ESIA Italy
Section 8 Assessments of Impacts and Mitigation Measures
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8 ASSESSMENT OF IMPACTS AND MITIGATION MEASURES

8.1 Introduction

In accordance with the ESIA approach and Methodology (described in Section 5 of this report and detailed for each of the components in the Annex 6), the identification and assessment of the Project’s environmental and social impacts has been conducted in a phased approach applied throughout all the different phases of the Project (construction, operation and decommissioning) as well as unplanned events as follows:

- Overview;
- Potential Impacts;
- Mitigation Measurements analysis;
- Residual impacts assessment.

This approach has been applied to all the components potentially impacted by the various types of activity, together with their associated emissions and discharges where appropriate.

In line with the components identified in the baseline (Section 6) this will include the following:

- Offshore Physical Environment (Section 8.2);
- Offshore Biological Environment (Section 8.3);
- Offshore Socioeconomic and Cultural Heritage Environment (Section 8.4);
- Onshore Physical Environment (Section 8.5);
- Onshore Biological Environment (Section 8.6);
- Onshore Socioeconomic Environment (Section 8.7);
- Onshore Cultural Heritage (Section 8.8).
8.1.1 General Mitigation Measures

The EIA process is intended to reduce the negative impacts and enhance the benefits of an intended activity by identifying impacts and benefits and the ways of dealing with them during the planning and design stages of the project. In this assessment the mitigation hierarchy for planned events is as follows:

Table 8-1 Mitigation Hierarchy

<table>
<thead>
<tr>
<th>The Mitigation Hierarchy for Planned Project Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoid at Source; Reduce at Source</td>
</tr>
<tr>
<td>Avoiding or reducing at source is essentially ‘designing’ the project so that a feature causing an impact is designed out (e.g. a waste stream is eliminated) or altered (e.g. reduced waste volume). Often called minimisation.</td>
</tr>
<tr>
<td>Abate on Site</td>
</tr>
<tr>
<td>This involves adding something to the basic design to abate the impact - pollution controls fall within this category. Often called “end-of-pipe”.</td>
</tr>
<tr>
<td>Abate at Receptor</td>
</tr>
<tr>
<td>If an impact cannot be abated on-site then measures can be implemented off-site - an example of this would be to use the stand-by vessel to help control the level of interference with fishing activity.</td>
</tr>
<tr>
<td>Repair or Remedy</td>
</tr>
<tr>
<td>Some impacts involve unavoidable damage to a resource, e.g. vegetation disturbance. Repair essentially involves restoration and reinstatement type measures.</td>
</tr>
<tr>
<td>Compensate in Kind</td>
</tr>
<tr>
<td>Where other mitigation approaches are not possible or fully effective, then compensation, in some measure, for loss, damage and general intrusion might be appropriate.</td>
</tr>
</tbody>
</table>

The assessment of impact took into account a set of mitigation measures, implemented by TAP AG for each of the components potentially impacted. Component-specific measures are detailed in component specific Sections, in line with the aforementioned structure.

In contrast, general measures to reduce the impacts associated with the TAP Project are included in the following list which includes mitigation measures that are not component-specific (i.e. covering more than one of the component):

- Detailed route investigations
  - Route and associated infrastructure location selection
  - Restrict construction during certain periods/seasons at certain areas (i.e. touristic season)
  - Select working window to minimise impacts.
  - Minimise footprint wherever possible (e.g. narrower working strip)
  - Location of new roads, temporary accesses and work sites away from sensitive landscape locations
• Development of Environmental and Social Management Plans for construction, operation and decommissioning activities, including:
  o Waste Management Plan;
  o Soil Management Plan;
  o Emergency Response Plan;
  o Water Management Plan;
  o Traffic Management Plan;
  o Cultural Heritage Management Plan;
  o Pollution Prevention Plan;
  o Chemical Management Plan;
  o Health and Safety Management Plan;
  o Stakeholder Engagement Plan;
  o Livelihoods Restoration Plan;
  o Social and Environmental Investment Plan;
  o Workers Management Plan;
  o Infrastructure and Utilities Management Plan;
  o Community Health Management Plan;
  o Biodiversity Action Plan;
  o Landscape Management Plan.

• Early Stakeholder Engagement/ Continuous Stakeholder Engagement;
  o TAP’s Grievance Mechanism;
  o TAP’s Stakeholder Engagement Strategy;
  o TAP’s Corporate Social Responsibility (CSR) strategy;

• Use of best available techniques for the equipment and machineries used during construction and operation phases;

• Periodic maintenance of the equipment and machinery during each phase of the Project.
8.2 Offshore Physical Environment

8.2.1 Introduction

As defined in Section 6.2 the Italian offshore physical environment is characterised as the inshore Adriatic Sea. As such there is minimal tidal movement (range~0.4 m), a wave height maximum of ~3m, with the dominant conditions being calm (<0.5 m), and the predominant sediment being comprised of sand. The offshore pipeline route in Italian waters is approximately 45km in length, however the corridor of potential impact along the route fluctuates in terms of the project construction and operation scope (direct laying on sea bed, intervention works, shore approach method, etc.) and the physical environmental conditions (e.g. sediment types, bathymetry, etc.).

Predicted impacts in the Italian offshore physical environment will occur as a result of the following activities identified during the three initial phases of the Project. These include the following phases.

8.2.1.1 Construction and Pre-commissioning Phase

- Anchor handling (the need for anchoring depends on the type of vessel that will be used during construction)
- Seabed interventions for microtunnel construction and fibre optic cable (FOC) installation
- Pipe-laying
- Vessel movement
- Pipeline flooding, testing, dewatering, drying

Concerning the sea bed intervention works, the only planned activities on the sea bed during this project phase are the ones related to the microtunnel construction and the FOC installation.

The overall work for the microtunnel construction consist of the following 6 phases.

- Trenching/pre-dredging: at the microtunnel exit point, a trench will be prepared prior to the excavation. The trench will be 110 m long starting from the microtunnel exit point at 867 m from the shoreline. The overall volume of the excavation will be 15500 m³. This trench will have the aim of joining the microtunnel to the offshore pipeline. Furthermore it will facilitate the recovery of the boring machine at the microtunnel exit point.
- Microtunnel groundwork: groundworks, including excavation, will start at the worksite onshore and will finish at the microtunnel exit point, where the boring machine will reach the sea bottom at the beginning of the previously prepared trench.
- Boring Machine Recovery: the boring machine will be recovered once the excavation will have been completed.
- Pipe-laying: once the tunnel is excavated a section of the pipeline with the same length of the trench will be laid.
Gravel dumping: will be undertaken from the end of the excavated trench (977 m) to 1223 m from the shoreline, to facilitate the operation of pulling-in the pipeline through the microtunnel.

Backfilling: along the trench, the pipeline will be further covered with the sediments coming from the trenching/pre-dredging activities that were deposited aside the trench itself.

**Figure 8-1** Pipeline installation in nearshore section - schematic figure

The aforementioned workflow, representing the seabed work activities in the Italian offshore project section, will be indicated as ‘Seabed interventions for microtunnel construction’ or ‘Seabed intervention works’ in the following document sections.

The Fibre Optic Cable (FOC) will be installed parallel to the pipeline at approximately 50 m. The FOC, where necessary, will be buried 1 m beneath the seabed to protect against trawl fishing, ships anchoring and other activities. 0.5 m³/m of material is expected to be moved and backfilled where the FOC is buried. It is estimated that a total maximum volume of 22,500 m³ of material will be moved in the Italian Exclusive Economic Zone (EEZ).
8.2.1.2 Operational phase

- Pipeline presence on / in the seabed
- Routine inspections and maintenance work

The predicted impacts are identified and assessed as per each resource or receptor in the physical and biological environment. Impacts that are deemed to be of significance when they occur are assessed in full by means of the methodology presented in Annex 6. Impacts that are deemed to be insignificant based upon previous knowledge and experience in similar projects are described but not assessed in detail.

8.2.2 Oceanography and water quality

8.2.2.1 Overview

As defined in Section 6.2, the seawater temperature in the region has an annual average of 18.3°C, a minimum and maximum of 5.6°C and 31.0°C respectively. The salinity in the Italian offshore project area is saline water ranging between 38.33 psu at a depth of 1.2 m, and 38.58 psu at a depth of 21 m. The Italian offshore region has dissolved oxygen which varies little (ranging between 3.81 mg/l at a depth of -1.4 m at station, and 5.07 mg/l at a depth of -3.0 m) and is not oxygen deficient. Chlorophyll-a showed high concentrations which can be associated with eutrophic marine coastal areas, the values ranged between 2 μg/l and 5 μg/l, which whilst high for the Mediterranean is considered normal for other European waters which are not considered eutrophic. The metal concentrations recorded indicate that the water is free from heavy metal contamination, with metal levels also low in concentration within the sediment of the Italian offshore project area.

The oceanography in the Italian offshore environment is considered to have a low sensitivity throughout. The oceanographic parameters such as salinity, temperature and wave regime are known to support a number of species as such as fish, birds and marine mammals (assessed below in Section 8.3). However, these parameters are not considered to be particularly sensitive to change, provided no significant features of the water column and physical processes are reported. The main activities in the Italian offshore environment which are expected to have an impact on the oceanography of the project area will occur during the construction phase and, to a lesser extent, the pre-commissioning operational phase.

The following box shows the key sources of impact, potentially impacted resources and receptors, and baseline and project influencing factors associated with the impacts of the TAP Project on oceanography and water quality.
Box 8-1  Key Sources of Impact, Potentially Impacted Resources and Receptors

Sources of Impact

- Construction Phase: pipe-laying activities, anchor handling, seabed interventions for microtunnel exit construction resulting in re-suspension and spreading of sediments; routine and occasional discharges from support and installation vessels/barges to the marine environment.
- Operations and maintenance phase: external inspections and maintenance works resulting in sediment suspension in the vicinity of the pipeline.
- Decommissioning phase: the pipeline remains underground and is filled with a suitable material.

Potentially Impacted Resources and Receptors

- Sea water

Baseline Influencing Factors

- The oceanographic parameters such as salinity, temperature and wave regime are known to support a number of species.

Project Influencing Factors

- Specific techniques used for micro tunnelling, trench excavations, direct seabed positioning and waste and construction management.

The following table presents the key potential impacts of the TAP Project on oceanography and water quality during the key project phases.

Table 8-2  Key Impacts – Oceanography and water quality

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Temporary re-suspension of sediments with associated effects on water column.</td>
<td>- Release of pollutants.</td>
<td>- None</td>
</tr>
<tr>
<td>- Potential temporary decreasing of seawater quality by liquid effluents.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Each potential impact has been expanded in the following paragraphs, providing information on the magnitude and the mitigation measures built into the Project.

8.2.2.2  Construction and Pre-commissioning Phase

The following sources of potential impact have been identified for the construction and pre-commissioning phase of the project. The sources listed below could potentially cause impacts on water quality.
Table 8-3 Oceanography and Water Quality Impact Sources - Construction and Pre-commissioning Phase

<table>
<thead>
<tr>
<th>Source of Potential Impact</th>
<th>Potential Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe-laying</td>
<td>Temporary limited disturbance of sediment with resulting increase of turbidity</td>
</tr>
<tr>
<td>Anchor handling</td>
<td>Temporary limited disturbance of sediment with resulting increase of turbidity</td>
</tr>
<tr>
<td>Seabed interventions for microtunnel construction and FOC installation</td>
<td>Temporary disturbance and subsequent re-suspension of sediments together with the associated compounds such as nutrients and contaminants (water column) with resulting increase of turbidity.</td>
</tr>
<tr>
<td>Routine and occasional discharges from support and installation vessels/barges to the marine environment</td>
<td>Potential temporary decreasing of seawater quality by liquid effluents.</td>
</tr>
</tbody>
</table>

Using the above sources, the following potential impact led assessment was completed for oceanography and water quality, in which all sources of impact are grouped so that an overall assessment can be made of the key impacts associated with the project as outlined at the beginning of the section.

8.2.2.2.1 Potential Impacts

Impacts upon the water column during the construction phase are limited to the re-suspension and spreading of sediments resulting in an increase in turbidity and the possible release of contaminants (heavy metals & organic pollutants) and nutrients as a result of pipe-laying, anchor handling and seabed intervention works.

Increase in Turbidity

Seabed intervention works will result in the disturbance and subsequent re-suspension of sediments together with the associated compounds such as nutrients and contaminants, which may be present. This would increase the turbidity levels as well as compound concentration in the water column. Sediments are re-suspended for a period of time before being deposited elsewhere. Certain types of sediment are generally prone to suspension due to their fine textures. Areas with sandy bottoms are expected to experience less re-suspension and spreading of sediments.

Activities that are expected to disturb the seabed include pipe-laying, anchor handling, seabed interventions for microtunnel construction and FOC installation. The latter activities are expected to generate the most re-suspended sediment, whilst pipe-laying and anchor handling are expected to contribute very little. The amount of sediment disrupted is highly dependent on the methods and equipment used during the pipeline installation phase, as well as the extent of the construction works.

Pipe-laying can result in minor re-suspension and spreading of sediments due to the current generated in front of the pipeline as they near the seabed as well as from the pressure transfer when the pipeline hit the seabed.
Pipe-laying activities will extend along the entire length of the pipeline, but anchor handling will only be used up to the 300m depth contour, that correspond to a distance of about 25 km to the shoreline. Impacts deriving from these activities are similar to the bottom trawling activities (dragging of trawls along the seabed) and to normal anchoring in the Adriatic Sea. During any anchor placement and retrieval that should occur, and assuming a sediment density of 1,500 kg/m³, approximately 0.1 m³ of sediment will be placed in suspension during each activity per anchor on average. Anchoring activities will add small contribution to the overall amount of re-suspended sediment anticipated during the construction phase.

Seabed intervention for the microtunnel construction is anticipated to be the activity leading to higher levels of sediment suspension and dispersion.

Concerning excavation works, they will be performed from the onshore part in rocky formations; therefore they will not produce sediments dispersion. Boring machine recovery and rock dumping will have negligible impacts on water turbidity, as well as pipe-laying.

A sediment dispersion simulation based on the 3D model MIKE 3 HD FM was performed by the Danish Hydraulic Institute to estimate the impacts of trenching and backfilling activities (see Annex 10 – Sediment Dispersion). Simulations of hydrodynamic fields and sediment dispersion pattern have been conducted for two representative scenarios of current, temperature and salinity conditions, taking into consideration the nature of the dredged material and assumptions on the spill location and the spill rate.

In the autumn/winter scenario, the plume (Suspended Sediment Concentration > 0.002 g/l, threshold under which sediment concentration cannot be considered reliable) during trenching/dredging operations, has an extension of around 210 m along route, and 130 m across route, and it is approximately centred on the dredged area. The maximum SSC is along the dredging stretch, with values locally exceeding 0.008 g/l. In the layer immediately above the seabed layer, therefore, the SSC is not relevant. During backfilling operations, at the seabed, the plume has an extension of around 150 m along route, and 240 m across route. The extension of the plume is approximately centred on the backfilled area. The maximum SSC can be found along the backfilling stretch, with values locally exceeding 0.015 g/l. These SSC values (0.002-0.020 g/l) are within background variability of coastal areas.

In the spring/summer scenario, the plume during trenching/dredging operations has an extension of around 120 m along route, and 180 m across route, and it is approximately centred on the dredged area. The maximum SSC is along the dredging stretch, with values locally exceeding 0.010 g/l. In the layer immediately above the seabed layer, the SSC is not relevant. During backfilling operations, at the sea bed, the plume has an extension of around 150m along route, and 210 m across route. The extension of the plume is approximately centred on the backfilled area. The maximum SSC can be found along the backfilling stretch, with values locally exceeding 0.015 g/l.
The maximum value of bed thickness change is about 3 mm, corresponding to a total net deposition accumulated of about 580 g/m². The maximum settling is reached along the pipeline route, in the middle of the dredging area. A bed thickness change greater than 0.2 mm can be found over a distance of 180 m along route, and 350 m across route. The extension of this area spreads clearly towards the south-east (mean direction of the main current). On the whole, the total increase of thickness from re-deposited sediments obtained by modelling application during dredging and backfilling operations, in both scenarios, is very similar.

The sediment dispersion modelling refers to the fine fraction, considering that the sand fraction is expected to be deposited close to the release point. Through simple desktop calculations involving settling velocity and current velocity, most of the released sand fraction will settle in the first 50 m from the release zone. A rough estimation for the dredged area brings approximately 50,200 g/m² of settled sand within the 50 m radius area, during the dredging operations, and the same amount during the backfilling operations. More details are given in Annex 10 – Sediment Dispersion.

**Release of Contaminants**

Contaminants (identified as cadmium, mercury, lead, zinc, copper, arsenic, chromium, nickel, Polycyclic Aromatic Hydrocarbons (PAH) and tributyltin) are present in the Italian offshore environment in low background levels as demonstrated through the survey campaign carried out in 2013.

Contaminants have the ability to be mobilised into the water column but would generally be diluted. Moreover, release of contaminants will have limited extent and duration given that seabed interventions are limited to microtunnel construction and FOC installation. Furthermore, in excavation activities the spoils will be removed through a closed loop slurry system. No resulting slurry dispersion is expected; while dispersion from trenching/pre-dredging activities will be similar to natural movements of water due to the low/background concentrations.

**Release of Nutrients**

A release of nutrients, such as nitrogen and phosphorus, during the re-suspension and spreading of sediment could stimulate phytoplankton production, should they reach the photic zone, and thereby increase the biomass. An increase in primary production due to the release of nutrients could also potentially contribute to oxygen consumption by degradation of organic matter. A release of oxygen-consuming compounds during trenching may aggravate potential situations with local oxygen deficiency at the sea bottom, these may act in accumulation with natural phenomena such as storms and levels are not expected to increase significantly beyond background levels.
Contamination from wastewater and waste disposal systems from vessel operations

During construction there will be the following routine and occasional discharges from support and installation vessels/barges to the marine environment that may locally affect water quality:

- Treated sewage, grey water and kitchen waste;
- Open drainage systems and bilge water potentially containing traces of hydrocarbons.

**Sewage, Grey Water and Kitchen Waste**

Treated sewage will be discharged into the water or taken onshore for treatment depending on distance to coast and according to MARPOL regulations. Macerated food wastes will also be disposed overboard beyond 12 miles from the coast or taken onshore for treatment. These streams will introduce small quantities of nutrients and organic material to well-mixed, well-oxygenated surface open waters. Grey water (water from showers, baths, washbasins and the galley) is disinfected prior to disposal overboard.

All discharges will be carried out in accordance with relevant legislation (relevant MARPOL requirements and provisions specified in its Annex IV – Sewage – and Annex V – Garbage).

**Drainage and bilge water**

The drainage systems will collect water generated from washing and the storage areas. The effluent will be treated and discharged only with a concentration less than 15 ppm oil in water, (in accordance with MARPOL Annex I).

8.2.2.2 Mitigation Measures

Due to the limited extent and duration of seabed interventions and that such work will only occur at specific points along the pipeline route, identified impacts are considered to be negligible or of small magnitude and therefore no mitigation measures will be implemented, with the exception of general mitigation measures listed in the previous Section 8.1.

8.2.2.3 Residual Impacts

*Table 8-4* presents a summary of residual impacts.
Table 8-4  Residual Impacts

<table>
<thead>
<tr>
<th>Impact</th>
<th>Mitigation Commitments to Address the Impact*</th>
<th>Significance of Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oceanography and Water Quality Impact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase in turbidity</td>
<td>None</td>
<td>Minor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Limited extent and duration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Seabed intervention works only at specific points</td>
</tr>
<tr>
<td>Release of contaminants</td>
<td>None</td>
<td>Not significant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Limited extent and duration of sediment disturbance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Low background levels of contaminants</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Seabed intervention works only at specific points</td>
</tr>
<tr>
<td>Release of nutrients</td>
<td>None</td>
<td>Not Significant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Amount released during construction similar to that produced by natural phenomena in coastal waters such as storms</td>
</tr>
<tr>
<td>Contamination from wastewater</td>
<td>None</td>
<td>Not Significant</td>
</tr>
<tr>
<td>and waste disposal systems</td>
<td></td>
<td>• Limited extent and duration</td>
</tr>
<tr>
<td>from vessel operations</td>
<td></td>
<td>• Low intensity</td>
</tr>
</tbody>
</table>

The sensitivity of seawater as a receptor to the impacts listed above is considered to be low, while impact magnitude and impact significance, summarised in Table 8-4, are reported in the following paragraphs.

**Increase in Turbidity**

Due to the limited extent and duration of increased turbidity levels, and the fact that seabed interventions are limited to microtunnel construction and FOC installation, the impact (negative and direct due to a change in the resource) on the water column in Italian Offshore environment is expected to be local, of temporary duration and of small magnitude. On this basis, impact significance is expected to be **minor**. Impacts will be reversible within a few days as sediment settles to the seabed.
Release of Contaminants

Considering:

- the limited extent, low background levels of potential increase in pollutant concentrations;
- the short duration of potential increase in pollutant concentrations;
- the fact that seabed intervention works will only occur at a specific location along the pipeline route;

The impact (negative and direct) of the release of contaminants is expected to be at a local scale, of temporary duration and of low intensity. Impact magnitude will be very small. Impact significance is expected to be not significant. Impacts will be reversible within a few days. The proposed activities will not result in the increase of contaminants in the Adriatic Sea during seabed intervention but they would potentially be active in their relocation.

Release of Nutrients

Nitrogen, Phosphorus, and Total Organic Carbon concentrations were below the applicable Limits of Detection for all sampled locations during the sampling campaign 2013. Low concentrations of dissolved organic carbon and nutrients are typical of Southern Adriatic waters which receive relatively low anthropogenic inputs. They are rarely subject to eutrophication and widely considered as oligotrophic in nature. The total input of both nitrogen and phosphorus into the Adriatic Sea annually, the amount expected to be released during construction and the amount removed by commercial fishing is expected to be broadly similar. Impact magnitude is small. Based upon such comparisons, the impact of nutrient release on the water column during construction is expected to be not significant.

Contamination from Wastewater and Waste Disposal Systems from Vessel Operations

Discharges of treated waste into the offshore environment will be of limited magnitude and duration. Any impact (negative and direct) of the release of residual contaminants is expected to be at a local scale, of temporary duration, and of low intensity. Impact magnitude is considered small. Impact significance is expected to be not significant. Impacts will be reversible within a few days.

8.2.2.3 Operations and Maintenance Phase

Impacts upon the water column during the operation phase are limited to the transfer of heat that is generated by the movement of natural gas within the pipeline as well as the release of pollutants from anti-corrosion anodes in place on the pipeline. The sources listed below could potentially cause impacts on water quality.
Table 8-5  Oceanography and Water Quality Impact Sources –Operations and Maintenance Phase

<table>
<thead>
<tr>
<th>Source of Potential Impact</th>
<th>Potential Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Movement of natural gas within the pipeline</td>
<td>Transfer of heat to the water column</td>
</tr>
<tr>
<td>Presence of anti-corrosion anodes on the pipeline</td>
<td>Potential release of Ions</td>
</tr>
</tbody>
</table>

The following potential impact led assessment has been completed from the above sources for water resources where all sources of impact are grouped, so that an overall assessment can be made of the key impacts associated with the project as outlined at the beginning of the section.

8.2.2.3.1 Potential Impacts

Impacts upon the water column during the operation phase are limited to the transfer of heat that is generated by the movement of natural gas within the pipeline as well as the potential release of ions from anti-corrosion anodes in place on the pipeline.

**Transfer of Heat**

An increase of gas temperature is expected at the compressor terminal in Albania as a result of the natural gas heating during compression. Comparable pipelines in operation show that the temperature increase is a maximum of 0.5°C in the water near the seabed and in the water on the downstream side of the pipeline, in respect to the tidal current direction, up to a distance of 0.5 to 1 m from the pipeline. It is expected that the gas will expand as it moves further away from the Albanian landfall and thus decrease in temperature. Consequently the impacts on the Italian offshore environment are deemed **not significant**.

**Release of Ions**

The potential impacts on water quality from pipeline anodes are related to the release of metal ions from the anode material during the lifetime of the pipeline. Comparable data from pipeline in operation show that the expected release of ions and their effect on the water column are insignificant compared with other sources of metals to the sea. Therefore a substantial change in the aforementioned concentrations is not foreseen after the planned activities.

8.2.2.3.2 Mitigation Measures

None necessary.
8.2.2.3.3 Residual Impacts

Table 8-6 presents a summary of the residual impact

<table>
<thead>
<tr>
<th>Impact</th>
<th>Mitigation Commitments to Address the Impact*</th>
<th>Significance of Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oceanography and Water Quality – Operation and Maintenance Phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transfer of heat</td>
<td>• None</td>
<td>Not significant</td>
</tr>
<tr>
<td>Release of ions</td>
<td>• Installation of anodes at regular intervals along the pipeline.</td>
<td>Not significant</td>
</tr>
</tbody>
</table>

The sensitivity of the resource seawater is considered to be low, while impact magnitude and impact significance, summarised in Table 8-6, are reported in the following paragraphs. The criteria are reported in Annex 6 Baseline and Impact Assessment Methodology.

Transfer of heat

The impacts on the water column in the Italian Offshore environment are expected to be not significant.

Release of ions

Comparable data from pipeline in operation show that the expected release of ions and their effect on the water column are not significant compared with other sources of metals to the sea. Impact magnitude is small. Based on these it is concluded that there is no significant risk posed by the release of compounds from anodes. As such, the impacts on the water column are deemed to be not significant.

8.2.2.4 Decommissioning Phase

For the pipeline decommissioning, considering that the pipes will remain underground/on the sea bed, the related impacts on water resources will be not significant.
8.2.3 Climate and Air Quality

8.2.3.1 Overview

The impacts of pollutants released into the atmosphere are well documented, and operate on a local, regional and global scale. The Adriatic Sea experiences a seasonal pattern of precipitation and air flow, with stronger north-easterly winds throughout the year and less intense western and north-westerly winds. Therefore, any pollutants released into the atmosphere above the Adriatic Sea will be rapidly transported offshore towards the eastern part of the Adriatic.

At a local scale, hydrocarbons (HC) and nitrous oxides (NO\textsubscript{x}) can have negative effects on human health, and formation of low-level ozone as a result of HC emissions is also known to damage health, crops and buildings. However, since the receptors for local impacts of pollutants are largely terrestrial (including humans), and the source of these impacts for the TAP Project would be marine, these impacts are considered to be not significant.

At a regional and global scale, the main activities with potential to impact the atmosphere, and subsequently impact on marine and terrestrial receptors, are expected to occur during the construction phase and, to a lesser extent, during the operational and pre-commissioning phases.

The following box shows the key sources of impact, potentially impacted resources and receptors, baseline and project influencing factors associated to the impacts of the TAP project on climate and air quality. In particular this section addresses the principal issues (potential impacts), proposed mitigation and management measures and then discusses the residual environmental impacts of project construction and operations activities relating to climate and air quality.

