Galway Harbour extension: assessment of compensatory measures (Strategic Infrastructure Case 61.PA0033).

For An Bord Pleanála –Project P-ABP-001

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Contents

1. Summary

This is a report on the progress made on the discussion of compensatory measures for the loss of Annex I habitats within Galway Bay Complex SAC that would occur during the construction of the proposed expansion of Galway Harbour, and on my review of the specific compensatory measures.

It is based on the information provided to me by An Bord Pleanála (the Board), and inspections of the sites relevant to the proposed compensatory measures undertaken by Senior Planning Inspector Paul Caprani and I on the 16th and 17th February 2017.

Following a letter from the Board, the applicant submitted reports addressing the requirements set for Phase 1. The approach taken is based on the criteria and principles set out by the EU Commission's guidance on Article 6 (4) (EU, 2007/2012), as advised by the Board. For this, the applicant identified potential replacement habitats for the Annex I intertidal and stony bank habitats that would be lost due to the construction of the new harbour, and saltmarsh habitats that were lost in the past due to the construction of the Galway Harbour Enterprise Park.

Based on my current understanding of the ecological status of the habitats considered for compensatory measures, and the information available at this stage (Phase 1), my conclusions are as follows:

1. The extension of the Galway Bay Complex SAC to the north west, to include intertidal habitats in the area between Barna and the SAC would be an appropriate measure to compensate for the losses associated to the construction of the proposed harbour extension.

2. The management of areas of intertidal habitats currently within the SAC is less likely to result in appropriate compensation for this loss. This could be established with more confidence once evidence on the status of these habitats is obtained by undertaking qualitative and quantitative surveys and acquiring data.

3. The extension of the Galway Bay Complex SAC to the north west, to include stony bank habitats in the area between Barna and the SAC would be an appropriate measure to compensate for any losses associated to the construction of the proposed harbour extension.

4. Adequate, targeted management to improve and protect the existing stony bank habitat that would be adversely affected by the proposed development is the best available alternative to maintain the integrity of the SAC.

5. Appropriate management to improve and protect the existing saltmarsh habitats within the SAC would be the best option to compensate for the losses of this habitat caused by the construction of the GHEP in the past.

2. Introduction

Galway Harbour Company Limited (GHC) is applying for planning permission for an extension of Galway Harbour (Connaught, Ireland). This extension would be adjacent to the Galway Harbour Enterprise Park (GHEP), approximately 500m south-east of the existing commercial Inner Harbour. The proposed Galway Harbour Extension (GHE) would be constructed on land to be reclaimed from the sea to the south of the existing GHEP, which was also partially built on land reclaimed from the sea.

In December 2014, I was appointed by An Bord Pleanála (the Board) to review the environment impact assessment undertaken by the developer and presented in a series of documents. My brief included attending a Public Hearing organised by the Board between the 13th and 15th January 2015 in the Connacht Hotel (Galway) and writing a report addressing the potential impacts of the proposed development on marine ecology arising during both the construction and operational phases. This report (Bastreri, 2015) was completed and submitted to An Bord Pleanála in February 2015.

Further to receiving my report and recommendation, and the report of Senior Planning Inspector Mr Paul Caprani, the Board issued its initial Direction on this case on the 25th September 2015. On the 29th September 2015, the Board set up its statement of appropriate assessment, identified the resultant impacts on the integrity of the relevant European site arising from the proposed development and, on a without prejudice basis to the final determination of the application, sought to invoke the derogation provisions set out in Article 6(4) of the Habitats Directive in regard to Imperative Reasons of Overriding Public Interest (IROPI). The Board issued a letter in which it sought compensatory measures from the applicant to address the impacts on the integrity of the Galway Bay Complex Special Area of Conservation (SAC).

A response to this letter was written by the applicants on the 25th November 2015, setting out initial approaches for compensatory measures. The Board considered these initial measures and issued a Direction on the 29th January 2016, instructing that the applicant's submission be forwarded to the National Parks and Wildlife Service of Ireland (NPWS) for comments and to arrange a meeting between representatives of the Board and the NPWS to discuss the acceptability of the proposed measures.

The NPWS responded by way of a submission dated 27th May 2016, which included comments on the applicant's proposal for compensatory measures. A meeting between representatives of NPWS and the Board (Director of Planning and Assistant Director of Planning) was held on the 28th June 2016. Following this meeting, further discussions on the approach to the proposed compensatory measures were held between the applicant and the NPWS. A tripartite meeting between the Board, NPWS and the applicant was held on the 13th December. Previous to this meeting, the applicant submitted a further package of information setting out their proposals for compensatory measures, which was also discussed during the tripartite meeting.

3. The brief and objectives

With regard to the progress made on the discussion of compensatory measures, the Board has agreed to seek my expert advice on the approach to compensatory measures being proposed in the applicant's submissions. The following documents have been forwarded to me by the Board on the 25th January 2017:

1. An Bord Pleanála's Statement of Appropriate Assessment.

2. An Bord Pleanála's request to the applicant to submit proposals for compensatory measures (29th September 2015).

3. Proposed Compensatory Measures Associated with the Galway Harbour Extension, Renmore and Townparks Townlands, Galway, Aquafact, 25th November 2015.

4. National Parks and Wildlife's Service comments on the proposed measures, 27th may 2016.

5. Record of meeting between the Board and NPWS, 28th June 2016.

6. Proposed Compensatory Measures (Version 2.1) in relation to the proposed Galway Harbour Extension, An Bord Pleanála (Ref: 61.PA 0033). Aquafact, 9th December 2016.

7. Written record of tripartite meeting between the Board, NPWS and the applicant, 13th December 2016.

8. Proposed Compensatory Measures (Version 2.2) in relation to the proposed Galway Harbour Extension, An Bord Pleanála (Ref: 61.PA 0033). Aquafact, February 2017

Following the initial briefing and set of documents, a third document including proposals for compensatory measures was submitted to the Board by the applicant on the 28th February 2017. This is document 8 in the above list. The information on proposals for compensation in this document has been reviewed, and its content also discussed in section 7.

My brief is to continue providing expert ecological advice to the Board as the case advances, and at this stage, addressing the points listed below:

1. Review documents 1 to 8 above and any subsequent related information provided by the Board.

2. Consider the extent of any further information that might be of assistance to the Board at the current initial phase in relation to the proposed compensatory measures and to advise accordingly in writing of necessity for any further clarification or information required.

3. Carry out site inspections as agreed in advance by the Assistant Director of Planning (ADP)/ Director of Planning (DoP).

4. Provide interim advice to the Board on the general approach and adequacy of initial compensatory measures being proposed as set out in the documents provided, and in particular in the report provided by the applicant on 9th December 2016 (Aquafact, 2016, V2.1).

