# MERSEY TIDAL POWER

## FEASIBILITY STUDY: STAGE 3

## Landside Facilities Report

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Project Sponsors:

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Northwest REGIONAL DEVELOPMENT AGENCY

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# Project Background

In the face of current and anticipated issues of security of supply and climate change, the need to find local sources of renewable energy has never been more urgent.

The Mersey Estuary has one of the largest tidal ranges in the UK, making it one of the best locations for a tidal power generation scheme. It has the potential to make a significant contribution to the Government's target to secure 15% of UK energy from renewable sources by 2020.

A large scheme could deliver enough renewable electricity to meet the needs of a significant proportion of the homes within the Liverpool City Region, as well as beyond. Any scheme put forward will need to take into account the ecological diversity of the Estuary, which supports internationally important bird habitats.

## Phase 1 Pre-Feasibility Study - 'Power from the Mersey'

Peel, in partnership with the NWDA set out to explore the potential, the impacts and the implications of utilising the Mersey Estuary's renewable energy potential for the benefit of the Northwest region.

The Mersey Basin Campaign gave its full backing to the work and a consortium of consultants led by Buro Happold was commissioned in July 2006 to undertake a 'pre-feasibility' Phase 1 Study.

The primary objective of the Phase 1 Study was to undertake a full and open assessment of the options available for the generation of renewable energy and to undertake a preliminary assessment of viability.

A number of potentially viable schemes were identified. The continued development of marine power technology means that others may also need to be considered as the project moves into the next phase.

## Meeting 2020 Renewable Energy Targets

An overall timetable was defined to ensure the project supports the policy objective of contributing to 2020 renewable energy targets. The key milestones of the project include submission of applications for planning or other statutory consents by 2012 and commissioning of the scheme by 2020.


## Phase 2 Feasibility Study

Peel Energy and the Northwest Development Agency are progressing the project in line with the principles for sustainable development. A feasibility study has been commissioned to assess the options and identify a preferred scheme to take forward for submission of a planning application.

The feasibility study has been led by URS Scott Wilson, EDF and Drivers Jonas Deloitte, and supported by RSK, APEM, HR Wallingford, Regeneris, Turner and Townsend, University of Liverpool, Proudman and Global Maritime.

The feasibility study has been undertaken in three stages as follows:

- Stage 1: Definition of project strategies, data gathering and gap analysis, and selection of long list of suitable technologies
- Stage 2: Appraisal of the long list of technologies and formulation and appraisal of scheme options to identify a shortlist
- Stage 3: Further refinement and appraisal of the short list of scheme options and selection of the preferred scheme.

The project has been pursued in an open and transparent manner, building on the consultation and stakeholder engagement started in the Phase 1 study. An extensive programme of stakeholder engagement has taken place through project advisory groups, consultation with statutory and non-statutory consultees and public consultation targeted during appropriate stages of the project.

## Mersey Tidal Power Scheme Objectives

The objectives of the Mersey Tidal Power scheme are:

(a) To deliver the maximum amount of affordable energy (and maximum contribution to Carbon reduction targets) from the tidal resource in the Mersey Estuary with acceptable impacts on environment, shipping, business and the community either by limiting direct impact in the Mersey Estuary or providing acceptable mitigation and/or compensation;

and in doing so,

(b) To maximise social, economic and environmental benefits from the development and operation of a renewable energy scheme, including where appropriate:

(i) the development of internationally significant facilities and skills to support the advancement of renewable energy technologies and their supply chains,
(ii) improvements to local utility and transport infrastructure,
(iii) improvements to green infrastructure and environmental assets,
(iv) the development of a leisure opportunity and tourist attraction.

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**Note on Terminology**

This technical report uses a different naming system to the Stage 3 Feasibility Report to refer to schemes variants, as follows:

- IBv2a = A1.02a;
- IBv2b = A1.02b;
- VLHBv2a = A2.01a; and
- VLHBv3a = A2.02a.

If a lower case letter is not used, this is because the operating regime (denoted by the lower case letter) is not relevant.

# 1 Introduction

1.1.1 The purpose of this report is to identify the landside facilities required to support a tidal power scheme located in Band A, following the identification of Band A as the preferred location for the scheme during Stage 3.

1.1.2 The report provides information on the size and extent of landside facilities for cost planning and for consenting risk identification purposes. This report sets out the related facilities required on the Liverpool and Wirral banks, the potential constraints on development and potential access routes. The tidal power schemes under consideration at Stage 3 are shown in Table 1 below.