During the development of the pipeline route, the Project has sought to avoid, minimise and mitigate impacts on marine environment in line with the Italian Decree 152/06, and EBRD standards.
Box 8-2  Key Sources of Impact, Potentially Impacted Resources and Receptors

**Sources of Impact**
- Construction phase: vessel operations resulting in emissions of pollutant gases.
- Operations and Maintenance Phase: external inspections (ROV) resulting in vessels operations resulting in emissions of pollutant gases.
- Decommissioning Phase: pipes remain underground and are filled with a suitable material.

**Potentially Impacted Resources and Receptors**
- Climate and Air Quality

**Baseline Influencing Factors**
- Adriatic Sea seasonal pattern of precipitation and air flow, with stronger north-easterly winds throughout the year and less intense western and north-westerly winds.

**Project Influencing Factors**
- Specific techniques used for micro tunnelling, trench excavations, direct seabed positioning and waste and construction management.

*Table 8-7* presents the key impacts of the TAP Project on the climate and air quality during the key project phases.

**Table 8-7  Key Impacts – Climate and Air Quality**

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Emissions of pollutant gases ($NO_x$, $CO_2$ and $SO_2$) potentially affecting climate and air quality</td>
<td>• Emissions of pollutant gases ($NO_x$, $CO_2$ and $SO_2$) potentially affecting climate and air quality</td>
<td>• None expected</td>
</tr>
</tbody>
</table>

8.2.3.2  Construction and Pre-commissioning Phase

For the construction and pre-commissioning phase of the project the following impact sources have been identified. Without mitigation, the sources listed below have the potential to cause impacts on climate and air quality.

**Table 8-8  Climate and Air Quality - Construction and Pre-commissioning**

<table>
<thead>
<tr>
<th>Source of Potential Impact</th>
<th>Potential Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vessel operations</td>
<td>Emissions of pollutant gases ($NO_x$, $CO$, $CO_2$, VOC, PM, and $SO_x$) potentially affecting climate and air quality</td>
</tr>
</tbody>
</table>

From the above sources, the following potential impact-led assessment has been completed for climate and air quality where all sources of impact are grouped so that an overall assessment can be made of the key impacts associated with the project.
8.2.3.2.1 Potential Impacts

**Impacts on local air quality due to marine vessels emissions: Overview**

At a national scale, emissions of NO\textsubscript{x}, SO\textsubscript{2} and CO\textsubscript{2} contribute to acidification which can damage sensitive ecosystems in both terrestrial and marine environments. Due to the high water exchange, the Adriatic Sea is moderately susceptible to the impacts of acidification. Also at a national scale, NO\textsubscript{x} emissions can contribute to eutrophication due to increased nutrients in water, and this could ultimately lead to oxygen depletion and suffocation of fish and other marine life forms. Shipping, road transportation and energy combustion are the main sources of nitrogen oxide emissions in the region.

At a global scale, release of CO\textsubscript{2} and some hydrocarbons from the burning of fossil fuels contribute to the greenhouse effect, which in turn causes global warming. It is estimated that shipping may account for 1.8% of the global contribution of CO\textsubscript{2} emissions. The main source of emissions to the atmosphere during the construction phase of the Project will be the diesel and heavy fuel oil used by the construction fleet.

Emissions associated with the TAP Project (based on offshore marine activities only) are predicted to be most intense during the construction phase. In terms of local air quality the highly dispersive nature of the marine environment and the absence of local receptors determine the insignificance of the impact.

**Quantification of Vessels emissions**

The Project construction phase anticipates the activity of vessels for the construction of the offshore pipeline. *Table 8-9* shows the number and type of vessels envisaged by the project along with information on their installed power and number of working days.

**Table 8-9 Vessels Involved in the offshore pipeline construction**

<table>
<thead>
<tr>
<th>Type of Vessel</th>
<th>Number</th>
<th>Working hours per day</th>
<th>Timing (days)</th>
<th>Power [MW]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backhoe dredge</td>
<td>1</td>
<td>24</td>
<td>5</td>
<td>18</td>
</tr>
<tr>
<td>Motopontoon</td>
<td>4</td>
<td>24</td>
<td>15</td>
<td>8</td>
</tr>
<tr>
<td>Pipelay barge</td>
<td>1</td>
<td>24</td>
<td>15</td>
<td>20.5</td>
</tr>
<tr>
<td>Anchor Handling Tug</td>
<td>3</td>
<td>24</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>Pipe carrier Barge</td>
<td>3</td>
<td>8</td>
<td>15</td>
<td>7</td>
</tr>
<tr>
<td>Supply vessel</td>
<td>3</td>
<td>8</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>Survey vessel</td>
<td>1</td>
<td>8</td>
<td>15</td>
<td>8</td>
</tr>
<tr>
<td>Crew boat</td>
<td>1</td>
<td>8</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Dive Support Vessel</td>
<td>1</td>
<td>8</td>
<td>5</td>
<td>11.5</td>
</tr>
<tr>
<td>Fall pipe vessel</td>
<td>1</td>
<td>24</td>
<td>3</td>
<td>6.5</td>
</tr>
</tbody>
</table>
The impact on local air quality produced by the project induced ship transport emissions has been qualitatively assessed by mean of an estimation of vessels emissions followed by a comparison with the regional emission inventory and with international and national guidelines on atmospheric emissions.

The calculation of ship transport emissions was based on the Methodology for Estimate Air Pollutant Emissions from Transport (MEET). The detailed MEET method for the calculation of ship transport emissions has been applied based on the Project data on vessels activity for the construction of the offshore pipeline. The total emissions from vessels for each macro pollutant have been calculated. Results are presented in Table 8-10.

**Table 8-10 Estimate of air pollutant Emissions from vessels**

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Ton emitted</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO\textsubscript{x}</td>
<td>75.09</td>
</tr>
<tr>
<td>CO</td>
<td>83.58</td>
</tr>
<tr>
<td>CO\textsubscript{2}</td>
<td>4293.23</td>
</tr>
<tr>
<td>VOC</td>
<td>19.44</td>
</tr>
<tr>
<td>PM</td>
<td>1.61</td>
</tr>
<tr>
<td>SO\textsubscript{x}</td>
<td>1.07</td>
</tr>
</tbody>
</table>

In terms of air quality, the dispersion of these emissions is rapid in an offshore environment, and background levels are reached close to the source. Additionally, emissions from vessels will be mobile and this will increase the dispersion of pollutants. No local effects on air quality are expected, and the impact is assessed as **not significant**.

In quantitative terms, the temporary predicted pollutants emissions are not significant if compared with the general emissions from maritime traffic in this area; the most recent data on vessels emission on the Brindisi province, in which the main port of the area is located, are available for the year 2005 from the Italian Environmental Agency Atmospheric Emission Inventory (APAT – INEMAR) and are presented in Table 8-11.

**Table 8-11 Marine Vessel Emission inventory for the years: 2005**

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>2005 [Ton]</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO\textsubscript{x}</td>
<td>459.85</td>
</tr>
<tr>
<td>NO\textsubscript{x}</td>
<td>2 846.32</td>
</tr>
<tr>
<td>NM-VOC</td>
<td>1 873.22</td>
</tr>
<tr>
<td>CO</td>
<td>5 627.45</td>
</tr>
<tr>
<td>CO\textsubscript{2}</td>
<td>289 902.52</td>
</tr>
<tr>
<td>PM10</td>
<td>317.42</td>
</tr>
</tbody>
</table>

*Source: Italian Environmental Agency Atmospheric Emission Inventory (APAT – INEMAR)*
8.2.3.2.2 Mitigation Measures

Given that identified impacts are considered to be negligible, no specific mitigation measures are required (with the exception of general mitigation measures listed in the previous Section 8.1.)

8.2.3.2.3 Residual Impacts

*Table 8-12 presents a summary of residual impacts.*

**Table 8-12 Residual Impacts**

<table>
<thead>
<tr>
<th>Impact</th>
<th>Mitigation Commitments to Address the Impact*</th>
<th>Significance of Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate and Air Quality Impact – Construction and Pre-commissioning Phase</td>
<td>• CO₂ and Pollutant gas emissions will be reduced where possible, by using state of the art equipments.</td>
<td>Not significant</td>
</tr>
<tr>
<td>Emissions to the atmosphere damaging flora and fauna</td>
<td></td>
<td>Residual impact on atmospheric CO₂ and Pollutants gas levels.</td>
</tr>
</tbody>
</table>

The sensitivity of the climate and air quality as a receptor to the above listed impacts is considered to be moderate, while impact magnitude and impact significance, summarised *Table 8-12*, are reported in the following paragraphs. The criteria are reported in Annex 6 Baseline and Impact Assessment Methodology.

After implementing general mitigation measures (specific measures are not planned) to minimise atmospheric emissions, there will still be a residual impact on atmospheric CO₂ levels, which will take place at a regional and global scale and over a long duration. This impact will be cumulative. However, since the annual release of CO₂ from vessel activities during construction will be low, relative to current emissions deriving from the marine traffic in the area, the impact magnitude is considered to be very small and impacts on the atmosphere from construction activities in the Italian Offshore environment are expected to be not significant.

8.2.3.3 Operations and Maintenance Phase

During the operational phase in the Italian offshore environment, external inspections, maintenance works will have associated pollutant emissions. Sources listed below could cause potential impacts on climate and air quality.

**Table 8-13 Climate and Air Quality – Operation and Maintenance Phase**

<table>
<thead>
<tr>
<th>Source of Potential Impact</th>
<th>Potential Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>External inspections with associated pollutants emission.</td>
<td>Emissions of pollutant gases (NOₓ, CO₂ and SO₂) potentially affecting climate and air quality</td>
</tr>
</tbody>
</table>
From the above sources, the following potential impact-led assessment has been completed for the climate and air quality where all sources of impact are grouped so that an overall assessment can be made of the key impacts associated with the project as outlined at the beginning of this section.

8.2.3.3.1 Potential Impacts

During the operational phase in the Italian offshore environment, external inspections and maintenance works will have associated pollutant emissions, similar to those during construction (emissions from vessels associated with routine inspections and maintenance).

8.2.3.3.2 Mitigation Measures

Given that identified impacts are considered to be negligible, no other specific mitigation measures have been defined in addition to general mitigation measures listed in the previous Section 8.1.

8.2.3.3.3 Residual Impacts

Table 8-14 presents a summary of residual impacts.

Table 8-14 Residual Impacts

<table>
<thead>
<tr>
<th>Impact</th>
<th>Mitigation Commitments to Address the Impact *</th>
<th>Significance of Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate and Air Quality Impact – Operation and Maintenance Phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emissions of pollutant gases (NOx, CO2 and SO2) potentially affecting climate and air quality</td>
<td>• CO2 and Pollutant gas emissions will be reduced where possible, by using state of the art equipments.</td>
<td>Not significant • Residual impact on atmospheric CO2 and Pollutants gas levels.</td>
</tr>
</tbody>
</table>

*) Mitigation measures in italic will be developed in a further stage of the project.

As outlined above, the sensitivity of the resource climate and air quality is considered to be moderate, while impact magnitude and impact significance, summarised in Table 8-14, are reported in the following paragraphs. The criteria are reported in Annex 6 Baseline and Impact Assessment Methodology.

Emissions associated with routine inspections and maintenance operations, will be much lower than for the construction phase although the duration of these activities will be much longer (50 years). Therefore, magnitude is considered to be small and impacts on the atmosphere from operation activities in the Italian offshore environment are expected to be not significant.

8.2.3.4 Decommissioning Phase

For the pipeline decommissioning, considering that the pipe will remain under/on the sea bed, the related impacts on climate and air quality will be not significant.
8.2.4 Seabed Geology and Morphology

8.2.4.1 Overview

The analysis of Apulian Adriatic seabed morphology shows that, with the exception of the area between Brindisi and San Cataldo, the seabed is typically characterized by a steep slope between the coast and the 50 m isobath. The seabed is generally flat or gently sloping below the 50 m isobath until it reaches the edge of the continental shelf around the 150 m isobath.

The seabed in the Italian offshore environment supports a range of marine fauna and flora. A comparison between the primary survey data and the literature regarding contamination of the surrounding area shows that the occurrence of metals is low, especially compared with that reported in other coastal areas affected by human activities, with the exception of iron. The field survey carried out in 2013 showed concentration values statically within the threshold levels from literature for metals in all the near shore sampled locations. The rate of sediment supplied by the Po and Apennine rivers reflects climatic and human impacts on catchment erosion. The mineralogical composition of the Adriatic clay sediments consists, typically, of illite and smectite as main components (70-80% of the total), with minor amounts of chlorite and kaolinite, and occasional low percentages of serpentine. As a result of the nearshore field survey 2013, the results showed a grain size distribution of 40-75% sand with peaks of > 80%, 40-60% silt – clay; null to 25% gravel. Further details are provided in section 6.2.

The seabed in the Project area is considered to have a low morphological sensitivity throughout. Since there are no known significant features of the seabed itself in the region, the seabed itself is not considered to be particularly sensitive to change.

The main activities during the Project which are expected to impact on the morphological elements of the seabed will occur during the construction phase and, to a lesser extent, the operational phase. No impacts are predicted for the pre-commissioning phase.

The following box presents the key sources of impact, potentially impacted resources and receptors, baseline and Project influencing factors associated to the impacts of the TAP Project on seabed geology and morphology. In particular this section addresses: principal issues (potential impacts), proposed mitigation, and management measures. The section also discusses the residual environmental impacts of project construction and operations activities related to seabed geology and morphology.

During the development of the pipeline route, the Project has sought to avoid, minimise and mitigate impacts on marine environment in line with the Italian Decree 152/06, and EBRD standards.
Box 8-3  Key Sources of Impact, Potentially Impacted Resources and Receptors

**Sources of Impact**
- Construction phase: pipe-laying, seabed interventions for microtunnel construction resulting in re-suspension and spreading of sediments and physical alteration of the seabed.
- Operations and Maintenance Phase: presence of pipeline resulting in sediment accumulation along the pipeline and seabed erosion.
- Decommissioning Phase: pipes remain underground and are filled with a suitable material.

**Potentially Impacted Resources and Receptors**
- Seabed

**Baseline Influencing Factors**
- Seabed morphology generally flat or gently sloping below the 50 m isobath, until the continental shelf around the 150 m isobath.
- Seabed habitat in the region is known to support a number of species of ecological significance.

**Project Influencing Factors**
- Specific techniques used for micro tunnelling, trench excavations, direct seabed positioning and construction management.

Table 8-15 presents the key impacts of the TAP project on the seabed during the key project phases.

### Table 8-15  Key Impacts – Seabed Geology and Morphology

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Re-suspension and spreading of sediments.</td>
<td>Sediment accumulation and/or scouring/ erosion.</td>
<td>None</td>
</tr>
<tr>
<td>Physical alteration of the seabed, directly and by the spreading of re-suspended sediments.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical alteration of the seabed due to the creation of depressions and mounds of sediment (trenching) and seabed depressions (anchor handling).</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 8.2.4.2 Construction and Pre-commissioning Phase

For the construction and pre-commissioning phase of the project the following impact sources have been identified.

### Table 8-16  Sediment Impact -Construction and Pre-commissioning

<table>
<thead>
<tr>
<th>Source of Potential Impact</th>
<th>Potential Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe-laying.</td>
<td>Re-suspension and spreading of sediments.</td>
</tr>
<tr>
<td></td>
<td>Physical alteration of the seabed, directly and by the spreading of re-suspended sediments.</td>
</tr>
<tr>
<td>Anchor handling activities.</td>
<td>Physical alteration of the seabed due to seabed depressions (anchor handling).</td>
</tr>
<tr>
<td>Seabed interventions for microtunnel construction</td>
<td>Physical alteration of the seabed, directly and by the spreading and deposition of re-suspended sediments (backfilling), and due to the creation of depressions and mounds of sediment (trenching) for a length of approximately 110m.</td>
</tr>
</tbody>
</table>
From the above sources, the following potential impact-led assessment has been completed for the seabed where all sources of impact are grouped so that an overall assessment can be made of the key impacts associated with the project as outlined at the beginning of this section.

8.2.4.2.1 Potential Impacts

Seabed interventions for microtunnel construction and FOC installation, pipe-laying, and anchor handling activities in the Italian Offshore project area during the construction phase are likely to result in the re-suspension and spreading of sediments, and physical alteration of the seabed, directly and by the spreading of re-suspended sediments.

Direct physical alteration of the seabed in the Italian offshore section of the Project area is likely to result from anchor handling, activities due to the creation of depressions and mounds of sediment. These effects will not themselves represent a significant impact on the seabed, since the impact is of a low magnitude, temporary and highly localised. Due to the gradual action of underwater currents and gravity with the sediments will refill and reduce the trench and mound heights, over time.

Similarly the direct physical alteration produced by the micro-tunnel related excavation of the exit trench, in particular to the excess material set aside of the trench as a longitudinal mound.

Spreading and deposition of sediments is also likely to occur due to the anchor handling and the described construction activities on the seabed. Similar sized projects data show that most deposition takes place in close vicinity to the disturbance point (as confirmed by the results of the Sediment Dispersion Model – ref. Annex 10).

8.2.4.2.2 Mitigation Measures

The spreading of sediment seabed intervention works are confined to specific sections of the pipeline’ route or specific locations further limiting the area affected by sediment disruption.

8.2.4.2.3 Residual Impacts

Table 8-17 presents a summary of the residuals.

Table 8-17 Residual Impacts

<table>
<thead>
<tr>
<th>Impact</th>
<th>Mitigation Commitments to Address the Impact</th>
<th>Significance of Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seabed Geology and Morphology Impact – Construction and Pre-commissioning Phase</td>
<td>• None</td>
<td>Not significant</td>
</tr>
<tr>
<td>Direct physical impact from anchor handling, seabed intervention for microtunnel construction and FOC installation</td>
<td>• None</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spreading of sediments</td>
<td>• Intervention works are confined to specific sections of the pipeline’ route</td>
<td>Not significant</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The sensitivity of the seabed geology and morphology as a receptor to the above impacts is considered to be low, while impact magnitude and impact significance, summarised in Table 8-17, are reported in the following paragraphs. The criteria are reported in Annex 6 Baseline and Impact Assessment Methodology.

Anchor handling during pipe-laying in the Italian offshore environment is likely to cause physical alteration of the seabed, creating depressions, sediment compression and the shifting of sediments. It is expected that the seabed will quickly reach a state of equilibrium where the depressions are refilled due to the redistribution of sediments by currents and gravity. Impact magnitude is considered to be small. Impacts on the seabed from both trenching and anchor handling are therefore deemed to be not significant.

As a result of the sediments dispersion and deposition model results (ref. Annex 10), and of the existing experience for anchor handling, the impact on seabed from the spreading of sediments (small magnitude) in the Italian offshore Project area due to anchor handling, and seabed intervention for microtunnel construction, is expected to be not significant as no major change is foreseen in terms of structure and function.

8.2.4.3 Operations and Maintenance Phase

Impacts on the seabed from the operational phase in the Italian offshore project area are limited to sediment accumulation and/or scouring/erosion resulting from the presence of the pipeline.

The sources listed below could cause potential impacts on seabed.

Table 8-18 Seabed Impact – Operation and Maintenance Phase

<table>
<thead>
<tr>
<th>Source of Potential Impact</th>
<th>Potential Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence of the pipeline.</td>
<td>Sediment accumulation and/or scouring/erosion.</td>
</tr>
</tbody>
</table>

From the above sources, the following potential impact-led assessment has been completed for the seabed where all sources of impact are grouped so that an overall assessment can be made of the key impacts associated with the project as outlined at the beginning of this section.

8.2.4.3.1 Potential Impacts

Impacts on the seabed from the operational phase are limited to sediment accumulation and/or scouring/erosion resulting from the presence of the pipeline.

These effects are possible following the introduction of the pipeline on the seabed, since its physical presence will change the flow conditions of sea currents in the vicinity of the pipeline, and will potentially alter the erosion/accumulation zones of fine seabed material around the installation.

8.2.4.3.2 Mitigation Measures

Pipeline route will avoid major rocky outcrops where these effects could be more noticeable.
8.2.4.3.3 Residual Impacts

Table 8-18 presents a summary of the residual impact associated with the impacts identified after the application of mitigation measures.

**Table 8-19 Residual Impacts**

<table>
<thead>
<tr>
<th>Impact</th>
<th>Mitigation Commitments to Address the Impact</th>
<th>Significance of Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seabed Geology and Morphology – Operation and Maintenance Phase</td>
<td>• Avoid major rocky outcrops where effects could be more noticeable.</td>
<td>Not significant • Comparison with data from similar projects.</td>
</tr>
<tr>
<td>Sediment accumulation and/or scouring/erosion.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The sensitivity of the resource seabed geology and morphology is considered to be low, while impact magnitude and impact significance, summarised in Table 8-19, are reported in the following paragraphs. The criteria are reported in Annex 6 Baseline and Impact Assessment Methodology.

The pipeline route will avoid major rocky outcrops, where these effects could be more noticeable; from data of similar projects, these effects are unlikely to happen in a significant way along the pipeline through the Project area. For this reason, magnitude is considered to be small and impacts, due to sediment accumulation, are predicted to be **not significant**.

8.2.4.4 Decommissioning Phase

Considering that the pipes will remain underground/on the sea bed, the related impacts on water resources will be **not significant**.
8.3 **Offshore – Biological Environment**

8.3.1 **Introduction**

The offshore pipeline route in Italian waters is approximately 45 km in length. However, the corridor of potential impact along the route fluctuates in terms of the project construction and operation scope (direct laying on sea bed, intervention works, shore approach method, etc.) and the biological environmental conditions (e.g. presence and abundance of different species and habitats, migration routes, spawning areas, etc.).

The predicted impacts are identified and assessed as per each resource or receptor in the physical and biological environment. Impacts that are deemed to be of significance are assessed in full by means of the methodology presented in Annex 6. Impacts that are deemed to be insignificant based upon previous knowledge and experience in similar projects are described and analysed, although not assessed in detail.

8.3.2 **Designated Sites and Sensitive Habitats**

8.3.2.1 **Overview**

The offshore environment study area hosts a number of sensitive habitats and Nature conservation areas that have been designated to protect sensitive habitats and species of local, regional, national and international importance under both national and international legislation (Natura 2000 sites).

The proposed pipeline route is located approximately 2.3 km southeast of the Le Cesine Site of Community Importance (IT9150032). The main habitats and species that are protected by the sites are listed in Annex 9 Habitats Directive Appropriate Assessment - Screening.

<table>
<thead>
<tr>
<th>Conservation Area Type</th>
<th>Name of Conservation Area</th>
<th>Approximate distance to pipeline</th>
<th>Main marine habitats and species protected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natura 2000 site</td>
<td>Le Cesine</td>
<td>2.3 km N</td>
<td>Posidonia oceanica,</td>
</tr>
<tr>
<td>Natura 2000 site</td>
<td>Alimini</td>
<td>5 km S</td>
<td>Posidonia oceanica</td>
</tr>
</tbody>
</table>

In addition to the sites listed in Annex 9, the following sensitive habitats are located in the vicinity of the proposed pipeline route for the Italian offshore section of the Project.

**Coralligenous algae**

Turf-forming algae are known to be more resistant to sedimentation and water turbidity than erect and encrusting forms. Sedimentation increase in the study area could negatively affect sub tidal assemblages on rocky bottoms and on deeper coralligenous formations, as already reported in literature for other habitats such as deep sandy bottoms and shallow rocky shores.
Seagrass meadows and patches

As reported in Section 6, two different types of seagrass are found in the landfall area, with different levels of protection:

- **Posidonia oceanica;** *Posidonia oceanica* meadows are considered the most important ecosystem in the Mediterranean and are listed as a “priority” habitat type under Annex I of the Habitats Directive (Council Directive 92/43/EEC - Code: 1120; see Section 6).

- **Cymodocea nodosa;** *Cymodocea nodosa* is not listed in the Annexes I or IV of the Habitats Directive and is not included among vulnerable species of the IUCN Red List.

Any marine seagrass meadow is important as a fundamental producer of oxygen, nursery for marine animal species, and substrate for algae and epifauna. The potential impact on sea grass from marine excavation/dredging operations include the physical removal or burial of vegetation and the indirect effects of temporary increases in turbidity and sedimentation.

The primary effect of increased turbidity on sea grass is a reduction in the amount of light available for photosynthesis. The tolerance of sea grass to low light conditions depends on their minimum light requirements. The minimum light requirements (expressed as a percentage of surface irradiance - SI) reported in literature for *Posidonia oceanica* range from 4.4 to 16% of SI.

Several studies have documented deterioration of sea grass meadows by smothering due to excessive sedimentation. The values reported in the literature for maximum allowable sedimentation rates for *Posidonia oceanica* are on the order of 5 cm per year.

Deepwater corals

The white coral biocoenosis in the area of the Ionian Sea/Adriatic Sea interphase consists of living corals mainly represented by the framework builders *Lophelia pertusa* and *Madrepora oculata*. There are also a number of offshore deepwater coral sites that have been found in recent years (Section 6.2). During the environmental fieldwork in 2013. There was no indication of such habitats in the Italian TAP route.

Other habitats

This assessment is limited to the particular impacts on features which determined the institution of conservation areas, including protected habitats and species in the areas. Impacts on faunal receptors, including mammals, reptiles and seabirds, are assessed in other sections of this report; however where these species are specifically protected, consideration will be given here as to the significance of potential impacts on these species in each conservation area.
Potential receptors for impacts from noise and vibration are limited to marine mammals, fish, seabirds and some benthic taxa. The primary features for which the areas have been designated are the seagrass meadows and coralligenous formations, neither of which will be directly impacted by the noise and vibration. Other sensitive and protected species in the area such as birds listed within the SPA and marine mammals can be affected by noise, but this aspect will be assessed in the following Sections. As the conservation areas are of national importance, their value and sensitivity are rated as high and, as such, consideration should be given to any significant impacts which might affect these sites.

The main activities anticipated to affect nature conservation areas are those occurring during the construction phase, such as dredging, trenching, anchor handling. Impacts during the pre-commissioning and operational phase are expected to be comparatively small, due to the less invasive nature of the activities in these phases.

The following box shows the key sources of impact, potentially impacted resources and receptors, and baseline and project influencing factors associated with the impacts of the TAP Project on designated sites and sensitive habitats.

**Box 8-4   Key Sources of Impact, Potentially Impacted Resources and Receptors**

**Sources of Impact**
- Construction Phase: seabed intervention for microtunnel construction and FOC installation, anchor handling, and pipe-laying. These activities result in noise and vibration and re-suspension and spreading of sediments causing an increase in turbidity and the release of contaminants and nutrients and physical alteration of the seabed; anchoring of the vessel in shallow water has a direct impact on the benthic substrate and any sensitive habitats or species present; and pipeline flooding resulting in underwater-noise and vibration.
- Operations and maintenance phase: natural gas movement in the pipeline resulting in noise and vibration; external inspections and maintenance works resulting in noise and vibration, re-suspension and spreading of sediments causing an increase in turbidity and the release of contaminants and nutrients and physical alteration of the seabed.
- Decommissioning phase: pipeline will remain underground and are filled with a suitable material.

