

## Collecting Data for NPDES Requirements

### Survey123 for ArcGIS Empowers Field Staff

By Lorraine Halderman, GIS/IM Administrator, Atascadero Mutual Water Company

Atascadero Mutual Water Company (AMWC) is located in San Luis Obispo County, California. AMWC was incorporated in 1913 and is the oldest continuously operating company in Atascadero. AMWC serves the entire city as well as properties in adjacent unincorporated areas. It is one of the largest mutual water companies in the state and is responsible for supplying water to more than 30,000 people for domestic and fire suppression purposes. AMWC's water system comprises approximately 250 miles of pipeline, 9 storage tanks, 17 active wells, and around 10,500 service connections.

Technology plays a part in almost every aspect of the water utility. Over the past several years, AMWC has made large

strides in converting from paper-based to digital workflow processes. Ten years ago, technology wasn't all that relevant to a field employee, but paper maps have since been replaced with fully operational geographic information system (GIS) technology and printed work orders converted to a GIS-centric computerized maintenance management system (CMMS).

For water utilities, keeping up with the constantly changing GIS technology helps to increase operational efficiency. My goal as a GIS administrator is to find ways to give staff the tools that will make their jobs less cumbersome and improve efficiency. With so many tools and applications available, I have to determine what is most beneficial for our organization.

One of the biggest challenges I face as a GIS professional is having buy-in from staff to implement new solutions. Staff can be resistant to using new methods, so it's critical to thoroughly understand their workflow and educate them about the benefits to themselves and the organization.

In addition to technology changes, there are the usual ongoing modifications to procedures and requirements. In 2016, the California State Water Resources Control Board began requiring all water systems that were not covered by a municipal separate storm sewer system (MS4) permit to apply for a newly implemented statewide drinking water system permit, the National Pollutant Discharge

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↓ Atascadero Historic City Hall Building, Completed in 1918, One of California's Historical Landmarks (no. 958)



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# Esri Water Conference 2017: One Water

By David Totman, Industry Manager, Esri Global Water Practice

The third annual Esri Water Conference was held February 7 through 9 in Orlando, Florida. The conference was attended by more than 300 water professionals. The atmosphere was dynamic, bringing together the supply and demand sides of the water industry and—in keeping with the conference theme—creating a one-water community.

As in previous years, the conference included paper presentations, technical sessions, the Hands-On Learning Lab, data health checks, and two tours. This year, we added a Partner Expo. The Expo was a great success, with attendees asking for more next year!

I would like to thank all attendees and our Water Conference sponsors for supporting Esri and being stewards of our most precious resource: water.

I look forward to seeing you at the 2018 Esri Water Conference!

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Visit [esri.com/events/water](http://esri.com/events/water) for information about the Esri Water Conference.

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## Collecting Data for NPDES Requirements continued from page 1

Elimination System (NPDES) permit. The NPDES permit program is authorized by the Clean Water Act (CWA) to regulate the discharge of pollutants into the waters of the United States. To comply with the NPDES permit requirements, AMWC needed an efficient way to collect information about each discharge.

