

e5 Major Projects Programme

Severn Trent Water's innovative programme delivery models

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Severn Trent Water have chosen to deliver eleven major wastewater non-infrastructure projects in AMP5 using an innovative collaborative delivery model. The model was developed following the appointment of the framework contractors to deliver the AMP5 Capital Non-infrastructure Programme in four geographic areas. The non-infrastructure framework contractors are Costain Ltd, Mott MacDonald Bentley Ltd, MWH Treatment Ltd and North Midland Construction plc. One of the key principles of the Severn Trent Water AMP5 programme is to encourage collaboration, not only within each framework contract but amongst all the AMP5 framework contractors. They are brought together with Severn Trent Water under the banner of the "One Supply Chain" (OSC). This commitment to collaboration is a fundamental success factor for the AMP5 capital programme.



Constructing new final settlement tanks utilising precast concrete units at Clay Mills STW - Courtesy of MWH Treatment

The e5 Programme

Whilst the framework contractors were appointed in April 2009 providing a year of preparation for the beginning of AMP5, flexibility was maintained in the precise procurement route which would be utilised for the major projects, which are generally in excess of £10m. As relationships developed within the OSC, it became clear that a novel approach would provide an exciting alternative to traditional delivery models. The approach was based on utilising the four non-infrastructure framework contractors, working together with Severn Trent Water, to jointly deliver these projects, on a single programme basis, known as the "e5 Programme" (efficiency to the power of 5 from the collaboration amongst the 5 parties).

The benefits of this model are derived from each contractor working collectively with the other contractors to deliver the whole programme in an approach that will maximise the efficiencies available. This has been achieved by the four contractors entering into a non-incorporated fully integrated collaborative arrangement.

The e5 Programme Team (e5 team) consists of the contractors working collaboratively with Severn Trent Water.

Novel arrangement

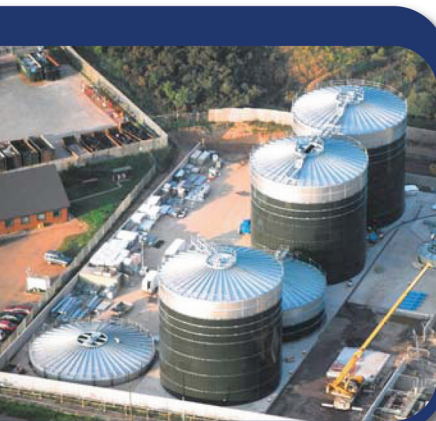
In a novel arrangement, the contractors have agreed that whilst they have contracted with Severn Trent Water for the individual projects (utilising the standard terms and conditions of the NEC3 based framework contracts), they will share equally the risks and rewards arising from the whole programme and have committed to providing a fair and equitable allocation of resource to achieve this. This commercial approach fully motivates common design and procurement, genuine cooperation, knowledge sharing, resource sharing and risk management throughout the life of the projects.

An e5 core management team was established with key staff from the 5 organisations. This team is managing the projects from first instruction by Severn Trent Water through the feasibility, outline and detail design stages. During these stages, design, procurement

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and programme management efficiencies are being realised. Once the projects are ready to start on site, they are managed and delivered by the individual contractors as Principal Contractor for that project. However, during the construction phase, e5 continues to manage the programme and all major procurement issues. The site teams' primary commercial reporting route is to the e5 Programme Management Team. This approach enables the knowledge and expertise of four contractors to be brought together in a collaborative environment without establishing a full four way joint venture for the delivery phase.

Efficiency targets

The biggest challenge in agreeing the proposal was to ensure that the programme would be delivered within the stretching efficiency target which Severn Trent Water faced in the AMP5 regulatory settlement (AMP5 delivery at 20% below AMP4 values). It was also essential that the offer would demonstrably provide Severn Trent Water with value for money and would provide better efficiencies than other procurement models.

A due diligence process took place with the contractors reviewing the Severn Trent Water outline solutions to deliver the required project outputs. Three months of value engineering, innovation and scope review led to a significant reduction in the individual project estimates and a further programme efficiency reduction of 6% led to an agreed target price for the whole programme at £187m which is 26% below Severn Trent Water's AMP4 estimates.

The Target Cost is backed up by a 50/50 pain/gain agreement with a cap for Severn Trent Water at their Business Plan allowance. This coupled with an external benchmarking process led to Severn Trent Water's agreement to award the projects in the e5 programme to Costain Ltd, Mott MacDonald Bentley Ltd, MWH Treatment Ltd and North Midland Construction plc on a truly collaborative and innovative basis.