**Potentially Impacted Resources and Receptors**
- Sensitive habitats (Posidonia meadows and seagrass patches, coralligenous algae, etc.). Possible presence of turtle “Caretta Caretta”
- Flora and fauna

**Baseline Influencing Factors**
- Long shore currents.

**Project Influencing Factors**
- Specific techniques used for micro tunnelling, trench excavations, direct seabed positioning and waste and construction management.

*Table 8-21* presents the key impacts of the TAP Project on designated sites and sensitive habitats during the key project phases.
The sensitivity of designated sites and sensitive habitats is reported in the following Paragraphs, and each potential impact has been expanded, providing information on the magnitude and the mitigation measures considered within the Project.

8.3.2.2 Construction and Pre-commissioning Phase

The following sources of impact have been identified for the construction and pre-commissioning phase of the project. The sources listed below could potentially cause impacts on designated sites and sensitive habitats.

### Table 8-22 Designated Sites and Sensitive Habitats Impact Sources - Construction and Pre-commissioning

<table>
<thead>
<tr>
<th>Source of Potential Impact</th>
<th>Potential Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dredging and general shipping activity.</td>
<td>Temporary effects of noise and vibration</td>
</tr>
<tr>
<td>Pipe-laying process, anchor handling and microtunnel construction activities, and FOC installation</td>
<td>Temporary effects of re-suspension and spreading of sediments and direct physical interaction</td>
</tr>
</tbody>
</table>

Using the above sources, the following potential impact assessment was completed for designated sites and sensitive habitats in which all sources of impact are grouped so that an overall assessment of the key impacts associated with the project can be made, as outlined at the beginning of the section.

8.3.2.2.1 Potential Impacts

**Noise and vibration**

The activities during construction that are likely to cause disturbance from noise and vibration are dredging post-lay trenching and general shipping activity. Dredging and trenching generate similar noise levels, with trenching having peak noise levels of 178 dB at 1 metre from the source at 160 Hz. Shipping activity noise depend both on power and speed. Albeit the power of some of the vessels is on the high end, their speed is very low. In any case the average noise output of the construction fleet is expected to be similar to small to medium size existing traffic (162 dB at 10-500 Hz). Microtunnel excavation activities can be considered negligible compared to the disturbances described above., given the characteristics of the adopted auger, the very low drilling velocity (1 to1.5 m/day), the depth under the seabed of the excavation minimize the noise and vibration effects.
The significance of any noise and vibration impacts on nature conservation areas will depend upon the distance between the source of the impact and the conservation areas themselves.

Potential impacts upon nature conservation areas during the construction phase include: impacts on migratory and resident bird species (such as the sandwich tern) from noise and vibration, direct physical interaction and turbidity impacts on habitats and fauna due to seabed intervention works, and pipe-laying activities. Potential impacts upon nature conservation areas during the pre-commissioning phase are limited to noise and vibration impacts on fauna generated by pipeline flooding. Based on similar situations, it is expected that the movement of pressure test water within the pipeline during pipeline flooding will only cause potential impacts on fauna in the immediate vicinity of the pipeline.

**Re-suspension and spreading of sediments**

Increases of turbidity in the water column due to re-suspension of sediments will result from the pipe-laying process, through seabed intervention including anchor handling and seabed intervention for microtunnel construction activities. This can potentially cause physiological damage to faunal species such as fish, or smothering of important benthic communities. Sedimentation of the re-suspended sediments on both *Posidonia oceanica* and *Cymodocea sp* patches and coralligenous algae will have a deleterious effect; however, impacts will only affect species within a relatively localised area surrounding the pipeline, and impacts are only likely within the areas identified by the sediment dispersion modelling at the microtunnel offshore outlet. According to the simulation results, under the most impacting scenario, the maximum horizontal extent of the plume will be 150m along route and 240 across route towards south-east (180 / 350m for fine sediment). Being the Natura 2000 site “Le Cesine” 2.3 km North of the outlet point. By a qualitative interpretation of the modelling results, the following considerations can be done:

- the microtunnel excavation avoid impact on *Posidonia oceanica* patches (as confirmed by 2013 survey);
- the very limited length of trenching (110 m) determines a relatively small amount of re-suspended sediments;
- the predominant current direction (long shore) determines spreading of sediments mostly along the coast (southeast), avoiding the areas on shallower depths towards the coast;
- concerning the potential effect on *Posidonia oceanica* patches parallel to the coast; these are located at shallower depths than the trenching area. Nearest SCI is about 2.3 km north;
- such distance leads to the conclusion that there is a low probability of deleterious effects on the *Posidonia oceanica* meadows in general, and of the Le Cesine SCI in particular (as assessed in Section 8.2.2.2 – Impacts During the Construction Phase). This is confirmed by the model outcome.
• Trenching area will directly affect small patches of *Cymodocea nodosa* at the microtunnel exit point.

**Direct physical interaction**

Physical alteration of the seabed due to anchor handling can impact directly on seagrass habitats. However the expected lay out of the pipeline anchor spread does not reach the nearest conservation area in the Italian Offshore environment (Le Cesine). The anchor spread would need one or two anchors deployed towards the shore, thus potentially affecting seagrass habitats outside protected areas.

Concerning trenching activities, the very limited length of works (110 m) allows minimizing the direct impact on *Cymodocea nodosa*.

The impact on deepwater coral formations would be associated with direct physical destruction due to pipe laying and FOC installation, which has a very small footprint, or anchor handling activities. However, no deepwater coral formations have been observed during 2013 field survey.

8.3.2.2.2 Mitigation Measures

**Noise and vibration**

Due to the low intensity and short term duration of noise and vibration impact no specific mitigation measures will be implemented.

**Re-suspension and spreading of sediments**

Impacts from anchor spread can be mitigated through specific measures comprising substitution of anchors by tugboats, or specific very careful anchor handling (avoidance of dragging through the seabed but rather raising during relocation). Dynamic positioned vessels are an option as well.

**Direct physical interaction**

Concerning seabed interventions for microtunnel construction, even if the model results showed a minor impact. In order to further protect the surrounding marine environment, specific operational mitigation measures will be taken to minimize the impact (e.g. minimizing movement of dredging material, reducing dredging speed, planning of dredging activities only with calm marine and meteorological conditions).

Furthermore, impacts on *Cymodocea nodosa* can be mitigated with further specific measures including: suspended sediments level monitoring during excavation activities; video survey of *Cymodocea nodosa* before excavation, immediately after, and after one year, to assess its colonization in the excavation area;
No deepwater corals were found along the route. Areas of hard substrate, preferred by deepwater corals, are expected to be avoided as far as the use of offshore detailed routing will be possible.

Further to this, deepwater corals are known to preferentially settle on hard substrates, and the pipeline is likely to provide additional hard substrate on which to settle.

8.3.2.2.3 Residual Impacts

*Table 8-23* presents a summary of the residual impact.

**Table 8-23 Residual Impacts**

<table>
<thead>
<tr>
<th>Impact</th>
<th>Mitigation Commitments to Address the Impact*</th>
<th>Significance of Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designated Sites and Sensitive Habitats Impact – Construction and Pre-commissioning Phase</td>
<td></td>
<td>Minor</td>
</tr>
<tr>
<td>Noise and vibration</td>
<td>• None</td>
<td>Low level of interaction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>between source of impact and receptor.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Limited extension of the plume.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High sensitivity of receptors.</td>
</tr>
<tr>
<td>Re-suspension and spreading of sediments and direct physical interaction</td>
<td>• Substitution of anchors by tugboats, or specific and very careful anchor handling (avoidance of dragging through the seabed but rather raising during relocation).</td>
<td>Low level of interaction between source of impact and receptor.</td>
</tr>
<tr>
<td></td>
<td>• Avoidance of hard substrate, preferred by deepwater corals, by offshore detailed routing.</td>
<td>Limited extension of the plume.</td>
</tr>
<tr>
<td></td>
<td>• Suspended sediments level monitoring during excavation activities;</td>
<td>High sensitivity of receptors.</td>
</tr>
<tr>
<td></td>
<td>• Monitoring of re-colonization of the trenching area, and possible active re-plantation interventions.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Specific operational mitigation measures need to be implemented to minimize the impact (e.g. minimize movement of dredging material, reducing dredging speed, dredging activities only with calm metoeomarine conditions)</td>
<td></td>
</tr>
</tbody>
</table>

*) Mitigation measures in italic will be developed in a further stage of the project.

The sensitivity of the resource designated sites and sensitive habitats is considered to be high, while impact magnitude and impact significance, summarised in Table 8-23, are reported in the following paragraphs. The criteria are reported in Annex 6 Baseline and Impact Assessment Methodology.
Noise and Vibration

Since the pipeline does not directly pass through either Le Cesine protected area and there are no sensitive receptors to noise and vibration impacts in the immediate vicinity of the pipeline, the derived noise impacts will result in a small magnitude. Furthermore considering the receptors defining the sensitive area (e.g. Posidonia), low levels of interaction are foreseen. In summary, impacts from noise and vibration on conservation areas in the Italian offshore area will be minor.

Re-suspension and spreading of sediments and direct physical interaction

As a summary, the impacts from pipe laying, seabed interventions for microtunnel construction on protected areas and sensitive habitats will have a low level of interaction and a small magnitude, however given the high sensitivity of these receptors, impact is considered to be minor. However, specific mitigation measures such as design of anchor spread and handling and monitoring of impacts need to be implemented to minimize the impact.

8.3.2.3 Operations and Maintenance Phase

During the operation phase, the sources listed below could potentially cause impacts on designated sites and sensitive habitats.

Table 8-24  Designated Sites and Sensitive Habitats Impact Sources – Operations and Maintenance Phase

<table>
<thead>
<tr>
<th>Source of Potential Impact</th>
<th>Potential Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural gas movement in the pipeline.</td>
<td>Noise and vibration and the release of pollutants from anti-corrosion nodes.</td>
</tr>
<tr>
<td>External inspections works.</td>
<td>Noise and vibration.</td>
</tr>
</tbody>
</table>

The following potential impact led assessment has been completed from the above sources for sensitive habitats where all sources of impact are grouped, so that an overall assessment can be made of the key impacts associated with the project as outlined at the beginning of the section.
8.3.2.3.1 Potential Impacts

Potential impacts upon nature conservation areas in the Project area within the Italian offshore environment during the operational phase from natural gas movement in the pipeline are limited to noise and vibration and the release of pollutants from anti-corrosion nodes. External inspections can produce noise and vibration.

8.3.2.3.2 Mitigation Measures

To minimise external corrosion and consequent potential release of pollutants, anodes are to be installed at regular intervals along each pipeline.

8.3.2.3.3 Residual Impacts

*Table 8-25 presents a summary of the residual impact.*

<table>
<thead>
<tr>
<th>Impact</th>
<th>Mitigation Commitments to Address the Impact</th>
<th>Significance of Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental stresses on sensitive areas due to impact from routine inspections</td>
<td>None</td>
<td>Not significant</td>
</tr>
<tr>
<td>Environmental stresses on sensitive areas due to potential impact from repair interventions</td>
<td>None</td>
<td>Minor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Physical alteration of seabed and re-suspension of sediments.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Le Cesine is 2.3 km from the pipeline.</td>
</tr>
</tbody>
</table>

The sensitivity of the resource designated sites and sensitive habitats is considered to be high, while impact magnitude and impact significance, summarised in *Table 8-25*, are reported in the following paragraphs. The criteria are reported in Annex 6 *Baseline and Impact Assessment Methodology*.

Similarly to pre-commissioning, noise and vibration generated by natural gas movement in the pipeline and routine inspections are expected to have a small magnitude and a not significant impact on conservation areas in the Italian offshore area for the same reasons. Even if routine inspections are not likely to cause any significant impacts, potential repair work may however require seabed intervention works of some nature, implying physical alteration of seabed and re-suspension of sediments in the water column. The extent of these impacts are likely to be much smaller than for the construction phase, however it is not possible to predict the frequency nor the extent of seabed disturbance from these activities. Since Le Cesine is 2.3 km from the pipeline, and given the nature of the expected activities, operational impacts will have a minor significance due to high sensitivity of the resource combined with the small magnitude and low level of interaction.
8.3.2.4  Decommissioning Phase

For the pipeline decommissioning, considering that the pipes will remain underground/on the sea bed, the related impacts on sensitive habitat will be not significant.

8.3.3  Nutrients and Plankton

8.3.3.1  Overview

The plankton dynamics in the Adriatic Sea vary widely with time and geographical scale. Values/sensitivities for both phytoplankton and zooplankton in the Italian Offshore environment are detailed in Section 6.2. Given the mobile nature of plankton, there is no potential for the TAP Project to change the abundance or distribution of plankton in general in the Italian offshore environment.

The following box shows the key sources of impact, potentially impacted resources and receptors, baseline and project influencing factors associated to the impacts of the TAP Project on nutrients and plankton. In particular this section addresses the principal issues (potential impacts), proposed mitigation and management measures and then discusses the residual environmental impacts of project construction and operations activities.

During the development of the pipeline route, the Project has sought to avoid, minimise and mitigate impacts on nutrients and plankton.

**Box 8-5  Key Sources of Impact, Potentially Impacted Resources and Receptors**

**Sources of Impact**
- Construction phase: re-suspension and spreading of sediments, from seabed intervention works and discharge of ballast waters resulting in changes to plankton dynamics; and seawater intake.
- Operations and Maintenance Phase: no source of impact for plankton.
- Decommissioning Phase: pipe remain underground and are filled with a suitable material.

**Potentially Impacted Resources and Receptors**
- Seawater and planktonic community.

**Baseline Influencing Factors**
- Mobile nature of plankton.
- Presence of nutrients in the sediments that can be re-suspended during project activities.

**Project Influencing Factors**
- Specific techniques used for micro tunnelling, trench excavations, direct seabed positioning and waste and construction management.
Table 8-26 presents the key impacts of the TAP Project on nutrients and plankton during the key project phases.

Table 8-26  Key Impacts – Nutrients and Plankton

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Release of nutrients affecting phytoplankton production.</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

8.3.3.2  Construction and Pre-commissioning Phase

For the construction and pre-commissioning phase of the project the following impact sources have been identified. Without mitigation, the sources listed below have the potential to cause impacts on nutrients and plankton.

Table 8-27  Nutrients and Plankton - Construction and Pre-commissioning

<table>
<thead>
<tr>
<th>Source of Potential Impact</th>
<th>Potential Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laying of the pipeline and seabed intervention.</td>
<td>Release of nutrients affecting phytoplankton production.</td>
</tr>
<tr>
<td>Discharge of ballast water by vessels associated with the construction stage of the project.</td>
<td>Introduction of alien and invasive marine organisms.</td>
</tr>
</tbody>
</table>

From the above sources, the following potential impact-led assessment has been completed for nutrients and plankton where all sources of impact are grouped so that an overall assessment can be made of the key impacts associated with the project as outlined at the beginning of this section.

8.3.3.2.1  Potential Impacts

The plankton dynamics are highly variable in the Adriatic Sea and occur at a wide scale across the proposed pipeline route. Plankton communities vary considerably with time and geographical scale. The laying of the pipeline and seabed intervention associated with construction has the potential to cause an increase in turbidity and subsequently result in the re-suspension of nutrients and contaminants from sediments into the water column.

A release of nutrients, particularly nitrogen and phosphorus into the photic zone could increase the risk of eutrophication in the Italian offshore region, thereby stimulating phytoplankton primary production. Whilst possible, the release of nutrients is expected not to rise above background levels or increases due to natural phenomena such as storms.

In terms of introduction of alien species, there is the potential for the plankton community to be impacted if construction vessels cause invasive species to be introduced to the Adriatic Sea. Discharge of ballast water by vessels associated with the construction stage of the project has the potential to contain alien and invasive marine organisms.
During the pre-commissioning phase potential impacts upon plankton are limited to seawater intake for test water. The impacts of seawater abstraction in the TAP Project area is expected not to have a detectable effect on plankton communities due to the expected depth of intake (lower than 25 m) and the very low density of plankton and plankton dynamics.

8.3.3.2.2 Mitigation Measures

The International Convention for the Control and Management of Ships’ Ballast Water and Sediments (BWM Convention) was held in 2004. The objective of this Convention is to prevent, minimise, and ultimately eliminate the transfer of aquatic organisms and pathogens through the control and management of ships’ ballast water and sediments. To prevent the transport of non-indigenous species via ballast waters TAP AG has planned to adhere to the following mitigation measures wherever practically possible:

- adhere to the Mediterranean region voluntary ballast water management regulations 2012;
- avoid the discharge of any water into the Mediterranean Sea picked up outside of the Mediterranean Sea; and
- discharge ballast waters of Mediterranean seawater only in to the Mediterranean Sea.

8.3.3.2.3 Residual Impacts

Table 8-28 presents a summary of the residual impact.

Table 8-28 Residual Impacts

<table>
<thead>
<tr>
<th>Impact</th>
<th>Mitigation Commitments to Address the Impact*</th>
<th>Significance of Residual Impact</th>
</tr>
</thead>
</table>
| Release of nutrients affecting phytoplankton production. | None | Not significant
|  |  | • Small amounts of released nutrients are comparable to natural phenomena.  
|  |  | • Fluctuations in planktonic community comparable with seasonal fluctuations. |
| Potential introduction of alien and invasive species. | Adhere to the Mediterranean region voluntary ballast water management regulations 2012.  
|  |  | • Avoid the discharge of any water into the Mediterranean Sea picked up outside of the Mediterranean Sea.  
|  |  | • Discharge ballast waters of Mediterranean seawater only in to the Mediterranean Sea. | Not significant  
|  |  | • Avoided through the application of the mitigation techniques. |

The sensitivity of the resource nutrients and plankton is considered to be low, while impact magnitude and impact significance, summarised in Table 8-28, are reported in the following paragraphs. The criteria are reported in Annex 6 Baseline and Impact Assessment Methodology.
The magnitude of the expected amount of nitrogen and phosphorus to be released during the construction phase is considered to be small in comparison to the total input of such nutrients into the Adriatic Sea as well as the expected removal of nutrients by commercial fishing. Given that, impact on nutrients is considered to be not significant. Taking this into consideration and the large scale plankton dynamics in the Project area, any fluctuations in the planktonic community as a result of the Project will not be detectable over the background ‘normal’ fluctuations that occur seasonally. As a result, impacts to plankton in the Project area from construction activities, such as seabed intervention works or pipe-laying, has a small magnitude and are therefore considered not significant.

Adoption of above mentioned mitigation measures will ensure that alien and invasive species are not introduced into the Mediterranean or Adriatic Sea, as a result of the construction of the pipeline. Magnitude is considered to be small and, consequently, the impacts of the construction phase on phytoplankton and zooplankton communities in the TAP Project area will be not significant.

For the same reason, the impacts of the pre-commissioning phase on phytoplankton and zooplankton communities in the TAP Project area will be not significant.

8.3.3.3 Operations and Maintenance Phase

No impacts to nutrients and plankton can be associated to operations and maintenance Phase.

8.3.3.4 Decommissioning Phase

For the pipeline decommissioning, considering that the pipes will remain underground/on the sea bed, the related impacts on nutrients and plankton will be not significant.

8.3.4 Marine Benthos

8.3.4.1 Overview

This section identifies and assesses the potential impacts on marine benthos during the construction; pre-commissioning and operational phases of the Project in terms of the methodology presented in Annex 6. Impacts during the operational and pre-commissioning phases are expected to be minimal in comparison to construction. The environmental surveys (2011 – 2013) undertaken in the offshore and nearshore Project areas showed a relatively low diversity and abundance of benthic fauna, with the exception of the scarce rocky and hard substrates found in the vicinity of the route. Detailed Information regarding benthos in the Adriatic Sea at the location of the Project is detailed in Section 6.2.

The following box shows the key sources of impact, potentially impacted resources and receptors, baseline and project influencing factors associated to the impacts of the TAP Project on marine benthos. In particular this section addresses the principal issues (potential impacts), proposed mitigation and management measures and then discusses the residual environmental impacts of project construction and operations activities.
During the development of the pipeline route, the Project has sought to avoid, minimise and mitigate impacts on marine benthos.

**Box 8-6 Key Sources of Impact, Potentially Impacted Resources and Receptors**

**Sources of Impact**
- Construction and pre-commissioning phase: physical alteration of the seabed and direct impact on the benthic substrate, any sensitive habitats or species present, as well as re-suspension and spreading of sediments from pipe-laying, anchor handling, and seabed interventions for microtunnel construction, generating an increase in turbidity and smothering from sedimentation; noise and vibration from seabed intervention and vessel movement; and seawater intake resulting in increase in noise and vibration and removal of larvae during seawater abstraction.
- Operations and Maintenance Phase: inspection and maintenance works, the presence of pipeline resulting in physical disturbance to benthic habitats.
- Decommissioning Phase: pipes remain underground and are filled with a suitable material.

**Potentially Impacted Resources and Receptors**
- Marine benthos and seabed.

**Baseline Influencing Factors**
- Composition and structure of marine benthos communities.

**Project Influencing Factors**
- Specific techniques used for micro tunnelling, trench excavations, direct seabed positioning and waste and construction management.

*Table 8-29* presents the key impacts of the TAP Project on marine benthos during the key project phases.

**Table 8-29 Key Impacts – Marine Benthos**

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Physical loss of seabed habitats.</td>
<td>• Alteration of the composition and abundance of the benthic community.</td>
<td>• None</td>
</tr>
<tr>
<td>• Increase in turbidity causing smothering of benthic fauna.</td>
<td>• Local disturbance of the seabed resulting in direct loss of benthic fauna.</td>
<td></td>
</tr>
<tr>
<td>• Change in sediment characteristics resulting in alterations in benthic community structure</td>
<td>• Local disturbance of the seabed resulting in direct loss of benthic fauna and smothering due to sediment re-suspension.</td>
<td></td>
</tr>
<tr>
<td>• Increase in turbidity and sediment deposition</td>
<td>• Noise and Vibration</td>
<td></td>
</tr>
<tr>
<td>• Noise and Vibration</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8.3.4.2 Construction and Pre-commissioning Phase

For the construction and pre-commissioning phase of the project the following impact sources have been identified. Without mitigation, the sources listed below have the potential to cause impacts on marine benthos.
### Table 8-30  Marine Benthos Impact -Construction and Pre-commissioning

<table>
<thead>
<tr>
<th>Source of Potential Impact</th>
<th>Potential Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seabed interventions for microtunnel construction and FOC installation</td>
<td>Physical loss of seabed habitats, increase in turbidity causing smothering of benthic fauna. Change in sediment characteristics resulting in alterations in benthic community structure. Noise and vibration</td>
</tr>
</tbody>
</table>

From the above sources, the following potential impact-led assessment has been completed for the marine benthos where all sources of impact are grouped so that an overall assessment can be made of the key impacts associated with the project as outlined at the beginning of this section.

During the pre-commissioning phase potential impacts upon benthos could derive as well from seawater intake for test water. The impact of seawater abstraction is not expected to have a detectable effect on benthos communities due to the limited duration of the activities and the expected depth of intake (lower than 25 m).

#### 8.3.4.2.1 Potential Impacts

**Physical loss of seabed habitats**

This has already been partially assessed in Section 8.3.2, and as such only habitats not assessed in that section (i.e. not included in the EU Habitat Directive) are included in this Section.

In the Italian waters of the TAP Project trenching activities are planned to occur for about 110 m from the microtunnel offshore exit point. The area of seabed that will be lost to the above construction works is a small area (approximately 3,000 m² for the trenched area and approximately 45,000 m² where the pipeline is laid on the seabed surface) restricted to the pipeline corridor, and in the case of anchors, to the anchor corridor, resulting in a temporary loss of habitat and destruction of the benthos themselves. Impact from anchor activities is expected to involve an area no larger than 240 m² at any one time.

**Increase in turbidity**

Sea bed intervention in general (trenching, pipe-laying and anchor operations) will cause an increase of suspended sediments as highlighted by the DHI simulation results, resulting in increased turbidity of the water causing smothering of benthic fauna.
Change in sediment composition

This impact has already been partially assessed in Section 8.3.2, and as such only habitats not assessed in that section (i.e. not included in the EU Habitat Directive) will be included in this Section. Sedimentation of the re-suspended sediments may have a deleterious effect, however impacts will only affect species within a relatively localised area surrounding the pipeline, and impacts are only likely within the areas which are identified from sedimentation modelling (Annex 10). The model results confirm a preliminary qualitative assessment related to the very limited length of trenching (110 m) determining a relatively small amount of re-suspended sediments;

The outcomes of the model show low depths and short distances of burial, which combined with the species and communities composition of benthos in the area, and the nature of the materials to be re-deposited (similar to receptor areas) determine that these benthic communities will most likely soon recover their original situation.

Noise and Vibration

Considering the limited extent and duration of seabed interventions and the fact that such intervention works will only occur at specific points on the pipeline route, the expected impacts of noise and vibration generated on benthic communities will be minor (temporary and of low intensity). As stated in the ESIA report, the benthic fish feeding in the vicinity of the offshore construction activities will temporarily move away and return once they have been completed. Moreover, the presence and passage of a few additional construction and support vessels over the construction period will not represent a significant increase in disturbance to benthic fish species

8.3.4.2.2 Mitigation Measures

Physical loss of seabed habitats

The mitigation measures planned and described in the mentioned Section 8.3.2, will address or reduce the significance of the identified potential impacts associated with physical loss of the seabed and impacts from anchor operations on the benthos.

Increase in turbidity

The mitigation measures planned to address or reduce the significance of physical disturbance will also have a mitigation effect on the identified potential impacts associated with increased sedimentation on benthic fauna.

8.3.4.2.3 Residual Impacts

Table 8-31 presents a summary of the residual impacts.
Table 8-31  Residual Impacts

<table>
<thead>
<tr>
<th>Impact</th>
<th>Mitigation Commitments to Address the Impact*</th>
<th>Significance of Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marine Benthos Impact – Construction and Pre-commissioning Phase</td>
<td></td>
<td>Minor</td>
</tr>
</tbody>
</table>
| Physical loss of seabed habitats            | • Substitution of anchors by tugboats, or specific and very careful anchor handling (avoidance of dragging through the seabed but rather raising during relocation).  
• Avoidance of hard substrate, by offshore detailed routing. | • Impact negative but local.  
• Short-term and reversible.  
• Change to benthos likely to be highly localised. |
| Increase in turbidity                       | • Substitution of anchors by tugboats, or specific and very careful anchor handling (avoidance of dragging through the seabed but rather raising during relocation).  
• Avoidance of hard substrate, preferred by deepwater corals, by offshore detailed routing.  
• Specific mitigation measures may need to be implemented to minimize the impact, depending on monitoring results | Not significant  
• Impact negative but local.  
• Sediment plume will not travel far.  
• Areas buried by sediments will be small. |

*) Mitigation measures in italic will be developed in a further stage of the project

The sensitivity of the resource marine benthos is considered to be medium/low (depending on the impact typology), while impact magnitude and impact significance, summarised in the table above, are reported in the following paragraphs. The criteria are reported in Annex 6 Baseline and Impact Assessment Methodology.