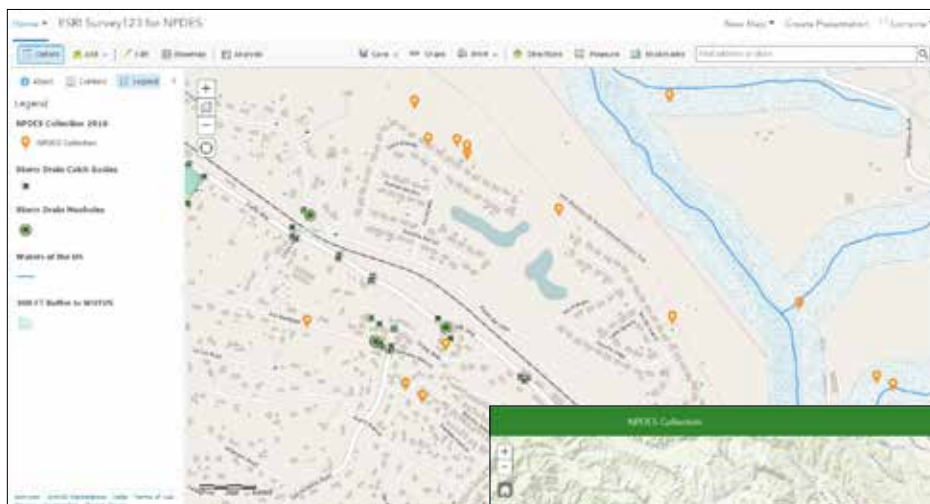
### The Challenge

With these new permit requirements, AMWC struggled to create a form that would meet the documentation criteria but not be too cumbersome for field staff to use. Depending on the type of discharge and number of variables, field staff could be required to complete several forms. Paper forms would need to be created with every possible scenario in mind, which would not be very intuitive for field staff. Managers realized that this could lead to confusion, result in incomplete paperwork, and cause management difficulty. In addition, the paper forms would need to be collected and risked being misplaced. Also, there would be no easy way to attach pictures (when applicable), and once the forms were turned in, the data would still need to be manually typed into a computerized spreadsheet for data summary and reporting. Since the NPDES requirements were going into

effect in just a few short months, the challenge for management was finding a solution that would meet all the criteria, be cost-effective and quickly implemented, and include any necessary training of field staff.

### The Solution

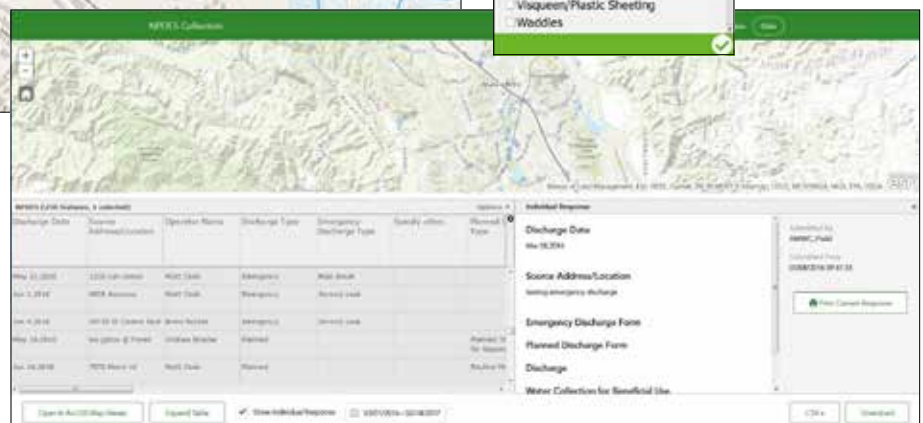
Management deemed that paper forms would be insufficient, and using AMWC's CMMS was also ruled out because it did not meet all the criteria. The solution would have to support relational data and condition-based logic, have prepopulated drop-down lists to limit the need for data entry in the field, and enable staff to take photos or attach images, all while working in a disconnected environment. Before the beta release of Survey123 for ArcGIS, a few different mobile-based solutions were looked at, but these didn't meet all the necessary criteria. Once Survey123 beta was available for a trial run, it was determined fairly quickly that it met



↑ ArcGIS Online Web Map Showing NPDES Regulated Discharges in Relation to Buffered Waters of the United States and Storm Drain Basins and Manholes



← Survey123 for ArcGIS Mobile Application Preview (emergency discharge type)



↑ Visualizing Data on Survey123 for ArcGIS Dashboard



↑ Best Management Practices in Place for Prevention of Jobsite Erosion

AMWC's requirements, and since GIS technology was already being used in the field, Survey123 would be a great solution.

Using Survey123 for ArcGIS, AMWC crafted Survey123 forms following strict NPDES guidelines. To make these smart forms intuitive for field staff, attention was given to leveraging features such as question grouping and skipping (conditional logic) and user-input validation rules. Even when disconnected from the network, field data collection was enabled through tablets and smartphones running the Survey123 mobile application.

## The Results

Field staff are now able to collect data for NPDES reporting with more confidence, benefiting from automatic validation rules and intuitive smart forms. Training field staff on the use of the mobile application itself was minimal. It is user-friendly even for the least experienced technology user. Due to the conditional logic, field data collection is accurate and simplified. Field crews only see what they need to see, based on their previous response, and there is no question as to which fields need to be completed. Additionally, data collection with Survey123 enables data captured in the field to be immediately available for analysis and reporting. With recent enhancements to the Survey123 dashboard, one can view, filter, analyze, and export survey data; print individual responses in PDF; and collaborate with others. Data can also be accessed from ArcGIS Online, where it can be viewed, edited, added as a feature to a map, and more.