The present report addresses points 1 to 4 above. It is based on the information provided to me by the Board in documents 1 to 8, and inspections of the sites relevant to the proposed compensatory measures undertaken by Senior Planning Inspector Paul Caprani and I on the 16th and 17th February 2017.

In addition to the documents provided by the Board (documents 1 to 8, listed in page 9), the following reports and documents were used for the preparation of this report:

EU (2007/2012) Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC

EU (2000). Managing Natura 2000 sites. The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC

CIEEM (2016) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd edition. Chartered Institute of Ecology and Environmental Management, Winchester

NPWS (2013) The Status of Protected EU Habitats and Species in Ireland. Overview Volume 1. Unpublished Report, National Parks & Wildlife Services. Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland. Editor: Deirdre Lynn.

NPWS (2012) Marine Natura Impact Statements in Irish Special Areas of Conservation

EPA (2002) Guidelines on the information to be contained in Environmental Impact Statements. Environmental Protection Agency, Ireland.

Author's competence

I am a marine ecologist with more than 26 years of continued professional experience, and a chartered scientist and chartered marine scientist with the UK Science Council through the Institute of Marine Engineering, Science and Technology (IMarEST) and a member of IMarEST. My experience relevant to this assignment includes providing specialist evidence-based advice on anthropogenic impacts on the marine and aquatic environment to UK government organisations, government organisations in the Middle East, and the private sector in the UK, Indonesia, Ecuador and Nicaragua. Between 2007 and 2013, I worked as a Marine Impact Assessor and science lead on the Regulatory Assessments Team of the Centre for Environment, Fisheries an Aquaculture Science (Cefas), an agency of the UK's Department of Food and Rural

Affairs (Defra), providing advice to England's marine regulator, the Marine Management Organisation (MMO) and their predecessors on the assessment of impacts of proposed developments, including nationally significant infrastructure projects. In this capacity, I provided specialist advice to the MMO on the impacts associated with harbour development works in the ports of Dover, London Gateway, Harwich, Sheerness, Ramsgate, Portland, Southampton, Portsmouth, Newhaven, Sovereign Harbour and Littlehampton. I also advised the MMO and their predecessors on other nationally significant infrastructure projects affecting the marine environment, including several offshore wind farms (London Array, Blyth, Thanet, Kentish Flats, Scroby Sands, Gunfleet, Westermost Rough, Rampion), the Thames Tideway Tunnel and the extraction of marine minerals in the English Channel and the North Sea.

I have undertaken research in the areas of plankton ecology and taxonomy, biological effects of pollutants associated to water and sediment, and the impacts of point and diffuse water discharges on coastal, estuarine and freshwater environments, including undertaking over 30 'Stage III Appropriate Assessments' of licensed water discharges to Natura 2000 (European Sites) in S and SE England (from the Thames Estuary to the North Norfolk Coast) on behalf of the Environment Agency. Other areas of research related to the application of the EU Birds and Habitats Directives and the EU Water Framework Directive in the UK include undertaking numerical analyses of benthic populations in estuarine and coastal waters in the NE of England, toxicity, bioavailability and bioaccumulation of pollutants in marine sediments within a European Site, and long term bioaccumulation studies in coastal fish, shellfish and seaweeds.

Between 1998 and 2003, I was the UK's Environment Agency scientific lead for the UK's National Marine Monitoring Programme (NMMP) in the NE of England. My duties involved planning, managing, and executing marine surveys, for taking water, sediment, fish and macrobenthos samples on regular intervals in a series of intertidal, coastal and offshore sites, adding the data to a national database managed by Cefas, and undertaking data analyses to understand trends and drives of environmental change at national level, and for the early implementation of the EU Habitats and Water Framework Directives. These included bioaccumulation studies involving fish, mussels and seaweeds (*Fucus spp*) and assessment of intertidal coastal habitats and macrobenthic populations in the NE and SE of England.

As a consultant over the last 4 years, I have assessed the impacts of the construction of large and small jetties in the Thames Estuary, decommissioning of an oil platform in the North Sea, undertaken several Water Framework Directive and Habitats Regulation Assessments, a study of long-term sediment chemistry and benthic populations in the Orwell and Stour Estuaries for Harwich Harbour Authority, and many other assessments regarding the impacts of navigation dredging and disposal of contaminated sediments.

4. The Board's Statement of Appropriate Assessment

After considering the documentation submitted by the applicant, which included a comprehensive list of Natura 2000 sites that could be potentially affected by the proposed harbour extension, An Bord Pleanála agreed with the screening assessment and conclusion reached in my report (*op. cit*.) that the following European Sites

- Galway Bay Complex SAC (site code 000268)
- Inner Galway Bay SPA (site code 004031)
- Lough Corrib SAC (Site code 000297)

are the relevant sites for which there is a likelihood of significant effects, requiring a 'stage II' assessment. The Board considered the Natura impact statement and all other relevant submissions, including further information submitted by the applicant and further submissions made in the course of the oral hearing, and carried out an appropriate assessment of the implications of the proposed development for these European Sites in view of the sites' conservation objectives.

An Bord Pleanála's Statement of Appropriate Assessment (SAA) (2015) concluded that the proposed development would not lead to a significant adverse impact on the Inner Galway Bay SPA, and would not affect the integrity of the SPA in view of the site's conservation objectives.

In relation to Lough Corrib SAC, the SAA concluded that whilst some adverse impacts are likely, a significant adverse effect on the integrity of the SAC will not arise in view of the site's conservation objectives.

The SAA also concluded that the integrity of the Galway Bay Complex SAC would be affected by the proposed development. This is due to the direct loss of fucoid-dominated reef habitat (reference 1170) and mud and sand flat habitat (reference 1140) that will occur within the footprint of the proposed new harbour, and due to the potential loss of perennial vegetation on stony banks due to the sheltering effect of the proposed harbour on the hydrodynamic regime at the site.

The 'fucoid dominated reef' habitat and the 'mud and sand flat not covered by sea-water at low tide' (Annex 1 habitats) that will be permanently removed by the proposed land reclamation are located in the inter-tidal zone directly adjacent to the existing Galway Harbour Enterprise Park. These habitats have a combined area of 5.93ha.

The habitat supporting perennial vegetation of stony banks is found adjacent to the GHEP, beside Renmore Lough, and comprises a low shingle bank running along the shore. The shingle bank has been affected by recent storms and it is expected to recover. The proposed development will lead to changes in the hydrological regime at local level, sheltering the south boundary of Renmore Lough, which in turn will prevent storm and wave surges from accessing the stony banks. This in turn will lead to an increase in colonisation by terrestrial vegetation. In consequence, the proposed harbour expansion may lead to the loss of this habitat, or more accurately, the modification of the habitat and its biological community. The total area of this habitat affected is approximately 0.35ha of which approximately 0.2ha lies within the boundary of the SAC.

