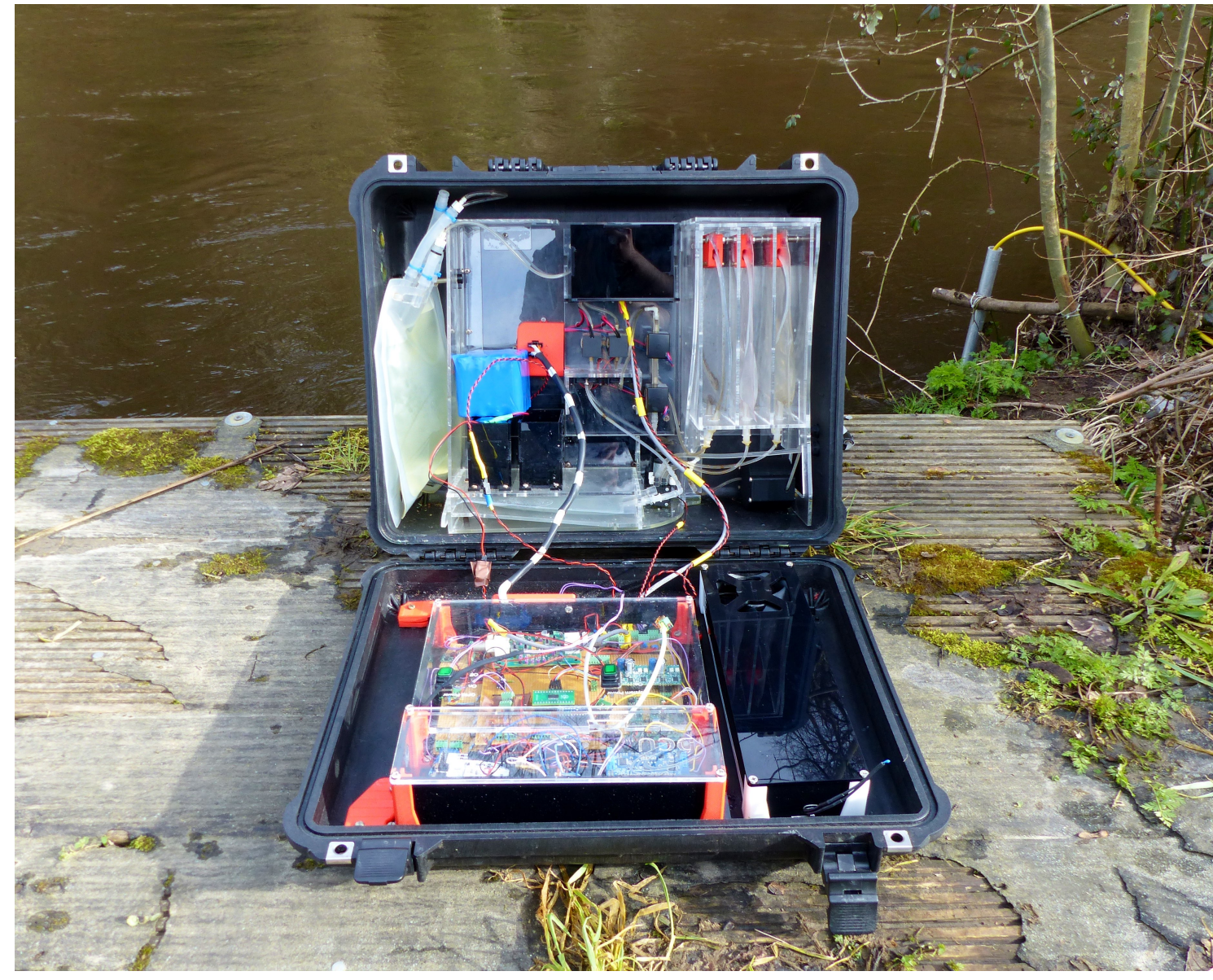


Cost Effective Platform for Detection of Phosphate in Fresh and Marine Waters.