**Physical loss of seabed habitats**

The loss of habitat and physical disturbance of the seabed after mitigation is expected to be negative and direct, but limited to a local area (48,000 m²) The impact is short-term as re-colonisation of the area is expected once construction is complete. The impact will have a moderate intensity as the impact will cause a noticeable change to benthos affected. However, the impact will have a small magnitude to a limited number of benthic species. The overall impact is expected to be minor and reversible with time.

**Increase in turbidity**

According to the modelling results in Annex 10, and as described in Section 8.2.4.2, the sediment plume will not travel far and the areas buried by sediments will be small and with small burial depths. Specific mitigation measures will be implemented to minimize the increase of turbidity during microtunnel offshore exit excavation and trenching activities. The duration of the impact will be short-term; will also be reversible in time with low intensity. Therefore, magnitude is considered to be small. Consequently, the potential impact of smothering by increased re-suspension and sedimentation on benthos is considered to be not significant.
Increase in noise

Noise from construction and pre-commissioning activities is expected to have a not significant impact on marine benthos, due to the expected low levels of received noise (small magnitude) and low sensitivity of benthic organisms. As the noisiest activities during construction are considered to be not significant, the impacts from noise during the pre-commissioning phase are expected to have also a not significant impact to marine benthos.

8.3.4.3 Operations and Maintenance Phase

The physical presence of the pipeline may alter the composition and abundance of the benthic community. In particular, the sources listed below could cause potential impacts on benthic community.

Table 8-32 Benthic Community Impact – Operation and Maintenance Phase

<table>
<thead>
<tr>
<th>Source of Potential Impact</th>
<th>Potential Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical presence of the pipeline</td>
<td>Alteration of the composition and abundance of the benthic community.</td>
</tr>
<tr>
<td>Routine inspections.</td>
<td>Local disturbance of the seabed resulting in direct loss of benthic fauna.</td>
</tr>
<tr>
<td>Potential repair and improvement works.</td>
<td>Local disturbance of the seabed resulting in direct loss of benthic fauna and smothering due to sediment re-suspension.</td>
</tr>
</tbody>
</table>

From the above sources, the following potential impact-led assessment has been completed for the marine benthos where all sources of impact are grouped so that an overall assessment can be made of the key impacts associated with the project as outlined at the beginning of this section.

8.3.4.3.1 Potential Impacts

Physical presence of the pipeline

The physical presence of the pipeline may alter the composition and abundance of the benthic community. Solid surfaces that are placed in marine environments often are colonised by marine organisms. Initially, a surface film is created, and subsequently colonised by a variety of microorganisms. Secondary colonists such as algal spores and the planktonic larvae of barnacles are the following group to settle, and they form a habitat for tertiary colonists including a wide variety of invertebrate species. The pipeline will form a hard surface in what is a mixed sand and soft bottom area which will support a different community of benthos to that of the surrounding seabed. An overall increase in localised biodiversity and abundance may result.
Routine inspections and maintenance

The pipeline will require routine inspections that will be infrequent and restricted to the pipeline itself. Moreover, repair and improvement works may also be required which will result in local disturbance of the seabed resulting in direct loss of benthic fauna and smothering due to sediment re-suspension.

8.3.4.3.2 Mitigation Measures

Due to the limited extent and duration of seabed interventions, and that such work will only occur at specific points along the pipeline route, identified impacts are considered to be negligible or of small magnitude and therefore no specific mitigation measures are required to be implemented (with the exception of general mitigation measures listed in the previous Section 8.1).

8.3.4.3.3 Residual Impacts

*Table 8-33 presents a summary of residual impacts.*

**Table 8-33 Residual Impacts**

<table>
<thead>
<tr>
<th>Impact</th>
<th>Mitigation Commitments to Address the Significance of Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Marine Benthos Impact – Operation and Maintenance Phase</strong></td>
<td></td>
</tr>
<tr>
<td>Alteration of the composition and abundance of the benthic community.</td>
<td>• None</td>
</tr>
<tr>
<td></td>
<td><strong>Minor (positive)</strong></td>
</tr>
<tr>
<td></td>
<td>• Direct and positive impact which will be local and long-term.</td>
</tr>
<tr>
<td></td>
<td>• Benthos is expected to use the pipeline as a habitat.</td>
</tr>
<tr>
<td>Local disturbance of the seabed resulting in direct loss of benthic</td>
<td>• None</td>
</tr>
<tr>
<td>fauna and smothering due to sediment re-suspension from repair and</td>
<td><strong>Minor</strong></td>
</tr>
<tr>
<td>improvement works.</td>
<td>• Short-term.</td>
</tr>
<tr>
<td></td>
<td>• Only affect a small area.</td>
</tr>
<tr>
<td></td>
<td>• only a limited number of individuals are impacted.</td>
</tr>
</tbody>
</table>

The sensitivity of the resource marine benthos is considered to be medium, while impact magnitude and impact significance, summarised in Table 8-33, are reported in the following paragraphs. The criteria are reported in Annex 6 Baseline and Impact Assessment Methodology.

A direct and positive impact is expected which will be local to the pipeline structure and long-term; the benthos are expected to use the pipeline as a habitat for as long as the pipeline are in place. The impact intensity is expected to be moderate as the impact will be greater than the limit of detection but will not affect the function of the benthos entirely, with a small magnitude as only a localised group of individuals within a medium sensitivity population will be affected resulting in a **minor** significance impact to the benthos.
As inspections will be infrequent and restricted to the pipeline itself there will only be low levels of disturbance to the seabed (small magnitude), the impacts on benthos are considered to be **not significant**. On the other hand, impact from repair and improvement works would be short-term as maintenance activities will only affect a small area for a limited period of time. It is expected to be small magnitude as only a limited number of individuals are expected to be impacted. The impact significance is expected to be **minor**. Impacts are reversible as impacted areas will recolonize within a few years, as shown in similar circumstances (Newell R.C et al; 2004&1998; Guerra-García J. et al, 2003; Dernie, K. M et al, 2003 ; Dalfsen, J. A. van et al, 2000; Kenny, A. J et al, 1996; Daan, R. and M. Mulder. 1996).

### 8.3.4.4 Decommissioning Phase

For the pipeline decommissioning, considering that the pipes will remain underground/on the sea bed, the related impacts on water resources will be **not significant**.

### 8.3.5 Fish and other Nekton

#### 8.3.5.1 Overview

This Project has the potential to impact fish and other nektonic organisms in the Italian Offshore environment during construction through impacts to water quality, changes to the seabed habitats, underwater noise, disturbance caused from the presence of vessels involved in construction and through pipeline maintenance and intake of pressure-test water during pre-commissioning. The area has richer fish community in comparison to other parts of the Adriatic Sea; Presence of particular and/or commercially important fish species was observed during the environmental campaigns. In general species richness and fish density are higher on *Posidonia oceanica* habitats. As a result, the area can be considered an important habitat for demersal and pelagic fish species, even though the pipeline route is not directly crossing *Posidonia oceanica* (ref. 8.3.2).The following box shows the key sources of impact, potentially impacted resources and receptors, baseline and project influencing factors associated to the impacts of the TAP project on fish and other nekton. In particular this section addresses the principal issues (potential impacts), proposed mitigation and management measures and then discusses the residual environmental impacts of project construction and operations activities relating to offshore environment.

During the development of the pipeline route, the Project has sought to avoid, minimise and mitigate impacts on marine environment.
**Box 8-7  Key Sources of Impact, Potentially Impacted Resources and Receptors**

**Sources of Impact**
- Construction and pre-commissioning phase: sea bed intervention resulting in re-suspension and spreading of sediments which will involve physical disturbance; discharges from vessels, noise and vibration and increase in turbidity; pipeline flooding during pressure testing resulting in noise and vibration and intake of ichthyoplankton and larvae.
- Operations and Maintenance Phase: inspection and maintenance works and the presence of pipeline resulting in noise and vibration and physical disturbance of the seabed.
- Decommissioning Phase: pipes remain underground and are filled with a suitable material.

**Potentially Impacted Resources and Receptors**
- Fish and other Nekton.

**Baseline Influencing Factors**
- The area has a richer benthic community in comparison to other parts of the Adriatic Sea.
- Important habitat for demersal and pelagic fish species.

**Project Influencing Factors**
- Specific techniques used for micro tunnelling, trench excavations, direct seabed positioning.

*Table 8-34 presents the key impacts of the TAP Project on fish and other nekton during the key project phases.*

**Table 8-34  Key Impacts – Fish and other Nekton**

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical and visual disturbance from vessels</td>
<td>Noise and vibration</td>
<td>None</td>
</tr>
<tr>
<td>Noise and vibration</td>
<td>Physical disturbance of the seabed</td>
<td></td>
</tr>
<tr>
<td>Increase in turbidity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ichthyoplankton alteration</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8.3.5.2  Construction and Pre-commissioning Phase

For the construction and pre-commissioning phase of the project the following impact sources have been identified.

**Table 8-35  Fish and other Nekton Impact - Construction and Pre-commissioning**

<table>
<thead>
<tr>
<th>Source of Potential Impact</th>
<th>Potential Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passage of construction and support vessel</td>
<td>Physical and visual disturbance from vessels</td>
</tr>
<tr>
<td>Passage of construction and support vessel</td>
<td>Noise and vibration</td>
</tr>
<tr>
<td>Pipe-laying, anchor handling and seabed interventions for microtunnel construction and FOC installation</td>
<td>Increase in turbidity</td>
</tr>
<tr>
<td>Hydrotecting water intake</td>
<td>Ichthyoplankton alteration</td>
</tr>
</tbody>
</table>
From the above sources, the following potential impact-led assessment has been completed for the fish and other nekton where all sources of impact are grouped so that an overall assessment can be made of the key impacts associated with the project as outlined at the beginning of this section.

8.3.5.2.1 Potential Impacts

**Physical and visual disturbance from vessels**

Vessels associated with commercial shipping and fishing regularly pass through the area and the presence and passage of a few additional construction and support vessels over the construction period will not represent a significant increase in disturbance to pelagic fish species such as sardines and larger pelagic species such as the swordfish.

**Noise and vibration**

Increased levels of underwater noise and vibration have the potential to impact fish and other nektonic species. As mentioned in Section 8.3.2, the maximum level of noise output anticipated from construction vessels is 162 dB similar to the range from vessels already operating in the Adriatic Sea, and thus expected to be indiscernible from generic traffic noise. Noise generated from trenching is not expected to exceed the vessel traffic noise significantly and these activities are being carried out at a spot nearshore location.

Behavioural changes in fish have been observed at sound levels of approximately 180 dB, higher than the source in this case, and have been demonstrated to increase with increasing sound intensity. In any case, if fish are continued to be exposed to noise this often results in habituation to the sound, followed by a re-commencement of normal behaviour. (Sarà, G. et al, 2007; Anon J., 2006; Engås, A et al; 1995&1998; Popper, A.N. and Carlson, T.J. 1998; Knudsen, F.R et al, 1993; Blaxter, J.H.S et al, 1981)

Tissue damage is not likely to occur to fish in the Project area as no piling activity or explosions are planned along the pipeline route. The pelagic, demersal and benthic fish feeding in the vicinity of the pipeline construction activities will temporarily move away from any area of excessive noise and vibration created during the construction phase and return once it is completed.

**Increase in turbidity**

Re-suspension of sediments and consequent increases in turbidity will result from pipe-laying, anchor handling, and seabed interventions for microtunnel construction and FOC installation and are considered as the main impacts likely to affect fish in the Project area. It is expected that anchor handling would contribute very little to the overall amount of sediment placed into suspension during the construction phase.
During the pre-commissioning phase potential impacts upon fish are limited to ichthyoplankton and larvae uptake associated with test water intake. The duration of the intake will be very limited and the water depth (lower than 25 m) therefore no detectable effect on ichthyoplankton is expected.

8.3.5.2.2 Mitigation Measures

Due to the limited extent and duration of seabed interventions, and that such work will only occur at specific points along the pipeline route, identified impacts are considered to be negligible or of small magnitude and therefore no specific mitigation measures are required to be implemented (with the exception of general mitigation measures listed in the previous Section 8.1).

8.3.5.2.3 Residual Impacts

Table 8-36 presents a summary of residual impacts.

Table 8-36 Residual Impacts

<table>
<thead>
<tr>
<th>Impact</th>
<th>Mitigation Commitments to Address the Impact *</th>
<th>Significance of Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish and other Nekton Impact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Construction and Pre-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>commissioning Phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical and visual disturbance from vessels</td>
<td>None</td>
<td>Not Significant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Short term and local impact.</td>
</tr>
<tr>
<td>Noise and vibration</td>
<td>None</td>
<td>Minor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Impact negative, direct and local.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Impact temporary and of low intensity.</td>
</tr>
<tr>
<td>Increase in turbidity</td>
<td>None</td>
<td>Not Significant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Same orders of magnitude than any storm event.</td>
</tr>
<tr>
<td>Ichthyoplankton alteration</td>
<td>None</td>
<td>Not Significant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Activity duration is short</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Water depth</td>
</tr>
</tbody>
</table>

The sensitivity of fish and other nekton as a receptor to the above impacts is considered to be low (depending on the impact typology), while impact magnitude and impact significance, summarised in Table 8-36, are reported in the following paragraphs. The criteria are reported in Annex 6 Baseline and Impact Assessment Methodology.

Physical and visual disturbance from vessels

The impact of additional vessels is therefore classified as a short term, local impact. The sensitivity of the resource is considered to be low, the magnitude of the impact is expected to be small and therefore the impacts of increased vessel traffic on fish are anticipated to be not significant. Moreover, as mentioned in Section 8.2.2 the discharges from vessels/barges are expected to have a not significant effect on marine water quality, and thus also a not significant effects on the species that inhabit the marine nektonic environment.
Noise and vibration

The impacts of noise generated from construction on fish will be negative, direct and regional, however the impacts will be temporary and of low intensity. The sensitivity of the resource to noise is considered to be low and overall magnitude is considered to be small, so impacts will be minor.

Increase in turbidity

As mentioned in previous Sections, the expected amount of intervention works and the material to be resuspended is possibly of the same orders of magnitude than any storm event, and thus indiscernible from natural phenomena (small magnitude). The sensitivity of the resource to increase in turbidity is considered to be low and, therefore, any changes to fish due to seabed intervention works will have a minimal impact and is assessed to be not significant. As mentioned, ichthyoplankton can be included in the general impacts to planktonic organisms, which has been considered to be not significant.

8.3.5.3 Operations and Maintenance Phase

For the operations and maintenance phase of the project the following impact sources have been identified.

Table 8-37 Fish and other Nekton Impact – Operation and Maintenance Phase

<table>
<thead>
<tr>
<th>Source of Potential Impact</th>
<th>Potential Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural gas movement through the pipeline and inspections and routine maintenance works.</td>
<td>Noise and vibration</td>
</tr>
<tr>
<td>Physical presence of the pipeline</td>
<td>Physical alteration of the seabed</td>
</tr>
<tr>
<td>Inspections and maintenance works.</td>
<td>Physical disturbance</td>
</tr>
</tbody>
</table>

From the above sources, the following potential impact-led assessment has been completed for the fish and other nekton where all sources of impact are grouped so that an overall assessment can be made of the key impacts associated with the project as outlined at the beginning of this section.
8.3.5.3.1 Potential Impacts

Impacts that will arise throughout the operational phase are anticipated to result from increased noise and vibration and by physical disturbance of the seabed.

**Noise and vibration**

The noise levels of natural gas movement through the pipeline is expected to be of much smaller magnitude than the one resulting from construction, thus it is unlikely that any fish species will be adversely affected by the sounds emitted from the pipeline and, as they do with shipping noise, fish that can detect the noise will quickly become habituated to it. Similarly inspections and routine maintenance works on the pipeline are assumed to have a low intensity.

**Physical disturbance of the seabed**

As the surface area of the seabed taken up by the physical presence of the pipeline will represent less than 0.001% of the total seabed area of the Adriatic Sea, the total substrate area of feeding and potential spawning grounds expected to be impacted is therefore negligible. Fish species that spawn in the Italian offshore environment predominantly spawn in the water column and therefore the physical presence of the pipeline on the seabed will not cause an obstruction to spawning. There will be no impact to fish migration due to the presence of the pipeline in the project area and therefore no mitigation measures are proposed.

The addition of hard substrates (such as pipeline) can have a positive impact on fish populations. Benthic and demersal species will benefit from increased habitat heterogeneity and the associated increase in prey availability gained from the presence of the pipeline.

Infrequent inspections and maintenance works on the pipeline may result in localised resuspension and spreading of sediments along the immediate pipeline route. This increase in turbidity could potentially have an impact on fish, specifically benthic and demersal species.

8.3.5.3.2 Mitigation Measures

Due to the limited extent and duration of seabed interventions, and that such work will only occur at specific points along the pipeline route, identified impacts are considered to be negligible or of small magnitude and therefore no specific mitigation measures are required to be implemented (with the exception of general mitigation measures listed in the previous Section 8.1).

8.3.5.3.3 Residual Impacts

*Table 8-38* presents a summary of residual impacts.
Table 8-38  Residual Impacts

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Mitigation Commitments to Address the Impact / Risk *</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish and other Nekton Impact – Operation and Maintenance Phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise and vibration</td>
<td>• None</td>
<td>Not significant</td>
</tr>
<tr>
<td>Physical alteration of the seabed (presence of the pipeline)</td>
<td>• None</td>
<td>Moderate (positive)</td>
</tr>
<tr>
<td>Physical disturbance (inspections works)</td>
<td>• None</td>
<td>Minor</td>
</tr>
</tbody>
</table>

The sensitivity of fish and other nekton as a receptor to the impacts above is considered to be low (depending on the impact typology), while impact magnitude and impact significance, summarised in Table 8-38, are reported in the following paragraphs. The criteria are reported in Annex 6 Baseline and Impact Assessment Methodology.

**Noise and vibration**

As the noise levels of natural gas movement through the pipeline, inspections and routine maintenance works on the pipeline are assumed to have a small magnitude, as such activities will be infrequent and restricted to the immediate pipeline route. Sensitivity of the resource to noise and vibration is considered to be low and therefore impacts are expected to be **not significant**.

**Physical disturbance of the seabed**

The impact of artificial habitat creation on demersal and benthonic species is anticipated to be a positive, long-term impact of medium magnitude and resources are considered to have a low sensitivity. Impacts also have the potential to have a positive impact in the provision of artificial habitat and therefore the associated impacts will be of minor significance to fish populations in the Project area. While, infrequent inspections and routine maintenance works on the pipeline are expected to produce a minimal increasing in turbidity, which combined with the tendency of fish to move away from disturbance, and the fact that these works are not expected to occur on a regular basis (small magnitude), result in a **minor** impact.

8.3.5.4 Decommissioning Phase

For the pipeline decommissioning, considering that the pipes will remain underground/on the sea bed, the related impacts on water resources will be **not significant**.
8.3.6 Marine Mammals and Reptiles

8.3.6.1 Overview

Three turtle species have been recorded in the Adriatic Sea, namely the loggerhead turtle (*Caretta caretta*), the green turtle (*Chelonia mydas*) and the leatherback turtle (*Dermochelys coriacea*). While the loggerhead and green turtles nest within the Mediterranean basin (a loggerhead nesting/birth event occurred in 2007 at the beach of San Foca (Tartanet project)), the leatherback turtle is considered a rare visitor. All of them, and in particular the loggerhead turtle, can nest in areas with sandy foreshores, which is the case of the current landfall area. Furthermore they may change nesting location from year to year. Hence, the following mitigations are proposed to avoid interference with potential turtle nesting at the landfall area using the precautionary principle.

With regard to cetaceans, approximately 21 cetacean species have been recorded in the Mediterranean and Black Sea. A number of species have also been cited in the literature as being potentially present in the Adriatic and Ionian sea among those the bottlenose dolphin (*Tursiops truncatus*) and the striped dolphin (*Stenella coeruleoalba*) are considered to be regular inhabitants of the Adriatic Sea, the Strait of Otranto and the Ionian Sea. Of baleen whales, only the fin whale has been sighted more than once, and only rarely the sperm whale. The main activities, which are expected to have an impact on marine mammals and reptiles, include those that take place during the construction phase. Impacts during the pre-commissioning and operational phases are expected to be minimal in comparison.

The following box shows the key sources of impact, potentially impacted resources and receptors, baseline and project influencing factors associated to the impacts of the TAP project on marine mammals and reptiles. In particular this section addresses the principal issues (potential impacts), proposed mitigation and management measures and then discusses the residual environmental impacts of project construction and operations activities.

During the development of the pipeline route, the Project has sought to avoid, minimise and mitigate impacts.
Box 8-8  Key Sources of Impact, Potentially Impacted Resources and Receptors

Sources of Impact
- Construction and pre-commissioning phase: pipe-laying, anchor handling, seabed interventions for microtunnel construction and vessel movements resulting in noise and vibration, potential collision of marine mammals and reptiles with fleet, and interference with migration patterns; re-suspension and spreading of sediment due to pipe-laying, anchor handling, and seabed interventions for microtunnel construction resulting in increase in turbidity, and the flooding of the pipeline during pressure testing resulting in noise and vibration.
- Operations and Maintenance Phase: natural gas movement in the pipeline resulting in noise and vibration; and external inspections works resulting in noise and vibration, potential repair work resulting in increase of turbidity, potential collision of marine mammals and reptiles with fleet.
- Decommissioning Phase: pipes remain underground and are filled with a suitable material.

Potentially Impacted Resources and Receptors
- Marine mammals and reptiles

Baseline Influencing Factors
- Turtle species have been recorded in the Adriatic Sea and in the San Foca area. Potential turtle nesting in the future cannot be excluded due to favourable beach material.
- Bottlenose dolphin (Tursiops truncatus) and the striped dolphin (Stenella coeruleoalba) are considered to be regular inhabitants of the Adriatic Sea, the Strait of Otranto and the Ionian Sea.
- Fin whale has been sighted more than once in the Adriatic Sea, the Strait of Otranto and the Ionian Sea, and only rarely the sperm whale.

Project Influencing Factors
- Specific techniques used for micro tunnelling, trench excavations, direct seabed positioning and waste and construction management.

Table 8-39 presents the key impacts of the TAP Project on marine mammals and reptiles during the key Project phases.

### Table 8-39 Key Impacts – Marine Mammals and Reptiles

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise and vibration</td>
<td>Noise and vibration</td>
<td>None</td>
</tr>
<tr>
<td>Localised increase in turbidity from re-suspension and spreading of sediments</td>
<td>Localised increase in turbidity from re-suspension and spreading of sediments</td>
<td></td>
</tr>
</tbody>
</table>

8.3.6.2  Construction and Pre-commissioning Phase

For the construction and pre-commissioning phase of the project the following impact sources have been identified.

### Table 8-40 Marine Mammals and Reptiles Impact - Construction and Pre-commissioning

<table>
<thead>
<tr>
<th>Source of Potential Impact</th>
<th>Potential Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction activities comprising pipe-laying, seabed intervention works and vessel movement.</td>
<td>Noise and vibration</td>
</tr>
<tr>
<td>Uptake of seawater for flooding of the pipeline.</td>
<td>Increase in turbidity</td>
</tr>
<tr>
<td>Construction activities comprising pipe-laying, seabed intervention works</td>
<td>Increase in turbidity</td>
</tr>
</tbody>
</table>
From the above sources, the following potential impact-led assessment has been completed for the marine mammals and reptiles where all sources of impact are grouped so that an overall assessment can be made of the key impacts associated with the project as outlined at the beginning of this section.

8.3.6.2.1 Potential Impacts

**Noise and vibration**

Noise and vibration will be generated during construction as a result of pipe-laying, seabed intervention work and vessel movement. Noise and vibration is the most evident impact on marine mammals. In general terms, and as mentioned in Section 8.3.2, dredging and trenching generate similar noise levels, with trenching having peak noise levels of 178 dB at 1 metre from the source at 160 Hz. Shipping activity noise depend both on power and speed. Albeit the power of some of the vessels is on the high end, the speed of such vessel is very low. In any case the average noise output of the construction fleet is expected to be similar to small to medium size existing traffic (162 dB at 10-500 Hz), and both sources would be indiscernible from general traffic existing in the area beyond the immediate vicinity of the source.

An increase in background noise or the introduction of specific noise sources may affect marine mammals in various ways. They may be prevented from detecting important sounds (masking), their behaviour may be altered, temporary or permanent hearing loss may be experienced or damage to tissue may occur:

- **Masking** occurs when undesirable noise interferes with a marine animal's ability to detect and process a sound of interest. This is of particular concern when the interfering noise is at frequencies similar to those of biologically important sounds, such as mating calls. The bottlenose dolphin and striped dolphin communicate by emitting high frequency sounds that do not coincide in frequency with the sources in the offshore construction. Only the very rare fin whale could experience any sort of masking effect from these activities, and in any case not different from general traffic noise.

- **Behavioural changes** include a reduced amount of time spent at the surface as well as swimming away from the interfering sound and others, which are potentially significant only in cases of areas of migration, reproduction or preferential feeding. None of these circumstances are relevant to the concerned area of the Adriatic, and the evidences of behaviour of dolphins with relation to vessel traffic are inconclusive.
Exposure to sound may cause elevated hearing thresholds or threshold shifts in marine mammals. If the hearing threshold returns to a baseline level, it is known as a Temporary Hearing Loss (THL). If a marine mammal is exposed to repeated shifts in the hearing threshold, Permanent Hearing Loss (PHL) may result. Hearing loss depends on a sound's intensity, frequency and duration. Given the intensity of vessel traffic and intervention works noise, none of these effects have been reported in the literature from this kind of sources.

It has been hypothesised that Damage to Tissue (TD) and subsequent stranding occurs when resonance from loud sounds causes air- or fluid-filled organs to vibrate at very high amplitudes. As the organs vibrate, the tissues surrounding the organs might haemorrhage and become damaged. This effect on marine mammals have only been reportedly associated with high intensity pulsating sounds such as military sonars and undersea detonations, and never related to traffic or subsea construction not involving explosions.

Seabed interventions for microtunnel construction, which include trenching, are restricted to a very small area along the pipeline route. These activities will generate noise and vibration at the level that exceeds that generated by other construction activities. Dredging (frequencies between 0.020 and 1 kHz, with a peak of approximately 0.020-2 kHz) and trenching (peak levels of 178 dB at 1 metre from the source at 160 Hz). In a very conservative scenario, and according to similar projects, intervention works activities are expected to have a maximum behavioural zone of influence on dolphins of approximately 1 km, in most cases cetaceans would vacate the construction area at the first instance of a foreign sound or change in background noise, and as for vessel noise, 1 km is minimal compared with the normal activity range.

