MT-IT JV
18, St. John Street, Fgura FGR 1447 Malta
T: +356 21803374 E: info@ais.com.mt

Architectural, Archaeological, Historical & Cultural Heritage and related Material Assets

Archaeological and Cultural impact studies related to the Malta-Italy Gas pipeline interconnection

Technical study

AIS REF. NO: ENV332801/A/18
CLIENT REF. NO: CT3109/2018
FOURTH VERSION

Publication Date

31 January 2020

This tender is being part-financed by the European Union under the Connecting European Facility (CEF) programme for 2014-2020

Co-financed by the Connecting Europe Facility of the European Union

DOCUMENT REVISION HISTORY

Date	Revision	Comments	Authors/Contributors
13/09/2019	1.0	First Draft	Chris Dalton Prof Timmy Gambin AIS Environment
18/11/2019	2.0	Second Draft	Chris Dalton Prof Timmy Gambin AIS Environment
21/01/2020	3.0	Third Draft	Chris Dalton Prof Timmy Gambin AIS Environment
31/01/2020	4.0	Fourth Draft – approved for submission	Chris Dalton Prof Timmy Gambin AIS Environment

AMENDMENT RECORD

Approval Level	Name	Signature
Internal Check	Sacha Dunlop	
Internal Approval	Mario Schembri	

DISCLAIMER

This report has been prepared by MT-IT- JV with all reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the client. Information reported herein is based on the interpretation of data collected and has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Ministry of Energy & Water; no warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from MT-IT JV. MT-IT JV disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.

Table of Contents

Table of Figures

1.0 Introduction

An Environmental Impact Assessment (EIA) is hereby being presented in relation to PA 08757/17. This application is entitled "*construction of the Malta-Italy gas pipeline EU Project of Common Interest, including a terminal station at DPS, an onshore HDD route through Delimara Peninsula and the laying of an offshore 22" diameter pipeline extending up to Gela, Sicily, Site at Delimara Power Station and offshore route within the Malta Territorial Waters, Delimara, Marsaxlokk, Malta*".

This technical study identifies the Architectural, Archaeological, Historical & Cultural Heritage and related Material Assets, and assesses the impacts caused in relation to the Environmental Impact Assessment (EIA) for the proposed gas pipeline between Malta and Sicily. The terrestrial aspect of this study falls within the locality of Delimara, Marsaxlokk.

The study will focus on the Maltese part of the Scheme only i.e. the area of land reclamation at Marsaxlokk bay, the trenchless tunnel route through the Delimara peninsula and the offshore pipeline until the median line between Malta and Sicily.

This report comprises an archaeological baseline study of the proposed Scheme, based on an archaeological assessment of reviewed records held by national inventories and secondary sources relating to the historic environment of the area. This archaeological baseline also includes an assessment of the value and sensitivity of any identified archaeological assets within the Scheme and additional 100 m wide buffer distance, supported by a field survey of the proposed construction footprint and surrounding area (Section 3.1). The conclusions and findings of this report may be used to assist and inform the planning process for the proposed project, any eventual monitoring programme or further development.

1.1 The Scheme

The project shall connect Malta to the Trans-European Gas Network in Sicily. The primary aim of the project is to import gas from the Italian National Gas network via an approximately 159km long pipeline between Delimara (Malta) and Gela (Sicily) of which approximately 151km is subsea.[1] The length of the onshore pipeline section in Delimara is about 700m and will be connected to a new Terminal Plant by means of a trenchless construction method with the exit target point at approximately 42m below mean sea level at circa 650m from shore. The designers have determined that the microtunnelling solution is the preferred option. A degree of preliminary trenching is required at the offshore target exit point to facilitate the entry of the pipeline from the seafloor into the trenchless borehole. The seabed shall be reinstated after the 22" pipeline installation is completed. The water depth of the offshore portion of the route ranges from 42m (offshore exit point at

[1] *The project was confirmed as a "project of common interest" (PCI) and re-confirmed in the 2nd, 3rd and 4th PCI lists.*

Delimara) to 158m at the deepest point and then it is buried from a depth shallower than 30m at the Gela side.

Once the project is implemented, the gas pipeline would provide a more reliable source to supply natural gas to Malta, eliminating the need for the Floating Storage Unit (FSU) recently installed to supply natural gas to the reciprocating internal combustion engine plant and the new gas turbines at the Delimara Power Station. The project will contribute to market integration and thus boost competitiveness. Use of sustainable energy will be supported by the project and will contribute towards the reduction of GHG emissions primarily from the LNG shipping and regasification process which currently take place as part of the FSU system. Once operational, the gas pipeline will also have the potential to import fuel gases from renewable sources (ex: biomethane) and thus help reduce Malta's carbon footprint.

The gas pipeline project shall be designed to operate in bidirectional mode with the first phase supplying gas from Sicily to Malta and depending on market developments, can in the future be used to supply gas from Malta to Italy. The phase 1 of the pipeline project, i.e. flow of gas from Italy to Malta, shall have an estimated capacity of approximately 1.2 billion standard cubic meters per year, with a guaranteed maximum flow of 141,000 Sm^3/hour.

The pipe will make contact with land in Malta on the eastern side of the Delimara peninsula at a depth of approximately 42m below sea level. It will then transect the peninsula and connect to the Delimara Power Station via a trenchless excavation method. The Power Station needs to be extended in order to accommodate the additional infrastructures required for the operation of the pipeline. In order to do this, it is necessary to reclaim an area of 8,000m^2 from the sea.

The Sicilian terminal station will be constructed within the Gela municipality at 37°04'51.80" N; 14° 19'01.00" E. The onshore pipeline route in Sicily is expected to be 7km long, and confined within the Gela municipality. Since the pipeline shall cross two railway lines, a number of roads and the Gela-Ragusa ethylene pipeline, three block valve stations shall be installed onshore Sicily to isolate the pipeline sections as required by Italian legislation.

On the Sicilian shore, several construction methodologies, including HDD are being considered by the FEED (Front End Engineer Design) contractor, Techfem/SPS. For mechanical protection purposes, the underwater pipeline shall be covered when passing through waters shallower than 30m, while in deeper waters, the pipeline shall be laid on the seabed. The pipeline route is located in relatively shallow waters on the Malta-Sicily underwater ridge. Such a route minimises stresses on the pipeline during both the laying of the pipe as well as during the operation of the pipeline itself.

The proposed development, subject to the EIA and hereinafter referred to as the "Scheme", involves the following interventions (Figure 1):

- Construction and laying of a 22" diameter gas pipeline between Delimara and Gela
- The construction of a terminal station (land reclamation) at Delimara Power Station
- Onshore tunnel route across the Delimara Peninsula

