



## CUSTOMER CASE STUDY:

# Integration of Thermo Scientific SampleManager LIMS™ and CSols Remote Sampler at Northern Ireland Water Delivers Enhanced Audit Trail, Significant Time and Cost Savings

*Northern Ireland Water (formerly Water Service) is the sole provider of water and sewerage services in Northern Ireland. It is a Government Owned Company (GoCo) set up in April 2007 to provide the water and sewerage services in Northern Ireland. There are approximately 795,000 domestic, agricultural, commercial and business properties in Northern Ireland connected to the public water supply and 660,000 connected to the public sewerage system. Northern Ireland Water (NI Water) supplies 625 million liters of clean water every day for almost 1.7 million people and treats 134 million m<sup>3</sup> of wastewater each year.*



NI Water installed a laboratory information management system (LIMS) as part of its continuous focus on improving the efficiency of their sample management process and the integrity of the samples collected from the field. The agency selected Thermo Scientific SampleManager LIMS to improve workflow efficiencies, productivity and sample integrity and has also recently implemented CSols Remote Sampler: handheld devices for water and other industries where in-the-field sampling is the norm. Remote Sampler allows

field samples to be taken and recorded in situ, and uploaded directly into LIMS, thus saving time, and reducing transcription errors as well as providing a secure record of sampler locations. NI Water has invested in this integrated approach, linking their enterprise-level LIMS with a remote field testing device, to further build upon their agency's technology advances and to cement their public position as a trusted provider of the public water supply.

### Profile

NI Water has offices across Northern Ireland, with a Head Office based in Belfast. It takes 1400 people to deliver the water and wastewater services that NI Water provides. In order to deliver this service, NI Water requires a huge system of pipes, pumping stations, water and wastewater treatment works and reservoirs. There are 26,500 kilometers of water mains and 14,500 kilometers of sewers in Northern Ireland (combined, enough to stretch from Belfast to New York and back four times).



In order to ensure the quality of its drinking water, NI Water carries out numerous tests to ensure the cleanliness of its water. Samples are analyzed at two sites, one in Belfast and one in Londonderry. The Belfast site conducts clean water bacteriological analysis and all clean water chemistry. Londonderry is responsible for some clean water bacteriological, cryptosporidia, wastewater and trade effluent analysis. NI Water standardized on Thermo Scientific SampleManager LIMS to improve efficiencies and sample management across its sites, and ensure it adheres to and can document its adherence to the strict regulations governing the water industry.

### Water Quality Regulations

NI Water supplies water for domestic use or food production, which must comply with the standards in the Northern Ireland Water Quality Regulations, including European Union standards and more stringent UK national standards. NI Water's water quality standards are improving year on year and at the tap its water was 99.74% compliant in 2009 measured as Mean Zonal Compliance. To make sure that the water supplied is clean and safe, NI Water takes thousands of samples for testing. These samples are taken from service reservoirs, water treatment works and directly from the taps in customers' homes. Every year, NI Water's state-of-the-art laboratories carry out over 150,000 sophisticated tests to ensure quality standards are met.

The Drinking Water Inspectorate (DWI) within the Environment and Heritage Service also independently audits these tests and issues a report each year on its findings. DWI ensures that water companies meet more than 50 legal standards for drinking water quality. The standards are strict and generally include wide safety margins. They cover: bacteria; chemicals such as nitrates and pesticides; metals such as lead; as well as such basic criteria as the appearance and taste of the water.

### Business Challenge

In 2001, in an effort to ensure that NI Water (at the time known as Water Service – an agency within the Department for Regional Development) continued to be the publicly trusted and reliable provider of Northern Ireland's most essential public service, the agency outlined a requirement to invest in a new LIMS system. Gareth Maxwell, LIMS and Compliance Reporting Manager at NI Water, explains that the company's main laboratory facilities used an in-house customized LIMS, which was developed with what was thought at the time as a unique way of labeling samples—using prefixes (for example, 95 for samples taken in the year 1995). This process for identifying and managing samples continued until Water Service reached a regulatory critical mass in the year 2000, and so a new, more robust and efficient solution was needed.

