Technical Study for Ecology Study in Relation to the 2nd Malta-Sicily Interconnector EIA

As per ERA requirements for EA/00018/21

Report

TECHNICAL STUDY
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1 INTRODUCTION

This report outlines the requirements for the study on ecology to fulfil the Environmental Impact Assessment (EIA) Terms of Reference (TORs) issued by the ERA for EA/00018/21.

The proposed development, hereinafter referred to as the "Scheme", involves the construction of a second electrical interconnector between Malta and Sicily. The Applicant has submitted a development permit, PA/04448/22 and a screening letter was issued by the Planning Authority. One of the conditions of the screening letter is the finalisation of the EIA.

1.1 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, Qalet Marku (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 maximum 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 placement.

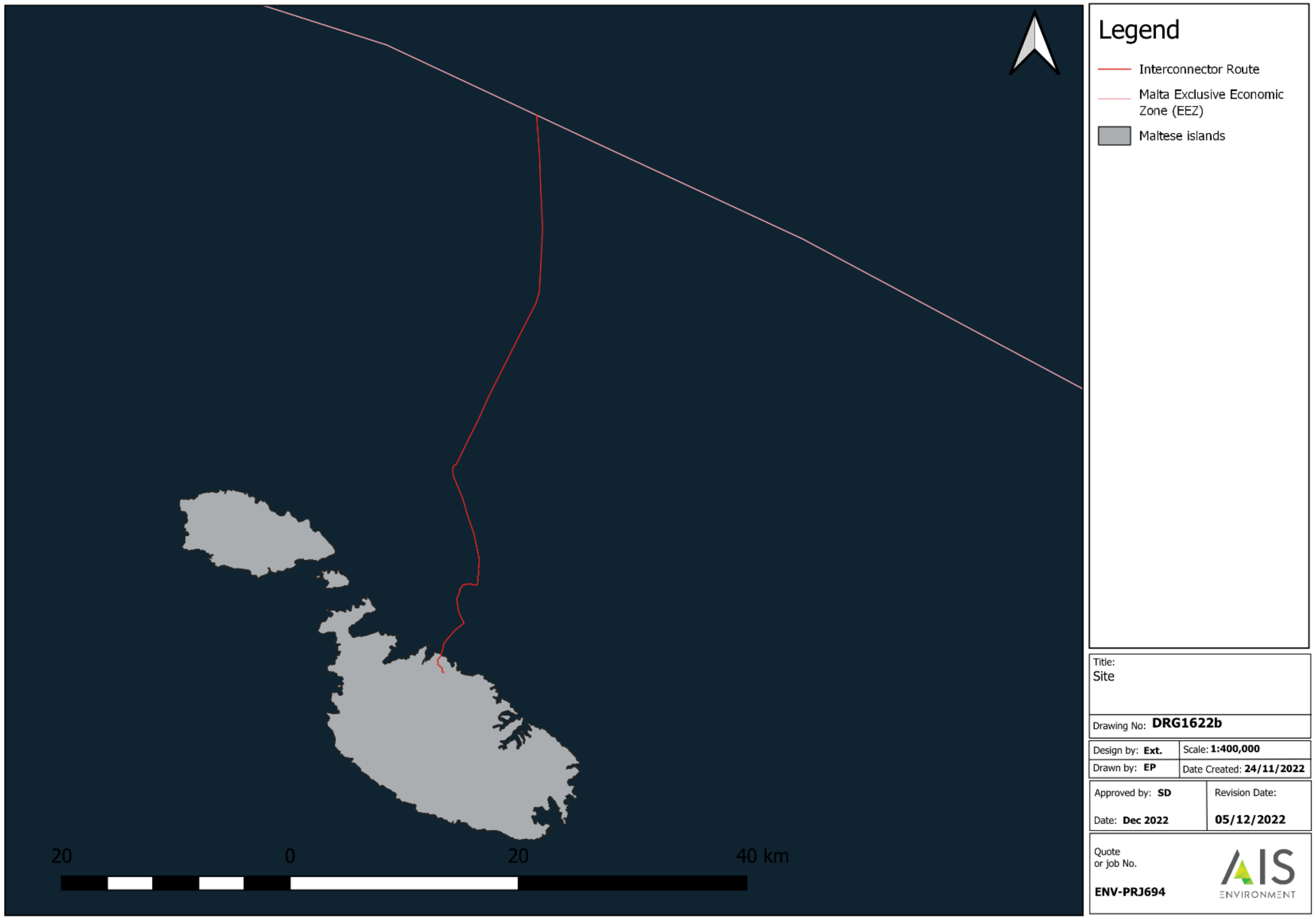

FIGURE 1: PROPOSED INTERCONNECTOR ROUTE IN THE MALTESE EXCLUSIVE ECONOMIC ZONE (EEZ)

2 TERMS OF REFERENCE

The ERA issued the Terms of Reference related to the study on ecology (including terrestrial ecology, avifauna and marine ecology) for the EIA in July 2022. They are replicated hereunder.

3.0 A DESCRIPTION OF THE SITE AND ITS SURROUNDINGS (I.E. ENVIRONMENTAL BASELINE)

The existing environmental features, characteristics and conditions, in and around the proposed development site as well as in all locations likely to be affected by the development or by ancillary interventions and operations, are to be identified and described in sufficient detail, with particular attention to the aspects elaborated further in the next sections.

The consultants should also identify (and justify) wherever relevant:

1. The geographic area (e.g. viewshed or other area of influence) that needs to be covered by each study;

2. The relevant sensitive receptors vis-à-vis the environmental parameter under consideration (e.g. residential communities, other users, natural ecosystems, specific populations of particular species, or individual physical features);

3. The location of the reference points or stations (e.g. viewpoints, monitoring stations, or sampling points (including depth of multiple sampling points at a single sampling point in the case of water media and sediment, where applicable) to be used in the study; and

4. Other methodological parameters of relevance, also noting that the assessment will normally require both desk-top studies and on-site investigations (including visual observations and sampling, as relevant).

***Note**: It is recommended that these details are discussed in advance with the ERA prior to commencement of the relevant parts of the studies, in order to pre-empt (as much as possible) later-stage issues.*

Wherever relevant to the environmental aspects under discussion, reference to legislation, policies, plans (including programmes and strategies) standards and targets, should also be made, such that the compatibility (or otherwise) of the proposal therewith is also factored into the assessment required by Section 4 below. The discussion should cover the following aspects, in the appropriate level of detail:

• Supra-national (e.g. European Union; United Nations; or other international or regional) legislation, directives, policies, conventions, protocols, treaties, charters, plans and obligations;

• National legislation, policies and plans (e.g. Structure Plan; National Environment Policy); and

• Sub-national legislation, policies and plans (e.g. local plans, site-specific regulations, action plans, management plans, and protective designations such as scheduling or Natura 2000).

Note: *In addition to already in-force legislation, policies and plans, the discussion should also cover any foreseeable future updates (or new legislation, policies and plans) likely to be fulfilled, affected or compromised by the proposed project. Furthermore, it should be noted that some cross-cutting legal/policy instruments (e.g. Water Framework Directive and Marine Strategy Framework Directive) may need to be factored into more than one aspect of the discussion.*

3.4 Ecology (including terrestrial ecology, avifauna and marine ecology)
The assessment should include:

1. A full bathymetric survey of the existing environment on and around the area likely to be affected, include:

a. Offshore bathymetric maps;
b. Aerial imagery of the area;
c. Details and maps of any services / utilities; and
d. Description of the sea-bed morphology and of the sediment characteristics of the site.

2. An investigation of the ecology of the site and its surroundings (including, as relevant: flora, fauna, avifauna, fish and other aquatic organisms, benthic, burrowing and pelagic organisms, and their habitats and ecosystems), duly covering the relevant seasons (e.g. wet and dry seasons, in the case of terrestrial ecology) to ensure adequate coverage of all relevant species and ecosystem components;

3. A reporting of the conservation status and ecological condition of the area and the state of health of its habitats, species and ecological features;

4. A reporting of 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;

5. A prediction of the potential impacts of the proposed project on the ecology of the site and its surroundings, including loss, damage or alteration of habitats and species populations (including potential increases in ambient noise levels in the marine environment) including alteration in the habitats and species' condition/state of health as measured through indicators used/specified for assessment of status in relevant EU policy;

6. Identification of all relevant species and assemblages (e.g. protected species or habitats, key species relevant to habitat characterisation, and monitoring indicators), and assess their abundance and distribution 8 patterns as well as the species' ecological niches. The findings should be supported by adequate maps and photographs. Classification of habitat types and species should be conducted in accordance with recognised classification systems (e.g. EUNIS and Palaearctic), to ERA satisfaction;

7. A noise and vibration study providing sufficient detailed information on any impacts on sensitive receptors (fauna and avifauna, natural ecosystems) due to increase in pressure in the area, and the cumulation with other existing sources including maritime vessel traffic and with other predicted sources such as new developments;

8. The nature of the changes (whether temporary or permanent) and effects of such changes on the ecological features; and

9. Other relevant environmental features.

In particular, the study should identify all relevant species and assemblages (e.g. protected species or habitats, key species relevant to habitat characterisation, and monitoring indicators), and assess their abundance and distribution patterns as well as the species' ecological niches. The findings should be supported by adequate maps and photographs. Classification of habitat types and species should be conducted in accordance with recognised classification systems (e.g. EUNIS and Palaearctic), to ERA's satisfaction.

***Note 1**: Separate Terms of Reference are being referred by ERA for the Appropriate Assessment required in terms of the Flora, Fauna and Natural Habitats Protection Regulations (S.L. 549.44).*

***Note 2**: Where the area of influence encompasses both marine and terrestrial environments, one or more of the sections indicated in these specimen TORs may need to be restructured accordingly to reflect the specific circumstances (e.g. separate reports for marine and terrestrial ecology).*

4.0 ASSESSMENT OF ENVIRONMENTAL IMPACTS AND ENVIRONMENTAL RISKS

All likely significant effects and risks posed by the proposed project on the environment during all relevant phases (including construction/excavation/ demolition, operation and decommissioning) should be assessed in detail, taking into account the information emerging from Sections 1, 2 and 3 above. Apart from considering the project on its own merits (i.e. if taken in isolation), the assessment should also take into account the wider surrounding context and should consider the limitations and effects that the surrounding environmental constraints, features and dynamics may exert on the proposed development, thereby identifying any incompatibilities, conflicts, interferences or other relevant implications that may arise if the project is implemented.

In this regard, the assessment should address the following aspects, as applicable for any category of effects or for the overall evaluation of environmental impact, addressing the worst-case scenario wherever relevant:

1. An exhaustive identification and description of the envisaged impacts;
2. The magnitude, severity and significance of the impacts;
3. The geographical extent/range and physical distribution of the impacts, in relation to: site coverage; the features located in the site surroundings; whether the impacts are short-, medium- or long-range; and any transboundary impacts (i.e. impacts affecting other countries);
4. The timing and duration of the impacts (whether the impact is temporary or permanent; short-, medium- or long-term; and reasonable quantification of timeframes);
5. Whether the impacts are reversible or irreversible (including the degree of reversibility in practice and a clear identification of any conditions, assumptions and pre-requisites for reversibility);

6. A comprehensive coverage of direct, indirect, secondary and cumulative impacts, including:

- *interactions (e.g. summative, synergistic, antagonistic, and vicious-cycle effects) between impacts;*
- *interactions or interference with natural or anthropogenic processes and dynamics;*
- *cumulation of the project and its effects with other past, present or reasonably foreseeable developments, activities and land uses and with other relevant baseline situations; and*
- *wider impacts and environmental implications arising from consequent demands, implications and commitments associated with the project (including: displacement of existing uses; new or increased pressures on the environment in the surroundings of the project, including pressures which may be exacerbated by the proposal but of which effects may go beyond the area of influence; and impacts of any additional interventions likely to be triggered or necessitated by situations created, induced or exacerbated by the project);*

7. Whether the impacts are adverse, neutral or beneficial;
8. The sensitivity and resilience of resources, environmental features and receptors vis-à-vis the impacts;
9. Implications and conflicts vis-à-vis environmentally-relevant plans, policies and regulations;
10. The probability of the impacts occurring; and
11. The techniques, methods, calculations and assumptions used in the analyses and predictions, and the confidence level/limits and uncertainties vis-à-vis impact prediction.
The impacts that need to be addressed are detailed further in the sub-sections below.

5.0 REQUIRED MEASURES, IDENTIFICATION OF RESIDUAL IMPACTS, AND MONITORING PROGRAMMES

5.1 Mitigation Measures

A clear identification and explanation of the measures envisaged to prevent, eliminate, reduce or offset (as relevant) the identified significant adverse effects of the project during all relevant phases including construction, operation and decommissioning [see Section 1.2.3 above].

As a general rule, mitigation measures for construction-phase impacts should be packaged as a holistic Construction Management Plan (CMP). Whilst the detailed workings of the CMP may need to be devised at a later stage (e.g. after the final design of the project has been approved and/or after a contractor has been appointed), the key parameters that the CMP must adhere to for proper mitigation need to be identified in the EIA. Broadly similar considerations also apply vis-à-vis operational-phase impacts [which may need to be mitigated through an operational permit] and decommissioning-phase impacts [see Section 5.4 below], where relevant.

Mitigation measures for accident/risk scenarios should be packaged as a holistic plan that includes the integration of failsafe systems into the project design as well as well-defined contingency measures.

The recommended measures should be feasible, realistically implementable to the required standards and in a timely manner, effective and reliable, and reasonably exhaustive. They should not be dependent on factors that are beyond the developer's and ERA's control or which would be difficult to monitor, implement or enforce. The actual scope for, and feasibility of, effective prevention or mitigation should also be clearly indicated, also identifying all potentially important pre-requisites, conditionalities and side-effects.

5.2 Residual Impacts
Any residual impacts [i.e. impacts that cannot be effectively mitigated, or can only be partly mitigated, or which are expected to remain or recur again following exhaustive implementation of mitigation measures] should also be clearly identified.

5.3 Additional Measures
Compensatory measures (i.e. measures intended to offset, in whole or in part, the residual impacts) should also be identified, as reasonably relevant. Such measures should be not considered as an acceptable substitute to impact avoidance or mitigation.

If the assessment also identifies beneficial impacts on the environment, measures to maximise the environmental benefit should also be identified.

