



# Dune Protection Plan for the Fingal Coast, Co. Dublin

**FINAL REPORT**

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## EXECUTIVE SUMMARY

This study was commissioned by Fingal County Council to assess the current condition and usage of sand dune systems at specific sites on the Fingal coast, Portmarnock, Portrane and Rush, and subsequently prepare dune management plans to address the issues prevalent at each site. The key issues that were specifically identified were erosion and coastal change, public access, sea buckthorn control, vandalism and fire control, provision of information and encroachment of development.

A literature review for coastal management material associated with the sites and general coastal management documents that considered the above issues was conducted. In parallel to this digital data was also collected and collated to generate site specific Geographical Information Systems (GIS) for application at each location. A series of site visits was also conducted to assess the current status of each of the sites and to identify the best suite of recommendations for each specific site.

There were a number of **cross-cutting issues** identified across the region which were relevant at each of the sites:

- lack of physical monitoring data e.g. beach profiles.
- poor or badly maintained user information e.g. signage
- anti-social behaviour e.g. vandalism

To address these regional issues the following main recommendations were put forward:

- A routine monitoring programme should be implemented across the region in order to collect and collate requisite physical data as part of an overall integrated plan for sustainable management, for the Fingal coastline.
- A review of signage content should be completed and, where applicable, new signs should be added and obsolete signs removed. Signage provided should aim to be informative (educational) rather than prohibitive and should be as innovative as possible.
- A seasonal beach warden should be employed to help with education, enforcement and monitoring as well as raising awareness. Support should be provided for the Warden by establishing a hotline for users to report detrimental usage of the amenity and local Gardai should be consulted to suggest further methods for controlling anti-social behaviour.
- All loose flammable material should be removed; evidence of previous fires removed and damaged areas replanted to reduce the potential for further damage from illicit fires.

The most pressing local issues identified for each site were:

- Portmarnock, problems with access and usage issues as a direct result of the sheer volume of users.
- Portrane, housing development, either completed or proposed, and its proximity to the eroding face.
- Rush, sea buckthorn spread and its significant threat to local biodiversity and vehicular access to the beach.

Therefore the following were identified as key to improving local management:

- Portmarnock: the access paths should be improved and the dilapidated fence between the golf course and the dunes should be removed. In addition the temporary chain-link should be carefully removed to avoid de-stabilising the dunes as it is now a potential danger to beach users. A recreational area could be created to help alleviate pressure on sand dunes and sea buckthorn should be carefully controlled.
- Portrane: a setback line should be considered to discourage development in close proximity to the eroding face and relevant bodies should be made aware of the changing coastline at this site and the implications for potential development. The sea buckthorn present should be removed before it has the potential to spread to adjacent areas.
- Rush: after a detailed ecological study and consultation with local stakeholders the sea buckthorn should be removed. Vehicular access to the beach should be banned and signage to the car park improved.

When the study was completed, all the recommendations were presented to local stakeholders at each of the three sites and their opinions sought for inclusion in the final report. Overall all the cross-cutting recommendations were well received as were the majority of the site specific recommendations put forward. There were specific concerns raised with respect to some of the recommendations including: (1) dune stability if fencing and sea buckthorn were removed, (2) design and route of new pathways, (3) issues with land ownership and (4) rights of access. However it was felt that if proper consultation was undertaken with the stakeholders that the recommendations put forward could form the basis for an effective dune management plan for the Fingal coastline.

## ACKNOWLEDGEMENTS

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## CONTENTS

	<i>Pg</i>
EXECUTIVE SUMMARY	i
ACKNOWLEDGEMENTS	iii
CONTENTS	iv
LIST OF FIGURES	vi
LIST OF TABLES	vii
1.0 INTRODUCTION	1
1.1 MANAGEMENT ISSUES	1
1.1.1 Erosion and Coastal Change	2
1.1.2 Public Access	2
1.1.3 Sea buckthorn ( <i>Hippophae rhamnoides</i> ) control	2
1.1.4 Vandalism and Fire Control	3
1.1.5 Provision of Information	4
1.1.6 Encroachment of Development	4
1.2 DESIGNATED AREAS	4
1.2.1 Portmarnock	4
1.2.2 Portrane and Rush	6
2.0 METHODOLOGY	8
2.1 IDENTIFICATION OF BEST PRACTICE IN MANAGEMENT APPROACHES	8
2.2 DETERMINATION OF THE TECHNIQUES EMPLOYED HISTORICALLY, EVALUATION OF THE CURRENT STATUS OF THE DUNES AND IDENTIFICATION OF ANY PATTERNS OF CHANGE	8
2.3 COLLECTION AND COLLATION OF ALL RELEVANT DATA SOURCES AND UTILISATION OF A SINGLE GEOGRAPHICAL INFORMATION SYSTEM (GIS)	8
3.0 RESULTS	10
3.1 OVERALL LITERATURE REVIEW	10
3.1.1 Sand dune protection	10
3.1.2 Access	13
3.1.3 Buckthorn control	13
3.1.4 Signage, Vandalism and Fire Control	14
3.1.5 Development Encroachment	15
3.2 SITE REVIEWS	16
3.2.1 Portmarnock	16
3.2.2 The Burrows, Portrane	31

3.2.3 South Beach, Rush	37
4.0 DISCUSSION	45
4.1 COASTAL CHANGE AND COASTAL PROTECTION	45
4.2 SIGNAGE/ VANDALISM / FIRE CONTROL	47
4.3 ACCESS	48
4.4 DEVELOPMENT ENCROACHMENT	49
4.5 SEA BUCKTHORN	50
5.0 RECOMMENDATIONS	52
5.1 VELVET STAND - PORTMARNOCK	52
5.1.1 Coastal Change / Dune Protection / Access	52
5.1.2 Vandalism/ Fire Control	53
5.1.3 Control of sea buckthorn ( <i>Hippophae</i> )	54
5.2 THE BURROWS – PORTRANE	54
5.2.1 Coastal Change	54
5.2.2 Vandalism/ Fire Control	54
5.2.3 Access and Provision of information (Signage)	55
5.2.4 Development Encroachment	55
5.3 SOUTH BEACH, RUSH	56
5.3.1 Coastal Change	56
5.3.2 Sea buckthorn ( <i>Hippophae</i> ) control	56
5.3.3 Access and Provision of information (Signage)	57
5.3.4 Vandalism/ Fire Control	57
6.0 STAKEHOLDER COMMUNITY CONSULTATION	58
7.0 REFERENCES	61
APPENDIX I: SITE RECOMMENDATIONS	A1
APPENIX II: BUCKTHORN CONTROL	A2
APPENDIX II: COASTAL MONITORING RECOMMENDATIONS	A4

## LIST OF FIGURES

	Pg
Figure 1.0: Map showing the location of the three study on the Fingal coast, Co. Dublin	1
Figure 1.1: Sea buckthorn ( <i>Hippophae rhamnoides</i> ) at Rush	3
Figure 1.2: Annotated aerial photograph showing designated areas and location of rare plants at Portmarnock	5
Figure 1.3: Annotated aerial photograph showing designated areas and location of rare plants at Portrane	6
Figure 1.4: Annotated aerial photograph showing designated areas and location of rare plants at Rush	7
Figure 2.1: Example from the dedicated Geographical Information System (GIS) for Fingal Coastline (Rush)	9
Figure 3.1: Setback distances at the Eastern Coromandel (Peninsula) Beaches, New Zealand (Environment Waikato, 2002)	16
Figure 3.2 Annotated aerial photograph (2005) showing the location of Portmarnock	17
Figure 3.3: Walkers on Velvet Strand, Portmarnock	22
Figure 3.4: Instability caused by undercutting at Portmarnock foredunes	22
Figure 3.5: Sand compaction from walking and horse riding on northern Velvet Strand	23
Figure 3.6: Embryo dunes to the south of Velvet Strand	23
Figure 3.7: Scouring at either side of protective rock armour at Velvet Strand	23
Figure 3.8: Erosion of backdunes on access path between golf courses at Portmarnock foredune	23
Figure 3.9: Sea buckthorn stands at the foredunes of the southern section of Velvet Strand	24
Figure 3.10: Signage intended to restrict access to damaged dunes at Portmarnock	24
Figure 3.11: Vandalised sign intended to prohibit access to Portmarnock golf links	24
Figure 3.12: Signage displaying permitted user activities at Velvet Strand	25
Figure 3.13: Vandalised signage at the main entrance at northern Velvet Strand	25
Figure 3.14: Evidence of bonfire remains at Portmarnock dunes	25
Figure 3.15: A sharp rusty object protruding the dune surface at Portmarnock	25
Figure 3.16: Annotated aerial photograph (2005) showing coastline evolution at Portmarnock	26
Figure 3.17: Annotated aerial photograph (2005) showing coastline evolution at Velvet Strand	27
Figure 3.18: Annotated aerial photograph (2005) showing sea buckthorn coverage along foredunes at Velvet Strand	28
Figure 3.19: Annotated aerial photograph of Portmarnock (2000) overlain (in red) with the 2005 extent of sea buckthorn layer	29
Figure 3.20: Annotated aerial photograph (2005) showing one potential route of the coastal walkway at Portmarnock	30
Figure 3.21: Annotated aerial photograph (2005) showing the location of The Burrows, Portrane	31
Figure 3.22: Vertical erosion of the dune face looking north on The Burrows, Portrane	32
Figure 3.23: Vertical erosion of the dune face looking south on The Burrows, Portrane	32
Figure 3.24: Holiday home development in close proximity to dune face at Portrane	33
Figure 3.25 Permanent housing in close proximity to the eroding dune face at Portrane	33
Figure 3.26: Evidence of vehicle use near salt marsh habitat at the northern end of The Burrows	33
Figure 3.27: Vehicle tracks through the salt marsh habitat at the northern end of The Burrows	33
Figure 3.28: Previous attempts to prevent vehicle access covered by accretion at northern end of The Burrows, Portrane	34

	<i>Pg</i>
Figure 3.29: Pedestrian paths cutting through the dunes at The Burrows, Portrane	34
Figure 3.30: Sea buckthorn at The Burrows, Portane	34
Figure 3.31: Spread of buckthorn to adjacent dune at The Burrows, Portrane	35
Figure 3.32: Vandalism of signage at The Burrows, Portrane	35
Figure 3.33: Signage prohibiting vehicular and pedestrian access and horse riding at The Burrows, Portrane	36
Figure 3.34: Annotated aerial photograph (2005) showing coastline evolution at The Burrows, Portrane	36
Figure 3.35: Figure 3.35: Annotated aerial photograph (2005) showing close proximity of development to the eroding dune face at Portrane	36
Figure 3.36: Figure 3.36: Annotated aerial photograph (2005) showing the location of Rush, South Beach	37
Figure 3.37: Sand dunes at South Beach, Rush	38
Figure 3.38: Embryo dune development and Marram grass establishment at South Beach, Rush	38
Figure 3.39: Vehicular control signage at South Beach, Rush	38
Figure 3.40: Signage at South Beach, Rush	38
Figure 3.41: Vehicles parked on the beach (car park in foreground) South Beach, Rush	39
Figure 3.42: Bonfire remains in the sand dunes South Beach, Rush	39
Figure 3.43: Extensive buckthorn establishment at South Beach, Rush	39
Figure 3.44: Buckthorn invading dune face at South Beach, Rush	39
Figure 3.45: Ad hoc coastal protection at South Beach, Rush	40
Figure 3.46: Housing close to the foreshore at South Beach, Rush	40
Figure 3.47: Vandalism of the Life Guard Hut at South Beach, Rush	40
Figure 3.48: Damaged signage on the beach at South Beach, Rush	40
Figure 3.49: Annotated aerial photo (2005) showing Sea buckthorn distribution at Rush, South Beach	41
Figure 3.50: Annotated aerial photograph (2005) showing Sea Buckthorn growth/spread from 2000 (yellow) to 2005 (red)	41
Figure 3.51: Annotated aerial photograph (2005) showing coastline evolution at South Beach, Rush	42
Figure 3.52: Annotated aerial photograph (2005) showing coastline evolution at the northern end of the South Beach, Rush	43
Figure 3.53: Annotated aerial photograph (2005) showing one potential route for a coastal walkway at South Beach Rush	43

## LIST OF TABLES

	<i>Pg</i>
Table 2.1: Acquired GIS layers from Fingal County Council Archives	8
Table 3.1: Range of options for dune erosion management (SNH and HR Wallingford, 2000)	12
Table 3.2: Review of coastal management documentation for Portmarnock	20
Table 3.3: Review of coastal protection at Portmarnock	21
Table 3.4: Review of coastal management documentation for Portrane	32
Table 4.1: Estimation of the scale of work required for implementation of proposed recommendations	57





## 1.0 INTRODUCTION

This study was commissioned by Fingal County Council to assess the current condition and usage of sand dune systems at Portmarnock, Portrane and Rush and subsequently prepare dune management plans to address the issues prevalent at each site. Research was conducted between October 2006 and March 2007 by members of the Coastal and Marine Resources Centre (CMRC) and the Department of Geography, University College Cork.

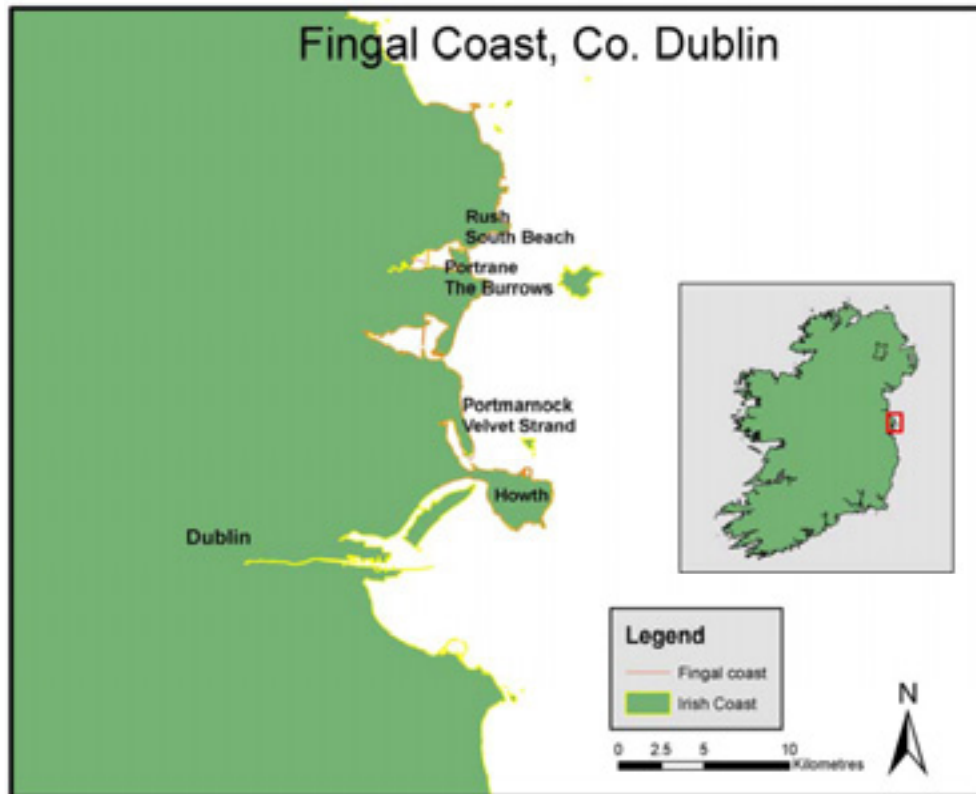


Figure 1.0: Map showing the location of the three study sites on the Fingal coast, Co. Dublin

The study sites Portmarnock (Velvet Strand), Portrane (The Burrows) and Rush (South Beach) are located in Fingal, North County Dublin on the east coast of Ireland. All the sites are situated close to the mouth of tidal estuaries and are characterised by the presence of sandy beaches and mature sand dune systems. The dunes are valuable amenities and are extensively utilised by local communities throughout the year and tourists in the summer. The sites are also located within, or in close proximity to, important conservation sites, which are afforded protection under national and international designation.

## 1.1 MANAGEMENT ISSUES

All the sites are subject to a variety of external pressures, are considered to hold an intrinsic value and have similar management issues as identified by the local authority in response to concerns of the respective local communities. The main issues identified for the region, some or all of which apply to the three sites investigated, are as follows:

- Erosion and Coastal Change
- Public Access
- Sea buckthorn Control

- Vandalism and Fire Control
- Provision of Information
- Encroachment of Development

### 1.1.1 Erosion and Coastal Change

The erosion of sand dunes can be caused by natural processes (aeolian [*wind*] or marine [*waves / tides*]) or anthropogenic forces (usage or development). The Fingal coast is a *soft* coastline that is particularly susceptible to coastal erosion and is characterised by a series of dune complexes which act as a natural buffer between the land and the sea. Short term adjustment and realignment of the coast is typical where beach barrier complexes occur and can take place as part of an ongoing long-term coastal change (Mulrennan 1990). Coastal change and its associated processes (i.e. erosion and accretion) are said to be part of a natural tendency towards equilibrium (ECOPRO, 1996). However, human activities can disrupt this balance and it has been recognised that this typically occurs where the coastal hinterland is of high economic, cultural or environmental value.

