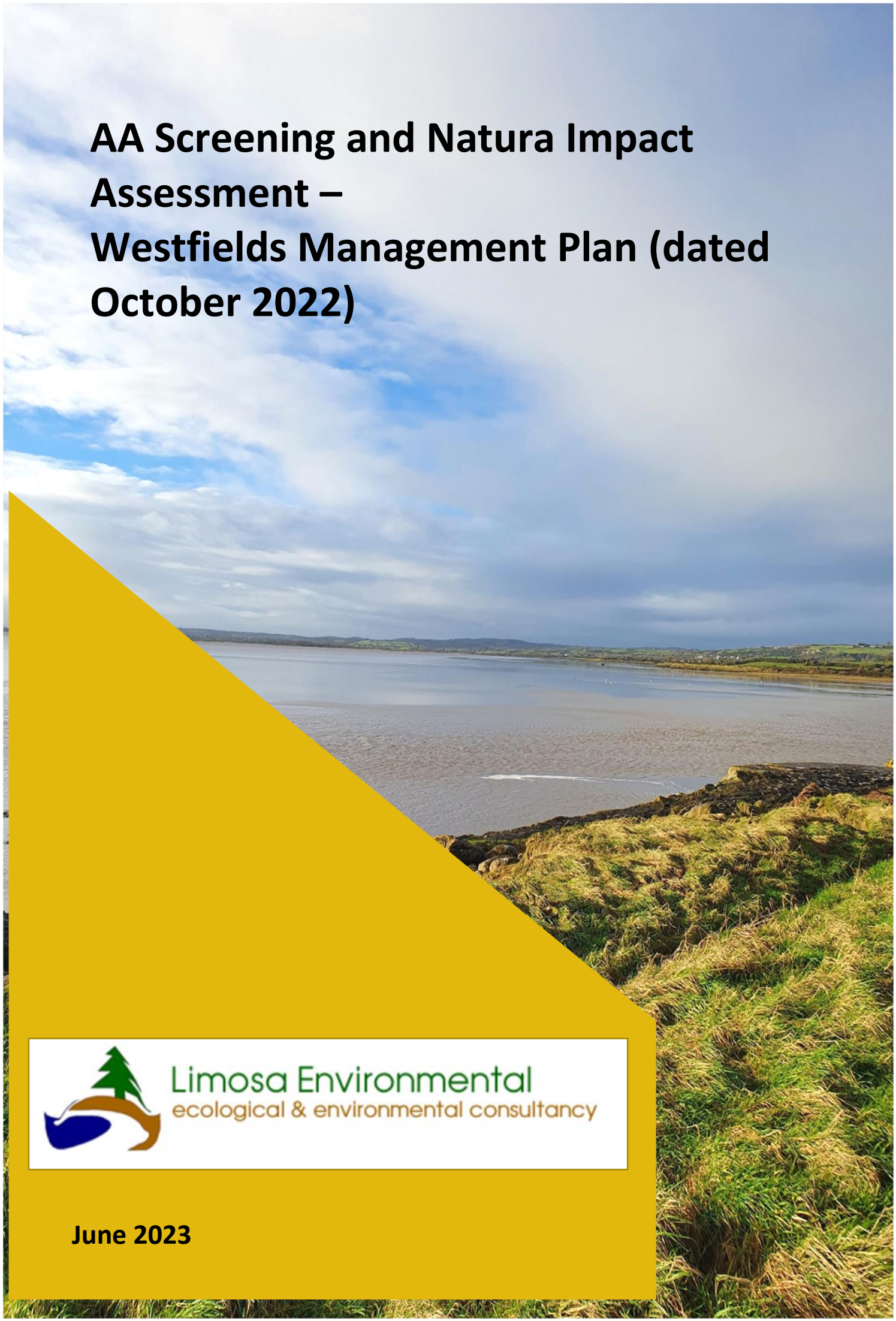
AA Screening and Natura Impact Assessment – Westfields Management Plan (dated October 2022)



Limosa Environmental
ecological & environmental consultancy

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A (Draft)	RP23-GW059-10-A	AA Screening/NIS	Lesley J Lewis/Ross Macklin	LJL	June 2023
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Front cover photo: The Shannon & Fergus Estuaries SPA (© L.J. Lewis).

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1. Introduction and background

Limosa Environmental was commissioned to provide information to inform Appropriate Assessment (AA) Screening and provide a Natura Impact Statement for the Westfields Management Plan (Limerick City & County Council, 2022).

The obligation to undertake Appropriate Assessment arises from Articles 6 (3) and (4) of European Union (EU) Council Directive 92/43/EEC (Habitats Directive) and transposed into Irish law by the European Communities (Birds and Natural Habitats) Regulations S.I. No 477 of 2011; further amended by the European Communities (Birds and Natural Habitats) Regulations 2011-2021.

Screening is the first stage of an Appropriate Assessment (AA) and aims to establish whether a proposed plan or project (in this case a plan), either alone or in combination with other plans or projects, could have significant negative effects on a Natura 2000 site in view of the site's conservation objectives. At Stage 2 (Appropriate Assessment), the impact of a project or plan alone and in combination with other projects or plans on the integrity of the Natura 2000 site is considered with respect to the conservation objectives of the site and to its structure and function (DoEHLG, 2009).

Natura 2000 sites are Special Areas of Conservation (SACs) designated under the EU Habitats Directive,[1] and Special Protection Areas (SPAs), designated under the EU Birds Directive.[2] As signatories to these Directives, Ireland like other EU Member states, has designated prime areas of ecological importance as SACs and SPAs, and these are part of a network of sites of 'community importance' for biodiversity across the EU called the 'Natura 2000' network.

Westfields Wetland in Limerick City covers *c.*25 hectares and is part of the Lower River Shannon Special Area of Conservation (SAC 002165). The wetland is also bounded by the River Shannon and River Fergus Estuaries Special Protection Area (SPA Site Code 4077). On account of the plan's location in relation to these Natura 2000 sites, and in accordance with legislative requirements (Articles 6 (3) and (4)) of European Union (EU) Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, a *Habitats Directive Screening Statement* should be prepared to assess the potential for impacts from the proposed development upon the Natura 2000 sites. Where potential impacts cannot be screened out, then the assessment is taken to Stage 2: Appropriate Assessment and a Natura Impact Assessment is undertaken.

2. Methodology

2.1 Appropriate Assessment methodology

There are 4 stages in an Appropriate Assessment as outlined in the European Commission Guidance document (EU Commission, 2001) (Figure 1). The following is a brief summary of these steps.

Stage 1 - Screening: This stage examines the likely effects of a project/plan either alone or in combination with other projects/plans, upon a Natura 2000 site and considers whether it can be

[1] Council Directive 92/43/EEC on the conservation of natural habitats and wild flora and fauna, as amended by Council Directive 97/62/EC. The Directive was transposed into Irish law by the European Communities (Natural Habitats) Regulations 2011, amended and later consolidated by the European Communities (Birds and Natural Habitats) Regulations 2011 – 2021.
[2] Directive 2009/147/EC (Birds Directive) on the conservation of wild birds (the codified version of Council Directive 79/409/EEC as amended).

objectively concluded that these effects will not be significant. The assessment of significance is carried out in consultation with the relevant nature conservation agencies.

Table 1. Steps for the undertaking of AA Screening

Step One	Determination of whether the plan or project is directly connected with the necessary management of the Natura 2000 site.
Step Two	Description of the proposed project/plan and the description of other plans/projects that in combination have the potential to have significant effects on a Natura 2000 site.
Step Three	Characteristics of the site. Identification of relevant Natura 2000 sites, and compilation of information on their qualifying interests and conservation objectives. Identification of the potential effects upon a Natura 2000 site and characterisation of the site as a whole to identify where impacts are most likely to fall.
Step Four	Assessment of the significance of effects on the Natura 2000 site. If the effects are deemed to be significant then the process must pass to Stage 2 – Appropriate Assessment.

Stage 2 - Appropriate Assessment: In this stage, the impact of the project on the integrity of the Natura 2000 site is considered with respect to the conservation objectives in place for the site.
Stage 3 - Assessment of Alternative Solutions: Should the Appropriate Assessment determine that adverse impacts are likely upon a Natura 2000 site, this stage examines alternative ways of implementing the project or plan that, where possible, avoid these adverse impacts.
In the absence of any reasonable alternatives for a project/plan that would be less damaging to the integrity of a Natura 2000 site, it is then necessary to proceed to Stage 4.
Stage 4 - Where imperative reasons of overriding public interest (IROPI) exist, an assessment to consider whether compensatory measures will or will not effectively offset the damage to the Natura site will be necessary.

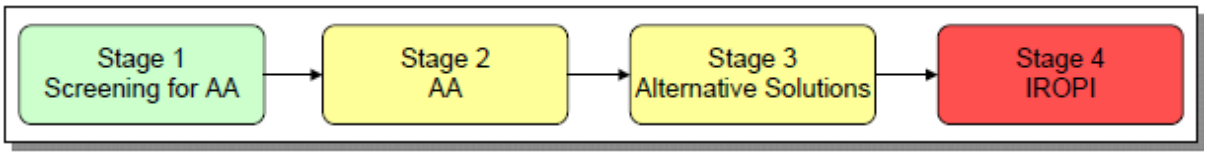

Figure 1. Summary of AA process (Source: DoEHLG, 2009).

The statutory agency responsible for designated areas in Ireland is the National Parks & Wildlife Service of the Department of Housing, Local Government and Heritage.

2.2 Assessment methodology

- **Identification of 'Relevant' Natura 2000 sites**

Appropriate Assessment focuses upon impacts on Natura 2000 sites and their qualifying habitats and species. An essential first step in the assessment process is the determination of whether there is an overlap or coincidence between the qualifying interest habitats and species of Natura 2000 sites and the 'zone of influence' of the proposed project or plan. The zone of influence (ZOI) can be defined as the geographical area over which a project or plan might affect the receiving environment in a way that could have significant effects on the Qualifying Interests of a European site. This should be established on a case-by-case basis using the Source-Pathway-Receptor framework (OPR, 2021). Natura 2000 sites are considered 'relevant' where a source-pathway-receptor link exists between the proposed development and the Natura 2000 site.

EC guidance highlights how the likelihood of significant effects may arise not only from plans or projects located **within** a protected site but also from plans or projects located **outside** a protected site. For example, a wetland may be damaged by a drainage project located some distance outside the wetland's boundaries, or a site may be impacted by an emission of pollutants from an external source. For this reason, it is important that Member States, both in their legislation and in their practice, allow for the Article 6(3) safeguards to be applied to any development pressures – including those which are external to Natura 2000 sites, but which are likely to have significant effects on any of them (EC, 2018).

In this study, Natura 2000 sites within a 15km radius of Westfields Wetlands were identified. We then assessed whether there is an overlap/coincidence or connectivity between the Natura 2000 sites and the ZOI of the actions contained within the Westfields Management Plan. Where such connectivity exists, then these Natura 2000 sites are considered to be 'relevant.'

- **Desk top Study**

Various sources of information were reviewed; these are referenced throughout the text as standard.

- **Reporting**

Ecological Impact assessment was carried out following the methodology detailed in Appendix 1 and aided using the following standard texts, while impact terminology follows EPA (2017). The assessment was undertaken with regard to the following documents:

- Assessment of plans and projects significantly in relation to Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC (EU Commission, Brussels (2021),
- Appropriate Assessment of plans and projects in Ireland: Guidance for planning authorities (DoEHLG, 2009),
- Managing Natura 2000 Sites: The Provisions of Article 6 of the Habitat's Directive 92/43/EEC (Commission Notice C (2018) 7621 final Brussels 21.11.2018),
- Appropriate Assessment Screening for Development Management (Office of the Planning Regulator, 2021),
- Guidelines on the information to be contained in Environmental Impact Statements (EPA, 2017),
- CIEEM (2018) *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine*. Chartered Institute of Ecology and Environmental Management, Winchester.

Where mentioned in the report, habitat classification follows '*A Guide to Habitats within Ireland*' (Fossitt, 2000). Statements of competency for the authors of this report are provided in Appendix 2.

3. Description of the Westfields Management Plan

3.1. Location

Westfields Wetlands are situated in Limerick City, located along the Condell Road on the northern bank of the River Shannon, close to Shannon Bridge (OS grid reference: R 56429 56991) (Figure 2, Figure 3). The wetland is bounded to the south by the embankment of the River Shannon and the Condell Road (R527) and, to the north, by housing.

The geographic scope of the management plan was determined to be (i) on the southside of Condell Road: from St. Michael's Rowing Club to Barrington's Pier, and (ii) on the northside of the Condell Road: from Ted Russell Park to Fernbank[3].

Figure 2. Location of Westfields Wetlands (Source: Google maps).

3.2. Aims and objectives of the Westfields Wetlands Management Plan

A Management Plan for the Westfields Wetlands was proposed by the Climate Action, Biodiversity and Environment Strategic Policy Committee of Limerick City and County Council in November 2019. In this context, the expressed aims of the Management Plan were to "explore opportunities for enhancement of the wetlands' amenity and recreational value while taking into account the ecological requirements of the SAC site and maintaining and enhancing biodiversity as a key objective" (Limerick City & County Council, 2022). The plan seeks to consider both the needs of nature for protected habitat space and the needs of people for a space to relax and enjoy the natural world. These needs are as follows (text taken directly from the management plan):

Human needs that the area serves:

- Nature time.
- Place to bring children to feed the birds or watch them.

[3] From Consultation Workshop Report 2019 (Doody Facilitation and Consulting Limited).

- Beautiful exercise route.
- Local park.
- Green area for games and other amenity.
- Place for meeting with others.
- Quiet outdoor place for socialising.
- Space to learn about nature.

Needs of nature that the area serves:

- Multiple habitats for birds, insects and other invertebrates, plants, mammals, reptiles, fish.
- Habitats include marsh, reed bed, lake, scrub, grassland, hedgerows, urban gardens, woodland and riparian; each of which provides shelter and/or food to a whole range of diverse fora and fauna.
- Core protected space to live, feed, grow, mate, nest and be without threat of excessive human disturbance.
- Part of a wider network of wetlands within Limerick city, forming a corridor for migrating birds and other fauna to move along the Shannon and other rivers and corridors within the city and country as a whole.

Wider global needs that the area serves – for both wildlife and people:

- Refuge for biodiversity as part of a global need for such wild space.
- Ecosystem services including carbon sequestration for climate resilience. There is considerable potential for this in the tree planting, the wetland areas, and the meadow areas, pending management methodology adopted.
- Springboard to a greater appreciation of nature, and thus an invaluable learning opportunity to strengthen those practices and habits that are supportive of the wider world: including, for example, reduced plastic use and waste, action on climate breakdown, greater care about water quality and water saving measures etc.

Two overall objectives steered the way in which the management plan was created. One was to assess the water quality and the ecological health of the area as measured by the habitats, flora and fauna in the area. The second objective was to use this information, and feedback from a process of public engagement, to provide clear direction on the long-term management of Westfields Wetland. The management plan was informed by a series of previous technical reports commissioned by Limerick City and County Council, and the results of public and stakeholder consultation, including input from the National Parks and Wildlife Service (NPWS) and the Office of Public Works (OPW).

3.3. Overview of themes and actions

Table 2. Overview of themes and actions contained in Westfields Management Plan.

Chapter	Topic	Actions
3	Water quality, providing results of water quality sampling, assessment of likely nutrient sources, other land use factors.	Actions to improve water quality.
4	Water levels and flow dynamics.	Actions regarding water levels and flows
5	Reed management.	Bulrush clearing and creation of open water
6	Biodiversity and non-native invasive species. Wildlife section exploring the habitats, flora and fauna of the site as well as examining the non-native invasive species that are present and whether and how these should be managed.	All-Ireland Pollinator Plan actions • Management actions for birds. • Management actions for enhancement of bat populations. • Management actions for mammals living in Westfields Wetland. • Management actions for invertebrates. • Management action to introduce opposite-leaved pondweed.
7	Signage and education.	Actions regarding signage and education.
8	Social aspects not covered by other sections, including challenging behaviour and possible solutions.	Actions regarding social aspects.
9	Infrastructure measures proposed for Westfields based on the stakeholder engagement and on the recommendations of this plan.	Infrastructure actions.

4. Designated sites for nature conservation

4.1 Determining relevant Natura 2000 sites

Natura 2000 sites are Special Areas of Conservation (SACs) designated under the EU Habitats Directive,[4] and Special Protection Areas (SPAs), designated under the EU Birds Directive.[5] As signatories to these Directives, Ireland like other EU Member states, has designated these prime areas of ecological importance as SACs and SPAs and these are part of a network of sites of 'community importance' for biodiversity across the EU called the 'Natura 2000' network.

SACs form part of a European-wide ecological network of sites hosting the natural habitat types listed in Annex I and species listed in Annex II of the EU Habitats Directive (SACs), while SPAs are areas designated for the protection of bird species listed on Annex I, regularly occurring populations of migratory species (e.g. ducks, geese or waders), and wetlands of international importance, under the

[4] Council Directive 92/43/EEC on the conservation of natural habitats and wild flora and fauna, as amended by Council Directive 97/62/EC. The Directive was transposed into Irish law by the European Communities (Natural Habitats) Regulations, SI 94/1997 which were amended and later consolidated by the European Communities (Birds and Natural Habitats) Regulations 2011 – 2015 (S.I. 355/2015).

[5] Directive 2009/147/EC (Birds Directive) on the conservation of wild birds (the codified version of Council Directive 79/409/EEC as amended).

EU Birds Directive. The aim of the network is to aid the long-term survival of Europe's most valuable and threatened species and habitats.

Natura 2000 sites within a 15km radius of Westfields Wetlands were identified (Figure 3, Table 3). We then assessed whether there is an overlap/coincidence or connectivity between the Natura 2000 sites and the zone of influence (ZOI) of the actions contained within the Westfields Wetlands Management Plan. Where such connectivity exists, then these Natura 2000 sites are considered to be 'relevant.'

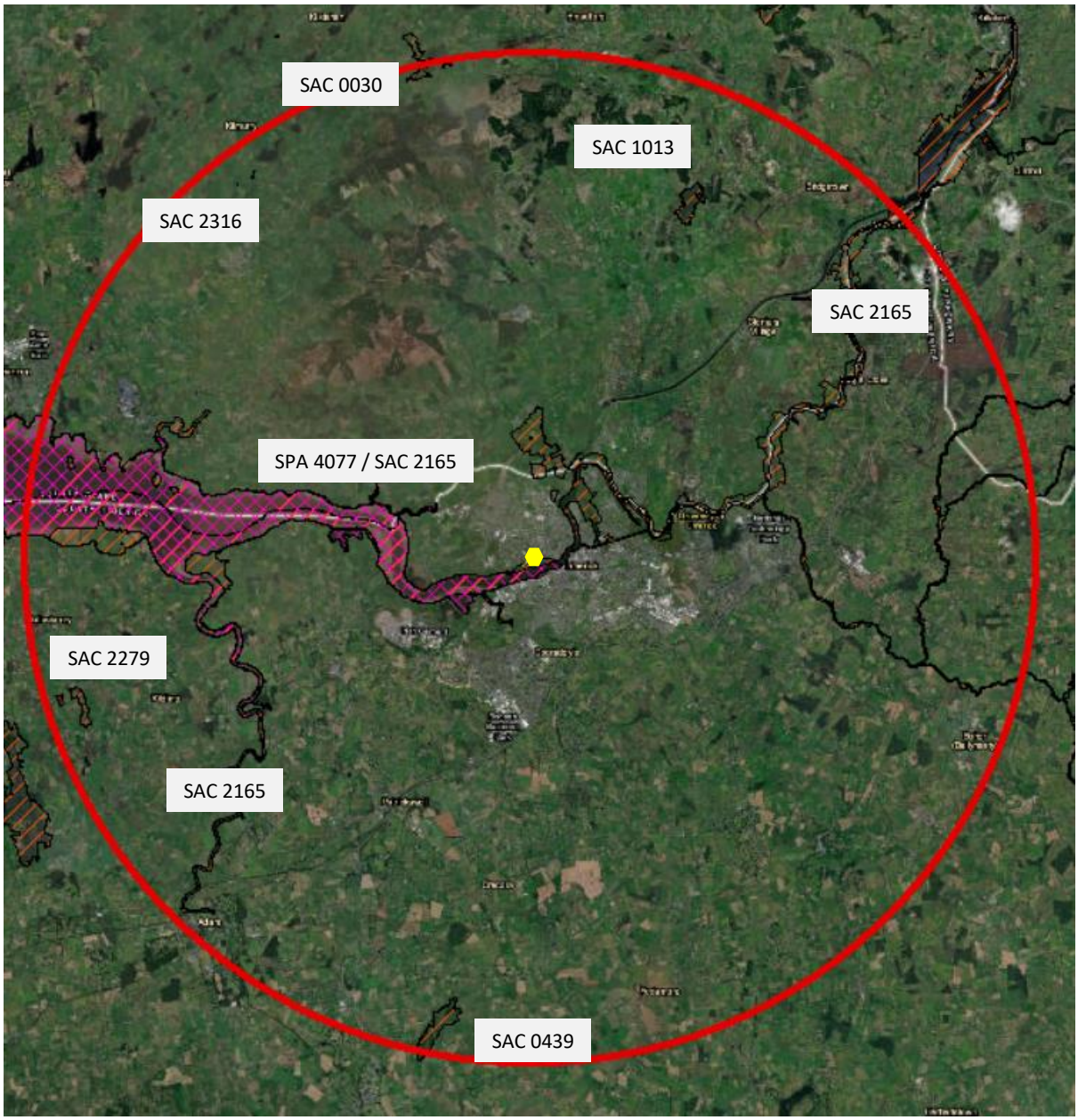

Figure 3. Natura 2000 sites within a 15km radius of Westfields Wetlands (denoted by red line). Westfields Wetlands indicated by a yellow dot. Pink shading denotes SPA sites while red shading denotes SAC sites.

Table 3. Natura 2000 sites within a 15km radius of Westfields Wetlands and an assessment of relevance and potential for a source-pathway-receptor link(s) to exist between Westfields Wetland and the Natura 2000 site.

Site name, site code and distance	Qualifying Interests	Potential for source-pathway-receptor links exist between the proposed development site and the Natura 2000 site
Special Areas of Conservation (SAC)		
Danes Hole, Poulnalecka Special Area of Conservation (Site Code 00030) c.14.6km distance (north).	Conservation Objectives Version 1.0 (NPWS, 2018a) • Caves not open to the public [8310] • Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0] • *Rhinolophus hipposideros* (Lesser Horseshoe Bat) [1303]	**No.** There is no potential hydrological or other pathway between Westfields Wetlands and this SAC.
Tory Hill Special Area of Conservation (Site Code 00439) c.13km distance (south).	Conservation Objectives Version 1.0 (NPWS, 2018b) • Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) [6210] • Calcareous fens with Cladium mariscus and species of the Caricion davallianae [7210] • Alkaline fens [7230]	**No.** There is no potential hydrological or other pathway between Westfields Wetlands and this SAC.
Glenomra Wood Special Area of Conservation (Site Code 01013) c.11.6km distance (north).	Conservation Objectives Version 1.0 (NPWS, 2018c) • Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0]	**No.** There is no potential hydrological or other pathway between Westfields Wetlands and this SAC.
Lower River Shannon Special Area of Conservation (Site Code 02165) 0km	Conservation Objectives Version 1.0 (NPWS, 2012a) • Sandbanks which are slightly covered by sea water all the time [1110] • Estuaries [1130]	**Yes.** Westfields Wetlands lies **inside** the SAC boundary.

	• Mudflats and sandflats not covered by seawater at low tide [1140] • Coastal lagoons [1150] • Large shallow inlets and bays [1160] • Reefs [1170] • Perennial vegetation of stony banks [1220] • Vegetated sea cliffs of the Atlantic and Baltic coasts [1230] • Salicornia and other annuals colonising mud and sand [1310] • Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330] • Mediterranean salt meadows (Juncetalia maritimi) [1410] • Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [3260] • Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) [6410] • Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) [91E0] • Margaritifera margaritifera (Freshwater Pearl Mussel) [1029] • *Petromyzon marinus* (Sea Lamprey) [1095] • *Lampetra planeri* (Brook Lamprey) [1096] • *Lampetra fluviatilis* (River Lamprey) [1099] • *Salmo salar* (Salmon) [1106]	

	• *Tursiops truncatus* (Common Bottlenose Dolphin) [1349] • *Lutra lutra* (Otter) [1355]	
Askeaton Fen Complex Special Area of Conservation (Site Code 02279) c.14km distance (west).	Conservation Objectives Version 1.0 (NPWS, 2018d) • Calcareous fens with Cladium mariscus and species of the Caricion davallianae [7210] • Alkaline fens [7230]	**No.** There is no potential hydrological or other pathway between Westfields Wetlands and this SAC.
Ratty River Cave Special Area of Conservation (Site Code 02316) c.14km distance (north-west).	Conservation Objectives Version 1.0 (NPWS, 2018e) • Caves not open to the public [8310] • *Rhinolophus hipposideros* (Lesser Horseshoe Bat) [1303]	**No.** There is no potential hydrological or other pathway between Westfields Wetlands and this SAC.
Site name, site code and distance	**Special Conservation Interests (SCIs)**	**Potential for source-pathway-receptor links exist between the proposed development site and the Natura 2000 site**
Special Protection Areas (SPAs)		
River Shannon and River Fergus Estuaries Special Protection Area (Site Code 04077) 0km (immediately adjacent)	Conservation Objectives Version 1.0 (NPWS, 2012b) • Cormorant (*Phalacrocorax carbo*) [A017] • Whooper Swan (*Cygnus cygnus*) [A038] • Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] • Shelduck (*Tadorna tadorna*) [A048] • Wigeon (*Anas penelope*) [A050] • Teal (*Anas crecca*) [A052] • Pintail (*Anas acuta*) [A054]	**Yes.** Westfields Wetlands lies **adjacent** to the SPA boundary.

	• Shoveler (*Anas clypeata*) [A056] • Scaup (*Aythya marila*) [A062] • Ringed Plover (*Charadrius hiaticula*) [A137] • Golden Plover (*Pluvialis apricaria*) [A140] • Grey Plover (*Pluvialis squatarola*) [A141] • Lapwing (*Vanellus vanellus*) [A142] • Knot (*Calidris canutus*) [A143] • Dunlin (*Calidris alpina*) [A149] • Black-tailed Godwit (*Limosa limosa*) [A156] • Bar-tailed Godwit (*Limosa lapponica*) [A157] • Curlew (*Numenius arquata*) [A160] • Redshank (*Tringa totanus*) [A162] • Greenshank (*Tringa nebularia*) [A164] • Black-headed Gull (*Chroicocephalus ridibundus*) [A179] • Wetland and Waterbirds [A999]	

4.2 Relevant Natura 2000 sites

Based on our assessment, there are two relevant Natura 2000 sites within 15km of the proposed development site:

- Lower River Shannon Special Area of Conservation (Site Code 02165) - 0km, Westfields Wetlands lies inside the SAC (Figure 4).
- River Shannon and River Fergus Estuaries Special Protection Area (Site Code 04077) - 0km, the SPA lies immediately adjacent to Westfields Wetlands (Figure 4).

