Benthic Ecological Survey Report

Wicklow Harbour dredging campaign – proposed spoil disposal site.

Final Report

MERC Ecological Consultants, Loughaunbeg, Inverin, Co. Galway.
info@mercenvironmental.ie www.mercenvronmental.ie

Client name	Wicklow County Council
Address	County Buildings, Whitegates, Wicklow Town. A67 FW96

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Contents

1. Introduction

Wicklow County Council commissioned MERC Ecological Consultants to carry out a series of boat based subtidal benthic ecology surveys, including associated data analyses and reporting in advance of proposed dredging campaigns for Wicklow Harbour. The ecological surveys were required to contribute to the environmental assessment of a proposed new dredge spoil disposal site located northeast of Wicklow Harbour.

1.1 Scope of Work

The studies were necessary to inform the consenting of any future dredge spoil disposal activity. The project aimed to create a dataset that would describe the benthic ecology of the proposed new dredge spoil disposal site. Specific objectives were to characterise the habitats present as well as describe in detail the associated biological communities present within the proposed disposal site. The project scope included the preparation of a detailed report presenting the methodologies and outputs of the work undertaken.

Reporting requirements included the following:

- Description of methodologies employed for all sampling
- Description of methodologies for the various sampling analysis
- Detailed description of results from onshore analysis (infaunal assessment, video assessment, Particle Size and Organic Carbon assessment, habitat assessment)
- Discussion of the results with the assessment of impacts associated with dredging and disposal activities
- Description of Residual Impact
- Recommendations
- Reference list
- Appendices with: species lists, species abundance, images from each sampling location etc.

1.2 Site description

The location of the proposed disposal site is shown in Figure 1. The proposed disposal site is fully saline and is located subtidally in waters 9km northeast of Wicklow Harbour, approximately 2.3km from the closest point on the adjacent shore at Five Mile Point. Water depths within the proposed site range from 11m to 29m. The site is rectangular and measures approximately 0.6km from E-W and 0.75km from N-S. The site has not been previously licensed for the disposal of dredge spoil.

The site is exposed to strong tidal flows, which in this area of the Irish sea are the dominant hydrographic feature. Peak tidal flows may reach up to 4.5 knots during spring tides. The seabed in the area is characterised by a range of mainly coarse sediments, with occasional fractions of gravel, cobble and larger stones. A review of seabed mapping imagery (ww.infomar.ie) indicates the seabed is strongly sedimentary and features a series of highly sorted sediments which form a series of seabed mega-waves. The available information (www.infomar.ie) indicates the seabed in this area is dynamic and is very likely subject to the effects of high levels of sediment scour due to tidal flows resuspending sediments.

1.3 Proposed surveys

In order to inform and support the consenting process for the site, the following ecological surveys were required:

Benthic infaunal studies – a series of grab samples to be collected using a 0.1m^2 Day grab. 3 replicate samples to be collected from each of 6 preselected sites. Each sample to be sieved to 1mm and faunal residues to be analysed by an NMBAQC accredited facility. Particle Size Analysis and Total Organic Carbon to be evaluated for each Station sampled.

Benthic imagery studies – a series of drop frame mounted camera surveys to be conducted to collect high-quality seabed imagery for preselected stations. Imagery must allow for an evaluation of seabed conditions and associated species and biological community. Both high resolution video and stills imagery collected using scaling laser/s and underwater lighting.

The present report describes the work carried out by MERC and presents the results of the subtidal seabed ecological investigations completed. The report also considers and discusses how these data, together with existing knowledge in relation to sensitivities of benthic communities, assists in appraising risks to ecology associated with the proposed disposal of dredge spoil on the selected site.

Fig. 1. Location of proposed dredge spoil disposal site 9km NE of Wicklow

2. Methods

2.1 Preliminary mapping

Following collation of the available ecological literature a GIS project (ESRI ARCGIS) was developed to allow all relevant data to be collated and made available to the survey in a GIS layer. This included all spatial data (location of the proposed disposal site), Infomar seabed data, subsea infrastructure, underwater archaeological data, sediment sampling locations and EMODnet Broad-Scale Predictive Habitat Mapping. This mapping was used to facilitate the planning of survey work and to subsequently compare and assess datasets generated during the present series of studies.

2.2 Benthic grab studies – characterisation of infaunal communities

2.2.1 Grab survey – sampling design

NMBAQC sediment sampling guidance and protocols were reviewed as part of the survey design. The following documents and protocols were referred to and incorporated into the sampling strategy design and implementation:

- NMBAQC Best Practice Guidance - Particle Size Analysis (PSA) for Supporting Biological Analysis v4 (3/3/2022)
- NMBAQC Best Practice Guidance - Collection and processing of Day Grab samples for benthic analyses
- Marine Institute protocols for the purpose of monitoring the Benthic Ecological Quality element of the Water Framework Directive's monitoring program.
- National Parks and Wildlife Service protocols for the purposes of monitoring subtidal benthic sediments as part of the EU Habitats Directive Article 17 sampling protocol

The objectives of the grab survey were to investigate the benthic infaunal community within the seabed sediments within the proposed disposal site. To this end, it was specified that a total of 6 stations were to be sampled for the purposes of obtaining seabed sediment samples from within the proposed disposal site. At each of 6 stations, 3 no. replicate samples were collected for faunal analysis along, with a further sample for the purposes of subsampling for PSA and TOC analysis.

Standard methodologies required that faunal sediment samples would be sieved to 1mm in order to retain the faunal fraction which would later be sent to an accredited laboratory for analysis (identification and enumeration of all taxa) using standard NMBAQC methodologies. Similarly, standard methodologies required that a sediment subsample would be taken at each station and that these samples would be preserved for later particle size analysis (PSA) as well as Total Organic Carbon (TOC) analysis using standard NMBAQC methodologies.

2.2.2 Details of sediment sampling programme

This section describes the sediment sampling activities, including vessel details, a summary of the sampling procedure and sampling timeline.

Details of the sampling platform used for collecting grab samples are provided below.

Table 2.1. Grab survey - sampling vessel details

Vessel Name	MV Rós Áine
Operator	Irish Commercial Charter Boats Ltd
Call Sign	EIZG5
Length	13m
Beam	4m
Draft	0.8m
Passengers	12
Equipment	PK 4501 M Crane

Figure 2.1 M.V. Rós Áine

Grab survey - Sampling procedure.

- Samples were collected using a 0.1m^2 Day grab deployed from the survey vessels onboard crane and winch system. The grab was ballasted appropriately due to the expected hard sediment present on the site. Total grab weight was 85kg including ballast. At each of the 6 sampling stations, a total of 4 no. grab samples were collected. 3 grab samples were collected consecutively for the purposes of faunal studies while maintaining position over the sample station. A fourth deployment was made for the purposes of obtaining a sediment sample for Particle Size Analysis (350ml volume) as well as TOC (100ml volume). Metadata including time, position and water depth were recorded at the moment of contact with the seabed for each grab deployment.
- Upon retrieval of each faunal grab, a labelled photograph was taken of the sampled surface and a description of the sediment recorded. The samples were then washed and sieved for macrofauna using a 1mm mesh sieve. A photograph was taken of the faunal residue in the sieve for each collected sample. Once processed, each sample was labelled internally and

externally, dewatered and preserved onboard in a clear plastic zip-lock bag using 10% buffered formalin.

- A Particle Size Analysis (PSA) grab sample was subsampled by coring from the sediment surface for each of the 6 sampling stations. PSA samples were immediately labelled and stored inside a cooler box onboard the vessel in clear plastic zip lock bags.
- Once faunal residue samples were processed, collected samples were stored by sample station ID in 5l white chemical resistant plastic buckets and transferred to personnel onshore for onward transport and laboratory analysis.
- PSA samples were transferred to a freezer and frozen to -20 degrees C for storage prior to analysis.

Grab survey - Mobilisation and timeline

Survey staff and equipment were mobilised from MERC's Galway base on the 27.2.2025. The vessel was mobilised from Arklow on the 27.2.2025. Equipment was loaded and crew boarded at Greystones on the 28.2.2025. Table 2.2 provides a timeline for the grab survey and related activity.

Table 2.2 Grab survey activity timeline

Timeline	Grab survey related activity
27.2.2025	Mobilisation of vessel, staff and equipment to Greystones Co. Wicklow.
28/2/2025 08:00	Arrive on site, Greystones Marina
28/2/2025 08:15	Loading survey equipment onto survey vessel
28/2/2025 08:55	Transit to survey site c.11km
28/2/2025 09:30	Arrive on site, begin sample collection
28/2/2025 12:50	Return transit and sample processing and preservation
28/2/2025 13:20	Arrive at port
28/2/2025 14:15	Demobilisation & sample handover
3/3/2025	Delivery of samples to analysing laboratory

Weather conditions during the survey were fair throughout. Cloud cover was minimal with a light southerly breeze peaking at 6 knots at the end of survey operations. Air pressure was steady at 1028 hPa. High Water Wicklow was 11.10am.

During the survey no hard bottom strata were encountered, and the grab sampler achieved sufficient penetration to obtain a minimum of 7cm sample depth at each deployment. Sampling was completed successfully and a total of 18 sediment samples were obtained over 6 stations for faunal analysis.

Grab sampling data

Table 2.3 summarises the grab station sampling data. Figure 2.2 presents the location of sampling stations within the proposed disposal site.

