

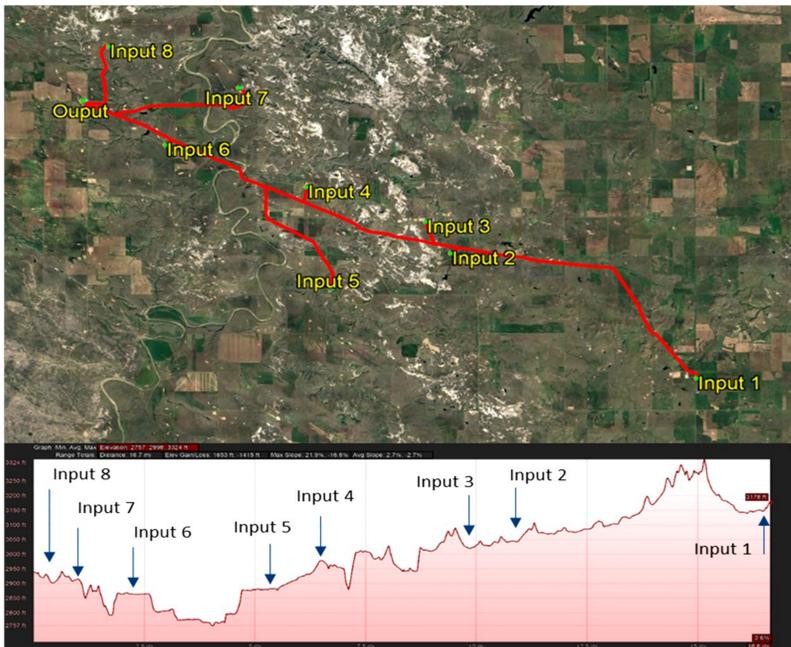
FLOWSTATE

A new approach to pipeline leak detection

IMPLEMENTATION CASE STUDY: CRUDE GATHERING LINE

Challenge: There are many hurdles in implementing leak detection on a gathering line. Transient behavior mixed with limited instrumentation make it very difficult to catch small leaks in a timely manner while minimizing false alarms.

The following shows how Flowstate's machine learning solution can be implemented quickly and meet these challenges.



Pipeline Segment Details

Location: SW North Dakota

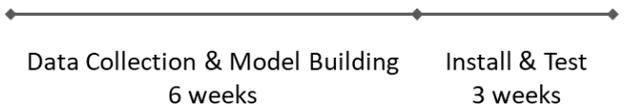
Topology: 8 inputs, 1 output

Length: 16 miles **Diameters:** 4" & 6"

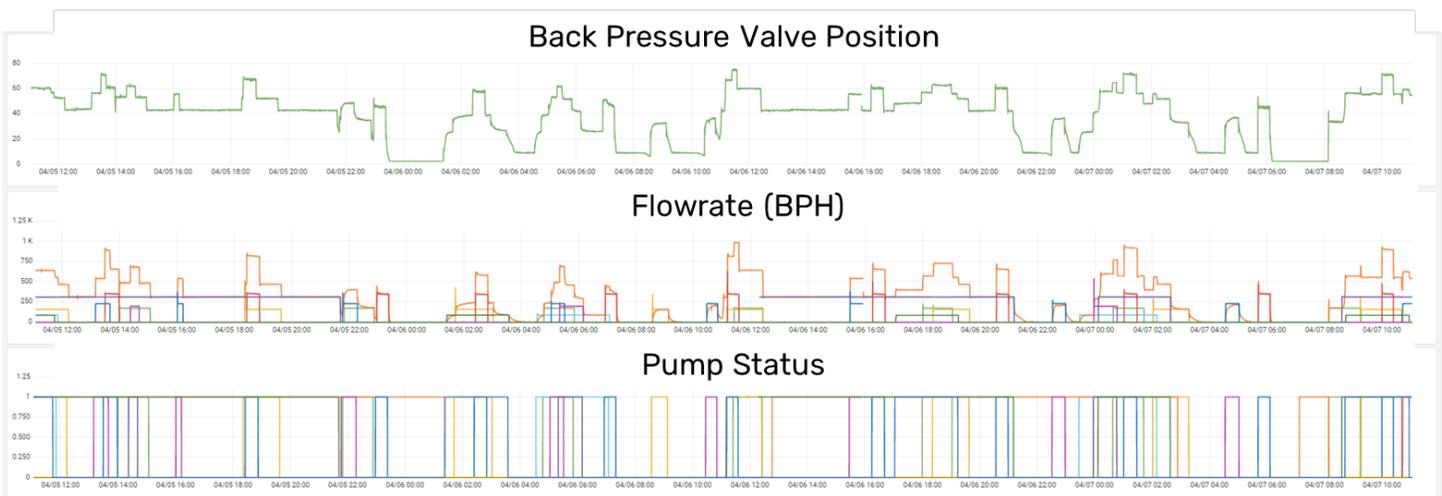
- All stations have flow meters, pressure transmitters, & pump status.
- Back pressure valve located at the output station, controlled by a pressure set point.