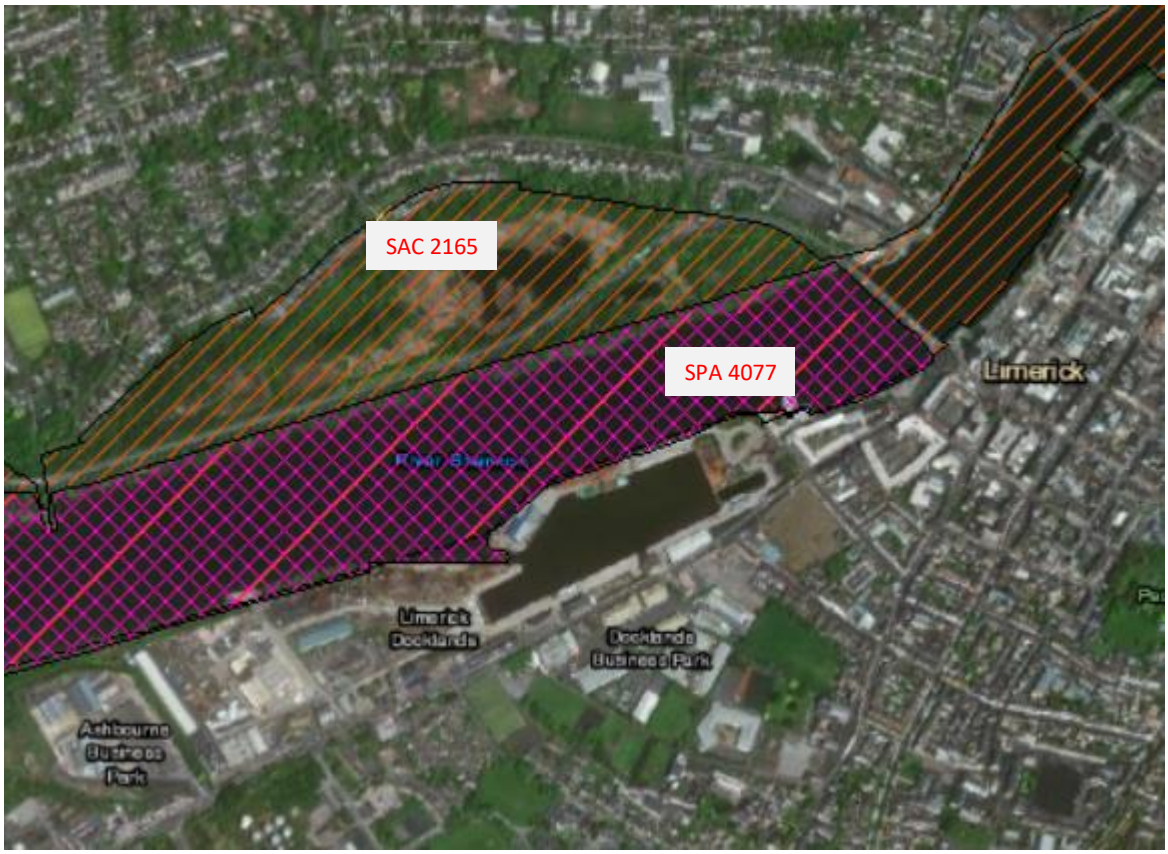

Figure 4. Relevant Natura 2000 sites adjacent to and within Westfields Wetlands (denoted by red line). Pink shading denotes part of the River Shannon & River Fergus Estuaries SPA sites while red shading denotes the Lower River Shannon SAC.

4.3 Lower River Shannon SAC – designation details

This very large site stretches along the Shannon valley from Killaloe in Co. Clare to Loop Head/ Kerry Head, a distance of some 120 km. The site encompasses the Shannon, Feale, Mulkear and Fergus estuaries, the freshwater lower reaches of the River Shannon (between Killaloe and Limerick), the freshwater stretches of much of the Feale and Mulkear catchments and the marine area between Loop Head and Kerry Head. Rivers within the sub-catchment of the Feale include the Galey, Smearlagh, Oolagh, Allaughaun, Owveg, Clydagh, Caher, Breanagh and Glenacarney. Rivers within the sub-catchment of the Mulkear include the Killeenagarriff, Annagh, Newport, the Dead River, the Bilboa, Glashacloonaraveela, Gortnageragh and Cahernahallia. The SAC is documented to be 68,300 ha in area

and the marine area represents 87% of this (Natura 2000 Standard data form). Fourteen habitats are selected as special conservation interests for the SAC including two priority habitats (coastal lagoons and alluvial forests). In addition, seven species are listed for the site that occur on Annex I/II of the EU Habitats Directive (Table 4). The NPWS Site Synopsis is shown in Appendix 3.

Conservation objectives

Site-specific conservation objectives for the Lower River Shannon SAC were published in 2012. NPWS (2012a) provides site-specific conservation objectives for each qualifying interest of the designated site. These are detailed site-specific objectives, and several attributes are used to define the features that should be preserved or restored to favourable conservation condition. Supporting documents published by NPWS provide background information on marine, coastal, lagoon, watercourse, and woodland habitats Conservation objectives documents are freely available (www.npws.ie) and were examined as part of the assessment reported here.

Conservation Status

Ireland, like other EU member states, is required to report on the conservation status of habitats and species listed on the annexes of the Habitats Directive (Article 17 reporting) at six-yearly intervals. In December 2007, Ireland submitted its first baseline assessments of conservation status for 59 habitats and *c.*100 species that occur in Ireland (NPWS, 2008). This assessment was updated in 2013 (NPWS, 2013a, b) and most recently in August 2019 (NPWS, 2019). Habitats are classified as being "favourable", "inadequate", "bad" or "unknown". The current national status classifications of the qualifying interests listed for the Lower River Shannon SAC are given in Table 5.

Table 4. Summary of Qualifying Interests for the Lower River Shannon SAC (002165)

	Description (after NPWS, 2008 & NPWS, 2019)	Site-Specific details (after NPWS, 2012a)
HABITATS LISTED IN ANNEX I OF THE EU HABITATS DIRECTIVE		
Sandbanks which are slightly covered by seawater at all times (EU Habitat Code 1110)	Sandbanks are distinct banks that arise from horizontal or sloping plains of sediment that ranges from gravel to fine sand. They are primarily composed of sandy sediments permanently covered by water, at depths of less than 20m below chart datum. The diversity and types of community associated with this habitat are determined particularly by sediment type together with a variety of other physical, chemical and hydrographical factors.	Occur in outer Shannon Estuary, west of Tarbert.
Estuaries (EU Code 1130)	Estuaries are downstream parts of a river valley, subject to the tide and extending from the limit of brackish waters. The mixing of freshwater and sea water and the reduced current flows in the shelter of the estuary lead to deposition of fine sediments, often forming extensive intertidal sand and mudflats. Estuaries are located on all parts of the coastline.	Habitat occurs along the entire designated area, up to and including Limerick city and upstream of the proposed development site.
Mudflats and sandflats not covered by seawater at low tide (EU Code 1140)	Intertidal mudflats and sandflats are submerged at high tide and exposed at low tide and are normally associated with inlets, estuaries or shallow bays. The physical structure of these intertidal flats ranges from mobile, coarse-sand beaches on wave exposed coasts to stable, fine-sediment mudflats in estuaries and other marine inlets.	Habitat occurs along the entire designated area, up to and including Limerick city and upstream of the proposed development site.
Coastal lagoons (EU Code 1150)	Lagoons are expanses of coastal salt water, of varying salinity, which are wholly or partially separated from the sea by sand banks or shingle, or less frequently by rocks.	Occur at four distinct locations along the Shannon Estuary system (Quayfield and Poulawela loughs, Shannon airport lagoon, Scattery lagoon and Cloonconeen pool); all a significant distance (>15km) downstream of the proposed development site.
Large shallow inlets and bays (EU Code 1160)	Large shallow inlets and bays are indentations of the coast with limited freshwater influence. They vary widely in habitat and species diversity depending on their location, exposure, geology and sediment composition, which determine their constituent habitat communities. The three most prevalent sediment communities are the Fine sand to sand community, Mud to fine sand community and Muddy sands/sandy muds community.	Occur in outer Shannon Estuary, west of Tarbert.
Reefs (EU Code 1170)	Reefs are marine features with hard substrate available for colonisation by plants and animals. In Irish waters they range from the intertidal to depths of 4,500m and more than 400km from the coast. Physical processes dictate the type of species that colonise them.	Occur in the mid to outer reaches of the Shannon Estuary.

Perennial vegetation of stony banks (EU Habitat Code 1220)	Perennial vegetation of stony banks is vegetation that is found above the high tide mark on beaches comprised of shingle (cobbles and pebbles). It is dominated by perennial species (i.e. plants that continue to grow from year to year).	Area of interest is in the outer Shannon Estuary.
Vegetated sea cliffs of the Atlantic and Baltic coasts (EU Code 1230)	A sea cliff is a steep or vertical slope located on the coast, the base of which is in either the intertidal or subtidal zone. Hard cliffs, composed of hard rock such as basalt, are at least 5m high, while soft cliffs, composed of softer substrates such as shale or boulder clay, are at least 3m high. Sea cliff habitat covers approximately 20% of the coastline of Ireland and is primarily distributed along the southern, western and north-western seaboards.	Area of interest are in the outer Shannon Estuary, for example Ballybunion, Kerry Head and Loop Head.
Salicornia and other annuals colonizing mud and sand (EU Code 1310)	Swards of glasswort (*Salicornia* spp.) are pioneer saltmarsh communities and may occur on muddy sediment seaward of saltmarsh. They may also form patches isolated from other saltmarsh on mudflats within a suitable elevation range.	Occurs at many locations along the estuarine system (e.g. Fergus estuary); all a significant distance (>10km) downstream of the proposed development site.
Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) (EU Code 1330)	Atlantic salt meadows generally occupy the widest part of the saltmarsh gradient. They also contain a distinctive topography with an intricate network of creeks and salt pans occurring on medium to large sized saltmarshes. Atlantic salt meadows contain several distinctive zones that are related to elevation and frequency of submergence.	Occurs at many locations along the estuarine system (e.g. Fergus estuary); all a significant distance (>10km) downstream of the proposed development site.
Mediterranean salt meadows (*Juncetalia maritimi*) (EU Code 1410)	Generally occupy the upper zone of saltmarshes and usually occur adjacent to the boundary with terrestrial habitats. They are widespread on the Irish coastline, although they are not as common as Atlantic salt meadows (1330).	Occurs at many locations along the estuarine system (e.g. Fergus estuary); all a significant distance (>10km) downstream of the proposed development site.
Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation (EU Code 3260)	Floating river vegetation occurs in virtually every Irish river and watercourse. Typical plant species include various water crowfoot species (Ranunculus spp.), water-milfoil (*Myriophyllum* spp.), water-starwort (*Callitriche* spp.), horned pondweed (Zannichellia palustris), pondweeds (*Potamogeton* spp.) and water moss (*Fontinalis antipyretica*).	Area of interest is centred in Limerick City inclusive of the Limerick Docks area and Ballinacurra Creek (map 13, Lower River Shannon conservation objectives – floating river vegetation). *Groenlandia densa* and *Schoenoplectus triqueter* shown on map as components of a transitional habitat representation of floating river vegetation.

Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) (EU Code 6410)	*Molinia* meadows are represented in Ireland by both fen and grassland communities on nutrient-poor soils. The habitat may be managed as traditional hay meadows (cut only once a year in late summer or autumn with the hay crop removed) or more usually as extensive pasture. *Molinia* meadows occur in lowland plains on neutral to calcareous gleys, sometimes with a marl layer beneath the surface, or on peaty soils in both lowland and upland situations.	This habitat has been recorded on the eastern bank of the Shannon, just north of Castleconnell, Co. Limerick (NPWS, 2012a) (Upstream of proposed development site). The full distribution of this habitat in this site is currently unknown and it almost certainly occurs elsewhere.
Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) (EU Habitat Code 91E0)	Alluvial Forests are typically woodlands of alder (*Alnus glutinosa*) and ash (*Fraxinus excelsior*), often with willows (*Salix* spp.) and sometimes oak (*Quercus robur*). This habitat occurs in areas subject to periodic flooding along rivers and on lake shores.	Areas of interest are upstream of Limerick City.
	Description (after NPWS, 2008 & NPWS, 2019)	**Site-specific details (after NPWS, 2012a)**
SPECIES LISTED IN ANNEX II OF THE EU HABITATS DIRECTIVE		
Freshwater Pearl Mussel (*Margaritifera margaritifera*)	The freshwater pearl mussel lives in nutrient-poor, acid to neutral waters of rivers flowing over granite or sandstone rock, mainly in the western part of Ireland, but also in areas of the south and south-east where geological conditions allow. The ecology of the species is particularly notable in that individuals can grow to very large sizes relative to other freshwater molluscs, building up thick calcareous shells, in rivers which have soft water with low levels of calcium. Their shell building is consequently very slow, and individuals in natural conditions live to over a hundred years of age.	There is a Freshwater pearl mussel population in the Cloon River, Co. Clare. The Cloon population is confined to the main channel and is distributed from Croany Bridge to approx. 1.5km upstream of Clonderalaw Bridge.
Sea Lamprey (*Petromyzon marinus*)	Sea lampreys spend their adult life in marine and estuarine waters, living as external parasites on other fish species. They migrate up rivers to spawn in areas of clean gravels. Once they have spawned, they die. After hatching, the young larvae settle in areas of fine sediment in still water, where they burrow. They live as filter feeders and may remain in fine sediments for several years before transforming into adult fish. Sea lamprey can grow up to 1m in length and are widely distributed around the coast. However, they tend to occur in low densities.	No details given in the SAC Conservation Objectives document, but anadromous sea and river lamprey have the potential to occur throughout the estuarine system. Brook lamprey spends its life in the freshwater reaches of the river or in estuarine areas of low salinity e.g. populations also known from the lower Abbey River tributary and other parts of tidal river.
River Lamprey (*Lampetra fluviatilis*)	The river lamprey grows to 30cm and has a similar life history to the sea lamprey. The brook lamprey is the smallest of the three lamprey species native	

Brook Lamprey (*Lampetra planeri*)	to Ireland at 15 to 20cm in length. It is also the only one of the three which is non-parasitic and spends all its life in freshwater. Despite the difference in ecology, brook and river lamprey are very similar genetically and cannot be distinguished by visual means. Therefore the brook and river lampreys are usually considered together despite different life strategies.	
Salmon (*Salmo salar*)	The Salmon breeds in freshwater but spends much of its life at sea. The salmon population in Ireland has declined by 75% in recent decades and although salmon still occur in 148 Irish rivers only 43 of these have healthy populations. There are numerous factors which impact negatively on salmon, the most important of which are reduced marine survival (probably as a result of climate change), poor river water quality (resulting from factors such as inadequate sewage treatment, agricultural enrichment, acidification, erosion and siltation), forestry-related pressures and over-fishing. The current estimates suggest that less than 10% of the wild smolts that go to sea from Irish rivers are surviving.	Can occur all along Shannon system from freshwater to marine during migration etc.
Common Bottlenose Dolphin (*Tursiops truncatus*)	The Bottlenose Dolphin is one of the most frequently recorded and familiar cetaceans occurring in Ireland. With adults averaging up to 3.0-3.8m in length, they are quite readily identifiable, bearing a substantial curved grey dorsal fin, a short but pronounced rounded beak, and lacking an obvious pattern in their grey body colouration except for a paler ventral surface	Extensive distribution along the Shannon system, but downstream of Limerick city.
Otter (*Lutra lutra*)	The Otter is widespread in Irish freshwater and coastal habitats. Its main prey includes sticklebacks, salmonids, frogs, crayfish and eels. While there has been some localised reduction in otter habitat quality, due mainly to water pollution and clearance of riparian vegetation, this has been balanced by the reduced occurrence of severe water pollution episodes and reduced river corridor disturbance.	Can occur all along Shannon system from freshwater to marine.

Table 5. National conservation status of qualifying interest habitats and species of the Lower River Shannon SAC (after NPWS 2019).

Habitats of Qualifying Interest	**Status (after NPWS, 2019)**
Sandbanks which are slightly covered by seawater at all times (EU Habitat Code 1110)	Favourable (stable trend)
Estuaries (EU Code 1130)	Inadequate (declining trend)
Mudflats and sandflats not covered by seawater at low tide (EU Code 1140)	Inadequate (deteriorating trend)
Coastal lagoons (EU Code 1150)	Bad (deteriorating)
Large shallow inlets and bays (EU Code 1160)	Bad (deteriorating)
Reefs (EU Code 1170)	Inadequate (stable trend)
Perennial vegetation of stony banks (EU Habitat Code 1220)	Inadequate (stable trend)
Vegetated sea cliffs of the Atlantic and Baltic coasts (EU Code 1230)	Inadequate (stable trend)
Salicornia and other annuals colonizing mud and sand (EU Code 1310)	Favourable (stable trend)
Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) (EU Code 1330)	Inadequate (deteriorating trend)
Mediterranean salt meadows (*Juncetalia maritimi*) (EU Code 1410)	Inadequate (deteriorating trend)
Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation (EU Code 3260)	Inadequate (deteriorating trend)
Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) (EU Code 6410)	Bad (deteriorating)
Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (EU Habitat Code 91E0)	Bad (deteriorating)
Species of Qualifying Interest	
Freshwater Pearl Mussel (*Margaritifera margaritifera*)	Bad (deteriorating trend)
Sea Lamprey (*Petromyzon marinus*)	Bad (stable trend)
River Lamprey (*Lampetra fluviatilis*)	Unknown
Brook Lamprey (*Lampetra planeri*)	Favourable
Salmon (*Salmo salar)*	Inadequate (stable trend)
Common Bottlenose Dolphin (*Tursiops truncatus*)	Favourable (stable trend)
Otter (*Lutra lutra*)	Favourable (stable trend)

4.4 River Shannon & River Fergus Estuaries SPA – designation details

The wetland habitats of the Shannon and Fergus Estuaries Special Protection Area cover an area of approximately 32,261 ha (NPWS, 2012c) and at the time of site designation supported numbers of Light-bellied Brent geese (*Branta bernicla hrota*), Black-tailed Godwit (*Limosa limosa*) and Dunlin (*Calidris alpina*) of international importance. The site also qualifies for designation as it regularly supports over 20,000 waterbirds during winter. Waterbird Special Conservation Interest (SCI) species listed for the Shannon & Fergus Estuaries SPA are shown in Table 6. Conservation objectives for the River Shannon and Fergus Estuaries Special Protection Area were published in 2012 (NPWS 2012b, 2012c).

The Shannon & Fergus estuaries system is known to support over 20,000 waterbirds during winter (Crowe, 2005, MKOS, 2019). Although lack of count cover during the Irish Wetland Bird Survey (I-WeBS) means that site total counts have not exceeded 20,000 waterbirds in recent years (Lewis et al. 2016), counts during the winter of 2017/18 season for the Shannon Integrated Framework Programme (SIFP) (MKOS, 2019) confirmed that over 20,000 waterbirds were present across all winter months.

The peak count of 43,093 waterbirds (December 2017) (MKOS, 2019) confirmed that the Shannon & Fergus estuaries is the most important site in the Republic of Ireland in terms of total waterbird numbers. This is highly likely to still be the case.

Table 6. Waterbird Special Conservation Interest (SCI) species listed for the River Shannon & River Fergus Estuaries SPA. * denotes Annex I species.

Species Name	Latin name	Annex I species	Baseline population[a]	Population status at baseline
Whooper Swan*	*Cygnus cygnus*	Yes	118	All-Ireland Importance
Light-bellied Brent Goose	*Branta bernicla hrota*		494	International Importance
Shelduck	*Tadorna tadorna*		1,025	All-Ireland Importance
Wigeon	*Anas penelope*		3,761	All-Ireland Importance
Teal	*Anas crecca*		2,260	All-Ireland Importance
Pintail	*Anas acuta*		62	All-Ireland Importance
Shoveler	*Anas clypeata*		107	All-Ireland Importance
Scaup	*Aythya marila*		102	All-Ireland Importance
Cormorant	*Phalacrocorax carbo*		245	All-Ireland Importance
Ringed Plover	*Charadrius hiaticula*		223	All-Ireland Importance
Golden Plover*	*Pluvialis apricaria*	Yes	5,664	All-Ireland Importance
Grey Plover	*Pluvialis squatarola*		558	All-Ireland Imporance
Lapwing	*Vanellus vanellus*		15,126	All-Ireland Importance
Knot	*Calidris canutus*		2,015	All-Ireland Importance
Dunlin	*Calidris alpina*		15,131	International Importance
Black-tailed Godwit	*Limosa limosa*		2,035	International Importance
Bar-tailed Godwit*	*Limosa lapponica*	Yes	460	All-Ireland Importance
Curlew	*Numenius arquata*		2,396	All-Ireland Importance
Greenshank	*Tringa nebularia*		61	All-Ireland Importance
Redshank	*Tringa totanus*		2,645	All-Ireland Importance
Black-headed Gull	*Chroicocephalus ridibundus*		2,681	All-Ireland Importance

[a] Five-year peak mean for the period 1995/96 – 1999/00 (I-WeBS baseline data).

Conservation Objectives

For coastal SPA sites, conservation objectives are defined for attributes relating to waterbird species populations, and for attributes related to the maintenance and protection of habitats that support them. These attributes are (1) population trend; (2) population distribution, and (3) habitat range and area. Site-specific conservation objectives for the River Shannon and River Fergus Estuaries SPA were published in 2012 and are shown in Table 7.

Table 7. Conservation Objectives – The River Shannon and River Fergus Estuaries SPA (after NPWS, 2012a, 2012b).

Objective 1 *To maintain the favourable conservation condition of the waterbird Special Conservation Interest species listed for the SPA.*	*To be favourable, the long-term population trend for each waterbird Special Conservation Interest species should be stable or increasing. Waterbird populations are deemed to be unfavourable when they have declined by 25% or more, as assessed by the most recent population trend analysis.*
	To be favourable, there should be no significant decrease in the range, timing or intensity of use of areas by the waterbird species of Special Conservation Interest, other than that occurring from natural patterns of variation
Objective 2 *To maintain the favourable conservation condition of the wetland habitat at the SPA as a resource for the regularly occurring migratory waterbirds that use it.*	*To be favourable, the permanent area occupied by the wetland habitat (32,261 ha) should be stable and not significantly less than the measured area, other than that occurring from natural patterns of variation.*

Conservation Status (Condition)

The conservation status of non-breeding[6] waterbird species of the River Shannon and River Fergus Estuaries SPA in relation to Objective 1a (population trend) was provided in the Conservation Objectives supporting document (NPWS, 2012b). However, this conservation status assessment would now be considered out of date and no more recent site population trends are available. The current, and recently published national trend for each of the waterbird SCI species is shown in Table 8 (after Kennedy et al. 2022).

Table 8. Current **national** trends for waterbird SCIs of the River Shannon and River Fergus Estuaries SPA. The listing under Birds of Conservation Concern 4 (Gilbert et al. 2021) is also given.

Species	5-year Trend	12-year Trend	23-year Trend	Trend class	BoCCI-4
Whooper Swan	-	-	-		Amber
Light-bellied Brent Goose	-11.2	1.2	93.3	Stable/Increasing	Amber
Shelduck	6.3	-0.8	9.3	Stable/Increasing	Amber
Wigeon	0.9	-17	-18.2	Intermediate decline	Amber
Teal	1.8	5.7	19.4	Stable/Increasing	Amber
Pintail	-0.8	-6	-13.7	Intermediate decline	Amber
Shoveler	23	-21.3	-10.8	Intermediate decline	Red
Scaup	-33.6	-82.9	-89.2	Large decline	Red
Cormorant	38.5	8.4	42.9	Stable/Increasing	Amber
Ringed Plover	-4.3	-26.8	-1.1	Intermediate decline	Amber
Golden Plover	-16.9	-58.1	-54.1	Large decline	Red
Grey Plover	-30.6	-39.4	-57.8	Large decline	Red
Lapwing	-6.5	-45.1	-63.9	Large decline	Red
Knot	0	-12.2	-9.8	Intermediate decline	Red
Dunlin	5.9	-21.2	-45.2	Moderate decline	Red
Black-tailed Godwit	22.5	25	92.3	Stable/Increasing	Red
Bar-tailed Godwit	-32.6	-13.9	-5.1	Intermediate decline	Red
Curlew	-9.4	-23.7	-43.1	Moderate decline	Red
Greenshank	0.9	7.3	41	Stable/Increasing	Green
Redshank	-14	-28.4	6.7	Stable/Increasing	Red
Black-headed Gull	-	-	-		Amber

[6] Conservation status is not available for the breeding population of Common Tern.

4.5 Other conservation designations

Natural Heritage Areas (NHAs) and Proposed Natural Heritage Areas (pNHAs)

National Heritage Areas (NHAs) are designations under the Wildlife Acts 1976 & 2000 that aim to protect habitats, species or geology of national importance. The boundaries of many of the NHAs in Ireland overlap with Natura 2000 sites. In addition to formally designated NHAs, there are about 630 proposed NHAs (pNHAs) which were published on a non-statutory basis in 1995 but have not since been statutorily proposed or designated. These are afforded the same full protection as NHAs.

Westfields Wetlands is part of the Inner Shannon Estuary – South Shore proposed Natural Heritage Area (pNHA 435) (Figure 5).

Other designations

Westfields Wetlands is a designated Wildfowl Sanctuary, protected by a no-shooting order (Lysaght, 1986).

Figure 5. Inner section of the Inner Shannon Estuary – South Shore proposed Natural Heritage Area (pNHA 435). (Source: NPWS Designations Viewer).

5. Baseline information for Westfields Wetlands

5.1 Habitats

A habitat survey was undertaken to inform the Management Plan and the results are detailed within the plan itself. An overview of the habitats recorded is shown in Table 9, while a habitat map is shown in Figure 6.

Table 9. Habitats recorded at Westfields Wetlands (after Limerick City and County Council, 2022).

Habitat code	Habitat name	Links to Annex I Habitats listed for the Lower River Shannon SAC
CW2	Tidal river	Links to Annex I habitat 'estuaries'. While not specified in the Westfield Wetlands Management Plan, tidal channels can support the Annex I Habitat, 3260 watercourses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation. This habitat is also shown adjoining Westfields Wetlands along the tidal River Shannon on map 13 of the conservation objectives for the Lower River Shannon SAC 002165 (NPWS, 2012a).
FS1	Reed and large sedge swamp	No
FS2	Tall herb swamp	No
FL5	Eutrophic lake	No
GA2	Amenity grassland	No
GS2	Dry meadows and grassy verges	No
WD1	(Mixed) broadleaved woodland	No
WD5	Scattered trees and parkland	No
WL2	Treelines	No
WN5	Riparian woodland	Potentially links to Annex I habitat Alluvial forests (91E0)
WN6	Wet Willow-Alder-Ash woodland	No
WS1	Scrub	No
WS3	Ornamental shrub	No
WS2	Immature woodland	No

Figure 6. Habitat map of Westfields Wetlands (taken from the Management Plan, Limerick City and County Council, 2022).