Survey123 has come a long way since it first came out in beta. There have been many improvements made to the application as well as the Survey123 dashboard. The help on the Survey123 website ([doc.arcgis.com/en/survey123/](http://doc.arcgis.com/en/survey123/)) is a great central hub for quick access to application downloads, the GeoNet forum, the Survey123 blog, FAQ, documentation, training videos, and technical support.



↑ Water Collection for Beneficial Use

# Leveraging ArcGIS during a Drought

By Matthew Palavido, Business Applications Manager—Information Services Department, Coachella Valley Water District

Located in the Southern California desert, the Coachella Valley Water District (CVWD) has been in existence since 1918. The district delivers canal water for irrigation and domestic use, collects and recycles wastewater, provides regional storm water protection, replenishes the groundwater basin, and promotes water conservation.

CVWD's service area covers approximately 1,000 square miles, from the San Geronio Pass to the Salton Sea, mostly within the Coachella Valley in Riverside County, California. The boundaries also extend into portions of Imperial and San Diego Counties. CVWD serves over 100,000 customers and has approximately 500 employees.

## California Drought

Droughts are a recurring theme in the history of California. According to the California Department of Water Resources, the state experienced significant droughts from 1929–1934, 1976–1977, and 1987–1992. The most recent significant drought began in 2012 and continues today. In an effort to conserve the valley's vast water resources for future generations, CVWD has called for a 20 percent reduction in water use by 2020 as part of its Water Management Plan.

## Citizen Engagement

To increase citizen engagement, CVWD embarked on a project to provide the public with a tool for reporting water waste observed throughout the valley. The tool needed to be simple to use on mobile platforms, as well as traditional desktop platforms, and integrate with our existing Esri technology-based enterprise GIS framework.

CVWD researched and evaluated several off-the-shelf services and tools and ultimately determined that the project could be accomplished most cost-effectively by using multiple Esri technologies available to us via the district's enterprise license agreement (ELA) with Esri.

## Project Approach

CVWD already makes extensive use of ArcGIS Online for organizations for public-facing maps and data as well as private organizational-based data and maps.



← Coachella Valley Water District (CVWD) uses ArcGIS Online for public-facing maps and data as well as private organizational-based data and maps.

CVWD researched several ArcGIS Online application templates and determined that the GeoForm template would be an ideal



fit for the front-end user experience. The GeoForm template application allows form-based editing of a feature service and works equally as well on mobile and desktop devices. The template also embeds nicely in CVWD's existing mobile customer service application, which is available in the Apple App Store and Google Play.

← CVWD integrated GeoForm template directly into its existing mobile customer service application.

GeoForm template is configured to allow the end user to fill out a basic form—in this case, a form with details about water waste that is observed by private citizens. The user then has the ability to attach a photo and locate the observance on a map either by using the current location, physically touching the map at the location, or specifying an address.

→ The customer service application provides a basic form to report observed water waste.

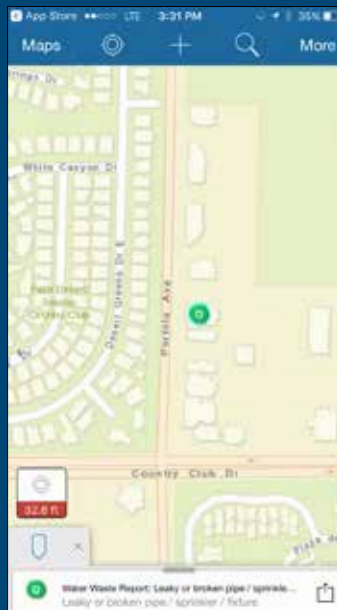


GeoForm template requires a publicly shared web map and feature service; however, to respect the public's privacy, CVWD employs a workaround to enable the submissions to remain anonymous. Accomplishing this involved setting up a feature service in an Amazon Web Services EC2 instance running ArcGIS Server built using the ArcGIS Server Cloud Builder tool. The feature service is published on this server with the Maximum records returned parameter set to zero. This allows the public to submit new records but not view or query any records already submitted. CVWD water conservation staff, along with the user reporting the water waste, receive an email confirmation of any new submissions. This functionality is accomplished using ArcGIS GeoEvent Server and Amazon Simple Email Service.

