Keady WwTW

Northern Ireland Water's £5m Investment to construct one of the largest RBC sites in Europe by Autumn 2012

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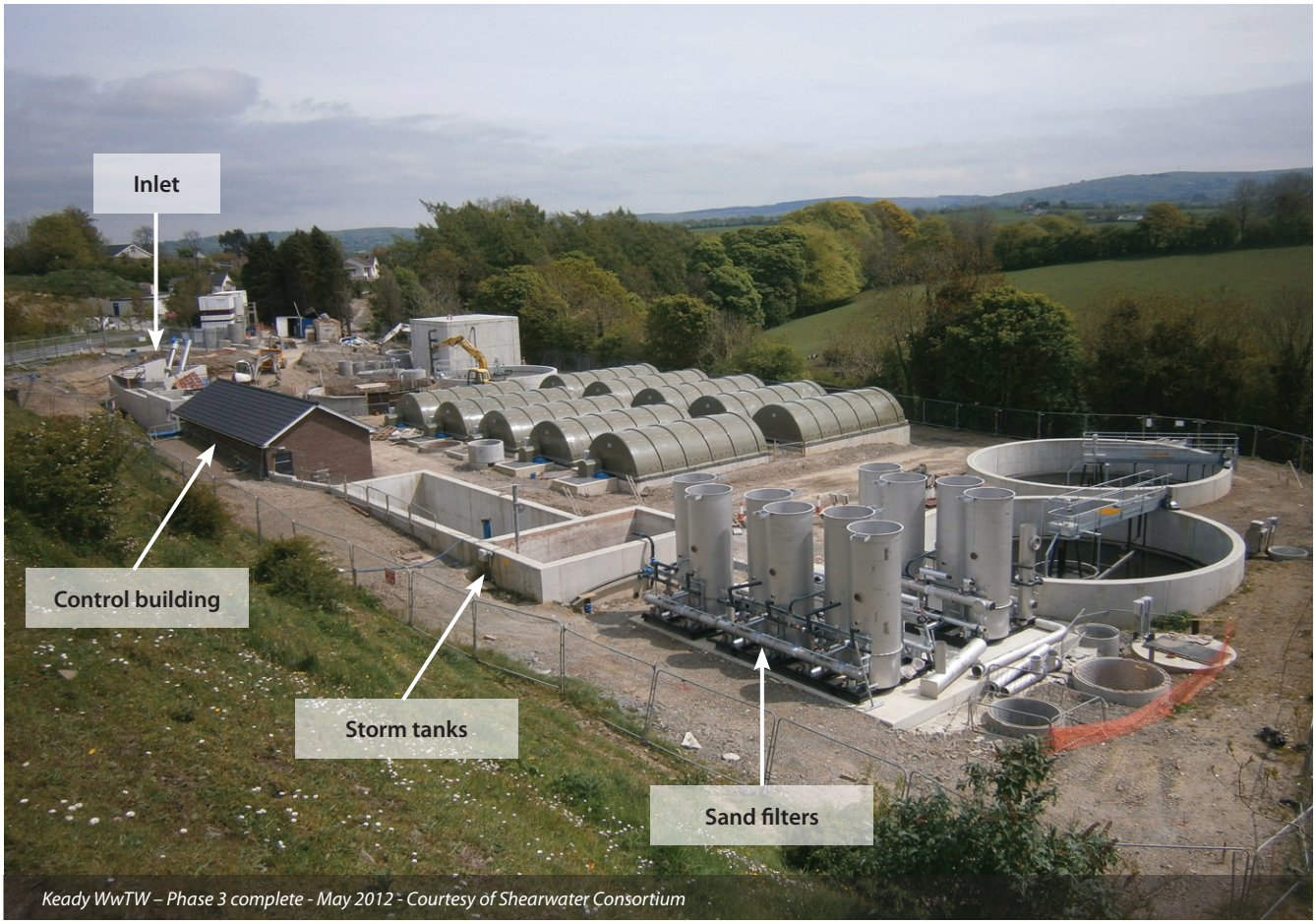
The Keady WwTW, which was constructed in 1955, originally consisted of a small primary tank, 2 (No.) biological filter beds and 4 (No.) sludge drying beds. In 1973 the works was upgraded with the addition of an inlet works, 3 (No.) primary settlement tanks, a storm water holding tank, 2 (No.) additional biological filter beds and 2 (No.) humus tanks. Final effluent from the works is discharged to the Clay River, located approximately 50m to the northeast of the site boundary. As a result of considerable development in the catchment, compliance with the Registered Discharge Standard 30:50 (BOD:SS) was becoming increasingly difficult and it was clear that some form of works upgrade would be required.