Table 2.3 Summary of grab station sampling data

Sample ID	Easting ITM	Northing ITM	Latitude	Longitude	Depth (m)	Field description
1A	734053	703297	53.063469	-5.999892	22m	Sand and shell fragments
1B	734032	703295	53.063456	-6.000206	25m	Sand and shell fragments
1C	734036	703290	53.06341	-6.000149	26m	Sand and shell fragments
2A	734516	702923	53.059993	-5.993145	18m	Sand and shell fragments
2B	734491	702934	53.060098	-5.993513	18m	Sand and shell fragments
2C	734519	702949	53.060226	-5.99309	17m	Sand and shell fragments
3A	734328	702885	53.059699	-5.995964	15m	Sand and shell fragments
3B	734355	702886	53.059701	-5.995561	16m	Sand and shell fragments
3C	734367	702887	53.059707	-5.995382	16m	Sand and shell fragments
4A	734132	702690	53.057997	-5.998967	19m	Sand and shell fragments
4B	734142	702662	53.057743	-5.99883	20m	Sand and shell fragments
4C	734125	702668	53.057801	-5.999081	20m	Sand and shell fragments
5A	734051	702905	53.059948	-6.000085	24m	Sand and shell fragments
5B	734065	702910	53.05999	-5.999875	24m	Sand and shell fragments
5C	734071	702936	53.060222	-5.999774	24m	Sand and shell fragments
6A	734412	703150	53.062058	-5.994601	18m	Sand and shell fragments
6B	734418	703122	53.061805	-5.994523	18m	Sand and shell fragments
6C	734416	703115	53.061743	-5.994556	18m	Sand and shell fragments

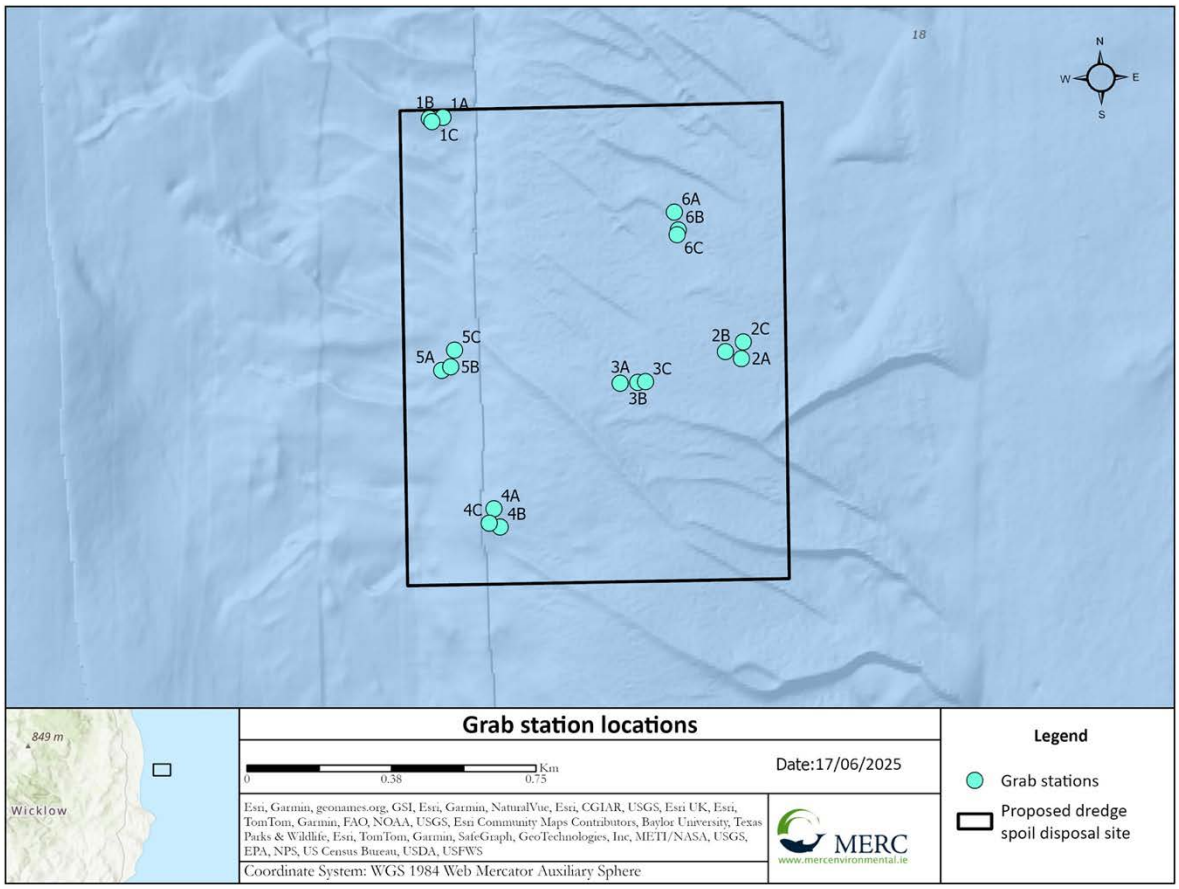

Fig 2.2 Graphic showing the location of sampling stations within the proposed disposal site.

Further details of the grab survey are provided in a series of appendices to this report. In this context, the following Appendices are provided as digital folders:

- *Appendix 1* - Environmental metadata in relation to each grab sample in spreadsheet format. The data include all relevant metadata data such as positions (WGS84), water depth, surface conditions as well as grab specific data.
- *Appendix 2* - Photographic catalogue for faunal grab samples showing the grab surface (a) and faunal residue after sieving (b), for each of the 3 faunal samples collected from all 6 stations. Photographs are organised by Station number and correspond to sampling stations as presented in Figure 2.2.
- *Appendix 3* – ArcGIS shapefile showing sample positions

2.2.3 Grab survey – analysis of faunal and PSA/ samples

Both faunal and PSA/ TOC samples were analaysed by Hebog Environmental Ltd. Samples were delivered to the laboratory's premises in Bangor, North Wales in March 2025. Hebog are an NMBAQC laboratory. As a scheme participant, the laboratory implements standardised NMBAQC methodologies in the analysis of the samples taken from the proposed dumpsite.

Relevant scheme documents applied during analysis were:

- NMBAQC's Best Practice Guidance - Particle Size Analysis (PSA) for Supporting Biological Analysis v4 (3/3/2022)
- NMBAQC's Best Practice Guidance – Guidelines for processing marine microbenthic invertebrate samples: a Processing requirements Protocol v1.0 2010

The details of the scheme's requirements are captured in the following relevant protocols routinely applied in the analysis of marine sediment grab samples in Ireland:

- Marine Institute protocols for the purpose of monitoring the Benthic Ecological Quality element of the Water Framework Directive's monitoring program
- National Parks and Wildlife Service protocols for the purposes of monitoring subtidal benthic sediments as part of the EU Habitats Directive Article 17

All samples were analysed for faunal taxa and identified to species level where possible. All taxa were enumerated. The analysis phase was completed without difficulty and a full set of valid analytical results were provided by the contracting laboratory during May 2025. The laboratory analysis results are supported with a detailed interpretation of the infaunal community. This has allowed for the community to be classified according to EUNIS classification (Level 1) and Level 2 for one station.

2.3 Drop down video and stills imaging surveys to characterise benthic habitats, communities and epi-fauna

2.3.1 Imaging surveys – sampling design

NMBAQC video and stills sampling best practice guidance were reviewed as part of the survey design. The guidance and protocols were referred to and were incorporated into the sampling strategy design and implementation:

- NMBAQC's Best Practice Guidance - Epibiota Remote Monitoring from Digital Imagery: Operational Guidelines

The objectives of the imaging survey were to collect data that would support infaunal grab surveys in developing a fuller and more detailed ecological appraisal of the benthic environment at the proposed disposal site. This was achieved by supplementing the infaunal studies from grab sampling with detailed epifaunal data acquired from both video and stills imaging using high quality underwater imaging equipment and lighting.

Due to the different lighting requirements and to avoid potential constructive interference between both stills and video studies due to differing lighting requirements, separate video imaging and stills imaging transects were conducted at each of the 6 stations that were targeted during the grab survey.

Wicklow County Council specified that a total of 6 stations were to be sampled for the purposes of obtaining high definition (1080p) imagery with topside video feed while using appropriate underwater lighting with scaling lasers also attached. The camera was required to be oriented in a downward facing position for both video and stills surveys.

In order to ensure video imaging could be georeferenced, the video feed was spatially encoded with a differential GPS signal. No GPS receiver offset correction was required due to the positioning of the GPS receiver directly above the drop camera frame during deployment. Georeferencing video enables the later review of positional data along with time , speed and direction of travel. In order to maximise the quality of seabed video, it was considered necessary to conduct imaging surveys during optimal sea state conditions, with mean wave heights of <30cm. Current speeds were used to allow the camera and support vessel to drift in tandem over a minimum distance of 100m for each video drop. Target maximum speeds of drift were 0.5knots while optimal speeds were in the region of 0.2-0.4 knots.

Similarly, stills imagery was collected while the survey vessel drifted over the seabed. A consistent field of view was maintained as far as this was possible given occasional rapid changes in seabed relief. The target altitude for the camera was 0.4m for stills imaging purposes, however the drop camera can be flown optimally at any height between 32 and 45 cm above the seabed. This ensures that lighting remained constant and avoided extreme changes in illumination and hence exposure. Minimum focal distance for the video and stills imaging drop camera is 32cm.

Stills images were collected continuously over a minimum of 100m of seabed. Stills images were georeferenced and metadata recorded in embedded EXIF file with each image.

Field notes were recorded while viewing the topside video feed including start and end points of drops, habitat type, depth and conspicuous epifauna and seabed features.

2.3.2 Details of seabed imaging surveys

This section describes the underwater image survey activities, including vessel details, a summary of the image sampling procedure and sampling timeline.

Details of the sampling platform used for collecting seabed imagery are provided below.

Table 2.4 Grab survey - sampling vessel details

Vessel Name	MV Reefrunner
Operator	Marine Environmental Resource and Conservation Consultants Ltd
Call Sign	EI7123
Length	8m
Beam	3.2m
Draft	0.7m
Passengers (MSO) P3	4
Equipment	Video and stills imagery equipment including drop camera winch

Figure 2.3 M.V. Reefrunner

Seabed imaging - sampling procedure

The imaging survey collected data from the same sites and general areas as the grab survey samples were taken from. As the imaging surveys were required to cover a larger area, both stills and video data were collected while the drop camera frame was suspended over the side of the vessel and 'flown' at a consistent height above the seabed.

