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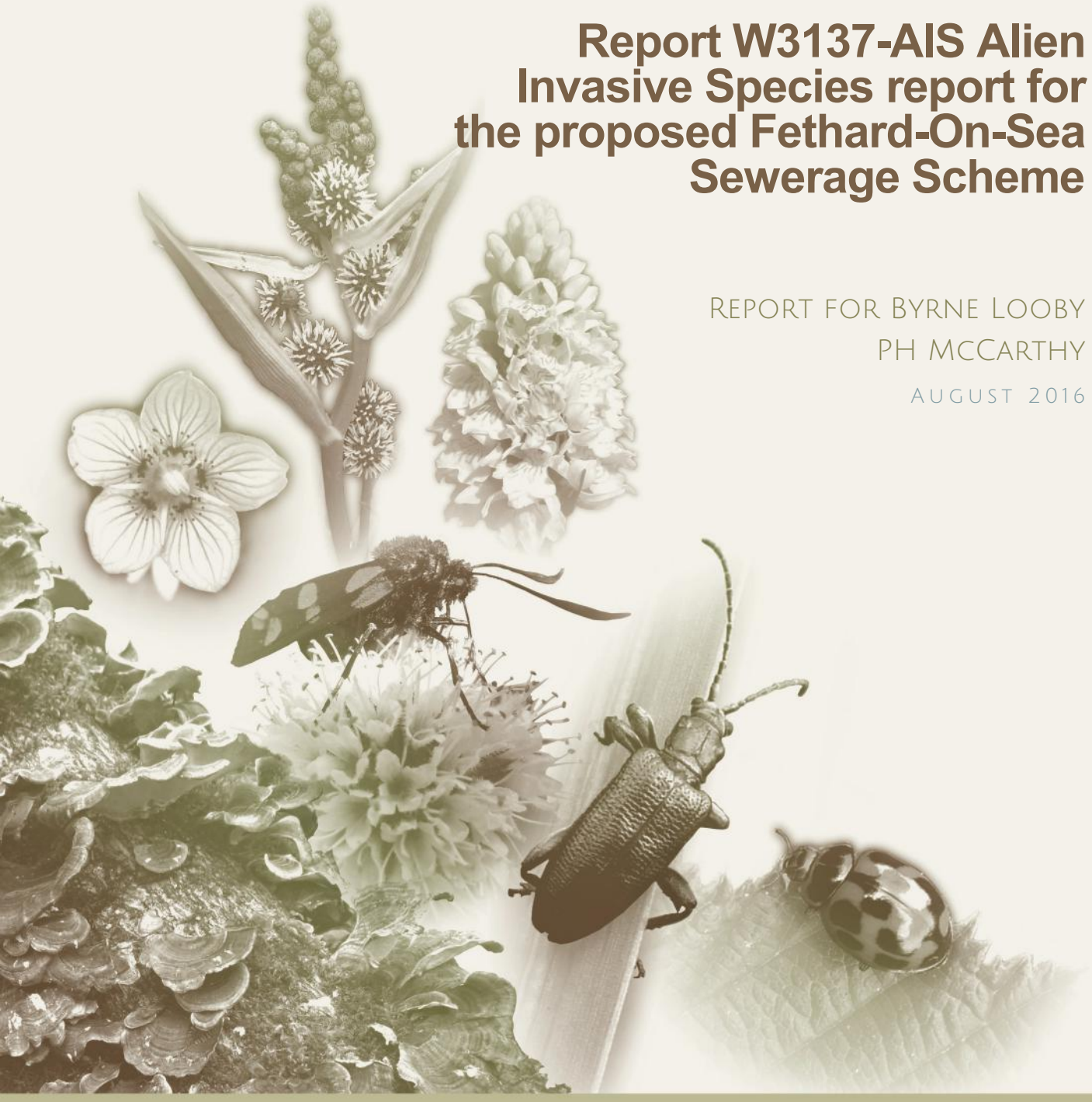
Report W3137-AIS Alien Invasive Species report for the proposed Fethard-On-Sea Sewerage Scheme



Report for Byrne Looby
PH McCarthy
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F.H. O'Neill

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Table of Contents

1 Introduction 1
2 Methodology 1
2.1 Desk study 1
2.2 Invasive species field survey 1
3 Results 2
3.1 Desk study 2
3.2 Invasive species field survey 3
4 Discussion and recommendations 7
5 Summary conclusions 12
6 Reference list 12
Appendix 1: Fethard-On-Sea proposed sewerage scheme – Location of works
Appendix 2: Site photographs
Appendix 3: Fethard-On-Sea proposed sewerage scheme – Location of Alien Invasive Species
Appendix 4: ITM coordinates of Three-cornered Leek and Common Cord-grass patches

1 Introduction

BEC Consultants were commissioned by Byrne Looby PH McCarthy to carry out an invasive species survey as part of the Fethard-On-Sea sewerage scheme. The initial survey was conducted by Dr Philip Perrin and Simon Barron on 4th April 2016, with a second survey undertaken on 18th July 2016 by Dr Fionnuala O'Neill. The site will be visited again towards the end of the 2016 growing season (August/September) to ensure that all invasive species are detected and their populations are monitored.

Invasive species can transform ecosystems and threaten native habitats and species (Kelly *et al*. 2013). Regulations 49 and 50 of S.I. 477/2011, the European Communities (Birds and Natural Habitats) Regulations, provide the legislative framework for invasive species within the State. Many invasive species originate outside Ireland and are considered to be non-native, i.e., alien species; however, some of the animals listed within S.I. 477/2011 are native. Kelly *et al.* (2013) assessed the risk posed by individual invasive species to Ireland with their list of high risk species (Tables 3 and 4 of Kelly *et al*. 2013) which was consulted during this study, as was the amber list from Invasive Species Ireland (ISI 2016). Irish Water has requested that the invasive species survey address species listed on the Third Schedule of S.I. 477/2011. These are the only species where there is a legal imperative to ensure that they are not transported or spread as a consequence of the proposed project.

The survey area is located at Fethard-On-Sea, Co. Wexford. The proposed sewerage scheme for Fethard includes the decommissioning of the existing primary treatment tank and outfall to the estuary, construction of a pumping station, associated storm overflow, rising main, wastewater treatment plant, and drilled marine outfall.

2 Methodology

2.1 Desk study

A desk study was carried out to identify any records of invasive species, both plants and animals, listed on the Third Schedule of S.I. 477/2011 within the locality of the survey area. This included a review of data available on the New Atlas of the British and Irish Flora (Preston *et al.* 2002) and the National Biodiversity Data Centre (NBDC) website (maps.biodiversityireland.ie). The nomenclature presented in this report follows S.I. 477/2011 for those species listed on the Third Schedule and Stace (2010) for all other vascular plants. Nomenclature for bryophytes follows Hill *et al.* (2008).

