

Brighton & Hove Wastewater Treatment Scheme

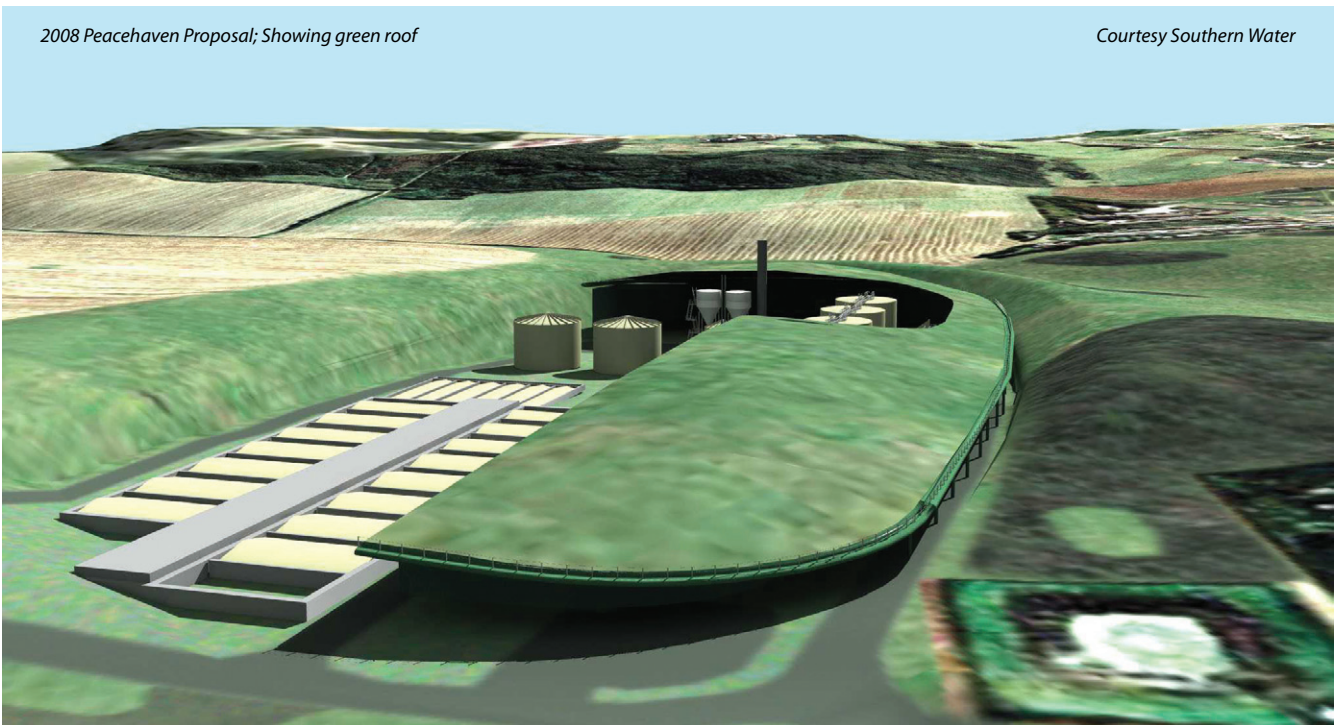
constructing one of the largest green roofs in Europe to bring cleaner seas to Sussex

by Alan Faherty MEng (Hons) GMICE

Work is continuing on a £300 million environmental improvement scheme to bring cleaner seas to the Brighton and Hove catchment in Sussex. The solution for this catchment, stretching from Hove in the west to Peacehaven in the east, was well described by Richard Goodridge MAPM in his article in *UK Water Projects 2010* (pages 123-126). The purpose of this article is to provide some history to the project and to provide further details on its unique, defining feature; one of the largest green roofs in Europe. Eighteen months into the scheme the roof is starting to take shape at site of the new wastewater treatment works in Peacehaven, East Sussex. Once completed the roof will screen the works from the surrounding viewpoints and preserve the natural beauty of the adjacent South Downs National Park.

2008 Peacehaven Proposal; Showing green roof

Courtesy Southern Water



Improvement driver

Under the Urban Wastewater Treatment Directive (UWTD), Southern Water is required to provide wastewater treatment to a secondary standard. The catchment area serves a population of over 250,000 and generates up to 95 million litres of wastewater per day. The current catchment flow is treated to a preliminary standard at the Portobello WwTW, before being released through a 1.8 kilometre outfall. The current situation means that the Brighton and Hove catchment is one of the last in Europe to meet the current standards for wastewater treatment.

The solution

The project scheme involves the construction of a new wastewater treatment works and associated infrastructure incorporating two new online network pumping stations, 11 kilometres of new sewer tunnel and a 2.5 kilometre long sea outfall.

