NON-TECHNICAL SUMMARY

FINAL

March 2008

TABLE OF CONTENTS

1 INTRODUCTION

This is a Non-Technical Summary (NTS) of the Environmental Statement (ES), which accompanies the Planning Application for proposed improvement works at Thames Water's Crossness Sewage Treatment Works (STW) in south-east London (see Figure 1).

The proposed development is part of a series of works that will lead to improvements in the water quality of Thames Tideway[1]. The development will form an extension to the existing STW and is to be located on land within the boundary of the existing operational site. This land is subject to Policy TS17 of London Borough of Bexley's (LBB) Unitary Development Plan (UDP)[i], which recognises the need to make adequate provision for future operational requirements at the STW.

The proposed development will provide additional capacity to fully treat an increased quantity of storm flows (flows during and after heavy rainfall). It will also treat these flows to a tighter consent standard and, therefore, improve the quality of the effluent discharged to the Thames Tideway. Together with improvements at other major STWs along the Thames Tideway (including Mogden, Longreach, Riverside and Beckton) this will result in improved dissolved oxygen levels in the river, which is important for fish populations and other aquatic species.

As part of the on-going work to support the project design and Environmental Impact Assessment (EIA) process for the proposed development, Thames Water commissioned an Energy Assessment to examine the potential for minimising energy demand and the feasibility of incorporating renewable energy technology. This work includes a direct response to the Greater London Authority's (GLA's) London Plan[ii] and Energy Strategy[iii] policies. As a result of this work, Thames Water proposes to install a 2.5 Megawatts (MW) wind turbine at the STW as part of the development.

[1] The Thames Tideway is the part of the River Thames stretching from Teddington Lock in the west to the open sea in the east.

2 ENVIRONMENTAL IMPACT ASSESSMENT

The ES has been prepared in accordance with the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 (SI 1999 No. 293) ('the EIA Regulations'), which implements the requirements of EC Directive 85/337/EEC as amended by EC Directive 97/11/EC.

The Environmental Impact Assessment (EIA) process is essentially a systematic procedure, using the best practicable techniques and best available sources of information, to determine the potential impacts of a proposed development (both positive and negative) and their significance. It also provides an opportunity for public scrutiny. This enables the importance of predicted effects to be evaluated by the Local Planning Authority (in this case the London Borough of Bexley) to ensure an informed decision on the planning application.

The purpose of the EIA is threefold:

(i.) To predict environmental effects and their significance;

(ii.) To identify means of reducing effects (i.e. the inclusion of mitigation); and

(iii.) To describe the residual effects after mitigation.

One of the first steps in the EIA process is to identify the 'scope' of the assessment in terms of its content and structure. A Scoping Report, which sets out the scope of the EIA for the proposed development and describes the methodology to be used for the assessment of individual environmental topics, was prepared and submitted to LBB for their consideration. The

Scoping Report was also submitted to the Environment Agency (EA), English Nature (now Natural England), English Heritage, and the London Borough of Greenwich. A Scoping Opinion setting out LBB's formal views on the scope of the EIA was issued on 4th April 2006. This scope was later extended to take account of the inclusion of the wind turbine.

Throughout the EIA process, environmental effects have been considered taking into account potential impacts on resources and receptors. Both positive and negative impacts have been considered, and the significance of any potential impact evaluated depending on the degree of impact (magnitude) and the sensitivity, value or number of affected resources or receptors. In most cases, this is achieved through the use of simple matrices that combine impact magnitude with resource value or receptor sensitivity to enable the significance of effects to be determined.

Mitigation measures have been identified to prevent, reduce and where possible offset any significant adverse effect on the environment. The approach taken from the outset of the EIA has been to integrate appropriate measures within the design of the scheme as it emerges, rather than provide 'bolt-on' solutions at the end of the design process. In addition, the EIA Regulations require that consideration be given to the main alternatives to the scheme and the main reasons for the scheme, taking into account the environmental effects. This has been addressed in the EIA, taking into account alternative site locations, processes and designs.

On a number of occasions over the project's lifetime consultation exercises have been undertaken to inform the design, EIA and planning of the proposed development. In relation to the EIA this has: enabled receipt of technical information; technical briefings; informing and seeking views of statutory consultees, local authority officers and Council Members and the local community.

Consultation meetings and events included:

- Liaison with LBB Technical Officers and interest groups to gather baseline data;
- Consultation on both the general approach to the EIA and on specific environmental topic methodologies. This was undertaken primarily through circulation of the Scoping Report to statutory consultees;
- On-going consultation with LBB and other key stakeholders, including the GLA and EA, to solicit comments on emerging EIA findings and proposed mitigation measures;
- Focus group meetings with Community Groups, including: Crossness Community Working Party, Erith Town Forum, Belvedere Forum, and Bexley Natural Environment Focus Group, to provide feedback on work undertaken and mitigation proposals;
- Posting newsletters to approximately 6000 residents in the local area Crossness STW;
- Public Exhibitions (at Upper Belvedere Library and Morrisons superstores in Thamesmead and Erith); and
- Presentations to LBB Council Members.