Keady WwTW – Phase 3 complete - May 2012 - Courtesy of Shearwater Consortium

Background

In order to estimate the existing works headroom a desktop population analysis together with a catchment flow and load survey was completed. These investigations indicated that the existing population equivalent (PE) for the catchment was 4,600. Having established the existing PE, a future population estimate, completed in consultation with Northern Ireland Planning Service, indicated that the future PE (25 year horizon) could rise to 7,000. The existing and future PE's and design flows for the catchment are summarised in the table below.

Based on the existing and future design flows (which were substantially higher than had been anticipated) NIW submitted a new discharge consent application to Northern Ireland Environment Agency (NIEA). In response NIEA provided the following design standards (to be enforced from 1st January 2013):

- Discharge to the Clay River (existing location) at a standard of 5 : 10 : 1.5 (BOD : SS : NH_3-N).
- Discharge to the Callan River (2.7km pump-away of final effluent) at a standard of 10 : 25 : 3 (BOD : SS : NH_3-N).

Date	Population Equivilent	DWF m³/day	Average Flow 1.25 x DWF	FFT m³/day	Formula A m³/day
2010	4,595	912	1,140	2,244	5,537
2025	5,800	1,119	1,399	2,801	5,533
2035	7,000	1,341	1,676	3,370	6,103

Capacity calculations for each of the main treatment elements indicated that the works could not comply with either standard. In addition to inadequate treatment headroom, it was evident that the works was in poor condition and was approaching its design-life horizon. It was therefore concluded that a substantial upgrade or replacement wastewater treatment facility would be required.

Objectives/needs

The following is a summary of the principal project drivers:

- ***Quality/Environmental:*** The existing WwTW could not comply with the new standard and did not have sufficient storm storage capacity.
- ***Quality/Growth:*** Since 2006, NI Water had refused the connection of 436 proposed dwellings (an additional 1,000PE) to the WwTW at Keady.
- ***Asset/Operation:*** The existing WwTW was nearing the end of the projected 'design life' and required substantial base maintenance.

Upgrade options

In an initial feasibility investigation it was determined that a final effluent pump-away solution would result in excessive whole-life costs. It was therefore decided to investigate two treatment options which would enable discharge compliance locally and without pumping the final effluent; (i) large diameter rotating biological contactors (RBCs), and (ii) traditional activated sludge (AS) treatment works.

Based on the NIW Wastewater Treatment Process Selection Guide (PSG), AS is the preferred option for the design PE and effluent quality requirements, however, both NIW Wastewater Services and Scientific Services indicated a preference for the RBC option due to lower operational costs and reduced maintenance requirements. In addition, the RBC option would not require polyelectrolyte dosing to promote sludge thickening, thus further reducing operational costs and eliminating the risks associated with chemical storage and use.

Solution

The large diameter RBC option received NI Water Capital Investment Panel approval in June 2010 and the contract documents and works specifications were forwarded shortly thereafter to the Shearwater Consortium.

The Shearwater Consortium is a joint venture consisting of Civil Engineering Contractors Lagan Construction and MEICA Contractors Enpure Ltd. The Consortium has worked for NI Water since 2004 as the Design/Build Contractors for the West Region as part of the Integrated Wastewater Framework - IWWF.