2.2 Invasive species field survey

A field survey was undertaken within the area of the Fethard sewerage scheme and when an invasive species (i.e., a species listed within the Third Schedule of S.I. 477/2011) was found the location was mapped and the following additional information recorded:

- an estimate of the area covered by the invasive species population;
- the Fossitt (2000) habitat category in which the invasive species was located.

The invasive species data recorded in the field was augmented with the following information:

i. the risk score (Kelly *et al*. 2013; ISI 2016);

ii. a description of the potential pathways of introduction and spread of the species, both intentional and unintentional;

iii. a description of the current distribution of the species within Ireland;

iv. a description of the adverse impact on biodiversity and related ecosystem services, including on native species, protected sites, endangered habitats, as well as on human health;

v. client's statutory obligations, such as a permit to move Japanese Knotweed or the soil it is growing in under S.I. 477/2011; and

vi. a list of any relevant references that can provide guidance on best practices for working in the vicinity of the species and details of biosecurity protocols.

3 Results

3.1 Desk study

The survey area partially overlaps with three Natura 2000 sites, i.e., Special Area of Conservation (SAC) or Special Protection Area (SPA). These are Hook Head SAC (000764), Bannow Bay SAC (000697) and Bannow Bay SPA (004033).

In relation to records for invasive species, the online NBDC resource had records for six invasive plant species listed on the Third Schedule of S.I. 477/2011 that are within approximately 2 km of the proposed project site (Table 1). No additional data were found in the New Atlas of the British and Irish Flora (Preston *et al.* 2002).

There was one NBDC record of the invasive non-native animal species Grey Squirrel (*Sciurus carolinensis*) within 5 km of the proposed development. However, this distance was deemed to be too great for the species to pose a problem for the proposed development, so this species is not considered further within this report.

Table 1. Six invasive species listed on the Third Schedule of S.I. 477/2011 that have been recorded within approximately 2 km of the proposed Fethard sewerage scheme. All records are from the NBDC. 1 km grid references (e.g. S7904) are according to TM65 Irish Grid.

Species group	Scientific name	Common name	Date of last record	Location notes
Flowering plant	*Allium triquetrum*	Three-cornered Leek	11/9/2008	Found in same 1 km square as proposed development (S7904)
Flowering plant	*Spartina anglica*	Common Cord-grass	26/9/2012	Found in saltmarsh in same 1 km square as proposed development (S7904)
Flowering plant	*Fallopia japonica*	Japanese Knotweed	6/11/2007	Found in same 1 km square as proposed development (S7904)
Flowering plant	*Rhododendron ponticum*	Rhododendron	26/9/2012	Found in adjacent 1 km square (S7905) north of proposed development
Flowering plant	*Hippophae rhamnoides*	Sea-buckthorn	26/9/2012	Found in two adjacent 1 km squares (S7905, S8003) north (Fethard townland) and south (Baginbun cliffs and strandline) of proposed development
Flowering plant	*Hyacinthoides non-scripta* × *H. hispanica*	Bluebell hybrid	19/5/2014	Found approx. 2 km west of proposed development (S7704, Ladywell Bridge)

The above table shows that three species – Three-cornered Leek (*Allium triquetrum*), Common Cord-grass (*Spartina anglica*) and Japanese Knotweed (*Fallopia japonica*) – have previously been recorded within the immediate vicinity (i.e., within approximately 0.5 km) of the proposed sewerage scheme. Three other species – Rhododendron (*Rhododendron ponticum*), Sea-buckthorn (*Hippophae rhamnoides*) and a non-native Bluebell hybrid (*Hyacinthoides non-scripta* × *H. hispanica*) – have been recorded within 2 km of it.

3.2 Invasive species field survey

A field survey was conducted at the proposed project site on the 4th April 2016 by Dr. Philip Perrin and Simon Barron of BEC Consultants. A map of the site layout is presented in Appendix 1. It should be noted that this initial site visit was conducted very early in the season for a habitat assessment (April to September). In the following site description, habitats are classified according to the Irish habitat classification system (Fossitt 2000) and also according to the Interpretation Manual of EU Habitats for habitats listed on Annex I of the EU Habitats Directive. The name and code of each habitat type is given.

The survey area, and the habitats and species recorded therein, are described below in two sections. The first is the northern section, which covers the existing Primary Treatment Tank location, Fethard Bridge, east of the bridge, west of the bridge, and along the road (R734). These five locations run sequentially from the existing Primary Treatment Tank location southwards to where a farm lane, which runs parallel to and south of Quay road, joins the R734 from the east.

The second section is the southeastern section, which encompasses the farm lane, fields and sea cliffs through to the bay. These locations run sequentially from the farm lane eastwards to the bay.

3.2.1 Northern section

The following two EU Annex I habitats were recorded in this part of the survey area:

- 1140 Mudflats and sandflats
- 1330 Atlantic salt meadows (saltmarsh)

The following 14 Fossitt (2000) habitats were recorded here:

- BC1 Arable crops
- BL1 Stone walls and other stonework
- BL3 Buildings and artificial surfaces
- CM1 Lower salt marsh
- CM2 Upper salt marsh
- CW2 Tidal rivers
- ED2 Spoil and bare ground
- GA1 Improved agricultural grassland
- GA2 Amenity grassland (improved)
- GS2 Dry meadows and grassy verges
- LS4 Mud shores
- WL1 Hedgerows
- WL2 Treelines
- WS1 Scrub

Existing Primary Treatment Tank location

The existing primary treatment tank is located in an ungrazed field to the east of the main street in Fethard. The area immediately surrounding the tank is fenced to prevent access, but the vegetation inside and outside the fence is very similar. It consists of a rank sward dominated by Cock's-foot (*Dactylis glomerata*). Herb cover within this sward is not very high but includes the following species:

Hogweed (*Heracleum sphondylium*), Knapweed (*Centaurea nigra*), Lesser Celandine (*Ficaria verna*), Ribwort Plantain (*Plantago lanceolata*), Creeping Buttercup (*Ranunculus repens*), Broad-leaved Dock (*Rumex obtusifolius*) and Common Nettle (*Urtica dioica*). It is best classified as GS2 Dry meadows and grassy verges.