5.2 Flora

Table 10 reproduces the list of plant species recorded during a habitat survey at Westfields Wetlands. Species marked with * are considered to be invasive, alien species (IAS species) (also refer to Section 5.5 below).

Table 10. Plant species recorded at Westfields Wetlands during a habitat survey 2022.

Scientific name	Species
Acer pseudoplatanus	Sycamore
Achillea millefolium	Yarrow
Aegopodium podagraria	Ground elder
Aesculus hippocastanum	Horse Chestnut
Alisma plantago-aquatica	water plantain
Alnus cordata	Italian Alder*
Alnus glutinosa	Alder
Berula erecta	Lesser Water-parsnip
Betula pendula	Birch
Buddleja davidii	Butterfly-bush*
Calystegia sepium	Bindweed
Carex pendula	Pendulous sedge*
Centaurea scabiosa	Knapweed
Corylus avellana	Hazel
Crataegus monogyna	Hawthorn
Crocosmia X crocosmiflora	Montbretia*
Cupressus macrocarpa	Monterey Cypress
Elodea nuttallii	Nuttall's waterweed*
Epilobium hirsutum	Great willowherb
Epilobium montanum	Broad-leaved willowherb
Fagus sylvatica	Beech
Fallopia japonica	Japanese Knotweed*
Fallopia x bohemica	Bohemian Knotweed*
Festuca rubra	Red fescue
Fraxinus excelsior	Ash
Glyceria maxima	Reed Sweet-grass
Griselinia littoralis	Griselinia*
Gunnera manicata	Giant Rhubarb*
Hedera hibernica	Ivy
Heracleum mantegazzianum	Giant Hogweed*
Impatiens glandulifera	Himalayan Balsam*
Jacobaea aquatica	Marsh ragwort
Koenigia polystachya	Himalayan Knotweed*
Lemma minor	Common Duckweed
Lemna minuta	Least Duckweed
Leucojum aestivum	summer snowflake
Leycesteria formosa	Himalayan Honeysuckle*

Lolium perenne	Yorkshire-fog
Lotus corniculatus	Birds-foot trefoil
Lycopus europaeus	Gypsywort
Lythrum salicaria	purple loosestrife
Mentha aquatica	water mint
Myriophyllum spicatum	Spiked Water-milfoil
Myriophyllum verticillatum	whorled water-milfoil
Oenanthe crocata	Hemlock Water-dropwort
Petasites hybridus	Butterbur
Petasites fragrans	Winter Heliotrope*
Phalaris arundinacea	reed canary grass
Phragmites australis	Common reed
Populus	Poplar
Prunus laurocerasus	Cherry Laurel*
Quercus petraea	Oak
Quercus rubra	Red oak*
Ranunculus repens	Creeping buttercup
Rubus fruticosus	Bramble
Rumex crispus	Curled Dock
Salix alba	White Willow*
Salix cinerea	Grey Willow
Salix viminalis	Osier Willow
Sambucus nigra	Elderberry
Schoenoplectus lacustris	Common Club rush
Sorbus aria	Whitebeam
Sorbus aucuparia	Rowan
Spirodela polyrhiza	Greater Duckweed
Stachys sylvatica	Hedge woundwort
Symphoricarpos albus	Snowberry*
Tilia cordata	Lime
Tussilago farfara	Coltsfoot
Typha latifolia	Bulrush
Ulmus glabra	Wych Elm
Urtica dioica	Nettle
Veronica serpyllifolia	Ivy-leaved Speedwell

5.3 Birds

Bird species are discussed here under the categories ‘wintering birds’ and ‘breeding birds.’

The term ‘waterbirds’ is defined as birds that are ecologically dependent on wetlands (Ramsar Convention, 1971) and is synonymous with *waterfowl* (Wetlands International, 2012). Following the Irish Wetland Bird Survey (e.g. Lewis et al. 2019), the term *waterbird* includes all species in the families Anatidae, (swans, geese and ducks), Gaviidae (divers), Podicipedidae (grebes), Rallidae (Water Rail *Rallus aquaticus*, Moorhen *Gallinula chloropus* and Coot *Fulica atra*), Haematopodidae

(oystercatchers), Charadriidae (plovers, lapwings), Scolopacidae (sandpipers, curlews, woodcocks, phalaropes) and Laridae (gulls and terns, excluding Kittiwake *Rissa tridactyla*). It also includes Cormorant *Phalacrocorax carbo*, Little Egret *Egretta garzetta*, Grey Heron *Ardea cinerea* and Kingfisher *Alcedo atthis*.

Waterbirds are an integral component to the amenity and biodiversity value of Westfields Wetlands. At an Irish wetland, some waterbird species are likely to be present year-round, but numbers of waterbirds rise considerably in Ireland during autumn and winter due to the arrival of migratory wintering waterbirds, that migrate to their breeding grounds at the end of the winter.

The waterbird species using Westfields Wetlands are likely to be part of the larger populations that use the River Shannon and River Fergus Estuaries SPA during winter (Natura Environmental Consultants, 2001). No dedicated wintering bird survey was carried out for the Management Plan, however long-term data (1987/88 to 2019/20) were supplied by local member of Birdwatch Ireland Limerick Branch, Tom Tarpey. These raw data were compiled, and the species recorded are shown in Table 11 below, along with species information such as the species' current national trend (after Kennedy et al. 2022). The species list contains seven species listed as waterbird SCI species of the River Shannon and River Fergus Estuaries SPA.

Waterbird data are usually assessed in five-year periods (five-year mean peaks) which dampen the effects of annual fluctuations in numbers. To assess trends in the waterbird data over time, five-year mean peak values were compared across time with changes shown as percentage change (% change). These trends are shown in Table 12. The majority of species appear to have declined in number at the wetlands over time. Limited data were available from I-WeBS for the wetland site. Data provided for winter 2020/21 (a single count) showed a peak count of nine Mute Swan which is the same as the mean peak number recorded during winter 1987/88 – 1991/92. This suggests numbers of Mute Swan are stable. A peak count of 49 Tufted Duck during winter 2020/21 is higher than recent mean peaks shown in Table 12, but still indicates a decline in number of this species. All other recent count data add to the overall trend for decline in waterbird numbers.

It is important to note however, that count coverage of Westfields Wetlands is relatively poor, with irregular, single counts in some recent winters. The true current numbers and status of waterbirds using Westfields Wetlands is therefore not known.

Table 11. Species recorded during waterbird surveys at Westfields Wetlands 1987/88 to 2019/20 (Data supplied by local BirdWatch Ireland Branch). The table also highlights species (*) listed as waterbird SCIs of the River Shannon & River Fergus Estuaries SPA, and **A**mber-listed species under 'Birds of Conservation Concern 4' (Gilbert et al. 2021). The table also shows the species national trend within I-WeBS (after Kennedy et al. 2022).

Species	Latin name	BoCCI-4	5-year trend	12-year trend	23-year trend	Trend class
Mute Swan	*Cygnus olor*	Amber	4.6	9.6	13.8	Stable/increasing
Green-winged Teal	*Anas carolinensis*					
Gadwall	*Anas strepera*	Amber	-26.5	4.3	24.4	Stable/increasing
Teal*	*Anas crecca*	Amber	1.8	5.7	19.4	Stable/increasing
Mallard	*Anas platyrhynchos*	Amber	-11.3	-19.7	-19.1	Intermediate decline
Shoveler*	*Anas clypeata*	Red	23	-21.3	-10.8	Intermediate decline
Pochard	*Aythya ferina*	Red	-19.8	-60.4	-79.1	Large decline
Red-crested Pochard	*Netta ruffina*					
Ring-necked Duck	*Aythya collaris*					
Tufted Duck	*Aythya fuligula*	Amber	-20.7	-28.9	-17.9	Intermediate decline
Goldeneye	*Bucephala clangula*	Red	-32.5	-39	-66.9	Large decline
Little Grebe	*Tachybaptus ruficollis*		6.1	16.7	38.2	Stable/increasing
Water Rail	*Rallus aquaticus*					
Moorhen	*Gallinula chloropus*					
Coot	*Fulica atra*	Amber	-10.1	1.1	-23.2	Intermediate decline
Cormorant*	*Phalacrocorax carbo*	Amber	38.5	8.4	42.9	Stable/increasing
Grey Heron	*Ardea cinerea*		1	-4.9	6.6	Stable/increasing
Lapwing*	*Vanellus vanellus*	Red	-6.5	-45.1	-63.9	Large decline
Dunlin*	*Calidris alpina*	Red	5.9	-21.2	-45.2	Moderate decline
Redshank*	*Tringa totanus*	Red	-14	-28.4	6.7	Stable/increasing
Green Sandpiper	*Tringa ochropus*					
Snipe	*Gallinago gallinago*	Red				
Black-headed Gull*	*Chroicocephalus ridibundus*	Amber				
Common Gull	*Larus canus*	Amber				
Lesser Black-backed Gull	*Larus fuscus*	Amber				
Herring Gull	*Larus argentatus*	Amber				
Ring-billed Gull	*Larus delawarensis*					

Table 12. Species recorded during waterbird surveys at Westfields Wetlands 1987/88 to 2019/20 (Data supplied by local BirdWatch Ireland Branch). Trends (percentage change of differing five-year mean peak counts are shown.

Species	(A) Mean peak 87/88 - 91/92	(B) Mean peak 94/95-98/99	(C) Mean peak 06/07 - 10/11	Mean peak 11/12 - 15/16	% Change B vs A	% Change C vs A	% Change D vs A
Mute Swan	9	6	6	8	-37	-35	-8
Gadwall	2	3	0	0	50	-100	-100
Teal	75	54	41	10	-28	-45	-87
Mallard	72	56	49	40	-22	-31	-44
Shoveler	12	12	23	13	1	100	9
Pochard	8	15	19	14	80	128	68
Tufted Duck	73	70	23	26	-4	-69	-64
Grey Heron	8	3	1	1	-70	-88	-85
Little Grebe	3	1	1	4	-72	-50	31
Moorhen	14	10	15	9	-32	5	-38
Coot	27	100	36	28	275	35	4
Lapwing	3	0	0	0	-100	-100	-100
Dunlin	4	0	0	0	-100	-100	-100
Redshank	4	23	0	0	527	-100	-100
Snipe	2	7	0	0	225	-100	-100
Black-headed Gull	130	100	91	116	-23	-30	-11
Common Gull	14	14	3	5	-2	-79	-66
Lesser Black-backed Gull	2	1	0	0	-55	-100	-100
Herring Gull	2	0	0	0	-100	-100	-100

The only systematic survey of breeding birds at Westfields was that carried out by Lysaght (1986) during 1982 and 1983 (Table 13). No recent breeding bird survey has been carried out. Collectively, there is therefore a data gap for both wintering and breeding bird populations of Westfields Wetlands.

Table 13. Bird species recorded to be breeding at Westfields Wetlands (Lysaght, 1986, shown in Natura Environmental Consultants, 2001).

Common name	Scientific name	Status	Abundance (no. of pairs)
Little grebe	*Tachybaptus ruficollis*	Breeding	3
Mute swan	*Cygnus olor*	Breeding	1
Mallard	*Anas platyrhynchos*	Breeding	?
Shoveler	*Anas clypeata*	Breeding	?
Tufted duck	*Aythya fuligula*	Breeding	2
Pheasant	*Phasianus colchicus*	Breeding	1
Water rail	*Rallus aquaticus*	Breeding	?
Moorhen	*Gallinula chloropus*	Breeding	Very common
Coot	*Fulica atra*	Breeding	Very common
Wood pigeon	*Columba palumbus*	Breeding	Common
Collared dove	*Streptopelia decaocto*	Breeding	>2
Meadow pipit	*Anthus pratensis*	Breeding	Common
Grey wagtail	*Motacilla cinerea*	Breeding	Common
Pied wagtail	*Motacilla alba yarrellii*	Breeding	Common
Wren	*Troglodytes troglodytes*	Breeding	Very common
Dunnock	*Prunella vulgaris*	Breeding	Very common
Robin	*Erithacus rubecula*	Breeding	Very common
Blackbird	*Turdus merula*	Breeding	Very common
Song thrush	*Turdus philomelos*	Breeding	Common
Mistle thrush	*Turdus viscivorus*	Breeding	Occasional
Sedge warbler	*Acrocephalus schoenobaenus*	Breeding	Common
Willow warbler	*Phylloscopus collybita*	Breeding	Common
Long-tailed tit	*Aegithalos caudatus*	Breeding	Common
Blue tit	*Parus caeruleus*	Breeding	Very common
Great tit	*Parus major*	Breeding	Common
Magpie	*Pica pica*	Breeding	Common
Chaffinch	*Fringilla coelebs*	Breeding	Common
Greenfinch	*Carduelis chloris*	Breeding	Common
Linnet	*Carduelis cannabina*	Breeding	Small numbers
Bullfinch	*Pyrrhula pyrrhula*	Breeding	Common
Reed bunting	*Emberiza schoeniclus*	Breeding	Common

5.4 Other fauna

No systematic survey of fauna has been undertaken at Westfields Wetlands and the ecological walkover survey undertaken during July 2020 could not possibly record all species present, both terrestrial and aquatic. While records have been collated from the National Biodiversity Data Centre (NBDC), these records can only provide a list of species recorded and submitted to the NBDC, and do not form a complete inventory of species associated with the wetland.

5.5 Non-native, alien invasive species

In 2015, the EU invasive, alien species regulation ('IAS Regulation'[7]) came into force, which set targets to prevent the spread of invasive alien species. At the core of the IAS Regulation is a list of invasive alien species of Union concern (the Union list), including some of those species that cause the most damage to native biodiversity, and for which concerted measures are required across the EU. As a member state, there was a need to know which of Ireland's non-native species, were considered invasive and which, if introduced to Ireland, might become invasive. This was done through a formal Risk Assessment; for example an assessment in 2012 identified 127 species as being of either high or medium risk (Kelly et al. 2013 a,b). The National Biodiversity Data Centre now hosts information on the invasive species of Ireland [8], provides a catalogue of non-native species and invasive species are classified as 'high impact' or 'medium impact.' A habitat survey was undertaken at Westfields Wetlands in July 2020 to inform the Management Plan. A total of 20 non-native plants was recorded (Table 10). Of these species, a total of 12 species are classified as either 'high impact' or 'medium impact' species (Table 14). Seven species are 'high impact, and five species are 'medium impact.' Four species are considered to be of EU concern under the IAS Regulation.

A separate Invasive Species Management Plan has been compiled which details the appropriate way in which invasive alien species should be managed. This is a stand-alone document and accompanies the main Management Plan.

[7] Regulation (EU) No 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species (since updated).

[8] https://invasives.ie/about/catalogue/

Table 14. 'High impact' and 'Medium' impact invasive plant species recorded at Westfields Wetlands.

Common Name	Latin name	Status	Species of EU Concern
Nuttall's Waterweed	*Elodea nuttallii*	High Impact	Yes
Japanese Knotweed	*Fallopia japonica*	High Impact	
Bohemian Knotweed	*Fallopia japonica* x *bohemica*	High Impact	
Giant Rhubarb	*Gunnera tinctoria*	High Impact	Yes
Giant Hogweed	*Heracleum mantegazzianum*	High Impact	Yes
Himalayan (Indian) Balsam	*Impatiens glandulifera*	High Impact	Yes
Cherry Laurel	*Prunus laurocerasus*	High Impact	
Sycamore	*Acer pseudoplatanus*	Medium impact	
Butterfly Bush	*Buddleja davidii*	Medium impact	
Himalayan Knotweed	*Persicaria wallichii*	Medium impact	
Himalayan Honeysuckle	*Leycesteria formosa*	Medium impact	
Red Oak	*Quercus rubra*	Medium impact	

6. Screening Assessment

6.1 Is the plan necessary for the management of Natura 2000 sites?

Under the Habitats Directive, plans that are directly connected with or necessary to the management of a Natura 2000 site do not require AA. For this exception to apply, management is required to be interpreted as nature conservation management in the sense of Article 6(1) of the Habitats Directive in that specific measures are included to address the ecological requirements of qualifying interest habitats and species. Despite some of the actions within the Westfields Management Plan being likely to result in positive impacts upon the relevant Natura 2000 sites i.e. the River Shannon and River Fergus Estuaries Special Protection Area, and the Lower River Shannon Special Area of Conservation, any positive impacts are considered to be indirect. Therefore, the Westfields Management Plan is not considered by the Habitats Directive to be directly connected with or necessary to the management of relevant Natura 2000 sites.

6.2 Consideration of sources of cumulative impacts

Article 6(3) of the Habitats Directive requires an assessment of a plan or project to consider other plans or programmes that might, in combination with the plan or project, have the potential to adversely affect European Sites. Section 8 of this document outlines a selection of plans or projects that may interact with the Westfields Management Plan to give rise to in-combination effects to European Sites.

6.3 Screening Assessment

Plan Details	
Name of plan	**Westfields Wetlands Management Plan** (dated October 2022)
Natura 2000 sites within zone of influence (ZOI)	- Lower River Shannon Special Area of Conservation (Site Code 02165) - 0km, Westfields Wetlands lies inside the SAC. - River Shannon and River Fergus Estuaries Special Protection Area (Site Code 04077) - 0km, the SPA lies immediately adjacent to Westfields Wetlands.
Qualifying features of Natura 2000 sites	Please refer to Section 4 of this report.
Distance of project from Natura 2000 sites	As above.
Is the project directly connected with or necessary to the management of the sites?	No.
Are there other projects that together with the project being assessed could affect the sites?	Yes - please refer to the preceding section of this report.
Brief description of project	A Management Plan for the Westfields Wetlands was proposed by the Climate Action, Biodiversity and Environment Strategic Policy Committee of Limerick City and County Council in November 2019. In this context, the expressed aims of the Management Plan were to "explore opportunities for enhancement of the wetlands' amenity and recreational value while taking into account the ecological requirements of the SAC site and maintaining and enhancing biodiversity as a key objective" (Limerick City & County Council, 2022).The plan seeks to consider both the needs of nature for protected habitat space and the needs of people for a space to relax and enjoy the natural world.

Describe the individual elements of the plan (either alone or in combination with other projects) likely to give rise to impacts on the Natura 2000 site), and,

Describe any likely direct, indirect or secondary impacts of the project (either alone or in combination with other plans or projects) on Natura 2000 sites by virtue of:

(a) Size and scale; (b) Land-take; (c) Distance from Natura 2000 Site or key features of the Site; (d) Resource requirements; (e) Emissions; (f) Excavation requirements; (g) Transportation requirements; (h) Duration of construction, operation etc.; and (i) Other.

Westfields Wetlands covers an area of c.25ha. Westfields Wetlands are part of the Lower River Shannon SAC. The wetland lies adjacent to the River Shannon and River Fergus Estuaries Special Protection Area.

Various proposed actions of the Westfields Management Plan have the potential to result in negative impacts upon the qualifying interests and conservation objectives of the relevant Natura 2000 sites. These are:

- proposals to remove sediment on a successional basis,

- any form of excavation (e.g. SuDS proposals, excavations to explore pipework),

- Bulrush removal.

- any proposals to raise or lower water levels,

- any proposals to change the salinity levels of the water (limit egress from River Shannon/increase freshwater supply.

Describe any likely changes to the site as a result of: (a) Reduction of habitat area, (b) disturbance to key species, habitat or species fragmentation, (c) reduction in species density, (d) changes in key indicators of conservation value or climate change. *..and* *Describe any likely impacts on the Natura 2000 site as a whole in terms of: (a) Interference with the key relationships that define the structure of the site, and (b) Interference with key relationships that define the function of the site.*
The project will not result in any direct habitat loss from within any Natura 2000 site. However, various proposed actions, if not approached carefully and with necessary baseline information on the ecology of the wetland and adjacent River Shannon, have the potential to result in significant negative impacts upon the relevant Natura 2000 sites. For example, the removal of sediment could directly impact the quality and extent of floating river vegetation habitat given the known distribution of *Groenlandia densa* and *Schoenoplectus triqueter* along the southern coastal boundary with the Westfields Wetlands site. Both species form components of the Annex I Habitat, 3260 Watercourses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation. In the absence of a dedicated macrophyte survey, this habitat could be directly impacted should examples occur within the wetland basins. Furthermore, the removal of sediment may result in indirect impacts to the communities of *Schoenoplectus triqueter* known from the tidal mudflats along the southern boundary of the wetland. Furthermore, the action proposing to remove sediment from the basins at Westfields, and actions involving any excavations could cause the mobilisation of sediment in the water column. Such mobilisation and release of pollutants could theoretically reduce water quality and negatively impact qualifying interest fish, Otter and bird species given connectivity with the study area and downstream estuarine habitat. In addition, the lack of adequate baseline data on the wintering waterbird assemblages using the wetland and adjacent estuary, means that ruling out impacts of disturbance (e.g. during Bulrush removal works) upon waterbirds listed for the River Shannon and River Fergus Estuaries SPA is not possible. Full assessment of the potential for impacts is also precluded by the lack of detailed methods for the proposed actions and as a consequence many actions will require project specific AA.

6.4 Conclusion

Given the high level nature of the Management Plan coupled with the broad scope and extensive programme of proposed actions, it is not possible to screen out the potential for significant negative impacts upon the relevant Natura 2000 sites. The assessment now passes to Stage 2: Appropriate Assessment.

7. Appropriate assessment

This section of the report takes each management plan theme and related actions and provides an assessment of the potential impacts (both positive and negative) upon the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA.

7.1 Water quality (Chapter 3)

7.1.1 Overview

Water quality, defined as the physicochemical characteristics of water, provides part of the abiotic[9] environment of a wetland. An assessment of water quality is therefore an integral part of the physical assessment of any wetland or waterbody. During 2020, eight sampling locations were identified for sampling, as follows:

Location 1 – Western end of central wetland,
Location 2 – Inlet/outlet point from central wetland,
Location 3 – Inlet/outlet point from eastern wetland/lake,
Location 4 – Near viewing platform,
Location 5 – Eastern end of the eastern wetland/lake,
Location 6 – South-western side of the southern wetland,
Location 7 – Northern side of the southern wetland,
Location 8 – Open drainage channels to the east end of the southern wetland.

These locations were sampled on a three-weekly basis throughout a sampling period that extended from June to November 2020 inclusive (Figure 7). Physicochemical parameters selected for sampling included: Oxygen, Carbon and Suspended Solids, Biochemical Oxygen Demand (as mg/l O2), Dissolved Oxygen (as mg/l and %), Total Suspended Solids (mg/l), Dissolved Organic Carbon (mg/l) and Total Organic Carbon (mg/l). Nutrient sampling included: Ammonia (ionised NH4, as N, mg/l), Nitrate (NO3, as N, mg/l), Nitrite (NO2, as N, mg/l), Total Phosphorus (as P, mg/l) and Orthophosphate (mg/l P).

Figure 7. Water quality sampling locations 1-8 (Limerick City & County Council, 2022).

The following summary of water quality results are taken directly from Chapter 3 of the Westfields Management Plan, with reference to Appendix 3 of that plan.

[9] Abiotic – relating to physical, rather than biological processes.

Table 15. Summary of water quality results.

Number	Location	Summary of water quality results
1	Western end of central wetland	Location 1 showed the most enrichment. Results showed the highest average levels of BOD and lowest Dissolved Oxygen levels. It shares the highest concentrations for Ammonia, has the second highest average Suspended Solids levels and third highest average phosphate levels.
2	Inlet/outlet point from central wetland	Amongst the lowest BOD and ammonia levels of any of the 8 sample locations, as well as being low in phosphate concentration. Nitrate levels were amongst the highest recorded across the sampling locations. Note that the tide levels have a direct bearing on water quality in this location.
3	Inlet/outlet point from eastern wetland	This is the inflow/outflow point from the main lake, the Eastern Wetland. The water here was relatively good quality, with low BOD and elevated oxygen saturation. Phosphate concentrations here were the highest for any of the locations sampled, as well as being elevated for Nitrate.
4	Near viewing platform	BOD levels here were low, with good high dissolved oxygen concentrations. Suspended solids levels were relatively high. Ammonia and phosphorus concentrations were amongst the lowest recorded, with comparatively high levels of Nitrate and Nitrite.
5	Eastern end of the eastern wetland/lake	High DO and low BOD were recorded indicating good water quality. Faecal coliforms and *E.coli* were also notably low here compared with other locations. Mid-range for other parameters relative to other locations.
6	South-western side of the southern wetland	Results here were average for physical and chemical data, but generally showed amongst the lowest Faecal Coliform and *E.coli* counts.
7	Northern side of the southern wetland	Low suspended solids results. Otherwise this location had generally average results compared with other locations.
8	Open drainage channels to the east end of the southern wetland	This location had amongst the highest of the suspended solids and BOD results returned. Ammonia, Phosphate, Organic Carbon and all microbial analysis were also relatively high for this location compared with other sampling points.

7.1.2 Issues concerning water quality

The wetland complex (central and eastern sections) is connected to the River Shannon via a flap valve which results in an inflow at high tide. However, the saline influence is negligible with mean salinity readings of ≤0.34ppt and a maximum value of 0.7ppt recorded in the wetland during the 2020 sampling period. The average salinity[10] of freshwater is 0.5ppt (Sandrin et al. 2009) and thus the wetlands can be considered a freshwater environment with only sporadic and negligible brackish influences (related to tidal cycles). Indeed, the River Shannon adjoining the site is a freshwater body without saline influence from the wider estuary (Appendix 3).

[10] water with <0.5 ppt, 0.5–30 ppt and >30 ppt salt are termed fresh, brackish and saline, respectively

Determining the trophic status of the wetland required annual measurements of chlorophyll *a* concentration, and was beyond the scope of the study. However, the results of physicochemical sampling undertaken in the June to November 2020 period are indicative of relatively high levels of nitrogen and phosphorus (eutrophication). The main sources of excess nutrients in the Irish aquatic environment continue to be agriculture and wastewater (Trodd & O'Boyle, 2021).

The European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 (S.I. 77 of 2019) sets no specific boundary conditions for nitrate. However, EPA assessment of high-quality water sources has set boundary conditions of 0.8mg/l NO3-N (nitrate as nitrogen) for high quality waters and 1.8mg/l NO3-N for good quality waters. Mean nitrate levels typically fell within this good quality threshold. However, nitrate levels were considerably higher at sites 2, 3 & 4 than elsewhere on site (Appendix 3.2 of Management Plan). These sampling points were located in the vicinity of the River Shannon outflow/inflow and typically spiked (often doubled) on flooding tides (i.e. inflows to the wetland), regularly exceeding 3.5mg N/l at these locations. This pattern would suggest the Shannon is contributing significantly to the eutrophication of the site. Storm water sources (grey water), such as that identified in the western extent of the central wetland (sampling site 1) are also a potential source, as is the high rates of aquatic plant decomposition, high waterfowl numbers within the wetland and surrounding land use practices.

