

## Twelve ♦ Underground flow transfer infrastructure

### INTRODUCTION

#### The proposed development in overview

12.1 The route taken by the underground flow transfer infrastructure is shown in figure 12.1. The route begins in the west at the flow interception point at Black Rock where a new underground chamber would be constructed. From here the underground tunnel would run eastward at deep level through a new chamber at Marine Gate to a new pumping station, Marine Drive pumping station. From this pumping station the tunnel would continue eastwards at a higher level, falling towards the Portobello site where a new pumping station would be constructed. The tunnel would closely follow the route of the A259 Marine Drive. Along this length of tunnel new chambers would be constructed to intercept the existing sewerage at Roedean, Ovingdean, Rottingdean, Saltdean and Saltdean East.

12.2 The flow would be lifted to a higher-level tunnel at the proposed Portobello pumping station, and will then flow once more under the influence of gravity towards the wastewater treatment works site. This tunnel would take a direct route to the treatment works beneath Peacehaven and as a result pass under residential and other properties. A chamber would be provided at the Meridian Centre car park in order to facilitate construction. At the treatment works a third pumping station would be constructed to lift flows from treatment into the works.

12.3 A further tunnel would be constructed from the treatment works to the long sea outfall at Friars Bay. This would convey the treated effluent for discharge to the sea. Southern Water has already secured the consents to build and operate the

#### Site-specific development plan policy

12.4 There is no development plan policy specifically addressing underground infrastructure provision.

### DESIGN EVOLUTION

#### Tunnel route constraints and parameters

12.5 The route of the underground flow transfer infrastructure has to work within the following parameters:

- the required start and finish points for the new sewerage, namely the interception point at Black Rock to the wastewater treatment works and from the treatment works to a new long sea outfall;

- The location of existing infrastructure, particularly local sewerage networks requiring interception to enable the wastewater to be diverted to the new treatment works;
- hydraulic design and consent requirements.

12.6 The downland topography features deep valleys intersecting the potential transfer corridors, generally inhibiting the possibility of open cut tunnel construction, particularly for the longer routes where frequent intermediate pumping would be required in the valleys to lift the flow over the ridges. Tunnelled construction has therefore been chosen to limit the number of intermediate pumping stations required.

### **Wastewater flow transfer route options**

12.7 Two principal route options were considered for the required tunnel between Black Rock and the proposed wastewater treatment works at Peacehaven:

- A. a southern route generally following the A259 coastal road from Black Rock to Peacehaven;
- B. a more northerly, inland route skirting to the north of Ovingdean, Saltdean and Peacehaven and generally avoiding developed areas.

#### *Option A: southern route*

12.8 The southerly coastal route was found to offer the following advantages:

- it is more direct and therefore shorter;
- because it is routed along a trunk road, the alignment benefits from good access to tunnel access shafts and work sites;
- it facilitates the interception of existing sewerage networks serving Roedean, Woodingdean, Rottingdean and Saltdean, which gravitate downhill towards the coast.

12.9 The disadvantages of option A are as follows:

- where it passes through the built-up areas of Rottingdean, Saltdean and Peacehaven, the route corridor is narrow and, in some cases, winding. As a result the tunnel route is forced under existing buildings, most notably in the Peacehaven area;
- the route is close to the existing coastal interceptor sewer in both alignment and level;
- the depth of some of the transecting valleys as they approach the coast, especially the Rottingdean valley, is such that they tend to force the level of the transfer tunnel down deeper to maintain minimum ground cover;

- the route is closer to coastal cliffs.

*Option B: northern route*

12.10 The northerly inland route option has the following advantages:

- it avoids developed areas and is also well away from the existing interceptor sewer and other underground utilities;
- the topography is less constraining on the vertical profile of the tunnel route.

12.11 The main disadvantages of the inland route are:

- it is longer;
- the generally higher ground levels along the route mean that the depth of the tunnel below ground is generally greater, and it is not always possible to locate access shafts at low points;
- there is a lack of established access to the tunnel access shafts and associated construction work sites, and some of these would be within the Sussex Downs AONB;
- substantial additional sewerage infrastructure would be required to transfer flow from interception points in Roedean, Woodingdean, Rottingdean and Saltdean to the main transfer tunnel.
- the route passes through a groundwater protection zone in some sections.