3 SITE AND SURROUNDINGS

Crossness STW site is located within the LBB (see Figure 2). This part of London has historically been associated with industrial uses particularly alongside the river. More recently it has been the focus for regeneration and re-development as part of the Thames Gateway, and is expected to experience further new residential and employment growth.

The STW is surrounded by a patchwork of residential, commercial and industrial land uses. Immediately to the east of the operational STW site is the Crossness Nature Reserve (CNR) and to the south, beyond the A2016, are the Crossness Southern Marshes (CSM), both of which are owned by

Thames Water and are part of the wider 'Erith Marshes'. CNR is a Local Nature Reserve and extends to the east from the operational STW site boundary. Further to the east, in Belvedere, and to the south, pockets of land have been allocated within the LBB UDP as industrial development and employment sites. To the immediate west of the site is a golf course, beyond which lies the Thamesmead residential area.

The STW site is relatively remote from residential areas. The closest properties are located in Thamesmead, approximately 250m from the western STW boundary and the nearest school is located approximately 675m from the southern boundary of the operational STW site. There are a network of recreational paths and cycleways in the immediate and surrounding area.

The Crossness STW site contains the Crossness Conservation Area, within which lies the Beam Engine House, a Grade I listed building. The northern section of the STW site, including part of the proposed development site, is designated as an Area of Archaeological Search in the UDP.

Extensive parts of the proposed development site and surrounding area are designated for their ecological value. In addition to the River Thames Site of Metropolitan Importance, the CNR, CSM and large parts of the proposed development site are designated as Areas of Metropolitan Importance for Nature Conservation (AMINC). Land further to the south and west (the golf course) is designated as Sites of Borough Importance for Nature Conservation and Sites of Local Importance for Nature Conservation. The proposed development site contains rough grassland, scrub and some trees. These areas have biodiversity importance where they provide habitat for a variety of birds.

The site and surrounding area is not subject to a national or local landscape designation, although most of the area surrounding the STW and much of the proposed development site is designated as Metropolitan Open Land (MOL). Three Strategic Views cross the STW site as designated on the UDP Proposals Map. The surrounding landscape character is open in nature but with strong industrial influences, particularly with large warehouse developments to the east in Belvedere and industrial uses to the north of the River Thames.

The STW site is on the south bank of the River Thames and is in the immediate tidal floodplain. It is protected from flooding by the River Thames flood defences. The STW site is underlain by a minor aquifer. The main water bodies on the proposed development site are a series of disused sludge lagoons that have been mainly colonised by reeds.

The geology of the area is typical of land in the Thames Estuary, comprising alluvium (clay, silt and peat), overlying river terrace deposits (gravels), lithologically variable lower tertiary bedrock (clay, silt, sand and gravel units) and upper chalk. The entire existing operational STW site was raised above natural ground level during construction. Parts of the proposed development site have historically been used for the deposition of screenings, digestor arisings and construction material. These materials are collectively referred to in this document as 'Made Ground'.

4 ALTERNATIVES AND DESIGN EVOLUTION

The proposed development is the culmination of a significant amount of work over a number of years to investigate how the water quality of the Thames Tideway can be improved.

London's combined sewer system, dating back to the 19th Century, conveys both foul sewage and rainwater runoff to various sewage treatment works for treatment. Currently, when heavy rainfall and the consequent runoff across an individual STW catchment reaches a threshold, the excess flow of combined rainwater and sewage is discharged directly to the Thames Tideway via a series of Combined Sewer Overflows (CSOs). Untreated storm sewage (rainwater mixed with

sewage) also discharges into the Thames Tideway from the STWs when the treatment capacity is reached.

In 2000, Thames Water together with the EA, the GLA, Department for Environment, Food and Rural Affairs (DEFRA) and the Water Services Regulation Authority (Ofwat), began the Thames Tideway Strategic Study (TTSS)[iv] in order to address acknowledged problems of water quality within the Thames Tideway arising as a result of storm discharges from CSOs along the river. In summary, the original objective of the study was '*to protect the Thames Tideway from the adverse effects of waste water discharges'* which in turn led to three principal objectives:

- To protect the ecology of the Tideway;
- To reduce the aesthetic pollution due to sewage-derived litter; and
- To protect the health of recreational water users.

These three principal objectives arise from a variety of existing and forthcoming statutory drivers as well as a number of non-statutory requirements. Paramount among the statutory drivers is the Urban Waste Water Treatment Directive (UWWTD) which requires secondary treatment of urban waste water to prevent the environment from being adversely affected by the disposal of insufficiently-treated urban waste water.