**Table 1: Schemes Considered**

| Scheme Ref | Description | Rated Capacity | Outlet Power |
|---|---|---|---|
| A1.02 | 28 turbine barrage operated using unrestricted head on ebb tide only | 700 MW | 1,050 GWh |
| A2.01 | 44 turbine barrage operated using restricted head on ebb tide only | 660 MW | 560 GWh |
| A2.02 | 44 turbine barrage operating using restricted head on ebb and flood tides | 660 MW | 520 GWh |

1.1.3 The primary element of the landside team at Stage 3 has been a critical review of the landside facilities identified at Stage 2 and a confirmation of the scale and indicative layout of those landside facilities. The generic concept of “hard” and “soft” facilities representing technical and public facilities respectively has been applied to the Stage 3 schemes and a landside facilities location masterplan has been drawn up. An additional group of facilities has been considered at Stage 3 – navigation aids, which are facilities and structures required to support navigational activities.

1.1.4 The second element of work relates to the impact of constraints identified by the wider project team, potential access routes and other local planning constraints on the Wirral and Liverpool banks.

# 2 Methodology

2.1.1 The assessment methodology was carried out as follows:

- A visual assessment was undertaken of the access to the Band A landside site around the Bromborough Dock area.
- A design planning assessment was prepared of areas required for the landside facilities which include;
  - Group 1 (G1) – 'hard' facilities
  - Group 2 (G2) – 'soft' facilities
  - Group 3 (G3) – navigation facilities
- The scoping of the facilities within each Group is outlined in Section 4.2 later.
- Concept development drawings have been prepared showing the location and extent of facilities in the context of Band A, and the adjacency of the Liverpool and Wirral banks.

2.1.2 The study area includes adjacent land on the Liverpool bank and the Wirral bank.

2.1.3 Building planning design standards referred to were compiled using the Architects Metric Handbook Planning and Design Data (Adler, 1999).

2.1.4 The outline design of all Stage 3 schemes uses the same alignment with the same landing points on the Liverpool and Wirral banks (see Figure 1 and the Stage 3 Civil Engineering (Power) report).

2.1.5 The approach to the study has been informed by the knowledge gained during the feasibility study from reviewing other marine power or similar landside facilities.

2.1.6 No external consultation has been undertaken in respect of landside facilities.

2.1.7 Internal consultation has been undertaken with the wider project team as follows:

- guidance on the reserved areas for high voltage (HV) and low voltage (LV) transforming areas, was given by the grid connection team;
- guidance on highways access and car parking requirements was given by the transport team;
- guidance on power generation workshops was given by the civil engineering (power) team; and
- constraints mapping was provided by the planning team.

# 3 Conclusions from Stage 2

3.1.1 The planning of the landside facilities have taken into account:

- Road access to the Liverpool and Wirral banks connecting to the barrage pontoon to facilitate construction and maintenance of turbines and equipment.
- The location of navigational aids.
- Hard, soft and navigational facilities are shown located together on one bank. However subject to further masterplanning of the scheme, some of the 'soft' facilities (e.g. visitor facilities) could be located on either bank. Similarly certain elements of the 'hard' facilities could be located below ground or positioned to avoid any detriment to the visual amenity.
- Visitor facilities may attract between 60,000-100,000 visitors per annum and create 30-40 part-time jobs (equivalent to 10-30 full-time jobs)

# 4 Overview of Schemes

4.1.1 All landside facilities are currently shown located on the Wirral bank, but it would be possible (subject to further masterplanning) to locate some of the 'soft' facilities, such as visitor facilities, on the Liverpool bank.

4.1.2 The Wirral bank is identified for the HV substation as there are advantages to the connection to the National Grid (as identified in the Stage 3 Grid Connection report). Further masterplanning would be undertaken at future stages to address potential use of reclaimed land adjacent to the lock.

4.1.3 Future master planning would also consider the details of the Liverpool bank, building massing, neighbours, stakeholders and the overall visual amenity.

## 4.2 Landside Facilities

4.2.1 Landside facilities would comprise:

- G1 – hard facilities, for the operation and maintenance of the tidal power scheme, including high voltage electricity bulk supply plant, workshops, and other operation and maintenance facilities;
- G2 – soft facilities, those associated with visitor's facilities such as a visitors centre, education centre, café etc; and
- G3 – navigation facilities, those associated with the navigation functions of the barrage.