In consequence, the Board decided that approval of the proposed development could not be considered under article 6 (3) of the Habitats Directive.

I can confirm that the conclusions arrived by the Board in relation to the impacts of the proposed harbour extension on the integrity of the relevant European Sites are in agreement with my own conclusions and my advice, as stated in my report of February 2015.

Board's letter to applicant

Following the completion of the Appropriate Assessment, the Board wrote to the developer (Galway Harbour Company, GHC) on the 29th September 2015, to ask if they wished to have the project considered for approval under Article 6(4) of the Habitats Directive. The Board also advised that GHC should submit proposals for compensatory measures to address the impacts on the integrity of the Galway Bay Complex SAC mentioned above. These compensatory measures would be addressed in two phases:

Phase 1, in which the proposals for compensatory measures would be set out by GHC for initial consideration. GHC is advised to liaise with the NPWS in this regard.

Phase 2: Pending the outcome of Phase 1, the applicant will be afforded further time to develop the compensatory measures in more detail leading to submission of a detailed proposal for consideration by the Board.

5. Phase 1: Initial proposals for compensatory measures

Following the Board's letter, the applicant submitted a report (Aquafact, 2015) addressing the requirements set for Phase 1. The approach taken by the developer's consultants (Aquafact) is based on the criteria and principles set out by the EU Commission's guidance on Article 6 (4) (EU, 2007/2012), as advised by the Board. For this, the applicant identified potential replacement habitats for the Annex I intertidal and stony bank habitats that would be lost due to the construction of the new harbour.

The area of intertidal habitats that would be lost to the development and require addressing by compensatory measures is 5.93ha. The intertidal habitats affected by the proposed project include both fucoid-dominated reef Annex I habitat [1170] and Annex I sand/mud flats [1140].

The stony bank habitat supporting perennial vegetation that would be affected is approximately 0.35ha, of which approximately 0.2ha lies within the boundary of the SAC.

5.1 Intertidal habitats

The compensation options initially considered and assessed for the loss of intertidal habitats were:

- Inundation by the sea of either reclaimed land or non-marine/agricultural fields.
- Infilling of shallow subtidal areas of Galway Bay to turn them into intertidal habitat.
- Identifying similar intertidal habitats outside the boundary of the Galway Bay Complex cSAC but in close proximity of it, that could be considered for designation.

The first two options (inundation and infilling) were screened out during the initial stages of the assessment.

In relation to the flooding of reclaimed, agricultural or other non-marine land, it was concluded that the potential for the new intertidal habitats to be created by this process to develop functional fucoid-dominated communities in a short period of time was low. Additionally, the flooding of reclaimed or agricultural land may lead to further impacts on the adjacent coastal waters, potentially on the European Sites. These potential impacts have been correctly identified in the Aquafact (2015) document, and include resuspension of contaminated material and changes in the coastal profile that could in turn lead to changes in the hydrodynamic regime – tidal patterns, currents, etc.

These impacts would need to be assessed, together with the regulatory implications of such works. Because of these concerns, the inundation of land was not considered as a feasible method to compensate for the loss of intertidal habitat within the SAC.

In relation to the infilling of subtidal areas within Galway bay, it is considered that there are uncertainties in relation to the re-establishment of the fucoid-dominated communities in the new habitats. The applicant also concluded that the infilling of subtidal habitats is likely to lead to further environmental impacts, which will also need

to be assessed, and the need to address the regulatory requirements of these works.

In consequence, the remaining option left to the developer was to identify similar intertidal habitats outside, but in the proximity of the SAC. An area on the north coast of Galway Bay, adjacent to the SAC and to the west of the existing Galway harbour was identified by the developer as containing intertidal habitats that are similar to those that would be lost to the proposed development. This is an area of the coast between Silverstrand and Barna, which includes intertidal fucoid-dominated reef and sandflat and mudflat habitats. The report states that there are 21.5ha of fucoid-dominated reef and 7.47ha of mudflats and sandflats within this section of the coast, and that these habitats are similar to those that would be lost to the development. These habitats are considered to be fully functional, and similar in structure to those which will be lost. Therefore, the developer proposes the designation of this section of the coast as part of the Galway Bay Complex SAC. Whilst they acknowledge that further discussion with the NPWS would be necessary to reach an agreement regarding the ratio of habitat replacement, they suggest that a 1:1 ratio would be appropriate – this is, the designation of 5.93ha of intertidal habitats.

5.2 Stony bank habitats

The compensatory measures proposed by the applicant in relation to the stony bank habitats is to identify, acquire rights to and designate stony bank habitat within a part of the coast immediately adjacent to the north-west limits of the SAC. This section of the coast would be included within the same area proposed for compensation of intertidal reefs and sandflats/mudflats. This option would be the best solution, in the opinion of Dr Michelene Sheehy Skeffington, a botanist and Emeritus Professor in the Plant Ecology Research Unit of National University of Ireland Galway consulted by the applicant.

The proposed compensatory measure is, in consequence, to designate new areas adjacent to the SAC which include this habitat. This is based on the assumption that these habitats are fully functional, and that it would be possible to purchase or obtain access rights for the lands within the proposed area that are owned by private persons. The proposed compensatory measures also include reverse constraints to the landward migration of the stony banks by the removal of sea defences. This would

allow the stony banks present in this section of the coast to return to their natural dynamic nature, preventing colonisation by terrestrial plant species.

The report (*ibid.*) states that an appropriate assessment under the Habitats Directive will be required, and recommend undertaking 'an annual survey of key species of this habitat order that National Parks and Wildlife can comply with Article 17 of the Habitats Directive'. The rationale for these recommendations is not explained in the report.

5.3 Wetland creation and designation

In addition to the designation of intertidal and stony habitats currently outside of the Galway Bay Complex SAC, the developer proposed the creation and designation of saltmarsh and wetland habitats.

These include the creation of new wetland habitats by permanent flooding of low lying lands that are currently subject to flooding only at extreme tidal events, by blocking existing drainage structures. It is not clear where these lands would be situated, other than within a 30km stretch of coast to the west of the SAC, marked in figure 4 in the report.

The other proposed compensation measure in relation to wetlands is the designation of 3ha of land in Renmore, which belongs to GHC. The report claims that these lands are currently part of the Galway Bay SPA, though this may not be the case – it shows to be outside the SPA in the GIS layer in the mapping service of the Department of Environment, Communities and Local Government of Ireland, and this has also been questioned by the NPWS (see section 6). The proposal involves the designation of this extension of land as part of the Galway SAC. This is based on the presence here of saltmarsh and wetland habitats that are qualifying interests of both the SAC and the SPA. Another reason would be the proximity of this site to Renmore Lagoon and Lough Atalia, which are coastal lagoons and priority habitats under the Habitats Directive.