### 1.1.2 Public Access

Sand dune areas are often used as beach access routes and suffer from increased recreational pressure (ECOPRO, 1996). The main threats to sand dunes from public access include car parking in and around the sand dunes and vegetation trampling in the dunes. Dune vegetation is particularly vulnerable to trampling and if unchecked can eventually lead to vegetation degradation, aeolian erosion and blow-out formation. The degradation of dune vegetation is usually paralleled with the development of a network of paths and tracks. These usually originate from a central or main access route or car park and can cover an extensive area of the frontal dunes. Blowout formation may eventually increase dune susceptibility to more intense marine erosion. At popular sites the general public are usually entitled to access public areas and amenities through prescribed “public rights of way”. However, user access can be controlled and limited to particular areas (using Bye - laws) if current practice is detrimental to the resource. An effective management response to access problems requires site specific recommendations in order to account for the type and extent of detrimental usage.

### 1.1.3 Sea buckthorn (*Hippophae rhamnoides*) control

The structure and functioning of ecosystems are often dramatically affected by invasive species and these are therefore considered to be one of the major threats to the earth’s biodiversity (Binggeli, 1996). Sea buckthorn (Figure 1.1) is a nitrogen fixing woody plant in which seed dispersal is attributed to birds and is considered to be a highly invasive alien species in Ireland (Stokes and O’ Neill, 2004). The species was first recorded in Ireland c.1838 in Wexford and is thought to have been originally introduced to stabilise eroding dune systems (Binggeli *et al*, 1992). For more than a century, the *H. rhamnoides* shrub was controlled naturally in sand-dune ecosystems by rabbit grazing and was not considered “invasive” until the 1950s. An extensive woody plant species invasion occurred following the decline in rabbit numbers in the mid 1950s due to the outbreak of viral myxomatosis (Binggeli *et al*, 1992). The subsequent decline and slow recovery in coastal rabbit populations resulted in a significant expansion of *H.rhamnoides*

and suppression of lower growing plants in coastal areas. Nutrient enrichment, increased stabilisation and the acceleration of succession tend to be prevalent in areas where *H.rhamnoides* is dominant. This process can threaten and alter the composition of mesofauna and ground beetle communities (Binggeli *et al*, 1992). It is now widely recognised that sea buckthorn has impacted significantly on numerous sand dune ecosystems by altering ecosystem structure and by transforming the soil chemistry and nutrient availability.



Figure 1.1: Sea buckthorn (*Hippophae rhamnoides*) at Rush

The presence of extensive sea buckthorn stands can transform dune flora composition and decrease dune plant diversity, many of which are rare and require very specific nutrient conditions. In time, the soil enrichment can support larger trees such as elder (*Sambucus* species) and oak (*Quercus* species) and these can out compete *H.rhamnoides*. Once these more competitive species become established over a wide area, the succession from dune to woodland habitat is inevitable. In the Murlough dune system, Co. Down, *H.rhamnoides* first replaced typical dune vegetation and then Sycamore (*Acer pseudoplatanus*) out competed *H.rhamnoides* to eventually form woodland in place of the original dunes.

Management options for sea buckthorn control depend on a large number of variables including the conservation status of site/area, the age of stands, the extent /area of coverage, and the terrain.

#### 1.1.4 Vandalism and Fire Control

Anti-social behaviour at dunes and beaches can take many forms (McKenna *et al*, 2000). In the case of the Fingal coast, vandalism is the more prominent and threatens the amenity and environmental value of these particular sites. Signage and fencing are particularly at risk and have been damaged extensively, while bonfires and associated littering (e.g. beer cans and bottles) have caused localised damage to the dunes.

The coastal manager can do little to tackle the root causes of a group or individual's anti-social behaviour. However, a number of techniques can be used to discourage particular behaviours

(e.g. vandalism) and Bye-laws could be implemented to prohibit particular acts being carried out on the beach/ dune system (McKenna *et al*, 2000).

#### 1.1.5 Provision of Information

Lack of local signage, or the poor condition of the signage, can suggest a lack of ownership or responsibility. Signage can be used to inform on a range of uses including providing warnings about hazards, highlighting facilities, outlining and explaining management initiatives, and requesting compliance (McKenna *et al*, 2000). It can also help alleviate problems associated with public access, vandalism and fire control. The provision of information is essential to the success of dune restoration works and is an important managerial tool.

#### 1.1.6 Encroachment of Development

Beach hinterlands often become the focus of tourist/leisure development as they are valued for their scenic and recreational qualities (McKenna *et al*, 2000). Holiday home development has become increasingly popular within Ireland's coastal zone, where high demand in the property market has increased the land owner's willingness to maximise profit (McKenna *et al* 2000). Housing development and the construction industry boom have been driven by Ireland's "Celtic Tiger Economy". However, sand dunes are dynamic in nature and usually do not have the capacity to withstand large scale developments. Increased numbers of dwellings including houses (holiday or otherwise), caravans, mobile homes and built dwellings are evident at each of the sites on the Fingal coast.

### 1.2 DESIGNATED AREAS

This coastline is an important amenity but it also has a significant conservation role and each of the sites investigated contains protected areas for flora or fauna. These areas are designated under International, European and National Conventions and have associated legal implications and therefore any proposed management initiative needs to be aware of the particular designations for each of the sites.

#### 1.2.1 Portmarnock

Baldoyle Bay (Site code: 4016) is a designated Special Protected Area (SPA) under the EU Birds Directive (Figure 1.2) which seeks to protect, manage and regulate all bird species and their habitats. The Bay extends from just below Portmarnock village to the west pier at Howth, Co. Dublin. Large areas of mudflat are exposed at low tide and provide good quality feeding areas and roosting sites for a wide range of waterfowl species. These include an internationally important population of Pale-bellied Brent Geese (*Branta bernicla hrota*) and several nationally important populations of Bar-tailed Godwit (*Limosa limosa*) and Golden Plover (*Pluvialis spp.*). The Sluice River Marsh site is also a proposed Natural Heritage Area (pNHA).

The Bay is also a candidate Special Area of Conservation (SAC) [Site code: 000199]. The site contains four habitats listed in Annex I of the EU Habitats Directive: *Salicornia* mudflat, Mediterranean salt meadows, Atlantic salt meadows and tidal mudflats. Areas of saltmarsh

occur near Portmarnock bridge and Portmarnock Point with narrow strips along other parts of the estuary. Species such as glasswort *Salicornia* (*Salicornia spp*), sea purslane (*Halimione portulacoides*) and sea rush (*Juncus maritimus*) are also present at this site.

The dune hills at Portmarnock Point are afforded protected under Article 3 of Directive 92/43/EEC on the conservation of natural habitats and wild flora and fauna, as part of the NATURA 2000 network. This network encompasses both SAC and SPA designations. Marram grasses (*Ammophila arenaria*) and Lyme-grass (*Leymus arenarius*) are found throughout this area. Baldoyle Bay was designated under the convention on Wetlands (RAMSAR) in 1988 [Site no: 413] [http://www.ramsar.org/profile/profiles\\_ireland.htm](http://www.ramsar.org/profile/profiles_ireland.htm).



**Figure 1.2: Annotated aerial photograph showing designated areas and location of rare plants at Portmarnock**  
 Birds are also protected under the Important Bird Area Programme [Site code: IE112] of Birdlife International, as co-ordinated in Ireland by Birdwatch Ireland which aims to improve the conservation status of all birds by protecting bird habitats that are of global significance.



### 1.2.2 Portrane and Rush

The Rogerstown Estuary divides Rush, to the North, from Portrane to the South (Figure 1.3 / Figure 1.4) and is a candidate Special Protection Area (cSPA). The northern extremity of the Estuary mouth is comprised of a sandy beach (Rush, South Beach) backed by sand dunes while the southern area is protected by the Brook beach backed by the Burrow dune system. The estuary is divided by a causeway and narrow bridge that carries the Dublin-Belfast railway line. Intertidal flats are extensive at low tides where Green algae (*Enteromorpha spp.* and *Ulva lactuca*) thrive. Salt marsh is present at the north of the Burrows and contains sea rush (*Juncus maritimus*) and the common saltmarsh grass (*Puccinellia maritima*).



Figure 1.3: Annotated aerial photograph showing designated areas and location of rare plants at Portrane

The estuary is an internationally important wildfowl site noted for the presence of the Pale-bellied Brent Goose (*Branta bernicla hrota*). In addition, nationally important bird species populations present include redshank (*Tringa totanus*), Golden Plover (*Pluvialis apricaria*) and Black-tailed Godwit (*Limosa limosa*).

The Rogerstown estuary also has SAC status with several habitats listed in the EU Habitats Directive. These include intertidal flats, Atlantic salt meadows and fixed and Ammophila dunes. The two plant species, Hairy Violet (*Viola hirta*) and Meadow Barley (*Hordeum secalinum*), legally protected under the Flora Protection Order (1999), are also found at this site.

Rogerstown Estuary was designated under the Ramsar convention in 1988 [Site no: 412] [http://www.ramsar.org/profile/profiles\\_ireland.htm](http://www.ramsar.org/profile/profiles_ireland.htm). Birds in this area are also protected under the important bird area programme [Site code: IE115].

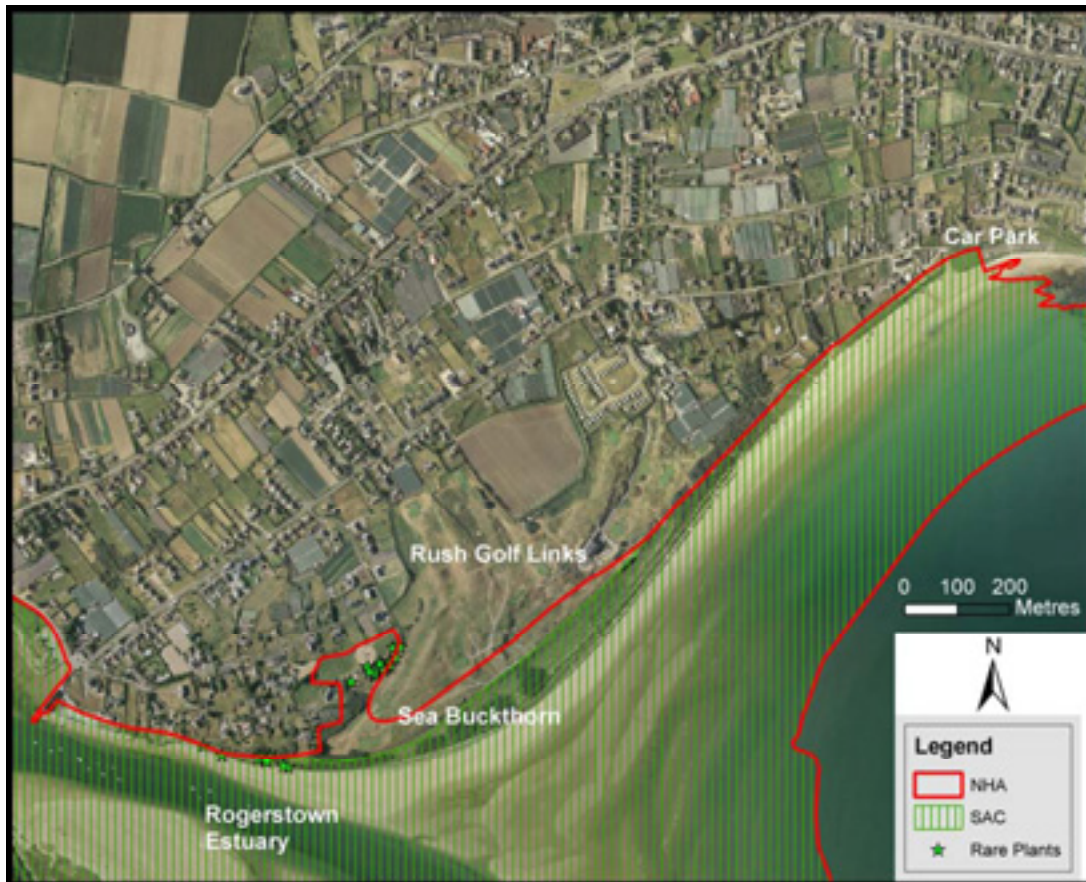


Figure 1.4: Annotated aerial photograph showing designated areas and location of rare plants at Rush



## 2.0 METHODOLOGY

In order to produce a dune protection plan it was deemed necessary to:

- Identify best practice in management approaches
- Determine the management techniques historically employed at each site, evaluate the current status of the dunes and identify any patterns of change
- Gather all relevant data sources and utilise a single Geographical Information System (GIS) to quantify historical change with respect to coastline variation and land use patterns

### 2.1 IDENTIFICATION OF BEST PRACTICE IN MANAGEMENT APPROACHES:

To identify best practice in management approaches a general review of contemporary literature was conducted. This included reference to national and international management techniques in dune protection, access control, invasive species, signage and fire control. Contact was also made with professional companies to ensure that recommended practices were both contemporary and applicable.

### 2.2 DETERMINATION OF THE TECHNIQUES EMPLOYED HISTORICALLY, EVALUATION OF THE CURRENT STATUS OF THE DUNES AND IDENTIFICATION OF ANY PATTERNS OF CHANGE:

A review was conducted of all existing reports and associated material on the dunes, dune degradation and dune protection measures in Portmarnock, Portrane and Rush. This was essentially a desktop review of all material that could be gathered from sources including Fingal County Council, Engineering Firms and members of the academic community.

A series of field visits were undertaken between October 2006 and February 2007 in order to determine existing usage of the dunes, degradation patterns, the extent of the sea buckthorn, potential walking routes and issues with rights of way. In addition a Global Positioning System (GPS) was used to survey access points, potential walking routes and the extent of sea buckthorn.

### 2.3 COLLECTION AND COLLATION OF ALL RELEVANT DATA SOURCES AND UTILISATION OF A SINGLE GEOGRAPHICAL INFORMATION SYSTEM (GIS):

All relevant geospatial holdings were collected and collated in a local GIS which can be utilised as a tool for future management decisions and strategies. Spatial datasets were retrieved from

Ecology	Base Mapping
Special Area of Conservation – SAC	OS Discovery Series
Special Protected Area – SPA	OS 2000 Aerial Photos
Natural Heritage Area – NHA	BKS 2005 Aerial Photos
Rare Plants Species	OS Historic Maps
	OS Coastline of Ireland

Table 2.1: Acquired GIS layers from Fingal County Council Archives

Fingal County Council archives (Table 2.1) and a dedicated GIS was created using ESRI ArcGIS 9.1 (Figure 2.1).

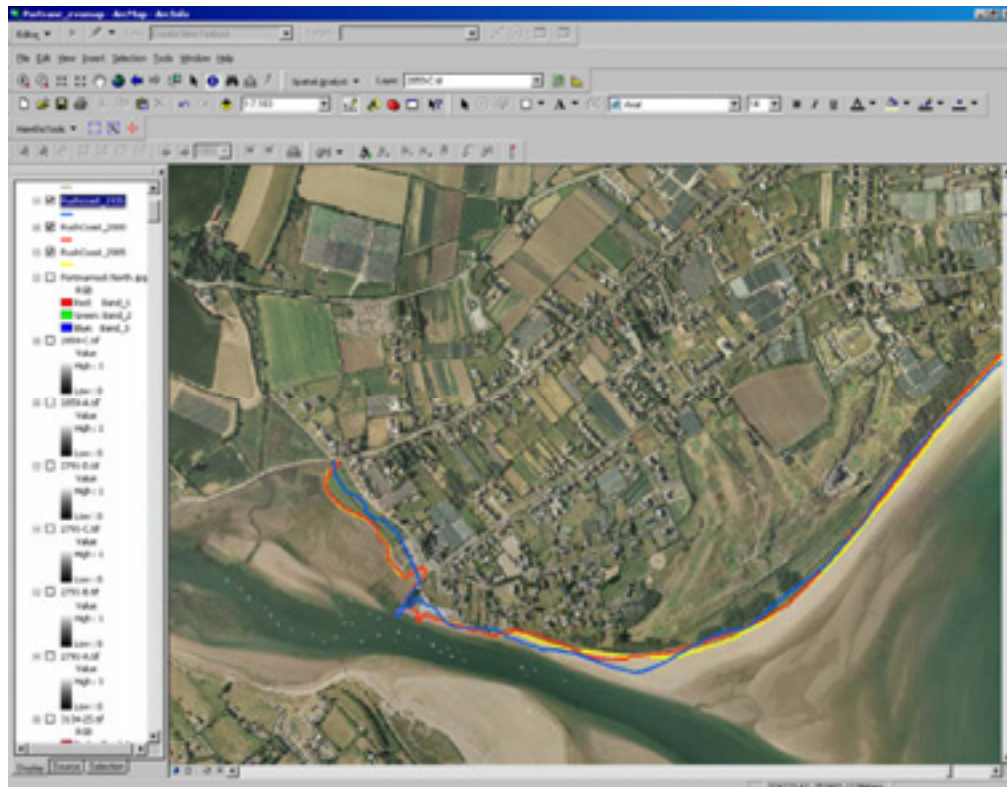


Figure 2.1: Example from the dedicated Geographical Information System (GIS) for Fingal Coastline (Rush)

Additional layers, including the output from the GPS surveys, were added after the site visits had been completed. After a number of field visits, the GIS was expanded to include layers such as coastline evolution, dune blowouts and sea buckthorn expansion.