In both instances, the same practical considerations as indicated vis-à-vis mitigation measures should also apply.

5.5 Monitoring Programme
A realistic and enforceable programme for effective monitoring of those works envisaged to have an adverse or uncertain impact. The monitoring programme should include:

1. Details regarding type and frequency of monitoring and reporting, including spot checks;
2. The parameters that will be monitored, their units of measurement, the monitoring indicators to be used; and standard analytical methods in line with relevant EU policy;
3. An effective indication of the required action to address any exceedances, risks, mitigation failures or non-compliances for each monitoring parameter;
4. An evaluation of forecasts, predictions and measures identified in the EIA; and
5. An indication of the nature and extent of any additional investigations (including EIAs or ad hoc detailed investigations, if relevant) that may be required in the event of any contingencies, unanticipated impacts, or impacts of larger magnitude or extent than predicted.

The programme should address all relevant stages, as follows:
(a) Where relevant, monitoring of preliminary on-site investigations that may entail significant disturbance or damage to site features (e.g. archaeological excavations, geological sampling, or any works that require prior site clearance or any significant destructive sampling);. [Note: Official written consent from the competent authorities

(e.g. Superintendence of Cultural Heritage) may also be required for such interventions.]
(b) Monitoring of the construction phase, including the situation before initiation of works (including site clearance), during appropriate stages of progress, and after completion of works;
(c) Monitoring of the operational phase, except where otherwise directed by ERA (e.g. where monitoring would be more appropriately integrated into an operating permit); and
(d) Where relevant, monitoring of the decommissioning phase, including the situation before initiation of works, during appropriate stages of progress, and after completion of works.

5.6 Identification of required authorisations

The assessment should also identify all environmentally-relevant permits, licences, clearances and authorisations (other than the development permit to which this EIA is ancillary) which must be obtained by the applicant in order to effectively implement the project if development permission is granted. Any uncertainty, as to whether any of these pre-requisites is applicable to the project, should be clearly stated.

Note on Sections 5.1 to 5.6 above:

The expected effects, the proposed measures, the residual impacts, the proposed monitoring etc. should also be summarised in a user-friendly itemised table that enables the reader to easily relate the various aspects to each other. An indicative specimen table is attached in Appendix 3 – attached to Method Statement as Appendix 1.

3 Methodology

This study describes the existing ecology present within the project footprint and surrounding area and outlines any proposed interventions. This information was then used to assess the impact of the proposed project on the area's ecology.

3.1 Area of Influence

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.

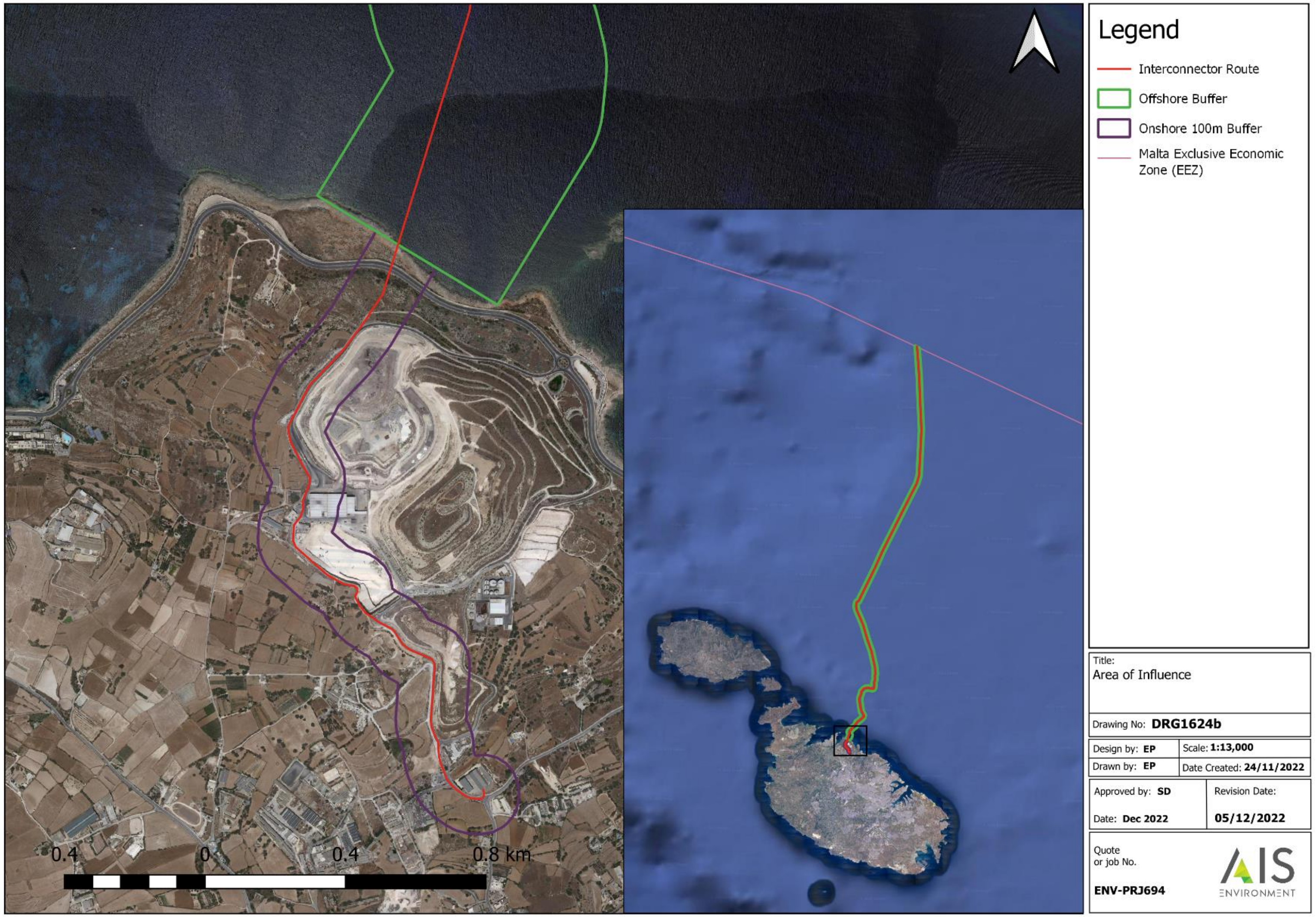

Figure 2: Area of Influence for the terrestrial and marine ecology study

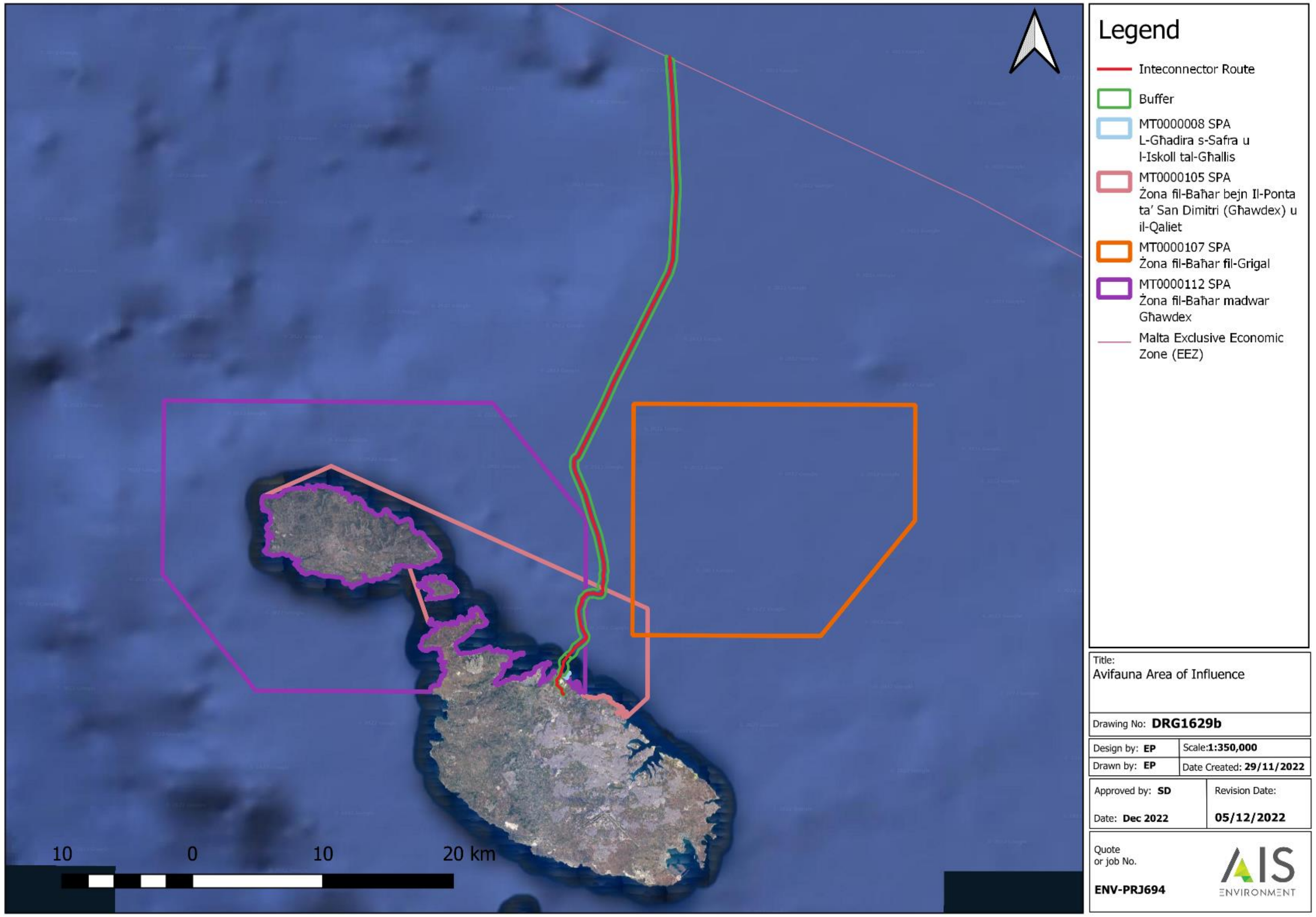

FIGURE 3: ADDITIONAL AREA OF INFLUENCE FOR THE AVIAN ECOLOGY STUDY

3.2 MARINE ECOLOGY

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]

3.2.1 Field Sampling

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 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

[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.

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 4. 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.

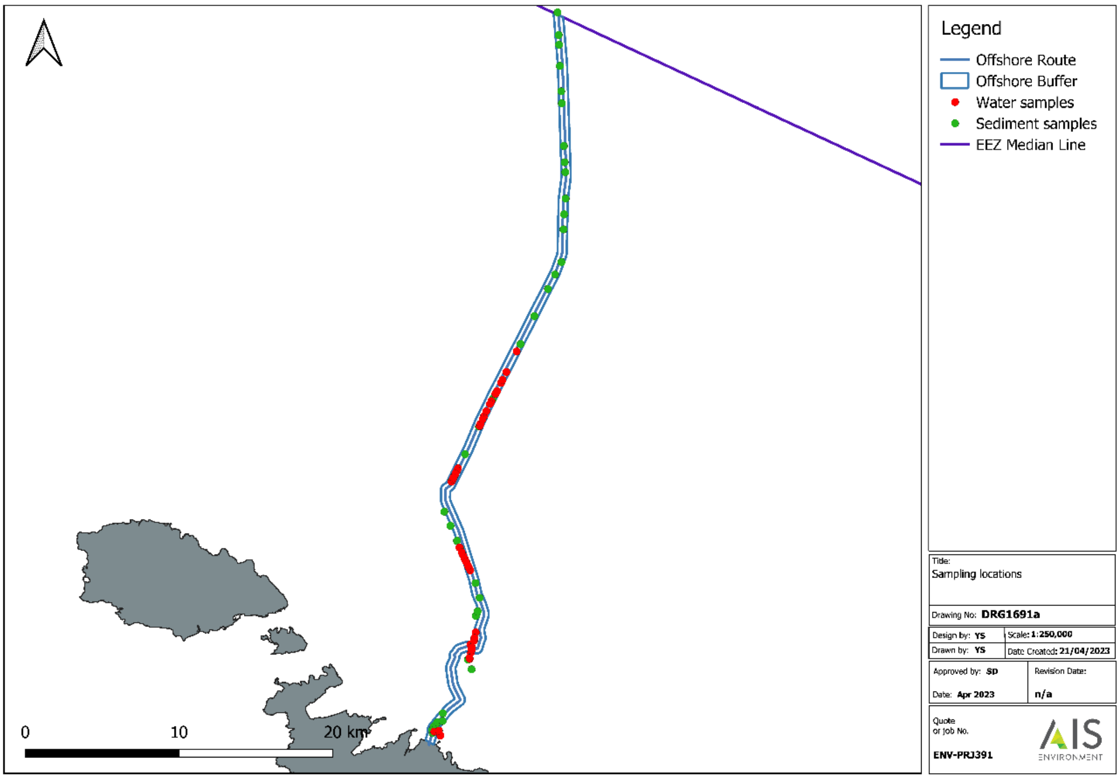

FIGURE 4: WATER AND SEDIMENT SAMPLING POINTS

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 4.

3.2.2 Indicators

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.

3.2.3 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")

4 BASELINE STUDY

4.1 MARINE ECOLOGY

4.1.1 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 5 to Figure 9, 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 10.