Integration

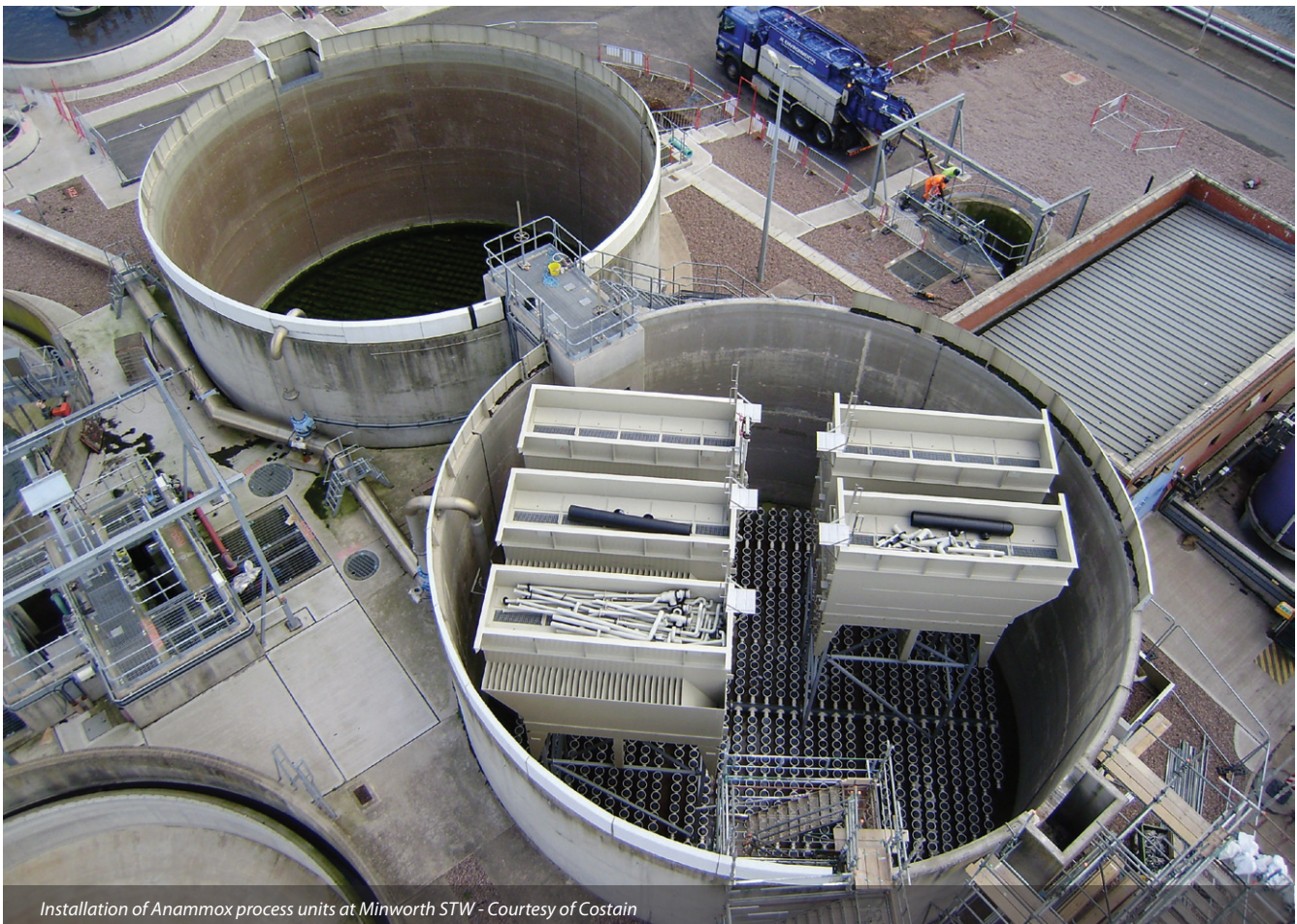
To encourage maximum integration, the delivery model also includes Severn Trent Water's project costs within the Target Cost. This ensures that the integrated team, formed from members of all 5 organisations, is fully motivated to provide the most efficient overall outcome. These costs cover the provision of staff to act as "Expert Client" providing the following inputs to the e5 programme:

1. Process Design. The fundamental process design is provided by Severn Trent Water's Process Design Group.
2. Solution development. Ensuring that the solutions developed will meet the required outputs in accordance with Severn Trent standards. Solutions are selected on a lowest whole life cost basis ensuring that the optimum long term solutions are delivered.
3. Administration and management of the NEC3 based contracts and internal financial reporting.
4. Facilitating liaison with service delivery on all aspects of the project's design and delivery, particularly as it impacts on the operation of the existing sites.

