

Simplifying Regulatory Compliance with Remote Injection Well Monitoring

A WellAware Case Study



About the Operator: Maverick Natural Resources focuses on the development and production of long-lived oil and gas reserves throughout the United States. Maverick's California assets include several large, complex crude oil fields within the Los Angeles Basin located in Orange and Los Angeles Counties. These mature oil fields generate steady cash flow from stacked pay sands, water floods, and optimized well work.

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Introduction

Recent changes to California's regulatory requirements governing underground injection control (UIC) programs are requiring oil and gas operators with EOR or disposal injection wells to pivot to comply with new demands. WellAware worked closely with Maverick Natural Resources through their acquired subsidiary Breitburn Operating to specify, design, and implement a continuous injection well monitoring platform within the unique constraints of an urban oilfield environment.



TOPICS

The Challenge:
Continuous monitoring in an urban oilfield environment

The Solution:
Low power network and application design to achieve high frequency monitoring

The Result:
Improved workforce efficiency and simplified compliance



Generating accurate CalGEM reports on time takes a lot of field people going around and manually collecting data from wells. It's expensive to maintain.

Senior Engineering Technician

The Challenge: Urban Oilfield Environment

California's LA Basin is a unique location to produce oil and gas. Stricter regulatory requirements than most states make producing and operating complex fields more challenging than in other environments. At the time of the project, Maverick Natural Resources produced approximately 4.1 MBoe/d from their operations in Southern California's high-density urban areas where wells are spread across large fields amongst commercial and industrial facilities. This spread makes compliance efforts challenging. According to the Maverick's Senior Engineering Technician, "Generating accurate, timely CalGEM reports takes time and field labor to manually collect well data." The steep cost of non-compliance, however, necessitates the investment to avoid fines that can reach up to \$25,000 per day per violation.

The California Geologic Energy Management (CalGEM) division requires periodic high-pressure testing of Maverick's injection wells to ensure well and environmental integrity, requiring a considerable investment of manpower to complete within the regulatory guidelines. Sustained pressures

exceeding the maximum allowable surface pressures can cause leaks in well tubing, well casing, completion packing and even in cementing, which would lead to potentially expensive workovers in addition to downtime and lost production. In severe cases, testing requirements could result in permanent shut-in and abandonment. Compounding the issue is the risk of non-compliance and associated fines if reporting and testing requirements are not met.

Urban environments create unique challenges

The Senior Engineering Technician and his team struggled to find a means to monitor injection well pressure that would satisfy the rigorous CalGEM requirements and not risk well integrity. Specific to this field were some unique challenges:

- The wells were spread across an urban neighborhood with higher-than-average crime rates. Monitoring solutions needed to be discreet so as not to attract theft.



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The total cost of a system proposed by an engineering consulting firm exceeded their annual operating budget for labor by five times!

- Most wells did not have access to grid power, and the solar panels which had been used in the past to provide localized power had frequently been stolen.
- The wells were spaced between buildings and structures in the urban environment, making wireless networking challenging.
- CalGEM required continuous monitoring of casing and injection pressure with a monitoring frequency of five minutes or less.

Many options that Maverick considered simply did not provide solutions to these major challenges. Battery-powered local radio network systems were far too expensive, distributed cellular modems at each well would result in high communications costs, and most heavily-engineered systems were very expensive to install and maintain at the necessary operating conditions to satisfy regulatory requirements.

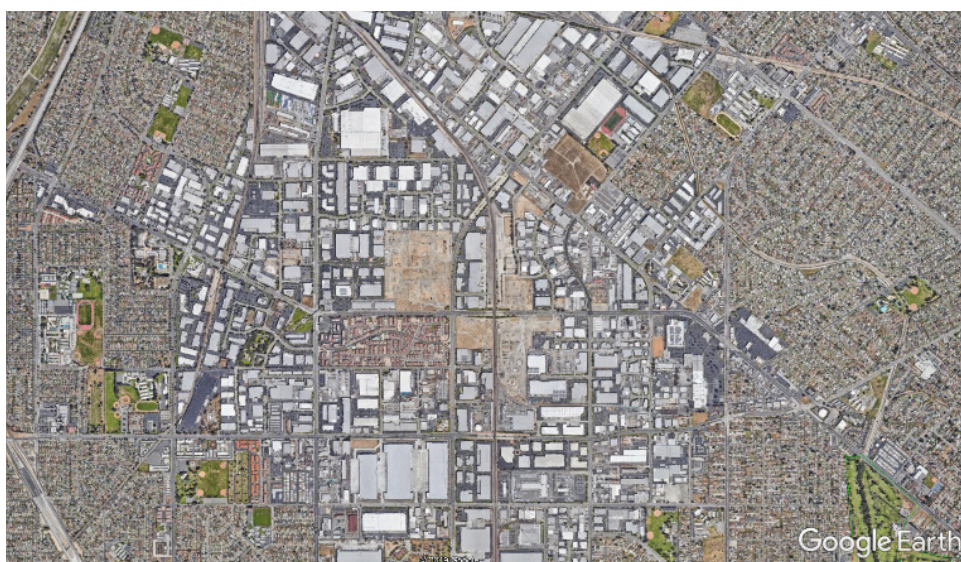


Figure 1. A bird's eye view of the urban environment (credit: Google Earth)

Legacy operational technology (OT) solutions were too expensive

The bid for the initial project, which included monitoring of casing pressure, tubing pressure, and injection flow rates and volumes on 90 injection wells (some with multiple tubing strings), which Maverick received from a local engineering consulting firm, far exceeded the Maverick's available budget.

