A630 Deephams Sewage Works Upgrade

Strategic Options Review

Stage 1 Report

Public consultation version

Deephams
Sewage Works Upgrade
Creating a cleaner, healthier River Lee

Revision	*Date*	*File Name*		
Public consultation version	June 2012	Description	Strategic options review report, published as part of phase 1 public consultation	
			Prepared by	Checked by
		Name	TR	PH/NF/LG
		Signature		

Table of Contents

List of Figures

List of Tables

1 Executive summary

1.1.1 Deephams Sewage Works, located in Enfield in north east London, is the ninth largest sewage works in England. It treats sewage collected from within its catchment and discharges treated effluent that flows into the Salmon's Brook, a tributary of the River Lee, in accordance with a discharge consent set by the Environment Agency.

1.1.2 The Environment Agency has issued a new discharge consent that requires us to make improvements to the quality of the discharge. The Deephams Sewage Works Upgrade (the upgrade) will improve the quality of effluent (treated wastewater) discharged from the Deephams Sewage Works into the Salmon's Brook. It will accommodate growth within the catchment to at least 2031, and improve infrastructure at the sewage works, much of which is now over 50 years old.

1.1.1 The upgrade has to be delivered whilst the existing sewage works remains operational to treat the sewage to the existing consent levels. This places significant engineering constraints on our ability to implement the upgrade within the boundaries of the existing sewage works site.

1.1.2 This report documents how we have reviewed strategic options for delivering the upgrade. Through this process we have identified and reviewed four strategies for upgrading the Deephams Sewage Works. These are:

- Strategy 1: reduce or remove enough of the incoming flow to Deephams Sewage Works to permit each of the existing three treatment streams to be turned off and upgraded in turn.
- Strategy 2: combine various options from Strategy 1 to reduce or remove incoming flow to Deephams Sewage Works.
- Strategy 3: build part of a new sewage works on another site and transfer flows between the new plant and the existing Deephams Sewage Works for treatment.
- Strategy 4: construct on Deephams Sewage Works.

1.1.3 The viability of each of these strategies has been reviewed and two of the four strategies have been taken forward for more detailed consideration. These are:

- Strategy 3: build part of a new sewage works on another site and transfer flows between the new plant and the existing Deephams Sewage Works for treatment.
- Strategy 4: construct on Deephams Sewage Works.

2 Introduction

2.1 Section objectives

2.1.1 This introduction explains the background to the Deephams Sewage Works and the need for the upgrade, and outlines the strategic options considered for achieving the upgrade.

2.2 Background to Deephams Sewage Works

2.2.1 Deephams Sewage Works is one of our six main sewage works that serve London. It is located off Picketts Lock Lane in Edmonton, as shown in Figure 1 below. It is the ninth largest sewage works in England and serves a population equivalent of 885,000 people (as of 2010). The catchment that Deephams Sewage Works serves extends over large parts of north east London, and northwards beyond the M25.

Figure 1: Plan showing location of Deephams Sewage Works

2.2.2 Sewage treatment has been undertaken in this part of Edmonton since the 1870s when the first Edmonton sewage farm was developed on adjoining land. The sewage treatment works was largely constructed on the current site in the 1950s and 1960s.

2.2.3 Despite the various improvements over the last 30 to 40 years, and those under construction, the current sewage works is predominately the works that was first constructed in the 1950s and 1960s. The ageing plant is under increasing pressure to meet and maintain treatment standards.

2.2.4 The current plant layout and treatment processes are shown in Figure 2, and are described briefly below.

2.2.5 The Deephams Sewage Works is a conventional activated sludge treatment works. It comprises an inlet works, where grit and rags are removed from the incoming sewage, followed by primary settlement tanks, where solids are settled out and sent to the sludge treatment plant.

Figure 2: Deephams Sewage Works

2.2.6 Following primary settlement, the settled sewage flows into activated sludge tanks, and is aerated to encourage bacteria to break down the organic load. The treated effluent is then settled again to separate any activated sludge biomass from the final effluent. The activated sludge is recycled to the aeration tanks and the final effluent is discharged to the Salmon's Brook (as shown on Figure 2), which runs adjacent to the works. A disc filter tertiary treatment plant is currently under construction to improve effluent quality, and will be completed in 2012.

2.2.7 Solids from the primary settlement tanks and any surplus activated sludge are pumped to the sludge treatment plant, where they are treated by anaerobic digestion. The digested sludge product is dewatered and recycled as fertiliser on agricultural land, and the biogas produced during the digestion process is reused as a renewable energy source on site.

2.3 Summary of the need for the upgrade

2.3.1 The need for the upgrade is set out in the National Policy Statement for Waste Water, and can be summarised as the requirement to respond to:

- an increase in the discharge consent requirements
- an increase in flow to the works:
  - a requirement to provide sufficient treatment capacity to meet population growth within the catchment already served by the works.
  - a requirement to respond and adapt to the challenges of climate change.
- ageing infrastructure under pressure to meet and maintain treatment standards

2.3.2 The upgrade will also deliver wider social or environmental benefits, for example reduced odour emissions and, depending on the option selected for implementation, increased renewable energy generation.

2.4 Summary of the assessment methodology

2.4.1 We have developed an assessment methodology for selecting the most appropriate option for delivering the upgrade, including the assessment of site and treatment technology options.