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

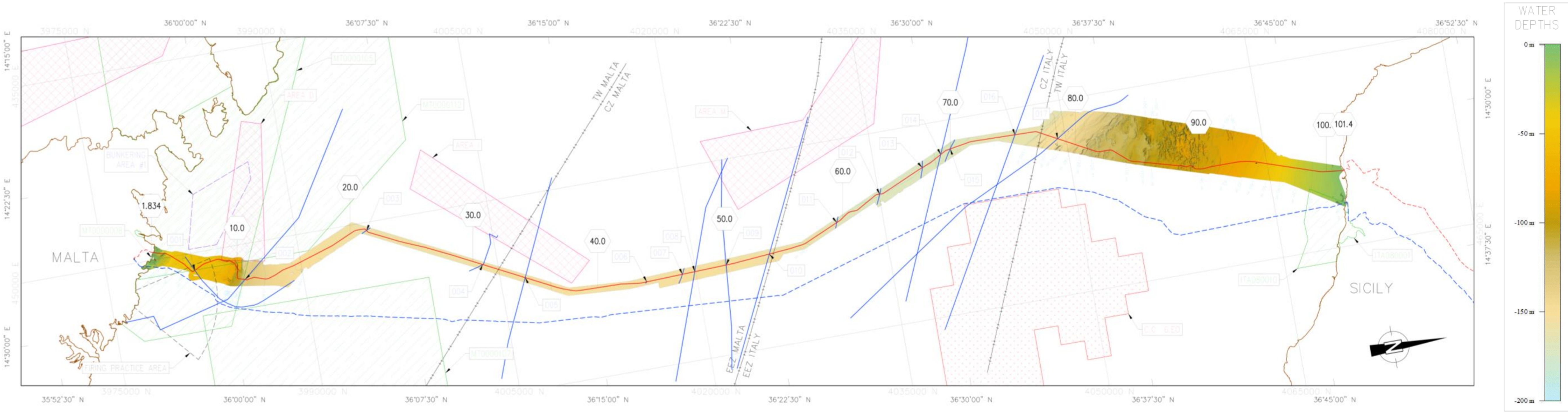

Figure 5: Bathymetry along the Entire Cable Route

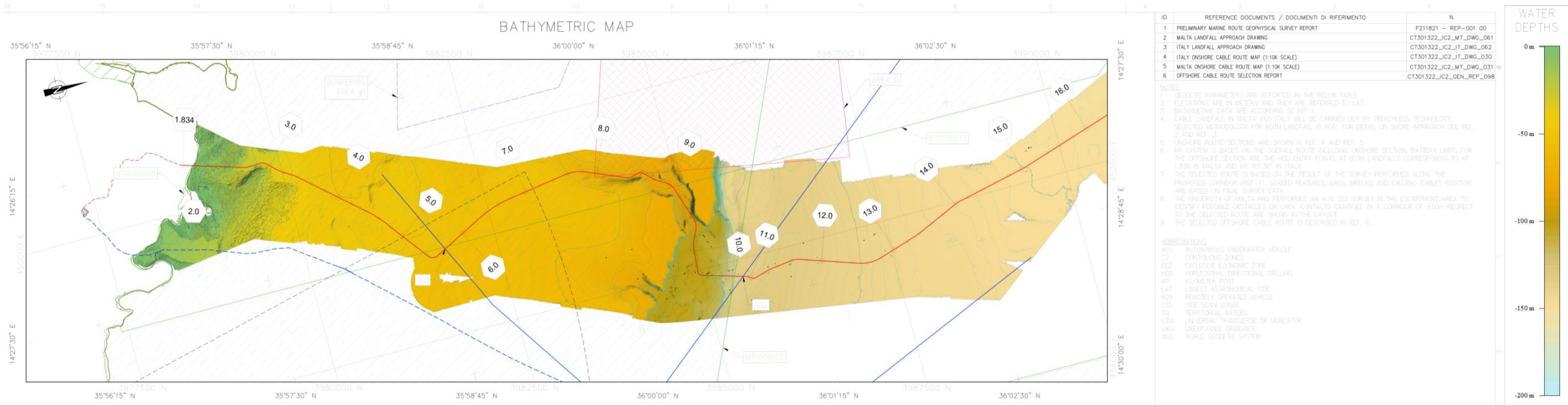

Figure 6: Bathymetry Between KP2 and KP16

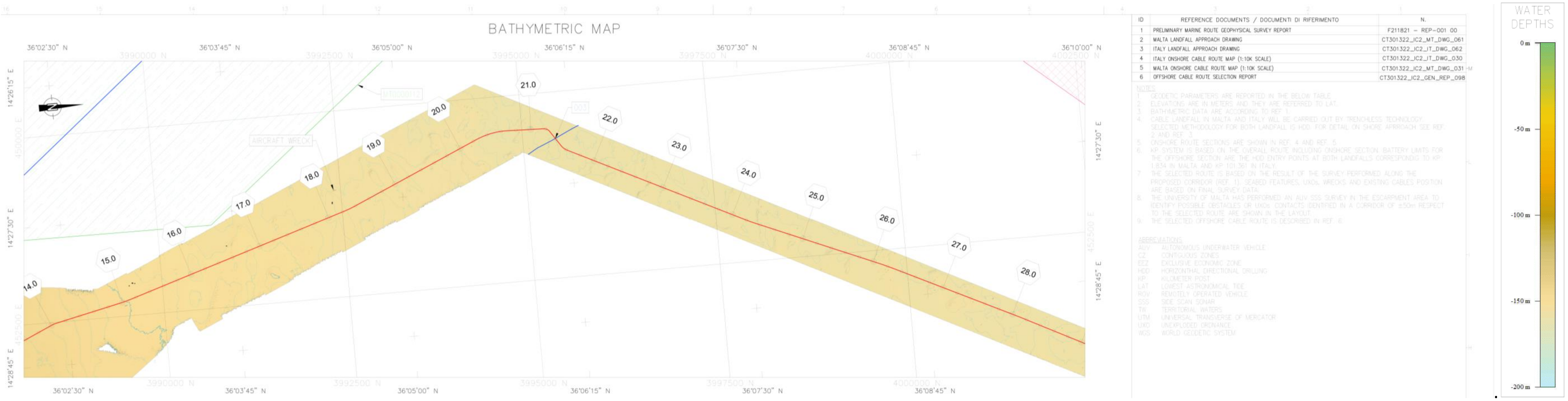

FIGURE 7: BATHYMETRY BETWEEN KP14 AND KP28

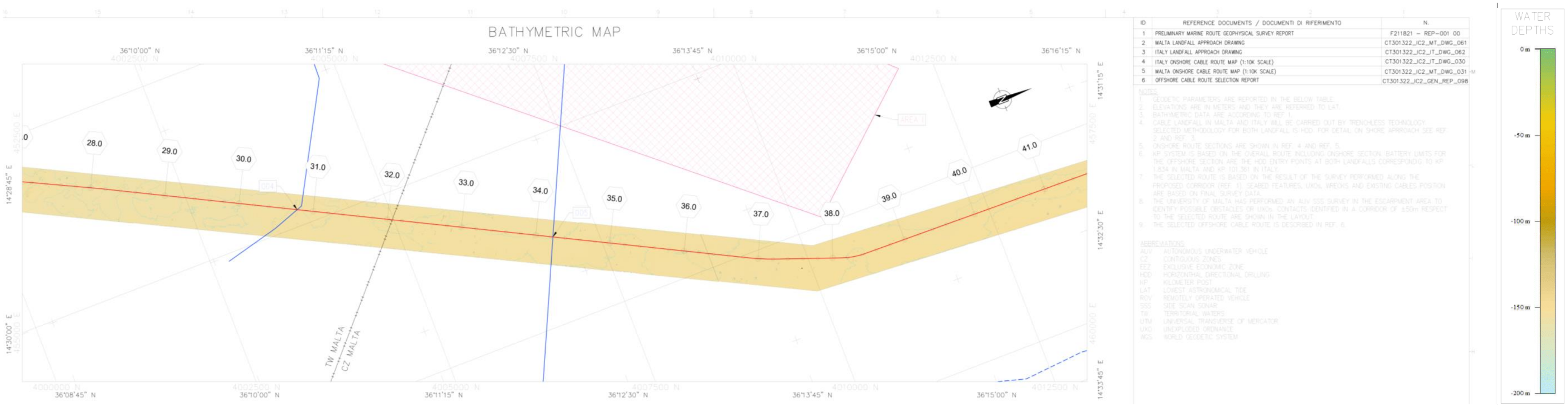

FIGURE 8: BATHYMETRY BETWEEN KP28 AND KP41

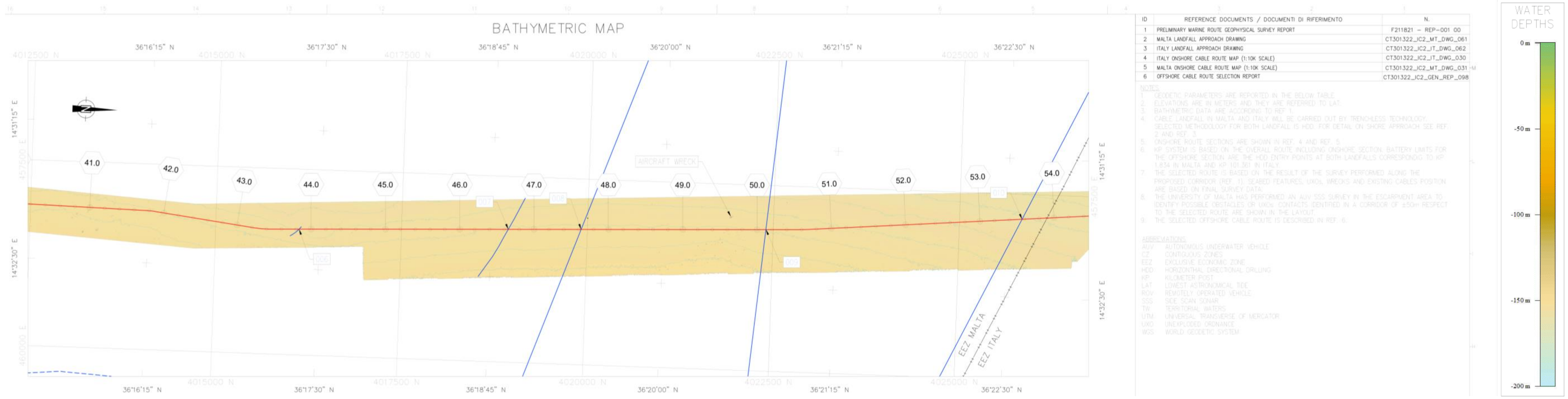

Figure 9: Bathymetry Between KP41 and KP54 (EEZ Boundary)

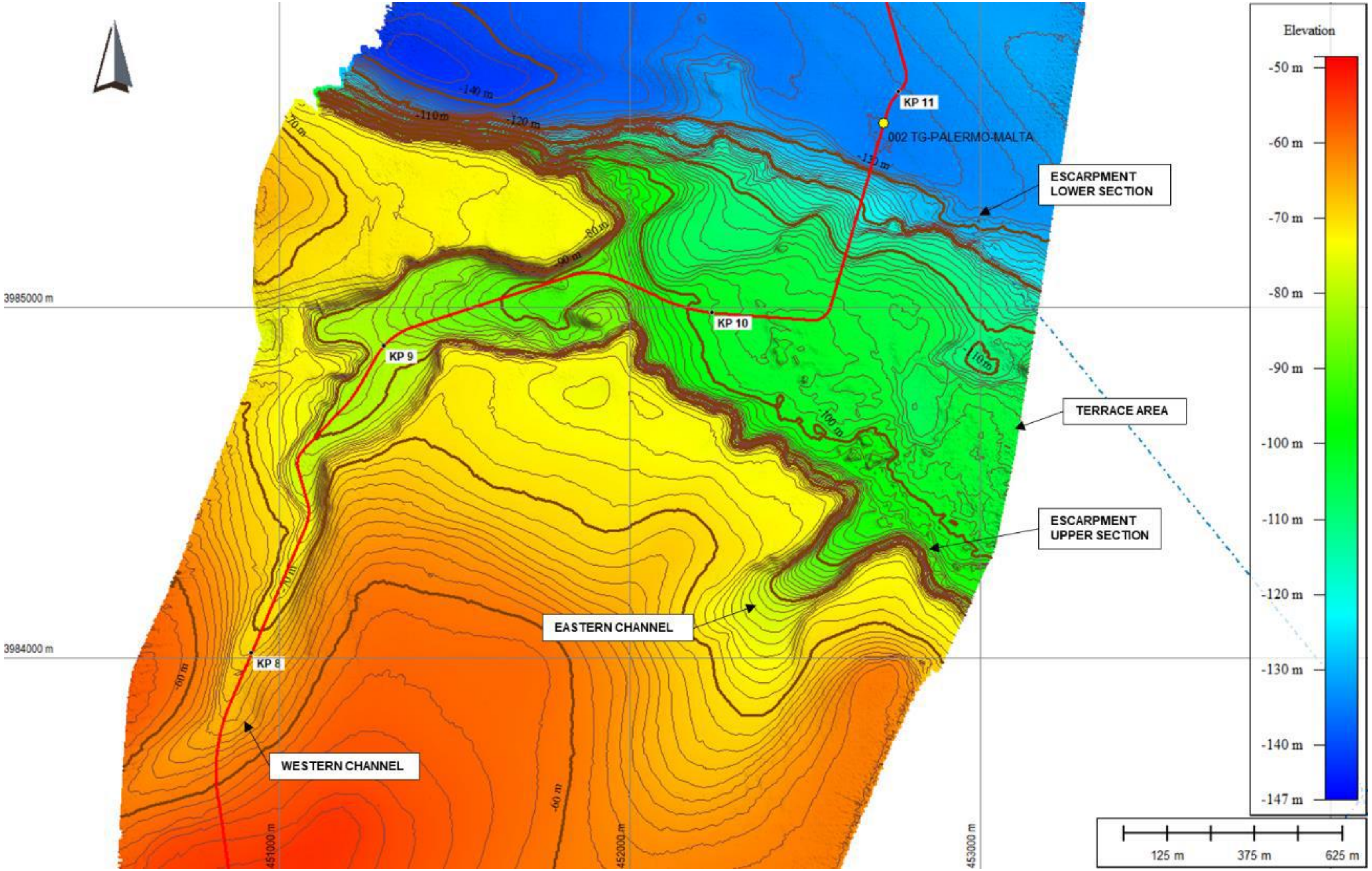

FIGURE 10: BATHYMETRIC MAP FOR THE ESCARPMENT BETWEEN KP8 AND KP11

4.1.2 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 11 to Figure 14. A seabed substrates map has also been generated from the EMODNET portal, as presented in Figure 15. The cable will pass over sand (close to the shore), mixed sediment and rocks & boulders (close to the EEZ boundary).