The TTSS concluded that much of the improvement, particularly in terms of significant polluting events, could be achieved through the construction of a Storage Tunnel, which would capture discharges from the worst offending CSOs[2]. The Study also concluded that a significant part of the benefit to the Tideway in respect of dissolved oxygen[3] could be achieved by making capacity and quality improvements to the existing Tideway STWs. Further work was then undertaken to define exactly what measures were required at each Tideway STWs to achieve the improvements that, together with the Storage Tunnel, would deliver the necessary water quality objectives. This work concluded that improvement works would be required at each of the five main Tideway STWs (Crossness, Beckton, Longreach, Riverside and Mogden). At Crossness STW these improvements are to treat an increased quantity of storm water flows and to treat these to a higher standard. The proposed works have collectively become known as the Tidal Thames Quality Improvements (TTQI).

The proposed improvements at Crossness STW will allow Thames Water to meet tighter controls, set by the EA, on the quality of the effluent discharged.

Consideration was given to the possibility of locating the proposed development remotely from the existing STW, but it was concluded that, even if available land could be found, the costs associated with linking the two discrete works would be prohibitively expensive.

A comprehensive optioneering exercise was undertaken to consider the most appropriate treatment technology to be used in the extended works. Over recent years a number of alternative waste water treatment processes have emerged which involve different technologies to those within the current STW. Some of these technologies could result in a more compact form of works and, therefore, could reduce the amount of land take required. However, they have not been selected for a number of reasons, most notably because they have not been implemented at the required scale, or been demonstrated as being capable of achieving the required consent standards. As a result, it was concluded that the design should proceed on the basis of proven treatment technology similar to that within the existing works.

[2] On 22nd March 2007, the Environment Minster gave approval for 'Tideway Tunnel' to proceed.
[3] Dissolved oxygen (DO) is important in relation to the ecology of the Thames Tideway where, for example, fish death increases with low DO levels.

In recognition of the MOL and AMINC designations covering much of the site, the EIA team has worked closely with the engineering design team to optimise the use of available land within the STW site. The location and form of the works has also been influenced by the findings of the EIA, particularly in terms of minimising the impact on ecologically sensitive areas such as the Thames foreshore and the CNR.

5 THE PROPOSED DEVELOPMENT

The proposed development is located within the operational Crossness STW site boundary. It will improve the water quality of the River Thames through providing additional capacity to treat dry weather sewage flows to a higher standard and provide additional capacity to fully treat an increased quantity of storm flows (flows during and after heavy rainfall). The proposed footprint (where new buildings and structures are proposed) of 8.2ha (see Figure 3) will include:

- An Inlet Pumping Station;
- Preliminary Treatment, in the form of screenings and grit removal, as well as a building containing conditioning and washing plant;
- Primary Sedimentation, in the form of tanks which use gravity settlement to separate and remove sewage sludge and flotation for the removal of fat, oil and grease;
- Secondary Treatment, using aeration tanks and final settlement tanks. This process stage includes a 'blower' house building and a recirculation pumping station;
- Sludge thickening and handling plant contained in a building;
- Odour management plant;
- A number of smaller substation enclosures and ancillary structures;
- Roads and hardstandings; and
- Associated temporary construction compounds within the STW site.

Figure 4 is an aerial photo of the existing site. Figure 5 shows how the site will look with the proposed development in place.

To meet the requirements of the GLA's energy policies, Thames Water proposes to install a 2.5 Megawatt wind turbine, which will contribute approximately 20% of the proposed development's energy demand. Although the precise specification of wind turbine is yet to be determined, a variable speed turbine with no gearbox or drive train, up to 86m height (to the hub) and a rotor diameter of 90m, is anticipated.

The proposed STW improvements are required to be operational by March 2014, with construction anticipated to start in 2009 running for approximately 4.5 years. The maximum anticipated construction workforce on-site during one month will be approximately 230.

The predominant route for construction HGV traffic will be to utilise the existing access route, via the A2041 Harrow Manorway, Harrow Manorway slip road and Belvedere Road. A temporary, dedicated construction traffic entrance from Belvedere Road will be provided and located within the south of the operational STW boundary, south of the existing STW site entrance. Where possible, construction waste materials, including a modest amount of demolition material, will be re-used on-site. Excavated material, where feasible, will remain on-site where it will be re-used for backfilling, levelling and landscaping. Where required, some excavated material may be exported to a landfill site, under an appropriate licence.

A Construction Environmental Management Plan (CEMP), to reduce the risk of the adverse impacts of construction on sensitive environmental resources and minimising residential disturbance will be submitted to the LBB for approval prior to construction commencing. This will ensure that the mitigation measures identified in the ES are delivered by the Contractor.

Once operational, staff numbers at the STW will increase from 30 to 52. Access will continue to be via Belvedere Road and the existing security gate during operation.

6 PLANNING POLICY CONTEXT

The ES considers relevant planning policy at a national, regional and local level. The key documents at a local level are LBB's UDP, which was adopted in April 2004, and, at a regional level, the GLA London Plan adopted in 2004, as these form the statutory development plan.

