

*Geology, Geomorphology, Palaeontology, Hydrogeology In
Relation To An Environmental Impact Assessment*

For the Proposed Jerma Palace Hotel Redevelopment at
Marsascala

Technical Report

CLIENT REF. NO: PA 0437/23

FIRST VERSION

Publication Date

18 September 2026

Table of Contents

1.0	Introduction	6
1.1	This Report	7
2.0	Terms of Reference	8
3.0	Study Methodology	13
3.1	Literature Review	13
3.2	Study Methodology.....	13
3.3	Impact Assessment Criteria	14
3.3.1	Impact Significance	14
3.4	Impact Mitigation and Monitoring	20
4.0	Baseline Conditions	21
4.1	A Description of the Site and its Surroundings	21
4.2	Area of Influence.....	24
4.3	Geology	25
4.3.1	Stratigraphy.....	25
4.3.2	Assessment of Excavation Material	31
4.3.3	Slope Stability.....	31
4.4	Geomorphology and Soils	32
4.4.1	Geomorphologic Features	32
4.4.2	Soils	35
4.5	Hydrology and Hydrogeology	36
5.0	Impact Assessment.....	39
5.1	Construction Phase	39
5.2	Operational Phase.....	40
6.0	Monitoring & Mitigation.....	41
6.1	During Construction.....	41
6.2	During Operation	41
6.3	Residual Impacts – The Cumulative Effect.....	42
7.0	Impact Summary Table	43
8.0	References	46

Table of Figures

Figure 1: Location of the site (ex-Jerma Hotel) in Marsascale.....	6
Figure 2:Block plan of the proposed development (Source: PDS)	7
Figure 3: Map showing the ex-Jerma Palace Hotel.....	21
Figure 4: Photograph taken from the east of the site showing the stone wall that protected the ex-Jerma Palace Hotel from extreme wave breakers.	22
Figure 5: Map showing environmental designations in the environment of the Scheme ...	23
Figure 6: Photograph showing typical salt pans that dot the shore platform	23
Figure 7: Area of Influence for geomorphology hydrology and hydromorphology	24
Figure 8: Stratigraphic column	25
Figure 9: Geological map of Marsascale (OED, 1993)	26
Figure 10: Exposure of Lower Globigerina Limestone at the shore platform and a thin phosphate conglomerate bed succeeded upwards by the lowermost beds of the Middle Globigerina Limestone Mb	28
Figure 11: Phosphate conglomerate bed seen in the foreground and Lower Globigerina Limestone exposed on the shore platform. The ex-Jerma Palace Hotel can be seen in the background.....	29
Figure 12: Photograph showing the trench that surrounds the San Tumas Tower which exposes Lower Globigerina Limestone at the base and Middle Globigerina Limestone (about 1.8m thick at the top).....	29
Figure 13: Low cliff on the northern margin of St Thomas Bay about 6m high, exposing grey marls and marly limestone of the Middle Globigerina Limestone Mb	30
Figure 14: Photograph showing the colour and weathering properties of the Middle Globigerina Limestone Note the concoidal fractures	30
Figure 15: 3-D Diagrams showing typical rock wedge failure.....	31
Figure 16: Map showing the geomorphological units in the environs of the ex-Jerma Palace Hotel	33
Figure 17: Photograph showing part of the shore platform that lines the coastline on the east of the Proposed Scheme. Note the boulders in the foreground and the ex-Jerma Palace Hotel in the background	34

Figure 18: Photograph showing part of the shore platform on the west of the proposed development. On the backshore the shore platform terminates at a low scarp composed of weathered Middle Globigerina limestone	34
Figure 19: Lang’s Soil Map (part of) of the site and its environs (Lang, 1962)	35
Figure 20: Plan of Marsascala showing that the site in the region of the ex Jerma Place Hotel is completely developed. (Source: https://pamapserver.pa.org.mt/	36
Figure 21: Bare rock exposed at the coastline representing the Xaghra Soil Series	36
Figure 22: Map showing the catchment upstream of the site.....	37
Figure 23: Cross section showing the ground water body tapering out at the coastline	37
Figure 24: Map showing the groundwater protection zone in the region of Marsascala....	38

Table of Tables

Table 1: Significance criteria for Geology & Palaeontology	14
Table 2: Significance of impacts on geomorphology	15
Table 3: Significance of impacts on soil	16
Table 4: Significance of impact on hydrology/hydrogeology	17
Table 5: Significance of impact on water quality	18
Table 6: Significance of impact on mineral resources.....	19
Table 7: Impact summary table	43

1.0 Introduction

This Report represents the study on Geology (including inland Surface Geology, Palaeontology Geomorphology, Soils and hydrogeology, as relevant), to fulfil the Terms of Reference issued by ERA, in relation to the Environmental Impact Assessment (EIA) for the proposed Ex-Jerma Palace Hotel Redevelopment, at Marsascala (Figure 1).



Figure 1: Location of the site (ex-Jerma Hotel) in Marsascala

The proposed development hereby known as the 'Scheme', will include two hotels. One of the hotels will be a five-star hotel with 134 rooms, whilst the other hotel will consist of a six-room boutique hotel.

Level 0 of the five-star hotel will include the hotel lobby, the hotel's administration, an ancillary bar and an ancillary restaurant. The Scheme will also include 259 serviced apartments. The residential units will span from Level 1 to Level 7. It will have a total of 155 residential units and will also have six food & beverage outlets and seven retail outlets, which will be located at Level 0. There will also be a chapel located at this level. It will include the rehabilitation of the rocky coast through the removal of any concrete accretions.

The developable area is 17,570m², although the actual site footprint is much larger given that it includes the protected foreshore and public streets. The site specifically includes the five-storey dilapidated former Jerma Palace Hotel, areas dedicated to

landscaping and concrete terraces, a public road and two open spaces on the sides of It-Torri ta' San Tumas ditch.

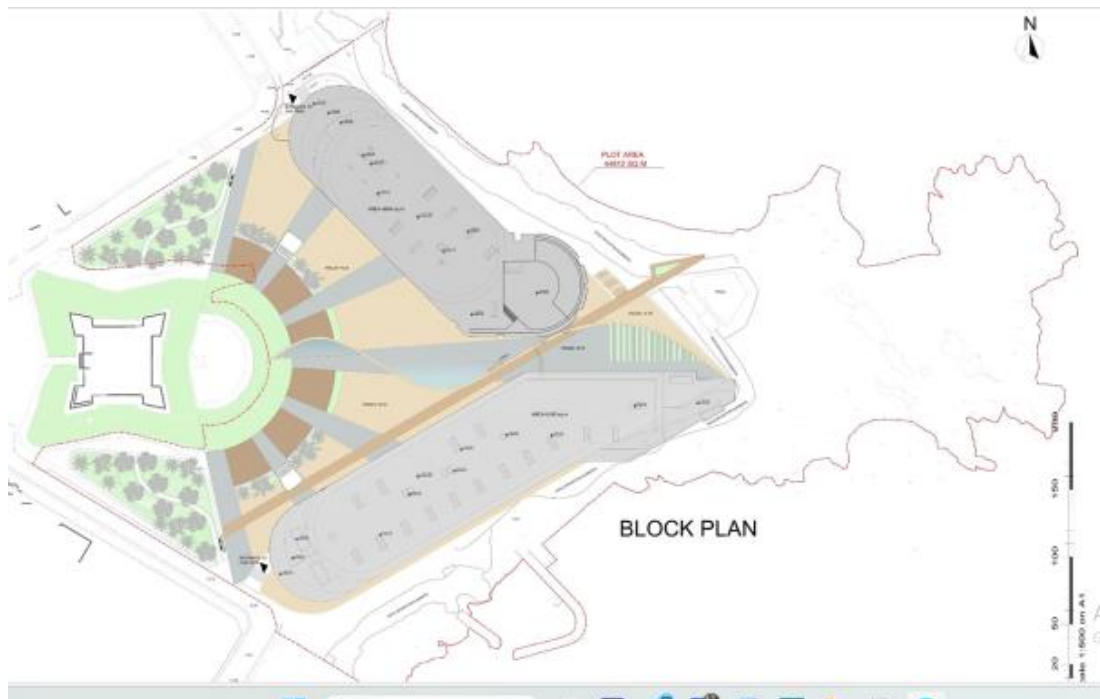


Figure 2:Block plan of the proposed development (Source: PDS)

1.1 This Report

This report presents the geo-environmental baseline study for Geology, Geomorphology, and Hydrogeology as part of the Environmental Impact Assessment.