Along the southeast edge of the field, at the top of a bank above the saltmarsh, is a strip of WS1 Scrub consisting mainly of Blackthorn (*Prunus spinosa*) and Bramble (*Rubus fruticosus* agg.). It has probably developed from an old hedgerow. Common Gorse (*Ulex europaeus*) and Sycamore (*Acer pseudoplatanus*) occur in this scrub but are infrequent. Fox (*Vulpes vulpes*) track and droppings were found in this area. This scrub is potentially used by Otter (*Lutra lutra*) as a resting place (see *East of bridge* section below for further details).

The route of the proposed pipeline leads from the existing Primary Treatment Tank down to the gate leading into this field from the main street. Here is found a small section of WL2 Treelines consisting of Alder (*Alnus glutinosa*), beneath which can be found Alexanders (*Smyrnium olusatrum*), Cleavers (*Galium aparine*), Common Nettle, Hogweed, Lesser Celandine and Bramble.

No invasive species were found in this section.

Fethard Bridge

The proposed pipeline route runs across Fethard Bridge, a historical stone structure over a small estuary. It can be categorised as BL1 Stone walls and other stonework. The parapets on either side support a well-developed community with Stonecrop (*Sedum sp*.), Common Bird's-foot-trefoil (*Lotus corniculatus*), Polypody (*Polypodium* sp.), Ivy (*Hedera helix*), Silky Wall Feather-moss (*Homalothecium sericeum*) and Red Fescue (*Festuca rubra*).

There appears to be only a small opening in the bridge through which water can pass, this occurring near the southern end, and possibly this is a sluice. The estuary on both sides of the bridge can be categorised as CW2 Tidal rivers.

No invasive species were found in this section.

East of bridge

To the east of the bridge the water appears to be quite saline. The estuary is dominated by an expanse of CM1 Lower salt marsh vegetation with a well-developed creek system. The majority of the saltmarsh is composed of beds of the non-native Common Cord-grass (*Spartina anglica*). There are, however, some fringing areas on the north side that constitute Annex I habitat 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*). This habitat consists of two vegetation communities, one dominated by Sea-purslane (*Atriplex portulacoides*) and the other by Common Saltmarsh-grass (*Puccinellia maritima*). Sea Plantain (*Plantago maritima*) and Sea Arrowgrass (*Triglochin maritimum*) also occur here. The habitat is only a couple of metres across in some places, but is more extensive further north in the area surrounding the existing outfall pipe.

Close to the bridge are some unvegetated areas of LS4 Mud shores. These constitute Annex I habitat 1140 Mudflats and sandflats not covered by sea water at low tide.

Behind the saltmarsh proper, a band of Common Couch (*Elytrigia repens*) occurs in places. Below the parapet of the bridge, Sea Beet (*Beta vulgaris*) and English Scurvygrass (*Cochlearia anglica*) were found. Animal paths were observed along the edge of the saltmarsh on the northern side below the scrub which are likely to belong to the Annex II species Otter (*Lutra lutra*). It is possible that Otter use the scrub to the north of the saltmarsh as a resting place. A Little Egret (*Egretta garzetta*) was observed in the marsh.

Common Cord-grass is listed on the Third Schedule of S.I. 477/2011, therefore there is a legal imperative on the contractor to ensure that the species is not transported or spread as a consequence of the proposed project.

West of bridge

To the west of the bridge, the water appears to be more freshwater in character, but is still tidally influenced. Mute Swan (*Cygnus olor*) and Mallard (*Anas platyrhynchos*) were observed here. On the northern bank are a small Wexford County Council depot (BL3 Buildings and artificial surfaces, ED2 Spoil and bare ground) and an area of rank CM2 Upper salt marsh. The sward is largely Common Couch but also found in the grassland were False oat-grass (*Arrhenatherum elatius*), Hogweed, Common Nettle, Broad-leaved Dock, Bramble and Hard Rush (*Juncus inflexus*).

No invasive species were found in this section.

Road (R734)

To the south of the bridge, the proposed pipeline route runs along the R734 road up the hill. The first section of road lies between the bridge and the turning on the east side for the quay. On the western side of this road section is a length of WL2 Treelines dominated by non-native species including New Zealand Broadleaf (*Griselinia littoralis*). Behind this lies the Fethard RNLI Station (BL3 Buildings and artificial surfaces, GA2 Amenity grassland (improved)). On the eastern side of the road is a tall, steep bank surmounted by a WL1 Hedgerow of Bramble and Blackthorn. The shady bank here supports an array of woodland species including Honeysuckle (*Lonicera periclymenum*), Lords-and-ladies (*Arum maculatum*), Greater Stitchwort (*Stellaria holostea*), Cleavers, Ivy, Herb Robert (*Geranium robertianum*), Soft Shield-fern (*Polystichum setiferum*), False Brome (*Brachypodium sylvaticum*) and Common Nettle. Behind the hedge lies a field of GA1 Improved agricultural grassland.

The second section of road runs from after the turning for the quay southwards to the point where the pipeline route turns off to the east down a farm lane. On the western side of the road here is a series of houses and gardens (BL3 Buildings and artificial surfaces, GA2 Amenity grassland (improved)), lying behind WL1 Hedgerows and WL2 Treelines. Between two of the houses is a small area of GS2 Dry meadows and grassy verges and WS1 Scrub. On the eastern side of the road is a low WL1 Hedgerow of Blackthorn and Bramble, behind which is a large ploughed arable field (BC1 Arable crops). Also along this section of road can be found Ash (*Fraxinus excelsior*), Privet (*Ligustrum* sp.), Ivy, Lords-and-ladies, Primrose (*Primula vulgaris*), Red Fescue, Hogweed and Common Nettle. Near to one of the first houses in this section the invasive non-native Montbretia (*Crocosmia aurea* × *C. pottsii*) is growing next to a hedge. At the junction with the farm lane at the other end of this section, the invasive non-native Three-cornered Leek (*Allium triquetrum*) is growing at the side of the road (Appendix 2).

Monbretia is invasive but is not listed on the Third Schedule of S.I. 477/2011, therefore there is no obligation on the contractor to prevent its spread. However, best practice dictates that every reasonable effort should be taken to minimise the spread of this species.

Three-cornered Leek is listed on the Third Schedule of S.I. 477/2011, therefore there is a legal imperative on the contractor to ensure that the species is not transported or spread as a consequence of the proposed project.

3.2.2 Southeastern section

One EU Annex I habitat was recorded in this part of the survey area, namely 1230 Vegetated sea cliffs of the Atlantic and Baltic coasts.