Phosphorus levels (Total P) were also elevated at the site with all sampling point means exceeding the good status threshold for stillwaters of ≤0.025 mg P/l as set out under S.I. 77 of 2019. Total P levels ranged from 0.06mg P/l (sites 2 & 4) to 1.06mg P/l (site 8), whilst the mean levels ranged from 0.06-0.57mg P/l. Significant spikes were observed on flooding (incoming) tides at sites 3 and especially 8 where a very high Total P concentration of 4.28mg P/l was recorded in September 2020. The majority of phosphorus in lake/wetland ecosystems is usually stored in the bottom sediment and aquatic vegetation (Pettersson, 1998). Thus, the levels of phosphorus in the heavily vegetated and heavily silted wetland complex are likely far higher than physicochemical sampling indicates. Phosphorus release from lake sediments increases at higher pH levels. Phosphorus release is also encouraged during reducing dissolved oxygen conditions, higher water temperatures and the disturbance of the sediment surface, including via wind action and excavation/desilting works (Søndergaard et al. 2013). High phosphorus release rates from the sediment encouraged during higher summer temperatures (exacerbated in shallow lakes) favour harmful algal blooms (Burger et al. 2008). The large phosphorus sink at the site (i.e. wetland sediments) will perpetuate a high cover of macrophytes, including Bulrush and the disturbance of sediment sinks of phosphorous may remobilise it from sediment.

Mean levels of un-ionised ammonia (NH_3) exceeded the good status threshold of ≤0.065mg N/l as set out under S.I. 77 of 2019 at all sampling points (0.10-0.19mg P/l). Decomposing organic (plant and animal) matter releases ammonium (NH_4+). At higher pH levels this is converted to ammonia (NH_3). Ammonium is then oxidized (combined with oxygen) by specialized bacteria to form nitrites (NO_2-) and nitrates (NO_3-). Both unionised ammonia and nitrite is toxic to fish and aquatic organisms, even at very low concentrations and the levels recorded at Westfields are likely impacting the health of aquatic life.

The contribution of phosphorous and nitrates from both the River Shannon and or grey water sources would need to be established to inform management decisions with regards water inflow/ outflow

regulation (e.g. lake turnover and water level changes) and also with regards mobilisation from sediments (i.e. through sediment testing).

7.1.3 Proposed actions and assessment

7.1.3a Nutrient sources and birds

An action of the Management Plan is to provide signage to encourage reduced/modest amount of feeding. Note that the second action under this section/heading (Bulrush *Typha latifolia* removal) will be considered in Section 7.3 'Vegetation Management'.

Action:
- Install signage to limit bird feeding.
Assessment:
- Describe any likely changes to a Natura 2000 site as a result of: (a) Reduction of habitat area, (b) disturbance to key species, habitat or species fragmentation, (c) reduction in species density, (d) changes in key indicators of conservation value or climate change.
- Describe any likely impacts on a Natura 2000 site as a whole in terms of: (a) Interference with the key relationships that define the structure of the site, and (b) Interference with key relationships that define the function of the site.
- Describe any additional likely impacts on a Natura 2000 site.

The feeding of birds at a wetland can create several problems, including, but not limited to those related to water quality. One such issue is disturbance, which can be caused to waterbird species that are present, but species that gain no benefit from the feeding. The feeding of birds can cause elevated aggregations of species such as pigeons and gulls, which in large, noisy and mobile flocks can cause disturbance to more sedentary waterbird species. Such species may be associated with the River Shannon and River Fergus Estuaries SPA and hence, *ex situ* impacts upon waterbird Special Conservations Interests of this SPA are a potential.

While the feeding of birds may be a popular pastime and seen as a beneficial way for people to interact with wildlife, the feeding of bread to wildfowl does have negative points as follows:

- Bread is a poor form of nutrition for wildfowl,
- Feeding birds can lead to the spread of disease and/or dietary or nutritional problems within the wildfowl,
- Feeding birds may lead to over-crowding of waterfowl, un-natural behaviour, increased hybridisation etc,
- Feeding birds may lead to 'un-social' behaviour e.g. aggression in species such as gulls and corvids that are attracted to the area by the food.
- Uneaten food may attract rodents to the wetland shoreline. This could have detrimental effects during the bird breeding season if rodents can gain access to nesting sites.

In terms of impacts upon water quality, the feeding of birds may contribute to water pollution (over-enrichment or eutrophication) which can lead to excessive growth of algae/vegetation. In addition, if the feeding of birds leads to congregation of birds in areas where they are fed, and therefore 'artificially' elevated numbers of birds at certain times, then this will lead to an elevated rate of bird

defecation into the waterbody. In turn, this will lead to an increase in nutrients, microorganisms and other contaminants. For instance, several studies have shown the link between birds and faecal pollution (e.g. *E. coli*) of waterbodies (e.g. Wither et al. 2003). Furthermore, recent Irish research based on data collected at an amenity park in greater Dublin has shown that resident wild birds are potential disseminators of antimicrobial resistant bacteria[11].

The waterbirds at Westfields Wetlands are a central feature of the attractiveness and interest of the area. However, based on the above potential impacts, signage to encourage modest amounts of bird feeding is welcomed. Following assessment, the action to provide signage to encourage reduced/modest amount of feeding is considered to be a slight to moderate positive impact upon the River Shannon and River Fergus Estuaries SPA. This action is also considered likely to have a negligible effect upon the habitats and species listed for the Lower River Shannon SAC. Moreover, this action is likely to have moderate positive impacts on the water quality and birdlife of Westfields Wetlands itself.

Impact assessment conclusions

The action to provide signage to encourage reduced/modest amount of bird feeding is considered to have no significant impact on the qualifying interests and conservation objectives of the River Shannon and River Fergus Estuaries SPA and the Lower River Shannon SAC. This action is likely to result in slight to moderate positive impacts upon the wetland's birdlife as well as water quality of the wetland.

Additional recommendations

We recommend that the action to install signage to reduce the feeding of birds be monitored to assess the effectiveness/efficacy of this action. In addition, given the recent occurrence of cases of Highly Pathogenic Avian Influenza (HPAI) in recent years, we recommend that the feeding of birds be prohibited/ceased at times when the virus may be circulating in local bird populations. This recommendation is to prevent the aggregation of birds due to feeding at such times when the virus is circulating in wild bird populations, and in doing so, this will prevent the spread of the virus. Ultimately, the feeding of birds, and especially bread, to birds should perhaps be considered further. Weighing up the human desire for this activity vs the potential negative impacts upon birds and the environment, perhaps this activity should be ceased/prohibited altogether.

7.1.3b Remobilisation of sediments, nutrients etc

Sediments were not assessed during the monitoring programme, but the condition of different sediments at different locations was compared visually during the regular sampling periods at the site. Sampling at some areas, for example the western end, suggest sediment anoxia, whereas sediment at the eastern end were shallow and brown which suggested good oxygenation. The Management Plan explains the natural and slow process of vegetation decay and accumulation of organic matter at the bottom of shallow lakes. The accumulation of plant remains (peat) together with sediments is a natural

[11] https://www.veterinaryirelandjournal.com/images/2022/june2022/pdf/focus1_june2022.pdf

successional process whereby over a long period of time, a lake will develop into a fen (e.g. Barry, 1969).

A desirable outcome of the Management Plan is to create more open water habitat. Therefore, actions have been developed around the subject of sediment removal. Note that the first action under this heading (Bulrush *Typha latifolia* removal) will be considered in Section 7.3 'Vegetation Management'.

Actions:
- Analyse sediments for stored nutrients and sediment oxygen demand at a number of locations, to assess the merit of sediment removal as a nutrient removal measure,
And,
- Remove sediments on a successional basis, taking care of ecological considerations. This will deepen the water in selected areas, whether or not there is an abundance of stored nutrients.
Assessment:
- Describe any likely changes to a Natura 2000 site as a result of: (a) Reduction of habitat area, (b) disturbance to key species, habitat or species fragmentation, (c) reduction in species density, (d) changes in key indicators of conservation value or climate change.
- Describe any likely impacts on a Natura 2000 site as a whole in terms of: (a) Interference with the key relationships that define the structure of the site, and (b) Interference with key relationships that define the function of the site.
- Describe any additional likely impacts on a Natura 2000 site.

No dedicated macrophyte survey was undertaken in the basins at the Westfields Wetland study area. Given that the stronghold of opposite leaved pondweed (*Groenlandia densa*) is in the lower Shannon, and in light of a known location of the plant in the eastern portion of the southern wetlands (map 13; Lower River Shannon SAC conservation objectives, floating river vegetation) (NPWS, 2012a), it would be essential to establish the full distribution of this plant within the wetland prior to any actions to remove sediment. Furthermore, as this macrophyte species and triangular clubrush (*Schoenoplectus triqueter*) are considered components of a transitional form of the Annex I Habitat, '3260 Watercourses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation' the distribution of both species needs to be fully documented. Incidentally, the southern tidal embankment of the Westfields study area is shown to support triangular clubrush (map 13; Lower River Shannon SAC conservation objectives, floating river vegetation) (NPWS, 2012a).

According to the trophic status monitoring carried out on Irish transitional waters for the Reporting period 2018-2020 by the EPA, the Limerick Dock area (IE_SH_060_0900) in which the Westfields Wetlands area discharges, has unpolluted water quality. However, currently the Limerick Dock, while being a heavily modified waterbody under review, is currently at risk of not achieving good status under the Water Framework Directive objectives by 2027. Importantly, sediment mobilisation with associated nutrient and or other pollutant mobilisation could result in further risk to a deterioration in water quality and the attainment of WFD targets that would have knock on impacts to qualifying interests for the Lower River Shannon SAC such as fish and Otter.

Specifically, a Waste Acceptance Criteria (WAC) test would need to be carried out in sub-basins of the wetland where sediment and Bullrush removal is proposed to establish the presence of contaminants (e.g. metals As, Cd, Cr, Cu, Hg, Ni, Pb, Zn); total BTEX (benzene, toluene, ethylbenzene, xylenes), mineral oil, polycyclic aromatic hydrocarbons (PAHs) and Polychlorinated Biphenyls (PCBs). Sediment nutrient tests could also be undertaken. This would help infer the potential mobilisation of

contaminants and transfer of the same to the River Shannon SAC via the tidal channel connection from the main wetland (i.e. central and eastern sections). Given the tidal sluice valve is damaged and is permanently open a mechanism to regulate control of the valve during Bullrush removal would help settle out remobilised pollutants in sediment to prevent uncontrolled release.

Impact assessment conclusions

The removal of sediment could directly impact the quality and extent of floating river vegetation habitat given the known distribution of *Groenlandia densa* and *Schoenoplectus triqueter* along the southern coastal boundary with the Westfields Wetlands site. Both species form components of the Annex I Habitat, '3260 Watercourses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation'. In the absence of a dedicated macrophyte survey, this habitat could be directly impacted should examples occur within the wetland basins. Furthermore, the removal of sediment may result in indirect impacts to the communities of *Schoenoplectus triqueter* known from the tidal mudflats along the southern boundary of the wetland. As such **significant negative impacts** may arise from the proposed removal of sediment.

The action proposing to remove sediment from the basins at Westfields is considered to have a potential **significant negative impact** on the qualifying interests and conservation objectives of the River Shannon and River Fergus Estuaries SPA and the Lower River Shannon SAC. The mobilisation of pollutants could theoretically reduce water quality and negatively impact qualifying interest fish, Otter and bird species given connectivity with the study area and downstream estuarine habitat.

Additional recommendations

The removal of sediment will require dedicated macrophyte surveys that will identify the range and extent of floating river vegetation habitat in addition to the potential presence of rare lacustrine communities of *Chara connivens* and *Chara canescens* that are known from the Lower River Shannon SAC. The presence and or absence of these species will inform a dredge plan that would be subject to Ecological Impact Assessment (EcIA) and project-specific Appropriate Assessment. The cost-benefit of open water versus continued succession of the basin for qualifying interest species should be considered. The creation of open water should however, once avoiding the identified constraints and minimising water quality deterioration, have an overall net benefit for qualifying interest species once carefully planned.

All wetlands sequester carbon from the atmosphere through plant photosynthesis and by acting as sediment traps for runoff. Carbon is held in the living vegetation (e.g. Bulrush) as well as in litter, peats, organic soils, and sediments that have built up over considerable time. in some instances, over thousands of years. Indeed, wetlands can be some of the largest stores of carbon on the planet. Therefore, carbon storage and climate change mitigation are additional considerations when considering proposals to remove sediments from Westfields Wetlands.

7.1.3c Stormwater inputs

Stormwater inputs are known to enter the wetland. These can be observed along the southern shore of the lake and wider wetland area, entering from gullies on the Condell Road spaced at c.30m intervals. Storm water is considered one of the largest threats to water quality in urban areas given it is difficult to attenuate storm water from large areas of hard surfaces. Stormwater can contain oils, greases, chemicals from vehicles, pesticides and nutrients from lawn applications, pet waste and overflows from wastewater treatment and or unregulated sewer sources. These unregulated contributions of pollution to the Westfields Wetlands will reduce the biodiversity value of the habitats while also contributing to impacts to the downstream connecting European Sites. Management Plan actions are proposed that aim to work towards a Sustainable Urban Drainage System (SUDS) approach to reduce polluting waters entering the wetland.

Actions:
- Conduct analysis of the stormwater inputs after a rainfall event (taking first flush runoff only to avoid excessive dilution of the sample). Assess for hydrocarbons, suspended solids, microplastics (from tyre wear) and selected heavy metals. This process will help to clarify the SUDS sizing and selection requirements.
- Select the SUDS type (or combination) that best fits the wider wetland design approach.
- Design accordingly,
- Implement as and when appropriate in the context of other site works.

Assessment:
- Describe any likely changes to a Natura 2000 site as a result of: (a) Reduction of habitat area, (b) disturbance to key species, habitat or species fragmentation, (c) reduction in species density, (d) changes in key indicators of conservation value or climate change.
- Describe any likely impacts on a Natura 2000 site as a whole in terms of: (a) Interference with the key relationships that define the structure of the site, and (b) Interference with key relationships that define the function of the site.
- Describe any additional likely impacts on a Natura 2000 site.

Stormwater sources, such as that identified in the western extent of the central wetland are likely contributing to the high rates of nitrates recorded at the site (in addition to tidal inflow from the River Shannon), in addition to contamination of heavy metals, hydrocarbons and sewage inputs. Therefore, given the likely damaging water quality effects on qualifying interests and non-qualifying interest species and habitats within and adjoining the wetland, the appropriate design and implementation of SUDS on existing stormwater inputs will have a positive impact on both the wetland site and European sites.

The creation of attenuation wetland basins (i.e. ICW) within the existing wetland to receive stormwater inputs would result in a net improvement of water quality and likely reduce the contamination of sediments. Whilst this approach would be beneficial to a range of qualifying interest and non-qualifying interest species and habitats, wetland basin construction/excavation may, counterintuitively (in absence of correct design), result in **significant negative impacts** to water quality through mobilisation of contaminants and nutrients from existing sediment. The land take required for attenuation basin construction may also reduce the area of existing higher-quality wetland habitat, impacting bird, amphibian, macrophytes (including opposite-leaved pondweed, if present), invertebrate and aquatic mammal species, including qualifying interest Otter. Incorrect design could lead to significant negative impacts in terms of reduction in habitat area and quality for Otter.

Impact assessment conclusions

The implementation of a SUDS approach to address stormwater inputs to the Westfield site is considered to have a positive significant impact on European sites via a reduction in contamination and improvement of water quality. However, the construction/provision of stormwater attenuation basins is considered to have a potential **significant negative impact** on the qualifying interests and conservation objectives of the River Shannon and River Fergus Estuaries SPA and the Lower River Shannon SAC. This is given the potential for water quality impacts and a reduction in mature (higher quality) wetland habitat.

For proposed actions to proceed, the proposed analysis of the stormwater inputs needs to be undertaken. Further proposals then need to be subject to Ecological Impact Assessment (EcIA) and project-specific Appropriate Assessment, considering the potential for negative impacts described above.

Additional recommendations

A Waste Acceptance Criteria (WAC) test would need to be carried out in sub-basins of the wetland where sediment release/mobilisation may occur during the construction/excavation of proposed stormwater attenuation basin(s). This would help infer the potential mobilisation of contaminants and transfer of the same to the Lower River Shannon SAC. Surveys for macrophytes (including opposite-leaved pondweed), Otters and fish (including European eel) would be required to inform attenuation basin design.

7.1.3d Water flow from River Shannon

A single pipe connects the main wetland (central and eastern sections) with the River Shannon. This flows out of the wetland at low tide and, due to an open flap valve, into the wetland on high tide. Water quality sampling has suggested that the levels of suspended solids and nitrates are somewhat elevated entering the wetland as compared with leaving, suggesting that the Shannon may be a source of these parameters to the wetland.

Actions:
- Assess the feasibility of raising the level of the outlet from locations 2 and 3 (the Central and Eastern Wetlands), to limit ingress from the Shannon on high tides. Any works resulting from this feasibility assessment can only be initiated after a flood risk assessment has been carried out and the works deemed to be safe. Alternatively:
- In advance of weir works it is proposed that the freshwater spring be located and that the volume potential be estimated by a hydrogeological study to assess the potential for this as a source of water for the wetland. Physical and chemical analysis should also be carried out to assess the water quality of the spring prior to deciding on whether to rely on it even further by minimising river water ingress. Temporary reinstatement of the flap valve may yield valuable feedback about water flow dynamics in this context.

Assessment:

- Describe any likely changes to a Natura 2000 site as a result of: (a) Reduction of habitat area, (b) disturbance to key species, habitat or species fragmentation, (c) reduction in species density, (d) changes in key indicators of conservation value or climate change.
- Describe any likely impacts on a Natura 2000 site as a whole in terms of: (a) Interference with the key relationships that define the structure of the site, and (b) Interference with key relationships that define the function of the site.
- Describe any additional likely impacts on a Natura 2000 site.

The raising of existing inflows/outflows to/from the wetland may improve water quality of the Westfields site (e.g. reduce nitrate influence from River Shannon). However, it may result in significant impacts to qualifying interest and non qualifying interest species and habitats. Altering the existing hydrology and tidal/inundation regime of the wetland may result in direct significant negative impacts to components of floating river vegetation [3260] habitat, should examples of this habitat and or indicator species such as opposite-leaved pondweed (*Groenlandia densa*) occur within the site (the species is known along the adjoining River Shannon). Water salinity, nutrient changes and hydrological changes as a result of works could all impact such habitat and species. A dedicated wetland macrophyte survey would be required to elucidate potential impacts in this regard.

Construction works associated with the raising of inflows/outflows could also result in pollution to the River Shannon, primarily via sediment and or nutrient release. This may cause direct impacts to triangular club-rush (*Schoenoplectus triqueter*), known from the River Shannon along the southern boundary with the wetland site. However, in light of the inherently high sediment/suspended solid loads in the tidal River Shannon, any release through construction works is unlikely to cause significant impacts to qualifying interests of European sites. Nonetheless, elevated nutrients and the release of other contaminants including heavy metals, hydrocarbons and sewage inputs during works may cause impacts to the SAC/SPA. A Waste Acceptance Criteria (WAC) test would need to be carried out in sub-basins of the wetland where sediment release/mobilisation may occur during the proposed raising of inflows/outflows. This would help infer the potential mobilisation of contaminants and transfer of the same to the Lower River Shannon SAC.

Works may also directly and indirectly impact qualifying interest species Otter through disturbance and effects on foraging habitat and prey resources. A dedicated Otter survey would be required to identify the presence of Otter breeding and resting areas in the vicinity of proposed works.

There is scope to use the existing freshwater spring as a water source to the wetland in light of proposed limitation of water flow/connectivity from the River Shannon. However, this may result in significant hydrological impacts to the wetland and groundwater of the site over time, leading to negative effects on fish populations, waterfowl, invertebrate communities, Otter (if present) and qualifying interest aquatic vegetation [3260] (if present) through a reduction in water quality and or a reduction in water surface area.

Impact assessment conclusions

The alteration (raising) of the inflows/outflows between the wetland and the River Shannon is considered to have a potential **significant negative impact** on the qualifying interests and conservation objectives of the River Shannon and River Fergus Estuaries SPA and the Lower River Shannon SAC. This is given the potential for water quality impacts and hydrological changes to the

wetland and downstream connecting habitats. Whilst the undertaking of a feasibility study will have no impacts upon local ecology or sites of European interest, for additional proposed actions to proceed, then full Ecological Impact Assessment (EcIA) and project-specific Appropriate Assessment will need to be undertaken, considering the potential for negative impacts described above.

Additional recommendations

As above, a feasibility study investigating the raising of wetland inflows/outflows will have no significant effects on European sites, but a site-specific EcIA is needed, as well as a project-specific Appropriate Assessment, if any alterations to water flow are implemented. This would include a full macrophyte and Otter surveys within the wetland site and adjoining habitats.

A full hydrological survey would be required to determine the viability of using the existing freshwater spring as the sole source of water for the wetland, following the restriction of connectivity with the River Shannon. This would also require a site-specific EcIA, as well as a project-specific Appropriate Assessment, if any alterations to water flow are implemented.

7.1.3e Sewage/grey water

Historically sewage most likely leaked into Westfields via the old sewage pipes that flowed through the site *en route* to the River Shannon. Also, since the pipe entering/exiting the wetland is located close to the old sewer outfall, sewage effluent was likely to have been pulled into the wetland at high tide. This outfall is no longer in use, since a main drainage project was completed in the early 2000s, but there still exists a risk that some grey water/sewage enters the wetland. Actions are proposed in the Management Plan that focus on exploring this issue and seeking cessation of sewage/grey water inputs.

Actions:
- Explore the possible presence of greywater pipework at the Western Wetland sampling point when an excavator is on-site for other works. If there are unauthorised outflows from houses, homeowners can be informed of findings in order to achieve reconnection to mains sewers.
- Alternatively, if grey water inputs are present but the exact source is unclear, a small constructed wetland may be designed for filtering the water source prior to entry into the main wetland habitat.
- Assess the DNA of the water-born Coliforms to check whether they are of human or animal/avian origin, which may assist with the diagnosis of inputs at different locations.

Assessment:
- Describe any likely changes to a Natura 2000 site as a result of: (a) Reduction of habitat area, (b) disturbance to key species, habitat or species fragmentation, (c) reduction in species density, (d) changes in key indicators of conservation value or climate change.
- Describe any likely impacts on a Natura 2000 site as a whole in terms of: (a) Interference with the key relationships that define the structure of the site, and (b) Interference with key relationships that define the function of the site.
- Describe any additional likely impacts on a Natura 2000 site.

While the examination of greywater contributions to the site inclusive of identified historical sources would benefit the longer-term water quality of the Westfield Wetlands once a remediation plan was implemented, the site investigation works using an excavator presents the risk of mobilising

concentrated contaminants within disturbed sediment. Without prior WAC analysis of sediment from the site investigation areas and without a plan with appropriate mitigation, such works present the risk of **significant negative impact** to water quality that could impact the quality of the receiving habitat and impact qualifying interest bird, Otter and fish populations of the River Shannon and River Fergus Estuaries SPA and the Lower River Shannon SAC. There is also a risk of disturbance to qualifying interest Otter and birds during mobilisation of heavy plant and during excavation works.

Impact assessment conclusions

Studies to assess the DNA of the water-born Coliforms will have no observable impacts upon the European sites of interest. However, investigation works using an excavator is considered to have a potential **significant negative impact** on the qualifying interests and conservation objectives of the River Shannon and River Fergus Estuaries SPA and the Lower River Shannon SAC. Full Ecological Impact Assessment (EcIA) and project-specific Appropriate Assessment will need to be undertaken, considering the potential for negative impacts described above.

Additional recommendations

No specific recommendations.

7.1.3f Contaminants from a spring

There is a spring located in the Eastern Wetland, located at a point c.60m from the platform, and closer to the northern half of the lake. The water quality and flow of this spring have not been studied.

Actions:
- Sample the spring water for the full suite of parameters and compare with the existing data for the lake water body.
- Carry out an estimate of the flow volumes entering the lake via the spring, to assess the potential for a raised stable lake level in the absence of River Shannon ingress on each high tide.

Assessment:
- Describe any likely changes to a Natura 2000 site as a result of: (a) Reduction of habitat area, (b) disturbance to key species, habitat or species fragmentation, (c) reduction in species density, (d) changes in key indicators of conservation value or climate change.
- Describe any likely impacts on a Natura 2000 site as a whole in terms of: (a) Interference with the key relationships that define the structure of the site, and (b) Interference with key relationships that define the function of the site.
- Describe any additional likely impacts on a Natura 2000 site.

The contribution of ground water from the spring and associated water quality would be important in determining whether the spring is providing a positive impact on the Westfields Wetlands. This would inform management of the tidal contribution via the main piped source to the central wetland via a defunct sluice. An understanding of the hydrological regime of the wetlands including lake turnover based on contributions from various sources including the spring would inform appropriate management including the risk of contamination of water quality to the Limerick Dock area of the Lower River Shannon SAC. Without these studies in place the best management decisions in terms of water regulation/ supply in the wetland cannot be arrived at.

Impact assessment conclusions

The action to conduct water quality analysis of the spring and estimate source contribution of water volumes are considered to have **no significant impact** on the qualifying interests and conservation objectives of the River Shannon and River Fergus Estuaries SPA and the Lower River Shannon SAC. These actions will benefit the implementation of a management plan that minimises impacts by design and by having a more robust understanding of source contributions, water quality and flood risk.

Additional recommendations

No specific recommendations.

7.1.3g Other land Use factors

The Management Plan describes how other contributory factors may be impacting on the quality of the water at Westfields. These include land use factors such as biocide spraying, and the dumping of compostable garden clippings and woodchips into the lake margins. Actions are proposed to reduce/cease these inputs.

Actions:
- It is recommended that biocide spraying be ceased for all areas of the Westfields wetland area and adjoining park. Cease all use of biocides within the park area unless as part of non-native invasive species control measures, preferably only as part of a catchment-wide programme.
- Review the spray protocols within the wider city, so that herbicide use is limited or reduced within the wider stormwater catchment of Westfields (namely along Condell Road and within Westfields Park).
- Engage with local homeowners through local events (or directly approach residents with gardens bordering the wetland) and highlight the need for careful management of garden clippings/mowings so that they do not impact on the wetland. e.g. setting all composting activities >10 m from high flood level. This process should actively encourage homeowners to compost garden clippings in their own gardens (>10m to water) or place such clippings in green waste bins for collection for municipal composting.
- Ensure that contractors carrying out tree felling works export all chips from the area or use them as a mulch around trees at least 10m away from high flood level of the water's edge.

Assessment:
- Describe any likely changes to a Natura 2000 site as a result of: (a) Reduction of habitat area, (b) disturbance to key species, habitat or species fragmentation, (c) reduction in species density, (d) changes in key indicators of conservation value or climate change.
- Describe any likely impacts on a Natura 2000 site as a whole in terms of: (a) Interference with the key relationships that define the structure of the site, and (b) Interference with key relationships that define the function of the site.
- Describe any additional likely impacts on a Natura 2000 site

The proposed actions to reduce/cease other contributory factors that may be impacting on the quality of the water at Westfields are likely to all be positive in their effect on the environment. These actions will be positive at a site-based, local level, but will also have knock-on positive effects on the wider environment including the relevant Natura 2000 sites. The overall impact is considered to be positive, with imperceptible to slight positive impacts upon the qualifying interests and conservation objectives of the River Shannon and River Fergus Estuaries SPA and the Lower River Shannon SAC.