4.2.2 The schedule of all landside facilities is summarised in Table 2 below, with an indication of the footprint area of each facility as well as the total land area required for each Group of facilities. The potential arrangements of these facilities are shown in Figures 1 to 3.

## Table 2: Landside Facilities Summary

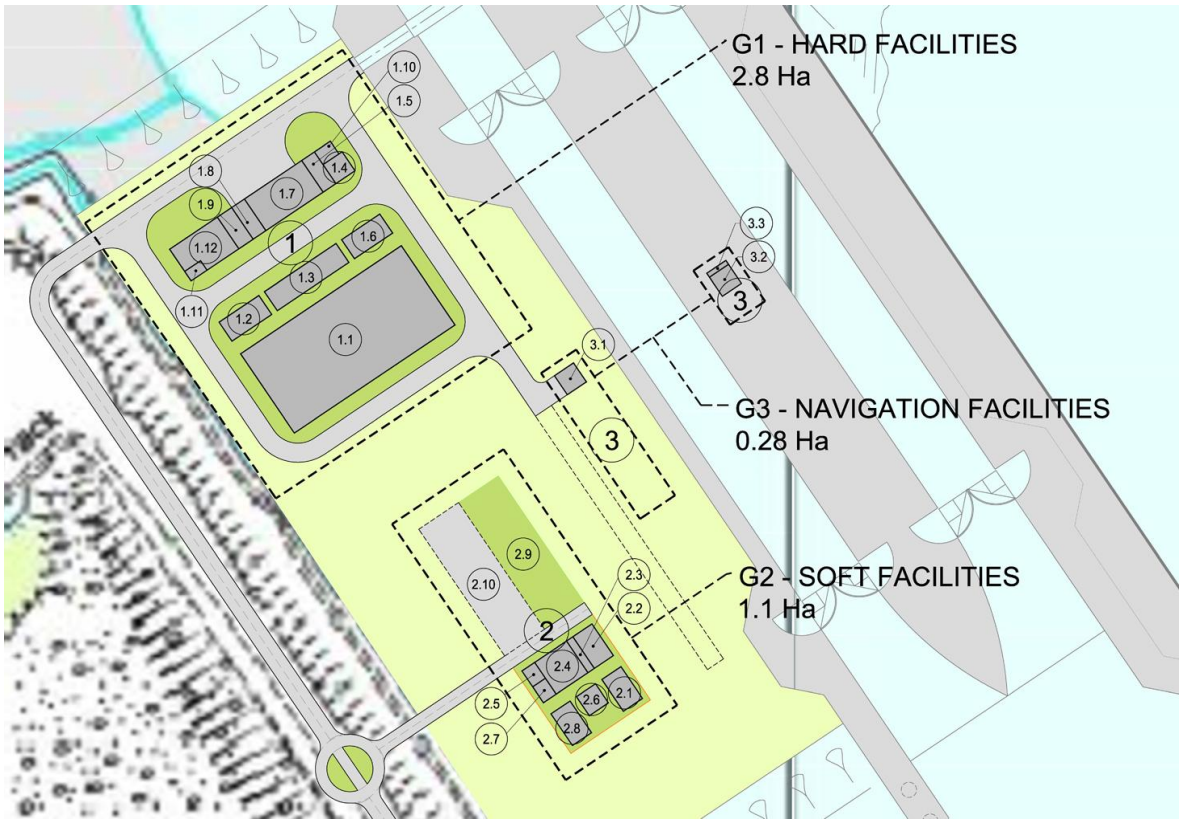
| Facility Number | Description | Length (m) | Width (m) | Area ($m^2$) | Height (m) | Comment |
|---|---|---|---|---|---|---|
| **1** | **G1 'HARD'** | | | **2.8 ha** | | |
| 1.1 | Bulk Supply Area | 100 | 50 | **5,000** | 0 | Could be located below ground in the reclaimed land zone |
| 1.2 | HV Switchgear | 25 | 12 | **300** | 7 | Could be located below ground in the reclaimed land zone |
| 1.3 | LV Switchgear | 45 | 12 | **540** | 7 | Could be located below ground in the reclaimed land zone |
| 1.4 | Landside / Aqua Cable Intake Landing Station(s) | 10 | 8 | **80** | 7 | Could be located below ground in the reclaimed land zone |
| 1.5 | Oil Cooler House | 20 | 8 | **160** | 7 | |
| 1.6 | Air Cooling Farm | 24 | 12 | **288** | 7 | |
| 1.7 | Turbine Workshop | 36 | 20 | **720** | 10 | |
| 1.8 | E&M Workshops | 20 | 8 | **160** | 7 | |
| 1.9 | E&M Office | 20 | 12 | **240** | 5 | |
| 1.10 | Support Facilities | 12 | 12 | **144** | 5 | |
| 1.11 | Gatehouse / Security | 10 | 5 | **50** | 5 | |
| 1.12 | Car Parking (Operations) | 20 | 27 | **540** | 0 | |
| | **Total** | | | **8,222** | | |
| **2** | **G2 'SOFT'** | | | **1.1 ha** | | |
| 2.1 | Education Centre | 20 | 12 | **240** | 5 | |
| 2.2 | Visitors Centre | 20 | 20 | **400** | 5 | 100.000/year=274/ day and 34/hour |
| 2.3 | Viewing Gallery | 20 | 4 | **80** | 5 | |
| 2.4 | Café / Shops | 20 | 20 | **400** | 5 | |
| 2.5 | Entrance | 10 | 8 | **80** | 5 | |
| 2.6 | Offices / Back of House / Stores | 12 | 12 | **144** | 5 | |
| 2.7 | Ablutions / Support | 12 | 12 | **144** | 5 | |
| | +20% Circulation | | | **298** | 5 | |
| 2.8 | General Compounds and Stores | 10 | 16 | **160** | 0 | Uncovered |
| 2.9 | Landscaping / Public Realm | 80 | 25 | **2,000** | 0 | |
| 2.10 | Car Parking | 80 | 25 | **2,000** | 0 | |
| | **Total** | | | **5,946** | | |
| 3 | **G3 NAVIGATION FACILITIES** | | | **0.28 ha** | | |
| 3.1 | Maintenance Store | 6 | 4 | **24** | 5 | |
| 3.2 | Lock Machinery Housing | 6 | 4 | **36** | 7 | |
| 3.3 | Local Lock Operations Control Room | 6 | 4 | **24** | 5 | |
| | **Total** | | | **72** | | |