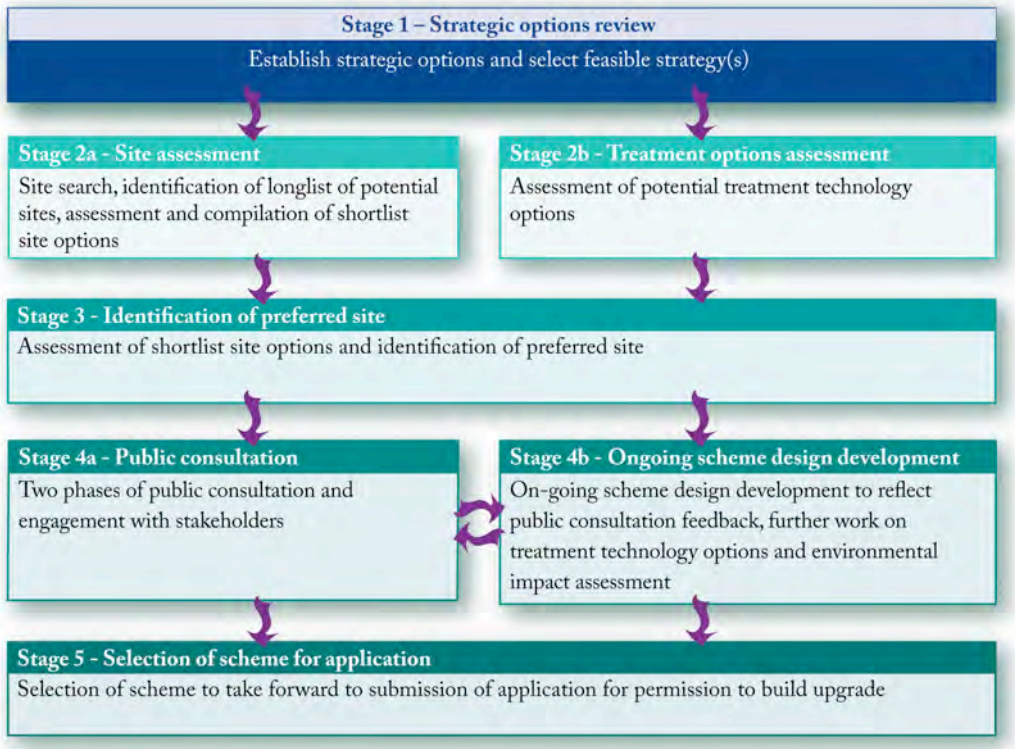
2.4.2 The methodology allows for the assessment of a range of strategies for meeting the need for the upgrade. It allows for the consideration of potential locations for new sewage treatment infrastructure. The construction of the upgrade could be on the existing site, although the site would have to remain operational throughout the upgrade, or it could be on a new site nearby. A suitable treatment technology option has to be selected, to meet the treatment requirements of the new discharge consent within funding, programme, treatment technology and physical site constraints.

2.4.3 The proposed methodology is a multi-stage process, with stages undertaken both in parallel and sequentially. Figure 2 below illustrates this process diagrammatically.

2.4.4 The assessment process firstly allows an initial review of strategic options for meeting the need for the upgrade to be undertaken. From this, an assessment of treatment options is undertaken, alongside an assessment of potential development sites. A more detailed assessment of a shortlist of sites is then undertaken to enable a preferred site to be identified. The preferred site is then published for a first phase of public consultation and stakeholder engagement.

2.4.5 Alongside, and following on from, the first phase of consultation we will undertake scheme design development work and further work on treatment options. This will confirm the feasibility of our preferred site and treatment technology options for delivering the upgrade. A second phase of public consultation will then be held on our proposals and designs for the upgrade and information on the potential environmental impacts of the upgrade and our plans for mitigating them. An application for permission to build the upgrade will then be submitted.

Figure 3: The assessment methodology



2.4.6 An essential part of the methodology is an ongoing process of review and checking the validity of previous assessments through feedback loops at all stages of the process. This enables the assessment of sites and options to remain valid as information changes and new information is obtained. Thus, where necessary, stages in the process may be repeated (or 'back-checked') in order to take account of new information or other changes of circumstance.

2.4.7 This report documents Stage 1 of the process shown in Figure 3.

2.5 Structure of this report

2.5.1 This report documents the review of strategic options which we have undertaken for upgrading Deephams Sewage Works. It is structured as follows.

2.5.2 Section 3 outlines the range of strategic options that have been identified. Section 4 reviews the potential for reducing or removing sufficient incoming flow to Deephams Sewage Works to allow the existing sewage treatment streams to be upgraded in turn. Section 5 considers the possibilities of combining various options to reduce or remove incoming flow to Deephams Sewage Works discussed in Section 4.

2.5.3 Section 6 evaluates building part of a new sewage works on another site to treat flows from Deephams Sewage Works. Section 7 considers redevelopment of the existing Deephams Sewage Works site. Finally, section 8 sets out the conclusions of the review.

3 Strategic options

3.1 Section objectives

3.1.1 This section outlines the strategic options which have been identified to facilitate upgrading the works.

3.2 Current and future constraints

3.2.1 An upgrade of the primary, secondary and tertiary treatment process is required to meet the new discharge consent. This would require an upgrade of the three existing treatment streams A, B and C (which comprise the primary settlement tanks (PSTs), activated sludge plant and final settlement tanks shown in Figure 2 above), together with an expansion or upgrade of a new tertiary treatment plant which is currently under construction. The existing inlet works, storm tanks and sludge treatment plant (also shown in Figure 2) would be retained on site.

3.2.2 The Environment Agency has confirmed that any upgrade to the primary, secondary and new tertiary treatment process will need to be performed while maintaining the existing discharge consent and flows. The current works treat flows up to 443Ml/d (million litres per day) of sewage and rainwater combined, with flows in excess of this being treated in the storm tanks. Approximately one-third of these flows pass through each treatment stream.