### **Treated effluent disposal options**

12.12 A range of treated effluent disposal options was considered during the design development of the project, including new outfall locations in several positions between Portslade in the west and Friar's Bay in the east; the re-use of the Portobello outfall, and effluent re-use for other purposes. Neither the re-use of the Portobello outfall nor reliance on effluent re-use were considered appropriate and, given the preferred location of the treatment works at Peacehaven, nearby Friars Bay was identified as the optimum location for a new long sea outfall.

### **Consultations**

12.13 Route options for the flow transfer infrastructure were presented at the consultation events described in chapter three of this design and access statement. The consultation exercise indicated a preference for a tunnel route that:

- minimised the need for above-ground disturbance;
- did not compromise the structural integrity of the cliffs;
- minimised the risk of settlement in buildings.

These principles have been taken into account and would be accorded with in the proposed development.

### Option selection and design rationale

12.14 On the basis of the identified operational requirements, assessment of tunnel route options and the feedback from public consultations, Southern Water chose the southern, coastal route (option A). The route is direct and thus relatively short, and would thus require only two pumping stations. It would facilitate the interception of local sewerage networks at their low points close to the existing tunnel. By following the general route of the A259 Marine Drive / South Coast Road, the tunnel could be constructed under an undeveloped corridor, minimising the need to pass under buildings and far enough inland to avoid compromise to the structural integrity of the cliffs. Furthermore, the A259 offers road verges into which tunnel shafts can be constructed without disruption to road traffic.

## DESIGN OF THE FLOW TRANSFER SYSTEM

### Design principles and objectives

12.15 The design principles and objectives can be summarised as follows:

- to connect the required start and finish points for the new sewerage, namely the interception point at Black Rock to the wastewater treatment works and from the treatment works to the long sea outfall;
- to intercept local sewerage systems and provide storm overflow to the Portobello headworks and LSO;
- to achieve a robust hydraulic design that meets discharge consent requirements are met;
- to achieve appropriate ground cover for tunnel construction, taking into account likely geotechnical conditions and the potential effects on existing structures;
- to provide appropriate construction and operational access;
- to ensure that the tunnel is above groundwater level where practicable to improve tunnel constructability and spoil disposal and to reduce the risk of future infiltration to the tunnel;
- to align the tunnel beneath public roads as far as practicable and minimise tunnelling below buildings in poor ground or at shallow depth;
- to provide a design solution that can be constructed within the technical and health and safety constraints of available tunnelling constraints;
- to minimise environmental and community impacts as far as practicable.

## Layout, amount and scale

12.16 The principal components of the flow transfer infrastructure are shown in figure 12.1. The proposed development is located partly in the Brighton and Hove and partly in East Sussex. Although Brighton and Hove City Council has already granted planning permission for those elements of the project within its jurisdiction, the whole flow transfer system will be described here in the interest of completeness.

12.17 Within Brighton and Hove, the proposals incorporate the following elements.

- An underground shaft for the interception of wastewater flow from the existing interceptor sewer at the Black Rock penstock chamber on the platform at the foot of the chalk cliff adjacent to the ASDA supermarket car park, at the west end of Brighton Marina. The design quantity of wastewater intercepted would be equivalent to the flow to full treatment (FFT) for the upstream catchment (i.e. 2,143 litres per second [l/s]).
- A gravity flow wastewater tunnel approximately 690 metres long with an internal diameter of 1.8 metres at depths of between 10 to 39 metres below ground for transfer of intercepted wastewater at a maximum flow of 2,143 l/s. This stretch of tunnel will run from the interception point via the Marine Gate driveshaft to the Marine Drive pumping station located in a traffic island on the A259 near Roedean Café.
- Marine Drive pumping station at Roedean, which will incorporate three duty and one standby fixed speed pumps with a nominal capacity of 2,143 l/s and static head of approximately 18 metres to lift intercepted wastewater to the start of a gravity flow sewer tunnel to Portobello (below).
- A gravity flow wastewater transfer tunnel approximately 5.4 km long from the Marine Drive pumping station to the Portobello pumping station. This tunnel will have an internal diameter of 2.4 metres and will be constructed at a depth to tunnel crown of between 6.5 and 45 metres below ground, the range reflecting the varied downland terrain along this stretch of the coast. The tunnel would incorporate five intermediate access/interception shafts at Roedean Way, Ovingdean, Rottingdean, Saltdean and Saltdean East. (For the avoidance of doubt, the easternmost section of this tunnel, along with the Saltdean east shaft, lie with East Sussex and are thus included within the current planning application).
- Facilities for the interception of all wastewater flows from the drainage sub-catchments of Roedean, Ovingdean, Woodingdean, Rottingdean and Saltdean and for diversion of intercepted flow to the wastewater transfer tunnel from the Marine Drive pumping station to Portobello at the intermediate shaft locations.

