AIS ENVIRONMENT

Appropriate Assessment in Relation to the 2nd Malta-Sicily Interconnector EIA

As per ERA requirements for EA/00018/21

Report

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DISCLAIMER

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1 Executive Non-technical Summary

This Appropriate Assessment report describes the ecological impacts arising from the construction and operation of the proposed development (PA/04448/22). The development application proposes the "*construction of the second cable link inter-connector project. The proposal includes trenching, laying, cable jointing and installation between the Enemalta 132kV Maghtab Terminal Station and the near shore approach, construction of underground joint bays, a trench-less transition from onshore to offshore and the laying and protection of the submarine cable up to the median line between Maghtab, Naxxar and Ragusa, Sicily*".

The project, hereinafter referred to as the "Scheme", aims to secure the electrical supply to the Maltese Islands. This study identifies the terrestrial ecological features in the area and assesses the impacts caused in relation to the AA for the proposed development, in line with the requirements issued by the ERA under EA 00018/21.

2 Project Description

The proposed cable shall connect Malta to the TERNA 220kV substation located in Sicily. The primary aim of the project is to transmit electricity via a second electrical interconnector (IC2) between Maghtab, Naxxar (Malta) and Contrada Cimillà, Ragusa (Sicily).

The length of the submarine cable is estimated to be 99.6km, while the onshore cable is estimated to be around 1.8km in Malta and between 20.6km in Sicily. The transmission voltage to Malta shall be at 220kV with transformation to match the local 132kV network in Malta. To maximize the project's benefits, the proposed interconnector shall operate in parallel with the existing link in an unrestricted manner.

Malta has been connected to the European electricity grid through a submarine cable interconnection (IC1) to Sicily since 2015. Once the project is implemented, it is expected to not only assist Malta with the ever-increasing electrical demand attributed primarily to economic growth and an influx in population number but will also be an enabler of further renewable energy generation as it can allow for RES intermittency. The need for such a project also stems from the European Green Deal and other policy documents which oblige member states to prioritise carbon emission neutrality by 2050. In fact, the proposed cable is expected to reduce the dependency on fossil fuel power generation at Delimara Power Station and increase the security of supply with the potential for increased energy input from renewables.

In order to minimise the environmental impact of the project, the applicant is proposing to make use of the existing transmission station just outside the Ecohive complex, Maghtab, Naxxar. On shore, the cable shall be installed in underground trenches passing through or in close proximity to the Ecohive complex which is operated by WasteServ Malta. The onshore and nearshore approaches will be connected via trenchless drilling techniques passing underneath the Coast Road. The offshore cable shall be buried beneath the seafloor to a nominal depth of circa 1.5m on the most optimal route and where it will not be possible to cover the submarine cable, it will be protected by means of rock protection/placement.

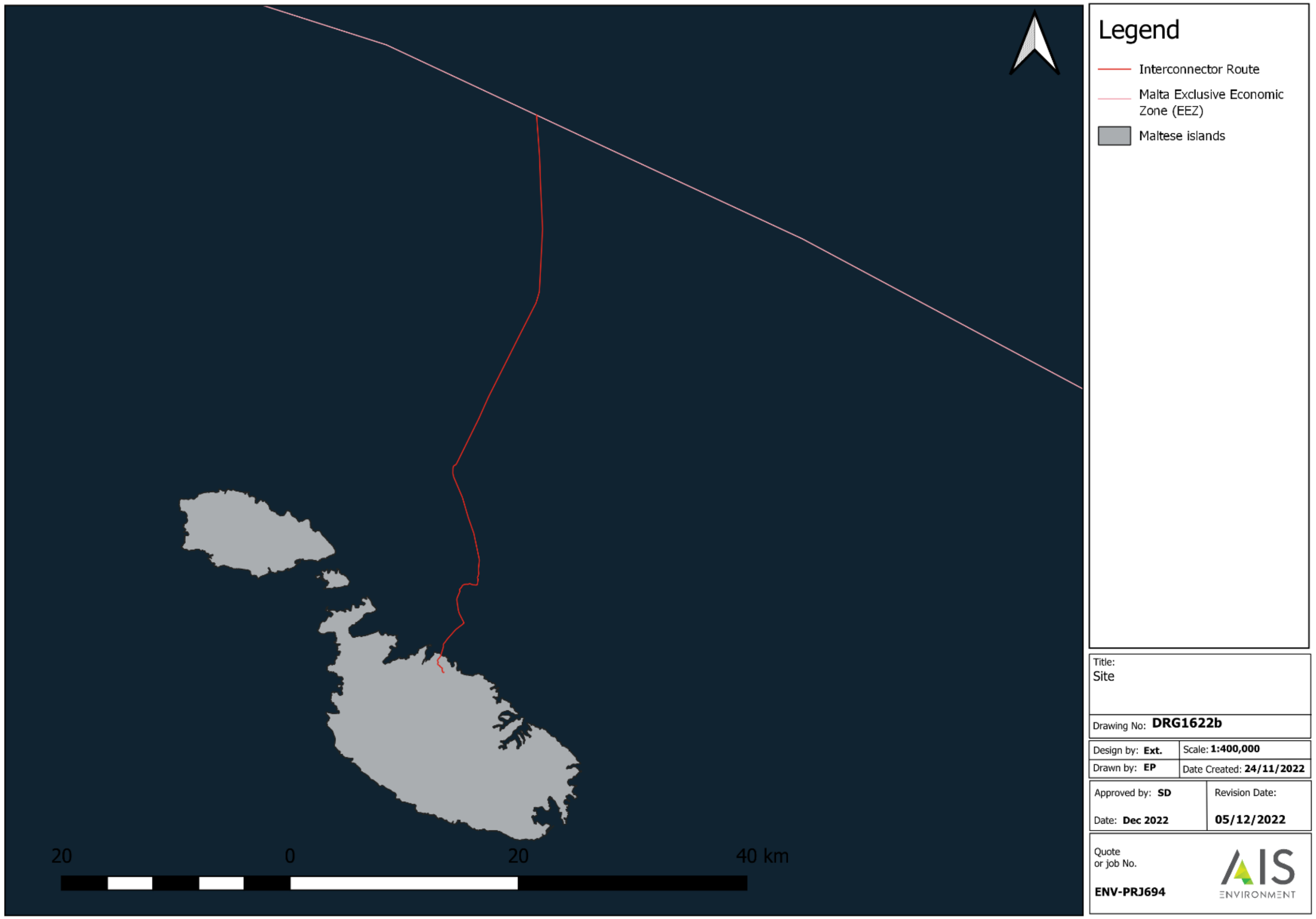

Figure 1: Proposed Interconnector route in the Maltese Exclusive Economic Zone (EEZ)

The connection between the cable laid in the marine environment and the onshore electrical distribution network will be possible by adopting a trenchless drilling approach, specifically Horizontal Direction Drilling (HDD), through which the cable shall cross Triq Tul il-Kosta and the shoreline for approximately 200 meters. This method is being proposed to avoid open trenching impacts which may lead to direct impacts on daily road usage, public access to the coast, and the ecological features present in the area. This technique is typically used in nearshore locations to connect cables and pipes from land to sea.

More importantly, the route has been purposely designed to steer away from a nearby terrestrial Natura 2000 site also known as l-Ghadira is-Safra u l-Iskoll tal-Ghallis (MT0000008) which is designated as a Special Area of Conservation (SAC). Other marine and bird protection areas are present within or in close proximity to the marine cable route, chiefly:

- Zona fil-Bahar bejn il-Ponta ta' San Dimiti (Ghawdex) u il-Qaliet (MT0000105) – Special Area of Conservation (SAC) of International Importance
- Zona fil-Bahar tal-Grigal (SPA) of International Importance
- Zona fil-Bahar ta' madwar Ghawdex (MT0000112) – Special Protection Area (SPA) of International Importance

Natura 2000 sites comprise a network of protected areas established by the EU to conserve wildlife and habitats. The network covers various sites across all EU member states, including Malta. The main aim of the Natura 2000 network is to protect and conserve threatened species and habitats, and to ensure the long-term survival of Europe's most valuable and threatened species and habitats.

2.1 Study Methodology

2.1.1 Terrestrial Study

The Area of Influence (AOI) for the terrestrial component of the study comprised of a 100m buffer zone around the proposed onshore route of the interconnector cable. The study also entailed a survey of the terrestrial Natura 2000 Site (MT0000008) and a review of the site's published literature.

The AOI of the onshore component is mapped in Figure 2.

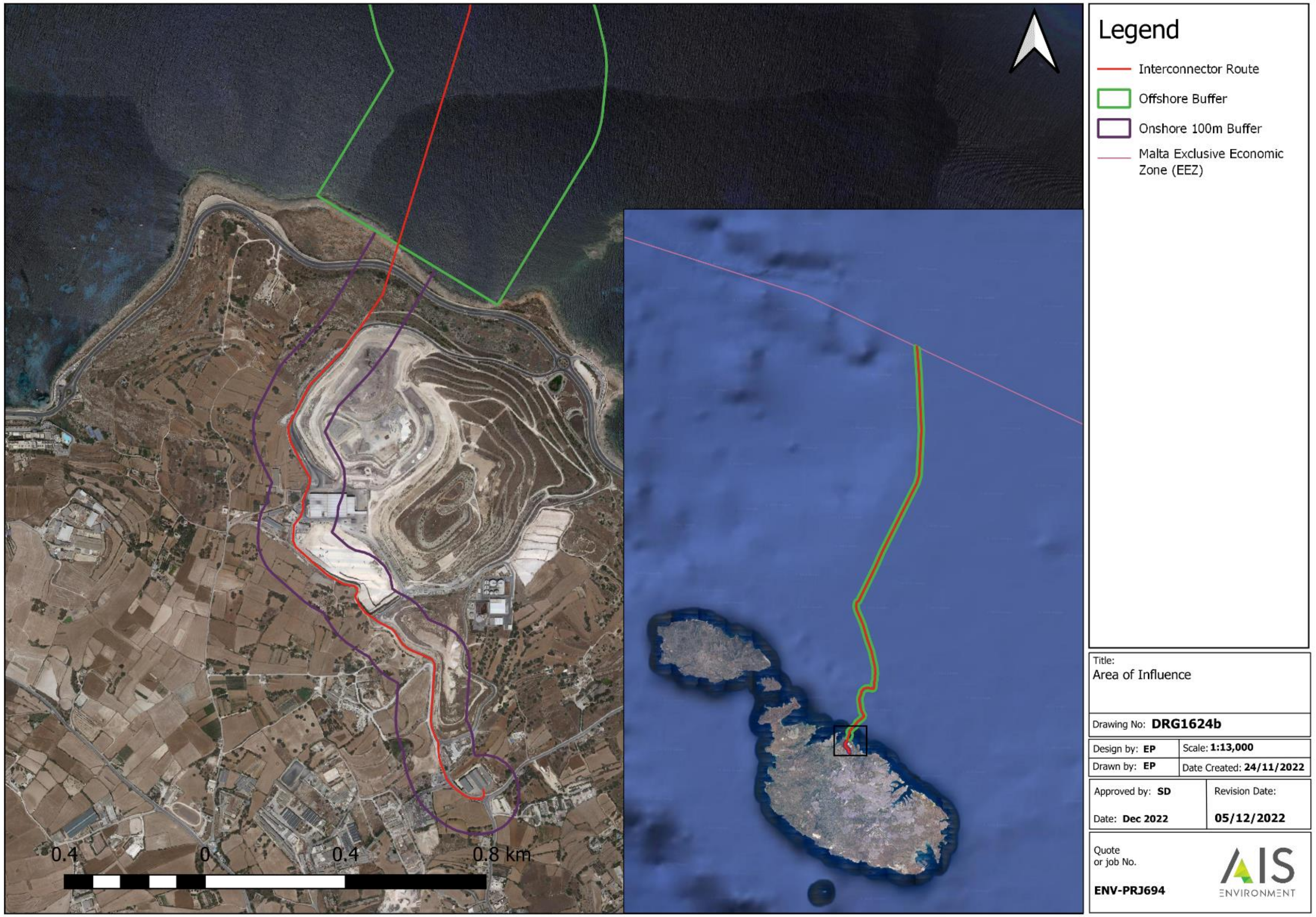

Figure 2: Area of Influence for the terrestrial and marine ecology study

This study describes the existing ecology present with the project footprint and surrounding area and outlined any proposed interventions. This information was then used to assess the impact of the proposed project on the area's ecology. The Consultant first carried out a thorough literature review of readily available data and previous studies in the AOI. This involved a review of readily available data and previous research studies will be carried out for the AOI and includes:

- Central Malta Local Plan
- SPED (Strategic Plan for the Environment and Development)
- Previous environmental studies carried out in the same area

Following on from the desktop study, the Consultant conducted a broad-brush terrestrial survey within the AOI in February 2023. The Consultant recorded the vegetation assemblages and any faunal species encountered during the survey. The baseline survey also included a survey of all species present within the site and buffer zone, including their scientific and vernacular name to identify species protected in line with the TREES AND WOODLANDS PROTECTION REGULATIONS (S.L.549.123) and the Flora, Fauna, and Natural Habitats Protection Regulations (S.L.549.44). Photographic evidence was collected during the field survey, including aerial drone shots.

The report details the conservation status and ecological condition of the area and the state of health of its habitats, species and ecological features. All protected, endangered, rare, unique, endemic, high-quality, keystone, invasive/deleterious, or otherwise important species, habitats, ecological assemblages, and ecological conditions found in the area under study were also studied.

2.1.2 Avian Study

The study at hand considers populations of wild birds, in particular populations of protected species and of species with conservation concern as relevant sensitive receptors.

The Area of Influence for the avifauna assessment of the terrestrial part of the planned development, from here onwards labelled as AoI-1, consists of:

- A 0.1 km buffer either side of the trenched part of the proposed onshore cable route of which approximately 0.5 km are flanked by (disused) agricultural land, internal routes within the ECOHIVE complex and approximately 1.3 km along the side of a road (see Figure 1).
- The temporary construction yard and access road for the HDD facility of approximately 2800 m^2 and a 0.1 km buffer around it.

The Area of Influence for the avifaunal assessment of the marine part of the planned development, labelled AoI-2 from here onward, consists of a 0.5 km buffer each side of the proposed offshore cable route, considered as the extent of potential influence of activities on marine avifauna during construction, operation, and decommissioning.

The additional potential impact on marine avifauna specifically caused by light pollution during the construction of the offshore cable route is assessed as a 5.0 km buffer (direct line of sight) at each side of the prosed offshore cable route, labelled AoI-3 from here onward.

The assessment of potential impacts on avifauna receptors in the identified AoIs was performed through a literature review.

Main references considered are:

- Malta Breeding Bird Atlas 2008 (BirdLife Malta 2009)
- Malta Breeding Bird Atlas 2018 (Epsilon 2019)
- The Breeding Birds of Malta (Sultana et al. 2011)
- Malta Marine IBA Inventory Report (BirdLife Malta 2015)
- MSFD initial assessment report, seabirds (Borg et al. 2013)
- MSFD second assessment report (ERA 2020)
- BirdLife International (2020) IUCN Red List for birds (http://www.birdlife.org)
- Bird species of Annex I of the Birds Directive (Last updated: 14/09/2020)

The Natura 2000 sites partially overlapping with the AoI-2 (offshore cable routes plus 0.5 km buffer) are the SAC L-Għadira s-Safra (MT0000008) and the marine SPA Żona fil-Baħar madwar Għawdex (MT0000112).

Additional areas of importance for avifauna which are protected within the Natura 2000 network are located within/ bordering the 5.0 km buffer of the offshore cable route, AoI-3, and are therefore considered for potential impacts e.g. from light pollution. These are the SAC Is-Salini (MT0000007), and SAC Il-Gżejjer ta' San Pawl (Selmunett, MT0000022) as well as the SPA Żona fil-Baħar tal-grigal (MT0000107).

The report details the conservation status of the relevant bird species within the AoIs and in the above-mentioned Natura 2000 sites.

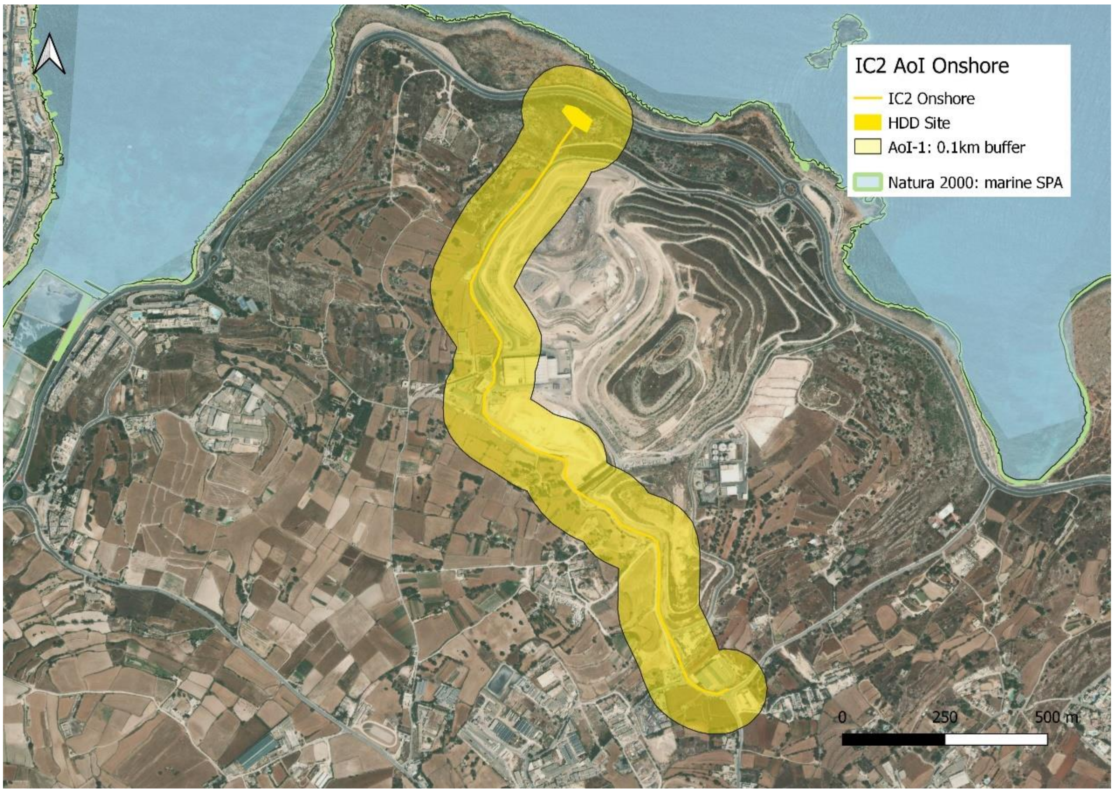

FIGURE 3: ONSHORE CABLE ROUTE AND HDD SITE WITH AOI RELEVANT TO AVIFAUNA.

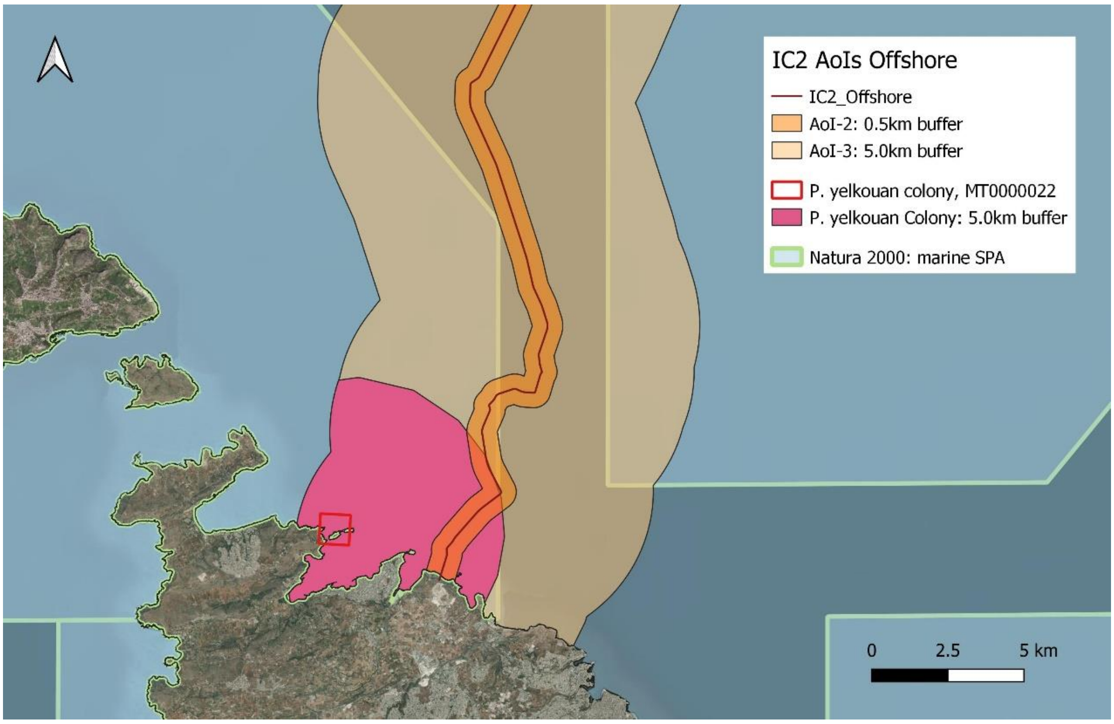

FIGURE 4: OFFSHORE CABLE ROUTE WITH AOIS RELEVANT TO AVIFAUNA, RELEVANT P. YELKOUAN COLONY WITH BUFFER OVERLAPPING WITH AOIS (PINK), MARINE SPAS.

2.1.3 Marine Study

The nearshore and offshore marine AOI followed the proposed interconnect corridor's centreline extending 300m from each side of this proposed centreline. The offshore study area stops at the boundary of the Maltese Exclusive Economic Zone. The AOI is mapped in Figure 2.

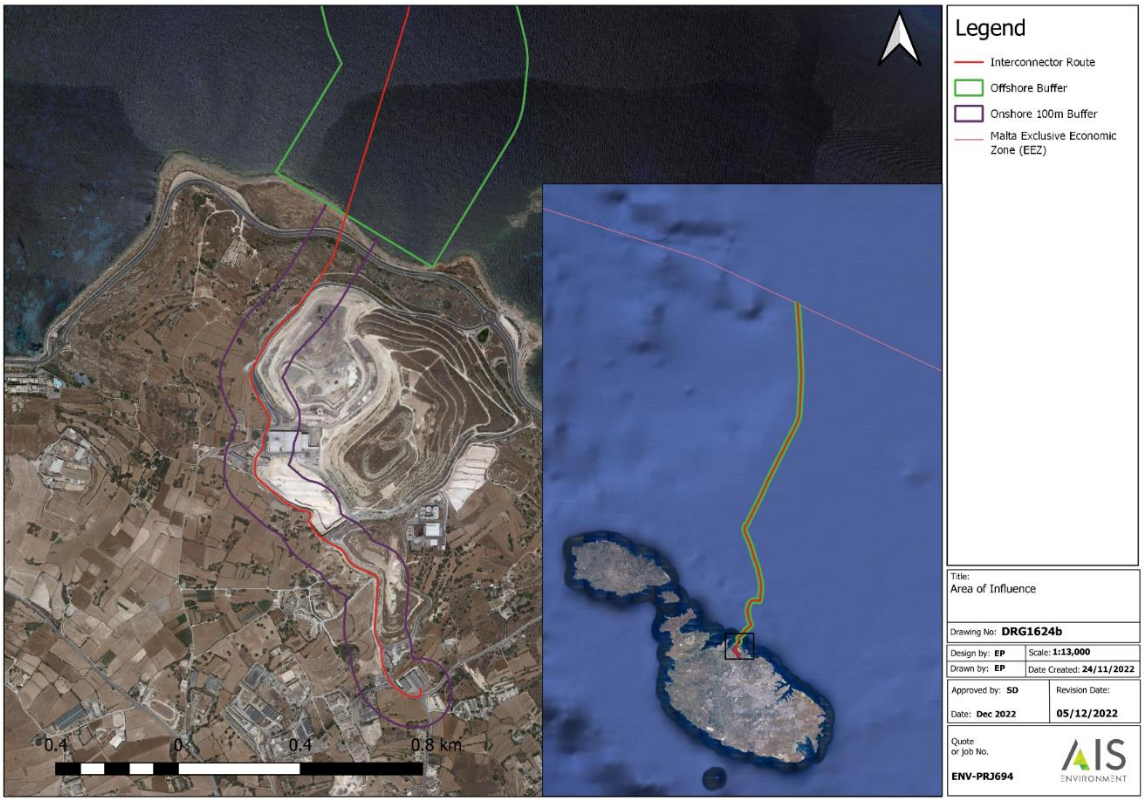

FIGURE 5: AREA OF INFLUENCE FOR THE TERRESTRIAL AND MARINE ECOLOGY STUDY

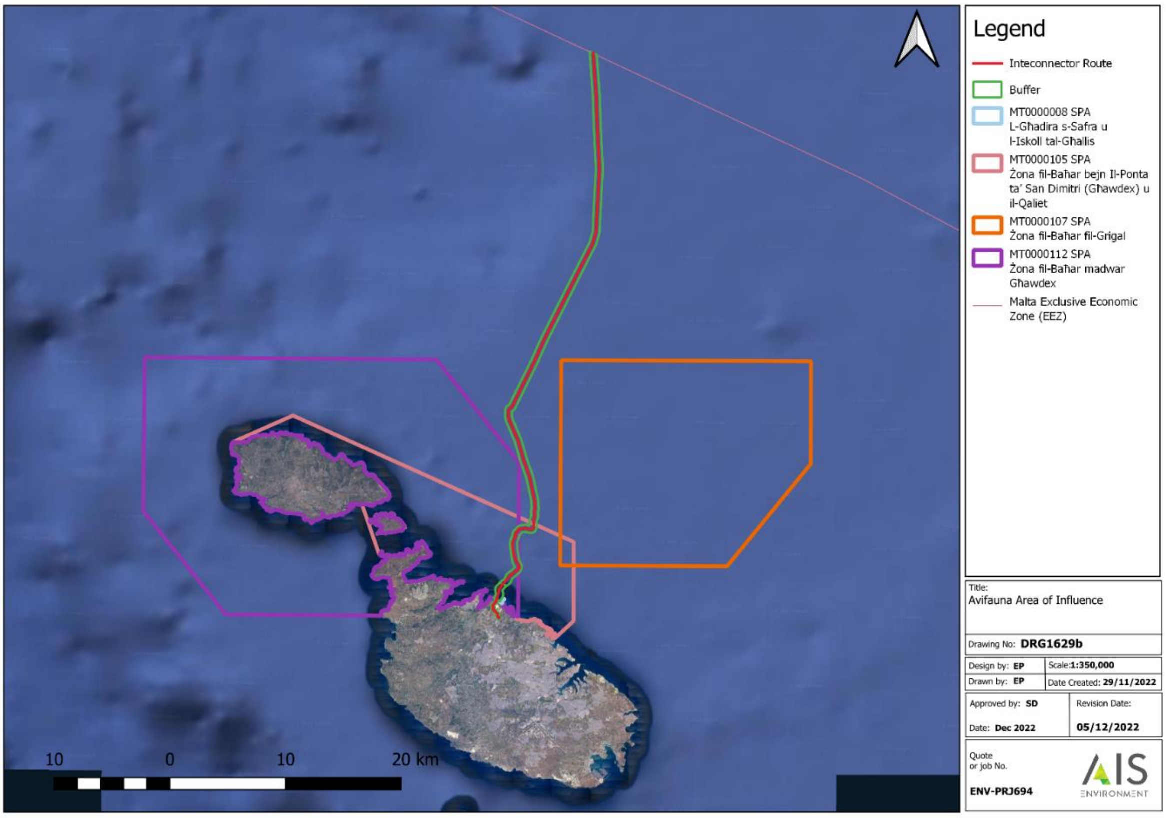

FIGURE 6: ADDITIONAL AREA OF INFLUENCE FOR THE AVIAN ECOLOGY STUDY

The marine component of the study identified any species listed under the HABITATS AND BIRDS DIRECTIVES and mapped their distribution within the study area. This included benthic assemblages of conservation importance, such as seagrass meadows, coral formations, underwater caves, reefs, and maerl assemblages. The Consultant recorded the species and habitats in accordance with recognized conventions, including the EUNIS, Palaearctic and the RAC/SPA classification systems of Mediterranean marine benthic habitats, as adapted for the Maltese context.[1]

A third-party PMRS contractor (Fugro) conducted field sampling and provided the data to the Consultant for expert analysis. Ecological sampling included:

- Seabed surveys
- Water samples
- Plankton samples
- Sediment samples

Seabed Surveys

Seabed surveys were carried out using multi-beam echosounder, sub-bottom profiler, side-scan sonar, magnetometer, and ROV surveys. This enabled the bathymetry and

[1] Borg, J.A., Schembri, P.J., Knittweis, L. (2013). Compilation of an interpretation manual for marine habitats within the 25 NM Fisheries Management Zone around the Republic of Malta.

morphology and characteristics of the seabed to be mapped within the survey area. Following the completion of the geophysical survey, the ROV surveys were only carried out around the remote sensing targets and other interesting areas and targets of interest identified during the survey.

The ROV footage was also used to identify the nektonic (mainly fish) species encountered within the survey area.

Water Samples

The water sampling included the taking of in-situ measurements and the collection of water samples for laboratory analysis. The in-situ measurements were taken using a CTD, multi-parameter sonde, and Secchi disk, and the measured parameters were:

- Temperature (°C)
- Dissolved oxygen (mg/L O_2 and % saturation)
- pH
- Salinity (ppt/psu)
- Turbidity (measured using the Secchi disk)

The water samples for laboratory analysis were collected using a Niskin bottle and stored in appropriate receptacles depending on the tests that were carried out. The tests determined the level of chemicals within the water which determined the organisms that could survive, special attention was given to test the chlorophyll-a levels.

Water samples were collected in both the nearshore and offshore areas. One water sampling location was collected in the Maltese nearshore waters. Offshore water sampling was performed at 4 locations in the Maltese territorial offshore waters. The exact location and depths of the water sampling stations were recorded using GPS and sonar systems, as mapped in Figure 7. Samples were taken at three depths at all sampling stations: 0.5m from the surface, mid-range and 0.5m from the seabed. Three replicates were taken per depth.

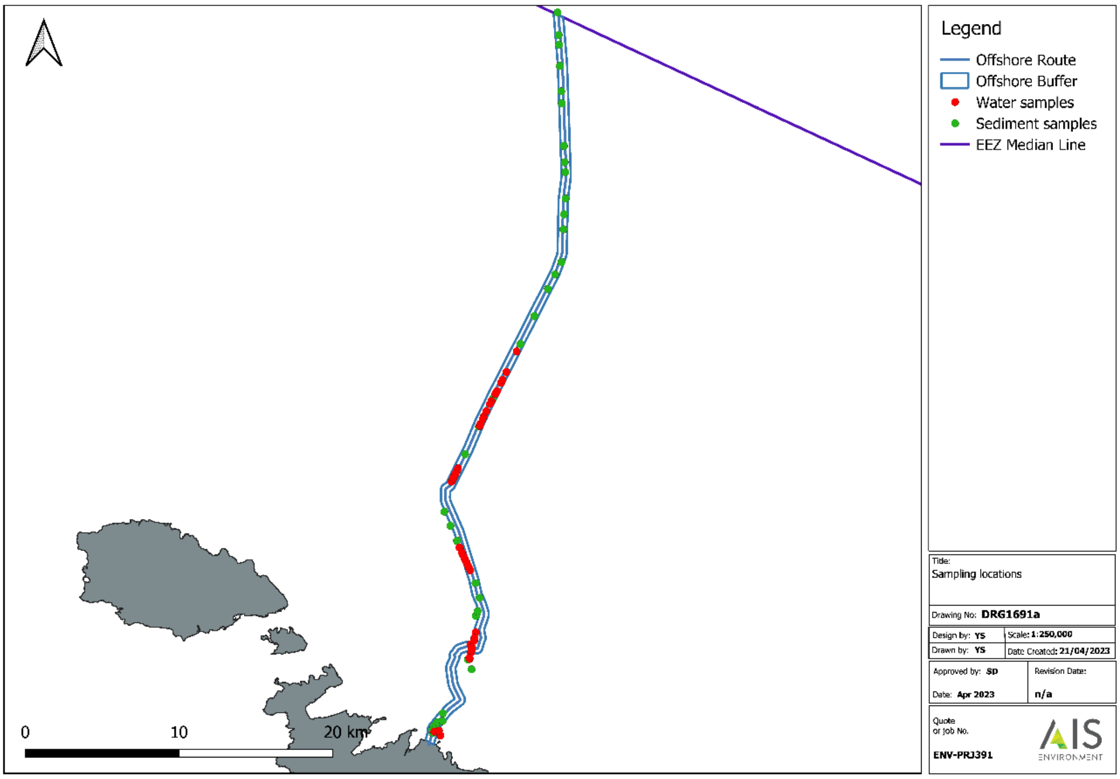

FIGURE 7: WATER AND SEDIMENT SAMPLING POINTS

Plankton Samples

Plankton samples were collected using two methods depending on the depth of recovery:

1) Horizontal plankton net (surface samples)

   The surveying vessel towed a horizontal plankton net, attached to a flow meter for a known period of time. Two different sized meshes were used: 25µm for phytoplankton and 200µm for zooplankton.

2) Niskin water bottle(mid-depth and 0.5m from seafloor samples)

A Niskin water bottle(of known volume) was used to gather the samples at the required depth. The samples were filtered through a sieve: 25µm for phytoplankton and 200µm for zooplankton. All of the samples were stored in distilled water and acidic Lugol's iodine for preservation purposes. One sampling station was collected in the Maltese nearshore waters. Offshore water sampling was performed at 4 locations in the Maltese territorial offshore waters. The exact location and depths of the water sampling stations were recorded using GPS and sonar systems. Samples were taken at three depths at all sampling stations: 0.5m from the surface, mid-range and 0.5m from the seabed. Three replicates were taken per depth.

Sediment Samples

Sediment samples were taken to determine the main microbiological characteristics of the sediment and identify any benthic organisms within. The samples were retrieved using a van-veen grab in the nearshore area and a 40l volume box grab in the offshore area.

The samples for the microbiological characterization were stored in a freezer, whereas those for benthic analysis were filtered through a 0.5mm sieve and stored in 80% ethanol. This ensured that the samples were preserved until the time of laboratory analysis.

A total of 5 sediment samples were collected within the proposed interconnector corridor in the nearshore area. They were located at 200m intervals for a distance of 1km away from the shoreline. Sediment samples were taken at approximately 2.5km intervals along the proposed interconnector corridor in the offshore areas (beyond 1km from the shoreline). This resulted in a total of 12 samples in Maltese waters and were analysed in this technical study. These are mapped in Figure 7.

Following the baseline survey, the following indicators were used to gauge possible impacts relevant to the ecological status of the marine environment in the Area of Influence. These included:

- Benthic communities (including outcrops, bioconstruction, seagrass, etc.). Thematic mapping and photographs at an adequate scale;
- Observation of marine mammals, reptiles, and fish.
- All relevant species and assemblages (e.g. protected species or habitats, key species relevant to habitat characterization, and monitoring indicators) were identified and their abundance and distribution patterns, as well as the species' ecological niches, were recorded and assessed.
- Classification of habitat types and species was conducted in accordance with recognized classification systems (e.g. EUNIS and Palaearctic).
- Particular attention had to be paid to *Posidonia oceanica* and *Cymodocea nodosa* species of seagrass, from close inshore out to the maximum depth contour along the cable route.

WFD Assessment

The Water Framework Directive (WFD) assessment has been carried out in the form of a desktop review of the Scheme site and its influence on the hydrodynamics of the water body and the achievement of the water body's WFD objectives, in line with Article 4(7) of the WFD. Article 4(7) of the WFD states that:

"*7. Member States will not be in breach of this Directive when:*

- *failure to achieve good groundwater status, good ecological status or, where relevant, good ecological potential or to prevent deterioration in the status of a body of surface water or groundwater is the result of new* *modifications to the physical characteristics of a surface water body or alterations to the level of bodies of groundwater, or*

- *failure to prevent deterioration from high status to good status of a body of surface water is the result of new sustainable human development activities*

and all the following conditions are met:

(a) all practicable steps are taken to mitigate the adverse impact on the status of the body of water;
(b) the reasons for those modifications or alterations are specifically set out and explained in the river basin management plan required under Article 13 and the objectives are reviewed every six years;
(c) the reasons for those modifications or alterations are of overriding public interest and/or the benefits to the environment and to society of achieving the objectives set out in paragraph 1 are outweighed by the benefits of the new modifications or alterations to human health, to the maintenance of human safety or to sustainable development, and
(d) the beneficial objectives served by those modifications or alterations of the water body cannot for reasons of technical feasibility or disproportionate cost be achieved by other means, which are a significantly better environmental option."

The study was carried out since the proposed Scheme may modify the hydrographical characteristics of the water body. Such modifications may adversely impact the marine environment present in the surrounding areas and cause a deterioration in its ecological status. In order to carry out this WFD assessment, various literature sources have been consulted to determine the extent of the impact, if any, including:

- EC (2009). COMMON IMPLEMENTATION STRATEGY FOR THE WATER FRAMEWORK DIRECTIVE (2000/60/EC) – Guidance Document No. 20 on Exemptions to the Environmental Objectives
- EC (2017). COMMON IMPLEMENTATION STRATEGY FOR THE WATER FRAMEWORK DIRECTIVE AND THE FLOODS DIRECTIVE – Guidance Document No. 36 on Exemptions to the Environmental Objectives according to Article 4(7)
- MEPA (2011). THE WATER CATCHMENT MANAGEMENT PLAN FOR THE MALTESE ISLANDS (henceforth "1st WCMP")
- ERA (2015). THE 2ND WATER CATCHMENT MANAGEMENT PLAN FOR THE MALTA WATER CATCHMENT DISTRICT 2015 – 2021 (henceforth "2nd WCMP")

2.1.4 Onshore Noise Study

The identified ecological noise receptor locations are described in Table 1 below and annotated approximately in Figure 8**Error! Reference source not found.** further below.

Table 1: Noise Sensitive Receptors

Noise-Sensitive Receptor	Description of Receptor	Distance to Site boundary, m (approx.)
NSR1	The Ghadira s-Safra Nature Reserve to the east of the preferred cable route; and	300
NSR2	Blata tal-Ghallis SPA located off-shore to the north-east of the preferred cable route.	600

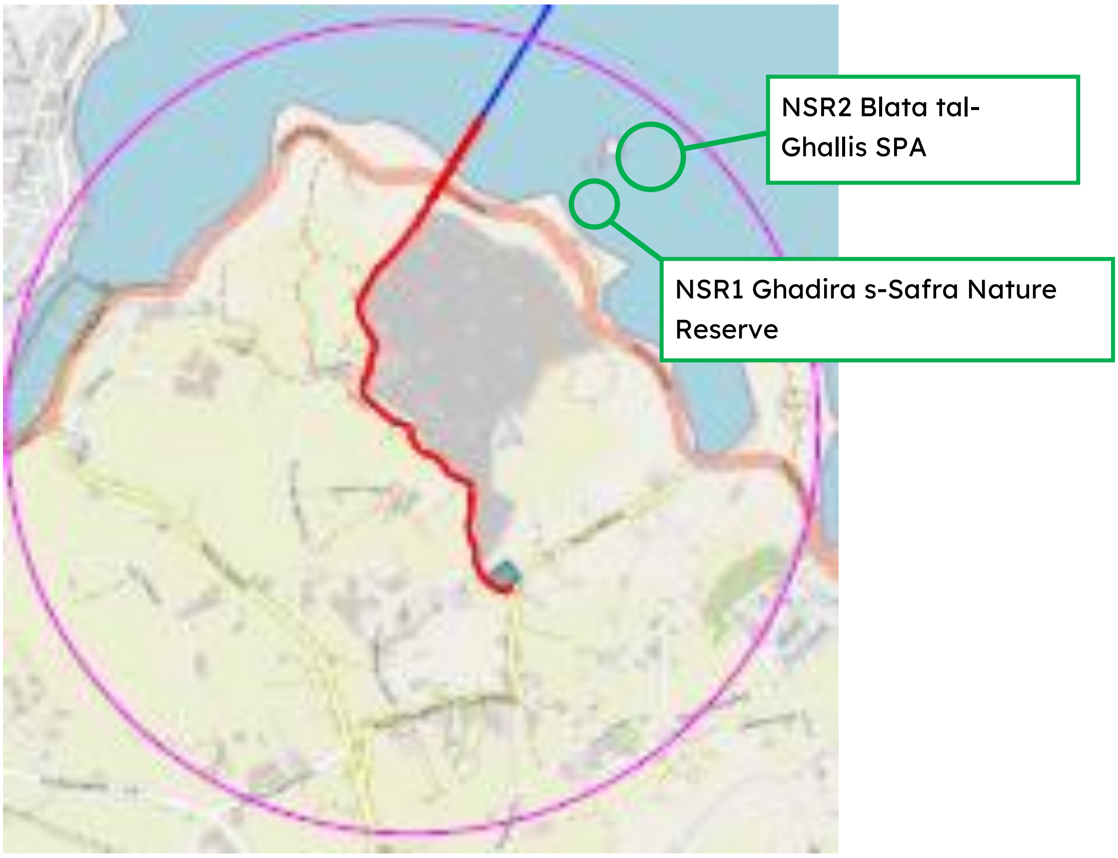

Figure 8: Ecological Receptors

The proposed assessment methodology was approved by the Environment and Resources Authority (ERA) in January 2023.

A summary of the agreed assessment methodology is provided below.

- noise levels generated by the construction of the underground cable route, including any HDD operations would be predicted at the nearest ecological receptors to the Site.

- The predicted noise levels would be assessed in accordance with the absolute limits contained in AQTAG09 Guidance on the effects of industrial noise on wildlife; and
- The predicted levels would also be compared the ambient levels measured as part of the Maghtab Waste to Energy assessment to determine whether construction operations would cause a significant change/increase in the ambient noise climate.

The results of the assessment would then indicate whether any noise mitigation measures would be required to reduce any identified impacts, which would be included as part of the assessment if deemed necessary.

The construction noise levels have been predicted in conjunction with the most appropriate guidance, in this case calculation algorithms contained in BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise.*

As previously stated, the predicted noise levels have then been assessed in conjunction with the absolute limits contained in AQTAG09 Guidance on the effects of industrial noise on wildlife.

A summary of the guidance documents referenced above is provided below.

Construction noise levels have been calculated in accordance with BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*. This standard sets out a methodology for predicting noise levels arising from a wide variety of open site activities and contains tables of sound power levels generated by a wide variety of mobile and fixed plant equipment.

Noise levels generated by open site construction operations and experienced at local receptors will depend upon a number of variables, the most significant of which are likely to be:

- The amount of noise generated by plant and equipment being used during the construction phases, generally expressed as a sound power level;
- The periods of operation of the plant, known as the “on-time”;
- The distance between the noise source and the receptor, known as the “stand-off”;
- The attenuation due to ground absorption or barrier screening effects;
- Reflections of noise due to the presence of hard vertical faces such as walls.

The Air Quality Technical Advisory Group 09 *Guidance on the effects of industrial noise on wildlife* (ATAG09), provides guidance to assist planning and/or licensing officials handling pollution prevention and control applications for industrial installations on relevant noise emissions and relates these to the requirements of the Habitats Regulations.

The HABITATS DIRECTIVE (92/43/EEC) specifies that, where specific noise from industry (and in this case construction activity), measured at the habitat / nest site is below the levels in Table 2, it is considered unlikely that it will have an adverse impact on designated species. Where noise levels are exceeded further, more detailed assessment will be required.

TABLE 2: SPECIFIC NOISE LEVELS AT HABITAT / NEST SITES

PARAMETER	NOISE LEVEL, DB
$L_{Aeq,\ 1hr}$	55
L_{Amax}	80

2.1.5 Offshore Noise study

A list of modelling scenarios with relevant major noise-generating equipment is developed based on relevant operation activities information provided and the general project description. Broadband source levels (SL) and their spectra have been sourced from relevant literature. These scenarios and relevant noise sources are summarised in Table 3.

For non-impulsive noise, it is assumed that the source SEL levels are equivalent to their corresponding RMS SPL source levels, considering the consistency and longer durations of the typical continuous noise emissions.

TABLE 3: OPERATIONAL ACTIVITIES AND SOURCES TO BE ASSESSED WITH RELEVANT BROADBAND NOISE SLS

OPERATIONAL ACTIVITY	MAJOR NOISE SOURCE	BROADBAND SL (DB RE 1μPA @ 1 M)
Sonar survey	Single-beam echo-sounder (SBES) – (40 kHz and 200 kHz)	233*
Trench Dredging	Cutter Suction Dredger (CSD) vessel – Athena or Al Mahaar (Zykov 2013)	184
Cable Laying	Cable Laying Vessel (CLV) with DPS - *Castorone* (Nedwell and Edwards 2004)	192

Operational Activity	Major Noise Source	Broadband SL (dB re 1µPa @ 1 m)
	Anchor Handling Tug (AHT) - *Katun* (Hannay et al. 2004)	189
	Offshore Supporting Vessel (OSV) - *Setouchi Surveyor* (Hannay et al. 2004)	184
	Combined cable laying effort	194

*Peak to peak SPL (dB re 1µPa @ 1 m)

The sonar devices for seafloor mapping mid to high frequency (a few kHz to hundreds of kHz) impulsive (tens of milli-seconds) signals, and their noise emissions are highly directional towards the seabed. As a result, less energy propagates horizontally. Therefore, noise impact from these sources is expected to be predominantly near-field and immediate rather than cumulative over time at far-field distances. Spherical spreading loss is assumed to be the transmission loss estimate for the near-field sonar noise propagation.

An extensive review of existing data on the underwater sound produced by the Oil and Gas Industry (Wyatt 2008) has shown that seabed survey sonar devices generate impulsive signals with Pk-Pk SPL ranging 200 dB re 1µPa @ 1 m to 233 dB re 1µPa @ 1 m. Therefore, based on a worst-case consideration, it is assumed that the sonar devices to be used for the pre-laying survey have the Pk-Pk SPL of 233 dB re 1µPa @ 1 m.

The one-third octave spectral source levels for the Cutter Suction Dredger (CSD) vessel are used based on the field measurements undertaken by SLR during a port development in Northern Queensland, Australia, for the large-sized CSD Athena and Al Mahaar (total installed power 11,224 KW) under their full operation conditions (Zykov 2013). The spectral source levels with an overall SL of 184.0 dB re 1µPa @ 1 m is shown in Figure 9.**Error! Reference source not found.**

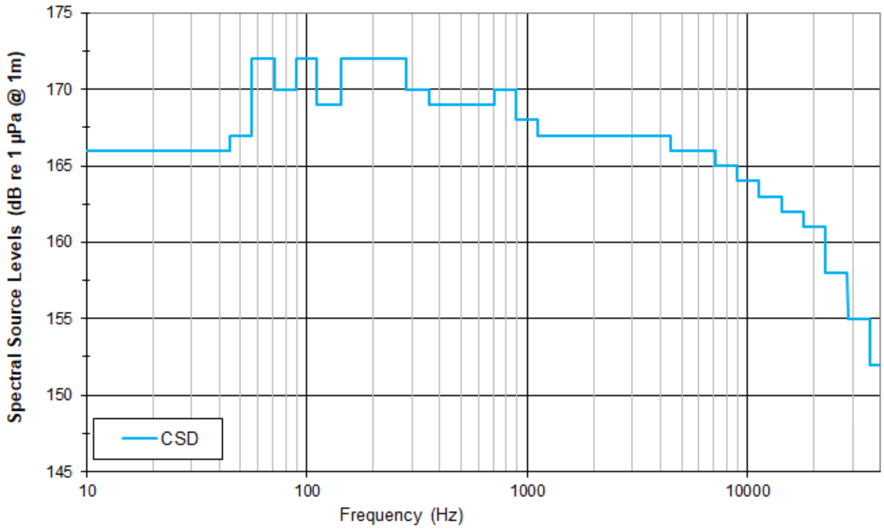

FIGURE 9: ONE-THIRD OCTAVE BAND SPECTRAL SLS FOR THE CSD VESSEL ATHENA (ZYKOV 2013)

Underwater noise emissions from the Cable Laying Vessel (CLV) are predominantly from propulsion operations. For deep water operations, noise emissions are also generated by the thrusters from the operation of the DP system. The spectral source levels with an overall SL of 192 dB re 1µPa @ 1 m for the cable laying vessel, as shown in Figure 10, are assumed to be similar to the *Castorone* barge with a propulsion power of 67,000 kW (Nedwell and Edwards 2004).

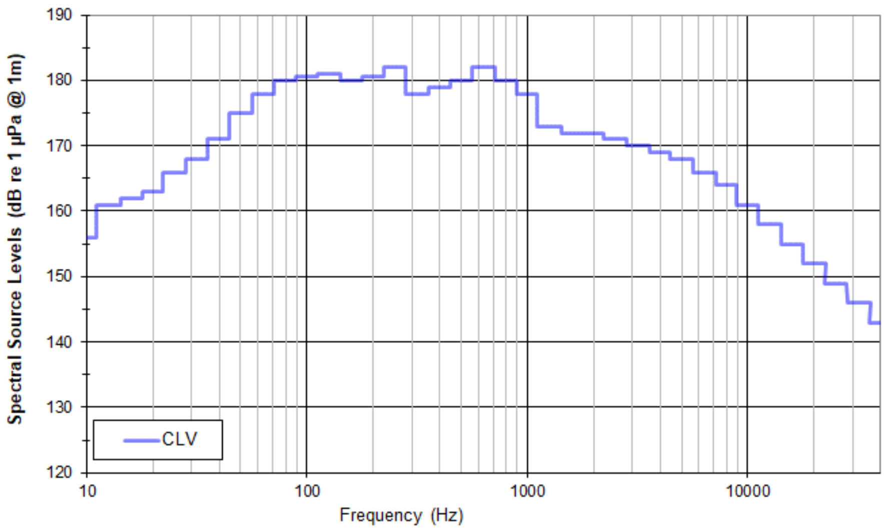

FIGURE 10: ONE-THIRD OCTAVE BAND SPECTRAL SLS FOR THE CLV CASTORONE (NEDWELL AND EDWARDS 2004).

The major noise emissions from the Anchor Handling Tug (AHT) operations are expected to be from the cavitation noise generated by propellers and thrusters, with energy predominantly below 1 - 2 kHz.

The spectral source levels with an overall SL of 189 dB re 1µPa @ 1 m for the AHT, as shown in Figure 11, are assumed to be similar to the barge Katun with a propulsion power of 9,000 kW (Hannay et al. 2004) under transiting operations.

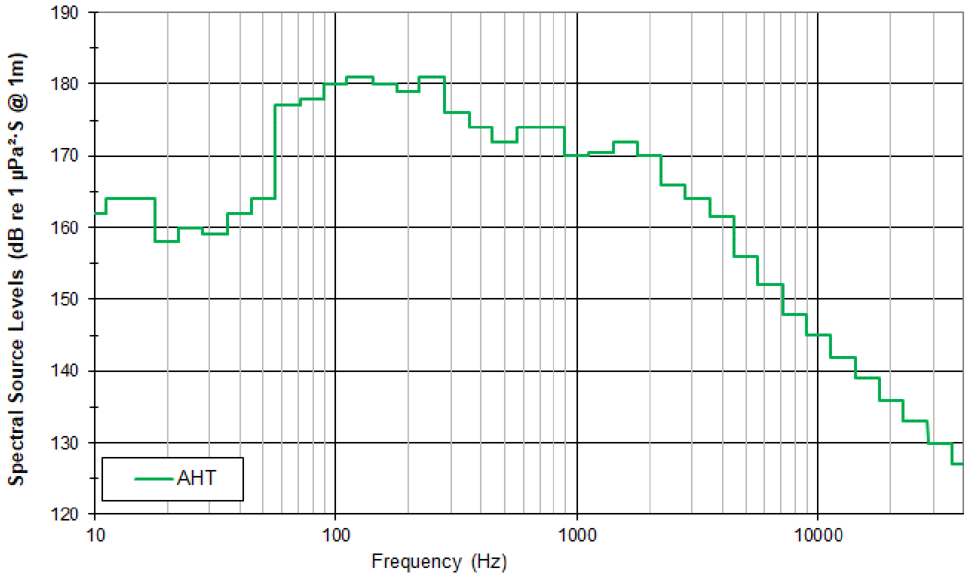

FIGURE 11: ONE-THIRD OCTAVE BAND SPECTRAL SLS FOR THE AHT KATUN (HANNAY ET AL. 2004)

The source spectral levels for Offshore Supporting Vessel (OSV) were assumed to be similar to those of the *Setouchi Surveyor* (Hannay et al. 2004), as shown in Figure 12, with an overall SL of 184 dB re 1µPa @ 1 m. The offshore supporting vessel *Setouchi Surveyor* is 64.8 m long with an 11.3 m beam, with a propulsion power of 3,400 kW.

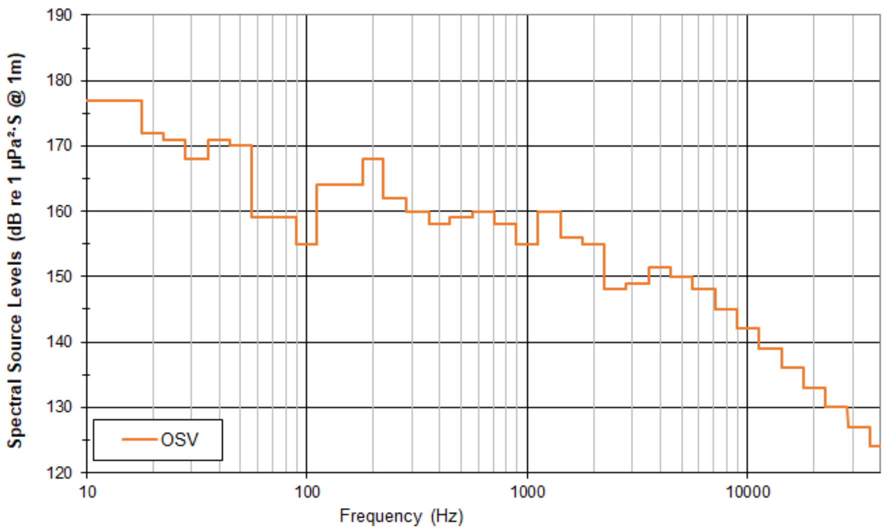

FIGURE 12: ONE-THIRD OCTAVE BAND SPECTRAL SLS FOR THE OSV *SETOUCHI SURVEYOR* (HANNAY ET AL. 2004)

The overall noise level from combined noise emissions from the CLV, AHT and OSV is approximately 194 dB re 1 µPa @ 1 m (or dB re 1 µPa²·S @ 1 m). The one-third octave spectral levels for each source and combined total levels are shown in Figure 13. For the purposes of the cumulative noise modelling, it was assumed that cable laying activities would be continuous and may occur on a 24-hour schedule.

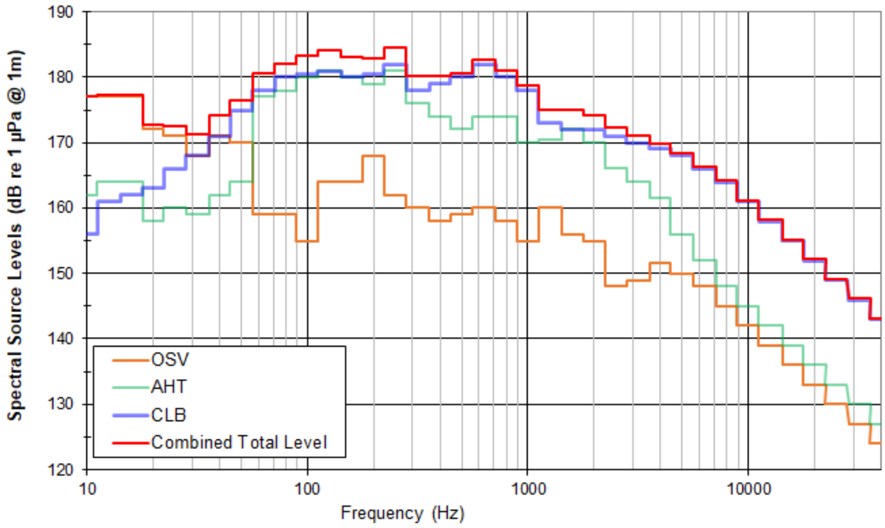

FIGURE 13: ONE-THIRD OCTAVE SPECTRAL SLS FOR THE COMBINED CABLE LAYING SOURCES

Underwater noise propagation models predict the sound transmission loss between the noise source and the receiver. When the SL of the noise source based on is known, the predicted transmission loss (TL) is then used to indicate the received level (RL) at the receiver location as:

$$RL = SL - TL \qquad (1)$$

The parabolic equation is range-dependant and accepts variable bathymetry and water/sediment environmental inputs. The PE is suitable for low-frequency problems. The input to the solver is configured so that the sediment layer is extended down to 2 times the depth of the water column, with the attenuation rapidly increasing at the lowest depths. The intention is to remove energy that would be reflected from the very bottom of the sediment layer. The sea surface is a pressure-release interface. As sharp discontinuities in density cause incorrect calculation results, the density is smoothed between water and seabed and between seabed layers by means of a hyperbolic tangent function.

The ray tracer forms a solution by tracing rays from the source out into the sound field. Many rays leave the source covering a range of angles, and the sound level at each point in the receiving field is calculated by combining the components from each ray. It is often useful to set this number very low as a fast initial 'checking' solve before increasing the number of rays and running a full solution which may take some time. The overlying space is modelled as a vacuum. The ray tracer is suitable for high-frequency problems.

When multiple seafloor layers are present, rays are not split and traced into the seafloor. A complex reflection coefficient is calculated, which is representative of the underlying layers, and this coefficient is applied to the ray at the point of seafloor reflection. The reflection coefficient calculation follows Computational Ocean

Acoustics, Jensen et al. Springer 2011. The ray tracer is used for time domain calculations. Instead of returning a transmission loss at each point in the slice, a list of ray arrivals is returned (with separate entries for each frequency). These arrivals lists can be used to calculate the effective time series at each point in the slice, which is then used to calculate peak, peak-to-peak, and frequency band SEL levels. These calculation methods are extensively documented in Computational Ocean Acoustics (Jensen et al., Springer, 2011).

Dredging is modelled as a stationary continuous source for a duration of 24 hours. Cable laying and combined sources are modelled as continuous moving sources for 24 hours or 7 km of cable lay.

For the purposes of the high-level prediction of SBES, sound propagation is assumed from a stationary single-pulse exposure (i.e., impulsive noise) with spherical spreading loss and a Pk-Pk SPL of 233 dB re 1μPa @ 1 m.

A spreadsheet tool from the National Marine Fisheries Service (NMFS) it was used as means to estimate distances (i.e., isopleths) where PTS thresholds may be exceeded (NMFS 2018). Results provided in this report do not represent the entirety of the comprehensive effects but rather serve as a tool to help evaluate the effects of a proposed action on marine mammal hearing and behavioural response on marine mammals and fish.

The bathymetry data used for the sound propagation modelling were obtained from the General Bathymetric Chart of the Oceans (GEBCO) dataset grid (GEBCO 2022). This is the fourth GEBCO grid developed through the Nippon Foundation-GEBCO 'Seabed 2030 Project' (https://seabed2030.org). The bathymetric imagery within and surrounding the proposed IC2 route is presented in Figure 14.

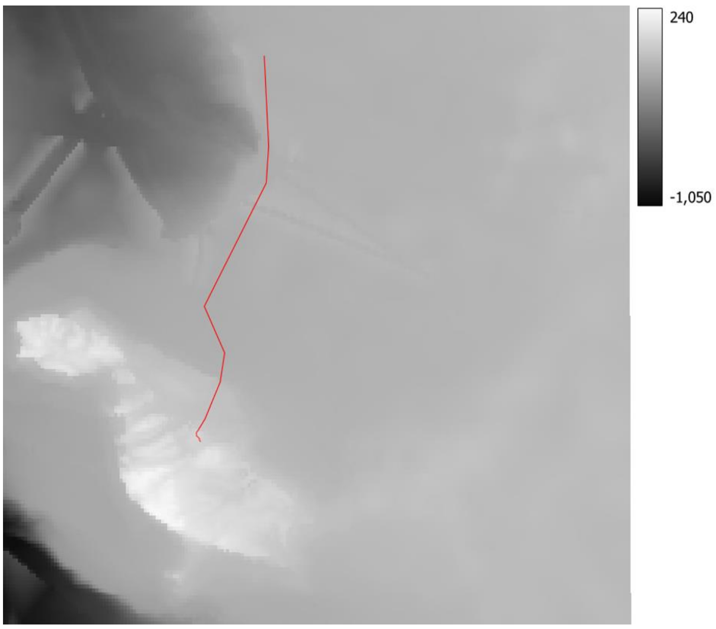

FIGURE 14: THE BATHYMETRIC IMAGERY (M) WITHIN AND SURROUNDING THE PROJECT AREA. THE COORDINATE SYSTEM IS BASED ON WGS 84 ZONE 5 NORTH. THE RED LINE SHOWS THE PROPOSED CABLE LAY ROUTE.