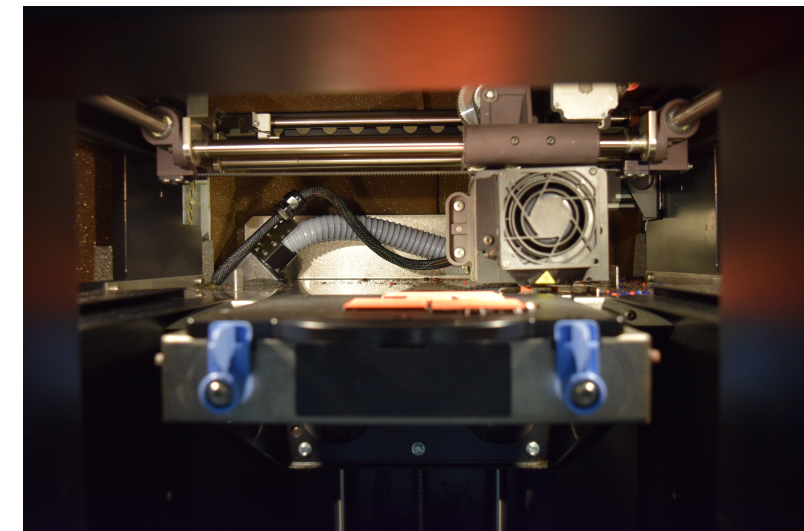
Andrew Donohoe, Margaret McCaul, Dermot Diamond
Insight Centre for Data Analytics, Dublin City University, Ireland

Nutrients such as Phosphate, Ammonia, Nitrite and Nitrate are central in any environmental processes, including several microbial, plant and animal metabolic processes. The nutrient platform is based on a combination of microfluidic analytical systems, colorimetric reagent chemistries, low cost LED based optical detection and wireless communications. Each component was developed, assessed and optimised to evaluate the suitability before being integrated to form a working pre-competitive prototype.



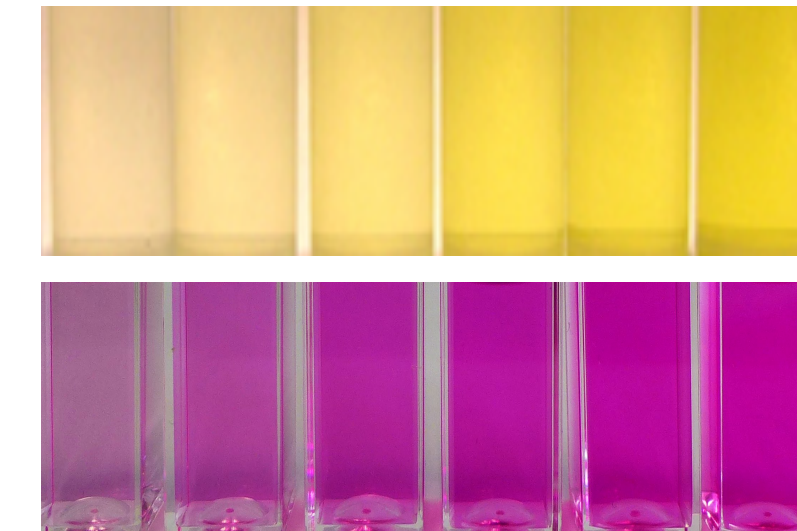
Nutrient Platform deployed along the River Liffey measuring Phosphate (PO_4^{3-}) every 3 hours