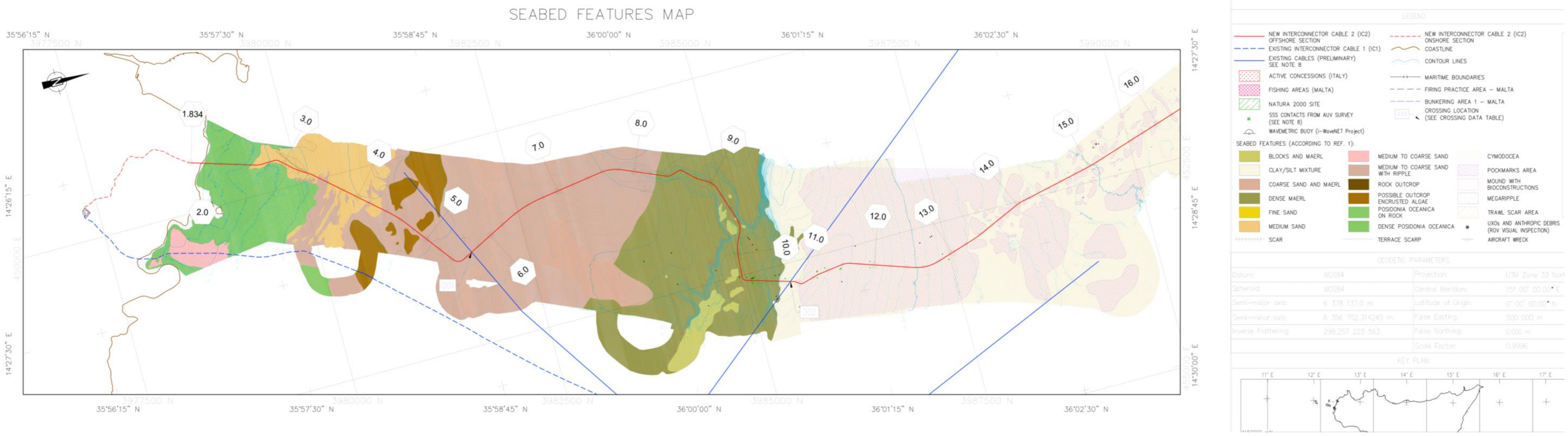

Figure 11: Seabed Features Between KP2 and KP16

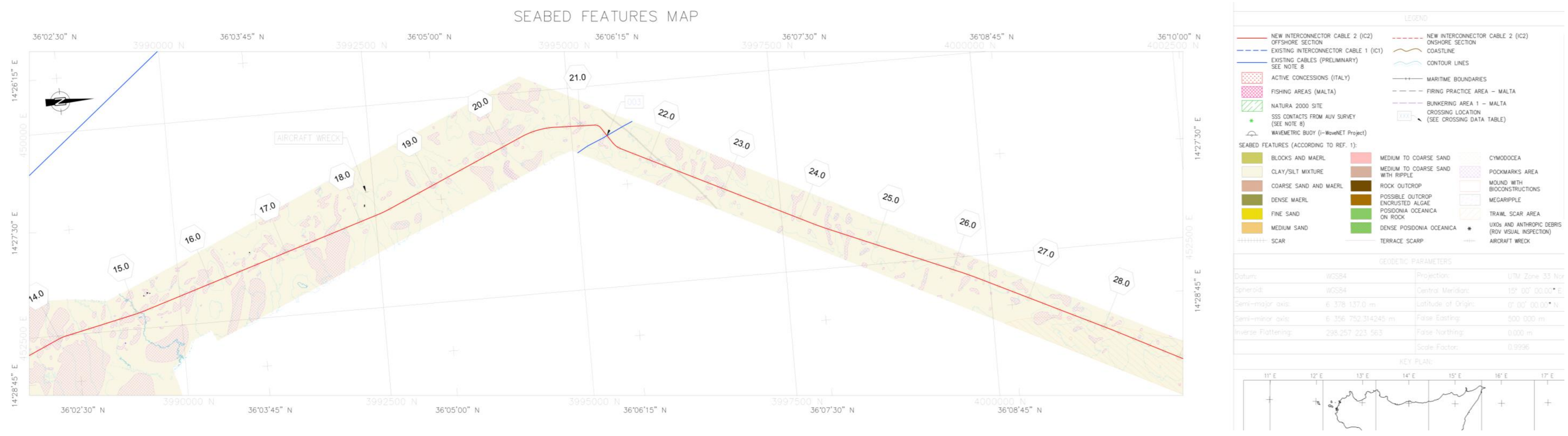

Figure 12: Seabed Features Between KP14 and KP28

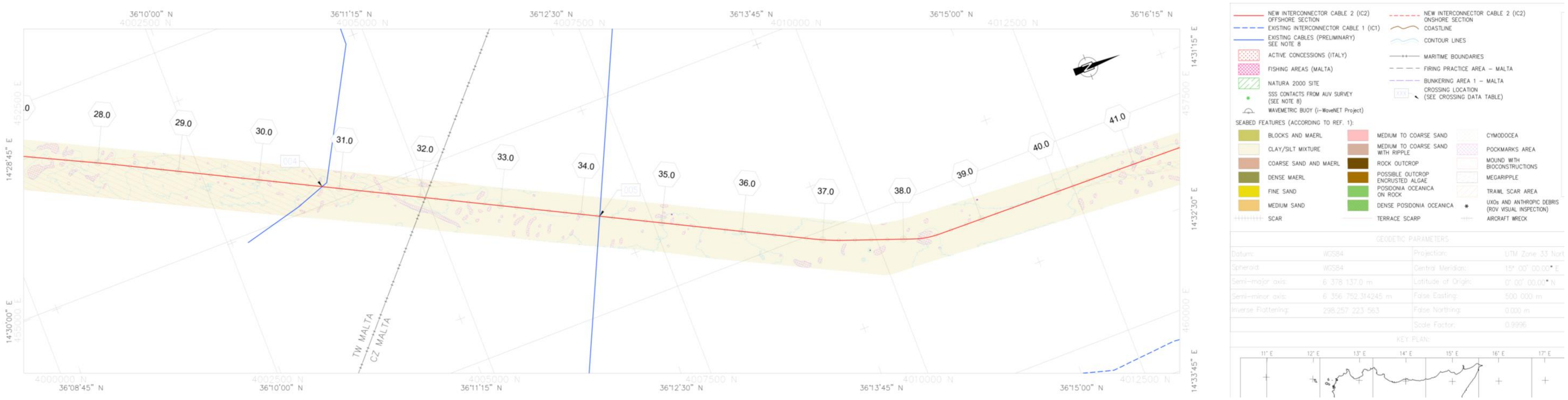

FIGURE 13: SEABED FEATURES BETWEEN KP28 AND KP41

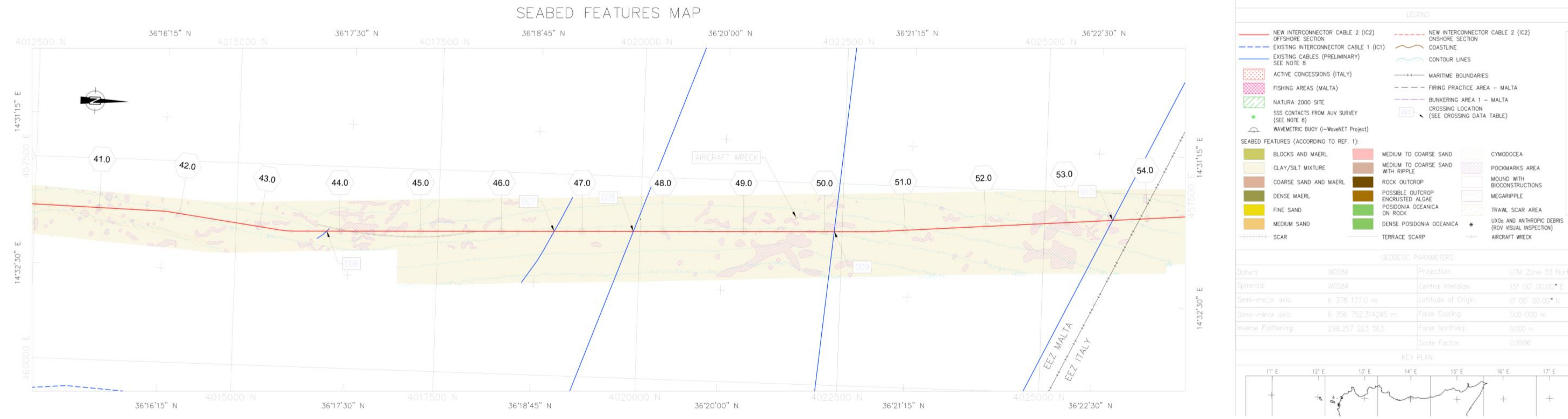

FIGURE 14: SEABED FEATURES BETWEEN KP41 AND KP54 (EEZ BOUNDARY)

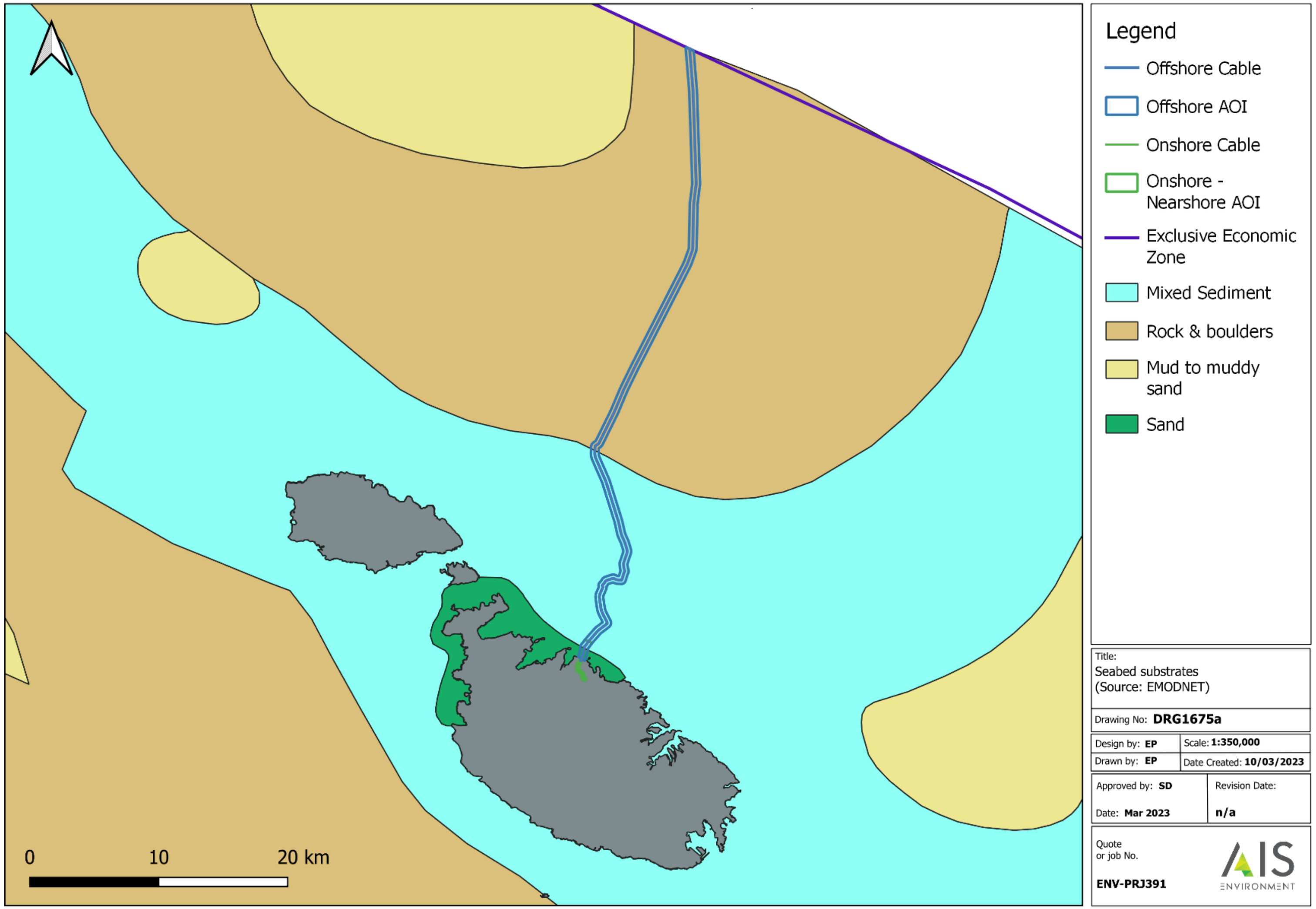

FIGURE 15: SEABED SUBSTRATES MAP (SOURCE: EMODNET)

4.1.3 Benthic habitats & species

The EUNIS seabed habitats map produced by EMODNet is shown in Figure 16. 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.