12.18 In East Sussex, Southern Water proposes to build the following flow transfer infrastructure, all of which is included in the current planning application with the exception of the Friar's Bay long sea outfall where it extends beyond the mean low water mark.

- Facilities for the interception of all wastewater flows from the drainage sub-catchments of Saltdean East and for diversion of intercepted flow to the wastewater transfer tunnel from Marine Drive pumping station to Portobello at the intermediate shaft location.
- Portobello pumping station, with three duty and one standby fixed speed pumps with a nominal capacity of 2,360 l/s and static head of approximately 15 metres to lift wastewater arriving in the transfer tunnel to the start of a gravity flow sewer tunnel to the proposed Peacehaven wastewater treatment works.
- A combined sewer overflow and emergency outfall weir immediately upstream of the Portobello pumping station to allow wastewater flows in excess of the defined flow to full treatment (FFT) to be discharged to Portobello Headworks via a short 1.8 metre diameter connecting tunnel to the old interceptor sewer immediately upstream of an existing penstock chamber at Portobello.
- Infrastructure at Portobello pumping station for the interception, control and diversion of wastewater flows from the Peacehaven drainage sub-catchment to the main wastewater transfer stream, and for the diversion of excess flow to the upstream of the overflow weir.
- A gravity flow wastewater transfer tunnel approximately 2.7 km long from Portobello pumping station to the treatment works inlet pumping station. This tunnel would have an internal diameter of 2.4 metres at depths from about 8.5 to 33 metres below ground. The tunnel would include one intermediate shaft provided for access, at the Meridian Centre car park.
- The treatment works inlet pumping station, including three duty and one standby variable speed pumps with a nominal capacity of 2,525 l/s and a static head of 25 metres to lift wastewater arriving in the transfer tunnel from the Portobello pumping station to the inlet of the Peacehaven wastewater treatment works.
- A gravity flow treated effluent transfer tunnel approximately 1.1 km long, running from the outlet of Peacehaven wastewater treatment works to the head chamber of a new long sea outfall at Friars Bay. This tunnel would have an internal diameter of 2.4 metres and would run at depths between 10 and 39 metres below ground.
- A long sea outfall for the discharge of treated effluent to the sea at Friar's Bay. The LSO would comprise two separate sections – a 1.8 metres internal diameter inshore tunnelled section approximately 775 metres long running from the Friar's Bay head chamber shaft to an offshore reception pit, and an offshore section of pipe 1.29 metres in internal diameter pipe, laid in a dredged trench approximately 2.1 km long, with a 200 m tapering diffuser section at the end. The inshore tunnelled section would include an

intermediate shaft near the shoreline on the undercliff promenade.

### **Design and appearance of surface level elements**

12.19 The proposed design and appearance of surface level elements of those parts of the flow transfer system within East Sussex is as follows.

#### *Saltdean East shaft*

12.20 Two new underground chambers would be constructed, as shown in planning drawing RS-019. Following completion of construction the only visible surface level elements would be new cast iron manhole covers. The interception point manhole would have a 1200mm x 900mm cover, with the tunnel shaft having a 1200mm x 1200mm cover and a 300mm x 300mm cover.

#### *Meridian Centre car park*

12.21 A single underground chamber would be constructed, as shown in planning drawing RS-025. Following construction the only visible surface level elements would be a new cast iron manhole cover. The shaft would have a 1200mm x 1200mm cover.