3.2.3 Any solution to meeting the new consent will also need to cater for the increase in flows due to predicted growth in the catchment. The new consent requires the works to treat a flow of 497Ml/d before any flow is discharged to the storm tanks. As each of the three treatment streams treats up to a third of the flow, any permanent strategic options for taking one stream out of operation to facilitate upgrading would need to provide a treatment capacity equivalent to one third of the future flow, i.e.166Ml/d.

3.2.4 The treated effluent from Deephams Sewage Works supports the flow in the Salmon's Brook, to which it is discharged under the terms of the consent. The Salmon's Brook in turn supports flows in Pymmes Brook and the River Lee. Any flows removed from Deephams Sewage Works for treatment elsewhere would need to be returned to the consented discharge point in order to maintain the flow in the Salmon's Brook.

3.2.5 There is little space available on the existing site in order to upgrade the existing works.

3.2.6 Various strategic options for meeting the new consent have therefore been evaluated, as described below.

3.2.7 The Deephams Sewage Works inlet pumping stations, preliminary treatment works, sludge treatment and storm tanks will remain on the current site irrespective of the option selected for the upgrade. This decision has been taken as these elements of the works would not need any significant upgrade in order to meet the new discharge consent.

3.3 Strategies considered

3.3.1 As a result of the constraints noted above, a number of strategies for meeting the new consent were developed by the project team through informal workshops, and were then discussed with stakeholders at a Stakeholder Forum. The strategies identified comprise:

- Strategy 1: reduce or remove enough of the incoming flow to Deephams Sewage Works to permit each of the existing three treatment streams to be turned off and upgraded in turn.
- Strategy 2: combine various options from Strategy 1 to reduce or remove incoming flow to Deephams Sewage Works.
- Strategy 3: build part of a new sewage works on another site and transfer flows between the new plant and the existing Deephams Sewage Works for treatment.
- Strategy 4: construct on Deephams Sewage Works.

3.3.2 The options for each of these strategies is detailed in Table 1. Each of the strategies has to ensure that treatment of the sewage flows from the Deephams catchment is maintained throughout.

Table 1: Strategic options for review

Strategy	Option
Strategy 1: reduce or remove enough of the incoming flow to Deephams Sewage Works to permit each of the existing three treatment streams to be turned off and upgraded in turn	A. Reduce flows at source by: - water efficiency and metering -Sustainable Drainage Systems (SuDS) B. Transfer Deephams flows by pipeline to another existing sewage works (Rye Meads Sewage Works, Beckton Sewage Works) C. Split Deephams catchment and transfer flows from part of the catchment to another existing sewage works (Beckton Sewage Works, Mogden Sewage Works) D. Split Deephams catchment and transfer flows from part of the catchment to a new sewage works (near the M25, or in the Palmers Green area)
Strategy 2: combine various options from Strategy 1 to reduce or remove incoming flow to Deephams Sewage Works	A combination of transfers to other existing or new sewage works
Strategy 3: build part of a new sewage works on another site and transfer flows between the new plant and the existing Deephams Sewage Works for treatment	Transfer flows by pipeline from Deephams to a new treatment plant (i.e. part of a new sewage works) off-site
Strategy 4: construct on Deephams Sewage Works	Reconfigure part of the existing Deephams Sewage Works site to permit construction of a new plant to treat part of the flow, allowing the remaining existing treatment plant to be upgraded

3.3.3 Any plant constructed for treatment off-site would need to be permanent rather than temporary, because the capital investment in plant and tunnels or pipelines to and from Deephams Sewage Works would be substantial. A temporary plant would be required to operate for up to 8 years while the existing plant on Deephams Sewage Works was upgraded. The capital cost of the temporary plant and transfer system would then have to be written off, so this option would not represent good value to our customers.

3.3.4 The following sections describe the range of options that have been developed in relation to the strategies above, and why in some cases they are considered to be impracticable and thus have been rejected from further consideration. A summary of those options considered viable and which have been taken forward for further investigation is given in Section 8.

4 Strategy 1: Reduce or remove incoming flows to Deephams Sewage Works

4.1 Section objectives

4.1.1 This section discusses potential opportunities to reduce or remove enough of the incoming sewage flow to Deephams Sewage Works to allow each of the existing treatment streams to be taken out of use in turn, while they are upgraded to meet new effluent quality standards. Because each of the three treatment streams treats up to a third of the flow, any strategic options for taking one stream out of operation for upgrading would need to provide a treatment capacity equivalent to one third of the future flow, i.e.166Ml/d. The strategic options would need to achieve this reduction before the first treatment stream could be taken out of use, which would be within the next few years.

4.1.2 Four options have been identified under this strategy, as follows:

- Strategy 1A: Reduce flows at source
- Strategy 1B: Transfer Deephams flows by pipeline to another existing sewage works
- Strategy 1C: Split Deephams catchment and transfer flows from part of the catchment to another existing sewage works
- Strategy 1D: Split Deephams catchment and transfer flows from part of the catchment to a new sewage works.

4.1.3 Each of these options are discussed in turn below.

4.2 Strategy 1A: Reduce flows at source

Introduction

4.2.1 This section describes potential ways to reduce the amount of sewage flowing into Deephams Sewage Works in order to create 166Ml/d of surplus treatment capacity in the existing works. This would allow the existing treatment streams to be refurbished or demolished and reconstructed in turn, while maintaining treatment of the reduced flows to the works.

Water efficiency and metering

4.2.2 Measures to reduce the demand for water (and hence the amount of sewage arising) are set out in our Water Resources Management Plan 2012. We predict that the water efficiency measures for which Ofwat has funded us will reduce demand over the period 2010-2015 by a rolling average of 5Ml/d, while metering is expected to reduce demand by 2.5Ml/d per year. As these figures are for London as a whole, and Deephams Sewage Works is one of several major works that treat London's sewage, the effect on flows to the works arising from currently planned measures would be very small compared to the reduction needed of 166Ml/d. We are proposing to introduce universal metering in the future but this would not be implemented within the timescales required for the Deephams Sewage Works upgrade.