Temperature and salinity data required to derive the sound speed profiles were obtained from the World Ocean Atlas 2009 (Locarnini et al. 2010; Antonov et al. 2010). The hydrostatic pressure needed for the calculation of the sound speed based on the depth and latitude of each particular sample was obtained using Sanders and Fofonoff's formula (Sanders and Fofonoff 1976). The sound speed profiles were derived based on Del Grosso's equation (Del Grosso 1974).

Figure 15 presents the typical sound speed profiles of four seasons around the proposed IC2 route. The figure demonstrates that the most significant distinctions for the profiles of the four seasons occur within the mixed layer near the surface. In the upper layers, propagation is characterized by upward refraction in winter and an acoustic channel in summer. It is also noticed that the sound speed profiles differ from those in temperature zones of the open oceans. This is due to the vertical thermal structure of the Mediterranean Sea, characterized by a reduced or absent permanent thermocline and by warmer deep waters (Salon et al. 2003).

Due to the upward refraction within the profile, the winter season is expected to favour the propagation of sound from a near-surface acoustic source.

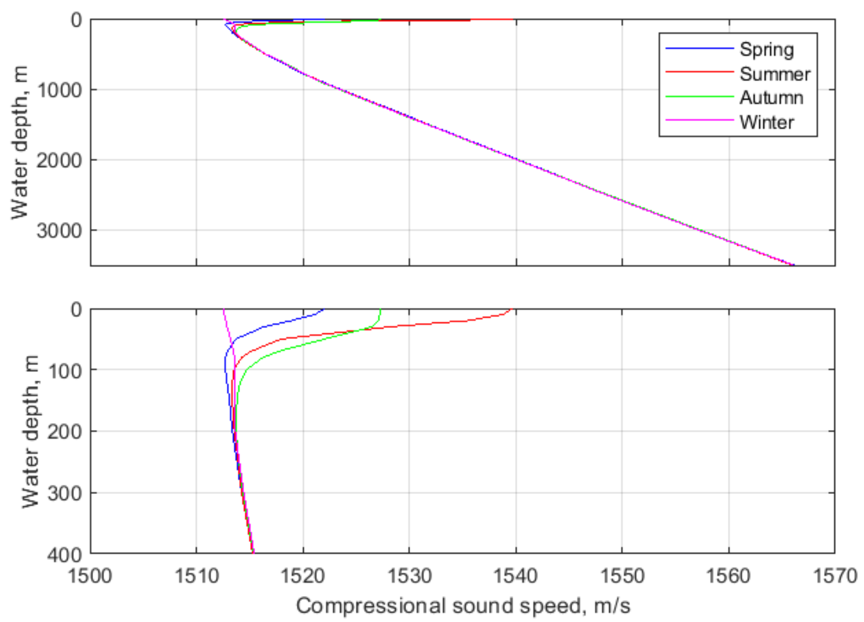

Figure 15: Typical sound speed profiles within deep (top) and shallow (bottom) water regions surrounding the proposed gas pipeline route for different northern atmosphere seasons.

The seafloor geoacoustic model for the modelling area is developed based on a habitat mapping study carried out for the continental shelves off Malta's northwest coast and the Maltese Islands' east coasts (Prampolini et al. 2017).

The study reveals that for the coastal areas off Malta's northwest coast and the Maltese Islands' east coasts, the seabed sediments range from sand and rock (moraine) at the nearshore areas to fine to sand clay and fine silty sand at areas further offshore. Therefore, the seafloor geoacoustic model is proposed to be divided into two areas: nearshore and offshore, as detailed in Table 10. The geoacoustic properties of sandy sediments are described in Hamilton (1980) and Jensen et al. (2011). The elastic properties are treated as negligible.

TABLE 4: GEOACOUSTIC PARAMETERS FOR THE PROPOSED SEAFLOOR MODEL (NEARSHORE)

SEAFLOOR MATERIALS	DEPTH RANGE, M	DENSITY, ρ, (KG.M^{-3})	COMPRESSIONAL WAVE	
			SPEED, c_P, (M.S^{-1})	ATTENUATION, α_P, (DB/λ)
Sand	5	1900	1650	0.8
Rock (Moraine)	∞	2100	1950	0.4

TABLE 5: GEOACOUSTIC PARAMETERS FOR THE PROPOSED SEAFLOOR MODEL (OFFSHORE)

SEAFLOOR MATERIALS	DEPTH RANGE, M	DENSITY, ρ, (KG.M^{-3})	COMPRESSIONAL WAVE	
			SPEED, c_P, (M.S^{-1})	ATTENUATION, α_P, (DB/λ)
Sandy Clay	20	1500	1500	0.2
Silty Fine Sand	∞	1700	1575	1

Noise modelling locations for the exploration programme are consistent with the proposed operation areas, as detailed in Table 6 below with their corresponding coordinates, water depths and localities.

TABLE 6: DETAILS OF THE TWO SELECTED SOURCE LOCATIONS FOR NOISE MODELLING

Source Location	Water Depth, m	Coordinates [Easting, Northing]	Locality
Nearshore Cable Lay Start & post trenching/cover protection	20	[449 676, 3 979 214]]	Nearshore, shallow water location
Nearshore Cable Lay End	98	[452 298, 3 985 658]	Nearshore, shallow water location
Offshore Cable Lay Start	152	[458 110, 4 019 219]	Offshore, deep water location
Offshore Cable End & post trenching/cover protection	155	[457 782, 4 026 249]	Offshore, deep water location

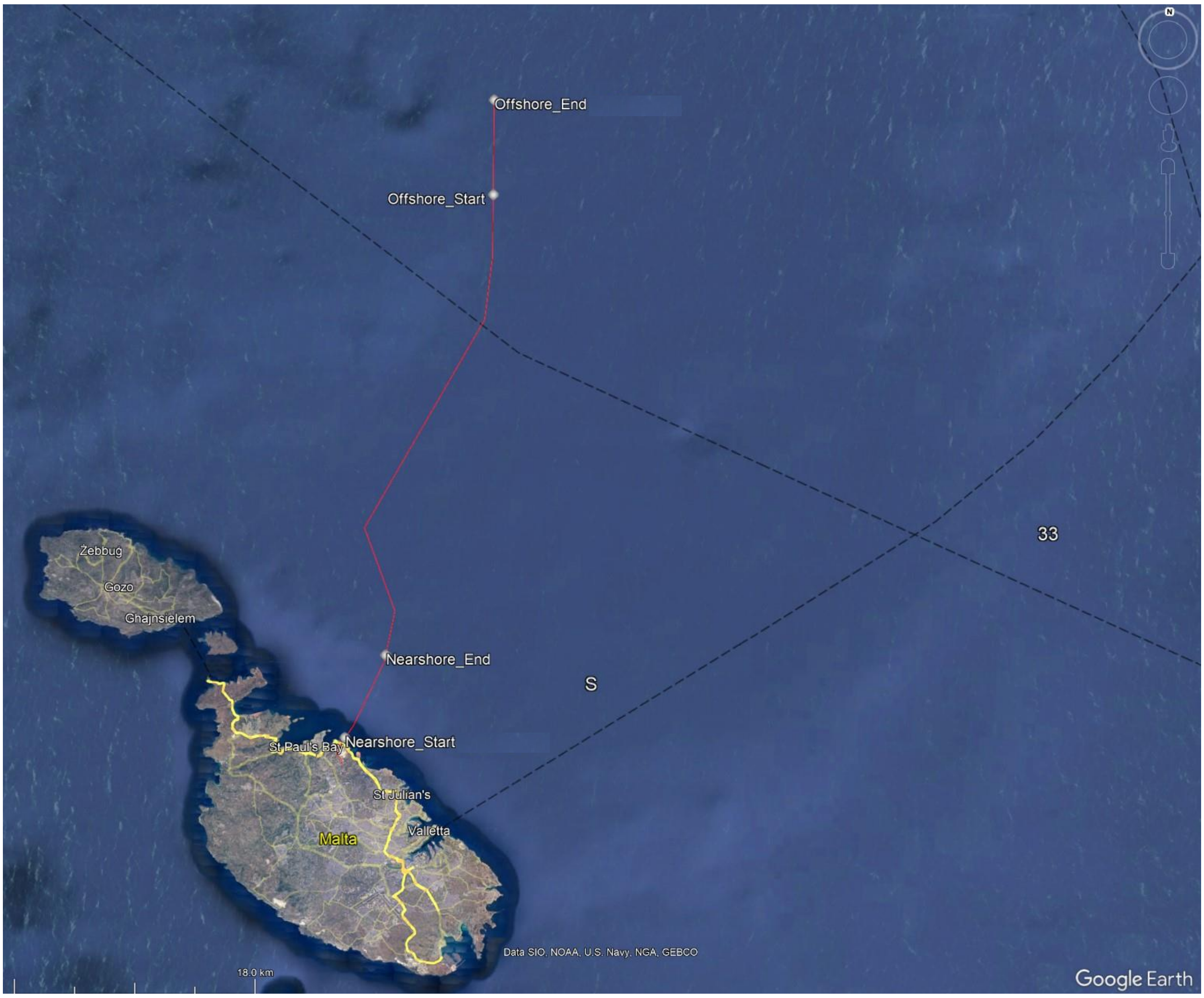

FIGURE 14:THE SELECTED SOURCE LOCATIONS ARE INDICATED AS WHITE DOTS. THE RED LINE INDICATES THE PROPOSED CABLE LAY ROUTE. THE CABLE LAY DISTANCE BETWEEN THE NEARSHORE AND OFFSHORE START/STOP POINTS IS 7 KM.

2.2 IMPACT ASSESSMENT CRITERIA

The Consultant evaluated the potential impacts arising from the construction and operation of the proposed Scheme on the local terrestrial ecology. The potential impacts also provided a basis for comparison between the existing conditions and the new conditions established during the operation of the Scheme.

The following information have been provided for each of the identified impacts:

- Project phase (construction or operational phase)
- Policy importance
- Extent of effect (widespread or localised)
- Duration (temporary or permanent)
- Type (beneficial or adverse)
- Reversibility (reversible or irreversible)
- Sensitivity of receptors (high, moderate or low)
- Probability of occurrence (inevitable, likely, uncertain, unlikely or remote)
- Scope for mitigation or enhancement (very good, good or none)

Based on the above criteria, the Consultants assessed the significance level of each of the identified impacts. Different criteria were used for the different components of the study, as summarised in Table 7 to Table 15.

TABLE 7: DURATION OF IMPACT CRITERION DESCRIPTION

DURATION OF IMPACT	
Permanent	Impact would still be detectable following decommissioning of project
Temporary	Impact would persist throughout the phase of project under consideration only

TABLE 8: EXTENT OF IMPACT CRITERION DESCRIPTION

EXTENT OF IMPACT	
Widespread	Impact is expected to affect in the entire area of study and/or may extend beyond the boundaries of direct intervention into adjacent areas
Localised	Impact is expected to affect receptors in the immediate vicinity of its source

TABLE 9: CONSEQUENCES OF IMPACT CRITERION DESCRIPTION

CONSEQUENCES OF IMPACT	
Direct	Changes that result from the cause-effect consequences of interactions between the environment and project activities
Indirect	Changes that result from cause-effect consequences of interactions between the environment and direct impacts
Cumulative	The cumulative consequences of ecological impact refer to the gradual and long-term effects that result from the combined impact of various ecological disturbances or stressors on an ecosystem over time.

TABLE 10: EFFECT OF IMPACT CRITERION DESCRIPTION

EFFECT OF IMPACT	
Adverse	A negative effect on the sustainability of the resource under consideration, which are distinguishable from background fluctuations
Beneficial	A positive effect on the sustainability of the resource under consideration, which are distinguishable from background fluctuations

TABLE 11: REVERSIBILITY OF IMPACT CRITERION DESCRIPTION

REVERSIBILITY OF IMPACT	
Reversible	The state of the resource is expected to return to baseline state following cessation of the source of impact
Irreversible	The state of the resource is not expected to return to baseline state following cessation of the source of impact

TABLE 12: SENSITIVITY OF RESOURCES TO IMPACT CRITERION DESCRIPTION

SENSITIVITY AND RESILIENCE OF RESOURCES TO IMPACT	
High	The resource under consideration is highly susceptible to a detectable deviation from the background state and its general dynamics
Moderate	The resource under consideration is vulnerable but able to tolerate a degree of detectable deviation from the background state and its general dynamics
Low	The resource under consideration is highly tolerant to a detectable deviation from the background state and its general dynamics

TABLE 13: PROBABILITY OF IMPACT OCCURRING CRITERION DESCRIPTION

PROBABILITY OF IMPACT OCCURRING	
Inevitable	Impact will occur irrespective of any mitigation measures taken
Likely	Impact may occur despite the implementation of mitigation measures
Unlikely	Impact would only occur in cases of major mitigation failure
Remote	Impact would only occur in exceptional circumstances

Probability of Impact Occurring	
Uncertain	Probability of impact cannot be predicted reliably due to missing information or unknown factors

Table 14: Impact Significance Criterion Description

Impact Significance	
Significant	Will affect keystone and/or protected species and/or habitats
Non Significant	Will not affect any keystone and/or protected species and/or habitats

Table 15: Residual Impact Significance Criterion Description

Residual Impact Significance	
Signficant	The effect on the existing state of the feature under consideration will lead to a noticeable and significant change in its resilience after application of mitigation measures (if any) and impact cessation
Non Significant	The effect on the existing state of the feature under consideration will lead to no significant change that will alter its resilience after application of mitigation measures (if any) and impact cessation

2.2.1 Onshore Noise assessment criteria

In this section the sensitivity criteria, impact magnitude and the level of effect have been described. A summary of the significance of impact will be put forward in terms of whether the impact is considered not significant, of minor significance, of moderate significance, or of major significance.

The level of significance is determined in relation to the magnitude of impact together with the sensitivity of the receptor. Different noise-sensitive receptors (NSRs) can be classified in levels of sensitivity: High, Medium, low and negligible as described in Table 16 below.

TABLE 16: LEVEL OF SENSITIVITY ASSOCIATED WITH VARIOUS NSRS

SENSITIVITY	DESCRIPTION OF NSRS
High	Residential properties (night-time), Schools and healthcare building (daytime)
Medium	Residential properties (daytime), SAC, SPA, SSSI (or similar areas of special interest)
Low	Offices and other non-noise producing employment areas
Negligible	Industrial areas

The HABITATS DIRECTIVE (92/43/EEC) specifies that, where specific noise from industry, measured at the habitat/nest site is below the levels in Table 16, it is considered unlikely that it will have an adverse impact on designated species. Where noise levels are exceeded, more detailed assessment may be required. For the purposes of this assessment, the AQTAG daytime limit of 55 dB $L_{Aeq,\, 1\, hr}$ will be used. Although a detailed analysis of the maxima sound pressure levels in terms of $L_{Amax,F}$ is outside of the cope of this assessment, it is considered that the maxima event levels are unlikely to be exceeded at the receptor locations as a result of construction noise, based on the standoff distances and the construction activities involved.

TABLE 17: SPECIFIC NOISE LEVEL LIMITS AT ECOLOGICAL HABITATS

PARAMETER	NOISE LEVEL, DB
$L_{Aeq,\, 1hr}$	55
L_{Amax}	80

Based on the above guidance limits the impact magnitude of the proposed development during the construction phase is defined in Table 18 and Table 19.

TABLE 18: IMPACT MAGNITUDE - AQTAG

MAGNITUDE	DESCRIPTION
Major	Limit value exceeded by more than 5dB
Moderate	Limit value exceeded between 3.0 and 4.9dB
Minor	Limit value exceeded between 1.0 and 2.9dB

MAGNITUDE	DESCRIPTION
Negligible	Limit value exceeded between 0.1 and 0.9dB

TABLE 19: IMPACT MAGNITUDE – EXISTING AMBIENT LEVELS

MAGNITUDE	DESCRIPTION
Major	Greater than 10 dB L_{Aeq} change in sound level at a noise-sensitive receptor
Moderate	A 5 to 9.9 dB L_{Aeq} change in sound level at a noise-sensitive receptor
Minor	A 3 to 4.9 dB L_{Aeq} change in sound level at a noise sensitive receptor
Negligible	Less than 2.9 dB L_{Aeq} change in sound level at a noise-sensitive receptor (inaudible change under normal conditions)

The different levels of effect relating the magnitude of impact with a medium sensitivity for ecological receptors are defined in Table 20.

TABLE 20: LEVEL OF EFFECT

MAGNITUDE OF ADVERSE IMPACT	LEVEL OF EFFECT RELATIVE TO ECOLOGICAL RECEPTOR OF MEDIUM SENSITIVITY
Major	Substantial
Moderate	Moderate
Minor	Minor
Negligible/no change	Minor/Neutral

Note: Effects of 'moderate' significance or greater are defined as significant with regards to the EIA Regulations 2017.

2.2.2 Offshore Noise Assessment criteria

Malta has no specific national legislation or regulatory guidelines for assessing underwater noise impacts on marine fauna species. Therefore, the assessment has been undertaken considering current industry best practices applied internationally and being consistent with impact studies undertaken for other similar major offshore development projects elsewhere globally.

The effects of noise and the range over which these effects take place depend on the acoustic characteristics of the noise (e.g., source level, spectral content, temporal characteristics[2], directionality, etc.), the sound propagation environment, as well as the hearing ability and physical reaction of individual marine fauna species. The potential impacts of noise on marine fauna species include audibility/detection, masking of communication and other biologically important sounds, behavioural responses and physiological impacts, which generally include discomfort, hearing loss, physical injury, and mortality (Richardson et al. 2013; Erbe et al. 2018; Popper and Hawkins 2019).

Physical injuries can occur when the animal is close to the acoustic source. As the animal moves further away from the source, the impacts are expected to decrease gradually to a point where the impacts are negligible. The theoretical zones of noise influence, according to Richardson et al. (2013), based on the severity of the noise impact are illustrated in Figure 16.

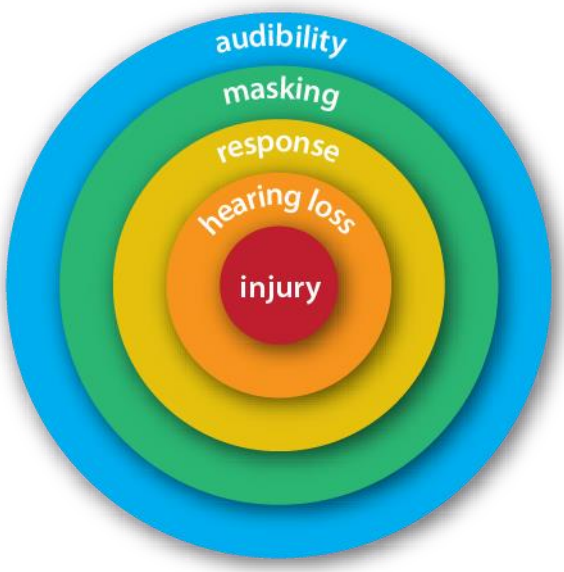

FIGURE 16: THEORETICAL ZONES OF NOISE INFLUENCE (ADAPTED FROM RICHARDSON ET AL. 2013)

A sound is audible when the receiver is able to perceive it over background noise. The audibility is also determined by the threshold of hearing that varies with frequency. The frequency dependant hearing sensitivity is expressed in the form of a hearing curve (i.e., audiogram). In general, marine mammals and fish species usually have U-shaped audiograms, meaning that within their respective hearing ranges, they are more sensitive to the sound energy component in the mid-frequency range and less sensitive to the energy components in the lower and upper-frequency ranges (Finneran 2016; Southall et al. 2019; Popper et al. 2019).

For fish species, their sound detection is based on the response of the auditory portion of their ears (i.e., the otolithic organs) to the particle motion of the surrounding fluid

[2] Impulsive noise is typically very short (with seconds) and intermittent with rapid time and decay back to ambient levels (e.g., noise from pile driving, seismic airguns and seabed survey sonar signals).

(Popper and Hawkins 2018). Some fish species can detect sound pressure via gas-filled structures near the ear and/or extensions of the swim bladder that functionally affect the ear, in addition to purely the fluid particle motion, which as a result, increases hearing sensitivity and broaden the hearing bandwidth (Nedelec et al. 2016; Popper and Hawkins 2018).

Masking occurs when the noise is high enough to impair the detection of biologically relevant sound signals, such as communication signals, echolocation clicks and passive detection cues that are used for navigation and finding prey. The zone of masking is defined by the range at which sound levels from the noise source are received above the threshold within the 'critical band'[3] centred on the signal (Richardson et al. 2013) and, therefore, strongly dependent on the background noise environment.

The potential for masking can be reduced due to an animal's frequency and temporal discrimination ability, directional hearing, co-modulation masking release (if noise is amplitude modulated over a number of frequency bands) and multiple looks (if the noise has gaps or the signal is repetitive), as well as anti-masking strategies (increasing call level, shifting frequency, repetition, etc.) (Erbe 2016).

Responses to noise include changes in vocalization, resting, diving and breathing patterns, changes in mother-infant relationships, and avoidance of the noise sources. For behavioural responses to occur, a sound would mostly have to be significantly above ambient levels and the animal's audiogram.

The behavioural response effects can be very difficult to measure and depend on a wide variety of factors such as the physical characteristics of the signal, the behavioural and motivational state of the receiver, its age, sex and social status and many others. Therefore, the extent of behavioural disturbance for any given signal can vary within a population and within the same individual. Behavioural reactions can vary significantly, ranging from very subtle changes in behaviour to strong avoidance reactions (Ellison et al. 2012; Richardson et al. 2013).

The physiological effects of underwater noise are primarily associated with the auditory system, which is likely to be most sensitive to noise. Therefore, the exposure of the auditory system to a high level of noise for a specific duration can cause a reduction in the animal's hearing sensitivity or increase the range to the threshold (Finneran 2016; Popper and Hawkins 2019; Southall et al. 2019).

If the noise exposure is below some critical sound energy level, the hearing loss is generally only temporary, and this effect is called temporary hearing threshold shift (TTS). However, if the noise exposure exceeds the critical sound energy level, the hearing loss can be permanent, and this effect is called permanent hearing threshold shift (PTS).

In a broader sense, physiological impacts also include non-auditory physiological effects. Other physiological systems of marine animals potentially affected by noise include the vestibular system, reproductive system, nervous system, liver or organs

[3] In biological hearing systems, noise is integrated over several frequency filters, called the critical bands.

with high levels of dissolved gas concentrations and gas-filled spaces. Noise at high levels may cause concussive effects, physical damage to tissues and organs, cavitation, or result in the rapid formation of bubbles in the venous system due to massive oscillations of pressure (Groton 1998).

From an adverse impact assessment perspective, among the potential noise impacts above, physiological impacts are deemed the primary adverse impact, and behavioural responses are the secondary adverse impact. The following sub-sections outline the corresponding impact assessment criteria for marine mammals, fish and sea turtle species, and human divers and swimmers based on a review of relevant guidelines and/or literature published.

There have been extensive scientific studies and research efforts to develop quantitative links between marine noise and impacts on marine mammal species, fish, and sea turtles. For example, Southall et al. (2019) have proposed noise exposure criteria associated with various sound types, including impulsive noise (e.g., seismic airgun and sonar noise) and non-impulsive noise (e.g., vessel and dredging noise) for certain marine mammal species (i.e., cetaceans, and carnivores), based on a review of expanding literature on marine mammal hearing and physiological and behavioural responses to anthropogenic sounds. Popper et al. (2014) and Popper and Hawkins (2019) proposed sound exposure guidelines for fish, considering the diversity of fish, the different ways they detect sound, as well as various sound sources and their acoustic characteristics. Finneran et al. (2017) presented a revision of the thresholds for sea turtle injury and hearing impairment (TTS and PTS).

The following subsection provides the noise exposure levels above which adverse effects could be expected on various groups of marine mammals, fish, and sea turtles. The latter is based on all available relevant data and published literature (i.e., the state of current knowledge).

The newly updated scientific recommendations in marine mammal noise exposure criteria (Southall et al. 2019) propose PTS-onset and TTS-onset criteria for impulsive noise events.

- The PTS-onset and TTS-onset criteria for impulsive noise are outlined in Table 21, which incorporate a single-criteria approach based on peak sound pressure level (SPL).

The PTS-onset and TTS-onset criteria for non-impulsive noise, as outlined in

Table 22, are based on cumulative SEL within a 24-hour period (SEL24hr).

For behavioural changes, the widely used assessment criterion for the onset of possible behavioural disruption in marine mammals is root-mean-square (RMS) SPL of 160 dB re 1 µPa for impulsive noise and 120 dB re 1 µPa for non-impulsive noise, as shown in the table below.

TABLE 21: PTS AND TTS THRESHOLD LEVELS FOR INDIVIDUAL MARINE MAMMALS EXPOSED TO IMPULSIVE NOISE EVENTS (SOUTHALL ET AL. 2019)

MARINE MAMMAL HEARING GROUP	PTS AND TTS THRESHOLD LEVELS – IMPULSIVE NOISE EVENTS	
	INJURY (PTS) ONSET	TTS ONSET
	PK SPL, DB RE 1μPA	PK SPL, DB RE 1μPA
Low-frequency cetaceans (LF)	219	213
High-frequency cetaceans (HF)	230	224
Very-high-frequency cetaceans (VHF)	202	196
Phocid carnivores in water (PCW)	218	212
Other marine carnivores in water (OCW)	232	226

TABLE 22: PTS- AND TTS-ONSET THRESHOLD LEVELS FOR INDIVIDUAL MARINE MAMMALS EXPOSED TO NON-IMPULSIVE NOISE (SOUTHALL ET AL. 2019)

MARINE MAMMAL HEARING GROUP	PTS AND TTS THRESHOLD LEVELS – NON-IMPULSIVE NOISE EVENTS	
	INJURY (PTS) ONSET	TTS ONSET
	WEIGHTED SEL_{24HR}, DB RE $1\mu PA^2 \cdot S$	WEIGHTED SEL_{24HR}, DB RE $1\mu PA^2 \cdot S$
Low-frequency cetaceans (LF)	199	179
High-frequency cetaceans (HF)	198	178
Very-high-frequency cetaceans (VHF)	173	153
Phocid carnivores in water (PCW)	201	181
Other marine carnivores in water (OCW)	219	199

TABLE 23: BEHAVIOURAL DISRUPTION THRESHOLD LEVELS FOR INDIVIDUAL MARINE MAMMALS – IMPULSIVE AND NON-IMPULSIVE NOISE (NOAA 2019)

Marine mammal hearing group	Behavioural disruption threshold levels, RMS SPL, dB re 1µPa	
	Impulsive noise	Non-impulsive noise
All hearing groups	160	120

In general, limited scientific data regarding sound effects on fish are available. As such, assessment procedures and subsequent regulatory and mitigation measures are often severely limited in relevance and efficacy. To reduce regulatory uncertainty for all stakeholders by replacing precaution with scientific facts, the U.S. National Oceanic and Atmospheric Administration (NOAA) convened an international panel of experts to develop noise exposure criteria for fish and sea turtles in 2004, primarily based on published scientific data in the peer-reviewed literature. The panel was organized as a Working Group (WG) under the ANSI-Accredited Standards Committee S3/SC 1, Animal Bioacoustics, which the Acoustical Society of America sponsors.

The outcomes of the WG are broadly applicable to sound exposure guidelines for fish, fish eggs and larvae (Popper et al. 2014, Popper and Hawkins 2019), considering the diversity of fish and the different ways they detect sound, as well as various sound sources and their acoustic characteristics.

High-frequency active sonar sources (above 10 kHz), such as SBES sources, are not expected to cause an adverse hearing impact on fish species due to the low-frequency hearing ranges of these animals (from below 100 Hz to up to a few kHz) (Popper et al. 2014). However, high-frequency sonar could potentially generate behavioural responses in some species (e.g., American shad and Gulf menhaden) that can detect ultrasound (up to 180 kHz) (Mann et al. 2001).

Currently, there is no direct evidence of mortality or potential mortal injury to fish from non-impulsive noise sources such as shipping noise or dredging activities (Popper et al. 2014). However, continuous noise of any level that is detectable by fish can mask signal detection and impact their behaviour (Popper and Hawkins 2019). Increased noise levels may affect a wide range of behaviour patterns over the long term. For example, anthropogenic sounds can interfere with foraging behaviour by masking the relevant sounds or resembling sounds that prey may generate. Similarly, fish might avoid predators by listening to sounds that predators make deliberately or inadvertently (Popper and Hawkins 2019).

For behavioural disruption threshold levels for all fish species, the National Marine Fisheries Services (NMFS) uses the U.S. Navy Phase III criteria for all noise thresholds (Navy 2017). As of December 2021, potential effects on endangered listed fish species may occur when impulsive or non-impulsive activities produce sounds that exceed the thresholds, according to Table 24.

TABLE 24: EXPOSURE CRITERIA FOR BEHAVIOURAL DISRUPTION - ALL FISH SPECIES (NAVY 2017)

TYPE OF ANIMAL	BEHAVIOURAL DISRUPTION THRESHOLD LEVELS, RMS SPL, DB RE 1μPA	
	IMPULSIVE NOISE	NON-IMPULSIVE NOISE
Fish	150	150

Popper et al. (2014) suggested threshold levels for the occurrence of mortality and potential mortal injuries (PTS) of sea turtles. However, these adopted levels were extrapolated from other animal groups, such as fish, based on the logic that the hearing range of turtles is much closer to that of poorly hearing fish. More recently, Finneran et al. (2017) revised the sea turtle thresholds (PTS) by reviewing individual references from at least five different species to construct their composite audiograms and provide thresholds for the onset of temporary hearing impairment (TTS). Finneran et al. (2017) agreed that even within their best hearing range, sea turtles have low sensitivity with audiograms more similar to those of fish without specialized hearing adaptations for high frequency, like some marine mammals.

No data on sea turtles and their response to high-frequency sonar is available. However, since turtles detect sound below 1 kHz, any effect would only be in response to low-frequency sonar (Popper et al. 2014).

The revised thresholds for sea turtles relevant to the non-impulsive noise from shipping and other sources, such as dredging, are presented in Table 25. Additionally, 175 re 1 μPa SPL RMS is expected to be the received sound level at which sea turtles would actively avoid exposure to non-impulsive noise activities, such as shipping and dredging operations, as shown in

Table 26 (Finneran et al. 2017).

TABLE 25: PTS THRESHOLD LEVELS FOR SEA TURTLES EXPOSED TO NON-IMPULSIVE NOISE EVENTS (NAVY 2017)

TYPE OF ANIMAL	PTS THRESHOLD LEVELS – NON-IMPULSIVE NOISE EVENTS
	INJURY (PTS) ONSET
	CRITERIA - WEIGHTED SEL_{24HR}, DB RE $1\mu PA^{2}\cdot S$
Sea turtles	220

TABLE 26: THE BEHAVIOURAL DISRUPTION THRESHOLD LEVEL FOR INDIVIDUAL SEA TURTLES TO NON-IMPULSIVE NOISE (FINNERAN ET AL. 2017)

TYPE OF ANIMAL	BEHAVIOURAL DISRUPTION THRESHOLD LEVELS, RMS SPL, DB RE 1µPA
	NON-IMPULSIVE NOISE
Sea turtles	175

Received noise levels can be predicted using known source levels in combination with models of sound propagation transmission loss between the source and the receiver locations. Zones of impact can then be determined by comparison of the predicted received levels to the noise exposure criteria for the marine fauna species of concern.

It is expected that the noise generated by the major cable laying sources and cable protection activities can be significantly higher than the natural ambient noise levels (90 - 130 dB re 1 µPa as described above).

Predicted zones of impact define the environmental footprint of the noise-generating activities and indicate the locations within which the activities may have an adverse impact on marine fauna species of interest, either behaviourally or physiologically. This information can be used to assess the risk (likelihood) of potential adverse noise impacts by combining the acoustic zones of impact with ecological information such as habitat significance and migratory routes in the affected area.

In all cases, zones of impact are conservatively determined by using the maximum predicted noise level across the water column to determine the zone of impact. Since noise levels vary with depth at any location, areas in the water column within the identified zone of impact will be exposed to lower noise levels than implied by the identified zones of impact, representing worst-case scenarios.

2.3 BASELINE STUDY

2.3.1 Terrestrial study

The terrestrial component of the proposed IC2 project spans about 2km. The cable runs from the existing interconnector terminal station, through the ECOHIVE waste management complex operated by Wasteserv, traverses the Ten-T road network known as Triq il-Kosta via a trenchless tunnel and ends up at the bottom of the sea just outside the Qalet Marku area in an areas known as l-Ghallis.

The site is mostly rural in character, dominated primarily by the engineered landfills and waste management operations conducted by Wasteserv. The onshore route also abuts parcels of agricultural land, some afforested areas, coastal garigue and other natural communities reminiscent of garigue, steppe and degraded areas.

The offshore to nearshore transition joint Bay and temporary HDD working areas are proposed to be positioned just outside ECOHIVE's northern vehicular access road. This temporary laydown area lies specifically in a garigue area which abuts the heavily frequented Triq il-Kosta. The scheme site is also surrounded by various terrestrial, avian and marine Natura 2000 sites. L-Għadira s-Safra u l-Iskolla tal-Għallis (MT 0000008) is considered specifically in this report since it is located in close proximity to the proposed trenchless drilling and is designated as a Special Area of Conservation (SAC) via GN No. 1373 of 2016, in accordance with the Flora, Fauna and Natural Habitats Protection Regulations, 2016 (S.L. 549.44).

2.3.1.1 L-Għadira s-Safra u l-Iskolla tal-Għallis

L-Għadira s-Safra u l-Iskolla tal-Għallis is a wetland covering 2.82 hectares of land and is designated as a Special Area of Conservation according to G.N. 1379 of 2016 in accordance with the Flora, Fauna and Natural Habitats Protection Regulations, 2016.

This site is unique in the Maltese islands as it is a transitional wetland that consists of brackish water, which is neither fresh nor saltwater. It has rock pools that are filled with rainwater during rainy seasons and seawater during wave actions. During the summer, excessive heat causes most of the freshwater to evaporate, leaving behind puddles of saline water. As a result, the ecosystem supports biotic assemblages that are typical of freshwater habitats in the winter and species that can tolerate saline conditions in the summer.

The site was initially proposed as a Site of Community Importance in 1995 and was confirmed in 2008. It comprises of two Annex I habitat types, namely Mediterranean and thermo-Atlantic halophilous scrubs (Habitat 1420) and Mediterranean temporary ponds (Habitat 3170).

L-Għadira s-Safra u l-Iskolla tal-Għallis (see Figure 19 **Error! Reference source not found.**) is home to a variety of rare species, including the endangered Prickle Grass, the rare tadpole shrimp, and the Fairy Shrimp (*Branchipus schaefferi*), along with other rare inhabitants such as the Morning Glory (*Cressa cretica)*, the Sea knotgrass (*Polygonum maritimum)*, and the endangered woodlouse (*ylos latrellei sardous)*. The site also accommodates *Riella helicophylla*, a liverwort listed as an Annex II species in the Habitats Directive. The vegetation in the area includes *Plantago* spp., the Sea Fennel (*Crithmum maritimum)*, and the Golden Samphire (*Limbarda crithmoides)*, which are typical of coastal garigue areas. Some areas of the site have also been planted with *Tamarix* spp. trees through afforestation projects (Figure 18 **Error! Reference source not found.**).

FIGURE 17: PHOTOGRAPH OF THE DRY ROCKPOOLS AT L-GĦADIRA S-SAFRA U L-ISKOLLA TAL-GĦALLIS TAKEN IN FEBRUARY 2023

Figure 18: Tamarisk trees planted at the site's boundary

The conservation objectives of the site are to minimise and restrict public access to the protected brackish rockpools and increase the natural buffer of the site through the maintenance and improvement of the scheduled Annex I habitats. Other measures targeting the improved educational awareness of the site's importance, effective monitoring strategies and enforcement of existing legislations are also proposed in the government notice. Furthermore, it is envisaged that the site will expand in size through inland relocation and the rehabilitation of the carriageway to increase the buffer area.

G.N. 1373 of 2016 also recognises various anthropogenic impacts which remain mostly unmitigated, including: "littering, trampling, presence of ruderal and invasive alien species and the permanent destruction of the clay layer". It also recognises the fact that due to its small size, the presence of the adjacent arterial road network and recreational activities are direct threats to the habitats present within the site.

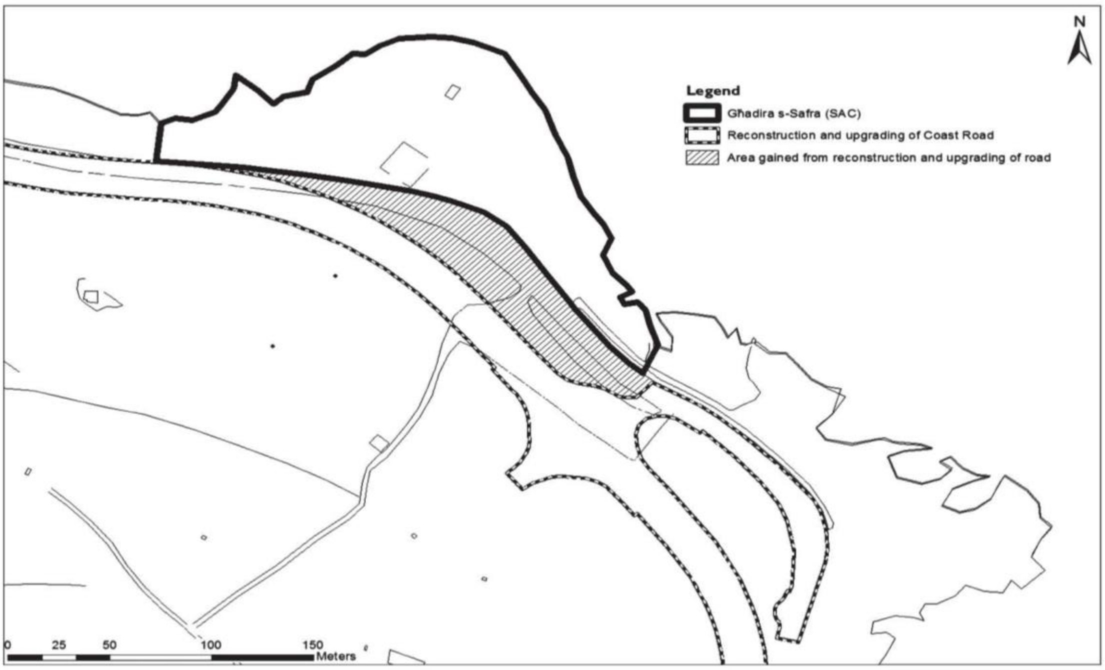

FIGURE 19: L-GĦADIRA S-SAFRA U L-ISKOLLA TAL-GĦALLIS SITE BOUNDARY

2.3.1.2 Local Plans

The area of influence and its surroundings were assessed through a desktop review of the relevant local plans, legislations and any applicable policy documents. This exercise revealed that the scheme site is not located on any areas of ecological and/or legislative importance. Nevertheless, other sites of ecological and environmental importance have been identified in the immediate surroundings.

Searches on the Planning Authority Geoserver (2023) revealed that the existing Terminal Station is located on a listed Ecological Area (CG22) as indicated in Figure 20. The agricultural use of the surrounding areas is further substantiated by the Local Plan of 2006 which designates most of the adjacent parcels as an Agricultural Area (CG24) awaiting classification of agricultural value.

The onshore trench proposed within the ECOHIVE complex passes through an area which is also listed as a Site of Scientific Importance (CG22), marked in a purple outline in Figure 20. This area lies in close proximity to the new engineered landfill that is currently being excavated just in front of the Malta North Facility and the main ECOHIVE offices.

The entire coastal stretch of Qalet San Marku is also protected through the provisions of the Central Malta Local Plan as this part of the coast is designated as a “Protected Natural Coast with public access” (NA04).

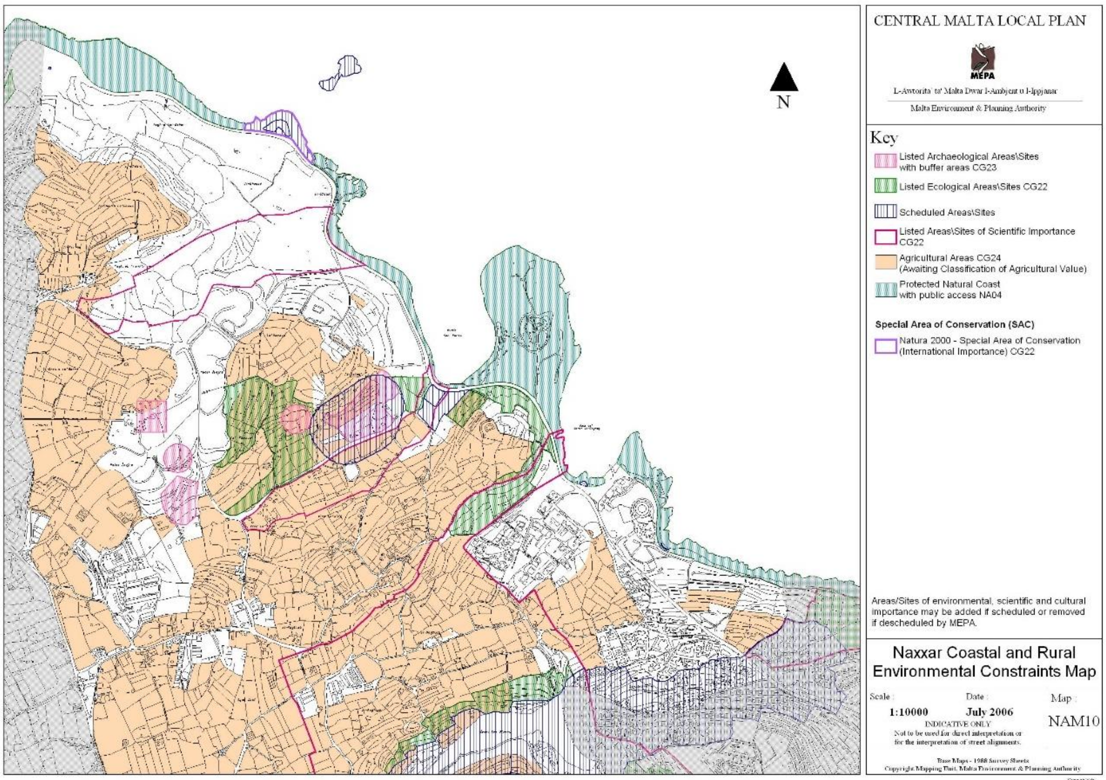

FIGURE 20: NAXXAR COASTAL AND RURAL ENVIRONMENTAL CONSTRAINTS MAP (CENTRAL MALTA LOCAL PLAN, 2006)

In Figure 21, there are seven Areas of Ecological Importance (AEI) marked as A to G that intersect with both the AOI and the scheme site at various points. These AEIs were identified through the NHLP survey in 1996 and have been used to designate protection areas in the Local Plans of 2006.

Site A is partially situated within the existing terminal station site and is granted a level 4 degree of environmental protection due to its dense vegetation of maquis-like shrubs and trees intermingled with agricultural land.

Site B encompasses most of the engineered landfills and waste management activities within the ECOHIVE complex and has the largest ecological protection area within the AOI, designated as a level 3 degree of environmental protection. This site includes sections of the Għallis engineered landfill and a rocky garigue/steppe community dominated by Agave spp. plants, which were introduced in the mid-20th century and have rapidly propagated in this area. The coastal stretch leading to the Għallis Tower is lined with mature tamarisk trees and prickly pear shrubs, hindering access to the area. Other garigue and steppe species and communities may be found in areas that are not invaded by Agave spp. as anthropogenic impacts in this zone are infrequent.

Site C acts as a buffer for Site D, which is a coastal wetland known as l-Għadira is-Safra u l-Iskolla tal-Għallis and is recognized as a Natura 2000 site (MT0000008). Site D has a level 1 degree of protection, while Site C has a level 3 degree of protection. Further information on the coastal wetland is provided in later sections of the report.

Site E is a large tract of coastal garigue with a level 4 degree of protection. Site G is adjacent to Site E and also includes the same coastal garigue habitat, therefore granted the same level of protection. These sites led to the designation of NA04 "Protection of the Natural Coast with public access" as described earlier.

Site F, located further inland, comprises a typical garigue habitat that is considerably less exposed to invasion from Agave spp. and other anthropogenic impacts compared to other garigue AEIs mentioned in this section. Sites F and G are situated outside of the AOI considered in this report.

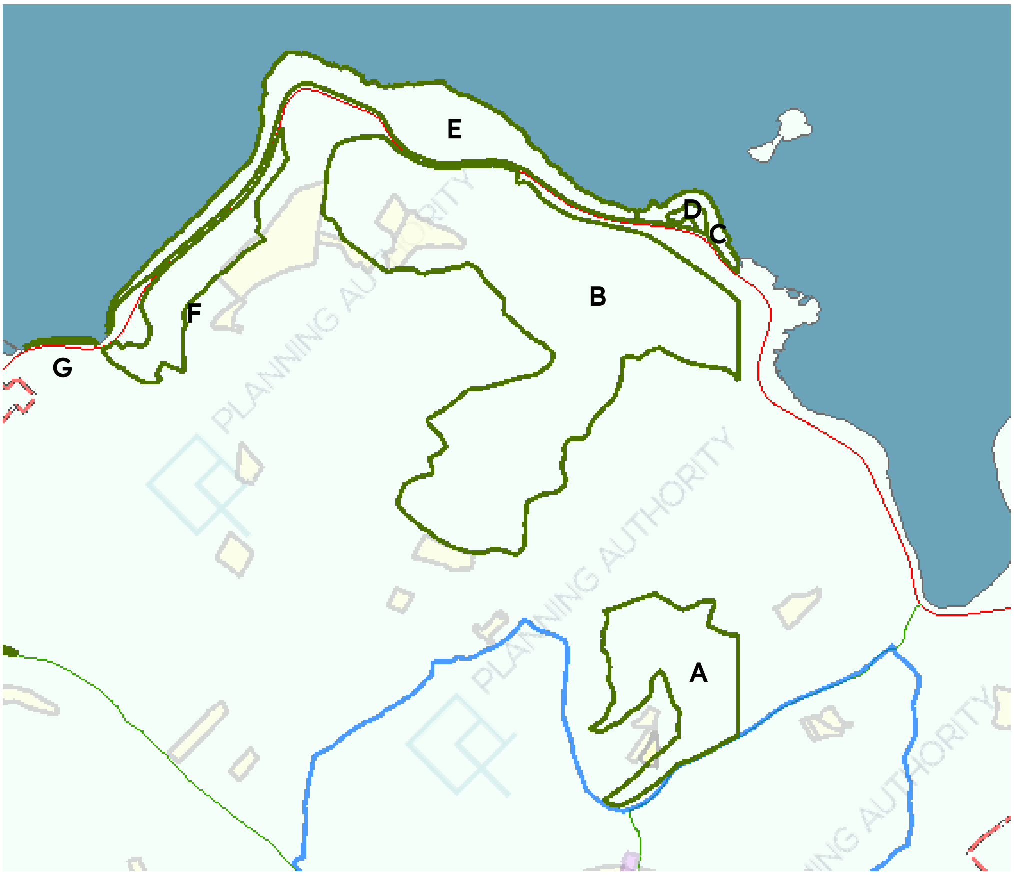

FIGURE 21: AREAS OF ECOLOGICAL IMPORTANCE (A-G) AROUND THE SITE ARE MARKED WITH A GREEN OUTLINE (PA GEOSERVER)

2.3.1.3 S.L. 549.44 (repealing the Flora, Fauna and Natural Habitats Protection Regulations, 2006 [LN 311 of 2006])

This legislation establishes a National Ecological Network of special areas of conservation having National or International Importance. The Legal Notice transposes the obligations of the HABITATS DIRECTIVE which call for the establishment of a European Network of Special Areas of Conservation (Natura 2000) composed of sites having the natural habitat types and species listed in Annexes I and II to the Directive (listed under Schedule I and II of the same Legal Notice). Schedule III lists animal and plant species of community importance whose conservation requires the designation of Special Areas of Conservation, whilst Schedule IV lists the criteria for selecting sites eligible for identification as Sites of National Importance and of International Importance and Designation as Special Areas of Conservation. Schedule

V lists animal and plant species of community interest in need of strict protection, whilst Schedule VI lists animal and plant species of national interest in need of strict protection.

Schedule VII lists animal and plant species of community interest whose taking in the wild and exploitation may be subject to management measures, whilst Schedule VIII lists animal and plant species of national interest whose taking in the wild and exploitation may be subject to management measures. Schedule IX includes provisions for identification and monitoring, whilst Schedule X lists endemic species not covered by Regulation 26 of the same Legal Notice.

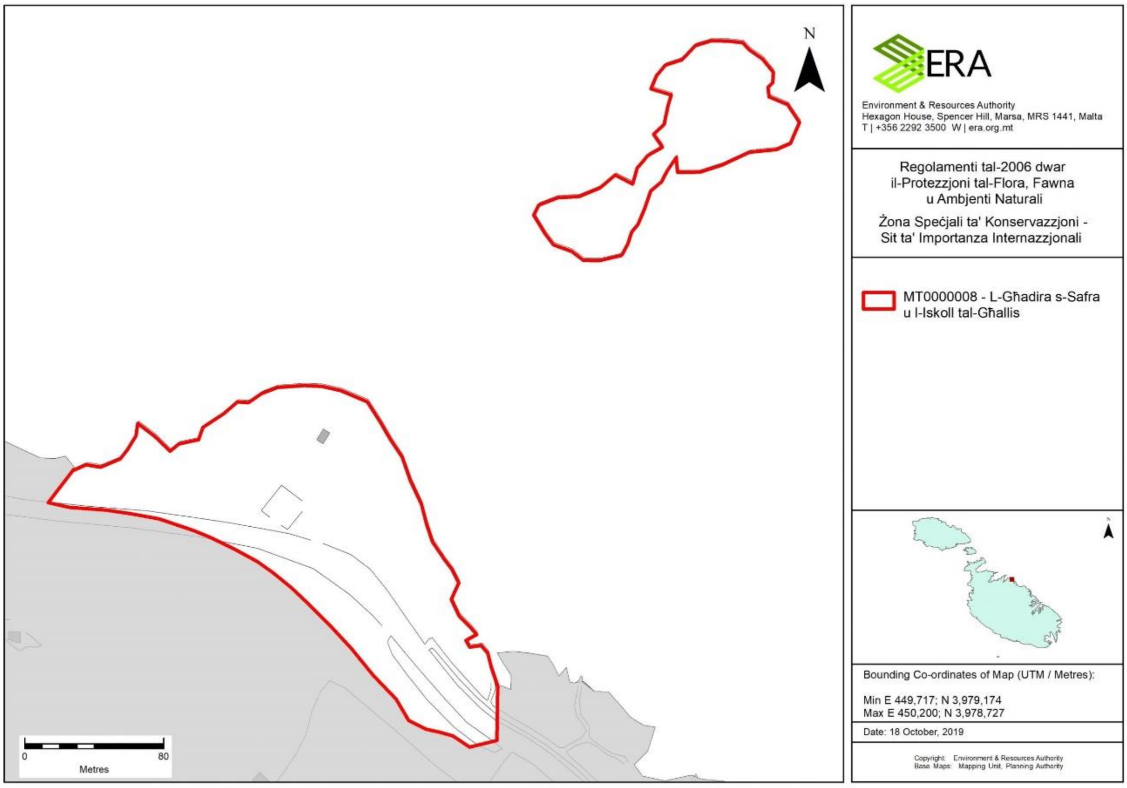

FIGURE 22: L-GHADIRA S-SAFRA U L-ISKOLL TAL-GHALLIS TERRESTRIAL NATURA 2000 SITE

2.3.1.4 S.L.549.123 (Trees and Woodlands Protection Regulations)

This legislation protects trees and woodlands in the Maltese islands to safeguard them from anthropogenic activity and to regulate the activities that may have an effect theron. The legislation identifies the areas and the species of trees which merit protection, subdividing them into distinct Schedules based on their level of protection.

The first Schedule Part A Table 1, lists the trees which are protected in all locations in Malta, Table 2 lists species which are protected within protected areas, in ODZ, green areas, in natural or rural/green enclaves in an urban area or in urban public open spaces only. The Second Schedule lists down the invasive, alien or environmentally incompatible species, whilst the Third Schedule lists down the fees to be paid for registration and permit applications. The Fourth Schedule lists down the penalties to be paid by offending contraveners against these regulations.

2.3.1.5 Site survey

A broad-brush terrestrial survey was conducted within the AOI in February 2023. Since the onshore component of the project is about 2km and the AOI is 100m wide, the ecological characteristics are rather heterogenous. In the vicinity of the Terminal Station towards the south of the AOI, the ecological characteristics mainly consist of agricultural elements, along with ruderal and opportunistic species that are commonly found at the edges of cultivated fields. These species are particularly prevalent in small rural paths that are lined with traditional rubble walls, as well as in abandoned and deteriorated fields (refer to Figure 23 to Figure 25). Some of the most prevalent species encountered in this area include: *Glebionis coronaria* (Crown Daisy), *Malva arborea* (Tree mallow), *Nicotiana glauca* (Tree tabocco), *Opuntia ficus indica* (Prickly pear), *Borago officinalis (*Borage) and *Ricinus communis* (Caster oil plant).

In such rural areas, human-made disruptions appear sporadically, including abandoned sheds, walls made of rubble, seldom-used paths, and locations where people dump trash. These disturbances can be observed scattered throughout the agricultural landscape.

FIGURE 23: RUDERAL VEGETATION AT THE PERIPHERY OF CROP PRODUCING FIELDS

Figure 24: Anthropogenic presence within the AOI (littering, building infrastructure & utilities)

Figure 25: Agricultural fields bordered by rubble walls and large Tuart trees

The eastern border of the Terminal Station is surrounded by an Area of Ecological Importance (AEI) Level 4 as shown in Figure 21. The site is characterized by low-lying trees and large shrubs coupled with ruderal species that are symbolic of a disturbed Mediterranean maquis habitat. Some of the most commonly encountered species in the area include: *Olea europaea* (Olive tree), *Acacia* spp. (Wattle), *Ceratonia siliqua*

(Carob tree), *Foeniculum vulgare* (Fennel) and *Diplotaxis tenuifolia* (Perennial wall-rocket). As seen in Figure 12, unvegetated (barren) parcels are occasionally encountered in this area. These barren areas are wrapped around by hardy vegetated plants that thrive in disturbed areas. These are normally situated in lower elevations and amidst the maquis-like trees. This observation could suggest that the land is still recovering from the effects of construction activities at the Terminal Station, such as trampling that may have taken place outside the confinements of the site less than ten years ago.

FIGURE 26: REMNANTS OF THE MAQUIS-LIKE COMMUNITY LOCATED TO THE EAST OF THE TERMINAL STATION

The Terminal Station and the southern entrance of the ECOHIVE complex are bounded by soft landscaping areas comprising primarily of horticultural trees. The species makeup in these areas comprises of *Yucca gloriosa* (Spanish dagger), *Cuppressus sempervirens* (Cypress trees), *Pistacia lentiscus* (Lentisk tree), *Ficus elastica* (Rubber fig), *Nerium oleander* (Oleander), *Phoenix dactylifera* (Date palm), *Rosmarinus officinalis* (Rosemary), *Atriplex halimus* (Shrubby orache), *Tamarix africana* (Tamarisk) and *Ceratonia siliqua* (Carob tree).

Figure 27: Soft landscaping at the Maghtab civic amenity site

Figure 28: Soft landscaping at the southern entrance of the Ecohive complex

As the route moves northwards and into the ECOHIVE complex, the ecological landscape dynamics gradually become more influenced by the ongoing waste management operations. Terraced fields that are used for cereal production offering lower cultivation value are still encountered in the outskirts of the AOI. Due to the intensification of anthropogenic activities, opportunistic species become more prevalent along this stretch. Dense populations of *Glebionis coronaria* (White wall-rocket), *Avena sterilis* (Sterile oat), *Arundo donax* (Greater reed), *Diplotaxis tenuifolia* (Perennial wall-rocket), *Borago officinalis* (Borage), *Foeniculum vulgare* (Common fennel) and *Ricinus communis* (Caster oil plant) amongst other species cover the large heaps of the rehabilitated Zwejra landfill on the east. Likewise, these groups also cover the edges of freshly added debris on the western side of the AOI, which are likely a result of the new landfill's excavation in the ECOHIVE complex. The recommended path for digging the cable trench in this region is also distinguished by comparable groups of plants that hold little ecological and preservation importance.

FIGURE 29: OPPORTUNISTIC SPECIES COVERING THE EASTERN HEAPS OF THE REHABILITATED ZWEJRA LANDFILL

FIGURE 30: OPPORTUNISTIC SPECIES COVERING THE WESTERN HEAPS OF INERT MATERIAL AS WELL AS THE PROPOSED TRENCH PATHWAY

The farmland located on the eastern side of the trench path is comparable in terms of ecological makeup and performance to the ones outlined on the southern part of the Scheme location. However, it is less disjointed and supports a smaller area of rural buildings. The agricultural land within the AOI is encircled by rubble walls. These human-made countryside structures are abundant in flora and fauna species that tend to flourish in the protection and foundation they provide. Vegetation species encountered along rubble walls include *Ficus carica* (Fig tree), *Ferula communis* (Common fennel), *Arundo donax* (Greater reed), *Sonchus oleraceus* (Crown daisy), *Asparagus aphyllus* (Mediterranean Asparagus), as well as a number of monocot grasses such as *Bromus* spp., *Polygonum aviculare* (Knotgrass) and *Piptatherum miliaceum* (Smilograss). The abundance and biodiversity of such species reduces considerably on concreted rubble-walls which are periodically encountered along the onshore trench route.

FIGURE 31: AGRICULTURAL LAND WEST TO WASTESERV MALTA AREA, LOOKING WEST

FIGURE 32: TYPICAL VEGETATION ON BOUNDARY RUBBLE WALLS

FIGURE 33: VEGETATION ASSEMBLAGES ON RUBBLE WALL STRUCTURES

Further north, at the proposed location of the Joint bays and HDD temporary laydown area, the topography slopes gently downwards towards the coast. The ecological features shift and become more synonymous with the typical Mediterranean garigue and steppe habitats. This area is not easily accessible as it is surrounded by fences on the southern periphery, and an almost impenetrable layer of spiny *Agave americana* (Agave) and *Opuntia ficus indica* (Prickly pear) at the north that delineates Triq il-Kosta.

The area features a high occurrence of *Agave americana*, a type of plant that stores water and has unusually large clusters of flowers that generate both flowers and small plants through sexual and asexual reproduction. This species is highly invasive and can quickly overtake land, causing harm to the indigenous plants and/or ecosystems. The area which forms part of a Level 3 AEI, also comprises of similar ruderal and opportunistic species, but the community is generally more mature in terms of ecological succession. This is particularly evident in the lower sections of the site, with occasional shrubs of *Thymbra capitata* (Mediterranean Thyme) and *Pistacia lentiscus* (Lentisk tree) being observed.

This zone also comprises of distinct bands of *Pinus halepensis* (Pine trees) and *Tamarix africana* (Tamarisk) at the higher elevation levels closest to the ECOHIVE complex. The species makeup gradually transitions into low-lying shrubs of *Atriplex halimus* (Shrubby orache), *Teucrium fruticans* (Olive-leaved germander), *Asphodelus aestivus* (Branched asphodel), *Urginea pancration* (Sea squill), *Thymbra capitata*

(Mediterranean thyme), *Phagnalon rupestre* subsp. *graceum* (Eastern phagnalon), and *Oxalis pes-carpae* (Bermuda buttercup).