4.2.3 The general arrangement of all facilities is shown in Figure 1 below.

**Figure 1: General Arrangement**

4.2.4 The Wirral bank landside access and facilities are shown in Figure 2 below. See Table 2 for explanation of the reference numbers.

**Figure 2: Wirral bank landside facilities**



4.2.5 The Liverpool bank landside emergency access is shown in Figure 3 below.

**Figure 3: Liverpool bank emergency access**


## 4.3 Access

4.3.1 Access would be required to the Liverpool bank for emergency controlled access and to the Wirral bank for the full extent of the technical and navigational facilities (G1 and G3), and for G2 non-technical staff and visitors to the visitors centre and offices.

4.3.2 The Liverpool bank access is proposed from Riverside Drive (A5036), Dingle. This access does not appear to be affected by or affect the Liverpool Garden Festival Site re-development.

4.3.3 The Wirral bank access is proposed from the existing Dock Road South, Bromborough. A new two lane road would connect from Dock Road South to the landside facilities. There are two possible routes proposed and these are referred to as Access Routes 1 and 2 shown in Figure 1. Two options for connecting with Dock Road South have been developed both of which would use existing bridges over Bromborough Dock. The preferred option will depend on the outcome of further investigations. Similar to Dock Road South, the new road would be up to 10m in width to allow large vehicles to pass easily - particularly heavy goods vehicles during the construction stage and coaches, passenger vehicles and delivery vehicles once the facility is in operation.

4.3.4 The proposed options provide the most effective means of connecting with the public highway network. Other options to the west would require either access via Dock Road

North leading to a residential road, Bolton Road East, or access via the playing fields north of Graylands Road. Access via Bolton Road East would be inappropriate due to its residential nature. Constructing a road link via the playing fields would be unlikely to receive support from the local planning authority.