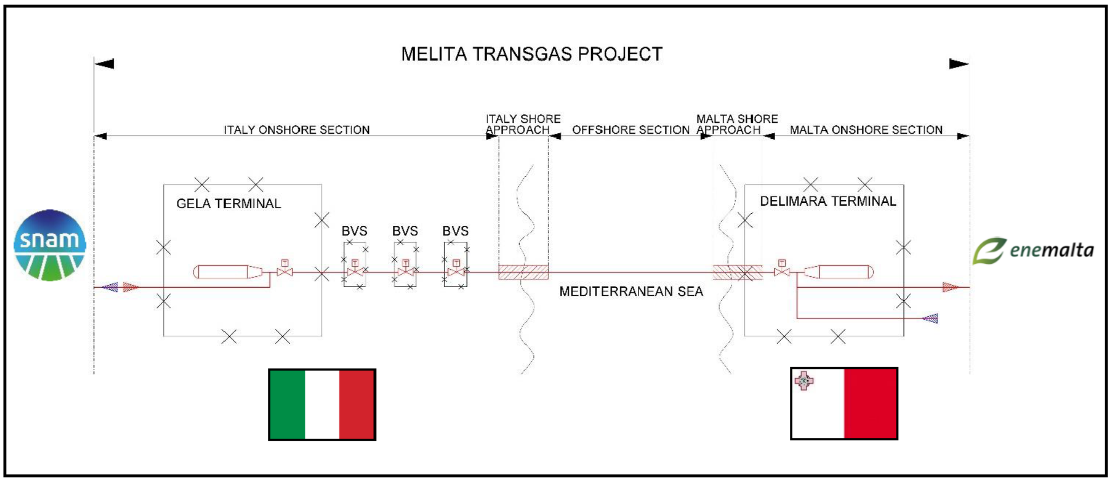

Figure 1: Project schematic

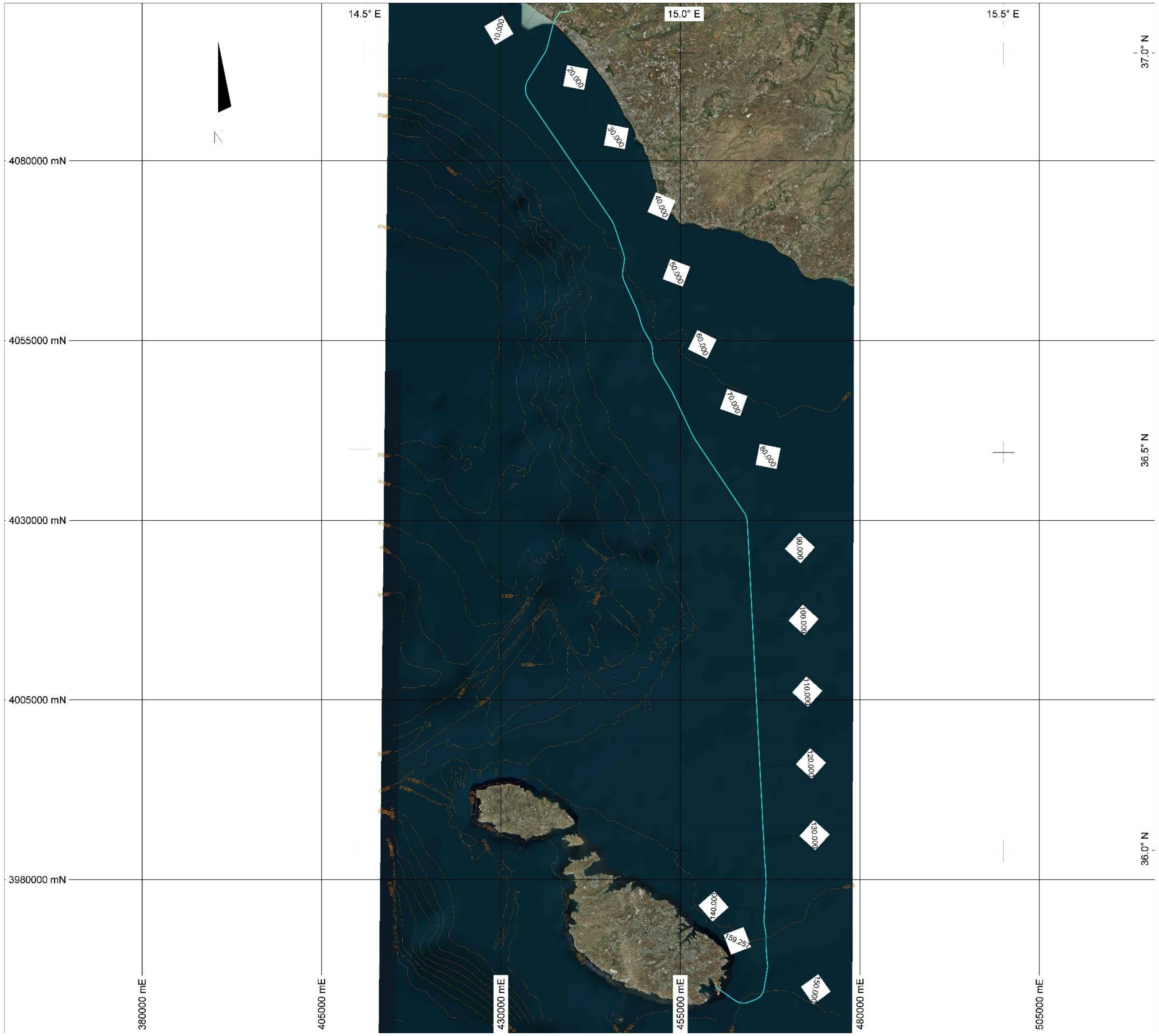

Figure 2: Site plan showing the 22" offshore pipeline route

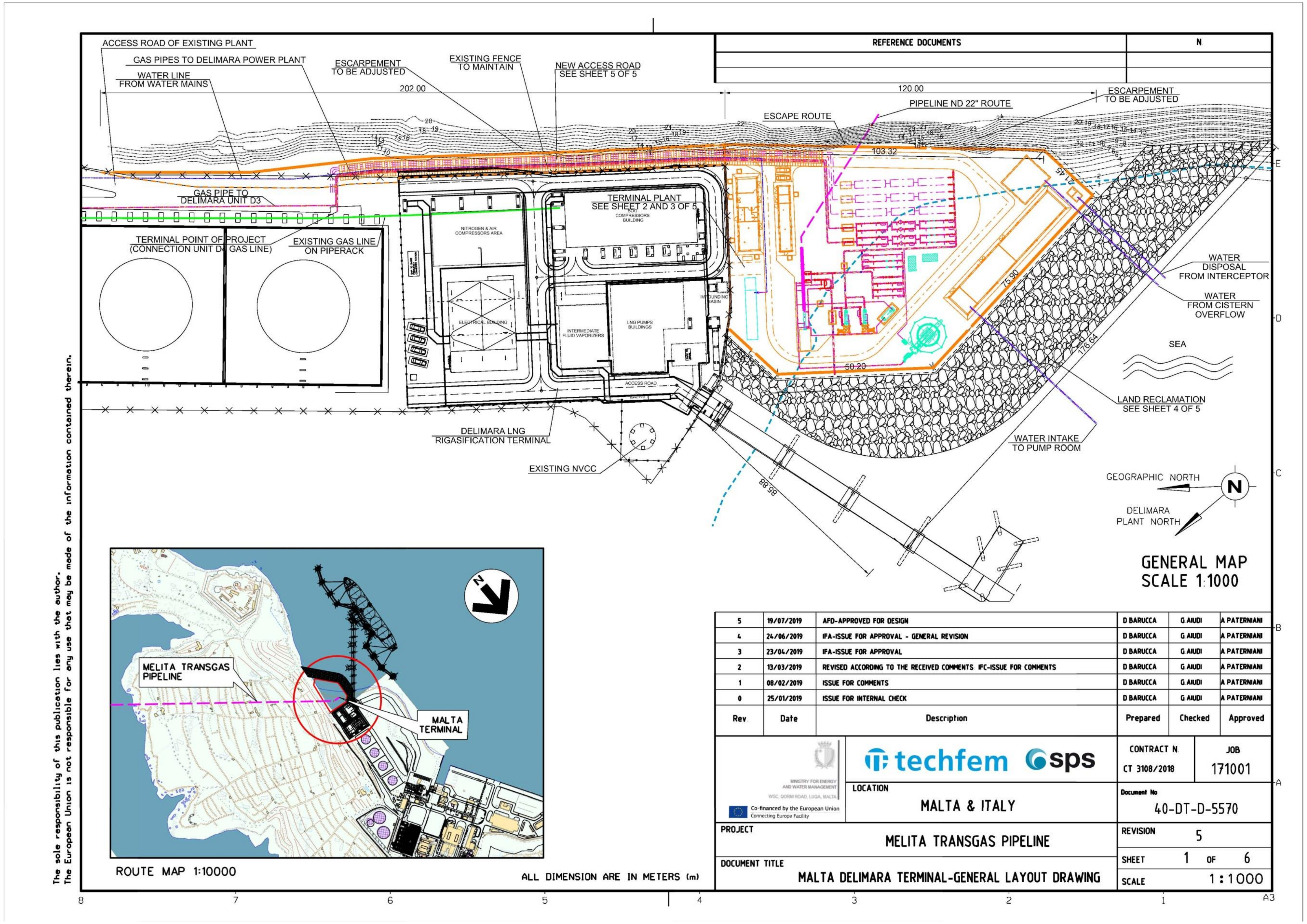

Figure 3: Site plan for the proposed Malta terminal and land reclamation area

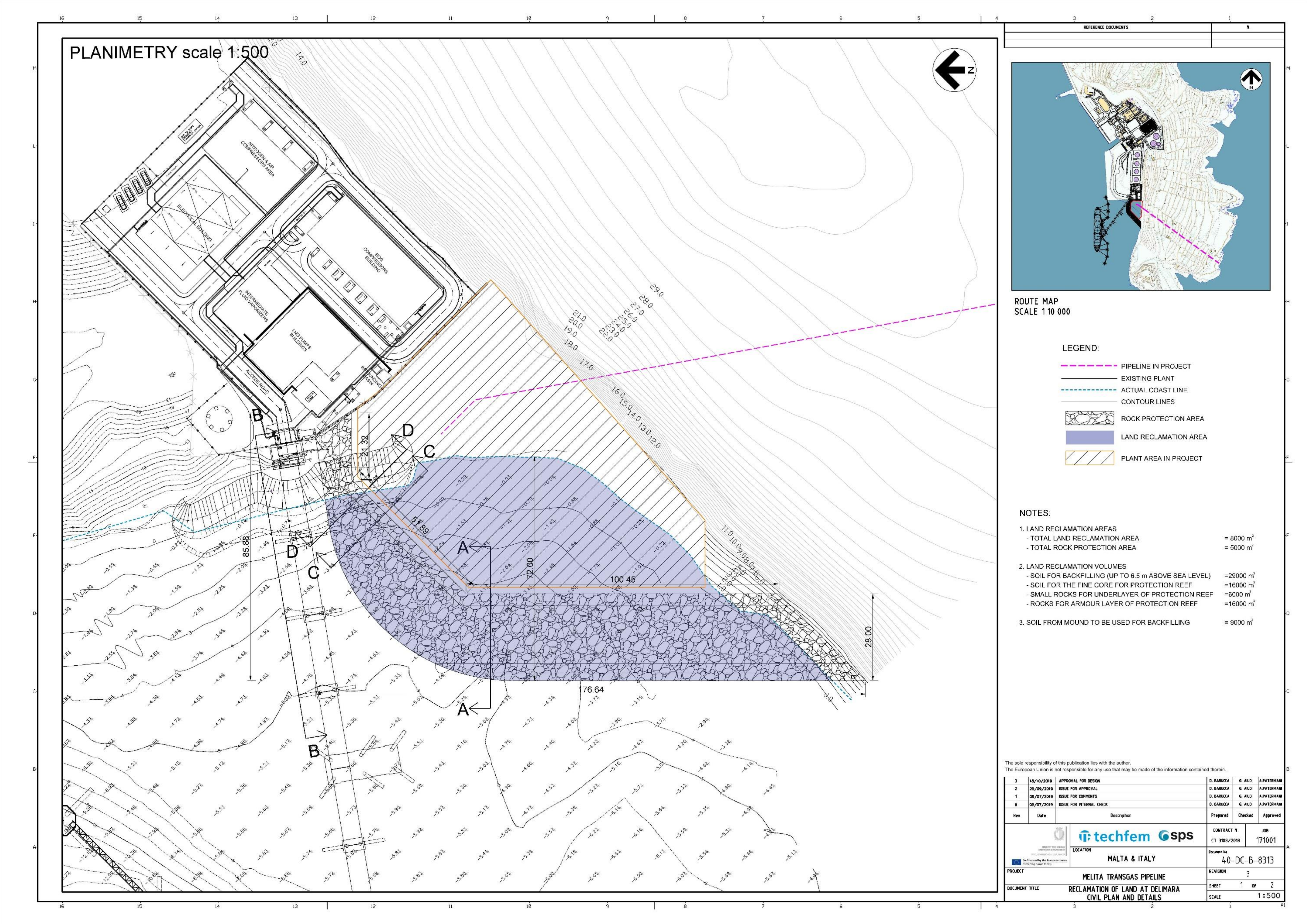

Figure 4: Land reclamation at Delimara

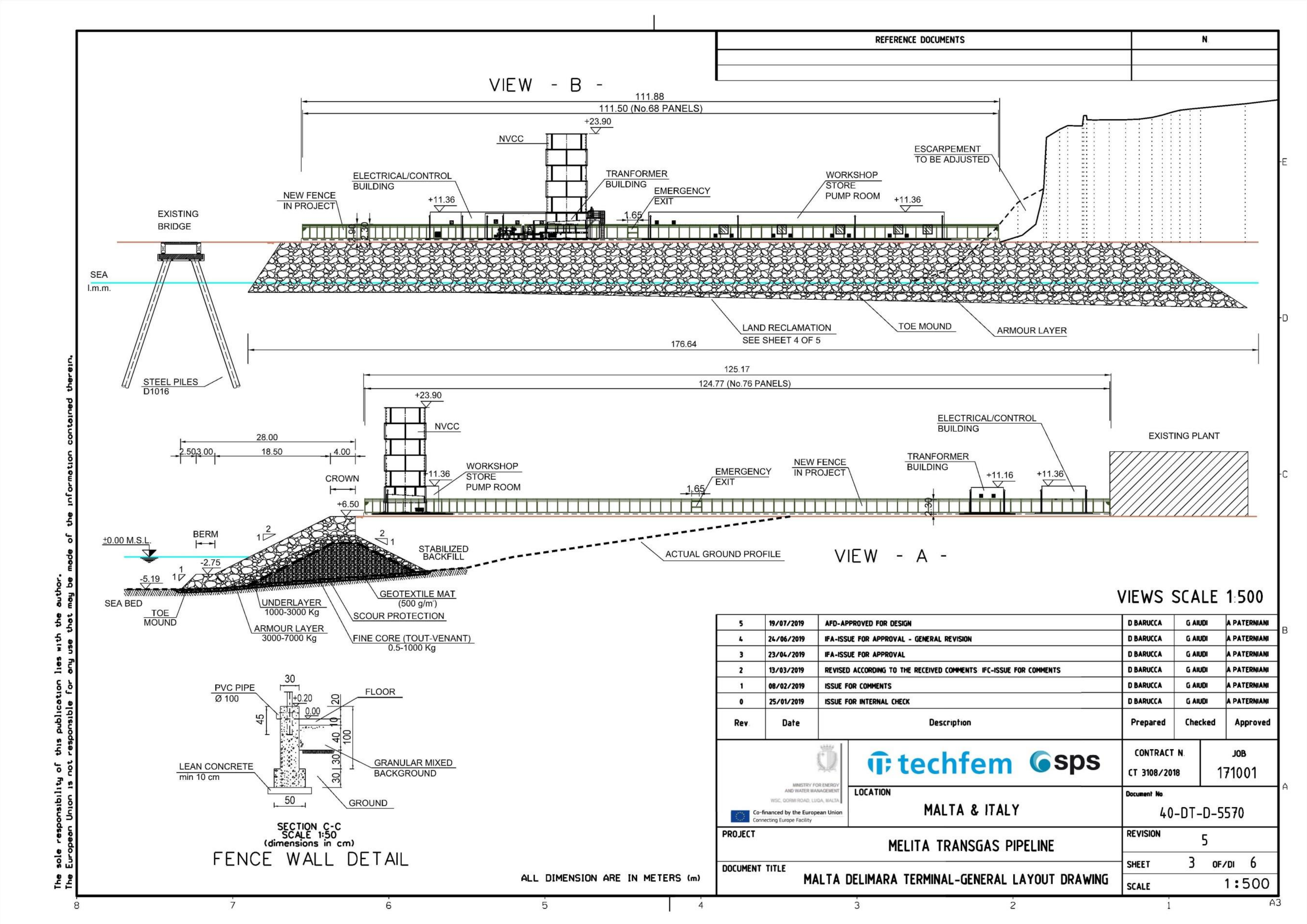

Figure 5: Sections for the proposed Malta terminal

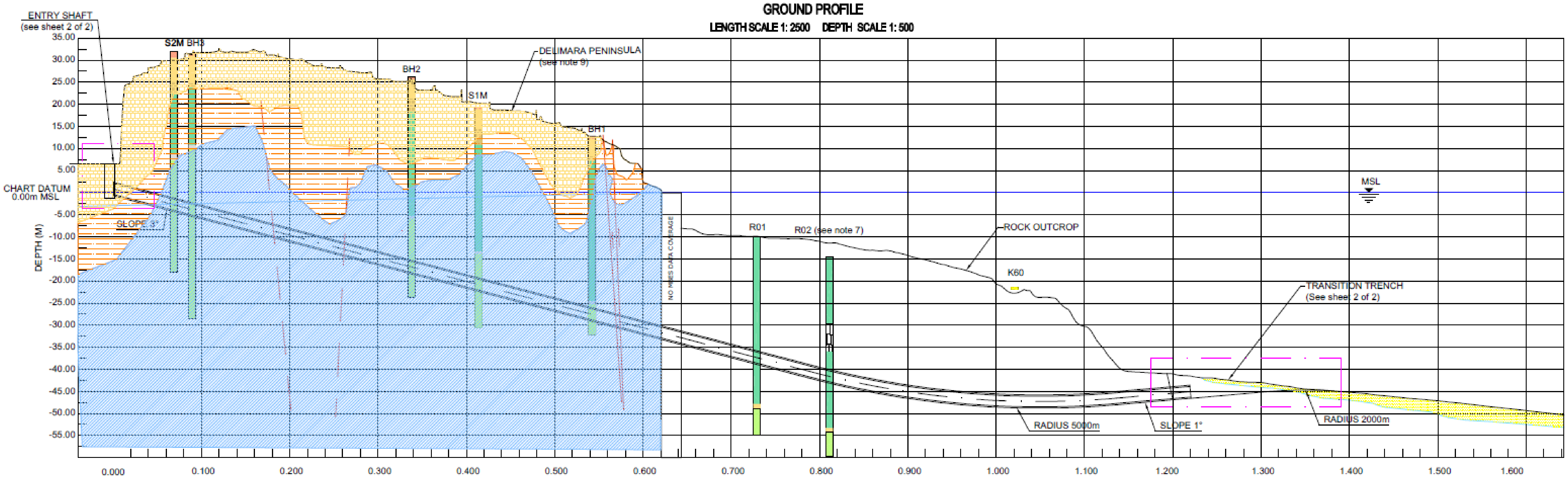

Figure 6: Profile for the onshore tunnel and shore approach

1.2 Scope of Document

The specific aim of this assessment is to summarise the known and potential archaeological baseline within the Scheme area to subsequently inform the EIA.

The objectives of the assessment are to produce details of relevant legislations, national and local planning policy, and best practice guidance and assess the significance of the known and potential archaeological resources through weighted consideration of their valued components.

2.0 Terms of Reference

The Terms of Reference related to the study architectural, archaeological, historical & cultural heritage and related material assets for the EIA issued by ERA in March 2018 are:

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

This description is identified by the area of influence depicted in Figure 65 and Figure 76*. This description shall include:*

3.6 Architectural, Archaeological, Historical & Cultural Heritage and related Material Assets

Refer to Appendix 2 – attached to the Method Statement as Appendix 1.

4.0 ASSESSMENT OF ENVIORNMENTAL IMPACTS AND ENVIRONEMENTAL 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.

4.1 Effects of the environment aspects identified in Section 3

The assessment should thoroughly identify and evaluate the impacts and implications of the project on all the relevant environmental aspects identified in Section 3 above, also taking into account the various considerations outlined in the respective sections.

With regards to Section 3.4 and 3.5 above, the ecological status of the area in question is to be evaluated, taking into consideration the definition of status by relevant EU Policy, and assessing the extent to which the project will cause deterioration in status or compromise the achievement of good status in line with Article 4(7) of the EU Water Framework Directive.

5.0 REQUIRED MEASURES, IDENIFITICATION OF RESIDUAL IMPACTS, AND MONITORING PROGRAMME

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]. Such measures could include technological features; operational management techniques; enhanced site-planning and management; aesthetic measures; conservation measures; reduction of magnitude of project; and health and safety measures. Particular attention should be given to mitigation of impacts on the marine resources and of conflicts between the different uses on site.*

*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.

5.4 Decommissioning Plan

A decommissioning plan (DP) should also be proposed to address the following circumstances, as relevant:

1. *Removal of any temporary or defined-lifetime development (or of any structures, infrastructure or land use required temporarily in connection with it) upon the expiry of their permitted duration; and*
2. *Removal of the development (or of any secondary developments, infrastructure or land use ancillary to it) in the event of redundancy, cessation of operations, serious*

default from critical mitigation measures, or other overriding situations that may emerge in future.

The DP should also include, as relevant, a phasing-out plan, proposals for site remediation or decontamination, and methodological guidance on site reinstatement or appropriate after-use.