Impact assessment conclusions

The actions to reduce/cease other contributory factors that may be impacting on the quality of the water at Westfields (e.g. pesticides/herbicide applications) are considered to have no significant negative impacts on the qualifying interests and conservation objectives of the River Shannon and River Fergus Estuaries SPA and the Lower River Shannon SAC.

Additional recommendations

None.

7.2 Water levels and flow dynamics

7.2.1 Overview

A key local desire regarding the amenity and recreational value of Westfields Wetland is to create more open water areas, while taking care that any works are carried out in a sensitive manner and do not negatively impact on the wildlife of the area.

The main flow into the wetland area appears to be via a pipe from the River Shannon on high tide, which splits beneath the pedestrian causeway to enter both the Central Wetland and Eastern Wetland waterbodies. There is also a spring reported to have been used historically by the Cleeve's factory, located within the lake in the Eastern Wetland. There are at least three distinct outlet points visible from aerial photographs of the wetland. These are shown as a rutting of the estuary silt on the banks of the Shannon at low tide. One of these is the formal entry/exit point described above, from the connecting pipe leaving the central and eastern wetland waterbodies. The other two appear to be well established conduits beneath the Condell Road and through the flood bund. These are located at the western and eastern extremities of the area: near Barrington's Pier and at Shannon Bridge respectively. Other ingress/egress seepage points are likely. While EPA mapping[12] shows no watercourses entering the wetlands, in general the mapping is not complete for many small watercourses. The primary input however is thought to be via the River Shannon, with inputs and outputs related to incoming and outgoing tides.

7.2.2 Issues concerning water levels and flow dynamics

The contribution of ground water from the spring and associated water quality would be important in determining whether the spring is providing a positive impact on the Westfields Wetlands. This would inform management of the tidal contribution via the main piped source to the central wetland via a defunct sluice. An understanding of the hydrological regime of the wetlands including lake turnover, salinity and associated flood risk while also considering climatic change effects, would inform appropriate management including the risk of contamination of water quality to the Limerick Dock area of the Lower River Shannon SAC. Without these studies in place, the best management decisions

[12] https://gis.epa.ie/EPAMaps/

in terms of water regulation/ supply in the wetland cannot be arrived at. The appropriate management of the water regime would also depend on accurate baseline studies of the fisheries value, macrophyte and invertebrate compositions of the wetland. The presence of rare and or protected species relative to the existing water levels, flow dynamics and salinity would inform how water regulation in the wetlands can be managed without inadvertent impacts to qualifying and non-qualifying interest aquatic species and habitats.

7.2.3 Proposed actions and assessment

Actions:
- It is proposed that the freshwater spring be located; checked to confirm presence or absence of the reported cap; and that the volumetric potential be estimated by a hydrogeological study to assess the potential for using this as a source of water for the wetland. Water quality monitoring is also recommended.
- Further hydrological assessments, as well as water quality analysis, are also recommended to ascertain both the merits and logistics of any water level amendments that may be considered.
Before any weir works are carried out a flood risk assessment would be needed to assess the potential for raising the water level.

Assessment:
- Describe any likely changes to a Natura 2000 site as a result of: (a) Reduction of habitat area, (b) disturbance to key species, habitat or species fragmentation, (c) reduction in species density, (d) changes in key indicators of conservation value or climate change.
- Describe any likely impacts on a Natura 2000 site as a whole in terms of: (a) Interference with the key relationships that define the structure of the site, and (b) Interference with key relationships that define the function of the site.
- Describe any additional likely impacts on a Natura 2000 site

The actions to locate the freshwater spring, conduct water quality analysis of the source and conduct hydrological studies including a flood risk assessment are considered to have no significant impact on the qualifying interests and conservation objectives of the River Shannon and River Fergus Estuaries SPA and the Lower River Shannon SAC. These actions will benefit the implementation of a management plan that minimises by design impacts to qualifying interest species and habitats of the adjoining European sites by having a more robust understanding of source contributions, water quality and flood risk.

Impact assessment conclusions

The actions to locate the freshwater spring, conduct water quality analysis of the source and conduct hydrological studies including a flood risk assessment are considered to have no significant impact on the qualifying interests and conservation objectives of the River Shannon and River Fergus Estuaries SPA and the Lower River Shannon SAC.

Additional recommendations

The hydrological assessment should consider the existing contributions from the spring and also tidal inundation and lake turnover. The effect of a change in the hydrological regime of the lake by contribution from the spring in place of tidal contributions should examine likely effects on the salinity

of the lake and ensure that such changes will not have implications for aquatic species with specific salinity tolerances or proclivity for precise salinity gradients.

7.3 Vegetation management

7.3.1 Overview

Actions relating to vegetation management are described in Section 5 of the Management Plan. The lake within Westfields Wetlands is located in the eastern wetland area (refer to Figure 6), located between Westfields Park housing estate to the north and Condell Road to the south. The central causeway forms the western boundary of the lake.

The Management Plan describes how, prior to the construction of Condell Road, this area was tidal, and fed via a large pipe with a non-return valve which exited via the flood bund along the River Shannon. The flood bund formed a promenade which was historically a popular walking route for the city residents. Over the past couple of hundred years the land use within the area has changed from farmland, subjected to flooding during spring tides, to the current lake that is present today. With the construction of Condell Road in the 1980s, the pipe beneath the flood bund was made smaller and the flow into and out of the lake became reduced. Since that time, the lake has become very overgrown with tall emergent plants around the outer perimeter, with considerable encroachment into more central areas also. This is part of a natural process of succession from lake to fen to raised bog; but the rate of plant encroachment has been exacerbated by nutrient inputs from a variety of sources including road runoff, inputs from the River Shannon, dumped garden and landscaping clippings, possible historic plumbing of both grey water and sewage and potential elevation of bird numbers by feeding and possibly the spring into the Eastern Wetland. The plant community is now dominated by Bulrush (*Typha latifolia*).
The Management Plan considers that the encroachment of Bulrush has reduced the area of open water, which reduces the area of open water for waterbirds as well as impacting upon their movement across the lake. Evidence of the reduction in open water can be seen in Figure 8. The lack of open water is also of concern for local residents as visible open water has been reduced. It is noted that reducing the plant encroachment has been a top priority in past public consultation.

The Management Plan recognises the need for any works that are carried out to be done in a manner that will actively improve the wildlife and biodiversity value of the wetland. Thus, it is proposed that vegetation removal works be carried out incrementally, to ensure that a variety of habitats and successional stages are present at any given time.

Figure 8. Encroachment of Bulrush c.2012 to c. 2018 (Source: Management Plan Appendix 5).

7.3.2 Background to proposed vegetation management

A gradual phased approach is proposed for Bulrush removal. The first priority is Area A (Figure 9) whereby Bulrush that extends around the viewing platform of the central causeway is removed to enable better views across open water and to enable waterbirds to swim across to the causeway.

It is proposed that Area A is the only area to be cut in year 1, and that it will be revisited in each subsequent maintenance year to remove regrowth and potentially to widen the lake at this location over time. Area A is c.0.5ha, which is less than one third of the current Bulrush cover across the eastern wetland.

Area B is *c*.0.25ha (green); Area C is *c*.0.1ha (purple) and Area D is *c*.0.2 ha (orange). These are all areas which have encroached in the past 6-8 years. It is proposed that these areas be harvested by cutting or root removal on a phased basis, with only one of these areas being worked on in any given year.

The green outline is the outer perimeter of the wetland area.
The yellow line is the area of open lake from 2011-2013 aerial photos.
The blue line is the reduced area of open lake from 2013-2018 aerial photos.
Image: ©Ordnance Survey Ireland/Govt. of Ireland 2021/OSi_NMA_141

Figure 9. Priority areas for vegetation removal (Source: Page 37 of the Management Plan).

The Management Plan describes the methods by which vegetation can be managed within the wetland which include excavation, root removal, plant cutting, herbicide application and flooding, as follows:

- Excavation is considered to be potentially the most effective method for Bulrush removal, since it lowers the sediment level within the lake along with removal of the Bulrush rootstock. Thus, it is likely to have the most lasting effect. This method temporarily reverses the natural succession from lake to fen, slowing the overall progression from open water to full plant cover across the wetland. It is an expensive method and would require extensive earthworks and potentially the draining of the lake.
- Root removal – direct hand pulling can be effective. As with excavation, and cutting, root removal will remove nutrients from the lake, thus limiting the rate of further regrowth and slowing the natural succession from lake to fen by removing biomass. This method can be costly, and as with excavation, this method can lead to temporary disturbance to sediments with associated sedimentation and mobilization of nutrients in the waterbody.
- Plant cutting – Plant cutting involves the removal of bulrush stems and leaves at a good depth below the water surface; preferably cutting as close to base sediment level as possible. Cutting during the appropriate season drowns the roots and thus limits regrowth. It also removes the vegetation, and the nutrients that they contain, from the lake. This has the long-term effect of lowering the overall nutrient content of the lake, thus reducing regrowth across the wetland. This method has the twin benefits of being relatively low cost compared with dredging or root harvesting and potentially very effective if carried out as part of a regular maintenance programme. Cutting may be done with a mechanical harvester or hand cutting with a short-bladed scythe.
- Herbicide application – not recommended.

- Flooding – flooding by raising the lake water level is considered to be an ineffective method as the Bulrush is well established and flooding would require a flood risk assessment to ensure no impacts upon local pathways and developed areas.

It is proposed to take removed material to Mungret Recycling Centre for composting. Removal of Bulrush during the bird breeding season has been specifically prohibited by the National Parks and Wildlife Service (NPWS). Research for the Management Plan suggests that cutting in late summer/autumn is the best time.

7.3.3 Proposed actions and assessment

Notwithstanding that the Management Plan states that Limerick City and County Council have carried out AA screening for winter cutting of Bulrush and have screened out the need for Stage 2: Appropriate Assessment, this assessment has screened this activity in, and full assessment is undertaken below.

To fully assess Management Plan actions and their resulting impacts, either positive or negative, it is useful to review the history of the wetland site. Appendix 4.3 of the Management Plan provides a useful summary of the history of Westfields Wetlands. This is summarised below:

- Prior to 1800 maps and construction of the flood bund, the wetland was the natural floodplain of the River Shannon and therefore subject to regular inundation by incoming tides.
- After the flood bund was built, the area was used for agriculture. The eastern wetland was supplied by a spring, which was reportedly abandoned in the 1950's.
- Also in the 1950's, a breach in the Shannon flood bund meant that the area was flooded and turned from agricultural land into wetland.
- During the repair works after the flooding, a concrete culvert with a nonreturn valve is reported to have been constructed between the river and the wetland to drain the area. This is understood locally to have created a tidal wetland.
- Close to the completion of the Condell Road, in 1988, a 14" diameter steel pipe with steel flap valve was apparently laid to replace the original concrete pipe, which was capped, but left *in situ*. Concerns were raised by residents at the reduction in throughput of water.
- Concerned by the low water throughput and the potential impact on the wetland and the wildlife there, residents met with the Corporation on a number of occasions to try and have the larger pipe reinstated, but no amendments were made.
- The flap valve is reported to have jammed closed at one stage, leading to flooding of the wetland area (which suggests that the spring may indeed have a significant influence on the water balance of the wetland). As a result of that flood, the flap valve was jammed open rather than closed, leading to free flow of water both in and out of the wetland.

The free flow of water into and out of the wetland from the River Shannon means that the wetland is at least in part, brackish, the eastern wetland also likely to be spring-fed. Water levels can vary by as much as much as 0.4m between high and low tides. Given the wetlands proximity to the Shannon, it is likely that the tide might also exert an effect on ground water levels (Limerick City and County Council, 2020).

Lysaght (1986) also explains how, prior to the construction of the Condell Road, the southern boundary of the wetland was an embankment, but one main channel was present which allowed a constant natural flow of water between the wetland and the tidal river. The flow was regulated by a tidal sluice, but nevertheless, the wetland at this time (1980's) was a coastal marsh with brackish vegetation such as Common Reed (*Phragmites australis*) (Figure 8). What is interesting in Figure 10 is that the area of vegetation in the eastern wetland was expansive at that time. Open water in the eastern wetland, certainly along the western boundary close to the current viewing platform was limited and the area of open water near the viewing platform was nearly totally enclosed by vegetation (as highlighted by red line), not dissimilar to today. However, the dominant vegetation appears (from this earlier drawing) to be Common Reed and not Bulrush. Some clearing of vegetation was undertaken during 2008 which explains how the open water area has been greater in more recent years than in the 1980's.

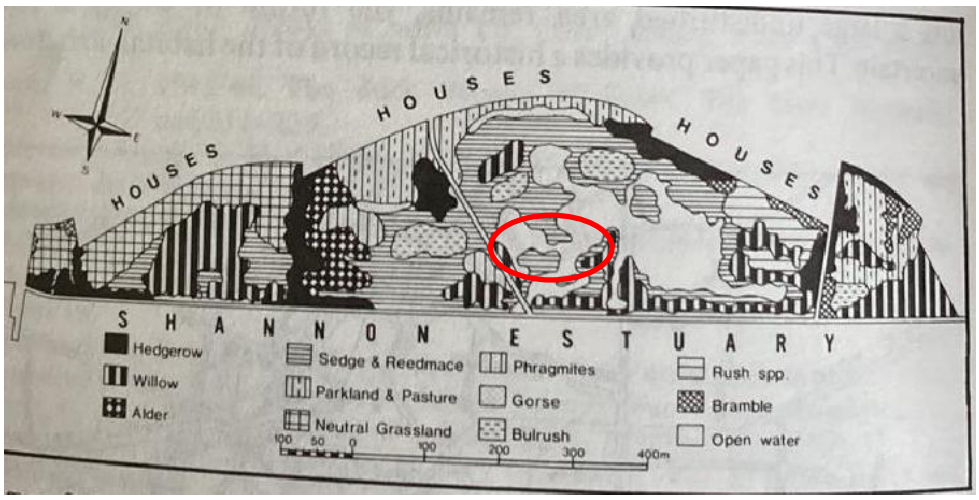

Figure 10. The vegetation at Westfields before construction of the Condell Road. (Source: Lysaght, 1986).

Water depths of the wetland have been assessed previously and in the eastern wetland depths range from 0.15m and 1.5m (Figure 11).

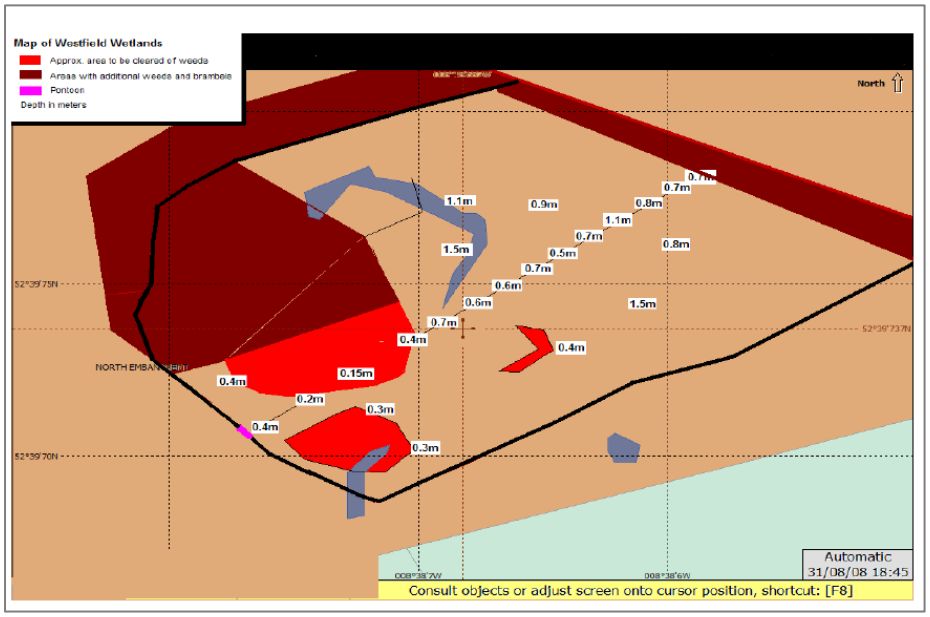

Figure 11. Water depths across the eastern wetland (Source: Limerick City and County Council, 2020).

To assist impact assessment, desk-top research was undertaken on Bulrush and wetland management. Common Bulrush *Typha latifolia*, also known as Reed Mace or Cattail, is abundant across many parts of northern Europe and North America and is well known to conservationists and gardeners alike. The plant is an obligate wetland plant, meaning that it cannot survive in non-wetland habitats. It has wind-dispersed seeds which means it can rapidly colonise wetlands across great distances. and its rapid growth rate, large stature, and aggressive clonal propagation can result in dense monotypic stands (Bansal et al. 2019). The Irish name for Bulrush is *Coigeal na mban sí* translating to 'spindle of the banshee'. While the encroachment of Bulrush and other vegetation at Westfields may be viewed as negative for the biodiversity of the wetland, including waterbirds, it is important to recognise that Bulrush is a native plant and as such, will play an important part in a wetland ecosystem.

Benefits

Typha latifolia provides habitat and food for a wide range of species, playing an important role in wetland ecosystems. The leaves and stems provide shelter for small mammals and birds, while the shoots and seeds provide food for terrestrial birds and waterfowl. The flower heads are home to the Bulrush bug (*Chilacis typhae*), which overwinters within the seed heads and breeds on them between spring and autumn. The plant may also be home to the Ruddy darter dragonfly (*Sympetrum sanguineum*) which can be seen on the wing between June and November. Bulrush is used as breeding habitat as after mating the female lays her eggs below the waterline, where they remain until the mature nymph is ready to crawl up a stem. Additionally, Bulrush plays an important role in preventing soil erosion and acts as a natural filter, removing excess nutrients and pollutants from the water[13]. It has been shown to absorb harmful bacteria and chemical pollutants (Dhir, 2020), and as such is one of a suite of plants that can be used in constructed wetlands to treat wastewater, while it can also remove heavy metals from wastewater (Githuku et al. 2018). Importantly, Bulrush can also be regarded as a form of 'Blue Carbon', carbon captured by the oceans and coastal ecosystems. Bulrush and other wetland plants store carbon in their leaves and roots. Tidal marshes, mangroves, seagrasses and wetland plants such as Bulrush therefore play an important part in 'carbon sequestration'. As such Bulrush has an important additional value - blue carbon is essentially the term used in a climate change mitigation context that refers to 'biologically driven carbon fluxes and storage in marine systems that are amenable to management' so Bulrush is essentially a carbon credit and can be used to offset national/global carbon dioxide (CO_2) emissions.

Downsides

Typha latifolia is a highly adaptable plant species and will establish itself quickly and easily in new habitats. However, it can sometimes dominate and displace other native plant species, the dense stems of Bulrush can alter the structure and function of wetland ecosystems and negatively affect the diversity of plant and animal species. Bulrush can become an invasive monoculture in disturbed aquatic communities. The plant often responds to disturbances by forming dense monocultures, ultimately closing open water, eliminating vital wildlife cover and food, and reducing the opportunity for other plants to grow and survive (Motivans & Apfelbaum, 1987). According to Motivans & Apfelbaum (1987) in their element stewardship abstract for the US Nature Conservancy, "three basic events precede the growth of *Typha* monocultures: 1. modified surface hydrology, 2. wildfire suppression, and 3. wetland enrichment.

[13] https://fensforthefuture.org.uk/creating-the-future/wetland-crop-typha

Impact assessment

Actions:
- Annual Bulrush removal should be carried out for at least the next five years to ensure that root remnants do not regrow successfully and recolonise the area. Thereafter, a new assessment should be carried out to explore the appropriate removal frequency.
- Bulrush removal is part of a natural successional process, so long term management will be required in some form. It is recommended that a number of different removal approaches are used and that the effectiveness of each be carefully recorded to help inform long term management.
- removal of sediments carried out in tandem with Bulrush removal.

Actions for submerged aquatic vegetation:
- Annual removal of submerged waterweeds to be carried out initially, with the possibility to reduce this if the plant cover becomes significantly reduced in subsequent years.
- Removal of submerged aquatic plants to be carried within the same timeframe as Bulrush removal to minimise habitat disturbance.

Assessment:
- Describe any likely changes to a Natura 2000 site as a result of: (a) Reduction of habitat area, (b) disturbance to key species, habitat or species fragmentation, (c) reduction in species density, (d) changes in key indicators of conservation value or climate change.
- Describe any likely impacts on a Natura 2000 site as a whole in terms of: (a) Interference with the key relationships that define the structure of the site, and (b) Interference with key relationships that define the function of the site.
- Describe any additional likely impacts on a Natura 2000 site.

In theory, the proposals to manage vegetation, especially Bulrush, within Westfields Wetlands are underpinned by sound conservation science. In general, the relative proportions of shallow, open water and vegetation are important in influencing a wetland's flora and fauna (Ausden, 2007). However, as described above, Bulrush also has some beneficial effects for wetland biodiversity and the pros and cons of Bulrush removal need to be carefully considered.

Notwithstanding the very best intentions, the proposals to remove Bulrush and annual plants annually cannot at this time, pass the tests of Appropriate Assessment. A project-specific Appropriate Assessment will need to be undertaken, and even then, the proposal to remove Bulrush may not be possible to progress without the risk of serious negative impacts on sensitive ecological features that occur within the wetland site (and SAC) and wider SPA. This is for the following reasons.

- As described in Section 5.3 above, collectively there is a data gap for both wintering and breeding waterbird populations of Westfields Wetlands. Data have been supplied by a local BirdWatch Ireland member up to winter 2019/20 but it is unknown as to the level of survey coverage (e.g. monthly throughout winter vs once-off in a winter). In addition, there is only a single count available since 2019/20 via I-WeBS (January 2021). Without a recent, robust set of data on the abundance and distribution of wintering waterbirds at Westfields, we cannot rule out significant negative effects upon waterbirds listed as SCIs for the River Shannon and River Fergus Estuaries SPA with the necessary confidence. Waterbirds listed for the SPA utilise the wetland and therefore *ex situ* impacts must be assessed, especially as the timing of the works has been estimated to be late summer – autumn, the latter when wintering waterbirds are present[14]. Assessment must be based on up-to-date, robust and quantitative count data.

[14] The wintering waterbird season is from September to March inclusive.

For some waterbird species, good proportions of the numbers using the entire Shannon and Fergus systems were once recorded at Westfields. For instance, over a decade ago, the five-year mean peak number of Shoveler was equivalent to 21% of the baseline number recorded for the entire River Shannon and River Fergus Estuaries SPA. Based on the dataset available and local evidence, it appears that waterbirds have declined in number at Westfields Wetlands. However, despite these declines, the wetlands may still support important concentrations of waterbird SCI species at times. Limerick City and County Council (2020) state how after Storm Ophelia in October 2017, large numbers of Tufted Duck used the wetland as a resting place/retreat. While Tufted Duck are not a SCI species for the SPA, this example does show how the wetland could be used by large numbers of waterbirds at times. At certain times, the wetland may serve as a refuge, for example after storms, when there are disturbance events occurring in other areas of the estuary, or at periods of particularly high spring tides. As above, assessment must be based on up-to-date, robust and quantitative count data.

- A further consideration is the potential for disturbance to the bottom sediments through either the Bulrush removal work, or the proposed excavation of sediments. This has the potential for sediment to mobilise in the water column and to enter the River Shannon (and SAC/SPA) leading to potential indirect impacts upon qualifying interest habitats and species of the Lower River Shannon SAC, and waterbird special conservation interests of the River Shannon & River Fergus SPA. While sedimentation in itself is not necessarily a bad thing, especially in an estuarine system which is inherently an ecosystem characterised by sediment deposition, the fact that the sediments may contain various pollutants is of concern. These sediments may contain contaminants including heavy metals, hydrocarbons and sewage inputs. Potential contaminants were identified from the central wetland area in the vicinity of Condwell Road (water sampling location 1). For a more detailed assessment of the remobilisation of sediments, please refer to section 7.1.3b of this report.

  A Waste Acceptance Criteria (WAC) test should be carried out in sub-basins of the wetland where sediment and Bulrush removal is proposed to establish the presence of contaminants (e.g. metals As, Cd, Cr, Cu, Hg, Ni, Pb, Zn); total BTEX (benzene, toluene, ethylbenzene, xylenes), mineral oil, polycyclic aromatic hydrocarbons (PAHs) and Polychlorinated Biphenyls (PCBs). Sediment nutrient tests could also be undertaken. This would help infer the potential mobilisation of contaminants and transfer of the same to the River Shannon SAC via the tidal channel connection from the main wetland (i.e. central and eastern sections). Given the tidal sluice valve is damaged and is permanently open, a mechanism to regulate control of the valve during Bulrush removal would help settle out remobilised pollutants in sediment to prevent uncontrolled release.

  According to the trophic status carried out on Irish transitional waters for the reporting period 2018-2020 by the EPA, the Limerick Dock area (IE_SH_060_0900) in which the Westfields Wetlands area discharges, has unpolluted water quality. However, currently the Limerick Dock, while being a heavily modified waterbody under review, is at risk of not achieving good status under the Water Framework Directive objectives by 2027. Further, risk to a deterioration in water quality as a result of sediment mobilisation with associated nutrient and or other pollutant mobilisation could result in further risk to the attainment of WFD targets.

- In advance of any proposal for the removal of vegetation, a dedicated macrophyte survey would be required of each of the basins at the Westfields Wetland study area. Given that the stronghold of opposite leaved pondweed (*Groenlandia densa*) is in the Lower River Shannon, and in light of a known location of the plant in the eastern portion of the southern wetlands (map 13; Lower River Shannon SAC conservation objectives, floating river vegetation) (NPWS, 2012a) (Figure 12), it would be essential to establish the full distribution of this plant within the wetland. Furthermore, as this macrophyte species and triangular clubrush (*Schoenoplectus triqueter*) are considered components of a transitional form of the Annex I Habitat, '3260 Watercourses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation' the distribution of both species needs to be fully documented. Incidentally, the southern tidal embankment of the Westfields study area is shown to support triangular clubrush (map 13; Lower River Shannon SAC conservation objectives, floating river vegetation) (NPWS, 2012a).

  While not a qualifying interest, the macrophyte survey would also establish the presence of the Annex I Habitat, 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels (6430)' that is associated with tall herb swamps known to be present at the site. The survey would need to be undertaken by a small rib to ensure its extent can be mapped. Ideally it should be accompanied by a drone survey of the entire wetland area to facilitate accurate habitat mapping of this fringe habitat in addition to floating river vegetation described above. The extent of the habitat could then be superimposed on the recent ortho-photography layer captured which could then be used as a base for coordinated and planned Bulrush and macrophyte removal. The ortho-photography layer would be very important as a template for management given the complexity of the mosaics of open and enclosed water with varying degrees of vegetation encroachment. This would help map vegetation management parcels in each wetland block to avoid impacts to rare and or protected macrophytes mapped within respective wetland parcels.