The UDP includes a specific policy relating directly to the Crossness STW site in the form of the Thames-side Special Area Policy TS17. The proposed development is entirely within the operational site as defined by the UDP Proposals Map. The Council acknowledges the potential need for expansion of the Crossness STW site in the future and the policy provides a set of criteria to which any development on the site should have regard. The policy is as follows:

'Within the area identified on the Proposals Map as Thames Water Utilities operational land, the Council recognises the need to make adequate provision for future operational requirements. In considering development proposals, the Council will have regard to the following:

1. The requirement for Thames Water to enhance and modernise its facilities in line with government directives;

2. The need to reduce significant adverse environmental impacts, such as airborne or waterborne pollution, noise, smells and unreasonable traffic generation;

3. The need to ensure that development in that part of the area designated as Metropolitan Open Land minimises the impact on the predominantly open character of the land; and

4. The need to minimise the effects of development on wildlife habitats and the need to protect rare species.'

Whilst Policy TS17 establishes a clear mandate for further STW related development within the operational site, the requirement to address points 2 – 4 above has been fully addressed, through the EIA process.

7 WATER RESOURCES

As a consequence of the proposed development there will be a marked improvement in the quality of the treated effluent discharged to the Tideway. The proposed development will lead to a reduction in the biochemical oxygen demand (BOD) concentrations and a reduction in ammoniacal nitrogen concentrations of the treated effluent, as well as reducing the frequency of discharges from the storm tanks where effluent, partially treated by settlement, is discharged into the Tideway. Together with the other Tideway STW improvements (or TTQI programme) this will result in a significant improvement in the dissolved oxygen levels within the Thames Tideway. Based on the high nature conservation value of the River Thames, the proposed development will have a significant positive effect.

Groundwater sources at the site are considered to be of medium importance, due to the presence of two minor aquifers (River Terrace Deposits and Thanet Sands) and a major aquifer (Chalk). The River Terrace Deposits Aquifer is considered to be at greatest risk from potential mobilisation of contaminants during construction due to it only being overlain by the Made Ground and Alluvial strata. The Thanet Sands and Chalk aquifers are overlain by the Lambeth Group stratum. This Lambeth Group contains clay and silt bands, thus reducing the potential for vertical migration of contaminants. During construction appropriate site controls enable the prevention of contact between contaminated soil and groundwater.

Measures to minimise potential risks to the surface water environment during construction, such as accidental leakage or spillage of fuels or chemicals, will be included within the CEMP to be agreed with LBB prior to the commencement of construction.

The operation of the extended works is not expected to present a more significant risk to the water environment than the current STW. The main risks from the operational phase are from leakage or breakage of pipelines and tanks containing sewage and sewage sludge. As these will be newly built for the development, the risk from such breakage or leakage will be low. Additional mitigation measures include the safe return of grey waters to the inlet pumping station for treatment and attenuation of rainwater runoff from clean areas, in line with EA recommendations.

8 AQUATIC ECOLOGY

The key objective of the proposed development is to improve the conditions within the Thames Tideway for fish and other aquatic species. The ES examines in detail the contribution that the TTQI projects make to the water quality within the Tideway and the benefits that will result.

The proposed improvements will benefit many of the invertebrate species present within the river. This in turn may lead to higher species diversity. The improvements are also likely to generate improvements in the local area's invertebrate fauna due to a reduction in the number of periods of low levels of oxygen. As a result this could create a more balanced population structure.

A wide diversity of freshwater and marine species of fish have been found in the Thames Tideway. The proposed development will assist in improving water quality so that it is no longer the limiting factor in the distribution of certain life-stages of fish. It will increase the habitat opportunities, so improving diversity and the presence of pollution sensitive fish. This will be of benefit to wildlife and recreational users of the Tideway, including anglers.

The Tideway is visited from time to time by several species of mammal including dolphin, porpoise and otter. Although these aquatic mammals are not directly affected by water quality, the anticipated diversification of food-fish species throughout the Tideway may encourage them to remain for longer. At certain times Planktonic algae can be found in the river which produce oxygen. These are important as they reduce the number of fish dying during periods of low oxygen levels in the Tideway. It is unlikely that any of the changes arising from the proposed development will have direct effects upon the algal flora. However, because some larger scale aquatic ecosystem changes are predicted, it is possible that some more fundamental beneficial changes may take place indirectly.

9 TERRESTRIAL ECOLOGY

Detailed surveys for reptiles, invasive plants, amphibians, water voles, breeding birds, wintering birds, foraging bats, aquatic invertebrates and terrestrial invertebrates were carried out on the proposed development area, the CNR and CSM. Small populations of grass snake, small numbers of foraging pipistrelle and noctule bat and numerous species of breeding / wintering bird (most notably barn owl feeding on the CNR) and terrestrial invertebrate were recorded within the proposed development area, CNR, and CSM. The development area also lies within the Erith Marshes AMINC (see Figure 6).

The proposed development will result in permanent landtake of approximately 7ha of semi-natural habitat within the AMINC and operational STW and temporary landtake from a further 3ha. This will include some permanent loss of areas of open water, swamp and scrub, with the majority of landtake being from tall, dense wasteland vegetation (heavily dominated by hemlock and black mustard). In the absence of mitigation this would lead to significant adverse effects on wintering birds,

breeding birds, terrestrial invertebrates and the Erith Marshes AMINC itself.

