Luxembourg, 18 November 2014

Environmental and Social Data Sheet

Overview

Project Name: Thames Tunnel
Project Number: 2012-0306
Country: United Kingdom
Project Description: The Thames Tideway Tunnel (TTT) is the largest of a combination of measures called the Thames Tideway Improvements, a series of measures to address capacity constraints of London's existing sewage system in relation to rainwater, which currently result in an untreated mix of sewage and rain water flows overflowing into the tidal section of the Thames. The Improvements also include the Lee tunnel, under construction, and upgrades at London's 5 main sewage treatment works, which have been completed. The TTT will consist of a 22km sewage tunnel under the River Thames, running from Ealing in the West, to Abbey Mills Pumping Station in the East, where it will connect to the Lee tunnel. It will intercept 34 Combined Sewer Overflows from the sewer catchments of Crossness and Beckton sewage treatment works. It is designed to comply with the EU Urban Waste Water Treatment and Water Framework Directives. The TTT is complemented by enabling and interfacing works being funded and implemented separately.

EIA required: Yes

Project included in Carbon Footprint Exercise[1]: Yes

Summary of Environmental and Social Assessment, including key issues and overall conclusion and recommendation

The Thames Tideway Tunnel (TTT) will provide new storage capacity for London's sewer system, in order to reduce the frequency and volume of excess flows discharging directly to the tidal Thames following rainfall. It will also provide flexibility and resilience to the system of main interceptor sewers that were built 150 years ago for a smaller population and less rain water and groundwater infiltration. The primary design objective of the Project is to achieve compliance with the Urban Wastewater Treatment Directive (91/271/EEC). The combined sewer systems in the Crossness and Beckton catchments covering central London are in breach of the Directive as confirmed by a decision of the European Court of Justice in 2012. The Project has also been designed to achieve specific targets for Dissolved Oxygen for the tidal section of the Thames, aimed at enabling the proper functioning of fish populations and the ecology as a whole. These targets are considered necessary to fulfilling the objective for the tidal Thames of good ecological potential by 2027 under the Water Framework Directive (2000/60/EC), in accordance with which the tidal Thames has been classified as a Heavily Modified Water Body.

The Promoter has a proven track record in environmental assessment practices, specifically compliance with the requirements of EU EIA Directive 2011/92/EC as well as Articles 6(3) and/or 6(4) of the Habitats Directive 92/43/EEC. The environmental regulator, the Environment Agency, independently monitors compliance with effluent discharge permits and will follow the performance of the TTT closely for several years during an extending commissioning period. The Project requires a full EIA, and an Environmental Statement was issued in 2013 as part of the application for development consent, due in September of 2014. An SEA was carried out in preparation of the National Policy Statement for Waste Water I 2012, which formally designated the Tunnel as a Nationally Significant Infrastructure Project. The Project is strongly environmentally driven and has predominantly positive effects on the environment. The Project is considered sound for EIB financing.

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[1] Only projects that meet the scope of the Pilot Exercise, as defined in the EIB draft Carbon Footprint Methodologies, are included, provided estimated emissions exceed the methodology thresholds: above 100,000 tons CO2e/year absolute (gross) or 20,000 tons CO2e/year relative (net) – both increases and savings.

The Promoter shall not commit any EIB funds against schemes that require an EIA according to EU and national law without, prior to commitment, submitting the EIA and the non-technical summary of the EIA to the Bank for review and publication on the Bank's website. The Promoter shall not commit any EIB funds against any scheme that may have potential effects on a site of nature conservation importance, without receiving and informing the Bank of the conclusions from the relevant Competent Authority of the appropriate assessment carried out according to Articles 6(3) and/or 6(4) of the Habitats and Birds Directives.