5.4 Construction of a tern nesting platform

This proposal involves the construction of a concrete-made structure of 20m X 20m, built on piles, between Hare and Rabbit Islands. This structure would be used as a tern

nesting platform, and since the site is within the within the Galway Bay SPA, it is regarded by the applicant as giving the terns a permanent nesting facility.

5.5 Removal of construction rubble from the Lough Atalia channel

This would involve the removal of construction rubble that has been abandoned following works undertaken in the past to realign the access channel, or is part of these works. It is not clear in the report which of the two cases this is, or how this would relate to maintaining the integrity of designated habitats within the SAC.

6. Response from the NPWS

The initial (Phase 1) proposals for compensatory measures were reviewed by the NPWS, and comments were submitted to the Board (Document 4, in Chapter 2, page 8). In this document, NPWS express concerns about the adequacy of scientific information provided by the applicant. They state that they consider the proposals to be vague in nature, whilst accepting that these proposals would be only an initial outline at this stage. For these reasons, they conclude that they are not in a position to agree with the developer regarding the appropriateness of the proposed compensatory measures, or whether these are or will be acceptable to them. Their response in relation to the different proposed compensatory measures is summarised below:

6.1 Intertidal Annex I habitats

They consider that it would not be appropriate to delineate the individual contribution of each Annex I habitat to the area to be lost. On the proposed compensatory measures, the NPWS consider that there is lack of evidence on the appropriateness of the proposed compensatory habitats. They state that biological survey results would satisfy these shortfalls, but they do not offer any further detail regarding the scope of these surveys.

6.2 Perennial vegetation on stony banks

NPWS consider that there is lack of information - such as survey data and photographic records - on the stony bank habitat that would be lost due to the proposed

development. They also highlight the lack of detailed information on the proposed compensatory habitats to the west of Galway (30km stretch of coast), and that there are differences in the profile and particle size distribution of the stony banks in this area and those affected by the proposed development. NPWS also refer to the National Shingle Beach Survey (1999), which shows the presence of 'high (conservation) value' perennial vegetation on stony banks' in Tawin Point, within the Galway Bay Complex SAC. Results from another survey (Coastal Monitoring Project, Ryle *et al*., 2009) suggest the presence of this habitat in two sites within the SAC, Bishopsquarter and Barna.

NPWS also question the lack of direct statements from the expert (Dr Sheehy-Skeffington) in relation to the appropriateness of the proposed compensatory measures for the potential loss of this habitat.

6.3 Wetland creation and designation

In relation to the proposal for the designation of 3ha of land in Renmore, which belongs to GHC as part of the Galway SAC, the NPWS point out that this land is not currently included within the Galway Bay SPA. They consider that they need further information on its 'current ecological merits' for inclusion in SAC.

6.4 Construction of a tern nesting platform

In relation to this proposed measure, the NPWS consider that the applicant has not yet explained the need for this in relation to site integrity or compensation required to maintain network coherence. They also point out that the potential adverse impacts of this structure on the Galway Bay Complex SAC should be assessed, and that an Appropriate Assessment of the impacts on the conservation objectives for Qualifying Interests of the SAC would be required.

6.5 Removal of rubble from the Lough Atalia channel

In relation to this proposed measure, NPWS state that it is not clear why this is considered as a compensatory measure, rather than an issue related to disposal waste or management of the site.

6.6 Additional comments

In addition to their comments on the compensatory measures listed above, the NPWS raised concerns in relation to the potential adverse impacts of the proposed works on the population of harbour seal (a Qualifying Interest in the Galway Bay Complex SAC), bird populations which are designated features of the Galway Bay SPA (turnstone and great northern diver) and the cumulative impact of habitat loss when considering the combined loss due to the construction of the existing Galway Harbour Enterprise Park and the proposed Galway Harbour extension.

During the tripartite meeting held on the 13th December 2016 between representatives of the Board, NPWS and the developer it was agreed that the focus of this meeting would be the identification and assessment of potential compensatory measures for the impacts as outlined in ABP's request to the applicant, and no further consideration was required in relation to those further issues identified in the NPWS letter of 27th May 2016 (harbour seals, birds and cumulative effect). For this reason, and following advice from the Board, these additional issues will not be discussed in this report.

7. Second proposal of compensatory measures

Following NPWS' comments on the initial set of compensatory measures (outlined in section 4), the applicants submitted a second report with a new set of compensatory measures. This report (Aquafact, December 2016) includes a package of measures with focus on three areas within Galway Bay SAC.

In this proposal, the habitats for which compensatory measures are required also include an area of saltmarsh, that was lost during the development of the Galway Harbour Enterprise Park (GHEP). For this reason, the Atlantic salt meadow (*Glauco - Puccinellietalia maritimae*) [1330] has been added to the above two habitats.

The compensation areas for loss of qualifying interest (QI) habitats in the Galway Bay Complex SAC due to the proposed expansion of Galway Port and the development of the GHEP are described as:

- Intertidal habitats (mud and sand flat and reefs):14.51ha
- Stony bank: 0.63ha
- Salt marsh: 7.39ha.

The difference in the areas for intertidal habitats (14.51ha in this proposal, 5.93ha in the previous proposal) is because intertidal areas lost during the construction of the GHEP are now included in the proposed compensation scheme, as highlighted by the NPWS in their comments (page 13, last paragraph). Similarly, the area of stony bank habitat is now 0.63ha, while it was 0.35ha in total and 0.2ha within the SAC in the previous report.

A second version of this report was written by Aquafact on behalf of the applicant, and submitted to the Board on the 28th February 2017. The proposals included in both reports are summarised below.

The proposed compensatory measures are based on the Tawin Island (also named Tawin Headland), in the eastern central part of the Galway Bay Complex SAC. The report states that all relevant habitats (stony bank, saltmarsh and intertidal muds, sand and reefs) are present in this area.

Following the advice from NPWS to the Board in their submission, a desk-based study was undertaken by the developer's consultants, to review existing published literature on the distribution of the habitats requiring compensation in the Galway Bay area, including the north shore of County Clare. The results of this desk based study showed that the eastern part of Galway Bay contains the largest areas of these habitats. Aquafact also undertook a walk survey of the coast from Oranmore, in the east end of Galway Bay to Renville, Ardfry, ending at the south-eastern corner of Tawin. Areas of intertidal mudflat, stony bank and salt marsh were recorded and mapped, and the results presented in a map (Fig. 2 in the Aquafact report, not in fig 1 as erroneously stated).

Based on the results of these initial surveys, which showed extensive areas of saltmarsh, stony bank and intertidal reef, mudflat and sandflat in Tawin Island, this area was selected for the proposed management plan.

