

IDENTIFYING POINT SOURCE POLLUTION VIA SENSOR-EQUIPPED ROBOTIC BOATS

PROJECT BACKGROUND

Effective water management is a high-profile challenge in the Netherlands, a country where 26 percent of land sits below sea level. Intensive agriculture, both in fields and greenhouses, is essential to this small, densely populated country. But nutrient and pesticide runoff associated with high-yield growing activity puts water quality at risk.

Regional water boards actively manage the country's water resources and are some of the oldest forms of local government in the Netherlands, dating back to the 13th century. The Hoogheemraadschap van Delfland water authority is responsible for managing an area of concentrated greenhouse agriculture activity situated along many kilometers of small canals throughout Delft, Midden-Delfland and The Hague.

The water authority is particularly focused on reducing contaminant levels in area waterways, as they look to identify greenhouses with high fertilizer and pesticide runoff. Identifying these point sources and eliminating them through constructive discussions with growers is critical to the board's mission to improve water quality and agricultural efficiency.

With limited agency resources, the water board partnered with Platypus, a company that uses robotic boats and advanced analytics to provide cost-effective data collection for inland water bodies. Platypus has deployed boats in projects spanning six continents, leveraging its Aqualytics™ platform to generate deep insights enabling faster, more targeted water quality improvements.



Figure 1. Mapping greenhouse discharge in the canal system

COMPLEX CANAL SYSTEMS CREATE DATA COLLECTION CHALLENGES

In the Netherlands, a dense system of small canals provides water to many fields and greenhouses in an area containing up to 1 km of canal per hectare. The complexity of the canal systems made manual water quality sampling inefficient, making it difficult for the water board to collect data sufficient to identify problem greenhouses.

With so many greenhouses concentrated in such a small area, the water authority also needed high-resolution water quality data to accurately determine pollution sources. Only with detailed data could they link individual greenhouses with specific hotspots of increased nitrates and contaminants associated with excess fertilizer and pesticide use.

"We typically used pH and conductivity sensors to look for contamination, but one challenge we faced was that some fertilizers are pH-neutral," says Paul Scerri, President of Platypus. "What we needed was an instrument that allowed us to measure nitrate levels directly, in order to identify areas of increased fertilizer application."

COMBINING ROBOTIC BOATS WITH AUTOMATED WATER QUALITY SENSORS

Platypus deployed robotic Lutra boats equipped with In-Situ's Aqua TROLL 600 water quality sensors to assess canal water quality.

"We chose the Aqua TROLL 600 because we knew it would provide high-quality nitrate data," Scerri says. "It also provides continuous data, requires just a short settling time and is fully submersible, all three of which are critical requirements for our robots."

The multiparameter sonde allows the team to collect accurate, high-quality data on parameters that include:

- Nitrate
- Temperature
- pH
- Electrical conductivity
- Dissolved oxygen (DO)

Each morning, technicians calibrate the sensors and accompany the boats from canal to canal to ensure smooth passage from one sampling location to the next. While nominally connected, the canals can be difficult to navigate due to gates and excess vegetation.

At each sampling site, the robotic boats pause for up to three minutes to minimize water turbulence for the most accurate sensor readings. Traveling at speeds of 2-4 km/h, the boats covered 10 km of canals covered on the first test run.

NEW APPROACH ENABLES MORE EFFECTIVE MANAGEMENT

The first round of data collection took roughly two and a half days; the second round took place two months later over the course of just two days. Without the robotic boats and the Aqua TROLL 600, nitrate monitoring over the same period would have taken weeks or months to complete manually, depending on sampling resolution.

“The Aqua TROLL 600 simplifies the process by letting us quickly collect up to 1,200 data points per kilometer of nitrate data,” says Scerri, adding that they also use the Aqua TROLL to verify data generated by hard-wired instrumentation. “We use the logger to ‘sanity check’ the data from other sensors when we put the boat in the water every day.”

The instrument’s quick-read LCD screen allows technicians to easily verify that the instrument is working and generating reliable data. And should the team need it, the Aqua TROLL 600’s integrated Bluetooth communication enables wireless data collection to a mobile device.