Rapid Prototyping



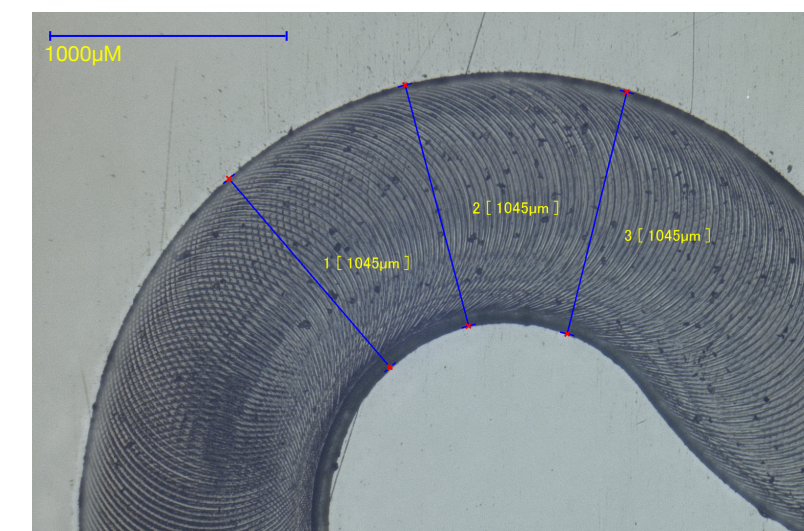
A series of Rapid Prototyping techniques such as Laser ablation, 3D printing and precision micro milling are used to fabricate the nutrient platform. The use of these techniques allow for cost effective prototyping.

Colorimetric Chemistries



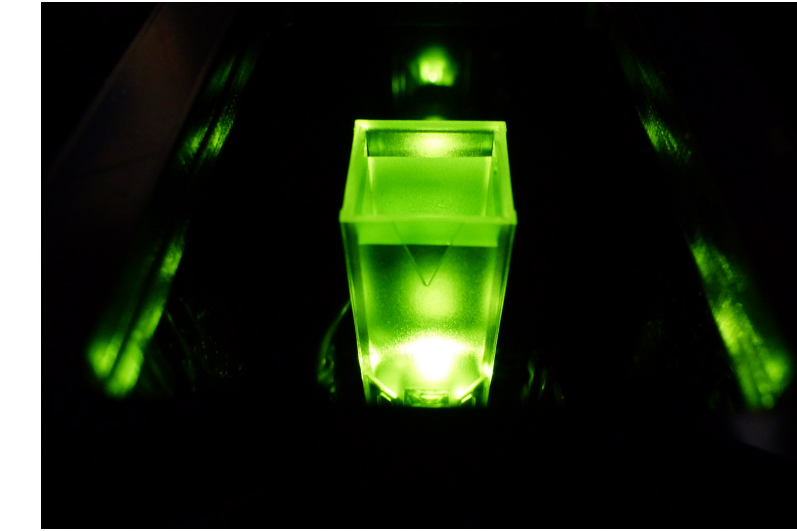
The nutrient platform utilises colorimetric chemistries for the detection of nutrients in waters. The platform is adaptable to various colorimetric chemistries for the detection of Phosphate (PO_4^{3-}), Nitrite (NO_2^-) and Nitrate (NO_3^-).

Microfluidics



A two-layer PMMA microfluidic chip is integrated into the nutrient platform. The chip is comprised of two inlets and one outlet, a novel mixing pathway utilising shear forces for mixing and a 2cm Optical detection pathway.

Optical Detection



Optical detection is carried out through the use of a pulse width modulated LED and photodiode detector positioned between the optical pathway. Modification of LED wavelength allows for detection of various analyses