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. marine environment in terms of the benthos, 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)(including monitoring of the marine environment in terms of the benthos, water quality and other sensitive receptors); 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 4*** *- attached to Method Statement as Appendix 2.*

3.0 Methodology

3.1 Area of Influence

The Area of Influence (AoI) will be described in two parts:

1. Offshore section – the subsea connection between Sicily and Malta; and
2. Onshore section – the Delimara Peninsula of which the onshore tunnel route and terminal station will be located

3.1.1 Offshore section

The Malta Plateau extends southwards from the Hyblaen Plateau in mainland Sicily and has been subjected to continuous subsidence during the Late Miocene-Early Pliocene but has been stable since the Middle Pliocene (Osler & Algan, 1999). At the end of the Last Glacial Maximum, the Malta Plateau was flooded by sea level rise which remains submerged today (Micallef, *et al*, 2013). As such, it can be assumed that any potential archaeological remains will exist on the seabed or buried beneath the seabed surface.

The proposed route of the pipeline crosses the Sicily Channel and the Malta Plateau and will measure 159km between Delimara (Malta) and Gela (Sicily). Approximately 151km of this length is subsea, with the underwater pipeline to be buried in waters shallower than 30m for protection purposes (not applicable in Malta, since the entry point is at 42m), whereas in deeper waters, the pipeline will rest upon the seabed. Between Malta and Sicily, the plateau consists of almost constant depths of around 100-200m (Osler & Algan, 1999).

While the proposed development extends from Malta to Sicily, the EIA will only focus on the area from Delimara to the Malta-Sicily median line, which is located at about KP 92.55. For the offshore section, the buffer zone on either side of the route varies in width from 1km for the first nautical mile to 600m up to the median line (Figure 7). Although the proposed pipeline corridor extends from Malta to Sicily, the marine archaeology and cultural heritage survey will only focus on the area from Delimara to the Malta-Sicily median line. The area between the median line and Sicily is the subject of a separate EIA being prepared under the Italian EIA Regulations and will be available for public consultation in Malta.

3.1.2 Onshore section

Located in the Southeast of Malta, the Delimara Peninsula forms part of the larger Marsaxlokk bay area and is largely formed of Upper Globigerina Limestone (Foresi, *et al*, 2011). The proposed pipeline will connect with Malta on the eastern side of the Delimara Peninsula and will then transect it to connect to the Delimara Power Station. A buffer zone of 100m either side of the 700m onshore route was considered in order to provide a context for the discussion and interpretation of the known and potential resource within the Scheme (Figure 8).

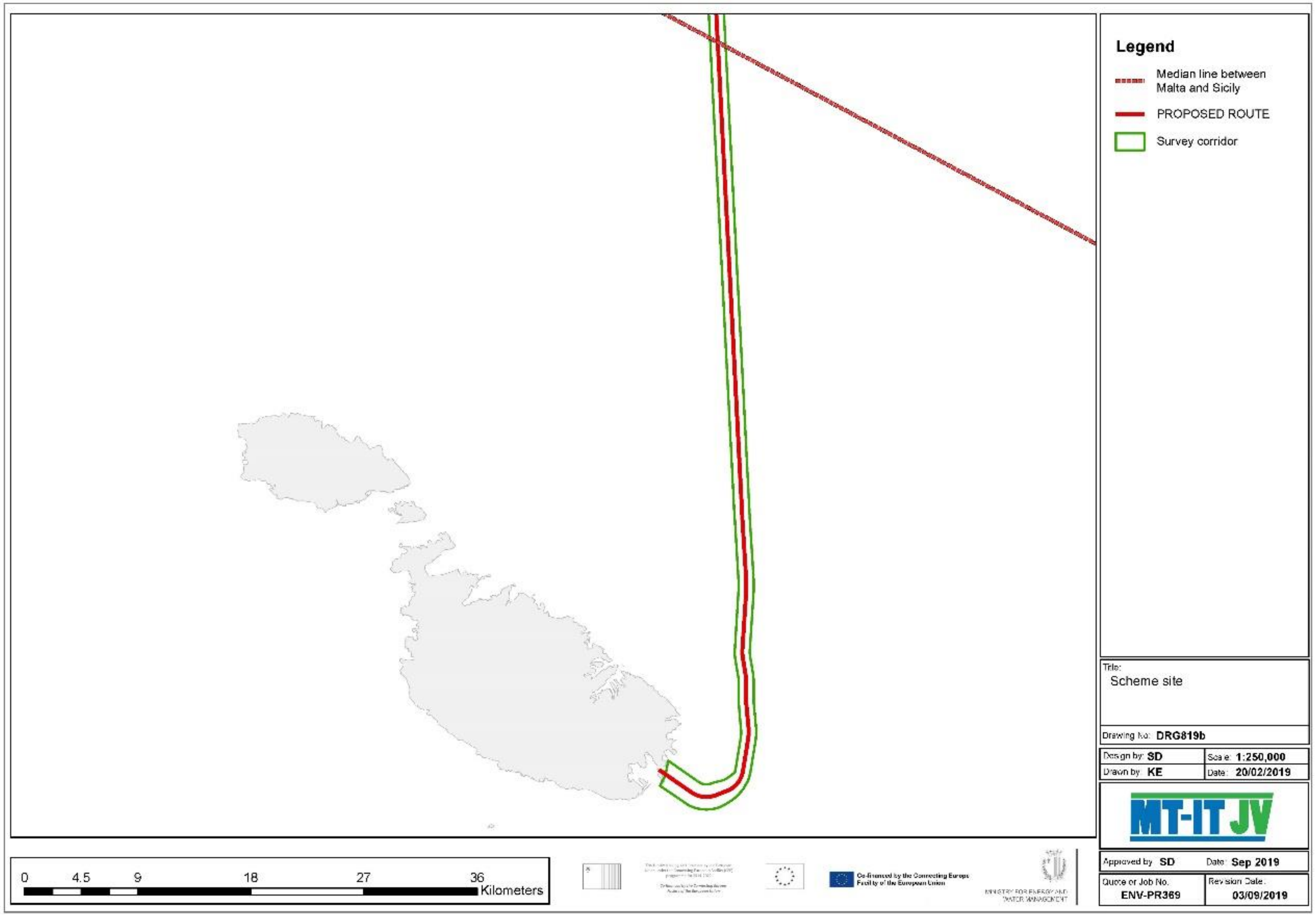

Figure 7: Offshore corridor for the gas to the Malta-Sicily median line

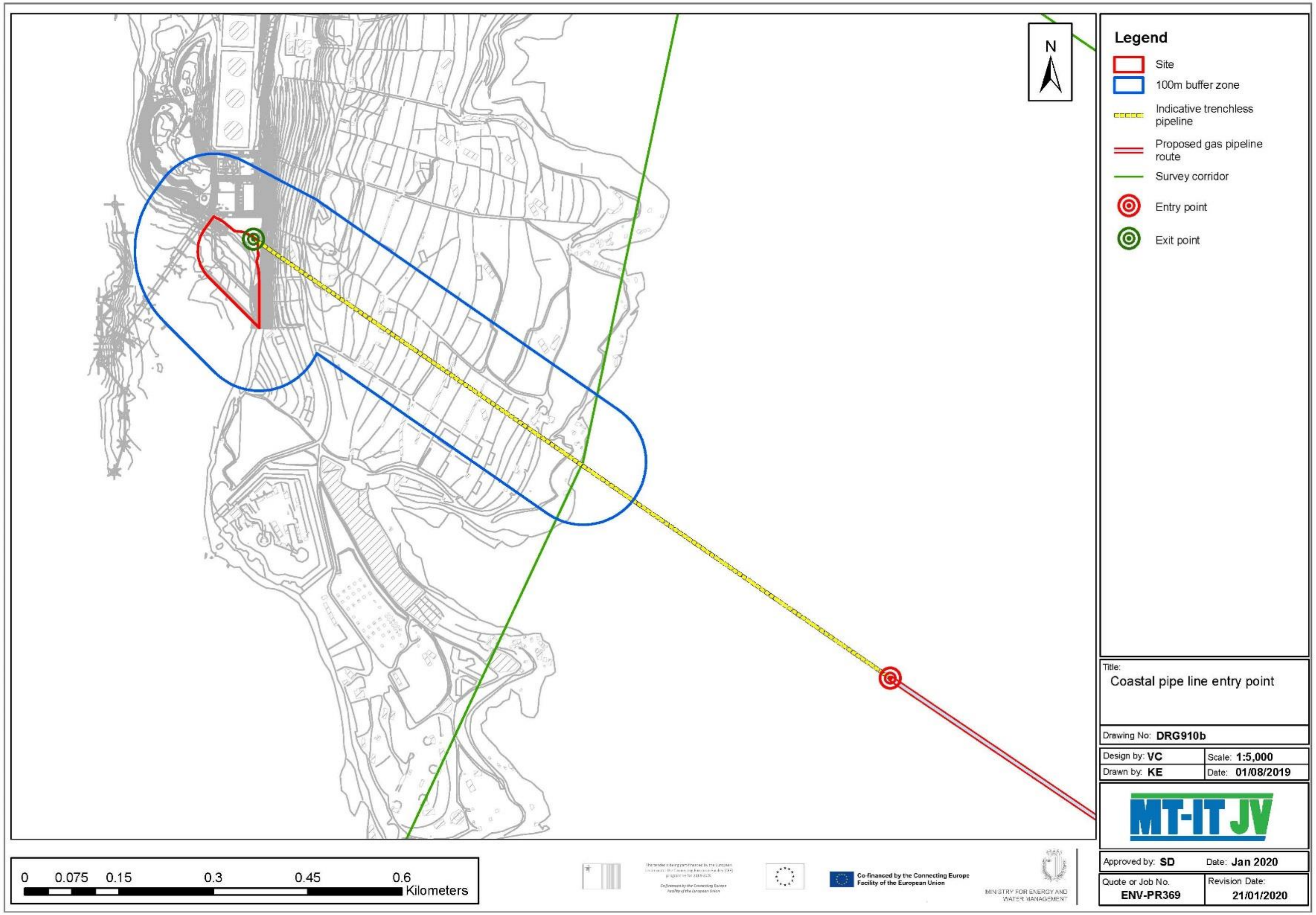

Figure 8: Onshore study area including entry and exit points

3.2 Literature review

A number of publicly accessible sources of primary and synthesised information were consulted, including:

- National heritage datasets including the National Inventory for Malta and Scheduling (HS) constraints available on the Planning Authority (PA) Geoportal;
- Relevant mapping including survey maps and Local Plans; and
- Relevant documentary sources, including Museum Annual Reports (MAR) and grey literature.

A bibliography of documentary, archive, and cartographic sources consulted is included in the References section of this report.

3.3 Offshore section

3.3.1 Side Scan Sonar

Side Scan Sonar (SSS) is an essential tool in the investigation of possible Underwater Cultural Heritage (UCH) on the seabed. The data provided by this technology allows the differentiation between natural phenomena, such as rocks (Figure 10), and archaeological objects and features. The imagery can also be used to distinguish between aircraft (Figure 11), or shipwrecks (Figure 12).

Sonar is a technology which typically employs the reflection of sound waves to detect and locate underwater features. Specifically, SSS is used to record and map the seafloor topography. Consequently, the uses for SSS include numerous different areas of study including geological, biological and archaeological among other disciplines. When towed by a vessel, the SSS can document the seabed for many hundreds of metres either side of the vessel (Figure 9). Moreover, the SSS can also be used to take very highly detailed images of a feature of interest on the seabed well below the surveying vessel. As such, SSS can be used in a blind survey, such as investigating large areas of the seabed for the potential of UCH, as well as following up on already known targets in a much greater concentrated area and level.

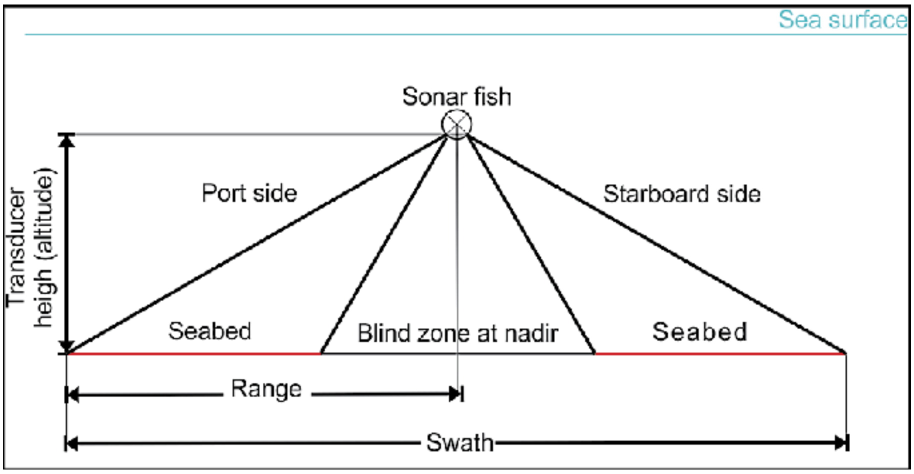

Figure 9: Transverse view of a towed side-scan sonar fish system (Source: Lazar et al, 2013)

SSS emits a fan-shaped acoustic ping (referred to as a pulse) perpendicular from its direction of travel. As the ping travels away from the fish, it hits the seabed and any other obstructions or objects resting upon it. Some of this sound energy is then reflected back in the direction of the sonar fish (known as backscatter). The time of the returning pulse is recorded, as well as its amplitude (the strength of the signal) as a time series and sent to the computer system for interpretation and display. The computer then stitches the data from successive pulses together which results in a long continuous image of the seafloor, following the towpath of the original towed sonar fish. At this point the data is then interpreted by an individual with expertise in interpreting the data, with targets of interest recorded for the investigation of potential cultural heritage, ecological features etc.

3.3.2 Interpretation of Side Scan Sonar Imagery

Since SSS images are based on sound energy, only the echoes of objects that reflect sound back are recorded. Consequently, hard shiny surfaces may only be seen when perpendicular to the sonar fish, and rough seabed textures may camouflage targets completely. Boulders, coarse gravel, recently extruded volcanic rock and metals are examples of materials that are particularly efficient at reflecting acoustic pulses (known as a high backscatter). Conversely, fine-grain sediments, including clay and silt, do not reflect the acoustic pulses well (known as a low backscatter). The strong reflector materials create strong echoes, whereas weak reflectors result in weaker echoes. Consequently, the strength of the backscatter from the SSS allows for the interpretation of the seafloor composition and any objects that may be resting upon it.