The following nine Fossitt (2000) habitats were recorded here:

- BC1 Arable crops
- BL3 Buildings and artificial surfaces
- CS1 Rocky sea cliffs
- GA2 Amenity grassland (improved)
- GS2 Dry meadows and grassy verges
- LR1 Exposed rocky shores
- LS2 Sand shores
- WL1 Hedgerows
- WL2 Treelines

Farm lane

The pipeline route turns off the public R734 road, through a gateway, and runs down a short farm lane. The southern side of this lane is mostly a WL2 Treeline of Leyland Cypress (*Cupressus* × *leylandii*) behind which is a house and curtilage (BL3 Buildings and artificial surfaces, GA2 Amenity grassland (improved)). Beneath this treeline, some small patches of Three-cornered Leek (*Allium triquetrum*) can be found growing. The northern side of the lane is bordered by a low WL1 Hedgerow of Bramble (*Rubus fruticosus* agg.) and Blackthorn (*Prunus spinosa*) behind which lies a ploughed field (BC1 Arable crops). There are a few specimens of Butterfly-bush (*Buddleja davidii*) growing in this hedge.

Butterfly-bush is invasive but is not listed on the Third Schedule of S.I. 477/2011, therefore there is no obligation on the contractor to prevent its spread. However, best practice dictates that every reasonable effort should be taken to minimise the spread of this species.

Three-cornered Leek is listed on the Third Schedule of S.I. 477/2011, therefore there is a legal imperative on the contractor to ensure that the species is not transported or spread as a consequence of the proposed project.

Fields

The lane opens out into a large barley field (BC1 Arable crops) at the eastern end. The pipeline route runs close to the northern boundary of this field which is a sparse WL1 Hedgerow of Blackthorn, Bramble and Gorse (*Ulex europaeus*). The Gorse has been burnt in the recent past. Some Primroses (*Primula vulgaris*) grow beneath the hedge. While it does not lie directly on the pipeline route, it should be noted that the western boundary hedge in this first field supports several patches of the invasive non-native Three-cornered Leek (*Allium triquetrum*).

The route exits this field to the east and enters a second field which is the proposed location of the new wastewater treatment plant (WwTP). The northwestern, southwestern and northeastern boundaries of this field are also sparse WL1 Hedgerows. Near the northern corner, wetter ground by the hedge supports Common Reed (*Phragmites australis*). Some Fox (*Vulpes vulpes*) droppings were noted along the boundaries and it is likely that some of the smaller holes observed have been used by Rabbit (*Oryctolagus cuniculus*). Robin (*Erithacus rubecula*) and Blackbird (*Turdus merula*) were observed.

Just to the north of the WwTP field is a grassy field of rank Red Fescue (*Festuca rubra*) with abundant Wild Carrot (*Daucus carota*). Also present here are Kidney Vetch (*Anthyllis vulneraria*), Red Clover (*Trifolium pratense*), Ribwort Plantain (*Plantago lanceolata*) and Broomrape (*Orobanche* sp.). It does not appear to be grazed by livestock so it is best classified as GS2 Dry meadows and grassy verges.

Rabbit is invasive but is not listed on the Third Schedule of S.I. 477/2011, therefore there is no obligation on the contractor to prevent its spread.

Three-cornered Leek is listed on the Third Schedule of S.I. 477/2011, therefore there is a legal imperative on the contractor to ensure that the species is not transported or spread as a consequence of the proposed project.

Sea cliffs

To the southeast, the WwTP field is bordered by CS1 Rocky sea cliffs. These are approximately 8-9 m high, mostly rocky, but capped with a thick layer of soil and sediment. Along the top of the cliffs is a thick mat of Red Fescue with Thrift (*Armeria maritima*) also common and frequent patches of Sea Plantain (*Plantago maritima*). Also present are Common Bird's-foot-trefoil (*Lotus corniculatus*), Hogweed (*Heracleum sphondylium*), Yarrow (*Achillea millefolium*) and the invasive non-native Three-cornered Leek (*Allium triquetrum*). These cliffs constitute Annex I habitat 1230 Vegetated sea cliffs of the Atlantic and Baltic coasts. At the foot of the cliffs is a small area of LS2 Sand shores, behind a stretch of LR1 Exposed rocky shores. The marine section beyond the cliffs has been designated for the Annex I habitats 1160 Large shallow inlets and bays and 1170 Reefs within the Hook Head SAC.

Three-cornered Leek is listed on the Third Schedule of S.I. 477/2011, therefore there is a legal imperative on the contractor to ensure that the species is not transported or spread as a consequence of the proposed project.

Table 2 summarises the locations of Three-cornered Leek and Common Cord-grass within and in the vicinity of the footprint of the Fethard sewerage scheme. The locations are shown in Appendix 3 and grid references are given in Appendix 4.

Table 2. Description of the locations of species listed on the Third Schedule of S.I. No. 477/2011.

Species	Location	Fossitt habitat	Area covered	Location description
Allium triquetrum	1	BL3 Buildings and artificial surfaces	3-5 m^2	At the junction of the R734 road with the farm lane, growing at the side of the road.
Allium triquetrum	2	WL2 Treeline	1-2 m^2	At 2-3 locations beneath a treeline along the farm lane.
Allium triquetrum	3	WL1 Hedgerow	5-10 m^2	Western boundary hedge of barley field (note: does not lie directly on the pipeline route)
Allium triquetrum	4	CS1 Rocky sea cliffs	<1 m^2	Along the top of Annex I sea cliffs.
Spartina anglica		CM1 Lower salt marsh	5.6 ha *	In saltmarsh east of Fethard Bridge and adjacent to the existing treatment tank.

* From McCorry & Ryle (2009): area given for *Spartina* swards in the Fethard subsite of Bannow Bay SAC.

4 Discussion and recommendations

The two invasive species Three-cornered Leek and Common Cord-grass, listed on the Third Schedule of S.I. 477/2011, were found within or adjacent to the footprint of the proposed Fethard sewerage scheme. Japanese Knotweed, although recorded within the same 1 km square as the proposed development, was not recorded during this initial survey.

Three-cornered Leek and Common Cord-grass are listed on the Third Schedule of S.I. 477/2011. Part 6 of S.I. 477/2011 is entitled *Prohibition on introduction and dispersal of certain species* and the most pertinent paragraphs, 2, 3, and 7a, within Regulation 49 are reproduced below:

> (2) Save in accordance with a licence granted under paragraph (7), any person who plants, disperses, allows or causes to disperse, spreads or otherwise causes to grow in any place specified in relation to such plant in the third column of Part 1 of the Third Schedule, any plant which is included in Part 1 of the Third Schedule, shall be guilty of an offence.
> (3) Subject to paragraph (4), it shall be a defence to a charge of committing an offence under paragraph (1) or (2) to prove that the accused took all reasonable steps and exercised all due diligence to avoid committing the offence.
> (7)(a) One or more persons may make an application for a licence, under this paragraph, for the purposes of complying with the requirements of paragraph (1) or (2).