Environmental and Social Assessment

Environmental Assessment

The Project area and vulnerability of the Thames

The Thames River Basin is an area spanning 16,133km^2 from the source of the River Thames in Gloucestershire through London to the Southern North Sea. The freshwater Thames becomes the tidal Thames at a weir in Teddington. The basin does not generate large natural river flows and these are further reduced by abstractions from the Thames upstream of Teddington for use as a potable water supply for London. The tidal River Thames does not therefore receive large flows of freshwater from upstream, a significant proportion of which is already treated wastewater, to provide dilution of further pollution. The tidal effect moves water up to 15km up and down the River Thames on each flood and ebb tide, but on aggregate as little as half a kilometre per day towards the sea with very little mixing. The net seaward movement takes up to three months to travel along the estuary from the western limit of tidal section at Teddington Weir to Southend.

The tidal Thames has undergone significant man-made physical modifications over hundreds of years, including raising of flood defences and the installation of barrages such as the Thames Barrier. Encroachment through riverside development has meant that through central London the estuary is so narrow that there is a tidal range of up to 7 meters, with the water moving very fast. The tidal Thames is also heavily used for navigation, which requires dredging. The result of all these physical modifications has been a reduction in available natural habitat on the intertidal Thames foreshore and along the banks of the river. The natural habitats along the tidal Thames continue to be under pressure from inter alia foreshore encroachment and recreational uses.

Flowing through central London, the tidal Thames is subject to a wide range of environmental pressures. Notably, the combined sewer systems covering Central London that were planned and constructed 150 years ago discharge an untreated mix of rain water and sewage over once per week, resulting in microbial and chemical pollution, specifically a general reduction as well as acute depletions of dissolved oxygen. This preventing the proper functioning of ecology and creates health risks, as further discussed below.

Environmental Objectives and Environmental Quality Standards

Under the Water Framework Directive, the tidal Thames is classified as both a transitional and coastal water body (TraC), an intermediate between fresh and marine water. The tidal Thames is further split into three TRaC water bodies. Thames Upper ranges from Teddington to Cremorne Gardens and is mainly a freshwater habitat. Thames Middle ranges from Cremorne Gardens to Standford-le-Hope and comprises the brackish zone where water transitions between freshwater and marine. Conditions here are harsh with a high tidal range of 7m, strong currents and ever changing salinity. Thames Lower comprises the marine zone and ranges from Stanford-le-Hope to Haven and Warden Point in the Outer Estuary. The channel here is wider than further upstream and the habitats exhibit more connections between the aquatic and terrestrial environment.

All three of the tidal Thames water bodies have been designated as Heavily Modified Water Bodies (HMWB) in the Environment Agency's River Basin Management Plan for the Thames River Basin District which was published in 2009. The Environment Agency's investigations have led to all three tidal Thames water bodies being classified as Moderate[2]. The investigations have highlighted failures in the amount of freshwater flow, the extent of the physical changes made to the estuary, contamination from heavy metals, herbicides and preservatives as well as some ecological deficiencies.

The first principle of the WFD is to prevent deterioration in aquatic ecosystems, requiring that the tidal Thames does not deteriorate from its current classification as Moderate. The HMWB designation changes the status that the water body is expected to be able to achieve to 'Good Chemical Status' (GCS) and 'Good Ecological Potential' (GEP)[3]. A deadline of 2027 has been adopted in the 2009 River Basin Management Plan for the Thames.

Dissolved oxygen (DO) standards were developed for the Thames Tideway by the Thames Tideway Strategic Study (2000-2006) before general WFD DO standards were developed for the whole of the UK. There is close compatibility between the two sets of standards but the Tideway standards are tailor-made, based on modelling fish mortality for a suite of seven species of fish with a range of physiological types and DO tolerances. They are shown below. The standards were defined to protect all species of fish within the Thames Tideway and fish are considered a good surrogate for the ecology as a whole. The DO standards may need to be reviewed long term, inter alia as the result of effects of climate change on the environment and species.