Regulatory requirements were a key driving factor in the decision to seek a new sample management solution, and the specification was to provide a LIMS system to meet the requirements of the Drinking Water Quality Regulations Northern Ireland 1994 and 1995. Being a government agency at the time added additional pressure to invest in a new system with a high level of professional sophistication and reputation. Water Service specified that in order to have credibility it required system-wide integration capabilities and robust processes – the new LIMS would be specified to support these objectives.

### Vendor Selection

The initial decision to purchase a new LIMS was a corporate decision made in March 2001. The team posted an OJEU notice and created a user group committee to evaluate tenders. The team selected Thermo Scientific SampleManager LIMS with the Water Management Module from a shortlist of three vendors. In June 2001 the contract was signed and the implementation went live in January 2002.

Gareth Maxwell explains that the users selected SampleManager for several reasons, but a critical component of the LIMS analysis was its ability to scale-up when needed. SampleManager LIMS can be implemented in one or multiple instances and is scalable for a large user base. It is a flexible solution that can be tailored to different project specifications and workflows and for Water Service, with multiple labs in geographically remote locations, as well as many more contracted water samplers.

SampleManager LIMS integrates easily with other applications and instruments in and out of the lab, providing one standard user-interface and helping NI Water more easily introduce process standardization across its multiple labs.

### Implementation

Thermo Scientific SampleManager LIMS was selected for its ease of use and because it could be easily configured and managed according to the specific workflow requirements. Since its implementation, the system has been upgraded



four times to keep pace with regulatory requirements and software version updates or enhancements, illustrating the LIMS has the flexibility to easily accommodate and upgrade as necessary to any major Microsoft OS enhancements.

The LIMS was required for three main tasks:

- Receipt of samples for chain of custody from field procurement
- Sample login and storage at NI Water laboratories
- Results and reporting to management and regulatory agencies.

Today, samples are logged into a central repository which includes the following steps: sample receipt, login, barcodes, and transfer to labs.

Gareth Maxwell explains, “We have sample reception facilities at both sites. We have a two-scan process; the first scan identifies that the bottle has been received and the second scan identifies that the bottle is in the correct laboratory for analysis.”

### Additional NI Water and Industry Needs

For many years, UK water utilities involved in water and wastewater sampling have identified a need for a solution to automate current manual/paper processes in the field that would also integrate with LIMS. Water companies have to collect their water samples in a closely regulated environment. Sampling plans are held in LIMS (having been agreed and set up in advance to meet regulatory requirements) and these plans are used to generate a collection run for each sampler. The collection run defines where samples must be taken from, what sample bottles must be collected and what onsite tests have to be performed. Details of what has been carried out in the field then have to be entered into the LIMS. A solution was needed that would automate this last step, but not make the samplers’ job any more difficult or onerous; the goal was to make the field sampling process more efficient and improve the audit trail. Discussions at various user meetings revealed that ruggedized PDAs (personal digital assistant) could be an ideal solution as they are typically small, easy to use, and have a number of useful technologies built-in, such as GPS, GPRS, bar code readers, Wi-Fi and Bluetooth.

### NI Water Requirements

NI Water carries out tests for water quality, wastewater, trade effluent and ad hoc sampling and takes around 150,000 samples per year – these all were being processed manually. NI Water’s wastewater services are provided for customers who are connected to the sewerage system and those who have a septic tank or other domestic treatment works. NI Water aims to provide a reliable and efficient service for collecting, treating and disposing of wastewater, and to ensure that any problems that occur with the public sewerage system are dealt with efficiently and without unnecessary delay.

NI Water has accredited laboratories and accredited sampling and is subject to various audits. Its internal audit identified that while the company has a good audit trail from the time samples enter the laboratory, it had no real audit trail for samples prior to them entering the labora-

tory other than paper based and verbal records. NI Water realized that it needed to adopt an automated system to enhance the existing audit trails and maximize efficiencies across their workflows and improve the accuracy of sample collection. An integrated solution was required to work in tandem with SampleManager LIMS that would readily generate data in an acceptable format to support internal investigation and reporting functions as well as external regulatory reporting and audit requirements.