4.2.3 We do not therefore consider that there is any realistic potential for further significant flow reductions arising from more intensive water efficiency or metering programmes at present, beyond those which are already assumed in future flow projections.

Sustainable Drainage Systems (SuDS)

4.2.4 Under the Flood and Water Management Act 2010, developers and local planning authorities are required to install sustainable urban drainage systems (SuDS) in order to reduce the volume of rainwater that runs off hard surfaces and enters the sewerage system. While modern drainage systems have separate collection systems for foul sewage and for rainwater, many existing systems collect both in combined sewers, thus sewage works have to cope with storm flows as well as the normal baseload of wastewater.

4.2.5 Removing rainwater from the system can reduce the flows that sewage works receive and reduce the carbon emissions associated with pumping and treating these additional flows[1]. Whilst rainwater removal can be designed into new developments, retrofitting separate systems in existing urban areas is difficult and extremely expensive. We are currently undertaking trials on retrofitting SuDS in combined sewer catchments, such as Counters Creek in the London Boroughs of Hammersmith and Fulham and Kensington and Chelsea, to assess their potential for reducing flows to the foul sewerage system. The use of SuDS in the Counters Creek catchment will be beneficial, but it is not expected to avoid the need for upgrading the local sewerage networks.

4.2.6 Drainage within the Deephams catchment is generally separate rather than combined, but rainwater connections to the foul sewers do exist in some older parts of the catchment. In comparison to Counters Creek, separating out rainwater would be potentially more difficult because it would involve works in many very small areas. A combination of lots of these small improvements would be needed to have any significant effect, and because they would only occur in part of the catchment, they would not reduce flows to Deephams Sewage Works by 166Ml/d.

[1] The carbon emissions from treatment of sewage at Deephams Sewage Works is approximately 180kg carbon dioxide equivalent (CO_2e) per megalitre (1000m3) of sewage (equivalent to 16,000 tonnes CO_2e a year) based on electrical power consumption.

4.2.7 In addition to retrofitting SuDS on the existing drainage system, SuDS are also required for most new developments. However, the responsibility for implementing them for new developments in the Deephams catchment lies with a variety of bodies, and is not under our direct control. Developing the necessary partnerships to secure the delivery of SuDS on a large enough scale to reduce flows to Deephams Sewage Works within the timescale of the upgrade is not considered to be realistic. While we are committed to the use of SuDS and will continue to work towards their implementation, in this case they cannot be relied upon as a sole solution.

Conclusions

4.2.8 Water efficiency, metering and SuDS are already and will continue to be implemented within the catchment, which will help to reduce the amount of sewage arriving at Deephams Sewage Works. However, these measures will not make a big enough reduction in wastewater/sewage flows in the next few years to permit one of the treatment streams at Deephams to be taken out of commission while it is upgraded.

4.2.9 It is also important to note that savings from water efficiency and metering (described in paragraph 4.2.2 – 4.2.3 above) are already taken into account in predicting the future flows to Deephams Sewage Works. SuDS would have to be implemented on a very large scale before part of the existing sewage works could be taken out of service for upgrading, but this is not practicable or likely within the timescales for the upgrade. Furthermore, while these measures will reduce the volume of sewage, it will still contain largely the same polluting load which will need to be treated.

4.2.10 They have therefore been discounted from further assessment within this study.

4.3 Strategy 1B: Transfer Deephams flows by pipeline to another sewage works

Introduction

4.3.1 This section describes potential ways to remove sewage from Deephams Sewage Works by transferring some of the flows from the works to another of our large sewage works in London. As for Strategy 1A, this would create surplus treatment capacity in the existing works and allow the existing treatment streams to be refurbished or demolished and reconstructed in turn, while maintaining treatment of the reduced flow.

Rye Meads Sewage Works

4.3.2 A 600mm diameter rising main runs north from Dundee Way Pumping Station (which intercepts the flow in a trunk sewer approximately 3km north of Deephams Sewage Works) to Rye Meads Sewage Works. This pipeline was designed for a 25Ml/d raw sewage transfer to Rye Meads Sewage Works, so that the treated effluent could be discharged further up the River Lee in the event of a drought.

4.3.3 Whilst it would be technically possible to use this pipeline to transfer raw sewage to Rye Meads for treatment while the existing plant at Deephams was upgraded, the existing pipeline is only designed to carry 25Ml/d. As noted above, in order to replace one of the three treatment streams at Deephams, it would be necessary to transfer 33% of the future flow, 166Ml/d, therefore the existing pipeline would not provide sufficient capacity. A new 1.35m diameter pipeline in a tunnel would therefore have to be built for a 166Ml/d transfer, with additional pipelines to return sludge back to Deephams Sewage Works for treatment and the treated effluent back to the Salmon's Brook for discharge.

4.3.4 There would be insufficient capacity at Rye Meads Sewage Works to treat this additional flow, as it is less than half the size of Deephams Sewage Works. A new treatment plant would therefore need to be constructed, designed to meet the new Deephams Sewage Works consent.

4.3.5 The cost of constructing pipelines and a pumping station for transfer of flows to Rye Meads and the return of treated effluent and sludge to Deephams Sewage Works is estimated to range from £220-600M for partially and fully tunnelled solutions, with a further estimated £100M for construction of new plant at Rye Meads. The need to pump sewage approximately 20km from the Deephams catchment to Rye Meads Sewage Works and back again would also be very energy intensive and result in very high carbon emissions, estimated as 550,000 tonnes carbon dioxide equivalent (CO_2e) over the lifetime of the scheme[2].