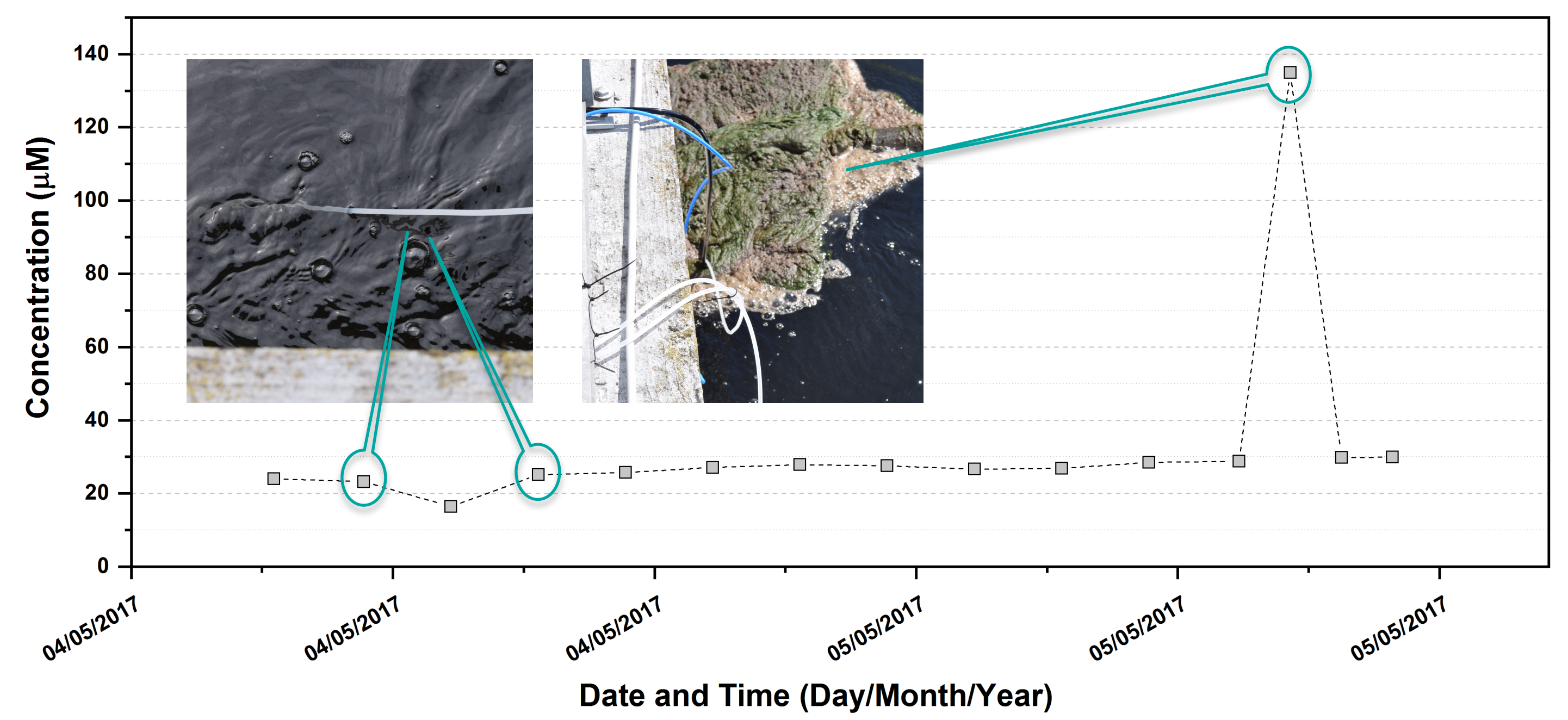


Nutrient Platform deployed after 2nd Stage Clarification at Milano San Rocco Waste Water Treatment Plant

The Nutrient Platform was deployed at Milano WWTP sampling every two hours for Phosphate (PO_4^{3-}) after the second stage clarifier. 13 measurements total were taken over the deployment from the 4th to the 5th of May

Background levels of approximately 20 - 25 μM were measured during the deployment with one spike measured during an overflow of activated sludge within the plant as pictured.