Dissolved Oxygen (mg/l)	Return period (years)	Duration (no. of 6 hour tides)
4	1	29
3	3	3
2	5	1
1.5	10	1
Note: The objectives apply to any continuous length of river >=3km. Duration means that the DO must not fall below the limit for more than the stated number of tides. A tide is a single ebb or flood. Compliance will be assessed using the network of Automatic Quality Monitoring stations.		

The Crossness and Beckton sewerage systems

The Beckton and Crossness sewerage systems serving London along the tidal Thames are largely combined sewer systems which collect domestic and industrial sewage and rainwater run-off and convey it to sewage works for treatment. The main arteries of these systems are the so-called intercepting sewers that run from West to East.

The design took into account the established circumstance that many of London's rivers were functioning as sewers and that sewers were effectively draining rain water. When such combined sewers reach capacity during rainfall beyond a certain level of intensity, the system discharge excess flows, an untreated mix of rain water and waste water. 57 Combined Sewer Overflow structures were built along the tidal River Thames and have operated to this day.

At the time of construction of the Crossness and Beckton systems 150 years ago, the population of London was around 2.5 million, but they were designed to cope with a population of about 3.5 million, which was already exceeded by 1890ies. The systems were designed overflow only when the rainfall level exceeded 6mm during peak water demand, resulting in overflows only occurring approx. 1-2 times per year initially.

The population in the Crossness and Beckton catchments has grown to around 5.2 million, and it is forecast to grow to around 6 million by the 2020ies and to over 8 million by 2080. The catchments have also been extended. Moreover, the sewers effectively act as groundwater drains in some areas, because of the high groundwater table in London (a portion of the infiltrate is also leakage from the Thames Water water distribution network), and some

[2] This is intended as measures of the degree of deviation from "good status". Establishing the boundary between different states has been the subject of an EU-wide inter-calibration exercise of water bodies, including TraCs. It has been a challenge and refinements can be expected in the future.

[3] The minimum target for water bodies not classified as heavily modified is Good Ecological Status (GES).

properties and their basements are reliant on this de facto drainage. The result of increased loading and infiltration is that even in dry weather, up to half of the flow reaching treatment can be fresh water and that many sewers run 70-80% full, leaving a greatly reduced volume for rain flows that originally provided for. Very importantly, there has been a gradual concreting-over of open spaces, resulting in significantly more intense surface water run-off in rain events than was originally the case.

Overall, overflow frequencies into the Thames have consequently increased more than 20-fold since the combined sewer system was originally built, with over 50 overflow events in the average year, discharging some 39 million m^3 of untreated sewage, groundwater and rain water into the river. In 2012, this reached 53 million m^3. Overflow events take place more than once per week. Because of the specific hydrodynamics of the tidal Thames, plugs of discharged sewage are slow to disperse and get washed up and down the river with the tide, often coalescing to form larger zones of reduced dissolved oxygen levels and microbial pollution. Furthermore, solid material tends to be washed onto the foreshore during the ebb tide.

Significant improvement to the ecological state of the Thames River basin has already taken place during the last decades, with major investment in wastewater treatment both upstream and downstream the Teddington weir. With the upgrade of London's 5 largest sewage treatment plants and construction of the Lee tunnel due for completion in 2015, also financed by EIB, effluent quality is further being improved and London's most significant Combined Sewer Overflow (CSO) at Abbey Mills will be captured. A reduction of overflows to approx. 18 million m3 on average is expected with the completion of these works. However, overflow frequencies into the tidal Thames will still remain higher than allowed and limiting to further ecological improvements and further reduction in frequency and volumes are required.

Compliance with the Urban Wastewater Treatment Directive and Water Framework Directive
The Urban Wastewater Treatment Directive (91/271/EEC) requires member states to have systems that collect and treat waste water in urban areas under all normal local climatic conditions. Full compliance was required by 31 December 2000. In 2006, the European Commission initiated proceedings against the UK government for failing to comply with the Directive. The Commission considered the frequency and volume of wastewater currently being discharged into the tidal Thames before treatment to be in breach of the Directive. In 2012, the Court of Justice of the European Union determined that the Commission had been correct in finding that the UK had failed to fulfil its obligations under the Directive, specifically that collecting and treatment system put in place in London (Beckton Sewage Treatment Works and Crossness Sewage Treatment Works) did not meet the obligations.