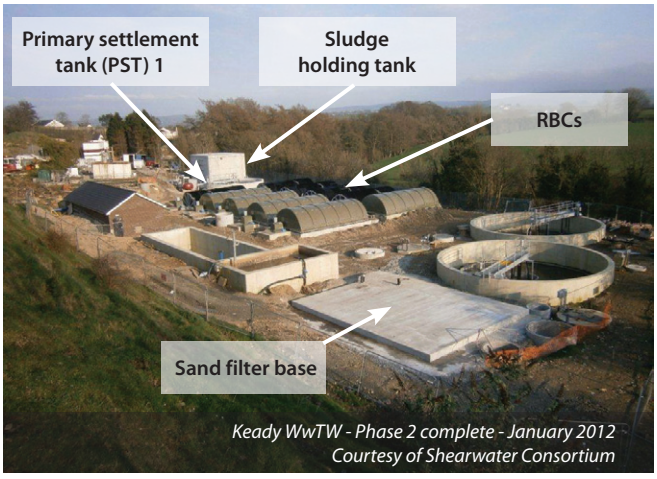
The design of the new works was advanced and there was close cooperation among the team members - Shearwater (Design/Build Contractor), NI Water Engineering Procurement and Operations Teams and AECOM Ltd (Project Managers) - throughout the design process. As a result, not only was the final design quickly agreed, but difficult issues relating to construction phasing and maintaining treatment throughout the construction phase were eliminated during the design process.

Xylem Water Solutions (formerly ITT Water & Wastewater), manufacturer of the Flygt® range of products, were the main supplier of pumps, mixers and storm tank cleaners on the project. These included recirculation pumps for the RBC's and their high efficiency, clog resistant 'N-pumps' for the sludge tanks. They worked closely with Shearwater Consortium to ensure all design requirements were met.

The tender for the works was returned in September 2010 and the contract (NEC2 ECC Option A) was agreed at a total cost of £4.71m.

Keady WwTW - Start of work - December 2010
Courtesy of Shearwater Consortium

Large diameter RBCs under construction
Courtesy of Shearwater Consortium



Keady WwTW - Phase 2 complete - January 2012
Courtesy of Shearwater Consortium

RBCs under construction
Courtesy of Shearwater Consortium

Works description

The Main elements of the Keady scheme include:

- New inlet works incorporating grit, grease and screening removal.
- New storm tanks incorporating on-line and blind storage areas.
- New sludge holding tank.
- New MCC building.
- 2 (No.) 10m diameter, radial-flow primary settlement tanks.
- 10 (No.). 4.5 meter Rotating Biological Contactors.
- 2 (No.) 12m diameter, radial-flow final settlement tanks.
- Tetra Modular, deep-bed, tertiary treatment sand filters;10 (No.) cells.
- Demolition of the existing WwTW.

Construction

Construction commenced on site in December 2010. The main challenge for the team involved ensuring that compliance with the discharge consent was maintained throughout the construction period. This was achieved by developing a three-phase construction sequence. The first phase involved demolition of the existing sludge drying beds and the construction of: the control building, the final settlement tanks and 3 (No.) RBCs.

Once Phase 1 was completed the storm tanks were brought on line to function as a sludge holding tank. The 3 (No.) large diameter RBCs were also brought on line. This enabled demolition of the filter beds to proceed as the treatment capacity of the RBCs was sufficient to ensure compliance with the existing 30:50 (BOD:SS) standard. The final settlement tanks were also brought on line. This enabled demolition of the existing FSTs.

Phase 2 involved the installation of the remaining RBC units, one of the primary settlement tanks, the construction of the sludge holding tank and the construction of the sand filter base. During this phase the inlet works and primary settlement tanks were retained. With Phase 2 completed and primary settlement tank 1 brought on line, a temporary inlet works was constructed. This enabled the existing inlet works and primary tanks to be demolished and a new inlet works and PST2 to be constructed.

Discussion

The scheme has sought to bring value and innovation to NI Water without compromising discharge consent standards. The new works, constructed to serve a PE of 5,800 (with the potential for expansion to treat a PE of 7,000 with the installation of 2 (No.) additional RBCs) is based on the use of large diameter RBC technology.