However due to the risk to affect reproductive turtle females in their potential route to the future potential nesting beach at landfall, and in order to apply the precautionary principle, landfall construction works are planned to take place outside the turtle nesting period of June-August (Marine turtles in the Mediterranean - Groombridge, B., WCMC) During pre-commissioning activities, the uptake of seawater and flooding of the pipeline, the noise and vibration emissions will be much lower than for the other planned activities.
Increase in turbidity

As mentioned for the impacts on the water column and fish, the Italian offshore environment has naturally occurring levels of turbidity in the coastal area and it is thus expected that turbidity levels will be not be increased significantly above background levels and any sediments that are placed into suspension will not contribute significantly to existing levels. Overall, any increase in turbidity levels is expected to be of short duration and localised to the construction area. In any case, the amount of intervention works expected and the material to be re-suspended, confirmed by the results of the specific modelling carried out to that effect, are expected to show the same orders of magnitude than any storm event; thus indiscernible from natural phenomena (small magnitude).

8.3.6.2.2 Mitigation Measures

Due to the limited extent and duration of seabed interventions, and that such work will only occur at specific points along the pipeline route, identified impacts are considered to be negligible or of small magnitude and therefore no specific mitigation measures are required to be implemented (with the exception of general mitigation measures listed in the Paragraph 8.1.1).

As mentioned, and for precautionary purposes, the period of turtles' nesting (June-August) is planned to be avoided for landfall activities in order to prevent any interference. Furthermore, as a protective measure, trained Marine Mammals Observers will be included during pipelaying and coastal works.
The following table presents a summary of residual impacts.

**Table 8-41 Residual Impacts**

<table>
<thead>
<tr>
<th>Impact</th>
<th>Mitigation Commitments to Address the Impact *</th>
<th>Significance of Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Marine Mammals and Reptiles Impact – Construction and Pre-commissioning Phase</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise and vibration</td>
<td>Marine mammals observation</td>
<td>Minor</td>
</tr>
<tr>
<td></td>
<td>landfall construction works are planned to</td>
<td></td>
</tr>
<tr>
<td></td>
<td>take place outside the turtle nesting period</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Marine mammals have already</td>
<td></td>
</tr>
<tr>
<td></td>
<td>habituated to the noise and vibration by vessel movement.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Impacts from seabed intervention works</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Impacts on a regional scale but of short</td>
<td></td>
</tr>
<tr>
<td></td>
<td>duration and reversible.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low intensity impact from</td>
<td></td>
</tr>
<tr>
<td></td>
<td>uptake of seawater and flooding of</td>
<td></td>
</tr>
<tr>
<td></td>
<td>the pipeline.</td>
<td></td>
</tr>
<tr>
<td>Localised increase in turbidity</td>
<td>Marine mammals observation</td>
<td>Not Significant</td>
</tr>
<tr>
<td>from re-suspension and spreading of sediments</td>
<td>landfall construction works are planned to</td>
<td></td>
</tr>
<tr>
<td></td>
<td>take place outside the turtle nesting period</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mammals use their hearing ability for</td>
<td></td>
</tr>
<tr>
<td></td>
<td>navigation and hunting.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other marine fauna, on which</td>
<td></td>
</tr>
<tr>
<td></td>
<td>marine mammals and reptiles would feed, may</td>
<td></td>
</tr>
<tr>
<td></td>
<td>vacate the construction area.</td>
<td></td>
</tr>
</tbody>
</table>

*) Mitigation measures in italic will be developed in a further stage of the project

The sensitivity of marine mammals and reptiles as receptors to the above impacts, particularly noise is considered to be medium, while impact magnitude and impact significance, summarised in Table 8-41, are reported in the following paragraphs. The criteria are reported in Annex 6 Baseline and Impact Assessment Methodology.

**Noise and vibration**

Sensitivity of the resource to noise and vibration is considered to be medium. General shipping activity and pipe laying in high seas is likely to cause behavioural changes in marine mammals at a distance of 0.5 km. These distances are minimal considering the normal ranges of distance of activities. Also as the pipeline route is largely within or close to normal shipping lanes it is expected that cetaceans in the area have already habituated to the noise and vibration generated by vessel movement (small magnitude) and thus the impact is minor.

Impacts from seabed intervention works are expected to be on the individual rather than at the population level. Impacts are both negative and direct, will be on a regional scale around the source of impact but of short duration during construction and will be reversible. Impact magnitude is small. Impact significance is expected to be minor.
The impact from uptake of seawater and flooding of the pipeline on marine mammals and reptiles (small magnitude) is considered not significant.

**Increase in turbidity**

As marine mammals use their hearing ability for navigation, as well as for hunting, the sensitivity of the resource is considered to be low. Magnitude is considered to be small and, therefore, an increase in turbidity is expected to yield a not significant impact on individuals. Other marine fauna, on which marine mammals and turtles would feed, may vacate the construction area due to noise and an increase in turbidity. This may temporarily affect feeding areas but the associated impact is expected to be not significant as marine mammals and reptiles are able to hunt over large distances and would typically avoid the construction areas.

8.3.6.3 Operations and Maintenance Phase

During the operation phase and maintenance phase, the sources listed below could cause potential impacts on marine mammals and reptiles.

**Table 8-42 Marine Mammals and Reptiles Impact – Operation and Maintenance Phase**

<table>
<thead>
<tr>
<th>Source of Potential Impact</th>
<th>Potential Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas movement within the pipeline, external inspections and routine maintenance works.</td>
<td>Noise and vibration</td>
</tr>
<tr>
<td>External inspection/maintenance works.</td>
<td>Localised increase in turbidity from re-suspension and spreading of sediments</td>
</tr>
</tbody>
</table>

From the above sources, the following potential impact-led assessment has been completed for the marine mammals and reptiles where all sources of impact are grouped so that an overall assessment can be made of the key impacts associated with the project as outlined at the beginning of this section.

8.3.6.3.1 Potential Impacts

Impacts upon marine mammals during the operational phase are limited to noise and vibration from gas movement within the pipeline as well as from external inspections. An increase in turbidity is expected to coincide with external inspections and routine maintenance works should they interact with the seabed.

8.3.6.3.2 Mitigation Measures

Due to the limited extent and duration of offshore activities, identified impacts are considered to be negligible or of small magnitude and therefore no specific mitigation measures are required to be implemented (with the exception of general mitigation measures listed in the previous Section 8.1).
8.3.6.3.3 Residual Impacts

Table 8-43 presents a summary of residual impacts.

Table 8-43 Residual Impacts

<table>
<thead>
<tr>
<th>Impact</th>
<th>Mitigation Commitments to Address the Significance of Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marine Mammals and Reptiles Impact – Operation and Maintenance Phase</td>
<td></td>
</tr>
<tr>
<td>Noise and vibration</td>
<td>None</td>
</tr>
<tr>
<td>Localised increase in turbidity from re-suspension and spreading of sediments</td>
<td>None</td>
</tr>
</tbody>
</table>

The sensitivity of the resource marine mammals and reptiles is considered to be low, while impact magnitude and impact significance, summarised in Table 8-43, are reported in the following paragraphs. The criteria are reported in Annex 6 Baseline and Impact Assessment Methodology.

The noise generated by the movement of gas within the pipeline falls below or very near the audibility threshold of the marine mammals and reptiles present in the Italian Offshore environment (small magnitude). As such, it is expected that gas movement in the pipeline would have little to no impact on marine mammals and reptiles at either an individual or population level. The impact is deemed to be not significant.

External inspections and routine maintenance works are expected to generate similar noise to the vessel traffic during construction, and as will be restricted to the pipeline route and infrequent (i.e. not constant) are thus assumed to have a small magnitude and not significant impact upon marine mammals and reptiles.

Similarly re-suspension and spreading of sediments and a subsequent increase in turbidity are not expected to occur on a regular basis and will be localised, the impacts on marine mammals and reptiles are expected to be not significant.

8.3.6.4 Decommissioning Phase

For the pipeline decommissioning, considering that the pipes will remain underground/on the sea bed, the related impacts on water resources will be not significant.
8.3.7 Seabirds

8.3.7.1 Overview

The TAP Project pipeline does not pass through any national or international sites designated for birds, and there will therefore be no direct loss of habitat or other effects on birds within designated sites in the Adriatic Sea.

Potential visual and physical disturbance to birds from vessels involved in the three phases of the TAP Project are most likely to impact on migrating birds aggregating on open water, post moult flocks rafting on open water and birds feeding in open water. Since a greater amount of vessel movement is associated with marine pipeline construction activities than for pre-commissioning pressure testing or operational routine inspection and maintenance activities, the greatest impact on birds is expected during the construction phase. Impacts during the pre-commissioning and operational phases are expected to be minimal in comparison.

The following box shows the key sources of impact, potentially impacted resources and receptors, baseline and project influencing factors associated with the impacts of the TAP Project on seabirds. In particular this section addresses the principal issues (potential impacts), proposed mitigation and management measures and then discusses the residual environmental impacts of project construction and operations activities.

During the development of the pipeline route, the Project has sought to avoid.

Box 8-9 Key Sources of Impact, Potentially Impacted Resources and Receptors

<table>
<thead>
<tr>
<th>Sources of Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction and pre-commissioning phase: seabed intervention works, pipe-laying activities and vessel movements resulting in noise and vibration; and visual/physical disturbance.</td>
</tr>
<tr>
<td>Operations and Maintenance Phase: routine inspection and maintenance works resulting in noise and vibration, and visual/physical disturbance.</td>
</tr>
<tr>
<td>Decommissioning Phase: pipes remain underground and are filled with a suitable material.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Potentially Impacted Resources and Receptors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sea birds</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Baseline Influencing Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAP project pipeline does not pass through any national or international sites designated for birds, but the presence of seabirds along the pipeline route cannot be excluded</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project Influencing Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific techniques used for micro tunnelling, trench excavations, direct seabed positioning</td>
</tr>
</tbody>
</table>

Table 8-44 presents the key impacts of the TAP Project on the seabirds during the key Project phases.
Table 8-44 Key Impacts – Seabirds

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Noise and vibration.</td>
<td>• Noise and vibration.</td>
<td>• None</td>
</tr>
<tr>
<td>• Visual / physical disturbance.</td>
<td>• Visual / physical disturbance.</td>
<td></td>
</tr>
</tbody>
</table>

8.3.7.2 Construction and Pre-commissioning Phase

For the construction and pre-commissioning phase of the Project the following impact sources have been identified.

Table 8-45 Seabirds Impact - Construction and Pre-commissioning

<table>
<thead>
<tr>
<th>Source of Potential Impact</th>
<th>Potential Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passage of construction and support vessel.</td>
<td>Noise and vibration.</td>
</tr>
<tr>
<td>Passage of construction and support vessel.</td>
<td>Visual / physical disturbance.</td>
</tr>
</tbody>
</table>

From the above sources, the following potential impact-led assessment has been completed for the seabirds where all sources of impact are grouped so that an overall assessment can be made of the key impacts associated with the Project as outlined at the beginning of this section.

8.3.7.2.1 Potential Impacts

Noise and vibration

Comparatively little is known about the impacts of noise and vibration on birds, current research has shown that some seabirds such as terns can be sensitive to particular sound producing activities such as piling. However, noise and vibration generating activities for the TAP Project are expected to be consistent rather than intermittent and the areas of importance for birds are sufficient distance for this impact to be minimal, and because noise generated at sea surface-level will be of comparable volume to that for other shipping activity in the Adriatic Sea.

Visual / physical disturbance

The construction activities for the TAP Project are not located close to the shallow waters that are regularly inhabited by seabirds in the Adriatic Sea along most of their route. However, in some places physical and visual disturbance of birds may result from vessels encountering flocks of birds at sea, during pipeline construction. The distance from which different species of birds are affected by this type of disturbance varies between species, and depends on the nature of a vessel’s movement. The pipe-laying vessels for the TAP Project will move slowly, since pipe-laying will progress at a rate of 2 to 3 km a day. Therefore, the risk of disturbing sitting birds is very low.

8.3.7.2.2 Mitigation Measures

Due to the limited extent and duration of offshore activities, identified impacts are considered to be negligible or of small magnitude and therefore no specific mitigation measures are required to
be implemented (with the exception of general mitigation measures listed in the previous Section 8.1.1).

8.3.7.2.3 Residual Impacts

Table 8-46 presents a summary of residual impacts.

Table 8-46 Residual Impacts

<table>
<thead>
<tr>
<th>Impact</th>
<th>Mitigation Commitments to Address the Impact*</th>
<th>Significance of Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seabirds Impact – Construction and Pre-commissioning Phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise and vibration.</td>
<td>None</td>
<td>Not Significant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Small magnitude</td>
</tr>
<tr>
<td>Visual / physical disturbance.</td>
<td>None</td>
<td>Not Significant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Sea birds are accustomed to vessel movements.</td>
</tr>
</tbody>
</table>

The sensitivity of the resource seabirds is considered to be low, while impact magnitude and impact significance, summarised in Table 8-46, are reported in the following paragraphs. The criteria are reported in Annex 6 Baseline and Impact Assessment Methodology.

**Noise and vibration**

Due to small magnitude of the impacts and low sensitivity of the resource, it is concluded that noise impacts are expected to be **not significant**.

**Visual / physical disturbance**

Sea birds are accustomed to vessel movements in the area and will experience little disturbance. While birds may be put off landing in the immediate area of construction works, the pipe-laying vessel is unlikely to disturb flocks and the impacts associated with vessel movement on seabirds during the construction phase are considered to be of small magnitude and **not significant**.

8.3.7.3 Operations and Maintenance Phase

For the operation and maintenance phase of the Project the following impact sources have been identified.

Table 8-47 Seabirds Impact – Operation and Maintenance Phase

<table>
<thead>
<tr>
<th>Source of Potential Impact</th>
<th>Potential Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>inspections and maintenance activities.</td>
<td>Noise and vibration.</td>
</tr>
<tr>
<td>inspections and maintenance activities.</td>
<td>Re-suspension and spreading of sediments.</td>
</tr>
<tr>
<td>inspections and maintenance activities.</td>
<td>Visual / physical disturbance.</td>
</tr>
</tbody>
</table>
From the above sources, the following potential impact-led assessment has been completed for the seabirds where all sources of impact are grouped so that an overall assessment can be made of the key impacts associated with the project as outlined at the beginning of this section.

8.3.7.3.1 Potential Impacts

Inspections and maintenance activities are assumed to have limited impact upon sea birds, will be restricted to the pipeline route and will be occasional and infrequent.

8.3.7.3.2 Mitigation Measures

Due to the limited extent and duration of offshore activities, identified impacts are considered to be negligible or of small magnitude and therefore no specific mitigation measures are required to be implemented (with the exception of general mitigation measures listed in the previous Section 8.1.1).

8.3.7.3.3 Residual Impacts

Table 8-48 presents a summary of residual impacts.

Table 8-48  Residual Impacts

<table>
<thead>
<tr>
<th>Impact</th>
<th>Mitigation Commitments to Address the Impact</th>
<th>Significance of Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seabirds Impact – Operation and Maintenance Phase</td>
<td></td>
<td>Not significant</td>
</tr>
</tbody>
</table>
| Noise and vibration. | None | • Inspections and maintenance activities are not expected to occur on a regular basis.  
• Low sensitivity of the resource. |
| Re-suspension and spreading of sediments. | None | Not significant  |
| Visual / physical disturbance. | None | Not significant  |
| | | • Inspections and maintenance activities are not expected to occur on a regular basis.  
• Low sensitivity of the resource. |

The sensitivity of the resource seabirds is considered to be low, while impact magnitude and impact significance, summarised in Table 8-48, are reported in the following paragraphs. The criteria are reported in Annex 6 Baseline and Impact Assessment Methodology.
As routine inspections and occasional maintenance activities are not expected to occur on a regular basis, and would only result in a few extra vessel sailings, the impacts on birds in terms of noise and vibration and visual / physical disturbance are expected to be far lower in both magnitude (small) and duration than for the construction phase and for the operational phase are again considered to be **not significant**.

8.3.7.4 Decommissioning Phase

For the pipeline decommissioning, considering that the pipes will remain underground/on the sea bed, the related impacts on water resources will be **not significant**.
8.4 Offshore Socioeconomic and Cultural Heritage Environment

8.4.1 Fishermen and Livelihood, Marine Traffic

8.4.1.1 Overview

This section presents the potential impacts on the offshore social environment, particularly in terms of fishing, livelihoods and marine traffic activities, as a result of Project related activities. Where significant impacts are foreseen, measures to prevent or mitigate adverse impacts or to enhance positive impacts are included in this report and will be implemented. In the case of unforeseen impacts the Project will implement mitigation measures as needed to reduce impacts to acceptable levels. Based on an assessment of potential impacts, after these measures are implemented, a summary table of residual impact designations is provided for each area of impact. TAP AG designed a Grievance mechanism based on past experience and in line with international standards (see Section 7). These mechanisms as measures to pre-empt rather than react to and will be monitored and revised during the Project’s lifetime and will be utilised “both as a risk mitigation approach and a barometer of success for other stakeholder engagement processes” (IFC, 2009)

The Project description and the baseline information about the environmental, social, and economic conditions (see Sections 4 and 6) have been used to assess the possible socioeconomic impacts.

The box below shows the key sources of potential impacts, resources and receptors, baseline and Project influencing factors associated with the impacts of the TAP project on offshore social activities.

**Box 8-10 Key Sources of Impact, Potentially Impacted Resources and Receptors**

**Sources of Impact**
- Project use of Brindisi Port
- Marine vessel traffic
- Offshore pipeline construction activities
- Offshore trenching and related construction to landfall point

**Potentially Impacted Resources and Receptors**
- Fishermen in the Study Area
- Marine traffic

**Baseline Influencing Factors**
- Fishing activity in the area
- Low productivity and incomes of small-scale fishermen

**Project Influencing Factors**
- Pipeline route
- Pipeline construction activities
- Number of marine vessels, marine traffic routes and travel times
- Safety zone
- Duration of offshore construction activity
The following table presents the key impacts of the TAP Project on offshore social activities during the key Project phases.

Table 8-49  Key Potential Impacts – Offshore Social Environment

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Temporary impacts on fishermen livelihoods.</td>
<td>• Potential perception of risk for fishing activities along the route of the pipeline.</td>
<td>No potential impacts are foreseen. The Decommissioning Phase will be limited to onshore structures (i.e. the PRT and BVS).</td>
</tr>
<tr>
<td>• Increases in marine traffic and safety risks (i.e. potential vessel collisions).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Restricted access to certain offshore areas during offshore construction activity.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8.4.1.2  Construction and Pre-commissioning Phase

8.4.1.2.1  Potential Impacts

Temporary impacts on fishermen livelihoods

The offshore construction and pre-commissioning phase is expected to last for a total of around 6 months. During certain parts of this period some interference with fishermen’s use of the sea in the Project Area is likely to occur, however this interference is likely to be limited in geographic area and time and confined to a limited number of Project vessels.

Use of Brindisi Harbour

Brindisi Harbour is likely to be chosen as the location of the laydown yard for piping and other materials and supplies needed for offshore construction. If chosen, all offshore materials and crew will be transported through Brindisi harbour, and all waste and wastewater will be unloaded at this harbour. The number of Project marine vessel movements are estimated at a maximum of 2-3 vessels per day during the construction period. These vessels will be active in the area between Brindisi Harbour and the Project Area. Brindisi has developed its port areas, creating new docks and new space designated for industrial activities (Outer Port, 3 million m²). Thus, no capacity problems related to the Project’s use of this harbour are foreseen.

The Project use of the Outer Port is likely to minimise potential impacts on commercial and other marine users who utilise the Middle and the Inner Port. Because of the limited use of Brindisi by fishermen (who are commonly based from other, smaller, nearby harbours) the Project’s use of the port is likely to have an insignificant impact on fishermen.

Fishing Areas

While the Port of Otranto is mostly used by fishermen employed in the large-scale fishery, the Port of San Foca is a centre for small-scale fishing. Fishermen venturing into coastal waters between Torre Specchia Ruggeri and San Foca are generally employed in both sectors, and practice bottom trawling as well as passive fishing techniques (in this case, fishing nets are not attached to the vessel).
Direct and indirect potential impact on fishing activities arising from the Project were identified and evaluated. The Project will result in the temporary loss of a small portion of fishing ground due to a safety zone of approximately 2-3 km radius (depending on the anchor spread) that would be adopted to prevent interferences with marine users. However, no significant interferences with fishing activities are foreseen, mostly due to:

- The small size of the affected area;
- The short-term duration of the offshore activities in the areas used by small-scale fishermen (typically 1.5 - 3 miles from the coast) and large-scale fishermen (typically 3 – 12 miles from the coast);
- The availability of alternative fishing areas within the immediate vicinity of the Project area; and
- The temporary and insignificant loss of fisheries production.

Project construction activities that have been taken into consideration due to their potential impact on fishing activities are the following:

**Sea bed preparation and dredging at the landfall microtunnel exit:** The microtunnel exit will be located 1100 m from the coastline and at approximately 27-30 m water depth. In the area just outside the tunnel exit, for a length of approximately 50 metres, the seabed will be trenched and backfilled in preparation for receiving and retrieving the Tunnel Boring Machine (TBM). Beyond 50 metres distance, the seabed will be pre-trenched for about 150 metres. Further out the pipeline will be laid directly on the seabed. The microtunnel exit and associated seabed preparations is at 1,1-1,3 km from the coastline which is not within the area most frequently used by fishermen (1,5 miles (2,4 km) seawards). As per the Project description, there will be only limited dredging activity with localised and temporary impact on the seafloor at the arrival pit of the TBM (see Sections 8.2 – 8.3).

**Pipeline pull-in into the landfall microtunnel:** The pipelaying vessel will be anchored at approximately 500 m from the microtunnel exit (1.6 km from the coastline) during this operation. The pull-in operation will last about 1 week. However, since anchor wires, and the associated safety zone, may extend into the area that is used by fishermen, a short duration interference (over one week) with fishing activity may result.

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1 “The use of trawls, seines or similar nets is prohibited within 3 nautical miles of the coast or within the 50 m isobath where that depth is reached at a shorter distance (Article 3.1 of Council Regulation (EC) No. 1626/94 of 27th June 1994). However, the use of dredges for catching shellfish may be authorized irrespective of the distance from the coast and depth, provided that the catch of species other than shellfish does not exceed 10% of the total weight of the whole catch (Article 3.2 of Council Regulation (EC) No. 1626/94 of 27 June 1994).” Cfr. www.faoadriamed.org.
Pipelaying offshore: After the pull-in into the landfall microtunnel is completed, the offshore pipelaying will start. The pipelaying vessel will move at a speed of 2-3 km per day and will move through the area of interest to small-scale fishermen in around 1 day, while the area where large-scale fishermen are operating will be passed in around 5 additional days. Alternative fishing areas both in front of and behind the laying vessel will be available at all times. Fishing restrictions will only apply in the safety zone area to avoid a risk of Project vessel and other marine vessel interactions. No significant impact to fisheries during this activity is foreseen.

During pre-commissioning, i.e. hydrostatic pressure testing of the offshore pipeline after installation, a barge equipped with water pumps providing water for the hydrotesting will be anchored some hundred meters outside the microtunnel exit approximately 1.5 km from the coast. No significant interference with fishing activities or other users of the sea is anticipated.

Local stakeholders working in the fishing businesses consulted during the field survey have voiced concerns related to overall Project impacts, both short- and long-term, on fishing stock and marine fauna. These concerns have been taken into consideration by the Project, which will implement the construction activities mainly during winter time and outside the main biological production period to minimise potential impact on fishing stocks.

In conclusion, no significant impacts on fishermen livelihoods and fishing vessels operating in the Study Area are anticipated.

Marine Traffic

Project vessel movements will add to existing navigation and shipping traffic in the Project area, potentially increasing marine traffic safety risks. Potential marine traffic risks during the construction phase are likely to include:

- Risk of vessel collisions;
- Restricted access to certain offshore areas; and
- Increased traffic along Project navigation routes.

The Port Regulatory Plan (PRP) and the Port Operative Plans (POT) were used as a source of primary information in order to provide detailed characterization of current marine traffic volumes and assess the potential interferences of the Project with local marine traffic.
The characterization has been carried out including an analysis of impacts on local marine traffic produced by construction equipment. Furthermore data derived from the desktop analysis performed in order to develop the baseline of the ESIA of the Albanian portion of TAP Project are presented. Where no useful data were available from the PRPs or POTs, data from the local port Authorities registers have been used. These potential impacts are likely to be short-term and limited by there being only 2-3 vessels active in the area. As a matter of standard operating procedures, special attention will be given to areas where shipping lanes and other heavy traffic areas are crossed. To minimise the risk of incidents, all activities will be notified to mariners/users of the sea well in advance of the activity taking place, and watch duties will be performed to alert vessels on anintersecting course.

**Brindisi Operative Plans and Otranto Port Regulatory Plan**

The analysis of the available *Port of Brindisi-Three Years Operative Plans (2013-2015)*, highlighted the aim of expansion of the Brindisi Harbour.

The investments/upgrades in Brindisi Marine State Property is expected to amount to around 136 million euros for the three years period. The main investments/upgrades will be focused on:

- Adjustment of the chemical and gas pier
- Completion of port berthing ferries structures
- Expansion of “Carlottu Navy barracks”
- Infrastructural works
- Infrastructure works of Security System of the inner harbour terminal (Sant’Apolinnare e Costa Morena)
- Upgrading of Roll on – Roll off (Ro-Ro) ships moorings
- Redevelopment and renovation of the Regina Margherita promenade (Waterfront of Brindisi)

Based on this information, Brindisi is expected to become the logistics centre for the Apulia Region through the expansion of its Harbour.

According to the analysis of the *Port of Otranto Regulatory Port Plan* the Otranto harbour is expected to expand also. The preliminary project for the harbour expansion, developed by the *Italian Company for Water Infrastructures* (*Società italiana per condotte d’acqua S.p.A.*), has already been approved by the Authorities. The final project has been presented to the Otranto Municipality and to the Apulia Region (July 2011) and a local environmental impact assessment has been carried out together with the finalization of the ESIA document.

Based on this project, a new harbour basin will be realized in the area surrounding the existing basin, covering a total surface of 135,000 m². The new basin will have capacity for 417 sailboats and motorboats, ships and cruise liner. The development of new commercial places, harbour services and touristic centres has also been planned.

The following *figure* shows of the new harbour basin in Otranto (red line).
The analysis highlighted that both harbours (Brindisi and Otranto) have a large capacity and are able to support a large number of ships; besides both ports are expected to grow in terms of capacity and surface area.

The pipe laying operation requires the activities of specific vessels. In particular most of the pipe laying activities will be carried out by pipeline installation vessels, such as a Pipe laying Barge or Dynamic Positioned Lay Vessel, (specialized vessels). In addition, other vessels will be needed during the activities, such as supply vessel to provide the material needed, crew vessel to ensure the crew shift, pipe carrier barge, etc. The following table presents the vessels involved in pipe laying activities.
Table 8-50  Vessel involved in the pipelaying activities

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipelay barge</td>
<td>1</td>
</tr>
<tr>
<td>Anchor handling tug</td>
<td>3</td>
</tr>
<tr>
<td>Supply Vessel</td>
<td>3</td>
</tr>
<tr>
<td>Pipe carrier barge</td>
<td>3</td>
</tr>
<tr>
<td>Crew boat</td>
<td>1</td>
</tr>
</tbody>
</table>

Source: Saipem (October 2011)

The Pipe laying barge, and the Anchor handling tugs will be involved in the pipe laying operation, thus they will not make use of the ports for dock or supply. Among the vessels presented in the previous table only the vessels involved in the supply of the pipe laying barge with pipes and goods and in the crew shifts will use the ports infrastructures in Brindisi.