FIGURE 34: GARIGUE AREA LOCATED BEYOND THE FENCE

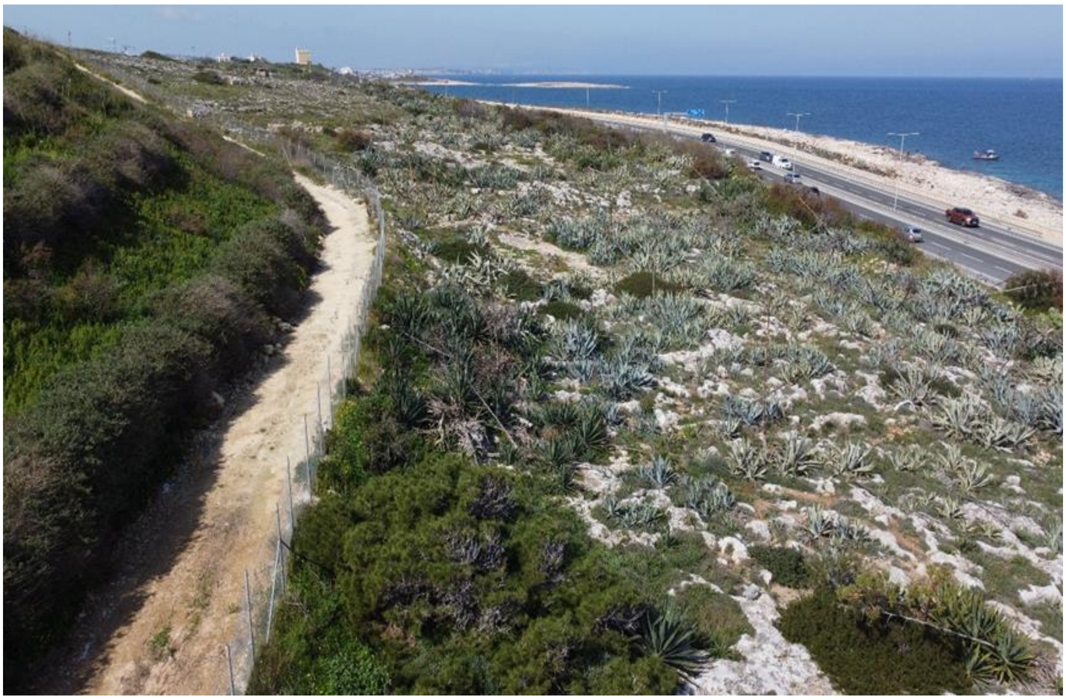

FIGURE 35: AERIAL DRONE VIEW OF THE GARIGUE AREA

Figure 36: A dense layer of spiny succulents separating the garigue area from Triq il-Kosta

Figure 37: Garigue habitat dominated by *Agave* spp.

FIGURE 38: MEDITERRANEAN THYME, LENTISK AND AGAVE SPECIMENS INTERTWINED IN THE GARIGUE AREA

The coastal garigue at the shoreline comprises another ecosystem that is mostly barren from vegetation due to the continuous exposure from wind and waves. Nevertheless, occasional shallow soil pockets accommodating coastal shrubs such as *Limbarda crithmoides* (Golden samphire) and other opportunistic species were encountered throughout this coastal stretch.

FIGURE 39: COASTAL GARIGUE MOSTLY BARREN FROM VEGETATION

A list of species encountered during the broad-brush survey within the AoI (including fauna) is provided in Table 27. Other potential fauna species which were not observed during the survey are likely to be encountered in this area. These include: the Algerian Hedgehog (*Atelerix algirus*), the Western whip snake (*Coluber viridflaviorus)*, the Leopard snake (*Elaphe situla)*, the Moorish wall gecko (*Tarentola mauritanica)* and the Oscillated skink (*Chalcides ocellatus)*. The presence of bats cannot be excluded from this area, as old dilapidated farmland buildings can provide attractive roosting sites which are unknown or undocumented.

TABLE 27: LIST OF VEGETATIVE SPECIES ENCOUNTERED ON SITE

SPECIES NAME	ENGLISH NAME	PROTECTION	TYPICAL HABITAT IN AOI
Acacia saligna	Blue-leafed wattle	Schedule II (invasive) S.L. 549.123	Agricultural land, maquis & disturbed areas
Agave americana	Century plant	None	Steppe & garigue areas

Species Name	English Name	Protection	Typical habitat in AoI
Antirrhinum tortuosum	Greater snapdragon	None	Agricultural land & disturbed areas
Armadillum schmalfussi	Maltese woodlouse	None	Disturbed areas
Arthrocnemum macrostachyum	Glaucous glasswort	None	Coastal garigue & nearby wetland
Arundo donax	Greater reed	None	Agricultural land & disturbed areas
Asparagus aphyllus	Mediterranean asparagus	None	Agricultural land, disturbed areas & steppe
Asphodelus aestivus	Summer asphodel	None	Steppe & garigue areas
Atriplex halimus	Shrubby orache	None	Soft landscaping areas & outskirts of garigue areas
Avena sterilis	Sterile oat	None	Steppe & disturbed areas
Bituminaria bituminosa	Pitch trefoil	None	Agricultural land, disturbed areas & steppe
Borago officinalis	Borage	None	Disturbed areas & agricultural land
Bromus spp.	Brome grass	None	Agricultural land, disturbed areas & steppe
Ceratonia siliqua	Carob tree	Schedule I Part A Table 2 S.L.549.123	Agricultural land & maquis

Species Name	English Name	Protection	Typical habitat in AoI
Convolvulus arvensis	Field bindweed	None	Agricultural land & disturbed areas
Crithmum maritimum	Rock samphire	None	Coastal garigue
Cupressus sempervirens	Italian cypress	Schedule I Part A Table 2 S.L. 549.123	Soft landscaping areas
Diplotaxis tenuifolia	Perennial wall rocket	None	Agricultural land & disturbed areas
Dittrichia viscosa	False yellowhead	None	Agricultural land & disturbed areas
Ecbalium elaterium	Squirting cucumber	None	Agricultural land & disturbed areas
Eucalyptus gomphocephala	Tuart tree	None (not located in public urban space)	Agricultural land
Euphorbia pinea	Pine spurge	None	Steppe
Ficus carica	Fig tree	None	Agricultural land
Foeniculum vulgare	Common fennel	None	Disturbed areas, agricultural land & steppe
Galactites tomentosa	Mediterranean thistle	None	Garigue & steppe
Glebionis coronaria	Crown daisy	None	Agricultural land & disturbed areas
Lavatera arborea	Mallow tree	None	Disturbed areas, garigue areas & agricultural land

Species Name	English Name	Protection	Typical Habitat in AoI
Limbarda crithmoides	Golden samphire	None	Coastal garigue & disturbed areas
Mercurialis annua	Annual mercury	None	Soft landscaping area & disturbed areas
Nicotiana glauca	Tree tobacco	Schedule II (invasive) S.L. 549.123	Disturbed area & agricultural land
Olea europaea	Olive tree	Schedule I Part A Table 2 S.L. 549.123	Agricultural land & soft landscaping areas
Opuntia ficus indica	Prickly pear	None	Agricultural land & garigue area
Oxalis pes-caprae	Bermuda buttercup	None	Disturbed areas, steppe & garigue
Podarcis filfolensis maltensis	Maltese wall lizard	Schedule V of S.L. 549.44	Disturbed area & steppe
Phagnalon graecum subsp. *hinzbergi*	Eastern phagnalon	None	Steppe & garigue areas
Phoenix dactylifera	Date palm	Schedule I Part A Table 2 S.L. 549.123	Soft landscaped areas
Pinus halepensis	Aleppo pine tree	Schedule I Part A Table 2 S.L.549.123	Soft landscaped areas
Piptatherum miliaceum	Smilograss	None	Steppe
Pistacia lentiscus	Lentisk tree	Schedule I Part A Table 2 S.L. 549.123	Garigue & soft landscaped areas

Species Name	English Name	Protection	Typical habitat in AoI
Plantago spp.	Plantain	None	Disturbed areas & steppe
Rattus norvegicus	Brown rat	None	Agricultural land & disturbed areas
Ricinus communis	Caster oil tree	Schedule II (invasive) S.L. 549.123	Disturbed area & agricultural land
Rosmarinus officinalis	Rosemary	None	Soft landscaped areas
Sulla coronaria	Sulla	None	Agricultural land
Sonchus oleraceus	Sow thistle	None	Disturbed areas & garigue
Tamarix africana	African tamarisk	Schedule I Part A Table 2 of S.L.549.123	Afforested areas & garigue
Teucrium fruticans	Olive leaved germander	None	Garigue
Urginea pancration	Sea squill	Schedule VIII of S.L.549.44	Garigue & steppe
Washingtonia filifera	California fan palm	None	Soft landscaped areas
Yucca spp.	Spanish dagger	None	Soft landscaped areas

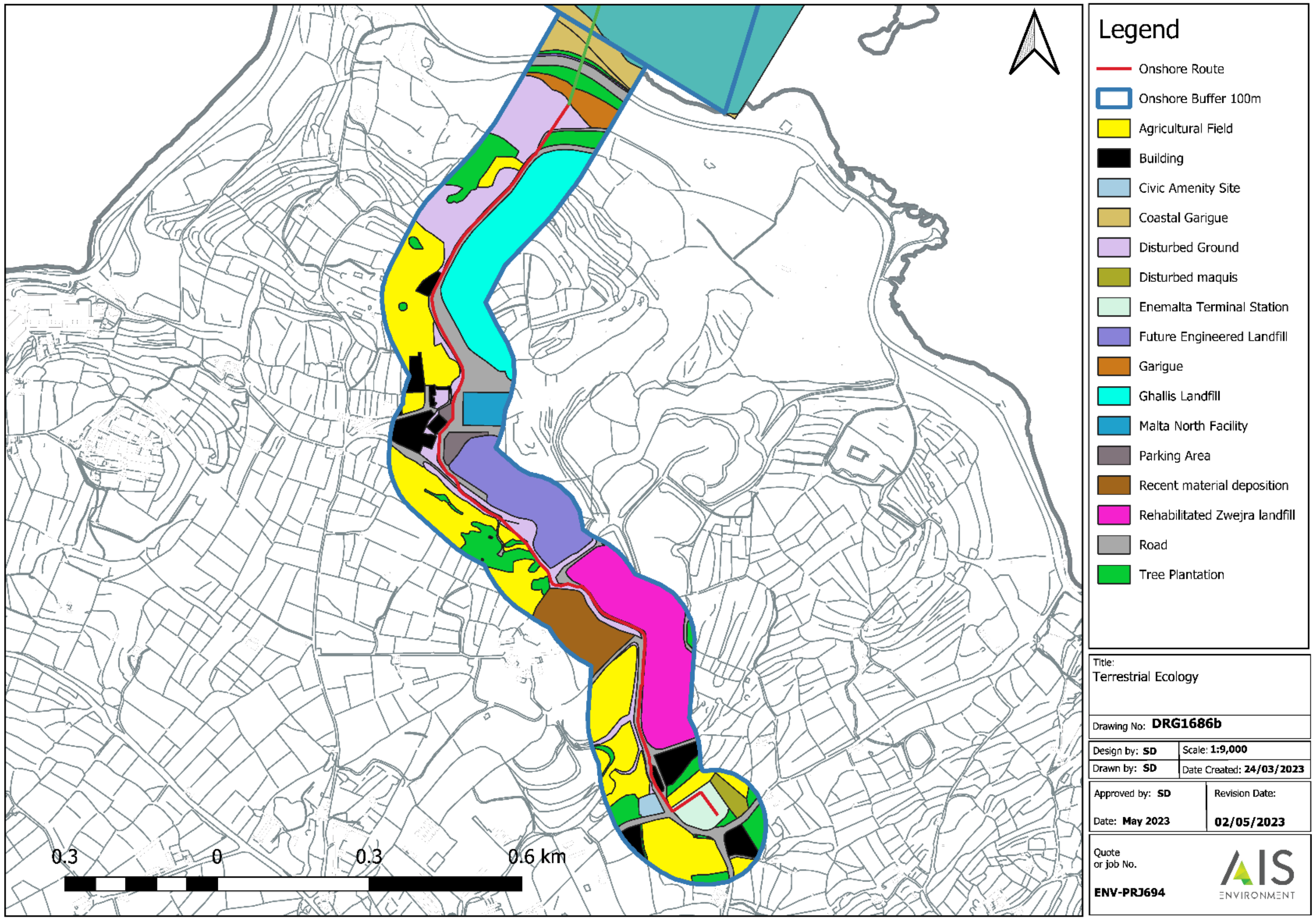

FIGURE 40: TERRESTRIAL ECOLOGY MAP SHOWING HABITATS AND LAND USES WITHIN THE SCHEME'S ONSHORE AOI

2.3.2 Avian Study

More than 400 bird species have been recorded in the Maltese Islands and its FMZ (25NM) (Bonavia, pers. comm.). Slightly above two hundred of these species occur in the Maltese Islands regularly[4]. Up to 48 bird species have been recorded breeding on the Maltese Islands, of which 23 are regular breeders from wild populations[5]. Three species, all pelagic seabirds, hold significant breeding populations in the Maltese islands from an EU, European and global perspective, and are listed under Annex I of the EU Birds Directive[6]. Information regarding the species' conservation status, population numbers, trends and range presented below are derived from BirdLife International's Data Zone[7]. All information regarding species listed in Annex I of the EU-Birds Directive such as population numbers in the EU were obtained from the Environment, Nature and Biodiversity site of the European Commission[8].

AoI-1 and/or AoI-2 partially overlap with the following sites of conservation interest in relation to bird species:

- SAC L-Għadira s-Safra u l-Iskoll tal-Għallis (MT0000008)
- SPA Żona fil-Baħar madwar Għawdex (MT0000112)

Additionally, three areas, all protected within the Natura 2000 network and with various importance for avifauna were considered for the assessment at hand, as they are located within the 5.0 km buffer each side of the proposed offshore cable route, considered for potential impact by light pollution during the construction phase.

- SAC Is-Salini (MT0000007)
- SAC Il-Gżejjer ta' San Pawl (Selmunett, MT0000022)
- Żona fil-Baħar fil-Grigal (MT0000107)

This baseline study intends to inform in general which receptors (bird species) can be expected to occur in the AoI and in the above listed, potentially impacted protected areas in relevant numbers.

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[4]Bonavia et al. (2005): Systematic list 1996-1999, Il-Merill 31, 1-34.

Bonavia et al. (2010): Systematic list 2000-2005, Il-Merill 32, 55-109.

[5] Epsilon Malta Ltd, Nature Conservation Consultants (2019). Malta Breeding Bird Atlas 2018. Malta: Wild Birds Regulation Unit, Ministry for the Environment, Sustainable Development and climate Change

[6]Maltese Environment and Resources Authority - ERA (2020): Update of Articles 8, 9 and 10 of the Marine Strategy Framework Directive (2008/56/EC) in Malta's Marine Waters. Second Assessment Report, pp.321-344.

[7]BirdLife International (2020) IUCN Red List for birds. Downloaded from http://www.birdlife.org on 18/09/2020.

[8]https://ec.europa.eu/environment/nature/conservation/wildbirds/threatened/index_en.htm

2.3.2.1 Breeding land birds within the terrestrial part, AoI-1

Eight bird species have been reported at least possibly breeding within the AoI according to the Malta Breeding Bird Atlas 2008[9] and 2018[10], considering the breeding seasons 2008, 2017 and 2018. One of them, the Greater Short-toed Lark *Calandrella brachydactyla* is listed under Annex I of the EU Birds Directive. None are listed as having an unfavourable conservation status in Malta, the EU, or globally. None of the species can be considered specifically sensitive to the type of infrastructure as the planned development, while three of the eight species regularly choose anthropogenic structures as nest sites.

TABLE 1: LIST OF BREEDING BIRD SPECIES IN THE TERRESTRIAL AOI (AOI-1) AND THEIR STATUS

SPECIES	BREEDING STATUS IN TERRESTRIAL AOI	ABUNDANCE STATUS	TREND IN MALTA	TREND IN EUROPE	CONSERVATION STATUS	ANNEX I (EU BIRDS DIRECTIVE)
Common Swift *Apus apus*	Probable	Scarce	Increasing	Stable	Least Concern	No
Greater Short-toed Lark *Calandrella brachydactyla*	Probable	Common	Increasing	Increasing	Least Concern	Yes
Blue Rock Thrush *Monticola solitarius*	Possible	Frequent	Stable	Unknown	Least Concern	No
Sardininian Warbler *Curruca melanocephala*	Confirmed	Common	Decreasing	Stable	Least Concern	No
Spectacled Warbler *Curruca conspicillata*	Possible	Frequent	Decreasing	Unknown	Least Concern	No
Zitting Cisticola *Cisticola juncidis*	Probable	Abundant	Stable	Increasing	Least Concern	No

[9] Raine, A., Sultana, J., and Gillings, S. (2009) Malta Breeding Bird Atlas 2008. Malta: BirdLife Malta

[10] Epsilon Malta Ltd, Nature Conservation Consultants (2019). Malta Breeding Bird Atlas 2018. Malta: Wild Birds Regulation Unit, Ministry for the Environment, Sustainable Development and climate Change

SPECIES	BREEDING STATUS IN TERRESTRIAL AOI	ABUNDANCE STATUS	TREND IN MALTA	TREND IN EUROPE	CONSERVATION STATUS	ANNEX I (EU BIRDS DIRECTIVE)
Cetti's Warbler *Cettia cetti*	Possible	Frequent	Decreasing	Increasing	Least Concern	No
Spanish Sparrow *Passer hispaniolensis*	**Confirmed**	Abundant	Stable	Decreasing	Least Concern	No

2.3.2.2 Breeding seabirds making use of MT0000112 Żona fil-baħar madwar Għawdex

Three pelagic seabird species from the order Procellariiformes – the Yelkouan Shearwater *Puffinus yelkouan*, Scopoli's Shearwater *Calonectris diomedea*, and Mediterranean Storm-petrel *Hydrobates pelagicus melitensis* – nest on the Maltese Islands and inhabit Maltese waters in significant population numbers from a global and European population perspective. All three species are listed in Annex I of the EU Birds Directive. One of them, the Yelkouan Shearwater is listed as Vulnerable on the IUCN's Redlist. In addition to these, Malta hosts a breeding population of Yellow-legged Gull *Larus michahellis*, not listed in Annex I of the EU Birds Directive. The designation of the marine SPA Żona fil-baħar madwar Għawdex (MT0000112) was triggered by two of the above-mentioned species: The Yelkouan Shearwater and the Scopoli's Shearwater.

Scopoli's Shearwater *Calonectris diomedea – Least Concern, Annex I*

The Scopoli's Shearwater is currently listed as Least Concern by the IUCN. It is listed under Annex I of the EU-Birds Directive. The species is endemic (breeding) to the Mediterranean basin, with major colonies in the Central Mediterranean. The global population size was last estimated in 2013 at 285,000 – 446 000 mature individuals equating to 142,478 – 222 886 breeding pairs, showing a decreasing trend. For the Maltese islands, the total population estimate in 2018 was 2670 – 3605 breeding pairs according to Malta's second assessment report for the MSFD, roughly equating to around 1.6 – 1.9% of the global breeding population. Previous figures reported in 2013 had estimated the total Maltese population to be 3,046 – 3,962 breeding pairs. The available data suggests a decreasing population trend. Birds only approach land to breed, entering and leaving the colonies under the cover of darkness. Adults in and near the colonies and fledglings are sensitive to light pollution[11]. The closest breeding colony to the proposed development is Irdum tal-Madonna (SPA MT0000009) – this is not expected to be impacted directly by noise and light pollution from the development.

The Scopoli's Shearwater inhabits Maltese waters from February to November, with the highest activity at and in front of the colonies mainly from March to October. The species is strictly pelagic, foraging frequently together in large numbers on shoaling fish and squid by plunge-diving and pursue-diving, up to 15m deep. During the breeding period, Scopoli's Shearwaters congregate in large flocks, sitting on the water's surface exhibiting 'rafting' behaviour within a 4km radius in front of the colonies in the evenings[12], as described by Sultana et al. 2011. GPS-tracking of individuals from Maltese colonies during the chick-rearing period (July-October) shows that Scopoli's Shearwaters utilise at-sea areas in the Maltese EEZ, including the marine AoIs. The distribution of foraging Scopoli's Shearwaters within the FMZ (25nm), including the marine AoIs has been confirmed by vessel-based counts. Up to 7,300 individuals of the species make regular use of the SPA MT0000112, Żona fil-Baħar madwar Għawdex during the reproductive season as foraging ground and rafting areas in front the colonies. Frequent passage occurs through the marine AoIs by birds commuting between breeding grounds and foraging areas. While Scopoli's Shearwaters have not been reported breeding inside the AoIs, they make regular use of the marine part of the AoIs.

Yelkouan Shearwater *Puffinus yelkouan – Vulnerable, Annex I*

The IUCN lists the Yelkouan Shearwater as Vulnerable. It is furthermore listed under Annex I of the EU-Birds Directive. The Yelkouan Shearwater is endemic to the Mediterranean basin. The global population size, estimated in 2011, is 15,337 – 30,519 pairs, roughly equating to 46,000 – 92,000 individuals, although the quality of this estimate is moderate due to data gaps. According to the IUCN the global population trend is decreasing. The latest total population estimates of Yelkouan Shearwaters for the Maltese Islands (2016-2018) is 1,795 – 2,635 breeding pairs, roughly equating to 10% of the global breeding population. While previous figures reported in 2013 in the initial MSFD report suggest a short-term increase for Maltese population, the report stresses the fact that the apparent short-term increase of the Maltese Yelkouan Shearwater population is rather a result of intense research in recent years with the result of increased monitoring intensity rather than an actual increase in population

[11]Rodríguez et al. (2017). Seabird mortality induced by land-based artificial lights. Conservation Biology, 31(5), 986-1001.

Crymble et al. (2020): Identifying light-induced grounding hotspots for Maltese seabirds. Il-Merill 34, 23-43**.**

[12]BirdLife International (2010). Marine Important Bird Areas toolkit: standardised techniques for identifying priority sites for the conservation of seabirds at sea. BirdLife International, Cambridge UK. Version 1.2: February 2011.

numbers[13]. The long-term trend indicates a stable population. By-catch is likely to be responsible for low adult survival rates[14] as shown for Maltese Yelkouan Shearwaters. Birds only approach land to breed, entering and leaving the colonies under cover of darkness. Adults and fledglings are sensitive to light pollution[15]. The largest Yelkouan Shearwater colony in Malta is situated at Irdum tal-Madonna (MT0000009). The colony closest to the planned development is situated on Selmunett (MT0000022), within the 5km buffer area of the proposed offshore cable route (AoI-3).

The Yelkouan Shearwater inhabits Maltese waters, including the SPA MT0000112 and SPA MT0000107. It can be found in the colonies from October to July. Outside the breeding season, the birds disperse more widely across the Central Mediterranean and a significant part of the population migrates East to the Aegean and into the Black Sea[16]. Yelkouan Shearwaters are strictly pelagic, foraging frequently together in flocks on shoaling fish and squid mainly by pursuit-diving, up to 50m deep. Like Scopoli's Shearwaters, Yelkouan Shearwaters congregate in flocks exhibiting rafting behaviour within a 7km radius in front of the colonies in the evenings, according to GPS-tracking data. The individual rafts tend to be further out at sea than those of the Scopoli's Shearwaters and be made up of fewer individuals.

GPS-tracking of individuals during chick-rearing from the two main Maltese colonies (2012-14)[17] suggests that Yelkouan Shearwaters forage predominantly in waters further offshore and partially outside Maltese waters. Like other shearwater species, Yelkouan Shearwaters avoid crossing over land. The Yelkouan Shearwater is one of the trigger species for the designation of the relevant marine SPAs at hand (MT0000112, MT0000107). 3,270 – 4,650 individuals of the species make regular use of the SPA MT0000112 during the reproductive season as foraging ground and rafting areas in front the colonies. 380 – 450 individuals make regular use of SPA MT0000107 during the reproductive season as foraging ground. Frequent passage occurs regularly through AoI-2 and AoI-3 by birds commuting between breeding grounds and foraging areas. Yelkouan Shearwaters have been reported breeding inside the AoI-3, with the

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[13] *Maltese Environment and Resources Authority - ERA (2020): Update of Articles 8, 9 and 10 of the Marine Strategy Framework Directive (2008/56/EC) in Malta's Marine Waters. Second Assessment Report, pp.321-344.*

[14] Oppel et al. (2011): Is the Yelkouan shearwater Puffinus yelkouan threatened by low adult survival probabilities?. Biological Conservation, 144(9), 2255-2263.

[15] Crymble et al. (2020): Identifying light-induced grounding hotspots for Maltese seabirds. Il-Merill 34, 23-43.

[16] Raine, A. F., Borg, J. J., Raine, H., & Phillips, R. A. (2013): Migration strategies of the Yelkouan Shearwater Puffinus yelkouan. Journal of Ornithology, 154(2), 411-422.

[17] Metzger, B., Oppel, S., Carroll, M., Meirinho, A., Dias, M. P., Barbara, N., & Lago, P. (2015). Malta Marine IBA Inventory Report. https://birdlifemalta.org/wp-content/uploads/2018/03/LIFE10NATMT090-MSP-A8_mIBA_Report_final.pdf

latest population estimates for the colony in the SAC Selmunett (MT0000022) ranging from 45 to 70 breeding pairs[18].

[18] Metzger, B., Austad, M. (2022). Towards effective management of Malta's marine waters – Seabird Fieldwork Report 2021 (https://era.org.mt/wp-content/uploads/2022/11/Seabird-Fieldwork-Report-2021-public.pdf)

Mediterranean Storm-petrel *Hydrobates pelagicus melitensis* – *Least Concern, Annex I*

The Mediterranean Storm-petrel *Hydrobates pelagicus melitensis* is a Mediterranean subspecies, clearly separated both genetically[19] and morphologically[20] from the Atlantic breeding population of the European Storm-petrel. Neither IUCN/BirdLife International nor the EU-Birds Directive has assessed this taxonomic unit separately. The IUCN lists the species overall as Least Concern. It is listed under Annex I of the EU-Birds Directive. The Mediterranean subspecies *H. pelagicus melitensis* is endemic to the Mediterranean basin and therefore has a relatively restricted distribution range. The global estimated population size of the entire species is 430000 – 519999 mature individuals. However, the data quality is poor (estimated in 2015). The most recent population size estimates for the Mediterranean sub-species are 8,500 – 15,200 pairs, roughly 2 – 3% of the global population. While the global population trend is unknown, the population trend of Mediterranean sub-species is decreasing according to EU-Birds Directive. The closest breeding colony to the proposed development is Irdum tal-Madonna (MT0000009) – which is not expected to be directly impacted by noise and light pollution from the planned development.

A recent population assessment through capture mark recapture led to an overall population size estimate of 8575 breeding pairs for the Maltese Population, around 7% of the estimated global population of the species and at least 56% of the entire population of the Mediterranean subspecies. The short-term trend (2008-2018) and the long-term trend (1980-2018) for the Maltese population (2008-2018) are both reported to be stable[21].

The species is found in the Maltese EEZ year-round and in the colonies from February to October. It is by far more commonly seen in Maltese waters during the breeding season, and more frequently and in higher numbers southeast and south of Malta. Adults and fledglings are sensitive to light pollution[22].

The 70% KDE of seven Storm-petrels from the Filfla colony GLS-tracked during the breeding season indicate that the birds make use of the entire Maltese EEZ, but also of areas further offshore between Malta and Libya[23].

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[19]Cagnon et al. (2004): Phylogeographic differentiation of storm petrels (Hydrobates pelagicus) based on cytochrome b mitochondrial DNA variation. Marine Biol. 145(6): 1257–1264.

[20]Lalanne et al. (2001): Morphological differentation between European Storm-petrel subspecies: new results regarding two Mediterranean populations. Alauda 69(4): 475–482.

[21]*Maltese Environment and Resources Authority - ERA (2020): Update of Articles 8, 9 and 10 of the Marine Strategy Framework Directive (2008/56/EC) in Malta's Marine Waters. Second Assessment Report, pp.321-344.*

[22]Crymble et al. (2020): Identifying light-induced grounding hotspots for Maltese seabirds. Il-Merill 34, 23-43**.**

[23] Lago, P., Austad, M. & Metzger, B. (2019): Partial migration in the Mediterranean Storm Petrel Hydrobates pelagicus melitensis. Marine Ornithology 47: 105–113.

While not being a trigger species for the designation of the marine SPA MT0000112, Storm-petrels are commonly making use of this area (including AoI-3) year-round, and more so during the breeding season. Furthermore, they are one of the trigger species for the designation of the marine SPA MT0000107, with a modelled 1700 individuals making use of the area, including AoI-3. While Storm-petrels have been captured at night on Selmunett (MT0000022) inside the AoI-3 during the breeding season, breeding has not been confirmed inside the AoI. Frequent passage of Storm-petrels is expected to occur regularly through AoI-2 and AoI-3 by birds commuting between breeding grounds and foraging areas.

Yellow-legged Gull *Larus michahellis – Least Concern*

The IUCN lists the Yellow-legged Gull as Least Concern with an increasing population trend. The Global population numbers are unknown. The European population is estimated at 409,000 – 534,000 pairs equating to 819,000 – 1,070,000 mature individuals, with an increasing trend. The latest assessment of the Maltese YLG population for Malta's Article 12 reporting to the EU[24] lists 250 breeding pairs for the Maltese islands with an increasing trend. The largest colony, approximately 202 ± 24 apparently occupied nests (5-year mean) is located on Filfla. Similar numbers have been reported from Filfla before. Smaller colonies at Ta' Ċenċ, Dingli and Wardija might have expanded in the last years and the species has established new breeding locations such as Comino, Għarb and within AoI-3 on Selmunett (MT0000022) recently[25]. Therefore, the actual number of breeding pairs might exceed 300 pairs.

Western to Central Mediterranean populations are mainly sedentary and dispersive but some populations are partially migratory. In the Maltese Islands a large number of non-breeders are present year-round. Ring recoveries show that birds ringed on Filfla as chicks utilise other locations in Malta and abroad, mainly Sicily and Southern Italy. Yellow-legged Gulls are highly opportunistic feeders and benefit from human activities, such as fishing, discard from fisheries and other vessels, food-waste, landfills, aquaculture and agriculture. In the Maltese islands, they occur in their highest densities and largest abundances in the harbours areas, around the largest colony (Filfla), around areas with large aquaculture facilities, especially tuna pens such as in the vicinity of St Paul's Island and the wider area off Selmun. Large numbers of feeding flocks can be observed in the AoI-1 at the Magħtab landfill and also in adjacent sea areas in the AoI-2 and AoI-3 inside SPA MT0000112 and SPA MT0000107.

2.3.2.3 Other avian species expected to occur in the AoIs

The following is a list of species expected to make use of the AoIs.

Seabird species *sensu lato*

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[24]https://circabc.europa.eu/sd/a/4e807e1b-8aa1-4ede-ac48-a13cdd32889f/MT_A12NatSum_20141031.pdf

[25]Crymble et al. (2020): New breeding sites of Yellow-legged Gull around the Maltese Islands. Il-Merill 34, 72-80.

Several seabird species *sensu lato* have been recorded to make use of the AoIs, mainly crossing the area during migration, but also stopping over during the migration period or staging extended periods of time during summer or winter. Two of these species are listed as Vulnerable and one is listed as Near Threatened. Overall, nine species are listed in Annex I of the EU Birds Directive.

Ferruginous Duck ***Aythya nyroca* – *Near Threatened, Annex I of the EU Birds Directive***

Population trend decreasing. A significant proportion of the European Ferruginous Duck population and more than 1% of the global population funnels through Gozo Channel situated in the marine SPA (MT0000112) annually, mainly during spring migration. The birds often pass in larger flocks, also alighting on the water to rest. Occasionally observed in Is-Salini (MT0000007). However, no larger numbers of the species have been recorded in the AoIs.

Greater Flamingo ***Phoenicopterus roseus* – *Least Concern, Annex I of the EU Birds Directive***

Overall population trend increasing. Flamingos migrate through the Maltese Islands, including the marine SPA MT0000112 annually often gathering in larger flocks. In recent years they have been recorded in increasing numbers, mainly in autumn. Expected to pass through the AoIs regularly on migration, but it is unlikely that this happens in significant numbers. Reported stopping over in Is-Salini (MT0000007).

Slender-billed Gull ***Chroicocephalus genei* – *Least Concern, Annex I of the EU Birds Directive***

European population size decreasing. In Malta Slender-billed Gulls are recorded annually on migration mainly from (July) August to March (April) in single to low double figures of daily observations. Slender-billed Gulls are considered a coastal species. The species can be expected to occur regularly in the AoI, including foraging at Magħtab landfill and foraging, roosting and passing over the marine part of the AoI that is situated in the SPA MT0000112. Furthermore, the species has been reported making use of the reserves, Is-Salini (MT0000007) and L-Għadira s-Safra (MT0000008) for foraging and roosting. However, it is very unlikely that numbers in any of the AoI reach significant levels from a global or European population perspective at any point.

Mediterranean Gull ***Larus melanocephalus* – *Least Concern, Annex I of the EU Birds Directive***

The European population trend is decreasing. In the Maltese islands the species is mainly recorded from October to April with numbers in the lower hundreds reported in the period from November to March. Regularly makes use of the SPA MT0000112, including the marine part of the AoI. Birds will also make use of the adjacent land areas for roosting as well as foraging at the landfill. SPA MT0000112. Furthermore, recorded regularly in Is-Salini (MT0000007), L-Għadira s-Safra (MT0000008) and Selmunett (MT0000022). It is not expected that Mediterranean Gulls reach relevant numbers in the AoI as compared with the European population which is equivalent to the global population.

Audouin's Gull ***Ichthyaetus audouinii – Vulnerable, Annex I of the EU Birds Directive***

The European breeding population is believed to be currently rapidly decreasing. Audouin's Gulls are mainly found in marine habitats year-round, very frequently following trawlers to feed discarded fish. The species is migratory and dispersive. Before 2000 the Audouin's Gull was considered a very rare bird species to the Maltese islands. The species' status has changed significantly since. From 2000 to 2009 there were 311 records of 535 individuals, with a maximum of 184 sightings during this period in 2007. During stopover on migration the species can be expected regularly in the AoIs, foraging at Magħtab landfill and roosting, foraging and passing through SPA MT0000112, including the AoIs. It has also been recorded regularly from Is-Salini (MT0000007), L-Għadira s-Safra (MT0000008) and Selmunett (MT0000022). However, it is very unlikely that numbers in any of the aforementioned areas reach significant levels from a global or European population perspective at any point.

Little Tern ***Sternula albifrons – Least Concern, Annex I of the EU Birds Directive***

The overall population trend is decreasing, the European population size trend is unknown. In Malta Little Terns are recorded annually in small numbers, mainly in spring (April-May). The species is at least partially migratory and dispersal in the region. Little Terns regularly frequent coastal areas, including lagoons and saltpans when foraging, including the marine part of the AoI inside SPA MT0000112. They also have been reported from Is-Salini (MT0000007). However, it is highly unlikely that significant numbers regarding the global, European or EU population are reached inside the AoIs.

Common Gull-billed Tern ***Gelochelidon nilotica – Least Concern, Annex I of the EU Birds Directive***

The global population is suspected to be in decline, while the European population is estimated to be increasing. The species is recorded in Malta annually in single to double digit numbers on migration, both in spring and autumn. It is likely that Gull-billed terns occur in the AoIs annually during passage on migration and make use of the area for foraging. However, it is highly unlikely that significant numbers regarding the European population are reached at any time.

Caspian Tern ***Hydroprogne caspia – Least Concern, Annex I of the EU Birds Directive***

The overall as well as the European population trend are increasing. The species is recorded in Malta annually in double digit numbers on migration, both in spring and autumn. It is likely that Caspian Terns occur in the AoIs annually during passage on migration and that they make use of it as foraging areas, plunge-diving for fish while feeding on the wing. However, it is highly unlikely that significant numbers regarding the European population are reached at any time. Ringed Caspian Terns that have been recorded in Malta were ringed in Finland (e.g. 9 until 1996), confirming that birds of the European population are passing through Malta regularly.

Black Tern ***Chlidonias niger – Least Concern, Annex I of the EU Birds Directive***

The overall population trend is declining, while the European population trend is unknown. The species occurs in Maltese waters annually and in good numbers mainly during autumn migration, peaking in the second half of August to the beginning of September with few scattered records from spring migration. The species passes through the Maltese islands mainly in offshore areas, frequently foraging on the wing for small prey items at or close to the sea surface. The birds are often attracted to the net cages of the Maltese Tuna aquaculture industry where they feed from next to the cages but also rest on the rails of the cages. Black Terns can also be frequently observed offshore resting on the floats of FAGs of the Dolphin-fish (Lampuka, *Coryphaena hippurus*) fisheries, but also on sun-bathing turtles (*Caretta caretta*), buoys and floating debris (all own observations). During vessel-based surveys and trips to tuna-cages in the Maltese FMZ end of August, numbers of up to 2000 individuals were counted during a single trip. On migration, Black Terns are very likely to pass through the AoI and use it to forage and rest during migration and stop-over. Nevertheless, it is not likely that significant threshold values are reached in the AoIs as compared to the global, European and EU populations at any point.

Sandwich Tern ***Thalasseus sandvicensis - Least Concern, Annex I of the EU Birds Directive***

The overall and European population trends are fluctuating. In Malta Sandwich Terns occur on passage and to a lower extend wintering from (August) September to March (April). They are reported annually in double figures. As other tern species, Sandwich Terns forage in coastal waters. Sandwich Terns occur in the SPA MT0000112 and SPA MT0000107, including the marine parts of the AoIs, annually during passage on migration and make use of it as foraging area. Furthermore, they are recorded or can be expected regularly in Is-Salini (MT0000007), L-Għadira s-Safra (MT0000008) and Selmunett (MT0000022). However, it is very unlikely that significant numbers regarding the global European or EU population are reached at any time.

Red-breasted Merganser ***Mergus serrator – Least Concern,*** expected to pass through the marine part of the AoIs in small numbers on migration, observed on passage and stopover in the marine AoI.

Common Shelduck ***Tadorna tadorna – Least Concern,*** recorded regularly from Is-Simar, (MT0000006), Is-Salini (MT0000007), observed on passage and stopover in the marine AoI.

Common Pochard ***Aythya ferina – Vulnerable***, recorded in small numbers on stop-over from Is-Simar (MT0000006).

Little Grebe ***Tachybabtus ruficollis – Least Concern,*** regularly winter visitor Is-Salini (MT0000007).

Great-crested Grebe ***Podiceps cristatus – Least Concern,*** scarce winter visitor and passage migrants, recorded from Is-Salini (MT0000007)

Black-necked Grebe ***Podiceps nigricollis – Least Concern,*** regular winter visitor and passage migrant in small numbers in Is-Salini (MT0000007)

Common Moorhen ***Gallinula chloropus – Least Concern***, recent breeding attempt from Is-Salini (MT0000007)

Northern Gannet ***Morus bassanus – Least Concern,*** expected to pass through and potentially forage in the marine AoIs, mainly during the winter months

Great Cormorant ***Phalacrocorax carbo – Least Concern,*** recorded regularly in increasing numbers wintering in the Maltese islands, including the marine part of the AoI and the relevant Natura 2000 sites (MT0000007, MT0000008 and MT0000022).

Little Gull ***Hydrocoloeus minutus – Least Concern,*** regularly passing through MT0000112 and MT0000107 during migration, has been occasionally recorded roosting and/or foraging in singles at Is-Salini (MT0000007).

Black-headed Gull ***Chroicocephalus ridibundus - Least Concern,*** large numbers migrate through the Maltese islands and winter there. Larger flocks forage and roost in the AoIs and the relevant Natura 2000 sites (MT0000007, MT0000008, MT0000022, MT0000112, MT0000107).

Lesser Black-backed Gull ***Larus fuscus – Least Concern,*** regular on migration and to some extend wintering in smaller numbers, making use of the AoIs for foraging and roosting, recorded in all relevant Natura 2000 sites (MT0000007, MT0000008, MT0000022, MT0000112, MT0000107).

Long-tailed Skua ***Stercorarius longicaudus - Least Concern,*** expected to pass through the marine part of the AoI (including MT0000112 and MT0000107) on migration in singles.

Arctic Skua ***Stercorarius parasiticus – Least Concern*** expected to pass through the marine part of the AoI (including MT0000112 and MT0000107) in small numbers on migration.

Pomarine Skua ***Stercorarius pomarinus – Least Concern*** expected to pass through the marine part of the AoI (including MT0000112 and MT0000107) in small numbers on migration and when wintering.

Great Skua ***Catharacta skua - Least Concern*** expected to pass through the marine part of the AoI (including MT0000112 and MT0000107) in small numbers on migration and when wintering.

Land-birds

Non-passeriformes

Here we provide a list of non-passeriform species that are recorded in the Maltese islands regularly to frequently on migration and as winter visitors. We also include those species that have been recorded breeding on the islands. Information regarding their conservation status, whether they are listed in Annex I of the EU Birds Directive, and their local occurrence (wintering, breeding, migrant) and frequency of occurrence (scarce, regular, common) is noted. Furthermore, information on their expected or reported status in the AoIs including the relevant Natura 2000 site is given. Of approximately 80 species, less than half of them are listed in Annex I of the EU Birds Directive. The majority is listed as Least Concern, while 8 are listed as Near Threatened, one is listed as Vulnerable and 1 is listed as Endangered.

The majority of species listed here mainly pass through the AoIs during migration. It is not expected that any of the species listed below will be significantly impacted by the planned development nor are they expected to ever reach threshold values in the AoIs.

Common quail ***Coturnix coturnix – Least Concern,*** declining, irregular breeder, common passage migrant (nocturnal), winters in small numbers, expected to occur regularly in the AoI-1, mainly on stopover during migration.

European Turtledove ***Streptopelia turtur – Vulnerable,*** strong decline, would breed regularly if spring hunting was abolished, regular passage migrant in declining numbers, more common in spring, can be expected stopping over in the AoI-1.

Collared Dove ***Streptopelia decaocto – Least Concern*****,** trend increasing, likely to occur in the terrestrial AoI-1.

European Nightjar ***Caprimulgus europaeus – Least Concern,*** common on passage in spring and autumn, can be expected to pass regularly through the AoIs on migration and make use of AoI-1 for foraging and roosting.

Alpine Swift ***Tachymarptis melba – Least Concern,*** recorded in small numbers during spring and autumn migration, aerial feeder, likely to pass occasionally through the AoIs.

Pallid Swift ***Apus palidus – Least Concern,*** in Malta regularly to commonly seen from March to October, small breeding populations in Malta, can be expected to make regular use of the airspace of the AoIs including the relevant Natura 2000 sites (MT0000007, MT0000008, MT0000022, MT0000112, MT0000107).

Common Swift ***Apus apus – Least Concern,*** common on migration in spring and autumn, small but increasing breeding population, including the AoI. Can be expected/ has been recorded to make regular use of the airspace of the AoIs, including the relevant Natura 2000 sites (MT0000006, MT0000007, MT0000008, MT0000022, MT0000107, MT0000112).

Common Cuckoo ***Cuculus canorus* – *Least Concern,*** fairly common on spring migration, less common during autumn, single breeding records in Malta. Expected to occur in the terrestrial part of AoI during migration and stopping over, reported from Is-Salini (MT0000007).

Western Water Rail ***Rallus aquaticus* – *Least Concern,*** population numbers decreasing. Frequent autumn migrant and common winter visitor in the wetlands of the Maltese islands. Some breeding attempts. Recorded from Is-Salini (MT0000007).

Spotted Crake ***Porzana porzana* – *Least Concern, Annex I of the EU Birds Directive,*** small numbers in spring and autumn on migration.

Common Crane ***Grus grus* – *Least Concern, Annex I of the EU Birds Directive,*** population trend increasing, recorded annually on migration in small flocks, potentially through the AoIs.

Black Stork ***Ciconia nigra* – *Least Concern, Annex I of the EU Birds Directive,*** European population increasing, in Malta annually in small numbers during migration, mainly in autumn.

White Stork ***Ciconia ciconia* – *Least Concern, Annex I of the EU Birds Directive,*** population increasing, in Malta annually in small numbers on migration mainly autumn, to less extend in spring. White Storks are frequently foraging on landfills. Therefore, can be expected to occur in the AoI.

Eurasian Spoonbill ***Platalea leucorodia* – *Least Concern, Annex I of the EU Birds Directive,*** trend increasing, in Malta mainly on passage in spring and autumn. Regularly migrating through the AoI, including MT0000107 and MT0000112 and has been recorded in Is-Salini (MT0000007).

Glossy Ibis ***Plegadis falcinellus* – *Least Concern, Annex I of the EU Birds Directive,*** European population increasing, in Malta recorded annually on migration. Has been recorded passing through the AoI, including MT0000107 and MT0000112.

Common Little Bittern ***Ixobrychus minutus* - *Least Concern, Annex I of the EU Birds Directive,*** European population stable, irregularly breeding in Malta, recorded annually in small numbers on migration. Expected to migrate through the AoIs (at night). Recorded on stopover during migration for the Natura 2000 site Is-Salini (MT0000007).

Black-crowned Night Heron ***Nycticorax Nycticorax* - *Least Concern, Annex I of the EU Birds Directive,*** decreasing in Europe, frequently migrating over Malta, regularly observed during stop-over at Salini (MT0000007), expected to migrate regularly through the AoIs.

Squacco Heron ***Ardeola ralloides* - *Least Concern, Annex I of the EU Birds Directive,*** European population considered stable, passing through Malta in small numbers on migration annually. Has been recorded at Is-Salini (MT0000007); expected to migrate through the AoIs regularly.

Grey Heron ***Ardea cinerea - Least Concern,*** regular visitor to the Maltese islands year-round but higher numbers during migration. Can be expected to migrate regularly through the AoIs. Has been recorded regularly to frequently in all relevant Natura 2000 sites (MT0000006, MT0000007, MT0000008, MT0000022, MT0000107, MT0000112).

Purple Heron ***Ardea purpurea - Least Concern, Annex I of the EU Birds Directive,*** European population decreasing, passing through Maltese islands annual during migration in good numbers. Has been recorded regularly at Is-Salini (MT0000007). Can be expected to pass through the AoIs on migration.

Great White Egret ***Casmerodius alba – Least Concern, Annex I of the EU Birds Directive,*** recorded annually on passage in small numbers, Is-Salini (MT0000007). Can be expected to pass through the AoIs on migration.

Little Egret ***Egretta garzetta – Least Concern, Annex I of the EU Birds Directive,*** fairly common passage migrant in spring and autumn, few individuals year-round, recently established small breeding population close to Is-Salini, at least partially founded by escapes. Recorded regularly Is-Salini (MT0000007), recorded in the AoIs and including the relevant Natura 2000 sites (MT0000008 and MT0000022, MT0000107, MT0000112) regularly.

Stone Curlew / Eurasian Thick-knee ***Burhinus oedicnemus – Least Concern, Annex I of the EU Birds Directive,*** recorded in Malta regularly in small numbers on migration in spring and autumn. Potentially passing through the AoIs in low numbers.

Oystercatcher ***Haematopus ostralegus – Near threatened,*** population declines across Europe, recorded in Malta annually in small numbers. Potentially passing through and resting/ foraging in the AoI in small numbers, including MT0000022.

Pied Avocet ***Recurvirostra avosetta – Least Concern, Annex I of the EU Birds Directive,*** recorded in Malta annually in small numbers mainly during autumn migration, potentially wintering. Recorded from Is-Salini (MT0000007).

Black-winged Stilt ***Himantopus himantopus – Least Concern, Annex I of the EU Birds Directive,*** frequent spring migrant in the Maltese islands, expected to occur regularly in the AoIs mainly on migration.

Grey Plover ***Pluvialis squatarola – Least Concern,*** in Malta recorded annually in small numbers during spring and autumn migration. Potentially migrating through the AoIs.

Eurasian Golden Plover ***Pluvialis apricaria - Least Concern, Annex I of the EU Birds Directive,*** population trend increasing. Common in Malta during winter months, both on migration and wintering. Expected migrating through and/or stopping over in the AoIs.

Eurasian Dotterel ***Charadrius morinellus - Least Concern, Annex I of the EU Birds Directive,*** in Malta annually in small numbers, stopping over mainly during autumn migration. Potentially migrating through and stopping over in the AoIs.

Common Ringed Plover ***Charadrius hiaticula – Least Concern,*** decreasing on EU and global level, fairly common passage migrant in spring and autumn. Recorded from Is-Salini (MT0000007). Expected to be also foraging and stopping over at MT0000022 on migration and to pass through the AoIs.

Little Ringed Plover ***Charadrius dubius – Least Concern,*** population decreasing, common passage migrant in spring and autumn; recorded regularly from Is-Salini (MT0000007). Expected to also occur in the AoIs including MT0000022.

Kentish Plover ***Charadrius alexandrinus – Least Concern, Annex I of the EU Birds Directive,*** regular passage migrant in small numbers in spring and autumn. Potentially occurring in the AoIs.

Northern Lapwing ***Vanellus vanellus – Near Threatened,*** overall declining population trend, recorded regularly in Malta during the winter months in small flocks regular passage migrant in small numbers in spring and autumn. Potentially occurring in the AoIs.

Whimbrel ***Numenius phaeopus – Least Concern,*** recorded annually in small numbers in spring and autumn during migration. Expected to occur in the AoIs in small numbers and irregularly, foraging/ roosting on the rocky shore and migrating through the area at night.

Eurasian Curlew ***Numenius arquata – Near Threatened,*** global population trend decreasing, passing regularly through Malta during spring and autumn. Expected to occur in the AoIs in small numbers and irregularly, foraging/ roosting on the rocky shore and migrating through the area at night.

Black-tailed Godwit ***Limosa limosa – Near Threatened,*** population trend decreasing, in Malta recorded annually, mainly on spring migration. Potentially migrating through the AoIs in small numbers.

Ruddy Turnstone ***Arenaria interpres – Least Concern,*** recorded in Malta annually in small numbers in spring and autumn. Expected to occur in the AoIs in small numbers and irregularly, foraging/ roosting on the rocky shore and migrating through the area at night.

Red Knot ***Calidris canutus – Near Threatened,*** global population trend decreasing, recorded in Malta almost annually in small numbers on passage. Potentially passing through the AoIs on migration.

Ruff ***Calidris pugnax – Least Concern, Annex I of the EU Birds Directive,*** population trend decreasing, recorded in the Maltese islands regularly and in good numbers, mainly during spring migration, including in Is-Salini (MT0000007). Expected to be passing through the AoIs on migration.

Curlew Sandpiper ***Calidris ferruginea – Near Threatened,*** suspected to be declining, in Malta regularly in small flocks on passage migration in spring and autumn. Recorded in Is-Salini (MT0000007) and expected to be passing through the AoIs on migration.

Temminck's Stint ***Calidris temminckii – Least Concern,*** population trend stable, recorded in Malta in small numbers during spring and autumn migration, including in Is-Salini (MT0000007). Expected to be passing through the AoIs on migration occasionally.

Sanderling ***Calidris alba – Least Concern,*** passing through Malta annually in small numbers during spring and autumn. Potentially passing through the AoIs.

Dunlin ***Calidris alpina – Least Concern,*** recorded in Malta annually in small numbers mainly on passage in spring and autumn including in Is-Salini (MT0000007). Expected to be passing through the AoIs on migration.

Little Stint ***Calidris minuta – Least Concern,*** singles recorded in Malta year-round, common during spring and autumn migration. Observations at Is-Salini (MT0000007) and expected to be passing through the AoIs on migration.

Eurasian Woodcock ***Scolopax rusticola – Least Concern,*** trend estimated stable, observed in Malta during the winter months, expected to occur in the AoIs during migration and wintering.

Great Snipe ***Gallinago media – Near Threatened, Annex I of the EU Birds Directive,*** overall trend decreasing, in Malta encountered annually in singles on spring migration. It is expected that the species occasionally passes through the AoI on migration.

Common Snipe ***Gallinago gallinago – Least Concern,*** common passage migrant, mainly in spring, regularly observed at Is-Salini (MT0000007). Can be expected to occur at L-Għadira s-Safra u l-Iskoll tal-Għallis (MT0000008) and to pass through the AoIs on migration.

Jack Snipe ***Lymnocryptes minimus – Least Concern,*** population trend stable, passing through the Maltese islands annually in small numbers during the winter months, potentially passing through and stopping over in the AoIs.

Common Sandpiper ***Actitis hypoleucos – Least Concern,*** overall population trend decreasing, common passage migrant in Malta in spring and autumn, recorded in small numbers year-round. Recorded or expected regularly in the AoIs, including all relevant Natura2000 sites (MT0000007, MT0000008, MT0000022, MT0000107, MT0000112).

Green Sandpiper ***Tringa ochropus – Least Concern,*** population trend increasing, regular passage migrant through the Maltese islands in spring and autumn and expected to pass through the AoIs on migration.

Spotted Redshank ***Tringa erythropus – Least Concern,*** population trend stable, recorded annually in Malta in small numbers on migration and in winter. Expected to occasionally pass through the AoIs.

Common Greenshank ***Tringa nebularia – Least Concern,*** population stable, common visitor to the Maltese islands in relatively low numbers on spring and autumn migration. Expected to pass through the AoIs.

Common Redshank ***Tringa totanus – Least Concern,*** European population has undergone a moderate decline, a regularly passage migrant in Malta in small numbers, both in spring and autumn. Expected to pass through the AoIs.

Wood Sandpiper ***Tringa glareola – Least Concern, Annex I of the EU Birds Directive,*** population trend stable, common passage migrant in the Maltese islands in spring and autumn. Expected to pass through the AoIs.

Marsh Sandpiper ***Tringa stagnatilis – Least Concern,*** overall population trend decreasing, recorded in Malta regularly in small numbers on migration. Recorded from Is-Salini (MT0000007). Potentially passing through the AoIs.

Collared Pratincole ***Glareola pratincola – Least Concern, Annex I of the EU Birds Directive,*** overall population trend decreasing, recorded almost annually in singles, mainly during spring migration. Recorded from Is-Salini (MT0000007). Potentially passing through the AoI.

Eurasian Scops-owl ***Otus scops – Least Concern,*** global population trend declining, regularly recorded in the Maltese islands, mainly during migration. Can be expected to pass through the AoIs occasionally and in low numbers and also use the terrestrial area during stopover on migration.

Short-eared Owl ***Asio flammeus – Least Concern, Annex I of the EU Birds Directive,*** population trend in Europe fluctuating, recorded annually in small numbers, mainly on migration, has been reported nesting in the Maltese islands, at least two times in recent years. Can be expected to pass through the AoIs on migration.

Osprey ***Pandion haliaetus – Least Concern, Annex I of the EU Birds Directive,*** European population trend increasing, regularly recorded in the Maltese islands on spring and autumn migration. Has been observed foraging and roosting at Is-Salini (MT0000007). Can be expected to pass through the AoIs regularly in small numbers.

European Honey-buzzard ***Pernis apivorus – Least Concern, Annex I of the EU Birds Directive,*** overall population trend decreasing, common passage migrant over the Maltese islands, mainly in autumn. Can be expected to migrate through the AoIs regularly.

Egyptian Vulture ***Neophron percnopterus – Endangered, Annex I of the EU Birds Directive,*** population trend declining in entire range, recorded in Malta almost annually in singles on migration, mainly in autumn. Birds might be attracted to the landfill and therefore the species might occur in the AoIs occasionally on migration.

Short-toed Snake-eagle ***Circaetus gallicus – Least Concern, Annex I of the EU Birds Directive,*** population trend stable, appears on passage in the Maltese islands annually in small numbers, mainly in autumn. Potentially passes through the AoIs on migration.

Lesser spotted Eagle ***Aquila pomarina – Least Concern, Annex I of the EU Birds Directive,*** European population estimated stable, in Malta almost recorded annually in singles to small flocks mainly on autumn migration. Potentially passes through the AoIs on migration.

Booted Eagle ***Aquila pennata – Least Concern, Annex I of the EU Birds Directive,*** population size increasing in Europe, recorded in Malta almost annually in singles mainly during autumn migration. Potentially passes through the AoIs on migration.

Western Marsh Harriers ***Circus aeruginosus – Least Concern, Annex I of the EU Birds Directive,*** population trend in Europe increasing, common passage migrant to the Maltese islands both in spring and autumn. Has been reported at Is-Salini (MT0000007). Can be expected to appear in the AoIs on passage migration regularly.

Montagu's Harrier ***Circus pygargus – Least Concern, Annex I of the EU Birds Directive,*** population decreasing in the EU, recorded in the Maltese islands annually in double figure numbers during spring and autumn migration. Can be expected to migrate through the AoIs occasionally.

Eurasian Sparrowhawk ***Accipiter nisus – Least Concern,*** overall population trend stable, recorded annually in Malta in small numbers on migration, mainly in autumn. Can be expected to pass through the AoIs occasionally.

Black Kite ***Milvus migrans – Least Concern, Annex I of the EU Birds Directive,*** population trend unknown, recorded in Malta annually in double figure numbers on migration. Species is attracted by landfills. Can be expected to occur in the AoIs occasionally.

Common Hoopoe ***Upupa epops – Least Concern,*** overall population trend decreasing, common passage migrant in Malta, both in spring and autumn, at least one breeding recorded in recent years. Has been observed at Is-Salini (MT0000007). Can be expected to pass through the AoIs and foraging and roosting there during stop-over on migration.

European Bee-eater ***Merops apiaster, Least Concern,*** overall population trend declining, common spring migrant in Malta, less common in autumn, has made single breeding attempts on the islands in recent years. Regularly observed in all relevant Natura 2000 sites and can be expected regularly in the AoIs on migration.

European Roller ***Coracias garrulus – Least Concern, Annex I of the EU Birds Directive,*** European population trend decreasing, recorded in Malta annually in small numbers, mainly during spring migration. Can be expected to pass through the AoIs occasionally.

Common Kingfisher ***Alcedo atthis – Least Concern, Annex I of the EU Birds Directive,*** European population trend decreasing, common winter visitor and passage migrant in Malta. Observed regularly making use of all relevant Natura 2000 sites. Expected to pass through the AoIs regularly on migration and when wintering.

Eurasian Wryneck ***Jynx torquilla – Least Concern,*** population trends: long-term decline, short-term increase, fairly common passage migrant and winter visitor to the Maltese islands. Can be expected to be present in the AoIs during migration, stopping over and potentially also wintering in the terrestrial part.

Lesser Kestrel ***Falco naumanni – Least Concern, Annex I of the EU Birds Directive,*** population trend previous severe declines, recently stable, fairly common passage migrant to the Maltese islands in spring and autumn. Expected to pass through the AoIs on migration and also foraging in the terrestrial area when stopping over.

Common Kestrel ***Falco tinnunculus – Least Concern,*** population trend decreasing, present in Malta year-round, common during passage in spring and autumn, breeding almost annually in very low numbers (1-3 pairs). Can be expected foraging in the terrestrial part of the AoIs year-round (local birds). Passage migrants can be expected to pass through all AoIs.

Red-footed Falcon ***Falco vespertinus – Near Threatened, Annex I of the EU Birds Directive,*** European population trend declining, in Malta fairly regularly encountered on migration, numbers higher in spring. Can be expected to pass through the AoIs and forage in the terrestrial part during passage.

Eleonora's Falcon ***Falco eleonorae – Least Concern, Annex I of the EU Birds Directive,*** European population size increasing, recorded in Malta annually in fairly good numbers on migration in spring and autumn. Can be expected to pass through the AoIs, including the relevant Natura 2000 sites on migration.

Merlin ***Falco columbarius – Least Concern, Annex I of the EU Birds Directive,*** population trend fluctuating, recorded in Malta annually in low numbers mainly on autumn migration. Might occasionally migrate through the AoIs.

Eurasian Hobby ***Falco subbuteo – Least Concern,*** overall population trend declining, fairly common in Malta on migration in spring and autumn. Can be expected to migrate through the AoIs regularly.

Peregrine Falcon ***Falco peregrinus – Least Concern, Annex I of the EU Birds Directive,*** population trend increasing, potentially regular breeder in the Maltese islands in very low numbers, would be more common if left undisturbed/ not persecuted, also appears on passage and as winter visitor. Can be expected to make use of the AoIs including the relevant Natura 2000 sites regularly and year-round, especially hunting for Black-headed Gulls etc. in the landfill area.

Passeriformes

Here we provide a list of all passerine species that are recorded in the Maltese islands regularly to frequently on migration and as winter visitors. We also include those species that are residents i.e. breeding on the islands. Information regarding their conservation status, whether they are listed in Annex I of the EU-Birds directive, and their local occurrence (wintering, breeding, migrant) and frequency of occurrence (scarce, regular, common) is noted. Furthermore, information on their expected or reported status in the AoIs including the relevant Natura 2000 site is given.