### The Solution – Integrating Field Sample Testing with the LIMS

NI Water decided to incorporate handheld PDAs to improve the efficiency of sample management and data collection to allow data to be transferred directly between a typographic information system and the SampleManager LIMS database. The project drivers were compliance with Water and Wastewater Quality Regulations and enhanced business efficiency for NI Water overall. NI Water, like many water utilities, does not carry the overhead of personnel to collect audit samples, but rather subcontracts this task to a partner company. The company’s stated aim, in alliance with NI Water goals, was firstly to put in place a means of providing a better audit trail for its field sample collection process. The initial intent was to ensure that there was a record for every detail regarding the samples. Its second aim was to make the sample log-in process faster and more accurate.

Before adopting a PDA solution in tandem with SampleManager LIMS, manually recorded information in the field had to be entered into the LIMS. The reception managers had to change the dates and times for the pre-registered samples, input the results of onsite tests, change address and postcode of where the sample was taken and



indicate if it's a registered trade address. This manual process was extremely time-consuming and NI Water identified that the process needed to be automated.

When selecting the solution, NI Water consulted with both Thermo Fisher and CSols, which had previously provided a direct data capture for NI Water's ICP and other laboratory instrumentation using CSols Links for LIMS. NI Water needed a methodology and software that would meet their requirements to improve the existing audit trail from the time a sample is collected from either a customer tap or NI Water fixed (collection point) asset.

The solution included the use of ruggedized PDAs to provide an enhanced audit trail for NI Water sub-contracted sampling. Initially, four Gotive H42 Remote Sampler PDAs were purchased as part of the pilot program, with a hub PC put in place in each laboratory. The SampleManager LIMS server supplies collection run data to the Hub PCs to program the devices, and also receives run information from the Hub PCs to update the LIMS database. All field testing and water quality sampling is now done using the Remote Sampler PDAs, which include GPS functionality in order to provide accurate sample location, and barcode scanners to scan the labels on sampling containers as the sample is collected to give additional proof of location. The Remote Samplers then deliver their sample information to SampleManager LIMS, currently through a direct USB connection but shortly to be extended through NI Water's secure firewall, continuously feeding data from field collections to SampleManager LIMS. The LIMS in return feeds collection and workflow data to the remote samplers so that field personnel are continuously updated on priorities, sample collection locations and specific testing required.

The integration of the Remote Sampler and SampleManager LIMS illustrates the broad partnership opportunities inherent in any collaborative relationship with Thermo Fisher Scientific. Thermo Fisher's long standing partnership with CSols enabled this solution to be delivered to NI Water, a solution which now serves



as a template for other water agencies or public service companies around the world. And the configurability of SampleManager LIMS, allowing for workflow customization in any industry setting, as well as its ability to be easily integrated with any kind of laboratory instrumentation or ERP system, further enabled this new Remote Sampler solution to be realized. The ultimate benefits

belong to NI Water and other companies at the forefront of solving pressing industry challenges.

### Benefits

The integration of a remote sampler field testing system with an enterprise-level LIMS has delivered essential transparency between data gathered in the field, and management reporting generated by the LIMS. The automation of both the front end sample collection and back end reporting has eliminated manual transcription errors and, because of the speed in receiving samples at reception, significant time savings are realized and quality of NI Water samples and reporting are enhanced.

Gareth Maxwell confirms, "We have introduced Remote Sampler in the field for all our water quality samplers. The use of Remote Sampler allows us to ensure that all samples taken in the field are accurately recorded, taken where they are claimed to be, and inputted into the LIMS at source. This saves time and facilitates the data management."

For NI Water, the entire sampling process has been enhanced. If a sampler cannot access a particular address they move onto another address, take a sample and scan the sample at the customer tap. The time and date of the scan, GPS location and change of address is recorded and the sampler is able to confirm in the field that the new address is still within the correct Water Quality Zone. Previously, this information was recorded manually and input into LIMS at reception. Now, the PDA is docked at reception and the bottles are scanned to prove the correct location for analysis. At sample reception, the time from the sample arriving to commencement of analysis is enhanced. The new system is saving the water sample reception in excess of two hours per day. Once the system is rolled-out to trade, waste and ad hoc sampling, NI Water estimates that it will save in excess of three hours per day, translating into significant cost savings for NI Water.

