TIDAL LAGOON CARDIFF

Chapter 11.0
Land Quality and Hydrogeology

11.0 Land Quality & Hydrogeology

11.1 Overview of existing situation

11.1.0.1 The information presented below provides a summary of issues relevant to the approximate landfall locations. A detailed assessment of land quality and hydrogeology impacts will only be possible when exact locations of the proposed landfalls have been confirmed.

Western Landfall

11.1.0.2 The Western landfall is located approximately 2km from the entrance to Cardiff Bay, to the south of the Queen Alexandra Dock, within Cardiff Docks, adjacent to Longships Road.

11.1.0.3 The areas surrounding the western landfall site include mixed commercial and industrial areas. There is also an operational timber yard and storage depot nearby.

Eastern Landfall

11.1.0.4 The Eastern landfall is located approximately 2km from the mouth of the River Usk,within the Wentlooge area of Newport. This area comprises primarily reclaimed agricultural land, as well as areas of tidal marsh known as the Wentlooge Levels. Land has been reclaimed since before Roman times by constructing sea walls and drainage ditches known locally as reens. The landscape associated with the Wentlooge Levels is characterised by a complex pattern of hedgerows and small irregular and regular shaped fields divided by the reen drainage system.

11.1.0.5 Within the Wentlooge Levels there are settlements which comprise several scattered farms with some intermittent linear developments along the B4239 approaching Newport (including a school). The Swansea to London Great Western main line railway traverses the Wentlooge Levels.

11.1.0.6 The eastern landfall site falls within the Gwent Levels – St Brides SSSI. The Gwent Levels are a sensitive ecological receptor made up of a number of separate Sites of Special Scientific Interest (SSSI). Few major land-use changes have been noted in this area since circa 1840.

11.2 Scope of potential impact to be assessed

11.2.0.1 The Project will have an effect on land quality and hydrogeology during the construction, operational and decommissioning phases. The scope for this chapter will assess the potential changes to land quality at the landfall areas and the hydrogeological regime across the area.

11.2.0.2 Water quality, coastal processes and flood risk/hydrology are discussed in separate scoping chapters. Consultation will be undertaken with other relevant disciplines to ensure an integrated approach in undertaking the EIA.

11.2.0.3 At this stage the most likely effects upon land quality and hydrogeology have been identified as the following:

i. Presence of contamination from historical industrial land uses (western landfall area) and therefore there is the possibility that during construction contaminants may become mobilised and migrate across the area;

ii. Dewatering may be required during construction which could cause mobilisation of contaminants or the potential for saline intrusion therefore reference will need to be made to the current guidance on dewatering "Hydrogeological impact appraisal for dewatering abstractions" EA Science Report – SC040020/SR1 (EA 2007);

iii. Change in hydrogeological regime across the land area within the tidal lagoon due to reduced tidal range;

iv. Change in salinity in the inland reen system and marshes due to change in tidal range;

v. Removal of topsoil and earthworks associated with the construction and creation of stockpiles of soils and construction materials, with increased potential for the generation of runoff with elevated concentrations of sediment which may enter groundwater bodies;

vi. Transportation, storage and use of oils and fuels for construction plant and handling of wet cement and concrete, with increased potential for surface and groundwater contamination;

vii. Handling and treatment of waste materials and wastewater;

viii. Construction works, including vehicular movements could result in compaction of the soils and a reduction in its infiltration capacity and therefore groundwater recharge; and

ix. There are potentially private water supplies in the area and the risk to these will need to be assessed.

11.3 Existing baseline data, consultation and need for survey

11.3.1 Site History

Western landfall location

11.3.1.1 With reference to historical mapping obtained from the old-maps website[1] the Western landfall is located within Cardiff docklands near Butetown and comprises a mixture of commercial and industrial areas. Historically, the rapidly increasing iron and coal trade was the catalyst for the construction of a number of docks during the 1830's. These included the Bute East Dock in 1855, Roath Basin in 1874, Roath Dock in 1887 and the Queen Alexandra Dock.

11.3.1.2 Several other industries associated with the docklands have historically been present between 1901 and circa 1964. These included iron works, brickyards, timber yards, sulphate / copper and iron works, a water treatment works, copper works, and a railway amongst others. These are all potential sources of contamination.

11.3.1.3 After the Second World War, demand for coal slumped and by the early 1980's Cardiff Docks had become a neglected wasteland of derelict docks and mudflats until its redevelopment from the 1990s onwards. This has transformed much of the area into a mix of housing, open space, commerce, leisure and industrial development areas.

Eastern Landfall Location

11.3.1.4 The eastern landfall location is located within the St Brides and Wentlooge areas and these primarily comprise agricultural land that is mainly used for grazing and taking hay/silage crops.

11.3.1.5 Historically the site has remained unchanged since the first published Ordnance Survey map dated 1883.

11.3.2 Geology

11.3.2.1 With reference to the 1:50,000 scale British Geological Survey (BGS) Sheet 263 of Cardiff[2] the entire landfall area between the Cardiff Docks (western) and Wentlooge (eastern) are underlain with superficial deposits comprising Tidal Flat Deposits. These are normally comprised of consolidated soft silty clay, with layers of sand, gravel and peat.