The vast majority of species is listed as Least Concern (only two are listed as Near Threatened, both not in Annex I of the EU Birds Directive) and only seven species are listed in Annex I of the EU-Birds-Directive (all Least Concern). Of all passerine species that have been recorded breeding in the Maltese islands, two are listed in Annex I of the EU Birds Directive. One of them is a common breeder – the Greater Short-toed Lark *Calandrella brachydactyla* (see above) while the other one has been reported breeding irregularly - the Tawny Pipit *Anthus campestris.*

In general, small passerines have relatively higher reproductive rates and shorter life-spans (generation cycles) compared to most larger non-passerine species. This, together with a large distribution range and often distribution density in most species listed below, reduces their overall population vulnerability. The majority of migratory species listed here mainly migrate during the night and cross the area in broad front. It is not expected that any of the species listed below will ever reach threshold values in the AoIs.

Species list of Passeriformes regularly encountered on the Maltese islands

Eurasian Golden Oriole *Oriolus oriolus* - Least Concern, common passage migrant, expected frequently in the AoIs on migration.

Red-backed Shrike *Lanius collurio* - Least Concern, Annex I, passage in low numbers, not expected to occur in the AoIs in relevant numbers.

Woodchat Shrike *Lanius senator* - Least Concern, regular passage migrant, expected to occur in the AoIs occasionally.

Penduline Tit *Remiz pendulinus* - Least Concern, passage in small numbers, might migrate through the AoI occasionally and in small numbers.

Greater Short-toed Lark *Calandrella brachydactyla* - Least Concern, Annex I, common breeder and passage migrant, reported breeding in the AoI-1 (see Figure 1), not expected to occur in the AoIs in relevant numbers, but expected to pass through on migration and potentially stopping over.

Woodlark *Lullula arborea* - Least Concern, Annex I, regular passage migrant in low numbers, expected to also pass through the AoIs.

Eurasian Skylark ***Alauda arvensis* -** Least Concern, common on passage and wintering, expected to occur in the AoIs regularly.

Zitting Cisticola ***Cisticola juncidis* -** Least Concern, common breeder in the AoI-1 (see Figure 1).

Olivaceus Warbler ***Iduna pallida* -** Least Concern, passage in low numbers, potentially occurring in the AoIs.

Isabelline Warbler ***Iduna opaca* -** Least Concern, passage in low numbers, potentially occurring in the AoIs.

Icterine Warbler ***Hippolais icterina* -** Least Concern, regular passage migrant, expected to pass through the AoIs regularly on migration.

Moustached Warbler ***Acrocephalus melanopogon* -** Least Concern, passage and wintering in low numbers, expected to pass through the AoIs occasionally in very low numbers.

Sedge Warbler ***Acrocephalus schoenobaenus*** – Least Concern, regular passage migrant, to pass through the AoIs regularly on migration.

Common Reed Warbler ***Acrocephalus scirpaceus*** - Least Concern, breeds in Malta in small numbers, regular passage migrant, single winter records. Expected to pass through the AoIs regularly on migration.

Great Reed Warbler ***Acrocephalus arundinaceus* -** Least Concern, regular passage migrant, expected to pass through the AoIs regularly on migration.

Savi's Warbler ***Locustella luscinioides* -** Least Concern, passage migrant in low numbers, expected to pass through the AoIs occasionally on migration.

Northern House Martin ***Delichon urbicum* -** Least Concern, rare breeder, common passage migrant, expected to make use of the airspace of the AoIs regularly, foraging in the area during migration, potentially roosting in the area, too.

Red-rumped Swallow ***Cecropis daurica* -** Least Concern, regular passage migrant, expected to make use of the airspace of the AoIs regularly, foraging in the area during migration, potentially roosting in the area, too.

Barn Swallow ***Hirundo rustica* -** Least Concern, breeder in low numbers, common passage migrant, expected to make use of the airspace of the AoIs regularly, foraging in the area during migration and potentially during breeding. Potentially roosting in the terrestrial part of the area, too.

Common Sand Martin ***Riparia riparia* -** Least Concern, regular passage migrant, expected to make use of the airspace of the AoIs regularly, foraging in the area during migration and potentially roosting.

Eastern Bonelli's Warbler ***Phylloscopus orientalis -*** Least Concern, regular passage migrant, expected to pass through the AoIs occasionally during migration.

Western Bonelli's Warbler ***Phylloscopus bonelli -*** Least Concern, regular passage migrant expected to pass through the AoIs occasionally during migration.

Wood Warbler ***Phylloscopus sibilatrix -*** Least Concern, common passage migrant, in good numbers, expected to regularly occur in the AoIs on passage.

Yellow-browed Warbler ***Phylloscopuls inornatus -*** Least Concern, regular passage migrant, expected to occur occasionally in the AoIs on migration.

Willow Warbler ***Phylloscopus trochilus* -** Least Concern, common passage migrant, expected to regularly pass through the AoIs on migration.

Common Chiffchaff ***Phylloscopus collybita -*** Least Concern, common passage migrant and winter visitor, expected to pass through the AoIs regularly on migration and winter in the terrestrial part regularly.

Cetti's Warbler ***Cettia cetti -*** Least Concern, common breeder, possibly breeding in the AoI-1 (see above) and at Is-Salini (MT0000007). Expected to occur in the AoI regularly also during dispersal.

Eurasian Blackcap ***Sylvia atricapilla -*** Least Concern, common passage migrant and winter visitor. Expected to pass through the AoIs regularly during migration and make use of its terrestrial part during stop-over and wintering.

Garden Warbler ***Sylvia borin -*** Least Concern, common passage migrant. Expected to pass through the AoIs regularly during migration and make use of its terrestrial part during stop-over.

Lesser Whitethroat ***Curruca curruca*** - Least Concern, passage migrant in small numbers. Expected to occur in the AoIs occasionally on migration.

Sardinian Warbler ***Curruca melanocephala*** - Least Concern, common breeder in Malta and probable breeder in the AoI-1 (see Figure 1), present year-round.

Subalpine Warbler ***Curruca cantillans*** - Least Concern, common passage migrant, expected to regularly pass through the AoIs during migration.

Common Whitethroat ***Curruca communis -*** Least Concern, common passage migrant, expected to regularly pass through the AoI during migration.

Spectacled Warbler ***Curruca conspicillata* -** Least Concern, regular breeder, possible breeder in the AoI-1.

Common Starling ***Sturnus vulgaris -*** Least Concern, breeding in small numbers, common passage migrant and winter visitor, expected to occur in the AoIs regularly in good number on passage and while wintering, including making use of the terrestrial area for foraging and potentially roosting.

Mistle Thrush ***Turdus viscivorus*** - Least Concern, regular passage migrant, can be expected to pass through the AoIs occasionally on migration.

Song Thrush ***Turdus philomelos*** - Least Concern, common passage migrant and winter visitor, can be expected to occur regularly in the AoIs.

Redwing ***Turdus iliacus*** **-** Near Threatened, regular passage migrant in small numbers, potentially wintering, can be expected to occasionally occur in the AoIs on migration.

Eurasian Blackbird ***Turdus merula*** **-** Least Concern, regular passage migrant and winter visitor, can be expected in the AoIs on passage and during wintering.

Fieldfare ***Turdus pilaris*** **-** Least Concern, regular passage migrant, potentially wintering, can be expected to occasionally occur in the AoIs on migration.

Rufous-tailed Scrub-robin ***Cercotrichas galactotes*** **-** Least Concern, rare but regular visitor, potentially occurring irregularly in singles in the AoIs.

Spotted Flycatcher ***Muscicapa striata*** **-** Least Concern, breeder in increasing numbers, common passage migrant, expected to be present regularly in the AoIs on passage and stopping over.

European Robin ***Erithacus rubecula*** **-** Least Concern, very common passage migrant and winter visitor. Expected to be present in the AoIs outside the breeding season in good numbers.

Bluethroat ***Luscinia svecica*** **-** Least Concern, Annex I, regular passage migrant, potentially wintering in small numbers, can be expected to pass through the AoIs occasionally on migration.

Common Nightingale ***Luscinia megarhynchos*** **-** Least Concern, common passage migrant, one breeding record from 1995, expected to pass through the AoIs on migration.

Semicollared Flycatcher ***Ficedula semitorquata*** **-** Least Concern, Annex I, regular passage migrant in small numbers, expected to pass through the AoIs occasionally on migration.

European Pied Flycatcher ***Ficedula hypoleuca*** - Least Concern, common passage migrant, expected to be present regularly in the AoIs during the migration periods.

Collared Flycatcher ***Ficedula albicollis*** – Least Concern, Annex I, regular passage migrant in low numbers, expected to pass through the AoIs during the migration periods.

Black Redstart ***Phoenicurus ochruros* -** Least Concern, common passage migrant, common winter visitor, expected to be regularly present in the AoIs during the non-breeding period.

Common Redstart ***Phoenicurus phoenicurus*** - Least Concern, common passage migrant, expected to regularly occur in the AoIs during the migration periods.

Rufous-tailed Rock-thrush ***Monticola saxatilis*** - Least Concern, regular passage migrant, can be expected to occur in the AoIs on passage and stop-over in the migration periods.

Blue Roch-thrush ***Monticola solitarius*** - Least Concern, common breeder, possibly breeding in the AoI-1, expected to make use of the terrestrial part of the AoIs year-round.

Whinchat ***Saxicola rubetra*** - Least Concern, common passage migrant, expected to pass through the AoIs on migration and also stopping over in the terrestrial area.

Common Stonechat ***Saxicola rubicola*** - Least Concern, common passage migrant and winter visitor, expected to be common in the AoIs during the non-breeding period.

Northern Wheatear ***Oenanthe oenanthe*** - Least Concern, common passage migrant, can be expected to pass through the AoIs on migration regularly.

Isabelline Wheatear ***Oenanthe isabellina*** - Least Concern, regular passage migrant in low numbers, might occasionally pass through the AoIs on migration.

Black-eared Wheatear ***Oenanthe hispanica* -** Least Concern, regular passage migrant, expected to occur in the AoIs regularly in low numbers during migration.

Goldcrest ***Regulus regulus*** - Least Concern, regular passage migrant and winter visitor, can be expected to regularly occur in the AoIs on passage.

Common Firecrest ***Regulus ignicapilla* -** Least Concern, regular passage migrant and winter visitor, can be expected to regularly occur in the AoIs on passage.

Dunnock ***Prunella modularis*** - Least Concern, regular passage migrant and winter visitor, expected to be present in the AoIs outside the breeding season in small numbers.

Spanish Sparrow ***Passer hispaniolensis* -** Least Concern, common breeder and regular passage migrant, common breeding resident in the AoI-1.

Eurasian Tree Sparrow ***Passer montanus*** - Least Concern, expected to occur in the AoIs during dispersal and in the non-breeding period in low numbers.

Tree Pipit ***Anthus trivialis* -** Least Concern, common passage migrant, during migration, expected to occur regularly in the AoIs on passage.

Red-throated Pipit ***Anthus cervinus*** - Least Concern, regular passage migrant, wintering in low numbers, expected to occasionally pass through the AoIs during migration and stopping over.

Meadow Pipit ***Anthus pratensis*** - Near Threatened, common passage migrant and winter visitor, expected to make regular use of the terrestrial part of the AoIs on stop-over during migration and as foraging grounds in winter.

Water Pipit ***Anthus spinoletta*** - Least Concern, rare passage migrant or winter visitor, expected to make use of the AoIs during migration occasionally.

Tawny Pipit ***Anthus campestris*** **-** Least Concern, Annex I, rare breeder, regular passage migrant, expected to pass through the AoIs occasionally on migration.

Western Yellow Wagtail ***Motacilla flava*** - Least Concern, common passage migrant, expected to pass through the AoIs regularly during migration, including foraging and potentially roosting during stop-over in the terrestrial part.

Grey Wagtail ***Motacilla cinerea*** - Least Concern, rare breeder, regular passage migrant and winter visitor, expected to occur in the AoIs occasionally to regularly in singles.

White Wagtail ***Motacilla alba*** - Least Concern, common passage migrant and winter visitor, expected to be regularly present in the AoIs during the non-breeding period.

Common Chaffinch ***Fringilla coelebs*** **-** Least Concern, regular passage migrant and winter visitor, potential breeder, but no breeding confirmed in recent years, expected to occur in the AoIs regularly during migration and as winter visitor.

Hawfinch ***Coccothraustes coccothraustes*** **-** Least Concern, regular passage migrant and winter visitor, expected to occur in the AoIs occasionally on migration and as winter visitor.

European Greenfinch ***Chloris chloris*** - Least Concern, common passage migrant and winter visitor, has bred occasionally on the Maltese islands but no confirmed breeding record in recent years. Can be expected to occur in the AoIs regularly during migration and as winter visitor.

Common Linnet ***Linaria cannabina*** - Least Concern, common passage migrant and winter visitor, irregular breeder in very low numbers, expected to occur in the AoIs regularly during migration and as winter visitor, potentially year-round.

European Goldfinch ***Carduelis carduelis*** - Least Concern, common passage migrant and winter visitor, irregular breeder in very low numbers, expected to occur in the AoIs regularly during migration and as winter visitor, potentially year-round.

European Serin ***Serinus serinus*** **-** Least Concern, common passage migrant and winter visitor, irregular breeder in very low numbers, expected to occur in the AoIs regularly during migration and as winter visitor.

Eurasian Siskin ***Spinus spinus*** - Least Concern, regular passage migrant and winter visitor, expected to occur in the AoIs on migration and as winter visitor occasionally.

Corn Bunting ***Emberiza calandra*** - Least Concern, regular breeder in Malta in very small numbers, might occasionally occur in the AoIs during dispersal.

Ortolan Bunting ***Emberiza hortulana*** - Least Concern, Annex I, regular passage migrant, expected to occasionally pass through the AoIs during migration.

Reed Bunting ***Emberiza schoeniclus*** - Least Concern, regular passage migrant and winter visitor, expected to pass through the AoIs occasionally during migration and in the winter months.

2.3.3 Marine Study

2.3.3.1 Bathymetry

The marine area is split into two components: nearshore and offshore. The nearshore area is the part up to about 1.5km away from the coast, which will include the HDD cable and the punchout hole. The precise location of the punchout hole has not yet been selected, however, the HDD overall length will be approximately 300 m from transition joint to the punchout hole with this punchout hole being at an approximate water depth of 10 m. The offshore area relevant to this technical study is the part between about 1.5km from the Maltese coast and the Malta-Italy EEZ boundary.

The water depth along the cable route is shown in Figure 41 to Figure 45, as produced by the FEED contractor. The water depth ranges between 0m and about 160m at the Malta-Italy EEZ boundary. There is a sharp bathymetric drop-off of 65m between KP8 and KP11, between -70m to -135m depth. This represents an escarpment area, as mapped in Figure 46.

Otherwise, the seabed is quite flat, with gentle slopes.

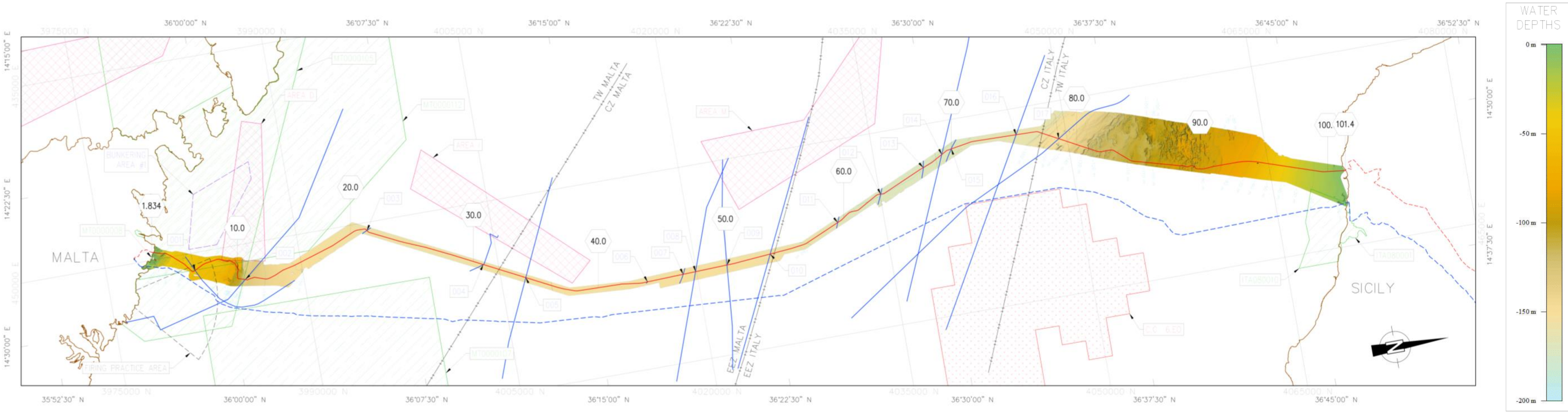

FIGURE 41: BATHYMETRY ALONG THE ENTIRE CABLE ROUTE

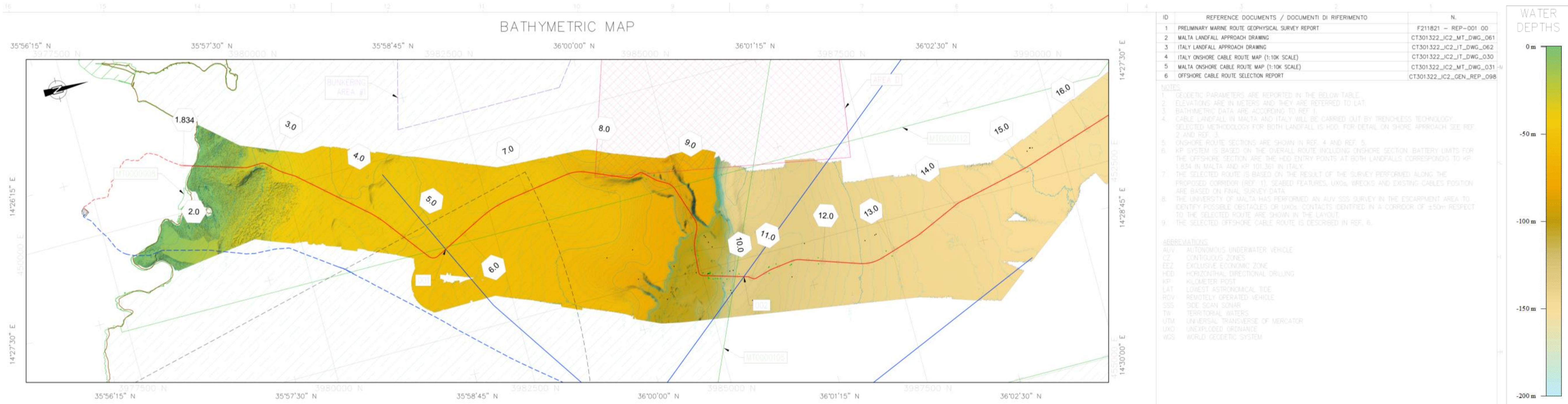

FIGURE 42: BATHYMETRY BETWEEN KP2 AND KP16

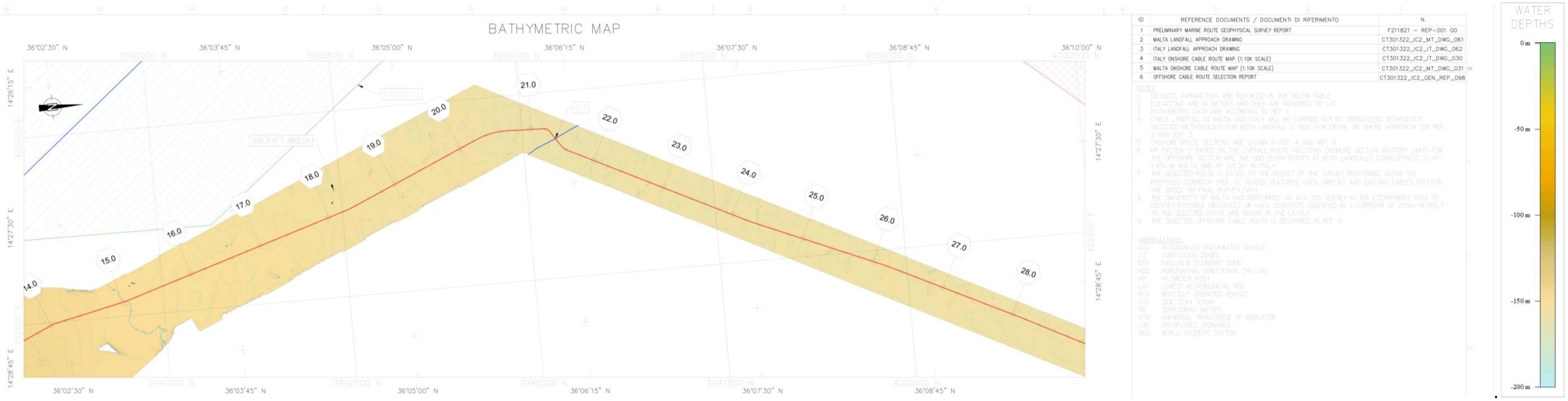

Figure 43: Bathymetry Between KP14 and KP28

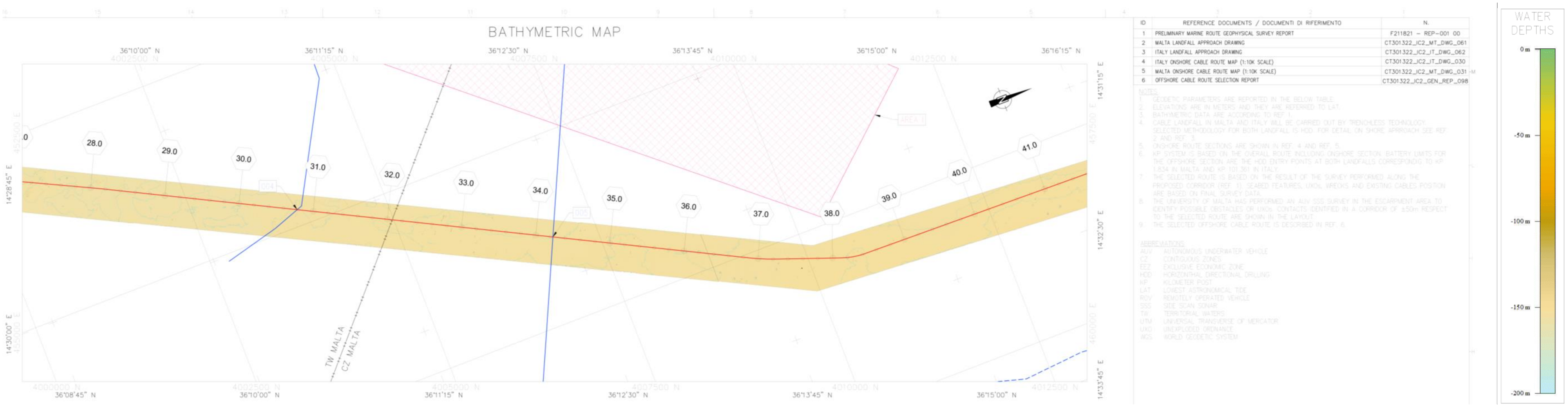

Figure 44: Bathymetry Between KP28 and KP41

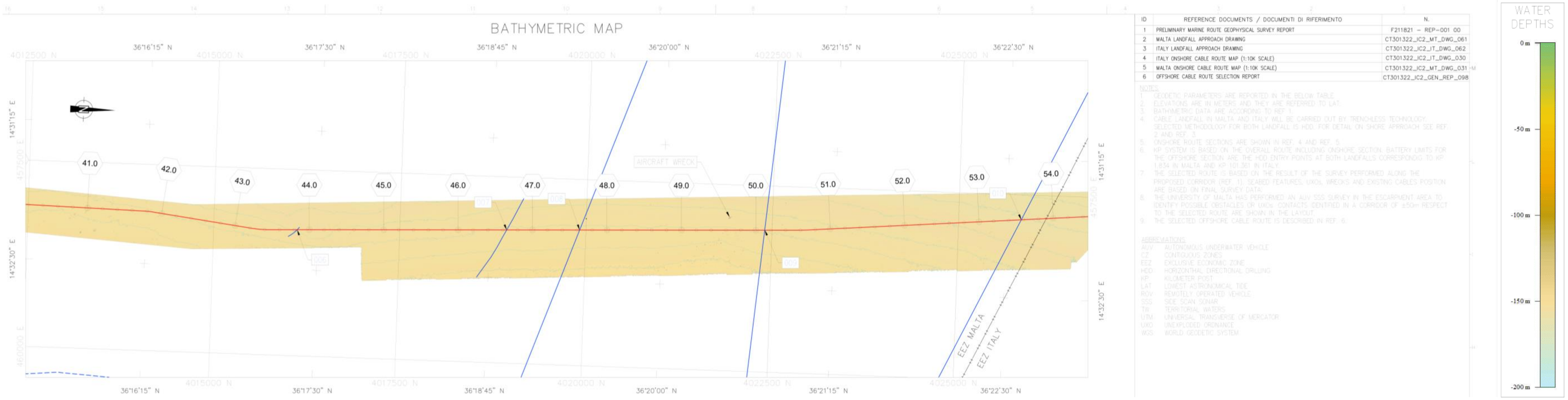

Figure 45: Bathymetry Between KP41 and KP54 (EEZ Boundary)

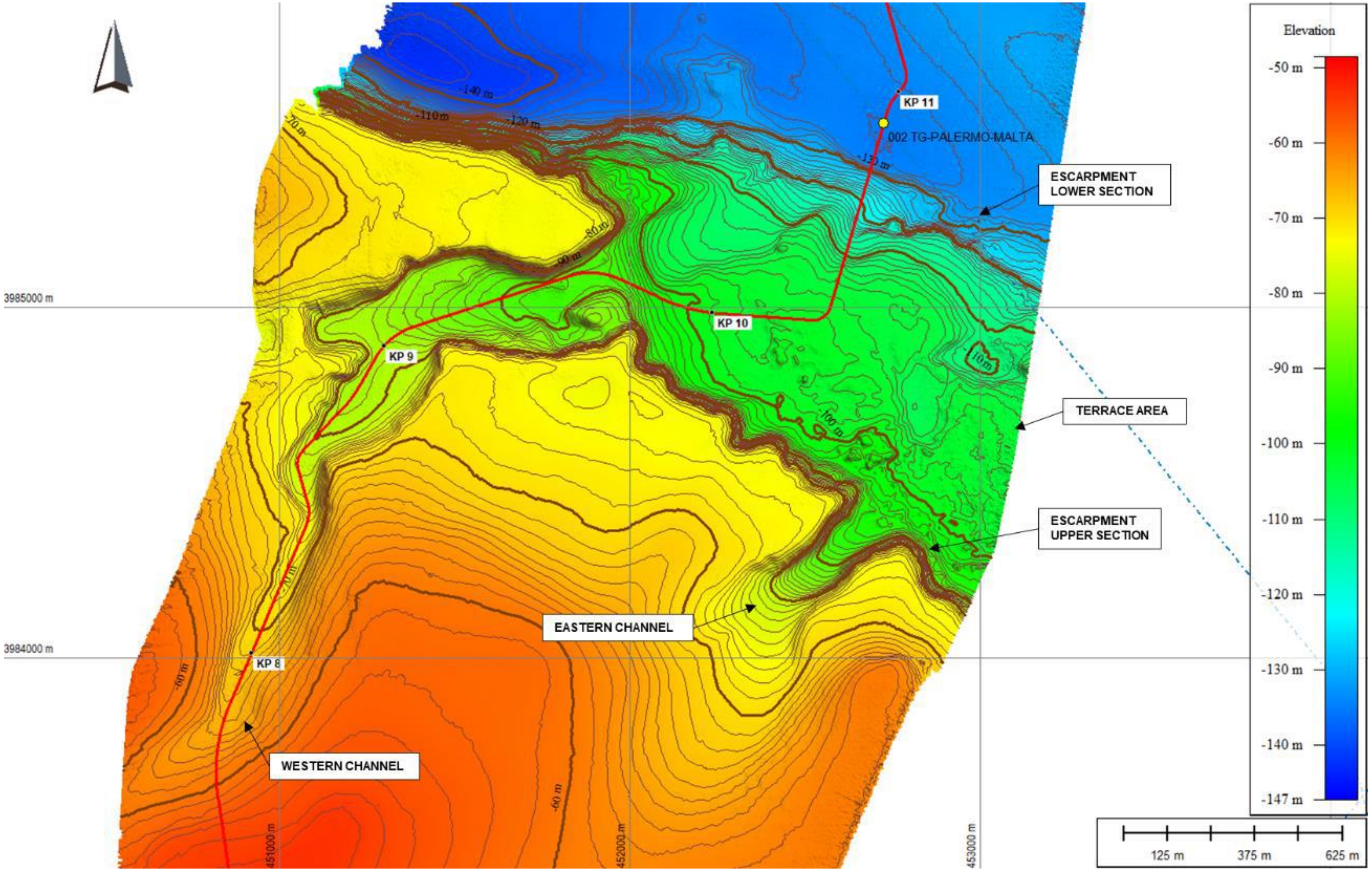

FIGURE 46: BATHYMETRIC MAP FOR THE ESCARPMENT BETWEEN KP8 AND KP11

2.3.3.2 Seabed morphology and sediment characteristics

Seabed morphological features along the cable route and within the study area include:

- Blocks and maerl
- Clay/silt mixture
- Coarse sand and maerl
- Dense maerl
- Fine sand
- Medium sand
- Medium to coarse sand
- Medium to coarse sand with ripples
- Rock outcrops
- Possible outcrop encrusted with algae
- *Posidonia oceanica* on rock
- Dense *Posidonia oceanica*
- *Cymodocea*
- Pockmarks area
- Mound with bioconstructions
- Megaripple
- Trawl scar area
- UXOs and anthropogenic debris
- Scar
- Terrace Scarp
- Aircraft wreck

Maps of the seabed features along the cable route is shown in Figure 47 to Figure 50. A seabed substrates map has also been generated from the EMODNET portal, as presented in Figure 51. The cable will pass over sand (close to the shore), mixed sediment and rocks & boulders (close to the EEZ boundary).

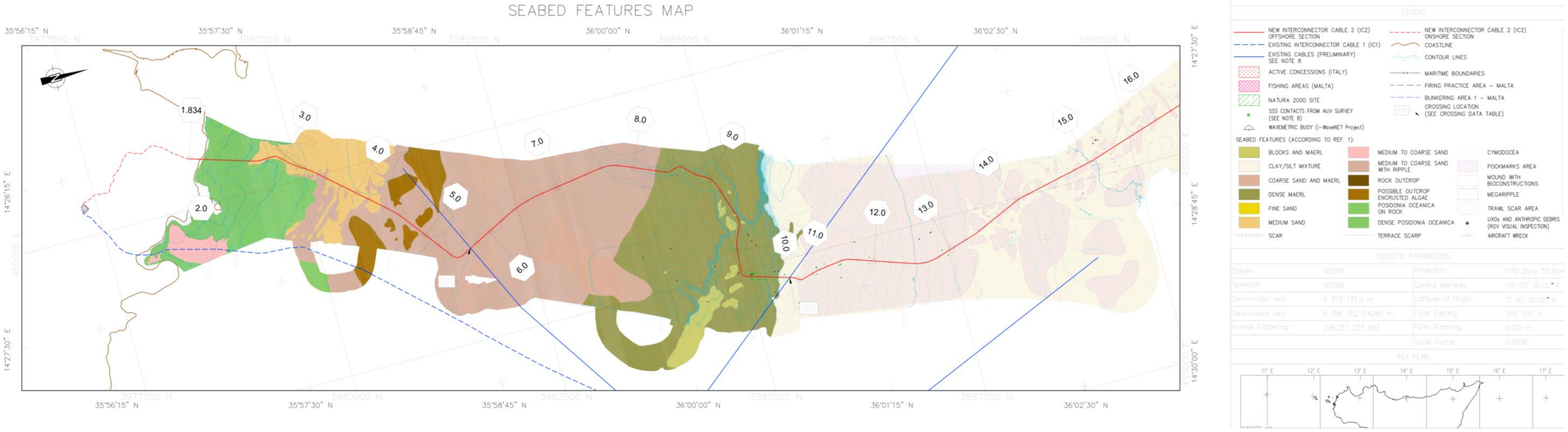

Figure 47: Seabed Features Between KP2 and KP16

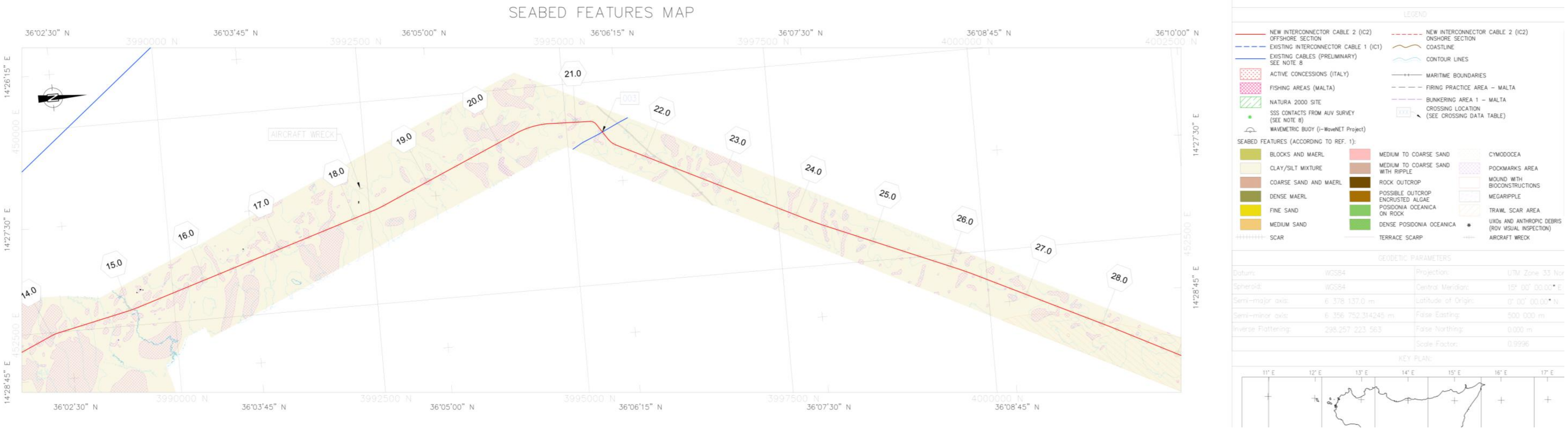

Figure 48: Seabed Features Between KP14 and KP28

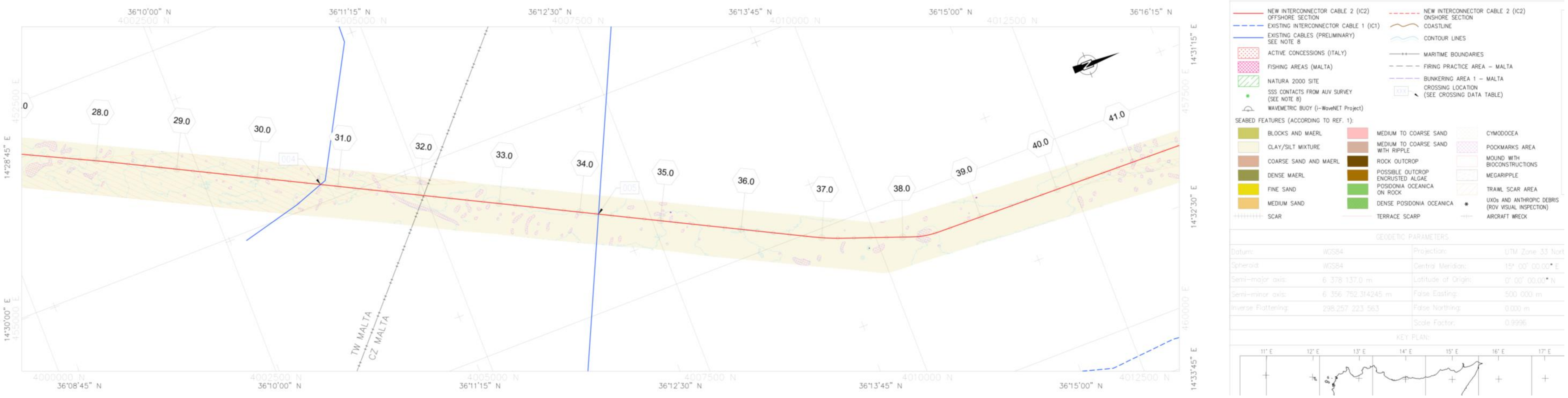

Figure 49: Seabed Features Between KP28 and KP41

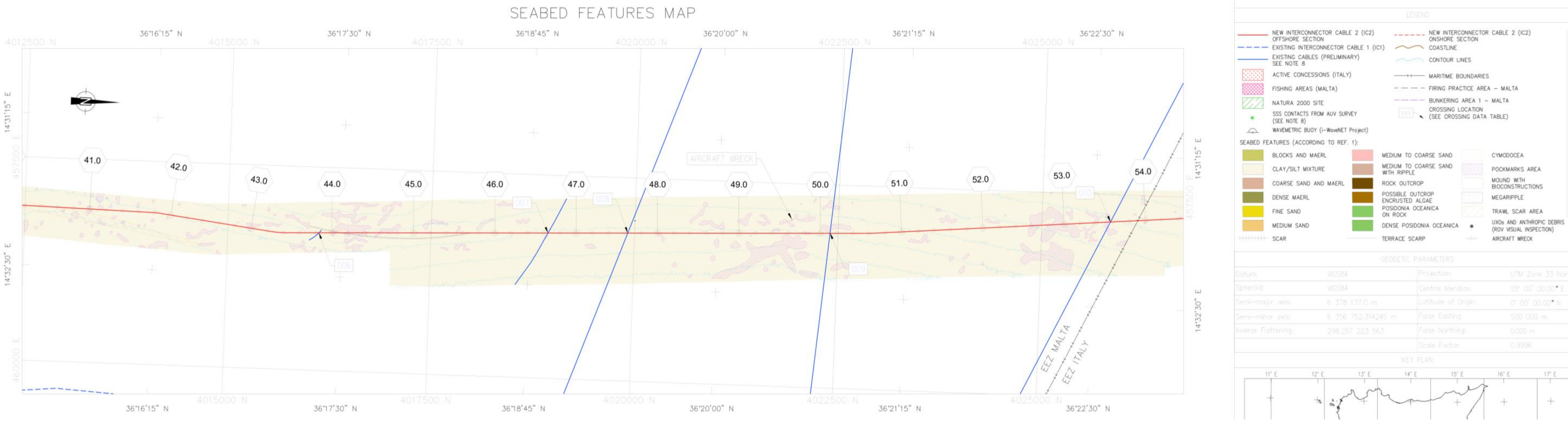

Figure 50: Seabed Features Between KP41 and KP54 (EEZ Boundary)

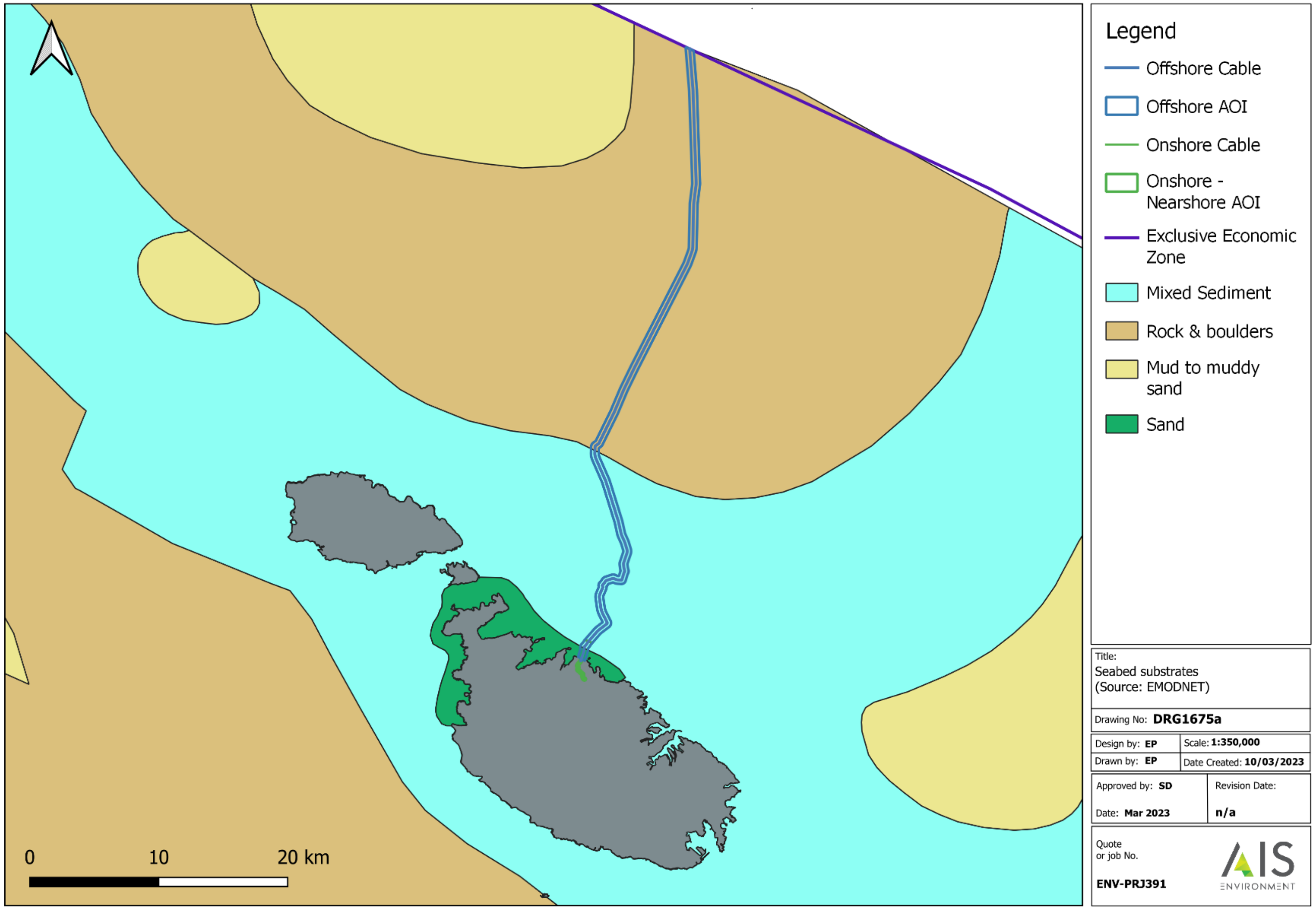

Figure 51: Seabed Substrates Map (Source: EMODNET)

2.3.3.3 Benthic habitats & species

The EUNIS seabed habitats map produced by EMODNet is shown in Figure 52. The list of EUNIS habitats which overlaps the AoI is reproduced below:

- MB15: Mediterranean infralittoral rock
- MB252: Biocenosis of [Posidonia oceanica]
- MB2523: Facies of dead "mattes" of [Posidonia oceanica] without much epiflora
- MB35: Mediterranean infralittoral coarse sediment
- MB55: Mediterranean infralittoral sand
- MB65: Mediterranean infralittoral mud
- MC151: Coralligenous biocenosis
- MC35: Mediterranean circalittoral coarse sediment
- MC45: Mediterranean circalittoral mixed sediment
- MC451: Biocenosis of Mediterranean muddy detritic bottoms
- MC651 Biocenosis of Mediterranean circalittoral coastal terrigenous muds
- MD151: Biocenosis of Mediterranean shelf-edge rock
- MD451: Biocenosis of Mediterranean open-sea detritic bottoms on shelf-edge
- MD651: Biocenosis of Mediterranean offshore circalittoral coastal terrigenous muds
- ME15: Mediterranean upper bathyal rock
- MF15: Mediterranean lower bathyal rock
- ME35: Mediterranean upper bathyal coarse sediment
- MF35: Mediterranean lower bathyal coarse sediment
- ME45: Mediterranean upper bathyal mixed sediment
- MF45: Mediterranean lower bathyal mixed sediment
- ME55: Mediterranean upper bathyal sand
- MF55: Mediterranean lower bathyal sand
- ME65: Mediterranean upper bathyal mud
- MF65: Mediterranean lower bathyal mud

Important benthic habitats and species are discussed in the following subsections.

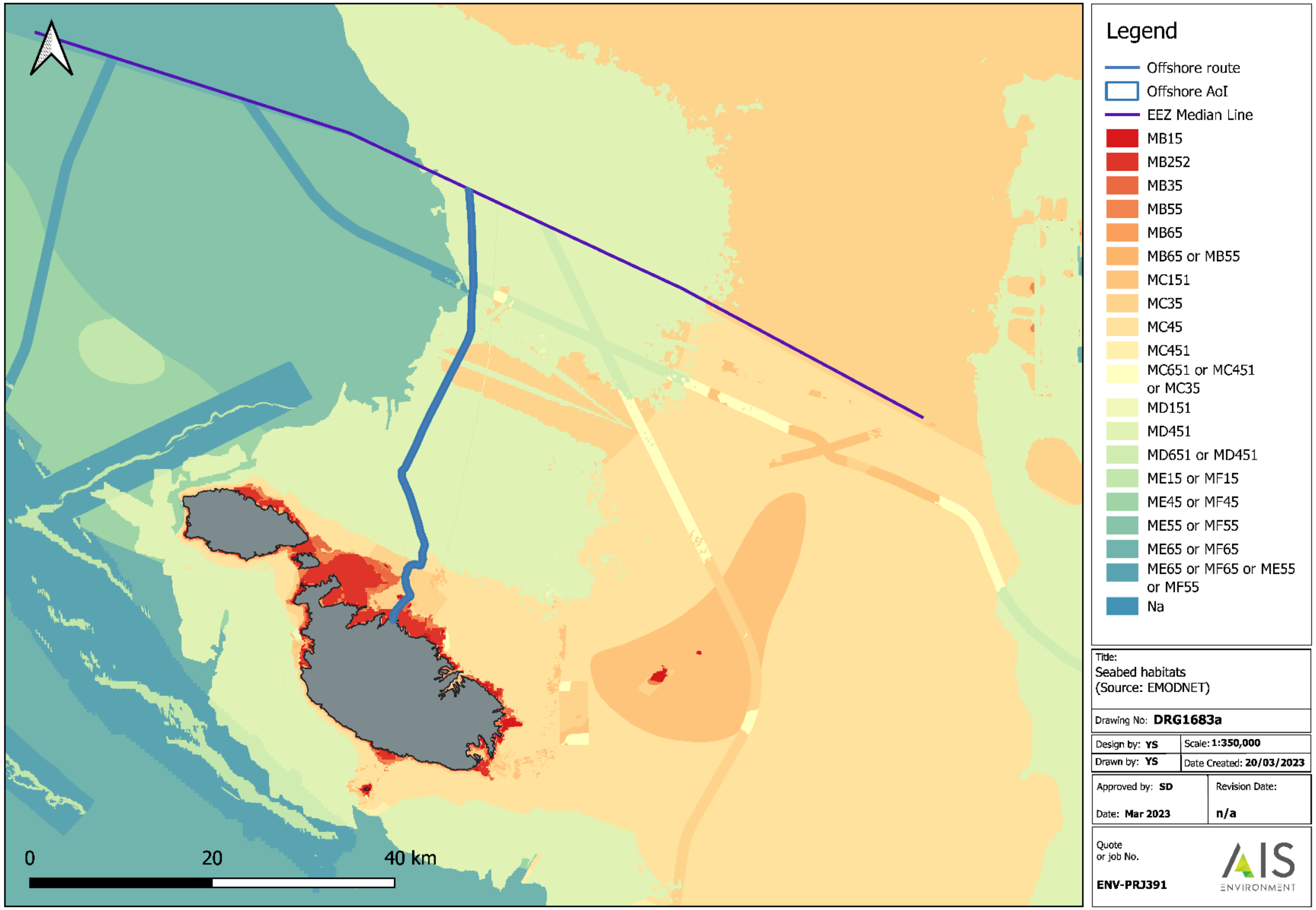

Figure 52: EUNIS Seabed Habitats (Source: EMODNet)

The PMRS contractor also undertook marine surveys to identify seabed benthic habitats. The important benthic habitats noted along the cable route and within the study area include:

- *Posidonia oceanica*
- Maërl & Coralligenous Outcrops

No *Cymodocea nodosa* was noted in the Maltese AoI. These habitats are described in further detail in the following subsections.

2.3.3.4 Biocenosis of *Posidonia oceanica*

P. oceanica meadows (Habitat MB252) are found in the nearshore segment of the planned cable route, in the AoI up to about KP1.5, as shown in Figure 53. This species occurs in continuous meadows, as well as reticulate meadows interspersed with patches of sand, exposed *P. oceanica* matte (Habitat MB2523) and areas which have accumulated dead *P. oceanica* leaves. Extracts from the ROV transects undertaken by the PMRS contractor are shown in Figure 54 to Figure 55.

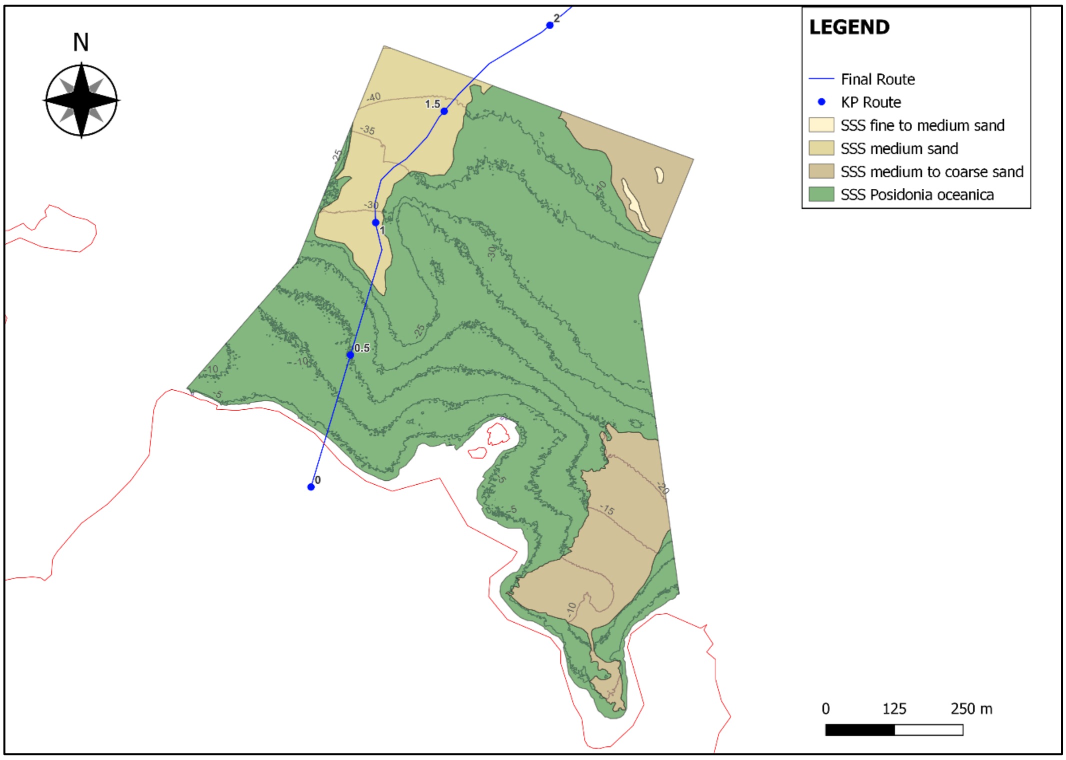

Figure 53: *P. oceanica* in Nearshore Zone (KP0.0 to KP1.5)[26]

[26] Fugro (2023). *Posidonia oceanica/Sensitive Marine Habitat Study*.

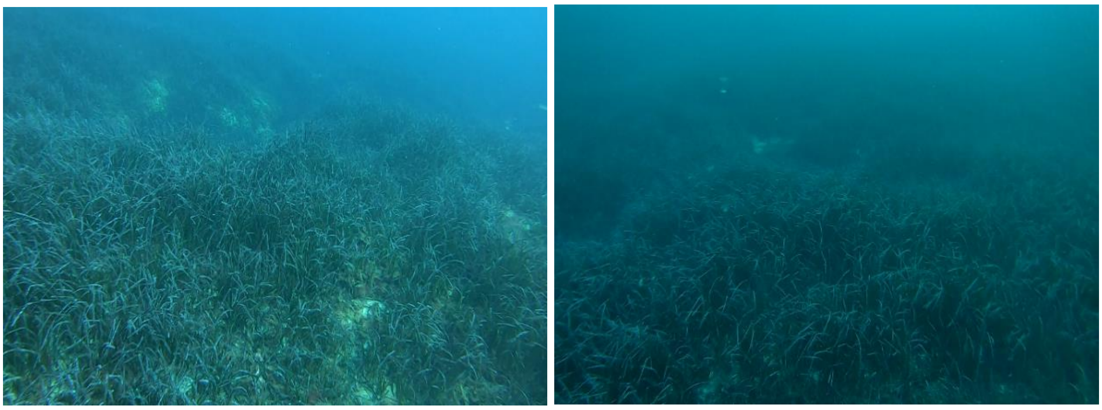

FIGURE 54: CONTINUOUS *P. OCEANICA* MEADOWS

FIGURE 55: RETICULATE *P. OCEANICA* MEADOWS WITH EXPOSED MATTE, SANDY PATCHES AND DEAD *P. OCEANICA* LEAVES

2.3.3.5 Maërl & Coralligenous Outcrops

As outlined in the PMRS reports, the offshore part of the AoI (between KP1.5 to KP 8.0) primarily consists of a mosaic of maërl beds (Habitat MC3523) and coralligenous outcrops (Habitat MC151). Maërl comprises of red coralline algae which forms dense beds or loose rhodoliths. The seabed in this area is mapped in Figure 56.

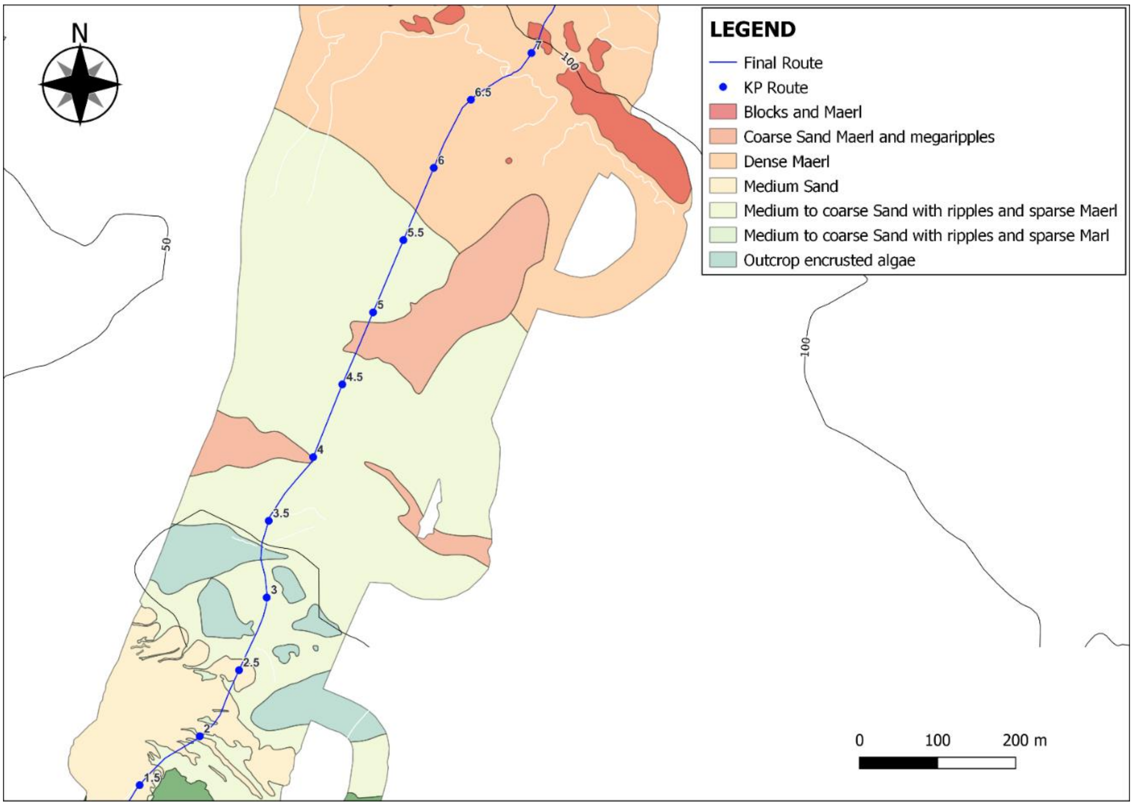

FIGURE 56: MAËRL & CORALLIGENOUS OUTCROPS ALONG THE OFFSHORE ROUTE (KP1.5 TO KP7.0)[27]

From KP1.5 to KP2.5, the seafloor is dominated by a large patch of medium to coarse sand with some interspersed ripples and patches of loose maërl. Between KP2.5 and KP5.5, the seabed largely comprises of medium to coarse sand with scattered maërl patches. In this part of the AoI, there are also interspersed patches of coralligenous outcrops and encrusting algae in the south area (KP2.5 to KP3.5). In KP2.5-KP3.5, there are two large patches of maërl beds among coarse sand on the eastern side and one on the western side of the cable route. Megaripples of maërl are also present in the middle-north section of the AoI between KP3.5 to KP6.0. Photos of this habitat are shown in Figure 57 to Figure 56.

[27] Fugro (2023). *Posidonia oceanica/Sensitive Marine Habitat Study*.

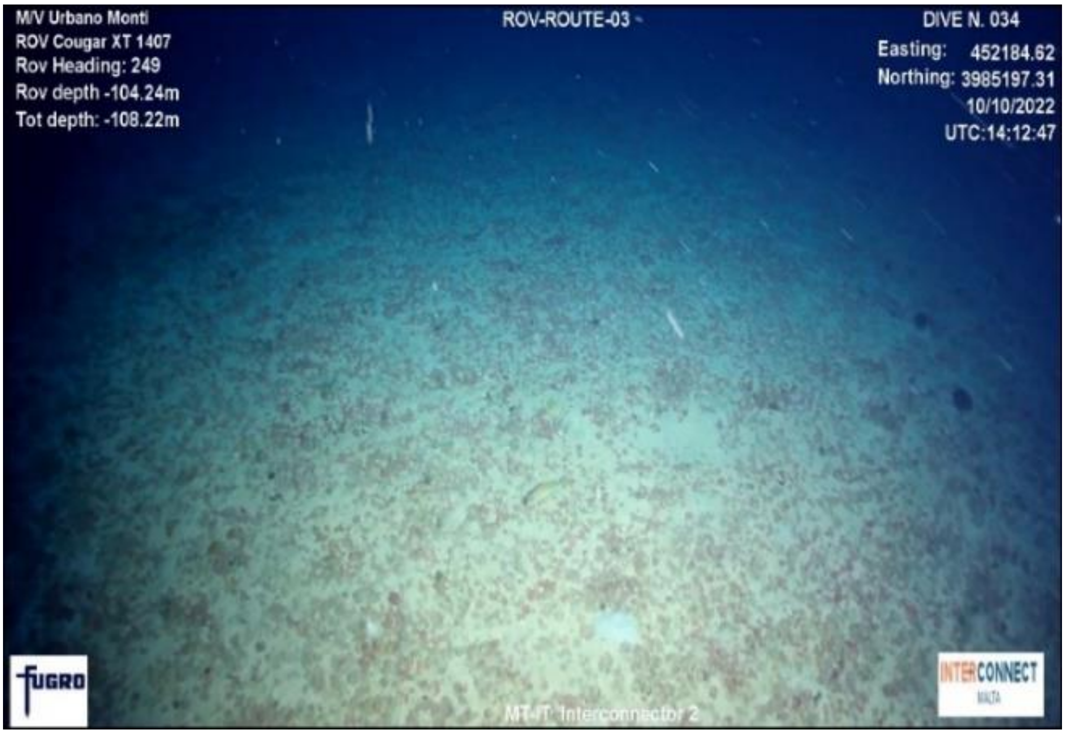

FIGURE 57: LOOSE MAËRL BEDS IN THE OFFSHORE ZONE

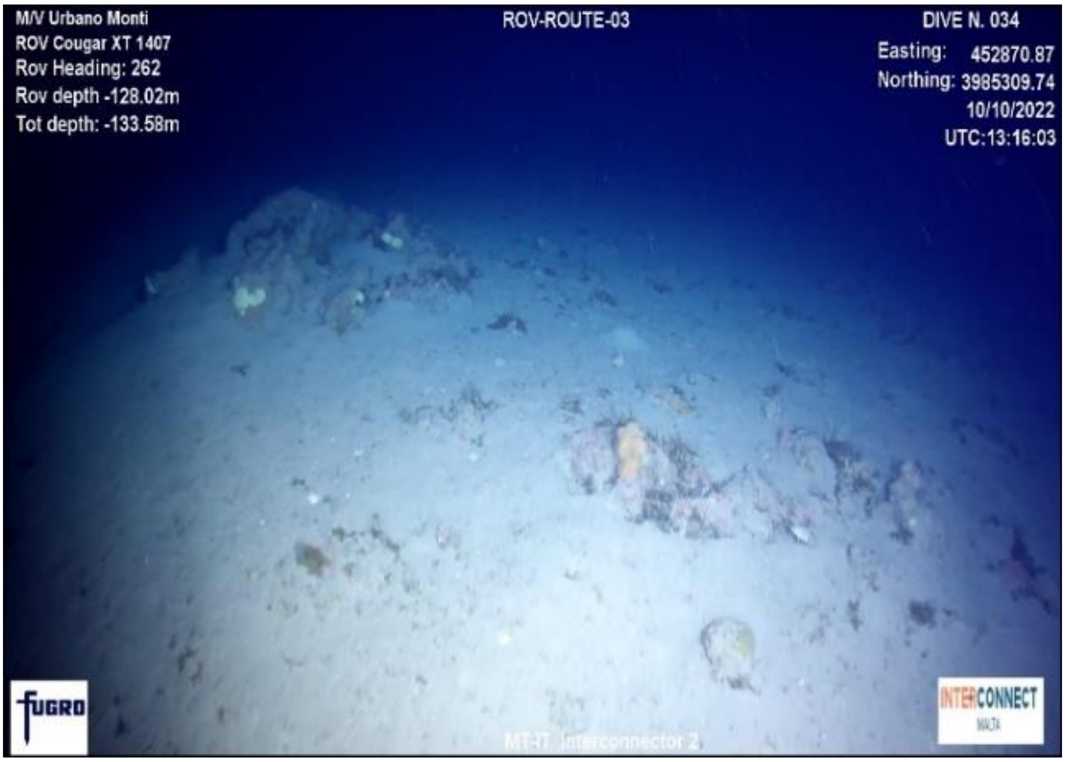

FIGURE 58: MAËRL BEDS IN RIPPLING FASHION IN THE OFFSHORE ZONE

FIGURE 59: CORALLIGENOUS OUTCROPS

The seabed between KP 5.0 and KP8.0 is dominated by a dense and extensive maërl bed with interspersed blocks and high-density maërl patches. This habitat supports an array of macroalgae such as *Halimeda tuna*, crustose coralline algae (CCA), Echinoderms (*Anseropoda placenta*, *Astropecten* spp.) and cnidarians (*Alcyonium digitamum*). Photos of this habitat are shown in Figure 61 and Figure 62.