Table 2.5 Specifications of subsea imaging equipment used

Item	Description
M12 R300 Camera	M12 R300 Camera, Water corrected port, 1080p Video, UHD Stills. Titanium, 512GB Storage, RS485 &Ethernet Lens: 20mm FOV H59° V35° D66° Aperture f1.3
Aphos 32-4 Ballast Light	Aphos 32 LED Panel Ballast light, Strobed, 24VDC, up to 150,000 lumen output, 4 LED Panels
Additional data storage	4TB M+ NAS drive via network switch
Fibre Cable	200m long, 2 Fibre - 2 power
Scale laser/s	2 x ORCA lasers depth rated 200m (green 510-530nm/red)

A Cathx Ocean M12 R300 digital camera was used for collecting both video and still imagery (see Table 2.5 for specifications). The camera, which has an optically corrected lens for underwater imaging, was operated as a drop stills and video camera allowing high definition (1080p) imaging of the seabed while being "flown" just above the seabed in mid water, providing continuous overview of the seabed. Stills were captured at a rate of 5 frames per second using strobe lighting. Continuous video feed provided live imaging of the seabed. Motion blur associated with capture of underwater video where artificial lighting is used was minimised through the use of purposefully designed and engineered underwater strobe lighting, whereby each frame is lit individually for several milliseconds only, freezing the images and eliminating practically all backscatter related blur that traditionally makes interpretation of UW video imagery difficult or uncertain. While the drop camera system has a variable aspect, it was deployed in a downward looking arrangement for the present surveys. The drop frame was ballasted to a total weight of 60kg in order to ensure it remained stable and current deflection from the recorded position GPS receiver was minimised and kept <1m at all times.

For both video and stills imaging data acquisition, the drop camera was deployed in a manner that ensured the natural tidal flow would ensure the vessel travelled along in a straight line following the current flow use of forward reverse vessel power ensured drift speeds could be controlled as required to produce acceptable imagery.

Video and stills data were spatially encoded with GPS positional data (WGS84) in real-time and saved to a 4TB networked onboard hard drive. Data was backed up automatically every 15 minutes to a separate SSD. Scaling lasers were set at 60mm to allow for scaling of seabed features and biota. Lasers were used for both video and stills imagery capture.

Conditions on the day were optimal in terms of tide and surface conditions and transects were completed successfully in the described manner, with the camera maintained at a constant height of between 32cm and 40cm above the seabed. Due to the relatively optimal conditions, the video live feed

was monitored continuously and adjustments to the altitude of the camera could be made rapidly and in real time using the fob operated electric deployment winch.

Imaging survey - Mobilisation and timeline

Survey staff and equipment were mobilised from MERC's Galway base on the 22.5.2025. Equipment was loaded and the vessel proceeded from Wicklow Harbour at 08.15. Table 2.6 provides a timeline for the imaging surveys and related activity.

Table 2.6 Image acquisition survey activity timeline

Timeline	Grab survey related activity
22/5/2025	Mobilisation of vessel, staff and equipment to Wicklow Harbour Co. Wicklow.
23/5/2025 08:00	Launch survey vessel Wicklow Harbour
23/5/2025 08:15	Depart Wicklow Harbour for proposed disposal site
23/5/2025 08:55-10.30	UW imaging systems check
23/5/2025 12.15	Arrive on site, begin imaging transects (video) collection
23/5/2025 14.30	Commence imaging drop (stills) transects
23/5/2025 15.50	Depart disposal site
23/5/2025 16:15	Recover sampling vessel Wicklow Harbour

Weather conditions during the survey were fair throughout. Cloud cover was minimal with a light southerly breeze peaking at 6 knots at the end of survey operations. Surface conditions were optima with wave heights less than 30cm. Air pressure was steady at 1032 hPa. High Water Wicklow was 14.20. Predicted tidal range was 1.8m.

Seabed imagery was successfully collected according to the planned survey programme. A large volume of video and stills evidence was collected. Image quality was considered excellent overall and the data facilitated a detailed evaluation of seabed conditions and associated biological communities within the area of the proposed disposal site.

Image acquisition survey data

Positional data in relation to the seabed imagery acquisition survey are provided in *Appendix 3* – shapefile showing image acquisition positions in an ArcGIS shapefile. Table 2.7 summarises image acquisition survey data. Figures 2.4a and 2.4b present the location of image sampling locations for video transects (a) and stills image stations (b).

Table 2.7 Summary of image acquisition survey data

Station ID	Camera Drop	Drop Type	Start Point Lat	Start point Long	End Point Lat	End Point Long	Depth(m)
1	**1**	Video	53.06468	-6.00092	53.06180	6.00209	24-28
1	**2**	Video	53.06438	-6.00012	53.06478	5.99854	24-28
1	**3**	Video	53.06183	-6.00116	53.06189	6.00102	24-28
1	**4**	Stills	53.06493	-5.99965	53.06186	6.00250	24-28
2	**9**	Video	53.06016	-5.99172	53.06009	5.99350	16
2	**10**	Video	53.06011	-5.99212	53.06083	5.99467	16
2	**11**	Video	53.05933	-5.99142	53.06025	5.99329	16
2	**12**	Stills	53.05969	-5.99187	53.06112	5.99369	16
3	**13**	Video	53.05942	-5.99492	53.06170	5.99607	15-17
3	**14**	Video	53.05881	-5.9953	53.06195	5.99591	15-17
3	**15**	Video	53.05950	-5.99591	53.06293	5.99606	15-17
3	**16**	Stills	53.05954	-5.99541	53.06388	5.99548	15-17
4	**21**	Video	53.05687	-5.99891	53.05991	5.99868	16-18
4	**22**	Video	53.05715	-5.99956	53.05947	5.99870	16-18
4	**23**	Video	53.05692	-5.99885	53.05891	5.99819	16-18
4	**24**	Stills	53.05695	-5.99901	53.05986	5.99863	16-18
5	**17**	Video	53.05877	-6.00082	53.06134	6.00048	22-25
5	**18**	Video	53.05858	-5.99967	53.06276	5.99832	22-25
5	**19**	Video	53.05885	-5.99979	53.06256	5.99949	22-25
5	**20**	Stills	53.05902	-6.00003	53.06192	5.99960	22-25
6	**5**	Video	53.06272	-5.99417	53.06102	5.99631	22
6	**6**	Video	53.06232	-5.99415	53.06073	5.99691	22
6	**7**	Video	53.06156	-5.9936	53.06157	5.99700	22
6	**8**	Stills	53.06189	-5.99432	53.06189	5.99564	22

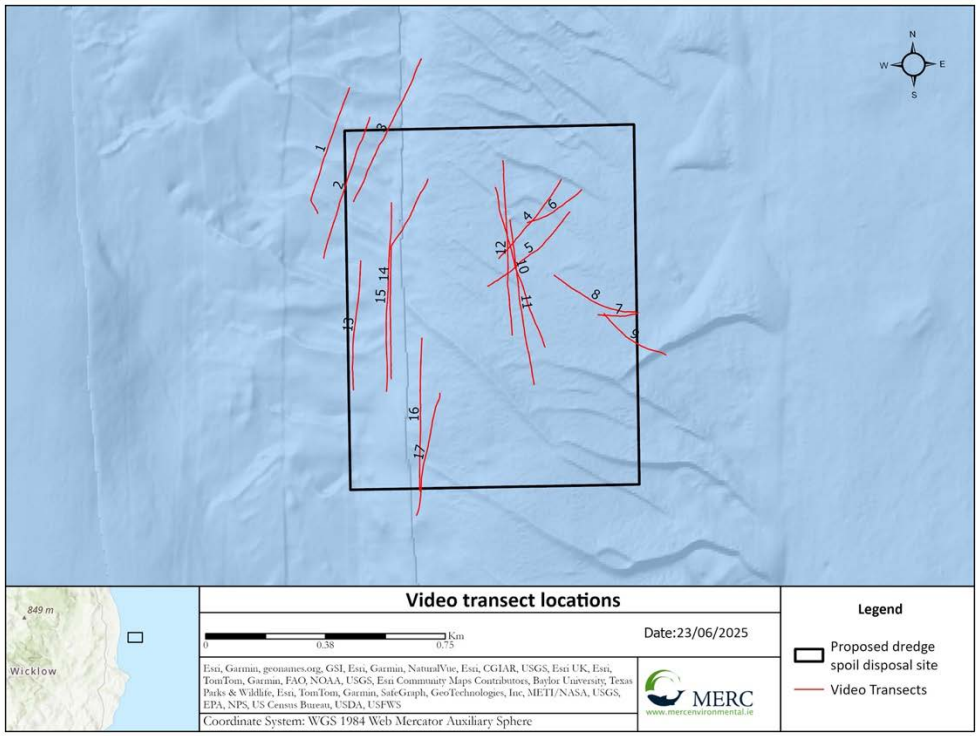

Fig 2.4a Graphic showing the location of video imagery transects within the proposed disposal site.