Beckton Sewage Works

4.3.6 A 300mm diameter sludge main runs south from Deephams Sewage Works to Beckton Sewage Works. The capacity of this pipeline is far too small to take 166Ml/d from Deephams Sewage Works, and parts of it have been leased out for other uses. Whilst leases could be revisited, the existing pipeline is too small to be of benefit to the Deephams upgrade scheme. A new 18km pipeline (1.35m in diameter) would therefore need to be built within a tunnel, with additional pipelines to return sludge back to Deephams Sewage Works for treatment and the treated effluent back to the Salmon's Brook for discharge. The cost of a tunnelled option with pumping stations is estimated as £600M. Whole life carbon emissions for the transfer are estimated at 490,000 tonnes CO_2e. Some cost and carbon saving might be possible if the flows from Deephams Sewage Works could be discharged to the Northern Outfall Sewer at Abbey Mills Pumping Station, and transferred onwards to Beckton Sewage Works.

4.3.7 Beckton Sewage Works is currently undergoing an upgrade to provide additional treatment capacity and to accommodate the Lee Tunnel works. Following completion of those works, Beckton Sewage Works will temporarily have spare capacity available (as the growth for which the update is intended will not yet have occurred), but this additional capacity is only estimated to be 47Ml/d compared to the 166Ml/d required for the Deephams Sewage Works transfer.

4.3.8 Beckton Sewage Works also has less stringent effluent quality requirements; the extended plant will have consent limits of 45mg/l suspended solids, 18mg/l BOD and 2.5-5mg/l ammonia (as 95 percentile values). This would not meet the Deephams Sewage Works future limit of 30mg/l suspended solids, 10mg/l BOD, 1 mg/l ammonia and 1mg/l total phosphorus.

4.3.9 Additional plant would therefore need to be built at Beckton Sewage Works to achieve this higher consent standard for the effluent to be returned to the Salmon's Brook, but space is currently too limited. Using the available capacity for treating Deephams sewage would also reduce Beckton Sewage Works' ability to treat storm flow events, and hence increase the frequency of storm overflows which can affect water quality in the Thames Tideway.

[2] Indicative whole life carbon estimate includes carbon embodied in the tunnel structure plus carbon from power used to pump sewage/treated effluent, over a 40 year scheme lifetime.

Conclusions

4.3.10 Both the potential transfers to Rye Meads Sewage Works and Beckton Sewage Works would require construction of new pipelines because the existing pipelines are too small to take the volume of flow needed. Additional pipelines would also be needed to return the treated effluent to the Salmon's Brook and sludge for treatment at Deephams Sewage Works.

4.3.11 Construction of these pipelines would be very costly and would give rise to significant temporary environmental impacts. These options would also have very high energy use and associated carbon emissions for pumping sewage to Rye Meads Sewage Works or Beckton Sewage Works and treated effluent back to Deephams Sewage Works for discharge to the Salmon's Brook.

4.3.12 The second option to construct a pipeline to Beckton Sewage Works is also constrained by lack of available space for additional treatment plant at Beckton Sewage Works that would be needed to treat the sewage to meet the Deephams effluent quality requirements.

4.3.13 Both options have been discounted on these grounds.

4.4 Strategy 1C: Split Deephams catchment and transfer flows from part of the catchment to another sewage works

Introduction

4.4.1 Similarly to Strategy 1B above, this section describes potential ways to remove sewage from Deephams Sewage Works, but by transferring some of the flows from outlying parts of the sewage catchment. The sewage would be transferred to another of our large sewage works in London. As for Strategy 1A and 1B, this would create surplus treatment capacity in the existing works and allow the existing treatment streams to be upgraded or demolished and reconstructed in turn, while maintaining treatment of the reduced flow.

Beckton Sewage Works

4.4.2 Part of the catchment/sewerage network to the south-west of Deephams Sewage Works, called the Markfield Road catchment (see Figure 4), could be diverted either by gravity or pumping to Beckton Sewage Works or the Lee Tunnel. The Lee Tunnel is part of the Tideway scheme and transfers flows from Abbey Mills Pumping Station to Beckton Sewage Works for treatment.

4.4.3 Whilst this could remove 27.5Ml/d from the Deephams catchment and hence Deephams Sewage Works, it is far short of the 166Ml/d required to divert one of the three treatment streams. As discussed above, there are also constraints on treating Deephams Sewage Works flows at Beckton Sewage Works.

Mogden Sewage Works

4.4.4 In the far south-west part of the Deephams catchment, flows could be diverted from Broughton Avenue Pumping Station to the Mogden Sewage Works catchment (see Figure 4). This would only remove 4.5Ml/d from Deephams which is far less than the 166Ml/d required.

4.4.5 Significant upgrades of the receiving sewers and a treated effluent return pipeline to the consented discharge point in the Salmon's Brook would be required. Mogden Sewage Works is currently being upgraded and has a planning condition imposed on its permission that would prevent any transfers of flows into it from outside the catchment, such as from Deephams Sewage Works[3].

Conclusions

4.4.6 Neither of the options above would remove sufficient flow from Deephams Sewage Works to be of benefit to the upgrade scheme. Space constraints on new treatment plant at Beckton Sewage Works and planning conditions at Mogden Sewage Works also mean that the options would not be able to implemented.

4.4.7 The options have thus been discounted.

4.5 Strategy 1D: Split Deephams catchment and transfer flows from part of the catchment to a new sewage works

Introduction

4.5.1 This section considers various options for intercepting a volume of sewage that allows for a stream on the existing Deephams site to be decommissioned and upgraded or rebuilt without detriment to the total existing handled flow. Currently flows to Deephams Sewage Works would need to be diverted to a new sewage works constructed elsewhere for treatment. Pipelines would need to be built from the new sewage works back to Deephams Sewage Works to return the sludge for treatment and the treated effluent to the Salmon's Brook.