Figure 10: An example of a mound of rocks on the seabed (Source: Lazar, et al, 2013)

The recognition of often subtle differences in the sonar data develops with experience. Anthropogenic objects and structures, such as modern shipwrecks and platforms, tend to have regular patterns that are easier to identify. Meanwhile, pronounced ripples and undulations in the seabed sediment may also be easily identifiable. Notably, the length of the acoustic shadow is related to the height of the object above the seabed, its range and the height of the SSS. Due to the potential for the sonar to be obscured when close to a large object or a depression in the seabed, the viewing range may be significantly reduced.

With the implementation of SSS, one is able to communicate the seabed topography and features to individuals who may not necessarily be trained in the interpretation of sonar data. Moreover, the precision of the mapping of objects ensures that the accuracy of the system is very reliable. This therefore allows an individual to return at a later date to an object detected using sonar, either for recovery or for a higher frequency sonar investigation.

Figure 11: Metals reflecting acoustic pings from a plane wreckage (Source: McGowen & Morris, 2013)

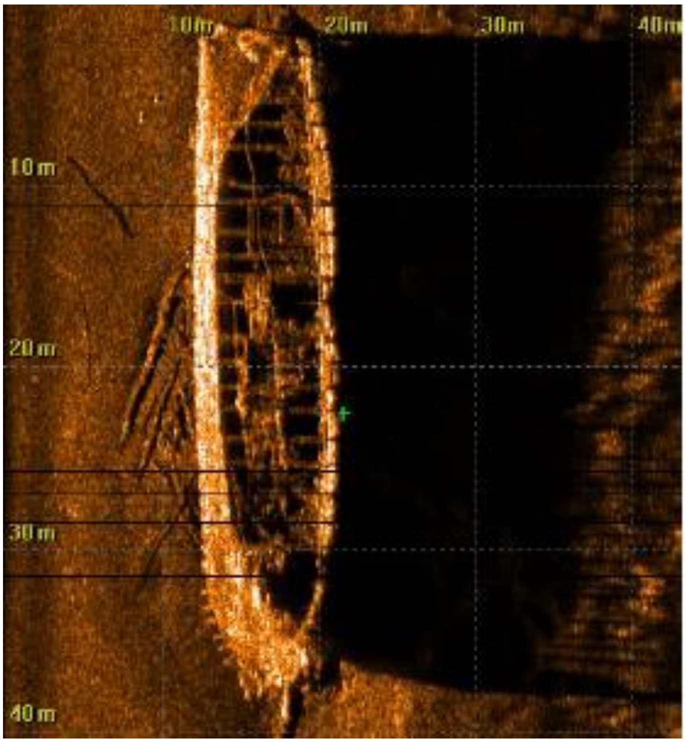

Figure 12: Tall shipwreck with a large echo shadow (Source Subzone OÜ, 2012)

3.3.3 Surveying Methodology

Underwater surveying was undertaken by Lighthouse S.p.A between 8th December 2018 and 2nd February 2019 for the offshore corridor and surveying of the Malta nearshore area took place between 26th April and 16th May 2019.

As outlined in the PRELIMINARY MARINE ROUTE SURVEY report, the seabed surveys covered a large geographical area and were therefore broken up into several stages:

» the Malta nearshore area (KP150.836-KP148.971);
» the Italy-Malta offshore area (KP9.705-KP148.971); and
» the Italy inshore area (KP0.097-KP9.705).

While this report only concerns the seabed surveying from Malta up to the Malta-Italy median line it should be noted that several vessels were employed for different sections of the AoI. Different surveying methods were also employed depending on the surveying area and the vessels involved. As such, each stage of the surveying will be discussed. Pipeline corridor surveys were conducted from the RV Odin Finder, a 46.5m long Class DNV 1AI oceanographic research vessel. The vessel has a draft of 6m and is equipped with a full range of hull and pole mounted, and towed survey sensors. The nearshore survey in Malta was carried out by the vessels MV Wilfred and RV Odin Finder.

Malta Nearshore Survey

The nearshore survey, as outlined in the GEOPHYSICAL AND GEOTECHNICAL PROJECT EXECUTION report, was carried out over a survey area of 2km by 1.8km (Figure 13). For the surveys, MV Wilfred was fitted with an Innomar-SES2000 Compact SBP, a MBES R2SONIC 2022, a Klein 3900 SSS system and a G882 marine magnetometer.

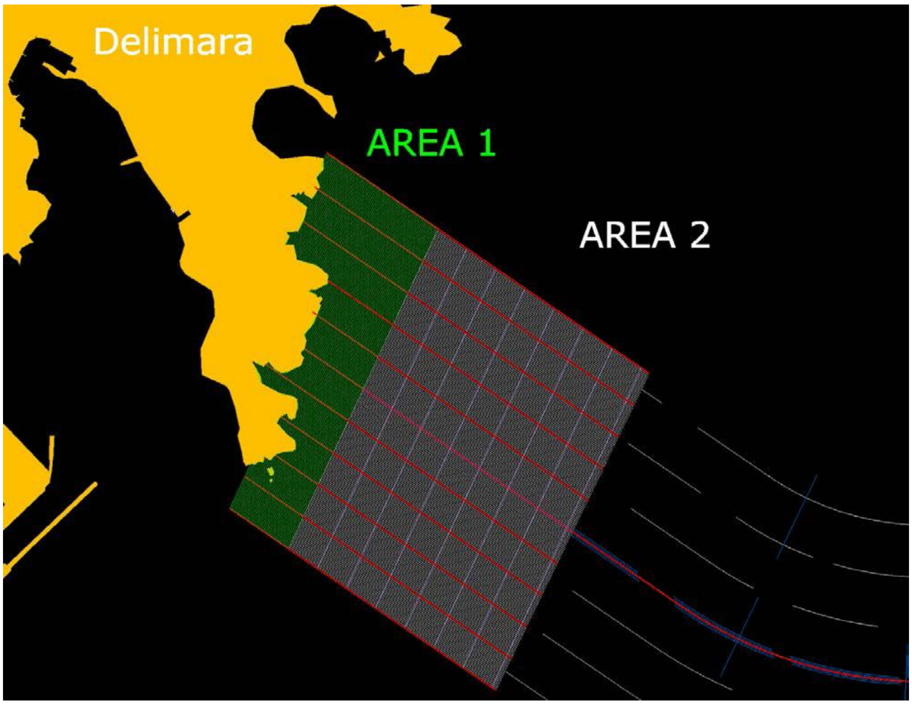

Figure 13: Nearshore survey area

A summary of the survey lines can be seen below:

» Area 2 (A2): 149 lines running parallel to the coastline with a spacing of 10m
» Area 1 (A1): 156 lines with different orientation with a spacing of 10m
» Both areas: a central line (running on the proposed pipeline route) plus 2 lines running to the left and 2 to the right from the central one with a spacing of 10m and 3 lines running the left and to right from central one with a spacing of 300m.

Malta-Sicily Offshore Survey

9 longitudinal lines were surveyed, with the central line running along the proposed pipeline route, 2 on either side with a spacing of 10m, and an additional 2 on either side with a spacing of 300m. Additional infill lines were surveyed if required. Cross lines were observed at 1,000m intervals to optimise data collection. Longitudinal line length was circa 147km. The vessel surveying speed was maintained at a steady state between 3.5-4 knots. In deep water operations, Odin Finder was fitted with a hull mounted ELAC Seabeam 3030 system whereas for shallow water operations it was fitted with an R2Sonic 2022 Multibeam Echo Sounder (MBES) system mounted on an over side pole. MBES was carried out on all longitudinal lines and crosslines, with infilling also taking place to provide 15% overlap between swathes. For the surveys, RV Odin Finder was fitted with Benthos Chirp III (SBP), R2SONIC 2024 and Elac Seabeam 3030 (MBES), Klein 3000 system (SSS) and a G882 marine magnetometer.

A summary of the survey lines can be seen below:

- A central line (running on the proposed pipeline route) plus 2 lines running to the left and 2 to the right from the central one with a spacing of 10m
- 4 lines running parallel to the central one with a spacing of 300m
- 140 lines running perpendicular with respect to the central one with a spacing of 1000m

3.4 Study method: Onshore section

3.4.1 Field-walkover survey

The Scheme area was surveyed on the 16th and 26th July 2019. However, there were several areas within the scheme that were inaccessible. The aim of the field walking exercise was to systematically identify and record any cultural/historical features visible in the landscape and identify potential for unknown cultural heritage assets.

A photographic record using an Olympus digital SLR/Zoom lens camera was made for each area visited and any identified cultural heritage assets (Figure 14).

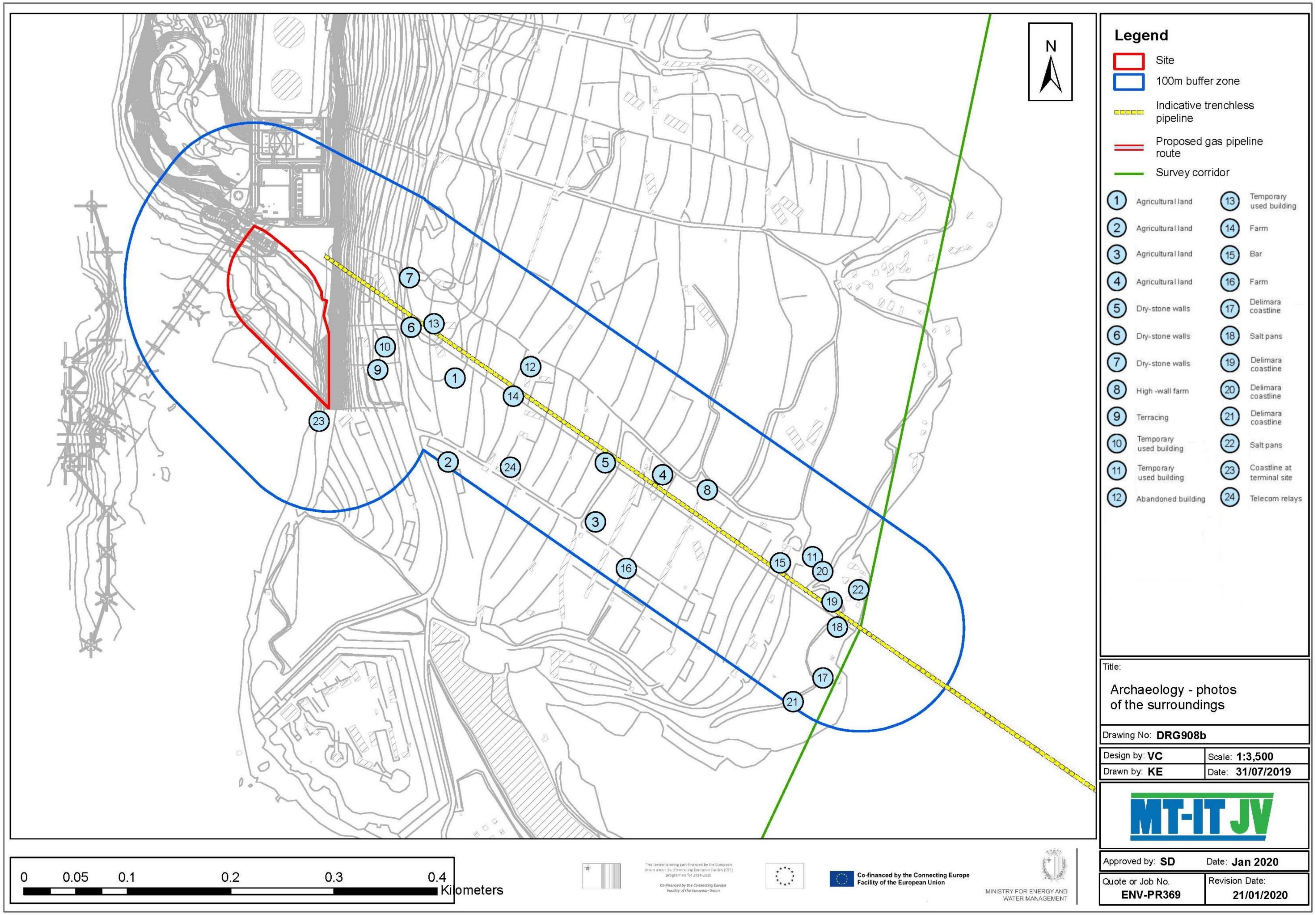

Figure 14: Location of photographic survey features

4.0 Legislation and Statutory Protection

The following section provides a summary of the national, regional and local planning, and legislative framework governing the protection and treatment of cultural heritage within the planning process.

The archaeological curator responsible for archaeological resources up to the 12 nautical mile limit, is the Superintendence of Cultural Heritage. This unit is responsible for managing and ensuring that the protection and accessibility of cultural heritage as defined in the Cultural Heritage Act 2001, is carried out.

4.1 Development Planning Act 2016

This Act aims at implementing a comprehensive planning system by means of a Spatial Strategy which regulates ''the sustainable management of land and sea resources covering the whole territory of the Maltese Islands'' (44.1). As per Directive 2014/52/EU (which supersedes Directive 2011/92/EU), Environment Impact Assessments are required to provide high level protection to the environment and human health and ensure that projects which are likely to have significant effects on the environment are adequately assessed before any development consent is granted.

Relevant to this assessment is the Subsidiary Legislation 552.01 of the Development Planning Act 2016 dealing with Rubble Walls and Rural Structures (Conservation and Maintenance). Rubble walls and non-habitable rural structures are protected, "in view of their historical and architectural importance, their exceptional beauty, their affording a habitat for flora and fauna, and their vital importance in the conservation of the soil and of water" (2).

4.2 Structure Plan for the Maltese Islands 1990

The Structure Plan for the Maltese Islands was drafted in 1992, with the aim to control development and channel it into existing and committed urban areas and improve the quality of all aspects of the environment of both urban and rural areas. Heritage falls under Chapter 13. Tourism and Recreation. However, it is largely dealt with in Chapter 15. Conservation. This section clearly sets out criteria to determine areas/assets of cultural significance, including Urban Conservation Areas; Listed Buildings; Rural Conservation Areas; Areas and Sites of Archaeological Importance; and Marine Conservation Areas.

4.3 Legislation relating to cultural heritage

The management and protection of cultural heritage is legally covered by the Cultural Heritage Act 2002.