7.1 Compensation measures for intertidal habitats

The proposal is to establish a marine nature reserve, as those designated in the port of Rotterdam (Netherland) and Flamborough Head, in the UK. The combined area of these three intertidal habitats in Tawin Island has been estimated as approximately 500ha, and the nature reserve would cover the totality of this extension. Additionally, the proposal includes the development of a programme for the eradication of the non-native tunicate *Didemnum sp*. at two aquaculture sites (Parknahalla, east side of Kinvarra Bay and Shanmullen Channel, Tawin South) within the Galway Bay Complex SAC.

The applicant proposes to undertake detailed surveys, to assess the suitability of Tawin Island as a site to implement the proposed compensatory measures for the loss of intertidal habitats due to the development.

7.2 Compensation measures for stony banks and saltmarsh

The plan is to “bring about the biological improvement of substandard areas of these habitats” which in places have been described as being of “unfavourable/inadequate” status in the report on the Saltmarsh Monitoring Programme Project (2006). This report refers to pressures on salt marsh and stony bank habitats arising from agriculture, including grazing, poaching by cattle, grazing tracks, dumping, excavation of stones and gravel.

The proposed management measures include stopping grazing, poaching, spread of slurry, and removal of cobbles. Other management measures involve the control of access by tractors, use of round and winter feeding, prevent the use of herbicides, prevent the maintenance and construction of sea defences, and removal of waste. The proposal includes the establishment of annual surveys of the habitats and audit of progress of the management plan, and the installation of signage describing the project and the habitats and their associated flora and fauna.

7.2.1 Management plan to avoid disappearance of stony bank in Renmore

A management plan to prevent the disappearance of the existing stony bank habitat at Renmore Lough was included in the second Aquafact report (2016). This would include the annual low-level reworking of the seaward strip of cobbles, removal of invasive species, and spraying of the cobbles with sea water. However, this option was not included in the third report (Aquafact, 2017).

8. Discussion

As detailed in sections 5.1, 5.2, 7.1 and 7.2, the proposed compensatory measures for the loss of habitats and to maintain the integrity of the SAC are:

- The designation of a coastal area on Galway Bay between Silverstrand and Barna, to the west of the existing Galway harbour as part of the Galway Bay Complex SAC (first proposal).

- The management of areas of intertidal and saltmarsh habitats, currently included within the Galway Bay Complex SAC, which have been identified as being of unfavourable status.

- The designation of part of these habitats within the SAC as Nature Reserve Zones.

8.1 Intertidal habitats

The reef and sand/mud flats are not considered individually in the proposed compensatory measures, and NPWS consider that it would not be appropriate to delineate the individual contribution of each Annex I habitat to the area to be lost (Section 5.1). The 5.93ha of intertidal habitats to be lost to the proposed development, and the areas lost to the development of the GHEP in the past include intertidal fucoid-dominated reef interspersed with sand and mud flats. As both habitats (reef and sand/mudflats) can be found together in the areas proposed for compensatory measures, I will discuss these in relation to both habitat types.

8.1.1 Intertidal fucoid-dominated reef [1170]

Intertidal fucoid-dominated reef communities are common and widespread around the coasts of Ireland and the British Isles. They are characterised by the dominance of brown seaweeds including bladder wrack (*Fucus vesiculosus*), serrated wrack (*Fucus serratus*), spiral wrack (*Fucus spiralis*), brown seaweed (*Fucus distichus*), knotted

wrack (*Ascophyllum nodosum),* channelled wrack *Pelvetia canaliculata* with their associated flora and fauna. Other seaweeds commonly associated to this habitat are *Codium spp.* and the red algae *Vertebrata lanosa* and *Hildebrandia rubra.*

The epifauna associated to this habitat includes the common limpet (*Patella vulgata*), common mussel (*Mytilus edulis*), the flat top shell *Gibbula umbilicalis* and the grey top shell *Gibulla cineraria,* periwinkles (*Littorina spp.)*, and crustaceans such as barnacles (*Balanus spp. and Semibalanus spp.)*. The seaweeds provide substratum and shelter for the tube worm *Spirorbis spirorbis*, herbivorous isopods, such as *Idotea*, and surface grazing snails, such as the flat common periwinkle *Littorina obtusata*. During high tide, the fronds provide substratum and shelter to an assemblage of planktonic and epibenthic invertebrates, which in turn are used as food resources by coastal fish larvae and juveniles. The overall status for these habitats in Galway Bay Complex SAC is bad (NPWS, 2013). Figures 1 to 3 (in the next two pages) show the intertidal habitats adjacent to the Galway Business Enterprise Park that would be lost due the expansion of the harbour. These images were taken during my visit on the 16th February 2017.

Fig 1: Intertidal fucoid-dominated reef and sand flats, Galway.

Fig 2: Intertidal habitats, close-up. Casts made by the lugworm *Arenicola marina* can be observed on the sand flats (left).

Fig 3:Close-up: bladder wrack, (*Fucus vesiculosus*), serrated wrack (*Fucus serratus*), knotted wrack (*Ascophyllum nodosum*), and the red algae *Vertebrata lanosa.*

The dominant species in this habitat - seaweeds of the Genus *Fucus* and *Ascophyllum* - are highly fecund, and each fully developed plant may produce over one million eggs, which adhere to rocks and almost any substrate within hours of settlement. The germling may be visible to the naked eye within two weeks (Knight & Parke, 1950), and the life cycle lasts between 2 and 5 years. Whilst the timing of reproduction of *Fucus spp.* is to a certain extent conditioned by wave exposure and local hydrodynamic patterns, what is known of the biology of these species suggests that colonisation of any new habitats (reefs) by *Fucus spp.* and their associated flora and fauna would take place within 2 to 5 years. These communities tend to be unstable, due to the combined effects of physical disturbance, competition, grazing, predation and recruitment variation. They are often dominated by a small number of species, which occupy the majority of available space (Hill *et al.*, 1998). Their sensitivity to impacts is low, and their recoverability high.[1]

Whilst intertidal rock habitats provide food resources and substratum for many commercially important species of fish during high water, there is little evidence of dependence on littoral communities (*ibid*.). These habitats also provide food for aquatic birds and opportunistic terrestrial mammals (Feare and Summers, 1985) during low water.

8.1.2 Intertidal sandflats and mudflats [1140]

The benthic communities characteristic of the sand and mudflats present in the areas to be lost are generally described in the 'Galway Bay Complex SAC Conservation objectives supporting document' (NPWS 2013). These are:

Intertidal sandy mud community complex

The fauna of this complex includes the thin tellin *Tellina tenuis*, the Baltic tellin *Macoma balthica*, the common cockle *Cerastoderma edule* and the polychaetes *Glycera tridactyla* and *Nephtys hombergii.* Other species, such as the brown shrimp *Crangon crangon*, the lugworm (polychaete) *Arenicola marina* and the peppery furrow shell

[1] (http://www.marlin.ac.uk/species/detail/1330;http://www.marlin.ac.uk/species/sensitivity_rationale)

Scrobicularia plana are present in moderate abundance, and their distribution is patchy in this habitat type.