Project grouping

The individual projects can be grouped in terms of the outputs that they are required to deliver. Five projects are named outputs to meet new phosphorus consents which will apply from 2014. Four projects involve investment in additional sludge treatment capacity, either to deal with the increased load from the site or to provide increased capacity as a regional sludge treatment centre. The two other projects meet unique outputs – one a new ammonia consent; the other is primarily capital maintenance.

Progress since the e5 Programme commenced in 2010 has been considerable with a co-located team providing solid evidence of the benefits of integration and collaboration. Significant efficiencies have been identified and realised in the following areas:



Installation of Anammox process units at Minworth STW - Courtesy of Costain

1. Solution development and design. Efficiencies are being realised by facilitating effective collaboration and knowledge sharing. As well as having a co-located office where key members of all the teams have been based, "task and finish" groups have been set up to enable specialists to decide on a common approach and develop standardised designs for aspects that are repeated on many projects. Examples are ASP, settlement tank, chemical dosing and sludge digestion groups. Reduced design costs and common solutions have resulted. This approach has also enabled innovation to be brought in from experiences elsewhere leading to many agreements with Severn Trent to depart from or amend standards.
2. The procurement of all significant project requirements is being managed on a programme basis. The projects identify their specific needs which are then collated to form common enquiry packages. With significant orders available to supply many projects and in general, plenty of time in the programme, the supply chain are actively encouraged to propose innovations and specification amendments. The supply chain is also able to take advantage of programme flexibility to suit manufacturing capacity. Key early packages let on a common basis were concrete supply (Lafarge Aggregates & Concrete and Cemex UK Operations Ltd) and FST Scrapers (MWH Treatment Ltd).
3. Programme management. Whilst the sites are geographically remote and being constructed by the four contractors individually, sharing of expertise, knowledge and resources throughout the construction phase is essential to maximise programme efficiencies. To facilitate this, all the project schedules are linked on a common server using P6 software updated monthly. This assists in resources being shared between the contractors effectively – staff, labour plant and materials. Staff from the projects

frequently visit each other and discuss successes and lessons learnt for immediate implementation elsewhere.

4. As each contractor has a framework contract, successes at e5 can naturally flow to the area contracts being performed by the four contractors providing a ratchet effect on the efficiencies delivered for Severn Trent Water.

On all these major projects there is a proactive customer communication plan. This ensures that local residents are kept informed about the work proposed with updates on progress. Communication with local communities takes many forms and includes letter drops, attendance at local meetings (such as Parish Councils), public exhibitions, press releases, local radio interviews and visits to the sites. In some cases a local residents' group has been formed for the duration of the project with representatives from the site team.

Project details

A synopsis of the work to be undertaken at the eleven major wastewater non-infrastructure projects is as follows:

Stoke Bardolph: Contractor - North Midland Construction

This £40.9m project, to meet a new phosphorus consent in September 2014, comprises a number of phases including:

- Conversion and extension of the existing activated sludge plant (ASP) to provide biological phosphorous removal.
- A centrate treatment process to remove ammonia and phosphorous (for conversion to fertilizer for sale to third parties).
- M&E replacement of equipment in the inlet works to achieve 6mm 2D screening, improved grit removal and distribution of load to the primary settlement tanks.
- A replacement SCADA system.
- Provision of 2 (No.) additional PSTs.



New ASP under construction at Stoke Bardolph STW - Courtesy of North Midland Construction Nomenca

The new inlet works and SCADA systems have been completed and handed over and the civils construction of the new 56,000m³ ASP and 8 (No.) 35m diameter final settlement tanks is well advanced. Reinforced concrete works are being carried out by STAM Construction Ltd on a target cost basis.

Clay Mills: Contractor - MWH Treatment

This phosphorus removal project comprises provision of a new carbonaceous Bio-P Activated Sludge Plant, refurbished tertiary ammonia filters, sludge thickening, acid phase digestion and additional CHP capacity.

The project value is £42m with completion of the ASP scheduled to meet the new consent in September 2014, with refurbishment of the filters to follow. This innovative solution achieves a saving of over £13m compared to a conventional solution, which would have involved a larger fully nitrifying ASP with the existing biofilters being abandoned. The provision of acid phase digestion will enable the generation of additional green energy, providing over £450k/yr of extra income.

Civils construction is well advanced with flood defences, excavation, deep pipework and piling complete. Construction of the base of the new 30,000m³ ASP has commenced with the works being carried out by Bell Formwork Ltd. The 6 (No.) 35.8m diameter final settlement tanks are being formed from precast units provided by Carlow Precast Engineering Ltd.

Newthorpe: Contractor - MWH Treatment

This £5.8m project is to meet a new tightening ammonia consent which is coming into force in March 2014. The project comprises the refurbishment/improvement of the existing filter beds, together with minor improvements to many of the site ancillary processes (liquor treatment plant, filter recirculation, sand filters, humus & primary settlement tanks).