A second secured feature service, which allows internal CVWD staff to access all the submissions, is then published in the Amazon Web Services EC2 instance. This second feature service is used in all the internal maps and applications for field and office staff.

CVWD needed a mechanism for following up and investigating the reports of water waste from the public. To accomplish this, Collector for ArcGIS is used on data-enabled CVWD iPhones and iPads by staff in the field.

➔ Collector for ArcGIS is used to investigate private citizens' reports of water waste.



Any open submissions from the public appear in a map within Collector along with a few additional internal fields, such as comments and investigation status, which staff can fill out. Additional photos can also be attached to the report.

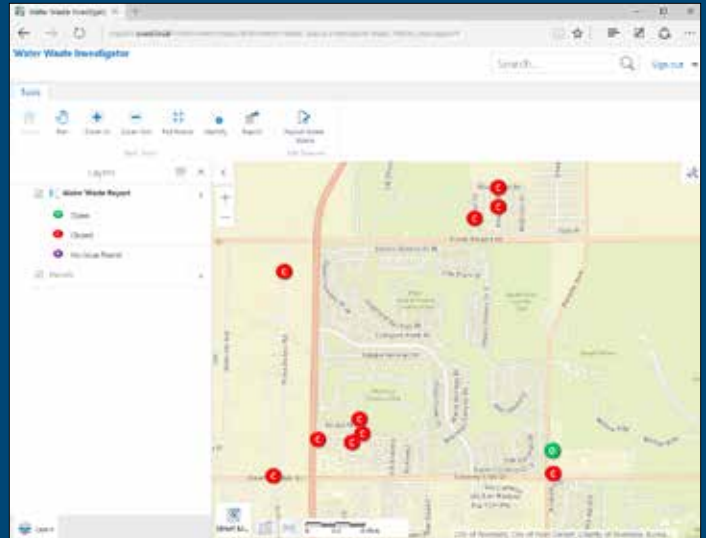
Two desktop tools are also available—one for managers to see a high-level overview and one for staff to update water waste reports.

The tool for management uses Operations Dashboard for ArcGIS from Esri to quickly display a map and a few basic statistics. An example of a basic statistic is Reports in the Past 24 Hours.



↑ Managers use Operations Dashboard for ArcGIS to view statistics such as Reports in the Past 24 Hours.

The second desktop tool uses a combination of ArcGIS Server and Geocortex to allow staff to quickly see submissions by investigation status (open, closed, no issue found) and to update records, as necessary, with additional information.



↑ ArcGIS Server and Geocortex allow staff to quickly see submissions by investigation status (open, closed, no issue found) and to update records, as necessary, with additional information.

## Conclusion

CVWD currently receives 40 to 50 submissions a week from the public in addition to the dozens of incidents each day that are observed and reported by CVWD water waste patrol staff. CVWD began actively promoting the new tool in January 2017 via the CVWD website, social media, and bill inserts. Since that time, the number of submissions has increased to roughly 70 to 80 a week and continues to grow. Even prior to actively promoting the application, the introduction of the water waste reporting application had streamlined CVWD's water waste investigation workflow and decreased response times to the reported incidents of water waste. The tools have also increased upper management's awareness of water waste and remediation efforts. Staff are now able to see water waste incident distribution spatially/geographically—something that has been lacking in the past. This allows staff to identify patterns and problem areas and more effectively target patrol efforts.



# Real-Time Geoinformation: Taking Asset Management to a Higher Level

By Harmen van Doorn, Esri Nederland B.V.

Evides is the second-largest water company in the Netherlands and supplies drinking water to 2.5 million consumers and businesses in southwest Netherlands. In addition, the company produces and supplies water for various types of industrial use and treats urban and industrial wastewater.

Geoinformation plays a crucial role at Evides, as it safeguards the quality and reliability of the water infrastructure now and for the future. The ArcGIS platform ensures that employees can use geoinformation—for instance, in asset management processes—by providing static and real-time data from a variety of

sources. This data is displayed on a map, providing insight into the functioning of the network.