For ease of presentation, the overall results are detailed separately for each of the three sites in the next chapter.

### 3.0 RESULTS

This section comprised the results from (1) the overall literature review (2) the site reviews for each location in terms of site specific literature, current status and the application of GIS for analysis of particular issues.

#### 3.1 OVERALL LITERATURE REVIEW

Literature was reviewed on National and International best practice in sand dune protection, access, sea buckthorn control, signage, vandalism, fire control and development encroachment.

##### 3.1.1 Sand dune protection

Within the period 1999-2002, between 250 and 300 houses had to be abandoned in Europe as a result of imminent coastal erosion risk and another 3,000 houses saw their market value decrease by at least 10% (European Commission, 2004b). Adverse impacts of coastal erosion most frequently encountered in Europe can be grouped into four categories: (i) coastal flooding as a result of complete dune erosion, (ii) destruction of assets located on retreating cliffs, beaches and dunes, (iii) undermining of sea defence associated with foreshore erosion and coastal squeeze, and (iv) loss of lands of economic and ecological value (European Commission, 2004a). Coastal erosion can almost never be attributed to one single cause, be it natural or human driven, but to a combination or accumulation of various factors which together create the conditions for erosion to take place (European Commission 2004a). Therefore, it is important for coastal managers to understand the coastal processes at work, in order to implement an efficient coastal protection plan. A good starting point for developing an understanding of the shoreline is the geomorphological status and recent history of the coastline position (Scottish Natural Heritage [SNH] and HR Wallingford, 2000). Site visits are vital and provide an opportunity to “ground proof” desktop findings and observations. Compiling a coastline evolution is vital in determining the pattern of coastal change in any particular area. Once the coastline evolution has been established, it is advisable to establish a monitoring programme prior to committing any significant effort to erosion control (SNH and HR Wallingford, 2000). It should be noted that the implementation of any monitoring programme usually depends on the availability of financial resources/funding. However, the allocation of funding to coastal erosion is usually associated with the risk posed to the resources concerned (environmental, economic, and cultural) (McKenna *et al*, 2000). Community participation should also be proactive in that the adoption of any coastal protection plan ought to work under the concepts of participatory planning and sustainable development. Local stakeholders may provide important local information on system processes which can lead to an overall better understanding of the system.

Community involvement is also adopted in the concept of Integrated Coastal Zone Management (ICZM) which is a dynamic, continuous and iterative process designed to promote the sustainable management of coastal zones.

The principles of ICZM are outlined in the final report; *Lesson Learned from the European Commission's Demonstration Programme on Integrated Coastal Zone Management (EU, 1999)*.

**1. Adopt a broad holistic approach:**

Advocates the use of management in the widest possible context beyond administrative and jurisdictional boundaries

**2. Local specificity**

An understanding of local issues can only be achieved by collecting and analysing local data and information

**3. Use adaptive management**

Flexibility is required because there are a wide range of factors (Physical, cultural, biological, economical, social etc) influencing coastal management decisions

**4. Work with natural processes**

Previous attempts to work against nature have proved costly, ineffective and sometimes counterproductive

**5. Take a long-term view**

Sustainability is the key to effective coastal management

**6. Use participatory planning**

The inclusion of local communities and interested stakeholders the formalisation and implementation of ICZM plans is essential in achieving consensus planning and management can help identify real issues of concern and build consensus between all involved

**7. Use a number of instruments**

Coastal Management that utilises a combination of instruments (legal, economic, political, technological and educational) is more effective

**8 Ensure the support and involvement of all relevant bodies**

Effective ICZM should ensure the inclusion and equality of input of all relevant administrative bodies in the management process

ICZM recognises erosion as a natural process that can be increased by man's activities. The adoption of the above principles is vital in achieving the sustainable development of coastal areas while conserving important habitats and utilising natural coastal protection. SNH and HR Wallingford, (2000) lists four general approaches to managing dune erosion:

- Non-interference, allowing natural processes to continue while accepting losses or taking appropriate action to relocate any backshore assets at risk.
- Delay erosion using small scale, short term (5-10 year life) schemes that can be implemented at relatively low cost and that will have a minimum impact on the coastal environment.
- Defend the frontage selectively using methods that may require the involvement of specialist consultants and may have a high impact on the immediate environment and coastal landscape; these may be short term, but are more likely to have a longer life expectancy (5-30 year life).

- Establish a fixed shoreline using large scale, long term (20-50 year life) defences that will require the involvement of specialist consultants and will significantly alter the coastal environment, landscape and recreational use of the beach.

On a European scale, estimated spending on coastal erosion management attained close to € 3.2 Billion in 2001. However, a significant amount of this money goes to dealing with the impacts of erosion in an ad-hoc manner rather than in support of a pro-active and preventative approach (<http://ec.europa.eu/environment/iczm/home.htm#coast>). There are a wide range of broadly similar options proposed for general dune management at different scales and particular locations (Table 3.1).

Non-interference	Small scale, short term	Selective frontages	Large scale, long term
<ul style="list-style-type: none"> <li>• Adaptive management</li> </ul>	<ul style="list-style-type: none"> <li>• Dune grass planting</li> <li>• Dune thatching</li> <li>• Dune fencing</li> <li>• Beach re-cycling</li> <li>• Sand bag structures</li> <li>• Beach nourishment</li> <li>• Beach drainage</li> <li>• Gabion structures</li> </ul>	<ul style="list-style-type: none"> <li>• Rock or gabion headlands</li> <li>• Groynes</li> <li>• Nearshore breakwaters</li> <li>• Artificial reefs</li> </ul>	<ul style="list-style-type: none"> <li>• Rock revetments</li> <li>• Timber revetments and breastwork</li> <li>• Impermeable revetments and seawalls</li> </ul>

**Table 3.1: Range of options for dune erosion management (SNH and HR Wallingford, 2000)**

The Sefton coast on the North West of England contains a number of well established sand dune systems. The local authorities have gained experience, such as with the Ainsdale dune system, which was subject to significant foredune erosion in the 1960s and 1970s due to recreational pressure. They originally implemented a sand-trap fencing programme in the 1980s and 1990s to restore foredune development. However, this was abandoned after ten years when a natural increase in dune development was recorded.

The Management team at Sefton have also highlighted the presence of bare sand patches as an important and integral part of the system. However, monitoring has been the key to providing information in order to implement effective management along the Sefton coast. Their monitoring programme includes an annual beach profile survey, beach topographic survey, visual inspection of coastal features and shoreline protection, monthly monitoring of foredune front position, sediment sampling at three year intervals, hydrographic profile extensions, recording of tidal levels and vegetation and species monitoring.

As a matter of policy, preference should be given to environmentally friendly, low cost techniques such as sand trap fencing and stabilising devices and beach nourishment (McKenna *et al*, 2000). Wind induced blowouts can be closed with brushwood fences and sand fencing. The exposed slopes of bare sand can be thatched with forestry thinning or mulch mats and planted with Marram or other sand binding grass species. In more extreme cases dunes can be rebuilt and re-profiled before thatching and planting (McKenna *et al*, 2001).

### 3.1.2 Access

Unmanaged access to beach and dune systems can lead to their eventual erosion and degradation. Successful access control requires a unified strategy determined by site conditions and local patterns of public pressure. Coastal access control usually involves restricting access to sensitive areas, such as unstable foredunes, while channelling people along attractive erosion-resistant routes through or around the restricted areas (Brooks and Agate, 2001). In most cases pedestrians do not intend to cause damage to the dunes but instead prefer to take the shortest route to the beach through the dunes.

McKenna *et al*, (2000) list numerous examples of practical access related management issues and solutions: to counteract the effects of trampling at Cushendun, Co. Antrim a beach dune boardwalk was constructed and this proved effective in preventing future trampling. In other areas the provision of shore parallel fencing can dissuade pedestrians from crossing the dunes. In Narwin, in west County Donegal cars historically parked on the beach but after 1995 the council completely prohibited any vehicular access. The “parking ban” appears to have been welcomed by most beach users with few complaints received since its implementation. It should be noted that the provision of a car park is essential prior to the introduction of a complete parking ban. McKenna *et al*, (2000) also highlight the National Trust decision to charge a fee per car to park on Portstewart Strand, Co. Derry with the revenue utilised to pay for other coastal management initiatives. Any managed beach parking scheme could be designed in concert with effective signage and designated parking at one end of the beach. Bollards or prohibitive structures must also be in place to prevent vehicular access to pedestrianised beach areas. Access control usually requires back-up in the form of wardening and Bye-laws (Brooks and Agate, 2001).

### 3.1.3 Buckthorn control

The invasive species sea buckthorn (*Hippophae rhamnoides*) is a major problem throughout the coast of Ireland (Binggeli *et al*, 1992). However, very few examples of buckthorn removal or control techniques have been documented. The shrub is native only to the eastern region of England but has become a major problem along the Welsh, Scottish and Western English coastlines. At Portstewart, Co. Derry, sea buckthorn was introduced in the 1930s to control user access to the sand dune. However, the shrub spread to consume 13% of the dune by 1989. As a result the management authority, the National Trust began forcefully controlling the shrub by employing cutting and spraying techniques. This had the desired effect of controlling sea buckthorn distribution before it colonised larger areas of the dune system (McKenna *et al*, 2000).

Sea buckthorn can spread rapidly and at a site in East Lothian, Scotland, vegetative spread is estimated to be as much as 4.3m per year (Brooks and Agate, 2001). Once both sexes of the shrub have become established its spread tends to increase and it usually grows unnoticed until it has colonised an extensive area in a relatively short period of time.

The UK has also seen the spread of sea buckthorn become a high priority dune management issue. The Ainsdale sand dunes, in Merseyside, England are managed by English Nature and



are internationally recognised for their important habitats and wildlife. However, encroachment of sea buckthorn once threatened the conservation interest of the open dune habitat and as a result measures were implemented to resolve this issue. Different methods of clearing sea buckthorn were employed, depending on the size of the stand. These included the deployment of four-wheel drive tractor with grab (Stands larger than 0.2 ha), chainsaw (Medium stand below 0.2 ha), and brush cutter and/or herbicide where suckers were up to 1-2cm at the base. These methods proved extremely effective for the Ainsdale dunes. Public objection to large scale removal was significant and the local community was outraged that they were not consulted prior to the sea buckthorn removal work commencing. Consultation with buckthorn removal expert, Peter Gahan, (who worked on the Ainsdale & Birkdale Sandhills Local Nature Reserve), revealed that older stands of sea buckthorn have less stems to cut, less individual plants to drag and dispose of, less stumps to treat and less re-growth to spray. However, it should be noted that stands have extensive root systems that may have an important role in influencing the structural stability of dunes. Younger and medium aged stands are thought to be more difficult to control once established over a wide area.

A wide range of factors need to be considered before implementing a buckthorn control strategy. These include:

- Density of stands
- Age of plants
- Ease of access
- Type of terrain
- Amount of re-growth.
- Habitat status
- Dune stability

All of these factors will have a significant impact on the final cost of sea buckthorn control or removal. Protected habitats may be sensitive to any sea buckthorn removal scheme and as a result mechanical removal (Bulldozers, excavators or tractors) is not always considered to be best practice in these situations (John Day *et al*, 2004). It is clear that different removal measures will be required for particular areas of dune. For example, areas of foredune that are colonised by sea buckthorn may now depend on that species for structural stability and its removal may simply break up the dune leaving it susceptible to aeolian and marine processes.

#### **3.1.4 Signage, Vandalism and Fire Control**

Signage has a range of uses including providing warnings about hazards, highlighting facilities, outlining and explaining management initiatives, and requesting compliance (McKenna *et al*, 2000). A common error with signs is that they are designed to simply prohibit access and/or particular behaviours and lack a positive and explanatory emphasis that is sometimes needed (Brooks and Agate, 2001). Negative signage can sometimes induce vandalism and in the end may serve to promote the very behaviour it originally intended to prohibit. Many site managers have observed that cheap, mass produced signs are more likely to be vandalised than carefully hand routed signs (Brooks and Agate, 2001). The alternative is to design signage that will withstand both vandalism and the elements (McKenna *et al*, 2000).

At Holkham National Nature Reserve, Norfolk, small signs are placed on short posts in backdune hollows where people tend to picnic. The signs read '*Please dig on the beach and not on the dunes as this causes erosion. Thank you*'. This method of signage was successful and applied only to the people who use the hollows (Brooks and Agate, 2001). At Ainsdale Sand Dunes, National Nature Reserve (NNR), Merseyside, discreet '*No Entry*' signs on 600mm (2') posts are placed along footpaths and beside gates in the dune woodlands, but set back so that only people who stray from permitted paths will see them. This negative signposting is balanced by positive routemarking along the paths themselves (Brooks and Agate, 2001).

Signage in a particular area may depend on the number of beach users and size of the area concerned. For example, less conspicuous signage is more suited to remote beaches.

Vandalism at beach and dune systems can take many forms. These include the intentional damage of property or the environment and range from damaging signposts to spray painting to lighting bonfires. Large fires on the seaward part of a dune system can cause blowouts and widespread aeolian erosion (McKenna *et al*, 2000). Fires can spread from human dune usage i.e. bonfires and barbeques but the natural occurrence of fires is also of significant threat to coastal dunes. The Intergovernmental Panel on Climate Change (IPCC, 2001) predicts increased changes in the frequency and severity of disturbances such as fire. Increases in evapo-transpiration and mean summer temperatures are also likely to lead to the large scale "drying out" of Marram and hence large scale fire disturbance (IPCC, 2007).

Voluntary measures such as codes of conduct are useful and are often all that are needed to curb unwanted activities. However, their success is dependent on the cooperation of beach users, which is not always forthcoming (McKenna *et al*, 2000).

Rosstown in Co. Donegal suffers from persistent vandalism and anti-social behaviour caused by adolescents (McKenna *et al*, 2000). This behaviour has been linked to a lack of facilities for families on vacation over summer months. The provision of appropriate leisure facilities may help alleviate such problems but it should be noted that vandalism is a complicated social issue with no immediate solution (McKenna *et al*, 2000). Bye - laws may be the most effective tool in curbing anti-social behaviour. However, their success is largely dependent on enforcement by the local police or an appropriately designated warden.

### 3.1.5 Development Encroachment

Beach hinterlands often become the focus of holiday home development as they are valued for their scenic and recreational qualities (McKenna *et al*, 2000). Such areas can often include sand dune systems that naturally erode and accrete over successive years. Best practice suggests that development should not be allowed on frontal dunes nearest to the beach and that if development is permitted within a dune system, a set back line system should be adopted (McKenna *et al*, 2000). A set-back line defines the landward margin of a shore contact zone within which there is virtually a blanket ban on development. This strategic and sustainable planning is adopted in many countries throughout Europe. The negative geomorphological and ecological consequences of second homes are recognised in countries such as Sweden where controls are in place and where development within 300m of the coast has been forbidden



(Shaw and Williams, 1995) within this “setback zone”. McKenna *et al*, 2000 refer to a particular example in South Carolina, where the set-back distance is calculated using the following formula:

$$\text{Set-back distance} = \text{mean annual erosion rate} \times \text{factor}.$$

In South Carolina USA a factor of 40 is used, with distances measured from the most seaward dune. The Waikato region in New Zealand has promoted setback distances of up to 300m in some areas (Environment Waikato, 2002). However, as the diagram below illustrates, the typical development has taken place closer to the minimum setback distance of 50m, (i.e. within the zone considered to be of greatest erosion risk). It should be noted that a significant amount of monitoring on coastal processes is required prior to the adoption of set back zones.