2.0 Terms of Reference

The terms of reference issued by ERA were the following:

3.0 A Description Of The Site And Its Surroundings (I.E. Environmental Baseline)

3.3 Geology, Geomorphology, Hydrogeology, and Soils

A comprehensive investigation of:

1. The geology and geomorphology of the site and its surroundings, including:

- (i) existing geology, stratigraphy, structure, lithology, physiography and geomorphology features;*
- (ii) palaeontological features;*
- (iii) hydrogeological features; and*
- (iv) soil types.*

Each feature shall be listed in a table, together with a short description and if any of the features are absent, this shall be stated. A scaled map, clearly depicting the feature occurrence within the area of influence, shall also be provided.

2. The geo-technical properties and considerations relevant to the site and its area of influence, including:

- (i) land stability;*
- (ii) mechanical, erosional and structural properties of the terrain and land mass;*
- (iii) any relevant fissures, faults, hollows, or weak points;*
- (iv) the vulnerability of the site to natural forces such as wave action, erosive elements, landslides and mass movements; and*
- (v) any other considerations affecting the implications and risks posed by the proposed development or by any of its ancillary interventions such as site clearance, earth-moving, and excavations.*

Each of the above shall be listed in a table along with a short description and if any of the features are absent, this shall be stated. A scaled map, clearly depicting the feature occurrence within the area of influence, shall also be provided.

3. The quality of the material that will be excavated (including soil, rock/mineral resource, and any existing fill material) and its potential for reuse.

4. Sampling and testing should comply with the relevant standards (unless otherwise agreed, BS standards or other recognised equivalents should be used), and should extend to a sufficient depth below the deepest level of the proposed development (taking into consideration all proposed excavations and underground structures). Wherever the study involves the drilling of core samples, the number, depth and location thereof should also be submitted for ERA approval prior to carrying out of any in situ tests.

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 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 geological 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 or 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, included 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 analysis 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 on the environmental 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, Identification 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].*

*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.

3.0 Study Methodology

3.1 Literature Review

A literature search in relation to previous geo-environment survey work relevant to the Aol was undertaken. This, together with the Consultant's own knowledge of the area, provided the context for the baseline surveys.

3.2 Study Methodology

The study establishes the existing geology, geomorphology and hydrogeological baseline. This involved:

- Identification and description of the geology, geomorphology and hydrogeology of the site within the Area of Influence (see Figure 7);
- Identification, mapping and description of any structural features (such as faults) that may be present, outcrop formations, members, or bed sub-divisions, including their palaeontological content;
- Identification and description of aquifers, water courses, drainage patterns; surface run-off; and springs and wells (if any);
- Identification of features that are protected by legislation, or which warrant such protection and their appropriate level of protection, as necessary
- The stability of the walls of the proposed excavation will also be determined by the field survey.

The conservation importance of geologic, geomorphologic and hydrogeological features were determined by reference to the MARSASCALA LOCAL PLAN, MINERALS SUBJECT PLAN and the EARTH CONSERVATION STRATEGY (The British Nature Conservancy Council, 1991) as well as the STRATEGIC PLAN FOR ENVIRONMENT AND DEVELOPMENT SPED, drawn in 2015 to replace the STRUCTURE PLAN FOR THE MALTESE ISLANDS drawn up in 1990.

The following outputs have been produced as part of the geo-environment baseline survey:

- Geological map
- Report of the quality of the stone material to be excavated and its potential reuse. This will be determined by visual inspection
- Report on slope stability and excavation stability (if any)
- Impact assessment

3.3 Impact Assessment Criteria

3.3.1 Impact Significance

This section includes, for each potential impact, the following criteria:

- Description of impact;
- Policy importance of impact (Local, National, International);
- Extent of effect;
- Duration of impact (temporary / permanent);
- Adverse or beneficial impact;
- Reversible / irreversible impact;
- Sensitivity of geo-environmental resources to impacts;
- Probability of impact occurring (certain, likely, uncertain, unlikely, remote); and
- Scope for mitigation / enhancement (very good, good, none).

Based on the above, a summary of the significance of the impact was judged in terms of whether the impact is considered to be:

- **Not significant:** Little or no change to the geological, geomorphological and hydrogeological regime.
- **Minor significance:** Changes to the geological, geomorphological and hydrogeological regime that may affect neighbouring properties but which may be offset by mitigation measures.
- **Moderate significance:** Changes to the geological, geomorphological and hydrogeological regime that are likely to affect neighbouring properties but which may be partially offset by mitigation measures.
- **Major significance:** Changes to the geological, geomorphological and hydrogeological regime that may affect neighbouring properties and which may not be offset by mitigation measures (if negative) or may be enhanced by mitigation measures (if positive).

Table 1: Significance criteria for Geology & Palaeontology

Significance of likely impacts on Geology and Palaeontology Policies RCO11 and RCO12	
Level of significance	Criterion
Major	Removal/degrading of sites of scientific importance - Rural conservation Policies RCO11 and RCO12 without any possible scope
Moderate	Removal of substantial quantities of strata from sites of no scientific importance involving extensive excavation works or removal of important strata with scope for mitigation
Minor	Development involving removal of minor amounts of rock strata

Negligible	Development that requires no excavation
Adverse/Beneficial Geology and Palaeontology	
Assessment	Criterion
Highly beneficial	Developments that will protect or enhance sites of scientific importance such as nature trails or geological parks
Beneficial	Developments that will protect or enhance geological sites not necessarily of scientific importance
Neutral	Developments that do not involve removal of geological strata
Adverse	All developments that involve removal of strata are adverse even though they might be small and may seem to be insignificant. The cumulative effect of the construction will lead to removal of extensive quantities of geological strata (e.g. Construction of a new neighbourhood or town).

Table 2: Significance of impacts on geomorphology

Significance of likely impacts on Geomorphology Policies RCO11 and RCO12	
Level of significance	Criterion
Major	Removal of sites of scientific importance - Rural conservation
Major	Visibly Impairing geomorphological features of high landscape value, such as such as hill slopes, valleys or watercourses or cliffs or limestone pavements or karst features by burial or the removal of rock strata. Cumulative effect of a number of sites added
Major	Developments leading to instability of Blue Clay slopes or to the cliff margins overlying the contact Blue Clay /Upper Coralline
Moderate	Removal of substantial Quantities of strata from sites of no scientific importance involving extensive excavation works but in low lying planar features
Low	Development involving removal of minor amounts of rock strata from sites of no landscape value or removal of strata with scope

Insignificant	Development that do not bury surface geomorphological features and do not require any excavation
Adverse/Beneficial	
Assessment	Criterion
Highly beneficial	Developments that will protect or enhance sites of scientific importance such as nature trails or geomorphological/geological
Beneficial	Developments that will protect or enhance geomorphological/geological sites not necessarily of scientific importance
Neutral	Developments that do not involve removal of geological strata
Adverse	All developments that involve removal of strata are adverse even though they might be small and may seem to be insignificant. The cumulative effect of the construction will lead to removal of extensive quantities of geological strata (e g Construction of a new neighborhood) and total obliteration of the geomorphology.