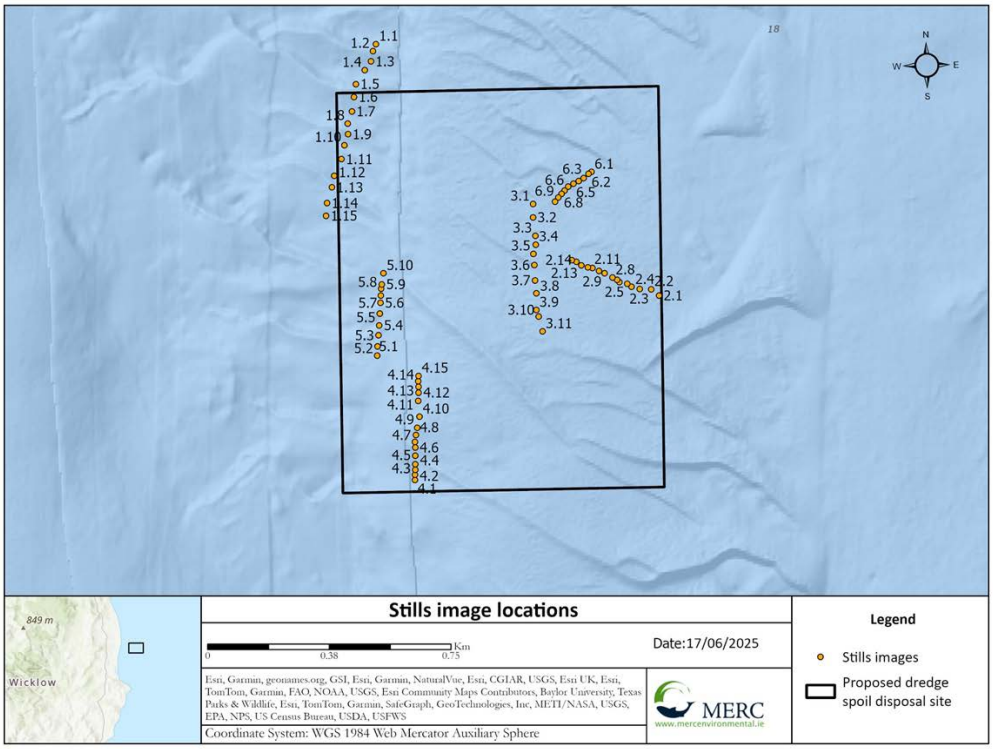

Fig 2.4b Graphic showing the location of stills imagery stations within the proposed disposal site.

2.2.3 Imaging surveys – analysis of video and stills imagery

Analysis of video imagery

In order to describe the seabed community along each video transect, an experienced marine ecologist with a high level of expertise in relation to underwater video analysis as well as extensive knowledge of seabed habitats from Irish coastal waters undertook an analysis of the video using a high resolution screen to review the data.

The evaluation allowed for the following descriptors to be developed for each seabed video transect:

- Habitat/s overview - description of seabed surface conditions including sediments present and conspicuous features.
- Description of biological community/communities – including details of live fauna and flora
- MNCR Biotope
- MNCR Code
- EUNIS Biotope
- EUNIS Code

Analysis of stills imagery

All stills imagery was reviewed, as per NMBAQC guidelines for epibiota remote monitoring (Turner *et al*, 2016). As such, video imagery was viewed at slow speed and start/stop. In the case of both video and stills analysis, where identification to species level was possible this was carried out. Where identification to species level was not possible (e.g. where macro imagery or sampling was required to aid identification), a higher level classification (e.g. genus) was used. All species nomenclature was aligned with the current World Register of Marine Species (WoRMS).

As the habitat was almost entirely sedimentary, collation and annotation of data within BIGGLE was not appropriate. All species and associated habitat data was therefore provided in excel format (see appendix XX).

The evaluation allowed for the following descriptors to be developed for each image:

- Habitat/s overview - description of seabed surface conditions including sediments present and conspicuous features.
- Description of biological community/communities – including details of live fauna and flora
- MNCR Biotope
- MNCR Code
- EUNIS Biotope
- EUNIS Code

Finally, outcomes of video data and stills data were reviewed and compared to ensure there was consistency between findings for stills and video imagery collected from the same locations.

3. Results

3.1 Grab sampling survey results

Sediments sampled in the proposed disposal site were all classified as Slightly Gravelly Sands. They were very consistent in their composition and the majority of the sediment, approximately 95% at all stations, were coarse (500-999µm) and medium (250-499µm) sand fractions. Gravels and silt/clays were present at all stations but recorded in insignificant amounts, 0.52-2.5% for particles over 2mm and <1% silt/clays (particles <63µm).

Total organic carbon was low which was as expected for these sediment types. A maximum of 2.31% was recorded at station 5.

Stations 1, 2, 3, 5 & 6 contained especially sparse faunal assemblages and had an average of 2 or fewer taxa recorded per 0.1m^2 and between 1 and 6 individuals per 0.1m^2. Taxa reported included the polychaetes *Nephtys cirrosa*, *Glycera oxycephala*, *Pisione remota* and *Ophelia borealis*, the mysid shrimp *Gastrosaccus spinifer*, juvenile Mytilidae bivalves and the robust bivalve *Spisula elliptica*. These taxa are characteristic of mobile coarse sands. This habitat is also known to support interstitial polychaete communities with taxa such as *Hesionura elongata, Microphthalmus spp.* and *Protodrilus spp.* being common components. It is likely that these taxa were not recorded during this survey due to the 1mm sieve size used to separate fauna from bulk samples.

Moderate to large numbers of the reef-building polychaete *Sabellaria alveolata* were recorded in 2 of the 3 grabs taken from station 4 where they numbered 164 per 0.1m^2 and 808 per 0.1m^2 in grabs B and C respectively. Apart from this species and some epifaunal taxa associated with the small reef mounds, other taxa recorded were indicative of the mobile coarse sands as described above. Although the *Sabellaria* were recorded in high abundance, particularly in grab 4C, the reef structures resembled small mounds rather than the extensive reef structures that can often be developed by this species.

Table 3.1. Designated EUNIS habitat classifications at each station, indicating certainty and whether a full or partial match.

Station	EUNIS habitat classification	EUNIS habitat classification 2 (if partial record)
1	A5.134 *Hesionura elongata* and *Microphthalmus similis* with other interstitial polychaetes in infralittoral mobile coarse sand. Certain match, full record.	
2	A5.134 *Hesionura elongata* and *Microphthalmus similis* with other interstitial polychaetes in infralittoral mobile coarse sand. Certain match, full record.	
3	A5.134 *Hesionura elongata* and *Microphthalmus similis* with other interstitial polychaetes in infralittoral mobile coarse sand. Certain match, full record.	
4	A5.134 *Hesionura elongata* and *Microphthalmus similis* with other interstitial polychaetes in infralittoral mobile coarse sand. Certain match, partial record.	A5.612 *Sabellaria alveolata* on variable salinity sublittoral mixed sediment. Certain match, partial record.
5	A5.134	

Station	EUNIS habitat classification	EUNIS habitat classification 2 (if partial record)
	Hesionura elongata and *Microphthalmus similis* with other interstitial polychaetes in infralittoral mobile coarse sand. Certain match, full record.	
6	A5.134 *Hesionura elongata* and *Microphthalmus similis* with other interstitial polychaetes in infralittoral mobile coarse sand. Certain match, full record.	

Detailed results of the grab survey are provided in a series of appendices to this report. In this context, the following Appendices are provided as digital folders:

- *Appendix 1* - Environmental metadata in relation to each grab sample in spreadsheet format. The data include all relevant metadata data such as positions (WGS84), water depth, surface conditions as well as grab specific data (spreadsheet).
- *Appendix 2* - Photographic catalogue for faunal grab samples showing the grab surface (a) and faunal residue after sieving (b), for each of the 3 faunal samples collected from all 6 stations. Photographs are organised by Station number and correspond to sampling stations as presented in Figure 2.2.
- *Appendix 3* – ArcGIS shapefile showing sample positions
- *Appendix 4* – Macrofaunal analysis results (spreadsheet)
- *Appendix 5* – PSA and TOC analysis results (spreadsheet)

3.2 Imaging survey results

Video imagery

All video data is organised by transect reference as shown in Figure 2.4a and is provided as a series of separate video files in Appendix 6. Video files are spatially encoded; however, these can be reviewed as stand-alone files with any video player (e.g. Windows Media Player, VLC). To review video as spatially encoded (geospatially located video) it will be necessary to download and install LineVision desktop. This application is subscription based and will allow video to be viewed while showing location on a user defined GIS layer.

Table 3.2 presents a summary of the findings based on video analysis and identifies the EUNIS habitat code based on visual assessment of the seabed from imagery. The seabed is classed as *Infralittoral Coarse Sediments* at all stations. Corresponding EUNIS classification is A5.13, which is consistent with the outcome of the grab survey. As the latter assesses infauna, the grab survey can confirm EUNIS classification to one level higher (A5.134), as a full species inventory is available for each sample point. The epifauna is exceptionally sparse at all locations sampled by video within the proposed disposal site. Very few taxa are recorded and most of these are mobile species. Most likely this is due to the dynamic nature of the environment with moving sand waves and very high levels of sediment scour displacing most epifaunal species.

There is some evidence of the presence of the polychaete reef forming *Sabellaria* sp. (most likely *S. alveolata*) in video transects 14,15 and 16. In some isolated and brief sections of these video data, *Sabellaria* sp. appears as small, raised mounds or encrustations on stones. It is not possible to confirm

precise species as it was not possible to collect samples during video surveys, however the grab survey data has confirmed the presence of *S. alveolata* at stations 4B and 4C. It is apparent that the presence of *Sabellaria* sp. appears to be confined to the southwestern quarter of the proposed site, based on both video and grab sample data. As in the findings for the grab survey, *Sabellaria* is not seen to form reef structures and is present occasionally encrusting the surface of small rocks or stones and rarely as small mounds <10cm on the seabed. There is no significant presence of *Sabellaria* reef in any of the video analysis.

The barnacle *Balanus crenates* is common on stones or rocks where these occur in isolation. Similarly, hard surfaces where recorded appeared to be partially encrusted with a coralline alga, likely to be the common *Lithophyllum incrustans*. Occasional occurrences of the hermit crab *Pagurus bernhardus*, starfish *Asterias rubens* and sessile species including bryozoans *Vesicularia spinosa, Securiflustra securifrons* (hornwrack) *and Alcyonidium diaphanum* (Sea-chervil) were noted from the video analysis. Overall taxa numbers were very low and none of the recorded species are of particular conservation concern. Sessile bryozoan species recorded are common, short lived and are capable of rapidly recolonising suitable habitats. Mobile species including hermit crab and starfish are also known to be very common. As opportunistic species, they are capable of rapid recolonisation and population recovery from impacts.