#### *Friar's Bay head chamber*

12.22 At the Friar's Bay head chamber a single underground chamber would be constructed, shown on planning drawing RS-056. Following construction the only visible surface level elements would be a new cast iron manhole cover. The shaft would have a 1200mm x 1200mm cover.

#### *Friar's Bay promenade*

12.23 A single underground chamber would be constructed on the undercliff promenade, as shown on planning drawing RS-056. Following construction the only visible surface level elements would be a new cast iron manhole cover. The chamber would have a 1200mm x 1200mm cover.

### **Sustainable development considerations**

12.24 With respect to the design objective to minimise environmental and community impacts as far as practicable, the design has sought to minimise the extent of development required and as a result to minimise construction activity, spoil disposal and all of the consequent impacts that might result. Of particular note is the issue of spoil generation and disposal, there being a strong incentive to keep tunnel levels up out of the groundwater and thereby minimise the potential extent of post-excavation treatment of potential saline-contaminated spoil on site prior to transport off site.

12.25 With respect to energy consumption, there is no direct energy consumption in the transfer tunnel system. The fall or gradient of the tunnels can affect the amount of lift required at the pumping stations, although the ultimate lift of the system is determined by the level of processes at the

wastewater treatment works. The design has responded to this and has sought to strike an appropriate balance between a tunnel gradient sufficient ensure that no solids deposition takes place and one where there is undue energy lost.

### **Safety and security**

12.26 The principal concern for the flow transfer infrastructure is to ensure that access to the tunnels is not possible without all of the necessary safety equipment, training and safe systems of work in place. All of the access points would be covered by cast iron covers. In addition, it is Southern Water's policy that the manholes and chambers are not be fitted with ladders or stairs. This measure prevents members of the public or Southern Water employees from entering the chambers or tunnels without the necessary safety equipment.

## **ACCESS TO THE FLOW TRANSFER SYSTEM**

### **Policy and principles**

12.27 As noted in the preceding section, it is Southern Water's policy that access to the below ground manholes, shafts and tunnels must not occur without all of the necessary safety equipment, training and safe systems of work in place. Accordingly, manholes and chambers are not fitted with ladders or stairs unless there is equipment installed that requires specific regular access. All safety equipment must be provided as part of the planned safe system of work.

### **Consultation and involvement**

12.28 Southern Water undertook negotiations with the landowners and occupiers of land and buildings on and beside proposed tunnel shaft locations in an effort to ensure that their interests would not be adversely affected. The proposed shaft position and construction compound layout for the Saltdean East shaft reflects detailed discussions with East Sussex County Council concerning the relationship of the development with an adjacent rest home.

### **Public rights of way**

12.29 No public rights of way would be closed or diverted as a result of the flow transfer proposals.

### **Pedestrian accessibility**

12.30 There is no pedestrian accessibility provided to the transfer system for the reasons described above.

**Vehicular access and servicing**

12.31 In the event of a planned entry to the tunnel from the shafts it is expected that an operational team would be in attendance. This would involve staff at the top of the shaft to operate a winch, in addition to staff within the tunnel. It is likely that two van-type vehicles would be required for the staff, winches, man-rider cage and safety equipment.

**Car and cycle parking**

12.32 The proposed tunnel access shafts are in open areas with room for service vehicles to park during maintenance inspection visits.

**Signage and lighting**

12.33 There is no requirement for above-ground lighting or signage.

**Emergency service access**

12.34 In the event of an emergency, access to the manholes for the emergency services would be the same as that for operational inspection procedures.

**Maintenance**

12.36 The general operation and maintenance requirements of the tunnels and shafts are expected to be low. Entry would be necessary to carry out condition checks and, very rarely, to clear obstructions. Shaft inspections are likely to be on an annual basis with tunnel inspections on a quinquennial basis.

12.37 Entry would be by crane and man-rider hoist through shaft access points in planned operations by trained personnel following Southern Water's procedures.

12.38 Shafts fitted with penstock actuators and/or level sensors would need to be visited more regularly as part of planned maintenance of the transfer system. Grit catchpits provided for the local sewer connections to the transfer system would need to be emptied on a regular basis using conventional 'gully-sucker' type equipment.