Intertidal sand community complex

In this community complex, species such as the polychaetes *Spio martinensis* and *Scoloplos armiger* and the bivalve common cockle *Cerastoderma edule* are generally associated to a sandy substrate, whilst the polychaetes *Exogone (Parexogone) hebes, Pomatoceros lamarcki, Travisia forbesii* and the chiton *Lepidochitona cinerea* are found associated to coarser material.

Both habitats and community types in mudflats and sandflats are common in coastal areas of northern Europe. They are important in providing structure to coastal ecosystems, and in the processes of energy production and transfer within the ecosystem and beyond. In this respect, their role in providing food resources for marine birds and coastal fish and shellfish is widely acknowledged as important. The overall status for these habitats in Galway Bay Complex SAC is inadequate (NPWS, 2013).

The sandflats at the affected site (see figures 4 and 5, taken at the site on the 16th February 2017) are similar to other intertidal sand and mudflats around the coasts of Ireland, the British Isles and Northern Europe. The flats are covered by casts on the sand, made by lugworms, (*Arenicola marina*), which is an indicative species of the intertidal sandy mud community complex.

Fig 4: Inter-spread intertidal sandflat and fucoid-dominated reef habitats.

Fig 5: Lugworm casts on intertidal sand flats in Galway (mid-right and low-right of the *Buccinum sp*. shell in the centre).

As stated in Section 5, the total area of intertidal habitats that would be lost to the development and require addressing by compensatory measures is 5.93ha. In addition to this, 8.58ha of intertidal habitats were also lost during the construction of the existing GHEP. These intertidal areas (combined) amount to 14.51ha. Considering the intertidal habitats as a complex including both reef and sandflat/mudflat habitats, the loss of these 14.51ha represents approximately 0.17% of the total, according to the combined extension of these two habitat types (1140 and 1170) in the Natura 2000 Standard Data Form for the site (3,516ha).

Following the guidance in the 'Managing Natura 2000 Sites (EU, 2011) document, the connotation or meaning of 'integrity' should be considered as a quality or condition of being whole or complete. In a dynamic ecological context, it can also be considered as having the sense of resilience and ability to evolve in ways that are favourable to conservation. The decision as to whether it is adversely affected has been correctly based on the site's conservation objectives, regardless of the extension of the affected habitats.

8.2 Proposed compensatory measures for intertidal habitats

8.2.1 Designation of intertidal habitats outside the SAC

An area on the north coast of Galway Bay, adjacent to the SAC and to the west of the existing Galway harbour was identified by the developer as containing intertidal habitats that are similar to those that would be lost to the proposed development. There are 28.62ha of intertidal reef and sand/mud flats in this area, of which 21.5ha are fucoid-dominated reef and 7.47ha of mudflats and sandflats. These habitats are indeed very similar to those affected by the development, though they seem to have a thicker coverage of seaweed, and more abundant and diverse associated macrofauna (Figures 6 to 11).

Fig 6: Intertidal habitats west of Barna (looking east).

Fig 7: Intertidal habitats west of Barna (looking west).

Fig 8: Intertidal fucoid-dominated reef, east of Barna

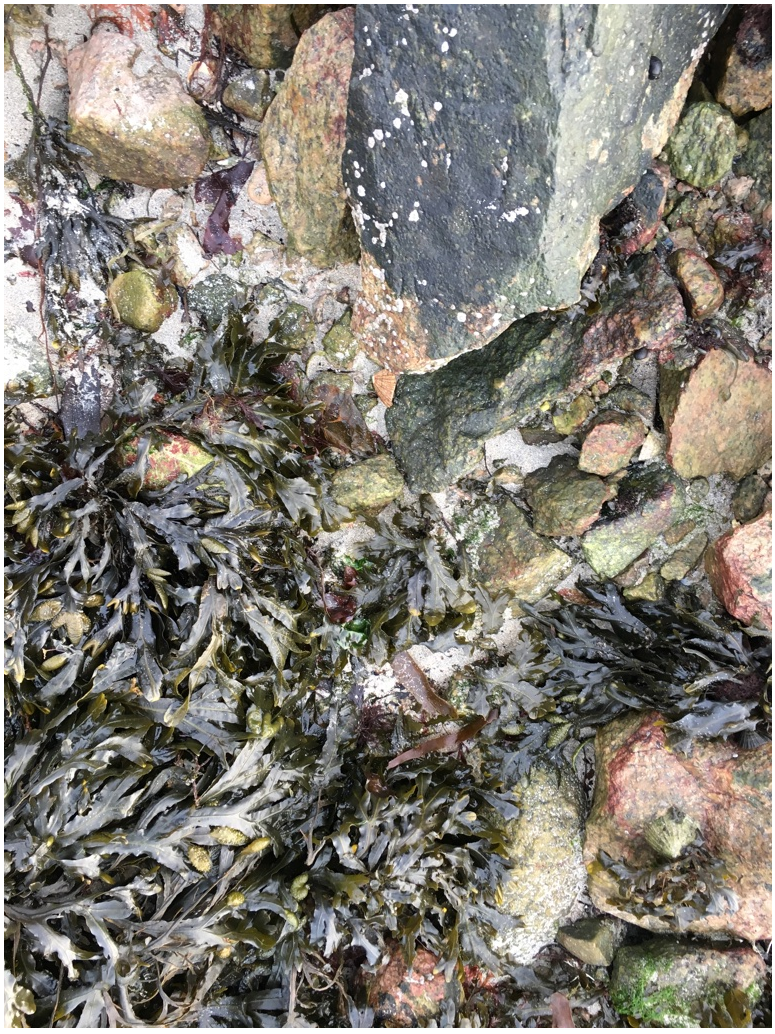

Fig 9: Close-up.

Fig 10: Mixed intertidal habitats with tide pools, west of Barna.

Fig 11: Fucoid-dominated reef and tidal pool, close-up.

As it can be seen in the photographs taken during my inspection on the 16th February 2017, these habitats are very similar to those that would be lost to the development. Further evidence could be easily obtained by undertaking qualitative and quantitative surveys of both reef habitats, using quadrats or other method that would result in acquiring data of species presence, abundance and seaweed coverage. If required, infauna of sandflats and mudflats could be sampled during low water, using hand corers. This survey technique is also quick and simple, but the subsequent laboratory analyses are more specialised and time-consuming that those required for quantitative analyses of fucoid-dominated reef.