Figure 3.1 compares the location of video data transects with sampling points from the grab survey. As can be seen there is a high level of overlap, while the video transect data covers a much larger area than each grab sampling location. In this regard however the results are indicative of relatively uniform seabed conditions and habitat types.

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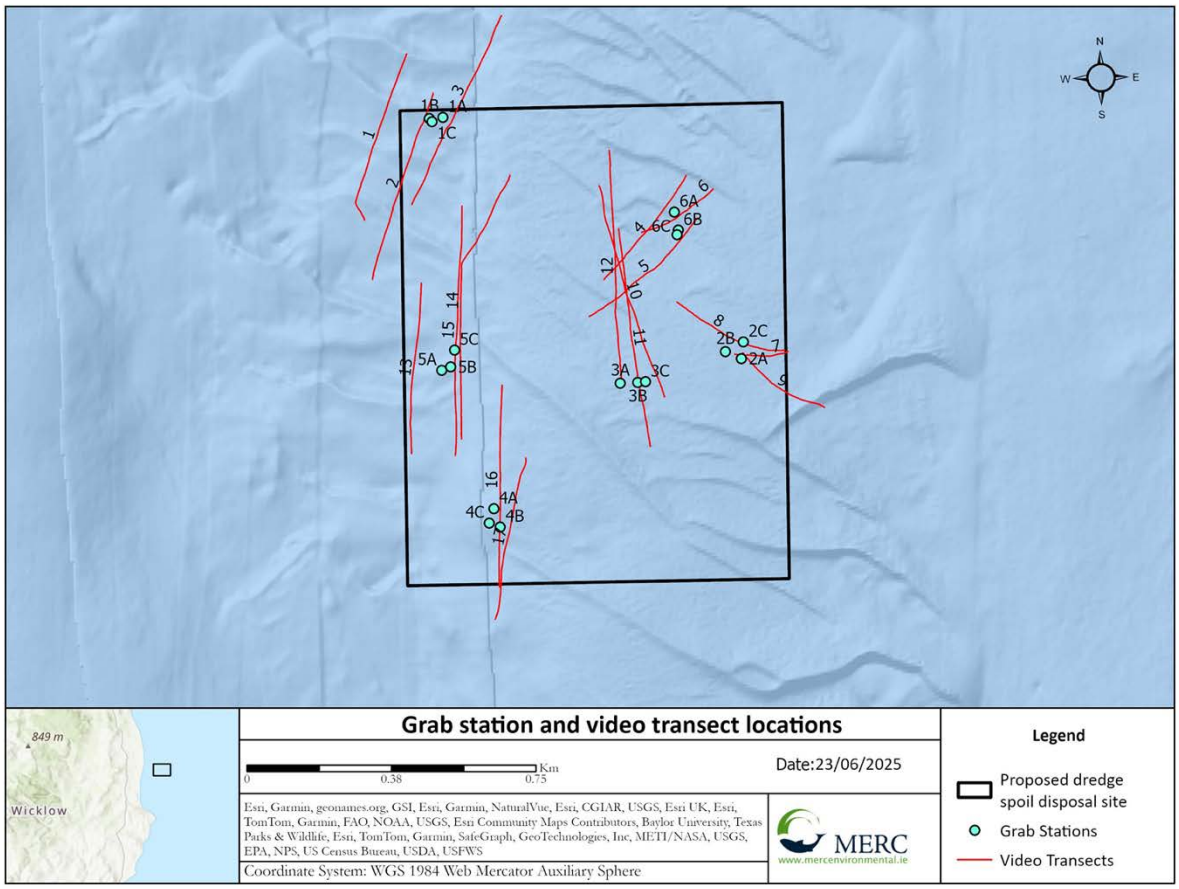

Figure 3.1 Video data transects shown along with grab sample stations.

Appendix 7 presents the full outcome of the video analysis shown in Table 3.2 along with both EUNIS classification and biotope as well as MNCR classification and biotope.

Table 3.2 Summary of analysis of video data.

Video Code	Habitat overview	Description	MNCR Biotope	MNCR Code	EUNIS	EUNIS Code
1	Sand waves with dead shell (mostly *Mytilus edulis* shell)	One individual (*Pagurus* sp.). Likely *P. Bernhardus* apparent in stills image	Infralittoral Coarse Sediment	SS.SCS.ICS	Infralittoral Coarse Sediment	A5.13
2	Sand waves with dead shell (mostly *Mytilus edulis* shell)	No visible fauna	Infralittoral Coarse Sediment	SS.SCS.ICS	Infralittoral Coarse Sediment	A5.13
3	Sand waves with dead shell (mostly *Mytilus edulis* shell)	No visible fauna	Infralittoral Coarse Sediment	SS.SCS.ICS	Infralittoral Coarse Sediment	A5.13
4	Sand waves with dead shell (mostly *Mytilus edulis* shell), small cobble pocket at one location	*Balanus crenates* on cobble where present	Infralittoral Coarse Sediment	SS.SCS.ICS	Infralittoral Coarse Sediment	A5.13
5	Sand waves with dead shell (mostly *Mytilus edulis* shell)	No visible fauna	Infralittoral Coarse Sediment	SS.SCS.ICS	Infralittoral Coarse Sediment	A5.13
6	Sand waves with dead shell (mostly *Mytilus edulis* shell), small cobble pocket at one location	*Balanus crenates* and coralline crusts on cobble	Infralittoral Coarse Sediment	SS.SCS.ICS	Infralittoral Coarse Sediment	A5.13
7	Sand waves with dead shell (mostly *Mytilus edulis* shell), occasional isolated cobble	*Balanus crenatus* and *Asterias rubens* on rocks	Infralittoral Coarse Sediment	SS.SCS.ICS	Infralittoral Coarse Sediment	A5.13
8	Sand waves with dead shell (mostly *Mytilus edulis* shell), occasional pebbles	*Balanus crenatus* and coralline crusts on pebbles	Infralittoral Coarse Sediment	SS.SCS.ICS	Infralittoral Coarse Sediment	A5.13
9	Sand waves with dead shell (mostly *Mytilus edulis* shell), occasional pebbles	*Balanus crenatus* and coralline crusts on pebbles	Infralittoral Coarse Sediment	SS.SCS.ICS	Infralittoral Coarse Sediment	A5.13
10	Sand waves with dead shell (mostly *Mytilus edulis* shell)	No visible fauna	Infralittoral Coarse Sediment	SS.SCS.ICS	Infralittoral Coarse Sediment	A5.13
11	Sand waves with dead shell (mostly *Mytilus edulis* shell), occasional isolated cobble and pebble	*Balanus crenatus* on cobble. Occasional coralline crusts.	Infralittoral Coarse Sediment	SS.SCS.ICS	Infralittoral Coarse Sediment	A5.13
12	Sand waves with dead shell (mostly *Mytilus edulis* shell), occasional isolated pebble	*Pagurus* sp. Likely *P. Bernhardus*, occasional	Infralittoral Coarse Sediment	SS.SCS.ICS	Infralittoral Coarse Sediment	A5.13
13	Sand waves with dead shell (mostly *Mytilus edulis* shell), occasional patches of pebble	Pagurus sp. Likely *P. Bernhardus*, *Asterias rubens* (1 individual), *Alcyoniid diaphanum* (Occasional where pebble present)	Infralittoral Coarse Sediment	SS.SCS.ICS	Infralittoral Coarse Sediment	A5.13

Video Code	Habitat overview	Description	MNCR Biotope	MNCR Code	EUNIS	EUNIS Code
14	Sand waves with dead shell (mostly *Mytilus edulis* shell), Areas of pebble, outcrops of Sabellaria sp (Likely *S. alveolata*)	*Pagurus Bernhardus* (Present), *Asterias rubens* (occasional), *Alcyonidium diaphanum* (Frequent where cobble present). *Balanus crenatus* on cobble. *Urticina felina* (Present). Unidentified bryozoan (Poss. *Securiflustra securifrons*), *Sabellaria* sp.	Infralittoral Coarse Sediment	SS.SCS.ICS	Infralittoral Coarse Sediment	A5.13
15	Sand waves with dead shell (mostly *Mytilus edulis* shell), Areas of pebble, some cobble, outcrops of *Sabellaria* sp (Likely *S. alveolata*)	*Vesicularia spinosa* (Occasional) , *Alcyonidium diaphanum* (occasional), *Securiflustra securifrons?* (occasional), *Pagurus Bernhardus* (Occasional), *Asterias rubens* (Frequent), *Sabellaria sp. Balanus crenatus* on cobble. *Urticina felina* (occasional).	Infralittoral Coarse Sediment	SS.SCS.ICS	Infralittoral Coarse Sediment	A5.13
16	Sand waves with dead shell (mostly *Mytilus edulis* shell), Areas of pebble, some cobble, outcrops of *Sabellaria* sp (Likely *S. alveolata*)	*Urticina felina* (Present), *Alcyonidium diaphanum* (occasional), *Securiflustra securifrons?* (occasional), *Pagurus Bernhardus* (Occasional), *Asterias rubens* (Frequent), *Sabellaria sp. Balanus crenatus* on cobble.	Infralittoral Coarse Sediment	SS.SCS.ICS	Infralittoral Coarse Sediment	A5.13
17	Sand waves with dead shell (mostly *Mytilus edulis* shell)	*Alcyonidium diaphanum, Asterias rubens, Pagurus* sp. Occasional coralline crusts.	Infralittoral Coarse Sediment	SS.SCS.ICS	Infralittoral Coarse Sediment	A5.13

Stills imagery

Stills imagery data is organised by Station ID reference (Stations 1-6), as shown in Figure 2.4b and is provided in Appendix 8 as a series of folders (1 per station) that each contain a minimum of 10 subsampled images that were analysed with the purpose of describing epifauna and seabed biological community. Image files are spatially encoded and can be viewed as .jpg images. Alternatively, ***Irfanview*** (www.irfanview.com) can be used to view images spatially positioned on background mapping on a PC. Images can also be viewed using *Preview* on MAC OS and locations shown using the *Maps* Application to geolocate the image.