Table 3: Significance of impacts on soil

Significance of likely impacts on Soils (Policy AHF4, Policy RCO 29)	
Level of significance	Criterion
Major	Removal or contamination of sites of scientific importance - Rural conservation Policies RCO11 and RCO12 – accelerated soil erosion
Major	Removal and burial or dispersal of substantial quantities of soil without any scope of later remediation
Moderate	Removal and burial or dispersal of small Quantities of soil without any scope of later remediation
Low	Development involving removal of minor quantities of soil from sites of no landscape value
Insignificant	Development that do not require the removal of soil

Adverse/Beneficial -Soils	
Assessment	Criterion
Highly beneficial	Developments that will protect or enhance sites of scientific importance such as nature trails or geomorphological/geological
Beneficial	Developments that will inhibit soil erosion such as the construction of Rubble Walls or terracing
Neutral	Developments that do not involve removal of soil
Adverse	All developments that involve removal of soil are adverse even though they might be small e.g. clearing for the construction of a new house. The cumulative effect of the construction of a new neighbourhood will lead to removal of extensive quantities of soil with a high

Table 4: Significance of impact on hydrology/hydrogeology

Significance of likely impacts on Hydrology/hydrogeology (Framework Directive 2000/60/EC)	
Level of significance	Criterion
Major	Contamination of the aquifer with liquid fuels. Liquid fuels are very hard to remove from the pores of the aquifer
Major	Alteration of the hydrological regime by increase or decrease of run-off which do not reflect the seasonal changes in the hydrological cycle leading to loss in infiltration and percolation of groundwater (Framework Directive 2000/60/EC)
Major	Alteration of the hydrological regime of the catchment basin leading to increase of run-off and accelerated hill slope erosion –silting of watercourse
Major	Destruction of karst features that promote percolation of run-off
Moderate	Alteration of the hydrological regime of the catchment basin
Low	Development involving minor changes in run-off of a catchment

Insignificant	Development that requires no excavation and/or paving. Excavation may reduce run-off while paving has the opposite effect.
Adverse/Beneficial -- Hydrology/hydrogeology	
Assessment	Criterion
Highly beneficial	Developments that will protect or enhance watercourses and catchment basins
Beneficial	Developments that will enhance infiltration
Neutral	Developments that do not involve any changes in the hydrological cycle
Adverse	All developments that involve paving of any type are adverse even though they might be small e.g. excavation for a garage or basement which might seem to be insignificant. The cumulative effect of the construction of a new neighborhood will lead to flooding in the lower reaches of the

Table 5: Significance of impact on water quality

Significance of likely impacts on Water Quality (Framework Directive 2000/60/EC)	
Level of significance	Criterion
Major	Alteration of the run-off characteristics leading to contamination of surface or groundwater eg major oil spills –contamination with organo- metallic compounds such as pesticides, nitrate contamination or contamination involving any other poisonous
Major	Irreversible contamination of the aquifer
Moderate	contamination with scope for mitigation
Low	contamination of groundwater by minor spillages with scope for easy mitigation
Insignificant	Developments where no kind of contaminant is handled
Adverse/Beneficial - Water Quality	
Assessment	Criterion
Highly beneficial	Developments for the treatment of run-off or groundwater

Beneficial	Natural Processes that are intended to purify run-off or groundwater such as reed beds.
Neutral	i) Developments that require the catchment of water and recirculation such as turf grass cultivation with underlying membrane to catch excess irrigation water to be recycled. ii) Spillage of freshwater say from a water bowser
Adverse	All spillages/leakages change the quality of groundwater normally by contaminating it and therefore are adverse

Table 6: Significance of impact on mineral resources

Significance of likely impacts on Mineral resources (Policies Min 1, MIN5 and MIN 6, subject plan Policies HS 3, HS 4, HS 5, HS 6, HS 7 and HS 8, DC1 to DC 22)	
Level of significance	Criterion
Major	Major excavations that will produce large quantities of mineral resources such as hardstone or the destruction of large reserves of good quality soft stone
Major	Sterilisation of large amounts of mineral resources
Major	Excavation next to 3 rd party property or other interests
Moderate	Excavation /sterilisation of moderate amounts of mineral resources
Low	Excavation /sterilisation of small amounts of mineral resources
Insignificant	Development that requires no excavation/sterilization of mineral resources
Adverse/Beneficial - Mineral resources	
Assessment	Criterion
Highly beneficial	Developments that will protect or enhance mineral deposits for posterity

Beneficial	Developments that will recycle mineral resources
Neutral	1a) Developments that do not involve removal of geological strata b) Excavations (moderate) with possibility to fully recycle moderate amounts of stone material
Adverse	a) Sterilisation of mineral resources b) Production of excessive amounts of mineral resources c) Destruction of mineral resources such as conventional excavations in good franka stone d) Production of waste stone material with no scope for

3.4 Impact Mitigation and Monitoring

The scope for mitigation was identified, and the need for monitoring of geological, geomorphological and palaeontological aspects within the Area of Influence are addressed in this report.

4.0 Baseline Conditions

4.1 A Description of the Site and its Surroundings

The Scheme site is located at the inner segment of a headland known as Il-Gżira between Il-Bajja ta' Marsaskala and Il-Bajja ta' San Tumas. A promenade runs along the northern coastline of the Area of Study. The coastal foreshore is characterised by rock-hewn salt pans forming part of a shore platform running from Il-Ponta Tal-Mignuna northward for about 250m and interrupted by a fault.

The existing building is in a derelict state in stark contrast with the San Tumas Tower across the road, Triq Ir-Ridott, at the back of the hotel.



Figure 3: Map showing the ex-Jerma Palace Hotel

The area fronting the promenade and the coast is characterised by low-density residences, whilst the inland part of the Area of Study is characterised by a mix of apartments, maisonettes and terraced houses. A sea wall protects the site from storm waves coming from the northeast (Figure 4).



Figure 4: Photograph taken from the east of the site showing the stone wall that protected the ex-Jerma Palace Hotel from extreme wave breakers.

The closest terrestrial environmental designation to the Scheme site is “Il-Bajja ta’ San Tumas to Il-Ponta tal-Miġnuna” Area of Ecological Interest (GN 400 of 1996). “Iż-Żona fil-Baħar tal-Lvant” Special Protection Area (MT0000108) is located less than 350 m to the east of Ras il-Gżira.

It-Torri ta’ San Tumas is found immediately to the west of the Scheme site. This coastal tower was built by Grand Master Alof de Wignacourt and dates back to 1614.

The foreshore surrounding the Scheme is characterised by extensive salt pans that are an important vernacular coastal feature. It has also been reported that Roman baths have been identified close to the proposed development.



Figure 5: Map showing environmental designations in the environment of the Scheme