Taking into account the limited and temporary use of the ports infrastructure during the offshore pipeline operations, the impact of TAP Project on the ports operation and related traffic will be negligible

Increased traffic along Project navigation routes.

The following information derives from the studies performed in order to develop the baseline Section of the ESIA for the Albanian section of the TAP Project and from TAP- Offshore Pipeline Risk Analysis.

During the Offshore Pipeline Risk Analysis commissioned by TAP in 2010, detailed data related to ship traffic in the interested area have been collected. The results of the assessment of ship traffic crossing the pipeline are shown in Figure 8-3 below. The Figure presents the ship traffic density plot in relation to the pipeline route. The colour ranging from yellow to red to black is used to indicate the ship traffic density for the given Automatic Identification System (AIS) data¹.

The maximum distance kept between two observations is 50 km with a maximum time of 7 hours. Constrained areas are shown as follows: Anchoring zones (green), entrance to Brindisi harbour (grey) and forbidden area (red).

With regard to ship traffic density on the Italian side of the Adriatic Sea, the area in front of the forbidden zone and Otranto Harbour are the most affected by ship traffic.

¹ In order to estimate the volume and particulars of ship traffic crossing the pipeline data from various sources were considered by TAP: (a) Automatic Identification System (AIS) data was used to obtain a qualitative information on where the ship crossed the pipeline, and (b) The specific numbers of ships crossing the pipeline were obtained from the report on the maritime traffic flow in the Adriatic Sea, /25/, and information of ship arrivals to ports in the Adriatic Sea.
Figure 8-3  Assessment of ship traffic crossing the TAP pipeline

Source: ERM

A large part of the observed ships which are crossing the pipeline travels close by Brindisi and not in the middle of the strait between Italy and Albania. This is possible due to the fact that most of the ships prefer to take the shortest path to their destination and the water depth at this part of the Adriatic Sea poses no restrictions with respect to maritime safety. From the density plots it is also observed that the ships avoid passing through the forbidden area (marked by red) and are therefore crossing the pipeline quite far from the Italian landfall.

The ferry traffic crossing the pipeline is mainly governed by the ferry routes between Italy and Greece. Also one ferry route between Italy and Albania has been identified. The routes operated by six different companies are typically departing from Venice, Bari or Brindisi in Italy and arriving in Igoumenitsa, Corfu, Patra, and Cephaloniam in Greece or Vlorë in Albania.

According to the offshore risk assessment undertaken by TAP AG, it is estimated that a passenger ferry will cross the pipeline approximately 7,900 times a year.

The study performed for the Albanian portion of TAP Project and the TAP - Offshore Pipeline Risk Analysis have been analysed in order to identify the potential impacts caused by the Project Construction and Operation phases on the marine traffic.
The analysis highlighted that the TAP offshore route will cross areas highly affected by marine traffic, and the pipe laying vessel spread will interfere with the existing traffic directly during the construction activities. However the following aspects have to be considered:

- The pipe laying operation is typically carried out at a rate of 2-3 km of pipe laid per day;
- The safety radius identified for the vessel spread will be only 2-3 km (depending on the anchor spread);
- During the pipe laying operation the vessel spread will be appropriately indicated, in order to allow incoming vessels to avoid the pipeline route.

Considering that the pipe laying operation will be carried out at a rate of 2/3 km per day, the interference of the project with local marine traffic will be limited at the first two weeks of pipe laying activities. Therefore, the impact caused by the Project on local marine traffic can be reasonably considered **low**.

8.4.1.2.2 Mitigation Measures

As described, potential impacts to fishing activities and marine traffic in the Project Area during construction and pre-commissioning are likely to be short-term. TAP will implement the following mitigation measures to minimise the potential impacts.

**Temporary impacts on fishermen livelihoods**

The following measures will be implemented to minimise any potential adverse impact on the fishing activities.

- As part of TAP AG’s Stakeholder Engagement Strategy, the Project will consult on an ongoing basis with fishermen and fishermen organisations (cooperatives) of San Foca, Otranto and Brindisi to disclose Project information, particularly regarding TAP Project offshore activities and any safety requirements with respect to exclusion zones.
- Two fishermen’s representatives (one from each of the cooperatives) will be invited to stay on board the pipelaying vessel at all times during pipelaying. The fishermen’s representatives will act as a liaison between the Project and the fishermen working in the area in order to facilitate and improve the communication and cooperation between the parties.
- While the Project does not foresee any economic displacement impacts to fishermen from routine construction or operations, any unforeseen impacts (through routine or non-routine circumstances) will be compensated in accordance with Italian legal requirements and Internationally Recognised Practice.
- As part of TAP AG’s Strategy for Grievance Redress, the Project will put in place a grievance process to capture and effectively respond to any stakeholder issues arising from the Project construction and pre-commissioning phase.
• All nearshore and offshore activities related to the construction and pre-commissioning of the TAP pipeline will be notified to mariners in accordance with established maritime practices at a national level. The pipeline route will be marked on nautical charts. Standard vessel navigation and communication equipment such as radar, ship-to-ship radio, etc. will be utilised.

• The Project will establish a safety/fishing exclusion zone around the pipelaying vessel with a radius of 2-3 km (depending on type of pipelaying vessel) to minimise the risk of interaction with marine vessels, including fishing vessels.

• All vessels involved in the Project will have Health, Safety and Environmental management systems in place in accordance with international regulations (MARPOL)

• The project will conduct offshore construction activities outside the summer season and will avoid the main period of biological reproduction to minimize potential impacts on fishing stocks.

Marine Traffic

The exclusion zones, notification procedures and liaison measures outlined above to manage the potential impacts on fishing will be equally applicable to avoid the risk of collision between Project and non-Project vessels.

8.4.1.2.3 Residual Impacts

The following table presents a summary of the residual impact associated with the impacts identified.
### Table 8-51  Residual Impacts – Offshore Social Environment - Construction and Pre-Commissioning

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Commitments to Address the Impact</th>
<th>Significance of Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Obstructing access to fishing areas.</td>
<td>Consult on an ongoing basis with fishermen and fishermen organisations (cooperatives) particularly regarding TAP offshore activities and any safety requirements with respect to exclusion zones.</td>
<td>Not Significant</td>
</tr>
<tr>
<td>• Temporary impacts on fishermen livelihoods.</td>
<td>Two fishermen’s representatives will be invited on board of the pipelaying vessel at all times during pipelaying. The fishermen’s representatives will act as a liaison between the Project and the fishermen venturing the area in order to facilitate and improve the communication and cooperation between the parties.</td>
<td></td>
</tr>
<tr>
<td>• Increase in marine traffic and safety risks (e.g. vessel collisions).</td>
<td>Pipeline route marked on nautical charts. Notify mariners of the presence and character of marine operations. The Project will establish safety exclusion zone around the pipelaying vessel (2-3 km radius, depending on type of pipelaying vessel). Construction activities will be implemented mainly during winter time and outside the main biological production period. Standard vessel navigation and communication equipment such as radar, ship-to-ship radio, etc. will be utilised. All Project vessels will have Health, Safety and Environmental management systems in place in accordance with international regulations (MARPOL).</td>
<td></td>
</tr>
<tr>
<td>• The microtunnel exit and associated seabed preparations is at 1.1-1.3 km from the coastline which is not within the area most frequently used by fishermen (1.5 miles (2.4 km) seawards). Fishing restrictions will be temporary and short-term and only apply in the safety zone area to avoid risk of Project vessel and other marine vessel interactions.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• In case of unforeseen impacts (due to unplanned events), TAP AG will compensate potential damages according to national legislation and the best international practices.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
8.4.1.3 Operations Phase

8.4.1.3.1 Potential Impacts

**Marine Traffic and Fishery**

After the pipeline is installed there will be no restrictions on marine vessel movements in the area. No restrictions on the operation of fishing equipment, including demersal trawling, will apply.

Even if the pipeline is dimensioned to withstand impacts from demersal trawls, some fishermen may perceive the presence of the pipeline on the seabed as an obstruction to the operation of such equipment. However, over-trawling tests conducted in the North Sea show that the trawl equipment crosses this type of pipeline without any significant problems. In conclusion, subsea pipeline during operation are unlikely to impede or obstruct fishing activities or cause damage to fishing equipments.

8.4.1.3.2 Mitigation Measures

TAP AG will implement the following mitigation measures to minimise the potential impacts.

- The location of the pipeline / the pipeline route will be marked on nautical charts.
- Grievance mechanism, to resolve any residual concerns relating to operational phase impacts (foreseen or unforeseen).

8.4.1.3.3 Residual Impact

The following table presents a summary of the residual impact.

### Table 8-52 Residual Impacts – Social Environment - Operation

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Commitments to Address the Impact</th>
<th>Significance of Residual Impact</th>
</tr>
</thead>
</table>
| Impact on the operation of demersal trawl equipment. | • Grievance mechanism.  
   • Mark the pipeline route on nautical charts. | Not Significant  
   • Overtrawling tests conducted in the North Sea show that the trawl equipment crosses this type of pipeline without any significant problems. |

8.4.1.4 Decommissioning Phase

8.4.1.4.1 Potential Impacts

No potential impacts are expected to result from the Project because decommissioning activities will only take place onshore (limited to the Pipeline Receiving Terminal and the Block Valve Station).
8.4.1.4.2 Mitigation Measures

No mitigation measures are necessary, as no project activities will be performed offshore during the decommissioning phase.

8.4.1.4.3 Residual Impact

No post-mitigation residual impacts are expected to result from the Project, as project activities will not be performed offshore during the decommissioning phase.

8.4.2 Marine Cultural Heritage

Box 8-11 shows the key sources of impact, the potentially impacted resources and receptors, baseline and Project influencing factors associated with the TAP offshore Project.

**Box 8-11 Key Sources of Impact, Potentially Impacted Resources and Receptors**

**Sources of Impact**

- Construction Phase: activities that disturb the seafloor and immediate sub-floor areas, including landfall construction activities.
- Operation Phase: No significant impacts identified;
- Decommissioning Phase: No significant impacts identified.

**Potentially Impacted Resources and Receptors**

- Marine surveys have not identified archaeological findings. However the potential risk for unknown marine archaeological resources remains.

**Baseline Influencing Factors**

- No presence of known cultural heritage evidence However the potential risk for unknown marine archaeological resources remains.
- **Project Influencing Factors**
  - Micro-tunnelling construction to reduce impact to the sea floor from trenching and pipe laying.
  - Fibre optic cable (FOC) installation
  - Cultural Heritage Management Plan procedures.

*Table 8-53 presents the key impacts of the TAP Project on marine archaeological findings during the key Project phases.*
Table 8-53 Key Potential Impacts – Offshore Cultural Heritage

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Loss of the scientific, cultural, or historical value of unknown underwater</td>
<td>• No impacts identified</td>
<td>• No impacts identified</td>
</tr>
<tr>
<td>archaeological sites due to direct physical disturbance or damage to a finding</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• No impacts identified</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• No impacts identified</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The following sections expand on each potential impact and provide information on how each source is likely to have an impact on receptors. The mitigation measures built into the Project will also be discussed.

8.4.2.1 Construction and Pre-commissioning Phase

8.4.2.1.1 Potential Impacts

**Loss of Scientific, Cultural, or Historical Value of Cultural Heritage Sites due to Direct Physical Disturbance or Damage to the Sites or Vibration**

The key sources of impact on cultural heritage will result from activities that disturb the seafloor, i.e. those involving microtunnel exit/landfall preparation. Based on the desktop research the offshore project area retains a moderately high potential for undiscovered sites. The investigations have not identified any specific areas of marine archaeological interest. However, unknown sites may only be encountered during ground-disturbing activities.

8.4.2.1.2 Mitigation Measures

**Loss of Scientific, Cultural, or Historical Value of Cultural Heritage Sites due to Direct Physical Disturbance or Damage to the Sites**

A Chance Finds Protocol will be implemented for construction. This includes monitoring of construction activities by a professional archaeologist and implementation of a stop work protocol if a site is discovered. Work would resume after the implementation of approved mitigation measures defined by relevant national and local authorities.

Based on international cultural heritage standards (e.g. IFC PS 8) if a chance find of importance is discovered during construction, rescue procedures should be conducted as outlined by international and Italian national standards, if it cannot be avoided through project redesign or rerouting.

Continuation of construction at an important chance find should only resume once the rescue excavation is complete.
8.4.2.1.3 Residual Impacts

Table 8-54 presents a summary of the residual impact associated with the impacts identified.

Table 8-54  Summary of the residual impact associated with the impacts

<table>
<thead>
<tr>
<th>Impact</th>
<th>Mitigation Commitments to Address the Impact*</th>
<th>Significance of Residual Impact</th>
</tr>
</thead>
</table>
| Cultural Heritage | • Implementation of archaeological monitoring and a “chance finds” procedure  
| | • Removal of any resources found by rescue excavations in accordance with relevant authorities’ requirement. … if it cannot be avoided through project redesign or rerouting. | Minor to Moderate  
| | • Even though no findings were identified by the survey, unknown archaeological findings could be present and may still be damaged. Therefore, archaeological monitoring will be undertaken during construction. Impacts, if they occur, would most likely be minor. | |

* Mitigation measures in italic will be developed in a further stage of the project

8.4.2.2 Operations and Maintenance Phase

8.4.2.2.1 Potential Impacts

No significant impacts have been identified on the potential unknown cultural heritage during operation phase in the offshore environment.

8.4.2.3 Decommissioning Phase

During the decommissioning phase the offshore pipeline will not be removed, avoiding any impacts on potential unknown archaeological sites.
8.5 Onshore Physical Environment

8.5.1 Onshore – Ambient Air Quality

8.5.1.1 Overview

This section assesses the potential impacts on local air quality over the onshore Project area that may arise as a result of the Project activities. Impacts on local air quality are likely to occur during each phase of the Project, construction and pre-commissioning, operation and decommissioning.

The Project’s contribution to ground level pollutant concentrations might produce exceedances of current air quality standards that determine air pollution. The latter may affect atmospheric properties, materials, vegetation, human health, and in general contribute to safety hazards and interfere with the enjoyment of life and property.

Potential receptors in the Project area consist mainly of the residential population of nearby settlements and workers, fauna and flora species, cultural and historic features, water quality, etc.

Box 8-12 shows the key sources of impact, potentially impacted resources and receptors, baseline and Project related influencing factors associated with TAP Project impacts on ambient air quality.

**Box 8-12 Key Sources of Impact, Potentially Impacted Resources and Receptors**

**Sources of Impact:**
- Temporary dust emissions from earth movement, excavation, vehicle movement, stockpiles, unpaved surfaces, etc. along the working strip, access roads and worksites during onshore Project construction.
- Temporary emissions of flue gases into the atmosphere from vehicles involved in onshore Project construction (i.e. excavators, bulldozers, side booms, trucks, cars).
- Temporary emissions of flue gases and particulate matter into the atmosphere from engine-driven machinery involved in the offshore hydrotesting phase (pre-commissioning) of the Project.
- Atmospheric emissions related to the activity of the PRT gas heating system which consists of two gas fired boilers; atmospheric emissions related to the general pipeline operational maintenance.
- Temporary emissions of dust and exhaust gases produced by earthworks and vehicles activity during the PRT decommissioning.
- Temporary emissions due to the dust production during the decommissioning of the PRT.

**Potentially Impacted Resources and Receptors:**
- Residential population living near the construction site, workers and local vegetation.

**Baseline Influencing Factors**
- The air quality field survey did not highlight any criticalities on NO₂ concentration in the study area.

**Project Influencing Factors**
- Location and emission levels of equipment in the PRT area; amount of machinery in use during the construction phase; specific techniques used for hydrotesting; water management; workers’ sites management, waste management and traffic management.

The following table presents the potential impacts of the TAP Project on local air quality during the Project phases.
Potential impacts relating to each of the three main Project phases are described below prior to presenting the mitigation measures that will be adopted by the Project. Residual impacts are presented taking into account the application of mitigation measures.

8.5.1.2 Construction and Pre-commissioning Phase

During Project construction, the potential impacts on local air quality are related to the following activities:

- Temporary dust emissions from earth movement, excavation, vehicle movement, stockpiles, unpaved surfaces, etc. along the working strip, access roads and work sites.
- Temporary emissions of flue gases into the atmosphere from vehicles (i.e. excavators, bulldozers, side booms, trucks, cars).
- Temporary emissions of flue gases into the atmosphere from engine-driven machinery, in particular from the compressors used during the hydrotesting (pre-commissioning).

The following part of this section analyses each of these activities and presents the methodologies applied in order to estimate their contribution in terms of pollutant emission load and ground level pollutant concentrations. Numerical results are shown and compared with guidelines for air quality protection and air quality standards in force. A detailed assessment of impacts is provided for each of the pollution sources identified.

8.5.1.2.1 Potential Impacts

Dust Emission Impacts

Dust Emission

During the realization of the planned works - PRT site preparation/construction and activities along the pipeline working strip - dust will be produced mainly by re-suspension due to wind and to vehicles’ transit on unpaved road. Moreover dust emissions will be produced by materials handling in yard arrangement, excavations, top-benching, aggregate transport and backfilling operations.
The construction of the PRT site will last 18 months and the area of its construction site is approximately 12 ha, whereas works along the working strip will last 6 months and its working area is approximately 21.3 ha.

The quantity of dust produced by handled material was calculated based on the methodology AP42 developed by US-EPA (AP-42 Fifth Edition, Volume I, Chapter 13, 13.2.4 Aggregate Handling and storage Piles), which takes into account also the contribution of wind. The dust emission factor (F) expressed as kilograms of dust produced per ton of handled material, has been calculated as following:

\[
F = 0.0016 \cdot k \left( \frac{U}{2.2} \right)^{1.3} \left( \frac{M}{2} \right)^{1.4}
\]

Where \( k \) is a non-dimensional parameter related to the dust grain size, \( U \) is the wind speed (m/s), and \( M \) is the humidity of the handled material (%).

The above presented formula can be applied only for wind speed values ranging from 0.6 to 6.7 m/s, and for handled material humidity values ranging from 0.25% to 4.80%. Moreover the formula is valid for silt contents (percentage of particles with a diameter lower than 75 \( \mu \)m) ranging from 0.44% to 19%, which characterises the majority of working sites.

**Table 8-56** Coefficient k, for the calculation of dust emissions from material handling for different grain sizes

<table>
<thead>
<tr>
<th>Grain size</th>
<th>k</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM30</td>
<td>0.74</td>
</tr>
<tr>
<td>PM15</td>
<td>0.48</td>
</tr>
<tr>
<td>PM10</td>
<td>0.35</td>
</tr>
<tr>
<td>PM5</td>
<td>0.20</td>
</tr>
<tr>
<td>PM2.5</td>
<td>0.053</td>
</tr>
</tbody>
</table>
The estimated handled material (excavated and backfilled) is approximately 290,300 m$^3$ for the PRT site and 233,100 m$^3$ for the working strip. Assuming 20.5 working days per month and 250 working days per year, the PRT site preparation and construction requires 375 workdays, whereas 125 workdays are required for the working strip activities. Hence, about 774 m$^3$ per day will be handled during the PRT site preparation and construction and about 1,865 m$^3$ per day for the activities along the working strip. A specific gravity of soil equal to 1.7 t/m$^3$ has been considered; a wind speed value of 5 m/s has been assumed based on the CALMET input at the PRT and working strip locations, and a value for the humidity of handled material of 1.5% has been considered. On the base of the above introduced parameters’ values, PM10 emission rates presented in Table 8-57, expressed in kg/day, were obtained for the PRT site and for the working strip.

**Table 8-57  PM10 Emission rates due to material handling**

<table>
<thead>
<tr>
<th>Activity</th>
<th>PM10 Emission Rate [kg/day]</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRT site</td>
<td>3.21</td>
</tr>
<tr>
<td>Working strip</td>
<td>7.72</td>
</tr>
</tbody>
</table>

Dust emissions due to vehicles’ transit re-suspension were calculated based on the EPA AP-42 Methodology for “Unpaved roads”. The dust emission factor due to vehicles’ transit resuspension (E) expressed as pounds of dust produced per mile of transit of a single vehicle, has been calculated as following:

$$E = k \cdot \left( \frac{S}{12} \right)^a \left( \frac{W}{3} \right)^b$$

Where $S$ is the silt load and $W$ the weight of a single vehicle expressed in tons. The coefficients $k$, $a$ and $b$ are related to the grain size of the dust being re-suspended as indicated in Table 8-58.

**Table 8-58  Coefficients $k$, $a$ and $b$ for the calculation of dust emissions due to vehicles’ transit resuspension for different grain sizes**

<table>
<thead>
<tr>
<th>Grain size</th>
<th>$k$</th>
<th>$A$</th>
<th>$B$</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM2.5</td>
<td>0.15</td>
<td>0.9</td>
<td>0.45</td>
</tr>
<tr>
<td>PM10</td>
<td>1.5</td>
<td>0.9</td>
<td>0.45</td>
</tr>
<tr>
<td>PM30</td>
<td>4.9</td>
<td>0.7</td>
<td>0.45</td>
</tr>
</tbody>
</table>

During the construction activities a variable number of working vehicles with different characteristics will be adopted in relation with various phases of the project.
In order to estimate the dust emission, the average characteristics of the vehicles operative during the whole construction phase has been described according to the project design and to the soil management plan; hence approximately forty vehicles will work for the preparation of the PRT site and 41 vehicles will work along the working strip. The weight of 20 vehicle per days will be about 16 tonnes, whereas the weight of the remaining vehicles per day (20 for PRT and 21 for the working strip) will be 35 tonnes. Each vehicle was assumed to cover a distance of 1 km/day on unpaved roads internally to the construction site of PRT and working strip. Assuming a silt load of 8.5 %, as suggested by the EPA AP-42 (Chapter 13.2.2 Unpaved Roads) methodology for “Construction site”, the following PM10 dust emissions rates due to vehicles’ transit resuspension, expressed in kg/day (Table 8-59), were obtained for the PRT site and for the working strip.

Table 8-59  PM10 emission rates due vehicles’ transit resuspension

<table>
<thead>
<tr>
<th>Activity</th>
<th>PM10 Emission Rate [kg/day]</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRT site</td>
<td>32.11</td>
</tr>
<tr>
<td>Working strip</td>
<td>33.05</td>
</tr>
</tbody>
</table>

In conclusion, taking into account the dust emission due to material handling and the dust emissions due to vehicles’ transit resuspension, 35.32 kg/day of PM10 will be emitted during the PRT site construction whereas 40.77 kg/day of PM10 will be produced by the working strip activities. It has to be noted that the calculation of these amounts of emitted dust did not take into account the reduction due to the mitigation measures presented in the following Section 8.5.1.2.2.

Dust Dispersion

In order to evaluate dust ground level concentration induced by the Project construction phase, the PM10 daily production values obtained with the above presented methodology have been used as input for the dispersion modelling study. The latter quantified the ground concentrations of PM10 produced by the PRT site construction and the activities along the working strip, enabling a semi-quantitative assessment of their impacts on local air quality. It has to be noted that the daily dust production rate of 35.32kg/day for the PRT site and 40.77 kg/day for the working strip have conservatively been considered continuous during the whole simulation period (entire 2010 year).

The air dispersion study has been performed with the CALMET– CALPUFF modelling system (version 5.8), adopted and recommended by US-EPA (http://www.epa.gov/ttn/scram/dispersion_prefrec.htm#calpuff). A detailed description of the modelling set up - dispersion modelling tool, model domain and meteorological data - is presented in Appendix 1 of Annex 6.
The air dispersion modelling study carried out assumed that the PRT site construction and the activities along the working strip occur at the same time, in order to take into account synergetic effects. PM10 ground level concentrations have been modelled over a 10 km x 8 km rectangular domain approximately centred on the dust emission sources. Figure 8-4 shows the simulation domain used for the dust dispersion modelling study highlighting the PRT and working strip locations.
**Figure 8-4** Simulation Domain - Dust dispersion modelling study

*Source: ERM (2013)*
The temporal domain chosen with respect to meteorological data is the entire year 2010 (8,760 hours). Although no construction activity is expected in the summer season in the coastal areas and the activities along the working strip will only last 6 months, the PM10 production rates have been calculated considering 250 working days per year (35.32 kg/day for the PRT site and 40.77 kg/day for the working strip), and have been conservatively assumed constant during the 365 days of the year. In particular the length of the activities along the working strip has been conservatively overestimated in order to evaluate synergetic effects in the worst meteo-diffusive conditions occurring during the simulated year, and to assess short term impacts (up to a 24 hour period). Long term impacts (on an annual base) have been assessed only for the PRT site construction phase. The latter lasts 18 months and is the only phase likely to produce long term impacts on local air quality.

A detailed description of the modelling set up - dispersion modelling tool, model domain and meteorological data - is presented in Appendix 1 of Annex 6; this paragraph briefly presents the considered emission scenario and the modelled dust’s ground level concentration values. The dust emission sources have been treated as polygon areas and the dust emission rates have been expressed in kilograms per day. Table 8-60 presents dust emission rates, both for the PRT site and the Working strip.

### Table 8-60 Dust Emissions rate

<table>
<thead>
<tr>
<th>Source</th>
<th>PM10 kg/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRT Construction site</td>
<td>35.32</td>
</tr>
<tr>
<td>Working Strip</td>
<td>40.77</td>
</tr>
</tbody>
</table>

The performed model simulation produced PM10 ground level concentration values, over the simulation domain.

PM10 modelled ground level concentrations induced by the Project PRT site and working strip construction are presented in the following Table 8-61 along with international and national air quality standards.
Modelled long term PM10 concentrations, connected only to the PRT site construction, comply with National and International air quality standards. Modelled PM10 short term concentrations due to the PRT site construction and to the activities along the working strip, whose simulation did not take into account mitigation measures as described in the following Section 8.5.1.2.2 comply with EU and National air quality standards but do not comply with IFC standards.

Figure 8-5 shows the PM10 maximum daily concentration map, and spatially localises the concentration maxima. The latter occur right next to the boundary of the PRT site.
Figure 8-5  Dust dispersion study - PM10 maximum daily concentration

Source: ERM (2013)
Modelled PM10 ground level concentration values allowed the assessment of short term and long term impacts on local air quality due to dust emitted during the Project construction phase. It has to be noted that the present impact assessment did not take into account the effect of mitigation, presented in the following Section 8.5.1.2.2; the assessment was based on the methodology presented in Annex 6. The latter is summarised in the following Table 8-62 and Table 8-63, which present the short term and long term impacts assessment on local air quality respectively.