The licence referred to can be obtained from the National Parks and Wildlife Service (NPWS). If transporting the species to a waste facility, the facility must be notified that the waste includes a plant species listed on the Third Schedule of S.I. 477/2011 and the waste facility must be licensed to accept this type of waste.

For the invasive species Three-cornered Leek and Common Cord-grass the following information should be considered, as an invasive species management plan must be put in place before works start on the Fethard sewerage scheme.

4.1 Three-cornered Leek

i. Three-cornered Leek has a medium risk score of 15 (ISI 2016). Although the species is not judged to be high risk, it is still judged to have a significant impact on native species and habitats.

ii. Three-cornered Leek is a bulbous perennial herb that is naturally spread by ant-dispersed seed (Preston *et al.* 2002) but is also spread either deliberately or inadvertently by humans. It is most commonly found along roadsides, hedgerows, and in disturbed or waste ground, but has also been recorded within woodland habitats. Three-cornered Leek was introduced into cultivation in Britain and Ireland by 1759 and naturalised populations were established by 1849 (Preston *et al.* 2002). The species has naturalised and become increasingly abundant in areas with a milder climate. Three-cornered Leek has increased in numbers and range over the last 50 years (Preston *et al.* 2002).

iii. Three-cornered Leek is most common in the east and south of Ireland and is virtually absent from the centre of the island and the western counties of Galway and Mayo. On the island of Ireland it has been recorded in 118 10 km^2 squares between 1987 and 1999 (Preston *et al.* 2002) or 12% of the 963 10 km^2 squares within Ireland.

iv. Where Three-cornered Leek becomes established it can form dense populations that can dominate an area to the detriment of native plant species and the biodiversity of native habitats such as hedgerows and woodlands. During the National Survey of Native Woodlands (Perrin *et al.* 2008), the species was recorded at nine native woodland sites, including one Nature Reserve and three sites with other designations (proposed Natural Heritage Areas or Special Areas of Conservation). Therefore Three-cornered Leek could be viewed as a species that is impacting on protected sites within Ireland.

v. Three-cornered Leek is a cultivated species with all parts of the plant reported to be edible; it therefore has no known negative implications for human health.

vi. During the proposed Fethard sewerage scheme this invasive species could be spread by the bulbs and seeds being dug up during pipe laying and either transported with soil/spoil from the site or inadvertently spread within the mud adhering to operatives and equipment.

vii. During the literature search no detailed specific guidance documents on best practices for working in the vicinity of Three-cornered Leek or specific biosecurity protocols were found. However, some web sites, such as www.downgardenservices.org.uk, do discuss the eradication of the species and generic documents for biosecurity protocols are available such as the *Biosecurity Protocol for Field Survey Work* (IFI 2010). Such sources were utilised when writing the recommendations listed below in Section 4.3.

4.2 Common Cord-grass

i. Common Cord-grass has a high risk score of 18 (ISI 2016). As a high-risk species (a score of 18 or higher) it is judged to have a significant impact on native species and habitats.

ii. Common Cord-grass is a deep-rooting perennial grass that spreads by stout, fleshy rhizomes, forming large clumps and extensive meadows (Hubbard 1984). It is an invasive species that is found on saltmarshes around the coast of Ireland and has the capacity to spread on unvegetated mudflats adjacent to the saltmarsh and into the lower saltmarsh zones, creating Common Cord-grass swards and various habitat mosaics (McCorry & Ryle 2009). Common Cord-grass was frequently planted in the past as a mud-binder in estuaries (Preston *et al*. 2002). It was first planted in Ireland in Cork Harbour in 1925, with no evidence of the plant having been found in the country before that time (McCorry *et al*. 2003). Further plantings subsequently took place in other estuaries around the country, including Baldoyle, Co. Dublin, Fergus Estuary, Co. Clare, Westport, Co. Mayo and Belfast Lough, Co. Antrim, and after 1950 it was noted that almost continuous swards had formed at some of these locations (McCorry *et al*. 2003).

Where Common Cord-grass becomes established it can form dense stands in estuaries (Preston *et al*. 2002). Data from the Saltmarsh Monitoring Project (McCorry & Ryle 2009) indicate that the majority of Common Cord-grass swards in Ireland have developed on intertidal mudflats rather than on saltmarsh.Spread of Common Cord-grass occurs in two phases: initial invasion and establishment of seedlings or vegetational fragments, followed by expansion of tussocks by radial clonal growth of up to 30cm per year (Global Invasive Species Database 2016). Spreading tussocks then coalesce into larger clumps that can form extensive swards. Seed production, viability and germination of Common Cord-grass is unpredictable and seed does not set in most years, so spread by clonal expansion is the main method of dispersal. Less than 5% of the spikelets produced by the plant are likely to produce viable seed, and seeds do not form a seed bank, so seeds failing to germinate in their first season do not remain viable (Global Invasive Species Database 2016).

iii. On the island of Ireland Common Cord-grass has been recorded in 69 10 km^2 squares between 1987 and 1999 (Preston *et al.* 2002) or 7% of the 963 10 km^2 squares within Ireland. The main concentrations are within the large estuaries of the mid-west, south, southeast, northeast and north. It is virtually absent from the west and northwest.

iv. Common Cord-grass can endure longer periods of inundation than other saltmarsh species, and can trap sediment by means of its extensive root and rhizome system, which allows it to actively and aggressively modify its habitat in its favour (McCorry *et al*. 2003). It can thus spread rapidly and is highly competitive. The main impact of the spread of Common Cord-grass on the Annex I saltmarsh habitat 1330 Atlantic Salt Meadows is by altering the sward structure (sward height is higher and denser) in the lower-pioneer saltmarsh community dominated by Common Saltmarsh-grass and/or Sea Purslane and creating *Spartina* sward habitat in former pioneer and lower saltmarsh (McCorry & Ryle 2009). However, while invasive Common Cord-grass is generally thought to out-compete most saltmarsh species in the lower marsh zone, it seems to have provided new habitat for colonisation by Perennial

Glasswort (McCorry & Ryle 2009). The majority of the increase of Common Cord-grass swards has been at the expense of mudflats (McCorry & Ryle 2009).