4.3.5 Dock Road South acts as a distributor road for a mix of industrial and residential areas to connect with A41 New Chester Road at the Port Causeway signalised junction. Importantly, although it does serve a small residential area, there is no residential frontage onto Dock Road South and drivers from this area also have the alternative of using Pool Lane to the north. Dock Road South is a wide single two lane road which has been designed to carry articulated heavy goods vehicles. As such it has good visibility and turning radii at corners and would therefore be wholly appropriate both for construction and operational traffic serving the Mersey Tidal Power project. Its junction with A41 New Chester Road via Port Causeway provides separate right turning lanes, is fully signalised and has sufficient space to allow for articulated heavy goods vehicles (and coaches) to turn on and off the A41.

4.3.6 As the masterplan for the scheme is developed, the integration of public transport services, cycleways and dedicated pedestrian ways will be developed.

## 4.4 Parking

4.4.1 Twenty-nine passenger vehicles spaces are provided for the G1 facilities (technical support and office staff).

4.4.2 Based on the calculations for car parking (Annex A) the facilities plan provides for 106 marked car spaces plus 4 coach parking spaces for the G2 facilities, with an area of made ground overflow spaces for a further 50 vehicles.

## 4.5 Planning & Constraints Mapping

4.5.1 The alignment of the Stage 3 schemes has been developed to avoid the Liverpool Garden Festival Site. The planning permission includes:

- a mixed use development comprising 1374 dwellings (1308 apartments and 66 townhouses) with supporting ancillary retail (A1), food and drink (A3/A4), offices (B1) and primary care (D1) uses; a new access road and pedestrian accesses onto Riverside Drive and temporary construction access onto Riverside Drive (outline planning permission); and
- a new public park comprising the restoration and enhancement of the former gardens with improvements to the wider landscaped area; improvements to existing highway infrastructure on Riverside Drive; a car park and other associated works; and environmental improvements to Priory Wood (full planning permission).

4.5.2 The Mersey Coastal Park plans for the Wirral bank promoted by NWDA and the Forestry Commission, propose to regenerate 6.5 km of the Mersey Coast between Rock Ferry and Eastham County Park. The plan is based around 5 projects which will improve access to the coastline. These projects are:

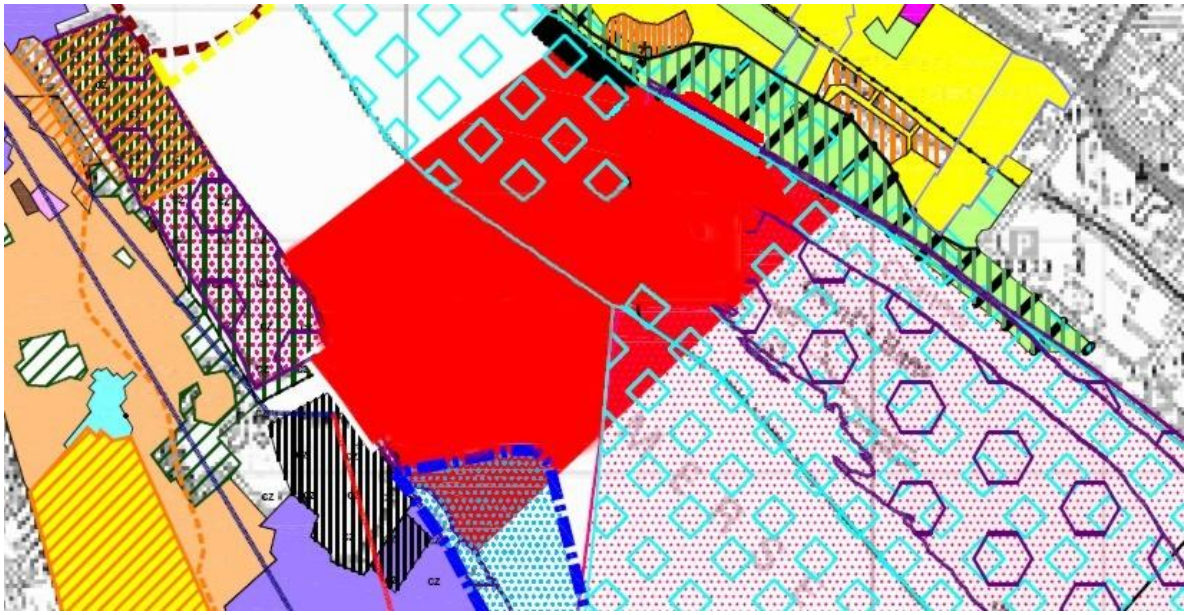
- Rock Park Conservation Area and Esplanade
- Shorefields Community Park
- Newlands 2 - Bromborough Landfill Site
- Wirral International Business Park
- Eastham Country Park