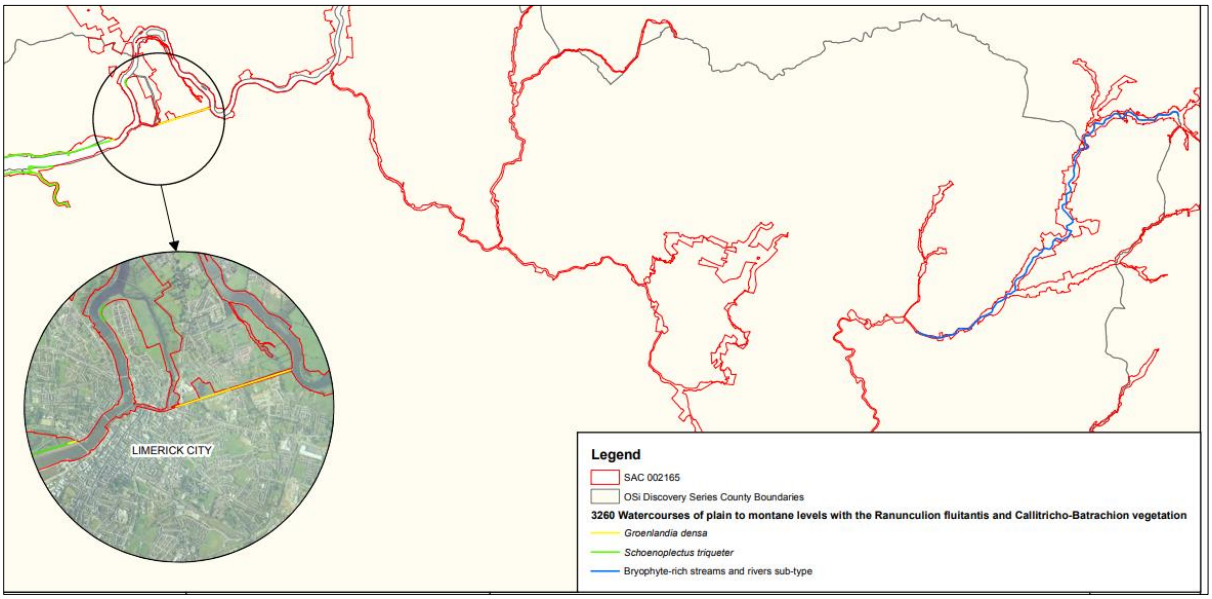

Figure 12. Location of Annex I habitats - Westfields Wetlands site is shown on western extent of inset ortho image. (Source: NPWS, 2012a).

- Dedicated surveys for rare, submerged stoneworts including *Chara connivens* and *Chara canescens* should be undertaken as part of the macrophyte surveys in advance of macrophyte

vegetation removal. These red-listed stoneworts are known to occur in the River Shannon SAC in coastal lacustrine sites and there may be suitability to support these species within the Westfields Wetland site.

- Further consideration needs to be given to the subject of removing a plant, and indeed sediment that stores carbon, particularly in an age when carbon sequestration and storage is important to mitigate the effects of climate change.

- Further consideration needs to be given to the potential for flooding. CFRAM mapping shows that Westfields Wetlands lies in an area subject to low and medium probability for coastal flooding. Medium Probability flood events have approximately a 1-in-a-200 chance of occurring or being exceeded in any given year. This is also referred to as an Annual Exceedance Probability (AEP) of 0.5%.

  Despite Limerick City and County Council and the OPW progressing works on Limerick City and Environs Flood Relief Scheme, efforts to manage habitats and vegetation at Westfields Wetlands may benefit from waiting for the results of the baseline studies carried out for the flood relief scheme. For instance, will the water flow regime remain as current after the scheme is in place, or will a different water flow regime be recommended?

  Climate change predictions and future flood maps (e.g.coastalclimatecentral.org) show areas of the coastline that will be flooded by 2050. In the future it may become prohibitively expensive to 'hold the line' with sea defences in all areas. Given the location of Westfields Wetlands and the fact that it was once a tidal wetland, with a greater tidal influence than perhaps today, it may be wise in the future to restore this wetland as a tidal marsh. Of note, is that restoration of Westfields Wetlands into a tidal marsh with a higher level of salinity (marine water) may also lead to a reduction in Bulrush, as Bulrush does not grow well in saline conditions (Bansal et al. 2019). Indeed, as explained above, the encroachment of Bulrush was most likely caused by nutrient enrichment in combination with the changes in salinity levels/water flow as a result of the construction of the Condell Road. This topic is discussed further below.

Impact assessment conclusions

The removal of Bulrush, macrophytes and associated sediment may impact on the quality of the water and give rise to **significant negative impacts** on the qualifying interests and conservation objectives of the River Shannon and River Fergus Estuaries SPA and the Lower River Shannon SAC. This is considered given the linkage between the wetlands and the SAC via the outfall from the main wetland area which could act as a conduit for pollution following the source-pathway-receptor model. Furthermore, the removal of macrophytes including Bulrush will need to consider the full distribution of *Schoenoplectus triqueter* and *Groenlandia densa* within or bordering the site before an assessment of impacts to the associated qualifying interest habitat, '3260 Watercourses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation', can be determined. In the absence of robust data there may be **significant negative impacts** to this habitat as a result of the proposed Bulrush and macrophyte removal. Additionally, without dedicated winter and breeding bird surveys the current data on the site is insufficient to make a conclusive impact assessment on the effect on bird species of special conservation interest for the River Shannon and River Fergus Estuaries

SPA. In the absence of this data and following the precautionary principle, **significant negative impacts** may arise. Furthermore, the removal of Bulrush and macrophytes could result in disturbance to qualifying interest species Otter listed for the Lower River Shannon SAC. This could theoretically also constitute a **significant negative impact**. Project-specific AA will need to be undertaken following collection of detailed baseline data. For more recommendations, please see below.

Additional recommendations

Future proposals to remove Bulrush should be informed by a thorough baseline ecological survey and assessment of the wetland site. This baseline assessment should include flora, breeding and wintering birds, mammals, and both terrestrial and aquatic invertebrates. Only with such detailed knowledge can the negative and positive impacts of removing the Bulrush be assessed. For instance, while removing some Bulrush and creating more open water may benefit some flora/fauna, it may also negatively impact other rare or sensitive flora and fauna.

Wetland management would benefit from a hydrological study to assess water flows and sources of marine and fresh waters, and to assist in determining the best wetland management strategies.

Westfields Wetlands was once a tidal wetland, with a greater tidal influence than today, and at that time, the Bulrush was not a dominant plant. Therefore, restoration of Westfields Wetlands into a tidal marsh with a higher level of salinity (marine water) could lead to a reduction in Bulrush, as Bulrush does not grow well in saline conditions (Bansal et al. 2019). Various reference sources state that Bulrush cannot grow well in high salinity waters and that the plant will die back if salinity levels rise. Germination will also be affected and mature plants can be killed (e.g. Baldwin & Cannon, 2007). Sojda & Solberg (1993) reported that flooding a marsh during most of the growing season with water of 10 ppt salinity kills Bulrush, while it also prevents germination (Choudhuri, 1968), retards growth and can even kill mature plants. Of further note, is that experimental work in Canada has found that Bulrush can adapt to local conditions, with *Typha latifolia* being capable of adapting to saline conditions (Tisshaw *et al. 2020*). This topic, and whether Typha has adapted to salinity at Westfields Wetland therefore warrants further investigation. If no such local adaptation has occurred, then increasing salinity may be an effective management measure, a cost-effective way to reduce the cover of the plant and gain more open water, and a measure which restores the wetland to its previous state as a tidal marsh/wetland. This will also give the wetland greater resilience in the future with regard climate change and sea level rise.

7.4 Actions in relation to Biodiversity and invasive species

7.4.1 Overview

Chapter 6 of the Management Plan describes the habitats and species present at Westfields Wetland. A desk-based study as well as field surveys were carried out by JBA Consulting during July 2020 to inform the Management Plan process. Long-term wintering bird data were supplied by the local branch of Birdwatch Ireland. Bat data were supplied from a survey carried out by JBA near the wetlands.

7.4.2 Issues in relation to habitats, flora and fauna

The Management Plan outlines constraints surrounding the baseline data for the wetland, these are:

- The site visit was carried out in July 2020 and the data do not reflect the whole ecology of the site throughout the year.
- The timescale of the management plan project (six months) meant there was no scope for carrying out wintering bird surveys, however long-term data from Birdwatch Ireland volunteers were supplied for this management plan.
- A request for wintering bird data through I-WeBS for the Westfields Wetland could not be fulfilled, as I-WeBS records were unavailable at the time of request.
- The scope of the survey did not extend to an assessment of aquatic macroinvertebrates or fish.

7.4.3 Proposed actions and assessment

Actions for wildlife/biodiversity are outlined in Appendix 10 of the Management Plan.

Actions (for full text see Appendix 10 of the Management Plan):
- A - protect what you have.
- B – reduce mowing frequency.
- C – Pollinator friendly planting.
- D – Provide/protect nesting habitats.
- E – Reduce use of pesticides.
- F – Raise awareness.

Actions for birds:
- install bird boxes.
- establish/maintain winter bird feeding station.
- Monitor Mink population.
- Clear Bulrush from central wetlands (refer to Section 6.3 for an assessment of this action).
- Signage and education.

Actions for bats:
- install bat boxes.
- organise bat walks.
- Increase native tree, shrub and flower planting.
- Consider impacts of lighting.

Actions for mammals:
- Remove litter.
- Signage and education.
- Monitor populations.
- Hedgehog houses/habitat.

Actions for Invertebrates:

- Follow All-Ireland Pollinator plan.
- Study invertebrate populations.

Actions for *Groenlandia densa*
Groenlandia densa is listed as 'Near Threatened' on the Irish Vascular Plant Red List (Wyse Jackson, *et al.* 2016); and is identified as one of the three high conservation elements (subtypes) of the Feature of Interest (Qualifying interest) of the Annex I habitat 'Water courses of plain to montane levels with the *Ranunculion fuitanis* and *Callitricho-Batrachion* vegetaton [3260]' within the Lower River Shannon Special Area of Conservation (SAC) (NPWS 2012a).
Action:
- Carry out a feasibility study for the introduction of this plant.

Actions for non-native invasive species.
- Produce and implement an Invasive Species Management Plan for Westfields Wetland.

Assessment:
- Describe any likely changes to a Natura 2000 site as a result of: (a) Reduction of habitat area, (b) disturbance to key species, habitat or species fragmentation, (c) reduction in species density, (d) changes in key indicators of conservation value or climate change.
- Describe any likely impacts on a Natura 2000 site as a whole in terms of: (a) Interference with the key relationships that define the structure of the site, and (b) Interference with key relationships that define the function of the site.
- Describe any additional likely impacts on a Natura 2000 site.

The proposed actions for wildlife/biodiversity are likely to all be positive in their effect on the environment. These site-based actions will be positive at a site and local level and are likely to have knock-on positive effects on the wider environment including the relevant Natura 2000 sites. The overall impact is considered to be positive, with imperceptible to slight positive impacts upon the qualifying interests and conservation objectives of the River Shannon and River Fergus Estuaries SPA and the Lower River Shannon SAC.

Impact assessment conclusions

The proposed actions for wildlife/biodiversity are considered likely to have no significant negative impacts on the qualifying interests and conservation objectives of the River Shannon and River Fergus Estuaries SPA and the Lower River Shannon SAC.

Additional recommendations

Data gaps – site baseline ecological data

A site walkover ecological survey undertaken for the Management Plan during July 2020 is considered insufficient to obtain an accurate and complete baseline knowledge of the flora and fauna of the wetland site. Different faunal groups require surveys at different times of the year and with differing methodologies, so while a one-day survey in July 2020 could record species present at that point in time, as stated in the constraints of the Management Plan, the survey data collected 'do not reflect the whole ecology of the site throughout the year'.

Many of the actions proposed in the Management Plan require site-based ecological impact assessment (EcIA) in order to prevent negative impacts upon sensitive ecological features that potentially occur within the wetland site. In order for a full EcIA to be carried out, baseline data on the habitats, flora and fauna will be required. These data should be collected using accepted standard survey methodology and undertaken at the correct time of year.

Baseline surveys should be undertaken to inform on the status of all potential flora and fauna at the wetland site to include terrestrial and aquatic species including invertebrates.

As part of this current assessment, a request for I-WeBS data yielded some recent data for Westfields Wetlands. However, it is important to note that count coverage of Westfields Wetlands has been relatively poor, with irregular, single counts in some recent winters. The true current numbers and status of wintering waterbirds using Westfields Wetlands is therefore not known. Similarly, no recent breeding bird survey of Westfields has been undertaken using standard methodology. We would therefore consider that baseline knowledge on the breeding and wintering bird species of Westfields Wetlands is insufficient.

Note, surveys of birds (waterbirds and terrestrial) should be undertaken during both the breeding season and the wintering season, the latter to inform on the species that utilise Westfields Wetlands that may also be waterbird SCIs for the River Shannon and River Fergus Estuaries SPA.

7.5 Signage and education

7.5.1 Overview

Signage and education are covered in Section 7 of the Management Plan, with actions summarised in Appendix 10.1.5.

Signage in Westfields provides good information on the wildlife of the area, but there has been some vandalism and natural deterioration. Improved maintenance and repair is proposed to address this. It is also proposed that additional information is included to broaden the appreciation of the wildlife present.

7.5.2 Proposed actions and assessment

Actions:

- Signage Infrastructure:

- Erect a sign at the platform and along the Condell Road path to highlight that feeding ducks and swans is welcome, but that the volumes must be modest, and a varied diet is important.
- Other additional signage as outlined in section 7.1, keeping the size and placement sensitive to the natural feel of the area and not excessively intrusive or prominent.
- Overhaul the Westfields Website on limerick.ie to include educational resources and information about the wildlife and history of Westfields. Add QR codes to new and/or existing signage, linking to corresponding information on the website.

Sign maintenance:
- Clean signage and/or repair or replace as needed to keep the information readily accessible to visitors.

Examine the feasibility of employing a Biodiversity Officer by LCCC with responsibilities which include the following:
- Co-ordinating regular walks, talks and other events, taking cognisance of the wildlife priorities and values inherent in this management plan.
- Engagement with local schools in hosting and organising events and personnel for tours and activities.
- Liaison with local art schools or groups to explore the option for sculpture or art installations or trails.
- Coordination of citizen science initiatives and liaise with local art schools or groups to have permanent or temporary sculpture or art trails on the walkways here.
- Engagement in sensitive communication with members of the public about feeding water birds.

Alternatively, or additionally, these educational roles may potentially be coordinated by existing LCCC staff, local biodiversity expertise or the local community.

Education infrastructure:
- Provide access for pond dipping; either as a wooden platform, short boardwalk or gravelled area to wade into.

Awareness raising:
- A campaign to raise awareness of the wildlife and amenity value of Westfields Wetlands should be organised to help promote the wetland and secure its future as a protected space for wildlife. A programme of guided walks and talks, and the development of promotional material (such as information leaflets and boards) should be initiated to help raise awareness of the value of the site among the local community and the wider city population, including visitors. Suitable themes may include the following: Bat walks, Pollinator Plan, Bird watching, Aquatic plants, Life below water, Invasive species, Importance of wetlands to wider area (SAC/SPA – biodiversity in urban environment).

Awareness campaign to reduce pesticide use:
- A campaign to raise awareness of the damage caused by pesticides to wildlife and to human health, as well as the unnecessary and unsightly use of these chemicals. If weeds need to be removed, alternatives should be sought, and pesticides should only be used a last resort, or as a tool to kill non-native invasive species. Additionally, a campaign could also be set up to change people's perceptions of urban plants growing on walls, pavement or tree pits. Similar awareness campaigns have been successfully implemented in many countries, for example a campaign devised in the UK called 'morethanweeds' (https://morethanweeds.co.uk/).

Assessment:
- Describe any likely changes to a Natura 2000 site as a result of: (a) Reduction of habitat area, (b) disturbance to key species, habitat or species fragmentation, (c) reduction in species density, (d) changes in key indicators of conservation value or climate change.
- Describe any likely impacts on a Natura 2000 site as a whole in terms of: (a) Interference with the key relationships that define the structure of the site, and (b) Interference with key relationships that define the function of the site.
- Describe any additional likely impacts on a Natura 2000 site

The proposed actions for signage and education are likely to all be positive in their effect on the environment. These site-based actions will be positive at a site and local level and are likely to have knock-on positive effects on the wider environment including the relevant Natura 2000 sites. The overall impact is considered to be positive, with imperceptible to slight/moderate positive impacts upon the qualifying interests and conservation objectives of the River Shannon and River Fergus Estuaries SPA and the Lower River Shannon SAC.

Impact assessment conclusions

The proposed actions for signage and education are considered likely to have no significant negative impacts on the qualifying interests and conservation objectives of the River Shannon and River Fergus Estuaries SPA and the Lower River Shannon SAC.

Additional recommendations

None.

7.6 Social aspects

7.6.1 Overview

Social aspects are covered in Section 8 of the Management Plan, with actions summarised in Appendix 10.1.6. Overall challenging social behaviour needs to be recognised and addressed sensitively.

7.6.2 Proposed actions and assessment

Actions:
- In order to protect and enhance the area for bats, no new lighting is to be introduced.
- Existing lighting to be assessed and capped if needed to limit night-time light pollution.

Assessment:
- Describe any likely changes to a Natura 2000 site as a result of: (a) Reduction of habitat area, (b) disturbance to key species, habitat or species fragmentation, (c) reduction in species density, (d) changes in key indicators of conservation value or climate change.
- Describe any likely impacts on a Natura 2000 site as a whole in terms of: (a) Interference with the key relationships that define the structure of the site, and (b) Interference with key relationships that define the function of the site.
- Describe any additional likely impacts on a Natura 2000 site

The proposed actions for social aspects are likely to be positive in their effect on the environment for bat species. These site-based actions will be positive at a site and local level and are likely to have knock-on positive effects on the wider environment including the relevant Natura 2000 sites. The overall impact is considered to be positive, with imperceptible to slight positive impacts upon the qualifying interests and conservation objectives of the River Shannon and River Fergus Estuaries SPA and the Lower River Shannon SAC.

Impact assessment conclusions

The proposed actions for social aspects are considered likely to have no significant negative impacts on the qualifying interests and conservation objectives of the River Shannon and River Fergus Estuaries SPA and the Lower River Shannon SAC.

Additional recommendations

None.

7.7 Infrastructure

7.7.1 Overview

Chapter 9 of the Management Plan covers infrastructural measures proposed as part of this management plan. The main infrastructure elements considered are grouped into the following categories (i) Access to water and views of the lake and River Shannon, (ii) Pathways, access and interconnectivity with wider walking routes, (iii) Provision of seating, (iv) Litter control and provision of bins, and (v) Other infrastructural measures.

7.7.2 Proposed actions and assessment

Actions:

Access to water and views

- Create views of open water in Eastern Wetland from the Condell Road Path. This will be achieved by removing bulrush cover along certain sections of the pathway. It is important that this measure be followed up with regular annual clearing in selected areas to keep the views and access to the water edge open into the future. Note Bulrush removal in covered in Section 7.3 of this assessment/report.
- Create a raised platform along this path. The most suitable location is at the opposite end of the lake from the existing platform, close to the eastern end of the path. It is proposed that this be simply a raised mound within the pathway, constructed as part of the improvement works to the path itself.
- Create openings through the trees at view height along the River Shannon to allow occasional views of open water. This can be done as a short-term measure without waiting for further works on the wider flood bund. Any works would need to be done in collaboration with NPWS.
- Extend platforms out into River Shannon. The current LCCC Flood Relief Scheme process is progressing and will set out changes to the existing flood bund between the Shannon and the rest of the city. As part of this process Cleeve's Bank, the flood bund bordering Westfields, will undergo improvements for flood protection. As part of that process, it is recommended that extended platforms or piers be considered for construction to enhance the view from this part of the Westfields area out over the River Shannon.

Maintenance

- Keep Bulrush clear in selected areas, in line with methods and timing outlined in Chapter 5 of the Management Plan. Note Bulrush removal in covered in Section 7.3 of this assessment/report.
- Keep selected views of open water clear of overhanging branches or growth of scrub or shrubs.

Pathways, access and interconnectivity

- Expand the walking routes at Westfields with a walkway to connect the platform with Ted Russell Park along one of the routes suggested in Section 9.2.1 of the Management Plan.

- Include perimeter walkways within the meadow habitat of the green area north of the Central Wetland.
- Keep new and existing pathways well maintained to ensure that they can continue to be used safely and comfortably by walkers, cyclists, push chairs and buggies etc. Factors include encroachment of perimeter grass growth; encroachment of branches from shrubs and trees; and maintenance of path surfaces as needed.
- Renew perimeter pathways through meadow areas each year and keep these cut as part of the lawn mowing regime. The locations should be kept by contactors to ensure that the pathways are selected with care each year.

Improved access between wetland areas
- Explore options for improved access between the River Shannon flood bund and the main wetland walkways. This should be carried out in conjunction with LCCC Roads Department taking account of best practice examples from cites with good, long-established cyclist and pedestrian routes, and taking into account stakeholder feedback.

Pathways
- As part of the Flood Relief Scheme flood bund upgrade works consider including tarmac pathways to allow for roller blading and/or children's scooters etc.
- Gravel surfaces have the advantage of being lower cost, lower overall environmental footprint, and providing infiltration rather than runoff, so these are recommended for use in selected areas where appropriate.
- All existing pathways to be mown regularly at the sides and augmented with woodchips or gravel where necessary to provide a safe and dry surface to walk on.
- Carry out a consultation process with residents and other stakeholders to explore the introduction of looped walks to complement existing pathways at Westfields.

Cycleways
- Assess the cycle lane infrastructure on the Condell Road and ensure that it is safe and effective for users. Make amendments if needed.
- Include of-road cycle path infrastructure into the new flood bund works.
- Keep the current pathways maintained so that cyclists can use them with ease and comfort and so that it is easy for a walker and a cyclist to pass safely with ease.

Safety Fencing
- Explore further the merits of erecting safety fencing at the inlet/outlet water points of the Central and Eastern Wetlands.
- Annual assessment of fencing and repair, cleaning or replacement as needed.

Integration of Westfields with wider walking routes
- Produce a map to complement the existing Walkable Neighbourhood map to show a larger area, linking to the main wetland areas around the extremities of the city as per Management Plan Section 9.2.5. The map could be made available on the LCCC website or printed for distribution via tourist office, schools, sports clubs etc. Any work on such a route should also take due consideration of the wider city population and relevant stakeholders prior to creation and publication.
- Preparation of a detailed Wild Waterways Network map, based on Figure 9.3 of the Management Plan. It is recommended that this map stick to off-road routes insofar as possible, and/or routes that run parallel to canals, streams and rivers in and around the city. It is also envisaged that this would also show navigable rivers and streams for use by kayakers and other boat users.

Seating
- Install two (2 no.) temporary benches at suitable locations on the Shannon flood bund, for removal once Flood Relief Scheme works commence.
- Install two (2 no.) log benches or other benches along the path to the south of the lake, set back from the path, but with views over open water.
- Ensure that no new seating is installed in proximity to Westfields Park houses or the green area nearby.
- Carry out repair and/or cleaning of seating as needed.

Litter control and provision of bins LCCC/Tidy Towns
- Assess the merits of Installing litter bins at the main pedestrian junctions at the site.
- Conduct regular checking of bins and emptying as needed.
- Conduct regular litter clean-ups of all park space, pathways and lawns; and within the water of the wetland areas and the banks of the River Shannon.

Remove metal box
- Assess the ownership and usage status of the metal box on the path between Condell Road and the lake, removing the box if possible, or moving it off the path if it is still in use.
- Follow careful adherence to a minimum intervention management approach at Westfields generally.
- Carry out annual cleaning, repair and/or replacement of park infrastructure such as pathways, signage, platform structure.
- Carry out annual mulching, pruning and general care of the orchard area at Westfields Park.

Assessment:
- Describe any likely changes to a Natura 2000 site as a result of: (a) Reduction of habitat area, (b) disturbance to key species, habitat or species fragmentation, (c) reduction in species density, (d) changes in key indicators of conservation value or climate change.
- Describe any likely impacts on a Natura 2000 site as a whole in terms of: (a) Interference with the key relationships that define the structure of the site, and (b) Interference with key relationships that define the function of the site.
- Describe any additional likely impacts on a Natura 2000 site.

The suite of actions proposed under the heading 'infrastructure' can be separated into those that have the potential for impacts upon the relevant Natura 2000 sites, and for which more assessment is required, and those that are likely to have no impact and that can proceed unhampered. Firstly, those actions that are considered benign, and in terms of impact assessment will have no observable impact (imperceptible impact) upon either local ecology or the relevant Natura 2000 sites are considered to be the following:

- Pathways maintenance (mowing, keeping paths clear),
- Explore options for better connectivity between wetlands (study and assessment),
- Cycleways (maintain current infrastructure, assess future options),
- Safety fencing (explore merits of erecting safety fencing, maintain fencing),
- Research and studies to investigate the integration of Westfields with other walking routes,
- Installation and maintenance of seating,
- Litter control,
- General maintenance of pathways, annual cleaning of seats, signs etc.

Actions in relation to 'creating access and views to water' as well as maintenance of same, all require further assessment in the form of project-specific AA screening/Natura Impact Assessment. This is because there is a potential for significant impacts upon the conservation objectives of the relevant

Natura 2000 sites. Project timing will need to be considered carefully i.e. bird breeding season *vs* winter waterbird season, and in some cases mitigation will be required. For a more detailed assessment of the proposal to remove Bulrush please refer to Section 7.3 of this document. Similarly, actions around extending pathways, or works to pathways will all require project-specific AA screening/Natura Impact Assessment once the detailed proposals are known.

Impact assessment conclusions

The suite of actions proposed under the heading 'infrastructure' can be separated into those that have the potential for impacts upon the relevant Natura 2000 sites, and for which more assessment is required, and those that are likely to have no impact and that can proceed unhampered. The results of this Management Plan AA are summarised in Table 16. Section 8.

Additional recommendations

Actions in relation to 'creating access and views to water' as well as maintenance of same, that require further assessment in the form of project-specific AA screening/Natura Impact Assessment, will also require site-level EcIA to ensure no significant impacts upon the site-based ecological features of importance.

8. Potential for cumulative (in-combination) effects

Article 6(3) of the Habitats Directive requires an assessment of a plan or project to consider other plans or programmes that might, in combination with the plan or project, have the potential to adversely affect European Sites. Below we outline a selection of plans or projects that may interact with the Westfields Management Plan to give rise to in-combination effects to European Sites. These were considered during the assessment.

Pressures upon water quality

Water quality – Shannon Estuary
According to the trophic status monitoring carried out on Irish transitional waters for the reporting period 2018-2020 by the EPA, the Limerick Dock area (IE_SH_060_0900) in which the Westfields Wetlands area discharges, has unpolluted water quality. However, currently the Limerick Dock, while being a heavily modified waterbody under review, is at risk of not achieving good status under the Water Framework Directive objectives by 2027.

Water quality and Limerick wastewater treatment
There is on-going work to upgrade wastewater treatment plants (WWTPs) around Limerick City and County, many in close proximity to the River Shannon & River Fergus Estuaries SPA, and Lower River Shannon SAC. The upgrading of wastewater treatment plant infrastructure is crucial to preventing the potential for cumulative impacts as a result of inadequate wastewater treatment and serious negative impacts upon the water quality of the Shannon system and Natura 2000 sites.