A comparison by McCorry & Ryle (2009) between observations made at Fethard during the NPWS Rare Plant Surveys (1990) and records made during the Saltmarsh Monitoring Project in 2007-2008 showed that the cover of Common Cord-grass had significantly increased in the interim at several locations on the saltmarsh.

v. Common Cord-grass has no known negative implications for human health.

vi. During the proposed Fethard sewerage scheme this invasive species could be spread by rhizomes or young plants being spread or dug up during laying of the storm overflow pipe and either transported with soil/spoil from the site or inadvertently spread within the mud adhering to operatives and equipment.

vii. The document *Biosecurity Protocol for Field Survey Work* (IFI 2010) is particularly relevant for Common Cord-grass as it deals specifically with working in aquatic environments, and it details what protocols need to be followed so that no invasive species are spread as a consequence of that work. As well as ensuring that invasive species are not spread from one part of the site to another, good biosecurity protocols will also ensure that no invasive species currently absent from the construction site (such as Zebra mussels) are inadvertently introduced into the area by construction machinery.

4.3 Recommendations to prevent the dispersal of Three-cornered Leek and Common Cord-grass

Under Regulation 49 of S.I. 477/2011 there are restrictions placed on the dispersal of Three-cornered Leek and Common Cord-grass and it is important that the works, particularly during the pipe laying with the associated movement of workers and machinery, do not inadvertently spread the species.

It is recommended that in this particular case the best approach for Three-Cornered Leek is to eradicate it from the footprint of the works (locations shown in Appendix 3) before any excavations commence.

For Common Cord-grass, because of the greater conservation value and vulnerability of the saltmarsh habitats in which it is found, and the greater mobility of herbicides in water, the emphasis should be placed on minimising spread of the species, largely through the careful removal, storage and subsequent replacement *in situ* of turfs from the saltmarsh during construction of the storm overflow. McCorry & Ryle (2009) have stated the following: “A general policy of active Common Cord-grass control in Irish saltmarshes is not recommended. Any available resources should be used to prevent the spread of this species to new sites, specifically along the west coast of Ireland and to eradication of new populations. There is very little rationale in attempting to control Common Cord-grass at large sites like the Shannon Estuary or Dundalk Bay where there is very limited likelihood of success without considerable outlay of resources.” For this reason, the recommendation of this AIS report is to aim to minimise the spread of the species during excavation for the storm overflow pipe in the saltmarsh, rather than eliminate it from the areas where works are due to take place.

Eradication of Three-cornered Leek

One of two eradication methods could be employed, either excavating the species and transporting it to a licensed waste facility, or targeted spraying of the species with a herbicide such as glyphosate. Some of the negative impacts on the environment due to herbicide spraying are limited by glyphosate residues being generally immobile in the soil and by glyphosate being degraded by soil microbes.

Consultation should take place between engineers and an ecologist before any eradication of the plant takes place. Such consultation will determine what populations of the plant are directly within areas that will be disturbed during the works. For these populations, it is recommended that they be sprayed with glyphosate in early May (before the species has set seed) and then re-sprayed, if required, at the end of the growing season (late August) and the following spring (April/early May) (Table 3). This should eradicate the species from within the footprint of the proposed project.

It is not considered that it is necessary to eradicate all plants from the local vicinity (outside of the footprint of works), nor is it incumbent upon the contractor to do so. As some populations of the plant may still be growing within the gardens of local residents, care should be taken near residences where Three-cornered Leek is growing, or where a naturalised population (i.e. one that is growing and reproducing freely outside the confines of a garden) is contiguous with a cultivated population. Some consultation with local people may be required to ensure that local sensitivities are respected.

Spraying operatives should either be trained in how to recognise Three-cornered Leek or an experienced botanist should accompany them during spraying. With appropriate training, the targeted spraying of the species represents the most environmentally sensitive solution.

The alternative to eradication is that the population remains *in situ* and biosecurity protocols are put in place to prevent the works inadvertently spreading the species. Biosecurity protocols would include fencing-off the known locations of the species, use of appropriate signage and training for site operatives, and a designated cleaning area and facilities (e.g., high pressure hoses) for all operatives and equipment that has worked within the fenced-off zone. This option is seen as less favourable due to the need for ongoing vigilance during the period of works.

Prevention of spread of Common Cord-grass

The NIS for the northern section of the Fethard sewerage scheme describes mitigation measures for the saltmarsh and mudflat habitat during construction of the storm overflow which include temporary storage of excavated material on a geotextile membrane during construction of the storm overflow to assist the recovery of buried plants (O'Neill *et al*. 2016). Some of this excavated material is likely to contain Common Cord-grass plants as well as typical Annex I saltmarsh species. Storage of excavated material should be in an area that is not susceptible to colonisation by Common Cord-grass; a concrete surface or improved agricultural grassland field would be suitable.

During transportation of the excavated material to the temporary storage area, every care should be taken to ensure that all living plants, plant material, mud and soil remain contained, as any of these could act as a source of accidental spread of the species outside of its existing area. If the temporary storage area is off site, a licence will need to be obtained from NPWS to transport material containing a plant species listed on the Third Schedule of S.I. 477/2011. If transporting any material containing Common Cord-grass to a waste facility, the facility must be notified that the waste includes a species listed on the Third Schedule of S.I. 477/2011 and must be licensed to accept this type of waste.

Biosecurity protocols should be put in place to prevent the works inadvertently spreading the species. For Common Cord-grass these include fencing off the temporary storage area for excavated material to prevent access, use of appropriate signage and training for site operatives, and a designated cleaning area and facilities (e.g. high pressure hoses) for all operatives and equipment that have worked on any saltmarsh excavations for the storm overflow pipe. The IFI (2010) document *Biosecurity Protocol for Field Survey Work* is again recommended as it lists procedures to be followed on a routine basis, e.g., for cleaning machinery and PPE.

5 Summary conclusions

- To date, two species listed on the Third Schedule of S.I. 477/2011 – Three-cornered Leek and Common Cord-grass – have been recorded in the footprint of the proposed Fethard sewerage scheme. This means that there is a legal imperative on the contractor to ensure that the species is not transported or spread as a consequence of the proposed project.
- An invasive species management plan must be put in place before works start on the Fethard sewerage scheme. The information provided in Section 4 will help to inform that management plan.
- To prevent the spread of Three-cornered Leek during laying of the pipelines, the species should be eradicated from areas to be disturbed before works commence, following consultation between engineers, ecologists and, if necessary, local residents.
- To prevent the spread of Common Cord-grass during construction of the storm overflow or any other works taking place where Common Cord-grass occurs (i.e., in the saltmarsh or mudflat habitats) the biosecurity recommendations set out in Section 4.3 should be followed to ensure there is no spread of the plant as a consequence of the transportation and temporary storage of excavated mud, or from adhesion of excavated Common Cord-grass plants to unwashed construction machinery.