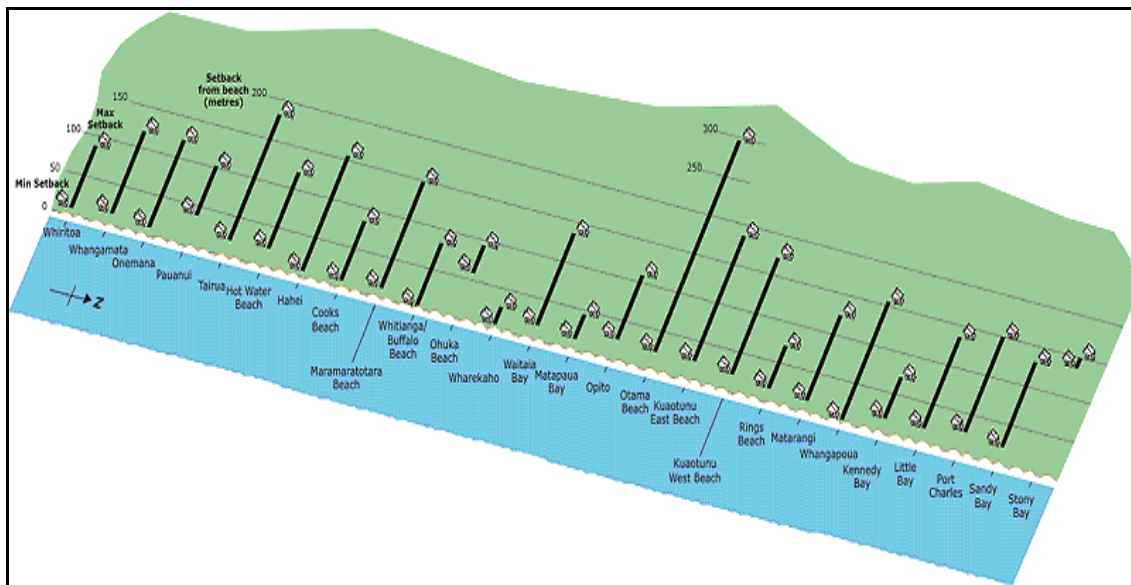


Figure 3.1: Setback distances at the Eastern Coromandel (Peninsula) Beaches, New Zealand (Environment Waikato, 2002).

In order to calculate a site specific set-back, monitoring data on erosion, flooding and accretion history is required. This approach has already been adopted in Co. Wexford, Ireland, where a general 50m setback has been adopted on soft coasts (McKenna *et al*, 2000).

## 3.2 SITE REVIEWS

### 3.2.1 Portmarnock

Velvet Strand, Portmarnock is situated in the north-east coast of County Dublin, on the east coast of Ireland. The strand is contained within the Portmarnock barrier beach complex and is the most southerly of a series of such complexes on the north Dublin coast and provides the seaward margin to the Baldoyle estuary (Mulrennan, 1993). A sand dune system backs Velvet Strand and is occupied by two golf courses.

This barrier system is Holocene, having formed as sea levels rose during the postglacial marine transgression (Mulrennan, 1993). The coastal dynamic regime at Portmarnock is driven by wind, wave and tidal energy and is greatly influenced by Irish Sea processes (Madden, 2003).

The section of coastline between Baldoyle and Portmarnock forms a mini sub-cell within the east coast sub-cell from Howth to Skerries (Kirk McClure Morton, 1999). Baldoyle Bay is a tidal estuarine bay constituting extensive mudflats and is separated from the sea by the Portmarnock dune system. The estuarine channels enter the Irish Sea at the southern tip of the system at Portmarnock Point. The Bay is fed by two small rivers, the Mayne and the Sluice.

The Portmarnock beach and dune system is a valuable local amenity and are utilised extensively by visitors in the Summer/Autumn months (May- September) and at weekends and to a lesser degree throughout the year. Urbanisation and associated population growth in Dublin and its suburbs have contributed to an overall increase in beach user numbers over recent years. These are estimated to be in the thousands of visitors (per day) in peak summer periods (Hans Visser. 2006, *pers. comm*). Key concerns amongst the local community and local authority include natural and anthropogenic erosion, access, invasive species and anti-social behaviour and vandalism. This is reflected in the numerous publications for this area listed below and referenced where available.



Figure 3.2 Annotated aerial photograph (2005) showing the location of Portmarnock

## Review of Coastal Management Documentation (Portmarnock)

Author (date)	Title
<b>K. Mawhinney, R. Goodwillie and R. Webb, Conservation and Amenity Advisory Service with An Foras Forbartha. (1984)</b>	<b>A report on the Portmarnock sand dunes area, with special reference to a possible special area amenity area order.</b>
Commissioned by Dublin County Council Planning Department to An Foras Forbartha with special reference to a possible Special Amenity Area Order (SAAO). It suggests that the planning authority can implement a SAAO on the grounds of scenic, recreational or nature conservation value and that the desired effect of an SAAO is to conserve the amenity value of the site in question. The document assessed the natural beauty, recreational and nature conservation value of the site. The botanical and zoological significance of the site was also referred to throughout the text. Issues pertaining to the <b>management of erosion (recreational and natural) and access</b> were highlighted and a number of management solutions were provided including: <ul style="list-style-type: none"> <li>• The construction of Groynes at right angles to the shore at the northern end of Velvet Strand to counteract the erosion problem.</li> <li>• The creation of a car park, hard surfacing, regarded grass slopes, gabion retaining walls, boardwalks steps to beach access points and Marram grass planting.</li> </ul>	
<b>M. Barrett. (1984-1985)</b>	<b>Report on special amenity area order for Portmarnock dunes</b>
Contains a detailed investigation concerning the provision of a SAAO for Portmarnock dunes. Zoning and County Development Plan objectives pertaining to the area were referred to and the physical characteristics of the site were listed. The text contained a complete account of the legal basis of SAAO and its historical practice to date. With this, practical considerations, historical ambiguities and conflicts related to SAAOs and the Portmarnock planning situation were also listed. It concludes with the suggestion of a SAAO or number of SAAOs for the Portmarnock dunes.	
<b>M. E. Mulrennan. (1986). Unpubl. Report for Dublin County Council.</b>	<b>The coastal environment of Portmarnock.</b>
A detailed study of the environment of Portmarnock and its functional interrelations. Environments were divided up into units i.e. estuarine, dunes etc and their complex geomorphological inter-relations were emphasised throughout. This report clearly stated that the northern end of <b>Velvet Strand was experiencing erosion and was under considerable "pressure" from natural and anthropogenic forces</b> . Managerial objectives proposed included the <b>monitoring of physical process and recreation</b> and a need to work with nature.	
<b>M. E. Mulrennan. (1987a). Interim Report for Dublin County Council</b>	<b>Portmarnock Special Amenity Order</b>
Gives a more detailed account of the geomorphology of the Portmarnock area. The author compartmentalises the environment into units and elaborates on the previous study. Potential environmental threats are also highlighted.	
<b>M. E. Mulrennan. (1987b). Final Report for Dublin County Council.</b>	<b>Portmarnock Special Amenity Order</b>
An extension of previous work by Mulrennan (1986, 1987a) this provides a more detailed account of the geomorphology. A detailed analysis of a number of fieldwork projects undertaken was presented along with a comprehensive account of geological, glacial and marine evolution. Suggestions towards the future management and control of the environment were also made. These addressed the need for improved recreational quality while conserving ecological and amenity value.	
<b>R. Goodwillie and E. Ni Lamhna (1988). Conservation and Amenity Advisory Service with An Foras Forbartha.</b>	<b>Management Plan for Portmarnock Sand Dunes.</b>
Commissioned by Dublin County Council with the aim of preserving and enhancing Portmarnock Dunes. The (then) current status of the system is outlined with emphasis placed on erosion, amenity, access and ecology. Recommendations include the paving of the northern extremity (now grass revetment) and access via sleeper steps. The planting of dune grasses and fencing was also advised. Dune re-contouring was recommended for the dunes south of the grass revetment. Blow-out degradation was to be reduced with wired chestnut paling, <b>Marram replanting and the establishment of proper access</b>	

<p><b>routes.</b></p> <p>The construction of groynes was also suggested to raise beach levels in the northern extremity. <b>Advice to relieve trampling pressure and control fire was also provided.</b> An account of the dune grazing patterns was delivered (previously grazed by cattle, rabbits and hares) and grazing monitoring was specifically advised. <b>The complete eradication of sea buckthorn (<i>Hippophae</i>) was also recommended so as to avoid future problems.</b></p>	
<p><b>M. E. Mulrennan. (1990). Unpubl. PhD thesis, UCD.</b></p>	<p><b>The geomorphic development of the Barrier-Beach Complexes of the North County Dublin Coastline</b></p>
<p>The most comprehensive study of the Portmarnock system. The geomorphic development of the barrier beach complexes (Portmarnock and Corballis) of the North Dublin coastline is presented. The long-term (5000 years), medium-term (200) and short-term (weeks-months-years) evolution of the systems is provided along with a detailed account of the systems geomorphology. Physical (wind) and biological (vegetation) variables likely to influence the geomorphic status of the system are also measured and analysed. A final hypothesis proposes that both systems are prograding at their distal ends and eroding at their northern ends due to infilling of the estuary and associated reductions in the volume of the estuaries tidal prism leading to the near closure of the estuary mouths.</p>	
<p><b>M. E. Mulrennan. (1993). Irish Geography 26 (1) 1-13.</b></p>	<p><b>Changes since the nineteenth Century to the Estuary Barrier Complexes of North County Dublin.</b></p>
<p>Focused on coastal processes at the Corballis and Portmarnock Estuary Barrier Complexes. The author examined a series of O.S maps over time to map coastal change and argued that progradation at the southern ends of the barriers was a result of land reclamation and the infilling of the estuaries. This was thought to alter tidal regimes by both reduction of the tidal prism volume and through retardation and retention of the tidal flow (Boon and Byrne, 1981). Reductions in the volume of the estuaries tidal prism and weakened ebb and flood currents have resulted in the near closure of the estuary mouths. The sediment starvation of the northern end of the systems was also related to progradation taking place at the distal end. Both processes were thought to be associated with changes to the dimensions of the ebb-tidal deltas.</p>	
<p><b>Dept. of Regional and Urban Planning, UCD (1996). Final Report Prepared for Fingal County Council.</b></p>	<p><b>A Special Amenity Area Order for Portmarnock</b></p>
<p>Final document prepared for Fingal County Council with respect to a Special Amenity Area Order (SAAO) for the Portmarnock area. The introduction gave the background to the undertaking of the study, value of Portmarnock Peninsula and basis for a SAAO as a management instrument. A historical review of the site planning context was also provided as was the nature conservation and recreational value of Portmarnock. Future likely threats were also outlined along with management suggestions. The arguments for and against a SAAO for the area were also proposed. However, it is concluded that a SAAO provides the most appropriate legal framework for the long-term management of the area.</p>	
<p><b>M. B. Quigley (1996).</b></p>	<p><b>A Report on Portmarnock Links Golf Course and its Environs.</b></p>
<p>Commissioned by Fingal County Council. The brief required the author to advise the council on "an appropriate overall strategy relating to the golf course and its environs" (which include public access areas and the foredunes). The report outlined the background to the study area and its importance as an area of scientific interest, amenity value and recreational potential. Specific recommendations concerning the measures and works that needed to be undertaken to alleviate the most critical problems were also provided. Recommendations from this report included:</p> <ol style="list-style-type: none"> <li>1. Construction of grass embankment be extended in like manner for a further 135 metres at the northern extreme of Velvet Strand.</li> <li>2. <b>Repositioning of the golf links boundary fence landwards to remove pedestrian traffic from dune crest.</b></li> <li>3. Dune re-contouring.</li> <li>4. <b>Dune replanting.</b></li> <li>5. <b>Access fencing to replanted areas.</b></li> <li>6. <b>Relocation of golf club boundary fence.</b></li> <li>7. <b>Raised board-walk construction.</b></li> </ol>	



8. <b>Public awareness raising and signage improvements.</b>								
9. <b>Remove sand trap fencing for safety reasons.</b>								
10. <b>Sand dune- employment of a coastal geomorphology expert to monitor success/failure of conservation methods.</b>								
R. M. Shaw (Kirk McKlure Morton) and M. B Quigley (1998). Joint Report. Unpublished report for IMG Developments and Fingal County Council.		Portmarnock Dunes						
Commissioned by IMG Developments Ltd (Portmarnock) and Fingal County Council. The short term geomorphological history (1996) of the system was revised and compared to the current state (1998) of the dunes. This report contains significant detail pertaining to the northern end of Velvet strand including the current vegetation and geomorphological status. Immediate, short-term and long-term recommendations relating to the preservation of the dunes were also provided, including:								
<table><tr><th>Immediate</th><th>Medium-Term</th><th>Long-term</th></tr><tr><td><b>Reduce human traffic through access control, signage and raising public awareness</b></td><td>Extend grassed platform. Sea-wall construction. Rock revetment installation. Regrading and replanting. Boundary fence realignment.</td><td><b>Modelling of sediment transport characteristics.</b> Beach Renourishment. Construction of Groynes.</td></tr></table>	Immediate	Medium-Term	Long-term	<b>Reduce human traffic through access control, signage and raising public awareness</b>	Extend grassed platform. Sea-wall construction. Rock revetment installation. Regrading and replanting. Boundary fence realignment.	<b>Modelling of sediment transport characteristics.</b> Beach Renourishment. Construction of Groynes.		
Immediate	Medium-Term	Long-term						
<b>Reduce human traffic through access control, signage and raising public awareness</b>	Extend grassed platform. Sea-wall construction. Rock revetment installation. Regrading and replanting. Boundary fence realignment.	<b>Modelling of sediment transport characteristics.</b> Beach Renourishment. Construction of Groynes.						
A methodology for dune rehabilitation and the works estimated cost was also presented. Detailed planting requirements in dune rehabilitation were also listed as appendices as supplied by Ted Walsh Associates.								
Kirk McKlure Morton (1999). Report for Fingal County Council.		Portmarnock Beach Renourishment						
Beach renourishment feasibility and scoping study. Information was provided on the: <ul style="list-style-type: none"><li>• Contemporary hydrodynamic and sediment transport regimes.</li><li>• Nature of dredged material.</li><li>• Nature of dredged material available.</li><li>• Dredging techniques and equipment to be used.</li><li>• Cost estimates.</li><li>• Potential effects on water quality.</li></ul>								
D. Maguire. (2000). Report Commissioned by Portmarnock Action Committee.		Conservation Measures for the Portmarnock Dune System						
Provides alternative dune conservation techniques to the hard engineering solutions proposed in the 1998 Portmarnock Dunes Conservation Plan (KMM and Quigley) concerned with the: a) The proposed extension of the grass revetment and b) The use of gabion mattresses Based on information contained in the ECOPRO- Environmentally Friendly Coastal Protection, Code of Practice, 1996. The negative effects of hard engineering on dune/beach sediment transfer and longshore drift coastal processes were also highlighted and the document proposes a range of alternative “soft” engineering solutions for dune protection at Portmarnock. Alternatives (to be used in tandem) to grass revetment and gabion mattresses included: <ul style="list-style-type: none"><li>• <b>Boardwalk.</b></li><li>• Dune re-contouring.</li><li>• Sand stabilisation.</li><li>• Wave barrier fencing.</li><li>• Marram grass planting.</li><li>• Enclosure fencing and sand trap fencing.</li></ul>								
O. Madden (2003). MSc thesis TCD.		A Review and Assessment of Coastal Protection at Portmarnock, County Dublin.						
Summarises previous studies and relevant literature concerning beach and dune dynamics, geomorphology, dune ecology, sea level rise and coastal protection. ICZM best practice was also reviewed and dune slope profiles and plant surveys are undertaken. Recommendations included: <ul style="list-style-type: none"><li>• Maintenance of the protective weldmesh fence for foreseeable future.</li></ul>								

- Grass planting to be carried out annually during spring.
- The fertilization of the dunes be incorporated into the dune replanting programme.
- **Establishment of a comprehensive dune monitoring programme.**
- Further consideration be given to beach renourishment.
- The appointment of a coastal zone manager to Fingal County Council.

Table 3.2: Review of coastal management documentation for Portmarnock

The results reveal that at least fourteen reports have been conducted on the Portmarnock dune system since 1984. Twelve of these have been commissioned by Dublin / Fingal County Council. This wealth of documented material highlights the significance of coastal management to this particular site. A number of issues are revealed in their historic context and many are still present today. Recurring themes include coastal erosion and dune assessment and associated protection measures. However, problems with access, signage, education/ awareness raising and sea buckthorn have also been highlighted as major problems and future threats to the sustainability of the Portmarnock dune system.