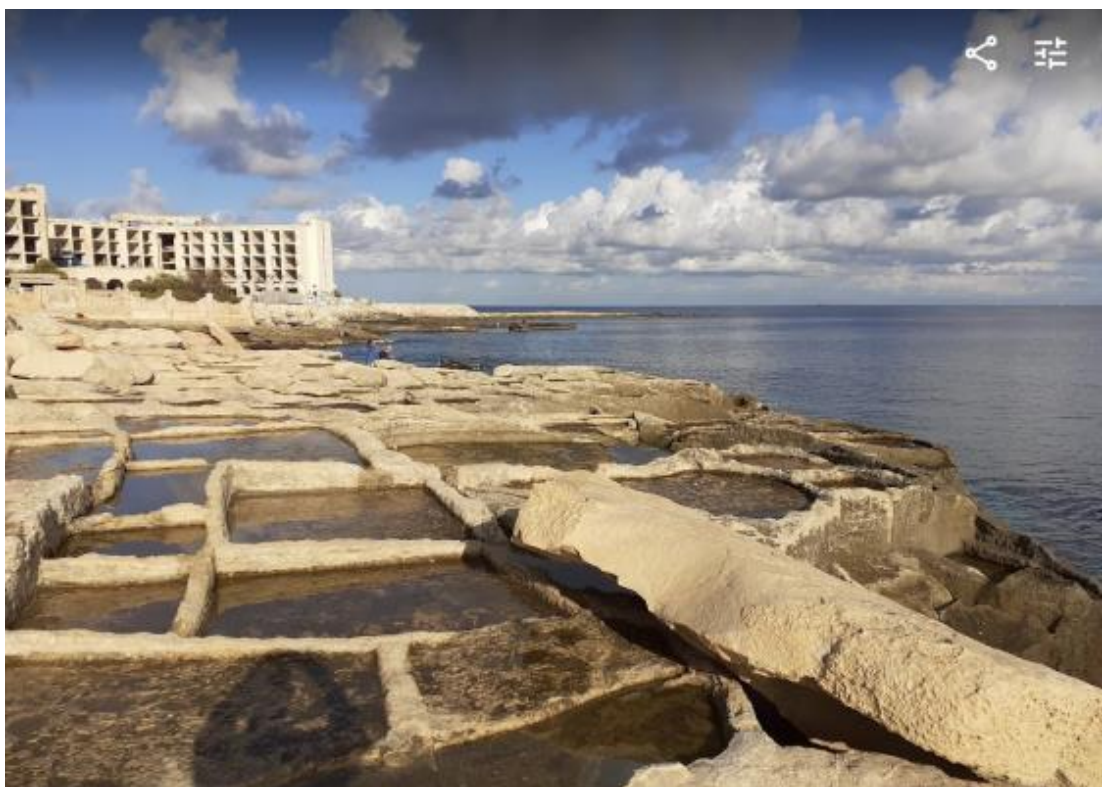


Figure 6: Photograph showing typical salt pans that dot the shore platform

4.2 Area of Influence

Marsascala is roughly a conical hill having a diffuse runoff discharge at the coastline. Drainage is largely controlled by the road network.

The site is the former Jerma Palace Hotel in Marsascale. It measures about 70m long by about 50m wide and lies at the coastline at about 0.8m above sea level. A stone wall protects the site from extreme storms.

The impacts arising from the proposed project depend largely on run-off characteristics which are directly related to the surface geology. For this reason, the area of influence for geomorphology, hydrology and soils are represented by a circle about 1000m radius to cover the highest point of Marsascala as well as the shore platforms on the north and south of the site.



Figure 7: Area of Influence for geomorphology hydrology and hydromorphology

The area of influence for geology, palaeontology and mineral resources will be restricted to the site where excavations might be undertaken and geological strata might be destroyed.

4.3 Geology

4.3.1 Stratigraphy

The five Late Tertiary rock formations exposed on the Maltese Islands are, from base to top are shown hereunder (Figure 8):

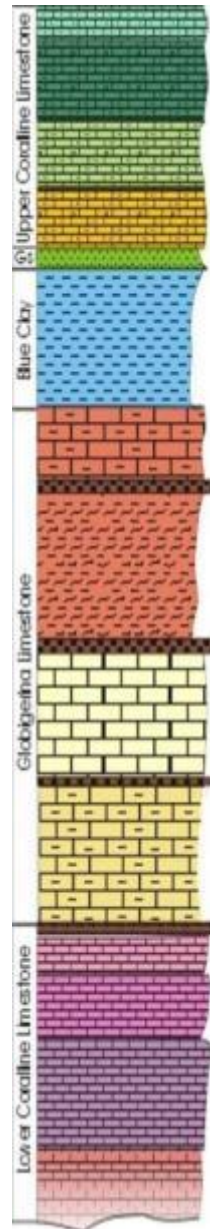


Figure 8: Stratigraphic column

- Lower Coralline Limestone (oldest)
- Globigerina Limestone
- Blue Clay
- Greensand
- Upper Coralline Limestone (youngest)

In addition to these formations, Quaternary continental deposits are also known to occur sporadically on the Maltese Islands. An unconformity and an erosional surface mark the boundary between these deposits and the underlying Miocene rocks.

The field geological survey has revealed that the rock formations and members preserved in the Study Area include (see Figure 9):

1. Lower Coralline Limestone formation
 - il-Mara Mb
2. Globigerina Limestone formation
 - Middle Globigerina Limestone and
 - Lower Globigerina Limestone Mb

The overlying rock formations: Blue Clay, Greensand and Upper Coralline Limestone have not been preserved in the Study Area. Quaternary deposits occur mostly in the form of surface calcrete crusts, have been identified within the Study Area.

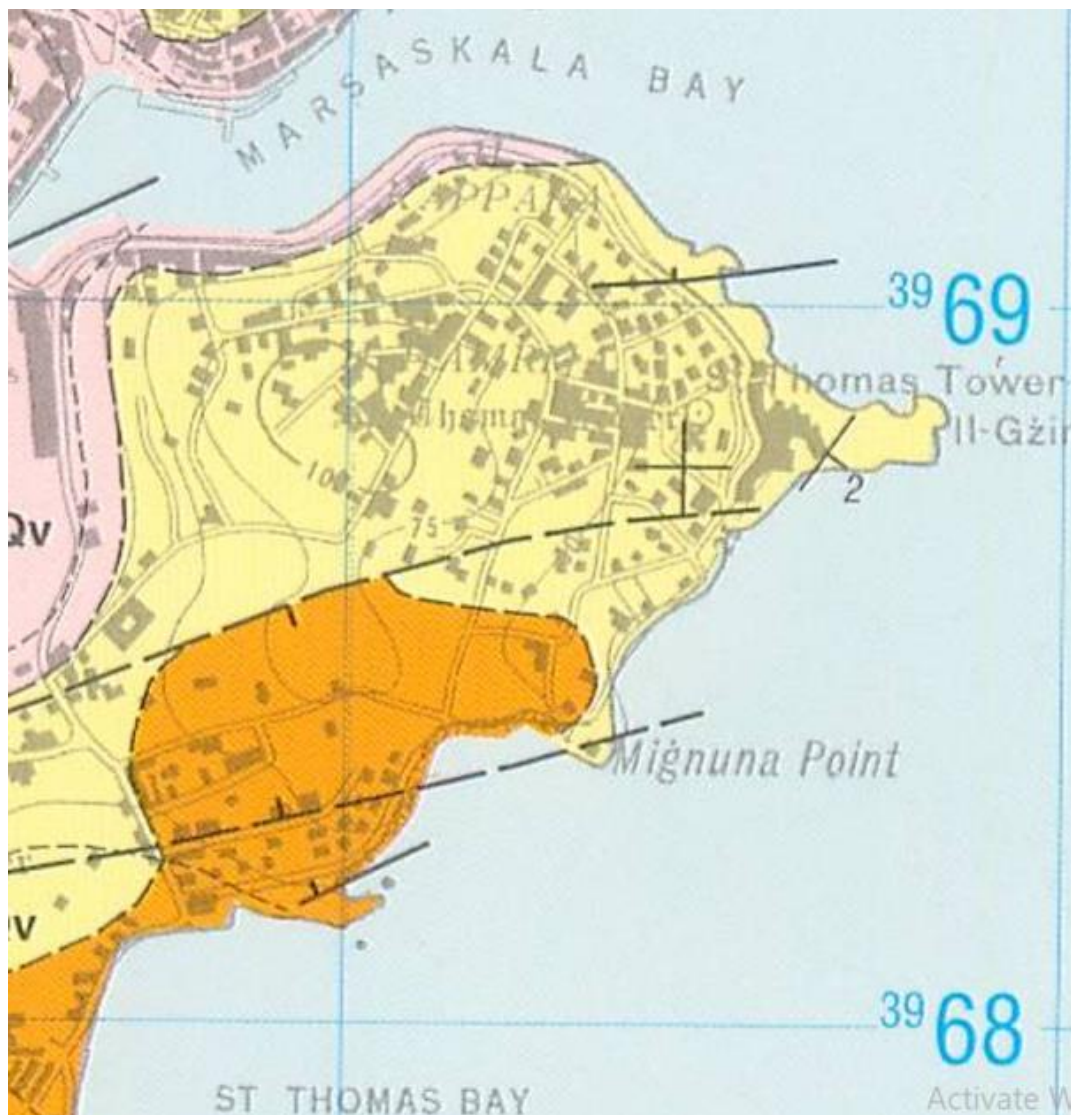


Figure 9: Geological map of Marsascala (OED, 1993)

The Globigerina Limestone rock formation is subdivided into three layers (Rizzo, 1932). Only the lower two members are present in the Study Area.