This solution achieves a significant saving of £4.1m compared to the original proposal of a new activated sludge plant and additionally saves £100k/annum of ongoing OPEX. The improvements to the ancillary processes are complete and refurbishment of the filter beds has commenced.

Minworth: Contractor - Costain

The project, valued at £13.5m, is a named AMP5 output to meet a new phosphorous consent. The solution comprises the modification of the liquor treatment process, conversion of the activated sludge plant and provision of top up chemical dosing to assist in biological phosphorous removal.

The provision of side stream Anammox process by Paques BV to remove ammonia is a first in the UK. The project will be completed in March 2014. This innovative solution achieves a saving of over £20m compared to a conventional solution of extending the ASP capacity. The Anammox process is due to be commissioned in late 2012 and conversion of the existing 24 (No.) ASP lanes has commenced.

Rushmoor: Contractor - Mott MacDonald Bentley

Rushmoor comprises 3 projects, together worth £16.5m.

The Rushmoor Growth Project is to provide additional capacity to meet a predicted 53% increase in load due to new housing and a new dairy (which accounts for 40% of all the growth). The proposed solution is to refurbish the existing primary settlement tanks and provide additional activated sludge plant capacity.

Also included is a new access road that will reduce risk of noise and odour complaints from nearby properties. The project has commenced with ASP construction underway with flows to be introduced by the end of 2012. The project will be fully completed by March 2013.



Excavation for the new anoxic zone at Rushmoor STW - Courtesy of Mott MacDonald Bentley

The Rushmoor Quality Project is a named AMP5 output to meet the new phosphorous consent. The project scope is to extend the existing 3,750m³ anoxic zone and provide an additional 3,000m³ anaerobic volume ahead of the ASP units. Top up chemical dosing is provided to assist in biological phosphorous removal. The project has also commenced and will be completed in March 2013.

The Rushmoor Sludge Project will replace the existing life expired digestion facility. The new sludge treatment centre will generate energy from gas produced from the digested sludge. The project will be completed in 2014 and will then provide an £85k/yr OPEX reduction. This project is being designed jointly with the sludge projects at Clay Mills, Worksop and Wanlip.

Strongford: Contractor - Mott MacDonald Bentley

This £16.0m project to meet a new phosphorus consent in September 2014, will comprise provision of a new carbonaceous activated sludge plant, SAS thickening and replacement of existing ASP blowers installed in the 1970s. Phosphorous removal is achieved by provision of ferrous chloride dosing to new and existing ASPs. The innovative carbonaceous ASP solution works in tandem with the existing nitrifying ASP streams and the nSAF constructed in AMP4. Construction will commence during the latter part of 2012.

Worksop: Contractor - Mott MacDonald Bentley

The project will provide additional digestion capacity. The new £14.7m regional sludge treatment centre will generate energy from the gas produced from the digested sludge. The scheme includes acid phase digestion which produces 20% more gas than traditional digestion. A new access road with 2 (No.) new bridges across the river and canal will also be built to remove the existing access issues that directly affect local residents. The project will provide a £650k/yr OPEX reduction when it is completed in 2014. Construction commences in the latter part of 2012.

Wanlip Inlet Works: Contractor - Costain

This project will deliver a new inlet works and storm handling facility, replacing the existing 2 (No.) inlet works. The scheme addresses potential non-compliances with the EA consent and will reduce unplanned maintenance throughout the treatment processes by taking out solids down to 6mm. The £19.0m scheme is part of the 25+yr capital investment strategy for the site, which will create a single process stream. A computer and physical model have been developed to optimise the hydraulic design and access for operation and maintenance. The project will be commenced in 2012 and completed in 2014.

Wanlip Sludge Digestion: Contractor - Costain

The project is a named AMP5 output to provide additional digestion capacity. The original scope, a £20m refurbishment of the existing facility plus some growth, was agreed not to be the best long term investment decision for the site when compared to a complete new build solution, valued at £28.9m. The scheme includes acid phase digestion. The new build is a key part of the 25+yr capital investment strategy for the site, providing a £700k/yr OPEX reduction. It will be commenced in 2012 and completed in 2015.

Conclusion

By early July 2012, in excess of 90% of the e5 programme had been approved for construction. There is a detailed article about the e5 project at Minworth STW elsewhere in this edition of UK Water Projects, and further project specific articles will be included in future editions as the programme advances.

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Filter bed refurbishment/improvements in progress at Newthorpe STW
Courtesy of Severn Trent Water



Clay Mills STW final settlement tank construction
Courtesy of MWH Treatment



Process units for Minworth STW liquor treatment plant
Courtesy of Costain



ASP under construction for the Rushmoor STW Growth Project
Courtesy of Mott MacDonald Bentley