Imaging review confirms that the barnacle *Balanus crenatus* is common on cobble and larger stones where these occur – at times these are in isolation while these sediments are more frequent at some location photographed. Similarly, hard surfaces, where recorded, were occasionally partially encrusted with coralline alga, likely to be the common *Lithophyllum incrustans*. Occasional occurrences of the hermit crab *Pagurus bernhardus*, starfish *Asterias rubens* and sessile species including bryozoans S*ecuriflustra securifrons* (hornwrack) *and Alcyonidium diaphanum* (Sea-chervil) were noted during image review. Other species recorded included the anemone *Urticina felina*, sea urchin *Echinus esculentus* and the mud sponge *Haliclona cinera* as well as Mermaid's glove sponge *Haliclona oculata*. As was the case for the video data reviewed, overall taxa numbers were very low in the stills imagery and none of the recorded species are of any particular conservation concern.

Table 3.3 presents a summary of the findings based on stills image analysis and identifies the EUNIS habitat code based on visual assessment of the seabed from imagery. The table summarises the findings in relation to seabed habitat and community according to MNCR and EUNIS habitats from the analysis of images captured during transects conducted at each Station. Further detail in relation to individual stills imagery analysis is provided in Appendix 9. The seabed is classed as *Infralittoral Coarse Sediments* in both MNCR and EUNIS classification systems, based on review and analysis of sample imagery captured from all stations. Corresponding EUNIS classification is A5.13, which is consistent with the outcome of the grab survey, as well as the video imagery analysis. As the former assesses infauna, the grab survey can confirm EUNIS classification to one level higher (A5.134), as a full species inventory is available for each sample point. The epifauna is exceptionally sparse at all locations sampled by stills (and video) within the proposed disposal site. Very few sessile taxa are present, and most recorded taxa are mobile species. It is highly likely that limited epifauna recorded is due to the dynamic nature of the environment with moving sand waves and very high levels of sediment scour displacing most epifaunal species and preventing colonisation by sessile species.

Table 3.3 Summary of analysis of stills imagery.

	Stills transects start and end positions								
Station ID	**Start Point Lat**	**Start Point Long**	**End Point Lat**	**End Point Long**	**Depth (m)**	**MNCR Biotope**	**MNCR Code**	**EUNIS biotope**	**EUNIS code**
1	53.06493	-5.99965	53.06186	6.00250	24-28	Infralittoral Coarse Sediment	SS.SCS.ICS	Infralittoral Coarse Sediment	A5.13
2	53.05969	-5.99187	53.06112	5.99369	16	Infralittoral Coarse Sediment	SS.SCS.ICS	Infralittoral Coarse Sediment	A5.13
3	53.05954	-5.99541	53.06388	5.99548	15-17	Infralittoral Coarse Sediment	SS.SCS.ICS	Infralittoral Coarse Sediment	A5.13
4	53.05695	-5.99901	53.05986	5.99863	16-18	Infralittoral Coarse Sediment	SS.SCS.ICS	Infralittoral Coarse Sediment	A5.13
5	53.05902	-6.00003	53.06192	5.99960	22-25	Infralittoral Coarse Sediment	SS.SCS.ICS	Infralittoral Coarse Sediment	A5.13
6	53.06189	-5.99432	53.06189	5.99564	22	Infralittoral Coarse Sediment	SS.SCS.ICS	Infralittoral Coarse Sediment	A5.13

Figure 3. compares the location of stills image transects with sampling points from the grab survey. As can be seen there is a high level of overlap, while the stills image data covers a much larger area than each grab sampling location. In this regard however the results are also indicative of relatively uniform seabed conditions and habitat types recorded.

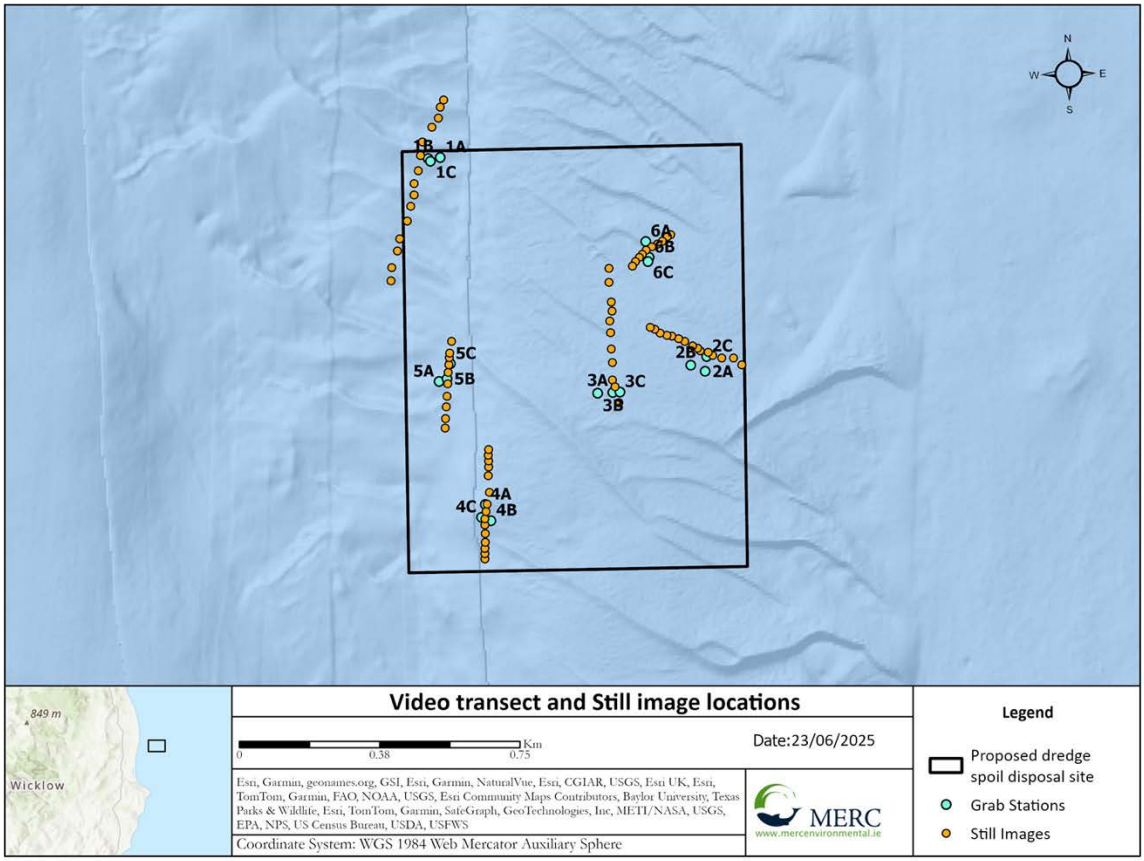

Figure 3.2 Stills imaging transects shown along with grab sample stations.

Stills imagery analysis indicated the possible presence of *Sabellaria alveolata* at some location where cobbles and boulders were recorded. Considering also the video analysis findings, it is considered likely that this species is present on some of the larger cobbles seen in some stills images. However, it has not been possible to confirm this from the review of stills imagery as still imagery only provides 2-dimensional representation of the seabed and species and it was not possible to collect biological samples during imaging surveys. Nevertheless, the grab survey data has confirmed the presence of *S. alveolata* at stations 4B and 4C. Accordingly it can reasonably be concluded that *S. alveolata* is present at some locations sampled, while the overall distribution of this species is limited to the southwestern quadrant of the proposed site, based on evaluation of both video and grab sample data.

4. Discussion

In the context of seabed sediment composition, the findings of the grab survey are supported and augmented by the imagery survey analysis. Both types of survey confirm the nature of the seabed as being characterised by coarser sediments. The grab survey sampled only those sediments that would be retained within the day grab (coarser sediments will prevent the grab from closing) and therefore in general do not appear in representative fractions during most grab surveys, while they may be present within the seabed sediments. In this context, both video and stills imagery provide useful data that augments the grab sample PSA analysis. The imagery confirms the presence of a range of coarser sediments including pebble and cobble that are not captured in the PSA analysis. This adds significantly to the overall understanding of the full range of seabed sediments (and therefore habitats) that are present within the proposed disposal site.

It is apparent from the sediment composition studies that the site is highly dynamic, with the dominant sediment type being medium and coarse sands and other mixed sediments including pebbles, gravel cobbles and occasional boulders being present, as confirmed by PSA analysis supplement by seabed imagery. Fine sands, very fine sands, clay and silt fractions in the PSA analysis were insignificant and the dominant grain sizes were of medium sands (250-499 μm) and coarse sands (500-999 μm) which together accounted for <95% of sample PSA sample volume for each station sampled. Very fine sands, fine sand, clays and silts were present in exceptionally low fractions or were absent from all PSA samples for all practical purposes. Folk classification for PSA analysis is slightly gravelly sands.

Total Organic Carbon levels were low as would be expected for these sediments, with a maximum of 2.3% being recorded at one station. The seabed sediment data are indicative of a site that is subject to high current flows with seabed sediments being well sorted and finer sediment fractions being absent or exceptionally low.

Analysis results from benthic infaunal studies at Stations 1, 2, 3, 5 & 6 confirm especially sparse faunal assemblages, with an average of 2 or fewer taxa recorded per 0.1m^2 and between 1 and 6 individuals per 0.1m^2. This is exceptionally low both in terms of taxa present and numbers of individuals. Mobile coarse sands are generally also known to support interstitial polychaete communities; with taxa such as *Hesionura elongata, Microphthalmus spp.* and *Protodrilus spp.* being common components. As indicated previously, it is likely that these taxa were not recorded during this survey due to the 1mm sieve size used to separate fauna from bulk samples. The latter communities are commonly associated with mobile coarse sediments and are not of conservation concern.