- Upper Globigerina Limestone
 - Not present in the Study Area
- Middle Globigerina Limestone
 - In exposure it is usually white and highly fractured with anastomosing cracks which render it highly vulnerable to weathering and erosion and in contrast to bounding members, it usually forms a more gently sloping landscape. When freshly excavated it is bluish grey in colour. The basal 1 - 0.5m usually consists of a competent white, greyish white or yellow limestone rich in foraminifera and phospho-glaucinitic clasts that pass upwards into a forma-coccolith marly limestone and marl interbeds of the order of 20cm to over 2m thick and often finely laminated. (Bennett, 1980).
 - On the geological map it is seen to disappear to the west due to the presence of a fault. However, in the field it can be seen exposed inside the trench that surround the St Thomas Tower where it is about 1.8m thick (Figure 12).
 - It is best exposed to the south away from the Ex-Jerma Palace Hotel where it forms a high cliff marking the northern boundary of St Thomas Bay (Figure 13).
 - This bed is the most widespread and most representative of the bed composing the Middle Globigerina and attains its maximum thickness of 30m south of Grey Marl facies where Bennett, (1980) has established its type section. Giannelli and Salvatorini (1972) record a maximum thickness of over 45m at Fomm ir-Rih.
 - The lower half of the unit is often characterised by silicified limestone and chert nodules and lenses. Chert nodules and thin lenses can best be observed at Fomm ir-Rih where they occur in layers about 25 cm thick in the bedding plane. The irregularly shaped concretions have a diameter of about 15-25 cm. Less conspicuous is a yellowish grey to greyish green chert.
 - This rock unit is best exposed in the cliff section marking the western boundary of St Thomas Bay but it is very thin or is absent from the Jerma Palace site.
 - This rock unit is characterised by its sparse macrofossils mainly consisting of rare bivalve shells.
 - Owing to its marly composition this rock unit weathers very easily on exposure. This rock type deteriorates rapidly when exposed to the atmosphere - a phenomenon commonly known as weathering. Hence a rock which appears to have desirable structural properties when freshly exposed may be unacceptable after having been allowed to wear there for a few months. In some extreme cases soft rock specimens left exposed to the atmosphere between preparation and testing may disintegrated into heaps of rubble within a few days (Figure 14).
 - The thin phosphate pebble bed marks its rapid transition to the Upper Globigerina Limestone Member is absent from this region.
- Lower Globigerina Limestone
 - It consists of pale-yellow brown to yellow medium grained moderately weak massive, often intensely bioturbated limestone. A thin phosphate pebble bed

(sometimes two) and scour surface is developed at the top of the Lower Coralline Limestone. The rock is composed of whole and fragmented tests of microforaminifera. The macrofossils usually present are echinoid spines and echinoid tests and whole or fragmented bivalve shells. Trace fossils are commonly represented by *Thalassinoides*.

- This rock unit can be seen on the shore platform from the Beach Post on the east to the fault that interrupts the exposure on the west
- The Lower *Globigerina* Limestone in this region is about 20m thick.
- Thin Phosphate conglomerate bed marks the sharp transition to the Middle *Globigerina* Limestone Mb.

Phosphate pebble bed or conglomerates mark the contact between the Lower and Middle *Globigerina* and the contact between the Middle and Upper *Globigerina* Limestone Members. This bed is only about 3cm thick and is composed of small rounded brown granule to pebble-size clasts.

Quaternary deposits consist of brown calcrete crusts and a couple of consolidated small phosphate pebble dunes. The pebbles originate from the weathering of the phosphate pebble bed at the contact between the Lower *Globigerina* Limestone and the Middle *Globigerina* Limestone.



*Figure 10: Exposure of Lower *Globigerina* Limestone at the shore platform and a thin phosphate conglomerate bed succeeded upwards by the lowermost beds of the Middle *Globigerina* Limestone Mb*



Figure 11: Phosphate conglomerate bed seen in the foreground and Lower Globigerina Limestone exposed on the shore platform. The ex-Jerma Palace Hotel can be seen in the background



Figure 12: Photograph showing the trench that surrounds the San Tumas Tower which exposes Lower Globigerina Limestone at the base and Middle Globigerina Limestone (about 1.8m thick at the top)



Figure 13: Low cliff on the northern margin of St Thomas Bay about 6m high, exposing grey marls and marly limestone of the Middle Globigerina Limestone Mb



Figure 14: Photograph showing the colour and weathering properties of the Middle Globigerina Limestone Note the concoidal fractures

4.3.2 Assessment of Excavation Material

The rock samples examined on site were composed of good quality Lower Globigerina Limestone. This rock normally has an average unconfined compressive strength ranging from 8MPa to 20MPa.

Material from the proposed excavation is inert and may be used as aggregate for mass concrete. Nowadays; it is finding frequent use to rebuild rubble walls when available in average fragments of a size ranging from about 10cm to 30cm.

4.3.3 Slope Stability

The terrain at the site is flat and is composed of Lower Globigerina Limestone a competent rock which is not subject to any movement.

However, the rock is fractured and depending on discontinuity orientation with respect to the proposed excavation boundary it may be subject to collapse (Figure 15). Monitoring of excavation as it proceeds is recommended.

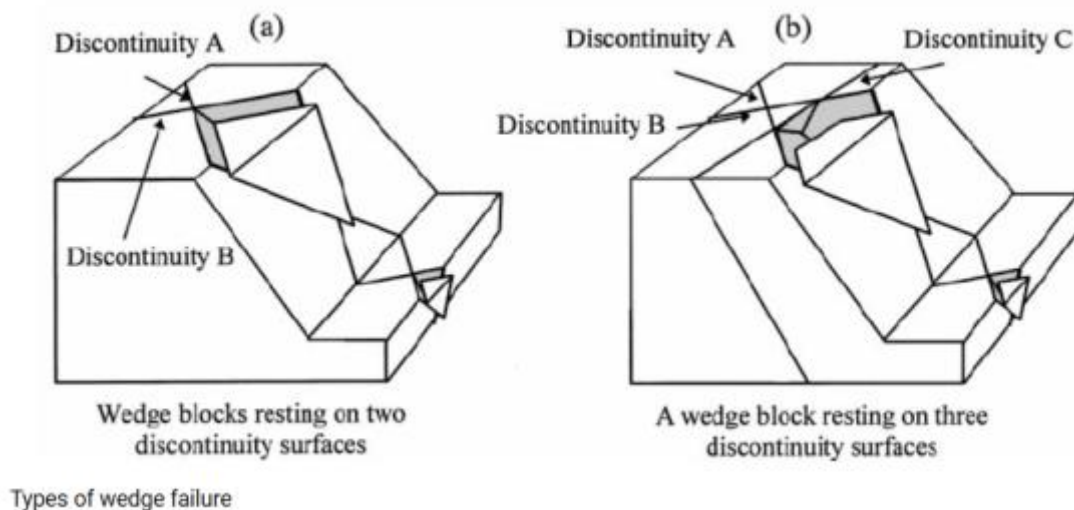


Figure 15: 3-D Diagrams showing typical rock wedge failure

4.4 Geomorphology and Soils

4.4.1 Geomorphologic Features

The main geomorphologic features within the area of influence of the site are (Figure 16):