## Real-Time Information

“Evides stands for robust, secure, and solid,” says Robbert Wever, manager, Infra. He sees GIS technology as a means to strengthen the reliability of the water company. “Managing the drinking water pipeline network is getting increasingly important,” he says. “And with GIS as the core tool of the department, we can better manage our assets so that, for instance, our people in the field know exactly where to expect to find the pipes

which are in need of replacement or repair.”

Real-time information is crucial for the daily work. It is increasingly important to accurately capture and easily unlock and link data, now that the subsoil is getting full. Evides uses the OSIsoft PI System to document the real-time data concerning the production and transportation of drinking and industrial water. Together with ArcGIS, this provides a dashboard that business managers like to use to get an up-to-date overview of the functioning of the network. The development of such a dashboard started after a pipe burst and went unnoticed while affecting clients.



## Experimenting

How can Evides respond to future challenges and, at the same time, continue to supply water in a reliable way? Wever says, “In order to do that, we need to be able to react quickly to changes from inside or outside of the organization. One way to do this is to get more employees involved with the development of quick solutions. [Since] we cannot have them experiment in the main IT systems, as they are too important for the day-to-day business, we developed the project GAMEs [Geographic Asset Management Evides]. This is a separate ArcGIS

↑ Field technicians rely on GIS to provide the location and condition of assets.

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## WE KNOW WATER

is a priority for your community. GIS-centric Public Asset Management helps you better manage the community assets critical for delivering clean drinking water and maintaining a healthy environment.

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environment for geo-related innovation. Call it a sandbox environment. An increasing number of employees got active in this project after they heard enthusiastic stories (and saw the results) of the early adopters. This experimental digital environment is accessible to everyone in the company via the intranet. Where the idea was to initially develop 4 new features, (or map layers), during the first year, it became 50! About 40 of these were created by the end users themselves and not via the IT/GIS department, indicating that people turned out to be much more creative than initially thought. The feeling of being involved is very important, experimenting with your own challenges and problems and finding a quick solution. The key to success is visualization, and ArcGIS excels in that.”

GAMEs Playground is an internal digital research environment—a playground for new ideas. Many features proved to be so important that it was decided to create a production environment, with the working name Serious

GAMEs. Wever says, “The new services must be stable and reliable, because our field staff will count on them for their daily tasks. Management should make it clear, for instance, who owns what data so that data can be kept reliable and up-to-date.”

### **Ability to Act Faster**

Jan Urbanus, acting from the beginning as project manager of GAMEs, indicates that business managers can act faster, now that they have a lot more information at hand. “When there is a leak somewhere in the network, they can quickly see which valves have to be closed, see which customers in the neighborhood are affected, and see whether a failure may be the result of ongoing work in the area.”

Field technicians use the map showing where their colleagues are active. The office staff also uses this map when disturbances occur, as it shows clearly who is working where and with what type of work. Also, it’s important to the

employees to unlock historical data and see it on the map. Jonas van Schroyenstein Lantman, who is tasked with the daily management of GAMEs Playground, comments, “There was a lot of information about the drinking water distribution system hidden in the gigantic database. Via the experiments we can do in GAMEs, we are discovering new patterns in the data and understand even better how our network behaves. This [is] thanks to the analytical functions and visualization tools of ArcGIS and TaKaDu.”

Big data software like TaKaDu uses sensor data from PI to generate events on anomalies in the water network. Those events can be visualized with ArcGIS. “We can now explore the data on a map and visualize the data in graphs, which leads to valuable insight. In this way, we can make well-founded decisions which make that water from the tap continue to flow. We can guarantee the quality of the water, and we can make our operation even more efficient.”

→ TaKaDu, PI, and ArcGIS provide Evides with valuable insight that helps to guarantee the quality of water provided to customers.



# ESRI WATER CONFERENCE 2017

## Sponsorship Editorials

### Making Your Data Smarter

We work with utility companies to improve how they manage their assets by building a holistic, consistent, and current view of their network data. As the need for more accurate and timely data increases, the use of our automated, rules-based data management engine becomes increasingly more valuable. Utilities around the world have used our tools to solve complex data issues—turning traditionally time-consuming, manual data tasks into straightforward, continuous processes—ensuring their data is always accurate, current, and trusted. We automate the processes of consolidation, validation, correction, and enrichment through the use of business rules. Accuracy, consistency, and efficiency are improved, while cost is reduced.