The designation of these habitats as part of the Galway Bay Complex SAC, or the modification of the existing boundaries of the SAC to include these intertidal areas would meet the requirements of the EU Guidance on article 6 (4), and the recommendations made in the 'Managing Natura 2000 Sites (EU, 2011) document. In reference to the site's conservation objectives for these habitats, it would be a net gain, as the loss of 14.51ha would be compensated by the designation of 28.62ha, a rate of nearly 2:1. These intertidal habitats have continuity and connectivity with those within the SAC, to the east of the proposed compensation area. Thus, the conservation objectives for these habitats of the SAC would not fail as a consequence of the proposed development. If we consider Galway Bay as an ecosystem, and a part of a wider coastal ecosystem, this integrity and continuity would add to its resilience and ability to evolve in a way that is favourable to conservation. For these reasons, it is my considered opinion that this specific compensatory measure is appropriate to maintain the structure, integrity and coherence of these habitats in the site, within the biogeographical region concerned, as stated within the EU Guidance on Article 6 (4).

8.2.2 Management and improvement of intertidal habitats outside the SAC

In reference to the above compensatory measures, as detailed in the applicant's submissions of November 2016 and February 2017, these involve the implementation of a management plan to improve intertidal habitats around Tawin Island and two aquaculture sites in Brandy Harbour, in Killeenaran. These sites were also inspected by Senior Inspector Paul Caprani (An Bord Pleanála) and I on the 17th February 2017.

I photographed extensive intertidal areas comprising fucoid-dominated reef and sandflats/mudflats habitats on the south, south west, west and north west of Tawin Island and two further sites in Brandy Harbour in Killeenaran, referred to as "two aquaculture sites, Parknahalla, east side of Kinvarra Bay and Shanmullen Channel, Tawin South", in the report (Aquafact 2017), and within the SAC. These also are – as it would be expected - very similar to the intertidal habitats affected by the development and those observed between Barna and the northeast boundary of the SAC. These habitats can be seen in figures 12 to 23.

Figure 12: Intertidal habitats, Tawin Island (north east). On the foreground, sea defences (rock).

Fig 13: Fucoid-dominated reef in Tawin Island (NW), close-up

Fig 14: Intertidal habitats beyond sea defences, Tawin Island (south).

Fig 15: Fucoid-dominated reef habitat beyond sea defences, Tawin Island (west).

Fig 16: Fucoid-dominated reef, Tawin Island (west), close-up.

Fig 17: Intertidal habitats in 'Parknahalla' site, looking south.

Fig 18: Intertidal habitats in 'Parknahalla' site, looking north.

Fig 18: Intertidal reef in the 'Parknahalla' site, close-up.

Fig 19: Intertidal reef in the 'Parknahalla' site, close-up.

Fig 20: Oyster culture in the 'Parknahalla' site.

Fig 21: Intertidal habitats in the Brandy Harbour/Shanmullen Channel site.

Fig 22: Intertidal habitats in the Brandy Harbour/Shanmullen Channel site.

Fig 23: Intertidal habitats in the Brandy Harbour/Shanmullen Channel site, close-up.

The proposal of managing these habitats and the adjacent stony bank and saltmarsh habitats (these are discussed in sections 8.4 And 8.5) to improve their condition would also lead to an improvement to the function of the ecosystem, as it would restore any provision of habitat for biological populations, transfer of energy between different trophic levels, etc. that could have been lost due to these habitats being in a degraded condition. As mentioned in relation to the intertidal habitats in the area east of Barna, there is no available evidence of these habitats being in a less or more favourable condition than those that would be lost. The observations made and the evidence recorded in a set of 210 digital images taken at these sites (some included in this report) suggests that the abundance and diversity of the biological communities present in the intertidal habitats at the three sites are very similar. They also suggest that the intertidal fucoid-dominated reefs to be lost to the development support a less abundant and diverse assemblage of macrofauna than those in the east of Barna, Tawin Island and Brandy Harbour sites. This also needs to be confirmed by survey data. The applicant proposes the designation intertidal areas within Tawin Island as a Marine Protected Area, such as Flamborough Head (and many others) in the UK. This might help to boost the protection status of these habitats, and the future management of the existing SAC. However, the site is already part of the SAC, the SPA and a proposed Natural Heritage Area, so it is not clear what the benefits of further designation entail. Also, it is difficult to understand how the new designation would help to maintain the integrity and ecological function of the SAC and especially, to compensate for the loss of intertidal habitats due to the construction of the new harbour.

The proposed management measures also include the eradication of a presumably alien and invasive species of tunicate (*Didemnum sp*.) from aquaculture sites (Parknahalla, east side of Kinvarra Bay and Shanmullen Channel, Tawin South) within the Galway Bay cSAC. This is not explained in the report, but it is expected that more detailed information, together with reports or papers of the results obtained in Westport Bay by Dr. Crowe will be made available during Phase 2.

The success of this set of compensation measures would also be dependent on identifying and applying correctly the necessary management operations. The potential environmental impacts and licensing requirements of the proposed

management operations should also be considered, and their full implications in relation to the conservation features and objectives of the SAC and the other nature conservation designations in the sites (Special Protection Area and proposed Natural Heritage Area).

Because of the lack of evidence on the need for improvement of the intertidal habitats proposed as compensation, and the relative uncertainty about the results of the proposed management plan, it is my opinion that this option offers less certainty on the success in achieving an appropriate compensation for the loss of intertidal habitats. On the positive side, it would mean a measurable improvement if the habitats are indeed in a less favourable condition, and the proposed management was successful, though it would not increase the area of intertidal habitat included in the SAC.

I note that the applicant and the NPWS agree in the need for the implementation of surveys of these habitats. These surveys should in my opinion, provide the evidence required to inform a final decision on this matter. I also note that all the involved parties agree on the necessity of defining the scope of these surveys in advance, which is reassuring.

On the basis of the information and evidence available at this stage, it is my opinion that the application of both proposed compensatory measures (designation and management) for intertidal habitats – including fucoid-dominate reef, sandflats and mudflats – should be considered during this stage of the process. In the absence of firm evidence of the status of the habitats involved and the potential for success of the proposed management, the designation of the intertidal habitats located between Barna and the Galway Bay Complex SAC and the management of those habitats in parts of Tawin Island offers the best possible alternative to ensure that the adverse impacts of habitat loss are offset by an increase in designated habitats within the SAC, and potentially, for an improvement of the function and the ecosystem services of the remaining habitats.

8.3 Perennial vegetation on stony banks

This habitat is situated adjacent to the intertidal habitats that would be lost to the development, and has a total area of approximately 0.35ha, of which approximately

0.2ha lie within the boundary of the SAC. This habitat was also inspected on the 16th February 2017 (figures 24 to 30).