Northern catchment split

4.5.2 To the north of Deephams Sewage Works, 24Ml/d of flows could be diverted from the Cuffley Road catchment and the Lee Valley Low Level catchment (see Figure 4) by gravity to a new sewage works built adjacent to the M25. As stated above, pipelines would need to be built from the new sewage works back to Deephams Sewage Works to return the sludge for treatment and the treated effluent to the Salmon's Brook.

4.5.3 Subject to finding suitable sites for a treatment works near the M25, this option is feasible, but it would result in the existing raw sewage transfer main from Dundee Way Pumping Station to Rye Meads Sewage Works being unable to be used to provide additional water resources in time of drought (described in paragraph 4.3.2-4.3.5). This is because there would be insufficient flow passing through Dundee Way Pumping Station to deliver a flow of 25Ml/d to Rye Meads Sewage Works after the catchments above had been diverted to discharge to another sewage works near the M25. As options are needed to maintain supplies to customers during prolonged periods without rainfall, that option must be maintained and hence the northern catchment split solution is not favoured.

[3] Condition 31 under which waste water cannot be diverted to Mogden Sewage Works from another Sewage Works (other than in an emergency) without prior permission from the Local Planning Authority to vary or remove the condition.

Western catchment split and trunk sewer interception

4.5.4 Three large trunk mains feed raw sewage into Deephams Sewage Works; the Lee Valley Sewer from the north; the Barnet High Level Sewer from the west and Tottenham Low Level Sewer from the south.

4.5.5 Network modelling indicates that approximately 30% of the Deephams Sewage Works flow could be intercepted in the Palmers Green area from the Barnet High Level Trunk Main Sewer. It would therefore be possible intercept the trunk main and divert 30% of the untreated sewage that normally enters Deephams Sewage Works from the west to a new sewage works. This would require constructing an interception shaft on the trunk sewer in Palmers Green, constructing a pumping station and pipeline to the new site, and building a new inlet works and primary, secondary and possibly tertiary treatment plant at a new sewage works site. Pipelines would also need to be built from the new sewage works back to Deephams Sewage Works to return the sludge for treatment and the treated effluent to the Salmon's Brook.

4.5.6 Palmers Green is a residential area comprising housing, shops and open space (parks), which is not suitable for locating a new sewage works. A suitable site would therefore need to be identified elsewhere. Construction of an interception shaft and pumping station in this residential area and laying pipelines to connect the shaft to the new sewage works could be potentially very disruptive and likely to cause significant impacts to residents.

4.5.7 Intercepting the trunk sewer before it entered Deephams Sewage Works would mean that a new inlet works would need to be built, rather than using the existing inlet works at Deephams Sewage Works, which would duplicate existing plant and incur additional cost.