History

The Brighton and Hove catchment has some of the oldest wastewater treatment infrastructure in the country, and has been using the current Portobello site since the 1870s. The works at Portobello have been upgraded and modernised several times in the intervening years.

In the 1990s, Southern Water, following the introduction of the UWTD in 1994, sought to invest in a new WwTW located at their present Portobello site. The planning application for this site was submitted in 1999 and was the topic of a heated planning review, which led to the refusal of the Portobello scheme in early 2001. In the refusal of Portobello, the planning inspectorate noted that:

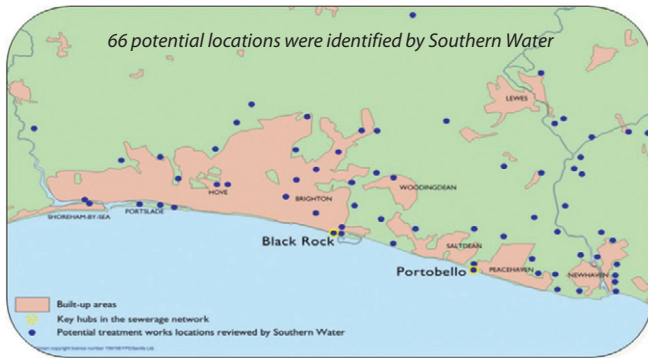
"The Secretary of State accepts that there is no real dispute over the need for and the national interest in the proposal..."

It was also noted that:

"There is a realistic prospect of there being a site available as an alternative to Portobello that would be less harmful in terms of adverse planning consequences..."

The right site

The search for a site was on. Southern Water carried out an exhaustive study of the available areas around the Brighton and Hove catchment, and identified 66 possible locations for the new wastewater treatment works. Once they had identified all the sites it was immediately obvious that there was no stand out location perfect for the catchment area.



Southern Water produced a report which rated each site against a number of constraints applicable to the area, these included:

- Area of Outstanding Natural Beauty.
- The proposed National Park (South Downs).
- SSSIs.
- Known archaeological sites.
- Flood plain and aquifer protection.
- Flow transfer connections.
- Road access.
- Conservation areas.
- Residential densities.

This report led Southern Water to submit a revised proposal to the planning authorities for the current site at Peacehaven in 2005. The scheme proposed was of a similar nature to the current scheme, however, the building housing the Primary Treatment and the Sludge Recycling Centre was to be a landmark zinc clad structure designed to showcase the works.

Another planning inquiry followed which led to the scheme being again rejected; however the following conclusions were drawn:

- *"In general, the Brighton and Hove area is subject to a notably high level of physical and environmental constraint..."*
- *"The proposal to site the facility at Peacehaven offered the least worst option..."*

A suitable location had been found, now to find the right scheme.

Peacehaven

After the rejection of the initial Peacehaven application, Southern Water realised that the objective should be to make the scheme as unobtrusive as possible. They studied the objections and proposals to its previous application and submitted a revised scheme in 2008. The scheme now included two important elements.

- The treatment works was sunk further into the landscape.
- The provision of a semi-intensive green roof to protect the views of the South Downs from key viewpoints.

The revised scheme was granted planning permission the same year by East Sussex County Council, on the basis of the above proposals. A judicial review was then launched by local opponents to the scheme, this was submitted in early 2009. The judicial review procedure continued until June 2009 when it was finally dropped and work started on the current project.

Designing the green roof

The size and shape of the green roof determined firstly by the operational requirements of the engineering, then by a 3D model being created of the site and building that allowed the roof and land-form design to be developed to ensure that the roof appears as a continuation of the surrounding grassland when viewed from the surrounding public viewpoints. Once Southern Water and its consultants RPS were satisfied that they could

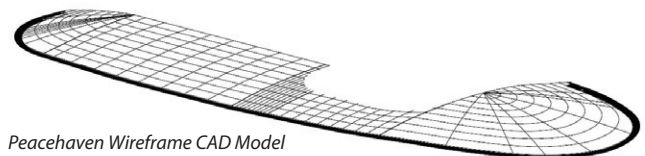


demonstrate that the visual strategy worked, the drawings were submitted to the local planning authority in conjunction with a technical specification for the green roof build-up. At 17,800m², or 2½ football pitches, this makes the green roof among one of the largest of its kind in Europe. The challenge now was for Southern Water and its contractor 4Delivery Ltd to turn the planning drawings into reality.

Wireframe CAD model

The first objective was to define the complex geometry that forms the roof. The roof is formed of three parts with the Preliminary Treatment Building (PTB) forming the western end of the roof, the Sludge Recycling Centre (SRC) the eastern end and a canopy spanning between the two to provide an unblemished continuation of the structure. The transition between the SRC which is a radial D shape and the canopy which has a single pitch to the South was particularly difficult.

It was achieved by creating a wireframe CAD model that was issued to all design parties to ensure that the planning constraints were met and that there was cohesion between each party.