Documents also reveal that there have been a number of schemes, including the provision of hard coastal protection measures, which have influenced the coastline at this site:

#### Review of Coastal Protection (Portmarnock)

Date	Details
<b>Pre-1989</b>	Rock Armour to about 2m in width and 1m high placed at the foot of the dunes in the mid/southern section of Velvet Strand in order to protect the golf course in adjacent lands.
<b>1989</b>	A grassy embankment was constructed in 1989 at the northern extremity of Velvet Strand and sand trap fencing was placed on the backshore zone to the south of the grass embankment.
<b>1990-1996</b>	Prior to 1996, the Golf Links erected a mesh fence on the seaward side of the dunes to promote the build up of sand. Marram grass was also planted during this period.
<b>1999-2000</b>	Initial portion of a sleeper wall was erected. Extension of the grass embankment ceased due to public opposition.
<b>Spring 2001</b>	Extensive work including dune recontouring (using mechanical plant), re-planting and insertion of gabion mattress commenced. Insertion of wooden access steps at the south end of the grass embankment. The existing sleeper wall was extended south at a distance of 240m and inserted into sand at 60°. The revetment was then planted to stabilise the sand. The area behind the extended sleeper wall was filled with limestone to within 400mm of the top of the sleeper wall, surfaced with sand and then planted with <i>Ammophils arenaria</i> , <i>Leymus arenaius</i> and <i>Rosa rugosa</i> . Sand trap fencing was also erected and the total dune works area was enclosed in protective weldwesh fencing. The large blow out immediately south of the sleeper wall had a gabion reinforced berm installed across the mouth of the blow out and the berm was then planted with Lyme grass. 200 metres of a large dune system was re-contoured, the toe of the dune reinforced with gabion mattress and the entire re-contoured dune planted with Marram grass, Chestnut sand trap fencing was erected across the dunes to accelerate build up of sand on the dune. The entire works area was fenced to reduce trampling by pedestrians and allow the Marram grass to establish. All areas that were planted with Marram grass had jute matting pinned to the surface prior to planting. Following planting the area was sprayed with a soil stabilizer to reduce sand movement while the Marram grass established.
<b>January 2002</b>	Realignment of perimeter golf club fence by 4m to west (inland)
<b>February 2002</b>	Major storm caused significant damage to the protection works and the dunes.

<b>Spring 2003</b>	Sleeper wall, backfill and geotextile mat replaced and the area planted with rose, Marram and lyme grass. Removal of exposed jute on re-contoured dune and installation of chestnut fencing. Replanting of all areas where plants did not establish or were vandalised. Replacement of damaged fencing and reinforcement of fencing at northern end of scheme where vandalism problems were greatest.
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Table 3.3: Review of coastal protection at Portmarnock

It can be seen that a significant amount of effort has gone into dune restoration in Portmarnock. This has included a mixture of dune re-contouring, sleeper wall construction, Marram grass planting, sand trap fencing and access fencing. These measures have had varying levels of success but mostly represent a short-term reactive approach to management. Extreme erosion events (natural or man-induced) have usually preceded any significant dune restoration works.

### Current Site Status (Portmarnock)

The geomorphological status of the study site was assessed along with general observations on amenity usage. The most recent assessment of Velvet Strand was undertaken by Madden (2003). By comparing the 2003 dune/beach status to its current state, a more detailed study may be able to highlight the areas subjected to the most change and then quantify the actual amount of erosion / accretion at these locations. Short term changes are typical in beach/dune systems and depend mostly on the prevailing tidal and weather conditions. A number of photographs were taken during site visits to illustrate both the usage pattern and the condition of the coastline. Observations suggested that walking (Figure 3.3) appeared to be the most popular “beach use” while football, jogging, horse riding and golf also proved popular.



Figure 3.3: Walkers on Velvet Strand, Portmarnock

Figure 3.4: Instability caused by undercutting at Portmarnock foredunes.

There was evidence of natural erosion (Figure 3.4) of the fore dunes in the central section of Velvet Strand and to the north of the rock armoured section. This may be attributed to seasonal variations in coastal processes resulting in the lowering of the beach level and exposing of the dune toe by wave and tidal action.

Observations confirm that the northern section of Velvet Strand is utilised more intensively (Figure 3.5) than the central and southern sections (Figure 3.6). The most southerly tip of Portmarnock point lies at a distance of approximately 3.5km from the public access point and grass revetment to the north. The beach thins significantly at a distance of 2.4 km where high

tides can reach the foot of the dunes and the base of the section of protective rock armour present at this location. For this reason beach users travelling further than this point run the risk of being cut off by incoming tides.



**Figure 3.5: Sand compaction from walking and horse riding on northern Velvet Strand**



**Figure 3.6: Embryo dunes to the south of Velvet Strand**

Site observations indicate that the southern end of Velvet Strand appears to be accreting (Figure 3.6). Particular sections of the dunes to the back of Velvet Strand are currently experiencing erosion by natural coastal processes and it was noted that the hard engineering solutions in place were causing “scouring” at both sides of these protective structures (Figure 3.7).



**Figure 3.7: Scouring at either side of protective rock armour at Velvet Strand**



**Figure 3.8: Erosion of backdunes on access path between golf courses at Portmarnock foredune**

Aeolian (wind driven) erosion (Fig 3.8) was recorded at numerous sites (e.g. across the dunes). However, comparisons with the status of previous blowouts (Madden, 2003) indicate that significant improvements in vegetative cover appear to have taken place. This may be a result of recent dune repair schemes which have included a number of replanting programmes and the construction of protective fencing.





Figure 3.9: Sea buckthorn stands at the foredunes of the southern section of Velvet Strand

The presence of sea buckthorn was also noted in the central and southern sections of Velvet Strand. Mature stands were noticeable and formed thick and impenetrable sections of the coastline. However, these stands were located mostly behind the golf club fence in the south of Velvet Strand. Further south the sea buckthorn has spread to areas of accreting foredune and



Figure 3.10: Signage intended to restrict access to damaged dunes at Portmarnock



Figure 3.11: Vandalised sign intended to prohibit access to Portmarnock golf links

embryo dune (Figure 3.9). Information relating to health and safety, dune conservation (Figure 3.10), access information (Figure 3.11) and Bye laws (Figure 3.12) was evident with the majority of information located at or close to beach/dune access points and recreational paths.

Signage is also provided along private land boundaries (Figure 3.11) and in most cases it is easily recognisable by beach/dune users. The signage witnessed was mostly intended to prohibit particular behaviours and reinforce the legal obligations of beach users. Some degree of defacement was evident on the majority of signs (Figure 3.13).



Figure 3.12: Signage displaying permitted user activities at Velvet Strand



Figure 3.13: Vandalised signage at the main entrance at northern Velvet Strand

Field assessments identified numerous bonfire sites or the remains of previous fires. Observed fire remains (Figure 3.14) measured less than 1m<sup>2</sup> and were concentrated in the dune slacks and foredune areas. It is believed that these re-occurring bonfires are started by teenagers who are also engaging in anti-social behaviour. Glass bottles and fire remains add to the overall littering problem within the system while “bonfire parties” are degrading dune vegetation. Old, rusted fencing was also observed (Figure 3.15) jutting out of the sand close to the public path that divides the two golf clubs. A number of the chain-link fences located within the dunes have also become buried as a result of accretion and as the condition of this fencing continues to degrade there are obvious it raises serious health and safety concerns. The local authority has expressed concerns over this issue and the potential for an injury to be caused to a beach user by the remnant pieces of fencing. .



Figure 3.14: Evidence of bonfire remains at Portmarnock dunes.



Figure 3.15: A sharp rusty object protruding the dune surface at Portmarnock

### Application of GIS (Portmarnock)

#### Coastal Change

The Portmarnock coastline has had a history of coastal change erosion in the northern sections and accretion in the southern sections recorded at Velvet Strand (Mulrennan, 1990; Shaw and Quigley, 1996).

Historical comparisons were made between the 1935 OS map series and ortho-photographs from 2000 and 2005 (Figure 3.16). These revealed that there has been extensive accretion at the southern end of Portmarnock by up approximately 300m between 1935 and 2005. Over the corresponding period, erosion of c15m has been recorded at the northern end of Velvet Strand. However, important areas of foredune seem to have recovered over the period 2000 to 2005. Particular areas of recovery are at the seaward end of blowouts (Figure 3.17). Over this five year period (2000-2005) vegetation has re-established possibly as a result of previous dune protection measures including Marram grass planting and protective fencing.



Figure 3.16: Annotated aerial photograph (2005) showing coastline evolution at Portmarnock

### Sea buckthorn

Sea buckthorn stands were identified and digitised from aerial photographs in the GIS (Figure 3.18). Comparisons between distance of spread over the five year period between 2000 and 2005 were difficult due to significant differences in photograph resolution. However, from the available data spreads of up to 5m were recorded over the five year period (Figure 3.19). In extreme cases this species has been recorded as being able to spread over 4m annually but in



Portmarnock its spread is limited to a stretch of ground running parallel to the beach on the perimeter of the golf course and close to the erosional face.



Figure 3.17: Annotated aerial photograph (2005) showing coastline evolution at Velvet Strand

It is likely that the Golf Course landscapers are keen to keep the sea buckthorn in check where its encroachment threatens fairways and walking paths. Future management of the shrub could be conducted by IMG/ Golf Links in association with the Parks Department, Fingal County Council.



Figure 3.18: Annotated aerial photograph (2005) showing sea buckthorn coverage along foredunes at Velvet Strand

The designated areas at the southern tip of Portmarnock point (accreting embryo dunes) may be threatened by buckthorn encroachment and therefore it may have to be removed to maintain the integrity at these locations.



Figure 3.19: Annotated aerial photograph of Portmarnock (2000) overlain (in red) with the 2005 extent of sea buckthorn layer

### Coastal Walkway

In March 2007, the local Council put forward a proposal to construct a series of coastal walkways along the Fingal coastline. These walkways are intended to increase the amenity status for the benefit of the Fingal community and all visitors to the Fingal coast whilst providing dune protection from human induced pressure. The GIS provided a useful tool for assessing the potential impact of any such initiatives. Base level photography was overlain with the route of the proposed walkway, using the output from the GPS field survey, thus indicating the possible areas of conflict.

For example, it is clear from Figure 3.20 that this proposed route would cut through the property of the golf clubs and therefore any construction would require consultation between the local authority, private land owners and the local community.





Figure 3.20: Annotated aerial photograph (2005) showing one potential route of the coastal walkway at Portmarnock

### 3.2.2 The Burrows, Portrane



Figure 3.21: Annotated aerial photograph (2005) showing the location of The Burrows, Portrane

The Burrows, Portrane (Figure 3.2) is a sandy spit which separates the outer Rogerstown Estuary from the Irish Sea (KMM, 1998). It forms part of the most northerly beach barrier system on the north coast of Dublin (Mulrennan, 1993). The section of coastline between Rush and Portrane forms a mini sub-cell within the east coast sub cell from Howth to Skerries (Mulrennan, 1993). The majority of the Rogerstown estuary dries out at low tide exposing important habitats for birds and wildlife. The nature of the spit and beach is strongly influenced by the tidal action of the estuary combined with waves approaching the shoreline from the Irish Sea.

The Ballyboghil and Caruff rivers enter the estuary to the west of the Dublin- Belfast railway line and together drain an area of some 77 km<sup>2</sup> (Kirk McClure Morton, 1998). Lambay Island, which is situated to the east of the beach, influences both the wave and the tidal conditions seaward of the beach. The Rogerstown estuary exerts a strong influence on the sediment regime of the Burrows area. A sand dune system occupies the spit but much of this has been lost over the last century with the conversion of fixed dunes to agricultural and residential land.

A number of caravan parks are present within the dunes system. As a result, a number of public access routes run through the dunes and on to the beach. The system is an important amenity, particularly to the local community and is of significant environmental importance.

However, recent research (Kirk McClure Morton, 1999) suggests significant erosion of the fore dunes to the south of the Burrows with a progradation of the spit in the northern extremity. This



natural change will need to be accommodated into any effective coastal management plan for this area.

### Management Documentation (Portrane)

Author (date)	Title
<b>Kirk McClure Morton, July 1999</b>	<b>The Burrow Portrane Coastal Study Report for Fingal County Council</b>
Commissioned by Fingal County Council. The assessment includes information pertaining to historical assessments, hydrographic and sediment surveys, wind/wave and tidal data, ecology and coastal protection options. The main recommendations include: <ul style="list-style-type: none"> <li>• The “do nothing” approach at the central and southern beach sections.</li> <li>• Repair to the rear dune blowouts.</li> <li>• Control and maintenance of beach access points.</li> <li>• Prohibit access of cars, caravans, motorbikes and cycles to beach.</li> <li>• Conserve salt marsh with constructed groyne system, sand fencing and dune grass planting.</li> </ul>	
<b>Oliver, A Russell. 1995.</b>	<b>Coastal Protection Schemes at Burrow Strand, Portrane. Preliminary report.</b>
<i>This document was requested on several occasions but a copy was not received.</i>	
<b>Kirk McClure Morton, Sept. 1992.</b>	<b>Environmental Survey of the Rogerstown Estuary.</b>
<i>This document was requested on several occasions but a copy was not received.</i>	

Table 3.4: Review of coastal management documentation for Portrane

### Current Site Status (Portrane)

The geomorphologic status of the study site was assessed along with general observations on amenity usage, dune vegetation status, sea buckthorn extent, development encroachment, signage, vandalism and access. The photographs taken during site visits provide evidence of the current use and condition of the coastline. Marine induced vertical erosion of the dune face was clearly evident along numerous sections of fore dune (Figure 3.22 and 3.23).



Figure 3.22: Vertical erosion of the dune face looking north on The Burrows, Portrane

Figure 3.23: Vertical erosion of the dune face looking south on The Burrows, Portrane

A lack of research literature pertaining to the Portrane area means that the comparison using the GIS was important in indicating historical trends of erosion. It is possible, that current erosion at Portrane is either a relatively new phenomenon or an ongoing part of cyclic coastal change but this is unclear because of a lack of primary data.



**Figure 3.24: Holiday home development in close proximity to dune face at Portrane**



**Figure 3.25: Permanent housing in close proximity to the eroding dune face at Portrane**

The most obvious management issue at the Burrows involves problems with planning and development control. There are a number of dwellings located close to the eroding dune face (Figure 3.24) and in some instances were found to be as close as 23m (Figure 3.25). Houses, mobile homes and caravans are scattered throughout the dune system and in recent years there has been an increase in the number of buildings and level of planning applications (*pers comm.*, Hans Visser, 2007). This method of management may be unsustainable and has directly contributed to the degradation of the dune system. This degradation is most evident in the system of access paths that cut through the dunes and onto the sandy beach (Figure 3.29). Although sand dunes are considered natural barriers to the encroaching sea, they do not guarantee protection during high tides and storms. Therefore, many of the dwellings located on the dunes are at considerable risk to marine induced erosion and/or flooding. In an ideal planning situation, permission would not be granted to dwellings located in such close proximity to the sea. Site observations also indicate that unmanaged access has also become a contributing factor to dune erosion and vegetation degradation.



**Figure 3.26: Evidence of vehicle use near salt marsh habitat at the northern end of The Burrows**



**Figure 3.27: Vehicle tracks through the salt marsh habitat at the northern end of The Burrows**

A number of tracks are utilised by vehicles and lead directly on to the foreshore at Portrane. These are located at the southern and northern ends of the Burrows. The local authority has expressed concern over the vehicular use of the beach (Figure 3.26) and in particular near the salt marsh habitat (Figure 3.27-protected as a designated area under the EU Habitats Directive 92/43/EEC) at the northern end of the Burrows. This habitat has formed the main car parking area during peak times/season and is currently in a state of decline as a result of human pressure. Bonfire remains were also observed at this area near embryo dune development. Site observations also revealed the instability of the beach surface and therefore the practical unsuitability of this area for routine vehicular use.



**Figure 3.28: Previous attempts to prevent vehicle access covered by accretion at northern end of The Burrows, Portrane**



**Figure 3.29: Pedestrian paths cutting through the dunes at The Burrows, Portrane**

Previous attempts to curb vehicular access have involved the placing of large boulders across foreshore access points. This particular type of access management has been ineffective in some areas (Figure 3.28) and requires regular maintenance due to the dynamic nature of the coast. A number of pedestrian dune pathways (Figure 3.29) run parallel to the beach and are extensively utilised by walkers. These pathways are not managed and as a result sometimes “branch off” and cut through the dune face onto the beach. This can lead to the cutting up of the dune face into “sections” or “blocks” which tend to be more sensitive to marine, aeolian and further human induced erosion.