Other plans

- Limerick Development Plan 2022-2028 (adopted June 2022) and related environmental reports – subject to SEA/AA and not anticipated to give rise to significant in-combination effects.

- The Limerick Regeneration Framework Implementation Plan - The master plans are built on three key pillars: Social regeneration, Physical regeneration and Economic regeneration. All elements of the regeneration plans have been subjected to SEA/AA, as they were developed. Not anticipated to give rise to significant in-combination effects.

- Shannon Integrated Framework Plan (SIFP) - The key objective of the SIFP is to research and develop an integrated approach to facilitating economic growth and promoting environmental management within and adjacent to the Shannon Estuary. Not anticipated to give rise to significant in-combination effects.

- Limerick Economic and Spatial Plan 2030 - Not anticipated to give rise to significant in-combination effects.

- Limerick City & Environs Flood Relief Scheme – Due consideration needs to be given to the potential for flooding. CFRAM mapping shows that Westfields Wetlands lies in an area subject to low and medium probability for coastal flooding. Medium Probability flood events have approximately a 1-in-a-200 chance of occurring or being exceeded in any given year. This is also referred to as an Annual Exceedance Probability (AEP) of 0.5%. Efforts to manage habitats and vegetation at Westfields Wetlands may benefit from waiting for the results of the baseline studies carried out for this flood relief scheme.

9. Assessment conclusions

A summary of the outcome of the scientific assessment of each proposed Management Plan action, grouped under main theme and sub-theme, is provided in Table 16 overleaf. A great many actions are considered to be positive, with likely beneficial impacts for both the wetland ecology and the Natura 2000 sites. However, a range of actions have failed the Appropriate Assessment tests and will need to be considered further in the form of (i) detailed baseline studies to inform overall wetland management decisions and key objectives for the future, (ii) detailed baseline studies to inform design decisions and work methods, (iii) hydrological studies, (iv) project-specific Appropriate Assessment, and (v) bespoke mitigation where required. The Westfields Management Plan therefore, in its current format and if implemented in full, has the potential to give rise to significant negative impacts upon European sites.

Of note is that this assessment discovered that *Groenlandia densa* and *Schoenoplectus triqueter* are known to occur along the southern coastal boundary with the Westfields Wetlands site; their distribution mapped with the NPWS SAC Conservation Objectives document (NPWS, 2012a). Both aforementioned species form components of the Annex I Habitat, '3260 Watercourses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation'. In the absence of a dedicated macrophyte survey, this habitat could be directly impacted should examples occur within the wetland basins. Indirect impacts could also occur as a result of some of the proposed actions. Given that the conservation objectives were prepared over a decade ago, the current status of the Annex I habitat is unknown, but establishing this status should now be a priority.

Our assessment aimed to give a balanced and objective view of the presence of Bulrush within the wetland. Investigations revealed that Bulrush encroachment over time is likely the result of a change in habitat and salinity levels within the wetland following the construction of the Condell Road in the 1980's. The southern boundary of the wetland was once an embankment, but a main channel was present which allowed a constant natural flow of water between the wetland and the tidal river. The flow was regulated by a tidal sluice, but nevertheless, the wetland at this time (1980's) was a coastal marsh with brackish vegetation such as Common Reed. Therefore, it may be worth considering/investigating if restoration of Westfields Wetlands into a tidal marsh with a higher level of salinity could lead to a natural reduction in Bulrush. Various reference sources state that Bulrush cannot grow well in high salinity waters and that the plant will die back if salinity levels rise. Increasing salinity may be an effective management measure, a cost-effective way to reduce the cover of the plant and gain more open water, and a measure which restores the wetland to its previous state as a tidal marsh/wetland. This would also give the wetland greater resilience in the future with regard climate change and sea level rise. However, such a management strategy would need to be informed by baseline ecological and hydrological studies as outlined above.

Table 16. Summary of proposed actions and outcome of Appropriate Assessment.

Man Plan Appendix Number	AA Document Section Number	Main Theme	Sub Theme	Proposed Action	AA Outcome	Project-specific AA required	EcIA required
10.1.1	7.1.3a	Water quality	Feeding of birds	Install signage to limit bird feeding	Pass	n/a	n/a
10.1.1	7.1.3b	Water quality	Remobilisation of sediments, nutrients etc.	Analyse sediments for stored nutrients and sediment oxygen demand	Fail	Yes	Yes
10.1.1	7.1.3b	Water quality	Remobilisation of sediments, nutrients etc.	Remove sediments on a successional basis	Fail	Yes	Yes
10.1.1 10.1.3	7.3.3	Water quality Bulrush clearing and open water	Vegetation management	Harvest Bulrush on an annual basis	Fail	Yes	Yes
10.1.1 10.1.3	7.3.3	Water quality Bulrush clearing and open water	Vegetation management	Removal of sediments in tandem with Bulrush removal.	Fail	Yes	Yes
10.1.1	7.1.3c	Water quality	Stormwater inputs	Conduct analysis of stormwater inputs after a rainfall event.	Pass	n/a	n/a
10.1.1	7.1.3c	Water quality	Stormwater inputs	Select the SUDS type (or combination) that best fits each stormwater input.	Fail	Yes	Yes
10.1.1	7.1.3c	Water quality	Stormwater inputs	Design accordingly (in coordination with other site works).	Fail	Yes	Yes
10.1.1	7.1.3c	Water quality	Stormwater inputs	Implement as and when appropriate in the context of other site works.	Fail	Yes	Yes
10.1.2	7.1.3d 7.2.3	Water quality / Water levels and flow	Water inflow from River Shannon	Assess the feasibility of raising the level of the outlet from locations 2 and 3 (the Central and Eastern Wetlands), to limit ingress from the Shannon on high tides.	Pass	n/a	n/a
10.1.2	7.1.3d 7.2.3	Water quality / Water levels and flow	Water inflow from River Shannon	Hydrological study to locate FW spring and assess water volume it provides. Physical and chemical analysis to assess the water quality of the spring.	Pass	n/a	n/a
10.1.2	7.2.3	Water quality / Water levels and flow	Water inflow from River Shannon	Flood risk assessment before any weir works.	Pass	n/a	n/a
10.1.1	7.1.3e	Water quality	Sewage/grey water assessments	Explore potential for greywater pipework in western wetland.	Fail	Yes	Yes

Man Plan Appendix Number	AA Document Section Number	Main Theme	Sub Theme	Proposed Action	AA Outcome	Project-specific AA required	EcIA required
10.1.1	7.1.3e	Water quality	Sewage/grey water assessments	If grey water present, design a small, constructed wetland for filter of water prior to wetland entry.	Fail	Yes	Yes
10.1.1	7.1.3e	Water quality	Sewage/grey water assessments	Assess DNA of water-borne Coliforms to detect origin (human/avian)	Pass	n/a	n/a
10.1.2	7.1.3f / 7.2.3	Water quality	Contaminants from a spring/water from spring	Water quality sampling of spring water.	Pass	n/a	n/a
10.1.2	7.1.3f / 7.2.3	Water quality	Contaminants from a spring/water from spring	Study to estimate flow volumes entering the lake, study to assess merits of water level amendment.	Pass	n/a	n/a
10.1.1	7.1.3g	Water quality	Other land use factors	Cease biocide spraying	Pass	n/a	n/a
10.1.1	7.1.3g	Water quality	Other land use factors	Review spraying protocols in wider city.	Pass	n/a	n/a
10.1.1	7.1.3g	Water quality	Other land use factors	Engage with homeowners re grass clippings/other materials entering wetland.	Pass	n/a	n/a
10.1.1	7.1.3g	Water quality	Other land use factors	Ensure contractors undertaking tree felling export all material away from the wetland.	Pass	n/a	n/a
10.1.4	7.4.3	Biodiversity and invasives	Protect what you have	Habitat mapping	Pass	n/a	n/a
10.1.4	7.4.3	Biodiversity and invasives	Reduce mowing frequency	Various mowing strategies listed in Appendix 10.1.4.1 of Man Plan.	Pass	n/a	n/a
10.1.4	7.4.3	Biodiversity and invasives	Pollinator friendly planting	Various actions listed in Appendix 10.1.4.1 of Man Plan.	Pass	n/a	n/a
10.1.4	7.4.3	Biodiversity and invasives	Provide/protect nesting habitats	Various actions listed in Appendix 10.1.4.1 of Man Plan.	Pass	n/a	Beneficial
10.1.4	7.4.3	Biodiversity and invasives	Reduce use of pesticides	Various actions listed in Appendix 10.1.4.1 of Man Plan.	Pass	n/a	n/a
10.1.4	7.4.3	Biodiversity and invasives	Raise awareness	Raise awareness/ Appendix 10.1.4.1 of Man Plan.	Pass	n/a	n/a
10.1.4	7.4.3	Biodiversity and invasives	Actions for birds	Various actions listed in Appendix 10.1.4.2 of Man Plan.	Pass	n/a	Beneficial
10.1.4	7.4.3	Biodiversity and invasives	Actions for bats	Various actions listed in Appendix 10.1.4.3 of Man Plan.	Pass	n/a	Beneficial
10.1.4	7.4.3	Biodiversity and invasives	Actions for mammals	Various actions listed in Appendix 10.1.4.4 of Man Plan.	Pass	n/a	Beneficial

Man Plan Appendix Number	AA Document Section Number	Main Theme	Sub Theme	Proposed Action	AA Outcome	Project-specific AA required	EcIA required
10.1.4	7.4.3	Biodiversity and invasives	Actions for invertebrates	Various actions listed in Appendix 10.1.4.5 of Man Plan	Pass	n/a	Beneficial
10.1.4	7.4.3	Biodiversity and invasives	Actions for *Groenlandia densa*	Actions for *Groenlandia densa.* Various actions listed in Appendix 10.1.4.6 of Man Plan.	Pass	n/a	Beneficial
10.1.4	7.4.3	Biodiversity and invasives	Actions for non-native species	Prepare an invasive species management plan.	Pass	n/a	Beneficial
10.1.5	7.5.2	Signage and education	Signage infrastructure	Various actions listed in Appendix 10.1.5 of Man Plan	Pass	n/a	n/a
10.1.5	7.5.2	Signage and education	Sign maintenance	Various actions listed in Appendix 10.1.5 of Man Plan	Pass	n/a	n/a
10.1.5	7.5.2	Signage and education	Biodiversity Officer	Various actions listed in Appendix 10.1.5 of Man Plan	Pass	n/a	n/a
10.1.5	7.5.2	Signage and education	Awareness raising	Various actions listed in Appendix 10.1.5 of Man Plan	Pass	n/a	n/a
10.1.6	7.6.2	Social aspects	Lighting issues	In order to protect and enhance the area for bats, no new lighting is to be introduced.	Pass	n/a	n/a
10.1.6	7.6.2	Social aspects	Lighting issues	Existing lighting to be assessed and capped if needed to limit night-time light pollution.	Pass	n/a	n/a
10.1.7	7.7.2	Infrastructure	Access to water and views	Bulrush removal	Fail	Yes	Yes
10.1.7	7.7.2	Infrastructure	Access to water and views	Create raised platform	Fail	Yes	Yes
10.1.7	7.7.2	Infrastructure	Access to water and views	Create views through trees.	Fail	Yes	Yes
10.1.7	7.7.2	Infrastructure	Access to water and views	Extend platforms into River Shannon	Fail	Yes	Yes
10.1.7	7.7.2	Infrastructure	Pathways, access, interconnectivity	Expand walking routes	Fail	Yes	Yes
10.1.7	7.7.2	Infrastructure	Pathways, access, interconnectivity	Routine path maintenance, mowing etc	Pass	n/a	n/a
10.1.7	7.7.2	Infrastructure	Improved access between wetlands	Explore options (study and assessment)	Pass	n/a	n/a
10.1.7	7.7.2	Infrastructure	Pathways	Routine path maintenance, mowing etc, explore options	Pass	n/a	n/a
10.1.7	7.7.2	Infrastructure	Cycleways	Maintain current infrastructure, assess future options	Pass	n/a	n/a

Man Plan Appendix Number	AA Document Section Number	Main Theme	Sub Theme	Proposed Action	AA Outcome	Project-specific AA required	EcIA required
10.1.7	7.7.2	Infrastructure	Safety fencing	Explore merits of erecting safety fencing, maintain fencing	Pass	n/a	n/a
10.1.7	7.7.2	Infrastructure	Integration with other walkways	Research/study	Pass	n/a	n/a
10.1.7	7.7.2	Infrastructure	Seating	Install seating and seating maintenance	Pass	n/a	n/a
10.1.7	7.7.2	Infrastructure	Litter control	Litter control actions	Pass	n/a	n/a
10.1.7	7.7.2	Infrastructure	Remove metal box	Remove metal box on Condell Road	Pass	n/a	n/a
10.1.7	7.7.2	Infrastructure	General maintenance	Annual maintenance and cleaning e.g. signs, seats	Pass	n/a	n/a
10.1.8	-	On-going management	On-going management	Establish a steering group	Pass	n/a	n/a

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Appendix 1

Ecological Evaluation and Ecological Impact Assessment (EcIA)

Ecological Impact Assessment (EcIA) process has three main steps:

1. Ecological evaluation – this step consists of evaluating each ecological resource (e.g. habitat, population, or species) within the zone of influence (area to be affected) using the criteria outlined in Table 1a (based on a geographic hierarchy of importance). Each ecological resource is given an evaluation value (ranking) as described in Table 1b.
2. Impact (Affect) prediction - based on information provided on the proposed project/development, this step aims to identify all direct and indirect impacts that may affect the ecological features in the zone of influence, and wider area. Table 1c gives impact terminology as per the EPA (2017).
3. Assessment of the magnitude of impact - impact magnitude refers to the 'size' or 'amount' of an impact/ affect (IEEM, 2006; EPA, 2017). The magnitude of an impact will depend on the nature and sensitivity of the ecological features and will be influenced by intensity, duration (temporary/permanent), timing, frequency and reversibility of the potential impact (CIEEM 2016). Levels of impact magnitude are given in Table 1d. Magnitude terminology is based on EPA (2003) while the rationale for assigning level of significant impact follows CIEEM (2016). Importantly, this step aims to identify the impacts which may be significant upon '*important ecological features*' (CIEEM, 2016).

Table 1a. Criteria for ecological evaluation

Evaluation criteria	Definitions and Notes
Site designations	Designated areas for conservation are areas that are designated under national and/or European laws in order to conserve habitats and species of national or international conservation importance. These include: • Natural Heritage Areas (NHA): a national designation given legal status by the Wildlife Amendment (2000) Act. • Special Areas of Conservation (SAC): areas considered of European and national importance whose legal basis is the EU Habitats Directive (92/43/EEC), transposed into Irish law through the European Union (Natural Habitats) Regulations, 1997. • Special Protection Areas (SPA): sites of conservation importance for birds whose legal basis is the EU Birds Directive (209/147/EC). • Wildfowl Sanctuary: designated under the 1976 Wildlife Act. • Ramsar Site: European designation based on the Ramsar Convention, 1984.
Species designations/criteria	Certain legislation refers directly to species/populations (e.g. annexed species): • Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora. • Council Directive 79/409/EEC on the Conservation of Wild Birds ('Birds Directive'). • Bern Convention on the Conservation of European Wildlife and Natural Habitats. • The Wildlife Act (1976) and the Wildlife (Amendment) Act (2000). • Birds of Conservation Concern in Ireland (Colhoun & Cummins, 2013). • Red Data Books (e.g. Wyse-Jackson *et al.* 2016) • Flora (Protection) Order, 2015.
Size	Includes both size of habitats (area) and population size of individual species and is intrinsically linked to other criteria such as rarity and fragility (below). Habitats: considers minimum viable size of habitats, habitat heterogeneity, species/area relationships, home-range size. Populations: considers concept of minimum viable population size (population viability), national and local population trends, extinction risk.
Diversity / Biodiversity	At a minimum species richness (number of species). Biodiversity defined as 'the variability among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part (Convention on Biological Diversity, 1993). Must be considered in terms of the habitat type - some habitats have low species diversity by nature.

	Keystone species deserve special attention – defined as a species whose removal would induce significant changes within the food web (Begon *et al.* 1996).
Rarity	Applies to habitats and to species. The degree to which a habitat or community approximates a natural state. The degree to which the site is a good example of the habitat types. National, county, local scales e.g. within 10-km^2 squares.
Naturalness	The degree of modification by human intervention. Habitats that are least modified are generally regarded more highly (Treweek, 1999). Also considers the extent to which the habitat is free of alien species.
Representativeness/ Typicalness	How well the area represents habitats or vegetation types on a wider scale (Treweek, 1999); 'degree of representivity of the natural habitat type on the area' (Council Directive 92/43/EEC; Habitats Directive).
Fragility	The degree of sensitivity of habitats, communities and species to environmental change.
Stability/Resistance/Resilience	Habitats and species. Stability refers to the ability of an ecosystem to maintain some form of equilibrium in the presence of a disturbance. Resilience is defined as the ability and speed with which a community returns to its former state following a disturbance. Resistance is defined as the ability of a community to avoid displacement by a disturbance (Begon *et al.* 1996).
Other criteria include:	
Recorded history (scientific value), Potential value, Educational value, Amenity value.	

Table 1b. Ecological Evaluation

Ecological value	Examples
A International	Sites designated as Special Protection Areas (SPA), Special Areas of Conservation (SAC), Ramsar Sites. Sites meeting criteria for international designation.
B National	Sites designated as Natural Heritage Areas (NHA) or sites qualifying for designation. Undesignated sites containing good examples of Annex I habitats. Undesignated sites containing significant numbers of resident or regularly occurring populations of Annex II species under the EU Habitats Directive or Annex I species under the EU Birds Directive or species protected under the Wildlife (Amendment) Act 2000. Sites supporting viable populations of Red Data Book species (nationally rare species).
C Regional	Undesignated sites that are prime examples of the habitat (natural or semi-natural) type, exhibit high biodiversity or support important communities/assemblages of species within the region. Sites exhibiting habitats that are scarce within the region. Sites that support nationally scarce plant species (recorded from less than 65 10-km^2 squares, unless they are locally abundant). Sites that hold regionally scarce vertebrate species.
D High Local	Sites that are prime examples of the habitat type, exhibit high biodiversity or important communities/assemblages of species within the local area. Habitats that are considered important in a local context – e.g. semi-natural habitats within an urban setting, hedgerows and treelines that serve as important ecological corridors within an otherwise modified landscapes. Sites exhibiting habitats/species that are generally scarce within the local area.
E Moderate Local	Sites that exhibit good quality semi-natural habitats. Hedgerows and treelines.
F Low Local	Artificial or modified habitats considered of low value for wildlife.

Adapted from CIEEM, 2016; IEEM, 2005; NRA, 2004; Regini, 2000.

Table 1c. Description of effects as per the EPA (2017):

Positive Impact	A change which improves the quality of the environment.
Negative Impact	A change which reduces the quality of the environment.
Neutral Impact	A change that falls within typical bounds of variation within the study area.
Indirect Effects/ Secondary Effects	Impacts not directly associated with the project, often produced away from the project site or because of a complex pathway.
Cumulative Effects	The addition of many small impacts to create one larger, more significant, impact.
Do-Nothing Effects	The environment as it would be in the future if no development was carried out.
Worst-Case Effects	Impacts arising from a development in the case where mitigation measures substantially fail.
Indeterminable Effects	When the full consequences of a change in the environment cannot be described.
Irreversible Effects	When the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost.
Residual Effects	The degree of environmental change that will occur after the proposed mitigation measures have taken effect.
Synergistic Effects	Where the resultant impact is of greater significance than the sum of its constituents.

Table 1d. Significance of Effects (terminology based on EPA 2017; CIEEM 2016).

Impact Magnitude	**Definition / Rationale**
Imperceptible	An effect capable of measurement but without noticeable consequences.
Not Significant	An effect that causes noticeable changes in the character of the environment but without significant consequences.
Slight Effects	An effect that has noticeable consequences without affecting its sensitivities.
Moderate Effects	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
Significant Effects	A significant effect is one which undermines the conservation objectives for '**important ecological features'** (CIEEM, 2016). In broad terms, significant effects encompass impacts upon the structure and function of a defined site, its habitats and species and their conservation status; or in other words on site integrity**. EPA (2017) measures these effects as those that significantly alter a sensitive aspect of the environment.
Very Significant Effects	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
Profound Effects	An effect that obliterates sensitive characteristics.

** Integrity is defined as 'the integrity of a site is the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified.

Table 1e. Quality of Effects (terminology based on EPA, 2017)

Impact Magnitude	**Definition / Rationale**
Positive Effects	A change which improves the quality of the environment (e.g. increasing species diversity, improving reproduction capacity or by removing nuisances).
Neutral Effects	No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error.
Negative Adverse Effects	A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; damaging health or property or by causing nuisance).

Appendix 2

Certificate of Competence

Limosa Environmental was established by **Dr Lesley J Lewis** and associates in 2004 and has since amassed a range of experience across both the private and public sectors. Our aim is to provide a first-class professional service at competitive prices in line with national and international best practice and adhering to the codes of conduct laid down by the Chartered Institute of Ecology and Environmental Management. We can provide a wide range of ecological and environmental services, bringing together teams of professionally qualified, accredited and specialist ecologists and environmental scientists to meet the specific requirements of each individual project. We hold current Professional Indemnity and Public Liability Insurances.

Relevant Experience in relation to Appropriate Assessment: Dr Lesley J Lewis has over 20 years of experience as a consultant ecologist. She was recently recruited to the panel of expert consultants by An Bord Pleanála.

Recent Experience Ecological Impact Assessment/Appropriate Assessment: development of a Data Centre, Little Island, Cork (2022 private client), private development Baltimore, Co. Cork (2021, private client), light industrial/warehousing development, Little Island, Cork (2021, private client), mixed-use development Carrigaline, Co. Cork (2021, Lidl Ireland), Youghal Front Strand Flood Mitigation Works (2020, Cork County Council), Mixed-use development (2020, Mallow, Co. Cork, Lidl Ireland), development of a light industrial park, Watergrasshill, Cork (2019, private client); Re-development of Carrignacurra Castle, Co Cork (2019, private client), private development Baltimore Co. Cork (2019, private client), bus shelter/accessible stop program – East Cork (2019, Cork County Council), development of a light industrial park, Little Island, Cork (2019, private client); installation of a zip-line on Bull Rock (2019, BirdWatch Ireland), development of a light industrial park/warehousing, Little Island, Cork (2019, private client); development of a light industrial park/warehousing, Watergrasshill, Co. Cork (2019, private client); repair works to sea walls Cork Harbour (2019, Cork County Council); housing development at Newmarket (2018, private client), housing development at Toonsbridge, Macroom (2018, private client), road re-surfacing at Toonsbridge, Macroom, Co. Cork (2018, for Cork County Council), development of pedestrian footbridges Castlemartyr, Co. Cork (2018, Cork County Council), private development Castletownbere Co. Cork (2018, private client), residential/business development Clonakilty, Co. Cork (2018, private client), re-development of site of former Duhallow Park Hotel (2018, private client), housing development (50 houses) Carrigtwohill, Co. Cork (2018, private client), road re-surfacing at Toonsbridge, Macroom, Co. Cork (2017, for Cork County Council), development of a discount foodstore Fermoy, Cork (2017, Lidl Ireland), housing development (47 houses), Cobh, Co Cork (2017, private client), extension to light industrial unit, Little Island, Cork (2017, private client), development of a discount foodstore Douglas, Cork (2017, Lidl Ireland), works to sea walls at Rosscarbery (2017 Cork County Council), development of a footbridge at Killeagh Co Cork (2017, Cork County Council), development of an eco-campsite in West Cork (2016, private client), Rosscarbery flood defence works (2016, Cork County Council), development of Lidl stores at Mallow and Kanturk (2016, Lidl Ireland).

Relevant Experience in relation to coastal ecology, wetlands and waterbirds:
1999- 2003 PhD Studies - Ecological disturbance and its effects on estuarine benthic invertebrate communities and their avian predators (wading birds).

Waterbird Surveys: Coordinator and participant in waterbird surveys at Bannow Bay (Co Wexford) during winters of 2014/15 – 2018/19 (for Inis Environmental/Marine Institute); Survey team member for waterbird surveys at Dungarvan Harbour (2015/16, 2017/18, 2018/19, 2020/21 and 2021/22

Atkins Ireland for the Marine Institute); Monthly I-WeBS counts at various sites including Clonakilty Bay (Co Cork) and Dungarvan Harbour (Co. Waterford) (September to March annually and on-going), waterbird surveys as part of ecological monitoring of Youghal Landfill (2014-2016, Cork County Council), and East Cork Landfill (2006 - 2016, Cork County Council). Survey team member during the NPWS Waterbird Survey Programme (2009-2012) including Castlemaine Harbour, Tralee Bay, Courtmacsherry Estuary, Ballyteigue Burrow, Dungarvan Harbour, Dundalk Harbour, Bannow Bay, Blackwater Estuary and Cork Harbour.

UCC Project Supervisor – Student supervisor that resulted in a published paper: Murphy, S., **Lewis, L. J.** & Kelly T. C. (2006) The spatial ecology of wildfowl in Courtmacsherry Bay, Southern Ireland, with particular reference to Shelduck *Tadorna tadorna*. *Irish Birds* 8, 51-58.

Estuarine benthic studies - annual benthic study of the River Fergus Estuary (2006 – current, private client); intertidal survey of the Owenboy estuary (2013 Atkins Ireland Ltd), benthic surveys of Rossmore Bay and peninsula (as part of annual monitoring of East Cork Landfill (2006 – 2014, Cork County Council); benthic surveys of Tramore Bay (as part of annual monitoring of Tramore Landfill (2004 – 2008, Waterford County Council); benthic surveys of upper Colligan Estuary (as part of annual monitoring of Dungarvan Landfill (2004 – 2008, Waterford County Council).

Project Manager BirdWatch Ireland (P/T 2009 - current) – Lesley is the current Project Manager of the Irish Wetland Bird Survey (I-WeBS) and Countryside Bird Survey (CBS). She is the lead or co-author on the most recent national assessments of waterbird status and trends in the Republic of Ireland and is actively involved in studies on the response of waterbirds to disturbance.

Birds of Conservation Concern in Ireland (BoCCI4) – co-author of the most recent assessment of the status of birds in Ireland (Gilbert et al. 2021). Presented this work to government ministers (Malcolm Noonan TD and Pippa Hackett TD).

Waterbird Ecologist (2009–2014) – As a BWI employee, Lesley was contracted to the National Parks & Wildlife Service (NPWS) between 2009 and 2014. In her role as 'Waterbird Ecologist' Lesley was responsible for the design and implementation of the NPWS Waterbird Survey Programme. Lesley was the project manager for the programme of surveys that ran over three winters (2009/10, 2010/11 and 2011/12) with surveys undertaken across 32 coastal Special Protection Areas (SPAs). Data collected from the low tide waterbird survey programme were analysed and used in the process of formulating conservation objectives for coastal SPAs. Lesley worked on all aspects of this process from the initial stages of conception and development, data analysis, through to the production of conservation objectives documents for all 32 coastal SPAs. This work culminated in the publication of standard low-tide survey methods for waterbirds (Lewis & Tierney, 2014).