Although time saving is a crucial benefit, NI Water has also realized an improvement in the integrity of samples across two geographical areas, as well as an improvement in the accuracy of the data resulting from those remotely-collected samples. Remote Sampler allows NI Water to prove exactly where every audit sample was actually collected, preventing samples being collected from incorrect locations and the subsequent re-sampling when this occurs. GPS ensures that customer tap samples are collected in the correct supply zone as the new address is checked against an on-board database. The system also allows NI Water's sample manager to move workloads between sample collectors as required, and also to add extra ad hoc samples, e.g. adding burst samples to an existing run, etc.

The use of the PDAs also allows sampling staff to transfer to different runs to suit NI Water's business needs as these samplers will no longer require training regarding site locations as the onboard GPS software gives them turn-

by-turn directions to the sample point. The remote sampler PDAs allow for more rapid and accurate transference of information to SampleManager, allowing analysts to begin their analysis faster, further improving on the quality of NI Water water analysis and generating favorable public opinion towards the agency.

### Business Benefits

NI Water needs to be able to produce management reports that validate that sample A was lifted at site B with a time and date stamp. These reports also include details that are not input into the LIMS, such as the cleanliness of each tap. The remote sampler PDAs allow samplers to capture more qualitative information and provide reports that are more comprehensive than the reports relying on data alone.

Going forward, the NI Water contracted samplers will be able to report on acceptability of sampling points and the safety of sampling sites. This information can then be added to the management report for remedial action, should any be necessary. GPS identifies the exact location and site of samples being scanned and provides proof that samplers are using the right sampling point, greatly enhancing the ability of NI Water to provide solid documentation for regulatory audits or routine inquiries.

Gareth explains, "With SampleManager LIMS in place and our investment into remote sampling with LIMS, NI Water is setting the benchmark in the future of water testing in Europe. This solution puts NI Water in the leading edge of extracting real benefits from our quality testing program. NI Water will have better sampling audits than most other UK water utilities currently."

### Future

The use of GPS on the PDAs will in the future facilitate automatic route planning to maximize the efficiency of the sample run. As the GPS will have all audit sample points programmed on it, it will also allow a sampler from another area to cover an area they are not familiar with. This will have a direct positive impact on the workflow and personnel planning. More efficient route planning should mean samples arrive at the laboratory earlier, in better condition, thus enhancing the quality of the testing.

Currently, data is recorded in the field on a PDA. Samples are then taken to one of the two locations, along with the PDA, where sample bottles are received and data is uploaded to the LIMS directly by docking the device at the Hub PC. In the future, NI Water is hoping to integrate mobile broadband within the PDAs via a data SIM card in the device, instead of docking the device in the laboratory. This will enable the samplers to send data to SampleManager LIMS from the field so by the time the sample arrives in the laboratory the information has already been received.



### Conclusion

With both a regulatory and efficiency driving rationale, NI Water has equipped its laboratories with the technologies and infrastructure that allow it to deliver consistent support to ensure the quality of its drinking water. To deliver consistent, reliable service while demonstrating regulatory compliance, NI Water has standardized on SampleManager LIMS in its laboratories. SampleManager LIMS has been in use at Water Service/NI Water since 2002. The major benefit realized at NI Water since the installation of SampleManager is improved operational efficiency, providing NI Water with a full sample recording, management and reporting system, while automating workflow and integrating with other laboratory instrumentation and systems in place at NI Water.

With the integration of the CSols Remote Sampler with SampleManager LIMS, data is entered one time only via Remote Sampler and uploaded into the LIMS at reception. This integration of an enterprise-level LIMS with a remote field-testing PDA has improved the efficiency and security of data entry and has greatly enhanced sample identification and tracking across all NI Water labs and field collection points. As all samples are now recorded on a single electronic database, the integrated solution has provided NI Water with a means to retrieve and report data in a way that would never have been possible previously.

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