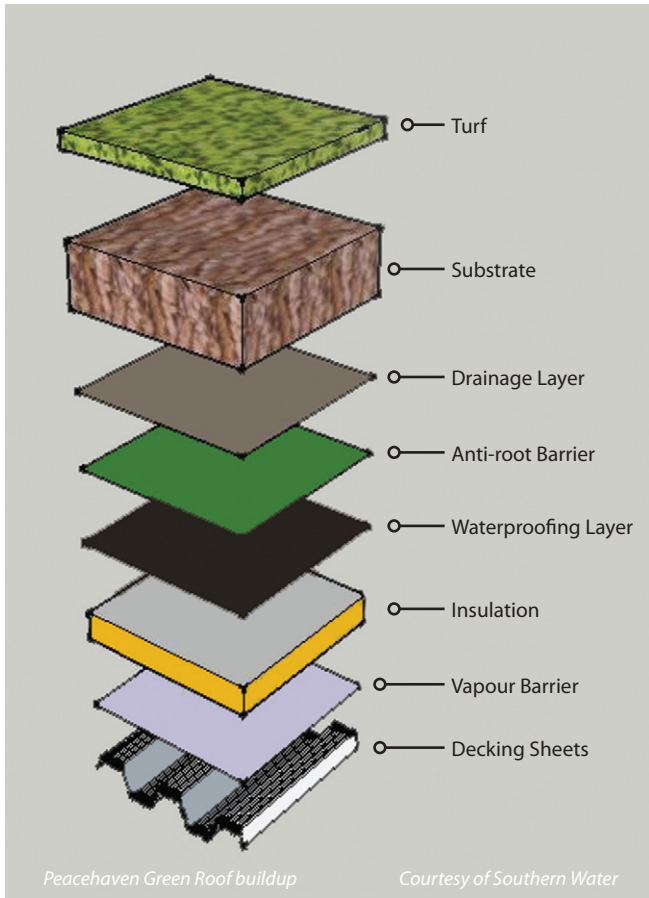
Peacehaven Wireframe CAD Model

The structural roof loading restrictions meant that strimming was the only suitable means to cut the grass. Grass cutting machinery was too heavy to use. Grass cuttings are required to be removed so that it does not enrich the soil. This shall allow wild flora from the surrounding downland to more readily flourish. Cutting is required to manage the grass height and improve sward density and vigour.

The biggest influencing factor on the structural design of the roof is the depth of substrate when wet. Hence sedum is the most popular type of green roof as it allows very thin substrate depths.

Having established the base design parameters the detailed structural modelling began. Due to the nature of the roof curve, the steel frame is formed mainly of faceted trusses with very little internal repetition between building grids, meaning that most elements had to be designed and modelled individually. The roof has a single expansion and contraction joint located in the centre of the canopy, this can accommodate 150mm of movement in each direction under severe weather conditions.

The purlins were then fixed off the main trusses with stools to help even out the facet further and begin to define the curve. As each stool height was unique to its specific location on the roof, this led to some very careful setting out and co-ordination to ensure that no errors were made and that the curve remained true to the original model. The proceeding layers of the roof construction then help reduce the facet until the substrate is installed in a layer approximately 200mm deep. The substrate is raked to a smooth



curve therefore providing the true curve of the roof that will be followed by the turf.

From the start of the project Southern Water decided to take a horticultural approach to the turfing of the green roof. The species of seed mix was carefully chosen to mimic the downland meadow conditions of the South Downs allowing the roof to blend into its local environment. The same grass species as used for the roof are being sown on the newly created surrounding grassland area.

The substrate which forms the main root zone of the turf was also specifically designed to provide a good representation of the surrounding chalk based subsoil, providing very similar nutrients and pH values. The substrate is produced by a specialist substrate manufacturer near to the project, and consists mainly of crushed porous brick and organic matter. Substrate is a lighter alternative to topsoil that can be more readily tailored to specific target conditions and allow the success of the downland meadow mix. This will ultimately allow the roof to react with the seasons in the same manner as the surrounding landscape.

The turf will be grown for 15 months off site in Cambridgeshire, under controlled conditions to ensure that the right species mix is maintained. For installation, the turf will be cut into lengths, rolled for transport and bedded on the roof at Peacehaven, no longer than 24 hours after being lifted. A temporary irrigation system is also being provided to ensure that the newly laid turf does not dry out. This helps to minimise the shock of transplantation and give the turf the best chances at establishment, providing an instant green roof. This is currently programmed for the autumn planting period of October, allowing the turf time to bed in over winter.

As a living roof there will be an element of cross pollination that will make the roof entirely homogenous with the surrounding vegetation. This homogeneity will help to achieve the required planning objective and make the project a success with the local population and Southern Water alike.

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