Should nothing be done to address the current situation, the UK faces the prospect of fines. Moreover, continuing population growth and incremental increases in the area of impermeable surfaces across London are expected to increase the volume and frequency of CSOs discharges to the river. Such increased discharges would have associated increased adverse environmental impacts, which would also contravene the Water Framework Directive that requires no further deterioration. The WFD objective of good ecological potential would also not be achievable.

Once the Thames Tideway tunnel is in operation, it is expected that frequencies of overflows from the captured CSOs of the Crossness and Beckton systems will be reduced to an average of 4 times year in 2023, bringing the total average number of overflows into the tidal Thames to 7. However, even a significant reduction in overflows will not remove the threat to fish entirely, since an overflow will always result in a potential local deficit in Dissolved Oxygen and potential barrier to migration. Juvenile fish are particularly sensitive.

Climate Resilience
The design of the tunnel is not designed to cover the entire range of uncertainty, as this is not considered cost effective. Analyses run of resilience to change has considered projected climate change in rainfall depth, number of rainfall events and seasonal patterns and projected population growth to the 2080s. The most likely scenario is with medium emission and median projections for climate change. This scenario suggests about a 20% increase in

winter rainfall volume and 20% decrease in summer rainfall volume. The projected change in rainfall volume would directly influence the amounts of CSO captured and residual discharge with an indication of more winter discharges and less summer discharges. Analysis show the substantial increase in volume captured by the proposed tunnel to treatment, and relatively low increase in CSO frequency at a limited number of locations, demonstrating general resilience of the tunnel to a changing climate and catchment population.

Other options available for reducing CSO discharge frequency – either as a result of change or stricter regulatory requirement - include revision to the tunnel operating strategy to utilise more of the tunnel storage before discharging to the tidal Thames, adjustment to the start of the bypass pumping to release tunnel capacity to select CSOs that have increased in discharge frequency, optimise the existing network storage and pumping station operation, additional treatment capacity at the Beckton and Crossness Sewage Treatment Works, additional storage tunnels added to the local network system and implementation of Sustainable Urban Drainage schemes / Green Infrastructure.

Options analysis

Other options to deep end-of pipe storage and conveyance were considered and ruled out in the planning and preparatory studies (combinations of options were not put forward per se):

- Construction of a new storm water sewer network; cost and disruption was considered prohibitive. Moreover, storm water sewers still mobilise significant pollution that must be captured and misconnections are always a risk. Separate sewage and storm sewers are nonetheless the norm for new developments (a practise that became normal as early as the 1920ies).
- Reducing or delaying rainwater entering into the network through Sustainable Urban Drainage Systems (SUDS) / Green Infrastructure (eg. green roofs, permeable road surfacing, local storage); availability of enough space for decentralised storage or infiltration as well as the time required for infiltration systems to recover between rain events (in particular in areas of low permeability) was considered to be limiting. It is also thought that the administrative and regulatory environment is not yet fully developed to be able to implement it rapidly at scale. While several sources provide compelling cases for cost-effective upstream surface water management, modelling by the promoter suggests that achieving full compliance in terms of overflow frequencies will require pervasive retrofitting and resurfacing throughout central London. For illustration, applying a 50% reduction in impermeable area was modelled as reducing the catchment wide CSO total volume from 18 million m^3 to 5.5 million m^3, however the maximum number of spill events from any of the catchment CSOs was only reduced from over 50 events to 39 events.

In general, these alternatives were assessed as requiring more time to implement than the preferred storage and conveyance tunnel, as being at least as costly and as not providing the same certainty in terms of the combination of the legally required reduction in overflows and achievement of environmental objectives for the Thames. The Tunnel was also estimated to be the cheapest option. Even with latest costings, the tunnel is still cheaper, though by a smaller margin.