Mitigation measures include careful site clearance techniques to avoid adverse effects upon nesting birds and reptiles, creation of habitat features within the proposed development and existing STW (including both brown roofs on buildings, 'wasteland' habitat on areas of hardstanding/amenity grassland and erection of further barn owl nest boxes). Careful lighting design and noise control measures during piling activity will be adopted. Measures will be taken to diversify the CNR and CSM through the creation of new habitat features including a reedbed, rough grassland, scrub planting, and a wader scrape (see Figure 7). These measures will increase the matrix and quality of habitats available within the remaining AMINC.

With this mitigation in place most impacts are rendered insignificant, although residual significant adverse impacts will remain upon terrestrial invertebrates and the AMINC itself. These however, will be offset through the significant enhancements to the water quality of the Thames Tideway (and thus the River Thames and Tidal Tributaries AMINC) that will occur as a result of this development, both alone and in combination with other elements of the TTQI programme.

10 LANDSCAPE AND VISUAL

The proposed development at Crossness STW takes account of the requirements of The London Plan and the LBB UDP, which recognise the importance of the River Thames as the key element of London's network of waterways and the need to protect its special landscape value. Despite the largely engineered nature of the industrial development proposed, a high quality of design within this Thames-side location will be achieved in relation to the new buildings, through bespoke architectural design, in conjunction with the environmental design inputs gained through the EIA process.

Thames Water currently makes a substantial contribution to biodiversity and landscape protection through its management of the adjacent CNR and CSM, which will not be compromised by the proposed development. Furthermore, the Thames Path, which runs adjacent to the site along this stretch of the River, will not be directly affected.

Although the proposed development site forms part of an area of MOL, the proposed development will not compromise the key criteria for designation of the MOL as a whole. As illustrated in Figure 5 the proposed development is largely low-lying and, therefore, largely hidden from the surrounding area. A series of photomontages showing views from a number of locations around the STW confirms that the extended works will not be visually intrusive. The bund running along the southern boundary of the site will be extended to ensure that views from the south and the CSM are protected.

Despite the compliance generally with landscape policy at all levels, inevitably a development of this nature will result in some adverse effects, chiefly during the 4.5 year construction period. In terms of landscape character, the land making up the proposed development area will be directly affected and construction activity will have indirect effects due to traffic movements and intervisibility between areas of open landscape. However, the landscape quality of the proposed development site is limited because it is operational land, unlike the well-managed, adjacent CNR, from which it is separated physically by fencing.

A great emphasis has been placed upon the importance of architects and environmental specialists working alongside engineers to enable the production of a more visually pleasing and coherent scheme. This will be to the benefit both of those who have views of the site from outside and those who are closely involved with the development on site as workers or visitors.

It is considered that, overall, the effects of the completed scheme are not likely to be significant in terms of landscape character or visual amenity.

Due to its size, little can be done to reduce the visibility of the turbine, but the choice of colour will be given careful consideration, so that it is as unobtrusive in the landscape as possible.

11 LAND QUALITY

Under UK law, land contamination is a material planning consideration and a planning authority may require investigation and, if necessary, a programme of remediation before planning permission is granted. This legislation is designed to protect resources and to prevent harm to people and the environment.

Review of published geological maps and site investigations undertaken during 2005 and 2006 show that the site is underlain by occasional topsoil, on top of Made Ground comprising silty/clayey, gravel and sand containing sewage screenings and other anthropogenic material. This overlies alluvium comprising clays, sands and peat; over River Terrace Deposits of clayey, sandy gravels. At a greater depth the Lambeth Group, Thanet Sands and the Upper chalk were encountered.

Review of groundwater maps for the site show that the River Terrace Deposits and Thanet Sands strata under the site are designated by the EA as minor aquifers, and the Upper Chalk layer is considered to be a major aquifer. Site investigations showed that groundwater generally flows towards the River Thames which is located adjacent to the northern site boundary.

Historically, parts of the proposed development site have been used for the deposition of screenings, digestor arisings and construction material, thus giving the potential for contamination. In order to assess the risks associated with the development two consecutive site investigations were undertaken to establish the land quality of the proposed development site. Based on the findings of these investigations, and the proposed land use, it is considered that there is a moderate to high risk with respect to ground contamination at the site, prior to mitigation. The primary source of any potential contamination is the presence of extensive areas of Made Ground with contamination hotspots, which are derived from the extended historical use of the land as a sewage treatment works.

The assessment of potential impacts is based upon the findings of a desk study and the two site investigations. A potential risk has been identified for construction workers, who could come into contact with contaminated soil or dust. This risk will be mitigated through appropriate site controls, dust suppression and Personal Protective Equipment. These measures will be included in the CEMP.