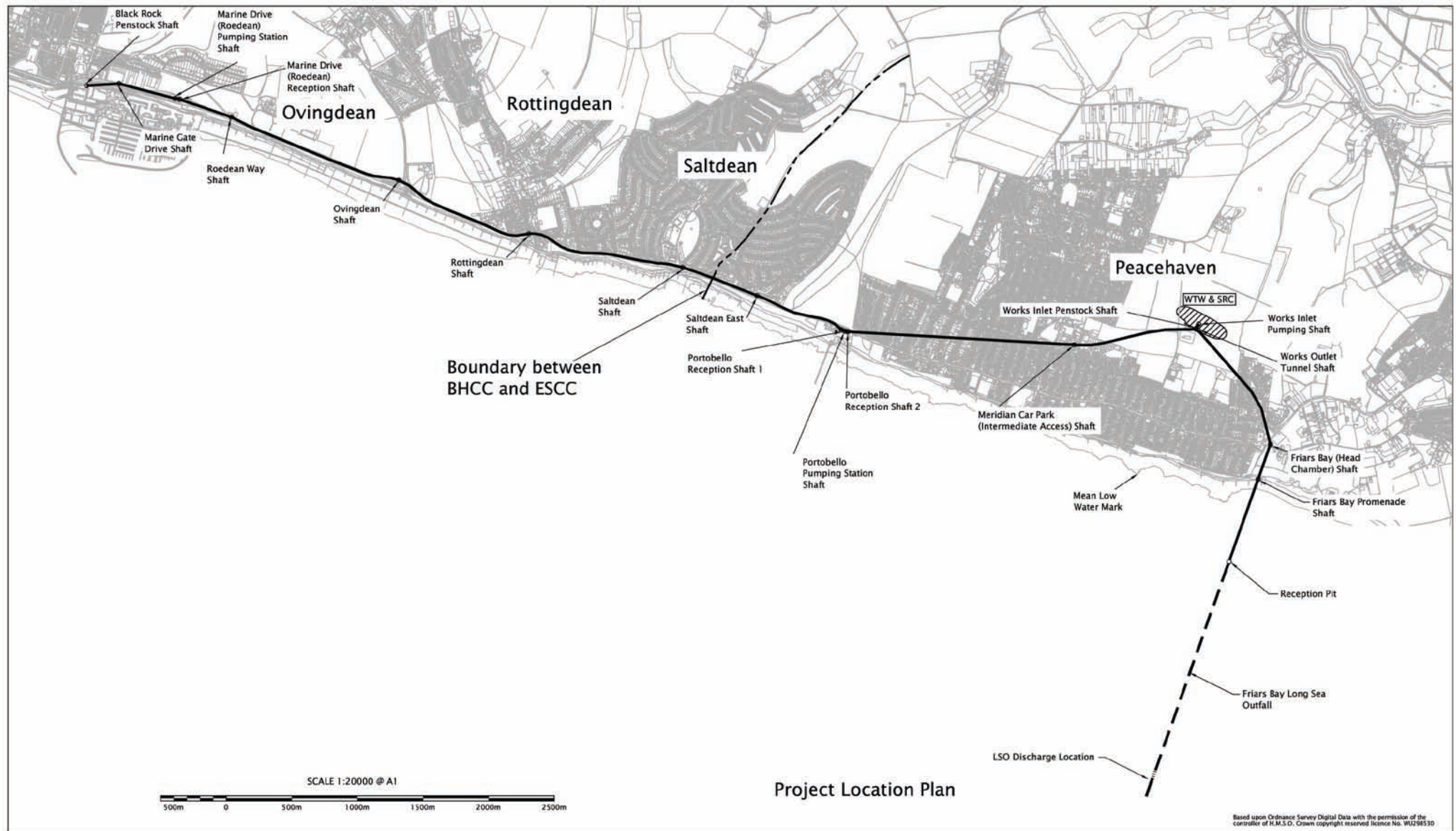


FIGURE 12.1: the proposed flow transfer route from Black Rock in the west to Friar's Bay in the east