6 Reference list

Fossitt, J.A. (2000) *A Guide to Habitats in Ireland.* The Heritage Council, Kilkenny.

Global Invasive Species Database (2016) Species profile: *Spartina anglica*. Downloaded from http://www.iucngisd.org/gisd/species.php?sc=76 on 27-04-2016.

Hill, M.O., Blackstock, T.H., Long, D.G. and Rothero, G.P. (2008) A Checklist and Census Catalogue of British and Irish Bryophytes. Updated 2008. Middlewich: British Bryological Society.

Hubbard, C.E. (1984) Grasses: A guide to their structure, identification, uses, and distribution in the British Isles. New edition, revised by JCE Hubbard. Penguin Books, London.

IFI (Inland Fisheries Ireland) (2010) Biosecurity protocol for field survey work. http://www.fisheriesireland.ie/Biosecurity/biosecurity-protocol-for-field-survey-work.html. Accessed 22/04/2016.

ISI (Invasive Species Ireland) (2016). Amber list. http://invasivespeciesireland.com. Accessed 22/04/2016.

Kelly, J., O'Flynn, C., & Maguire, C. (2013) Risk analysis and prioritisation for invasive and non-native species in Ireland and Northern Ireland. http://invasivespeciesireland.com/wp-content/uploads/2013/03/Risk-analysis-andprioritization-29032012-FINAL.pdf. Accessed 22/04/2016

McCorry, M.J., Curtis, T.G.F. & Otte, M.L. (2003) *Spartina* in Ireland. In: Otte, M.L. (Ed.) Wetlands of Ireland. Distribution, ecology, uses and economic value. UCD Press, Dublin, Ireland, pp. 44-50.

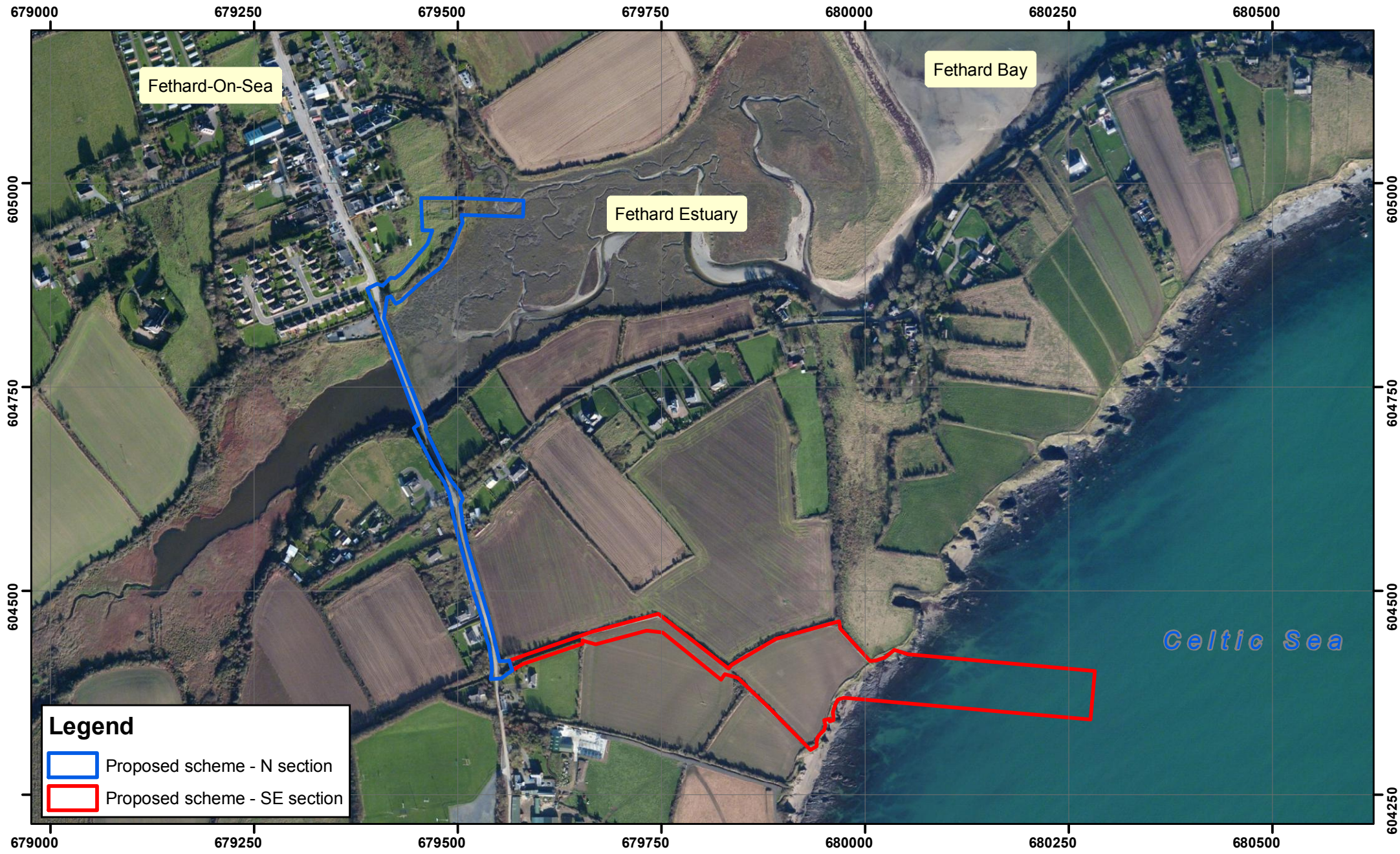
McCorry & Ryle (2009) Saltmarsh Monitoring Project 2007-2008: Final Report. Report for National Parks and Wildlife Service, Dublin.

Perrin, P.M, Martin, J.R., Barron, S.J., O'Neill, F.H., McNutt, K.E. & Delaney, A.M. (2008) National Survey of Native Woodlands 2003-2008: Volume I: Main report. Unpublished report for National Parks and Wildlife Service, Dublin.

Preston, C.D., Pearman, D.A. & Dines, T.D. (eds.) (2002) *New Atlas of the British and Irish Flora*. Oxford University Press, Oxford.

Stace, C. (2010) *New Flora of the British Isles* (3rd edition). Cambridge University Press.

