sure all stakeholders are well informed, and you have achieved buy-in.

2. Do you believe stakeholder input or lack of it can affect the outcome of a pilot project?

   I answer question 1 without reading all the questions. You have my answer already.☺

3. On a scale of 1 to 10, one being low, as a stakeholder of the Leak Free Sacramento Program how would you rate the impact of the program?

   a. Comments: N/A. I was not involved for most of the project for my input to be meaningful.

4. On a scale of 1 to 10, one being low, how effective was outreach for the Leak Free Sacramento Program?

   a. Comments: N/A. I was not involved for most of the project for my input to be meaningful.

5. On a scale of 1 to 10, one being low, as a stakeholder of the District Metered Area (DMA) Program how would you rate the impact of the program?

   a. Comments: N/A. I was not involved for most of the project for my input to be meaningful.

6. On a scale of 1 to 10, one being low, how effective was outreach for the District Metered Area Program?

   a. Comments: N/A. I was not involved for most of the project for my input to be meaningful.

7. What steps can program managers take to improve the effectiveness of a pilot program such as these?
   In addition to stakeholder buy-in, continuous communication with all parties and transparency.

City of Sacramento, Department of Utilities

Leak Free Sacramento and District Metered Area Program Survey Questions

Please utilize N/A if you were not a stakeholder of one of the projects.
Please respond by 6/24/2019.

1. In your opinion, what is one vital step that should be taken in the implementation of a pilot program to make it successful? Ensuring the new products are compatible with existing infrastructure.

2. Do you believe stakeholder input or lack of it can affect the outcome of a pilot project? Yes Knowledgeable input is necessary to any project.

3. On a scale of 1 to 10, one being low, as a stakeholder of the Leak Free Sacramento Program how would you rate the impact of the program?

    a. Comments: N/A

4. On a scale of 1 to 10, one being low, how effective was outreach for the Leak Free Sacramento Program?

    a. Comments: N/A I was only involved in the construction process.

5. On a scale of 1 to 10, one being low, as a stakeholder of the District Metered Area (DMA) Program how would you rate the impact of the program?

    a. Comments: N/A

6. On a scale of 1 to 10, one being low, how effective was outreach for the District Metered Area Program?

    a. Comments: N/A I was only involved in the construction process.

7. What steps can program managers take to improve the effectiveness of a pilot program such as these? PM's did just fine, for this particular program I believe the suppliers of the flow meters did not have the proper training/knowledge to advise on the product.

City of Sacramento, Department of Utilities

Leak Free Sacramento and District Metered Area Program Survey Questions

Please utilize N/A if you were not a stakeholder of one of the projects.
Please respond by 6/24/2019.

1. In your opinion, what is one vital step that should be taken in the implementation of a pilot program to make it successful?

Include stakeholders in the RFP Process to make sure all bases are covered.

2. Do you believe stakeholder input or lack of it can affect the outcome of a pilot project?

Absolutely!

3. On a scale of 1 to 10, one being low, as a stakeholder of the Leak Free Sacramento Program how would you rate the impact of the program?

    a. Comments:

    8

4. On a scale of 1 to 10, one being low, how effective was outreach for the Leak Free Sacramento Program?

    a. Comments:

    I am not aware of the outreach effort

5. On a scale of 1 to 10, one being low, as a stakeholder of the District Metered Area (DMA) Program how would you rate the impact of the program?

    a. Comments: 8

6. On a scale of 1 to 10, one being low, how effective was outreach for the District Metered Area Program?

    a. Comments: I am not aware of the outreach efforts

7. What steps can program managers take to improve the effectiveness of a pilot program such as these? Include ALL stakeholders that may be needed at the onset. Even those you may not think of as stakeholders.

City of Sacramento, Department of Utilities

Leak Free Sacramento and District Metered Area Program Survey Questions

Please utilize N/A if you were not a stakeholder of one of the projects.
Please respond by 6/24/2019.

1. In your opinion, what is one vital step that should be taken in the implementation of a pilot program to make it successful? Choosing the best program that will not only collect the data needed to make the program successful, but selecting a program that works with the design, benefits the stakeholders, and meets the goals that were set.

2. Do you believe stakeholder input or lack of it can affect the outcome of a pilot project? Absolutely! Engaging stakeholders from the beginning (design) to the end (evaluation) will benefit all the key functions of a successful program.

3. On a scale of 1 to 10, one being low, as a stakeholder of the Leak Free Sacramento Program how would you rate the impact of the program? 9

    a. Comments: The importance and concept behind the program will help identify troubled areas and provide stakeholders an additional tool that will help monitor the aged infrastructure.

4. On a scale of 1 to 10, one being low, how effective was outreach for the Leak Free Sacramento Program? 6

    a. Comments: Outreach from the Meters Matter Program and the Water Conservation Program overshadowed the Leak Free Sacramento Program.

5. On a scale of 1 to 10, one being low, as a stakeholder of the District Metered Area (DMA) Program how would you rate the impact of the program? 6

    a. Comments: Unfortunately, I do not know what goals were met, so I cannot fairly rate the impact of the program.

6. On a scale of 1 to 10, one being low, how effective was outreach for the District Metered Area Program? 5

a. Comments: Other City outreach programs overshadowed this program.