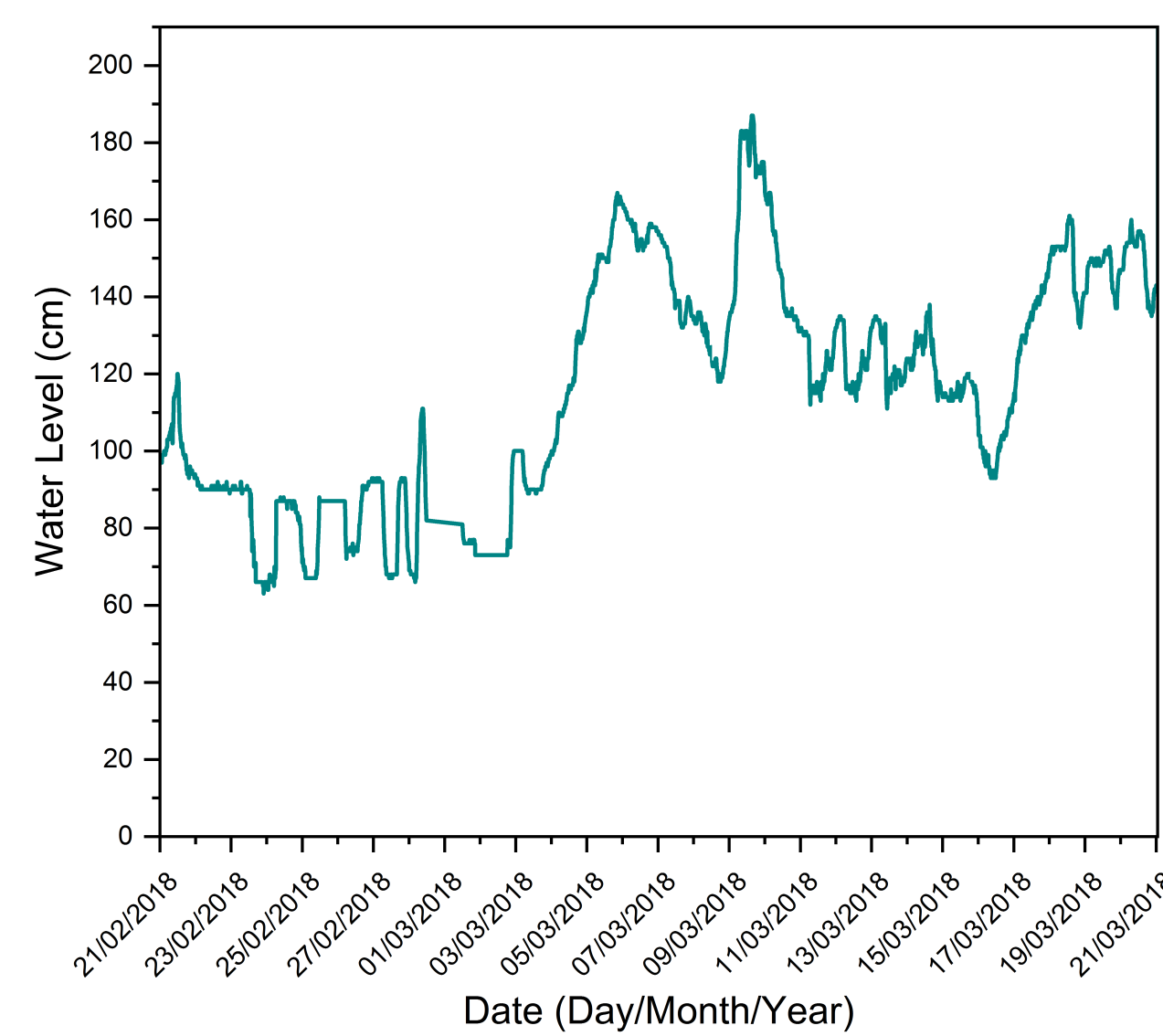
Nutrient Platform Phosphate (PO_4^{3-}) detection at Milano San Rocco WWTP, Milan