With the inherent capacity bottlenecks within the system that will not be addressed by the Tunnel, increasing population and loading as well as climate uncertainty, it is highly likely that a future proof sewer system and surface water management as a whole will require more local sewer/storage capacity and/or systematic implementation of SUDS complementary to the Tunnel, together with significant sewer rehabilitation, elimination of misconnections and general maintenance. There will be economies if these actions are coordinated with replacement of other ageing assets as well as hard surfaces.

While sewer separation is already the norm, it is also broadly acknowledged that and SUDS are a preferred paradigm for the future, in particular because of a number of side benefits such as creating a pleasant city environment and reduction of operating costs and carbon impact. SUDS are also scalable and designs can be adjusted as it is been rolled out. From a strategic and operational perspective is does not create reliance on a small number of critical pieces of infrastructure. Therefore there is increased interest in developing SUDS, with both the Promoter and local authorities already having gained significant experience.

It is nevertheless reasonable to conclude that reaching for a fully compliant solution through SUDS within a similar timeframe as the tunnel would be constrained by significant challenges in terms of the need for further development of new administrative and planning approaches, a new matrix of operation and maintenance responsibilities, available above- and below-ground space as well as cooperation among a multitude of actors – including the general public - on an unprecedented scale. Estimated costs would be at least comparable with the tunnel solution. In reality, as discussed above, it is not a question of either or if the system is to be future proof.

Environmental Impact
A significant project wide residual impact identified in the EIA (see below) is the net loss – due to permanent operational structures in the river at several project sites – of river foreshore of 1.2 hectare, which will have significant adverse effects on habitats and fish populations. It is not possible to include measures at each of the sites of these new structures to mitigate these effects. Mitigation is therefore being provided to enhance habitats elsewhere along the Thames and its tributaries, including the removal of disused weirs, allowing more free movement.

During construction, significant adverse effects have been identified at and around many sites due to the change in setting during construction phase from large plant and machinery. Similarly, significant adverse effects are predicted for a number of viewpoints adjacent to some of the sites. The noise of construction activities, generated by construction plant and vehicles, would be controlled on site through measures such as barriers to noise between sources and local properties. However, during certain periods of construction at some site, noise levels are anticipated to rise above the relevant standards.

The management of excavated material generated by the construction of the tunnel is addressed by the Excavated materials and waste commitments (EMWC) document that is part of the Development Consent Order. The EMWC sets out the projects objectives in relation excavated material and waste. It sets out a policy of maximising beneficial use of excavated material arising from tunnel construction.

The most important source of CSO overflows, at Abbey Mills, will resume discharges for over 10 months for works requiring the Lee Tunnel to be taken out of operation.

SEA / EIA
The post-adoption statement of the Appraisal of Sustainability following the provisions of the SEA Directive for National Policy Statement for Waste Water are available on DEFRA website:

https://www.gov.uk/government/publications/waste-water-national-policy-statement-appraisal-of-sustainability-post-adoption-statement

The Environmental Statement (which contains the EIA) that was submitted in February 2013 with the application for development consent is available on the UK Planning Inspectorate's website (*Documents >Developer's Application > Environmental Statement:* Environmental Statement Non- technical summary – 6.1, Environmental Statement – 6.2*):*
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http://infrastructure.planningportal.gov.uk/projects/london/thames-tideway-tunnel/?ipcsection=docs&stage=app&filter=Environmental+Statement

The Environment Statement was updated at the end of the examination and is also available on the Planning Inspectorate's website (*Documents >11-03-2014 - Submissions for 11 March deadline from Thames Water:* ES update report – APP208.01.*):*

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http://infrastructure.planningportal.gov.uk/projects/london/thames-tideway-tunnel/?ipcsection=docs&stage=4&filter=11-03-2014+-+Submissions+for+11+March+deadline+from+Thames+Water