[1] *old-maps website accessed December 2014* https://www.old-maps.co.uk/#/

[2] *British Geological Survey (BGS) Cardiff solid and drift edition geological map (1:50,000 Scale) geological map sheet 263*

11.3.2.2 The bedrock geology for the area is noted to comprise soils belonging to the Mercia Mudstone Group. These are described by the BGS as dominantly red, less commonly green-grey, mudstones and subordinate siltstones with thick halite-bearing units in some areas.

11.3.2.3 No made ground is indicated as present within the landfall areas. However, the western landfall area is within Cardiff Docks and therefore it is anticipated that some made ground will be present in this area.

11.3.2.4 It should be stated that the geology information provided on the geological maps covers the onshore information only and does not extend to within the River Severn and underneath the lagoon wall. With reference to the BGS website offshore Geoindex website[3] no further information was provided.

11.3.3 Hydrogeology

11.3.3.1 Although the Natural Resources Wales (NRW) has been formed in Wales, the Environment Agency (EA) website[4] still holds some relevant information relating to the site. The EA website indicates that the superficial deposits underlying the site is classified as a Secondary (undifferentiated) Aquifer. These are described as being cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

11.3.3.2 The bedrock underlying the site is predominately classified as a Secondary B Aquifer associated with the Mercia Mudstone Group. These are described as "permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers".

11.3.3.3 According to the EA database[4], the site is not located within a Groundwater Source Protection Zone (SPZ) and no SPZ are located within 500m of the site.

[3] *British Geological Survey (BGS), Geoindex website, (2015)* http://mapapps2.bgs.ac.uk/geoindex_offshore/home.html

[4] *Environment Agency Website (EA) website (2014) "What's in my backyard"* http://apps.environment-agency.gov.uk/wiyby/default.aspx

11.3.4 Pollution incidents & Landfills

Western Landfall Location

11.3.4.1 A review of the Environment Agency website[4] has identified no pollution incidents within the location of the landfall area or within 1km of the site.

11.3.4.2 The nearest historic landfill is located approximately 70m north and another approximately 100m north east of the landfall area. These are identified as South Side Queen Alexandra Dock. Both were active between 1993 and 1994 for industrial household and liquid / sludge waste.

11.3.4.3 Additional landfills were also shown approximately 1km to the south west and north east of the landfall area licenced for industrial and household waste between 1972 and 1988.

11.3.4.4 No surveys / investigations have been undertaken to date and once the exact landfall locations are known, the need for undertaking such work will be reviewed.

Eastern Landfall Location

11.3.4.5 A review of the Environment Agency website[4] has identified no pollution incidents within the location of the landfall area or within 1km of the site.

11.3.4.6 The nearest historic landfill is located approximately 50m north west of the landfall area known as Ty Mawr Farm Landfill. The operational dates and licences associated with the landfill are not known.

11.3.4.7 An authorised landfill is located 60m north east of the site known as The Saltings (West Usk) landfill. The landfill now has its licence closed but was permitted to accept other wastes between unknown dates.

11.3.5 Consultations

11.3.5.1 At this stage it is anticipated that consultations will be undertaken with NRW and Local Authorities (City of Cardiff Council and Newport City Council) to gather information on historical activities and contamination issues with regards to the landfall areas.

11.4 Proposed assessment methodology

11.4.0.1 It is anticipated that the proposed assessment methodology would broadly comprise the following:

i. Establish baseline conditions;

ii. Undertake detailed assessment of effects to receptors from the development and their significance quantified from magnitude and impact;

iii. Outline mitigation measures;

iv. Set out residual effects of the development following implementation of mitigation measures; and

v. Undertake cumulative effects analysis by identifying other major projects that are proposed locally.

11.4.0.2 The proposed study area for the land quality aspects would be 250m beyond the landfall boundaries, and for hydrogeological aspects the study area would be assessed on the basis of likely drawdown and flow impacts.

11.4.0.3 The methodology for the assessment of effects on geology and hydrogeology is based on the Water Environment section of the Design Manual for Roads and Bridges (DMRB) (Highways Agency, 2009) and the paper Practical Methodology for Determining the Significance of Impacts on the Water Environment (Mustow et al., 2005).

11.4.0.4 The significance of the predicted effects will be determined by giving consideration to the importance of the receptor and the predicted magnitude of the effect.

11.4.0.5 The significance of the predicted land quality effects will be determined by developing a Conceptual Site Model (CSM) and hence identification of potential pollutant linkages (contaminant source-pathway-receptor).

11.4.0.6 The hydrogeological impacts will be assessed by construction of a 2D-numerical model (assuming sufficient data is available) or by reference to other similar schemes.

11.4.0.7 From the CSM, the requirements for mitigation (commonly referred to as a remedial strategy) will be ascertained in accordance with the procedures set out in the EA guidance Model Procedures for the Management of Land Contamination (CLR 11).

11.5 References

British Geological Survey (BGS), Geoindex website, (2015) http://mapapps2.bgs.ac.uk/geoindex_offshore/home.html

Environment Agency Website (EA) website (2014) "What's in my backyard" http://apps.environment-agency.gov.uk/wiyby/default.aspx

Highways Agency (2009) Design Manual for Roads and Bridges

Mustow et al (2005) Practical Methodology for Determining the Significance of Impacts on the Water Environment.

Contaminated Land Report (CLR) 11, (2004) Model Procedures for the Management of Land Contamination