- Rounded hill slope
 - The ex-Jerma Palace Hotel lies at the foot of the hill slope of Marsascala that takes the shape of a rounded hill with a nearly flat top and terminating at the shore platform that lines the coastline.
- Shore platform
 - The coastline close to the hotel is in the form a long shore platform that extends from the beach post on the south to il- Gzira and further north.
 - The phosphate pebble bed that marks the transition from Lower Globigerina Limestone to Middle Globigerina Limestone forms a weak bed. Hydraulic action of wave breakers act on this weak horizontal bed. Erosion of the weak overlying conglomerate bed thus exposes the top of the Lower Globigerina Limestone which is a flat surface. This contact recedes landward as the overlying bed is eroded, producing a planar surface which marks the shore platform.
 - The Lower Globigerina Limestone is bedded. North of the fault which raises the top of the Lower Globigerina, exposes bedding planes which when acted upon by the hydraulic action of wave breakers lift and break the limestone beds forming a boulder scree composed of planer rock slabs that mark the landward boundary of the shore platform.
 - As bedding planes are flat and have a horizontal attitude erosion also generate a roughly flat surface.
 - At the beach post minor NE-SW trending faults lower the top of the Lower Globigerina Limestone below sea level. The rock expose at sea level is Middle Globigerina Limestone.
 - Wave action on Middle Globigerina Limestone produces undermining and collapse of the overhanging marl and marly limestone beds. In this way wave action generates a cliff which bounds the northern margin of St Thomas Bay.
- Il-Gzira headland
- Low cliff exposing Middle Globigerina Limestone marls on the west shoreline of St Thomas Bay.

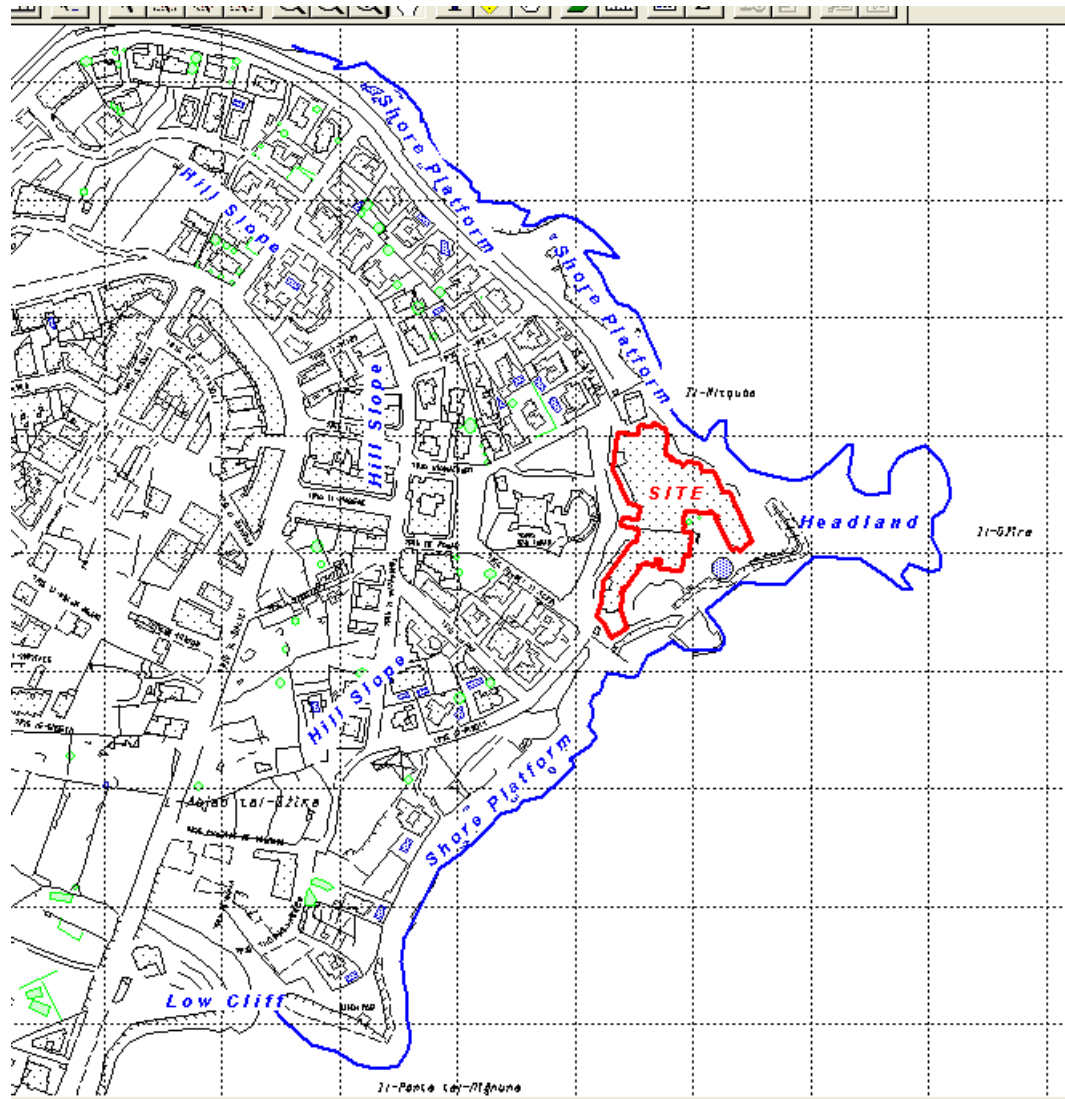


Figure 16: Map showing the geomorphological units in the environs of the ex-Jerma Palace Hotel



Figure 17: Photograph showing part of the shore platform that lines the coastline on the east of the Proposed Scheme. Note the boulders in the foreground and the ex-Jerma Palace Hotel in the background



Figure 18: Photograph showing part of the shore platform on the west of the proposed development. On the backshore the shore platform terminates at a low scarp composed of weathered Middle Globigerina limestone

4.4.2 Soils

The soils originally found in the area of influence and in the environs of the site are (Figure 19):

- Xaghra Series
- Tas-Sigra Series
- L-Inglin Complex
- San Biagio Soil Series

However, since the inception of Lang's soil map, with the exception of a corridor running along the coastline, most of the area of influence has been built up. Consequently, it can now be described as 'disturbed area'.

The only area that is not developed is the shore platform which in the Lang's soil map is represented by the Xaghra Soil Series consisting of a rocky shore platform composed of rock – exposed Lower Globigerina Limestone (Figure 21).

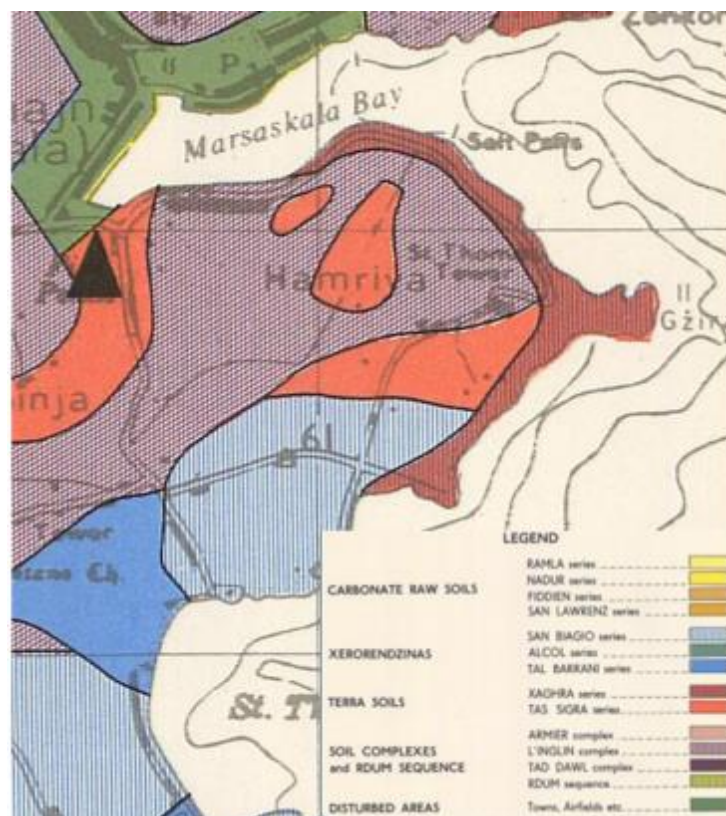


Figure 19: Lang's Soil Map (part of) of the site and its environs (Lang, 1962)