The engineering consulting firm selected off-the-shelf sensors and wireless transmitters with the ability to operate on internal battery power and designed a complex radio network requiring five network gateways, three cellular backhaul points, and 41 network repeaters to deliver to monitoring requirements using a standard 2.4 GHz wireless node network.

The total estimate for the project was over \$1.3 million, or about \$15,000 per well. While the off-the-shelf system may have accomplished the monitoring requirements of the CalGEM regulations, the cost to do so would have even exceeded the operating budgets devoted to manually collecting data for over 5 years! This was not an economical solution. There had to be a better way.



Figure 2. The RF solution proposed by an engineering consulting firm was not economical. (photo by Tony Stoddard)

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I would recommend WellAware to other colleagues in the industry who are seeking a way to implement real-time data based on a web or phone application. The web-based and mobile apps are easy to use and navigate and I have been satisfied with WellAware's customer support and service.

Senior Engineering Technician

The Solution: Low Power Remote Monitoring with WellAware

The best solution came in the form of the WellAware Underground Injection Control Platform, with applications configured to support the specific use-cases required to meet regulatory compliance.

The system deployed by WellAware collects data from sensors installed on the well using the battery-powered WellAware CONNECT cloud terminal unit to continuously monitor critical pressure and flow data in real-time to assure that casing and tubing pressures did not exceed the maximum allowable surface pressure. The solution offers Maverick a way to demonstrate to CalGEM that they are continuously monitoring the well to ensure mechanical integrity. Instantaneous alarms and 5-minute data polling frequency solved the problem of exceeding set thresholds.

Unlike other solutions, the WellAware UIC Platform solves the key challenges in the following ways:

- The CONNECT system is powered entirely by low-cost, 3.6V lithium D-cell batteries, eliminating the need for expensive and theft-prone solar panels.
- The entire wireless network operates using existing 4G LTE connectivity on a private WellAware APN, with group data plans that reduce and control communications costs.
- The configurable reporting intervals on WellAware CONNECT allow Maverick to respond to the need for increased polling frequency during special audits or step-rate tests.
- The WellAware solution costs five times less than the legacy OT solution proposed by an engineering consulting firm.

The WellAware solution doesn't just solve UIC program challenges

The WellAware system not only helps Maverick satisfy the CalGEM monitoring and reporting requirements cost-effectively; it has also been augmented and used in other capacities. With WellAware, Maverick can remotely monitor high-pressure system pump drive data, as well as monitor flare-stack temperature data and be alerted with an alarm when pumps or flares go off-line or exceed predetermined thresholds.

Maverick also extended the system to monitor vapor recovery units (VRUs) to help meet emissions and sustainability goals. In all of these applications, WellAware enables Maverick's field team to more effectively plan and schedule routes and complete field tasks.



Figure 3. The WellAware system improves workforce efficiency with mobile tools.

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The Senior Engineering Technician estimates that the WellAware system improved workforce efficiency by 70% and decreased the costs associated with regulatory compliance by 30%.

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With WellAware installed, the efficiency and reliability of the system far exceeded my expectations.

Senior Engineering Technician

The Result: Improved Efficiency and Lower Compliance Costs

Initially, Maverick began utilizing WellAware's system at its LA Basin Operations. After seeing the positive results, they added more wells to the system in two additional fields. "Presently, we have reduced transportation costs and man-hours, improved security, and have instantaneous, accurate data at our fingertips," says the Senior Engineering Technician. "This mobile technology has changed how we do business since reporting is more reliable and quicker than before. When we factor the accuracy, speed, and reduced costs - it's the most valuable solution."

The Senior Engineering Technician adds, "I would recommend WellAware to other colleagues in the industry who are seeking a way to implement real-time data acquisition and monitoring based on innovative Edge Computing Devices and the Cloud. The web-based platform and mobile apps are easy to use and navigate. And I have been satisfied with WellAware's customer support and service."

WellAware reliably solves difficult operational challenges

The capability to be rapidly notified with an alarm when thresholds are exceeded or when equipment goes off-line is invaluable. The necessity for fast response is vital for safety, reducing environmental risks, and avoiding potential production downtime. The Senior Engineering Technician estimates the measurable results from real-time data and alarming has improved the efficiency of his workforce by 70%, resulting in significant savings in operating expenses.

The additional cost savings realized by reducing the risk of damage with excessive pressure testing had the largest impact on the bottom line. Maverick has been able to avoid unnecessary workovers and keep all of its wells injecting.

"The usability of the web portal and the mobile app are a great plus to the WellAware system," the Senior Engineering Technician adds. "With WellAware installed, the efficiency and reliability of the system far exceeded my expectations."



Want to achieve the same result?

Check out our Underground Injection Control Monitoring Platform
by clicking the button below.

Get Started



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