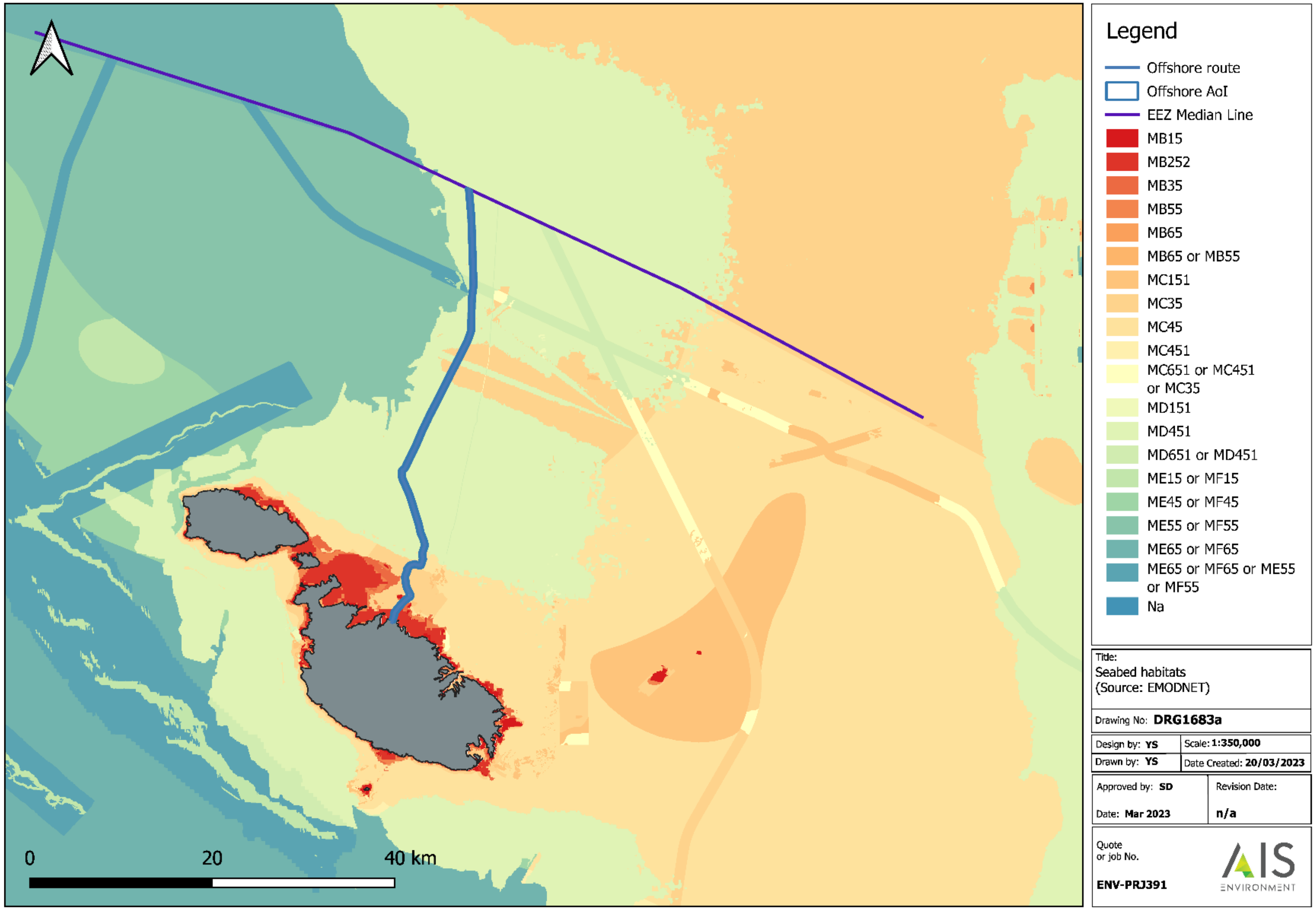

FIGURE 16: EUNIS SEABED HABITATS (SOURCE: EMODNET)

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.

4.1.3.1 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 17. 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 18 to Figure 19.

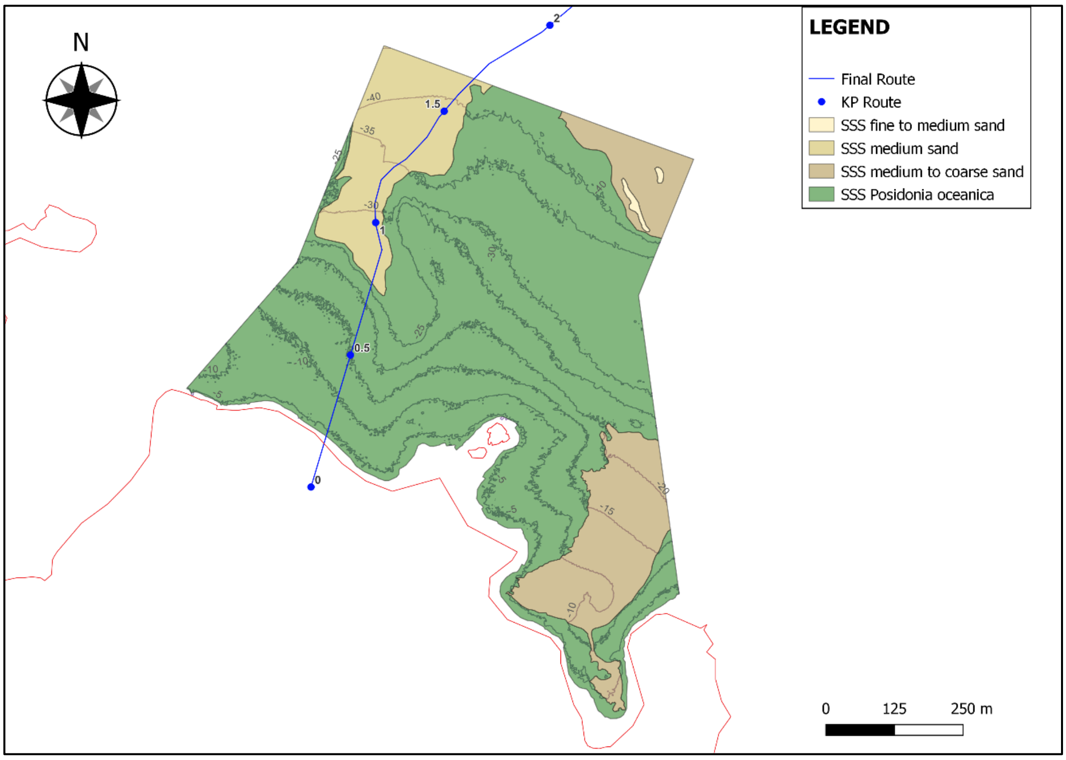

FIGURE 17: *P. OCEANICA* IN NEARSHORE ZONE (KP0.0 TO KP1.5)[2]

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

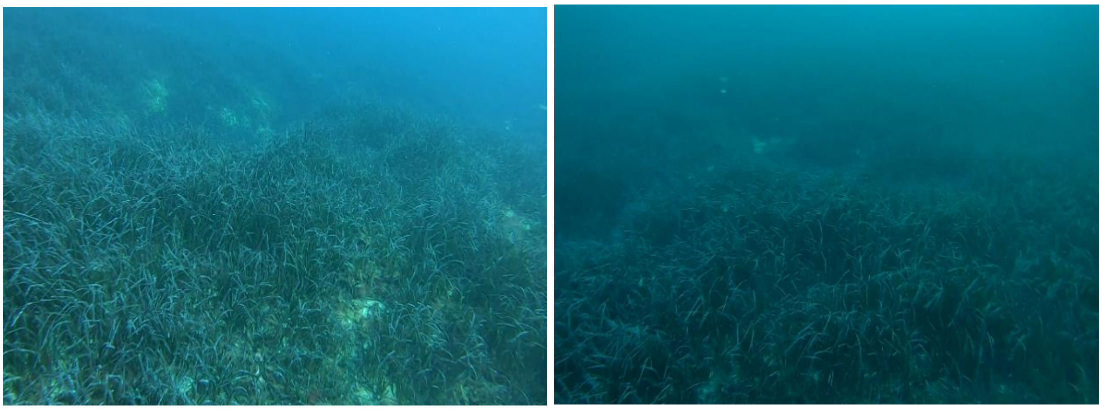

FIGURE 18: CONTINUOUS *P. OCEANICA* MEADOWS

FIGURE 19: RETICULATE *P. OCEANICA* MEADOWS WITH EXPOSED MATTE, SANDY PATCHES AND DEAD *P. OCEANICA* LEAVES

4.1.3.2 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 20.

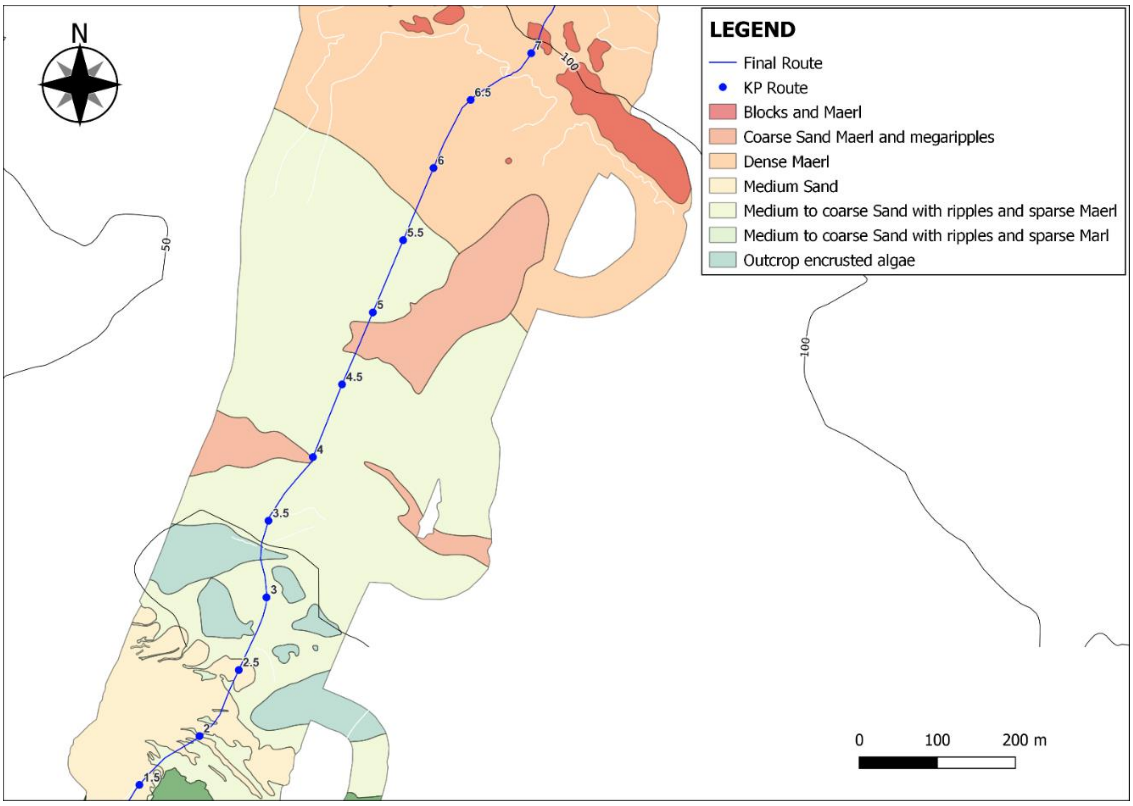

FIGURE 20: MAËRL & CORALLIGENOUS OUTCROPS ALONG THE OFFSHORE ROUTE (KP1.5 TO KP7.0)[3]

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 21 to Figure 20.

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

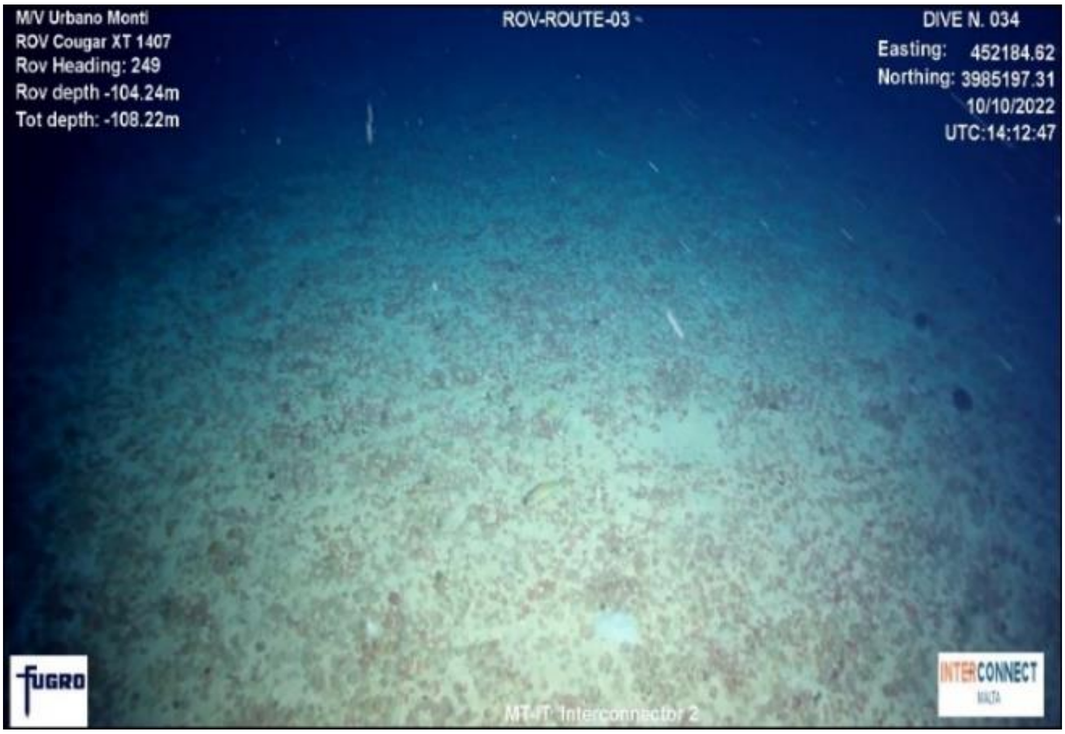

FIGURE 21: LOOSE MAËRL BEDS IN THE OFFSHORE ZONE

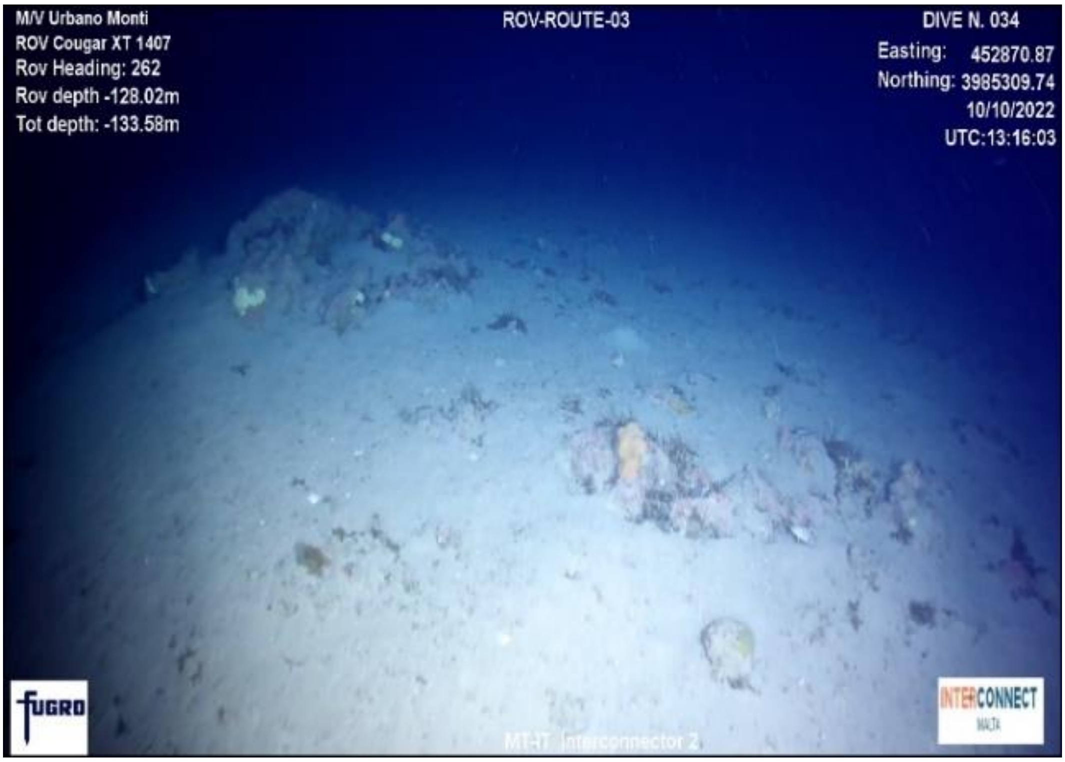

FIGURE 22: MAËRL BEDS IN RIPPLING FASHION IN THE OFFSHORE ZONE

FIGURE 23: 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 25 and Figure 26.