Figure 20: Plan of Marsascala showing that the site in the region of the ex Jerma Place Hotel is completely developed. (Source: <https://pamapserver.pa.org.mt/>)



Figure 21: Bare rock exposed at the coastline representing the Xaghra Soil Series

4.5 Hydrology and Hydrogeology

Important hydrological and hydrogeological characteristics relevant to the present reconstruction project are:

- The catchment upstream of the site

- The hydrological catchment upstream of the site is shown in Figure 22. It covers an area of approximately 105,000 m².
- Considering that the area is fully developed, the path taken by runoff is controlled by the road network.
- During a rain event on 2 Feb 2026, it was seen discharging next to the eastern margin of the ex-Jerma Palace Hotel.
- Runoff characteristics
 - The area upstream of the proposed development is a conical hill.
 - There are no watercourses. The flow of runoff is controlled by the road network.
 - Discharge is at the coastline and it is partly of a diffuse nature.
- The mean sea level aquifer
 - Fractured Lower Globigerina Limestone may act as an aquifer. However, the site lies at the coastline where the thickness of the Mean Sea Level Aquifer (MSLA) is zero (Figure 23), which means that the fractured rock underlying the site is saturated with seawater.
 - It is also noted that the site lies outside of the Mean sea level aquifer water protection zone (Figure 24).

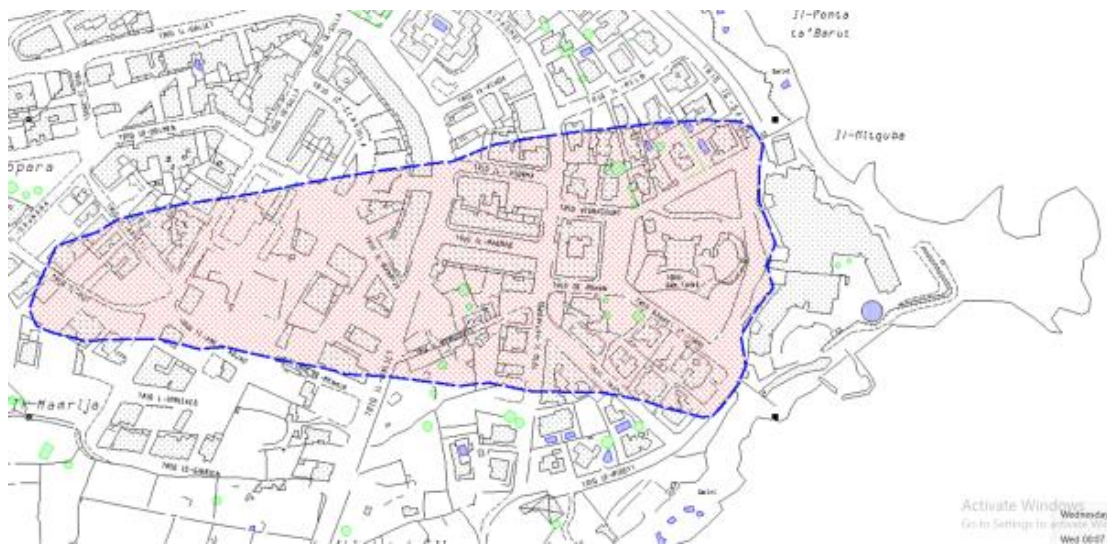


Figure 22: Map showing the catchment upstream of the site

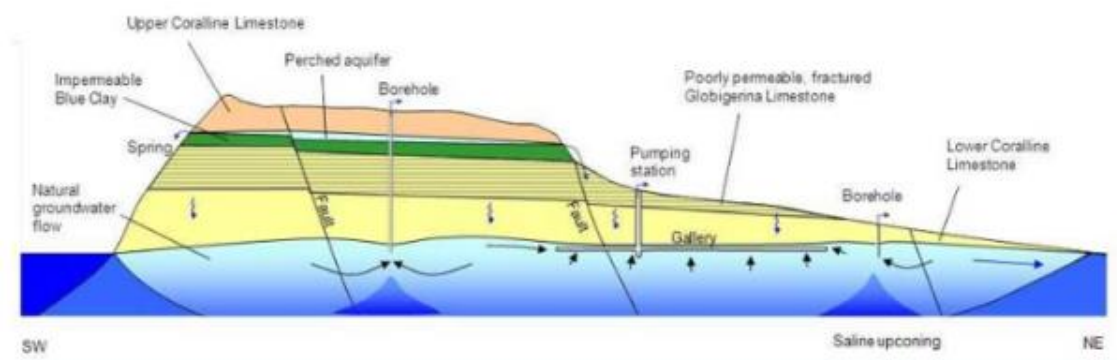


Figure 23: Cross section showing the ground water body tapering out at the coastline

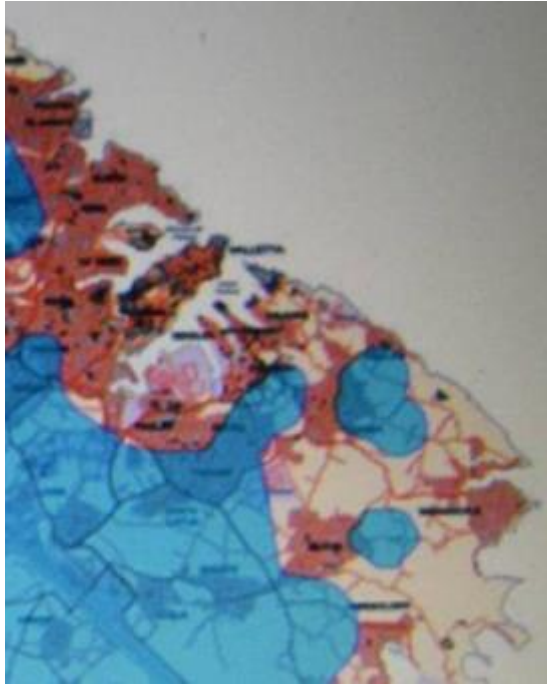


Figure 24: Map showing the groundwater protection zone in the region of Marsascala

5.0 Impact Assessment

In terms of geology geomorphology, hydrogeology, and soils, the geo-environmental impacts of proposed construction are likely to arise from the excavation and construction of proposed scheme. The impact of changes resulting from proposed construction on geology and geomorphology will mostly be restricted to the boundary of the site.

The potential impacts arising from the construction and operation of the proposed Scheme could include:

- Contamination of the mean sea level aquifer;
- Removal/degradation of stone beds containing important palaeontological features;
- Degradation of the geomorphology; and
- Degradation of the coastal waters

5.1 Construction Phase

The proposed excavation works will generate ca. 25,557m³ of bulk material (based on a bulking factor of 1.3). Once rock strata are extracted, they can never be replaced and take millions of years to be regenerated. Considering that the stone material to be extracted is of a considerable volume, the impact is considered to be of major severity.

The construction works shall also destroy / degrade any soil present on the shore platform. Since the site is already developed, the quantities of affected soil are expected to be relatively small. In light of this, the adverse impact is negligible.

During the excavation activities, the stability of the exposed walls could be compromised. Daylighting of natural joints can result in rock wedge failure. This constitutes a moderate adverse impact.

Since the Scheme is a redevelopment project, the geomorphology of the site has already been significantly altered in the past. However, the proposed additional excavation will further alter the sites geomorphology disrupting the once continuous shoreline feature. This further alteration constitutes a minor adverse impact.

In addition, the coastal salt pans could also be damaged by the movement of large machinery and inappropriate storage of materials or waste. However, since the salt pans are located outside of the building area, the likelihood of such damage occurring is low. Consequently, the adverse impact is considered to be minor.