Moderate to large numbers of the reef-building polychaete *Sabellaria alveolata* were recorded in 2 of the 3 grabs taken from station 4 (164 per 0.1m^2 and 808 per 0.1m^2 in grabs B and C). Apart from this species and some epifaunal taxa associated with the small reef mounds, taxa recorded were indicative of the mobile coarse sands. Where *Sabellaria* was recorded, the structures resembled small mounds rather than the extensive reef structures that can often be developed by this species, and which are a focus for the nearby Wicklow Reef Special Area of Conservation *Site code: 002274* (located circa 8km southwest of the proposed disposal site at its closest point).

In the context of epifaunal species assemblages, analysis of video and stills image sets confirms low number of epifaunal taxa recorded as well as low overall species abundance. In particular very few sessile taxa are recorded. Mobile epifaunal species abundances appear to be low, and species

observed most frequently included opportunistic feeders such as starfish *Asterias rubens* and scour tolerant species such as hermit crab *Pagurus bernhardus*. Very low abundance of grazers was noted – only two urchins *Echinus esculentus* were recorded. The low numbers of grazers observed is most likely related to lack of suitable grazing habitat, while the effects of sand scour would likely reduce grazing opportunity where suitable habitat does occur. Other scour tolerant species present included several bryozoan species (sessile), most notably Sea chervil (*Alcyonidium diaphanum*) and several hydroids (species unconfirmed); as well as anemones *Urticina felina* and *Metridium senile*. No burrowing epifanunal species were recorded during the imagery analysis. All taxa were recorded in low numbers. It is apparent from the analysis of video that the presence of *Sabellaria* sp. appears to be confined to the southwestern quarter of the proposed disposal site, based on both video and grab sample data. As in the findings for the grab survey, *Sabellaria* is not seen to form reef structures and is present occasionally encrusting the surface of small rocks or stones and rarely as small mounds <10cm on the seabed. There is no significant presence of *Sabellaria* reef in any of the video analysis.

The findings of the video and stills imaging survey indicate that the site has low species diversity and abundance. This is a direct consequence of the likely highly dynamic nature of the site whereby sediment fractions are resuspended and moved during periods of high tidal flows. This leads to scour and changes in seabed relief and features on a regular basis – limiting both infaunal and epifaunal taxa diversity and abundance.

While the present surveys were carried out during the early spring (grab survey) and early summer (video and stills), overall species diversity and abundance is unlikely to vary significantly during different seasons, taking into account the sediment profile and dynamic nature of the site. No algal species were recorded during the surveys.

The different surveys confirm the EUNIS habitat throughout the site as being representative of, EUNIS habitat code A5.13 **Infralittoral Coarse Sediment** (Eunis level 3 from video and stills imagery surveys); while (on account of the availability of data from analysis of infauna), the grab survey data confirms the EUNIS habitat code to the higher level 4 EUNIS A5.134 - ***Hesionura elongata*** **and** ***Microphthalmus similis*** **with other interstitial polychaetes in infralittoral mobile coarse sand**.
The grab survey also identifies a partial record for EUNIS habitat code A5.612 ***Sabellaria alveolata*** **on variable salinity sublittoral mixed sediment** from grab samples B and C at Station 4.

EUNIS Habitat descriptions for A5.13, A5.134 and A5.612 are provided in Appendix 10.

5. Residual impact

Sensitivity analyses for a wide range of EUNIS biotopes have been completed by the UK Marine Biological Association and other organisations with an interest in habitat classification in the northeast Atlantic. The analyses are available via a number of online resources. A review of the sensitivity analyses has been conducted in the context of the biotopes identified during the present series of surveys. This has allowed for likely effects and impacts of proposed dredge spoil disposal on the habitats and biotopes present within the proposed disposal site to be inferred.

A sensitivity analysis for infralittoral gravels and sands (corresponding to EUNIS A5.13 – Infralittoral coarse sediment) is available via the UK Marine SAC's portal.

A sensitivity analysis is available via the Marine Biological Association portal for the following EUNIS habitats:

- Sensitivity analysis for A5.134 - ***Hesionura elongata*** **and** ***Microphthalmus similis*** **with other interstitial polychaetes in infralittoral mobile coarse sand**

- Sensitivity analysis for A5.612 **–** ***Sabellaria 30lveolata*** **on variable salinity sublittoral mixed sediment**

In relation to **EUNIS A5.13** – **Infralittoral coarse sediments**, the UK Marine SAC assessment states the following:

> "*Dredged material disposal over subtidal sandbanks may occur adjacent to dredged areas. However, in areas of strong tidal current dispersion of dredge plumes may be high and thus the effects minimal. Any increase in the amount of suspended particles will influence turbidity, light penetration and primary production of the water column and substrata (Iannuzzi et al. 1996). Suspension- feeding invertebrates may also be affected by suspended dredge spoil, as it will clog their respiratory or breathing apparatus. However, it is emphasised that subtidal sandbanks are the result of relatively high energy conditions and as such will be naturally disturbed by changes in hydrographic conditions and will accommodate man-induced conditions such as dredge spoil*."

In relation to **EUNIS A5.134** - ***Hesionura elongata*** **and** ***Microphthalmus similis*** **with other interstitial polychaetes in infralittoral mobile coarse sand,** the MBA assessment provides the following assessment for smothering and siltation rate changes where deposition of up to 5 cm of fine material may be added to the seabed in a single discrete event:

> *"Where deposition of fine sediment occurs, typically further away from an obstruction such as a wind farm tower, or from deposition of aggregate or drilling waste will be likely to lead to reduction in abundance of characterizing species. Resistance to deposition of fine sediment is assessed as* ***'Medium'****. The species community displays high recoverability due to inhabiting mobile sediments and resilience is* ***'High'****. Sensitivity is assessed as* ***'Low****.'"*

In cases where heavy deposition of up to 30cm of fine material may be deposited in a single discrete event, the following assessment is made:

> "*Deposition of fine sediment, typically occurring further away from an obstruction such as a wind farm tower, or deposition of aggregate or drilling waste will be likely to lead to a change in the species community. The species community will return to that charcaterizing mobile medium-coarse sand if physical processes such as sediment transport provide a return to that habitat. Resistance is assessed as '**Low'**, Resilience to a single discrete event (given conditions are likely to return to coarser material over time) is '**Medium'** and Sensitivity is '**Medium**.'*
>
> *The spatial scale and duration are important to consider in utilizing this assessment. For instance, spatially the whole biotope or just a smaller area may be affected. Also different sediment types and associated species communities will occur at the site of aggregate extraction or scouring (where coarser sediment grain sizes prevail) and areas where finer sediment is deposited within the prevailing currents. The species characterizing this biotope are likely to colonize areas where extraction or scour has occurred and not the areas of deposition"*

In relation to **EUNIS A5.612** - ***Sabellaria alveolata*** **on variable salinity sublittoral mixed sediment,** the MBA assessment provides the following assessment for smothering and siltation rate changes:

> *"Sabellaria alveolata was reported to survive short-term burial for days and even weeks in the south west of England as a result of storms that altered sand levels up to two meters. they were, however killed by longer-term burial (Earll & Erwin 1983). Sabellaria alveolata has been identified as sensitive to changes in sediment regime in the Mediterranean Gulf of Valencia, Spain, where Sabellaria alveolata populations were lost as a result of sand level rise resulting from the construction of seawalls, marinas/harbours, and beach nourishment projects (Porras et al., 1996). It is likely that the length of survival, while dependent on length of burial, may be influenced by temperatures and oxygen levels so that seasonality and the depth and character of overburden partially determine sensitivity.*
> *Natural events such as storms may lead to episodic burial by coarse sediments with subsequent removal by water action and the degree of mortality will depend on a number of factors including the length of burial. As fine sediments may be relatively cohesive and as water and air penetration is limited the addition of an overburden of 30 cm is considered to potentially lead to some mortality if large areas are impacted. Resistance is therefore assessed as 'Low' and recovery is assessed as 'Medium', and sensitivity to this pressure is categorised as 'Medium'"*

Assessment of impacts of dredge spoil disposal and deposition

The two major impacts of dredge spoil disposal are:

- smothering of communities by sediments and
- increases in turbidity and increased light attenuation.

Taxa characteristic of the infralittoral mobile coarse sand habitat identified at all stations would be intolerant of increased levels of sedimentation by fine materials usually associated with dredge spoils. They are adapted to inhabiting environments with low amounts of these materials. If the immediate environment were to change in the longer term to be one of higher amounts of fine sediments it is unlikely that these taxa would continue to characterise the infaunal assemblage. However, infralittoral coarse sediment habitat is predominantly found in exposed and moderately exposed areas with strong to very strong tidal streams. Therefore, it is considered highly likely that any sediments released in the proposed disposal site will be resuspended and dispersed over a much wider area within a short time-frame (weeks or months). As a consequence, effects on the biological community of infauna as well as epifanuna are likely to be temporary and recovery would therefore be fast, as the majority of taxa recorded within this biotope are short-lived. It may be that the larger less robust bivalves would take longer to recover, depending on the extent and duration of any smothering.

The reefs formed by *Sabellaria alveolata* are a priority for protection status under the EU Habitats Directive and underpins the designation of nearby Wicklow Reef SAC Site code:002274. However, the mere presence of *Sabellaria alveolata* does not warrant protection and significant 'reefiness' has to be established in order to be of conservation significance. Holt *et. al.* (1998) suggested "[A reef] should be substantial in size (generally in the order of a metre or two across as a minimum, and somewhat raised) [and] should create a substratum which is reasonably discrete and substantially different to the underlying or surrounding substratum, usually with much more hard surfaces and crevices on and in which other flora and fauna can grow". Even at station 4C (sampled during the present grab survey) and which contained the highest abundance of *Sabellaria*, the structures were seen to be small discrete mounds of no bigger than 10cm. As such they would not constituent *Sabellaria* 'reef'. As discussed above, short-term changes of suspended sediment levels and smothering may occur after dumping of dredge spoils, however this taxa has been found to be tolerant of acute and short-term increases in suspended sediment and smothering (Jackson, 2008). Accordingly no long term or permanent change to this characterising species is likely to be seen in the circumstances of periodic or discreet one-off disposal of dredge spoil.