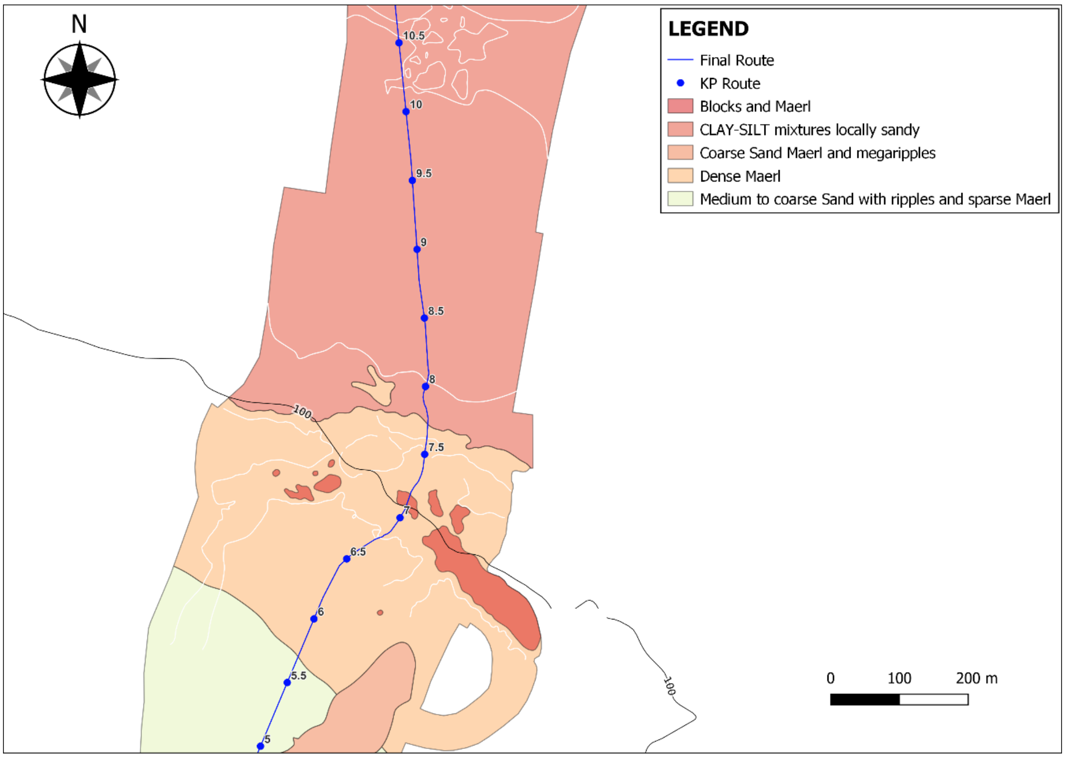

Figure 60: Maërl, Blocks and Sand between KP5.5 and KP10.5[28]

Figure 61: Dense Maërl Bed with *Halimeda tuna*

[28] Fugro (2023). *Posidonia oceanica/Sensitive Marine Habitat Study*.

FIGURE 62: DENSE MAËRL BED WITH *HALIMEDA TUNA*, SPONGES AND FISH

2.3.3.6 Fish & other pelagic species

In the Mediterranean, small pelagic fish are the main fishery resource in quantity of catches, primarily represented by three species: the sardine, anchovy and round sardinella.[29] Large pelagic fish mostly occur beyond the 12nm of territorial waters in the Mediterranean Sea. The diversity of large pelagic fish in the Mediterranean includes the North Atlantic Bluefin Tuna (*Thunnus thynnus*), the swordfish (*Xiphias gladius*) and some shark species.[30]

A total of 412 fish species have been confirmed in Maltese waters in a recent study.[31] Unfortunately, the species are not classified according to location and/or depth, and the presence of these pelagic species within the AoI cannot be discounted, particularly in the more productive nearshore areas. Protected fish species known to occur in the Maltese Islands are listed in Table 28.[32]

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[29] Lleonart, J. (2011). Fishery: Resources in the Mediterranean. https://www.iemed.org/wp-content/uploads/2011/09/Fishery-Resources.pdf.

[30] IUCN (2010). Mediterranean Pelagic Habitat: Oceanographic and Biological Processes, An Overview. https://www.rac-spa.org/sites/default/files/doc_fsd/med_pelagic_habitats.pdf.

[31] Borg, J. A., Dandria, D., Evans, J., Knittweis, L., & Schembri, P. J. (2023). A critical checklist of the Marine Fishes of Malta and surrounding waters. *Diversity*, *15*(2), 225. https://doi.org/10.3390/d15020225.

[32] FishBase (n.d.). List of marine fishes reported from Malta. https://www.fishbase.se/country/CountryChecklist.php?what=list&trpp=50&c_code=470&csub_code=&cpresence=reported&sortby=alpha2&vhabitat=saltwater.

TABLE 28: PROTECTED FISH SPECIES KNOWN TO OCCUR IN MALTESE WATERS

SPECIES	COMMON NAME	IUCN RED LIST FOR THE MEDITERRANEAN	LOCAL PROTECTION STATUS[33]
Acipenser sturio	European Sea Sturgeon	N/A	Schedule II and Schedule V
Alosa alosa	Allis shad	RE	Schedule II
Alosa fallax	Twait shad	N/A	Schedule II

Some fish species were observed within the AoI among the maërl bed during the ROV survey undertaken by the PMRS contractors. Comber (*Serranus cabrilla*) and the Common Pandora (*Pagellus erythrinus*) were noted.

Other marine fauna known to occur in the Mediterranean Sea are presented in Table 29. Further information on the trophic characteristics of these species can be found in the Marine Fauna Observations Report prepared by the PMRS contractor.

TABLE 29: MAMMALS & REPTILES KNOWN TO OCCUR IN THE MEDITERRANEAN SEA

GROUP	SPECIES	COMMON NAME	IUCN RED LIST FOR THE MEDITERRANEAN	LOCAL PROTECTION STATUS[33]
Pinnipeds	*Monachus monachus*	Monk seal	CR	Schedule II and Schedule V
Baleen whales	*Balaenoptera physalus*	Fin whale	VU	N/A
Toothed whales	*Delphinus delphis*	Short-beaked common dolphin	EN	N/A
	Gampus griseus	Risso's dolphin	DD	N/A
	Globicephala melas	Long-finned pilot whale	DD	N/A
	Physeter macrocephalus	Sperm whale	EN	N/A
	Stenella coeruleoalba	Striped dolphin	VU	N/A

[33] S.L. 549.44. Flora, Fauna and Natural Habitats Protection Regulations.

GROUP	SPECIES	COMMON NAME	IUCN RED LIST FOR THE MEDITERRANEAN	LOCAL PROTECTION STATUS[33]
	Steno bredanensis	Rough-toothed dolphin	NE	N/A
	Tursiops truncatus	Common bottlenose dolphin	VU	Schedule II
	Ziphius caviristris	Cuvier's beaked whale	DD	N/A
	Orcinus orca	Orca whale	DD	N/A
Porpoise	*Phocoena phocoena*	Harbour porpoise	VU	Schedule II
Reptiles	*Caretta caretta*	Loggerhead turtles	VU	Schedule II and Schedule V
	Chelonia mydas	Green turtle	EN	Schedule II and Schedule V
	Lepidochelys olivacea	Olive turtle	N/A	N/A
	Lepidochelys kempii	Olive ridly turtle	N/A	Schedule V
	Dermochelys coriacea	Leatherbacks	N/A	Schedule V

The PMRS contractors (Fugro) also undertook a marine fauna observations survey. The study area represented the cable route between Malta and Sicily, as shown in Figure 63. The whole survey resulted in a total of 139 visual sightings, including 12 individuals of loggerhead turtle (*Caretta caretta*, Figure 65), 10 individuals of bottlenose dolphin (*Tursiops truncatus*, Figure 66). There was also one sighting of the swordfish (*Xipias gladius*) and several sightings of the Atlantic bonito (*Sarda sarda*), but these species occurred in Italian waters. All sightings (including some seabirds and land birds) are mapped in Figure 64.

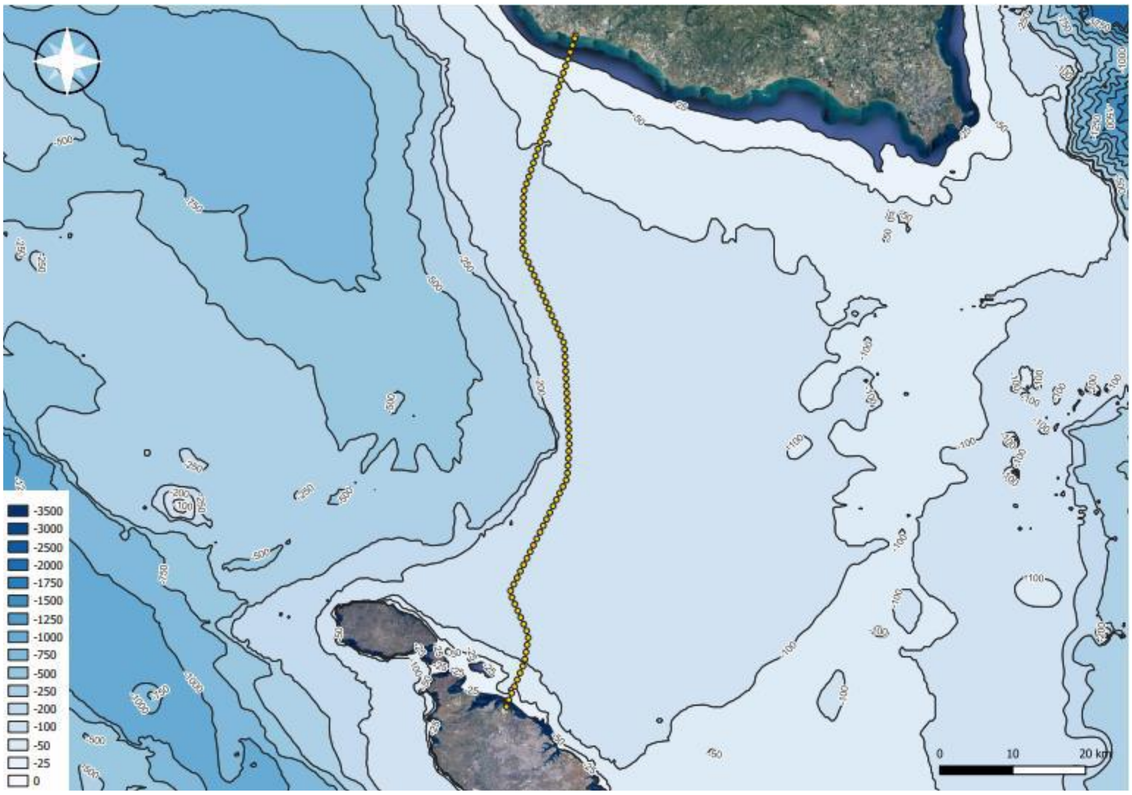


FIGURE 63: SURVEY AREA FOR THE MARINE FAUNA OBSERVATIONS SURVEY

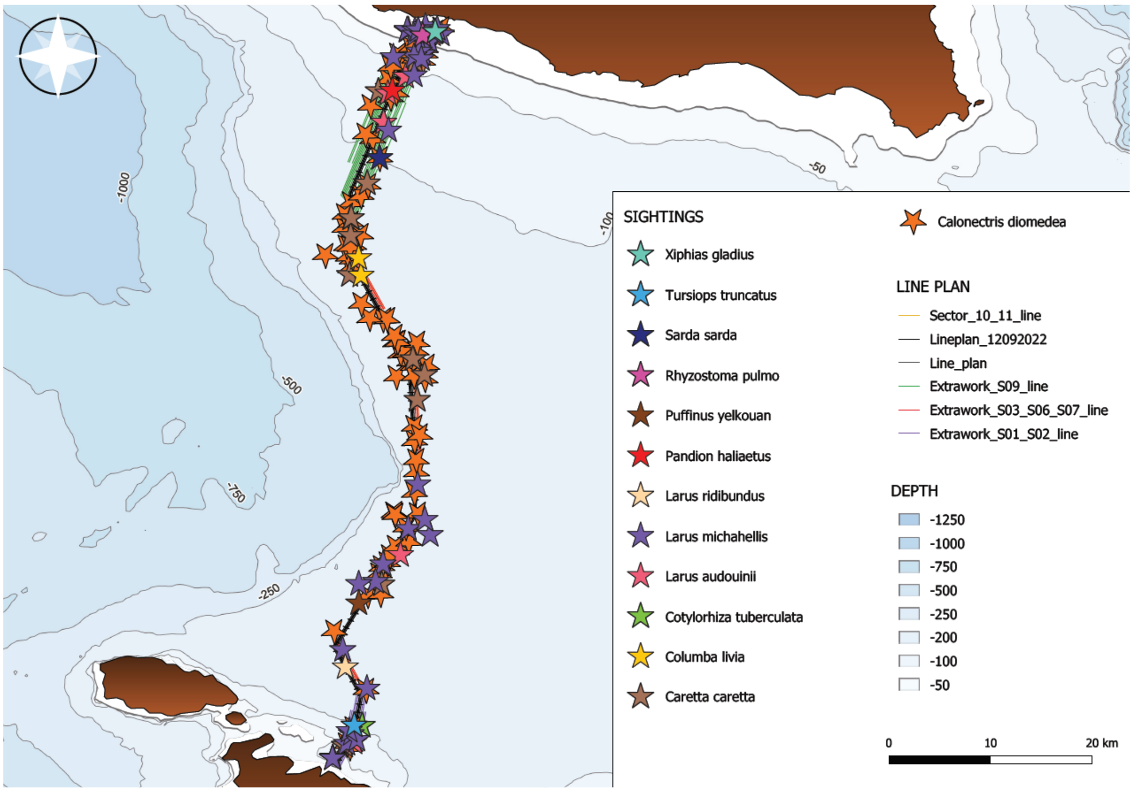


FIGURE 64: MAP OF ALL SIGHTINGS DURING THE MARINE FAUNA OBSERVATIONS SURVEY

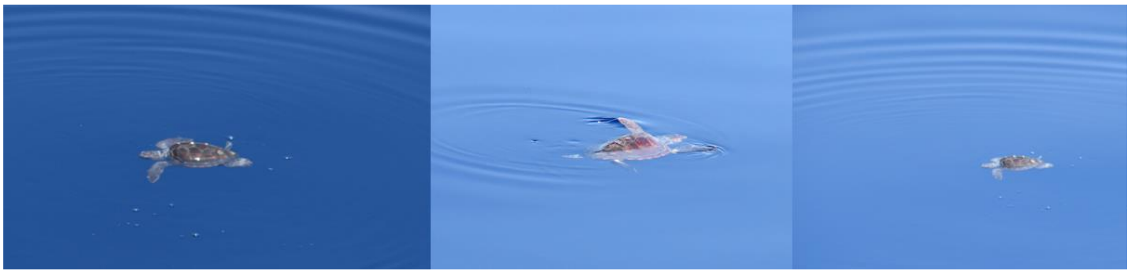


FIGURE 65: SIGHTINGS OF LOGGERHEAD SEA TURTLES (*CARETTA CARETTA*)

FIGURE 66: SIGHTINGS OF BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*)

2.3.3.7 Conservation status

The AoI passes through a marine protected area. This protected area is the Natura 2000 MT0000105 site known as: *Zona fil-Bahar bejn il Ponta ta' San Dimitri (Ghawdex) u il-Qaliet*. This site is designated as an SCI (Site of Community Interest of international importance) and SAC (Special Area of Conservation) via GN No. 682 of 2018, in accordance with the FLORA, FAUNA AND NATURAL HABITATS PROTECTION REGULATIONS, 2016 (S.L. 549.44).

MT0000105 is home to four different habitat types, reproduced in Table 30, three of which have been observed in the AoI.

TABLE 30: HABITAT TYPES KNOWN TO OCCUR IN MT0000105

HABITAT		COVER (HA)	NUMBER	NOTED IN AOI?
1110	Sandbanks which are slightly covered by sea water all the time	33.52	N/A	Yes
1120	Posidonia beds (Posidonion oceanicae)	5011.68	N/A	Yes
1170	Reefs	84.44	N/A	Yes
8330	Submerged or partially submerged sea caves	N/A	64	No

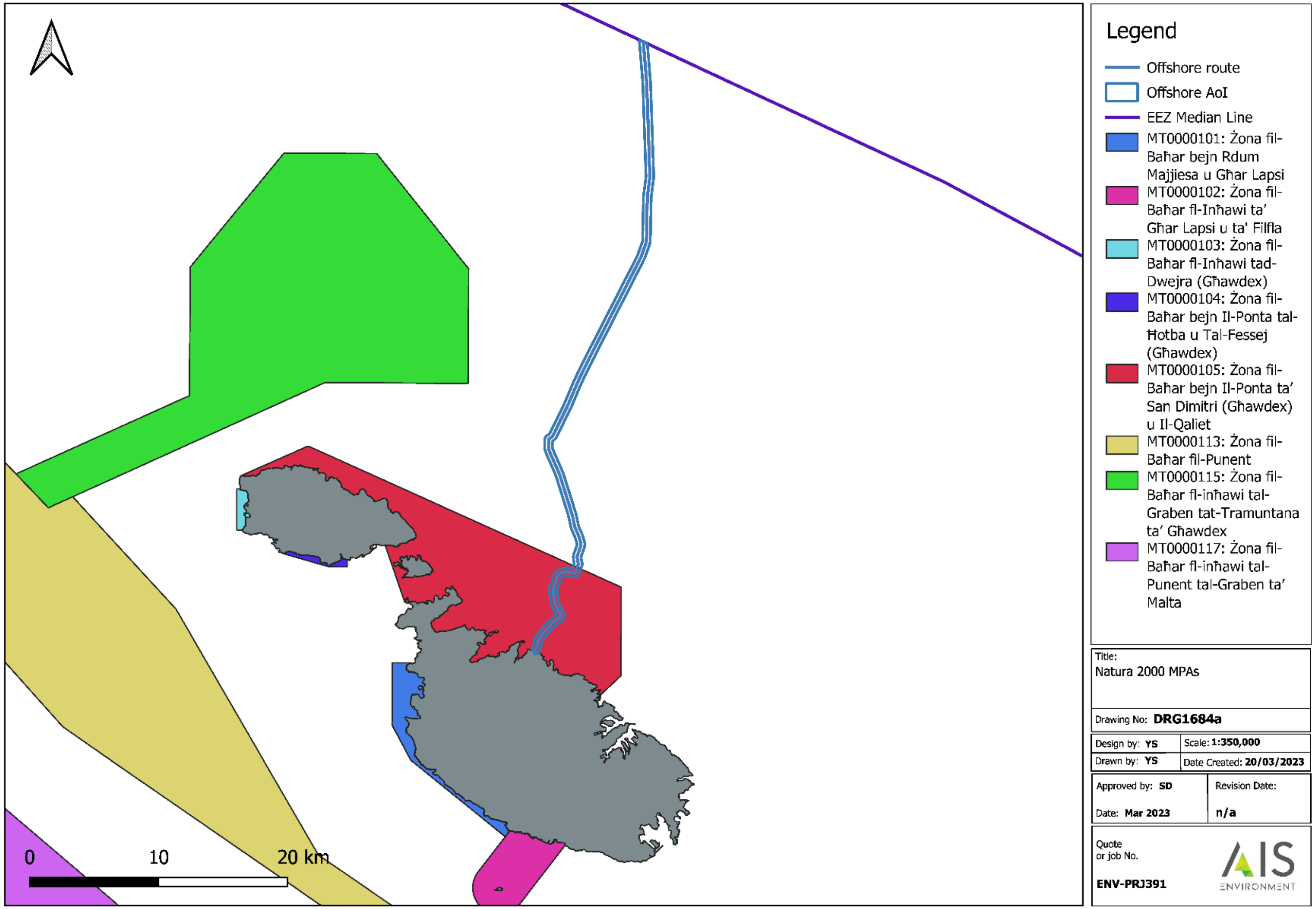


FIGURE 67: MARINE PROTECTED AREAS IN THE AOI

2.3.4 Onshore Noise Study

2.3.4.1 Baseline Sound Survey

The assessment is based on the fixed noise limit guidelines established for the identified ecological receptors. For additional context, reference is made to a previous baseline sound survey for the Maghtab Waste to Energy Facility carried out in early 2020, which describes the existing sound climate about the development area (document Ref: PA/03012/20 VERSION 1, dated 15/05/2020).

Baseline sound measurements were undertaken during both daytime and night-time periods at four locations as indicated in Figure 68.

- P1: Next to two residential units along the northernmost part of Triq ir-Ramla;
- P2: Next to residential units along the southernmost part of Triq ir-Ramla;
- P3: Inside Salini nature reserve, also to include Hotel Salini;
- P4: Next to a popular bathing area just off Tul il-Kosta.

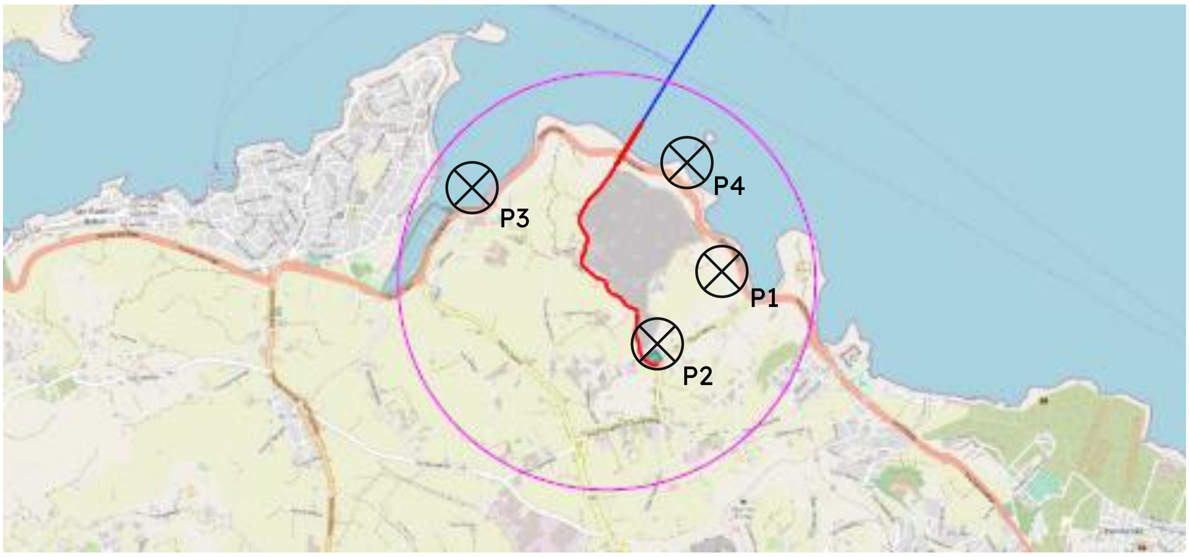


FIGURE 68: NOISE MONITORING LOCATIONS

The results of the sound survey are summarised in Table 31 including the median background sound level (L_{A90}), median L_{A10} and the ambient noise level (L_{Aeq}) and the highest L_{AFmax} values. The daytime period is taken between 07:00 and 23:00 hours and the night-time between 23:00 and 07:00 hours

TABLE 31: SOUND SURVEY SUMMARY

LOCATION	TIME PERIOD	L_{AEQ}	L_{A90}	L_{A10}	L_{AFMAX}
P1	Daytime	58.9	41.3	60.1	83.6
	Night-time	46.9	35.9	40.8	75.7
P2	Daytime	70.0	47.7	72.0	95.5
	Night-time	54.7	36.9	45.9	80.6
P3	Daytime	71.7	55.7	75.3	90.1
	Night-time	66.3	42.1	66.2	86.5
P4	Daytime	57.7	54.1	58.8	84.4

Measurement location P4 is representative of the prevailing sound climate at the identified ecological receptors and has been considered most relevant to this assessment in context. The measured daytime level has been summarised as 58 dB $L_{Aeq,16\ hour}$ rounded to the nearest decibel.

2.3.5 Offshore Noise Study

Ocean ambient noise poses a baseline limitation on the use of sound by marine animals, as signals of interest must be detected against background noise. The level and frequency characteristics of the ambient noise environment are the two major factors that control how far away a given sound signal can be detected (Richardson et al. 2013).

Ocean ambient noise is comprised of a variety of sounds of different origins at different frequency ranges, having both temporal and spatial variations. It primarily consists of noise from natural physical events, the noise produced by marine biological species and anthropogenic noise. These sources are detailed as follows:

Natural events: the major natural physical events contributing to ocean ambient noise include, but are not limited to, wave/turbulence interactions, wind, precipitation (rain and hail), breaking waves and seismic events (e.g., earthquakes/tremors):

- The interactions between waves/turbulence can cause very low-frequency noise in the infrasonic range (below 20 Hz). Seismic events such as earthquakes/tremors and underwater volcanos also generate noise predominantly at low frequencies from a few Hz to a few hundred Hz;
- Wind and breaking waves, as the prevailing noise sources in much of the world's oceans, generate noise across a very wide frequency range, typically dominating the

ambient environment from 100 Hz to 20 kHz in the absence of biological noise sources. The wind-dependent noise spectral levels also strongly depend on sea states which are essentially correlated with wind force; and

- o Precipitation, particularly heavy rainfall, can produce much higher noise levels over a wider frequency range of approximately 500 Hz to 20 kHz.

Bioacoustic production: some marine animals produce various sounds (e.g., whistles, clicks) for different purposes (e.g., communication, navigation, or detection):

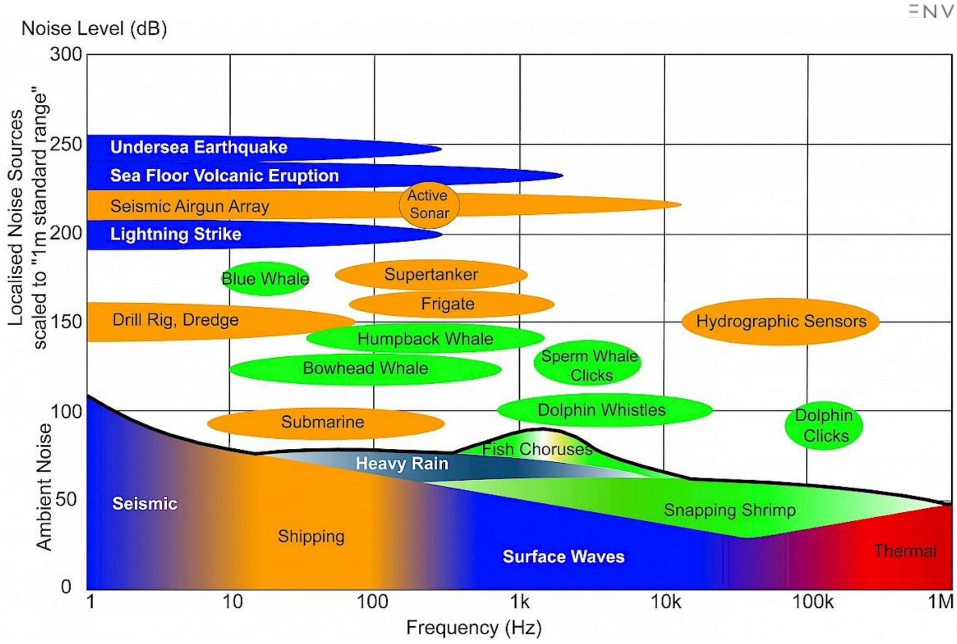
- o Baleen whales (e.g., great whales like humpback whales) regularly produce intense low-frequency sounds (whale songs) that can be detected at long range in the open water. Odontocete whales, including dolphins, can produce rapid bursts of high-frequency clicks (up to 150 kHz) that are primarily for echolocation purposes;
- o Some fish species produce sounds individually, and some species also make noise in choruses. Typically, fish chorusing sounds depend on species, time of day and time of the season; and
- o Snapping shrimps are important contributors among marine biological species to the ocean ambient noise environment, particularly in shallow coastal waters. The noise from snapping shrimps is extremely broadband in nature, covering a frequency range from below 100 Hz to above 100 kHz. Snapping shrimp noise can interfere with other measurement and recording exercises; for example, it can adversely affect sonar performance.

Anthropogenic sources: anthropogenic noise primarily consists of noise from shipping activities, offshore seismic explorations, marine industrial developments and operations, as well as equipment such as sonar and echo sounders:

- o Shipping traffic from various sizes of ships is the prevailing man-made noise source around nearshore port areas. Shipping noise is typically due to cavitation from propellers and thrusters, with energy predominantly below 1 kHz;
- o Pile driving and offshore seismic exploration generate repetitive pulse signals with intense energy at relatively low frequencies (hundreds of Hz) that can potentially cause physical injuries to marine species close to the noise source. The full frequency range for these impulsive signals could be up to 10 kHz; and
- o Dredging activities and other marine industry operations are additional man-made sources generating broadband noise over relatively long durations.

An overview of the indicative noise spectral levels produced by various natural and anthropogenic sources relative to typical background or ambient noise levels in the ocean is shown in **Figure 69**. Human contributions to ambient noise are often significant at low frequencies, between about 20 Hz and 500 Hz, with ambient noise in this frequency range being predominantly from distant shipping (Hildebrand 2009). In areas away from anthropogenic sources, background noise at higher frequencies tends to be dominated by natural physical or bioacoustics sources such as rainfall, surface waves and spray, fish choruses, and snapping shrimp for coastal waters.

FIGURE 69: LEVELS AND FREQUENCIES OF ANTHROPOGENIC AND NATURALLY OCCURRING SOUND SOURCES IN THE MARINE ENVIRONMENT (FROM HTTPS://WWW.OSPAR.ORG/WORK-AREAS/EIHA/NOISE). NATURAL PHYSICAL NOISE SOURCES REPRESENTED IN BLUE; MARINE FAUNA NOISE SOURCES IN GREEN; HUMAN NOISE SOURCES IN ORANGE



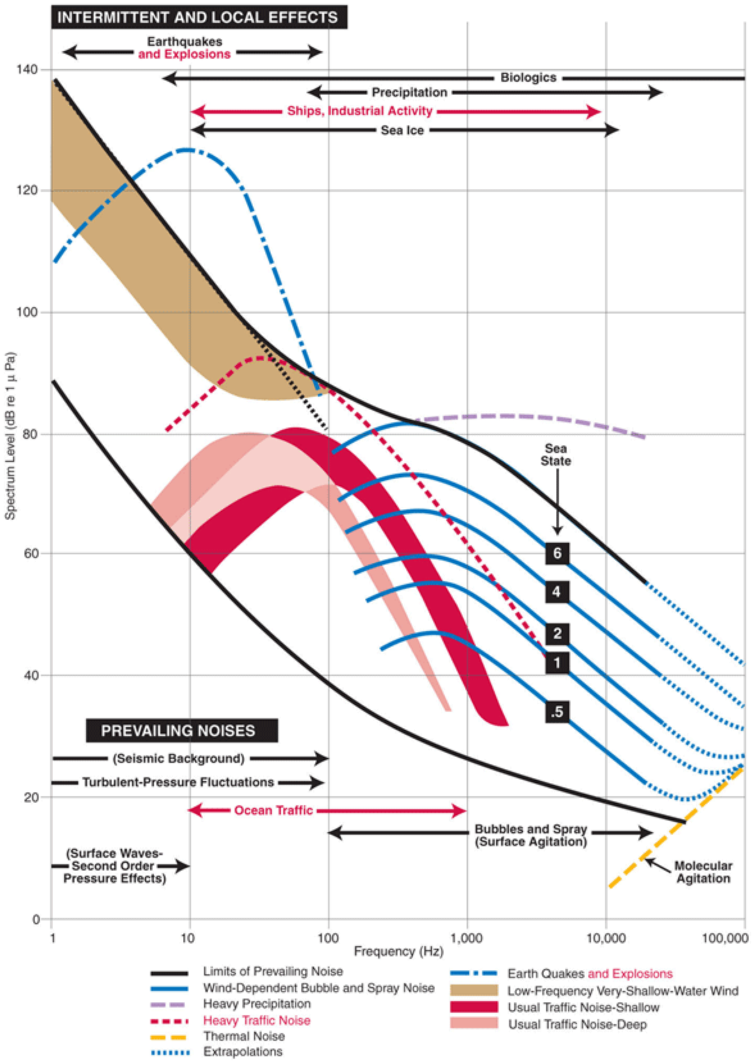
A summary of the spectra of various ambient noise sources based on a review study undertaken by Wenz (1962) is shown in **Figure 70**. It should be noted that although the spectral curves in the figure are based on average levels from reviewed references primarily for the North Atlantic Ocean, they are regarded as representative in general for respective ocean ambient noise spectral components.

Overall ambient noise levels typically range from approximately:

As low as 80 dB re 1 µPa for the frequency range 10 – 10 kHz for light surrounding shipping movements and calm sea surface conditions, to;

Up to 120 dB re 1 µPa for the 10 – 10 kHz frequency range for moderate to heavy remote shipping traffic and medium to high wind conditions.

FIGURE 70:SPECTRA AND FREQUENCY DISTRIBUTION OF OCEAN SOUND SOURCES BASED ON THE WENZ CURVES (MIKSIS-OLDS ET AL. 2013, ADAPTED FROM WENZ (1962))

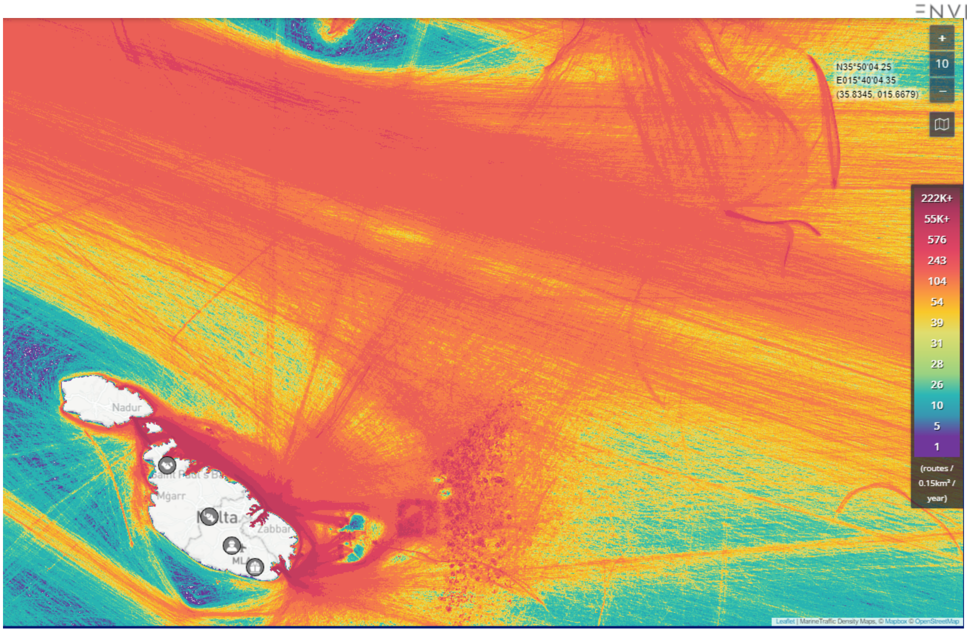


2.3.5.1 Shipping Traffic Offshore Malta

Shipping traffic density offshore Malta is shown in **Figure 71**. Major shipping routes are along the Malta coastline, connecting several points of the island. The figure shows that the site area has high shipping traffic density over the project area, particularly nearshore to Malta.

As such, the shipping noise component of the ambient noise environment is expected to be significant nearshore Malta and moderate offshore.

Figure 71: Shipping traffic density offshore Malta region (Source: http://www.marinetraffic.com/, accessed 16th February 2023)



2.3.5.2 Metocean conditions offshore Malta

A comprehensive metocean study has been performed for the design of the proposed submarine cable, including the wind distribution analysis based on long-term historical data for the Malta Channel derived from KNMI (The Royal Netherlands Meteorological Institute) observations from 1960 to 1980, hindcasted wind data during the period 1998 – 2017 at four DICCA (Dipartimento di Ingegneria Civile, Chimica e Ambientale) positions surrounding the pipeline route, as well as the long-term measurement data at one offshore monitoring location east of the pipeline route: Vega – a platform with a meteo-marine monitoring system installed (De Filippi 2019).

The annual wind rose from historical data in Malta Channel and long-term measurements at Vega indicate that the yearly prevailing wind directions are westerly to north-westerly, as shown in Figure 72. The frequency distributions of the wind speed vs incoming direction for the historical data based on KNMI observations from 1960 to 1980 are shown in Table 32. For yearly frequency distribution, wind speeds are below the speed of 6 m/s (i.e., Beaufort scale around 3) over 50% of the one-year period, over 15% of the period, the wind speeds within the range of 6 – 8 m/s (i.e., Beaufort scale around 4), and over 2% of wind speeds within the range of 16 – 20 m/s (i.e., Beaufort scale around 7 - 8).

Compared with generic ambient noise spectra in Wenz's curve in Figure 70, it illustrates that the offshore area surrounding the proposed IC2 route has generally calm sea state conditions and has a mid-range of wind-induced ambient noise spectral components.

FIGURE 72: ANNUAL WIND ROSE FROM HISTORICAL DATA (1960 - 1980) IN MALTA CHANNEL (LEFT) AND LONG-TERM MEASUREMENTS (2002 - 2017) AT VEGA (RIGHT).

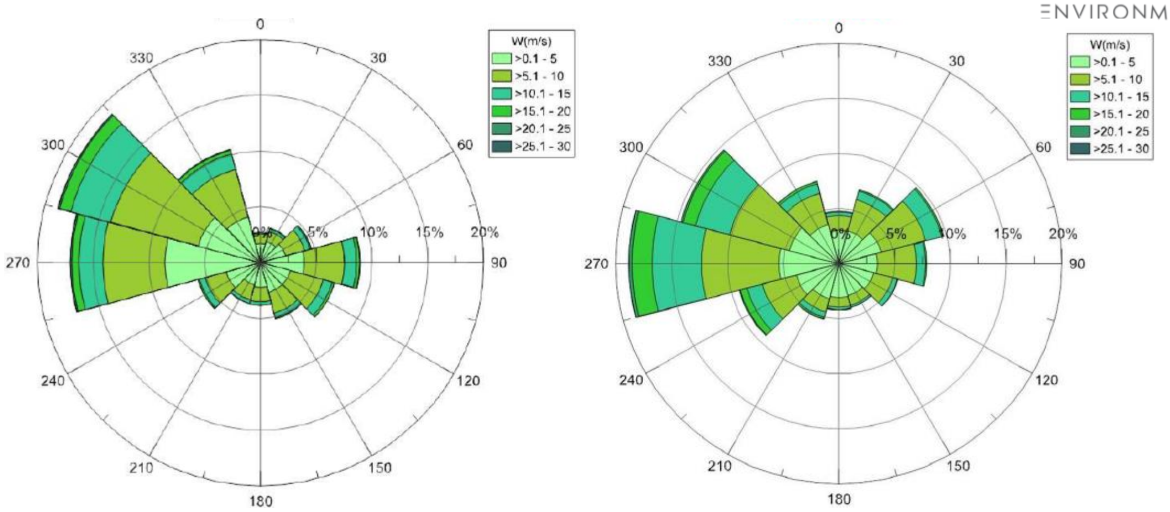


TABLE 32: FREQUENCY DISTRIBUTION (%) OF WIND SPEED VS INCOMING DIRECTION FOR HISTORICAL DATA IN MALTA CHANNEL (KNMI OBSERVATION 1960 - 1980)

DIRECTION (°N)	WIND SPEED (m/s)												
	4	6	8	10	12	14	16	18	20	22	24	>24	TOTAL
0	5.29	1.09	.58	.35	.11	.74	.04	.00	.01	.00	.00	.00	8.21
30	1.34	.87	.41	.26	.13	.07	.08	.02	.01	.01	.00	.00	3.19
60	1.54	1.20	.85	.48	.23	.20	.10	.05	.02	.01	.01	.00	4.69
90	2.68	1.99	1.64	1.12	.57	.40	.26	.09	.06	.01	.01	.00	8.82
120	1.81	1.71	1.35	.90	.50	.28	.15	.06	.04	.01	.00	.00	6.81
150	1.92	1.34	.88	.50	.24	.16	.08	.02	.01	.00	.00	.00	5.17
180	1.54	.97	.59	.38	.15	.12	.02	.01	.00	.00	.00	.00	3.78
210	1.47	.95	.64	.36	.18	.12	.03	.01	.00	.00	.00	.00	3.77
240	2.26	1.44	.82	.56	.27	.25	.08	.04	.02	.01	.00	.01	5.75
270	3.90	2.81	2.43	1.92	1.08	.87	.53	.17	.11	.08	.05	.02	13.96
300	3.64	3.62	3.35	3.13	1.81	1.64	.79	.33	.17	.08	.06	.02	18.64
330	2.63	2.49	2.02	1.43	.69	.63	.27	.10	.06	.03	.03	.02	10.39
TOTAL	30.02	20.49	15.56	11.40	5.96	5.47	2.43	.90	.51	.23	.15	.07	93.18
CALM:	6.82												

Given the high density of shipping traffic and moderate metocean conditions specific to the adjacent area surrounding offshore Malta (as described in the following relevant sections), the ambient noise levels are expected to be at least 10 dB higher than the lowest level, within the higher range of the typical ambient noise levels, i.e., 90 - 130 dB re 1 µPa for the frequency range 10 – 10 kHz.

3 IMPACT ASSESSMENT

3.1 CONSTRUCTION PHASE

3.1.1 Terrestrial Study

Figure 40 and Figure 73 show that the proposed area for trenching and HDD laydown will pose an adverse impact on the different ecosystems present along the entire route, including tree plantations, garigue, disturbed ground, and the internal road network in the ECOHIVE complex.

The partial take-up of garigue and partial disassembly of rubble walls will cause the destruction of all ecological features which are associated with the habitat types present within the AOI.

The impact is particularly relevant on life forms associated with the soil and rubble walls, particular soil infauna and sessile species.

Additionally, the Scheme is proposing the deposition of inert infill material on the northern garigue area near Triq il-Kosta to allow access for heavy machinery during the HDD drilling process and for the storage of raw material and waste. The area contains ecologically important species some of which are also protected in S.L.549.44 and S.L.549.123.

The construction of the temporary HDD lay down area involves clearing vegetation, flattening the ground, and compacting soil. This process is likely to result in the destruction of habitats and the loss of biodiversity in the area. The removal of vegetation can result in the loss of food and shelter for animals, and the destruction of the soil can disrupt the balance of nutrients in the ecosystem.

One of the most important impacts of the construction of the temporary lay down area is the loss of habitat for wildlife. The destruction of vegetation can lead to a decrease in food sources for herbivores, fauna shying away from the area, and a decrease in shelter for local biodiversity. The construction of the temporary lay down area can also cause physical harm to animals that inhabit the area, resulting in injury or death.

Another significant impact of the construction of the temporary lay down area is soil compaction. The heavy machinery used during the construction process can compact the soil, making it difficult for plant roots to grow and access nutrients, particularly because garigue and karst habitats are characterised by shallow soil pockets. This can result in the loss of vegetation and a decrease in soil stability, leading to erosion and sedimentation in nearby waterways. Soil compaction can also decrease the permeability of the soil, reducing the amount of water that can be absorbed, which can negatively impact water quality in a relatively xeric habitat.

The construction of the temporary lay down area can also result in the release of pollutants into the environment. The use of heavy machinery and construction materials can result in the release of pollutants such as nitrogen oxides, sulfur dioxide, and particulate matter into the air. These pollutants can harm both terrestrial and aquatic ecosystems, leading to health issues for both humans and wildlife. Since the duration of works in this area is temporary, the effects are unlikely to be long-lasting and significant. Furthermore, the prevailing wind direction is located in the opposite direction of the Natura 2000 site, therefore the impact of dust deposition onto l-Ghadira s-Safra and l-Iskoll tal-Ghallis is not significant.

The construction of a temporary lay down area to accommodate machinery for works on Horizontal Directional Drilling in an ecologically sensitive area can have severe ecological impacts. The destruction of habitats, soil compaction, and the release of pollutants can disrupt the balance of the terrestrial ecosystem and have long-lasting effects on the environment.

In conclusion, the laydown activity will result in the permanent destruction of the ecological communities in the area, which is considered a major adverse impact since it's located in an Area of Ecological Importance Level 3. Despite a major adverse impact on the ecological features present in the site (including infauna and surface habitats), it is pertinent to note that the construction works will not be carried out within the confinements of any terrestrial Natura 2000 sites mentioned in the previous sections of this report. Therefore, no loss of habitats, species and ecosystems are expected from Natura 2000 sites through the excavation process, as these activities are confined to the construction site boundary.

Figure 73: Temporary HDD laydown area

During excavation and construction, fine particles are produced that can be carried away from the site by wind and water. Windblown dust can harm nearby trees and vegetation by blocking and damaging their respiratory and photosynthetic surfaces, which can cause a decrease in their health and potentially alter the community structure. This suggests that windblown particles can have a significant and temporary negative impact on the local vegetation, particularly in ecologically sensitive areas.

Since the closest Natura 2000 site is about 300 meters away from the HDD laydown area and the prevailing wind direction is north-westerly, the nearby Natura 2000 sites are not expected to be affected by the dispersal of windborne dust. Conversely, the northern garigue area and the southern maquis areas denoted as Zone A and Zone B in Figure 21 may be adversely impacted by trenching and HDD preparation works.

Additionally, particulate matter can settle on the ground and be carried away by rainwater runoff, which can affect the quality of the surrounding substrate and harm low-lying species while burying propagules of important colonizing species. This may result in the proliferation of non-native species that could outcompete indigenous species if not properly managed. Despite these potential impacts, the generation of particulates during the construction phase is not considered to have significant or lasting effects, especially since these sites are already subjected to such impacts from the nearby landfilling operations. Furthermore, the likelihood of the impact decreases with distance, is influenced by the site's topography, and is also affected by the prevailing wind direction.

Noise, vibration and light emissions are likely to be produced during the construction phase of the Scheme. Noise and light pollution impacts are known to deter wildlife and to influence their behavioural patterns.

The assessment of construction noise has shown that the daytime and night-time threshold levels are not expected to be exceeded at the closest receptors. In addition, construction activities would be temporary and noise levels have been predicted for a worst-case scenario, resulting in no significant effects, particularly on Natura 2000 sites.

Excavation works will not be carried out at night, to minimise the disturbance towards local flora, fauna and nearby residential districts. Nevertheless, non-intensive construction works, including site maintenance, site upkeep and/or transportation of materials to the site may be carried out at night.

Subsequently, site illumination will be necessary if night-time activities are carried out, and impacts from light pollution on the biodiversity contained with the AOI are expected. Illumination is one of the most contentious issues with regards to nocturnal species especially avifauna, reptiles and mammals.

3.1.2 Avian Study

The proposed development will result in a temporary loss of potential breeding habitat for up to 8 terrestrial songbird species. The terrestrial part of the development, namely the onshore cable routing, will not be carried out inside Natura 2000 sites, however, the habitats disturbed during the construction phase along the trenched cable route and in the area of the HDD facility including a buffer set at 0.1 km provide nesting territories for some birds[34],[35]. Furthermore, any excavation material from the trenched cable route that will be used for refilling needs to be temporarily stored, while the excess excavation material needs to be permanently stored. The short-term disturbance and potentially long-term alteration or loss of additional breeding habitat for terrestrial species will depend on the location and area size utilized.

Several breeding territories of the Sardinian Warbler and the Zitting Cisticola, as well as single breeding territories of the Greater Short-toed Lark, the Cetti's Warbler and the Spectacled Warbler can be expected to be disturbed during the construction phase, if works will be carried out during the breeding season (March – August). 1-2 breeding pairs of Blue Rock Thrush could be disturbed during the construction phase, if works will be carried out during the breeding season (March – July). This can potentially lead to the complete temporary displacement and consecutive reduction in breeding success up to reproductive failure of the breeding pairs of these species during the construction phase if it coincides with the breeding season.

Foraging areas and potential colonial nest sites of the Spanish Sparrow can be expected to be reduced temporarily during the construction phase and some broods may fail if works are carried out during the breeding season (March – August).

No significant impact is expected on the population of Common Swift nesting in AoI-1 since no nest sites are expected to be disturbed during the construction phase.

Temporary habitat loss and disturbance can also be expected to result in the destruction of foraging areas for other breeding, wintering, and/or staging species in the AoI-1 depending on the period of the year in which the construction works will take place.

The impacts during the construction of the onshore cable route will act temporarily on a localised scale along the trenched route in AoI-1 and in the area of the HDD facility including the buffer, when creating the cable trench and culvert, placing the cable and re-filling the trench. These works are not expected to impact a significant proportion of the relevant bird populations on a national scale but are expected to impact few local breeders of common species significantly at least short-term.

3.1.2.1 Temporary reduction of available marine habitat (AoI-2)

Especially during the reproductive season seabirds are central place foragers, exploiting marine resources in a radius around the colonies. Marine habitat utilised by pelagic seabirds for foraging and resting will be reduced temporarily during the construction phase both, inside and a Natura 2000 site (marine SPA MT0000112) and in general along the offshore cable route in the Maltese EEZ. It can be expected that the three tubenose species holding significant populations in Maltese waters, will show avoidance behaviour in relation to the construction site (the cable laying vessel with 0.5 km buffer, AoI-2). However, due to the

[34] Sultana et al. (2011): The Breeding Birds of Malta. BirdLife Malta, Malta.

[35] Epsilon Malta Ltd, Nature Conservation Consultants (2019). Malta Breeding Bird Atlas 2018. Malta: Wild Birds Regulation Unit, Ministry for the Environment, Sustainable Development and climate Change

temporary and localized nature of this habitat reduction, the radius of 0.5 km around the construction site along the marine cable route, paired with the high mobility and flexibility of the relevant seabird species regarding exploitable foraging areas, it is not expected that the impact on populations of these seabird species is significant.

Other seabird species *sensu lato* that make use of the area might also show avoidance behaviour vis-à-vis the construction site. However, none of these species is expected to ever reach thresholds of significance regarding population numbers.

3.1.2.2 Impacts from light pollution (AoI-3)

Artificial light at night (ALAN) is well documented to negatively affect seabirds. Adults from all three procellariform species nesting on the Maltese Islands actively avoid approaching breeding areas under high levels of illumination and may desert colonies as a result of exposure to ALAN. That seabirds are negatively affected by temporary light pollution from large vessels in front of their colonies has been recently proven for a *P. yelkouan* colony in Malta[36]. Furthermore, ALAN causes the stranding of seabird fledglings on their first flight out of the colony. These may be injured or killed by collisions with structures, or they might get grounded. Unless grounded individuals are found and released, they are likely to die[37]. In general, light pollution from ALAN is additive and light trespass that creating skyglow adds to light pollution in areas that are otherwise dark.

While the planned development on land is not within the immediate line of sight of any seabird nest sites, the marine cable route is in direct line of sight of seabird colonies at Saint Paul's Island (MT0000022), Rdum tal-Madonna (MT0000009), and Comino, all holding significant breeding pair numbers of *P. yelkouan* and the latter ones holding smaller colonies of one or both other seabird taxa (*C. diomedea, H. pelagicus melitensis*). The marine construction site along the cable route will be a source of light pollution during the construction phase, particularly during proposed night-time construction activities. The seabird colonies at Rdum tal-Madonna and Comino – albeit in direct line of sight – are considered outside the AoI in which impact by ALAN is considered significant. However, light pollution from the construction site will likely have a significant negative impact on birds from the *P. yelkouan* colony on St Paul's Island (MT0000022) as the area falls within AoI-3 (5.0 km buffer). This negative impact will potentially act on 45-70 breeding pairs. Including their offspring and prospecting birds, this equates to 225-350 individuals.

Additionally, ALAN is known to have negative consequences on nocturnally migrating birds in general. Bright lights are known to attract, disorient, and ground birds in active migration during the night[38] if construction work or operations are carried out at night during spring or

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[36] Austad, M., Oppel, S., Crymble, J., Greetham, H., Sahin, D., Lago, P. & Metzger, B. (in press). The effects of temporally distinct light pollution from ships on nocturnal colony attendance in a threatened seabird

[37] Rodríguez, A., Holmes, N. D., Ryan, P. G., Wilson, K. J., Faulquier, L., Murillo, Y., Raine, A. F., Penniman, J. F., Neves, V., Rodríguez, B., Negro, J. J., Chiaradia, A., Dann, P., Anderson, T., Metzger, B., Shirai, M., Deppe, L., Wheeler, J., Hodum, P., … Corre, M. Le. (2017). Seabird mortality induced by land-based artificial lights. Conservation Biology, 31(5), 986–1001. https://doi.org/10.1111/cobi.12900

[38] Evans Ogden, L. J. (2002). Summary report on the bird friendly building program: Effect of light reduction on collision of migratory birds. In Fatal Light Awareness Program (Vol. 1).

autumn migration with no mitigation measures in place. A lit-up cable laying vessel during night-time operation is highly likely to have above mentioned impacts on nocturnally migrating birds passing within a 5.0 km radius of the construction site. However, it is extremely unlikely that the number of birds of any species impacted by the marine construction site during their nocturnal migration can reach threshold levels of significance.

3.1.3 Marine Study

The main activities relevant to the project which are envisaged to lead to substantial marine ecology impacts during the construction phase are:

- Punch out hole
- Release of drilling fluids and suspended sediments into the marine environment
- Cable laying activities and trenching
- Installation of cable supporting structures and cable crossing features
- Benthic impacts from servicing vessels (for trenching and drilling activities)
- Abandonment and recovery of abandoned cable components during rough weather
- Anthropogenic generation of submarine noise

The impacts which can arise from these activities are described in detail in the following subsections. The Impact Summary Table is reproduced in Section 7.

3.1.3.1 Obliteration of benthic assemblages from seabed take-up

Benthic habitats along the site footprint will be permanently damaged by the proposed works. The activities which will cause this impact include the punch out hole, the installation of the cable along the cable route, trenching, and the installation of the cable protection systems. The precise location of the punchout hole is as yet unknown, but the FEED contractor has advised that this will probably be located within dense continuous *P. oceanica* meadows. The loss of a large area of this protected seagrass meadow is therefore highly likely. Furthermore, some parts of the cable route will need to be trenched so as to bury it into the sediment and therefore protect it from anchoring/trawling impacts. This means that the seabed to be obliterated does not solely comprise of the cable route itself, but an additional area to either side, representing the trench.

When the cable is not buried in trenches, it will be protected by rock placement / mattress protection at certain points along the route. These structures will take up additional seabed dominated with *P. oceanica* and maërl, with certain obliteration of these protected benthic habitats lying directly underneath the structures. Apart from being protected, these habitats support a high diversity of biota such as fish which make use of the meadows and maërl for refuge, foraging, etc.

Both the *P. oceanica* meadows and the matte layer are protected locally and internationally, as are the maërl habitat and sandbanks which will be impacted by cable laying. This impact constitutes one of adverse significance.

3.1.3.2 Obliteration of benthic assemblages from work vessels

The vessels installing the cable can impact the marine ecology of the AoI in the vicinity of the site footprint through anchoring. Uncontrolled anchoring by work vessels and barges causes direct physical damage to seabed habitats including seagrass meadows, with an average of 33 shoots being uprooted or broken during anchoring.[39] Other important benthic habitats along the AoI could be affected by uncontrolled anchoring, including the maërl and coralligenous outcrops.

Anchor types differ in the intensity of damage inflicted to seagrass meadows, with the Danforth and Folding Grapnel types being the most damaging and the Hall being the least (Figure 74).[39]

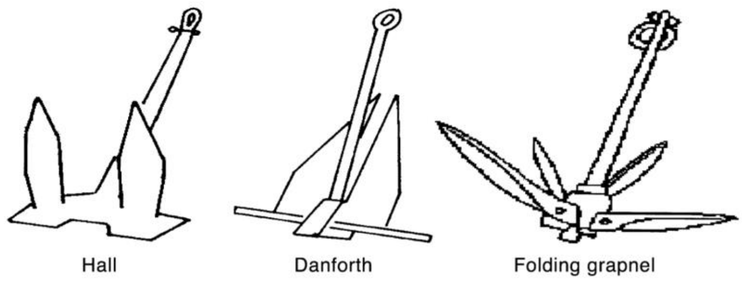

FIGURE 74: ANCHOR TYPES[39]

The benthic footprint to be affected by anchoring activities of this project is expected to be higher than for conventional anchors, given that:

- Most probably, anchor stabilisers will need to be deployed, which damage larger areas of seabed;
- The mooring corridor is likely to be larger than the laying corridor and significantly depends on encountered water depth; it can be typically estimated in a width of 1,000-1,500m approx. beside the route corridor axis.

The direct (hits, scour) and indirect (crabbing, for example) impacts of anchoring on seagrass meadows, maërl and other sensitive benthic assemblages is well-known. These impacts also affect associated fauna (particularly sessile ones) by altering their habitat structure, reducing the primary production and changing trophic relationships.[40]

Anchoring impacts from this project constitute one of adverse significance.

3.1.3.3 Atmospheric fall-out/ deposition of fine particulates

Atmospheric deposition of fine particulates has a significant impact on benthic habitats, such as *Posidonia oceanica* and sand. Particulate matter, including PM_{10} and $PM_{2.5}$, represents tiny particles that are less than 10 or 2.5 micrometers in diameter, respectively. These particles can be transported over long distances and can settle on the sea surface, affecting

[39] Milazzo, M., Badalamenti, F., Ceccherelli, G., & Chemello, R. (2004). Boat anchoring on Posidonia oceanica beds in a marine protected area (Italy, western Mediterranean): effect of anchor types in different anchoring stages. *Journal Of Experimental Marine Biology and Ecology*, *299*(1), 51-62. https://doi.org/10.1016/j.jembe.2003.09.003.