Using this unique data collection method, Platypus is able to provide the water authority with a high-resolution picture of nutrient and contaminant density along the canals.

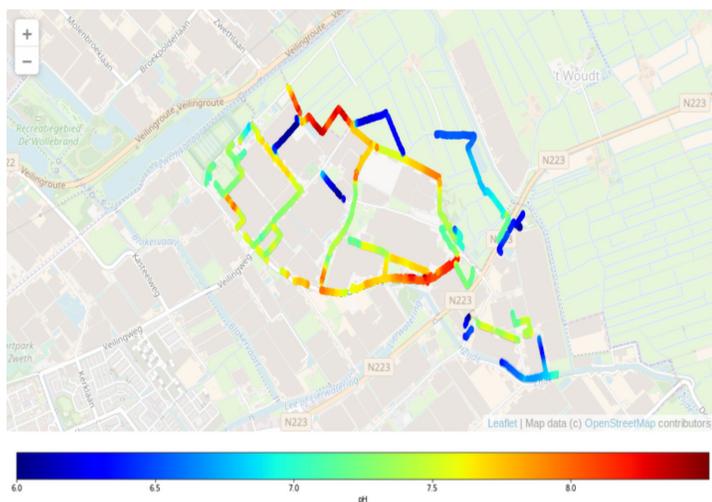


Figure 2. Overall pH readings in the canal system

This detailed map allows the team to identify hotspots based on high nitrate and low oxygen levels where two greenhouses were leaking disproportionate levels of nutrients into nearby canals. As a result, the water authority has been able to step in to identify relatively low-cost solutions that improve efficiency for growers while protecting water quality.

The Hoogheemraadschap van Delfland water authority presented these results to the technical company that serves the entire country’s water boards. Based on this clear return on investment, Dutch water management authorities now plan to use this method to collect data across most of the agricultural canals in the Netherlands.

To date, Platypus has mapped a total of 70 km of canals in the region, with the ability to map 30 km of canals in just 3 days. Platypus will also integrate Aqua TROLL 600 data from ongoing data collection into its Aqualtical Analytics platform. This analytics model will help predict changes in water quality over time, identify potential future water quality issues, and target data collection to optimize ongoing water monitoring efforts.

According to Scerri, the Aqua TROLL 600 is an important element of the company’s innovative approach to addressing canal pollution in the Netherlands.

“It provides high-quality, robust nitrate data we can rely on,” he says. “Add in continuous sensing capabilities, and we’ve got a package that we can integrate with robotics for a novel approach to data collection.”

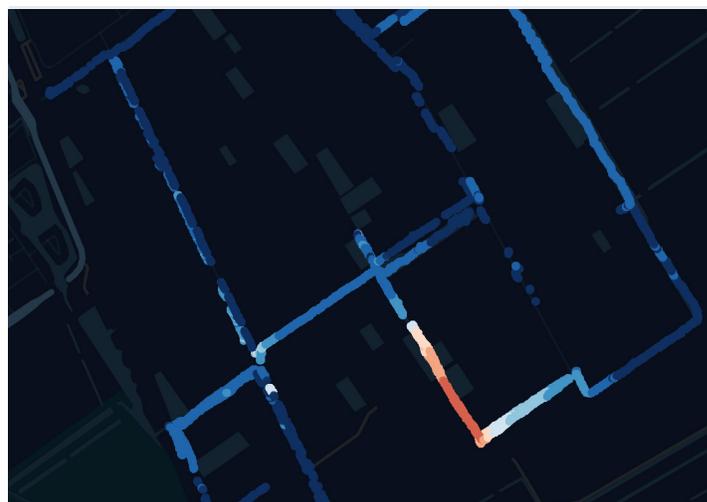


Figure 3. Nitrate hotspots in greenhouse discharge

www.in-situ.com

CALL OR CLICK TO PURCHASE OR RENT
 1-800-446-7488 (toll-free in U.S.A. and Canada) • 1-970-498-1500 (U.S.A. and international)

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
 Copyright © 2018 In-Situ Inc. All rights reserved. September 2018