**Figure 3.30: Sea buckthorn at The Burrows, Portrane**



**Figure 3.31: Spread of buckthorn to adjacent dune at The Burrows, Portrane**

Sea buckthorn stands were observed at a small area of foredune in the middle section of the Burrows (Figure 3.30). Although stands present had a limited extent (100m<sup>2</sup> approx), it was clear that adjacent areas of dune were being colonised by young sea buckthorn suckers. These neighbouring areas of dune present a prime habitat for buckthorn colonisation, and if it continues to grow unchecked its rapid spread is inevitable (Figure 3.31)



Figure 3.32: Vandalism of signage at The Burrows, Portrane



Figure 3.33: Signage prohibiting vehicular and pedestrian access and horse riding at The Burrows, Portrane

A variety of signage was observed at the Burrows (Figure 3.32 and Figure 3.33), some of which had been vandalised (Figure 3.32). Site visits revealed that vehicular access to the beach, sand dunes and salt marsh was relatively easy to accomplish. Pedestrian access management was limited to protective fencing around private property and private dwellings. This suggests that beach and dune users do not adhere to the current signage and that the current signage may be degraded or outdated.

### GIS Application (Portrane)

#### Coastal Change

Historical comparisons were made between the 1935 OS series maps, and 2000 and 2005 aerial photographs (OS, 2000 and BKS, 2005). These revealed that there has been a significant variation in the Portrane coastline position (Figure 3.34).

The northern section of the coastline has experienced significant erosion (240m) from 1935 to 2000. However, since 2000 significant foredune development has taken place and its associated accretion has led to an increase of 50m during this period. Coastal change has been less extreme in the southern sections over the 70 year period.

The coast has been eroding since 2000 with a decrease of over 5m recorded from 2000 to 2005. Previous studies comparing the high water mark suggest that there was erosion at the southern end of the Burrows between 1843 and 1938 (Kirk, McClure, Morton., 1998).



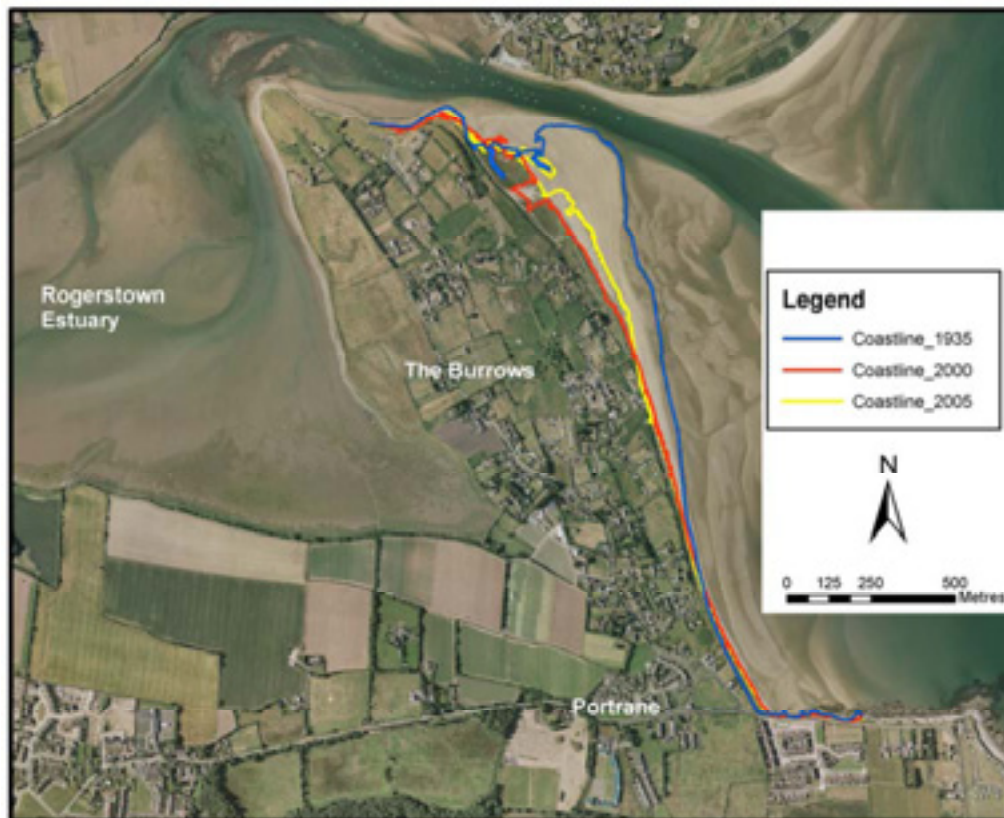


Figure 3.34: Annotated aerial photograph (2005) showing coastline evolution at The Burrows, Portrane

#### Development Encroachment and Access

Analysis of available aerial photographs suggests that comparatively limited development has taken place within the Burrows system over the 2000 – 2005 period. However the analysis does



Figure 3.35: Annotated aerial photograph (2005) showing close proximity of development to the eroding dune face at Portrane

show that at least 24 dwellings are located within 60m of the eroding dune face. Recently, fresh applications have been received to build a number of developments at the Burrows.

However, Fingal County Council are already concerned that the Burrows system has far exceeded its capacity for holiday home development and further development could only exacerbate current usage which has already created complicated access problems. GIS analysis (Figure 3.35) has revealed that individual dwellings at Portrane are located as close as 22m to the erosional face of the foredune at a location that has eroded up to 12m since 1935.

### 3.2.3 South Beach, Rush



Figure 3.36: Annotated aerial photograph (2005) showing the location of Rush, South Beach

South Beach, Rush (Figure 3.36) is situated to the east of Lambay Island and to the south west of Rush town on the North County Dublin coast. The section of coastline between Rush and Portrane forms a mini sub-cell within the east coast sub-cell (bays bounded by short headlands or rocky coast) from Howth to Skerries. The Rogerstown estuary exerts a strong influence on the sediment regime of the area while wind and tidal conditions have considerable influence on the beach and fore dunes. The mouth of the Rogerstown Estuary is located to the south of the beach/dune system which contains an eighteen hole golf course and clubhouse owned by the local golf club. The area behind the golf links to the north and west of South Beach is characterised by a series of residential developments.

The beach and surrounding dunes are valued as important environmental and amenity areas. The dunes and foreshore are afforded protection under European (92/42/EEC) and National



legislation (Wildlife (amendment) Act, 2000). A number of rare plants e.g. Hairy Violet (*Viola hirta*) and Meadow Barley (*Hordeum secalinum*) are also located within the site, the survival of which may be threatened by the spread of invasive sea buckthorn.

Access is also a significant problem, with vehicles being driven and parked on the beach and back dune areas and there is evidence of pathway erosion across the site.

### Current Site Status (Rush)



Figure 3.37: Sand dunes at South Beach, Rush.



Figure 3.38: Embryo dune development and Marram grass establishment at South Beach, Rush

Field assessments were carried out to assess the geomorphologic status of the site and record general observations on amenity usage, dune vegetation status, sea buckthorn extent, planning control, development encroachment, access signage and vandalism. Primary issues at South Beach, include invasive species control and access management.

Site observations indicated that the geomorphologic status of the system was relatively healthy and no obvious signs of recent erosion were present. A plentiful supply of sandy material was observed at the dune face (Figure 3.37), particularly at the mid-section of South Beach and embryo dune development was also recorded (Figure 3.38). However, the presence of a vertical dune face implies the area may have been eroded in previous years. Again, this change in coastline position is typical at sandy beaches that are backed by dune systems (McKenna *et al*, 2000).



Figure 3.39: Vehicular control signage at South Beach, Rush



Figure 3.40: User information signage at South Beach, Rush

Signage at Rush took a variety of forms and ranged from simple black and white prohibitive statements (Figure 3.39) to more detailed prohibitive statements with multicoloured symbols/illustrations (Figure 3.40). However, site observations indicated that this signage was not adhered to. Bottles were found near bonfire remains in the dunes. Illegal dumping is also taking place in the dunes and cars both park and drive in areas that are designated for pedestrian use. .



Figure 3.41: Vehicles parked on the beach (car park in foreground) South Beach, Rush



Figure 3.42: Bonfire remains in the sand dunes South Beach, Rush

Site observations also revealed that vehicles tend to park on the beach, even when the car park, located in close proximity is empty (Figure 3.41). This behaviour graphically illustrates the failure of signage and/or provision of information to deter this type of usage. Bonfire remains were found at several locations and a plentiful supply of fuel (pallets, sticks, plastic) that could be used in any future bonfire was located nearby (Figure 3.42).

Mature sea buckthorn stands are located throughout the Rush dune system (Figure 3.43). In many parts they are thick and impenetrable and cover a total area of over 30,000m<sup>2</sup>. Site observations reveal that the shrub is spreading rapidly. Stumps of mature stands measures up to 5-6cm in diameter and many stands are up to 3.5 metres tall. The entire dune system backdunes (Figure 3.43) to the foredunes (Figure 3.44) is now at risk from complete buckthorn colonisation. As a result a long-term sea buckthorn control scheme should be considered as part of any management plan.



Figure 3.43: Extensive buckthorn establishment at South Beach, Rush



Figure 3.44: Buckthorn invading dune face at South Beach, Rush

Site visits also revealed that a significant number of both holiday homes and permanent residencies are located in close proximity to the dune face at the southern extreme of the Beach. Some houses have adopted ad-hoc protection measures from the sea in the form of concrete slabs and mounds of gravel (Figure 3.45). However, this is not part of any co-ordinated or managed plan and adjacent properties can be seen to have no evident protection measures in place (Figure 3.46).



Figure 3.45: Ad hoc coastal protection at South Beach, Rush



Figure 3.46: Housing close to the foreshore at South Beach, Rush

Vandalism was prevalent at South Beach as illustrated by spray painting evident on the life guard hut (Figure 3.47) and damage to local signage (Figure 3.48).



Figure 3.47: Vandalism of the Life Guard Hut at South Beach, Rush



Figure 3.48: Damaged signage on the beach at South Beach, Rush

## GIS Application (Rush)

### Sea buckthorn

Sea buckthorn is of particular concern at South Beach, Rush. Figure 3.49 shows the current extent of buckthorn at South Beach dunes. At South Beach, buckthorn has become established within a Natural Heritage Area (NHA) and Special Area of Conservation (SAC). Sea buckthorn coverage was compared between 2000 and 2005 using aerial photography layers in the GIS. Figure 3.50 shows the extent of spread in buckthorn between 2000 (yellow) and 2005 (red). The 2000 buckthorn stands have spread up to 24m over the five year period and estimations of overall spread indicate an increase of c.23%.





Figure 3.49: Annotated aerial photo (2005) showing Sea buckthorn distribution at Rush, South Beach



Figure 3.50: Annotated aerial photograph (2005) showing Sea Buckthorn growth/spread from 2000 (yellow) to 2005 (red)

Site visits confirmed that stands are becoming increasingly impenetrable. This issue is further complicated by the fact that the buckthorn is contained in a designated nature conservation site and therefore a sensitive management approach will have to be adopted.

### Coastal Change

Historical comparisons were made between the 1935 OS series map and aerial photographs from 2000 and 2005 (Figure 3.51). Results indicate that the extent of shoreline change from 1935 to 2005 has been most pronounced at the southern and northern extremes of the Beach with erosion of over 25m and 30m being recorded over this period respectively. The overall coastline position in middle sections has remained relatively stable with alternating periods of erosion and accretion leading to limited net change.



Figure 3.51: Annotated aerial photograph (2005) showing coastline evolution at South Beach, Rush

Figure 3.52, shows that this particular stretch of coastline has experienced up to 28m of erosion between 1935 and 2000. However, accretion (5 to 6m) has occurred over the 2000 to 2005 time period and overall accretion appears to be the dominant trend along the Rush coastline during the 2000 to 2005 period.





Figure 3.52: Annotated aerial photograph (2005) showing coastline evolution at the northern end of the South Beach, Rush

### Access (Rush)

GIS analysis shows that the foredunes are currently under considerable pressure as a result of



Figure 3.53: Annotated aerial photograph (2005) showing one potential route for a coastal walkway at South Beach Rush



human recreation (mainly walking) causing degradation of the fabric of the dunes. Currently there may or may not be enough pressure to warrant building a coastal walkway but with the expected increase in pressure in the near future it may be worth considering potential management solutions. As there are no existing formal paths at Rush, the GPS was utilised to map a potential route and the data was then transferred to the GIS.

The route proposed was based on the assumption that the current buckthorn Stands would be removed and included the provision of various access points along the path to the beach (Figure 3.53). This suggested route is deliberately set back from the dune edge and as a result crosses privately owned land and therefore this could only proceed with the complete agreement of the landowners, Rush Golf Club.

## 4:0 DISCUSSION

### 4.1 COASTAL CHANGE AND COASTAL PROTECTION

The allocation of public money to coastal protection schemes often stems from strong public demand for amenity protection. This protection often requires a significant amount of research prior to the adoption of coastal protection measures. On the Fingal Coast, demand for dune protection has been most significant at Portmarnock and, to a lesser extent, Portrane whilst Rush has been afforded comparatively little in terms of dune protection.

In Ireland the property owner has the right to protect the property from erosion or inundation by the sea (ECOPRO, 1996). However, Local Authorities are usually expected to intervene where the property concerned is of high amenity value and in public ownership. Currently, coastal protection works are conducted by the Department of Communications Marine and Natural Resources (DCMNR) under the Coastal Protection Act, 1963.

It is clearly evident that the North Dublin coast has been experiencing coastal change over the last seventy years and this will continue to take place as the coastline evolves. Coastal change is a common occurrence on sandy beaches where periods of erosion are sometimes balanced by periods of accretion leading to no net change in shoreline position (McKenna *et al*, 2000). This can occur over varying time periods and is influenced by a wide range of continuously changing variables such as wind, waves, tides and vegetation status. As a result, beaches are fundamentally dynamic and long-term periods of accretion are sometimes reversed by intense short – term events such as storms (McKenna *et al*, 2000).

It is also important to place current impacts and changes to dune-beach environments at all the sites in context with the future impacts possible under global warming. The dune-beach environments are at present in a delicate state, with environmental deterioration evident at the three sites and in the case of the Burrows the shoreline is undergoing an active erosion cycle. Under the different IPCC scenarios of global warming (IPCC, 2007) this situation is likely to worsen. For the east coast of Ireland model simulations to 2050 show a seasonal water deficit of up to 15% less rainfall in summer, increased storm intensity, increased easterly on-shore winds (frequency and speed) and acceleration in sea level rise. These effects will worsen the condition of the dune-beach environments under human use/pressures, with coastal retreat, increased likelihood of dune vegetation fires and therefore wind blown sand.

A considerable amount of research has been undertaken on Velvet Strand and its environs since remedial work began in 1989/1990. Site visits and GIS analysis indicate that coastal change was not limited to erosion. Whilst foredunes to the northern end of Velvet Strand have eroded up to 15m over the 65 year period between 1935 and 2005, during the same period, a 300m accretion was recorded at the southern tip of Portmarnock point. Mulrennan (1990) has suggested that this phenomenon can be explained by land reclamation and the infilling of the estuary and associated

reductions in the volume of the estuary's tidal prism leading to the near closure of the estuary mouths and sediment depletion at the opposite end. It is clear that previous sediment starvation at the northern end of Velvet Strand has had an impact on beach lowering and foredune erosion and this has been exacerbated by severe storm events such as those that occurred in 2001. Extensive areas of foredune are being utilised for recreational activities (walking, running, football training) and this is causing vegetation degradation resulting in aeolian induced erosion. This combination of factors has contributed to the instability of the dunes at northern Portmarnock.

In order to understand these processes in greater detail and their influence on the sand dune system it may be necessary to undertake a comprehensive monitoring programme. Immediate requirements include the delay of human induced erosion using small scale, short term (0-1 year) schemes that can be implemented at relatively low cost and that will have minimum impact on the coastal environment.

The Burrows, Portrane has also experienced significant coastal change. Northern sections of foredune have eroded by some 240m between 1935 and 2000. However, this trend has been reversed over the 2000 and 2005 period when an accretion of 50m was recorded. Currently southern sections of the Burrows appear to be eroding (at least 5m between 2000 and 2005). Erosion at this section of coast has become a serious issue due to the fact that a significant number of dwellings are located in close proximity to the eroding section of coastline. As the coastline attempts to readjust and find its equilibrium position, which may be located further back within the dune system, these houses may come under threat. However, shoreline retreat is common on Ireland's eastern coasts and is expected to increase further as a result of climate change and associated sea level rise.

A way forward may be to adopt a "do nothing" approach – whilst this may appear like irresponsible abandonment in the face of difficult coastal erosion problems it is actually a deliberate, logical, strategy designed to facilitate a degraded coastline, to rebuild its natural defences and achieve a state of reasonable dynamic, equilibrium (ECOPRO, 1996).

Any hard engineering coastal protection works could interfere with coastal processes and may not be financially viable in the long-term. Furthermore, hard engineering coastal protection solutions cannot proceed without an in-depth knowledge and understanding of local coastal processes. At Portrane, there is a lack of this vital baseline information and prior to a decision to adopt any approach a full monitoring scheme would be essential. Short-term protection measures could be adopted during the monitoring period (i.e. sediment boxes and gabions) and these may slow the toe erosion of the dunes. However, these temporary solutions are costly, require regular maintenance, may be subject to storm damage and will themselves influence the dynamics of the system.