Cultural heritage is defined as ''movable or immovable objects of artistic, architectural, historical, archaeological, ethnographic, palaeontological and geological importance and includes information or data relative to cultural heritage pertaining to Malta or to any other country. This includes archaeological, palaeontological or geological sites and deposits, landscapes, groups of buildings, as well as scientific collections, collections of art objects, manuscripts, books, published material, archives, audio-visual material and reproductions of any of the preceding, or collections of historical value, as well as intangible cultural assets comprising arts, traditions, customs and skills employed in the performing arts, in applied arts and in crafts and other intangible assets which have a historical, artistic or ethnographic value (Part 1.2)

Part 3 of the Act states that "an object shall not be deemed to form part of the cultural heritage unless it has existed in Malta, including the territorial waters thereof, or in any other country, for fifty years, or unless it is an object of cultural, artistic, historical, ethnographic, scientific or industrial value, even if contemporary, that is worth preserving".

4.4 International Conventions

The European Convention on the Protection of the Archaeological Heritage (Revised) Valletta 1992 (Valletta Convention 1992), focusses on the conservation and enhancement of the archaeological heritage within urban and regional planning policies. The Articles of the Valletta Convention tackle various aspects:

- Article 1 deals with the inventorying and protection of sites and areas;
- Article 2 deals with the mandatory reporting of chance finds and providing for 'archaeological reserves' on land or underwater;
- Article 3 promotes high standards for all archaeological work undertaken by suitably qualified people;
- Article 4 requires the conservation of excavated sites and the safe keeping of finds; and,
- Article 5 is concerned with consultation that should take place between planning authorities and developers to avoid damage to archaeological remains.

Malta has signed and ratified this convention, along with the following:

- European Cultural Convention 1954; and
- Granada Convention 1985 on the Protection of the Architectural Heritage of Europe.

4.5 Local policy

The Marsaxlokk Bay Local Plan policy map indicates the major part of Delimara Peninsula as a National Park for conservation, protection and improvement of natural heritage (Figure 15). Only recreational uses consistent with such objective may be considered. In addition, the policy map identifies the eastern coastal fringe and the promontory as an Area of Ecological Importance and the rest of the Park as a Rural Conservation Area. Furthermore, the MBLP shows no features of archaeological importance in or around the area of the "scheme".

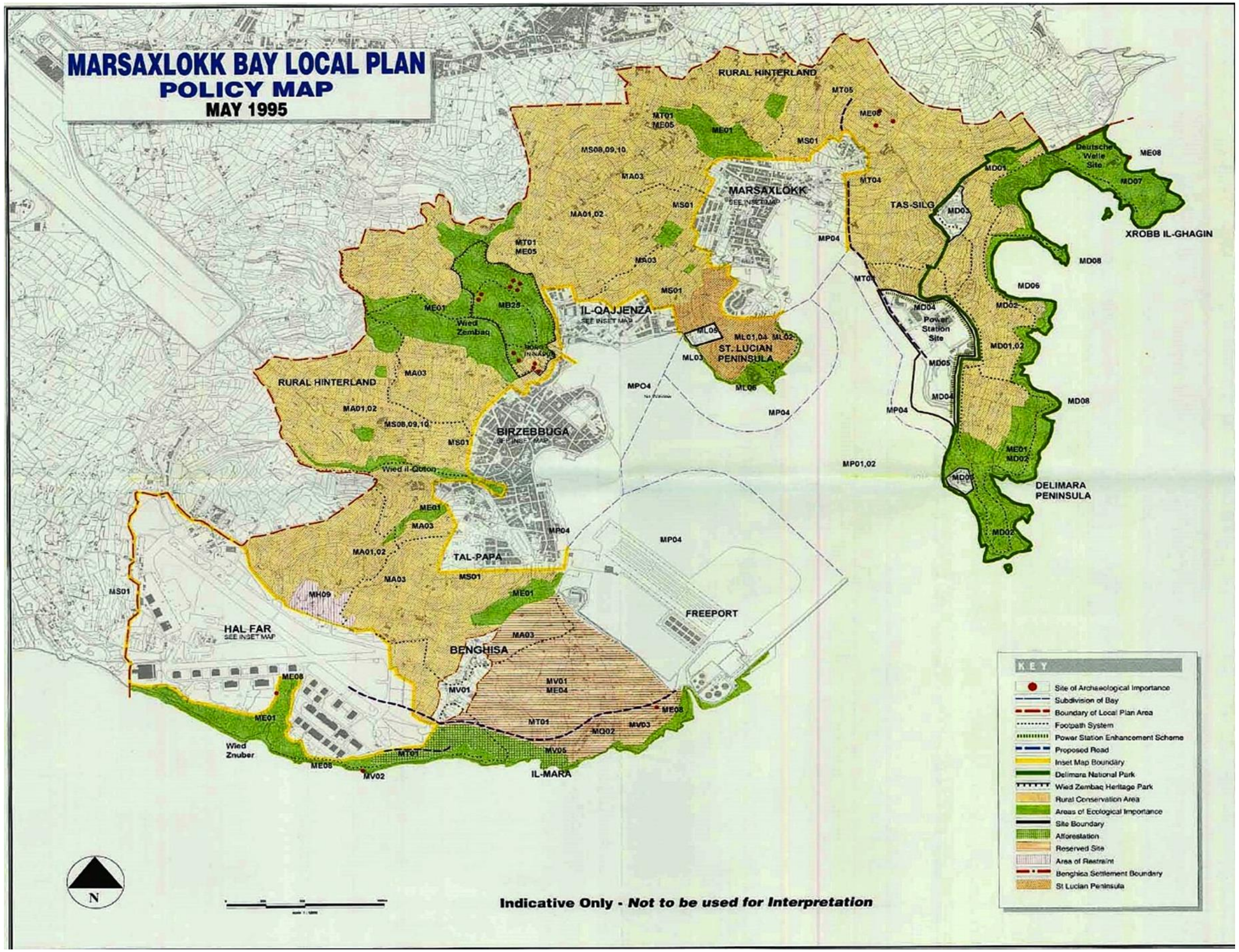

Figure 15: Marsaxlokk Bay Local Plan policy map 1995 (Source; P.A Malta, Local plans)

5.0 Baseline Survey

5.1 Desktop study

The accessibility of an archaeological site lends itself to the developed recording methods, and subsequently, the development of the field. As such, research into underwater archaeological sites is a much more recent phenomenon, largely stemming from developments in diving equipment. Before the establishment of underwater archaeology as a discipline in Malta, archaeological artefacts were typically recovered from the seabed by fishermen, amateur sports divers and other individuals not affiliated with a scientific or archaeological institute (Azzopardi & Gambin, 2012). More recently however, the development of international and national legislation related to underwater archaeology and archaeological impact assessments has led to an increase in controlled surveying, excavation and desk-based studies of these underwater sites.

The following section of the report will summarise the history of both the Delimara Peninsula and the Malta-Sicily Channel. The main reported archaeological finds were examined with numerous sources of information consulted, such as:

- Documentary;
- Cartographic;
- Reports of any previously discovered archaeological material; and
- Existing literature related to the cultural heritage and history of the study area.

Data used to compile this report consists of secondary information derived from a variety of sources, only some of which have been directly examined for the purposes of this Study. The assumption is made that this data, as well as that derived from other secondary sources, is reasonably accurate.

The records held by the PA on the geoportal are not a record of all surviving heritage assets, but a record of the discovery of a wide range of archaeological and historical components of the historic environment. The information held within it is not complete and does not preclude the subsequent discovery of further elements of the historic environment that are, at present, unknown.

5.1.1 Prehistory

Due to the passage of time and the intensification of land uses in the area, it can be particularly difficult to reconstruct the coastal landscape in prehistoric times. Gambin (2005) demonstrates that the prehistoric landscape of Malta may well have been drastically different than that of today and the environment has experienced numerous and significant changes over the millennia (Mariner *et al*, 2012). Indeed, archaeological indicators in Malta, including cart ruts and *Garum* production sites, indicate that modern sea levels are higher than those of prehistoric periods (Furlani *et al,* 2013). The prehistoric landscape of the Delimara Peninsula may well be significantly different than that of the contemporary landscape.

Sea level change has also factored into the alteration of the prehistoric landscape of the Malta-Sicily Channel. During the Last Glacial Maximum (LGM), Malta was connected to Italy via a land-bridge, however following sea level rise, Malta was subsequently cut off from the European mainland around 14500 years BP (Figure 16; Alexander, 1988; Furlani, *et al,* 2013). Prehistoric shipwreck assemblages of obsidian off of the coast of Pantelleria demonstrate the effect sea level change has had within the larger Sicily Channel (Abelli, *et al*., 2014). This is further demonstrated by the discovery of a submerged monolith within the Sicily Channel dated to the Mesolithic Period (Lodolo & Ben-Avraham, 2015).

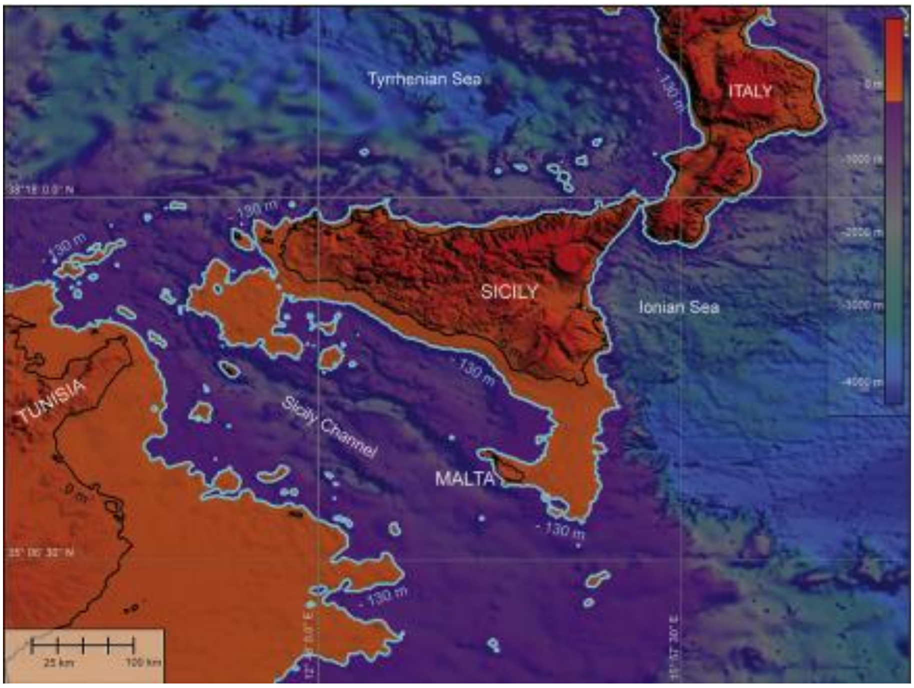

Figure 16: Land bridge between Sicily and Malta (Source: Furlani, et al, 2013)

Prehistoric remains have also been found on the Delimara peninsula, with a cluster of megalithic temples having been discovered within the area, including Ħal-Ġinwi, Xrobb L-Għaġin and Borġ in-Nadur (Pace, 2004, p.98-107). The archaeological site of Tas-Silġ, which is typically associated with Phoenician, Punic and Roman interactions, was originally built upon the remains and foundations of a late Neolithic temple. Demonstrably, the large concentration of Neolithic temple sites within the area is demonstrative of significant human activity in Malta during prehistoric times.

5.1.2 Antiquity

Surviving historical documents demonstrate the use of Malta's natural harbours in antiquity, when during the mid-first century BC, Diodorus Siculus described their use. Linking the use of the harbours and the Phoenicians, he states that Malta "*possesses many harbours which offer exceptional advantages*" (Gambin, 2015, p.7). He continues to draw a comparison between the prosperity of the islands' inhabitants and the fact that Malta is "*well supplied with harbours*". The physical evidence of the Phoenicians' use of Malta is reflected in archaeological sites including at Tas-Silġ where potsherds were discovered to be dedicated to the Goddess Astarte in Phoenician times (Gouder, 1991). Recent studies of ceramics recovered from Tas-Silġ indicated that the sanctuary was likely to have been used as a centre of exchange for both imported and local goods and materials (Bruno, 2009, p.135). Given the positioning of the sanctuary dominating the harbour below, and its intensive use by several cultures, it can therefore be assumed that this is reflective of an intensive maritime traffic in the harbour below, insofar as the sanctuary would have been an excellent wayfinding point for sailors.

The remains of a superior Roman edifice, possibly belonging to a seaside villa complete with a bath system, have been found in the Marsaxlokk area (MAR 1931-2). Other Roman material in the area include the remains of an oil producing site situated just behind Birżebbuga (Bonanno, 2005). Lead stocks from the anchors of ancient vessels have been found off of Delimara but cannot be cross dated with other finds (Azzopardi, Gambin & Zerafa, 2009). Consequently, it is unknown what archaeological context these anchor stocks originate from. This variety of material, combined with Punic ruins on the Delimara Peninsula (Sagona, 2015), demonstrates a high level of human activity in the area across antiquity.

The Malta-Sicily Channel would have also underpinned much of this human activity across the Delimara peninsula by representing an ideal shipping route for vessels departing from mainland Europe and Sicily. This greatly valued shipping route is also reflected in the material found in shipwreck assemblages within the Sicily Channel. Examples include the Byzantine-era Marzamemi 'church wreck', which was carrying architectural elements for assembly somewhere in North Africa and sank off the south-eastern coastline of Sicily (Leidwanger & Greene, 2016). Additionally, a sixth-century BC shipwreck off Gela, was found to be carrying 40 orichalcum ingots, a valuable type of brass, which would have been a great loss at the time of the ship's sinking (Caponetti, *et al*, 2017). As such, the presence of these shipwrecks carrying valuable types of materials throughout the Sicily Channel, stands testament to this invaluable ancient trade network.

5.1.3 Middle Ages

During the Middle Ages, Sicily, and by extension the channel, plays an important role in the facilitation of the invasion of Malta. This includes Muslim invaders, originating from North Africa, in the ninth century and Norman invaders led by Roger I in 1091 (Atauz, 2004). While the Sicily Channel clearly represented the possibility and means of conquest during the Middle Ages, it also provided a means for transport of goods and services. This exchange and interaction of cultures is manifested in shipwrecks from this period within the Sicily Channel, especially that of the *Contrada Bambina* located off the south of Marsala. This twelfth Century shipwreck contains within its contents a bronze pail with an inscription in early Arabic from the Qur'an (Bramoullé, *et al*, 2017; Ashmolean Museum of Art and Archaeology, 2016). As such, the Sicily Channel experienced turbid environments, supporting opportunity through territorial expansion or through monetary gain with other cultures.