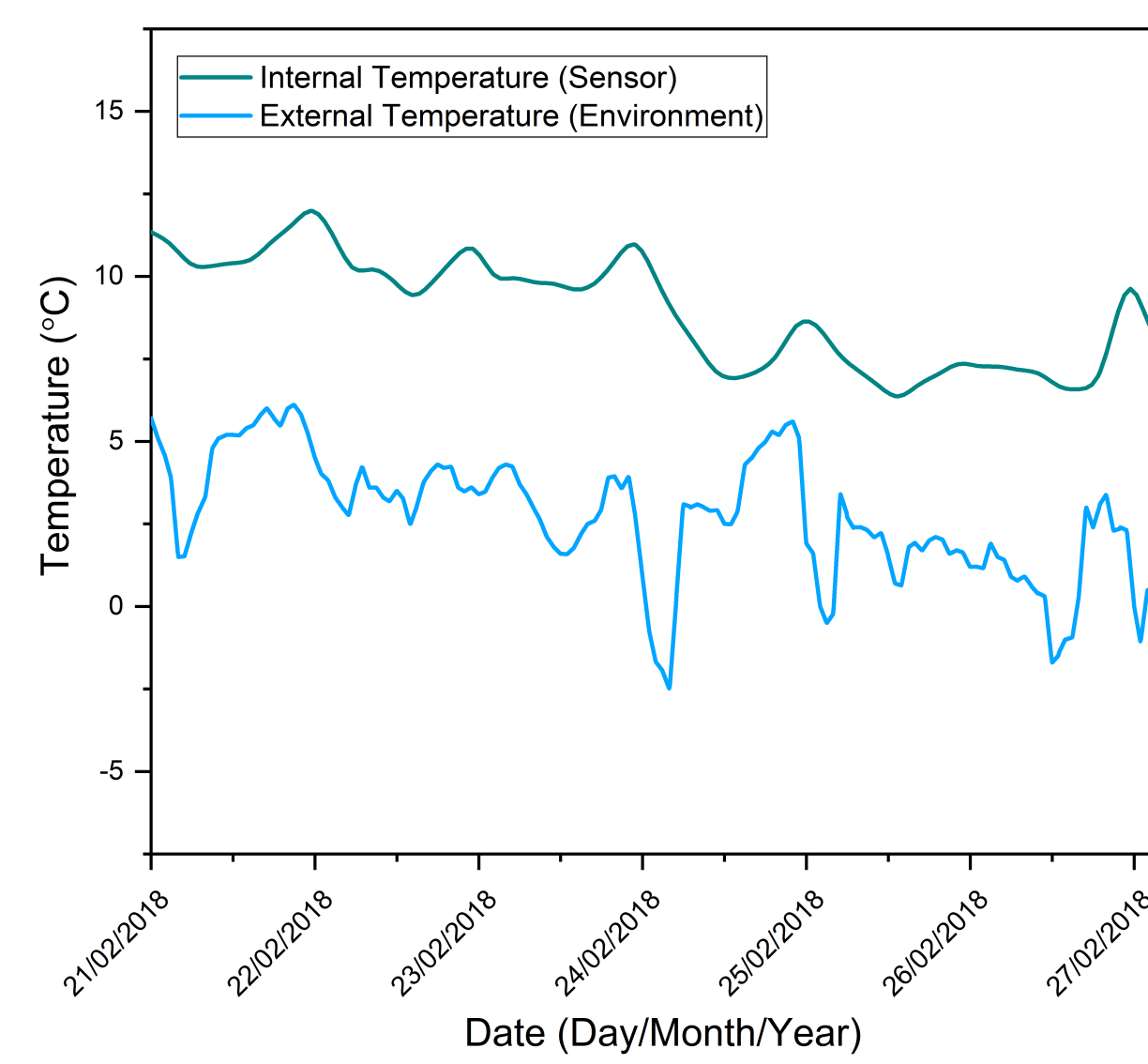
Deployment location River Liffey, Palmerstown, Dublin, Ireland