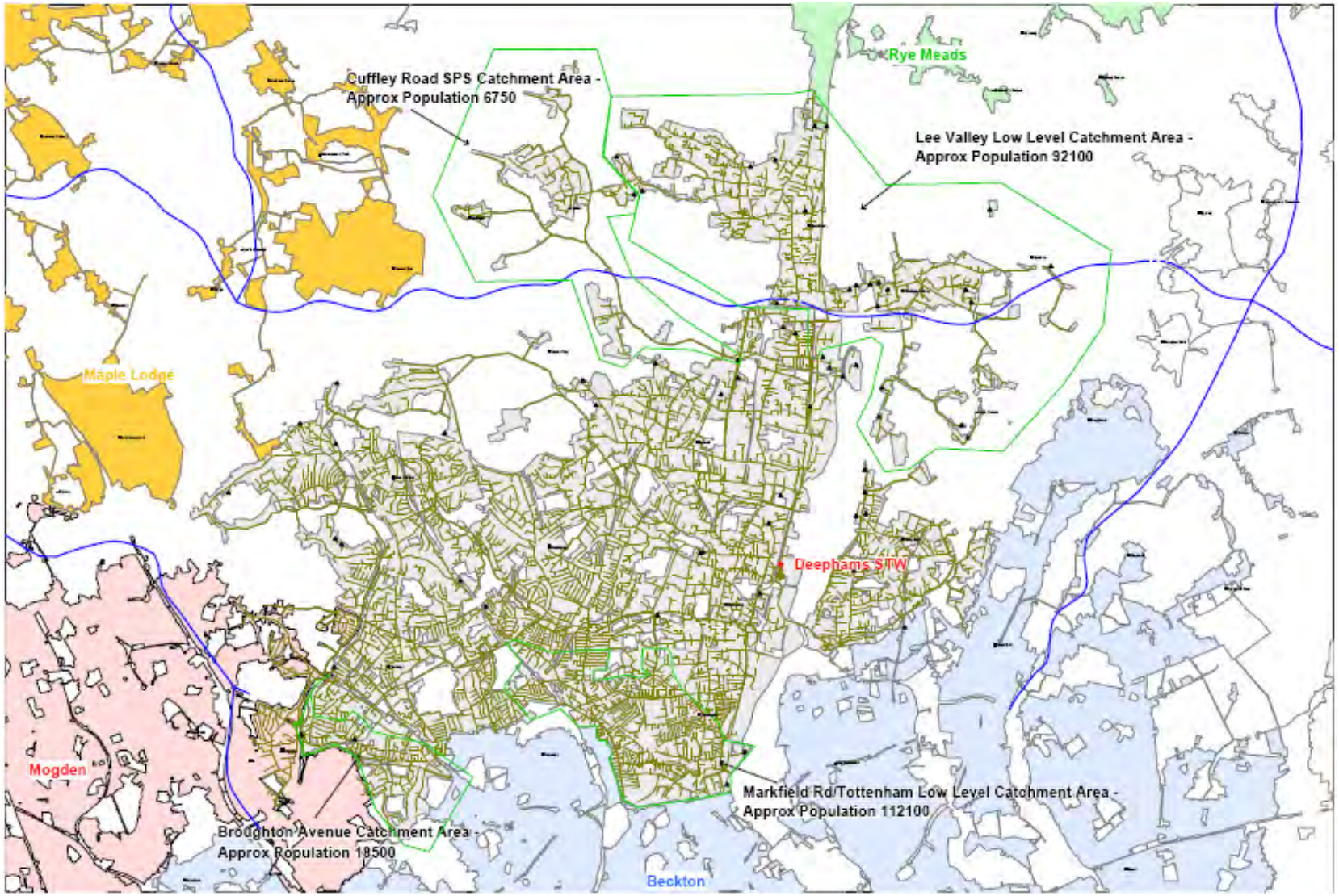
Conclusions

4.5.8 In order to allow one of the three existing treatment streams at Deephams Sewage Works to be taken out of service at a time and an upgraded replacement stream built in its place, any new option would need to treat 33% of the future design flow of 497Ml/d, which equates to 166Ml/d. The northern catchment spilt of 24Ml/d would not remove sufficient flow from Deephams Sewage Works to allow a treatment stream to be upgraded, hence this option has been discounted.

4.5.9 Intercepting the trunk sewer before it reaches Deephams Sewage Works to divert 30% of the incoming flow could adversely affect residents in Palmers Green and would incur cost due to the need to build an interception shaft, pumping station, pipeline and a new inlet works, as well as primary, secondary and possibly tertiary treatment plant. It would be more sensible to continue to use the existing inlet works at Deephams and to remove flows for treatment elsewhere at that point (rather than before they have reached Deephams), because this would avoid the cost of a shaft and new inlet works, and the impact on residents of construction works in Palmers Green.

4.5.10 The option of intercepting the trunk sewer serving the western catchment has thus not been considered further.

Figure 4: Areas of Deephams Sewage Works catchment potentially available for transfer of flows



5 Strategy 2: Combined options from Strategy 1 to reduce or remove incoming flow to Deephams Sewage Works

5.1 Section objectives

5.1.1 This section reviews the combination of a number of options described above that are too small on their own but which could form part of a joint solution.

5.2 Transfers and ccatchment splits

5.2.1 Whilst individually a number of the options identified in the previous section are too small to be of benefit, and have other potential constraints on their use as explained in the previous sections of this report, there is a potential option of using combinations of the following:

- Strategy 1C: transfer of Markfield Road catchment to Beckton Sewage Works (27.5Ml/d) requiring new pipelines and possibly additional treatment plant at Beckton Sewage Works;
- Strategy 1D: catchment splits

  - northern catchment split to a new sewage works near the M25 (24Ml/d) requiring new pipelines and new treatment plant;

  - western catchment split and trunk sewer interception in Palmers Green area to a new sewage works (approximately 135Ml/d) requiring new interception shaft, pumping station, pipelines, inlet works and treatment plant.

5.2.2 Using the transfer to Beckton Sewage Works (Strategy 1C) and the northern catchment split from Strategy 1D would provide a total of approximately 52Ml/d of transferred flows, which is less than the 166Ml/d needed.

5.2.3 The combined option would therefore need to include the western catchment split and trunk sewer interception in Palmers Green from Strategy 1D to ensure that sufficient flow (166Ml/d) could be removed from Deephams Sewage Works to allow the existing treatment streams to be upgraded in turn.

5.2.4 Both the catchment split options in Strategy 1D would require the possible purchase of a suitable site or sites for construction of a new sewage works. All of the options would require new infrastructure, including a pipeline to return the treated flows back to Deephams Sewage Works for discharge to the Salmon's Brook.

5.3 Conclusions

5.3.1 The cost and potential cumulative disruption of implementing several smaller options, each requiring relatively long pipelines and/or site acquisition and construction of new treatment plant in urban areas, would outweigh that of a single larger option that would benefit from economy of scale. Pipeline costs for options discussed under Strategy 1B are typically of the order of £30M per km for tunnels and £19M per km for cut and cover pipelines, so a combined option with multiple pipelines, together with possible land purchase, would be very expensive.

5.3.2 The combined option would need to include the western catchment split in Palmers Green (Strategy 1D), would be more costly and disruptive to implement than removing flows directly from Deephams Sewage Works due to the need to build an interception shaft and pumping station in a residential area, as well as a new inlet works.

5.3.3 The combined option has therefore not been considered further.

6 Strategy 3: Build part of a new sewage works on another site

6.1 Section objectives

6.1.1 This section describes a strategy where part of the sewage treatment works would be rebuilt on another site. The new plant would be designed to take the future design flow and to deliver an effluent quality which complies with the new discharge consent. Because of the need to transfer flows between the two sites (to return flows to the consented discharge point on the Salmon's Brook), it would be preferable if they were adjacent or close to each other. This would make future operation easier, and minimise the costs, community disruption, energy use and carbon emissions associated with pumping between the two sites.

6.2 New treatment plant off-site

6.2.1 The flow from the inlet works at Deephams Sewage Works could be transferred by pipeline to another site for primary, secondary and tertiary treatment. Potential sites could include land to the south of William Girling Reservoir (the Lower Hall site) which we own; the leisure park and golf course to the immediate north of Deephams Sewage Works (identified in the National Policy Statement for Waste Water (NPS)); industrial land to the south (also identified in the NPS), or other sites in proximity to the existing works. The choice of site would be constrained by the need to return flows to the Salmon's Brook for discharge and to return sludge from the sewage treatment plant to Deephams for treatment.