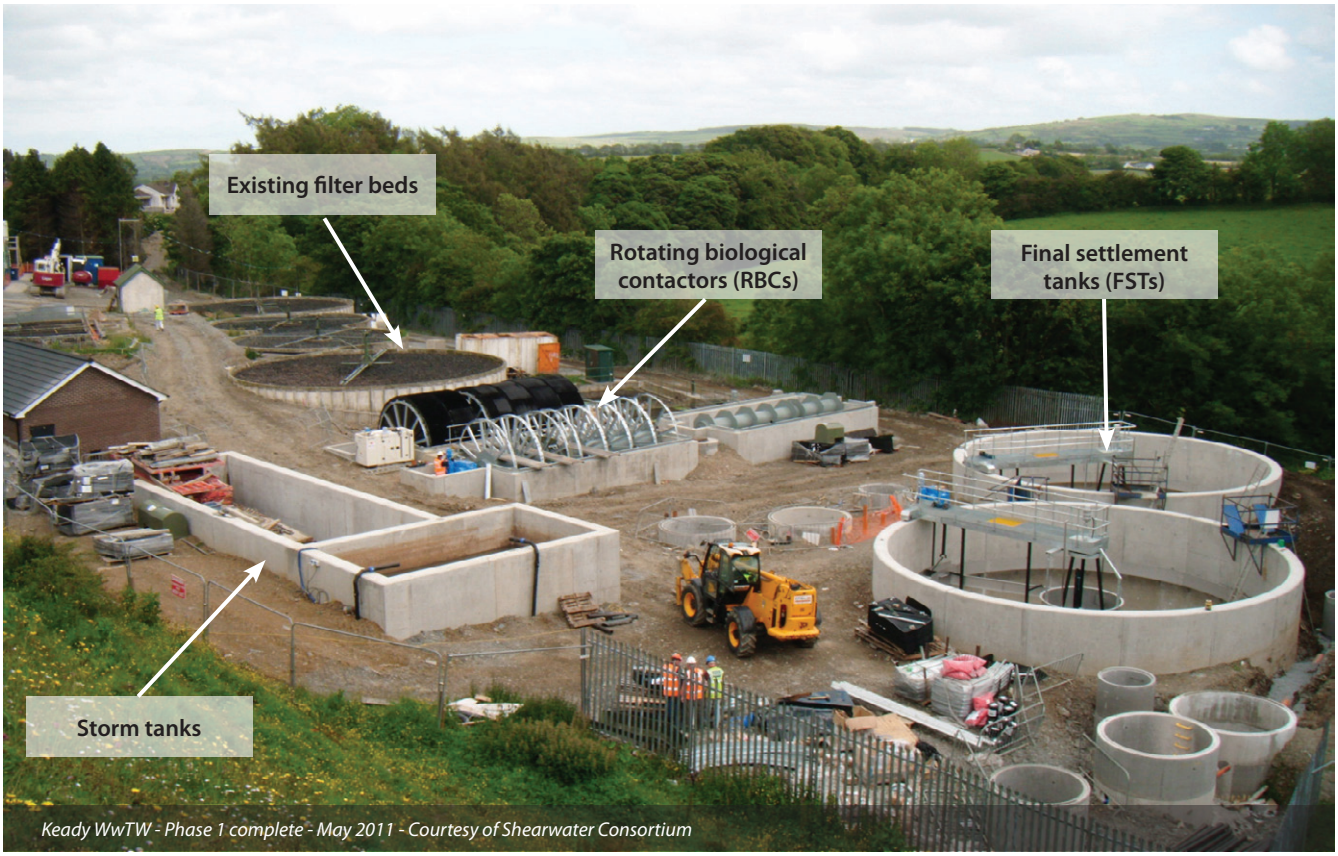
This is the largest RBC facility constructed in Northern Ireland to date, and one of the largest RBC sites in Europe. The use of large diameter RBC technology, together with deep-bed sand filters (which provide effluent polishing), provides NI Water with a robust, cost-effective and easily maintained wastewater treatment system capable of producing a high-quality effluent, compliant with the tight consent standard for the site: 5 (BOD) : 10 (SS) : 1.5 (NH_3-N).

Conclusion

This new state-of-the art facility represents a significant investment by NI Water to ensure the ongoing development of the Keady area. The plant has been designed to minimise operational costs whilst safeguarding the environment in which the plant has been constructed.

NI Water is committed to investing in projects that will deliver the best innovative solutions and benefit the local community, economy and environment. As one of Northern Ireland's most important environmental stewards, NI Water invests significant resources and measures in safeguarding it. Improving the wastewater infrastructure in Northern Ireland is a major priority for NI Water and by 2013, the company plans to invest in excess of £300m on improvements to the sewerage network system and wastewater treatment works.

The Editor & Publishers would like to thank John McGrane, Project Manager with Northern Ireland Water Ltd, for preparing the above article for publication.



Keady WwTW - Phase 1 complete - May 2011 - Courtesy of Shearwater Consortium

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