7. What steps can program managers take to improve the effectiveness of a pilot program such as these? Engaging and developing relationships with key stakeholders by communicating strategies, demonstrating program value, and reaching common goals.

City of Sacramento, Department of Utilities

Leak Free Sacramento and District Metered Area Program Survey Questions

Please utilize N/A if you were not a stakeholder of one of the projects.
Please respond by 6/24/2019.

1. In your opinion, what is one vital step that should be taken in the implementation of a pilot program to make it successful? Meeting regularly to discuss successes, near misses and failures, if there are any.

2. Do you believe stakeholder input or lack of it can affect the outcome of a pilot project? Yes. There is a greater potential for mistakes if stakeholders do not get invited to participate or if they do not take the time to participate

3. On a scale of 1 to 10, one being low, as a stakeholder of the Leak Free Sacramento Program how would you rate the impact of the program? 8

    a. Comments: The program continues but has changed slightly from the grant funded program. The cap is higher because of some limitations with the program, and we hope to have an RFP out very soon to solicit contractors

4. On a scale of 1 to 10, one being low, how effective was outreach for the Leak Free Sacramento Program? 6-7

    a. Comments: The best way to target this program is to go after long term leaks that are within the DAC and appear to be homeowner occupied.

5. On a scale of 1 to 10, one being low, as a stakeholder of the District Metered Area (DMA) Program how would you rate the impact of the program? 4.

    a. Comments: It might be more effective if it were done now, since we are closer to being fully metered, and if it involved more of the City. I think it could be something we explore in the future.

6. On a scale of 1 to 10, one being low, how effective was outreach for the District Metered Area Program?

    a. Comments: n/a, I think. What outreach?

7. What steps can program managers take to improve the effectiveness of a pilot program such as these? I cannot think of anything else to add here.

City of Sacramento, Department of Utilities

Leak Free Sacramento and District Metered Area Program Survey Questions

Please utilize N/A if you were not a stakeholder of one of the projects.
Please respond by 6/24/2019.

1. In your opinion, what is one vital step that should be taken in the implementation of a pilot program to make it successful?

Ensure all of the stakeholders are in agreement with the means, methods, and intent of the program as well as level of staff support that would be needed to proceed with and maintain such a program.

2. Do you believe stakeholder input or lack of it can affect the outcome of a pilot project?

Always.

3. On a scale of 1 to 10, one being low, as a stakeholder of the Leak Free Sacramento Program how would you rate the impact of the program?
   1
   a. Comments: The means and methods was not discussed in advance with stakeholders and those familiar with the system. It was expensive as it looked at only small regions of the City and could have been something of value beyond the minor leaks. The plan for determination of an area of concern wasn't initially planned out so there was no direction as to what qualified as a large enough "leak". Also, without areas being fully metered, results were going to be inconclusive at this time.

4. On a scale of 1 to 10, one being low, how effective was outreach for the Leak Free Sacramento Program?
   1
   a. Comments: It got better with time though.

5. On a scale of 1 to 10, one being low, as a stakeholder of the District Metered Area (DMA) Program how would you rate the impact of the program?
   1
   a. Comments: Staff and consultant were chasing a lot of "red herrings" when it came to trying to assess where losses were coming from, which led to a high expense. There were lower hanging fruit that would have produced more value if discussed at the beginning of the conceived concept, prior to the project existing.

6. On a scale of 1 to 10, one being low, how effective was outreach for the District Metered Area Program?
   1
   a. Comments: It got better with time though.

7. What steps can program managers take to improve the effectiveness of a pilot program such as these?

   Work with staff prior to the program being budgeted so that there is buy-in before the scope is given to potential grant suppliers or funding agencies. This will help the hurdles during the implementation side but also identify how (if applicable) the project would be maintained over time.

City of Sacramento, Department of Utilities

Leak Free Sacramento and District Metered Area Program Survey Questions

Please utilize N/A if you were not a stakeholder of one of the projects.
Please respond by 6/24/2019.

1. In your opinion, what is one vital step that should be taken in the implementation of a pilot program to make it successful?
   Define what needs to be piloted, monitored and evaluated.

2. Do you believe stakeholder input or lack of it can affect the outcome of a pilot project?

   Stakeholder can help guide the project, but they can also delay it. It depends on the part that the stakeholder is willing to play or not play.

3. On a scale of 1 to 10, one being low, as a stakeholder of the Leak Free Sacramento Program how would you rate the impact of the program?

   a. Comments:

4. On a scale of 1 to 10, one being low, how effective was outreach for the Leak Free Sacramento Program?

   a. Comments:

5. On a scale of 1 to 10, one being low, as a stakeholder of the District Metered Area (DMA) Program how would you rate the impact of the program?

   a. Comments:

6. On a scale of 1 to 10, one being low, how effective was outreach for the District Metered Area Program?

   a. Comments:

7. What steps can program managers take to improve the effectiveness of a pilot program such as these?
   Identify your goals
   Create time lines
   Establish success metrics
   Make time for Professional Development
   Get feed back

Appendix 15

DMA	Impact	Outreach
	6	5
	4	3
	4	1
	8	1
	1	2.5
	5	25
	4.67	
	46.66667	

LFS	Impact	Outreach
	8	6.5
	8	9
	9	7.75
	8.333333	77.5
	83.33333	