Fig 24: Stony bank affected by the development (looking east)

Fig 25: Stony bank affected by the development (looking west)

Fig 26: Litter on the stony bank.

Fig 27: Litter on the stony bank.

Fig 28: Litter on the stony bank.

Fig 29: Litter on the stony bank.

Fig 30: Art installation on the stony bank.

As can be seen in the photos, this is a narrow fringe of perennial vegetation between the strand line and terrestrial vegetation. The site was being used by dog walkers and other members of the public during our inspection, as it was during my first visit, in December 2014. A significant amount of litter can be seen, possibly most of it is from waste thrown to the sea or the River Corrib and deposited on the site by the action of tides and waves. This is not uncommon for densely populated areas and harbours, and suggests that the site is subject to a significant level of disturbance.

The photographs demonstrate that this is far from being a pristine site, and that the site would benefit from basic management, as litter picking and the presence of signs describing the rare plant species that could be found there, and exhortations to maintain the site clean and do not trample over the plants. Another observation made during our visit is that the particle size distribution of the site is more towards sand than larger particles, at least on the surface. This would appear to be a 'sandy bank' with a stony fringe in parts, rather than a 'stony bank'.

8.4 Compensatory measure proposed for the stony bank habitat

Three different compensatory measures were proposed by the applicant at different times in relation to this habitat.

8.4.1 Designation of stony bank habitats currently outside the SAC

The first proposal was to identify, acquire rights and designate areas of stony bank habitat within the part of the coast immediately adjacent to the north-west limits of the SAC, within the same area proposed for compensation of intertidal reefs and sandflats/mudflats. These habitats appear to be represented in this area, as shown in figures 31 to 33, taken during the inspection of the 16th February 2016.

Fig 31: Stony banks with perennial vegetation, east of Barna.

Fig 32: Stony banks with perennial vegetation, east of Barna.

Fig 33: Stony banks with perennial vegetation, east of Barna.

The proposed compensatory measure is to designate new areas adjacent to the SAC which include this habitat. This is based on the assumption that these habitats are fully functional, and that it would be possible to purchase or obtain access rights for the lands within the proposed area that are owned by private persons. The proposed compensatory measures also include to reverse constraints to the landward migration of the stony banks by the removal of sea defences. This would allow the stony banks present in this section of the coast to return to their natural dynamic nature, preventing colonisation by terrestrial plant species.

As it can be seen in the images shown in the previous pages, these habitats are present in the area between Barna and the SAC. The substrate is stone, rather than sand, as is the habitat affected by the proposed development. These habitats appear to be subject to less disturbance than those near the GHEP, and they are certainly cleaner. For this reason, their inclusion in the Galway Bay Complex SAC would in my

opinion meet the requirements for compensatory measures established in the relevant EU guidance.

8.4.2 Management plan for the stony banks to be affected by the development

A management plan to prevent the disappearance of the existing stony bank habitat at Renmore Lough was included in the second Aquafact report. This would include the annual low-level reworking of the seaward strip of cobbles, removal of invasive species, and spraying of the cobbles with sea water. Whilst this option was not included in the third report (Aquafact, 2017), it appears to be a relatively simple and low-cost measure to avoid the disappearance of this habitat. An automatic system consisting of an electric pump and underground pipes could be easily installed at the site, especially once the new harbour is constructed. This system would regularly spray seawater on the stony banks, to compensate for the sheltering effects of the proposed new harbour.

Complementary management measures should include periodical clean up and the display of signage. By maintaining this habitat, it would not be necessary to implement any further compensation, because the conservation objective for the habitat would be met, and integrity would not be any affected.

8.4.3 Management plan for stony banks in other areas of the SAC

The third proposal, included in the 2017 report involves ceasing and reversing when possible pressures on salt marsh and stony bank habitats in other areas of the SAC. This is based on the same set of management tools proposed for intertidal habitats and saltmarsh, including stopping grazing, poaching, spread of slurry, and removal of cobbles. Other management measures involve the control of access by tractors, use of round and winter feeding, prevention of the use of herbicides, prevent the maintenance and construction of sea defences, and removal of waste. The proposal includes the establishment of annual surveys of the habitats and audit of progress of the management plan, and the installation of signage describing the project and the habitats and their associated flora and fauna. As it is the case with the proposed management measures for intertidal habitats, there is little evidence that the stony banks present in these areas are in a degraded status and that they would benefit from management. Equally, the success of any management programme would depend on choosing the right measures, and applying these correctly. The potential

environmental impacts associated to any management measures would need to be assessed, together with any licensing and regulatory implications.

For this reason, it is my opinion that this compensatory measure has less scope for success than the conservation of the existing stony bank habitats adjacent to the area of the proposed port expansion, or the inclusion of areas of stony bank outside the SAC in it.

8.5 Saltmarsh habitat

Finally, the applicant proposes compensatory measures for the recovery of areas of saltmarsh within Tawin Island and the SAC which are currently in unfavourable status due to pressures associated with agriculture practices, as outlined in sections 8.2.2 and 8.4. There are 136.33ha of saltmarsh mosaic which have been mapped in Tawin Island, and some of these habitats ("in places") have been described as being of "unfavourable/inadequate" status in a report commissioned by NPWS (2006).

In relation to these habitats, the recovery of areas currently in unfavourable status would be an appropriate compensatory measure for the loss associated with the construction of the GHEP in the past. As mentioned previously, these would be dependent on selecting and applying adequate management measures. However, of the three habitats considered for management, the saltmarsh is the one with most possibilities of success, as the removal of direct adverse pressures should result in noticeable improvements. A reduction in organic loads discharged to the site and the reduction in grazing and disturbance that the proposed measures would bring will result in measurable improvements in the condition of these saltmarsh habitats.

9. Conclusions

1. The extension of the Galway Bay Complex SAC to the north west, to include intertidal habitats in the area between Barna and the SAC would be an appropriate measure to compensate for the losses associated to the construction of the proposed harbour extension.

2. The management of areas of intertidal habitats currently within the SAC is less likely to result in appropriate compensation for this loss. This could be established with more confidence once evidence on the status of these habitats is obtained by undertaking qualitative and quantitative surveys and acquiring data.

3. The extension of the Galway Bay Complex SAC to the north west, to include stony bank habitats in the area between Barna and the SAC would be an appropriate measure to compensate for any losses associated to the construction of the proposed harbour extension.

4. Adequate, targeted management to improve and protect the existing stony bank habitat that would be adversely affected by the proposed development is the best available alternative to maintain the integrity of the SAC.

5. Appropriate management to improve and protect the existing saltmarsh habitats within the SAC would be the best option to compensate for the losses of this habitat caused by the construction of the GHEP in the past.

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