[40] García Charton, J.A., Williams, I.D., Pérez Ruzafa, A., Milazzo, M., Chemello, R., Marcos, C., Kitsos, M.S., Koukouras, A. and Riggio, S. (2000). 'Evaluating the ecological effects of Mediterranean marine protected areas: habitat, scale and the natural variability of ecosystems'. *Environmental Conservation, 27*(2):159–178.

pelagic flora and fauna. These particles can also sink to the bottom and ultimately impact benthic habitats.

Posidonia oceanica, is particularly vulnerable to the impacts of atmospheric deposition. Seagrasses are known to act as carbon sinks, and *Posidonia oceanica* sequesters more carbon than any other seagrass species. However, exposure to fine particulate matter can lead to reduced photosynthesis rates and increased plant mortality, ultimately resulting in a reduction in carbon sequestration and a decline in seagrass meadow health.[41,42]

In addition to seagrass meadows, sand habitats are also impacted by atmospheric deposition. Fine particulate matter can clog the spaces between sand grains, reducing water flow and oxygen availability to benthic organisms.[43] This can lead to changes in community structure and a decline in biodiversity.

Overall, the impacts of marine contamination on flora and fauna in the nearshore area are a cause for concern, and constitute a adverse significance. Strategies to reduce the amount of $PM_{2.5}$ emissions, such as implementing strict regulations on the machinery and vessel emissions, covering of stockpiles and other dust containment techniques, are necessary to protect these valuable ecosystems.

3.1.3.4 Heightened marine contamination risk

Construction work on land and at sea can have significant impacts on the surrounding environment and marine ecology. The release of chemicals from construction sites can reach the marine environment through various pathways, including surface runoff from land-based construction sites (via heavy vehicles with improperly washed wheels or carrying excavation material which is improperly contained) and direct contamination of the sea from work vessels. Improper waste disposal practices can also contribute to contamination of the sea. Uncontained storage of construction waste, including hazardous materials and chemicals, can result in the release of pollutants into the sea.[44]

At sea, work vessels involved in construction activities can also contribute to the release of chemicals into the environment. Fuel spills and accidental discharge of wastewater/bilge water/ballast water from these vessels can result in the release of pollutants into the water. The impacts of these contaminants can be significant, affecting not only marine life but also human health. Chemicals can accumulate in the tissues of fish and other marine organisms,

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[41] Duarte, C. M. (1991). Seagrass depth limits. *Aquatic Botany, 40*(4), 363-377. doi: 10.1016/0304-3770(91)90012-8

[42] Marín-Guirao, L., Ruiz, J. M., & Sánchez-Lizaso, J. L. (2011). Long-term effects of an oil spill on seagrass meadows (Posidonia oceanica) at a Mediterranean site: A multidisciplinary approach. Marine *Pollution Bulletin, 62*(2), 270-280. doi: 10.1016/j.marpolbul.2010.09.021

[43] Gambi, M. C., Lorenti, M., Russo, G. F., Scipione, M. B., & Zupo, V. (2000). Impact of chronic and acute physical disturbances on the macrobenthos of soft-bottoms in the Gulf of Salerno (Tyrrhenian Sea, Mediterranean). *ICES Journal of Marine Science, 57*(5), 1391-1403. doi: 10.1006/jmsc.2000.0918

[44] NOAA (2019). *Impacts of Construction Activities on the Environment.* https://response.restoration.noaa.gov/sites/default/files/Impacts%20of%20Construction%20Activities%20on%20the%20Environment_0.pdf.

making them unsafe for human consumption.[45] Additionally, exposure to chemicals can cause neurological damage, liver damage, and other health problems.

The risk for marine contamination is considered to be a non-significant adverse impact.

3.1.3.5 Release of drilling fluids into the marine environment

Drilling fluids used in horizontal directional drilling (HDD), largely comprising of inert bentonite, is likely to escape from the punchout hole. The FEED reports have estimated that 20% of the bentonite used are likely to leak out if the conventional industry standard type of HDD was to be used. Bentonite is a type of clay that can cause smothering of the seabed and reduce the oxygen available to benthic organisms. It can also release suspended solids into the water column, reducing light penetration and affecting the growth of marine plants. Furthermore, bentonite can alter the pH of the water, affecting the survival and reproduction of aquatic organisms. However, the FEED contractors have proposed and designed a forward reaming type of HDD which reduces the release of bentonite into the sea by up to ten times from the conventional methods. The FEED contractors have estimated a total loss of about 4 cubic metres of bentonite. Assuming a spread of a 1cm thick layer of bentonite, this amount of bentonite could in theory affect over 400m^2 of seabed, largely colonised by protected *P. oceanica*. This impact is therefore considered to be one of **major adverse** significance.

3.1.3.6 Suspended sediment

Short and long term impacts on marine life can arise from an increase in suspended sediments due to disturbance of the seabed from activities such as the punchout hole, trenching along some parts of the cable route, laying of the cable and placement of the rock protection armour.[46] These impacts include the resuspension and settling of sediments, reintroduction of contaminants into the water column, accumulation of toxins in fish and shellfish, increased turbidity, depletion of dissolved oxygen, changes in circulation, saltwater intrusion into groundwater and inland surface water, altered species diversity, changes in water chemistry, changes in shoreline structure, loss of habitat and fisheries resources. Increased turbidity can cause a decrease in light penetration, ultimately affecting seagrass and macroalgal species that rely on light for photosynthesis. Benthic communities and filter-feeding species may also be affected since additional sediment may cause blockage of respiratory systems and may also cause soft body parts to die off.

Resuspended benthic sediment might contain sequestered pollutants and nutrients which might be released into the water column, causing a depletion of oxygen levels. Depletion of dissolved oxygen may also be compounded by the resuspension of anoxic sediments during punchout hole process. The seagrass meadows not falling within the identified footprint of the punchout hole will also be subject to additional related impacts, including regression due to siltation and a reduction in photosynthetic efficiency as a result of heightened turbidity.

[45] EPA (2019). Sources and Causes of Water Pollution. https://www.epa.gov/water-research/sources-and-causes-water-pollution

[46] Gupta, A. K., Gupta, S. K., Patil, R. S. (2005). Environmental management plan for port and harbour projects. *Clean Technologies and Environmental Policy. 7*(2): 133–141. DOI: 10.1007/s10098-004-0266-7.

HDD releases a significant amount of drilling mud which is likely to spread over a large distance.

The sediment dispersion study carried out by the PMRS contractors have modelled sediment concentrations in both winter and spring. In winter, the models showed an excess of 10 mg/l at a maximum distance of 5.2 km from the cable centreline, with an impact area of 1031 ha. In spring, the models showed sediment concentrations in excess of 10 mg/l are observed at a maximum distance of 1.6 km from the cable route, with an impact area of 353 ha. This modelling only considered cable laying, and not the excavation pit, meaning the impacted area is expected to be significantly higher in both seasons.

The sediment dispersion study carried out by the FEED contractors modelled sediment concentrations in different seasons. In Malta, the sediment concentrations reach peaks of 75 mg/l, with 10 mg/l within 250m from the cable. The predominance of sand means that the sediment deposits on the bottom quickly, with 10mg/l persisting for up to 12 hours, as shown in . The area dominated by *P. oceanica* will experience concentrations of 50mg/l, with up to 10mg/l lasting up to four hours. This modelling only considered post-trenching works, and not the punch out hole, meaning the impacted area is expected to be larger .

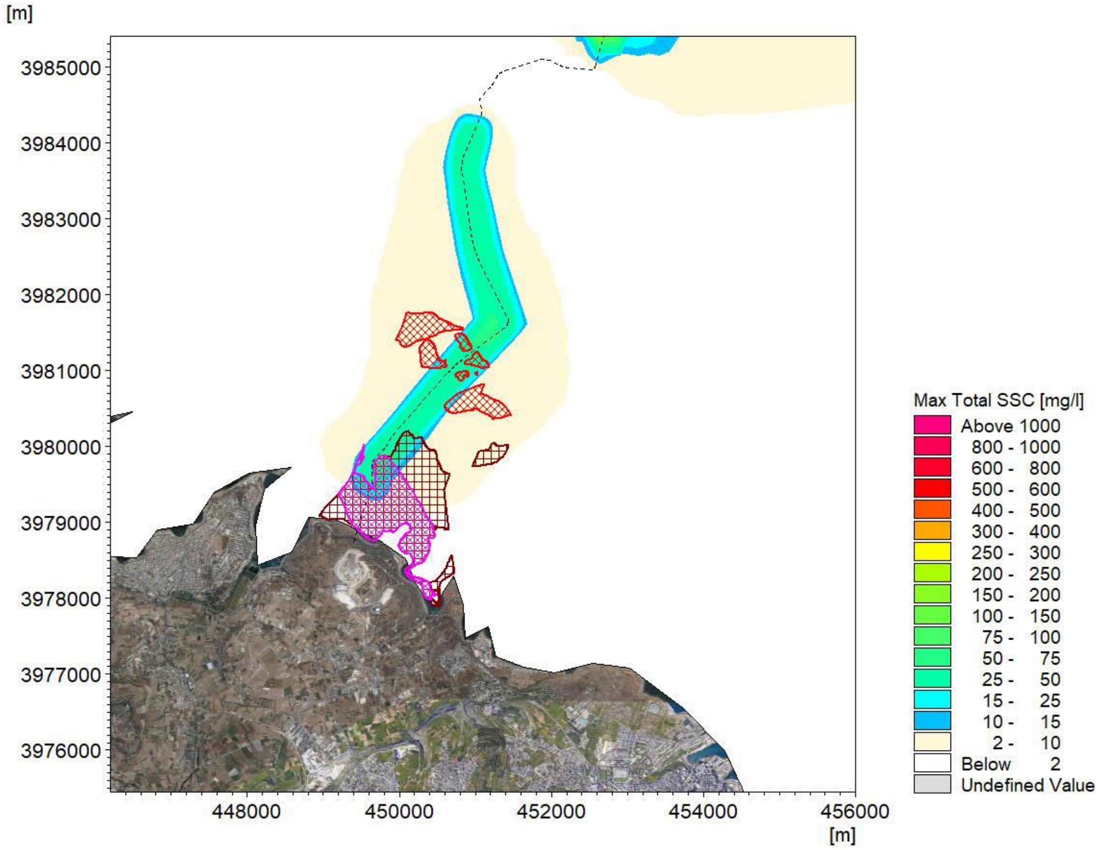

FIGURE 75: CONCENTRATION OF SUSPENDED SEDIMENTS CLOSE TO MALTA[47]

[47] CESI/Techfem (2023). Sediment Dispersion Study.

Considering the sensitivity of the benthic habitats in the AoI, the overall impact of resuspended benthic sediment is significant adverse.

3.1.3.7 Remobilisation of nutrients and pollutants sequestered within the benthic sediment

Remobilisation of chemicals in the sediment can occur during the punchout hole process. If not contained properly, sediments on the seafloor excavated during dredging can be resuspended and transported over long distances. Sediments could be contaminated with quantities of pollutants which would have historically been settled away. Sediment resuspension would release these chemicals back into the water column. These chemicals could negatively affect pelagic and demersal flora/fauna in the surrounding environment. These chemicals can have significant detrimental impacts on pelagic species such as fish and mammals, as well as benthic species such as *Posidonia oceanica*, sand, and maërl. The contaminants can include heavy metals, chemicals, and other harmful substances that can accumulate in the tissues of marine organisms, affecting their growth and reproduction. They could also potentially enter the food web, with some bioaccumulating and/or biomagnifying in large commercially-fished species.

The nearshore area is in close proximity to Malta's largest engineered landfill, and historical contamination of the sediment is possible. The PMRS contractors collected and analysed sediment samples. Some of the chemical concentrations were notably high, including total nitrogen, aluminium, arsenic, chromium, iron, lead, copper, zinc, vanadium and PAHs. No Sediment Quality Guidelines (SQG) exist at European level, so we have used the Italian Ministerial Decree (56/2009) to compare some of the compounds for which those targets exist. These chemicals were high in the nearshore samples taken in the area for the punchout hole. In fact, the concentrations of some of these chemicals exceed the Italian SDGs.

Release of these chemicals into the water column, and their dispersal through natural currents constitute a non-significant impact.

3.1.3.8 Anthropogenic generation of submarine noise

The worst-case scenario has been considered, where the works are continuous and affected marine animals stay at the fixed location over the entire 24-hour period. In fact, no dredging is expected for this project, however, dredging is considered as a worst-case scenario compared to post-trenching activities planned for this project. The works are expected to generate noise which can be significantly higher than the natural ambient noise levels (90 - 130 dB re 1 μPa). The impacts of noise on marine fauna has been modelled, with the results shown in Table 33.

Table 33: Summary of Submarine Noise Modelling Results[48]

Type of Animal	Operational Activities & Scenarios		Maximum threshold distances, m		
			Cumulative impact		Immediate Impact
			PTS onset	TTS onset	Behavioural disturbance
Marine mammals	Trench Dredging	Nearshore	80	690	82,910
		Offshore	175	1,455	28,110
	Cable Laying	Nearshore	775	2,350	102,800
		Offshore	1,630	12,230	30,100
Fish	Trench Dredging	Nearshore	-	-	1,870
		Offshore			1,450
	Cable Laying	Nearshore	-	-	5,110
		Offshore			2,800
Sea Turtles	Trench Dredging	Nearshore	-	-	<10
		Offshore			<10
	Cable Laying	Nearshore	120	-	180
		Offshore	40	-	160

Note: A dash indicates the threshold is not applicable.

In the case of dredging works, low frequency (LF) cetaceans have the lowest PTS-onset threshold (Permanent hearing threshold shift) and TTS-onset threshold (temporary hearing threshold shift). They therefore also have the largest impact zones among all marine mammal hearing groups, with the PTS-onset zone around 80 m and TTS-onset zone up to 690 m from the trenching location. However, dredging works are expected to cause behavioural disturbance impacts up to 82.91 km from the nearshore noise source and 28.11 km for the offshore noise source on marine mammals of all hearing groups. Conversely, behavioural disruption impacts for fish are expected to arise within 1.87 km from the nearshore noise source and 1.45 km from the offshore noise source. Turtle behaviour will be affected within a 10m radius for both nearshore and offshore noise sources.

For the cumulative combined cable laying noise sources, LF cetaceans and phocid carnivores in water (PCW) have the highest PTS-onset and TTS-onset impact zones among all marine mammal hearing groups. The PTS-onset zone for LF cetaceans and PCW is up to 775 m and 380 m, and the TTS-onset zones are up to 2.35 km and 2 km, respectively. In the offshore

[48] SLR (2023). Underwater Sound Transmission Loss Modelling Study.

scenario, the zones of impact will increase significantly, especially for the LF cetaceans. The PTS-onset zone is predicted to be within 1.63 km from the noise source, and the TTS-onset zone is within 12.23 km for LF cetaceans. For other cetacean groups, no PTS-onset is predicted, and TTS-onset is predicted to occur only within less than 2 km from the noise source. For the PCW, the TTS-onset zone will double up to 4.19 km. For fish, the PTS-onset zone for the nearshore scenario is within 120 m distance from the source location and that of the offshore scenario is 40 m. In terms of behaviour, the predicted zones of impact for marine mammals of all hearing groups are up to 102.8 km from the assessed nearshore scenario and up to 30.1 km from the assessed offshore scenario. For fish species, the predicted maximum zones of immediate impact from non-impulsive combined cable laying noise emissions are expected to occur within 5.1 km and 2.8 km distance from the noise source, respectively, for the nearshore and offshore scenarios. The potential behavioural disturbance from the non-impulsive cable laying operations for sea turtles is predicted to occur up to 180 m from both assessed scenarios.

The overall impact of submarine noise on marine fauna is therefore of significance.

3.1.3.9 WFD Assessment

The Scheme will cross through the coastal water body MTC 104, which includes the nearshore area from Mellieħa to Sliema, as shown in Figure 76. According to the 2nd WCMP, this water body has been exposed to contaminants through leaching from the Magħtab landfill and was found to have high concentrations of mercury, lead, copper and chromium. This was in fact confirmed through the water and sediment analyses carried out by the PMRS contractor. The area has also been subjected to hydromorphological alterations which have taken place along the accessible coastal stretch extending from Sliema up to Mellieħa. The 2nd WCMP states that "*given the nature of economic activity along this stretch of coast, hydromorphological pressures are foreseen to increase here*."

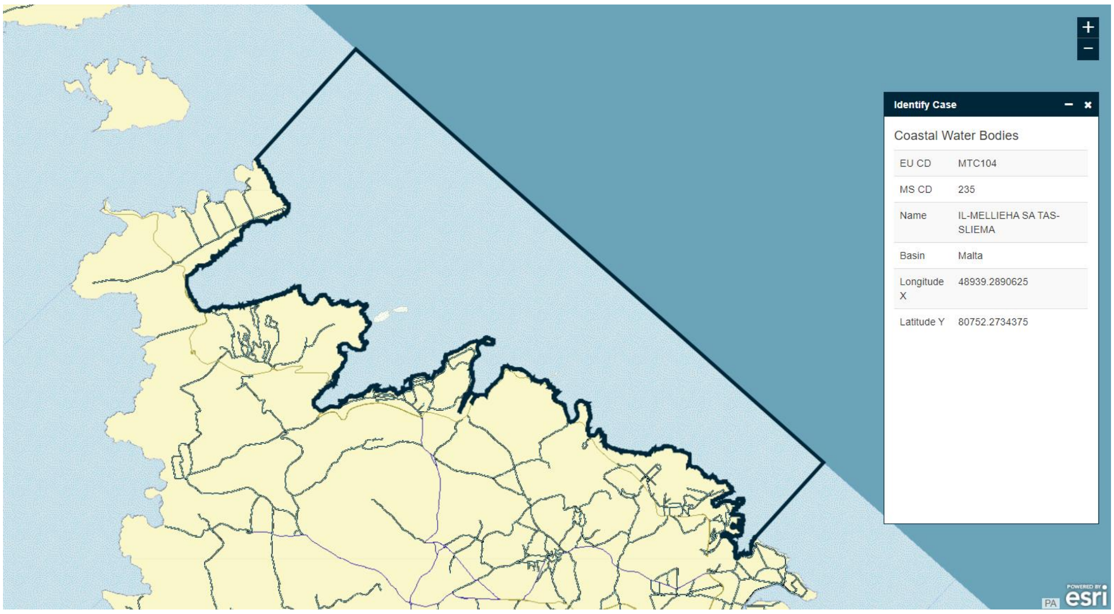

Figure 76: Coastal water body MTC 104 (Source: PA geoserver)

In the 2nd WCMP, MTC 104 was also assessed in terms of the four WFD BQEs, as outlined in Table 34. The water body was found to be in good status overall.

TABLE 34: WFD ASSESSMENT OF MTC 104 IN THE 2ND WCMP

WATER BODY	BIOLOGICAL QUALITY ELEMENT				OVERALL STATUS
	MACROALGAE	*P. OCEANICA*	BENTHIC INVERTEBRATES	PHYTOPLANKTON	
MTC 104^{Op1}	High	Good	High	High	Good
MTC 104^{Op2}	Good	High	Good	Good	Good

MTC 104 was defined as a "not at risk" water body in the 1st WCMP, despite the presence of three significant pressures: point source pollution, diffuse source pollution and hydromorphological pressures. In the 1st WCMP, MTC 104 was not listed among the heavily modified water bodies (HMWBs) which were exempt from the Article 4.4(a) and (c) of the WFD.

Nevertheless, exemption from the WFD regulation was sought for MTC 104 as part of the 2nd WCMP. The WFD exemption does not relate to hydromorphological pressures, but relates to the failure of the water body to achieve good chemical status. Exceedances of mercury and PAH contaminants beyond the Environmental Quality Standards were noted on more than one occasion during the monitoring period 2012-2013. The exemption was justified by the 2nd WCMP as follows: "*the level of knowledge concerning the potential sources and the extent of contribution of those sources to both mercury and PAH contamination is low and therefore any measures that have been developed as part of this plan may not be sufficient to guarantee that good chemical status will be achieved in MTC 104 by 2021.*"

The AoI has been evaluated for the impacts identified in the MTC 104 water body, in accordance with the same approach used in the 2nd WCMP. The impacts mentioned in the 2nd WCMP have been confirmed in the AoI, including trawl scars, damage to *P. oceanica* meadows from anchoring, etc.

The project could have significant hydrographical impacts on MTC 104 which would prevent the water body from achieving good status in line with the requirements of the WFD. This assessment is made on the basis that MTC 104's failure to achieve good status in the 2nd WCMP is due to the presence of high contaminant levels in seawater (mercury, lead, copper and chromium). The release of chemicals stored in the sediment could further degrade the chemical levels in the water column. Furthermore, some additional impacts might arise from the release of bentonite (aluminium phyllosilicate clay), which could further degrade the water and sediment quality in this water body. Conversely, although the Scheme involves the introduction of additional underwater infrastructure through the presence of a cable, the hydromorphological changes expected to arise are relatively small. The natural coastline within the area will remain largely undeveloped.

3.1.4 Onshore Noise Study

An assessment of construction noise has been completed with reference to BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites*, as an applicable working methodology to assess construction noise.

The BS 5228 calculation methods allow $L_{Aeq, T}$ noise levels to be determined for various site activities. The value of any such prediction is necessarily limited by the number of assumptions that must be made regarding the number and type of plant to be utilised, their location and detailed operating arrangements. Some of this information will be clarified as the project design progresses, but other information (such as exactly where the plant operates and for how long) will remain uncertain, even after works have commenced.

A schedule of construction plant has been agreed with the client as a preliminary selection of likely plant associated with the phases of activity assessed. The available information in BS 5228 Part 1 is considered sufficient to perform a generic noise assessment, focussing on key activities, along with SLR reference sound data for horizontal directional drilling plant.

An eight-month construction programme overview has been provided by the client; this assessment will consider the likely worst-case scenarios for the relevant phases of construction including site preparation, horizontal directional drilling, and cable route trenching works. All onshore construction works have been considered for daytime operation.

The following construction phases are considered:

- Phase 1 – Site Preparation: Preparing the land and access for the site compound.
- Phase 2 – Horizontal Directional Drilling (HDD) and Trenching. HDD compound located at sub marine cable entry point, routing cable under the N1 carriageway. The HDD will comprise a temporary construction compound with an approximate area 2,800 m^2. Trenching and laying of underground cable route will run to the Maghtab Terminal.

For each working phase, the items of plant and equipment which could be utilised have been considered, and with reference to Annex C of BS 5228:2009+A1:2014 and SLR reference data as agreed with the client. The corresponding sound power levels (L_{WA}) have been determined for each plant/activity, along with the assumed percentage (%) on-time for each item of plant and/or equipment per phase. This is detailed in Table 35.

It is acknowledged that there are likely to be other sub-phases of the construction work required; however, the main phases identified are considered to give a reasonable indication of the likely impact during the construction programme. The HDD and Trenching route activities have been considered under a single phase (Phase 2) as potential concurrent activity and tending toward a worst-case.

TABLE 35: CONSTRUCTION PLANT DETAILS – PHASE 1 SITE PREPARATION

WORKING PHASE	PLANT	SOUND POWER LEVEL, DB LWA	NO. PLANT	PERCENTAGE ON-TIME	DATA SOURCE
Phase 1 site preparation	20T Dumper	109	3	100	BS 5228
	Smooth Drum vibro road roller	103	1	100	BS 5228
	21T excavator	106	2	100	BS 5228
	5T Forward Tipping Dumper	106	1	100	BS 5228
	Loading shovel	108	1	100	BS 5228
	Tractor & fencing kit	108	1	100	BS 5228
	Tractor & trailer	107	1	70	BS 5228
	Tractor & Fuel bowser (or self-propelled)	117	1	10	BS 5228
	Tractor & Water bowser (for dust suppression)	111	1	25	BS 5228
	Grader	114	1	100	BS 5228
	Telehandler	107	1	70	BS 5228
	Mobile self-contained welfare unit	94	1	25	BS 5228
	Mobile generator	102	2	25	BS 5228
Phase 2 HDD plant	Generator	102	1	100	SLR reference data
	Telehandler	107	2	75	BS 5228
	Directional Drill Generator	105	1	100	SLR reference data

WORKING PHASE	PLANT	SOUND POWER LEVEL, dB LwA	NO. PLANT	PERCENTAGE ON-TIME	DATA SOURCE
	Mounting supports for directional drill (hydraulic hammer)	115	1	25	SLR reference data
	Mud Pump	108	1	100	SLR reference data
	Mixing Tank	103	1	100	SLR reference data
	Cuttings / Recycling Tank	108	1	100	SLR reference data
Phase 2 Trenching Plant	Trencher	105	2	50	Based on 40t Excavator as worst-case BS 8223 C4 ref 63
	Transit mixer for the transportation of lean mix to cover to fill the lower third (600mm) of the trench	108	2	20	Based on concrete truck mixer BS 5228 C4 Ref 20
	Petrol driven winch to pull the cable trough the trench	101	1	10	BS 8223 D.4 Ref 23
	Asphalt paving equipment	108	1	10	BS 8223 D.8 ref 26

Using the sound power levels and associated percentage on-times shown in Table 35 noise levels from each construction activity have been predicted at the identified ecological receptors to the Site.

The predictions have been undertaken using the proprietary noise modelling software CadnaA which incorporates the methodology outlined in BS 5228:2009+A1:2014. The model assumes mixed hard and soft ground (G = 0.5) and applies the screening effect of barriers from Figure F.3 of BS 5228:2009+A1:2014 at 500Hz.

The trenchless drilling compound plant has been positioned at the indicated directional drilling area as indicated in the client supplied HDD laydown drawing.

For simplicity and in representation of a worst-case assessment, all activities have been predicted to occur simultaneously to provide a single computer model output for each phase. In all cases, it is likely that plant would operate for shorter periods and not all activities would occur at the same time, resulting in lower noise levels. The graphical outputs have been provided in the figures below; the Phase 2 output includes an indicative stand-off distance (shown in green) to represent a predicted level of 55 dB $L_{Aeq,T}$ at approximately 100 m from the trenching construction route, for context.

The predicted construction noise levels have been summarised in Table 36 and have been rounded to the nearest decibel (dB).

TABLE 36: PREDICTED CONSTRUCTION NOISE LEVELS

LOCATION	CONSTRUCTION PHASE	PREDICTED NOISE LEVEL
NSR1 Ghadira s-Safra Nature Reserve	Phase 1 Site Preparation	50
	Phase 2 HDD and Trenching	57
NSR2 Blata tal-Ghallis SPA	Phase 1 Site Preparation	47
	Phase 2 HDD and Trenching	54

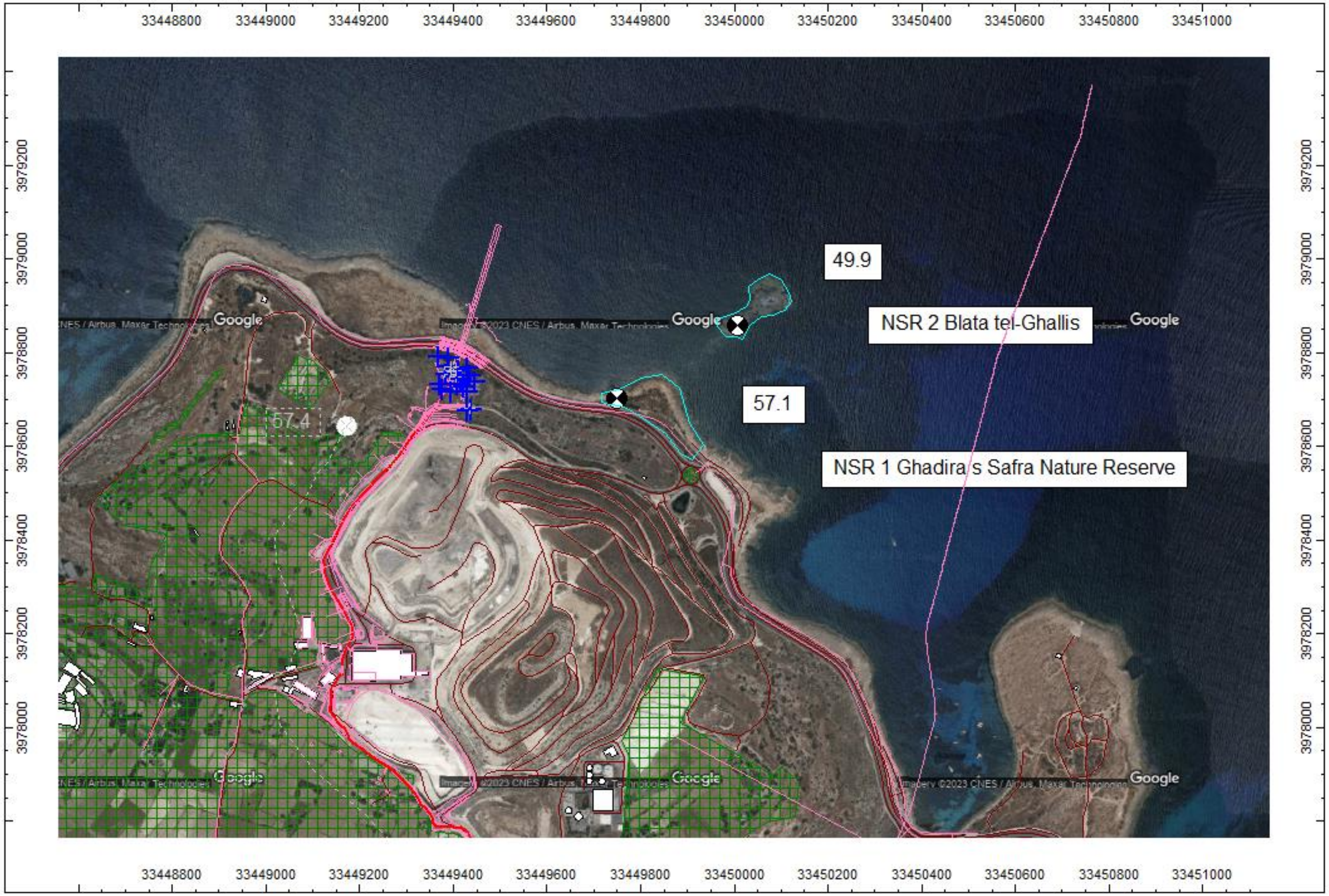

Figure 77: Phase 1 Site Preparation

Figure 78: Phase 2 Horizontal Directional Drilling And Trenching

3.1.4.1 AQTAG – Construction Noise Assessment

The predicted noise levels from each phase of working have been assessed in against the guideline noise limits from Table 18 which defines the AQTAG09 target assessment limit of 55dB $L_{Aeq,1hr}$.

TABLE 37: PREDICTED CONSTRUCTION NOISE LEVELS AND ASSESSMENT

LOCATION	CONSTRUCTION PHASE	PREDICTED NOISE LEVEL, DB $L_{AEQ,T}$	GUIDANCE LIMIT, DB $L_{AEQ,T}$	DIFFERENCE, DB	IMPACT MAGNITUDE
NSR1	Phase 1 Site Preparation	50	55	-5	Negligible
	Phase 2 HDD and Trenching	47	55	-8	Negligible
NSR2	Phase 1 Site Preparation	57	55	+2	Minor
	Phase 2 HDD and Trenching	54	55	-1	Negligible

With reference to Table 37 the magnitude of the impact would be *negligible* at NSR1 and *negligible* at NSR2 for Phase 2 and *Minor* at NSR 2 for Phase 1, following Table 18 definition of magnitude. The level of effect would correspondingly be *neutral* or in the worst-case *minor,* following Table 20 definitions for levels of effect. Where the level of effect is neutral or minor, the impact is not significant.

3.1.4.2 Assessment of Construction Operations on existing ambient levels

The predicted noise levels have also been assessed against the existing ambient noise levels to determine if there will any significant changes in the ambient level due to construction noise.

The changes in the ambient levels have been calculated by logarithmically adding the predicted specific sound level from construction operations to the daytime ambient levels ($L_{Aeq,T}$) measured measurement at location P4, which is representative of the prevailing sound climate at the identified ecological receptors, as described in Section 6.1.

The changed in ambient levels is shown in Table 38 below.

TABLE 38: CHANGES IN AMBIENT NOISE LEVEL DUE TO CONSTRUCTION NOISE

LOCATION	CONSTRUCTION PHASE	PREDICTED NOISE LEVEL, DB $L_{AEQ,T}$	EXISTING AMBIENT NOISE LEVEL	CALCULATED AMBIENT LEVEL, $L_{AEQ,T}$	CHANGE IN AMBIENT NOISE LEVEL, $L_{AEQ,T}$	IMPACT MAGNITUDE
NSR1	Phase 1 Site Preparation	50	58	58.6	+0.6	Negligible
	Phase 2 HDD and Trenching	47		58.3	+0.3	Negligible
NSR2	Phase 1 Site Preparation	57		60.5	+2.5	Negligible
	Phase 2 HDD and Trenching	54		59.5	+1.5	Negligible

With reference to Table 38 the magnitude of the impact of the changes in the ambient noise levels due to construction noise would be *negligible* at both NSR's considered during both construction phases, following Table 19 definition of magnitude.

The level of effect would correspondingly be neutral, following Table 20 definitions for levels of effect. Where the level of effect is neutral, the impact is not significant.

3.1.4.3 Construction Traffic Noise

The proposed Onshore Scheme would generate additional traffic on the local road network during its construction, with the proposed access to the site compound from the nearby coast road, Tul Il-Kosta. The majority of construction traffic is expected to be related to the site preparation and drilling compound operation. The overall duration of the HDD construction is not expected to last more than two months whilst the actual drilling itself is estimated to take approximately ten days. Therefore, vehicle trip generation during the construction of the proposed Onshore Scheme would be low intensity, short-term and temporary.

The laydown area for the HDD includes all the necessary facilities to avoid significant movement in and out of the site. Therefore, during the drilling operation, minimal vehicular movement is expected mainly for transfer of personnel or consumables. The compound area is understood to include the necessary pits for collection of drilling material via a hook loader, daily to remove the extracted volume.

Based on the above, it is considered likely that a low volume of site traffic would have a negligible impact relative to the overall volume of traffic already accommodated on the coast road which is notably a dual carriageway and a primary, national traffic route with relatively high volumes of existing traffic flow. Based on these straight-forward operational assumptions and site context, the noise impact of site road traffic has been considered negligible and therefore not significant.

3.1.5 Offshore Noise Study

The weighted SEL modelling results for different marine mammal hearing groups (Appendix B) are based on weighted SEL source level inputs which are derived by applying relevant auditory hearing functions to the unweighted SEL source levels as presented in Appendix C.

The modelling noise contour figures for the trench dredging and cable laying activities are presented in Appendix D. The contour figures are the modelling results based on unweighted SEL source level inputs in dB re 1 μPa2·s for non-impulsive noise of 1-second duration.

For cumulative SEL estimates of cable laying, and dredging noise, the following cumulative factor (CF) is applied:

$$CF = 10 \times \log10 \, (T) \qquad (2)$$

Where T is the exposure duration for the cable laying and dredging noise sources, respectively.

For non-impulsive noise, the root-mean-square sound pressure levels (RMS SPLs) are equivalent to the sound exposure levels (SELs) of 1-second duration.

The Pk SPL is relevant to the impact assessment for impulsive noise, such as the signal from a stationary single pulse sonar survey.

The predicted noise levels of all considered modelling scenarios were compared with relevant threshold criteria. The zones of different levels of noise impact for marine mammals and fish and sea turtle species were calculated, and all results are presented in Table 13 to Table 21, including:

- Impact zones from an SBES noise source with impulsive noise emissions are shown in Table 13 regarding the immediate impact on marine mammals. Table 14 shows the impact zones regarding behavioural disturbance for marine mammals and fish;
- Impact zones from trench dredging activities with non-impulsive noise emissions are shown in Table 15 and
- Table 16 regarding the immediate impact for marine mammals under two continuous exposure scenarios (i.e., 24-hour exposure nearshore and offshore). Table 17 shows the impact zones regarding behavioural disturbance for fish, marine mammals, and sea turtles; and

- Impact zones from the combined cable laying sources with non-impulsive noise emissions are shown in Table 18 to Table 20 regarding cumulative impact for marine mammals and sea turtles under two continuous exposure scenarios (i.e., 24-hour exposure nearshore and offshore), respectively. Table 21 shows the impact zones regarding behavioural disturbance for marine mammals, fish, and sea turtles.

The estimated impact zones are presented as a single maximum threshold distance to the source and as the ensonified area (km2) for each source scenario (i.e., nearshore and offshore).

Based on noise modelling prediction results and relevant post-processing analysis as described above, the zones of impact for marine fauna species assessed from all modelling scenarios are detailed in the following sections.

3.1.5.1 Zones of Impact – Immediate Exposure from an SBES pulse

Marine Mammals

SBES sources have extremely narrow source directivity along the cross-track direction. Thus, marine mammals are predicted to experience PTS at very close proximity to the sonar sources due to the immediate exposure to individual pulses. Based on zones of impact estimated Pk-SPL metric criteria as provided in Table 39, marine mammals of all hearing groups except very-high-frequency cetaceans are predicted to experience the PTS effect within less than 6 m from the sonar source. The maximum zones of the PTS effect for very-high-frequency cetaceans are predicted to be within 35.5 m from the sonar source.

The zones of TTS due to a single pulse exposure for marine mammals of all hearing groups except very-high-frequency cetaceans are predicted to be within less than 12 m from the sonar source. The maximum zones of the TTS effect for very high-frequency cetaceans are predicted to be within 70.8 m from the sonar source.

TABLE 39: ZONES OF IMMEDIATE IMPACT FROM A SBES PULSE FOR PTS AND TTS - MARINE MAMMALS

MARINE MAMMAL HEARING GROUP	ZONES OF IMPACT – MAXIMUM HORIZONTAL DISTANCES FROM SOURCE TO PEAK IMPACT THRESHOLD LEVELS			
	INJURY (PTS) ONSET		TTS ONSET	
	CRITERIA - PK SPL dB RE 1μPA	MAXIMUM THRESHOLD DISTANCE, M	CRITERIA - PK SPL dB RE 1μPA	MAXIMUM THRESHOLD DISTANCE, M
Low-frequency cetaceans (LF)	219	5.0	213	10.0
High-frequency cetaceans (HF)	230	1.4	224	2.8

Marine mammal hearing group	Zones of impact – maximum horizontal distances from source to peak impact threshold levels			
	Injury (PTS) onset		TTS onset	
	Criteria - Pk SPL dB re 1µPa	Maximum threshold distance, m	Criteria - Pk SPL dB re 1µPa	Maximum threshold distance, m
Very-high-frequency cetaceans (VHF)	202	35.5	196	70.8
Phocid carnivores in water (PCW)	218	5.6	212	11.2
Other marine carnivores in water (OCW)	232	1.1	226	2.2

Fish and Sea Turtles

High-frequency from SBES sources is not expected to cause an adverse hearing impact on fish species due to the low-frequency hearing ranges of these animals. Likewise, since turtles detect sound below 1 kHz, any effect would only be in response to low-frequency sonar. Thus, a PTS/TTS-onset zone in sea turtles is not expected from SBES sources.

Behavioural Responses

The zones of behavioural disturbance for marine mammals caused by the immediate exposure to individual sonar pulses for sonar surveys are presented in Table 40. The modelling results show that the maximum impact distance for the behavioural disturbance caused by the immediate exposure to individual sonar pulses is predicted to reach 4.46 km from the source for marine mammals of all hearing groups.

TABLE 40: ZONES OF IMMEDIATE IMPACT FROM AN SBES PULSE FOR BEHAVIOURAL DISTURBANCE – MARINE MAMMALS

TYPE OF ANIMAL	ZONES OF IMPACT – MAXIMUM HORIZONTAL DISTANCES FROM THE SOURCE TO IMPACT THRESHOLD LEVELS	
	BEHAVIOURAL DISTURBANCE	
	CRITERIA - RMS SPL, DB RE 1μPA	MAXIMUM THRESHOLD DISTANCE, M
Marine mammals	120	4,460

Fish species and sea turtles are not sensitive to high-frequency sonar.

3.1.5.2 Zones of Impact - Cumulative Post-Trencing Activities

Marine Mammals

Table 41 and Table 42 below present the zones of cumulative impact based on cumulative SELs from stationary dredging operation activities with the highest non-impulsive noise emissions (i.e., CSD vessel) for marine mammals.

For the worst-case consideration (i.e., the cutting dredging operations are continuous and affected marine animals stay at the fixed location over the entire 24-hour period), LF cetaceans are the only hearing group with PTS-onset and has the highest TTS-onset impact zones among all marine mammal hearing groups. From Table 41, the PTS-onset zone for LF cetaceans is up to 80 m, and the TTS-onset zone is up to 690 m for the nearshore scenario.

The zones of impact will at least double for the offshore scenario, as shown in Table 42. For example, the PTS-onset zone is predicted to be within 175 m from the noise source, and the TTS-onset zone is within up to 1,455 m for LF cetaceans. For other cetacean groups, no PTS-onset is predicted, and TTS-onset is predicted to occur only within less than 560 m from the noise source.

Fish and Sea Turtles

Non-impulsive noise sources such as dredging (i.e., cutting/trenching) are not expected to cause mortality or potential mortal injury to fish species. There would thus also be no cumulative impact from the non-impulsive dredging noise sources expected on fish species.

Unlike the combined cable lay noise sources, the higher noise emissions from dredging are not sufficient to generate cumulative impact zones for sea turtles based on the cumulative SELs of the two dredging operation scenarios (nearshore/offshore). Therefore, a PTS-onset zone in sea turtles is not expected.

Table 41: Zones of cumulative impact from trench dredging noise for marine mammals –nearshore

Marine mammal hearing group	Zones of impact – maximum horizontal distances from source to cumulative impact threshold levels					
	Injury (PTS) onset			TTS onset		
	Criteria – Weighted SEL_{24hr} dB re 1 mPa^{2}·s	Maximum threshold distance, m	Ensonified area (m^2)	Criteria – Weighted SEL_{24hr} dB re 1 mPa^{2}·s	Maximum threshold distance, m	Ensonified area (m^2)
Low-frequency cetaceans (LF)	199	80	30	179	690	1,870
High-frequency cetaceans (HF)	198	-	-	178	-	-
Very-high-frequency cetaceans (VHF)	173	-	-	153	325	470
Phocid carnivores in water (PCW)	201	-	-	181	470	1,010
Other marine carnivores in water (OCW)	219	-	-	199	-	-

TABLE 42: ZONES OF CUMULATIVE IMPACT FROM TRENCH DREDGING NOISE FOR MARINE MAMMALS –OFFSHORE

	MARINE MAMMAL HEARING GROUP	ZONES OF IMPACT – MAXIMUM HORIZONTAL DISTANCES FROM SOURCE TO CUMULATIVE IMPACT THRESHOLD LEVELS					
		INJURY (PTS) ONSET			TTS ONSET		
		CRITERIA – WEIGHTED SEL_{24HR} DB RE 1 MPA^2·S	MAXIMUM THRESHOLD DISTANCE, M	ENSONIFIED AREA (M^2)	CRITERIA – WEIGHTED SEL_{24HR} DB RE 1 MPA^2·S	MAXIMUM THRESHOLD DISTANCE, M	ENSONIFIED AREA (M^2)
Low-frequency cetaceans (LF)	199	175	70	179	1,455	6,860	
High-frequency cetaceans (HF)	198	-	-	178	-	-	
Very-high-frequency cetaceans (VHF)	173	-	-	153	560	990	
Phocid carnivores in water (PCW)	201	-	-	181	525	770	
Other marine carnivores in water (OCW)	219	-	-	199	-	-	

Behavioural Responses

Table 43 below presents the distances to potential behavioural disturbance from the non-impulsive noise emissions from dredging activities for marine mammals, fish, and sea turtles. The predicted zones of impact to occur for marine mammals of all hearing groups are up to 82.91 km from the assessed nearshore scenario and up to 28.11 km from the assessed offshore scenario.

For fish species, the predicted maximum zones of immediate impact from non-impulsive dredging noise emissions are expected to occur within 1.87 km and 1.45 km from the noise source, respectively, for the nearshore and offshore scenarios.

The potential behavioural disturbance from the non-impulsive dredging activities for sea turtles is predicted to occur within less than 10 m from both assessed scenarios.

TABLE 43: ZONES OF IMMEDIATE IMPACT FROM TRENCH DREDGING NOISE FOR BEHAVIOURAL DISTURBANCE –MARINE MAMMALS, FISH, AND SEA TURTLES

TYPE OF ANIMAL	ZONES OF IMPACT – MAXIMUM HORIZONTAL DISTANCES FROM THE SOURCE TO IMPACT THRESHOLD LEVELS		
	BEHAVIOURAL DISTURBANCE		
	CRITERIA - RMS SPL, DB RE 1μPA	NEARSHORE	OFFSHORE
		MAXIMUM THRESHOLD DISTANCE, M	MAXIMUM THRESHOLD DISTANCE, M
Marine mammals	120	82,910	28,110
Fish	150	1,870	1,450
Sea Turtles	175	<10	<10

3.1.5.3 Zones of Impact - Cumulative Combined Cable Laying Sources

Marine Mammals

Table 44 and Table 45 below present the zones of cumulative impact based on cumulative SELs from the combined cable laying sources with the highest non-impulsive noise emissions (i.e., cable laying barge, anchor handling tug and offshore supporting vessel) for marine mammals.

For the worst-case consideration (i.e., the cable laying operations are continuous and affected marine animals stay at the fixed location over the entire 24-hour period), LF cetaceans and PCW have the highest PTS-onset and TTS-onset impact zones among all marine mammal hearing groups. From Table 44, the PTS-onset zone for LF cetaceans and PCW is up to 775 m and 380 m, and the TTS-onset zones are up to 2.35 km and 2 km, respectively.

In the offshore scenario, the zones of impact will increase significantly, especially for the LF cetaceans, as shown in Table 45. For example, the PTS-onset zone is predicted to be within 1.63 km from the noise source, and the TTS-onset zone is within 12.23 km for LF cetaceans. For other cetacean groups, no PTS-onset is predicted, and TTS-onset is predicted to occur only within less than 2 km from the noise source. For the PCW, the TTS-onset zone will double up to 4.19 km.

TABLE 44: ZONES OF CUMULATIVE IMPACT FROM CABLE LAYING NOISE FOR MARINE MAMMALS –NEARSHORE

Marine mammal hearing group	Zones of impact – maximum horizontal distances from source to cumulative impact threshold levels					
	Injury (PTS) onset			TTS onset		
	Criteria – Weighted SEL_{24HR} dB re 1 µPa²·s	Maximum threshold distance, m	Ensonified Area (m²)	Criteria – Weighted SEL_{24HR} dB re 1 µPa²·s	Maximum threshold distance, m	Ensonified Area (m²)
Low-frequency cetaceans (LF)	199	775	13,510	179	2,350	28,480
High-frequency cetaceans (HF)	198	-	-	178	360	3,140
Very-high-frequency cetaceans (VHF)	173	<10	<40	153	615	6,890
Phocid carnivores in water (PCW)	201	380	5,050	181	2,000	23,690
Other marine carnivores	219	-	-	199	610	6,760

Marine mammal hearing group	Zones of impact – maximum horizontal distances from source to cumulative impact threshold levels					
	Injury (PTS) onset			TTS onset		
	Criteria – Weighted SEL_{24hr} dB re 1 μPa²·s	Maximum threshold distance, m	Ensonified area (m²)	Criteria – Weighted SEL_{24hr} dB re 1 μPa²·s	Maximum threshold distance, m	Ensonified area (m²)
in water (OCW)						

TABLE 45: ZONES OF CUMULATIVE IMPACT FROM CABLE LAYING NOISE FOR MARINE MAMMALS –OFFSHORE

Marine mammal hearing group	Zones of impact – maximum horizontal distances from source to cumulative impact threshold levels					
	Injury (PTS) onset			TTS onset		
	Criteria – Weighted SEL_{24hr} dB re 1 μPa²·s	Maximum threshold distance, m	Ensonified area (m²)	Criteria – Weighted SEL_{24hr} dB re 1 μPa²·s	Maximum threshold distance, m	Ensonified area (m²)
Low-frequency cetaceans (LF)	199	1,630	25,110	179	12,230	241,560
High-frequency cetaceans (HF)	198	-	-	178	125	1,290
Very-high-frequency	173	-	-	153	1,930	31,420

Marine mammal hearing group	Zones of impact – maximum horizontal distances from source to cumulative impact threshold levels					
	Injury (PTS) onset			TTS onset		
	Criteria – Weighted SEL_{24hr} dB re 1 $\mu Pa^2 \cdot s$	Maximum threshold distance, m	Ensonified area (m^2)	Criteria – Weighted SEL_{24hr} dB re 1 $\mu Pa^2 \cdot s$	Maximum threshold distance, m	Ensonified area (m^2)
cetaceans (VHF)						
Phocid carnivores in water (PCW)	201	55	790	181	4,190	52,970
Other marine carnivores in water (OCW)	219	-	-	199	155	2,180

Fish and Sea Turtles

Non-impulsive noise sources, such as those from cable laying, are not expected to cause mortality or potential mortal injury to fish species. Thus, there would be no cumulative impact from the non-impulsive cable lying noise sources expected on fish species.

Table 46 below presents the zones of cumulative impact for sea turtles based on cumulative SELs from two cable laying operation scenarios (nearshore and offshore) with the combined non-impulsive noise emissions. The PTS-onset zone for the nearshore scenario is within 120 m distance from the source location and 40 m for the offshore scenario.

TABLE 46: ZONES OF CUMULATIVE IMPACT FROM CABLE LAYING NOISE FOR SEA TURTLES –NEARSHORE & OFFSHORE

TYPE OF ANIMAL	ZONES OF IMPACT – MAXIMUM HORIZONTAL DISTANCES FROM THE SOURCE TO CUMULATIVE IMPACT THRESHOLD LEVELS				
	INJURY (PTS) ONSET				
	CRITERIA – WEIGHTED SEL_{24HR} dB RE 1 μPA²·S	NEARSHORE		OFFSHORE	
		MAXIMUM THRESHOLD DISTANCE, M	ENSONIFIED AREA (M^2)	MAXIMUM THRESHOLD DISTANCE, M	ENSONIFIED AREA (M^2)
Sea turtles	220	120	840	40	530

Behavioural Responses

Table 47 below presents the distances to potential behavioural disturbance from the non-impulsive noise emissions from cable laying operations for marine mammals, fish, and sea turtles. The predicted zones of impact to occur for marine mammals of all hearing groups are up to 102.8 km from the assessed nearshore scenario and up to 30.1 km from the assessed offshore scenario.

For fish species, the predicted maximum zones of immediate impact from non-impulsive combined cable laying noise emissions are expected to occur within 5.1 km and 2.8 km distance from the noise source, respectively, for the nearshore and offshore scenarios.

The potential behavioural disturbance from the non-impulsive cable laying operations for sea turtles is predicted to occur up to 180 m from both assessed scenarios.

TABLE 47: ZONES OF IMMEDIATE IMPACT FROM CABLE LAYING NOISE FOR BEHAVIOURAL DISTURBANCE –MARINE MAMMALS, FISH, AND SEA TURTLES

TYPE OF ANIMAL	ZONES OF IMPACT – MAXIMUM HORIZONTAL DISTANCES FROM THE SOURCE TO IMPACT THRESHOLD LEVELS		
	BEHAVIOURAL DISTURBANCE		
	CRITERIA - RMS SPL, DB RE 1µPA	NEARSHORE	OFFSHORE
		MAXIMUM THRESHOLD DISTANCE, M	MAXIMUM THRESHOLD DISTANCE, M
Marine mammals	120	102,800	30,100
Fish	150	5,110	2,800
Sea Turtles	175	180	160

3.1.5.4 Discussion and Summary

Dual metric criteria (i.e., per-pulse impact criteria Pk SPL and cumulative exposure impact criteria SEL24hr) are applied to assess PTS and TTS impact for marine mammals and sea turtles. The metric criteria of RMS SPL are applied to assess the behavioural response of marine mammals, fish, and sea turtles. The combined threshold distance for each impact effect is considered as the maximum threshold distance (i.e., the worst-case scenario) estimated from either metric criterion being applied.

The estimated maximum zones of impact for all operational activities (e.g., sonar survey, trench dredging and combined cable laying) are summarised in Table 48 below, based on the STLM results, prediction sheet and the zones of impact estimated as detailed in the above sub-sections.

TABLE 48: SUMMARY OF THE MAXIMUM ZONES OF IMPACT FOR MARINE MAMMALS, FISH, AND SEA TURTLES

TYPE OF ANIMAL	OPERATIONAL ACTIVITIES & SCENARIOS		MAXIMUM THRESHOLD DISTANCES, M		
			CUMULATIVE IMPACT		IMMEDIATE IMPACT
			PTS ONSET	TTS ONSET	BEHAVIOURAL DISTURBANCE
		Nearshore	35	70	4,460

TYPE OF ANIMAL	OPERATIONAL ACTIVITIES & SCENARIOS		MAXIMUM THRESHOLD DISTANCES, M		
			CUMULATIVE IMPACT		IMMEDIATE IMPACT
			PTS ONSET	TTS ONSET	BEHAVIOURAL DISTURBANCE
Marine mammals	SBES Sonar	Offshore			
	Trench Dredging	Nearshore	80	690	82,910
		Offshore	175	1,455	28,110
	Cable Laying	Nearshore	775	2,350	102,800
		Offshore	1,630	12,230	30,100
Fish	Trench Dredging	Nearshore	-	-	1,870
		Offshore			1,450
	Cable Laying	Nearshore	-	-	5,110
		Offshore			2,800
Sea Turtles	Trench Dredging	Nearshore	-	-	<10
		Offshore			<10
	Cable Laying	Nearshore	120	-	180
		Offshore	40	-	160

Note: A dash indicates the threshold is not applicable.

For general marine mammal species, low physiological impact, particularly the PTS impact, is predicted from impulsive sonar survey for the nearshore and offshore scenarios. The only marine mammal hearing group with a higher impact is the VHF cetaceans due to their higher hearing sensitivity to high frequencies. Those animals' behavioural responses could reach up to some kilometers from the noise source. SBES sources are not expected to cause an adverse hearing impact on fish species and sea turtles due to the low-frequency hearing ranges of these animals.

For all non-impulsive activities (e.g., cable laying and trench dredging), the cumulative exposure level at both scenarios was modelled based on the assumption that the marine animals are constantly exposed to the source at a fixed location over the entire operational period (up to 24 hours for continuous non-impulsive noise). However, marine fauna species, such as marine mammals and sea turtles, would not (under realistic circumstances) stay in the same location for the entire period unless the individual animals were attached to a specific feeding/breeding area. Therefore, the zones of impact assessed for marine mammals and sea turtles represent the worst-case consideration.

Among all identified non-impulsive noise emissions during the construction and operation of the IC2 development, the combined cable-lay vessel sources are predicted to have the highest noise impact (PTS and TTS), particularly for low-frequency cetaceans.

For general fish species, mortality or potential mortal injury is not expected to occur from non-impulsive noise emissions associated with operational activities. Therefore, the overall adverse impact on fish species relates to behavioural disturbance only. For Sea turtles, low physiological impact (only PTS) is predicted to occur at close distances from the noise source.

It should be noted that this modelling study is undertaken without detailed specifications of relevant equipment to be used for major noise-generating activities assessed as a worst case activity which is planned for this project. It is therefore recommended that detailed specifications be reviewed for major noise-generating equipment to be used once they are available. In addition, characterization of the source noise emissions and noise model validations via field measurements are also recommended for consideration.

3.2 OPERATIONAL PHASE

3.2.1 Terrestrial Study

Since the Terminal Station is already being operated at the site, the impacts are limited to noise and light emissions which are currently being emitted by the facility. No additional impacts are envisaged despite the intensification of an additional interconnector cable.

3.2.2 Avian Study

3.2.2.1 General standard operations versus repair scenarios

Situated on the seafloor and underground, the interconnector cable will physically not overlap with habitat that is utilized by the receptor species. Therefore, no significant residual impacts on avifauna is expected during standard operations. However, the cable can get accidentally damaged, which has happened in the marine area (Maltese national waters) at least once to the existing 1st Sicily-Malta Interconnector. It is expected that repair operations during the operational phase would have impacts on avifauna comparable to those during the construction phase. Such impacts would be probably more localized as it is unlikely that the cable gets damaged along the whole route or needs a complete replacement. However, a cable repair scenario is likely to entail strong time constraints. Therefore, the mitigation methods proposed for the construction phase linked to the timing of the work (not at night, not during reproductive season of sensitive receptors) can be expected to be less feasible, ultimately increasing the residual impact of such events during the operational phase. It is thus likely that residual impacts especially on vulnerable receptor species such as *P. yelkouan* remain for repair scenarios. Compensatory measures are therefore proposed (see chapter 5).

3.2.2.2 Source of energy and climate change

The indirect long-term impact of the proposed development will highly depend on the type of primary energy from which the electricity sent through the interconnector is generated. While this may not entirely be under national control, it has the potential to increase the proportion of the local energy supply from renewable sources while Malta's energy production is still predominantly based on fossil fuels.

Currently, Italy's energy production is also still predominantly produced through the burning of fossil fuels, but this is expected to change as the EU increases the proportion of renewable energy sources within the EU with the aim of reaching climate neutrality by 2050. Conventional energy production by burning fossil fuels such as coal, oil or natural gas inevitably produces large quantities of the greenhouse gas CO_2, the main contributor of man-made climate change, also leading to ocean acidification. Both are currently starting to have well-known catastrophic impacts on global ecosystems and biodiversity[49], including avifauna[50].

Some renewable sources of electricity production (biogas from intensively managed agriculture and forestry, windfarms) can also leave some detrimental impacts on biodiversity including receptor taxa if not properly planned or managed. As a result, decisions on energy sources are not trivial and require serious comparative assessment and long-term views within the context of the climate crisis.

Additionally, it must be stressed that the current rate of energy consumption is not sustainable and needs to be addressed, regardless of energy source.

Ultimately, this aspect of potential residual impacts of the proposed project during the operational phase can currently not be quantified.

[49] IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press. Cambridge University Press, Cambridge, UK and New York, NY, USA, 3056 pp., doi:10.1017/9781009325844.

[50] *BirdLife International (2015), BirdLife International's Position on Climate Change. Cambridge, UK: BirdLife International*

3.2.3 Marine Study

The main activities relevant to the project which are envisaged to lead to substantial marine ecology impacts during the operational phase are the following:

- Altered hydrodynamics in the vicinity of the cable;
- Benthic impacts from maintenance works & vessels (e.g. for exercises involving cable repairs or regular monitoring of the cable's integrity/structure);
- Anthropogenic generation of submarine noise during cable maintenance and repair works;
- Artificial surface for non-indigenous alien species;
- Leaching of anti-corrosion chemicals into the environment; and
- Electromagnetic force around cable

The impacts which can arise from these activities are described in detail in the following subsections. The Impact Summary Table is reproduced in Section 7.

3.2.3.1 Altered hydrodynamics in the vicinity of the cable

According to the FEED contractor drawings, the proposed submarine cable has a diameter of about 30cm. The bulk of the cable length will be buried to an approximate depth of 1.5m. In areas where trenching is not possible, the cable will be placed on the seabed and protected by means of rock placement/protection mattresses and also cast-iron shells in some areas.. In these areas, the physical presence of this cable along the seabed, as well as rock protection/protection mattresses, will alter the hydrodynamics in the surrounding areas, with increased sheer forces on either side of the infrastructure. This altered hydrodynamics is likely to cause further clearance of *P. oceanica* meadows over time, leading to loss of this important species, increased fragmentation, increased edge effects and an overall non-significant impact on this benthic habitat.

3.2.3.2 Benthic impacts from maintenance works & vessels

Benthic impacts arising from maintenance works and the vessels themselves include:

- Damage to seabed habitats from works themselves and vessel anchoring;
- Heightened turbidity and suspended sediments which could settle on marine flora and fauna and affect their growth;
- Marine contamination risk; and
- Remobilisation of nutrients and pollutants trapped in the sediment.

The impact significance depends on the area affected, the frequency of impact and duration of impact. The servicing and maintenance program is currently unknown. Taking a precautionary approach over a long time-period, the impact of maintenance works and the vessels are of not significant.

3.2.3.3 Anthropogenic generation of submarine noise during cable maintenance and repair works

Anthropogenic generation of submarine noise impacts are expected to be of the same nature as those arising during the construction phase but are expected to be of a lower significance given that maintenance works would be rarer, involve fewer vessels and span a smaller area during the operational phase.

3.2.3.4 Artificial surface for non-indigenous alien species

As with any other artificial structure placed in the sea, the cable's non-submerged surface area will eventually be colonised by fouling organisms. Some of these fouling species may be of low conservation value and have little effect on the local marine community. Others may be of high conservation value and bring about improved biodiversity without displacing endemic species. However, others may be non-indigenous species which could negatively impact the local community by replacing endemic species. The impact could therefore be beneficial, neutral or adverse.