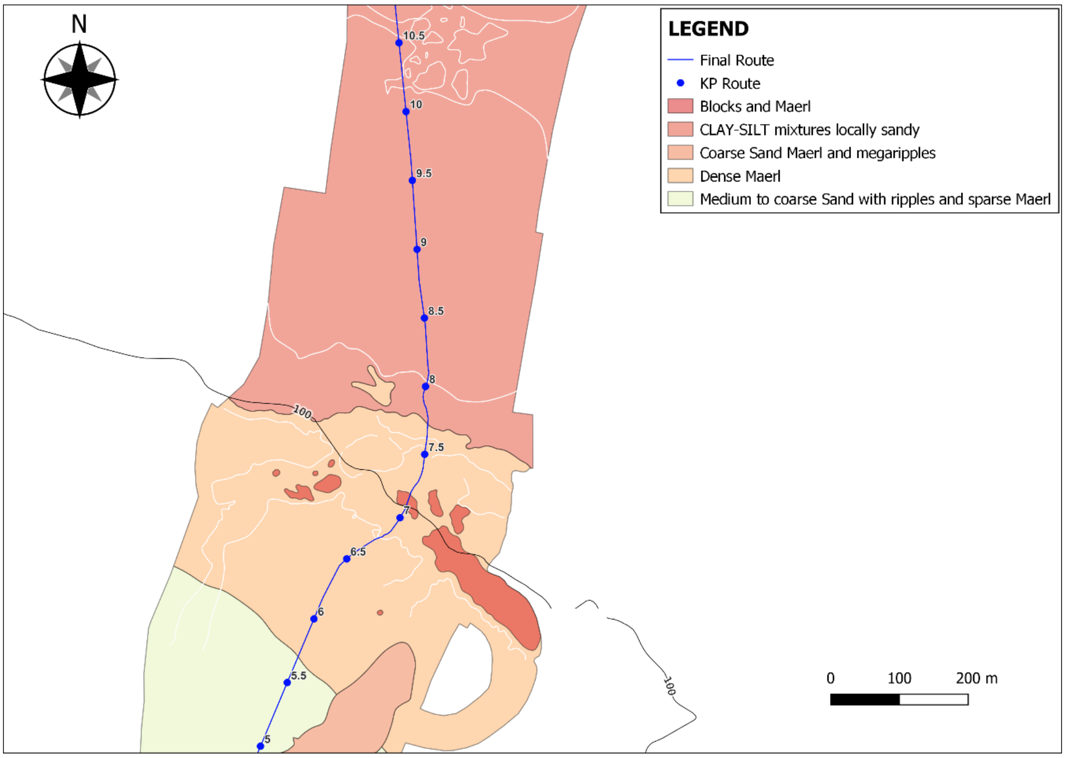

FIGURE 24: MAËRL, BLOCKS AND SAND BETWEEN KP5.5 AND KP10.5[4]

FIGURE 25: DENSE MAËRL BED WITH *HALIMEDA TUNA*

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

FIGURE 26: DENSE MAËRL BED WITH *HALIMEDA TUNA*, SPONGES AND FISH

4.1.4 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.[5] 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.[6]

A total of 412 fish species have been confirmed in Maltese waters in a recent study.[7] 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 1.[8]

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

[6] 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.

[7] 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.

[8] 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 1: PROTECTED FISH SPECIES KNOWN TO OCCUR IN MALTESE WATERS

SPECIES	COMMON NAME	IUCN RED LIST FOR THE MEDITERRANEAN	LOCAL PROTECTION STATUS[9]
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 2. Further information on the trophic characteristics of these species can be found in the Marine Fauna Observations Report prepared by the PMRS contractor.

TABLE 2: MAMMALS & REPTILES KNOWN TO OCCUR IN THE MEDITERRANEAN SEA

GROUP	SPECIES	COMMON NAME	IUCN RED LIST FOR THE MEDITERRANEAN	LOCAL PROTECTION STATUS[9]
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

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

GROUP	SPECIES	COMMON NAME	IUCN RED LIST FOR THE MEDITERRANEAN	LOCAL PROTECTION STATUS[9]
	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 27. The whole survey resulted in a total of 139 visual sightings, including 12 individuals of loggerhead turtle (*Caretta caretta*, Figure 29), 10 individuals of bottlenose dolphin (*Tursiops truncatus*, Figure 30). 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 28.

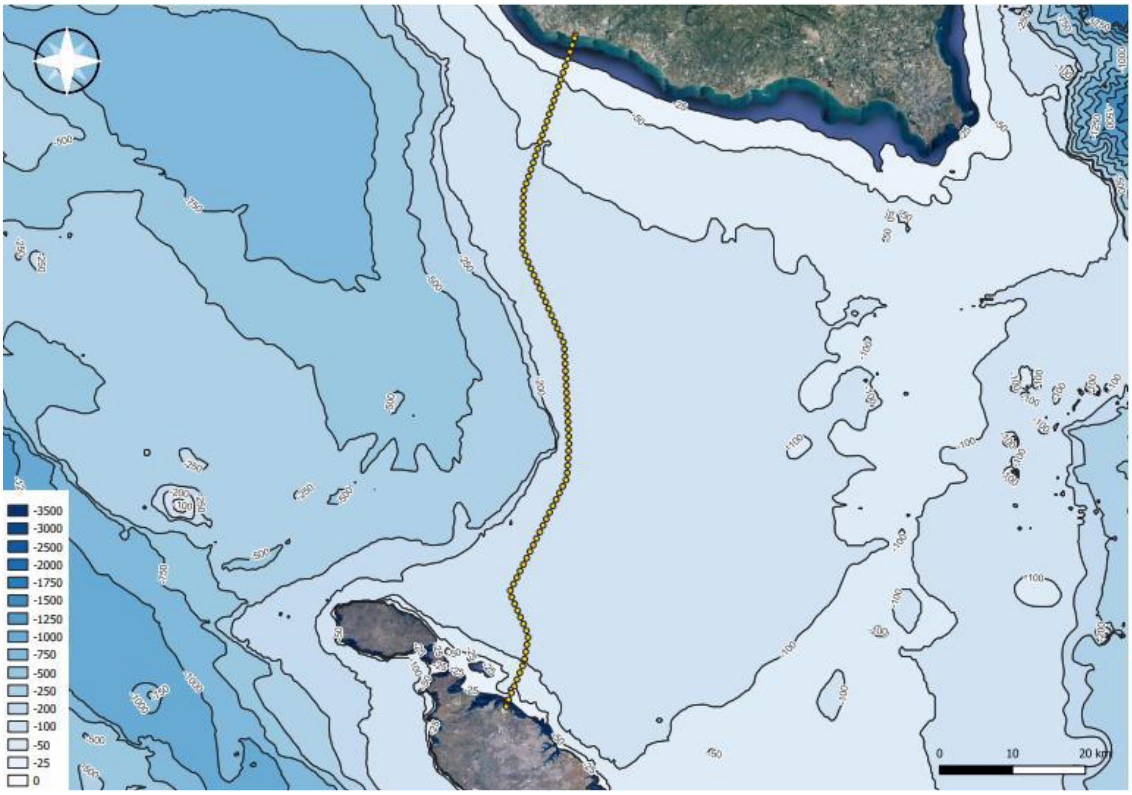

FIGURE 27: SURVEY AREA FOR THE MARINE FAUNA OBSERVATIONS SURVEY

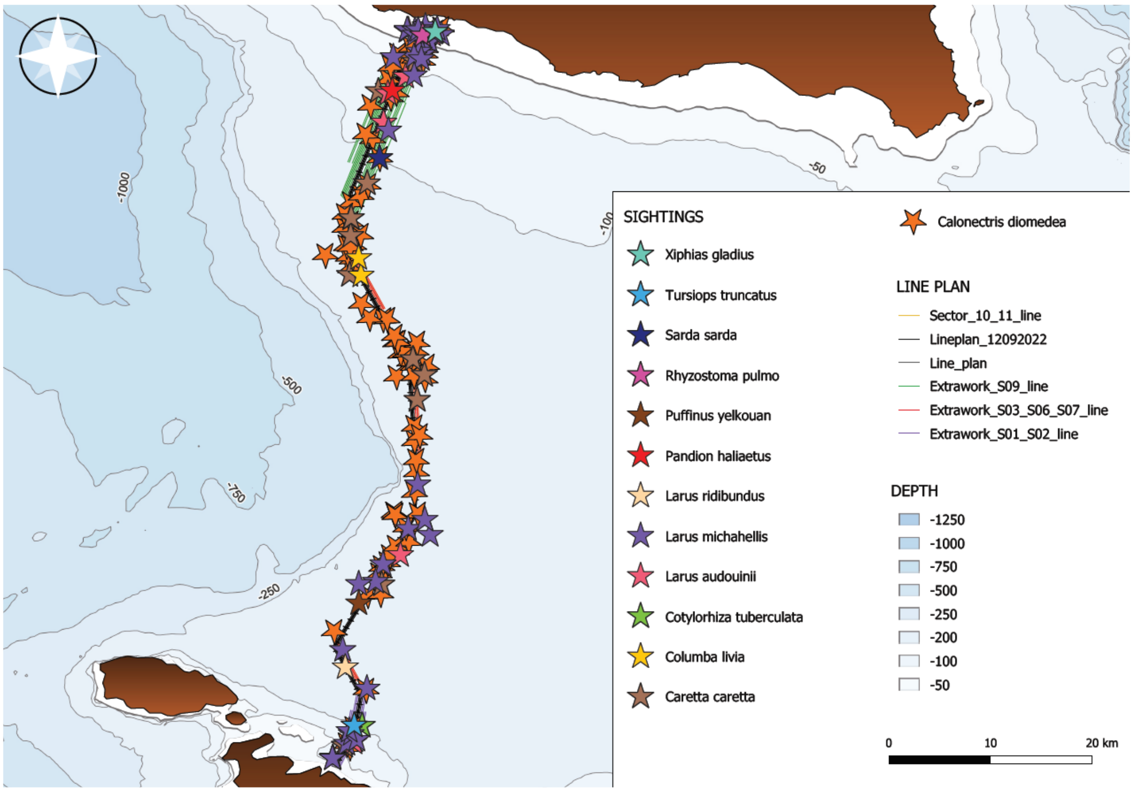

FIGURE 28: MAP OF ALL SIGHTINGS DURING THE MARINE FAUNA OBSERVATIONS SURVEY

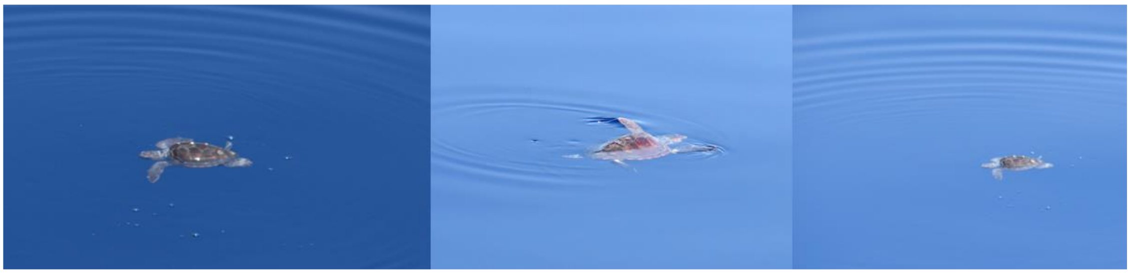

FIGURE 29: SIGHTINGS OF LOGGERHEAD SEA TURTLES (*CARETTA CARETTA*)

FIGURE 30: SIGHTINGS OF BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*)

4.1.5 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 3, three of which have been observed in the AoI.