Appendix 1: Fethard-On-Sea proposed sewerage scheme - Location of works



N

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Map Projection: IRENET95 Irish Transverse Mercator

1:6,000

0 62.5 125 250 Meters

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Appendix 2: Site photographs

See Appendix 3 for locations of photographs

Plate 1: Common Cord-grass in salt marsh: high risk of spread by works

Plate 2: Three-cornered Leek beside road opposite farm lane: medium risk of spread by works

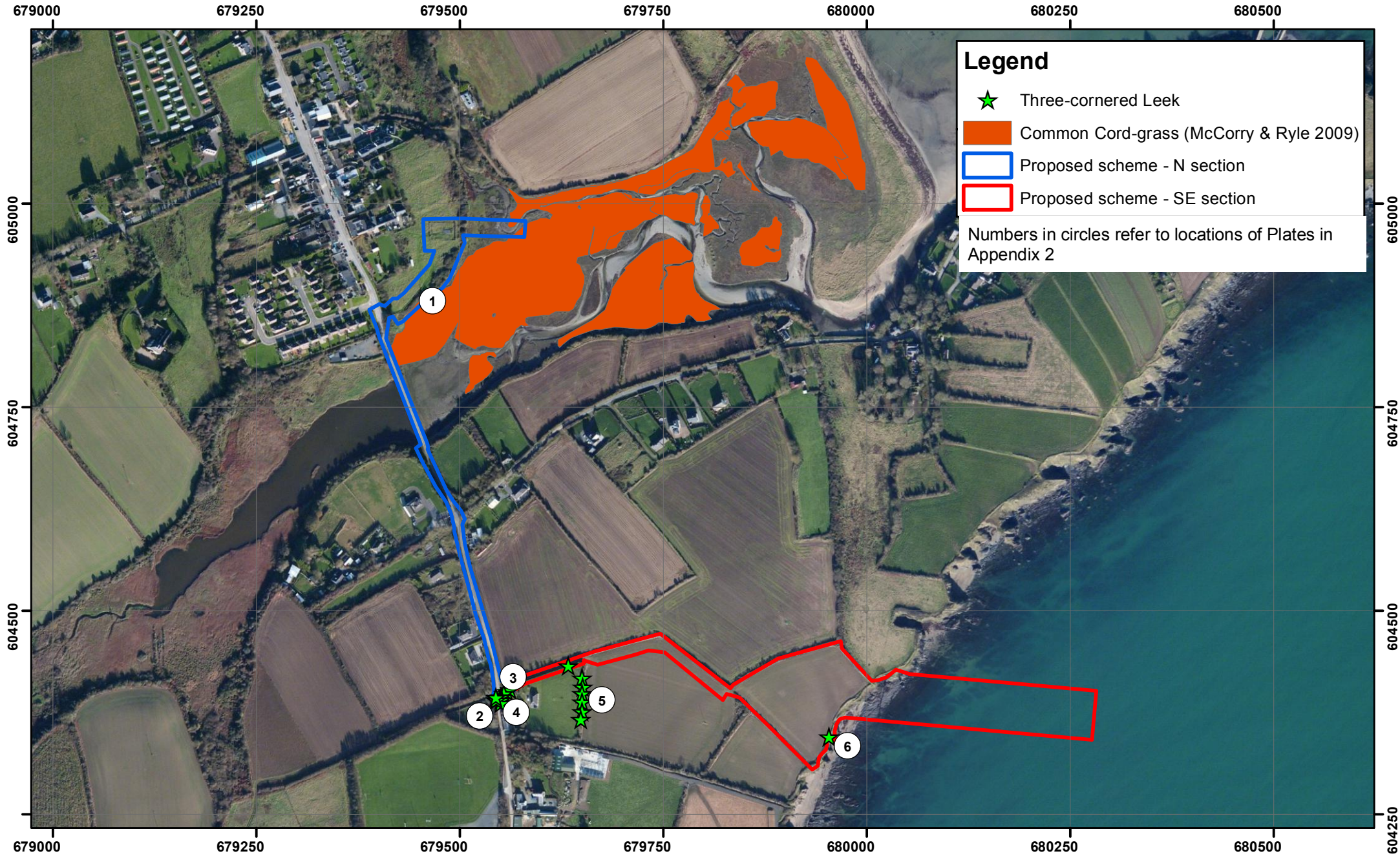
Plate 3: Three-cornered Leek beside heap of spoil at western end of farm lane: high risk of spread by works

Plate 4: Three-cornered Leek beside boundary wall of residence: low risk of spread by works

Plate 5: Three-cornered Leek in hedge south of footprint: low risk of spread by works

Plate 6: Three-cornered Leek on top of sea cliffs: low risk of spread by works

Appendix 3: Fethard-On-Sea proposed sewerage scheme - Location of Alien Invasive Species



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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Map Projection: IRENET95 Irish Transverse Mercator

1:6,000

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Appendix 4: ITM coordinates of Three-cornered Leek and Common Cord-grass

(a) Three-cornered Leek (*Allium triquetrum*). Coordinates are GPS waypoints of small individual patches recorded during field survey. Locations refer to those given in Table 2.

Location	*Eastings*	*Northings*
1	679558	604401
1	679562	604404
1	679555	604398
1	679551	604395
1	679551	604391
1	679550	604387
1	679545	604390
1	679545	604394
2	679633	604432
3	679651	604417
3	679651	604406
3	679651	604398
3	679650	604388
3	679650	604376
3	679649	604367
4	679954	604346

(b) Common Cord-grass (*Spartina anglica*). Coordinates are centroids of polygons mapped by McCorry & Ryle (2009) and ground-truthed during field survey for changes in extent. The 2009 polygons were found also to reflect the 2016 situation. ASM = Atlantic Salt Meadows (EU Annex I Habitat 1330).

Habitat	*Eastings*	*Northings*	*Polygon Area (m^2)*
Spartina swards	679524	604796	1,009.6
Spartina sward dominated with some ASM	679623	604824	1.7
Spartina swards	679444	604870	118.6
Spartina swards	679918	605076	4,774.5
Spartina sward dominated with some ASM	679736	604890	10,379.3
ASM/*Spartina* mosaic	679690	604954	280.0
ASM/*Spartina* mosaic	679966	605099	4,411.9
ASM/*Spartina* mosaic	679821	605082	154.4
Spartina swards	679639	605017	155.4
ASM/*Spartina* mosaic	679872	604948	2,055.0
Spartina swards	679805	604983	618.7
Spartina swards	679782	605014	4.6
ASM/*Spartina* mosaic	679859	605128	2,392.1
ASM/*Spartina* mosaic	679763	604997	1,754.8
ASM/*Spartina* mosaic	679754	605026	622.9
ASM/*Spartina* mosaic	679854	605032	193.6
Spartina swards	679600	604932	33,952.4

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