3.2.3.5 Leaching of anti-corrosion chemicals into the environment

Underwater cables are often treated with anti-corrosion chemicals to prevent deterioration of the cable and ensure its longevity. The precise chemicals to be used in this project are unknown. Some of the chemicals which could be used for this purpose can have far-reaching ecological consequences, leading to changes in community structure and ecosystem function.

The impact varies depending on the type and concentration of the chemical, as well as the duration and frequency of exposure. The potential pathways to affect marine life include direct toxicity, bioaccumulation, and biomagnification. Direct toxicity occurs when the chemical comes into contact with marine organisms, leading to adverse effects such as death, reduced growth, and impaired reproduction. Bioaccumulation arises when the chemical is absorbed by the organism and accumulates in the tissues of organisms, leading to long-term exposure. Biomagnification occurs when the chemical is passed up the food chain, with organisms at higher trophic levels receiving higher concentrations of the chemical.

The impact significance depends on the chemical to be used, but with the implementation of the proposed measures the impactis not significant.

3.2.3.6 Electromagnetic force around cable

The installation of submarine cables for telecommunications and power transmission has increased significantly in recent years, but it is still unclear what effects they may have on the underwater fauna. The electromagnetic fields (EMFs) generated by submarine cables can potentially disrupt the behaviour of marine organisms, including their feeding, migration, and communication. Effects on infauna and sessile organisms could include behavioural and physiological disruption of these organisms, leading to reduced growth, reproduction, and survival.

Research has shown that some species of fish and invertebrates can detect and respond to EMFs, potentially affecting their survival and reproduction. Exposure to EMFs from a high-voltage power cable affected the swimming behaviour of juvenile Atlantic salmon.[51] Additionally, EMFs from submarine cables may interfere with the acoustic communication of fish, which could affect their social interactions and breeding success.[52]

Like fish, cetaceans and marine mammals are known to use sound for communication, navigation, and foraging. EMFs can potentially interfere with these activities, impacting the survival and reproduction of these species. Research has shown that some species of cetaceans can detect and respond to EMFs. Sperm whales are known to exhibit avoidance behaviour when exposed to EMFs from a power cable, which could affect their feeding and migration patterns.[53] Additionally, EMFs from submarine cables may interfere with the echolocation and navigation abilities of some species of dolphins.[54]

While the long-term effects of submarine cable EMFs on marine life are still not fully understood, these fields have the potential to disrupt the behaviour of underwater fauna. The cable is expected to introduce a field of 3 μT within a 2.6m radius around the cable (Figure 79). Being an AC cable, electromagnetic fields at low intensities (below 5 μT) are not likely to be sensed by magnetite-based systems used in organisms such as mammals, turtles, fish and invertebrates.[55] However, impacts on benthic and demersal species close to the cables could still arise. The impact is considered to be non-significant.

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[51] Haver, S. M., Bjørn, P. A., Finstad, B., Harby, A., & Dragsund, E. (2019). High-voltage power cables affect the swimming behavior of juvenile Atlantic salmon. *Scientific reports, 9*(1), 1-10.

[52] Slabbekoorn, H., Bouton, N., van Opzeeland, I., Coers, A., ten Cate, C., & Popper, A. N. (2010). A noisy spring: the impact of globally rising underwater sound levels on fish. *Trends in ecology & evolution, 25*(7), 419-427.

[53] Leaper, R., Calderan, S., Donovan, G., Gillespie, D., Tasker, M., & Hooker, S. (2016). Sperm whales reduce foraging effort during exposure to 1-2 kH z vertical seismic surveys. *Marine Pollution Bulletin, 103*(1-2), 298-308.

[54] Stimpert, A. K., DeRuiter, S. L., Southall, B. L., Moretti, D. J., Falcone, E. A., Goldbogen, J. A., ... & Tyack, P. L. (2014). Acoustic and foraging behavior of a tagged Baird's beaked whale (Berardius bairdii) exposed to simulated sonar. *Scientific reports, 4*(1), 1-11.

[55] US Department of the Interior (2011). Effects of EMFs From Undersea Power Cables On Elasmobranchs And Other Marine Species.

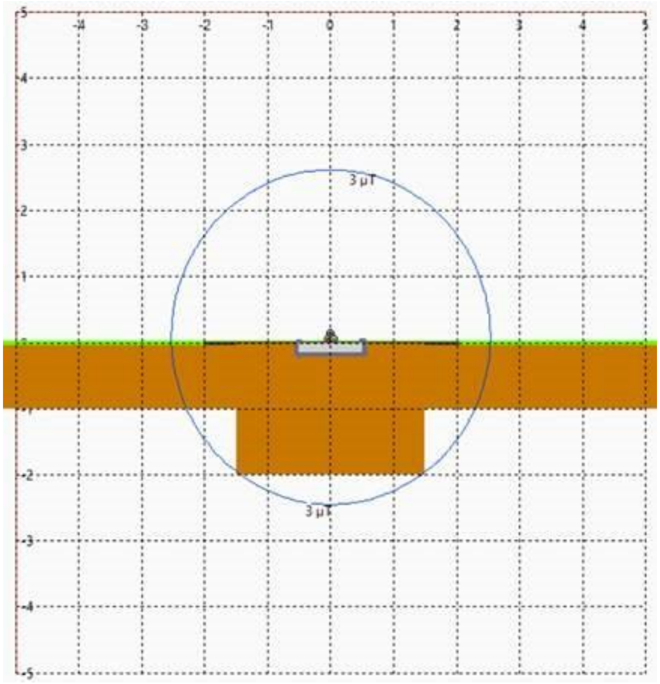

FIGURE 79: EMF AROUND THE INTERCONNECTOR CABLE

3.2.3.7 Effect on Health of *Posidonia oceanica*

The Natura 2000 SAC has an estimated coverage of 5,011.68 ha of protected *P. oceanica*. The health of *P. oceanica* within the SAC is characterised by a number of parameters, namely:

- Extent of *Posidonia* meadows in relation to total extent of *Posidonia* meadows within the SAC
- Lower depth limit of *Posidonia* meadow within the SAC
- Shoot density of *Posidonia* meadows
- Epiphytic load on *Posidonia* leaves
- Water quality in terms of levels of chlorophyll-a

Some 2,200 sqm of mostly reticulate meadows are to be obliterated along the footprint of the proposed Scheme, representing an impact on the extent of *P. oceanica*. The affected area represents less than 0.1% of the meadows in the SAC, meaning the proportion of meadows within the SAC to be affected by the Scheme is **insignificant**.

The lower depth limit of *P. oceanica* is mostly affected by water clarity (such as eutrophication and siltation) and to a lesser extent direct damage (such as dredging and anchoring).[56] Considering that the Scheme is not likely to affect the

[56] Zubak, I., Cizmek, H., & Mokos, M. (2020). Posidonia oceanica lower depth limits along a latitudinal gradient in the eastern Adriatic Sea. *Botanica Marina*, *63*(3), 209-214. https://doi.org/10.1515/bot-2019-0097.

hydrodynamics of the site, the Scheme is unlikely to affect the lower depth limit of this seagrass.

Some fragmentation of the meadows could arise from the proposed Scheme, possibly affecting the shoot density of the *Posidonia* meadows in the AoI.[57] The affected area represents less than 1% of the meadows in the SAC, meaning the Scheme's overall effect on meadow shoot density in the SAC is **insignificant**.

Epiphytic load and chlorophyll-a concentrations are primarily dependent on nutrient concentrations in the water column.[58, 59] The construction works will likely increase water turbidity in the immediate surroundings (which in turn lowers the removal capacity of seagrasses.[60] Nevertheless, the effect is temporary, spread over a small area and can be effectively mitigated. The operational phase is not likely to significantly increase sediment resuspension. On the other hand, nutrient concentrations are also affected by water circulation and residence time. No effect on water currents is expected during the operational stage, and the Scheme is unlikely to alter water circulation and residence time. The impact of the Scheme on epiphytic load or water quality in terms of chlorophyll-a is **insignificant**.

The Scheme is therefore not expected to have a significant detrimental effect on the integrity of the Natura 2000 SAC as a whole in terms of the *P. oceanica* meadows.

3.3 DECOMMISSIONING PHASE

The decommissioning of the cable refers to the process of ending its use and ceasing its operation. When a cable is decommissioned, it is typically disconnected from the power source or network it was connected to, and then either removed or left in place. In the case of the cable in question, it is unlikely to be de-buried and removed due to several factors.

Firstly, the cable is oil-free, which means it does not contain any hazardous materials that could cause long-term harm to the environment. Oil-free cables are a more environmentally friendly option compared to cables that contain oil, which can leak and cause damage to the ecosystem. Therefore, there is no immediate risk or danger to the environment if the cable remains in place.

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[57] Barcelona, A., Colomer, J., Soler, M., Gracias, N., & Serra, T. (2021). Meadow fragmentation influences Posidonia oceanica density at the edge of nearby gaps. *Estuarine, Coastal and Shelf Science*, *249*, 107106. https://doi.org/10.1016/j.ecss.2020.107106.

[58] Castejón-Silvo, I., Terrados, J., Domínguez, M., & Morales-Nin, B. (2012). Epiphyte response to in situ manipulation of nutrient availability and fish presence in a Posidonia oceanica (L.) Delile meadow. *Hydrobiologia*, *696*(1), 159-170. https://doi.org/10.1007/s10750-012-1190-1.

[59] Kucuksezgin F, Balci A, Kontas A, Altay O (1995). Distribution of nutrients and chlorophyll-a in the aegean sea. *Oceanologica Acta*, *18*(3), 343-352.

[60] Bulmer, R., Townsend, M., Drylie, T., & Lohrer, A. (2018). Elevated Turbidity and the Nutrient Removal Capacity of Seagrass. *Frontiers In Marine Science*, *5*. https://doi.org/10.3389/fmars.2018.00462.

Secondly, removing the cable would involve significant costs, both in terms of financial and environmental impact. The process of removing a cable requires a significant number of resources, including specialized equipment and personnel. Additionally, removing the cable would require disturbing the surrounding soil and seabed, which could potentially release harmful pollutants into the environment.

Lastly, leaving the cable in place does not pose any significant risk to human health or the environment, and the impact of the cable on the local ecosystem is minimal. Therefore, there is little incentive or justification for the cable to be removed, given the high cost and potential negative environmental impact that would result from doing so. Overall, the decision to leave the cable in place after its decommissioning is a practical and environmentally responsible choice.

4 Mitigation Measures

4.1.1 Terrestrial Study

Since the proposed development is not located on any terrestrial Natura 2000 sites and there are no direct and/or indirect impacts on such Natura 2000 sites, no mitigation measures are being proposed within the confinements of the Natura 2000 site. Nevertheless, there are various ecologically important areas within the AOI which require the implementation of diligent working practices and mitigation measures to reduce some of the identified impacts.

The Environmental Management Construction Site Regulations (S.L. 522.09) should be enforced to avoid the impacts from being generated in the first place and to ensure that environmental degradation is kept as low as possible. These regulations provide details on the containment and transportation measures for loose construction material on site and in transit, and other measures to prevent carrying out and/or depositing particulate matter.

Some of the proposed mitigation measures are highlighted below:

- Heavy machinery should not trample on natural areas located outside of the scheme site boundary
- Chemical spillages from machinery should be avoided by storing wastes and chemicals in bunded areas within the construction site
- All construction debris and soil should not be stockpiled near the base of trees and/or natural areas, but should be hauled away for proper disposal or in designated waste management areas
- Replacement/compensatory planting in the northern garigue area is necessary, some of the species to be considered include: *Thymbra capitata, Teucrium fruticans* and *Tamarix africana.* Compensatory planting should be avoided during the summer period.
- The necessary environmental permits to carry out interventions on protected species are obtained from the ERA
- Uprooting of invasive alien species should follow the recommendations in the ERA Guidelines on Works Involving Trees (2019) on managing non-native plant invaders and restoring native plant communities in terrestrial settings in the Maltese islands.
- Transplantation measures:
  - Should transplanting of trees be necessary, they should be pruned (not more than 25% of overall crown) to stimulate growth and reduce water loss. The trees should be watered for two consecutive days before removal, and the branches should be tied together during the transplantation phase.
  - An excavator or hand-held tools are necessary to dig a 60cm deep trench around the tree; the excavator should also dig a new pit which is around twice the original size of the root ball

- Transplanting should take place between October to March, and the tree should be regularly monitored for growth. Follow-ups are required for at least 3 years after the specimen has been transplanted

- Negligence during construction activities can be mitigated through regular and effective environmental monitoring to ensure that the construction impacts are not spilling over into the adjacent habitats.
- Hoarding should be set up (in line with the Environmental Management Construction Site Regulations, 2007) along the construction site to minimise dispersion of particulates. This should be covered with suitable mesh or material that precludes dispersion of particulate matter.
- Pre-soaking, dust suppressors and covered stockpiles are considered good practices to minimise dust emissions.
- Works should be avoided during the night-time as much as possible
- Although rodent control is encouraged when setting up a construction site, care must be taken not to negatively influence any resident fauna in the immediate surroundings
- Construction vehicles and machinery should be well-maintained and serviced such that they can be operated at the best of their environmental performance.
- If lighting is required, downward facing luminaires should be installed within the facility to reduce light pollution during the operational phase

4.1.2 Avifauna study

No direct negative residual impacts on avifauna are expected under the scenario that the project is not realized. However, with the importance of Malta's energy security in a period of increasing demand, it is unlikely that increased energy efficiency and economisations alone would render the project obsolete. Indirect residual impacts of this scenario would therefore highly depend on the source type and quantity of local electricity production, particularly alternative means with which to cover the natural intermittency of renewable energy sources, such as solar and wind.

4.1.2.1 Mitigation of impact on terrestrial breeding birds (AoI-1)

To further reduce the residual impact on local terrestrial breeding bird populations the following recommendations are made:

- The construction phase for the onshore cable route is kept as short as possible.
- Ideally, the construction phase would be timed to a period outside the main reproductive season (March to August) of the bird species breeding in the area, thus focusing on the autumn and winter months. However, as this appears to be unfeasible, it is recommended that:
  - The footprint of the construction sites, including the storage areas for material from the trenches, is kept as small as possible, specifically in the areas of natural and seminatural habitat (agricultural land, garrigue on disused agricultural land).
  - No works will be carried out during the night.
  - Adequate landscaping will be applied to restore the disturbed habitat in all affected areas at the end of the construction phase to mitigate any

longer-term impact. It is recommended that solely native plants are used for habitat restoration and that species with known benefit to avifauna are chosen.

4.1.2.2 Mitigation of impact on marine habitat (AoI-2)

To further reduce the residual impact on the receptor species utilising the marine habitats in the AoI, the following mitigation measures are recommended:

- Ideally, construction work (including the 0.5 km buffer area) which overlaps with the Natura 2000 site (MT0000112) is carried out outside the fledging period of the most vulnerable receptor species, *P. yelkouan*, which spans over the period June to July. However, if this appears to be unfeasible, mitigation methods listed below under 4.2.3 and/ or relevant compensatory measures as listed under 5.3 are implemented.

4.1.2.3 Mitigation of impact on seabirds caused by light pollution (AoI-3)

To reduce the residual impact on receptors (*P. yelkouan*) breeding in the AoI-3 to below threshold levels of significance the following mitigation methods are proposed:

- No construction is carried out during darkness and lights on the cable laying vessel are reduced to the ones required at anchor. If this is not feasible, the following alternative measures should be taken:
- The construction phase for the offshore cable route is kept as short as possible.
- The construction phase with work being carried out specifically in the area of the AoI-3 overlapping with the buffer zone around the *P. yelkouan* colony on St Paul's Island (MT0000022, see Figure 2, relevant area shown in pink) is timed to a period outside the fledging period (June to July) or, alternatively, during hours with daylight only.
- Where nighttime work cannot be avoided and artificial light is required, such lighting should strictly follow ERA's draft "Guidelines for the Reduction of Light Pollution in the Maltese Islands" throughout the duration of any nighttime works[61].

4.1.2.4 Mitigation measures during the operational phase

For the operational phase, significant impacts are expected to occur localised if the interconnector cable gets damaged and requires repair. Therefore, it is recommended to map the risks for accidental or intentional damage to the interconnector cable and take precautionary measures to reduce such risks.

If repairs become necessary during the operational phase, the same mitigation measures as proposed for the construction phase apply.

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[61] Environment and Resources Authority (2020): Guidelines for the Reduction of Light Pollution in the Maltese Islands. Draft (Public Consultation Document) downloaded from https://era.org.mt/topic/public-consultation-guidelines-for-the-reduction-of-light-pollution-in-the-maltese-islands/ on 12-07-20223.

Measures leading to the increase in energy efficiency, reduction in demand, the use of electricity from certified renewable sources produced with insignificant impact on avifauna, and the increase in "avifauna-friendly" energy production locally (e.g. via PV-systems installed on suitable flat roofs, roofing car parks) would help to mitigate indirect long-term impacts of the proposed development regarding climate change and biodiversity loss. In principle, a second Interconnector provides the possibility for increased importation of electricity sourced from renewables, and for an increase of local renewable energy sources through the enhancement of the grid stability and balancing of intermittent RES, and may lead to a net beneficial impact if it results in an absolute reduction in energy production from the burning of fossil fuels (as discussed under 3.2.2)

4.1.3 Marine Study

A number of mitigation measures can be applied to reduce dispersion of fine particulates from land:

- Prohibition of the marine discharge of any wastewaters, such as concrete washdown waters;
- Preventing unnecessary storage of loose excavation material by removing it from site within a short period of time;
- Coverage of stockpiles;
- Periodic wetting of the surface aggregate and soil within the coastal area housing heavy machinery, in order to reduce rates of air-borne transport of the same sediment particles;
- Installation of proper, waterproof hoarding for inert material stockpiled close to shore.

Punchout hole impacts

The dimensions of the punchout hole should be kept to a minimum. In a buffer area surrounding the punchout hole, *P. oceanica* shoots should be removed and prepared for transplanting. The transplantation could involve deploying a number of artificial reefs which are at least the size of the footprint to be obliterated. These reefs should be deployed at depths of 40-45m, inoculated with seagrass cuttings that were removed prior to the punchout hole process. The reef can either be redeployed back to the original site or in a different area. The deployment site should be carefully chosen to avoid damaging benthic communities of conservation importance falling within the footprint of the artificial reefs and to increase the survival success rates of the transplanted shoots. The survival rates of these shoots should be regularly monitored. Given recent progress, through a number of ad hoc case studies (e.g. those conducted within the EU-funded MERCES project[62] in the transplantation success of a number of

[62] MERCES Project - http://www.merces-project.eu/

high-conservation value benthic assemblages, including *P. oceanica* meadows), the implementation of such a mitigation measure is feasible.

Following removal of the *P. oceanica* shoots, HDD punchout hole can occur. Sediment recovered from this activity should be screened for the occurrence of translocatable specimens of species of conservation importance prior to disposal. Any species of importance should be moved to a suitable location to prevent its loss.

Control of preferred pre-lay cable crossing

The pre-lay cable crossing technology which presents the smallest footprint and thus, presumably, the least direct impact on benthic assemblages, should be selected. If used, dry rock bags for cable support setups should be individually inspected for leakages prior to deployment. Furthermore, these rock bags should not be stacked too high along the flanks of the cable to reduce burden on the bottom row of bags and reduce the likelihood of lateral displacement of the bottom bags.

Release of drilling fluids into the environment

Drilling fluids are likely to be dispersed into the marine environment with HDD. An estimated 20% of total bentonite used is expected to be released unless mitigation measures are taken. The contractors have advised that the quantity of bentonite released into the environment can be reduced with adequate monitoring. The pilot punchout hole will also be capped with carefully placed sandbags to minimise dispersion of drilling fluids. While microtunnelling would minimise the release of drilling fluids, the contractors have advised that this technology is not recommended for this site. Furthermore, microtunnelling would require a larger transition pit which would obliterate a larger quantity of P. oceanica.

Furthermore, biodegradable drilling fluids are feasible alternatives with lower impacts on the marine environment than their traditional counterparts. Considering the sensitivity of the marine flora and fauna in the AoI, biodegradable drilling fluids should be considered to reduce the impact of HDD drilling fluids.

Anthropogenic generation of submarine noise

The temporary deployment of air bubble screens should be considered for phases of the construction works which are likely to generate the highest levels of submarine noise, such as the punchout hole.

The methodological guidance on the mitigation of underwater noise issued by the ACCOBAMS (2019) lists a number of different underwater bubble screen arrays. Of these, two are most favourable due to the relatively small footprint they take up. The two arrays with lowest seabed footprint are the Big air Bubble Curtain (BBC) and the Hydro-Sound Damper (HSD). The BBC consists of a hose with drilled holes, supplied with compressed air. The hose is placed on the seabed and the air escaping from the holes forms the bubble screen. The HSD consists of fishing nets with small balloon filled with gas and foam (which is tuned to resonant frequencies) fixed to it. It can be applied in different ways.

The same methodological guidance from ACCOBAMS details the array of mitigation measures which should be adopted within scheduled marine-based works entailing drilling, pile-driving and dredging. Table 49 is a relevant excerpt from the same guidance report. It is to be noted that all these activities are not planned for this project and are considered as worst-case activities.

TABLE 49: MITIGATION MEASURES FOR UNDERWATER NOISE

Mitigation Framework for seismic surveys	
Planning phase (expected outcomes of an EIA)	1. Consider the adoption of alternative technologies (p. 13) 2. Review the presence of cetaceans in the candidate periods for the survey and carry out or fund research where the information is non-existent or inadequate 3. Define no-survey zones (biological reserves, especially protected areas etc.) 4. Select periods with low biological sensitivity 5. Use sound propagation modelling to define the extent of the exclusion area (EZ)
Real-time mitigation practices (p. 14)	1. Use the visual monitoring protocol* 2. Use the acoustic monitoring protocol* 3. Use the soft start protocol
Post-activity	1. Detailed reporting of real-time mitigation**

** PAM and MMO equipment (p. 15)*
*** Detailed reports of the mitigation activity should follow a standard form made available by ACCOBAMS*

Dispersion of resuspended fine sediment particles

The punch-out hole will be located among the *P. oceanica* meadows, resulting in significant impacts of resuspended sediments on this important protected species. The location of the punchout hole should be chosen on the basis of the impact extent of the sediment plume. The punchout hole location which would have the highest dispersal rate and lowest area of *P. oceanica* affected should be selected. This would minimise the probability of regression of the meadows through resettlement of the sediment which would significantly harm this species. The sediment generated from the punchout hole should be contained as much as possible by deploying a double silt geotextile curtain. The curtain should be able to withstand storm-associated battering to ensure continuous protection during the works.

Resuspension of sediment can also arise from the trenching works, placement of the cable, rock armour and placing of the protection covers when crossing other underwater infrastructure. Sediment traps could be used when installing the cable in deeper waters to reduce the dispersion of sediment generated from the works. In deeper waters, sediment traps need to be larger and stronger than their shallow water counterparts. If they need to be anchored to the bottom, they should only be used when anchoring would not directly impact important benthic habitats. Other sediment traps can be suspended in the water column at different depths to further reduce the dispersion of suspended sediments. Whatever material is used for the cable crossing (sandbags, rocks or concrete mattresses) should not be dropped from high levels, but instead placed gently from a small height to reduce resuspension of sediment.

Leaching and re-suspension of toxic chemicals

Any inert material to be stockpiled in the coastal area close to the development should be screened so as to ensure that it does not include any toxic contamination, which might potentially leach into the marine environment following heavy rainfall. Furthermore, where biodegradable alternatives to certain chemicals exist, they should be favoured over their traditional counterparts, both on land and on the work vessels. This includes biodegradable lubricants. Such a protocol will ensure that any accidental spills into the environment will cause less harm to marine flora and fauna.

The nearshore area is most likely to generate resuspension of sediment, in accordance with the PMRS sediment dispersion report. Consequently, a shallow layer of top sediment in this area would ideally need to be removed, since these layers would have the highest concentration of sediment. However, due the presence of important benthic species, this mitigation measure may do more harm than good. Therefore, no sediment will be removed from the marine environment during the laying and protection of the submarine cable.

Targeted anchoring activities

In order to mitigate anchor damage to sensitive benthic assemblages, the use of anchor stabilisation devices should be minimised, in order to reduce the impacted seabed footprint. Furthermore, anchoring areas should be designated outside seabed areas supporting sensitive assemblages such as *P. oceanica* and maërl, to avoid anchoring in these habitats at all costs. Designated areas should be confined to rock areas as far as possible. Alternative anchoring such as using eco-mooring buoys should be preferred in nearshore areas, while in deeper waters, gravity anchors or helix anchors, can be used to minimize the impact on benthic habitats. Crabbing (anchor dragging) should be prohibited during works. Otherwise, the vessel will use its dynamic positioning capabilities to keep the vessel position without the use of anchors.

Selection of anti-corrosion inhibitors

The use of anti-corrosion inhibitors is currently unknown. If such a system were to be used, biodegradable anti-corrosion chemicals should be selected to avoid impact on the marine environment. Bioaccumulating and biomagnifying chemicals such as mercury and indium should be avoided.

Operational mitigation measures

Impacts during operation are largely restricted to those which arise from maintenance of the cable. These impacts are similar to those which will occur during the construction phase, so the same mitigation measures are applicable. The leaching of anti-corrosion chemicals from the cable can be mitigated by making use of biodegradable anti-corrosion alternatives. The remaining operational impacts (such as the altered hydrodynamics in the vicinity of the cable, the artificial surface for non-indigenous alien species, and the electromagnetic force around the cable) are unmitigable.

4.1.4 Noise Study

The noise impact from construction activities has been predicted as not significant. The impact magnitude, in the worst-case, is minor and with calculation assumptions tending towards a worst-case. However, to further reduce the potential for adverse noise impacts, the following construction mitigation measures are provided as recommended good practice, to be implemented where appropriate:

- Consideration will be given to noise emissions when selecting plant and equipment to be used on site;
- All equipment should be maintained in good working order and fitted with the appropriate silencers, mufflers or acoustic covers where applicable;
- Stationary noise sources will be sited as far away as reasonably possible from noise-sensitive receptors and where necessary and appropriate, acoustic barriers will be used to screen them; and
- The movement of vehicles to and from the site will be controlled and employees will be instructed to ensure compliance with any noise control measures adopted.

There are many strategies to reduce construction noise by the limitation of activities that would result in predicted noise levels being reduced. Any such measures should be considered adequate, and the mitigation adopted should not be limited to the measures proposed.

5 Residual Impacts

5.1 Terrestrial Study

Residual impacts are those impacts which are bound to remain after taking into consideration the proposed mitigation measures. Despite the comprehensive adoption of the recommended mitigation measures, a number of unavoidable residual impacts are still expected to arise, namely:

- Impact on ecologically sensitive terrestrial ecosystems and assemblages falling directly within the footprint of the site interventions.
- Accumulation of dust, vibration and noise impacts within the immediate terrestrial ecosystems abutting the construction site boundary

5.2 Avifauna Study

Depending on the mitigation measures implemented, it cannot be excluded that a temporary significant impact on P. yelkouan population nesting on St Paul's Island (MT0000022) remains. Such impact would remain during the construction, as well as for repair scenarios during the operational phase.

In case a significant residual impact on the *P. yelkouan* colony inside MT0000022 remains, the following compensatory measures are recommended:

- Support of Invasive Alien Species (predator) control schemes to improve reproductive performance in the above mentioned or other nearby *P. yelkouan* colonies.
- Support of rescue campaigns of grounded *P. yelkouan* fledglings to reduce light pollution induced mortality.
- Support the implementation of fisheries by-catch mitigation measures to increase overall adult survival rates of relevant seabirds.

5.3 Marine Study

Despite the comprehensive adoption of the recommended mitigation measures, a number of unavoidable residual impacts are still expected to arise, namely:

- Obliteration of sensitive benthic assemblages including *P. oceanica* and maërl falling directly within the footprint of seabed interventions (i.e. cable, cable crossings, punchout hole, trenching, gravel overspill within benthic areas),
- Smothering of sensitive benthic assemblages through re-suspension/re-mobilisation of fine particulates through seabed disturbance activities (e.g. punchout hole, cable laying, trenching, etc),
- Anthropogenic generation of submarine noise,
- Discharge and subsequent dispersion of waste drilling muds into the marine environment;
- Remobilisation of nutrients and pollutants sequestered within the benthic sediment due to sediment disturbance;
- Altered hydrodynamics in the vicinity of the cable; and

- Fouling of the laid cable by epibiotic species.

The above impacts are not considered to be significant. The Scheme is therefore not expected to have a significant detrimental effect on the integrity of the Natura 2000 SAC as a whole in terms of the *P. oceanica* meadows.

5.4 Noise Study

The predicted noise impact upon the ecological receptors during the construction phases has been evaluated based on the AQTAG $L_{Aeq,1hr}$ 55 dB target limit. The impact magnitude has been considered, in the worst-case, as minor. Following good industry practice and management, construction noise is not likely to generate an adverse impact on the ecological receptors and therefore no residual effect is applicable.

6 MONITORING PROGRAMME

6.1 TERRESTRIAL ECOLOGY

Should the Scheme be permitted to be developed, a monitoring programme should be set up and implemented during the construction phases of development. The construction management plan prepared at project planning phase will be updated by the chosen contractor in order to ascertain that the best practicable environmental options available are followed through.

During the construction phase, periodic monitoring is being recommended to ensure that mitigation measures are in place and working as they should. This would ensure that no unwarranted impacts arise due to deviations from proposed working practices. Such deviations could have additional impacts over and above those originally predicted. All monitoring data should be presented to the relevant authorities at pre-agreed frequencies.

A terrestrial ecological monitoring approach is proposed in the northern garigue area where the HDD temporary laydown area shall be located. This is important to ensure that the site is restored back into its original condition following the implementation of construction works in this area. This approach can also be applied to other ecological important areas along the entire stretch of the onshore cable route, as deemed relevant by the competent authorities.

6.2 AVIAN STUDY

It is recommended to monitor the *P. yelkouan* population on St Paul's Island (MT0000022) regarding population size, reproductive performance, and survival rates in relevant breeding periods during the construction phase, as well as during the operational phase if repair scenarios occur. Data collected on the above-mentioned parameters can be then compared to available baseline values (with thresholds) to reveal whether a significant residual impact remains.

6.3 MARINE STUDY

A BACI (Before-After-Control-Impact) marine ecological monitoring approach is proposed, consisting of the following design:

- Adopting the mapping datasets collected during the pre-permitting phase to characterise the 'Before' component
- Collection of a second tranche of monitoring data, collected in the same manner as the 'Before' dataset (same survey location, as well as matching seasons and data collection techniques), so as to represent the 'After' component
- The adoption of control sites ('Control') within the monitoring protocol could be considered, although the sheer extent of the surveyed marine area makes it difficult to identify a suitable control site.

- A semi-quantitative comparative approach is conducted to identify any significant changes ('Impacts') between the two situations and identify the impacts between the two. One possible way of doing this is through the application of machine learning protocols (in the form of image analysis) to the processing of ROV footage, as has been applied previously within Maltese waters as a part of a separate environmental monitoring project (the Malta-Sicily Interconnector – Gauci et al., 2016).

A minimum interval of 12 months should be allowed prior to the conduction of the second survey to enable ecological responses to the disturbance wrought to the impacted marine ecosystems to emerge.

7 Summary of Impacts Table

Impact type and source			Impact receptor		Effect & Scale							Probability of impact occurring	Overall impact significance	Proposed mitigation measures	Residual impact significance	Other requirements
Impact type	Specific intervention leading to impact	Project phase	Receptor type	Sensitivity & resilience toward impact	Direct/ Indirect/ Cumulative	Beneficial/ Adverse	Severity	Physical/ geographic extent of impact	Short-/ Medium-/ Long-term	Temporary/ Permanent	Reversible/ Irreversible					
								Terrestrial impacts								
Destruction of habitats and species in ecologically sensitive areas	Trenching and Temporary HDD laydown area	Construction	Vegetation & faunal species in Natura 2000 sites	High	Direct	Adverse	High	Localised	Long-term	Permanent	Reversible	Inevitable	Not Significant	No direct works on l-Ghadira s-safra and l-Iskoll tal-Ghallis Natura 2000 site are proposed. Rehabilitating the impacted garigue areas outside the site through compensatory planting and monitoring construction activities to minimise spill over effects will be necessary.	Not significant	N/A
Dust and silting	Trenching and Temporary HDD laydown area	Construction	Vegetation & faunal species in Natura 2000 sites	Moderate	Direct	Adverse	Moderate	Localised	Short-term	Temporary	Reversible	Likely	Not significant	Implementation of effective dust suppression and water run-off harvesting techniques, particularly at the HDD laydown area.	Not significant	N/A
Illumination & Noise	Trenching and Temporary HDD laydown area	Construction	Faunal species in Natura 2000 sites	High	Direct	Adverse	Moderate	Widespread	Short-term	Temporary	Reversible	Likely	Not significant	Onshore works should not be carried out at night. Use of lighting for safety reasons should be limited to downward	Not significant	N/A

IMPACT TYPE AND SOURCE			IMPACT RECEPTOR		EFFECT & SCALE							PROBABILITY OF IMPACT OCCURRING	OVERALL IMPACT SIGNIFICANCE	PROPOSED MITIGATION MEASURES	RESIDUAL IMPACT SIGNIFICANCE	OTHER REQUIREMENTS
IMPACT TYPE	SPECIFIC INTERVENTION LEADING TO IMPACT	PROJECT PHASE	RECEPTOR TYPE	SENSITIVITY & RESILIENCE TOWARD IMPACT	DIRECT/ INDIRECT/ CUMULATIVE	BENEFICIAL/ ADVERSE	SEVERITY	PHYSICAL/ GEOGRAPHIC EXTENT OF IMPACT	SHORT-/ MEDIUM-/ LONG-TERM	TEMPORARY/ PERMANENT	REVERSIBLE / IRREVERSIBLE					
														facing, shielded and low-frequency luminaires.		
Garigue soil compaction	Machinery used at temporary HDD laydown area	Construction	Vegetation and soil infauna	High	Direct	Adverse	High	Localised	Short-term	Permanent	Irreversible	Unlikely	Not significant	Contractor's machinery, storage areas and personnel must be confined to the scheme site boundary to limit overspill trampling impacts on ecologically sensitive areas such as l-Ghadira s-Safra and l-Iskoll tal-Ghallis.	Not significant	N/A
Noise & lighting from the Terminal Station	Operation of the Terminal Station	Operation	Fauna	High	Direct	Adverse	Moderate	Widespread	Long-term	Permanent	Irreversible	Unlikely	Non-significant	N/A	Not significant	N/A
								Avifauna Impacts								
Loss of habitat for terrestrial avian species	Destruction of disturbed garrigue	Construction, repair during operation phase	Terrestrial avian species	High & Low	Direct	Adverse	Low	Local	Short-term	Temporary	Reversible	Inevitable	Not significant to significant	Keep time short, keep footprint low, avoid (if possible) reproductive season, habitat restoration	Not significant	N/A

Impact type and source			Impact receptor		Effect & Scale							Probability of impact occurring	Overall impact significance	Proposed mitigation measures	Residual impact significance	Other requirements
Impact type	Specific intervention leading to impact	Project phase	Receptor type	Sensitivity & resilience toward impact	Direct/ Indirect/ Cumulative	Beneficial/ Adverse	Severity	Physical/ geographic extent of impact	Short-/ Medium-/ Long-term	Temporary/ Permanent	Reversible / Irreversible					
Noise, vibration, and light pollution negatively affecting terrestrial avian assemblages in AoI-1	Excavation and construction activities, night-time operation	Construction, repairs during operation	Terrestrial avian species	Moderate & Moderate	Direct	Adverse	Low	Local along onshore cable route and HDD site (AoI-1)	Short-term	Temporary	Reversible	High	Not significant to significant	Limit night-time activities, reduce light pollution, avoid (if possible) sensitive periods	Not significant	N/A
Light pollution negatively impacting nocturnally migrating birds	Lighting during construction, repairs during operation	Construction, repairs during operation	Nocturnally migrating birds	Moderate & Moderate	Direct	Adverse	Low	Broad (AoI-1 and AoI-3)	Short-term	Temporary, potentially re-occurring	Reversable	High	Not significant to significant	Limit night-time activities, reduce light pollution, avoid (if possible) sensitive periods	Not significant	N/A
Marine Ecology Impacts																
Obliteration of benthic assemblages	Punchout hole & cable laying	Construction	Benthic assemblages, including *P. oceanica, maërl and sandbanks*	High	Direct	Adverse	High	Local/Restricted	Long-term	Permanent	Irreversible	Inevitable	Significant	In view of the lack of a technically feasible punchout site outside the *P. oceanica* meadows, the size of the punchout hole should be minimised	Not significant	Translocation of P. oceanica meadows prior to the start of excavation works
Obliteration of benthic assemblages	Heightened anchoring activity	Construction	Benthic assemblages, including *P. oceanica,* maërl and sandbanks	High	Direct	Adverse	High	Local/Restricted	Long-term	Permanent	Irreversible	Inevitable	Significant	Use of eco-mooring and/or designation of safe anchoring areas; Use of low-impact anchors or	Not significant	N/A

Impact type and source			Impact receptor		Effect & Scale							Probability of impact occurring	Overall impact significance	Proposed mitigation measures	Residual impact significance	Other requirements
Impact type	Specific intervention leading to impact	Project phase	Receptor type	Sensitivity & resilience toward impact	Direct/ Indirect/ Cumulative	Beneficial/ Adverse	Severity	Physical/ geographic extent of impact	Short-/ Medium-/ Long-term	Temporary/ Permanent	Reversible/ Irreversible					
														vessels with Dynamic Positioning		
Atmospheric fall-out/ deposition of fine particulates	Various works	Construction	Marine organisms and habitats	High	Indirect	Adverse	High	Moderate extent	Short-term	Temporary	Reversible	Likely	Significant	Use of dust mitigation techniques such as silt curtains in shallow waters that minimizes disturbance in deeper waters	Not significant	Monitoring
Heightened marine contamination risk	Accidental release of fuels, lubricant oils, additives, cement from cable support bags	Construction	Marine organisms and habitats	Medium	Indirect	Adverse	Medium	Moderate extent	Short-term	Temporary	Reversible	Unlikely	Not significant	Use of appropriate bunding, spill kits and booms; Use of biodegradable chemicals where possible	Not significant	Monitoring
Release of drilling fluids	Horizontal directional drilling	Construction	Marine organisms and habitats	High	Indirect	Adverse	High	Widespread	Short-term	Temporary	Reversible	Inevitable	Not significant	Using biodegradable drilling fluids where possible; using a forward reaming type of HDD	Not significant	Monitoring
Suspended sediment	Punchout hole & cable laying	Construction	Marine organisms	High	Direct	Adverse	High	Widespread	Short-term	Temporary	Reversible	Inevitable	Significant	Use of dust mitigation techniques such as silt	Not significant	Monitoring

IMPACT TYPE AND SOURCE			IMPACT RECEPTOR		EFFECT & SCALE							PROBABILITY OF IMPACT OCCURRING	OVERALL IMPACT SIGNIFICANCE	PROPOSED MITIGATION MEASURES	RESIDUAL IMPACT SIGNIFICANCE	OTHER REQUIREMENTS
IMPACT TYPE	SPECIFIC INTERVENTION LEADING TO IMPACT	PROJECT PHASE	RECEPTOR TYPE	SENSITIVITY & RESILIENCE TOWARD IMPACT	DIRECT/ INDIRECT/ CUMULATIVE	BENEFICIAL/ ADVERSE	SEVERITY	PHYSICAL/ GEOGRAPHIC EXTENT OF IMPACT	SHORT-/ MEDIUM-/ LONG-TERM	TEMPORARY/ PERMANENT	REVERSIBLE/ IRREVERSIBLE					
			and habitats											curtains in shallow waters		
Remobilisation of nutrients and pollutants sequestered within the benthic sediment	Punchout hole & cable laying	Construction	Marine organisms and habitats	High	Indirect	Adverse	Medium	Widespread	Short-term	Temporary	Irreversible	Likely	Not significant	For areas where high chemical concentrations have been detected, sediment removed from the seabed should not be returned to the marine environment. Material characterisation is necessary to determine disposal method.	Not significant	N/A
Anthropogenic generation of submarine noise	Various works	Construction	Marine organisms and habitats	Medium	Indirect	Adverse	Moderate	Widespread	Short-term	Temporary	Reversible	Inevitable	Not Significant	The temporary deployment of air bubble screens should be considered for phases of the construction works which	Not significant	N/A

Impact type and source			Impact receptor		Effect & Scale							Probability of impact occurring	Overall impact significance	Proposed mitigation measures	Residual impact significance	Other requirements
Impact type	Specific intervention leading to impact	Project phase	Receptor type	Sensitivity & resilience toward impact	Direct/ Indirect/ Cumulative	Beneficial/ Adverse	Severity	Physical/ geographic extent of impact	Short-/ Medium-/ Long-term	Temporary/ Permanent	Reversible/ Irreversible					
														are likely to generate the highest levels of submarine noise.		
Habitat loss and fragmentation of *P. oceanica*	Physical presence of the cable causing seabed sheer forces	Operation	Marine organisms and habitats	Medium	Indirect	Adverse	Low	Moderate extent	Short-term	Permanent	Irreversible	Likely	Not significant	N/A	Not significant	N/A
Benthic impacts	Cable maintenance and repair works	Operation	Benthic assemblages	High	Direct	Adverse	High	Widespread	Long-term	Permanent	Irreversible	Unlikely	Not significant	Use of eco-mooring and/or designation of safe anchoring areas; Use of low-impact anchors or dynamic positioning vessels	Not significant	N/A
Anthropogenic generation of submarine noise	Maintenance/ repair	Operation	Marine organisms and habitats	Medium	Indirect	Adverse	Moderate	Moderate extent	Short-term	Temporary	Reversible	Inevitable	Not significant	The temporary deployment of air bubble screens should be considered for phases of the	Not significant	N/A

Impact type and source			Impact receptor		Effect & Scale							Probability of impact occurring	Overall impact significance	Proposed mitigation measures	Residual impact significance	Other requirements
Impact type	Specific intervention leading to impact	Project phase	Receptor type	Sensitivity & resilience toward impact	Direct/ Indirect/ Cumulative	Beneficial/ Adverse	Severity	Physical/ geographic extent of impact	Short-/ Medium-/ Long-term	Temporary/ Permanent	Reversible/ Irreversible					
														construction works which are likely to generate the highest levels of submarine noise, such as the punchout hole.		
Colonisation of laid cable by epibiota	Physical presence of the artificial cable	Operation	Marine habitats	High	Direct	Beneficial, neutral or adverse	High	Widespread	Long-term	Permanent	Reversible	Inevitable	Not significant	N/A	Not significant	Monitoring
Toxicity to marine life	Leaching of anti-corrosion chemicals	Operation	Marine habitats	Medium	Indirect	Adverse	Low	Local	Long-term	Permanent	Reversible	Likely	Not significant	Use of biodegradable anti-corrosion chemicals	Not significant	N/A
Behavioural and physiological disruption to marine fauna	EMF around the cable	Operation	Marine habitats	Medium	Indirect	Adverse	Low	Local	Long-term	Permanent	Reversible	Likely	Not significant	N/A	Not significant	N/A
Lowered health of *P. oceanica*	Physical presence of the cable	Operation	*P. oceanica*	Medium	Indirect	Adverse	Low	Local	Long-term	Permanent	Irreversible	Unlikely	Not significant	N/A	Not significant	Monitoring
Onshore Noise Impacts																

Impact type and source			Impact receptor		Effect & Scale							Probability of impact occurring	Overall impact significance	Proposed mitigation measures	Residual impact significance	Other requirements
Impact type	Specific intervention leading to impact	Project phase	Receptor type	Sensitivity & resilience toward impact	Direct/ Indirect/ Cumulative	Beneficial/ Adverse	Severity	Physical/ geographic extent of impact	Short-/ Medium-/ Long-term	Temporary/ Permanent	Reversible/ Irreversible					
Construction noise	Site preparation	Construction	Wildlife Habitat	Medium	Direct	Adverse	Low	300 – 600 m	Short (8 months)	Temporary	Reversible (temporary noise)	Inevitable	Not significant	Follow construction good practice	Not significant	N/A
Construction noise	HDD drilling	Construction	Wildlife Habitat	Medium	Direct	Adverse	Low	300 – 600 m	Short (2 months)	Temporary	Reversible (temporary noise)	Inevitable	Not significant	Follow construction good practice	Not significant	N/A
Construction noise	Trenching	Construction	Wildlife Habitat	Medium	Direct	Adverse	Low	300 – 600 m	Short (8 months)	Temporary	Reversible (temporary noise)	Inevitable	Not significant	Follow construction good practice	Not significant	N/A
Construction Noise	Road Traffic	Construction	Wildlife Habitat	Medium	Direct	Adverse	Negligible	300 – 600 m	Short (8 months)	Temporary	Reversible (temporary noise)	Inevitable	Not significant	n/a	Not significant	N/A
Offshore Noise Impacts																
Immediate exposure from an SBES pulse	Construction	Injury PTS onset	Marine mammals	High	Direct	Adverse	High	Local	Short	Temporary	Irreversible	Remote	Not significant	N/A	Not significant	NA
		TTS onset		Mild			Mild	Local			Reversible	Likely	Not significant		Not significant	
		Behavioural response		Slight			Slight	Maximum zone of 4.4 km			Reversible	Likely	Not significant			
Cumulative trench	Construction	Injury PTS onset	Marine mammals	High	Cumulative	Adverse	High	Local	Short	Temporary	Irreversible	Unlikely	Not significant	N/A	Not significant	NA

Impact type and source			Impact receptor		Effect & Scale							Probability of impact occurring	Overall impact significance	Proposed mitigation measures	Residual impact significance	Other requirements
Impact type	Specific intervention leading to impact	Project phase	Receptor type	Sensitivity & resilience toward impact	Direct/ Indirect/ Cumulative	Beneficial/ Adverse	Severity	Physical/ geographic extent of impact	Short-/ Medium-/ Long-term	Temporary/ Permanent	Reversible/ Irreversible					
dredging activities		TTS onset		Mild			Mild	Local				Likely				
		Behavioural response		Slight			Slight	Maximum zone of 28.1 km				Likely	Not significant			
		Behavioural response	Fish	Mild	Direct		Mild	Maximum zone of 1.4 km			Reversible	Likely			Not significant	
		Behavioural response	Sea Turtles	Slight			Almost null	Less than 10 m				Remote	Not significant			
Cumulative combined cable laying sources	Construction	Injury PTS onset	Marine mammals	High	Cumulative	Adverse	High	Local	Short	Temporary	Irreversible	Unlikely	Not significant	N/A	Not significant	NA
		TTS onset		Mild			Mild				Reversible	Likely			Not significant	
		Behavioural response		Slight	Direct		Slight	Maximum zone of 30.1 km				Likely	Not significant			
		Behavioural response	Fish	Mild			Mild	Maximum zone of 2.8 km				Likely				
		Injury PTS onset	Sea Turtles	High			High	Local				Unlikely	Not significant		Not significant	
		Behavioural response		Slight			Slight	Maximum zone of 160 m				Likely	Not significant		Not significant	

8 Alternative solutions

8.1 Alternative sites

In this section, the report summarises the outcomes of a Site Selection Exercises carried out by the applicant to assess the suitability of various sites across Malta to accommodate the IC2 project. The assessment was focused on Delimara Power Station and the Maghtab Terminal Station in Naxxar as these two sites offer the main electricity distribution and power generation hubs on the island.

Figure 80: Alternative locations considered for the project

The Delimara Power Station is located in the south-eastern part of Malta, and encompasses various infrastructure that would complement and support the components required to implement the IC2 project. The Delimara Power Station was dropped from further consideration due to several technical issues. Firstly, the site was designated for the landing point of the Hydrogen ready Melita TransGas Pipeline, which would have added complexity to a project which is soon to be commissioned. Secondly, the addition of another 200MWe power to the most dominant power generation site in Malta (currently at 630MWe) would have reduced the benefits of the project from a security of supply perspective. Having all major electrical and power generation facilities in one confined area could destabilize the grid in the event of an unwarranted event leading to catastrophic circumstances.

Connecting IC2 to Delimara Power Station would also have increased the cost of the project due to the need for extra submarine cable length and added physical protection measures. This would have been a mandatory requirement for the cable due to the dense marine traffic in the Grand Harbour-Marsaxlokk

Port zones, which would pose additional hazard to the unprotected cable on the sea floor.

The Naxxar site offers a gentler slope compared to Delimara peninsula, reducing the need for pre-and post-trenching near the Delimara peninsula due to the rocky sea floor and its depth. Furthermore, the terminal station at Maghtab already has most of the necessary civil works required for the installation of the second interconnector, including the HV switchgear room, cable ducts at basement level, a transformer bay, and shunt reactor's bay, as well as cable tunnels to connect the station to the local electricity grid. Therefore, terminating the project at Maghtab Terminal Station offers an optimal solution, as it would require only minor modifications within the existing building to improve cable laying. This solution is the natural consequence of the generation planning process implemented in the energy sector in recent years.

The site is also far from residential areas, reducing the impact on the local community during construction.

8.2 Alternative Tecnhologies

8.2.1 Constructon phase

8.2.1.1 Onshore Trenchless approaches

Trenchless methods were preferred over open trenching methods to avoid ecological sensitive areas as well as navigating away from the rock shore approach.

Table 50: Comparison between trenchless technologies

Aspect	HDD	MT
Onshore site requirements	The HDD method requires the placement of temporary tanks for the storage of drilling fluids and the other for the recycling of mud. The material which is excavated for the HDD platform will be stored onsite and used to refill	The MT method requires the construction of an entry shaft. The exact size of the entry shaft depends on the TBM, thrust block and jacking frame which will be used. The excavated material used to create the entry shaft would be stored

Aspect	HDD	MT
	the pits once the drilling has been completed.	on site and used to reinstate the area to its original condition once the cable is laid, since this area may be used to house the equipment during operations. Some additional ground improvement work may be required in order to ensure the area is stable enough to cope with the loads during tunnelling. A winch system would also be necessary at the onshore site to enable the cable to be pulled into place.
Offshore trenching activities	No offshore trenching works are planned since the exit point will be in a rocky and not a sandy area.	If the exit point of the tunnel is located in either rock or hard soil, a receiving trench will need to be excavated to provide a sloping surface to allow the transitioning of the cable from land to the seabed
Methodology	**Pilot hole, punch out and marine assistance** The first step in the HDD method involves drilling a narrow-diameter pilot hole, which is used as a guide during the drilling of the main tunnel. The machinery used to drill	**Excavation at the tunnel face** Due to the area's geology, the trench and boring machinery (TBM) will be fitted with a mixed ground cutting head. The cutting head is equipped with single

Aspect	HDD	MT
	the pilot hole will begin from the onshore location and end at the offshore point. The drilling bit itself can be tracked using positional data so the path is adjusted as required. The point at which the drill bit reaches the end of the route and drives up through the seabed is known as the punch out. This process inevitably results in the release of bentonite mixture into the sea. In order to limit the amount of bentonite mixture released into the sea, a submersible pump will be placed at the tunnel exit to collect as much of the realised material as possible up to a support jack barge. Once the tunnel is complete, the drilling bit will be collected from the seabed by divers and recoiled from the shore. Three methods are considered to mitigate the spilling of bentonite **A) Delayed punch out** Delaying the punch-out operation until the hole	and twin cutting discs, the exact number of each will depend on the size of the cutting wheel and TBM. The cutting head will also be equipped with ripper tools.The cutting wheel turns during jacking, whilst the roller cutting disks break down the rock. The broken material is then transported to the crusher area where the rock is crushed into smaller fragments. **Removal and disposal of excavated material** A water-based mud mixture (including small quantities of bentonite as a lubricant) is pumped towards the head of the TBM through the mud pipeline. Once the mixture arrives at the drilling head, it mixes with the excavated material to form a slurry which is pumped back to the entry shaft via the slurry pipe. The slurry is filtered at the entry shaft to separate solid waste before being reused by the TBM.

ASPECT	HDD	MT
	is enlarged at the final diameter. The risks associated with this method include the fact that the position of the pilot exit point cannot be confirmed until forward reaming is carried out, the ground conditions may not allow the feasibility of forward reaming as far as expected, and potential of buckling the drill string to be considered in the selection of the BHA and drilling tools. **B) Soft plug** After punching out to the seabed and the exit point is confirmed, the drilled hole is closed with a grout injection. This will enable the reestablishment of a closed mud system for reaming steps. The solution is preferred because of the significant engineering and marine environmental benefits during drilling. **3) Alternative punch-out** If the above two options are considered too risky, a small punch out on the	**Provision of the tunnel lining** The tunnel is lined using a series of concrete hollow segments. The segments are installed as the TBM progresses along the tunnel route. Each segment is approximately 3m long. Laser-guidance systems are used to ensure that the pipeline is jacked to the correct line, grade and curve. When the TBM is first pushed into the ground, the first jacking pipe is placed directly behind it. Once all the segments in a tunnel section have been installed, the supply lines, cables, main jacks and thrust rung are pulled backwards. At this point a new jacking pipe is lowered into the tunnel and the processes is repeated. The concrete segments form a water-tight tunnel along the length of the tunnel. For long tunnel sections, intermediate jacking stations maybe used to generate enough force

ASPECT	HDD	MT
	seafloor can be created during forward reaming. Divers can recover the drill head and can deploy throds from the rig and deploy the BHA. The rods shall be left in free span from the vessel to the exit point and they will be used to guide the reamer advance. In this way a string of rod will be continuously inside the hole. A soft plug can also be created at the small exit hole. **Reaming passes** During the reaming process, the reamer is pulled from the rig offshore while the drill rods are added onshore. A second rig onshore is required to support the drilling operations. The drilled tunnel is filled with bentonite mixture to prevent collapse and the end of the tunnel is blocked with a clay plug and sand bags to prevent material from leaking. This process will be repeated until the final hole diameter is achieved. At the end of the tunnel, before the final part is	to push through the rock. Once the TBM reaches the end of the tunnel, the connecting pipes, controls and power are disconnected and brought back to land via the shaft. Before the TBM is removed, a messenger wire is installed and the tunnel is flooded. This is to prevent the dangerous situation of water suddenly entering the tunnel with a great force and causing damage to the structure. The TBM is recovered from the seabed using a crane. **Installation of cable** A winch, located onshore, is used to pull the cable through the tunnel. In an ideal world, the winch should be inside the entry shaft; however, if not possible due to space limitations it can be located outside and a ramp constructed to support the pull wire.

Aspect	HDD	MT
	drilled, the clay plug is removed. This will inevitably result in the release of bentonite into the sea, despite the concentration being very low in the final sections. A pump will be used at the end of the tunnel to pump as much of the drilling lubricant as possible up on to supporting jack barge. **Pull back** The pipe will be installed into the tunnel from the offshore jack-up barge. A pulling head is welded to the cable string. The string is then retracted from the onshore base, which will pull the cable through the excavated tunnel	

Extensive research has been conducted on various HDD alignments, geometries, and lengths since this is considered the preferred technology by the FEED contractor. This investigation was carried out to reduce the interference caused by the cable section crossing the *Posidonia oceanica* meadows surrounding the HDD. However, it is deemed impractical to move the HDD exit point beyond the meadow's end or rocky area due to the following reasons:

- High ground elevation difference between entry point (+13.0 / +14.0m msl) and exit point (-27.0/-28.0 m msl). This leads to the handling of large volume of drilling fluid to be recovered and recirculated.

- Mud fluid pressure pumping system to be designed in accordance with the relevant hydraulic gradient (approx. 40.0m).
- Length of the HDD, that, considering the nature of the soil and cable pull-in issues, is deemed to be quite critical and probably unfeasible.

Since there are no route alternatives that permit the complete avoidance of interferences with *Posidonia oceanica*, the attention was focused on the minimization of the impact, trying to find a compromise between HDD feasibility and environmental impact [63].

As part of the Malta landfall selection and Design Report prepared by CESI, Techfem & SPS (2022), three different headings for an offshore cable section are proposed with the aim of minimizing the impact on protected *Posidonia* meadows. The study evaluates the extension of the *Posidonia* meadow along the three different paths and concludes that it is not feasible to extend the drilling exit point beyond the end of the rocky outcrop/*Posidonia* meadows. Therefore, the study focuses on the minimization of the impact, by identifying compromises between feasibility and environmental impact, in order to define which among the three proposed alignments represents the best option. The assessment is based on the recommended limits for HDD drilling length and water depth.

The study concludes that the best solution is to conduct short drilling, up to a maximum water depth of -10m, with forward reaming from land to sea. A quantitative comparison among the three different alignments has also been performed, to substantiate the preferred option.[64]

8.2.1.2 Offshore Trenching approaches

To lay cables and create sea trenches, water jetting systems and ploughs are often used for cable protection. The ROV jetting tool is employed to bury the cable by using a combination of high flow/low pressure or low flow/high pressure water jets to fluidize the seabed. In order to keep the sediment suspended until the cable is lowered into the fluidized soil, multiple swords may be used. Two types of machines are available for this process: a tracked machine that moves directly on the seabed and a second machine that can operate in free-fly mode with minimal impact on the seabed.

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[63] CT301322_IC2_GEN_REP_098 , sheet 32

[64] Malta landfall selection and Design Report, CT301322 IC2 MT REP 0059

8.2.1.3 Cable laying

There are two main approaches to laying cables on the seabed. The first approach is the 'simultaneous lay and bury' method, where the cable is laid in a trench as it is formed, often using the same machinery. The second approach is the 'post-lay' method, where the cable is initially laid on the seabed by the CLV and then trenched (i.e., protected) afterwards. The post-lay method is widely used as it allows for a reduction in the installation time needed for the cable-laying vessel, leaving less expensive support vessels to perform the cable protection phase.

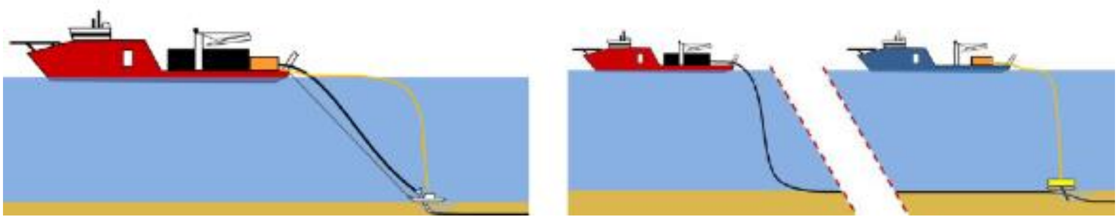

FIGURE 81: DIFFERENT CABLE LAYING TECHNIQUES CONSIDERED

8.2.2 Operational phase

It was determined that an additional electricity generating plant would be required to meet the projected increase in energy demand, as evidenced by Malta's 2030 National Energy and Climate Plan. However, such a plant would need to be hydrogen ready in order to comply with the reduced greenhouse emission limits required by the EU Green Deal policy. At this time, the technology required for hydrogen readiness is not mature enough, making it a risky proposition. The potential for early plants to become stranded assets due to rapidly evolving technology is also a concern. Additionally, the installation of more local generation would require additional investment in the source of fuel, potentially through a hydrogen-ready gas pipeline, as well as the availability of hydrogen through the European gas grid.

An alternative solution would be the accelerated installation of renewable electricity generating plants to meet the objectives of the Green Deal policy. However, these plants suffer from energy output intermittency, requiring additional supply either through local generation or by interconnection to balance this intermittency. Energy storage systems would also be required to match their output with the electricity demand characteristics of Maltese consumers, increasing the cost and implementation time of renewable energy sources.

Renewables and interconnection cable are complementary solutions and not direct competitors. An AC interconnection would provide the necessary spinning capacity for more renewables to be installed over a longer period of time to cater for intermittency. Alternatively, a DC cable link could be used to link the

Maltese and European networks, but this would result in increased area at both ends to house the converters necessary for operation, increasing capital cost and maintenance complexities and decreasing reliability. A DC connection would also not provide convenient backup capability in the event of a sudden loss in local generating plant, unless the converters are sufficiently oversized. Additionally, some consider the isolation of the Maltese grid from transients occurring on the Sicilian or southern Italian grid to be an advantage of the DC solution, but the fault contribution from the European grid is useful to ensure that the protection systems in Malta operate notwithstanding the increasing percentage of inverter-driven renewables. The effects of transient voltages and faults on the Sicilian system have rarely been detrimental to the performance of the Maltese grid and the supply to its consumers.