TABLE 3: 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

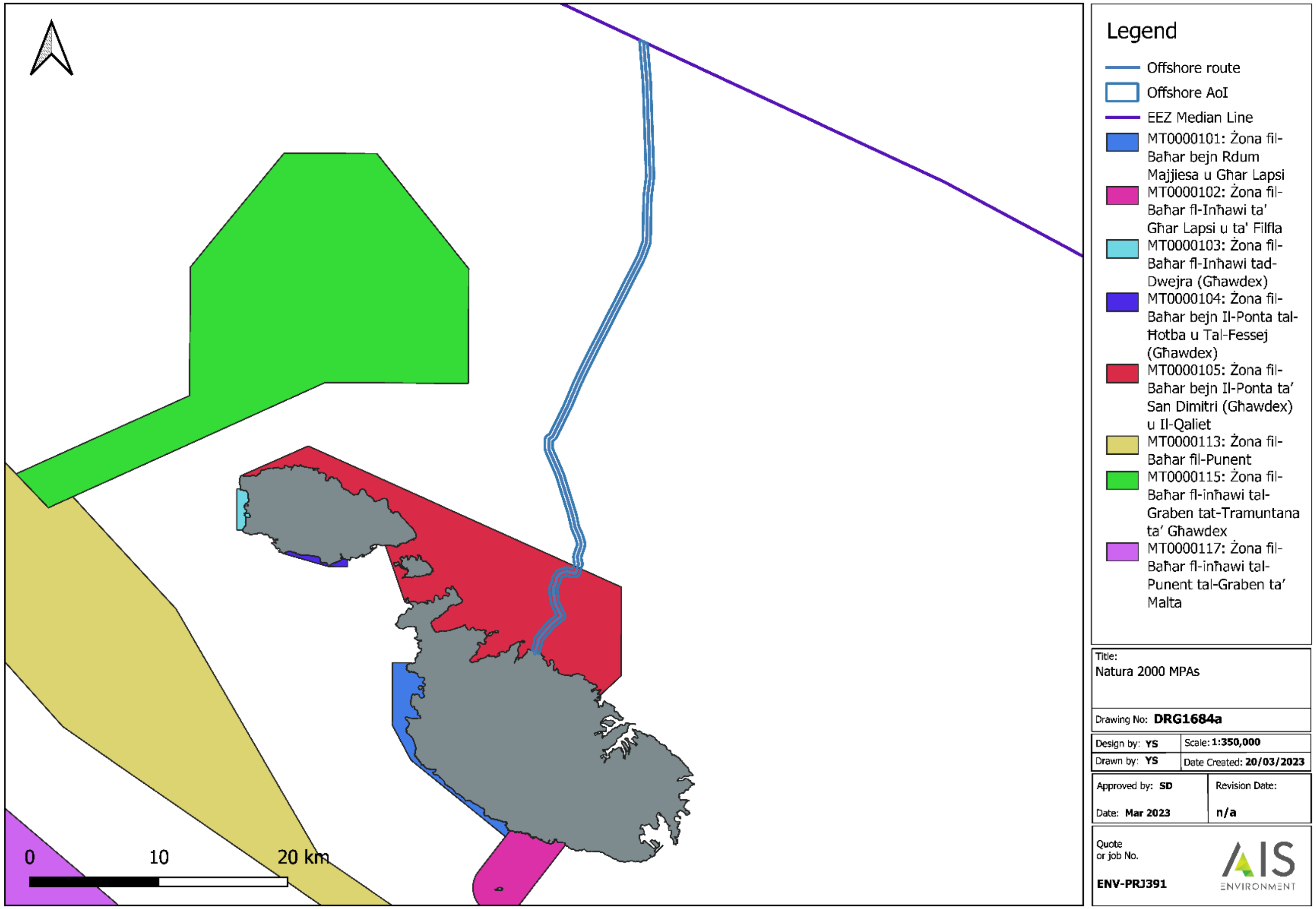

FIGURE 31: MARINE PROTECTED AREAS IN THE AOI

5 IMPACT ASSESSMENT

5.1 MARINE ECOLOGY

5.1.1 Construction phase

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 9.

5.1.1.1 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 has been identified (Figure 32), and will be located within dense continuous *P. oceanica* meadows. The punchout hole will be a maximum of 1.1m in diameter. The loss of approximately 10 sqm of this protected seagrass meadow is therefore 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. Assuming a maximum impacted width of 2.5m on each side of the cable, an estimated 2,200 sqm of *P. oceanica* will be impacted. Similarly, the cable will pass through an area covered by maërl where the cable will also be protected by cast iron shells and a covering of rocks. This will amount to about 12,500sqm of sparse maërl to be obliterated along the cable route.

When the cable is not buried in trenches, it will be further supported and protected by rock armour 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.

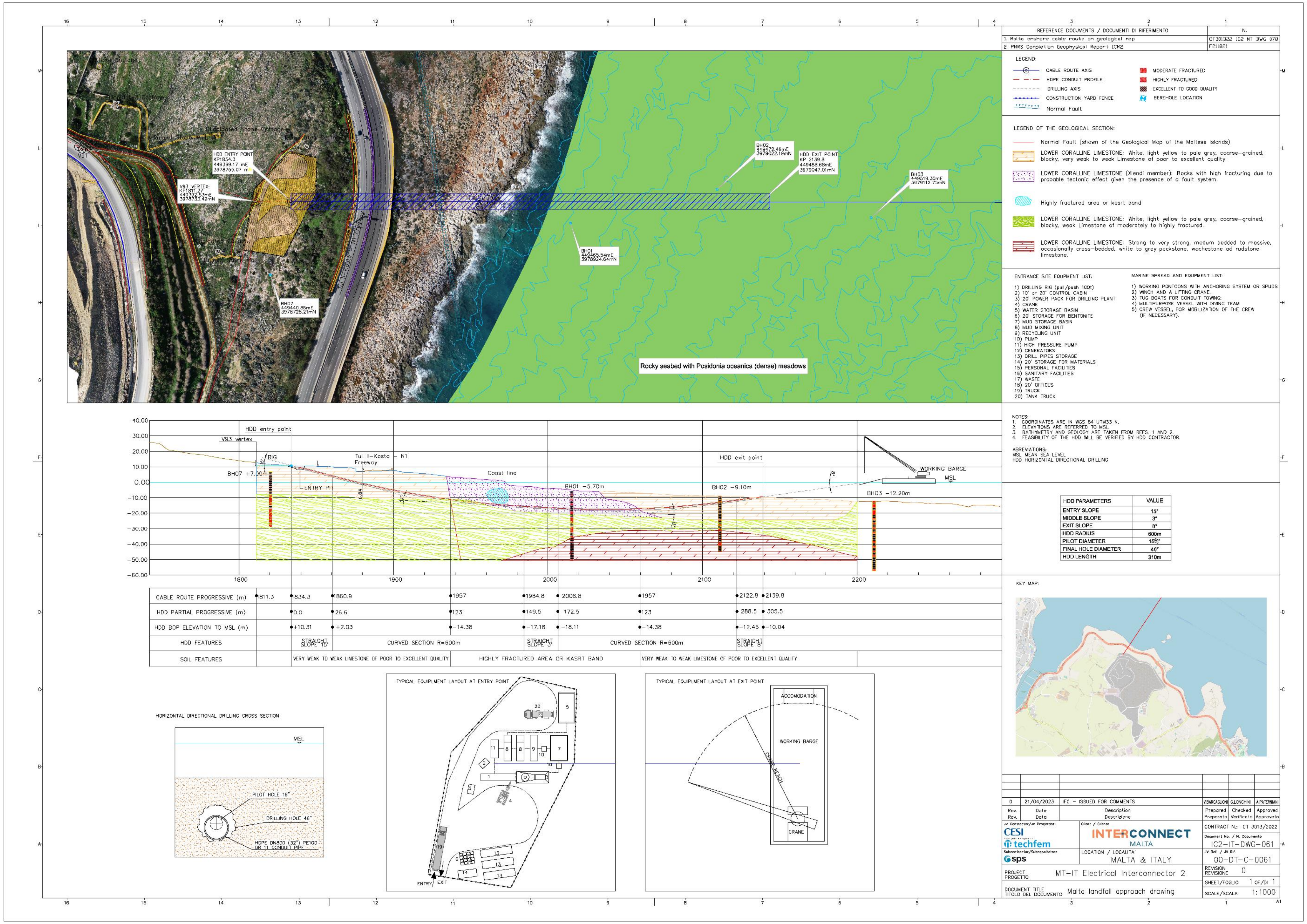

Figure 32: Punchout Hole

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. The loss of 2,200 sqm of *P. oceanica* and 12,500 sqm of sparse maërl constitutes an impact of **major adverse** significance.

5.1.1.2 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.[10] 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 33).[10]

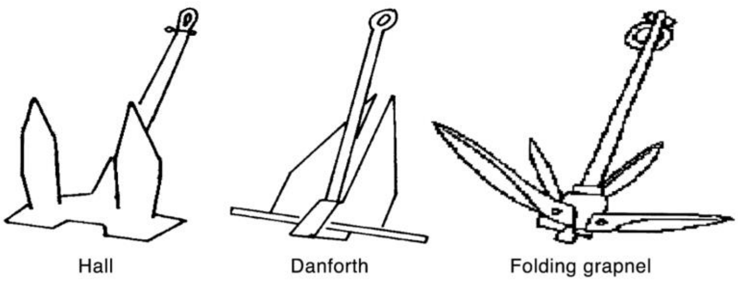

FIGURE 33: ANCHOR TYPES[10]

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

[10] 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.

habitat structure, reducing the primary production and changing trophic relationships.[11]

The work barges will be operating 24 hours a day, and will only stop in cases of poor sea conditions. Anchoring impacts from this project, although potentially of high magnitude, are unlikely to materialise if the works are scheduled properly. Consequently, this impact constitutes one of **moderate adverse** significance.

5.1.1.3 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 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.[12,13]

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.[14] 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 **major 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.

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[11] 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.

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

[13] 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

[14] 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

5.1.1.4 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.[15]

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, making them unsafe for human consumption.[16] Additionally, exposure to chemicals can cause neurological damage, liver damage, and other health problems.

The risk for marine contamination is considered to be a **moderate adverse** impact.

5.1.1.5 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.

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[15] 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.

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

5.1.1.6 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.[17] 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. 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 excavation pit, meaning the impacted area is expected to be significantly higher.

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[17] 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.

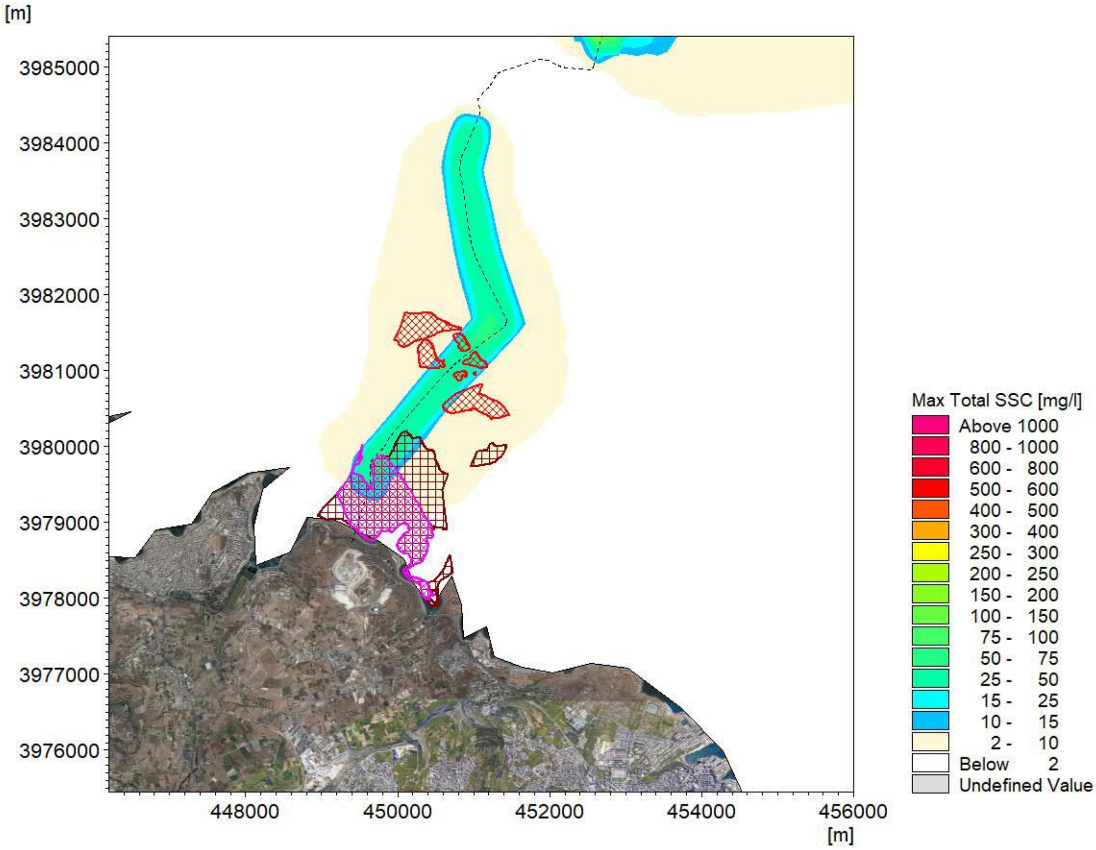

FIGURE 34: CONCENTRATION OF SUSPENDED SEDIMENTS CLOSE TO MALTA[18]

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

5.1.1.7 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.

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

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 being considered for the excavation of the pit. 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 **moderate adverse** impact.

5.1.1.8 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. 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 4.

TABLE 4: SUMMARY OF SUBMARINE NOISE MODELLING RESULTS[19]

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

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

TYPE OF ANIMAL	OPERATIONAL ACTIVITIES & SCENARIOS		MAXIMUM THRESHOLD DISTANCES, M		
			CUMULATIVE IMPACT		IMMEDIATE IMPACT
			PTS ONSET	TTS ONSET	BEHAVIOURAL DISTURBANCE
	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 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 **major adverse** significance.

5.1.2 Operational phase

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 9.

5.1.2.1 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 **minor-moderate adverse** impact on this benthic habitat.

5.1.2.2 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 **moderate adverse** significance.

5.1.2.3 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.

5.1.2.4 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.

5.1.2.5 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, ranging between **minor to moderate adverse** significance.

5.1.2.6 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.[20] Additionally, EMFs from submarine cables may interfere with the acoustic communication of fish, which could affect their social interactions and breeding success.[21]

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.[22] Additionally, EMFs from submarine cables may interfere with the echolocation and navigation abilities of some species of dolphins.[23]

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 35). 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.[24] However, impacts on benthic and demersal species close to the cables could still arise. The impact is considered to be a **minor adverse** one.

[20] 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.

[21] 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.

[22] 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.

[23] 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.

[24] US Department of the Interior (2011). Effects of EMFs From Undersea Power Cables On Elasmobranchs And Other Marine Species.