In general, the communities associated with *Sabellaria alveolata* are not particularly remarkable and are generally species poor on young or ephemeral reefs. The species itself is of conservation interest where it has formed extended three dimensional reef structures, generally greater than 1m across in size as suggested by Holt *et. al.* (1998). Where *S. alveolata* aggregations bind together mobile cobbles this may increase heterogeneity however no evidence of the presence of significant areas of cobble habitat or aggregations of *S. alveolata* binding cobbles together is apparent from a review of both video and grab sample data.

6. Recommendations

As it is considered best practice to avoid disposal of dredge material where there may be short term risks to areas of seabed where *S. alveolata* is recorded, it is recommended that a section of the proposed dump site western boundary be moved eastwards so as to exclude seabed areas where *S. alveolata* was recorded during benthic surveys. This will result in a reduction in the spatial extent of the proposed disposal site, while sufficient room would remain for marine plant to operate without hindrance. Following this recommendation, alternative site geometry is presented in Figure 6.1a. and 6.1b. A revised shapefile has also been provided to allow for site geometry and co-ordinates to be accurately determined (see Appendix 11).

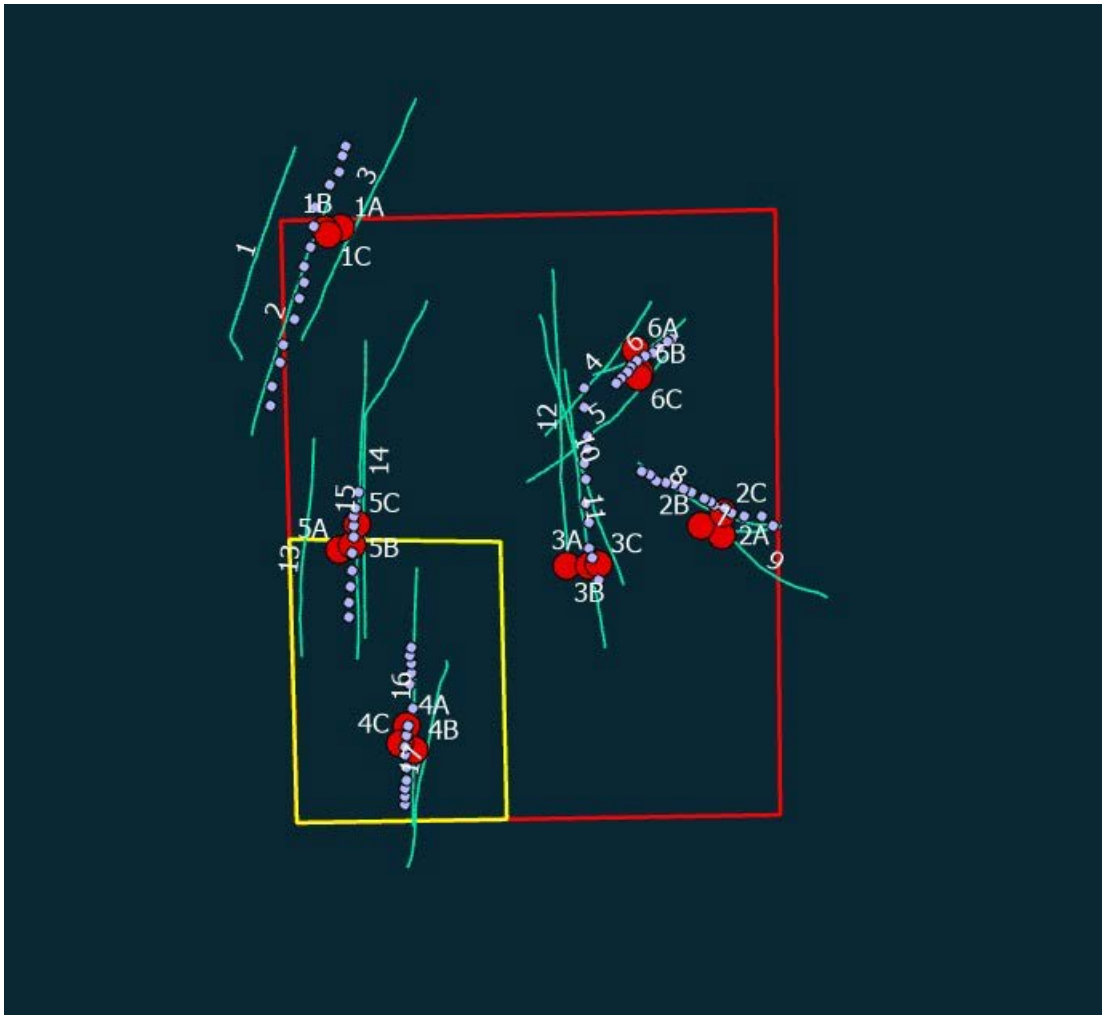

Figure 6.1 Revised proposed dumpsite geometry as recommended, avoiding the southwestern quadrant in order to minimise risks to communities of *S. alveolata*. It is recommended to remove the area contained within the yellow box from the dumpsite area.

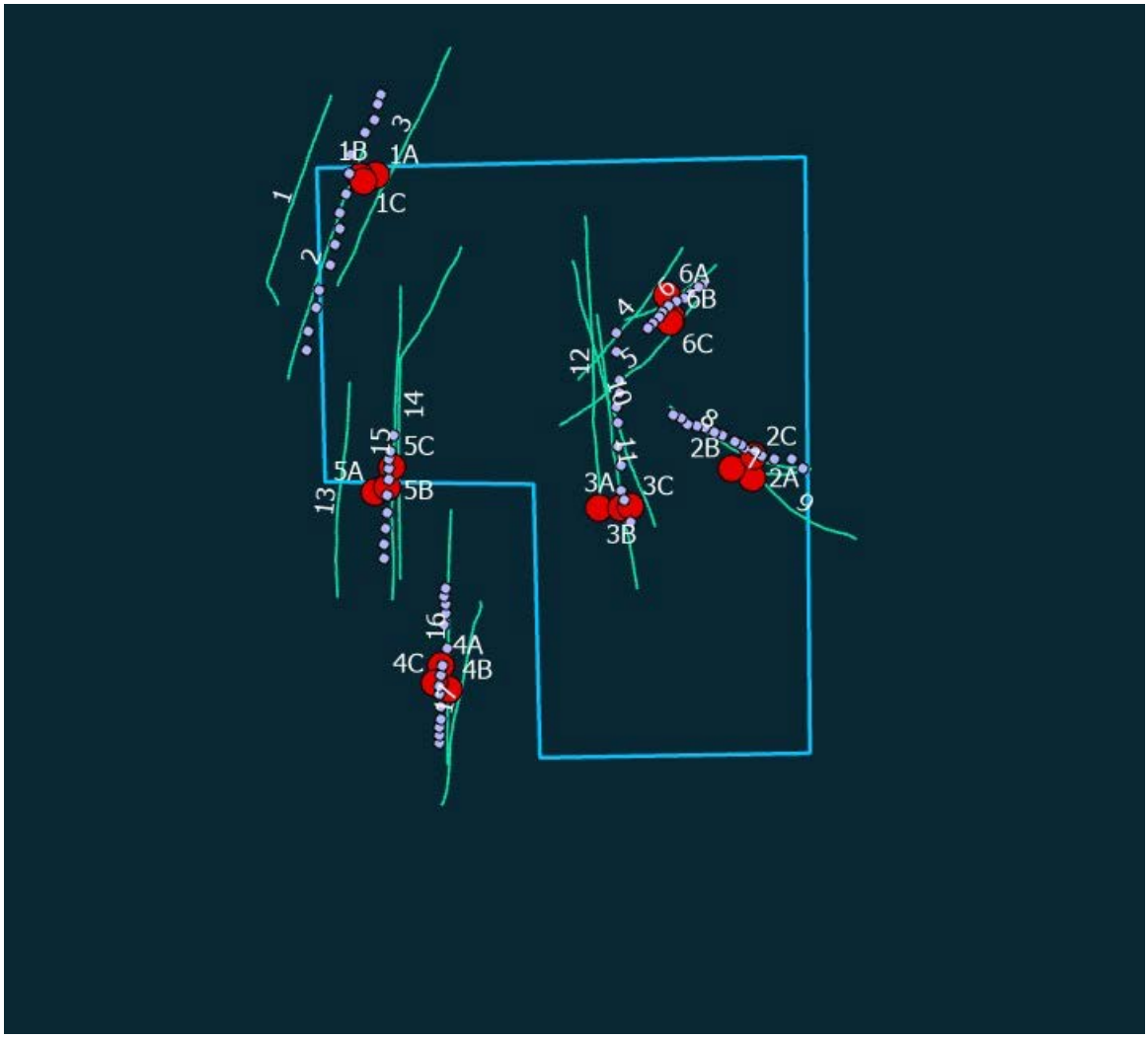

Figure 6.1b Revised proposed dumpsite geometry as recommended, with southwestern quadrant removed in order to minimise risks to communities of *S. alveolata*.

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8. List of Appendices

- Appendix 1 - Environmental data grab survey
- Appendix 2 - Photographic catalogue benthic samples
- Appendix 3 - ArcGIS shapefiles for grab and imagery sampling
- Appendix 4 - Macrofaunal analysis results
- Appendix 5 - PSA _ TOC analysis results
- Appendix 6 - Video imagery
- Appendix 7 - Results of video imagery analysis
- Appendix 8 - Stills imagery for camera drops
- Appendix 9 - Results of stills imagery analysis
- Appendix 10 - EUNIS Habitat descriptions
- Appendix 11 – Proposed amended site GIS files