4.5.3 The alignment of the Stage 3 schemesis adjacent to Newlands 2 - Bromborough Landfill Site which was to receive funding to turn the former landfill site into 'recreational greenspace' including community woodland. The proposed landside access roads would traverse this land (see Access Route 1 and 2 on Figure 1). This is not necessarily a constraint as post construction traffic levels are expected to be light and there is an obvious tie up between the community greenspace proposal and the provision of visitor facilities at the tidal power scheme site. The design solution would also enable complementary attractions.

4.5.4 The constraints mapping exercise identifies that the Local Plan allocates this land as a landfill site with a countryside recreation area overlay.

4.5.5 An extract of the planning constraints map (see Annex B) is provided at Figure 4. See Annex B for the key.

**Figure 4: Land Allocations**



# 5 Recommendations

5.1.1 There is sufficient landside area on the proposed reclaimed area to accommodate the proposed landside facilities.

5.1.2 The following recommendations are made:

- the 'hard' facilities comprising the electrical transmission technical facilities are best located immediately adjacent to the electrical landing station from the estuary, preferably to face toward National Grid's Bromborough substation;
- the 'soft' facilities should face away from the 'hard' facilities; towards the arrivals point and towards visual references on the estuary; and
- the research and development and educational facility would be a beneficial enterprise for marine study, a centre of excellence for the North West and technology development and investment.

5.1.3 Further work needs to be carried out to establish:

- detailed requirements for each facility;
- definitive size, scale and massing;
- design development of integrated facilities and landscape;
- feasibility of locating any facilities away from the reclaimed area in the event that the size of this area is reduced as part of the value engineering exercise;
- related to this, whether there is an opportunity to locate the visitor facilities within the proposed community greenspace area on Bromborough landfill site to contribute to the creation of this area - with a loss of public funding this may be a means of achieving the aspiration for the Mersey Coastal Park strategy;
- continual development of the masterplan aligned with the Liverpool Garden Festival Site, Wirral Coastal Park etc
- development of the detail of the navigational support facilities in consultation with navigation stakeholders;
- potential to accommodate public footpath/cycle path; public transport link, subject to health and safety considerations and further design of the scheme;
- the possibility of incorporating a ferry landing stage and/or marina as part of the scheme.

# 6 Assumptions and Limitations

6.1.1 The estimated building areas and land takes exclude supporting infrastructure such as rainwater retention ponds, and facilities associated with ground maintenance.

6.1.2 It has been assumed that:

- visitor facilities would be developed for any tidal power scheme (at this stage sizing has been based on assumed visitor numbers of 60-000 – 100,000 per annum but this assumption should be updated as the type and scale of facilities is developed);
- the incorporation of complementary facilities, such as a marina into the project would result in a different demand for supporting facilities considering the likely increasing visitor numbers; and
- land ownership issues associated with access to the landside facilities can be accommodated.

6.1.3 No detailed consideration has been given to landscaping.

6.1.4 The following gaps have been identified:

- strategic decisions will need to be made in terms of a desire for an iconic landmark, preferences for Liverpool/ Wirral bank locations and stakeholder visions (i.e. a lifestyle attraction) – a moderate scale development of ‘soft’ facilities in G2 has been assumed based on visitor numbers of 60,000-100,000 per annum but there is a risk that this may represent an under-estimate (La Rance, a tidal facility in France, prior to anti-terrorism measures being introduced, accommodated 300,000 visitors per year);
- Design Briefs should be prepared to substantiate the overall area required, informed by further consideration of the scale of G2 facilities (as described above) and further design of the preferred scheme; and
- a detailed assessment of maintenance and operational storage requirements, and number of operational personnel, is required.

# 7 Summary

7.1.1 The made ground allocation at the Wirral bank is sufficient to accommodate the landside facilities as currently envisaged.

7.1.2 The Liverpool bank access is practicable for emergency access.

## 7.2 Site Areas

7.2.1 Based upon Table 2 and Figure 1-3, an estimate of the total land take requirement is as follows:

- G1 – 'hard' (technical) facilities would require 2.8 ha;
- G2 – 'soft' (visitor and recreational) facilities would require 1.1 ha; and
- G3 – navigation facilities 0.28 ha.