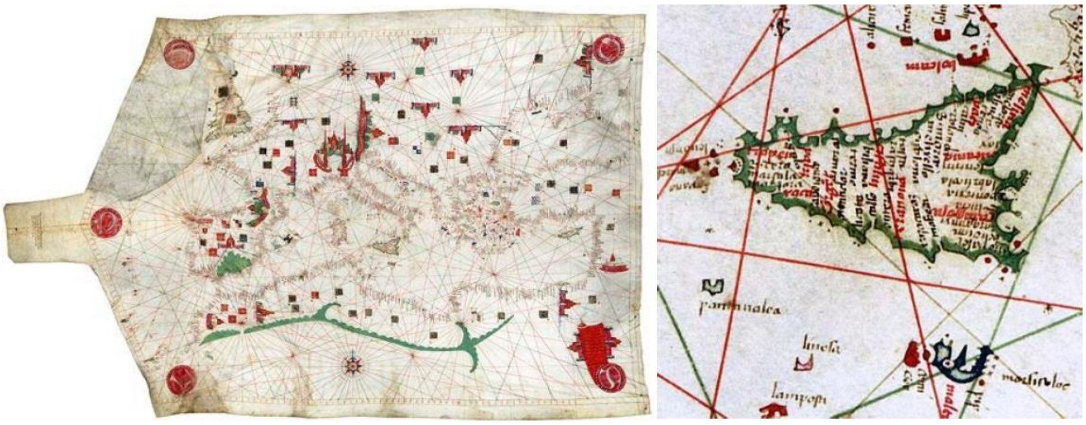

Figure 17: Portolan depicts Malta and Sicily drawn on vellum (Source: Gambin, 2008)

The use of Marsaxlokk as a harbour by Medieval seamen can be seen in contemporary portolani, which served as a descriptive Atlas that aided sailors in their navigation of Mediterranean ports and harbours. Some portolani dating back to the 13th Century mention variants of the name Marsaxlokk, including Marsa silocco, marza per sirocho and marza sinocho (Cassola, 1992). The '*Rizo*' portolan of 1490 provides sailing distances from Marsaxlokk to a variety of other ports throughout the Mediterranean, such as Tunis and Tripoli. Moreover, the oldest portolan in the collection of the Greenwich Maritime Museum, dated to 1456, depicts Malta and Sicily at the centre of the map, thereby highlighting the importance of Malta as a maritime hub and its connectivity throughout the Medieval Mediterranean (Figure 17; Gambin, 2008).

Traces of the Middle Ages can still be found on the Delimara Peninsula, particularly at Tas-Silġ, where large amounts of ceramic finds from the period have suggested the presence of a settlement near to the site due to the domestic nature of the sherds. Following on from this, towards the end of the Medieval period the temple was abandoned and quarrying and farming were largely adopted as the site's main use (Cardona, 2013).

5.1.4 Early Modern

During the Early Modern period, numerous attacks were made on Malta by North African corsairs, rendering the coastline largely bereft of settlements. While this may have been a factor in the populations of towns across the islands, this may not have resulted in the disuse of the Marsaxlokk harbour. Indeed, one of the most significant features of architecture on the Delimara peninsula during the period of the Knights is the Delimara Tower, constructed in the two year period of 1658-9, which was built alongside numerous other coastal defence towers at the time, including those of St Julian's, Għallis and other locales (Stephenson, 2004, p.18). This is likely to have been influenced by the Ottoman Fleet anchoring at Marsaxlokk during the Great Siege of 1565, before the capture of St Elmo and moving the fleet to the Marsamxett Harbour.

Coastal fortifications in the area around Marsaxlokk Bay were a priority for the Knights of St John. The first set of large defence towers on Malta commissioned by the Knights included St Lucian Tower, constructed in 1610, on the opposite side of Marsaxlokk Bay to Delimara (Spiteri 2008: 344). Later coastal watch posts were constructed to support the defence towers, including at Xrobb L-Għaġin and Tumbrell on the Delimara Peninsula (Abela 1647:

660), both located outside of the AoI for the cultural heritage study. In 1658, Grand Master de Redin commissioned thirteen smaller defence towers, two of which were built at the extreme end of the Delimara Peninsula (Delimara Tower) and at Xrobb L-Għaġin in 1659 (Spiteri 1994: 499), also both located outside of the AoI. The fortifications were further strengthened throughout the 18th Century, with a number of batteries being constructed on the Peninsula - the Wilġa Battery and the Tumbrell Battery, again both outside of the AoI. A small mortar battery was erected in the vicinity of the Delimara Tower in 1793 (Spiteri 1994: 499).

Following on from these events, during the invasion of Malta by the French and the subsequent blockade of 1798-1800, the larger Marsaxlokk area played an important role for Maltese revolutionaries alongside St Paul's Bay. Ships of allied nations, including Neapolitan, Portuguese, and British, passed through and operated from Marsaxlokk harbour. Once the British took control of the islands, further fortification of the Marsaxlokk area took place, with Fort San Luċjan upgraded with casements and disappearing guns, while work commenced on Fort Delimara in 1876 and other batteries (Castillo, 2005, p. 135).

5.1.5 Modern

In the early 19th Century, Marsaxlokk Bay was still considered to be a strategic port and the British, on their arrival, retained most of the then existing Knights' defences. In 1872, several new forts/batteries were planned for all along the south-eastern coast of Malta. These included three on the Delimara Peninsula – Fort Delimara (Plate 1.1,1.2), located approximately 70m outside the AoI to the south-west of the Scheme Site, as well as Fort Tas-Silġ and Wolseley Battery, located to the north of the AoI.

While structures from previous cultures in the AoI such as the Delimara Tower have since been demolished, Fort Delimara still stands today with four of its original Victorian guns. The largest development in the area during the modern period is largely due to bellicose policies. At the beginning of the 20th century, the British developed the Kalafrana area into a base for seaplanes, which ultimately exposed the base, and its immediate area, to bombing raids during WWII (refer to Figure 18). Notably, of the number of aircraft crashes recorded off Malta, 95 were considered to have crashed within 5 miles of Kalafrana or off Delimara Point or the Kalafrana area (p.56, Burgess & Gambin, 2010). War diaries of personnel based at Kalafrana describe the intense bombing of the site by Italian and, later, German forces due to the area's significant tactical value (Malta War Diary, 2016).

Figure 18: Aerial view of the Kalafrana base (Source: Malta War Diary, 2015)

5.1.6 Disturbance Factors

Before examining the discoveries within the study area, it is of importance to consider the various site formation processes and potential disturbance factors that may affect any archaeological deposits present within the area, both underwater and onshore, as outlined hereunder.

Unexploded Ordnance (UXO)

Given Malta's heavy bombing during World War II and the flight path of Italian bombers over the Malta-Sicily Channel, there is a strong possibility of encountering UXO and munitions within the sediments. Consequently, there is a risk of severe disturbance of multiple sediment levels by exploding bombs, especially if shipwrecks and crashed aircraft are encountered.

Farming Practices

Given that the path of the microtunnelling trenchless route passes below pre-existing farmland and the surface will not be affected in any way, the disturbance/discovery of buried cultural heritage is unlikely.

Anchoring

With Marsaxlokk's storied past as an anchoring point, there is a possibility of disturbance from anchors and/or sounding weights. Dropping and raising heavy anchors would most likely affect approximately the first 2 metres of sediment within the column.

Local Fishing Habits

The fishing technique for *gandoffli* consists of hand fanning of no more than 40cm of sediment resulting in the disturbance of the topmost layer of the sediment column. This type of fishing typically takes place in proximity to quays and the shoreline.

5.1.7 Discoveries

This section summarises any archaeological remains discovered during the course of the desk-based assessment within the Area of Influence. In addition, archaeological finds or sites within the immediate vicinity of the AoI will be discussed so that the AoI will be considered in relation to its surroundings.

Over the past few decades, various archaeological objects have been found and recovered from the seabed in Marsaxlokk Bay. Any objects reported to the relevant authorities would have been published in the Museum Annual Reports (MAR) issued by the former Museums Department. As a result, the variety and origin of these reported objects can suggest the variety of outstanding objects within the sediment column. The objects described herein were discussed in the Environmental Assessment within the same AoI, i.e. the Delimara peninsula (Gambin, 2013).

1. The largest object recovered has been a large bronze cannon which is now stored in a private collection.
2. A partial amphora brought up from the seabed in 1998 of probably a late Roman origin. This object is held within the collection of the St Agatha Museum in Rabat.
3. The base of an unidentified ceramic object also recovered from the seabed in 1998 of probably a medieval Arab piece. Also currently held at the St Agatha Museum in Rabat.
4. Pottery fragments were found during cleaning of the seabed in 1997.
5. Scattered ceramics were said to be found off of the Ghar L-Ahmar coast
6. Numerous ceramic fragments reported in the MAR.

Diver studies of the seabed around the DPS have also largely found it to be sterile of archaeological material apart from loose ceramic fragments and ammunition (p.22, Gambin, 2013). The nature of these loose archaeological objects is to be considered, for example whether these objects are more representative of being deliberately or accidentally discarded, or of shipwreck assemblages. Over time, sedimentation of ports and objects lost overboard form archaeological layers known as 'harbour deposits'. These deposits can record elements of daily life onboard vessels or of short-lived historical events such as battles. It is also worth considering that while these objects have been reported in some manner, there are almost certainly more artefacts that have remained and remain in the hands of private collectors who have fished or dived in the area over the past few decades.

It is also of a considerable note to discuss the potential for UXO discoveries within the proposed pipeline corridor. During the course of the reconnaissance survey, 21 UXO or suspected possible UXO were identified within the survey corridor. Some of these include squid bombs, naval mines and possible depth charges. Consequently, these possible and confirmed UXO will have to be removed prior to the laying of the pipeline. Furthermore, a map recording UXO and ammunition dumping sites in the sea, produced by the United Nations Environment Programme did not show any such sites within the proposed pipeline corridor (UNEP, 2009).

5.2 Field survey: Offshore section

The main results of this survey are the following:

1. An Excel field log with all sonar contacts including location, target dimensions and pictures of contacts
2. A GIS developed as well as a catalogue of the results

The Area of Influence was comprehensively surveyed as indicated within the methodology. Targets were then further investigated with the ROV with imagery of the objects collected. A variety of material was uncovered in the course of this survey ranging from objects of modern anthropogenic origin to those of likely probable cultural heritage. The next section will summarise the relevant identified targets.

Malta-Sicily Offshore Survey

The Side Scan Sonar survey identified a total of 230 targets in the survey corridor of the Italy-Malta offshore area. Of this number, 17 targets have a length greater than 10m. Within the Italy-Malta Offshore area, two wrecks were discovered (T0003 and T0208; Figure 20 and Figure 24 respectively) as well as two probable airplanes (T0189 and T0207; Figure 22 and Figure 23 respectively) and two other unknown objects (T0181 and T0206). A map of these targets can be seen in Figure 19.

Other targets which were noted during the survey included UXO features as listed in Table 1. Specific coordinates and details are outlined in the PRELIMINARY MARINE ROUTE SURVEY report, but have not been included here due to the sensitivity of such data.

Table 1: UXOs noted during the offshore surveys

Target ID	Type	KP	Relationship to route	
			Orientation	Distance (m)
MEW001_V023	Squid bomb	140-150	Right	300-400
MEW001_V027	Squid bomb	140-150	Right	100-200
MEW001_V053	Depth charge	140-150	Left	500-600
MEW001_V054	Depth charge	140-150	Left	500-600
MEW001_V119	Naval mine	140-150	Left	100-200
T0374/M1044	Naval mine	150-160	Right	500-600
T0490/M1085	Naval mine	140-150	Right	200-300
T0463	Naval mine	140-150	Left	0-50m

Malta Nearshore Survey

The Side Scan Sonar survey identified 148 targets in the nearshore area close to Malta. Of this total, a large number are probable anchors with discarded objects, including tyres, represented within the collection. No shipwrecks or aircraft remains were immediately identified by the SSS within the nearshore area, however the ROV later confirmed one target (T0479) as an airplane wing which the SSS had identified as an “unknown ferromagnetic and linear object” (Figure 26). Specific coordinates and details are outlined in the PRELIMINARY MARINE ROUTE SURVEY report, but have not been included here due to the sensitivity of such data.

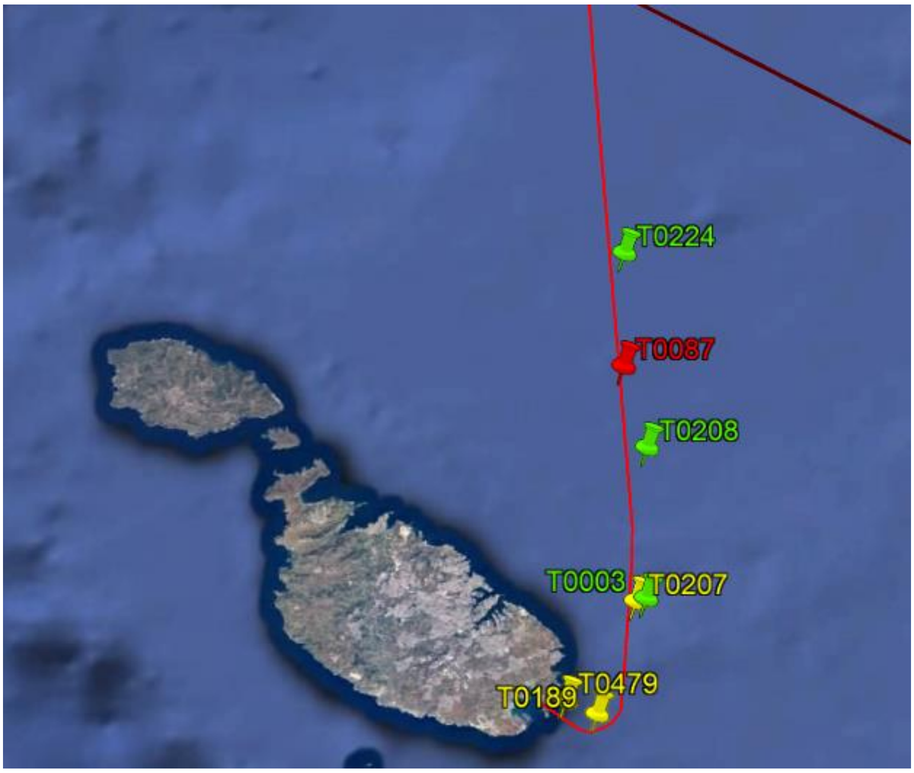

Figure 19: Targets of cultural heritage interest[2]