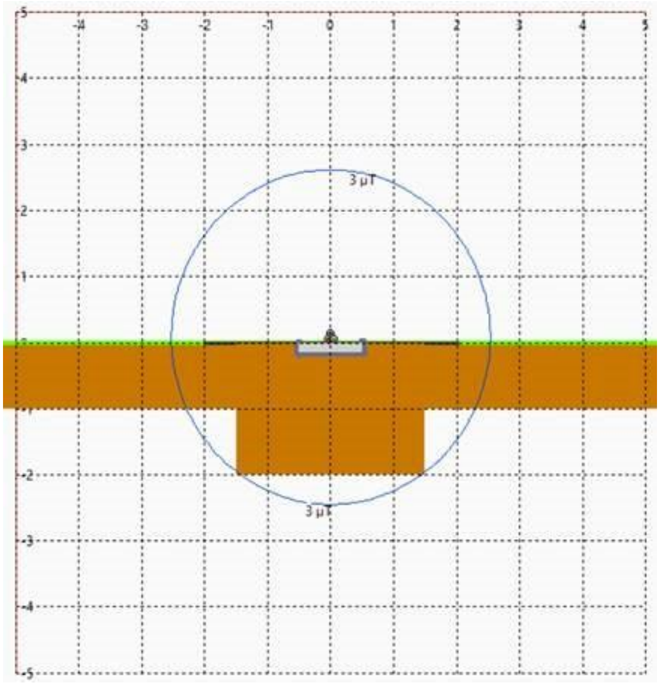

FIGURE 35: EMF AROUND THE INTERCONNECTOR CABLE

5.1.3 Decommissioning phase

The proposed cable has an anticipated lifetime of 40 years, after which the infrastructure might be partly (onshore sections only, given that the recovery of offshore sections of the cable is not deemed feasible) recovered. Recovery would bring about an array of marine ecological impacts similar to those occurring during the construction phase. Otherwise, the cable will be completely discarded, which is the most likely scenario. In this scenario, no marine ecological impacts would arise.

5.1.4 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 36. 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.*"

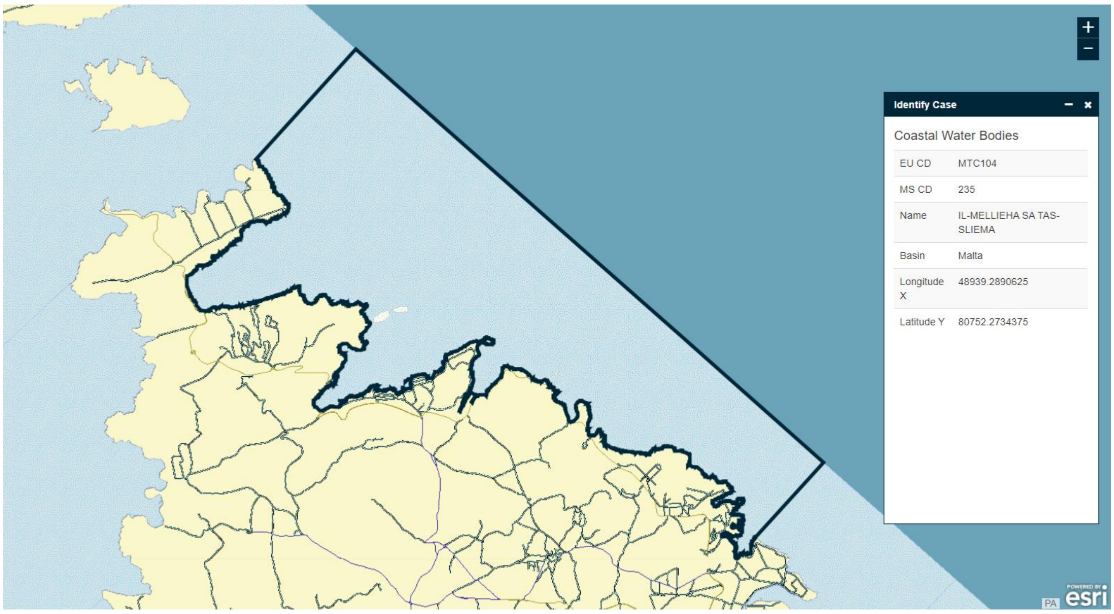

FIGURE 36: COASTAL WATER BODY MTC 104 (SOURCE: PA GEOSERVER)

In the 2nd WCMP, MTC 104 was also assessed in terms of the four WFD BQEs, as outlined in Table 5. The water body was found to be in good status overall.

TABLE 5: WFD ASSESSMENT OF MTC 104 IN THE 2ND WCMP

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

6 MITIGATION MEASURES

6.1 MARINE ECOLOGY

The worst impacts are expected to arise from the punchout hole within the protected *P. oceanica* meadows. The contractors have advised that locating the punchout hole outside the meadows is not considered to be technically feasible. Consequently, these impacts are not mitigatable with the proposed design.

Nevertheless, there is scope for some mitigation measures, as outlined below.

Mitigation of the transfer of fine particulates from land

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, divers should remove *P. oceanica* shoots and prepare them 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 by divers 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[25] in the transplantation success of a number of high-conservation value benthic assemblages,

[25] MERCES Project - http://www.merces-project.eu/

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. Divers should be present to aid in mitigating/monitoring the works and their impacts.

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 by divers. The pilot punchout hole will also be capped with carefully placed sandbags to minimise dispersion of drilling fluids. While microtunnelling would minimize the release of drilling fluids, the contractors have advised that this technology is not recommended for the 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 used 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 6 is a relevant excerpt from the same guidance report.

TABLE 6: 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 punchout 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. 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.

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.

7 RESIDUAL IMPACTS

7.1 MARINE ECOLOGY

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 support structures, 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.

8 MONITORING PROGRAMME

8.1 MARINE ECOLOGY

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.

9 Summary of Impacts Table

Impact Type and Source			Impact Receptor		Effect and Scale							Probability of impact occurring (inevitable/ likely/ unlikely/ remote/ uncertain)	Overall impact significance	Proposed mitigation measures	Residual impact significance	Other requirements
Impact type	Specific intervention leading to impact	Project phase	Receptor type	Sensitivity & resilience towards	Direct/ indirect/ cumulative	Beneficial/ adverse	Severity	Physical/ geographic extent of impact	Short/ medium/ long term	Temporary/ permanent	Reversible/ irreversible					
Obliteration of benthic assemblages	Punchout hole & cable laying	Construction	*P. oceanica*	High	Direct	Adverse	High	Local/Restricted	Long-term	Permanent	Irreversible	Inevitable	Major	Take-up of *P. oceanica* should be minimised as far as possible by locally adjusting the cable path to overlap with sparse meadows	Major (slight reduction)	Translocation of *P. oceanica* meadows prior to the start of excavation works
Obliteration of benthic assemblages	Cable laying	Construction	Maërl	High	Direct	Adverse	High	Local/Restricted	Long-term	Permanent	Irreversible	Inevitable	Major	Take-up of maërl should be minimised as far as possible by locally adjusting the cable path to overlap with sparse maërl	Major (slight reduction)	N/A
Obliteration of benthic assemblages	Cable laying	Construction	Sandbanks	Medium	Direct	Adverse	Medium	Local/Restricted	Medium-term	Permanent	Irreversible	Inevitable	Moderate	Take-up of sandbanks should be minimised as far as possible by locally adjusting the cable path to overlap with sparse sandbanks	Moderate (slight reduction)	N/A
Obliteration of benthic assemblages	Heightened anchoring activity	Construction	*P. oceanica*	High	Direct	Adverse	High	Local/Restricted	Long-term	Permanent	Irreversible	Likely	Moderate	Use of eco-mooring and/or designation of safe anchoring areas; Use of low-impact anchors	Minor	N/A

IMPACT TYPE AND SOURCE			IMPACT RECEPTOR		EFFECT AND SCALE							PROBABILITY OF IMPACT OCCURRING (INEVITABLE/ LIKELY/ UNLIKELY/ REMOTE/ UNCERTAIN)	OVERALL IMPACT SIGNIFICANCE	PROPOSED MITIGATION MEASURES	RESIDUAL IMPACT SIGNIFICANCE	OTHER REQUIREMENTS
IMPACT TYPE	SPECIFIC INTERVENTION LEADING TO IMPACT	PROJECT PHASE	RECEPTOR TYPE	SENSITIVITY & RESILIENCE TOWARDS	DIRECT/ INDIRECT/ CUMULATIVE	BENEFICIAL/ ADVERSE	SEVERITY	PHYSICAL/ GEOGRAPHIC EXTENT OF IMPACT	SHORT/ MEDIUM/ LONG TERM	TEMPORARY/ PERMANENT	REVERSIBLE/ IRREVERSIBLE					
Obliteration of benthic assemblages	Heightened anchoring activity	Construction	Maërl	High	Direct	Adverse	High	Local/Restricted	Long-term	Permanent	Irreversible	Likely	Moderate	Use of eco-mooring and/or designation of safe anchoring areas; Use of low-impact anchors	Minor	N/A
Obliteration of benthic assemblages	Heightened anchoring activity	Construction	Sandbanks	High	Direct	Adverse	High	Local/Restricted	Long-term	Permanent	Irreversible	Likely	Minor	Use of eco-mooring and/or designation of safe anchoring areas; Use of low-impact anchors	Insignificant	N/A
Atmospheric fall-out/ deposition of fine particulates	Various works	Construction	All marine organisms and habitats	High	Indirect	Adverse	High	Moderate extent	Short-term	Temporary	Reversible	Likely	Major	Use of dust mitigation techniques such as silt curtains in shallow waters and gentle placement of sand bags	Moderate	Monitoring
Heightened marine contamination risk	Accidental release of fuels, lubricant oils, additives, cement from cable support bags	Construction	All marine organisms and habitats	Medium	Indirect	Adverse	Medium	Moderate extent	Short-term	Temporary	Reversible	Unlikely	Moderate	Use of appropriate bunding, spill kits and booms; Use of biodegradable chemicals where possible	Minor	Monitoring
Release of drilling fluids	Horizontal directional drilling	Construction	All marine organisms and habitats	High	Indirect	Adverse	High	Widespread	Short-term	Temporary	Reversible	Inevitable	Moderate	Using biodegradable drilling fluids; Using a forward	Minor	Monitoring

IMPACT TYPE AND SOURCE			IMPACT RECEPTOR		EFFECT AND SCALE							PROBABILITY OF IMPACT OCCURRING (INEVITABLE/ LIKELY/ UNLIKELY/ REMOTE/ UNCERTAIN)	OVERALL IMPACT SIGNIFICANCE	PROPOSED MITIGATION MEASURES	RESIDUAL IMPACT SIGNIFICANCE	OTHER REQUIREMENTS
IMPACT TYPE	SPECIFIC INTERVENTION LEADING TO IMPACT	PROJECT PHASE	RECEPTOR TYPE	SENSITIVITY & RESILIENCE TOWARDS	DIRECT/ INDIRECT/ CUMULATIVE	BENEFICIAL/ ADVERSE	SEVERITY	PHYSICAL/ GEOGRAPHIC EXTENT OF IMPACT	SHORT/ MEDIUM/ LONG TERM	TEMPORARY/ PERMANENT	REVERSIBLE/ IRREVERSIBLE					
														reaming type of HDD.		
Suspended sediment	Punchout hole & cable laying	Construction	All marine organisms and habitats	High	Direct	Adverse	High	Widespread	Short-term	Temporary	Reversible	Inevitable	Major	Use of dust mitigation techniques such as silt curtains in shallow waters	Moderate	Monitoring
Remobilisation of nutrients and pollutants sequestered within the benthic sediment	Punchout hole & cable laying	Construction	All marine organisms and habitats	High	Indirect	Adverse	Medium	Widespread	Short-term	Temporary	Irreversible	Likely	Moderate	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.	Moderate (slight reduction)	N/A
Anthropogenic generation of submarine noise	Various works	Construction	Cetaceans and marine reptiles	Medium	Indirect	Adverse	Moderate	Widespread	Short-term	Temporary	Reversible	Inevitable	Major	Deployment of air bubble screens for stretches of high noise generation	Moderate	N/A
Habitat loss and fragmentation of *P. oceanica*	Physical presence of the cable causing seabed sheer forces	Operation	Marine species associated with *P. oceanica*	Medium	Indirect	Adverse	Low	Moderate extent	Short-term	Permanent	Irreversible	Likely	Minor-moderate	N/A	Minor-moderate	N/A

IMPACT TYPE AND SOURCE			IMPACT RECEPTOR		EFFECT AND SCALE							PROBABILITY OF IMPACT OCCURRING (INEVITABLE/ LIKELY/ UNLIKELY/ REMOTE/ UNCERTAIN)	OVERALL IMPACT SIGNIFICANCE	PROPOSED MITIGATION MEASURES	RESIDUAL IMPACT SIGNIFICANCE	OTHER REQUIREMENTS
IMPACT TYPE	SPECIFIC INTERVENTION LEADING TO IMPACT	PROJECT PHASE	RECEPTOR TYPE	SENSITIVITY & RESILIENCE TOWARDS	DIRECT/ INDIRECT/ CUMULATIVE	BENEFICIAL/ ADVERSE	SEVERITY	PHYSICAL/ GEOGRAPHIC EXTENT OF IMPACT	SHORT/ MEDIUM/ LONG TERM	TEMPORARY/ PERMANENT	REVERSIBLE/ IRREVERSIBLE					
Benthic impacts	Cable maintenance and repair works	Operation	Benthic assemblages	High	Direct	Adverse	High	Widespread	Long-term	Permanent	Irreversible	Unlikely	Moderate	Use of eco-mooring and/or designation of safe anchoring areas; Use of low-impact anchors	Moderate (slight reduction)	N/A
Anthropogenic generation of submarine noise	Maintenance/ repair	Operation	Cetaceans and marine reptiles	Medium	Indirect	Adverse	Moderate	Moderate extent	Short-term	Temporary	Reversible	Inevitable	Moderate	Deployment of air bubble screens for stretches of high noise generation	Minor	N/A
Colonisation of laid cable by epibiota	Physical presence of the artificial cable	Operation	Marine ecosystem	High	Direct	Beneficial, neutral or adverse	High	Widespread	Long-term	Permanent	Reversible	Inevitable	Moderate	N/A	Moderate	Monitoring
Toxicity to marine life	Leaching of anti-corrosion chemicals	Operation	Marine ecosystem	Medium	Indirect	Adverse	Low	Local	Long-term	Permanent	Reversible	Likely	Minor	Use of biodegradable anti-corrosion chemicals	Negligible	N/A
Behavioural and physiological disruption to marine fauna	EMF around the cable	Operation	Marine pelagic and benthic animals	Medium	Indirect	Adverse	Low	Local	Long-term	Permanent	Reversible	Likely	Minor	N/A	Minor	N/A