We have helped customers, such as Suez, KLIM-CICC, United Utilities, and Northumbrian Water, improve the management of their water network maintenance, better understand the location of underground networks, and develop assets to establish a more thorough picture of their overall holdings.

By encapsulating your experts' knowledge of your infrastructure in user-managed rules, we ensure your data will consistently meet your business requirements. Field collection is greatly enhanced as well with data validation occurring at the point of capture, ensuring accuracy and avoiding expensive revisits. Missing data? Automate the creation of unmapped assets and their attributes using advanced inference techniques combined with your engineers' knowledge of their construction, eliminating costly surveying.



### Lucity

Lucity ([www.lucity.com](http://www.lucity.com)) has expanded its portfolio of LucityAM Enterprise Asset Management (EAM) software solutions for water utilities. These solutions are integrated with the Esri ArcGIS platform with added value applications that extend beyond the traditional system's assets. These applications support important programs that utilities undertake to

- Control discharges of fats, oils, and grease (FOG) from food service establishments into publicly owned treatment works (POTWs).
- Regulate discharges of wastewater from industrial facilities into POTWs through proper pretreatment procedures.
- Mitigate urban stormwater runoff quantities/quality through the implementation of best management practices (BMPs).

Key capabilities of the LucityAM FOG, IPT, and BMPs modules are tracking inspections of facilities/assets to determine violations and associated corrective actions for compliance. The benefits of compliance cannot be understated, as the combined intent of such programs is to control SSOs; prevent pollutants/solids from being discharged into streams, rivers, and lakes; and reduce erosion and minimize flooding.

The inclusion of the FOG, IPT, and BMPs modules within LucityAM brings these important environmental programs within the managed EAM scope to take full advantage of integration with GIS technology, asset and infrastructure management, work management, preventive maintenance, customer service, community development, and civic engagement.



# Effective Field Data Collection and Management of the Complete Drinking Water Cycle in Chile

Empresa de Servicios Sanitarios de Los Lagos (also known as ESSAL) collects, treats and distributes drinking water for customers within its operating territory. The company's coverage includes two regions in Chile: Los Lagos and Los Rios. The efficient gathering of data related to the distribution and consumption of drinking water is critical for managing the supply to ESSAL's more than 200,000 customers, spread across these two regions.

## The Challenges

With so much ground to cover, ESSAL needed a solution to optimize and centralize field information. Capturing information from the field normally takes between one or two weeks, and the process of collecting and sharing data and work flows is cumbersome, making it difficult for management to draw conclusions and take important decisions on a timely manner.

## The Solution

Oscar Quezada, technology and communications lead and Jorge Bertin, GIS lead, both from ESSAL, implemented a

Geoportal with the platform ArcGIS Online that uses Collector for ArcGIS®, which serves as the mapping platform and geospatial content management system. Now, information is captured from the field by utilizing smartphones, stored in the Esri cloud and viewed in Operations Dashboard for ArcGIS. This solution was initially implemented in the Leak Detection unit as a pilot. Its implementation took two weeks. The Leak Assessment department has now been in production for over two years and the use of the ArcGIS Platform has expanded to other areas such as: Rural Drinking Water (APR), Industrial Fluid Treatment (RILES), Bio solids, Engineering, Planning, and Potable Water Quality.