Below is a list of possible cultural heritage within the AoI:

T0003 – Wreck

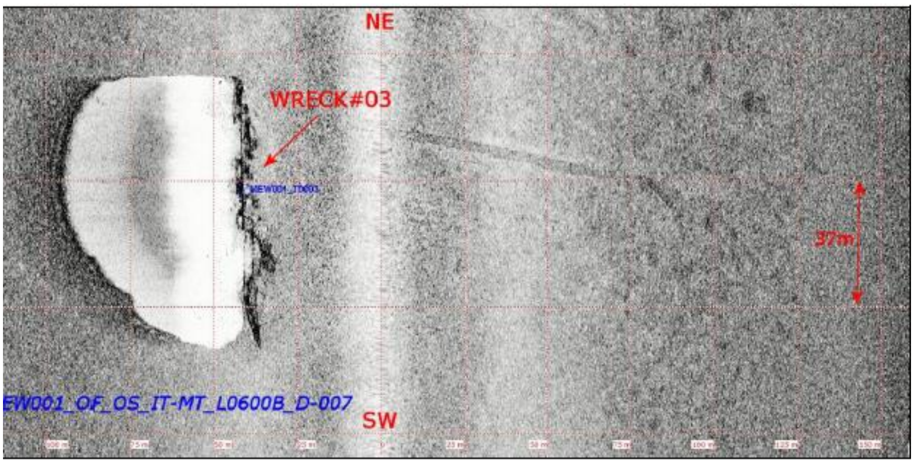

Figure 20: SSS imagery of a wreck of an unknown age, T0003

T0087 – Possible dumping area

[2] *Yellow targets are airplane remains; green targets are shipwrecks; red targets are dumping areas. The Malta-Sicily boundary can be seen in the top of the image.*

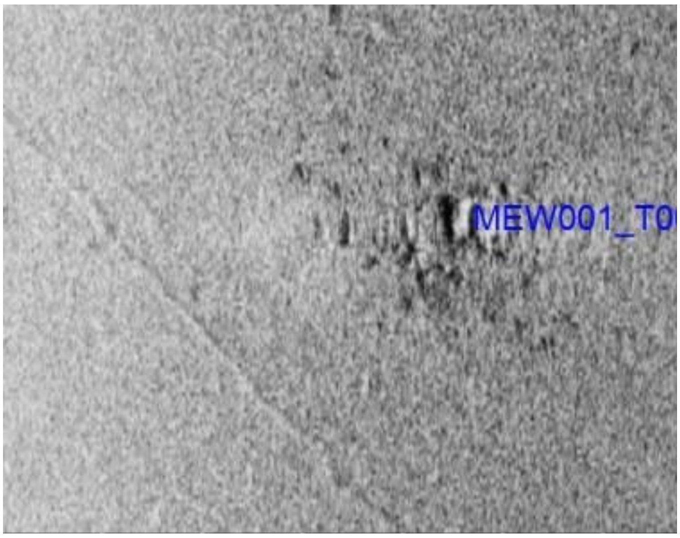

Figure 21: SSS imagery of a potential dumping site, T0087

T0189 – Airplane wreck.

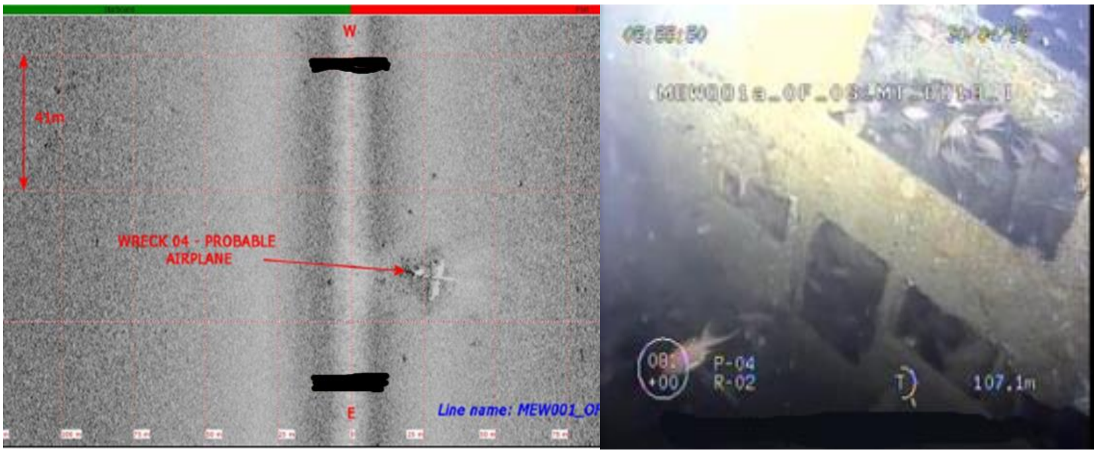

Figure 22: SSS imagery and ROV still of a World War II airplane, T0189.

T0207 – Probable airplane

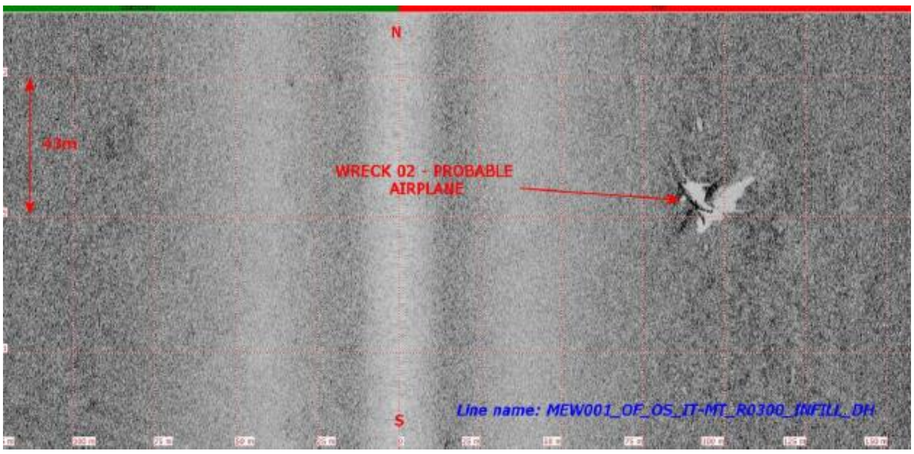

Figure 23: SSS imagery of a World War II airplane, T0207.

T0208 – Wreck

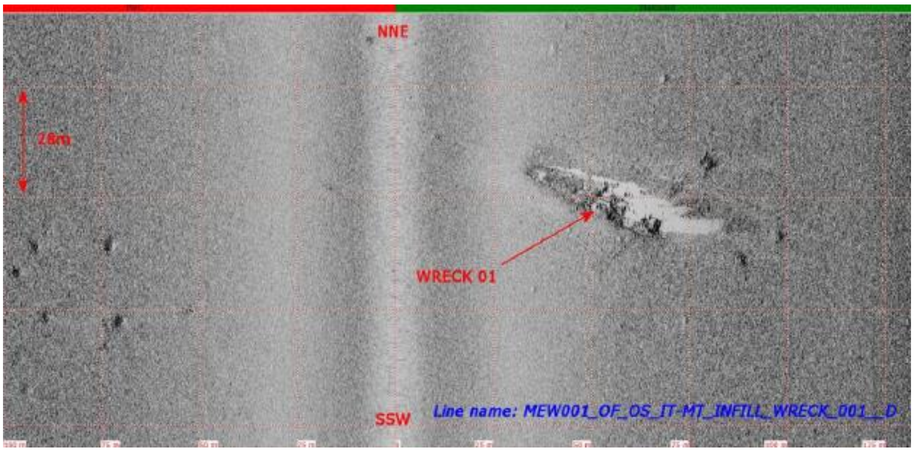

Figure 24: SSS imagery of a wreck of an unknown age, T0208.

T0224 – Unknown object, possible wreck, possibly ferromagnetic

Figure 25: SSS imagery of a possible wreck of possible ferromagnetic material, T0224.

T0479 – Airplane wing

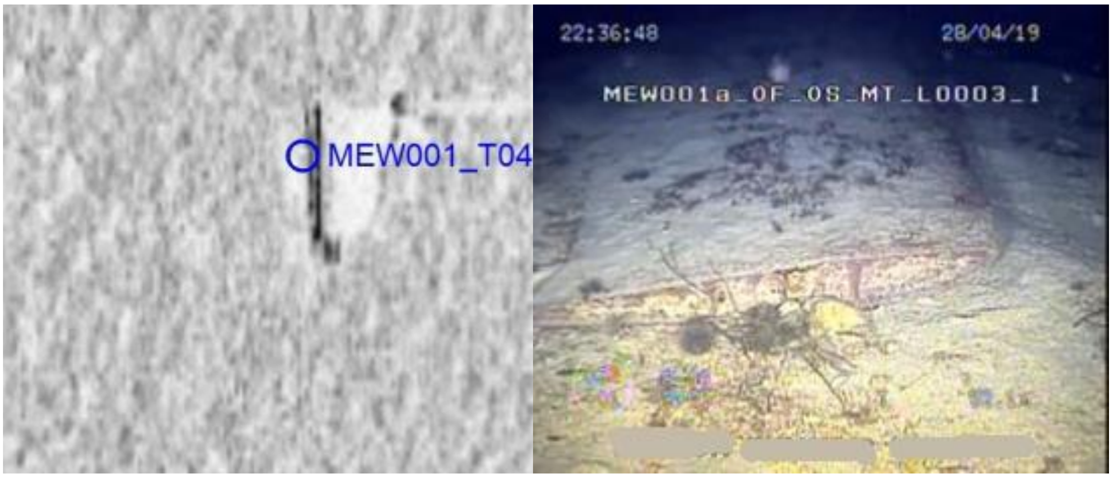

Figure 26: SSS imagery and ROV still of the airplane wing found in the nearshore area of Malta, T0479.

5.3 Field survey: Onshore section

Figure 27 shows the location of the identified cultural heritage features within the AoI. The majority of the AoI was accessible to the assessors during the site survey, with the exception of the area at the north-west terminal end of the “scheme” and surrounding area located within the existing boundaries of the Power Station and, as such, is inaccessible to the general public. Also inaccessible were two private agricultural properties surrounded by high stone walls. There is currently only one scheduled cultural heritage feature within the AoI.

Figure 27: Cultural Heritage features within AoI

Many of the buildings within the “scheme” footprint appeared to be temporary-use facilities (Figure 37, Figure 38, Figure 40 and Figure 51) or even abandoned/run down (Figure 39). During site visits, there was evidence of fresh ploughing and farming activity, confirming the current and ongoing agricultural use of the land (Figure 28 to Figure 31, Figure 36, Figure 41 and Figure 43). Photographs were also taken of the cliffs and coastline at both points of impact of the scheme (Figure 44 to Figure 50).

The area of the coast at the southeast arrival zone of the pipeline of the Scheme Site, in close proximity to Ponta Tat-Tawwalija, features a complex of salt pans (Section 5.3.2). The complex is located directly over the planned route and extends more than 50 m either side of said route (Figure 27). However, as the pipeline will be over 30m under the saltpans and the entry point will be approximately 600m from the actual coastline (Figure 8), there should be very little risk to the integrity of these features, if any. There is very little literature available about these salt plans; however, it is suggested that these may date from the Knights’ period, and the Planning Authority considers that they merit protection as Grade 2 scheduled features.

Also, rubble walls were noted within the Scheme Site and elsewhere within the AoI (Figure 27 and Section 5.3.3). Some of the walls, including within the Scheme Site, are built with traditionally sized rubble stones (Figure 34 and Figure 36), whilst others show frequent interventions with the introduction of larger sized blocks (Figure 32, Figure 33 and Figure 35). The walls within the Scheme Site are not of any particular historical importance. However, they do have protected status as structures of cultural importance. A detailed description of all the identified cultural heritage features is given in Section 5.3.

5.3.1 Photographic Register

The photos taken from the locations mapped in Figure 14 are shown in Figure 28 to Figure 51.

Figure 28: PHOTO 1 - Agricultural land; looking South.

Figure 29: PHOTO 2 - Agricultural land on edge of buffer zone with Fort Delimara nearby; looking SW

Figure 30: PHOTO 3 - Agricultural land; looking South.

Figure 31: PHOTO 4 - Agricultural land; looking East.

Figure 32: PHOTO 5 - Dry-Stone walls; looking North.

Figure 33: PHOTO 6 - Random rubble stone wall with concrete intrusions; looking South.

Figure 34: PHOTO 7 - Dry-Stone walls; looking North.

Figure 35: PHOTO 8 - Farmhouse wall: looking N East.

Figure 36: PHOTO 9 - Agricultural terracing; looking N West.

Figure 37: Photo 10 - Secondary use structure; looking West.

Figure 38: PHOTO 11 - Secondary use structure; looking South.

Figure 39: PHOTO 12 - Abandoned structure, Looking N West.

Figure 40: PHOTO 13 - Non-residential structure; looking N West.

Figure 41 : PHOTO 14 - Farmhouse; looking North.

Figure 42: PHOTO 15 – Residential unit; Looking West.

Figure 43: PHOTO 16 - Farmhouse; looking S East.

Figure 44: PHOTO 17 - Delimara coastline; looking N East.

Figure 45: PHOTO 18 - Salt Pans; looking East.

Figure 46: PHOTO 19 - Delimara coastline; looking West.

Figure 47: PHOTO 20 - Delimara coastline; looking N West.

Figure 48: PHOTO 21 - Delimara coastline; looking N East.

Figure 49: PHOTO 22 - Salt Pans; looking S East.

Figure 50: PHOTO 23 - Coastline at "Terminal" side of Delimara; looking North.