Whilst coastal change may currently not be the most significant management issue at Rush the coastline evolution results do indicate that there has been definite change over time. The coastline

has retreated at the northern and southern extremes between 1935 and 2000. More recently, between 2000 and 2005, it would appear that the majority of the coastline has been accreting, particularly at northern and central sections. However it should be noted that over the same period, there has been definite erosion at the southern extreme of the Beach.

A monitoring scheme should be implemented in an attempt to better understand the complexities of this system as this would provide decision makers with the baseline data required to make effective management decisions.

#### 4.2 SIGNAGE/ VANDALISM / FIRE CONTROL

The effectiveness of the design of particular notices within the three sites is questionable. Site observations indicate that most signs simply intend to prohibit access and/or particular behaviour and lack a positive and explanatory emphasis that is sometimes required (Brooks and Agate, 2001). Very little information was available on the environmental and cultural significance of the dunes and the underlying reasons for current dune access restrictions. Signage is an essential information and education opportunity and if possible should include a brief history of the area with graphical representations of the status with respect, for example, to coastal change and ecology. Other items for consideration include an outline of the any current plans or recommendations, the potential future scenario with/without management intervention and an indication of the importance of users' co-operation in maintaining the amenity.

In general, signs were found to be in a poor state of repair and this tends to suggest a lack of concern about definite management issues. Therefore where possible signs should be maintained and if they have become obsolete then they should be removed immediately.

Signage sometimes goes unnoticed and should be positioned at clearly visible access points along the beach or dune entrance. Enforcement may be necessary particularly in areas where signs are being deliberately ignored.

As consistent waymarking can be effective in keeping people on a path to avoid erosion or damage to restoration work (Brooks and Agate, 2001), this approach should be considered for all of the public rights of way and other established routes.

Many of the signs within the Fingal coast dune systems highlight existing Bye-laws. It should be noted that signage can be provided to prevent acts such as vandalism and illegal fires but does not address the underlying causes of anti-social behaviour. Voluntary measures such as codes of conduct are useful and are often effective in preventing unwanted activities. However, their success is dependent on the cooperation of beach users, which is not always forthcoming (McKenna *et al*, 2000).

A number of Bye-laws have been passed for the Fingal Coast under the following legislation:

- The Misuse of Drugs Act, 1977

- The Litter Pollution Act, 1997
- The Waste Management Act, 1996
- The Maritime Safety Act, 2005
- Control of Dogs Act, 1986 and the 1992 Control of Dogs (Amendment) Act and the Statutory Instruments S.I. No 442 of 1998 Control of Dogs Regulations
- Fingal County Council Prohibition of Consumption of Intoxicating Liquor on Roads and in Public Places Bye-laws 2002

The Bye-laws apply to all three sites and are concerned with prohibiting behaviour associated with litter, motor vehicles, firearms, fire, golf, begging, gambling, noise, graffiti, games, public swimming events, alcoholic beverages. Horses and dogs are also restricted at the beach during specified times. The local authority also has the power to designate particular areas of beach to surfing, sailing, jet skis, and powered boats.

It is understood that anti-social behaviour is taking place within the dunes, in the form of “bonfire parties”, underage drinking and littering. Furthermore, social gatherings are taking place in areas susceptible to erosion e.g. recovering dune slacks.

Overall along the Fingal coast, with the exception of littering, there appears to be a lack of enforcement of the Bye-laws. To counteract this, the local authority could designate an “Authorised Person” to enforce these Bye-laws. This “Authorised Person” or warden’s remit could cover the entire Fingal coast on a seasonal basis. It is realised that in some circumstances and when dealing with specific individuals that a warden will require police assistance to provide enforcement. To assist the Warden a telephone hotline could be established for beach users to report anti-social behaviour.

Where prosecutions are successful an attempt should be made to generate as much publicity as possible in order to discourage other users from committing similar offences. In addition the police should be encouraged to mount sporadic high profile campaigns to indicate that anti-social behaviour will not be tolerated and to promote socially responsible usage of these amenities.

#### 4.3 ACCESS

Public access is a major issue at all three sites. Site visits have revealed evidence of vehicles in the dunes and foreshore at both Rush and Portrane despite previous attempts by the local authority to curb vehicular access. Vehicles on the beach are not only a health and safety hazard but can also contribute to beach erosion. The fragile dune vegetation and unconsolidated sand substrate has a very limited load bearing capacity and this is thought to lead to the hardening of the beach surface (McKenna *et al*, 2000). It is noted that provision of beach parking can be the only option at peak times. But even when there is ample parking as was evident in Rush there is a pattern of car usage on the beach. To curb this type of usage a combination of restricting access and education of the users as to the damage being caused will be required.



The effects of human erosion could be reduced through careful signage and fencing. In some cases it may be necessary to designate particular areas of the beach for parking. Vehicular access to the beach is completely prohibited at Velvet Strand, Portmarnock. In the case of Portrane, parking takes place even though it is prohibited within an area of salt marsh habitat (protected under European Legislation). The provision of an alternative parking area for Portrane may need to be considered. Conversely, roadside parking can lead to traffic jams and environmental damage as visitors sometimes tend to cross the adjacent dunes to access the beach.

In summer months, in addition to the existing car park, a designated car parking area was created on the Rush beach using large boulders. However, these tended to sink through the sand and therefore allow access and there was also usage problems associated with cars and incoming tides. The boulders that were deployed at access routes appear to have succeeded in restricting access but these were then removed at the end of the season.

The trampling of dune vegetation is usually more detrimental than vehicular damage and in most cases is harder to control. Trampling of dune vegetation occurs mainly because pedestrians tend to take the shortest route to the beach that is physically passable (McKenna *et al* 2000). This problem can be avoided by creating access paths and using signage to inform the beach user of their potential contribution to beach erosion. A significant amount of access control has been implemented at Portmarnock where dune restoration works have been fenced off from public access.

This is showing slight signs of success in terms of vegetation status but a number of pedestrian tracks still cut through the dunes. In Portmarnock, some fencing has become broken and rusty and as a result parts of the dunes could be considered dangerous and pose a serious risk to user health and safety

Board walks have also been provided in the middle section of the Portmarnock dunes; however considerable erosion has occurred in areas adjacent to this path and close to the beach access point and this area needs further consideration.

#### 4.4 DEVELOPMENT ENCROACHMENT

Both permanent and holiday homes including caravans/mobile homes are located along the Fingal coast. The Burrows, Portrane has seen a significant increase in holiday home encroachment (H. Visser, *Pers. Comm.*, 2007). Site visits and GIS analysis indicate that many dwellings are currently located close to the eroding coastline. Given this fact and that the dune area is of high amenity and conservation value, development on the Burrows should be seriously restricted. A local planning authority can take measures to ensure frontal dunes are protected. For example, Co. Wexford has a general 50m setback on soft coasts. This is to be extended to 100m for soft coasts (Wexford County Council, 2007-2013) under objective CZ4 of the Draft 2007-2013 County Development Plan. This objective intends to "*Prohibit any new building or development including caravans and temporary dwellings within 100m of soft shorelines*".

Development encroachment is also a problem at Rush. A number of permanent dwellings have been located directly on the primary dune with little consideration given to the environmental and visual consequences of development.

Various complications can arise from developing in an unsustainable manner. For example, septic tanks associated with caravan parks and holiday homes located in sand dunes can cause local saturation of the sand, leading to nutrient enrichment which encourages the growth of plant species not normally found in the dune environment (McKenna *et al*, 2000). At Portmarnock, the development of two golf courses on the dunes has restricted development.

#### 4.5 SEA BUCKTHORN

A large number of reports have highlighted dune invasion by exotic species (Binggeli., *et al* 1992). In Ireland, one of the most aggressive species is sea buckthorn, *Hoppophae rhamnoides* which has colonised an extensive area since it was first introduced in Wexford in 1838. Its spread is an issue at Rush, and to a lesser degree at Portmarnock and Portrane, as when it matures it can become impenetrable and eventually cause problems with access and will tend to cause a reduction in biodiversity.

Sea buckthorn has spread extensively at Rush and now forms impenetrable thickets over many stretches of former mobile dunes and as a result, most of the flora of these stretches has been either eliminated or heavily modified (Ecological Study of the Coastal Habitats in County Fingal, 2004). The local authority has also expressed concern that the buckthorn stands provide cover for underage drinking parties and anti- social behaviour.

Particular caution must be exercised when considering buckthorn removal or management options at Rush as the protected areas and those adjacent to them may be particularly sensitive to changes in ecological structure (i.e. buckthorn removal). Before any action can commence, it is recommended that a detailed ecological study be conducted in order to establish the abundance and presence of rare flora and fauna species in and around sea buckthorn stands. The County Council's existing ecological study should provide important baseline information for any future research.

The extensive area covered by buckthorn at Rush implies the need for a long-term buckthorn/scrub management strategy. However, information pertaining to the local terrain (i.e. Digital Terrain Model - DTM) may also be required. If removal is to proceed, options and resources available for follow up treatment must also be considered, as scrub cutting without further management can increase the vigour of scrub and stimulate growth.

The option of complete eradication (of sea buckthorn) could be considered for the Portrane area. Here, buckthorn stands are relatively small in extent and could be eradicated and treated over 3-4 days. This would not include a determined follow up treatment and pulling programme as suckers are currently spreading.

The buckthorn situation at Portmarnock dunes is slightly complicated due to the terrain on which colonisation has taken place. Areas occupied by buckthorn include steep dune cliff faces and areas of sensitive accreting foredune. Any buckthorn control or removal programme (as part of a management plan) would require consultation with Portmarnock Golf Club. An assessment of flora and fauna would also be required along with the overall stability of the dune face and finalised recommendations could only be made once these findings are established. In the short-term, it is vital that buckthorn is kept in check in order to prevent it from spreading to adjacent dunes.

## 5:0 RECOMMENDATIONS

There is obvious and justified concern, from both the local community and the relevant authorities, regarding the Fingal coast. Despite this concern, there is virtually no monitoring data available nor is there any monitoring strategy for the region. This fundamental lack of information restricts the scope of any management plan and therefore, a fundamental recommendation would be to implement a routine monitoring programme as part of an overall integrated plan for sustainable management for the Fingal coastline.

As there is a limited amount of monitoring data available, the recommendations are focused, but not exclusively, on addressing the current human issues highlighted at each of the sites. It should be noted that in an ideal world any development in the dunes, either temporary or permanent, should be avoided. However, given the level of human pressure on this particular coastline it is envisaged that some physical structures may be required. For example, the provision of walkways in the dunes could help reduce the current level of damage caused in the dunes by uncontrolled trampling.

Recommendations are listed for each of the sites and for all of the issues identified as follows:

### 5.1 VELVET STAND – PORTMARNOCK

#### 5.1.1 Coastal Change / Dune Protection / Access

- Implement a monitoring programme in order to determine the:
  - Effect of the estuary on the sediment transport regime
  - Rate of dune toe erosion
  - Impact of human interference
- Create a recreational area in the already heavily eroded dune area directly south of the grass revetment. This designated area could help alleviate pressure on sand dunes to the south.
- Remove the existing golf club boundary fence and replace it with a more aesthetically pleasing fencing material. At present the fence is unstable due to undercutting in many places and large sections have been buried under blown sand thus allowing beach users to create tracks across the golf course.
- Control access through the dune with provision of a board walk using an adjustable or movable walkway such as a board and train track surface or duckboard. This adjustable path should be embedded in the sand, and could be relocated when areas adjacent to the path experience changes in sand surface levels. The width of the path should be between 1.5m – 2m to allow pedestrian flow in both directions.

- Undertake vegetation replanting in early spring in the degraded areas of the dunes with local stands of Marram grass (*Ammophila arenaria*) in order to decrease sand blow.
- Reinforce the access route to the Strand that runs through the dunes with hand rails (1.6km from the grass revetment). This may persuade beach users to stay on this path, thus avoiding the sporadic path development in the dunes that has become a feature in this area. It is suggested that a width of at least 2m be maintained between any railings to enable full access and that the any structure put in place should be sensitive to the surrounding landscape.
- Consider removal of the chain-link fencing as it is in poor condition and could pose a potential threat to public safety.
- Provide signage detailing the reason and extent of dune restoration at major access points augmented by secondary reminder signs at frequent intervals on the perimeter fences around replanted areas.
- Remove or replace all signs that are in a poor state of repair or that have become obsolete.
- Ensure that the signs restricting access are as non-intrusive as possible (only erected in areas where restrictions apply) and informative - education is seen as an essential tool in preventing human induced dune erosion.
- Establish consistent waymarking on access routes so that visitors have confidence in following the marked route and are less tempted to make their own way. Ensure that any signage provided is regular maintained, for example this approach could easily be applied to the access zone to the Strand that cuts through the two golf clubs.

#### 5.1.2 Vandalism/ Fire Control

It is unrealistic to expect the complete disappearance of bon-fires in the dunes but a variety of measures could be undertaken to try to reduce the number of bonfires and repair the damage they cause:

- Remove flammable material (e.g. sticks and plastic) from the dunes and beach.
- Clear the remains of existing bonfire sites to prevent them being used as sites for future fires.
- Use informative signage to increase awareness of the potential hazards and environmental consequences of bonfires.
- Replant damaged areas of dune with Marram grass and cover effected areas with surface stablisers such as jute matting.
- Thatch exposed slopes of bare sand with forestry thinning or mulch mats and plant with Marram or other sand binding grass species (McKenna *et al*, 2000).
- Employ a beach warden to help with enforcement of existing Bye-laws that the local authority has implemented under the Local Government Act 1994. This individual could be employed



on a seasonal basis at peak times (May – September) and could cover more than one coastal location. The warden's remit could include education, enforcement and monitoring as well as raising awareness.

- Provide support for the Warden by establishing a hotline for users to report detrimental usage of the amenity and ask the local Gardai to help to curtail anti-social behaviour.

### 5.1.3 Sea buckthorn (*Hippophae*) Control

- Undertake a detailed ecological study in and around the perimeter of buckthorn stands to determine the ecological impact of any buckthorn control scheme.
- Keep current *Hippophae* stands in check by grubbing up new suckers and treating with suitable herbicide unless there is a serious threat to protected flora and/or fauna, in which case full removal may have to be considered.
- Organise consultation between the local authority, IMG and Portmarnock Golf Club to effectively discuss the buckthorn issue prior to the commencement of any control schemes – the majority of plants are located within the golf club boundary.

## 5.2 THE BURROWS – PORTRANE

### 5.2.1 Coastal Change

- Invest in monitoring and modelling of coastal processes (Appendix II) in the Burrows/ Rogerstown area in order to determine why, and at what rate, erosion is taking a place.
- Whilst a monitoring scheme is being implemented a “*do nothing*” approach should be adopted. This period will provide the opportunity to assess the natural processes and then suggest the best solution in economic terms for this location. This may be a sensitive issue but the implementation of any short-term coastal protection schemes without relevant background data would be ill-advised.
- Inform the public of the retreating coastline and associated risk of coastal erosion in the area through signage and the media and advise the relevant authorities of the potential risk associated with granting planning for development in this area.

### 5.2.2 Vandalism/ Fire Control

As for the previous site, vandalism is a concern at Portrane. It is recognised that this is a difficult problem to eradicate but a variety of measures can be taken to try to reduce the impact of anti-social behaviour:

- Remove flammable material (e.g. sticks and plastic) from the dunes and beach.
- Clear the remains of existing bonfire sites to prevent them being used as sites for future fires.
- Use informative signage to increase awareness of the potential hazards and environmental consequences of uncontrolled bonfires.

- Employ a beach warden to help with enforcement of existing Bye-laws that the local authority has implemented under the Local Government Act 1994. This individual could be employed on a seasonal basis at peak times (May – September) and could cover more than one coastal location. The warden's remit could include education, enforcement and monitoring as well as raising awareness.
- Provide support for the warden by establishing a hotline for users to report detrimental usage of the amenity and ask the local Gardai to help to curtail anti-social behaviour.

### 5.2.3 Access and Provision of information (Signage)

- Remove or replace all signs that are in a poor state of repair or that have become obsolete.
- Provide information on the evolution of the coastline possibly to highlight the natural processes occurring and their influence on this section of Fingal coastline.
- Construct a gate or concrete bollards to further restrict vehicular access to the northern section of the Burrows
- Direct traffic towards the car park at the southern end of Portrane.
- Formalise existing path (running north – south) within dunes to decrease erosion and usage of alternative paths.
- Provide signage to dunes and caravan park entry points illustrating the important role that inhabitants/users have in dune conservation and reaffirming the need to keep to the designated routes.
- Install informative signage describing the nature and reason behind any monitoring programme.