## The Results

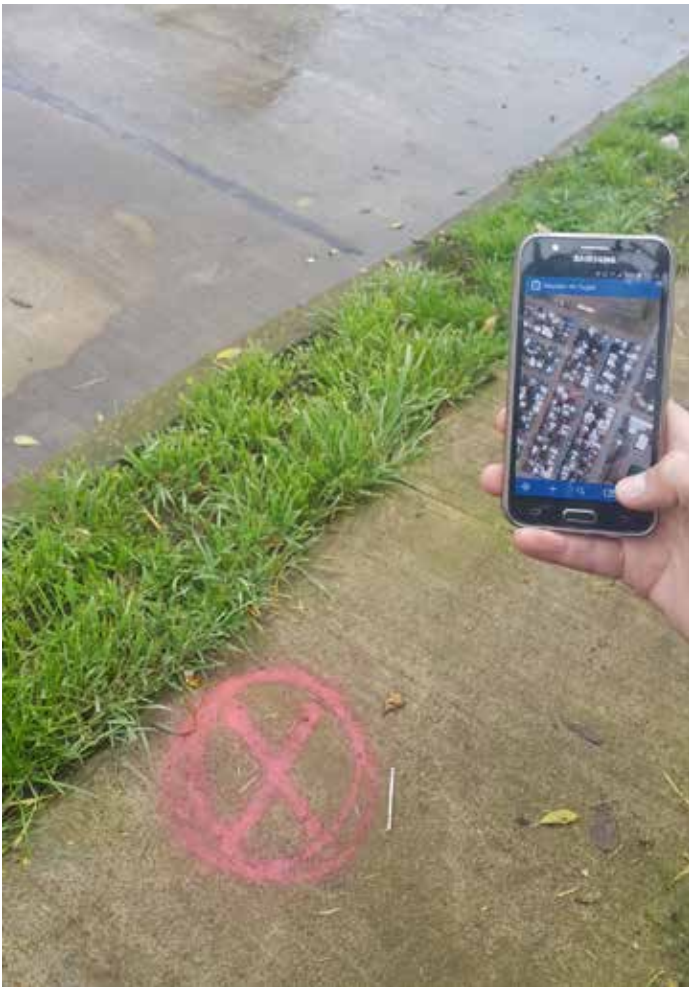
Using the ArcGIS platform, ESSAL has expedited capturing field information; what used to take one or two weeks is now done in only two or three days. Today, field information is highly reliable and readily available via this new centralized system, contributing to overall organizational efficiency. Additionally, with ArcGIS, ESSAL also gained efficiencies in many areas such as vehicle maintenance, fuel consumptions and workers time.



↑ Leakage Management: Displays incidents and types of leaks.



↑ Engineering Work: Shows progress on the status and priority of queries.



↑ Equipment in the Field for leakage assessment using Collector for ArcGIS.

“The use of these new cloud based tools has provided us with access to endless possibilities in terms of how we apply this geolocated information. This new system perfectly aligns with our overall strategic objectives. Esri has been a great partner in the implementation of this new centralized system, which has been an amazing business intelligence tool.”

Oscar Quezada  
Technology & Communications Lead  
ESSAL

“GIS has been adopted in ESSAL since 1997. ArcGIS Online opened a new universe for us, allowing the company to share geographic information across the entire organization transversally. We look forward to new updates.”

Jorge Bertin  
GIS Lead  
ESSAL

## WATER UTILITY

### User

Empresa de Servicios Sanitarios de Los Lagos, a drinking water treatment and distribution company serving over 200,000 people in two regions in Chile.

### Challenge

Overcoming outdated field work flows, lengthy delays and dispersed information collection, which made it difficult to consolidate, share and analyze data.

### Solution

ArcGIS Desktop  
ArcGIS Online  
Collector for ArcGIS  
Operations Dashboard for ArcGIS

### Results

Enhanced decision-making based on accurate data, contributing to efficiencies across the organization, and cost reduction in time, fuel and resources.



# Modernizing Preventative Maintenance with ArcGIS

To maintain district sewer mains, Silver Lake Water and Sewer District crews regularly clean them using a high-pressure water jetting nozzle. While all mains require cleaning, certain mains need it more frequently due to a lack of sufficient pipe slope, pipe damage, unusual sewage flows, or other reasons. Staff assigned to clean the sewer mains must stay on schedule to clean all pipes and, at the same time, clean problem mains more frequently.