The overall impact to underlying aquifers and the River Thames, from soil contaminants is considered minor to moderate. An assessment of risk to controlled waters, the River Thames and River Terrace Deposits aquifer, indicated that the soil hotspots did not pose a significant risk. The construction of tanks and other structures, plus the introduction of new roads and hardstanding will reduce the leaching potential, and relocation of soil sources away from the River Thames will increase the distance to this receptor. Both of these measures are seen as, beneficial, and as a result no significant impacts to controlled waters are expected from soil contaminants when the development is operational.

Excavated soil will remain on-site where feasible, and will be re-used for backfilling, ground raising and landscaping. A detailed methodology (Soil Management Plan), which looks at the appropriate re-use of all excavated material, will be agreed with LBB and the EA prior to construction commencing.

No significant impacts to the ground conditions are expected through the construction and operational phase of the developments, provided standard, best practice guidelines are followed.

The residual impact of the proposed development on ground conditions is considered to be negligible after the mitigation measures that have been identified are implemented. The relocation of contaminated soil and construction of the works including roads and hard standings will result in a permanent beneficial residual impact to the local environment.

12 WASTE MANAGEMENT

The proposed development will generate solid waste during the construction phase, through demolition, construction material wastage and excavated material.

Opportunities to minimise the need for off-site disposal, through recycling and re-use, have been fully explored. The Soil Management Plan will allow most of the excavated material to be retained on-site and re-used within the construction works. In so doing, the quantity of material requiring disposal to landfill, and the associated transport movements, has been significantly reduced.

The amount of additional waste generated during operation will be relatively limited and will not give rise to a significant number of transport movements.

13 CULTURAL HERITAGE

The majority of the proposed development is located some distance from the Crossness Conservation Area and Listed Buildings. However, a small part of the proposed works comprising a sewer chamber (11m by 9m) is located in the south-west corner of the Crossness Conservation Area. Consultation with LBB's Conservation Officer has confirmed the conclusions of the EIA, that these works will not have a significant effect on the character and setting of the Conservation Area or Listed Buildings. It was also agreed that, due to the distance from the Conservation Area, the proposed wind turbine would not have a significant effect.

The Crossness STW site is located in an area of archaeological and historical significance. A number of ground investigations on the STW site and surroundings had encountered peat and alluvial deposits. Some investigations outside the STW site had also encountered cultural material such as trackways and boats in the upper peat layer.

Three archaeological boreholes were drilled within the proposed development area in order to gain a more precise understanding of the geology of the site, and the potential for it to contain deposits of archaeological interest. The investigations revealed that a sequence of alluvial and peat deposits is present across the proposed development site and that the sequence shows little evidence of truncation. Much of the site is covered by a layer of Made Ground which is approximately 4m thick.

The material extracted from the boreholes was examined by experts in palaeo-environmental archaeology at Royal Holloway College, London University. Environmental archaeology is the identification of processes, factors and conditions of past biological and physical environmental systems and how they relate to cultural archaeology, such as pollen, insects and woodland clearance. Cultural archaeology is deposits, items or features representative of a material culture created by past human activity[v], such as artefacts and structures.

Consultation has been undertaken throughout the assessment with Greater London Archaeological Advisory Service (GLAAS). The proposed development risks damaging the integrity of some of the palaeo-environmental deposits and, therefore, it was agreed with GLAAS that mitigation would be provided in the form of three evaluation trenches to assess the extent and survival of any cultural material in the peat

sequence present on the STW site. These have been undertaken and the results submitted to GLAAS.

14 ODOUR

As with any sewage treatment facility, odour management is a major consideration at Crossness STW. By modifying and upgrading odour control systems serving the sludge handling aspects of the works operations, and the installation of a permanent odour controlled lime treatment facility, Thames Water has already managed to reduce odour emissions from the existing STW by approximately 50% compared to levels measured in 2005. This improvement has led to a significant reduction in the number of complaints from residents in the local area.

With regard to the proposed development, Thames Water's objective is to ensure that the extended works do not add to the existing levels of odour generated, i.e. so that they are 'odour neutral'. To that end, the proposed extension includes the following odour control measures:

- The new inlet pumping station, preliminary treatment works and raw sludge thickening plant will be enclosed and any odorous air extracted to a dedicated odour control system; and
- The new primary sedimentation tanks will be covered and any odorous air extracted to a dedicated odour control system.

In order to achieve the 'odour neutral' position it has been necessary to introduce the following additional odour control measures to elements of the existing works. These include:

- Covering the outlet weirs and channels serving the existing primary sedimentation tanks and extracting any odorous air to dedicated odour control systems;
- Covering chambers in the sludge pumping stations serving the existing primary sedimentation tanks and extracting any odorous air to dedicated odour control systems; and
- Covering the outlets from the existing constant velocity grit channels and extracting any odorous air to a dedicated odour control system.

The odour assessment has been undertaken by specialists, OdourNet UK Limited, and concludes that the measures introduced through implementation of the proposed development and its mitigation measures will lead to a 7.5% reduction in odour generation compared to the existing works (see Figure 8).