### 5.2.4 Development Encroachment

- Land use restrictions can have a profound environmental impact. The adoption of a setback line can allow the natural development of the coastal ecosystem that may lead to the establishment of wider beach profiles. Monitoring should determine the required setback distance in a particular area and this estimate should also take into account climate change scenarios. A minimum set back distance of 50m is recommended for soft coasts such as that found at Portrane.
- Further restrictions on development could be enforced through the Planning and Development Act (2000) and the relevant bodies should be made aware of the particular physical attributes of this site and their implications for potential development.

### 5.2.5 Sea Buckthorn Removal

- Completely remove established sea buckthorn stands in a 3-4 day period and prevent further spread to neighbouring dune areas:
  - Use Power tools (Chainsaws, clearing saws and brushcutters) to manually remove established plants.
  - Hand pull (including roots) suckers in surrounding foredune area and monitor subsequent results.

### 5.3 SOUTH BEACH - RUSH

#### 5.3.1 Coastal Change

- Undertake monitoring to develop baseline data on coastal geomorphology, hydrodynamics and sediment processes.

#### 5.3.2 Sea buckthorn (*Hippophae*) control

- Undertake detailed ecological study in order to establish species status in and around buckthorn stands.
- If conditions are favourable (limited biodiversity / low populations of significant species) then the restoration of the dune should proceed as follows:
  1. Suppression of pioneer growth:
    - Selective brush cutting and hand pulling could be undertaken at any time of year. Areas affected include foredune and immediate area around established buckthorn stands.
    - Mature stands should be tackled in winter to avoid disturbing nesting birds.
    - Power tools (Chainsaws, clearing saws and brushcutters), if sensitively applied, could be used in areas of foredune at this particular site.
    - A root-cutting chainsaw could be employed to remove stumps in more sensitive areas. Where necessary these could also be pulled by hand but this may be labour intensive and time consuming (non-herbicidal option).
  2. Phased removal of established scrub:
    - For large-scale removal a tractor and grab could be used to lift whole plants and roots. However, this is likely to destabilise the soil and should not be carried out near foredunes.
    - Cut stands should be removed from site and disposed of at a suitable location.
    - Sea buckthorn's nitrogen fixing capabilities can enrich substrate leading to invasions and future growth of various non-dune species and these weeds should be removed on a regular basis.
    - Due to sensitivity of habitat, particular care will need to be taken. A decision will have to be made on whether follow up treatment with herbicide is permissible (this will depend on the species present).

- Signage should to be provided to inform the public, prior to and during, of any proposed buckthorn removal scheme.

### 5.3.3 Access and Provision of information (Signage)

- Remove or replace all signs that are in a poor state of repair or that have become obsolete.
- Investigate the need for coastal pathways/walkways in order to preserve dune vegetation and amenity status.
- Enforce a ban on vehicular access to the beach at Rush. This control can be accomplished by placing concrete bollards (already available on site) across beach access roads and tracks.
- Provide signage to the beach car park with signposting from Rush town centre and all approach roads.

### 5.3.4 Vandalism/ Fire Control

As for the previous site, vandalism is a concern at Rush. It is recognised that this is a difficult problem to eradicate but a variety of measures can be taken to try to reduce the impact of anti-social behaviour:

- Remove flammable material (e.g. sticks and plastic) from the dunes and beach.
- Clear the remains of existing bonfire sites to prevent them being used as sites for future fires.
- Use informative signage to increase awareness of the potential hazards and environmental consequences of uncontrolled bonfires.
- Employ a beach warden to help with enforcement of existing Bye-laws that the local authority has implemented under the Local Government Act 1994. This individual could be employed on a seasonal basis at peak times (May – September) and could cover more than one coastal location. The warden's remit could include education, enforcement and monitoring as well as raising awareness.
- Provide support for the warden by establishing a hotline for users to report detrimental usage of the amenity and ask the local Gardai to help to curtail anti-social behaviour.

For costing purposes an estimation of the scale of the work required to implement the main recommendations at each of the sites is provided below (see also Appendix 1):

Description	Portmarnock	Portrane	Rush
Area of Marram Planting	1.4 Ha (14,000m <sup>2</sup> )	0.12 Ha (1,289m <sup>2</sup> )	To replace sea buckthorn
Area of Sea buckthorn removal	0.35 Ha (3,511m <sup>2</sup> )	0.12 Ha (1,289m <sup>2</sup> )	3Ha (30,000m <sup>2</sup> )
Number of Signs Required	10	9	15
Proposed length of Coastal Walkways	1387m	N/A	1357m

Table 4.1: Estimation of the scale of work required for implementation of proposed recommendations

## 6.0 STAKEHOLDER/ COMMUNITY CONSULTATION

Meetings were held on the 24<sup>th</sup> May 2007 with representatives concerned with the current and future management of the Fingal Coast from the following organisations, Rush Golf Club, Burrow Residents Association, Portmarnock Beach Committee, Portmarnock Golf Club and Portmarnock Hotel and Golf Links. The aim of this consultation process was to present the research findings, outcomes and recommendations of this report to each of the three local communities and discuss and take note of the views expressed. The consultation process also provided the authors with valuable local insight on the range of issues associated with the management of the Fingal coast in advance of the publication of the final report. As part of the process, questions from all parties were welcomed during each of the presentations and these formed the basis for constructive debate between the authors, representatives of Fingal County Council and the local stakeholders present. The views expressed below, and especially some of the justifiable reservations raised, with respect to the recommendations, will require careful consideration prior to their implementation as part of a dune management plan for the Fingal coast.

### Portmarnock

- It was recognised that there was a definite health and safety risk posed by the degradation of the chain-link fence but this was coupled with worries about the potential impact of any method of removal scheme as well as the effects of their actual removal.
- It was felt that any beach warden would require the support of the Gardai in order to have any real impact on current beach usage and most especially anti-social behaviour.
- It was agreed that there should be a method developed to address the bonfire issue e.g. provision of water point or hose for quenching fires
- There was a suggestion to provide permits for horse riding on the beach but it was agreed that this may be difficult to administer and police.
- Slight reservations concerning the proposed “play area” as is in close proximity to the 18<sup>th</sup> hole on golf course
- Participants concurred that there was a need for fresh signage and that an upgrade of existing access pathways merited further investigation provided that the design was aesthetically pleasing.
- The suggestion that current dilapidated golf course fence be replaced and subsequently replacement with a new coastal walkway to include handrail on seaward side was well received. Again with the proviso that any structure would be subject to design consideration and would need full consultation with both the golf clubs and the local residents.
- It was agreed that there was a need to continue ongoing Marram planting initiatives and the authors were pleased to be informed of the current levels of involvement of local school children.



- Proposed that buckthorn be managed in accordance with current practices and prevent its spread into neighbouring dunes.

### Portrane

- There was general recognition of the ongoing erosion problem at the southern end of the Burrows and support for the implementation of coastal processes monitoring programme.
- The recent development of pathways at the back of the dune system and the access restrictions put in place by the Council were welcomed but it was recognised that there were some outstanding issues with respect to rights of way.
- Local residents recognised the need to control planning especially given the specific environmental conditions at this site and their proactive ongoing role in addressing planning and sustainable development issues was acknowledged by the authors.
- There was major concern over land registry and the lack of clarity of ownership in the area and the effect that this was having on the current planning situation in the dune system.
- The residents group were in favour of the 'set-back line' concept and community ownership of coastal area but recognised the sensitivity of implementing such an initiative on an eroding coastline.
- There were genuine concerns over infrastructure concerned with developments – most notably with un-registered septic tanks and their potential environmental and health and safety implications.
- There was recognition that there was an ongoing dumping problem at the northern of the beach.
- It was felt that provision of effective signage was a priority for the area
- Concerns were expressed about the legality, in terms of its original construction and ongoing use, of the private jetty at the northern (estuary) end of Burrows.

### Rush

- There was general agreement that the spread of sea buckthorn was a major concern at this site and therefore that potential removal techniques merited further investigation.
- There were concerns expressed about increasing levels of anti-social behaviour and vandalism and it was felt that the provision of a beach warden with support from the Gardai would be a positive step.
- It was agreed that car access to the beach was a real problem and that action should be taken to prevent vehicles access to the beach
- There was opposition to creating a coastal walkway on the following grounds: (1), any route chosen would, by necessity, have to pass through golf course land, (2), this proximity to the golf course meant that there was potential for golf balls to injure pathway users and (3), that the

current user numbers did not merit the provision of a walkway. However it was recognised that the expected increase in visitor numbers in the future may justify the provision of a walkway and therefore that it was essential for ongoing dialogue between the Council and the Golf Club.

- There was recognition that general signage in the area with respect to beach management initiatives needed to be improved and that specifically signage to the public car park should be put in place.

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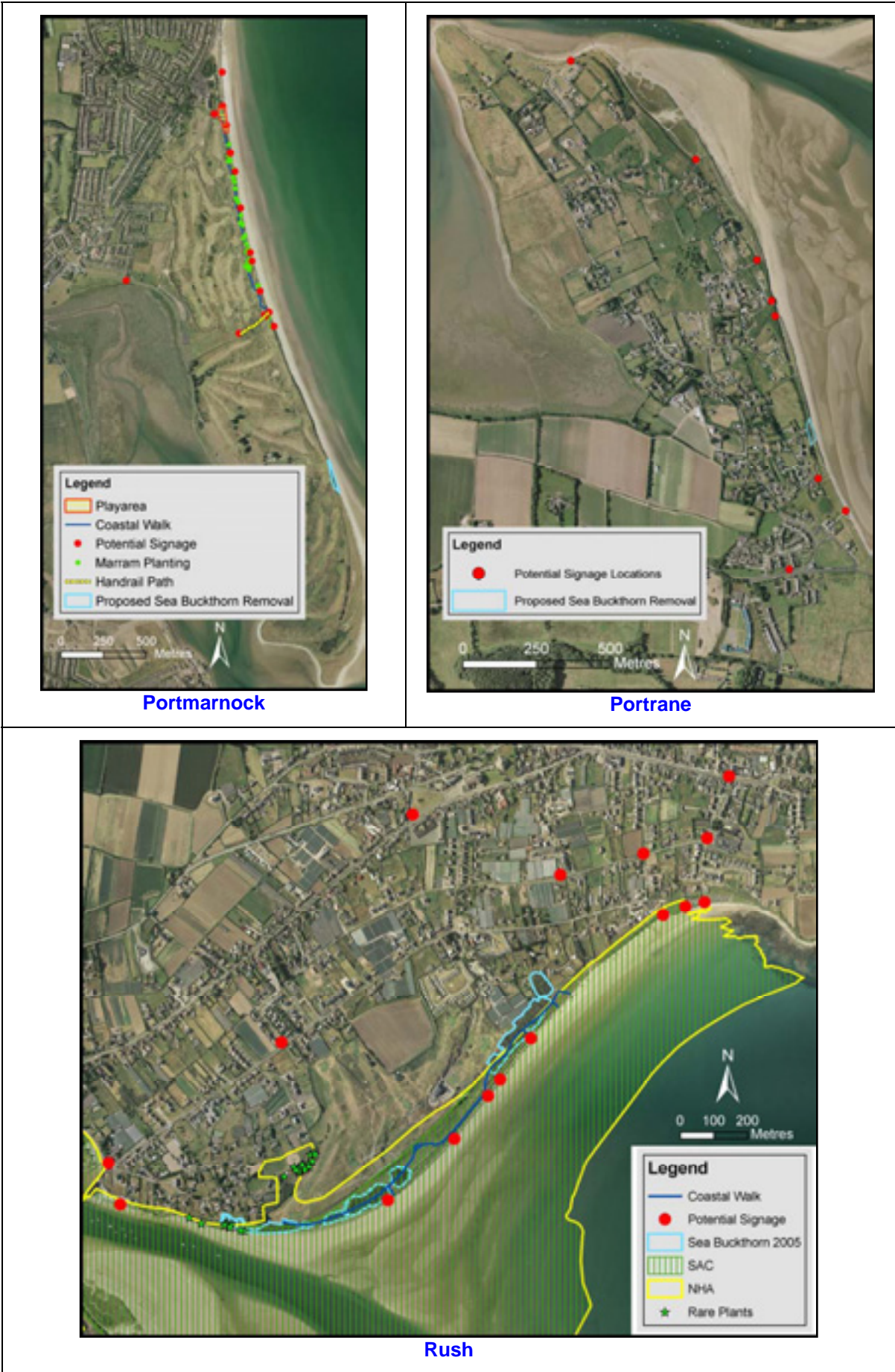
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APPENDIX I: SUMMARY OF SITE RECOMMENDATIONS



## APPENDIX II: BUCKTHORN CONTROL

### Sea buckthorn Methods of Control

On many sites a varied programme is most effective. The effectiveness of treatments varies greatly from one geographic area to the next. Techniques adopted from Brooks and Agate (2001).

#### Cutting

Advantages:

- Cutting is selective and thorough.
- Cutting is the easiest way to get rid of large plants where a mower or bulldozer is unavailable or site access is difficult.

Disadvantages:

- Cutting is labour intensive and may be costly.
- On sites where sea buckthorn regrows after cutting, stumps or regrowth must be treated with herbicide. This adds to the costs and overall work commitment.

#### Grubbing-up

Advantages:

- Grubbing-up, if done with care, largely prevents problems of regrowth although spot-treatment is often necessary for surviving suckers.
- Grubbing-up can be done by hand or machine depending on the size of the problem.

Disadvantages:

- Grubbing-up by hand is slow.
- Uprooting by machine is unselective and can damage the soil and produce erosion. However, this may be balanced by the benefit gained from disturbing the seed bank buried within the soil.

#### Burning standing material

Advantages:

- Where live sea buckthorn can be burnt it is a low-cost method of disposal.
- Burning can clear sizeable areas quickly.

Disadvantages:

- Burning is hazardous and must be done with great care to prevent it getting out of hand.
- Burning is very destructive to wildlife, especially ground flora and fauna.

## Herbicides

### Advantages:

- Herbicidal treatment can be effective in controlling growth. However, for complete eradication, repeated spraying of regrowth over many years may be needed, as the plant may continue to sprout from underground stems.
- Treatment can be done by one or two people.

### Disadvantages:

- The effects of herbicides on the environment are not fully understood and some herbicides may be hazardous to the operator.
- Chemicals and spray equipment are fairly costly.
- Dead material remains standing and is unsightly unless cut down. Small stems of young plants may be left standing to form a windbreak which can reduce soil erosion on dunes.

## Mowing

### Advantages:

- Mowing is quick and efficient.
- Mowing is suitable for a wide range of plant sizes, depending on the available machinery.
- In most cases, mown material can be left in place to rot down.

### Disadvantages:

- Regrowth is likely except from old plants or on sites where sea buckthorn does not flourish. The effect of mowing may be to produce a 'carpet' of suckers the next year. Even annual mowing may not eradicate the suckers and new seedlings will rapidly invade the area unless rank grasses grow up which choke them out.
- Mowing is relatively unselective.
- Mowing machines cannot be used on very steep terrain. Heavy-duty machines may cause unacceptable erosion on fragile dune soils, even on slopes where they would otherwise be able to operate.

## COST OF REMOVAL WILL VARY DEPENDING ON

- DENSITY OF STANDS
- AGE OF PLANTS
- EASE OF ACCESS
- TYPE OF TERRAIN AND HABITAT SENSITIVITY
- REMOVAL TECHNIQUE EMPLOYED
- AMOUNT OF REGROWTH

Estimating the initial costs for regrowth of buckthorn is difficult. This will not become apparent until the summer after removal and it is recommended an assessment of regrowth be conducted.

There are many herbicides on the market, some of which are non-specific and lead to the contamination of ecosystems. English nature consent the use of "Timberel" which is a wood specific herbicide. However, this can damage herbs adjacent to the target plant so specific care must be taken along with protective suit, rubber gloves; Wellington boots and visors (the later when mixing the chemical only). This chemical should be used for foliar spraying only.

## APPENDIX II: COASTAL MONITORING RECOMMENDATIONS

The following are presented in their likely order of priority for baseline measurement and ongoing monitoring of an open coast situation

- Dune face position, rate and lateral extent of erosion, rate of dune recovery following erosion, and variability of upper beach levels.
- Sediment distribution and variability, both spatially and temporally.
- Water levels, nearshore waves and winds.
- Geomorphology and ongoing evolution of adjacent cliffs, underlying foreshore strata and nearshore seabed features.
- Evolution of backshore dunes.
- Nearshore currents (more important in and around estuaries).
- Variation in backshore groundwater levels.

(Adapted from: Scottish Natural Heritage and HR Wallingford, 2000)

Note that these priorities do not include biological or social monitoring, although these may be equally important to the selection, planning and implementation of a management programme.