Table 8-62    Dust emissions -Short-term Impact Magnitude on local Air Quality

<table>
<thead>
<tr>
<th>Source of Impact</th>
<th>Magnitude Not Significant</th>
<th>Magnitude Small</th>
<th>Magnitude Medium</th>
<th>Magnitude Large</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predicted short-term incremental GLCs* are ≤ 25% of the assessment criterion</td>
<td>Predicted short-term incremental GLCs* &gt; 25% but ≤ 50% of the assessment criterion</td>
<td>Predicted short-term incremental GLCs* &gt; 50% but &lt; = 75% of the assessment criterion</td>
<td>Predicted short-term incremental GLCs* &gt; 75% of the assessment criterion OR 2. When added to existing baseline concentrations, the total concentration exceeds the assessment criterion</td>
<td></td>
</tr>
</tbody>
</table>

PRT site + Working strip MEDIUM IMPACT (EU and NATIONAL) (EU) LARGE IMPACT (IFC) *Ground Level Concentrations

Short term impacts magnitude on local air quality due to dust emissions from the PRT site construction and to the activities along the working strip, without taking into account mitigation measures, are classified as Medium, if comparing modelled concentration against EU and National air quality standards, and as Large if comparing modelled concentration against IFC standards. However, they have been assessed as Large for conservative reasons.
As presented in the previous Table 8-63 long term impact due to dust emissions connected exclusively to the PRT site construction, without taking into account mitigation measures, are classified as Medium.

Subsequently, the significance of the impacts on local air quality has been evaluated according to the methodology presented in Annex 6. The significance of impacts is defined exclusively on the base of receptors sensitivity and magnitude of impacts, as shown in the following Table 8-64. The latter summarises the significance of short term and long term impacts on local air quality caused by dust emissions during the project construction phase, without taking into account mitigation measures.

It has to be noted that the highest sensitivity at receptors was assumed for conservative reasons. Being the short term and long term impacts magnitude caused by dust emission during the project construction phase assessed as Large and Medium respectively, their significance will be classified as Major for short term impacts and as Moderate for long term impacts.

It has to be noted that the present impacts significance assessment is based on the results of the dust dispersion modelling study, which did not take into account the effect of mitigation measures presented in Section 8.5.1.2.2.
Table 8-64  Dust Emissions - Significance of Air Quality Impact

<table>
<thead>
<tr>
<th>Source of impact</th>
<th>Magnitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRT site + Working strips (Short term)</td>
<td></td>
</tr>
<tr>
<td>Sensitivity</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>Not Significant</td>
</tr>
<tr>
<td>PRT (Long Term)</td>
<td></td>
</tr>
<tr>
<td>Sensitivity</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>Not Significant</td>
</tr>
</tbody>
</table>

Note: This table does not consider mitigation measures described in Section 8.5.1.2.2 For residual impact due to dust emission, considering the mitigation measures, refer to section 8.5.1.2.3.

Vehicle Exhaust Emissions Impacts

The Project construction phase contemplates the activity of vehicles for PRT site construction (site preparation activities, general excavation, roads, fence and gates) and for the onshore pipeline construction. Table 8-65 and Table 8-66 below show the number and types of vehicle anticipated for the Project along with information on their installed power and number of working days for the PRT construction and for the onshore pipeline construction, respectively.

Table 8-65  Vehicles Involved in PRT Construction

<table>
<thead>
<tr>
<th>Type of Equipment</th>
<th>Peak number of vehicles per day</th>
<th>Working hours per day</th>
<th>Power (HP)</th>
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<tr>
<td></td>
<td>Earth movements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Truck</td>
<td>19</td>
<td>10</td>
<td>200-300</td>
</tr>
<tr>
<td></td>
<td>PRT civil works</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(site preparation activities, general excavation, roads, fence and gates)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Excavator</td>
<td>2</td>
<td>10</td>
<td>200-300</td>
</tr>
<tr>
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<tr>
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<td>200-300</td>
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<tr>
<td>Pipe Bending Machine</td>
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Table 8-66  Vehicles involved in the construction of the onshore pipeline

<table>
<thead>
<tr>
<th>Type of Equipment</th>
<th>Peak number of vehicles per day</th>
<th>Working hours per day</th>
<th>Power (HP)</th>
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</thead>
<tbody>
<tr>
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<td>Earth movements</td>
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<tr>
<td>Truck</td>
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<td>200-300 HP</td>
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<tr>
<td>Backhoe loader</td>
<td>1</td>
<td>10</td>
<td>200-300 HP</td>
</tr>
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A conservative assessment of the vehicle total emission load was performed using a methodology based on COPERT III (Computer Programme to Calculate Emissions from Road Traffic) emissions factors which estimated vehicle emissions produced during the Project’s construction phases; the adopted methodology and relative calculation utility was provided by ISPRA (http://www.sinanet.isprambiente.it/it/sinanet/fetransp). The value of vehicles exhaust emission identified was subsequently used as input for a dispersion modelling study using the CALINE model which is a line source Gaussian plume dispersion model developed by the state of California, Department of Transportation.

The dispersion study estimated the maximum ground level concentration of pollutants produced by vehicular traffic at the closest receptor, enabling a qualitative/quantitative assessment of construction phase impacts on local air quality due to vehicle exhaust emissions.

Vehicle emission estimate: COPERT III (Computer Programme to Calculate Emissions from Road Traffic)

The COPERT III methodology used to estimate the Project vehicular emissions during the construction phase was created by the European Environment Agency - EEA under the CORINAIR (CORRe INventory AIR emissions). The methodology allows estimation of emissions from different categories of vehicles for the major traffic-related macro pollutants.
COPERT III provides functions to calculate vehicle emissions and fuel consumption as a function of the travel speed for each vehicle category and for each pollutant emitted. These functions are based on average emission and fuel consumption curves, obtained from emissions measurements taken for different types of vehicles, in different countries and for different driving cycles.

The input data used to apply the COPERT III methodology were taken from the National Environmental Information System Network, (SINAnet - http://www.sinanet.apat.it). The emission factors provided are expressed in grams of gas emitted per vehicle. Dust emission factors include emissions from combustion (exhaust from diesel according to COPERT and from petrol according to the Netherlands Transport Organisation, (hereinafter TNO), 2001) and from wear-brakes, tires, asphalt, etc. (no exhaust emissions calculated according to TNO, 2001).

The COPERT III enables the user to select the following vehicle characteristics:

- type and size of vehicle;
- type of fuel;
- motor technology (EURO I - II - III);
- type of route (rural – urban).

The COPERT III emission factors used in this study are presented along with the calculation of the emission scenario in the following part of this section.

Vehicle emission dispersion study: CALINE 4 model

In order to evaluate pollutant ground level concentration caused by vehicle emission related to the Project construction phase, the vehicle exhaust emission value obtained with the COPERT III methodology was used as input for a dispersion modelling study, carried out with the CALINE 4 model. The following part of this section presents the CALINE model features, the modelling approach adopted for this modelling study along with modelling study inputs and outputs.

The CALINE model is a line source Gaussian plume dispersion model developed by the state of California, Department of Transportation. The CALINE4 computer code allows modelling of emission dispersion from linear sources from vehicular traffic. This model is based on the joint use of a box model and of the Gaussian dispersion law, valid for laminar winds and for stable atmosphere. The purpose of the code is to estimate the impacts on air quality in the proximity of roads or linear road networks. The computer code was validated at the end of the development phase by CALTRANS (California Department of Transportation), one U.S. agency responsible for planning, construction and maintenance of roads. Further studies on validation of the CALINE model are available in the literature. Among them, citing the article published in 2003 by BM Broderick et al., entitled "Modelling CO Concentrations under free-flowing and congested traffic condition in Ireland." In the course of this study the CALINE 4 model was validated by comparison with data on measured concentration of carbon monoxide, wind speed and direction.
The model divides the linear road into discrete elements, named “link” and calculates concentration at link locations.

The model uses two different equations to obtain concentration, one for wind direction perpendicular to the road and a second for wind direction parallel to the road. When the wind is parallel to the road, the latter is considered as a line of squared area sources whose dimensions coincide with the road’s width. These area sources are then treated as equivalent point sources, and their effects on concentration will be summed. In case of wind direction in between the road perpendicular and parallel directions and a weighted average of the two equations will be used.

CALINE 4 considers the planetary boundary layer (PBL) located on top of the road, and assumes steady turbulence conditions and emissions within the PBL region. Turbulence is mainly driven by the mechanical effect due to the transit of vehicles and to the heat effect related to heat exhaust. These turbulence’ driving factors are active, whereas the Gaussian model is based on passive dispersion conditions. In order to compensate for this discrepancy, CALINE calculates the initial dispersion parameter as a function of the residence time in the PBL.

CALINE4 uses a horizontal dispersion coefficient based on Draxler methodology, whereas its vertical coefficient is based on a modified version of the Pasquill – Smith curves. The exhaust’s heat effect can be taken into account with the latter.

With regards to the road’s geometric definition, the model divides the stretch of road analysed in up to a maximum of 20 segments, each having a different orientation. Each segment is straight and is characterised by uniform size, height, traffic and emission/vehicle factor.

Road outline and receptors’ scheme

The simulation carried out with the CALINE4 to quantify vehicle impacts on local air quality arising during the construction phase evaluated impacts on a generic stretch of road covered by the vehicles contemplated for the Project. The simulation considered the onshore pipeline construction activity, as this phase anticipates a higher number of vehicles than PRT construction; thus impacts arising from PRT construction in terms of vehicle emissions were considered negligible. In accordance with the CALINE4 code, the linear road was considered as a series of linear links (linear discrete elements).

Receptors were located on a regular grid, whose main direction is perpendicular to the road’s outline. The receptors’ grid is located at a distance from the road ranging from 5 to 200 metres, and the spacing between receptors increases with the distance from the road’s outline. The adopted receptors scheme is presented in *Figure 8-6*.

It must be noted that receptors located farther than 200 m from the road’s outline were not considered, since the effect of the volume of traffic anticipated at distances greater than 200 m from the road is negligible.
Receptors located at 5 metres from the road were conservatively considered in close proximity to the road so that they can be representative of the worst possible conditions in terms of spatial distance from the pollutant emission sources.

The contribution of each link into which the road has been divided was calculated at each receptor’s location and maximum hourly concentration values at each receptor were obtained for the following pollutants: Carbon Monoxide (CO), Nitrogen oxides (NOx) and Total suspended particles (TSP).

**Figure 8-6  Receptors’ scheme**

![Receptors' scheme diagram](image-url)
Emission Scenario

The estimate of the number of vehicles operating during the Project construction phase was based on the information contained in the previous Table 8-65 and Table 8-66.

Only vehicles involved in the onshore pipeline construction were considered, as a higher number of vehicles per hour is anticipated for this phase than for the PRT construction phase which produces less relevant impacts in terms of vehicle emissions. As said the evaluation has been focused on the traffic generated by the pipeline construction activities because the adopted approach aims to estimate the short term impacts, which are directly related to the number of operating vehicles per hour, without considering the entire period of the activities.

According to Table 8-66, 46 vehicles per day will be working on construction of the onshore pipeline. The emission estimate considered a conservative volume of traffic of 50 vehicles per day along the working strip, and a worst case situation characterised by the 50 vehicles in transit at the same time on the same stretch of road was assumed. Thus, considering 2 transits per vehicle per day and 10 working hours per day, a traffic volume of 10 vehicles per hour was calculated and a vehicle speed of 40 km/h was assumed.

A conservative assumption was also made on the choice of the type of vehicles; all 50 vehicles were considered heavy duty vehicles, with the maximum weight envisaged by the COPERT III methodology (32 t), powered by diesel engines and complying with EURO III.

The EURO III assumption is also conservative since stricter limits on vehicle emissions allowed are expected to be in force when the Project construction phase begins.

The COPERT III emission factors for diesel heavy duty vehicles (16-32 t) used in calculating the emission scenario are presented in Table 8-67 below and refer to rural driving conditions. It must be noted that Sulphur oxides (SO\textsubscript{x}) emissions were not considered, since SO\textsubscript{x} emission factors are not provided by the COPERT III methodology; the latter assumes the use of sulphur-free fuel, in compliance with current Directives. Therefore, the following macro pollutants were modelled: NO\textsubscript{x}, CO and TSP.

Table 8-67 COPERT III Emission Factors for Heavy Duty Vehicles/ Diesel/ 16 - 32 t, for Rural Driving Conditions

<table>
<thead>
<tr>
<th>Vehicle type: Heavy Duty Vehicles / Diesel / 16 - 32 t *</th>
<th>Pollutant</th>
<th>Emission Factor\textsuperscript{*} [g/km\textdegree{}c]</th>
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</thead>
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<tr>
<td></td>
<td>NO\textsubscript{x}</td>
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<tr>
<td></td>
<td>CO</td>
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</tr>
<tr>
<td></td>
<td>PM\textsubscript{10} **</td>
<td>0,19</td>
</tr>
</tbody>
</table>

\textsuperscript{*} Emission factor for interurban travel distances, which do not include motorways

\textsuperscript{**} Included combustion emissions from combustion (exhaust from diesel according to COPERT and from petrol according to TNO, 2001) and from wear on brakes, tires, asphalt.
The emission factors presented in Table 8-67 were subsequently multiplied by the number of vehicles per hour, and the value obtained was associated with each link (linear stretch of road) in input in the CALINE4 model.

It must be noted that conservative assumptions were made in estimating the number and type of vehicles and their transit conditions in order to maximise their emissions and therefore simulated pollutant ground level concentration.

Meteorological data

The meteorology used in the CALINE4 run is a worst case meteorology, representative of the worst meteorological conditions adverse to pollutant atmospheric dispersion. A sensitivity analysis was carried out to identify the meteorological conditions maximising ground level pollutants concentration; this analysis consisted of a series of CALINE model runs carried out using the same emission rates and geometric source characteristics and different meteorological conditions. The sensitivity analysis identified the following worst case meteorological conditions, wind speed of 0.5 m/s and stability class F.

The boundary layer height was conservatively set to 100 m, since traffic emissions are unlikely to spread upwards.

It must be noted with regard to wind direction that the setting “Worst case wind angle” was used. This setting was specifically developed to identify the wind angle, maximising the ground level pollutant concentrations at each receptor.

In conclusion, the following meteorological conditions were input to the CALINE4 run performed in this study:

- Stability Class Pasquill/Gifford: F;
- Wind Speed: 0.5 m/s;
- Temperature 20°C;
- Boundary layer height: 100 m.

Results

The simulation performed with the CALINE4 model produced the maximum hourly pollutant concentration caused by vehicular traffic during onshore pipeline construction. Results are presented in both a tabular and graphical format. An ID was associated with each receptor so that results can be unambiguously analysed at each receptor. Below shows the receptor scheme along with their IDs, whereas Table 8-68 presents the modelled pollutants’ concentrations at each receptor; the latter are compared with International, European and National air quality standards.
It must be noted that in comparing air quality standards simulated NO\textsubscript{x} was considered as Nitrogen dioxide (NO\textsubscript{2}), but in reality only a part of NO\textsubscript{x} converts to NO\textsubscript{2} depending on different factors (e.g. solar radiation, temperature, hydrocarbon atmospheric concentration). Hence, NO\textsubscript{2} simulated concentrations were overestimated. Moreover, TSP modelled concentrations for comparison with air quality standards were assumed to be particulate matter with a diameter up to 10 µm (PM10), since the rate between TSP and PM10 for vehicular emission is not known for vehicles’ exhaust; this assumption is conservative as not all TSP usually coincide with PM10, thus PM10 modelled concentration were overestimated.

**Figure 8-7  Receptors’ scheme and ID**

![Receptors' scheme and ID](image)

**Table 8-68  CALINE4 Results: CO NO\textsubscript{x} and TSP Maximum Hourly Concentration at Receptors**

<table>
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<tr>
<th>ID</th>
<th>Receptor</th>
<th>CO ($\mu g/m^3$)</th>
<th>NO\textsubscript{x} ($\mu g/m^3$)</th>
<th>TSP ($\mu g/m^3$)</th>
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<tbody>
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<td>1</td>
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<td>3.64</td>
<td>13.10</td>
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<td>ID Receptor</td>
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<td>NOx [µg/m³]</td>
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<td>66</td>
<td>0.19</td>
<td>0.69</td>
<td>0.05</td>
<td></td>
</tr>
</tbody>
</table>
It is clearly apparent from *Table 8-68* that pollutant concentrations modelled are considerably lower than regulatory limits even at the nearest receptors, located 5 m from the road’s outline. Besides, results in terms of maximum hourly concentrations were compared with stricter regulatory limits, referring to a longer averaging period (8 hours, 24 hours); it is noticeable that maximum hourly concentrations calculated in the worst meteorological conditions and at the nearest receptors are still lower than the maximum daily average concentration allowed. Hence, also considering the conservative approach adopted in this present study, vehicular induced ground level pollutant concentrations can reliably be considered negligible.

NO\textsubscript{x} hourly concentrations modelled are the highest among the pollutants modelled when compared with regulatory standards, although they are lower than regulatory limits. A NO\textsubscript{x} maximum hourly concentration map was produced to locate NO\textsubscript{x} maximum concentration at the nearest receptors and is presented in the following *Figure 8-8.*
Figure 8-8  Vehicle Exhaust Dispersion Study - NOx Maximum Hourly Concentration

Source: ERM (2013)
Figure 8-8 shows how the highest NO\textsubscript{x} hourly concentrations modelled, approximately 13 µg/m\textsuperscript{3}, are exclusively confined to 5 m from the road’s outline.

Ground level pollutant concentration values modelled allowed assessment of short-term impacts on local air quality due to vehicular traffic during the Project construction phase; the assessment was based on the methodology presented in Annex 6 which is summarised in Table 8-69 below, wherein the short-term impact assessment on local air quality is presented. It must be noted that long-term impacts on local air quality were not assessed for vehicular traffic produced during onshore pipeline construction, as this construction phase will last only 4 months, and a worst case modelling study focused on the maximum hourly ground level concentration was carried out.

Table 8-69  Vehicular Emissions - Short-term Impact Magnitude on Local Air Quality

<table>
<thead>
<tr>
<th>Source of Impact</th>
<th>Magnitude</th>
<th>Magnitude</th>
<th>Magnitude</th>
<th>Magnitude</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not Significant</td>
<td>Small</td>
<td>Medium</td>
<td>Large</td>
</tr>
<tr>
<td>Predicted short-term incremental GLCs are ≤ 25% of the assessment criterion</td>
<td>Predicted short-term incremental GLCs &gt; 25% but ≤ 50% of the assessment criterion</td>
<td>Predicted short-term incremental GLCs &gt; 50% but ≤ 75% of the assessment criterion</td>
<td>1. Predicted short-term incremental GLCs &gt; 75% of the assessment criterion OR 2. When added to existing baseline concentrations, the total concentration exceeds the assessment criterion</td>
<td></td>
</tr>
</tbody>
</table>

Vehicular emissions NOT SIGNIFICANT (CO – NO\textsubscript{x} – PM10)

*Ground Level Concentrations

As shown in the previous table, short-term impacts magnitude on local air quality due to vehicular emission, during the Project onshore pipeline construction phase, are classified as Not Significant for all the modelled pollutants.

Subsequently, the significance of the impacts on local air quality has been evaluated. The significance of impacts is defined exclusively on the base of receptors sensitivity and magnitude of impacts, as shown in the following Table 8-70. The latter summarises the significance of short term impacts on local air quality caused by vehicular traffic during the project construction phase.

It must be noted that the highest sensitivity at receptors was assumed for conservative reasons.

Being the magnitude of short term impacts caused by vehicular emission during the project construction phase assessed as Not Significant for CO, NO\textsubscript{x} and PM10, their significance is Not Significant.
Hydrotesting (Engine-driven machinery emissions impacts)

Engine-driven machinery and power generators are expected to be used to supply energy during the Project construction. In particular, a high number of engine-driven compressors will be used during the hydrotesting phase, and their activity is likely to have potential impact on local air quality; this potential impact was assessed by means of a dedicated air dispersion modelling study.

It must be noted that only the emissions produced by engine-driven machinery used during the hydrotesting phase have been considered in this modelling study. Emission from engine driven machinery other than the hydrotesting compressors are not significant if compared with the emissive contribution arising from the compressors operating during the hydrotesting phase. The latter requires the operation of the following engine-driven compressors:

- 16 Booster compressors, with an installed power of 430 kW each;
- 32 Feed compressors, with an installed power of 430 kW each.

Feed of the main compressors will be run at 90% of load and booster compressors will be run at 70% of load. Thus compressors operating during the hydrotesting phase will have a total capacity of 17,200 kW.

The air dispersion modelling study quantified ground concentrations of macro-pollutants generated by these compressors, enabling a qualitative/quantitative assessment of their impacts on local air quality.

The air dispersion study was performed with the CALMET–CALPUFF modelling system (version 5.8), adopted and recommended by the US-EPA (http://www.epa.gov/ttn/scram/dispersion_prefrec.htm#calpuff). A detailed description of the modelling set up - dispersion modelling tool, model domain and meteorological data - is presented in Appendix 1 to Annex 6.

Ground concentrations of macro pollutants produced by the compressors (NOx, CO, PM10) were modelled over a 20 km x 20 km domain, approximately centred on the compressor locations. It must be noted that the compressor activity will not emit SO2 in the atmosphere as sulphur free fuel will be used. Figure 8-9 below shows the simulation domain used for this modelling study, highlighting the compressor station locations.
Figure 8-9  Simulation Domain – Hydrotesting Compressors Air Dispersion Modelling Study

Source: ERM (2013)
The time period chosen is the entire year 2010 (8760 hours); although the compressors will operate for less than one month, the whole year was considered in order to obtain ground level pollutant concentration in the worst weather conditions. Moreover no construction activity is expected in the peak touristic season.

Emissions from the 48 compressors will be released into the atmosphere through a common stack, and its characteristics were set in the model. The rate of atmospheric pollutant emission from each compressor was calculated on the base of the engine specifications provided by the engine manufacturer. A detailed description of the modelling set up - dispersion modelling tool, model domain and meteorological data - is presented in Appendix 1 to Annex 6, whereas the following part of this section briefly presents the emission scenario considered and the ground level pollutant concentration modelled. Table 8-71 and Table 8-72 below present the emission source characteristics and the emissions rate and composition, respectively.

### Table 8-71 Emission source

<table>
<thead>
<tr>
<th>Source</th>
<th>Stack Height [m]</th>
<th>Stack Diameter [m]</th>
<th>Flue Gas Temp. [K]</th>
<th>Flue Gas Velocity [m/s]</th>
</tr>
</thead>
<tbody>
<tr>
<td>48 compressors (430 kW each)</td>
<td>20</td>
<td>1.94</td>
<td>518</td>
<td>16.5</td>
</tr>
</tbody>
</table>

### Table 8-72 Emissions Rate and Composition

<table>
<thead>
<tr>
<th>Source</th>
<th>NOx [g/s]</th>
<th>CO[g/s]</th>
<th>PM [g/s]</th>
</tr>
</thead>
<tbody>
<tr>
<td>48 compressors (430 kW each)</td>
<td>19.1</td>
<td>33.42</td>
<td>0.24</td>
</tr>
</tbody>
</table>

The air dispersion modelling study results are presented in Table 8-73 and must be interpreted considering some main aspects of the conservative approach adopted for the study:

- Simulated NOx will be considered as NO2, but in reality only a part of NOx converts to NO2 depending on different factors (e.g. solar radiation, temperature, and atmospheric hydrocarbon concentration). Hence, simulated NO2 concentrations will be overestimated;

- The model does not account for dry and wet deposition or photochemical reactions of the pollutants which in reality takes place and would reduce the concentrations of NOx and CO in the atmosphere. Thus, results overestimate the likely actual contribution of the sources. The approach, again, is on the safe side of assumptions and gives a conservative picture that maximises pollutant concentration values modelled over the simulation domain.

- The meteorological time period chosen is the entire year 2010 (8760 hours); although the compressors will operate for less than one month the whole year was considered in order to obtain ground level pollutant concentrations under the worst weather conditions.
Table 8-73  Maximum Ground Concentrations in the Simulation Domain

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Modelled concentrations [µg/m³]</th>
<th>IFC Limit [µg/m³]</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO(_x) 99.8° Percentile of Hourly Average Concentration(^{(1)})</td>
<td>69.21</td>
<td>200 (^{(1)}) (3)</td>
</tr>
<tr>
<td>NO(_x) Maximum hourly concentration</td>
<td>91.48</td>
<td>200</td>
</tr>
<tr>
<td>CO Maximum Daily 8 Hours Mean Concentration(^{(2)})</td>
<td>93.02</td>
<td>10000</td>
</tr>
<tr>
<td>PM10 90.4° Percentile of the daily average concentration(^{(4)})</td>
<td>0.26</td>
<td>50</td>
</tr>
<tr>
<td>PM10 Maximum daily average concentration</td>
<td>0.69</td>
<td>50</td>
</tr>
</tbody>
</table>

\(^{(1)}\) Corresponds to the hourly limit value for the protection of human health not to be exceeded more than 18 times a calendar year

\(^{(2)}\) The maximum daily eight-hour mean concentration will be selected by examining eight-hour running averages, calculated from hourly data and updated each hour. Each eight-hour average calculated will be assigned to the day on which it ends, i.e. the first calculation period for any one day will be the period from 17:00 on the previous day to 01:00 on that day; the last calculation period for any one day will be the period from 16:00 to 24:00 on that day.

\(^{(3)}\) Limits foreseen for NO\(_x\)

\(^{(4)}\) Corresponds to the daily limit value for the protection of human health not to be exceeded more than 35 times a calendar year.

It can be seen from Table 8-73 that pollutant concentrations modelled comply with International, European and national air quality standards.

In particular for CO and PM10, modelled air quality parameters are 3 orders of magnitude lower than regulatory threshold concentration values. Thus CO and PM10 ground level concentrations produced the compressors activity during the hydrotesting phase can reliably be considered negligible.

In comparing with regulatory standards, NO\(_x\) hourly concentrations modelled are the highest among the pollutants modelled, although lower than regulatory limits.

The following maps were produced to locate maximum NO\(_x\) short-term concentrations:

- NO\(_x\) 99.8° percentile of hourly average concentration map in Figure 8-10.
- NO\(_x\) Maximum hourly concentration in Figure 8-11.
Figure 8-10  Hydrotecting Dispersion Study - NOx 99.8° Percentile of Hourly Average Concentration

Source: ERM (2013)
Figure 8-11  Hydrotesting Dispersion Study -NOₓ Maximum Hourly Concentration
As shown in the previous Figures, the area most influenced by the compressors emissions during the hydrotesting phase is located NNE and SSW from the emission source. The area most affected follows the coastline and is confined to 1 km from the emission source.

Modelled ground level concentration values allowed the assessment of short-term impacts on local air quality caused by the compressors activity during the hydrotesting phase; the assessment was based on the methodology presented in Annex 6 which is summarised in Table 8-74 wherein the short-term impact assessment on local air quality is shown. It must be noted that long-term impacts on local air quality were not assessed for the compressor activity, since this will last less than one month and the modelling study focused on the maximum hourly ground level concentrations.