In addition to this, a separate project will install automatic cleaning equipment in the existing storm tanks, which will reduce odour by a further 1%.

15 TRAFFIC AND TRANSPORT

Vehicular access to the Crossness STW and the proposed development site is gained from Belvedere Road via an underpass beneath the A2041 / A2016 junction. The A2041 'Harrow Manorway', a dual carriageway. It is assumed that construction HGV traffic will predominantly follow this route, although it is likely that some local workforce traffic may chose a different route to the A2041.

The maximum off-site construction HGV movements during the 56 month construction phase are anticipated to be approximately 106 movements per day, an average of approximately 11 per hour (10-hour working day). Maximum construction workforce movements are likely to peak at 384 per day.

Additional average HGV movements resulting from the operation of the proposed development will be approximately 2.65 loads per day in 2021

(this is considered the worst-case scenario). Infrequent other HGV trips will be required once the proposed development is operational. These trips will be associated with maintenance and replacement of various process components. The operational staff will increase by 22 (totalling 52) during operation of the proposed development, which will not create a significant increase in road traffic.

The use of river transportation via the jetty at Crossness STW for delivery and removal of construction material has been considered. However, a condition and load capacity assessment established that use of the River Thames for materials movement for this development was not feasible, where the cost of either upgrading the existing jetty or providing a new one was not thought to be justifiable based on the temporary movement of a relatively small quantity of material which is associated with the proposed development.

The proposed development will minimise construction traffic movements through re-use of demolition and excavated material where feasible on-site, for example as piling mat material, and backfilling, ground raising and landscaping. Measures will be incorporated into the CEMP to encourage reductions in car usage by the construction workforce. Some of these initiatives may remain during the post-construction period.

16 AIR QUALITY

The ES includes an assessment of the effects of construction dust, road traffic emissions during the construction period and energy related emissions.

Fugitive emissions of construction dust from the site may have the potential to cause significant dust soiling up to 100m from the proposed development site boundary. The implementation of best practice dust control and monitoring measures for the project will reduce the impact of fugitive dust emissions, to a level that is imperceptible under normal meteorological conditions. Episodes of dust deposition, should they occur, will be short term, negligible to minor adverse in magnitude and reversible.

A worst-case assessment, based on peak levels of construction traffic, has concluded that emissions of road traffic pollutants will not result in a significant change in air quality along the access route to the site. Additionally, there will not be a risk of exceeding the current UK air quality objectives.

The increased energy demands of the proposals will increase off-site emissions to atmosphere by approximately 25%, in the absence of on-site sources of renewable energy. Thames Water has designed-in a number of energy efficiency measures which, together with the wind turbine, will reduce the overall energy consumption at the site, and comply with the GLA's energy policies.

17 NOISE AND VIBRATION

Background noise levels were monitored at the three closest residential locations to the proposed development, with additional monitoring at sensitive receptors, including the CNR.

Using BS5228 'Noise and Vibration Control on Construction and Open Sites'[vi] methodology, worst-case construction noise levels have been predicted and show that the levels at all receptors are below the 70dB LAeq,1hr which determines the onset of potentially significant impacts.

Using BS4142 'Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas'[vii] to assess the level of noise from the proposed works once operational it is predicted that noise will be well below existing minimum background noise levels at the closest residential receptors and complaints are therefore unlikely. The estimated internal noise levels to the nearest residential properties, from the operation of the proposed development, are significantly below the criterion level given in

WHO Guidelines and in BS8233 'Sound Insulation and Noise Reduction for Buildings – Code of practice' for good sleeping conditions, and it is concluded that operation of the proposed development will have no significant impact at the nearest residential properties.

An assessment of noise from the proposed wind turbine, using the recommended methodology, concluded that noise levels at the nearest sensitive receptors are predicted to remain well within the limits specified in guidance and the proposed wind turbine is therefore highly unlikely to lead to complaints from the nearest sensitive receptors.

Due to the distance to the nearest residential properties vibration resulting from piling activities (the worst-case construction activity) will not cause building damage or annoyance to existing residences.

18 SUSTAINABILITY

The engineering design team has identified a number of energy efficiency measures which will reduce the proposed development's energy demand by approximately 11%. By incorporating an on-site 2.5MW wind turbine, approximately 20% of the proposed development's average energy requirements will be met through a renewable source.

Although energy is an important aspect, it forms only a part of the sustainable design and construction strategy for the proposed development. A holistic view has been taken throughout the design process, giving consideration to a wide range of other issues such as material selection, water conservation, waste minimisation, conservation of the natural environment and community issues such as job creation.

A separate Sustainable Design and Construction Statement is submitted with the planning application.

19 WIND TURBINE TECHNICAL ISSUES

A number of technical issues associated with locating a wind turbine at the Crossness STW site have been assessed, including aviation and telecommunications interference, shadow flicker, icing and adverse weather, as well as proximity to roads, Rights of Way and power lines, and effects on birds. These risks have been minimised or eliminated during the evolving design process.