8.3 Alternative Layouts

8.3.1 Onshore Routes

All of the proposed onshore alternative route of the IC2 in Malta must adhere to a set of criteria in order to minimize or avoid any interference. By adhering to the criteria, the onshore route of IC2 will ensure the least amount of interference and the greatest sustainability for the project.

These criteria are:

- Maintaining a maximum separation distance between IC1 and IC2.
- Avoiding offshore crossings with IC1 whenever possible.
- Minimizing or avoiding any impact on Natura 2000 sites, important bird areas, and other sites of ecological importance.
- Minimizing or avoiding any impact on areas sensitive to Telecommunications (TM).
- Minimizing or avoiding any impact on critical infrastructure, including pipelines and cables.
- Minimizing or avoiding any impact on touristic areas.
- Minimizing or avoiding any impact on restricted or interdicted zones.
- Avoiding geological hazards, including documented areas of faults and soil liquefaction zones.
- Minimizing or avoiding any impact on military zones.
- Reducing impact on Wasteserv Malta operations

FIGURE 82: MALTA ONSHORE CABLE ROUTE OPTIONS

The figure above shows the Options for alternative routes, in different colors and numbers, described below.

8.3.1.1 Cable Route Option 1 (Yellow)

The yellow onshore route starts at Enemalta Terminal station in Malta and is installed under the road surface throughout its entire length of 2.017km. The route turns West towards Triq ir-Ramla and continues towards it in a NW direction for about 150m, as the route enters the Wasteserv ECOHIVE complex.

The route continues towards the Complex's internal roads in a Northern direction until it meets the protruding boundary of Zwejra landfill, which forces the route to divert in a North Western direction once again. The length of this stretch is about 750m. The route continues in the internal roads of the ECOHIVE complex abutting the new landfill extension area and the Malta North facility, until it exists the northern entrance of the complex.

The first section of the onshore route interferes with existing services which have been located thanks to detailed surveys.

FIGURE 83: ONSHORE CABLE ROUTE 1 (YELLOW)

8.3.1.2 Cable Route Option 2 (Cyan)

The Cyan route also starts at the Enemalta terminal station in Maghtab and is also intended to be installed completely underneath the road surface throughout its entire length of 1.813km. From the Enemalta station, the route turns west for about 150m into the ECOHIVE Complex and then turns towards the eastern side of the Zwejra landfill. The route continues throughout the internal roads of the ECOHIVE complex for about 1.4km. It then exists the complex and turns East, parallel to Triq il-Kosta. It crosses the road via a trenchless method and approaches the landfall area at the coastline, on the eastern side of l-Ghadira s-Safra u l-Iskoll tal-Ghallis area.

FIGURE 84: CABLE ROUTE OPTION 2 (CYAN)

8.3.1.3 Cable Route Option 3 (Orange)

The orange route starts at the Enemalta terminal station and is intended to be installed completely underneath the road surface. The route encompasses a total length of 2.061km and like Option 2 also traverses on the eastern side of the Zwejra landfill within the ECOHIVE Complex. The difference between the two options lies in the final landfall location. In this case, the landfall is located 200m further away on the western side of l-Ghadira s-Safra u l-Iskoll tal-Ghallis.

FIGURE 85: ONSHORE CABLE OPTION 3 (ORANGE)

8.3.1.4 Cable Route Option 4 (Green)

The green route starts at Enemalta terminal station in Maghtab, and follows the same path described for Options 2 and 3. The difference proposed in this option is the location of the landfall area. In this case, the landfall is located towards the North-East of the approved Waste-to-Energy facility (demarcated by a pale colored four-sided plot of terraced fields) at the ECOHIVE Complex. At this point, it crosses Triq il-Kosta via trenchless methodos and approaches the landfall area at the coastline.

This 1.425km route follows the Wasteserv ECOHIVE complex internal roads for almost its entire length. Additional attention must be given to the proposed landfall location, since the water pipeline of the Waste-to-Energy project are intended to be housed in this same area.

FIGURE 86: ONSHORE CABLE OPTION 4 (GREEN)

8.3.1.5 Cable Route Option 5 (Pink)

The Pink route starts at Enemalta terminal station in Maghtab and is also intended to be installed under the road surface throughout its entire length of 0.865km. This option provides the shortest route possible as the route does not pass through the ECOHIVE Complex. Instead, the route turns immediately East towards Triq ir-Ramla and continues in the same direction until the landfall approach. This option is identical to the ICM1 cable installation, and thus poses some risks in terms of continuity of service during construction and maintenance.

FIGURE 87: ONSHORE CABLE ROUTE OPTION 5 (PINK)

8.3.1.6 Cable route option 6 (Red)

The sixth option also starts at the Enemalta terminal station but shall be located within a culvert on a vertical section inside a dedicated cable tray and underneath the road surface. From the terminal station, the route turns immediately West and will be installed inside a culvert for a brief linear section as shown in the figure below. After 65m, the cable exists the culvert and will be laid inside a dedicated cable tray installed on a vertical wall in order to reach an installation level positioned 16m above. Once the level is reach, the route shall continue North passing an existing parking area and then entering the Wasteserv ECOHIVE complex. From this point, the route will following the same paths described for Options 1 (Yellow route).

When this option is applied to the preferred option (Option 1), the total onshore cable route length is decreased to 1.834km.

FIGURE 88: CABLE ROUTE OPTION 6 (RED) – MAGHTAB TERMINAL STATION EXIT

FIGURE 89: ONSHORE ROUTE OPTION 6 (REd)

8.3.1.7 Onshore route options comparison

TABLE 51: COMPARISON BETWEEN ONSHORE ROUTE OPTIONS IN MALTA

ROUTE OPTION	ADVANTAGES	DISADVANTAGES
Option 1 (Yellow)	- Feasibility of the landfall approach - Impact on environmental constraints at landfall approach is minimized - MInimisation of the offshore cable section length - Strategic distance from the existing IC1, allowing continuous service if one link is out of service	- Landfall construction site area to be organized in order to minimize the impact on the morphology of the area - Congested area at Maghtab terminal station since the presence of several existing services - One of the entrances at Wasteserv gate should be closed to traffic during installation phases interfering with Wasteserv complex operations
Option 2 (Cyan)	- Strategic distance from the existing IC1, allowing continuous service if one link is out of service	- For what concerns the landfall approach, the increase in installation works and relevant reinstatement leading to a greater extent of environmental and landscape impact
Option 3 (Orange)	- Strategic distance from the existing IC1, allowing continuous service if one link is out of service	- For what concerns the landfall approach, the increase in installation works and relevant reinstatement leading to a greater extent of environmental and landscape impact

ROUTE OPTION	ADVANTAGES	DISADVANTAGES
Option 4 (Green)	- Moderate overall route length - Strategic distance from the existing IC1, allowing continuous service if one link is out of service	- Existing service (in project) nearby the landfall area
Option 5 (Pink)	- Shorter solution proposed so far in terms of length - No critical bends are foreseen due to the linearity of the proposed route	- The proposed route is strictly parallel (onshore and offshore) to the IC1. The main scope is to maintain a safety distance from the existing IC1 in order to prevent any service interruption
Option 6 (Red)	- Feasibility of the landfall approach - Impact on environmental constraints at landfall is minimized - Minimization of the onshore cable section length - Strategic distance from the existing IC1, allowing continuous service if one link is out of service - Minimum interference with Wasteserv complex operations - First section installation inside a dedicated culvert means easier maintenance of the section	- Landfall construction site area to be organized in order to minimize the impact on the morphology of the area

8.3.2 Offshore Routes

Three alternative offshore route options have been identified between Malta and Sicily and these are shown in the figure below. Of these three options, one passes to the east of the present interconnector while the other two pass to the west. Each route takes a different path from the existing IC1 in order to avoid common mode issues that can lead to failure of both cable connections. This was affected to enhance security of supply. Each route has been considered in terms of known restrictions being the Vega oil field in the Italian EEZ, possible areas for hydrocarbon studying, bunkering and trawling zones in the Malta zone. Other obstacles including possible wrecks, UXOs and other man-made hazards but as these are considered localised in areas they can easily be bypassed.

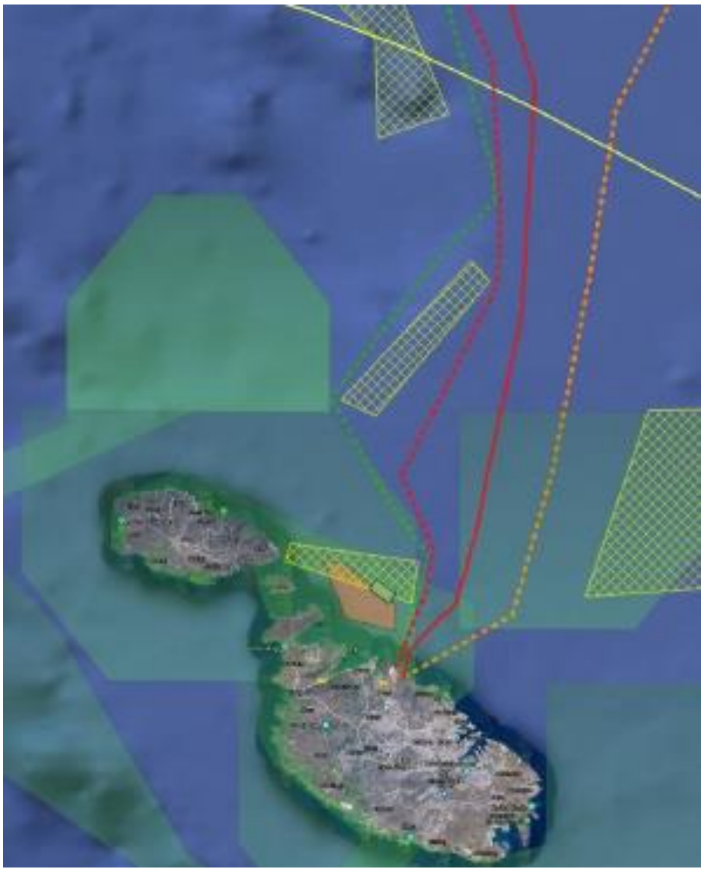

Figure 90: IC1 (red solid line), and alternative offshore routes (Red, Orange and Green Dotted lines)

8.3.2.1 Red (solid) route

The red solid route encompasses the route adopted for the IC1. The route starts from within Qalet Marku bay and follows a northern direction towards Sicily landing at Marina di Ragusa. The cable lies completely on the Malta-Sicily plateau and is buried to a depth of 1.5m below the seabed in sandy stretches.

Rock protection is provided in rocky areas. This route is 98km long and skirts the Vega oilfield extraction concession are along its western perimeter

8.3.2.2 Orange (dotted) route

The orange (dotted) route lies to the east of the current interconnector. It exits the Sicily shoreline in the south-eastern direction from an area in between Playa Grande and Donnalucata to pass outside the eastern border of the Vega oilfield. South of this point, the route turns towards the south southwest passing west from a gas field in the Malta area and then continues to the proposed landing point at Qalet Marku to continue the land route towards Maghtab Terminal Station. This route corridor generally lies between 5 to 17km to the east of IC1 and the estimated underwater length of this route corridor is 101.5km.

8.3.2.3 Green (dotted) route

The green route passes to the west of the existing interconnector and is compatible with Maltese onshore route options. This proposal avoids potential hydrocarbon study fields. In fact, it takes a detour to the West of the adjacent trawling area. Its proximity to the end of the Malta-Sicily channel makes it a very risky corridor to choose for further studying. The proposed landfall in Sicily is on the west side of the Porto di Marina di Ragusa and is 2.54km to the west of the present landfall in Sicily. However, the existing landing point can still be used without the need of any offshore crossings.

8.3.2.4 Red (dotted) route

The red dotted route is similar to the green route as it also passes to the west of the IC1 and is compatible with the onshore routes described in the previous section. This proposal is the shortest offshore route being considered and avoids all known anthropogenic constraints. The proposed landfall in Siciliy is on the wst side of the porto di Marina di Ragusa and is about 2.5km to the west of the present landfall in Sicily.

This option is considered as the preferred route. The following section describes the advantages and disadvantages of each option considered and why the red (dotted) route is considered the preferred layout.

8.3.2.5 Comparison between offshore route options

TABLE 52: COMPARISON BETWEEN OFFSHORE ROUTE OPTIONS

ROUTE OPTION	ADVANTAGES	DISADVANTAGES
Orange (dotted)	- Onshore route does not cross the present IC1 - Due to the large east-west distance from IC1, this route provide the best security of supply protection in case of offshore faults - Whole route lies on the Malta-Sicily plateau making cable laying easier - Route avoids and is farthest away from all known trawling areas in Maltese waters - Route avoids all known potential hydrocarbon study field areas in Maltese waters - No landing point issues expected in Sicily as it uses the same shore landing point as IC1	- Long route may be problematic to deviate route after/during PMRS in search of suitable sandy seabed - In order to avoid crossings, the onshore route in Sicily is constrained to follow the existing cable routing and hence provides the least security of supply - New landing point in Sicily may encounter permitting issues
Green (dotted)	- Compatible with all three western shore approach options in Malta - Does not interfere with any of the trawling zones in Maltese waters - Avoids offshore crossing with IC1 - Can use both existing and new landing point in Sicily	- New landing point in Sicily may encounter permitting issues - The route is longer than IC1 - The route passes on the edge of the Malta-Sicily plateau in an area which is characterized by a slope, and which can be of a relatively unstable nature

ROUTE OPTION	ADVANTAGES	DISADVANTAGES
		- Long route may become a problem to deviate route
Red (dotted)	- Shortest of all 3 proposals being also shorter than the present IC1 thus allowing for longer shore approach and onshore routes in Malta - Compatible with all three western shore approach options in Malta - Does not interfere with any of the trawling zones in the Maltese waters - Avoids offshore crossing with IC1 - Can use both existing and new landing point in Sicily	- New landing point in Sicily may encounter permitting issues as works to be carried out within touristic zone

8.3.3 HDD Layouts

Different HDD alignments, geometries and lengths have been investigated with the aim to minimize the extent of the cable section crossing the Posidonia Oceanica meadow outside the HDD. It is not considered feasible to extend the HDD exit point beyond a certain point. This is due to the long distances involved in the horizontal directional drilling (HDD) process, as well as the presence of Posidonia Oceanica meadow and rocky areas beyond the designated point. The HDD process involves drilling a long distance underground, which can be challenging and risky, especially when passing through challenging terrain. Additionally, as already described, the presence and extent of the sensitive Posidonia Oceanica meadow and rocky areas can make it difficult to extend the HDD exit point beyond the designated area without added environmental impacts.

8.4 Downscaling of the project or elimination of project components

Downscaling of the project was considered through the rearrangement of the Onshore and Offshore Route layout. The IC2 system requires all of its components to be present and operational for it to function successfully. Therefore, downsizing any of the components is not feasible, as it could negatively impact the overall performance of the system. However, it is possible that future enhancements may be suggested for the proposal, which could further improve its performance or efficiency.

8.5 Zero Option (do-nothing scenario)

Implementing the zero option implies that the impacts associated with the construction and operation of the IC2 will not be realized, thus maintaining the status quo in environmental terms. Nevertheless, the IC2 project is vital in helping Malta reduce its dependency on fossil fuels and lower carbon emissions. Currently, Malta relies heavily on imported fossil fuels to generate electricity, which is not only costly but also has a significant impact on the environment. By implementing the interconnector project, Malta can access clean energy from other countries, reduce its reliance on fossil fuels and contribute to the reduction of carbon emissions.

Secondly, the IC2 project will help Malta achieve stability in its electricity supply. Currently, Malta faces challenges in meeting its electricity demand during peak periods. The interconnector will provide Malta with a reliable and stable supply of energy, reducing the risk of blackouts and ensuring the uninterrupted supply of electricity to households and businesses.

Lastly, the interconnector project will also help Malta reach the European Climate Change targets. The European Union has set ambitious targets to reduce greenhouse gas emissions and increase the share of renewable energy in its member states. By implementing the interconnector project, Malta will contribute to achieving these targets and demonstrate its commitment to tackling climate change.

In summary, the do-nothing scenario is not favorable as the interconnector project is vital to helping Malta reduce its dependency on fossil fuels, achieve stability in its electricity supply, and reach the European Climate Change targets.

8.6 Hybrids/combination of the above

There are no available hybrid or combined options for the above technologies. The lack of available hybrid options may be due to various factors, such as technical constraints, environmental considerations, economic feasibility, or regulatory requirements. For example, there may not be suitable alternative routes for the interconnector, or the available technologies may not meet the required capacity or reliability standards. Environmental concerns such as the potential impact on marine life or sensitive habitats may also limit the available options. Moreover, the cost of implementing and operating an alternative technology or route may be prohibitively high compared to the interconnector.

9 Conclusions

Overall, the development of the 2nd Sicily-Malta interconnector is not expected to have a direct significant impact on the terrestrial and avifauna protection sites if the appropriate mitigation measures are adopted. For the former, the impact assessment concluded that there is no significant impact during construction activities as these shall be confined to the Scheme site which is located at a considerable distance away from the MT0000008 terrestrial Natura 2000 site.

Affecting relatively small areas of the marine SPA MT0000112 and MT0000107 temporarily, the impacts of the planned development on the seabird community inside the marine SPAs is estimated to be not significant as long as the proposed mitigation measures are fully implemented. With these mitigation measures in place, specifically concerning light pollution, the impact magnitude and extent of the proposed development on the marine SPAs and on the relevant seabird populations triggering them are expected to be not significant in relation to Article 6(3) of the EU Habitats Directive, and the overall dynamics and conservation status of the marine Natura 2000 sites concerning the pelagic seabird species will not be impacted significantly.

Remaining concerns arise from the potential residual impacts of temporary light pollution from the marine construction site on seabirds, particularly on the *P. yelkouan* colony on St. Paul's Island, inside the Natura 2000 site MT0000022. Such residual impacts are likely if it appears unfeasible to fully implement the relevant mitigation measures. As a result, it is recommended to monitor the situation in this seabird colony carefully during relevant periods and take compensatory measures if necessary. Following the principle of precaution, such compensatory measures could alternatively be implemented irrespective of the outcome of the monitoring.

The project activities are also expected to give rise to some impacts on marine ecology during the construction phase. The activities causing impact such as the HDD punch out hole and cable laying will permanently damage benthic habitats along the site footprint. Furthermore, cable supporting structures will take up additional seabed, including protected benthic habitats such as *P. oceanica* and maërl. Atmospheric deposition of fine particulate matter can significantly impact benthic habitats, such as *P. oceanica* and sand. An increase in suspended sediments due to disturbance of the seabed from activities such as the punchout hole, trenching, and cable laying can have short- and long-term impacts on marine life. The Scheme is not expected to have a significant detrimental effect on the integrity of the Natura 2000 SAC as a whole in terms of the *P. oceanica* meadows.

This assessment has also considered the likely effects of the proposed Onshore Scheme with respect to noise construction noise emissions. The assessment has been undertaken with reference to relevant standards and guidelines, to include BS 5228:2009+A1:2014 and AQTAG2009. The significance of these effects has been determined with reference to the targeted limits from AQTAG2009 for ecological receptors and in terms of the ambient noise level increase as a result of the construction noise. Industry standard calculation methods using computer modelling techniques have been used following BS 5228:2009+A1:2014 calculation methods.

The assessment of construction noise has concluded, in the worst-case, a minor impact magnitude at the identified ecological receptors with reference to AQTAG target limits; the level of effect has been concluded as not significant.

The assessment of construction noise has concluded, in the worst-case, a non-significant impact at the identified ecological receptors with reference to the predicted increase in ambient noise levels; the level of effect has been concluded as not significant. Baseline sound levels representative of the assessment locations have been considered further in context; construction noise emissions are not expected to give rise to a significant impact at the identified receptor locations.

Appendix I

Terms of Reference

ERA
Environment & Resources Authority

Terms of Reference for the Preparation of an

Appropriate Assessment

EA 00018/21

SECOND ELECTRICAL INTERCONNECTOR BETWEEN MALTA AND SICILY; SITE AT UNDERWATER AND ONSHORE CABLE LINK BETWEEN THE MAGĦTAB TERMINAL STATION AND THE RAGUSA 220KV SUBSTATION

Note 1 **This document is intended to set out minimum specifications <u>that need to be satisfied</u> in order to determine whether the proposed intervention or any part thereof will have a significant impact on the integrity of any relevant protected sites, ecosystems, habitats and species covered by the provisions of the Flora, Fauna and Natural Habitats Regulations (S.L. 549.44).**

Note 2 **The applicant is to propose consultants for ERA's attention prior to the commencement of the Appropriate Assessment (AA) studies.**

Note 3 **It is the consultants' responsibility to adopt and justify the appropriate methodologies and areas of influence. Furthermore, in the interest of optimising the assessment process, the proposed methodology is to be discussed with ERA prior to actual commencement of the studies,**

Note 4 **Unless otherwise specified in these Terms of Reference (TORs) and in the absence of any site-specific conservation objectives drawn up by ERA, the assessment shall be guided by the following environmental objectives:**
- **Where the conservation status is favourable, this is retained and not reduced; and**
- **Where the conservation status is not favourable, this is improved.**

Note 5 **The requirement for further AA studies needs to address the issues outlined in the screening carried out by ERA, as well as any other AA-relevant impacts identified by the consultants. Should further surveys be deemed necessary by the consultants, ERA is to be informed of such need PRIOR to the commencement of such surveys.**

Note 6 **Wherever available, already-existing information should be made use of without any unnecessary duplication of work. Any uncertainties and gaps in information should be acknowledged.**

Note 7 The consultants should refer to the appropriate EU guidance documents, and should clearly quote such sources accordingly.

Note 8 ERA reserves the right to question (or disagree with) the methodologies and area of influence, to request revisions thereof, and to request additional information or studies at any stage prior to, during and following completion of the AA.

Note 9 These TORs are primarily intended to guide the AA investigations rather than as a basis for tendering or other non-ERA processes. In this regard any use for such purposes is at the sole risk of the applicant, as requirements may vary following technical negotiations, updating of legislation or standards, changes to the proposed project, or other circumstances.

The proposal requires the submission of an Appropriate Assessment (AA) as per Regulation 19(1) of the Flora, Fauna and Natural Habitats Protection Regulations, 2006 (S.L. 549.44), given that the project may cause significant impacts on protected sites:

- *MT0000008 (L-Għadira s-Safra u l-Iskoll tal-Għallis) Special Area of Conservation (SAC) of International Importance.*
- *MT0000105 (Żona fil-Baħar bejn il-Ponta ta' San Dimitri (Għawdex) u Il-Qaliet): SAC of International Importance;*
- *MT0000107 (Żona fil-Baħar tal-Grigal) Special Protected Area (SPA) of International Importance*; and
- *MT0000112 (Żona fil-Baħar ta' madwar Għawdex) SPA of International Importance.*
- as declared through the provisions of the Flora, Fauna and Natural Habitats Regulations of 2006 (S.L. 549.44).

Note: It should be noted that the AA shall not be restricted to the above-mentioned protected sites only, which have been identified through screening to determine whether the proposal requires the submission of an AA. It is the consultants' responsibility to adopt and justify the appropriate area of influence, based on the available information, which takes into consideration any relevant protected site, ecosystems, habitats and species covered by the provisions of the Flora, Fauna and Natural Habitats Regulations (S.L. 549.44).

The Appropriate Assessment report should follow the following format:

1. Executive Non-Technical Summary

A description of the salient points of the AA study including surveys, impacts and their significance, proposed mitigations measures, and any residual impacts.

2. **Project Description**

A description of the proposed project, with particular emphasis on those elements that are likely to give rise to potentially significant effects on the on the integrity of the protected site, or on its habitats, species and ecosystems. The description shall also address any foreseeable consequential requirements or implications of the proposal (e.g. need for new or altered access or infrastructure).

3. **Site Description**

A general description of the site environment within the area of influence, with particular emphasis on the salient features of the site and its species, habitats and ecosystems. Any other aspects of the physical environment and its processes that may in any way interact with the development or its impacts shall also be described.

The description shall also address any other constraints relevant to the site, including statutory legal protection, any relevant management plan framework.

4. **Impact Assessment vis-à-vis the integrity of the site and its species, habitats and ecosystems.**

An evaluation of the way in which the integrity of the site and its species, habitats and ecosystems are likely to be affected by the project.

Impact assessment should clearly indicate all foreseeable direct and indirect impacts, and their expected timeframes (short/long-term, etc.). Any impact interactions (e.g. accumulation, synergy, interaction with natural forces) shall also be identified and assessed. The significance of all AA-relevant impacts must also be discussed.

Impact assessment shall also take into account practical implications (e.g. conflicts with site protection or management plan implementation, any foreseeable constraints on future management plan formulation, etc.)

5. **Mitigation Measures**

Where possible, measures should be identified to eliminate and/or mitigate adverse effects on the integrity of the site as well as on the relevant habitats and species.

In this regard, the AA should include:

- A reasonably detailed identification of the measures to be introduced for all relevant phases of the project;
- An explanation of how the measures will eliminate and/or mitigate adverse effects;
- Evidence of how the mitigation measures will be tangibly implemented and by whom;
- Evidence of the degree of confidence in their likely success;
- A timescale, relative to the project, when they will be implemented;
- An explanation of any proposed monitoring scheme and how any mitigation failure will be addressed; and
- Proposals for decommissioning as may be appropriate.

6. Residual Impacts

The report should include a prediction of residual impacts and implications of the proposal on the site and its species, habitats and ecosystems, following the implementation of the mitigation measures. The report shall also evaluate the significance of such residual impacts and implications. Residual impacts are to be evaluated individually as well as holistically. The latter should indicate whether the proposal will or will not adversely affect the integrity of the site(s) concerned.

7. Alternative solutions

A list of alternatives to the proposal is to be submitted. Examples of alternatives may include, but not necessarily limited to, alternative technologies, alternative layouts, and relocation or downsizing of the project. The zero-option (do-nothing scenario) should also be considered. Each alternative is to be thoroughly assessed by comparing it with the original proposal and clearly indicating the relative effects on the site's listed habitats and species.

Appendix II

Alternative Site Assessment

Preliminary Route Identification Report

Second Malta – Italy electrical interconnector.

InterConnect Malta

September 2021

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1. Introduction

Malta has been electrically connected to Italy through the first Malta-Sicily interconnector since March 2015. This 230kV, 50Hz interconnector allows the exchange of a nominal 200MW between the sub-station at Ragusa, Sicily and the terminal station at Maghtab in Malta. The synchronous connection between the grids uses XLPE cable and has brought frequency stability and increased reliability to the Maltese electrical grid.

Malta is now planning to install a second electrical interconnector to Sicily. This is required in view of the expected increase in electrical demand due to local development and expected transport electrification as well as the substitution of old generating plant. The second interconnector shall also increase the security of electrical supply to the Maltese consumer and be another tool for Malta to meet its environmental commitments towards the European Green Deal as it allows the importation of electrical energy from large scale renewable sources plugged to the European grid.

The second interconnector is planned to connect the same two stations at Ragusa and Maghtab through another 50Hz link operating in parallel with the first one.

There are various route options as identified by the technical team for this second interconnector and the following is a preliminary report on the advantages and disadvantages of each of these identified routes.

2. Onshore Malta side.

Five alternative options have been identified between the Maghtab terminal station and offshore section, as shown in Figure 1.

It is to be noted that in the area of influence, Wasteserv have applied for a development permit for a waste to energy plant on their site – PA3012/20. This includes two HDPE pipes from the site towards the northeast within Qalet Marku for the intake and the discharge of the cooling water for this plant. This plant is planned for commissioning between 2023 and 2024. However, it is pertinent to note that Wasteserv project PA/3012/20 is still undergoing its permitting process and, at the time of writing of this document, the development permit has not been issued and the proposal is still pending. It is listed in this section for the comprehensive description of the proposed developments in the area.

Similar to the first interconnector, all shore approaches shall be of the trenchless type. This method allows no visual intrusion of the cable approach to the coastline and therefore shall not affect the touristic and landscape values of the coast. There are two methods for such approaches – Horizontal Directional Drilling (HDD) and Microtunnelling. As whichever method to be adopted shall be decided during the eventual design stage, this report will not deal with these options but shall list both under the generic “trenchless type” approach.

The presence of Posidonia Oceanica at Qalet Marku area shall impact all options discussed below. Therefore, careful coordination with the environmental competent authority is necessary to ensure the smooth workflow during the works.

The characteristics of each of the route options are as follows:

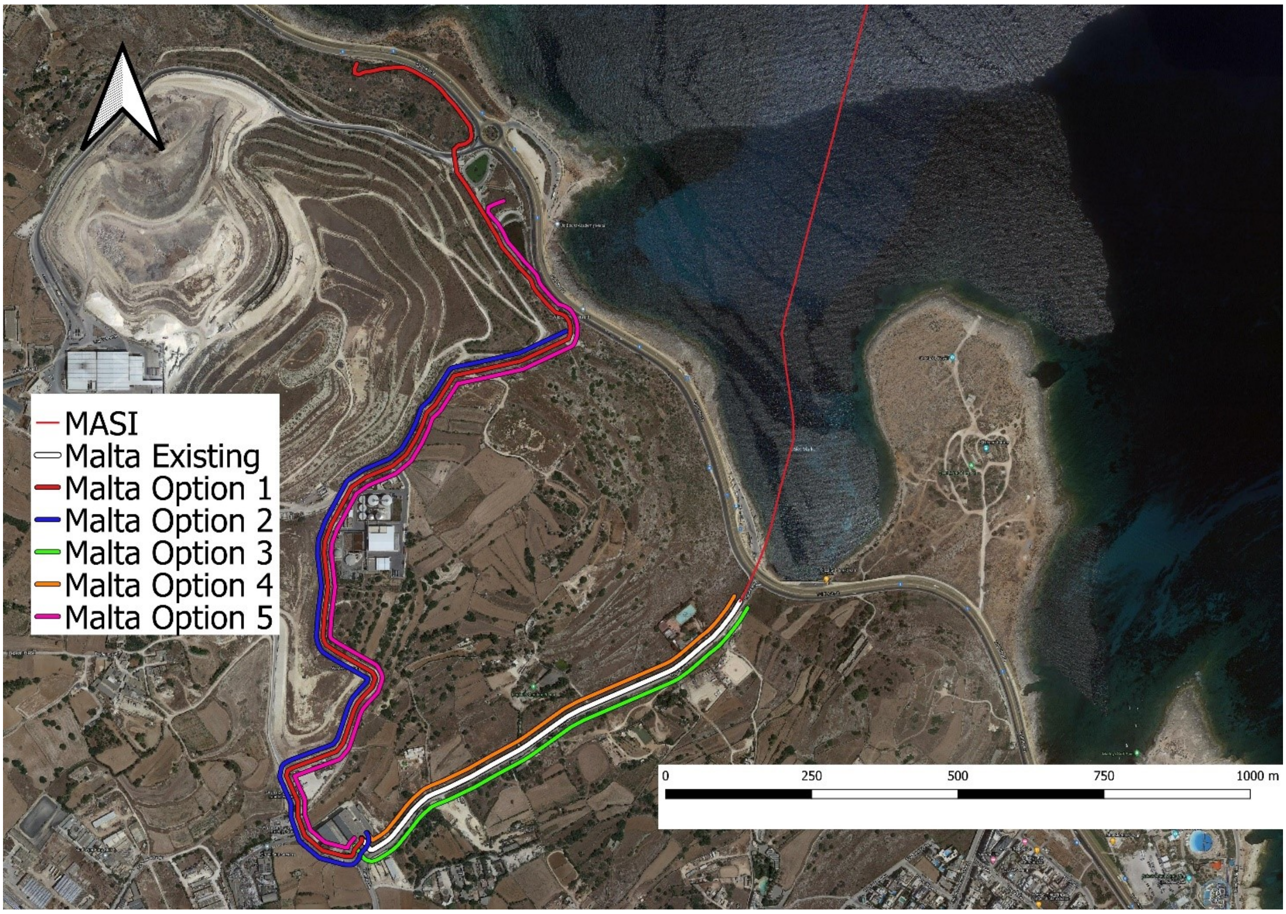

Figure 1: Alternative Onshore Routes - Malta

a. Existing Interconnector - White Route Figure 1

This is the route that is followed by the present (no.1) interconnector (IC1, MASI). The onshore cable from the Maghtab station towards the seashore at Qalet Marku passes through an underground culvert along the north-western side of Triq ir-Ramla and crosses Triq Tul il-Kosta through a trenchless approach up to approximately 200m from the coast. The offshore cable is laid on the seabed protected with cast-iron shells in posidonia meadows and then buried or protected by rock along the route to Sicily. The overall length of the onshore cable section is 800m.

b. Option 1 – Red Route Figure 1

This route exits from the Maghtab Terminal station at its southeast end, turns clockwise and follows the public road (no name) until Wasteserv's Maghtab facility south west entrance. It then passes through the ring road of the Wasteserv's facility on the eastern side and while still within Wasteserv's premises is directed towards the northwest parallel to Triq Tul il-Kosta. It then exists Wasteserv's north east's gate and still parallel to Triq tul il-Kosta for approximately 250m within the public land. A trenchless shore approach method is then used to cross Triq Tul il-Kosta and the shoreline for a distance of approximately 200m north and west of the Natura 2000 site L-Ghadira s-Safra (Special Area of Conservation MT0000008 as per Government Notice G.N. 1373 of 2016). The route exits the shoreline in a northerly direction to the west of the present interconnector.

Advantages:

- Route is the most western approach (800m) from the existing interconnector thus being the most immune from any accident that may occur to the two interconnectors near the Malta shore approach.
- The major part of the onshore route is within Wasteserv's Maghtab facility and therefore there is no interference with the general public during the cable laying works.
- There is no offshore interference with the planned Wasteserv's thermal plant sea water cooling pipework.
- This option completely avoids Qalet Marku.
- As the exit from the shoreline is towards the north, the straight-line offshore cable pulling within the trenchless approach should be the easiest of the options. Adequate space is available for a transition joint from submarine to land cable.
- As a separate onshore route from the present interconnector, it avoids common mode faults (e.g. accidental damage) that can impact both interconnectors thus increasing security of supply.

Disadvantages:

- As the route lies within the south-eastern and north-eastern border of Wasteserv's area, it is the one that most interferes with any future development plans of the site – no construction shall be allowed on top of the cable route and cable trench/ culvert top cover have to be of the heavy duty type so as to allow laden trucks to pass over.
- Cable will have to cross the path of the cooling sea water inlet and outlet paths (possibly near the cooling water pump area) and therefore a planned and coordinated crossing within the Wasteserv's property has to be carefully planned.
- Any possible future repair to the cable will impact Wasteserv operations for the duration of such repairs. Therefore, alternate heavy vehicle operational routes for such cases will have to be agreed prior to the installation of the cable.
- Passes near a Natura 2000 site.
- Longest route.
- A transition joint would be necessary, thus adding extra works and a possible additional point of failure.

c. Option 2 – Blue Route Figure 1

This option follows the route through Wasteserv property in a similar fashion to option 1 but stops prior to turning northwest within the Wasteserv area and therefore leaves the northeastern boundary of the site unobstructed. The cable exits the Wasteserv site through a trenchless method in the vicinity of the planned site for the cooling sea water pump. Depending on the arrangement with Wasteserv, the crossing of the two pipes to the north shall either be on land as per option 1 or under the seabed. The cable exits the shoreline in a north easterly direction and turns northwards with the route passing to the west of the present interconnector.

Advantages:

- The offshore route lies outside the Qalet Marku bay therefore presenting less problems for the cable laying ship to align itself with the trenchless approach tunnel.
- Presents less interference to Wasteserv's expansion plans in the area than option 1 although it runs all along the southeast border.
- The major part of the onshore route is within Wasteserv's Maghtab facility and therefore there is no interference with the general public during the cable laying works.
- Avoids interference with onshore Malta Natura 2000 sites.
- As a separate onshore route than the present interconnector, it avoids common mode faults (e.g. accidental damage) that can impact both interconnectors thus increasing security of supply.

Disadvantages:

- Route option presents the highest interference with the two proposed Wasteserv sea water cooling pipelines. Such an interaction will have to be carefully managed in order to avoid complications if the latter's permit is approved.
- Any possible future repair to the cable will impact Wasteserv operations for the duration of such repairs. Therefore, alternate heavy vehicle operational routes for such cases will have to be agreed prior to the installation of the cable.
- No construction shall be allowed on top of the cable route and cable trench/ culvert top cover have to be of the heavy-duty type so as to allow laden trucks to pass over. A road wide enough to allow a van to pass through will have to be allowed to ease access during cable repair/ testing procedures.
- Longer than the present interconnector.
- Passes close to the existing interconnector at the start of the offshore route which reduces the security of supply in this zone.
- A transition joint would be necessary, thus adding extra works and a possible additional point of failure.

d. Option 3 – Green Route Figure 1

The onshore route option follows the same onshore route of the present interconnector i.e. exiting the Maghtab terminal station at the south-east corner and proceeding through Triq ir-Ramla to Triq Tul il-Kosta exiting the seashore at the south western corner of Qalet Marku through a trenchless approach. In order to avoid any interference with the already operating interconnector, the cable will have to pass on the southern side of the Triq ir- Ramla with an underground crossing of the present interconnector being carried out (new cable will have to pass below the present interconnector) at the vicinity of the intersection with Triq Tul il-Kosta. Cable shall continue offshore to the west of the present interconnector.

Advantages:

- Passes through public roads (already disturbed ground)
- Onshore cable is a relatively straight line making this the shortest option of all considered.
- Offshore cable has the longest trenchless approach method. It is therefore considered to be the most protected route nearshore.
- Route shall be away from any Wasteserv site developments.
- Avoids onshore Natura 2000 sites in Malta
- Shortest distance.

Disadvantages:

- Inconvenience to residents and road users during works associated with the trenching or the construction of culverts for the onshore cable laying.
- Attention to be paid to possible underground services passing through Triq ir-Ramla
- Triq ir-Ramla has to be crossed at two points; one near the terminal station and the other near Triq Tul il-Kosta. Traffic Management is to be undertaken.
- Offshore cable is the nearest route to the present cable thus being subject to common mode faults nearshore.
- The long trenchless shore approach presents the most risks during construction.
- Cable crosses the two Wasteserv sea water cooling pipes offshore. Coordination has to be undertaken with Wasteserv to ensure that this interference is at minimum and to coordinate the final installation works.
- Uses same route as existing cable. No diversification would lead to issues in security of supply.

e. Option 4 – Orange Route Figure 1

This onshore route follows the same path as Option 3 with the exception that as the route passes to the east of the existing cable, it avoids completely any cable crossings onshore Malta as well as nearshore Malta.

Advantages:

- Passes through public roads (already disturbed ground)
- Onshore cable is a relatively straight line making this one of the shortest options of all considered.
- Route shall be away from any Wasteserv site developments.
- Avoids onshore Natura 2000 sites in Malta
- Only one road crossing at Triq ir-Ramla near Terminal Station

Disadvantages:

- Exits within Qalet Marku bay very near present interconnector. Therefore, offshore route most exposed to common mode faults with the existing cable nearshore Malta.
- Inconvenience to residents and road users during works associated with the trenching or the construction of culverts for the onshore cable laying.

- Attention to be paid to possible underground services passing through Triq ir-Ramla
- Cable crosses the two Wasteserv sea water cooling pipes offshore. Coordination has to be undertaken with Wasteserv to ensure that this interference is at minimum and to coordinate the final installation works.

f. Option 5 – Pink Route Figure 1

This route passes through the Wasteserv Maghtab complex in a similar fashion to options 1 and 3. It exits the Wasteserv sites midway between the exit points of options 1 and 3. Thus it follows the southeast border of the site and exits part of the way on the northeast border passing below the present parking area which is being used as a temporary caravan camp site. Exit is carried out through a 450m trenchless approach from the Wasteserv complex, passing below the present interconnector offshore route and exiting from the sea floor to the east of the present interconnector. This cable exits outside of the Qalet Marku bay.

Advantages:

- The major part of the onshore route is within Wasteserv's Maghtab facility and therefore there is no interference with the general public during the cable laying works
- There is no offshore interference with the Wasteserv's thermal plant sea water cooling piping.
- This option completely avoids Qalet Marku
- As a separate onshore route than the present interconnector, it avoids common mode faults (e.g. accidental damage) that can impact both interconnectors onshore.
- Avoids onshore Natura 2000 site
- As cable emerges outside Qalet Marku Bay, there should be no issues for the pulling of cable into the trenchless approach tunnel.

Disadvantages:

- As the route lies within the south-eastern and north-eastern border of Wasteserv's area, it may interfere with any future development plans of the site – no construction shall be allowed on top of the cable route and cable trench/ culvert top cover have to be of the heavy-duty type so as to allow laden trucks to pass over. A road wide enough to allow a van to pass through will have to be allowed to ease access during cable repair/ testing procedures.
- Cable will have to cross the path of the cooling sea water inlet and outlet paths just offshore and therefore a planned and coordinated crossing within the Wasteserv's property has to be carefully planned.
- Any possible future repair to the cable will impact Wasteserv operations for the duration of such repairs. Therefore, alternate heavy vehicle operational routes for such cases will have to be agreed prior to the installation of the cable.
- Cable passes below the present offshore interconnector and thus careful planning is required during installation.
- Relatively long trenchless shore approach which may lead to technical challenges.

- A transition joint would be necessary, thus adding extra works and a possible additional point of failure.

3. Offshore Route

Three alternative offshore route options have been identified between Malta and Sicily and these are shown in Figure 2. Of these three options, one passes to the east of the present interconnector while the other two pass to the west.

The following main features have been considered when identifying the proposal:

Each route takes a different path from the existing interconnector one in order to avoid common mode issues that can lead to failure of both cable connections. This was affected to enhance security of supply.

Each route has been considered in terms of known restrictions being the Vega oil field in the Italian EEZ, possible areas for hydrocarbon studying, bunkering and trawling zones in the Malta zone. There may be other obstacles including possible wrecks, UXOs and other man-made hazards but as these are considered localised in areas they can easily be bypassed. Although it is known that the area within the Italian EEZ several licences have been granted and have been taken up for oil field exploration activities, as yet there is no public information available as to whether such areas have been designated for hydrocarbon extraction/studying purposes. Therefore, this report assumes that no other oil exploration zones have been granted in the interconnector path.

Regarding geological features, the EIA for the first interconnector stated that:

- From 0 – 11 km from Malta coast, there is the presence of rocks and rock subcrops with an escarpment which lies between 5 and 7.9 km from the shoreline
- From 11 to 65 km from the Malta coast, the seabed is smooth consisting of sandy clay and silty fine sand. Pockmarks are present but these are not large.
- From 65 km to Sicily landfall, seabed is made from sediments composed of silty clay and very fine silty sands. No rock outcrops or subcrops are found in this area

All the proposed routes are sited on the Malta- Sicily Plateau.

Along the offshore route, at present, there are 13 submarine communications cables that have to be crossed. At least another communication cable from France to Egypt passing through Malta is being planned to be laid within the short term.

Apart from the Melita TransGas Pipeline project, which is planned to connect Malta to Sicily, no other pipelines seem to be planned along the routes considered. The Argo – Cassiopea project which has recently been given the green light by the Italian authorities shall be installed from Gela towards the west and this is outside the area considered for the interconnectors

As both interconnector cables use alternating current technology, only slight changes in length are allowed as otherwise equal load sharing would be problematic and it would be possible where one cable would be fully loaded with the other cable still being partly loaded thus never reaching the theoretical potential of the link.

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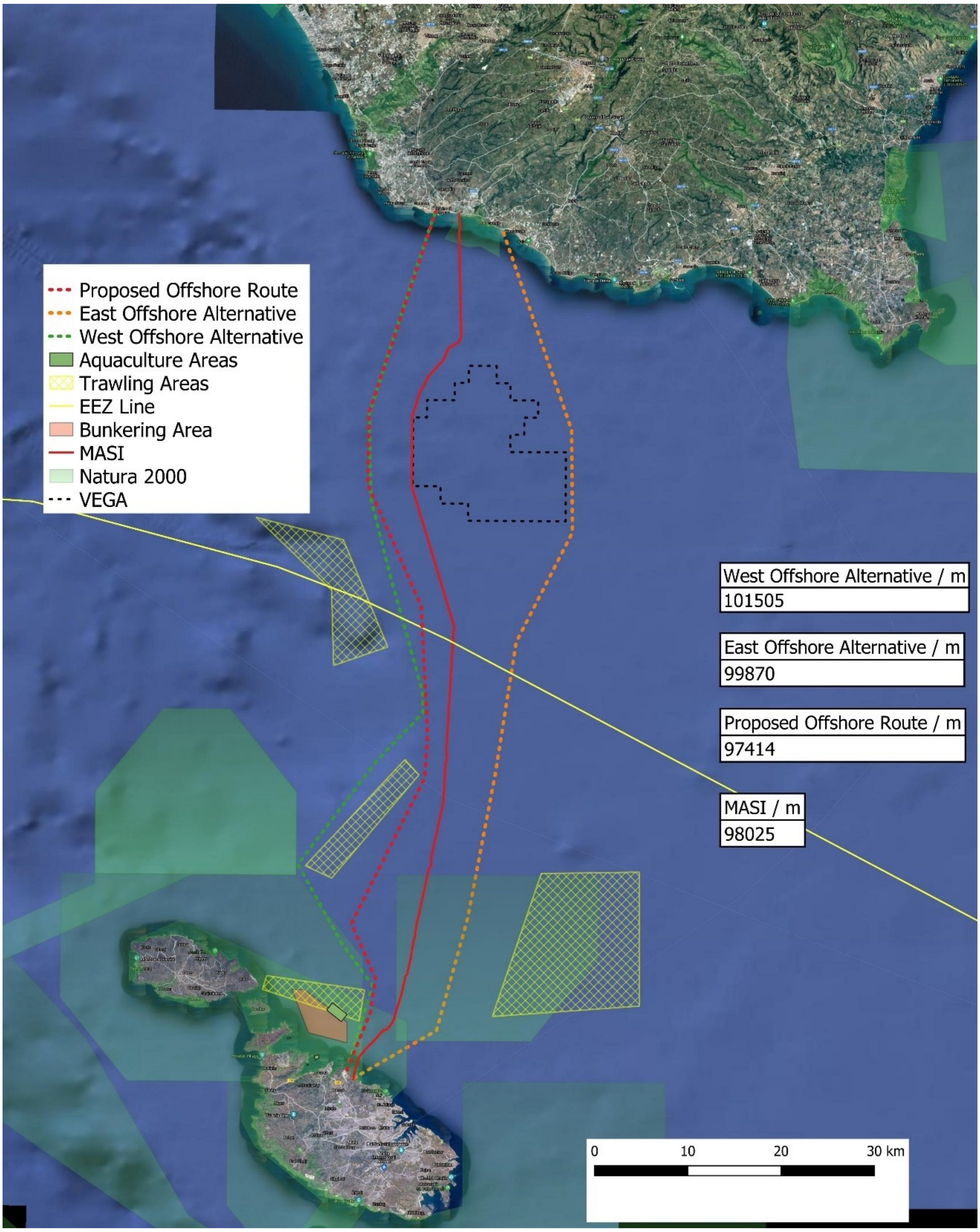

FIGURE 2: ALTERNATIVE OFFSHORE ROUTES

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a. Existing interconnector – Red Route Figure 2

This route starts from within Qalet Marku (see above) and then basically follows a northern route towards Sicily landing at Marina di Ragusa shoreline to the east of the town. Seashore approach in Sicily is through a trenchless HDD method due to the touristic potential of the area. The cable lies completely on the Malta – Sicily Plateau and is buried to a depth of 1.5m below the seabed in sandy stretches. Rock protection has been adopted to protect the cable in rocky areas and cast-iron shells where it is close to the respective shores. The offshore route is 98km long and skirts the Vega oilfield extraction concession area along its western perimeter.

b. East Offshore Alternative – Orange Dotted Route Figure 2

This proposed route lies to the east of the current interconnector. It exists the Sicily shoreline in the south-eastern direction from an area in between Playa Grande and Donnalucata to pass outside the eastern border of the Vega oilfield. South of this point, the route turns towards the south southwest passing west from a gas field in the Malta area and then continues to the proposed landing point at Qalet Marku to continue the land route towards Maghtab Terminal Station. This proposed route corridor generally lies between 5 to 17km to the east of IC1 and the estimated underwater length of this route corridor is 101.5km. This corridor would match with Sicilian onshore routes 1, 3 and 4.

It is important to note that the cable along this offshore route can also land at the existing landing point of the present interconnector in Sicily.

Advantages:

- Onshore route proposal 1 coupled to Malta onshore route option 4 does not cross the present interconnector anywhere.
- Due to the large east west distance from the present interconnector cable, provides best security of supply protection in case of offshore faults.
- Whole route lies on the Malta- Sicily Plateau making cable laying easier.
- Route avoids and is farthest away from all known trawling areas in the Maltese sector
- Route avoids all known potential hydrocarbon study field areas in the Maltese sector
- No landing point issues expected in Sicily as it uses the same shore landing point as existing interconnector

Disadvantages:

- Long route may become a problem to deviate route after/during marine route survey in search of suitable sandy seabed.
- In order to avoid crossings, the onshore route in Sicily is constrained to the follow the existing cable routing and hence provides the least security of supply.
- New landing point in Sicily may encounter permitting issues

c. Proposed Offshore Route – Red Dotted Route Figure 2

This route proposal passes to the west of the existing interconnector and is compatible with Maltese onshore route options 1, 2 and 3. This proposal is the shortest offshore route of the three routes, being also shorter than the present interconnector and avoids all known anthropogenic constraints. The proposed landfall in Sicily is on the west side of the Porto di Marina di Ragusa and is 2.54km to the west of the present landfall in Sicily. However, the existing landing point can still be used without the need for any offshore crossings.

Advantages:

- Shortest of all 3 proposals being also shorter than the present interconnector thus allowing for longer shore approach and onshore routes in Malta.
- Compatible with all three western shore approach options in Malta.
- Does not interfere with any of the trawling zones in the Maltese zone
- Avoids offshore crossing with existing interconnector.
- Can use both existing and new landing point in Sicily.

Disadvantages:

- New landing point in Sicily may encounter permitting issues as works to be carried out within touristic zone.

d. West Offshore Route – Green Dotted Route Figure 2

This route proposal passes to the west of the existing interconnector and is compatible with Maltese onshore route options 1, 2 and 3. This proposal is very similar to Proposal 2; however, it avoids potential hydrocarbon study fields. In fact, it takes a detour to the West of the adjacent trawling area. Its proximity to the end of the Malta-Sicily channel makes it a very risky corridor to choose for further studying. The proposed landfall in Sicily is on the west side of the Porto di Marina di Ragusa and is 2.54km to the west of the present landfall in Sicily. However, the existing landing point can still be used without the need of any offshore crossings.

Advantages:

- Compatible with all three western shore approach options in Malta.

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- Does not interfere with any of the trawling zones in the Maltese zone
- Avoids offshore crossing with existing interconnector.
- Can use both existing and new landing point in Sicily.

Disadvantages:

- New landing point in Sicily may encounter permitting issues.
- The route is longer than the existing interconnector.
- The route passes on the edge of the Malta-Sicily plateau in an area which is characterised by a slope, and which can be of a relatively unstable nature.
- Long route may become a problem to deviate route after/during marine route survey in search of suitable sandy seabed.

4. Onshore Route - Sicily

The onshore route in Sicily is mainly dependent on whether the same landing point will be used or a different one is chosen.

In case a different landing point is to be used, this is to be to the West of the current interconnector landing point since there is an extensive Natura 2000 site to the East (Riserva Naturale Macchia Foresta del Fiume Irminio). Once onshore, the route is bound to follow either the SP25 to the Ragusa terminal or the route taken by the existing cable. The route is restricted to these two roads to maintain a similar length of cable since different cable lengths would create technical issues. (See figure 3).

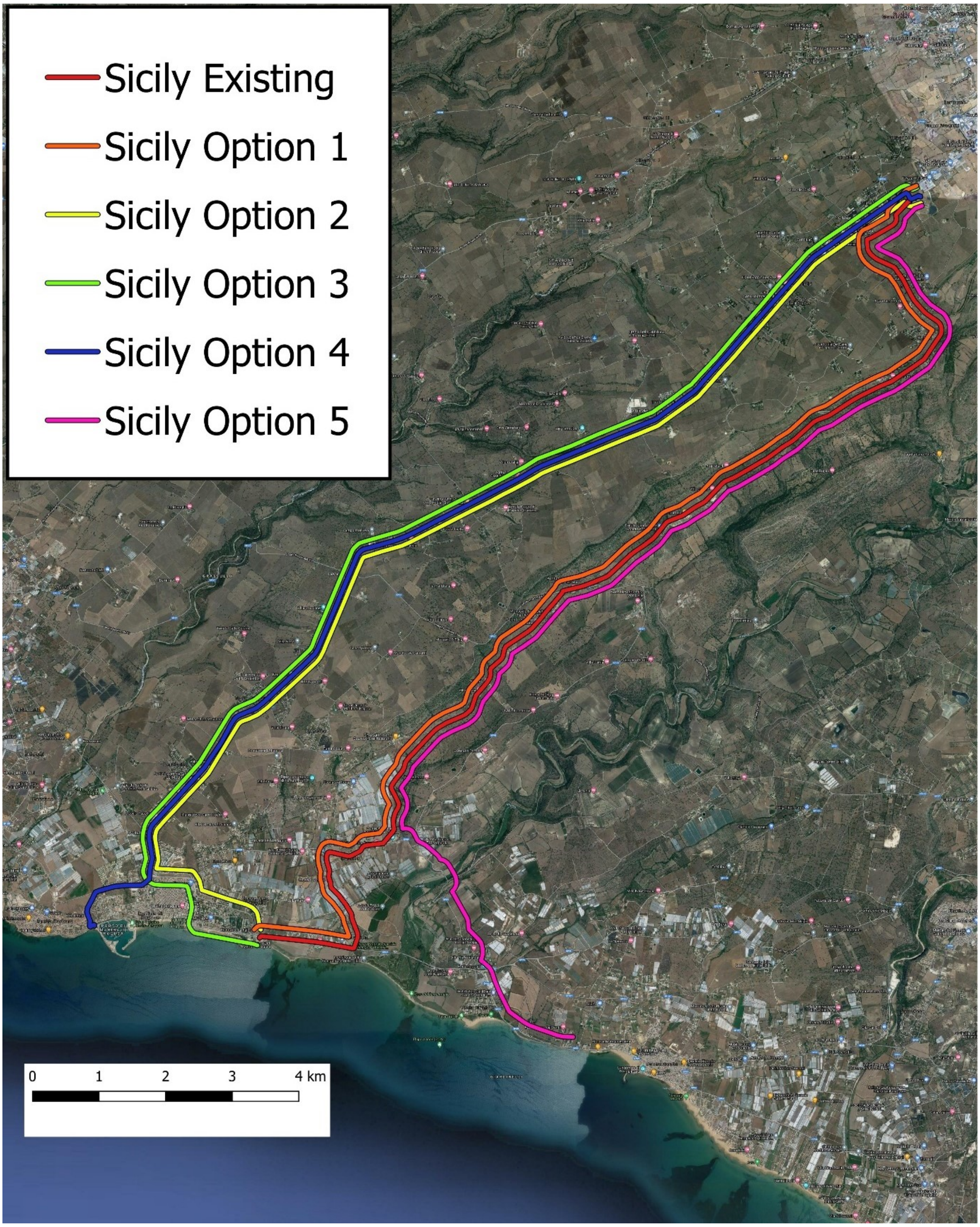

FIGURE 3: ALTERNATIVE ONSHORE ROUTES - SICILY

a. Option 1 / Existing – Orange / Red Route Figure 3

This option lands at the same landing point of the existing interconnector and follows the same route onshore to the terminal station. It starts of by following SP63 until it continues along SR82. The cable is buried along this road until the junction with SP89 where it takes this route then. The route then follows the rural road SR63 until it joins with SP37 for only around 250m from where it then takes the route along the SP81. This route is followed until it gets close to the area where there is the Terna terminal station. However, the last part of the route follows Strada comunale Fallira-Fortugno with the final section passing underneath existing fields.

Advantages:

- Exact same length of the existing road
- Potentially offers the least planning restrictions from Italian authorities in view that route will be the same as already used
- Can verify whether we can use the same EIA and update it accordingly

Disadvantages:

- Least security of supply since it is the same exact route
- Landing zone was rehabilitated recently, and project would require this to be destroyed and re-constructed
- Crossing might be required at the landing zone
- Route contains a number of underpasses where the cable will be exposed

b. Option 2 – Yellow Route Figure 3

This option lands at the same landing point of the existing interconnector but immediately takes a different route once onshore. It follows Via Portovenere, Via Caboto and Via Ammiraglio Luigi Rizzo before it joins SP25 and follows it all the way to the Ragusa terminal station.

Advantages:

- Shorter onshore distance allows for a longer offshore route
- Most of the route follows only one road, SP25, which is multi-carriageway allowing easy traffic management
- Most of SP25 has an unused verge where the cable can be laid in. One may consider suggesting that the cable route is converted into a cycle lane between Ragusa and Marina di Ragusa.
- No underpasses detected from preliminary investigation

Disadvantages:

- A new route requires more permitting and clearances from Authorities
- The first section passes through a residential area

- Landing zone was rehabilitated recently, and project would require this to be destroyed and re-constructed
- Crossing might be required at landing site
- A new EIA is required

c. Option 3 – Green Route Figure 3

This option adopts the same landing point as the existing interconnector but immediately takes a different route once onshore. It follows Lungomare Andrea Doria, then Via Caboto and then Via Ammiraglio Luigi Rizzo before it joins SP25 and follows it all the way to the Ragusa terminal station.

Advantages:

- Shorter Sicilian onshore distance allows for a longer offshore route
- For most of the part follows only one road, SP25, which is multi-carriageway allowing easy traffic management
- Most of SP25 contains enough space to lay the cable away from underneath the paved road with the possibility to also include a cycle lane (for example)
- No underpasses detected from preliminary investigation

Disadvantages:

- A route requires more permitting and clearances from Authorities
- The first section passes through a residential and touristic area along the coast
- Landing zone was rehabilitated recently, and project would require this to be destroyed and re-constructed
- Crossing might be required at landing site
- A new EIA is required

d. Option 4 – Blue Route Figure 3

This option uses a different landing point just west of the Porto di Marina di Ragusa. Following landing, the route moves along Via F.Spata, then Via Cervia, Via Gaetano Schembri and finally it joins SP25 until the Ragusa terminal station.

Advantages:

- Gives the most security of supply from all the options considered
- Shortest onshore distance allows for a longer offshore route
- SP25 allows easy traffic management being a relatively wide road
- Most of SP25 contains enough space to lay the cable away from underneath the paved road with the possibility to also include a cycle lane (for example)
- No underpasses detected from preliminary investigation
- The landing zone is not rehabilitated yet and is a No Swimming zone

Disadvantages:

- A new landing zone and route requires more permitting and clearances from Authorities

e. Option 5 – Pink Route Figure 3

This option uses a different landing point between Plaia Grande and Donnalucata. Following landing, the route moves along SP89 up to the point where it joins the same unmanned road mentioned for the existing interconnector. From then onwards, the same roads as the first interconnector are used.

Advantages:

- Gives more security of supply having a different landing point
- For most of the route it follows the existing cable presenting less challenges in view of permitting and clearances from Authorities
- Avoids crossings in case of an East offshore route

Disadvantages:

- Is the longest route
- Most of the route will be along the existing one reducing the security of supply
- Passes through some geographically challenging areas including a Natura 2000 valley (Fiume Irminio) and a corresponding crossing bridge
- Route contains a number of underpasses where the cable will be exposed

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5. Alternative Route Lengths

Table 1: Malta Onshore Route Lengths

Option	Onshore Length / km
Existing	0.8
1	2.1
2	1.3
3	0.8
4	0.85
5	1.6

Table 2: Italy Onshore Route Lengths

Option	Onshore Length / km
Existing	18.9
1	18.9
2	18.4
3	18.6
4	17.9
5	20.1

Table 3: Offshore Route Lengths

Proposal	Offshore Length / km
Existing	98.0
East Offshore Alternative	99.9
Proposed Offshore Route	97.4
West Offshore Alternative	101.5

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The Applicant notes that the route alternatives provided are preliminary and the respective alignments are indicative and subject to potential improvement in step with the forthcoming assessments, studies and design. The offshore route will be surveyed along a 1.2km wide corridor which will serve as the area where the interconnector can be laid subject to design, bathymetry, cultural and environmental considerations. The area selected for the marine, geophysical and geotechnical surveys shall therefore provide a measure of flexibility vis-à-vis any other intermediary routes, hybrid/compromise alignments or other variations that may be necessary or desirable to address any emerging technical challenges, or environmental considerations, during the design and permitting stages.