Figure 51: PHOTO 24 - Telecommunications relay station

5.3.2 Salt Pans

Cultural Heritage Data Capture Sheet			
Location Delimara, M'Xlokk	**Category** Architecture	**Type** Industrial	**Site Location** Delimara Peninsula, Marsaxlokk
Eastings 60528.9362581	**Northings** 64814.438825	**Feature** Salt Pans	**Period – Year** Unknown, possibly Knight's Period (1530-1797)
S.S. No. 1: 6064	**S.S. No. 2.** 6065	**Description** **Salt Pans** Rock-cut features, predominantly rectangular in form, used for the collection of sea-water for the production of salt. Very little is known about these Salt pans. However, it is thought that many may date from the Knight's Period (1530-1797).	
Date of S.S. N/A			
Present Utilization Artisan salt harvesting			
Existing Legal Protection N/A		**GN. Number** N/A	**GN. Date** N/A
Comments:			
Site Map			

(Source; Superintendence of Cultural Heritage)

Archaeological Characteristics - Sketch/Scaled Drawings:	
	
Condition: N/A	**Degree of Protection:** Recent communication with the Planning Authority reveals that the Heritage Unit considers that salt pans found around the Delimara peninsula merit protection as Grade 2 scheduled features[4].
State of Security: N/A	**Proposed Utilization:** N/A
Basic Bibliography: N/A	

(Source; Superintendence of Cultural Heritage)

5.3.3 Dry-Stone Walls

Cultural Heritage Data Capture Sheet

Location	**Category**	**Type**	**Site Location**
Delimara, M'Xlokk	Architecture	Rural	Delimara Peninsula, Marsaxlokk
Eastings	**Northings**	**Feature**	**Period – Year**
N/A	N/A	Rubble and Dry-Stone walls	Unknown.

S.S. No. 1:	**S.S. No. 2.**	**Description**
6064	6065	**Rubble/Dry-stone walls & other retaining walls** Rubble and other various retaining walls were/are field and/or property boundary walls, constructed primarily of irregular natural dry stones. Both the scheme site and Area of Influence contained rubble walls. Some of these are built with traditionally-sized rubble stones, whilst others have been clearly altered, added to or repaired with the introduction of larger cut stones and, in some instances even more modern materials (eg; cement and concrete).
Date of S.S.		
N/A		
Present Utilization		
N/A		

Existing Legal Protection	**GN. Number**	**GN. Date**
Legal Notice 160 of 1997	N/A	N/A

Comments:
L.N 160/97 prohibits the dismantling of such walls except by permission from the competent authority

Site Map

Archaeological Characteristics	
	
Condition Some abandoned, some partly collapsed, others repaired or rebuilt.	**Degree of Protection** Legal Notice 160 of 1997 Prohibits dismantling of such walls except by permission from the competent authority.
State of Security N/A	**Proposed Utilization** N/A
Basic Bibliography N/A	
Compiled by: Vincenzo Cherubini **Date:** 30th October 2019	**Checked by:**

(Source; Superintendence of Cultural Heritage)

6.0 Impact Assessment

Assessment of the significance of a site sets out to identify how particular parts of a place and different periods in its evolution contribute to, or detract from, identified heritage values associated with the site.

With regard to the scheme however, due to the nature and method of the proposed onshore construction, which will be laid via trenchless MT (microtunnelling), coupled with the fact that the scheme will be located at a depth of between 10m and 30m (approximately) below the surface (Figure 6), should ensure that there would be no direct impact to any archaeological or cultural feature on or immediately below the surface.

The MT method involves the boring of a microtunnel (as the name implies) well below the surface, into which the said pipe is inserted and either pushed or pulled through. This ensures minimal ground surface disturbance and disruption, with the only real risk coming from possible subsidence:

"*Subsidence is especially an issue during trenchless construction activities, such as tunnelling. As the tunnel boring machine (TBM) advances along the intended bore path, it removes the surrounding soil. This activity loosens the ground while leaving soil layers directly above the bore path unsupported. As a result, the strength and stability of the soil matrix are affected, causing the earth to shift in a downward direction. TBMs control ground subsidence by employing a construction technique known as the Sequential Excavation Method (SEM). During SEM, the tunnel is divided, excavated, and supported in several relatively small segments. As tunnel construction moves forward, the cutting head at the face of the tunnel boring machine loosens the surrounding soil. The cuttings are then removed by a system of screw and belt conveyors to the entrance pit location. Once the cutting head has advanced the tunnel to the required distance, precast concrete liner segments are fed to the TBMs rotating ring erector system. This mechanism uses a vacuum to lift each precast section into position for installation. The liner segments are installed one by one around the circumference until the tunnel section is complete. This completed tunnel segment possesses strength properties which allow it to support the layers of soil above the bore path. The hydraulic jack system then pushes the cutting head forward, and the lining process is repeated. Each excavated segment is carefully monitored using specialized equipment to ensure that soil movements do not exceed allowable limits. TBMs and SEM techniques allow long and complex tunnels to be constructed without inducing subsidence caused by excessive soil disturbance" (Source: Nanan, n.d.).*

The only factors that may remotely give a cause of possible concern are the effects of ground vibrations, tremors and subsidence during the drilling process, which may (in the extreme) affect the stability of the cliff face at both entry and exit points. However, given the relative depth of the scheme and method of construction, combined with the absence of any known archaeological feature, this scenario seems highly unlikely. Furthermore, long-term impacts on the physical features of the area are outlined in the geology chapter of this EIA.

For the offshore area, one target identified as an airplane (T0189) is located at an offset of 56m from the proposed pipeline route, while another target identified as a probable airplane (T0207) is located at an offset of 75m from the route. The presence of these invaluable UCH will have to be considered when planning the lay barge anchor pattern and the position of the catenaries will have to consider these objects. If this is not possible, a minimum clearance will have to be implemented in order to ensure their protection. As such, the selection of a suitable anchor pattern design is of paramount importance to ensure the survival of the identified UCH objects. The methodology for laying anchors has already been identified in Technical Note 006 for the PIPELINE BUFFER ZONE, UXOS, CHOS AND INTERFERENCE WITH OTHER AREAS.

Ensuring the removal and controlled detonation of UXO should feature during the construction phase as 21 confirmed possible UXO were discovered during the course of this project. Possible UXO should still be removed due to the potential risk posed by this hazard. Of a considerable note, one of these naval mines, T0463, is located within 5m of the proposed pipeline route. As such, the risk posed by this object necessitates its removal from the pipeline route.

During the installation of the pipeline, a Dead Man Anchor system (DMA) will be implemented, which may have implications on buried UCH. A fixed point will be preliminarily installed, with either one or two anchors employed. During this process, attention should be paid to the possible presence of archaeological material within the sediment column. The possibility of buried material within the sediment column can also be considered in relation to the microtunnelling methodology for installing the pipeline. While disturbance will occur underneath the surface, the laying of the pipeline will not affect the top surface layer.

7.0 Monitoring and Mitigation Measures

7.1 Construction Phase

During works, the recommended distance from contacts of cultural heritage interest must be at least 500 metres to ensure their safety. This includes the laying of the pipeline, as well as its burial in shallower areas. The positioning of the catenaries and the formation of a suitable anchoring pattern must be considered in relation to their proximity to UCH targets. In the event of construction or the laying of pipeline within 500 metres of an UCH target, an archaeological monitor must be present on board the vessel.

7.2 Operational Phase

Monitoring during the operational phase of the pipeline will not be necessary.

Bibliography

Abelli, L., *et al*., (2014). Marine geological and archaeological evidence of a possible pre-Neolithic site in Pantelleria Island, Central Mediterranean Sea. In: Harff, J., Bailey, G., & Lüth, F., (eds.), Geology and Archaeology: submerged landscapes of the continental shelf. Geological Society, London, Special Publications 411.

Alexander, D., (1988). A review of the physical geography of Malta and its significance for tectonic geomorphology. Quaternary Science Reviews, 7(1), pp. 41-53.

Ashmolean Museum of Art and Archaeology, (2016). Storms, war and shipwrecks: Treasures from the Sicilian seas. Available at: <https://www.ashmolean.org/sites/default/files/ashmolean/documents/media/stormswarsandshipwreckssteachernotes.pdf>, [Date Accessed: 23/07/19].

Atauz, A.D., (2004). Trade, piracy and naval warfare in the central Mediterranean: the maritime history and archaeology of Malta. Dissertation of Doctor of Philosophy: Texas A&M University.

Azzopardi, E., and Gambin, T., (2012). Archaeology and the Sea in the Maltese Islands. Midsea Books: Malta.

Azzopardi, E., Gambin, T & Zerafa, R., (2009). Ancient anchors from Malta and Gozo. Malta Archaeological Review, 9, pp. 22-31.

Bonanno, A., (2005). Malta: Roman, Phoenician, Punic. Midsea Books: Malta.

Bramoullé, D., *et al*, (2017). Le mobilier céramique dans la Méditerranée des xth-xiith siècles. Annales Islamologiques, 51, p.191-221, [In French].

Bruno, B., (2009). Roman and Byzantine Malta: Trade and Economy. Midsea Books: Malta.

Burgess, A., & Gambin, T., (2010). The underwater aviation heritage of the second siege of Malta. Malta Archaeological Review 2010-2011, 10, pp.53-60.

Caponetti, E., *et al*., (2017). First discovery of orichalcum ingots from the remains of a sixth century BC shipwreck near Gela (Sicily) seabed. Mediterranean Archaeology and Archaeometry, 17(2), pp. 11-8.

Cardona, D., (2013). Tas-Silġ: From prehistoric temple to Byzantine church. World Archaeology Magazine, 59, pp.18-24.

Cassola, A., (1992). The Maltese Toponomy in three Ancient Italian Portulans (1296-1490) Al-Masaq Studia Arabo-Islamica Mediterranea International Journal of Arabo-Islamic Mediterranean Studies, 5, 47-64.

Castillo, D., (2005) The Maltese Cross: A strategic history of Malta. Praeger: Westport, US.

Council of Europe, (1992). Convention for the Protection of the Archaeological Heritage of Europe (Revised), Valletta. Available at: <https://rm.coe.int/168007bd25>, [Date Accessed: 11/07/19].

Cultural Heritage Act, (2002). Available at: <http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=8911&l=1>, [Date Accessed: 12/07/19].

Foresi, L.M., *et al*., (2011). Integrated stratigraphy of St. Peter's Pool section (Malta): new age for the Upper Globigerina Limestone member and progress towards the Langhian GSSP. Stratigraphy, 8 (2-3), pp.125-43.

Furlani, S., *et al*., (2013). Holocene sea level change. Quaternary International, 288, pp.146-57.

Gambin, T., (2005) The Maritime Landscapes of Malta from the Roman period to the Middle Ages, Vol.1, PhD in the Faculty of Arts, University of Bristol, UK.

Gambin, T., (2008). The maritime cartography of the Sicily-Malta Channel, In: Malta and Sicily: Miscellaneous Research Projects, Bonanno, A., (Ed.). KASA.

Gambin, T., (2013). Report on Marine Archaeology for the proposed power station at Marsaxlokk Bay, Malta, August 2013. Environmental Impact Assessment, Appendix Two, Volume Five.

Gambin, T., (2015). The Maltese Islands and the Sea in Antiquity, In: Gambin, T. (Ed.), The Maltese Islands and the Sea. Valletta, Malta: Midsea Books.

Gouder, T.C., (1991). Malta and the Phoenicians. Annual Report 1991, Lombard Bank Malta: Valletta.

Lazar, A.V., *et al.,* (2013) Side-scan sonar mapping of anthropogenically influenced seafloor: a case-study of Mangalia Harbor, Romania. Geo-Eco Marina, 19, pp.59-64.

Leidwanger, J., & Greene, E.S., (2016). The Marzamemi Shipwreck Excavation: A Late Antique Church under the sea. INA Quarterly, 43.3/4. Available at: <https://nautical arch.org/ wp-content/uploads/2015/07/Featured-Article.pdf>, [Date Accessed: 21/7/19].

Lodolo, E., & Ben-Avraham, Z., (2015). A submerged monolith in the Sicilian Channel (central Mediterranean Sea): Evidence for Mesolithic human activity. Journal of Archaeological Science: Reports, 3, pp. 398-407.

Malta War Diary., (2015). 20 July 1940: War office keen to raise morale in Malta. Available at: <https://maltagc70.wordpress.com/2015/07/page/2/>, [Date Accessed: 22/7/19].

Malta War Diary., (2016). 11 June 1940: Malta's First Day at War. Available at: <https://maltagc70.wordpress.com/tag/kalafrana/>, [Date Accessed: 22/7/19].

MAR, (1931-2). Superintendence of Cultural Heritage. Report on the working of the museum department, Malta: Department of Information.

MAR, (1959). Superintendence of Cultural Heritage. Report on the working of the museum department, Malta: Department of Information.

MAR, (1960). Superintendence of Cultural Heritage. Report on the working of the museum department, Malta: Department of Information.

MAR, (1964). Superintendence of Cultural Heritage. Report on the working of the museum department, Malta: Department of Information.

MAR, (1965). Superintendence of Cultural Heritage. Report on the working of the museum department, Malta: Department of Information.

MAR, (1967). Superintendence of Cultural Heritage. Report on the working of the museum department, Malta: Department of Information.

Mariner, N., *et al*., (2012). Geoarchaeology of the Burmarrad ria and early Holocene human impacts in western Malta. Palaeogeography, Palaeoclimatology, Palaeoecology, 339-341(3), pp.52-65.

McGowen, D., & Morris, R., (2013) Choosing side scan sonar frequencies: Dual-Frequency Options Allow for Flexibility in Capturing Images. Available at: <https://www.edgetech.com/images/ut-news/EdgeTech-Sea-Technology-mag-article-on-freq-selection.pdf>, [Date Accessed: 13/07/19].

Micallef, A., *et al*., (2013). The submerged paleolandscape of the Maltese Islands: Morphology, evolution and relation to Quaternary environmental change. Marine Geology, 335, pp.129-47.

Nanan, K. (n.d.) https://www.trenchlesspedia.com/how-does-a-tunnel-boring-machine-tbm-control-the-subsidence-of-the-ground-above-the-trenchless-installation/7/4077.

Osler, J., & Algan, O., (1999). A high resolution seismic sequence analysis of the Malta Plateau. NATO Undersea Research Centre, Report SR-311, May 1999.

Pace, A., (2004). The Sites. In Cilia, D., (ed), Malta before History. Miranda Publications: Malta.

Sagona, C., (2015). Melita and Gaulos during the Punic Period, In: The Archaeology of Malta: From the Neolithic through the Roman Period, pp. 218-63. Cambridge University Press: Cambridge.

Stephenson, C., (2004). The Fortifications of Malta: 1530-1945. Osprey Publishing: Oxford.

Subzone OÜ, (2012) Side-scan sonar image of shipwreck “Aid” in Estonia. Available at: <https://commons.wikimedia.org/wiki/File:Laevavrakk_%22Aid%22.png>, [Date Accessed: 23/07/19].

UNESCO, (2001). Underwater Cultural Heritage: Text of the 2001 Convention. Available at: <http://www.unesco.org/new/en/culture/themes/ underwater-cultural-heritage/ 2001- convention/official-text/>, [Date Accessed: 11/07/19].