Relevant aviation and telecommunication organisations have been consulted, including the Civil Aviation Authority, London City Airport, Biggin Hill Airport, National Air Traffic Services, Defence Estates and Port of London Authority. Various telecommunication links cross the site and these have been considered in the choice of location of the wind turbine. No objections to the proposed turbine have been raised by the aforementioned consultees.

Shadow flicker occurs from rotating wind turbine blades which can cast moving shadows that cause a flickering effect and can affect residents living nearby. Similarly, gloss surface blades flash when they rotate[viii]. Shadow flicker occurs when specific combinations and conditions coincide in specific locations at particular times of the day and year. In the UK only buildings within 130 degrees either side of north relative to the turbines can be affected. Also, for the height of turbine proposed, only those buildings within approximately 900m of the turbine would potentially be affected by shadow flicker. A shadow flicker assessment using "WindFarmer" software found only non-residential, less sensitive buildings within the Crossness STW site itself, would potentially be affected by shadow flicker. In the unlikely event that shadow flicker occurs and causes disturbance to STW personnel, mitigation measures (such as effective blinds or shutters) could be implemented

Icing of the turbine is highly unlikely. For ice to build up on wind turbines particular weather conditions are required and such conditions occur for less than one day on average per year in England. Modern turbines can continue to operate with thin accumulations of ice. However, with heavier

build up of snow and ice, vibration sensors detect an imbalance and cause the turbine to shut down. The turbine will shut down automatically at wind speeds above 28-34 metres per second or gale force 10 to reduce the risk of damage. A lightning protection system conducts lightening to the earth.

Drivers are faced with a number of varied and competing distractions during any normal journey, including advertising hoardings, which are deliberately designed to attract attention. Wind turbines should therefore not be treated any differently from other distractions a driver must face and should not be considered particularly hazardous. The location of the turbine at Crossness is over 200m away from the nearest bridleway and the turbine's position is such that it does not over-sail any public Right of Way.

Companies supplying products and services to the wind energy industry operate to a series of International, European and British Standards, blade failure is therefore most unlikely. Properly designed, erected and maintained wind turbines are a safe technology. There has been no example of injury to a member of the public.

20 MITIGATION AND MONITORING

The aim throughout the EIA process has been to work closely with the engineering and architectural teams to minimise environmental impact through the design process. This has been essential in ensuring that environmental considerations have been taken into account in all decision-making. It has also been particularly important in directing development away from sensitive receptors such as the Thames foreshore and CNR.

Early engagement with key stakeholders during the design process has also assisted in ensuring that matters of main concern have been considered wherever possible during the development of the scheme.

The mitigation measures included in the ES fall into three broad categories:

- Mitigation incorporated during development design;
- Mitigation through controls during demolition and construction; and
- Mitigation through operational management.

Impacts during construction will be minimised through the production of the CEMP, which will be approved and enforced by LBB and other regulatory authorities, e.g. the EA.

Once operational, the measures incorporated into the design will be monitored to ensure they are functioning as anticipated.

21 RESIDUAL EFFECTS AND CONCLUSIONS

The need for the proposed development at Crossness STW is driven by the statutory requirement to improve water quality within the Thames Tideway. The improvements at Crossness STW will deliver the required standards and consequent benefits in terms of aquatic ecology. Notwithstanding the environmental benefits, Thames Water fully acknowledges the scale of the works involved and the presence of sensitive resources and receptors within and in proximity of the STW site. Furthermore, whilst LBB's UDP establishes a clear mandate for further STW related development within the operational STW site, it also states that Thames Water must have regard to minimising the environmental impact of such development.

The inclusion of mitigation measures will ensure that there are no residual significant adverse effects. The only exception is the residual loss of AMINC within the STW, which despite its limited habitat value, is considered by the GLA to be a significant loss within Greater London. However, the key statutory consultees on biodiversity matters, including

the GLA, have concluded that this loss must be weighed against the wider environmental benefit to the Thames Tideway and the need for Thames Water to respond to current and emerging statutory requirements.

REFERENCES

[i] London Borough of Bexley 'Unitary Development Plan' (Adopted 2004).
[ii] GLA 'Spatial Development Strategy: The London Plan' (February 2004) and Draft Further Alterations to the London Plan (September 2006).
[iii] GLA 'Energy Strategy' (February 2004).
[iv] Thames Tideway Strategic Study Steering Group (2000 – 2005) Reports, available from http://www.thamestidewaystrategicstudy.co.uk.
[v] Collins Dictionary of Archaeology Bahn P, 1992 Harper Collins.
[vi] BS5228: 1997 Noise Control on Construction and Open Sites, British Standards Institution, 1997.
[vii] BS4142: 'Method for rating industrial noise affecting mixed residential and industrial areas'. British Standards Institution, 1997.
[viii] DTI, Renewable Energy (2005) http://www.dti.gov.uk/energy/sources/renewables/planning/onshore-wind/shadow-flicker/page18736.html, accessed Feb 2007.