As with all construction sites, there is a risk of spillage of fuel, lubricants, oils and other chemicals. These harmful liquids can easily penetrate into rock strata via open fissures., especially during excavation activities when the rock surface is exposed. This constitutes a moderate negative impact on the hydrogeology of the immediate and surrounding area.

There shall be no impact on palaeontology since the excavation material is Lower Globigerina Limestone, which is not renown for particular fossil beds.

5.2 Operational Phase

During operation there could be accidental leakage of sewer or other discharges; as well as spills of edible oils. Such effluents may percolate into the subsurface contaminating the geology and hydrogeology. Decontamination of rocks from oils and fats is difficult and costly. In light of this, the adverse impact is classified as moderate.

The shoreline salt pans will be easily accessible to members of the general public and those people visiting the Scheme facilities. This will put the structures at increased risk of potential damage, leading to alterations in the geomorphology. They will also be subject to potential littering. This constitutes a minor adverse impact.

The site is located on low ground, close to the shoreline meaning that it is vulnerable to sea level rise and exception storm waves. Current trends indicate a 1 cm per year local sea level rise. A sea level rise of 50 cm by 2050 and 100 cm by 2100 was assumed for the assessments and adaptation measures in the Maltese islands.

6.0 Monitoring & Mitigation

6.1 During Construction

Loss of Geological Strata

If the excavation waste is recycled, rather than disposed of, this will partially offset the adverse impact. Lower Globigerina Limestone can be recycled and used in the following ways:

- As an aggregate used in mass concrete;
- As a sub-base in road construction;
- Sizeable clasts can be used for the construction of rubble walls.

Loss of Soil

This may be mitigated by preserving it for later reuse during operation.

Rock Stability

The walls of the excavation should be monitored by a competent geologist for timely intervention if and when necessary.

Protection of Salt Pans

Containing the machinery movements and activities (including material and waste storage) within the site boundary, away from the salt pans will reduce the severity if this adverse impact.

Protection of Hydrogeology

By implementing environmentally good working practices on site, the risk of oil lubricant and chemical spillages and leaks are reduced. If such incidents were to occur, the provision of spill kits on site and prompt action will further mitigate the potential adverse impacts on the site and surrounding areas hydrogeology.

6.2 During Operation

Monitoring of Effluents

Periodic checks of effluents and second-class water effluent systems would ensure that no harmful substances are leaked to the ground. Groundwater analysis as part of the baseline study would produce a baseline water quality which would serve as a base for future monitoring of the water quality.

Liquid Storage

All potentially harmful liquids, most notably oils and fats, stored on site need to be stored and handled appropriately to minimise the likelihood of accidental spills occurring.

Protection of Salt Pans

Information boards should be installed in the salt pan areas advising people not to enter the salt pans.

6.3 Residual Impacts – The Cumulative Effect

Although a development site might be considered to have little impact on each of the components of the Geo-Environment: geology including mineral resources, geomorphology, palaeontology, geomorphology, soils, hydrology and hydrogeology - the residual impact is always present.

The building of a house or even perhaps a larger development site, nowadays accompanied by excavation for a basement will always be accompanied by:

- Loss in reserves of mineral resources
- Increase in waste stone material
- Loss of geological strata
- Loss of geomorphology
- Loss of soil
- Increase in run-off or decrease depending on availability of storm water storage reservoir/s
- Loss of recharge
- Loss of groundwater quality - leakage of sewers pollution of run-off e.g. traffic or acid rain
- Loss of recharge to the aquifers

All these impacts, arising from a single building or larger development site, might be very small indeed and would cause no significant change to the Geo-Environment when taken on a one –by- one basis. But collectively they would produce a town with all the accompanying cumulative negative impacts on the geo-Environment that are usually associated with towns and large villages.

7.0 Impact Summary Table

Table 7: Impact summary 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 Impact	Direct/Indirect/Cumulative	Beneficial/Adverse	Severity	Physical/Geographic Extent of Impact	Short/Medium/Long Term	Temporary/Permanent	Reversible/Irreversible					
Geology: loss of rock strata-Loss of mineral resources	Excavation	Construction	Rock strata	Low	Direct	Adverse	Medium	Site	Long	Permanent	Irreversible	Certain	Major	None. Marine Sedimentary rocks require millions of years to form	Major	Recycling and reuse of excavated material
Geomorphology: change in shore platform	Excavation	Construction	Shore platform	Low	Direct	Adverse	Medium	Site	Long	Permanent	Irreversible	Certain	Minor	N/A	Minor	/
Geomorphology: degradation / destruction of surface features	Various construction activities	Construction	Salt pans	High	Indirect	Adverse	High	Surrounding foreshore area	Long	Permanent	Irreversible	Unlikely	Minor	Isolate the site from the foreshore with appropriate hoarding	Negligible	/
Geomorphology: soils	Excavation	Construction	Soil	Medium	Direct	Adverse	High	Site	Long	Permanent	Irreversible	Remote	Negligible	Reuse soil on site	Negligible	/

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 Impact	Direct / Indirect / Cumulative	Beneficial / Adverse	Severity	Physical / Geographic Extent of Impact	Short / Medium / Long Term	Temporary / Permanent	Reversible / Irreversible					
Palaeontology	Excavation	Construction	Fossils	Medium	Direct	Adverse	Medium	Site	Long	Permanent	Irreversible	Remote	Negligible	/	N/A No known fossil beds of scientific importance	/
Hydrogeology: Pollution of water bodies	Spillage of oils & fuels	Construction	Rock strata and water bodies	Medium	Indirect	Adverse	High	Site and immediate surroundings	Medium	Temporary	Reversible	Possible	Moderate	Appropriate liquid storage and handling protocols on site	Minor	/
Stability of exposed walls	Excavation	Construction	Exposed rock faces	Medium	Indirect	Adverse	Medium	Site and immediate surroundings	Short	Temporary	Reversible	Remote	Moderate	Monitoring during excavation	Minor	Rock wedge stabilisation may not be permanent
Hydrogeology: Pollution of water bodies	Sewer/effluent leaks & oils/fats spills	Operational	Rock strata and water bodies	Medium	Indirect	Adverse	High	Site and immediate surroundings	Medium	Temporary	Reversible	Unlikely	Moderate	Appropriate liquid and effluent storage and handling protocols on site	Minor	Monitoring & maintenance of effluent infrastructures
Geomorphology: damage to salt pans	People walking in the salt pans	Operational	Salt pans	Medium	Direct	Adverse	High	Site and surrounding area	Long	Permanent	Irreversible	Possible	Minor	Installation of informati	Minor (reduced)	/

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 Impact	Direct / Indirect / Cumulative	Beneficial / Adverse	Severity	Physical / Geographic Extent of Impact	Short / Medium / Long Term	Temporary / Permanent	Reversible / Irreversible					
														on boards		

8.0 References

- BRGM Study of the Freshwater resources of Malta (1991)
- ATIGA Consortium Wastes Disposal and Water Supply Project Malta (1972)
- ERA 2015. The new Strategic Plan for the Environment and Development (SPED)
- ERA 2011: The Water Catchment Management Plan for the Maltese Islands
- J. Edelman The Conservation of Runoff Water (1968)
- MRA 1999-2000: Annual report
- MRA 2003-2004: Annual report
- MRA 2004, On the Development of "A Water Policy for the Future"
- MRA (LN XXX of 2006)- Licensing conditions of petroleum filling stations
- Lorenz, W. and Gwosdz, W, 2003. Manual on the Geological Technical Assessment of Mineral Construction Materials. Geol. Jb. Sonderhefte, SH15, 498p, 103 figs, 301 tables.
- Malta Environment and Planning Authority 2004, Structure Plan Review Public Consultation
- Hoek E., 2001 Practical Rock Engineering
- Rockscience 2004, DIPS 5 Interactive analysis of orientation based geological data.
- Planning Authority 1990, Structure Plan for the Maltese Islands
- 1996, Mineral resource Assessment