7.2.2 These areas are shown on Figures 1-3 and exclude the access roads and the like.

# 8 References

Adler, D. (1999) *Metric Handbook – Planning and Design Data.* Architectural Press London

URS Scott Wilson (2011) *Mersey Tidal Power: Stage 3 Civil Engineering (Power) Report*

# Annex A – Visitor Parking Spaces

## Methodology

Two separate methodologies have been adopted to forecast the number of parking spaces that would be required at the Mersey Tidal Power visitor centre. Initially, an estimate was calculated, using the forecast number of annual visitors (up to 100,000), producing an estimate of 106 parking spaces.

The second methodology adopted parking space standards obtained from the Liverpool Unitary Development Plan, Supplementary Planning Guidance Note 8 (SPG8) and the Wirral Metropolitan Borough Council, Supplementary Planning Document 4 (SPD4) – Parking Standards. The Liverpool standards have been used primarily as they provide a more detailed breakdown of the various types of parking spaces required. Both sets of standards calculate the number of parking spaces required based upon numbers of employees and publicly accessible Gross Floor Areas (GFA) respectively.

## Staff Parking Spaces

Based upon the estimated number of staff that would be employed at the visitor centre ( around 30) and using the Liverpool SPG8 parking standards for (Use class D1) Museums and Art Galleries (Public or Exhibition Hall standards are identical) of 1 space per 2 members of staff, a total of 29 car parking spaces are estimated to be required. Using the Museums and Art Galleries standards for cycle spaces of 1 space per 10 members of staff, a total of 10 cycle stands are planned.

## Visitor Parking Spaces

As with the staff parking space calculations, two separate building use criteria within the Liverpool SPG8 standards, have been used to develop a minimum and maximum estimate of parking spaces, namely, Public or Exhibition Hall (Maximum estimate) and Museums and Art Galleries (Minimum estimate).

Both sets of standards calculate the number of parking spaces based upon the total publicly accessible GFA. Table A.1 summarises the individual components of the visitor centre and their respective GFA's.

**Table A.1: MTP Visitor Centre GFA's**

| Component | GFA ($m^2$) |
|---|---|
| Education Centre | 240 |
| Visitor Centre | 400 |
| Viewing Gallery | 80 |

The Liverpool SPG8 parking standards for visitor parking are listed in Table A.2.

**Table A.2: Liverpool SPG8 Parking Standards**

| Use Class | Maximum Car Parking Requirement | Minimum Car Parking Requirement | Minimum Cycle Parking Requirement |
|---|---|---|---|
| **Public or Exhibition Hall** | 1 visitor space per 30 sqm of public floor space | 1 visitor space per 35 sqm of public floor space | 1 stand per 60 sqm of public floorpsace for visitors |
| **Museums and Art Galleries** | 1 space per 5 sqm of public floor space for visitors | 1 space per 10 sqm of public floor space for visitors | 1 stand per 35 sqm of public floor space for visitors |

The Wirral MBC SPD4 parking standards have been used to determine the number of disabled parking spaces required at the visitor centre. The standards state:

*"Use Class D1 – Non-Residential Institutions, Vehicles for people with disabilities (Minimum) 1 in the first 25 spaces should be allocated for disabled people. Thereafter 1 in every 25 spaces should be allocated for disabled people or 6% of the total maximum standard, whichever is greater."*

Consequently, the number of visitor parking spaces has been calculated as shown in Table A.3.

**Table A.3: Forecast Number of Visitor Centre Parking Spaces**

| Parking Space Type | Recommended Number of Spaces | Type | Allowed Number of Spaces |
|---|---|---|---|
| Cars | 240 | (Public or Exhibition Hall) | 140 |
| | 40 | (Museum and Art Galleries) | |
| Cycles | 34 | (Public or Exhibition Hall) | 34 |
| | 20 | (Museum and Art Galleries) | |
| Disability | 40 | (Public or Exhibition Hall) | 30 |
| | 7 | (Museum and Art Galleries) | |
| Motorcycles | 12 | (Public or Exhibition Hall) | 12 |
| | 2 | (Museum and Art Galleries) | |
| Coaches | 6 | (Public or Exhibition Hall) | 2-6 |
| | 2 | (Museum and Art Galleries) | |

The allowance was determined by following a calculation of the maximum and minimum numbers of recommended spaces by type.