Recent relevant selected publications and reports:

Gilbert, G., Stanbury, A. & Lewis, L.J. (2021) Birds of conservation concern in Ireland 4 2020 – 2026. *Irish Birds* 43, 1-22.

Burke, B., McElwaine, J. G., Fitzgerald, N., Kelly, S.B.A., McCulloch, N., Walsh, A. J., & Lewis, L. J. (2021) Population size, breeding success and habitat use of Whooper Swan *Cygnus cygnus* and Bewick's Swan Cygnus *columbianus bewickii* in Ireland: results of the 2020 International Swan Census. *Irish Birds* 43, 57-70.

Lewis, L. J. & Hayes, W. (2019) Waterbird survey of Lough Gur, County Limerick 2018 – 2019. Final Report. Report commissioned by Limerick City & County Council in association with Lough Gur Development Co-Operative Society Ltd and prepared by BirdWatch Ireland and Limosa Environmental. June 2019.

Lewis, L. J., Burke, B., Fitzgerald, N., Tierney, T. D. & Kelly, S. (2019) Irish Wetland Bird Survey: Waterbird Status and Distribution 2009/10 - 2015/16. Irish Wildlife Manuals No. 106. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht, Ireland.

Lewis, L. J. (2019) An assessment of the effects of recreational and other activities on the waterbirds using the Bull Island saltmarsh. Final Report. Report commissioned by Dublin City & County Council and prepared by BirdWatch Ireland. April 2019.

Adcock, T., Lewis, L. J. & Hodd, R. (2019) Sutton to Sandycove (S2S) cycleway and footway ecology and ornithological monitoring 2018-2019. Report by BirdWatch Ireland to Dublin City Council. June 2019.

Burke, B., **Lewis, L. J.,** Fitzgerald, N., Frost, T., Austin, G. & Tierney, T. D. (2018) Estimates of waterbird numbers wintering in Ireland, 2011/12 – 2015/16. *Irish Birds* 11, 1-12.

Burke, B. & **Lewis, L. J.** (2018) Assessment of numbers and distribution of post-breeding terns at Irish coastal wetlands in August and September 2017. BirdWatch Ireland & the National Parks & Wildlife Service.

Pavon-Jordán, D., Clausen, P., Dagys, M., Devos, K., Encarnacao, V., Fox, A. D., Frost, T., Guadard, C., Hornman, M., Keller, V., Langendoen, T., Tawocki, T., **Lewis, L. J.,** Lorentsen, S-H., Luigujoe, L., Meissner, W., Molina, B., Musil, P., Musilova, Z., Nilsson, L., Paquet, J-Y., Ridzon, J., stipniece, A., Teufelbauer, N., Wahl, J., Zentatello, M & Lehikoinen, A. (2018) Habitat- and species-mediated short- and long-term distributional changes in waterbird abundance linked to variation in European winter weather. Diversity & Distributions https://doi.org/10.1111/ddi.12855.

Burke, B., Fitzgerald, N. & **Lewis, L. J.** (2018) Irish Wetland Bird Survey: Results of waterbird monitoring in Ireland 2015/16. BirdWatch Ireland & the National Parks & Wildlife Service.

Lewis, L. J., Fennessy, G. & Cummins, S. (2018) Light-bellied Brent Goose *Branta bernicla hrota* at Sruwaddacon Bay, north-west Co. Mayo, Ireland. Goose Bulletin 2018.

Lewis, L. J. Austin, G., Boland, H., Frost, T., Crowe, O. & Tierney, T. D. (2017) Waterbird populations on non-estuarine coasts of Ireland: results of the 2015/16 Non-Estuarine Coastal Waterbird Survey (NEWS-III). Irish Birds 10, 511-522.

Appendix 3

Site Name: Lower River Shannon SAC

Site Code: 002165

This very large site stretches along the Shannon valley from Killaloe in Co. Clare to Loop Head/ Kerry Head, a distance of some 120 km. The site thus encompasses the Shannon, Feale, Mulkear and Fergus estuaries, the freshwater lower reaches of the River Shannon (between Killaloe and Limerick), the freshwater stretches of much of the Feale and Mulkear catchments and the marine area between Loop Head and Kerry Head. Rivers within the sub-catchment of the Feale include the Galey, Smearlagh, Oolagh, Allaughaun, Owveg, Clydagh, Caher, Breanagh and Glenacarney. Rivers within the sub-catchment of the Mulkear include the Killeenagarriff, Annagh, Newport, the Dead River, the Bilboa, Glashacloonaraveela, Gortnageragh and Cahernahallia.

The site is a Special Area of Conservation (SAC) selected for the following habitats and/or species listed on Annex I / II of the E.U. Habitats Directive (* = priority; numbers in brackets are Natura 2000 codes):

[1110] Sandbanks
[1130] Estuaries
[1140] Tidal Mudflats and Sandflats
[1150] Coastal Lagoons*
[1160] Large Shallow Inlets and Bays
[1170] Reefs
[1220] Perennial Vegetation of Stony Banks
[1230] Vegetated Sea Cliffs
[1310] *Salicornia* Mud
[1330] Atlantic Salt Meadows
[1410] Mediterranean Salt Meadows
[3260] Floating River Vegetation
[6410] *Molinia* Meadows
[91E0] Alluvial Forests*
[1029] Freshwater Pearl Mussel (*Margaritifera margaritifera*)
[1095] Sea Lamprey (*Petromyzon marinus*)
[1096] Brook Lamprey (*Lampetra planeri*)
[1099] River Lamprey (*Lampetra fluviatilis*)
[1106] Atlantic Salmon (*Salmo salar*)
[1349] Bottle-nosed Dolphin (*Tursiops truncatus*)
[1355] Otter (*Lutra lutra*)

The Shannon and Fergus Rivers flow through Carboniferous limestone as far as Foynes, but west of Foynes Namurian shales and flagstones predominate (except at Kerry Head, which is formed from Old Red Sandstone). The eastern sections of the Feale catchment flow through Namurian rocks and the western stretches through Carboniferous limestone. The Mulkear flows through Lower Palaeozoic rocks in the upper reaches before passing through Namurian rocks, followed by Lower Carboniferous shales and Carboniferous limestone. The Mulkear River itself, immediately north of Pallas Green, passes through an area of Rhyolites, Tuffs and Agglomerates.

The Shannon and Fergus Estuaries form the largest estuarine complex in Ireland. They form a unit stretching from the upper tidal limits of the Shannon and Fergus Rivers to the mouth of the Shannon Estuary (considered to be a line across the narrow strait between Kilcredaun Point and Kilconly Point). Within this main unit there are several tributaries with their own 'sub-estuaries' e.g. the Deel River, Mulkear River, and Maigue River. To the west of Foynes, a number of small estuaries form indentations in the predominantly hard coastline, namely Poulnasherry Bay, Ballylongford Bay, Clonderalaw Bay and the Feale or Cashen River estuary.

Both the Fergus and inner Shannon Estuaries feature vast expanses of intertidal mudflats, often fringed with saltmarsh vegetation. The smaller estuaries also feature mudflats, but have their own unique characteristics, e.g. Poulnasherry Bay is stony and unusually rich in species and biotopes. Plant species are typically scarce on the mudflats, although there are some eelgrass (*Zostera* spp.) beds and patches of green algae (e.g. *Ulva* sp. and *Enteromorpha* sp.). The main macro-invertebrate community which has been noted from the inner Shannon and Fergus estuaries is a *Macoma-Scrobicularia-Nereis* community.

In the transition zone between mudflats and saltmarsh, specialised colonisers of mud predominate. For example, swards of Common Cord-grass (*Spartina anglica*) frequently occur in the upper parts of the estuaries. Less common are swards of Glasswort (*Salicornia europaea* agg.). In the innermost parts of the estuaries, the tidal channels or creeks are fringed with species such as Common Reed (*Phragmites australis*) and club-rushes (*Scirpus maritimus, S. tabernaemontani* and *S. triquetrus*). In addition to the nationally rare Triangular Club-rush (*Scirpus triqueter*), two scarce species are found in some of these creeks (e.g. Ballinacurra Creek): Lesser Bulrush (*Typha angustifolia*) and Summer Snowflake (*Leucojum aestivum*).

Saltmarsh vegetation frequently fringes the mudflats. Over twenty areas of estuarine saltmarsh have been identified within the site, the most important of which are around the Fergus estuary and at Ringmoylan Quay.The dominant type of saltmarsh present is Atlantic salt meadow occurring over mud. Characteristic species occurring include Common Saltmarsh-grass (Puccinellia maritima), Sea Aster (Aster tripolium), Thrift (Armeria maritima), Sea-milkwort (Glaux maritima), Sea Plantain (Plantago maritima), Red Fescue (Festuca rubra), Creeping Bent (Agrostis stolonifera), Saltmarsh Rush (Juncus gerardi), Long-bracted Sedge (Carex extensa), Lesser Sea-spurrey (Spergularia marina) and Sea Arrowgrass (Triglochin maritima). Areas of Mediterranean salt meadows, characterised by clumps of Sea Rush (Juncus maritimus) occur occasionally. Two scarce species are found on saltmarshes in the vicinity of the Fergus estuary: a type of robust saltmarsh-grass (*Puccinellia foucaudii*), sometimes placed within the species Common Saltmarsh-grass (P. maritima) and Hard-grass (*Parapholis strigosa*).

Saltmarsh vegetation also occurs around a number of lagoons within the site, two of which have been surveyed as part of a National Inventory of Lagoons. Cloonconeen Pool (4-5 ha) is a natural sedimentary lagoon impounded by a low cobble barrier. Seawater enters by percolation through the barrier and by overwash. This lagoon represents a type which may be unique to Ireland since the substrate is composed almost entirely of peat. The adjacent shore features one of the best examples of a drowned forest in Ireland. Aquatic vegetation in the lagoon includes typical species such as Beaked Tasselweed (*Ruppia maritima*) and green algae (*Cladophora* sp.). The fauna is not diverse, but is typical of a high salinity lagoon and includes six lagoon specialists (*Hydrobia ventrosa, Cerastoderma glaucum, Lekanesphaera hookeri, Palaemonetes varians, Sigara stagnalis* and *Enochrus bicolor*). In contrast, Shannon Airport Lagoon (2 ha) is an artificial saline lake with an artificial barrier and sluiced outlet. However, it supports two Red Data Book species of stonewort (*Chara canescens* and *Chara cf. connivens*).

Most of the site west of Kilcredaun Point/Kilconly Point is bounded by high rocky sea cliffs. The cliffs in the outer part of the site are sparsely vegetated with lichens, Red Fescue, Sea Beet (*Beta vulgaris* subsp. *maritima*), Sea Campion (*Silene vulgaris* subsp. *maritima*), Thrift and plantains (*Plantago* spp.). A rare endemic type of sea-lavender, *Limonium recurvum* subsp. *pseudotranswallianum,* occurs on cliffs near Loop Head. Cliff-top vegetation usually consists of either grassland or maritime heath. The boulder clay cliffs further up the estuary tend to be more densely vegetated, with swards of Red Fescue and species such as Kidney Vetch (*Anthyllis vulneraria*) and Common Bird's-foot-trefoil (*Lotus corniculatus*).

The site supports an excellent example of a large shallow inlet and bay. Littoral sediment communities in the mouth of the Shannon Estuary occur in areas that are exposed to wave action and also in areas extremely sheltered from wave action. Characteristically, exposed sediment communities are composed of coarse sand and have a sparse fauna. Species richness increases as conditions become more sheltered. All shores in the site have a zone of sand hoppers at the top, and below this each of the shores has different characteristic species giving a range of different shore types.

The intertidal reefs in the Shannon Estuary are exposed or moderately exposed to wave action and subject to moderate tidal streams. Known sites are steeply sloping and show a good zonation down the shore. Well developed lichen zones and littoral reef communities offering a high species richness in the sublittoral fringe and strong populations of the Purple Sea Urchin *Paracentrotus lividus* are found. The communities found are tolerant to sand scour and tidal streams. The infralittoral reefs range from sloping platforms with some vertical steps, to ridged bedrock with gullies of sand between the ridges, to ridged bedrock with boulders or a mixture of cobbles, gravel and sand. Kelp is very common to about 18 m. Below this it becomes rare and the community is characterised by coralline crusts and red foliose algae.

Other coastal habitats that occur within the site include stony beaches and bedrock shores (these support a typical zonation of seaweeds such as *Fucus* spp., *Ascophyllum nodosum* and kelps), shingle beaches (with species such as Sea Beet, Sea Mayweed - *Matricaria maritima*, Sea Campion and Curled Dock - *Rumex crispus*), sandbanks which are slightly covered by sea water at all times (e.g. in the area from Kerry Head to Beal Head) and sand dunes (a small area occurs at Beal Point, where Marram – *Ammophila arenaria* is the dominant species).

Freshwater rivers have been included in the site, most notably the Feale and Mulkear catchments, the Shannon from Killaloe to Limerick (along with some of its tributaries, including a short stretch of the Kilmastulla River), the Fergus up as far as Ennis, and the Cloon River. These systems are very different in character: the Shannon is broad, generally slow flowing and naturally eutrophic; the Fergus is smaller and alkaline; while the narrow, fast flowing Cloon is acid in nature. The Feale and Mulkear catchments exhibit all the aspects of a river from source to mouth. Semi-natural habitats, such as wet grassland, wet woodland and marsh occur by the rivers, but improved grassland is the most common habitat type. One grassland type of particular conservation significance, *Molinia* meadows, occurs in several parts of the site and the examples at Worldsend on the River Shannon are especially noteworthy. Here are found areas of wet meadow dominated by rushes (*Juncus* spp.) and sedges (*Carex* spp.), and supporting a diverse and species-rich vegetation, including such uncommon species as Blue-eyed Grass (*Sisyrinchium bermudiana*) and Pale Sedge (*C. pallescens*).

Floating river vegetation characterised by species of water-crowfoot (*Ranunculus* spp.), pondweeds (*Potamogeton* spp.) and the moss *Fontinalius antipyretica* are present throughout the major river systems within the site. The rivers contain an interesting bryoflora with *Schistidium alpicola* var. *alpicola* recorded from in-stream boulders on the Bilboa, new to Co. Limerick.

Alluvial woodland occurs on the banks of the Shannon and on islands in the vicinity of the University of Limerick. The woodland is up to 50 m wide on the banks and somewhat wider on the largest island. The most prominent woodland type is gallery woodland where White Willow (*Salix alba*) dominates the tree layer with occasional Alder (*Alnus glutinosa*). The shrub layer consists of various willow species with Rusty Willow (*Salix cinerea* ssp. *oleifolia*) and what appear to be hybrids of *S. alba* x *S. viminalis.* The herbaceous layer consists of tall perennial herbs. A fringe of bulrush (*Typha* sp.) occurs on the river side of the woodland. On slightly higher ground above the wet woodland and on the raised embankment remnants of mixed oak-ash-alder woodland occur. These are poorly developed and contain numerous exotic species but locally there are signs that it is invading open grassland. Alder is the principal tree species, with occasional Pedunculate Oak (*Quercus robur*), elm (*Ulmus glabra* and *U. procera*), Hazel (*Corylus avellana*), Hawthorn (*Crataegus monogyna*) and the shrubs Guelder-rose (*Viburnum opulus*) and willows. The ground flora is species-rich.

While woodland is infrequent within the site, however Cahiracon Wood contains a strip of old oak woodland. Sessile Oak (*Q. petraea*) forms the canopy, with an understorey of Hazel and Holly (*Ilex*

aquifolium). Great Wood-rush (*Luzula sylvatica*) dominates the ground flora. Less common species present include Great Horsetail (*Equisetum telmeteia*) and Pendulous Sedge (*Carex pendula*).

In the low hills to the south of the Slievefelim Mountains, the Cahernahallia River cuts a valley through the Upper Silurian rocks. For approximately 2 km south of Cappagh Bridge at Knockanavar, the valley sides are wooded. The woodland consists of birch (*Betula* spp.), Hazel, oak, Rowan (*Sorbus aucuparia*), some Ash (*Fraxinus excelsior*) and willow (*Salix* spp.). Most of the valley is not grazed by stock, and as a result the trees are regenerating well. The ground flora features prominent Great wood-rush and Bilberry (*Vaccinium myrtillus*), along with a typical range of woodland herbs. Bracken (*Pteridium aquilinum*) is a feature in areas where there is more light available.

The valley sides of the Bilboa and Gortnageragh Rivers, on higher ground north-east of Cappamore, support patches of semi-natural broadleaf woodland dominated by Ash, Hazel, oak and birch. There is a good scrub layer with Hawthorn, willow, Holly and Blackthorn (*Prunus spinosa*) common. The herb layer in these woodlands is often open, with a typically rich mixture of woodland herbs and ferns. Moss species diversity is high. The woodlands are ungrazed. The Hazel is actively coppiced in places.

There is a small area of actively regenerating cut-away raised bog at Ballyrorheen. It is situated approximately 5 km north-west of Cappamore in Co. Limerick. The bog contains some wet areas with good cover of bog mosses (*Sphagnum* spp.). Species of particular interest include Cranberry (*Vaccinium oxycoccos*) and White Sedge (*Carex curta*), along with two regionally rare mosses, including the bog moss *S. fimbriatum*. The site is being invaded by Downy Birch (*Betula pubescens*) scrub woodland. Both commercial forestry and the spread of Rhododendron (*Rhododendron ponticum*) has greatly reduced the overall value of the site.

A number of plant species that are listed in the Irish Red Data Book occur within the site, and several of these are protected under the Flora (Protection) Order, 1999. These include Triangular Club-rush (*Scirpus triquetrus*), a species which is only found in Ireland only in the Shannon Estuary, where it borders creeks in the inner estuary. Opposite-leaved Pondweed (*Groenlandia densa*) is found in the Shannon where it passes through Limerick City, while Meadow Barley (*Hordeum secalinum*) is abundant in saltmarshes at Ringmoylan and Mantlehill. Hairy Violet (*Viola hirta*) occurs in the Askeaton/Foynes area. Golden Dock (*Rumex maritimus*) is noted as occurring in the River Fergus estuary. Finally, Bearded Stonewort (*Chara canescens*), a brackish water specialist, and Convergent Stonewort (*Chara connivens*) are both found in Shannon Airport Lagoon.

Overall, the Shannon and Fergus Estuaries support the largest numbers of wintering waterfowl in Ireland. The highest count in 1995-96 was 51,423 while in 1994-95 it was 62,701. Species listed on Annex I of the E.U. Birds Directive which contributed to these totals include: Great Northern Diver (3; 1994/95), Whooper Swan (201; 1995/96), Pale-bellied Brent Goose (246; 1995/96), Golden Plover (11,067; 1994/95) and Bar-tailed Godwit (476; 1995/96). In the past, three separate flocks of Greenland White-fronted Goose were regularly found, but none were seen in 1993/94.

Other wintering waders and wildfowl present include Greylag Goose (216; 1995/96), Shelduck (1,060; 1995/96), Wigeon (5,976; 1995/96), Teal (2,319; 1995-96), Mallard (528; 1995/96), Pintail (45; 1995/96), Shoveler (84; 1995/96), Tufted Duck (272; 1995/96), Scaup (121; 1995/96), Ringed Plover (240; 1995/96), Grey Plover (750; 1995/96), Lapwing (24,581; 1995/96), Knot (800; 1995/96), Dunlin (20,100; 1995/96), Snipe (719, 1995/96), Black-tailed Godwit (1,062; 1995/96), Curlew (1,504; 1995/96), Redshank (3,228; 1995/96), Greenshank (36; 1995/96) and Turnstone (107; 1995/96). A number of wintering gulls are also present, including Black-headed Gull (2,216; 1995/96), Common Gull (366; 1995/96) and Lesser Black-backed Gull (100; 1994/95). This is the most important coastal site in Ireland for a number of the waders including Lapwing, Dunlin, Snipe and Redshank. It also provides an important staging ground for species such as Black-tailed Godwit and Greenshank.

A number of species listed on Annex I of the E.U. Birds Directive breed within the site. These include Peregine Falcon (2-3 pairs), Sandwich Tern (34 pairs on Rat Island, 1995), Common Tern (15 pairs: 2 on

Sturamus Island and 13 on Rat Island, 1995), Chough (14-41 pairs, 1992) and Kingfisher. Other breeding birds of note include Kittiwake (690 pairs at Loop Head, 1987) and Guillemot (4,010 individuals at Loop Head, 1987).

There is a resident population of Bottle-nosed Dolphin in the Shannon Estuary. This is the only known resident population of this E.U. Habitats Directive Annex II species in Ireland. The population is estimated (in 2006) to be 140 ± 12 individuals. Otter, a species also listed on Annex II of this Directive, is commonly found on the site.

Five species of fish listed on Annex II of the E.U. Habitats Directive are found within the site. These are Sea Lamprey (*Petromyzon marinus*), Brook Lamprey (*Lampetra planeri*), River Lamprey (*Lampetra fluviatilis*), Twaite Shad (*Allosa fallax fallax*) and Salmon (*Salmo salar*). The three lampreys and Salmon have all been observed spawning in the lower Shannon or its tributaries. The Fergus is important in its lower reaches for spring salmon, while the Mulkear catchment excels as a grilse fishery, though spring fish are caught on the actual Mulkear River. The Feale is important for both types. Twaite Shad is not thought to spawn within the site. There are few other river systems in Ireland which contain all three species of lamprey.

Two additional fish species of note, listed in the Irish Red Data Book, also occur, namely Smelt (*Osmerus eperlanus*) and Pollan (*Coregonus autumnalis pollan*). Only the former has been observed spawning in the Shannon. Freshwater Pearl Mussel (*Margaritifera margaritifera*), a species listed on Annex II of the E.U. Habitats Directive, occurs abundantly in parts of the Cloon River.

There is a wide range of land uses within the site. The most common use of the terrestrial parts is grazing by cattle, and some areas have been damaged through over-grazing and poaching. Much of the land adjacent to the rivers and estuaries has been improved or reclaimed and is protected by embankments (especially along the Fergus estuary). Further, reclamation continues to pose a threat, as do flood relief works (e.g. dredging of rivers). Gravel extraction poses a major threat on the Feale.

In the past, cord-grass (*Spartina* sp.) was planted to assist in land reclamation. This has spread widely and may oust less vigorous colonisers of mud and may also reduce the area of mudflat available to feeding birds.

Domestic and industrial wastes are discharged into the Shannon, but water quality is generally satisfactory, except in the upper estuary where it reflects the sewage load from Limerick City. Analyses for trace metals suggest a relatively clean estuary with no influences of industrial discharges apparent. Further industrial development along the Shannon and water polluting operations are potential threats.

Fishing is a main tourist attraction on the Shannon and there are a large number of angler associations, some with a number of beats. Fishing stands and styles have been erected in places. The River Feale is a designated Salmonid Water under the E.U. Freshwater Fish Directive. Other uses of the site include commercial angling, oyster farming, boating (including dolphin-watching trips) and shooting. Some of these may pose threats to the birds and dolphins through disturbance. Specific threats to the dolphins include underwater acoustic disturbance, entanglement in fishing gear and collisions with fast moving craft.

This site is of great ecological interest as it contains a high number of habitats and species listed on Annexes I and II of the E.U. Habitats Directive, including the priority habitats lagoon and alluvial woodland, the only known resident population of Bottle-nosed Dolphin in Ireland and all three Irish lamprey species. A good number of Red Data Book species are also present, perhaps most notably the thriving populations of Triangular Club-rush. A number of species listed on Annex I of the E.U. Birds Directive are also present, either wintering or breeding. Indeed, the Shannon and Fergus Estuaries form the largest estuarine complex in Ireland and support more wintering wildfowl and waders than any other site in the country. Most of the estuarine part of the site has been designated a Special Protection Area (SPA), under the E.U. Birds Directive, primarily to protect the large numbers of migratory birds present in winter.

NPWS 2013.

SITE NAME: River Shannon and River Fergus Estuaries SPA

SITE CODE: 004077

The estuaries of the River Shannon and River Fergus form the largest estuarine complex in Ireland. The site comprises the entire estuarine habitat from Limerick City westwards as far as Doonaha in Co. Clare and Dooneen Point in Co. Kerry.

The site has vast expanses of intertidal flats which contain a diverse macro-invertebrate community, e.g. Macoma-Scrobicularia-Nereis, which provides a rich food resource for the wintering birds. Salt marsh vegetation frequently fringes the mudflats and this provides important high tide roost areas for the wintering birds. Elsewhere in the site the shoreline comprises stony or shingle beaches.

The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for the following species: Cormorant, Whooper Swan, Light-bellied Brent Goose, Shelduck, Wigeon, Teal, Pintail, Shoveler, Scaup, Ringed Plover, Golden Plover, Grey Plover, Lapwing, Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Greenshank and Black-headed Gull. It is also of special conservation interest for holding an assemblage of over 20,000 wintering waterbirds. The E.U. Birds Directive pays particular attention to wetlands and, as these form part of this SPA, the site and its associated waterbirds are of special conservation interest for Wetland & Waterbirds.

The site is the most important coastal wetland site in the country and regularly supports in excess of 50,000 wintering waterfowl (57,133 - five year mean for the period 1995/96 to 1999/2000), a concentration easily of international importance. The site has internationally important populations of Light-bellied Brent Goose (494), Dunlin (15,131) and Black-tailed Godwit (2,035). A further 18 species have populations of national importance, i.e. Cormorant (245), Whooper Swan (118), Shelduck (1,025), Wigeon (3,761), Teal (2,260), Pintail (62), Shoveler (107), Scaup (102), Ringed Plover (223), Golden Plover (5,664), Grey Plover (558), Lapwing (15,126), Knot (2,015), Bar-tailed Godwit (460), Redshank (2,645), Curlew (2,396), Greenshank (61) and Black-headed Gull (2,681) - figures are five year mean peak counts for the period 1995/96 to 1999/2000. The site is among the most important in the country for several of these species, notably Dunlin (13 % of national total), Lapwing (6% of national total) and Redshank (9% of national total).

The site also supports a nationally important breeding population of Cormorant (93 pairs in 2010).

Other species that occur include Mute Swan (103), Mallard (441), Red-breasted Merganser (20), Great Crested Grebe (50), Grey Heron (38), Oystercatcher (551), Turnstone (124) and Common Gull (445) - figures are five year mean peak counts for the period 1995/96 to 1999/2000.

Apart from the wintering birds, large numbers of some species also pass through the site whilst on migration in spring and/or autumn.

The River Shannon and River Fergus Estuaries SPA is an internationally important site that supports an assemblage of over 20,000 wintering waterbirds. It holds internationally important populations of three species, i.e. Light-bellied Brent Goose, Dunlin and Black-tailed Godwit. In addition, there are 18 species that have wintering populations of national importance. The site also supports a nationally important breeding population of Cormorant. Of particular note is that three of the species which occur regularly are listed on Annex I of the E.U. Birds Directive, i.e. Whooper Swan, Golden Plover and Bar-tailed Godwit.