6.2.2 Potential sites for new sewage treatment plant could also include the use of our raw water storage reservoirs adjacent to Deephams Sewage Works. In the event that one of the Lee Valley Reservoirs was to be decommissioned, new treatment plant could be located within the footprint. However, none of these reservoirs will be surplus to requirements in the next 25 years, and the King George V, Lockwood and William Girling reservoirs are to receive significant investment for future use. Placing sewage treatment plant on decking above one of the reservoirs could be considered as an innovative use of existing assets, but would result in an unacceptable risk to water quality for our customers, because there could be a risk of sewage leaking from the works into the reservoir. As the plant would be elevated above the level of the reservoir, it could also have a number of adverse environmental effects on conservation, landscape and visual amenity in particular.

6.3 Conclusions

6.3.1 Subject to finding suitable sites, and excluding the use of the Lee Valley Reservoirs, the strategy of transferring flow from Deephams Sewage Works to new primary, secondary and tertiary treatment plant located on another site is considered feasible. This option has thus been investigated further, as reported in the separate "Site assessment stage 2a report".

7 Strategy 4: Construct on Deephams Sewage Works

7.1 Section objectives

7.1.1 This section describes the option of reconfiguring part of the existing Deephams site to permit construction of a new plant to treat part of the flow, while the existing primary and secondary treatment plant is either refurbished or demolished and rebuilt in phases.

7.2 Redevelopment on-site

7.2.1 The existing inlet works, storm tanks and sludge treatment plant would be retained, while the existing primary and secondary treatment plant was upgraded or replaced and the new tertiary treatment plant was extended or upgraded. One approach would be to take sets of primary settlement, activated sludge and final settlement tanks in a treatment stream (shown in Figure 2) out of service and to rebuild them one set at a time. This sequential replacement of each element of the primary and secondary plant, while also maintaining full treatment, could take up to 12 years, which would substantially delay the achievement of the higher discharge consent standard.

7.2.2 Alternatively, part of the site could be reconfigured to permit construction of a new treatment stream using innovative technology to treat a third of the flow to the new discharge consent standard. Once that new stream was commissioned, the remaining existing treatment infrastructure could be upgraded stream by stream to meet the new standard. The site of the redundant sludge digestion plant in the north west of the Deephams site is an area that could be considered for this purpose, together with any other areas of land that can be made available within the sewage works – e.g. through relocation of administrative or office accommodation. Even if all potentially available land on site is used, in order to facilitate this option it may still be necessary to find additional adjacent land for temporary use as contractors compounds and for temporary storage of construction materials, as these areas may not be able to be accommodated within the works boundary.

7.3 Conclusions

7.3.1 As there are some areas of the existing site which are currently not in use and could be redeveloped, this option is considered feasible in principle and has been investigated further in the separate “Site assessment stage 2a report”.

8 Conclusions

8.1 Overall conclusions

8.1.1 A number of strategic options to meeting the new discharge consent for Deephams Sewage Works have been considered. A summary of the conclusions is set out in Table 2 below.

Table 2: Conclusions of strategic options review

Strategy	Option	Conclusions	Outcome
Strategy 1: reduce or remove enough of the incoming flow to Deephams Sewage Works to permit each of the existing three treatment streams to be turned off and upgraded in turn	A. Reduce flows at source by: - water efficiency and metering -Sustainable Drainage Systems (SuDS)	Effect on flows to Deephams Sewage Works from these measures would be very small.	Discounted
	B. Transfer Deephams flows by pipeline to another existing sewage works (Rye Meads or Beckton Sewage Works)	Capacity of existing pipeline is too small. Other treatment works have insufficient capacity. High energy costs and carbon impacts.	Discounted
	C. Split Deephams catchment and transfer flows from part of the catchment to another existing sewage works (Beckton or Mogden Sewage Works)	Transfer flows would be too small,. Other treatment works have insufficient capacity.	Discounted
	D. Split Deephams catchment and transfer flows from part of the catchment to a new sewage works (near the M25, or in the Palmers Green area)	Northern catchment spit too small, Barnet catchment split would duplicate plant, and have high construction impacts in a residential area.	Discounted
Strategy 2: combine various options from Strategy 1 to reduce or remove incoming flow to Deephams Sewage Works	A combination of transfers to other existing or new sewage works	Combined cost and impact would exceed that of a single option	Discounted
Strategy 3: build part of a new sewage works on another site and transfer flows between the new plant and the existing Deephams Sewage Works for treatment	Transfer flows by pipeline from Deephams to a treatment plant (i.e. part of a new sewage works) off-site	Potentially feasible option	Taken forward for further consideration
Strategy 4: construct on Deephams Sewage Works	Reconfigure part of the existing Deephams Sewage Works site to permit construction of a new plant to treat part of the flow, allowing the remaining existing plant to be upgraded	Potentially feasible option	Taken forward for further consideration

8.1.2 Following a review of strategic options for upgrading Deephams Sewage Works to meet new effluent consent limits, it is concluded that the most viable options are either:

- to build part of a new sewage works on another site and transfer flow between the new plant and the existing Deephams Sewage Works for treatment (Strategy 3), or
- to construct new treatment streams on the existing Deephams Sewage Works site to allow the three treatment streams at Deephams Sewage Works to be upgraded in turn (Strategy 4).

9 Next steps

9.1.1 The two viable strategic options identified above are taken forward for further assessment.

9.1.2 Stage 2a of the assessment methodology will identify and assess potential sites for delivering the upgrade, including the existing Deephams Sewage Works site and other potential sites.

9.1.3 The conclusions of the site assessment work are reported separately in the “Site assessment stage 2a report”, and “Identification of preferred site stage 3 report”.