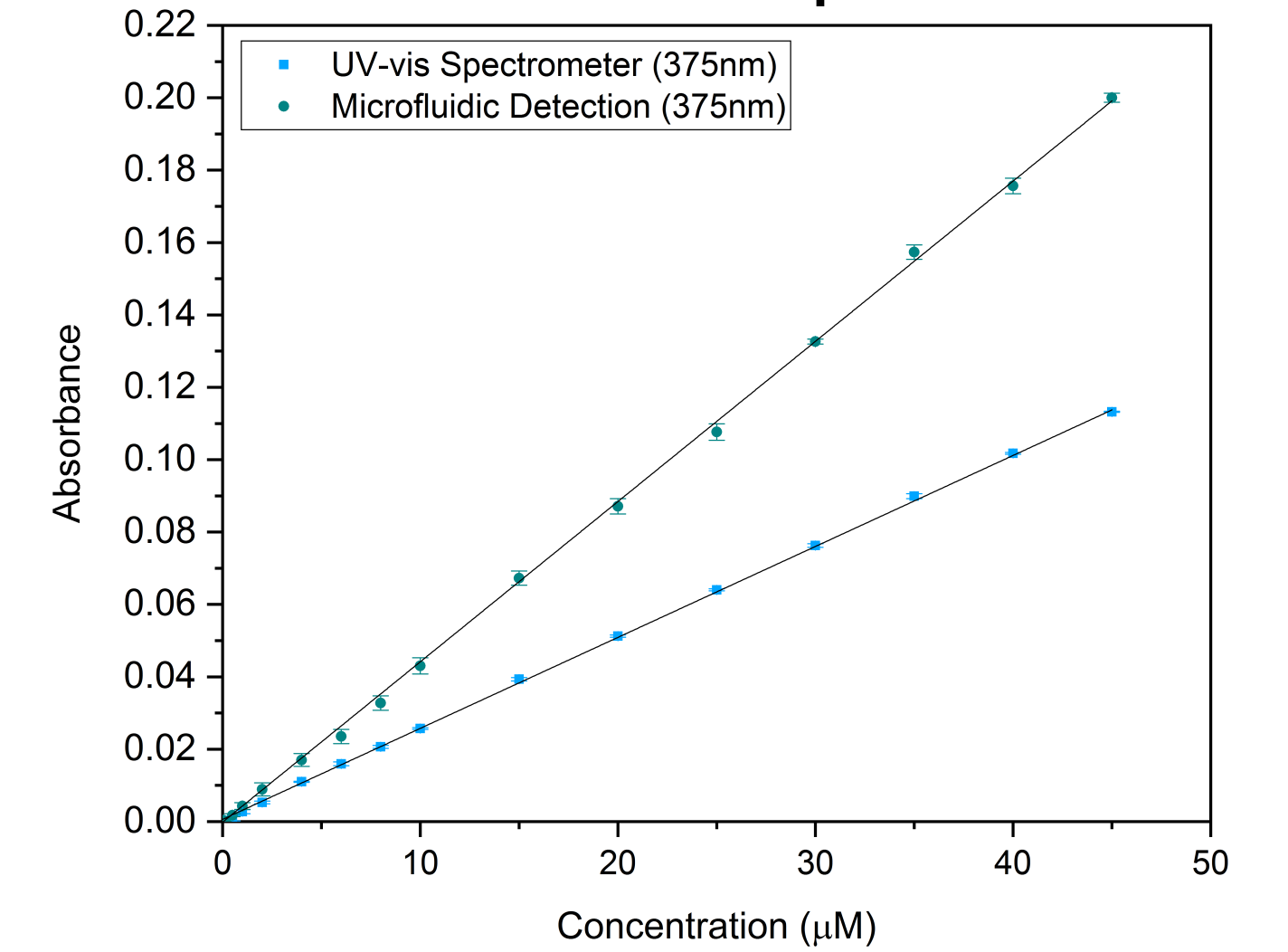
River Liffey Water Levels (21/02/2018 - 21/03/2018)



Internal and External Temperature (21/02/2018 - 27/02/2018)



Phosphate (PO_4^{3-}) Detection Nutrient Platform vs Spectrometer



Nutrient Platform Phosphate (PO_4^{3-}) detection over a 27 day period (21/02/2018 - 20/03/2018)