## The Challenge

A large paper map was being used to track the sewer cleaning work. As the sewer mains were cleaned, they were highlighted on the map, listed at the bottom of the map, and put into a spreadsheet. Once

*“Using the Collector application makes keeping track of work so much easier than the paper process. We can mark our work as we do it, and it is much easier to review the work we have done.”*

Jeff Enns, Maintenance Worker

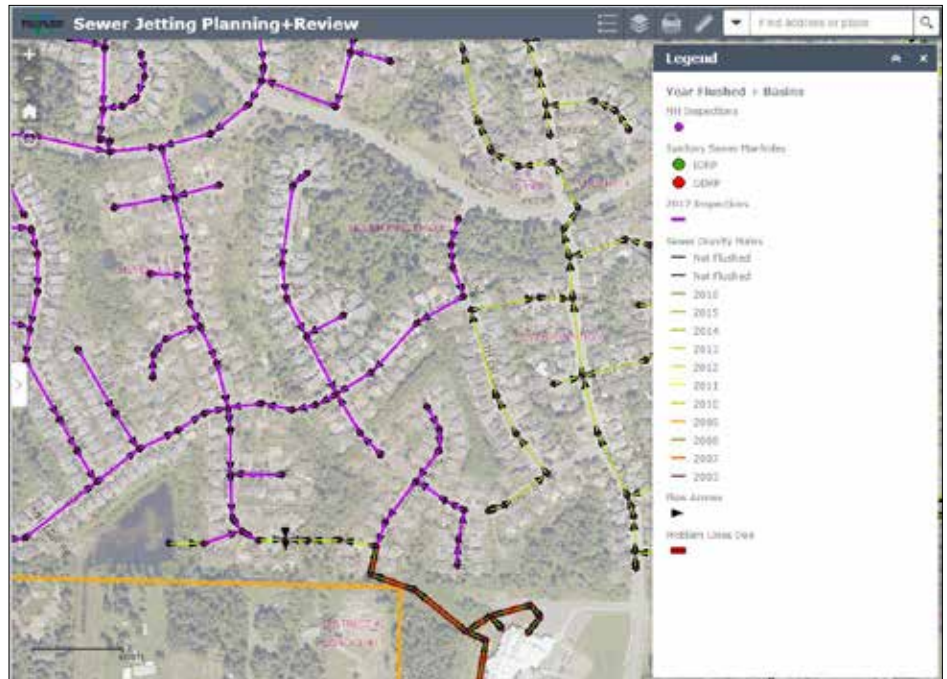
a year, the data was entered into the GIS system and a new map was printed. This was a manual process that often resulted in duplicated efforts because crews either couldn't remember whether the line needed to be cleaned when they were out in the field or skipped cleaning a line because they thought it had been done.

In the field, crews were using map books that could become out-of-date. In the past, when crews found something in the

field that didn't match the map book, they could spend up to half a day researching as-builts back at headquarters, trying to figure out what was going on. A new system was needed to enable the crews to work efficiently and share their work across their organization.

## The Solution

Collector for ArcGIS was configured for the crews to maintain current records of their



↑ Web AppBuilder was used to configure a web app that enables crews and supervisors to monitor and plan daily work.

← Collector for ArcGIS allows staff to easily see which mains and manholes are due for inspection and is used to maintain current records of field work.

“I have been impressed with how reliable and easy to use the Collector for ArcGIS applications have been. The crews keep asking for new Collector applications.”

Chad Phelan, Technical Services Manager

work, including photos. This allows them to easily see which mains and manholes are due for inspection and provides access to asset information such as pipe diameter, length, and date of last inspection. This also provides a means to note comments associated with the cleaning, which helps the GIS staff improve records of the infrastructure.

Web AppBuilder for ArcGIS was used to create an application that enables crews and their supervisors to monitor and plan daily work. The application includes the same information as the Collector for ArcGIS configuration and adds the ability to filter inspection results to easily review the work being completed. This is useful for determining whether to clean a line

again if it has had trouble in the past or, if there is a sewer backup, to determine how long since the last cleaning it has taken for a blockage to build up. Also, it is easier for the supervisors to see how work is progressing.

### The Results

Implementing Collector for ArcGIS and building the web application has saved the field crews hours of time by eliminating the need to bring paper reports from the field back to the office, update the paper map, and then update the spreadsheet. Record keeping has been dramatically improved, and by providing an easy way to view status of the work being completed, daily work is more efficiently assigned.

## WATER

### User

Silver Lake Water and Sewer District, Bothell, Washington

### Challenge

Move from a paper-based system to a digital solution

### Solution

Collector for ArcGIS and Web AppBuilder for ArcGIS

### Results

Hours of time saved; more reliable, easily accessible data



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