Implementation Timeline

Machine learning models were built in just 6 weeks. The system was installed and site acceptance tested 3 weeks later.



2-day Operational Profile



See how our machine learning solution performs on this challenging line. →

FLUID WITHDRAWAL TESTS

Segment Flowrate	Leak Size	Time to Detection
715 BPH	24 BPH / 3.4 %	52 mins
550 BPH	33 BPH / 6.0 %	66 mins
875 BPH	41 BPH / 4.7 %	50 mins
315 BPH	26 BPH / 8.2 %	66 mins
315 BPH	55 BPH / 17 %	22 mins

Flowstate LDS was able to detect each simulated leak. Recent improvements in the deep learning model suggest times could be by 30-75%!

Putting it to the test

The solution was tested with five fluid withdrawal tests. **The Flowstate system detected each simulated “leak”.**

In comparison, the legacy line balance system was unable to detect any of the withdrawals. This was due to the fact that the thresholds had to be set at high volumes and durations to avoid excessive false alarms.

Flowstate LDS

ALL simulated leaks detected

2 False alarms in 7 months

Legacy Line Balance

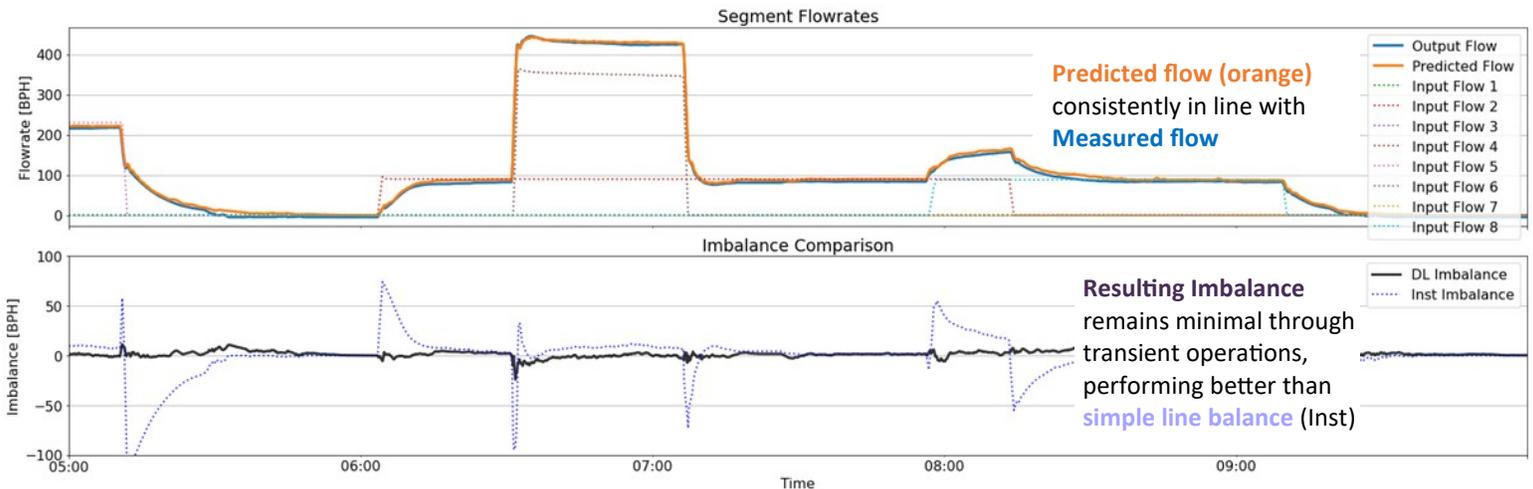
NO simulated leaks detected

5 False alarms in 6 months

BENEFITS OF DEEP LEARNING

The deep learning model utilizes flowrates, pressures, pump statuses, and back pressure valve position. With just a few weeks of data, it is able to learn the hydraulics of the system predict real time output flow rate, much like a detailed hydraulic model.

As shown below, the model does an excellent job of accurately predicting flow through transients caused by operations such as increase in flow rate, turning on/off of injections, and packing and unpacking.



Flowstate offers a solution that is

Affordable: No additional pipeline or computer infrastructure required

Easy to implement: works with your existing instrumentation

Secure: includes state of the art security—in the cloud or on premise

Flexible: works across your system—both gathering and transmission

Quick to Deploy: If your data is ready, you can be up and running in about 2 months