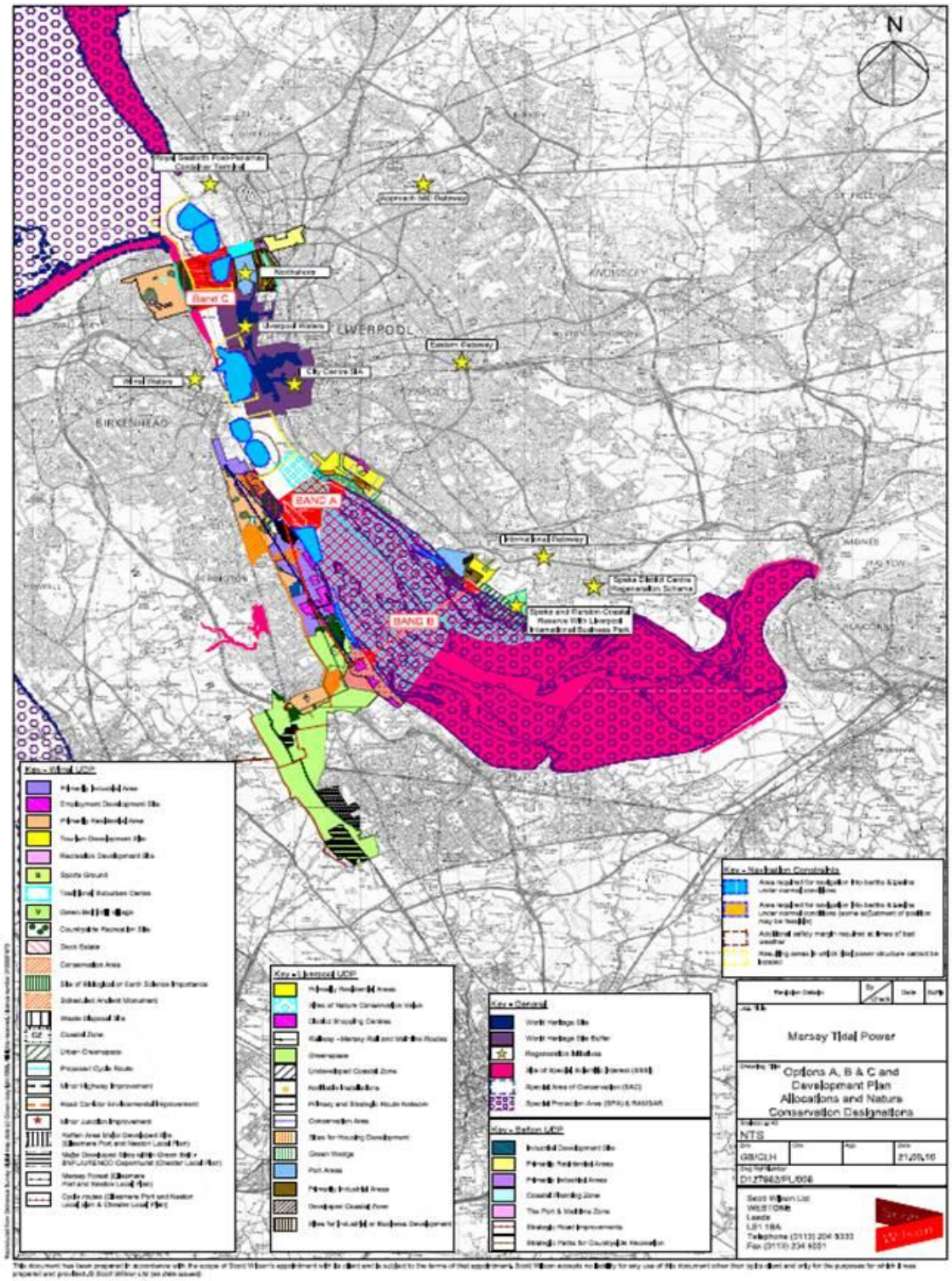
It can be seen that a total of 170 car parking spaces are forecast to be required. It is likely that an allowance of between 2 and 6 coach parking spaces would be prudent.

**Overflow Parking**

The provision of overflow parking would provide additional parking capacity for visitors in the event of an exhibition or other special event. The overflow area is also allocated for maintenance lay-down space.

# Annex B – Constraints Mapping

**Figure B1: Development Plan Allocation & Nature Conservation Designations**



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