Table 8-74  Hydrotesting- Short-term Impact Magnitude on Local Air Quality

<table>
<thead>
<tr>
<th>Source of Impact</th>
<th>Magnitude Not Significant</th>
<th>Magnitude Small</th>
<th>Magnitude Medium</th>
<th>Magnitude Large</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Predicted short-term incremental GLCs* are &lt;= 25% of the assessment criterion</td>
<td>Predicted short-term incremental GLCs* &gt; 25% but &lt;= 50% of the assessment criterion</td>
<td>Predicted short-term incremental GLCs* &gt; 50% but &lt;= 75% of the assessment criterion</td>
<td>1. Predicted short-term incremental GLCs* &gt; 75% of the assessment criterion OR 2. When added to existing baseline concentrations, the total concentration exceeds the assessment criterion</td>
</tr>
<tr>
<td>Hydrotesting phase</td>
<td>NOT SIGNIFICANT (CO – PM10)</td>
<td>SMALL IMPACT (NOx)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Ground Level Concentrations

As apparent in the previous table, the short-term impact magnitude on local air quality arising from the compressors activity during the hydrotesting phase is classified as Not Significant for CO and PM10 and Small for NOx.

Subsequently, the significance of the impacts on local air quality has been evaluated. The significance of impacts is defined exclusively on the base of receptors sensitivity and magnitude of impacts, as shown in the following Table 8-75. The latter summarises the significance of short term impacts on local air quality arising from the compressors activity during the hydrotesting phase.

It must be noted that the highest sensitivity at receptors was assumed for conservative reasons.

Being the magnitude of short term impacts caused by the compressors activity during the hydrotesting phase assessed as Not Significant for CO, PM10 and as Small for NOx, their significance is Not Significant and Minor respectively.
**Table 8-75** Hydrotesting - Significance of Air Quality Impact

<table>
<thead>
<tr>
<th>Source of impact</th>
<th>Not significant</th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrotesting (Short-term)</td>
<td>High</td>
<td>Not Significant (CO - PM10)</td>
<td>Minor (NOx)</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

**8.5.1.2.2 Mitigation Measures**

The impacts on local air quality related to the construction phase are mainly short term impacts, due to the relatively temporary nature of construction activities. Therefore, temporary mitigation and control measures will be taken.

The potential impacts on local air quality, arising during the Project construction phase are classified as follows:

- **Not significant** impacts due to temporary emissions of flue gases into the atmosphere from vehicles (i.e. excavators, bulldozers, side booms, trucks, cars).
- **Minor** and **Not significant** impacts due to temporary emissions of flue gases into the atmosphere from engine-driven machinery, in particular from the compressors used during the hydrotesting.
- **Major** and **Moderate** impacts due to temporary dust emissions from earth movement, excavation, vehicle movement, stockpiles, unpaved surfaces, etc. along the working strip, access roads and work sites.

Impacts from vehicles, already classified as not significant, will be mitigated by mean of best practices, such as maintenance of equipment and vehicles, development of a traffic management plan.

Mitigation measures will not be taken for the impact arising from the compressors activity during the hydrotesting phase as the compressors activity will last for less than one month and its impacts have been classified as **Not significant** (CO and PM10) and **Small** (NOx).

The significance of impacts arising from dust emissions is the highest among the considered emission sources. Thus the following mitigation measures will be put in place in order to limit dust production:

- wet suppression which includes watering, spraying dusty surfaces especially in dry weather;
- limiting vehicle speed;
- dust control measures such us covering loose materials and sheeting trucks;
- periodical maintenance of the shape of the roads (in the construction strip and PRT), in order to ensure a proper crown, adequate drainage, a good mix of fines and aggregates and a well compacted surface.
The above presented mitigation measures will produce a reduction of dust emission and in turn a reduction of PM10 ground level concentrations, which has been estimated by mean of a dedicated air modelling study. The latter followed the dust emission estimation and dispersion modelling methodologies presented in Paragraph 8.5.1.2.1 with regard to Dust Emission Impacts.

According to the EPA AP 42, the general equation for emissions estimation takes into account the overall emission reduction (e.g. due to mitigation measures), as presented in the following equation taken from the AP-42, *Compilation of Air Pollutant Emission Factors*:

\[
E = A \times EF \times \left(\frac{1 - ER}{100}\right)
\]

*Where:*

- \(E\) = emissions;
- \(A\) = activity rate;
- \(EF\) = emission factor, and
- \(ER\) = overall emission reduction efficiency, %

Several studies have proved that using effective dust control measures can significantly reduce dust emission and help preserve road surfaces. In particular, according to common best practice, dust control can reduce dust production by 30% to 80%. For example only cutting average vehicles speed from 40 mph to 35 mph reduces dust emission by 40%.(US department of Transportation: Federal Highway Administration, 2010 - Gravel Roads Maintenance and Design Manual (SD LTAP); Wisconsin Transportation Information Center, 1997. Wisconsin Transportation Bulletin No 13).

Taking into account the mitigation measure to be put in place, a conservative dust emission reduction factor of 40% has been assumed for dust emissions arising from both PRT and working strip construction.
Hence, dust emission rates have been re-estimated based on this mitigation reduction factor and on the methodology AP42 developed by US-EPA (AP-42 Fifth Edition, Volume I, Chapter 13, 13.2.4 Aggregate Handling and storage Piles); the same assumptions presented in Paragraph 8.5.1.2.1 with regard to dust emission estimation have been made. Subsequently, dust emissions rates have been used as input for a second air dispersion modelling study, carried out with the CALPUFF CALMET modelling system. The modelling study followed all the assumptions presented in section 8.5.1.2.1 with regards to dust dispersion modelling and impact assessment. The modelling study estimated PM10 ground level concentrations induced by the PRT site and working strip construction, considering the mitigation measures in place; its results are presented in the following Table 8-76 along with international and national air quality standards.

<table>
<thead>
<tr>
<th>Source</th>
<th>Parameter</th>
<th>Estimated concentrations [µg/m³]</th>
<th>IFC Standard [µg/m³]</th>
<th>2008/50/EC and D.Lgs. 155/2010 Limit [µg/m³]</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRT Construction site +</td>
<td>PM10 90.4° Percentile of the daily average concentration (2)</td>
<td>18.33</td>
<td></td>
<td>50(1)</td>
</tr>
<tr>
<td>Working strip</td>
<td>PM10 Maximum daily average concentration</td>
<td>33.78</td>
<td></td>
<td>50</td>
</tr>
<tr>
<td>PRT Construction</td>
<td>PM10 Maximum Annual Average Concentration</td>
<td>10.00</td>
<td></td>
<td>40</td>
</tr>
</tbody>
</table>

(1) Limit on the maximum daily average concentration not to be exceeded more than 35 times during the calendar year
(2) It corresponds to the daily limit value for the protection of human health not to be exceeded more than 35 times a calendar year

Modelled long term PM10 concentrations, connected only to the PRT site construction, comply with European and National air quality standards. PM10 short term concentrations due to the PRT site construction and to the activities along the working strip, comply with International, EU and National air quality standards.

Figure 8-12 shows the PM10 maximum daily concentration map, and spatially localises the concentration maxima. The latter occur right next to the boundary of the PRT site.
Figure 8-12  Dust Emission Mitigation- PM10 maximum daily concentration

Source: ERM (2013)
Subsequently, the significance of the impacts on local air quality has been evaluated according to the methodology presented in Annex 6. The highest sensitivity at receptors was assumed for conservative reasons; the significance of impacts is summarised in the following Table 8-77. As apparent from the following table, mitigations reduce the significance of impacts on local air quality previously presented in Table 8-64. Long Term Impacts are classified as Minor, whereas short term impacts are classified as Minor if compared with EU and Air Quality Standards and as Moderate of compared against IFC limits.

Table 8-77  Dust Emissions Mitigation - Significance of Air Quality Impact

<table>
<thead>
<tr>
<th>Source of impact</th>
<th>Magnitude</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not significant</td>
</tr>
<tr>
<td>PRT site + Working strips (Short term)</td>
<td>High</td>
</tr>
<tr>
<td>PRT (Long Term)</td>
<td>High</td>
</tr>
</tbody>
</table>

8.5.1.2.3  Residual Impacts

Residual impacts have been conservatively considered equal to the above described potential impacts, with the exception of impacts produced by dust emissions. The following Table 8-78 summarises the type of impacts on local air quality arising from the Project construction phase, their mitigation and residual impacts.

Table 8-78  Construction Phase Residual Impacts

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Mitigation Commitments to Address the Impact</th>
<th>Significance of Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Air quality – Construction phase (Base Case Route and Rerouting Kp0-Kp0.9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short term Impacts due to dust emission - PRT site + Working strips</td>
<td>• Wet suppression</td>
<td>Minor/Moderate (EU national limits) / Moderate (IFC)</td>
</tr>
<tr>
<td></td>
<td>• Covering loose material</td>
<td>• Modelled ground level concentration values are about 38 % of European Air quality standards and 68 % of the IFC limits.</td>
</tr>
<tr>
<td></td>
<td>• Limiting vehicle speed</td>
<td>• Concentration maxima are localized in the near proximity of the PRT construction site.</td>
</tr>
<tr>
<td></td>
<td>• Sheeting trucks</td>
<td></td>
</tr>
</tbody>
</table>
8.5.1.3 Operation and Maintenance Phase

During the operation and maintenance phase atmospheric emissions will be related to the activity of PRT gas heating system which consist of two gas fired boilers, moreover negligible atmospheric emissions will be related to the general pipeline operational maintenance.

The following part of this section analyses the potential impacts and the residual impacts arising during the operation and maintenance phase on local air quality.

8.5.1.3.1 Potential Impacts

The temporary activity of the PRT gas heating and the general maintenance of the pipeline will produce negligible air emissions. Impacts on local air quality will be negligible.

PRT Gas Heating System

According to the project description reported in the Section 4 the equipment in the PRT has been designed for a capacity of 10 billion cubic metres /year (bcm/year), but the facility may be expandable to the ultimate capacity of the pipeline which is 20 bcm/year.

In normal conditions the electrical heater, which is designed to provide a duty of approximately 2 MW, is intended to cover most of the operational heating requirements. The gas fired boilers, designed for the remaining duty, are intended to cover mainly start-up and abnormal operation conditions (gas fired boilers in this scenario are expected to be operating for about 2% of PRT operating time).
The PRT operation will release atmospheric emissions, produced by the following emission sources:

- PRT Gas Fired Boilers
- Emergency cold vents (natural gas emission) – only in case of emergency events;
- Emergency diesel generator – only in case of emergency events.

The emergency cold vents and diesel generator is designed to be operative only under emergency conditions which are anticipated to be very rare events and of short duration; thus their impact on local air quality can be assessed as negligible.

The potential impact of the PRT Gas Fired Boilers was assessed by means of a dedicated air dispersion modelling study. Each boiler has a nominal capacity of 3.5 MW, and will be fuelled with the same natural gas transported in the pipeline.

The air dispersion modelling study quantified ground concentrations of macro-pollutants generated by these boilers, enabling a qualitative/quantitative assessment of their impacts on local air quality.

The air dispersion study was performed with the CALMET–CALPUFF modelling system (version 5.8), adopted and recommended by the US-EPA (http://www.epa.gov/ttn/scram/dispersion_prefrec.htm#calpuff). A detailed description of the modelling set up - dispersion modelling tool, model domain and meteorological data - is presented in Appendix 1 to Annex 6.

Ground concentrations of macro pollutants produced by the gas fired boilers (NOx, CO) were modelled over a 20 km x 20 km domain. Figure 8-13 below shows the simulation domain used for this modelling study, highlighting the location of the stack of the PRT Gas Heating System.
Figure 8-13 Simulation Domain – PRT Gas Heating System Air Dispersion Modelling Study

Source: ERM (2013)
The time period chosen is the entire year 2010 (8760 hours); although the PRT Gas Fired Boilers will operate in total for approximately 2% per year, the whole year was considered in order to obtain ground level pollutant concentration during all the possible weather conditions.

The average rate of atmospheric pollutants emitted by the PRT Gas Fired Boilers was calculated on the base of an average flue gas mass flow rate of 4965 kg/h per boiler, referred to an average capacity of 3MW per boiler. The concentration of NO\textsubscript{x} in dry flue gases with 3% of oxygen, was taken from the Project design data presented in Section 4 (Project Description) of this document along with the characteristics of the emission source presented in the following Table 8-79. CO concentration in dry flue gases with 3% of oxygen, was assumed equal to 100 mg/Nm\textsuperscript{3} as shown in the following Table 8-80; the latter presents the PRT Gas Fired Boilers emissions rate and composition simulated by the model.

A detailed description of the modelling set up - dispersion modelling tool, model domain and meteorological data - is presented in Appendix 1 to Annex 6, whereas the following part of this section briefly presents the emission scenario considered and the ground level pollutant concentration modelled.

### Table 8-79  Characteristics of the Emission source

<table>
<thead>
<tr>
<th>Source</th>
<th>Stack Height [m]</th>
<th>Equivalent Stack Diameter [m]</th>
<th>Flue Gas Temp. [°C]</th>
<th>Flue Gas Velocity [m/s]</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRT Gas Heating System boilers(^{(1)})</td>
<td>10</td>
<td>1.41</td>
<td>200</td>
<td>2.36</td>
</tr>
</tbody>
</table>

\(^{(1)}\) The stacks of the 2 boilers are co-located adjacent to one another and modelled as a single stack on the base of the standard procedure for modelling stack emissions (U.S. EPA EPA-454/R-92-019 Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised). This is reflected in model input values and the effective diameter is based upon 2 x 1m diameter stacks.

### Table 8-80  Emissions Rate and Composition

<table>
<thead>
<tr>
<th>Source</th>
<th>NO\textsubscript{x} concentration in Dry flue gas (3% Oxygen) [mg/Nm\textsuperscript{3}]</th>
<th>CO concentration in Dry flue gas (3% Oxygen) [mg/Nm\textsuperscript{3}]</th>
<th>NO\textsubscript{x} mass flow rate [g/s]</th>
<th>CO mass flow rate [g/s]</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRT boilers</td>
<td>100</td>
<td>100</td>
<td>0.213</td>
<td>0.213</td>
</tr>
<tr>
<td>Limit (D.Lgs. 152/2006)</td>
<td>350</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

The PRT gas heating system average flue gas mass flow rate: 9930 kg/h

The air dispersion modelling study results are presented in Table 8-81 and must be interpreted considering some main aspects of the conservative approach adopted for the study:

- Simulated NO\textsubscript{x} will be considered as NO\textsubscript{2}, but in reality only a part of NO\textsubscript{x} converts to NO\textsubscript{2} depending on different factors (e.g. solar radiation, temperature, and atmospheric hydrocarbon concentration). Hence, simulated NO\textsubscript{2} concentrations will be overestimated;
The model does not account for dry and wet deposition or photochemical reactions of the pollutants which in reality takes place and would reduce the concentrations of NOx and CO in the atmosphere. Thus, results overestimate the likely actual contribution of the sources. The approach, again, is on the safe side of assumptions and gives a conservative picture that maximises pollutant concentration values modelled over the simulation domain.

The time period chosen is the entire year 2010 (8760 hours); although the boilers will operate for approximately 2% of the time per year the whole year was considered in order to obtain ground level pollutant concentrations under all the possible weather conditions.

Table 8-81 Maximum Ground Concentrations in the Simulation Domain

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Modelled concentrations [µg/m³]</th>
<th>IFC Limit [µg/m³]</th>
<th>2008/50/EC and D.Lgs. 155/2010 Limit [µg/m³]</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOx Annual Average</td>
<td>1.73</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>NOx 99.8° Percentile of Hourly Average</td>
<td>37.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concentration (1)</td>
<td></td>
<td>(1)</td>
<td></td>
</tr>
<tr>
<td>NOx Maximum hourly concentration</td>
<td>45.41</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO Maximum Daily 8 Hours Mean Concentration (2)</td>
<td>31.59</td>
<td></td>
<td>200</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10000</td>
</tr>
</tbody>
</table>

1) Corresponds to the hourly limit value for the protection of human health not to be exceeded more than 18 times a calendar year.
2) The maximum daily eight-hour mean concentration will be selected by examining eight-hour running averages, calculated from hourly data and updated each hour. Each eight-hour average calculated will be assigned to the day on which it ends, i.e. the first calculation period for any one day will be the period from 17:00 on the previous day to 01:00 on that day; the last calculation period for any one day will be the period from 16:00 to 24:00 on that day.
3) Limits foreseen for NO2.

It is clearly apparent in Table 8-81 that pollutant concentrations modelled comply with International, European and national air quality standards.

In particular CO modelled air quality parameters are 3 orders of magnitude lower than regulatory threshold concentration values. Thus CO ground level concentrations produced by the PRT Gas Heating System during the Project operation phase can reliably be considered negligible.

NOx modelled air quality parameters are one order of magnitude lower than regulatory threshold concentration values. In comparing with regulatory standards, modelled NOx hourly concentrations values are the highest among the modelled pollutants.

The following maps were produced to locate maximum NOx concentrations:

- NOx Annual average concentration map in Figure 8-14;
- NOx 99.8° percentile of hourly average concentration map in Figure 8-15;
- NOx Maximum hourly concentration in Figure 8-16.
Figure 8-14  PRT Gas heating System, Dispersion Study - NOx Annual Average Concentration Map

Source: ERM (2013)
Figure 8-15  PRT Gas heating System, Dispersion Study - NOₓ 99.8° Percentile of Hourly Average Concentration

Source: ERM (2013)
Figure 8-16  PRT Gas heating System Dispersion Study -NOₓ Maximum Hourly Concentration

Source: ERM (2013)
As shown in the previous Figures, the area mainly influenced by the boilers emissions is located almost entirely inside the PRT boundaries, it extends NE from the emission source and is confined within 720 m from the emission source.

Modelled ground level concentration values allowed the assessment of short-term and long-term impacts on local air quality caused by the PRT gas heating system activity during the Project operation phase; the assessment was based on the methodology presented in Annex 6 which is summarised in the following Tables wherein short-term and long-term impact assessment on local air quality is shown.

### Table 8-82  PRT Gas Heating System - Short-term Impact Magnitude on Local Air Quality

<table>
<thead>
<tr>
<th>Source of Impact</th>
<th>Magnitude Not Significant</th>
<th>Magnitude Small</th>
<th>Magnitude Medium</th>
<th>Magnitude Large</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Predicted short-term incremental GLCs* are &lt; = 25% of the assessment criterion</td>
<td>Predicted short-term incremental GLCs* &gt; 25% but &lt; = 50% of the assessment criterion</td>
<td>Predicted short-term incremental GLCs* &gt; 50% but &lt; = 75% of the assessment criterion</td>
<td>1. Predicted short-term incremental GLCs* &gt; 75% of the assessment criterion OR 2. When added to existing baseline concentrations, the total concentration exceeds the assessment criterion</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRT Gas Heating System</th>
<th>NOT SIGNIFICANT (NOx-CO)</th>
</tr>
</thead>
</table>

*Ground Level Concentrations

As apparent in the previous table, the short-term impact magnitude on local air quality arising from the PRT Gas Heating System is classified as Not Significant both for NOx and CO.

### Table 8-83  PRT Gas Heating System - Long-term Impact Magnitude on Local Air Quality

<table>
<thead>
<tr>
<th>Source of Impact</th>
<th>Magnitude Not Significant</th>
<th>Magnitude Small</th>
<th>Magnitude Medium</th>
<th>Magnitude Large</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Predicted long-term incremental GLCs* are &lt; = 1% of the assessment criterion</td>
<td>1. Predicted long-term incremental GLCs* &gt; 1% but &lt; = 25% of the assessment criterion OR 2. When added to existing baseline concentration, the total concentration is &lt; 50% of the assessment criterion</td>
<td>1. Predicted long-term incremental GLCs* &gt; 25% but &lt; = 50% of the assessment criterion OR 2. When added to existing baseline concentration, the total concentration is &gt; 50% but &lt; 100% of the assessment criterion</td>
<td>1. Predicted long-term incremental GLCs* &gt; 50% of the assessment criterion OR 2. When added to existing baseline concentration, the total concentration exceeds the assessment criterion</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRT Gas Heating System</th>
<th>SMALL IMPACT (NOx)</th>
</tr>
</thead>
</table>

*Ground Level Concentrations
As apparent in the previous table, the long-term impact magnitude on local air quality arising from the PRT Gas Heating System is classified as small for NO\textsubscript{x}.

Subsequently, the significance of the impacts on local air quality has been evaluated. The significance of impacts is defined exclusively on the basis of receptor sensitivity and magnitude of impacts, as shown in the following Table 8-84. The latter summarises the significance of short term and long term impacts on local air quality arising from the PRT boilers activity during the operation phase.

It must be noted that the highest sensitivity at receptors was assumed for conservative reasons.

Being the magnitude of short term impacts caused by the PRT Gas Heating System activity during the operation phase assessed as Not Significant for both NO\textsubscript{x} and CO, their significance is Not Significant. With regard to NO\textsubscript{x} long term impacts, being their magnitude Small their significance is Minor.

<table>
<thead>
<tr>
<th>Source of impact</th>
<th>Not significant</th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRT Gas Heating System (Short-term)</td>
<td>High</td>
<td>Not Significant (NO\textsubscript{x} - CO)</td>
<td>Minor</td>
<td>Moderate</td>
</tr>
<tr>
<td>PRT Gas Heating System (Long-term)</td>
<td>High</td>
<td></td>
<td>Minor (NO\textsubscript{x})</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

8.5.1.3.2 Mitigation measures

Not significant impacts are anticipated for this phase of the projects, thus mitigation measures are not required.

8.5.1.3.3 Residual Impacts

Conservatively, residual impacts are considered equal to the below described potential impacts (Table 8-85).
Table 8-85  Operation and Maintenance Phase Residual Impacts

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Mitigation Commitments to Address the Impact</th>
<th>Significance of Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Local Air quality – Operation phase</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short term</td>
<td>Mitigation measures are not anticipated.</td>
<td>Not significant (CO)</td>
</tr>
<tr>
<td>Impacts due to CO and NOx emission produced by the PRT gas heating system</td>
<td></td>
<td>CO modelled ground level concentration values are below the 25% of European Air quality standards.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CO concentration maxima are localized in the near proximity of the PRT gas heating system emission source.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minor</td>
</tr>
<tr>
<td>Long term</td>
<td>Mitigation measures are not anticipated.</td>
<td><strong>NOx</strong> modelled long term ground level concentrations (annual average) are about 4% of European Air quality standards.</td>
</tr>
<tr>
<td>Impacts due to NOx emission produced by the PRT gas heating system</td>
<td></td>
<td>NOx annual concentration maxima are localized in the near proximity of the PRT gas heating system emission source.</td>
</tr>
</tbody>
</table>

8.5.1.4  Decommissioning Phase

The useful life of the pipeline is at least 50 years; at the end of this period the pipeline and associated facilities will be decommissioned safely and with due regard for the environment. The environmental conditions existing prior to the Project will be restored within a reasonable time thus future land use will not be compromised.

The PRT equipment will be disassembled and all buildings will be demolished and the sites reinstated.

The onshore pipeline will be pigged, purged and filled with suitable material (e.g. sand) in order to prevent subsidence.
8.5.1.4.1 Potential Impacts

The decommissioning phase will include the following activities:

- Disassembling of PRT equipment;
- Demolition of buildings;
- Pigging, purging and filling of the pipeline.

A similar number and type of dust producing activities taking place during the construction of the PRT will be required for its decommissioning whereas the decommissioning of the pipeline will not produce dust.

Moreover fewer emissions from vehicular traffic anticipated for the construction phase is expected for the decommissioning phase.

**Dust Emission Impacts**

Dust emissions during the decommissioning phase will arise mainly from the PRT decommissioning. It has to be noted that impacts arising from the PRT site decommissioning are not comparable with impacts produced during its construction since the decommissioning activities will be carried out on paved surfaces. Therefore, the contribute of dust resuspension due to vehicles transit on unpaved road during the decommissioning phase will be negligible and the main dust emissions will be produced by handled material. On the base of the dust estimation method and calculation presented in Paragraph 8.5.1.2.1, the dust emitted by handled material accounts for about 9 % of the total dust emitted during the PRT construction. Thus, impacts on local air quality produced by dust emissions from handled material during the decommissioning phase are expected to be significantly lower than the impacts assessed for the dust emissions during the construction phase.

Assuming the highest sensitivity at receptors, the significance of short term and long term impacts on local air quality arising from the Project decommissioning phase has been reasonably assessed one degree of significance lower than what presented in Table 8-64 relatively to the Project construction phase. Thus, the significance of short and long term impacts arising from the PRT decommissioning has been assessed as **Minor** and **Not Significant** respectively.

**Vehicle Exhaust Emissions Impacts**

The decommissioning operations require a smaller number of vehicles and equipment compared to the to the construction phase; however, conservatively the same magnitude of impacts assessed for the vehicles emission during the construction phase is anticipated for the decommissioning phase. Therefore - as presented in the previous Table 8-70 - assuming the highest sensitivity at receptors the magnitude of short term impacts caused by vehicular emission during the Project decommissioning phase is assessed as **Not Significant** for CO, NOx and PM10, and their significance is **Not Significant**.
8.5.1.4.2 Mitigation measures

The same mitigation measures anticipated for the construction phase with regards to the dust production and vehicular emissions (Paragraph 8.5.1.2.2) will take place.

8.5.1.4.3 Residual Impacts

The following Table 8-86 summarises the type of impacts on local air quality arising from the Project decommissioning phase, their mitigation and residual impacts.

**Table 8-86 Decommissioning phase residual impacts**

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Mitigation Commitments to Address the Impact</th>
<th>Significance Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Local Air quality</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short term impacts due to dust emission</td>
<td>• Wet suppression</td>
<td>Minor</td>
</tr>
<tr>
<td>related to the PRT site decommissioning</td>
<td>• Covering loose material</td>
<td>Dust emissions will be produced only by handled material.</td>
</tr>
<tr>
<td></td>
<td>• Limiting vehicle speed</td>
<td>The decommissioning activities will be carried out on paved</td>
</tr>
<tr>
<td></td>
<td>• Sheeting trucks</td>
<td>surfaces and there will not be dust resuspension related to</td>
</tr>
<tr>
<td>Long Term Impacts due to dust emission</td>
<td></td>
<td>vehicles' transit on unpaved roads.</td>
</tr>
<tr>
<td>related to the PRT site decommissioning</td>
<td>• Wet suppression</td>
<td>Concentration maxima are localized in the near proximity of</td>
</tr>
<tr>
<td></td>
<td>• Covering loose material</td>
<td>the PRT site.</td>
</tr>
<tr>
<td></td>
<td>• Limiting vehicle speed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Sheeting trucks</td>
<td></td>
</tr>
<tr>
<td>Short term Impacts due to Vehicular emissions</td>
<td>• Maintenance of equipment and vehicles.</td>
<td>Not Significant</td>
</tr>
<tr>
<td></td>
<td>• Development of a traffic management plan.</td>
<td>Dust emissions will be produced only by handled material.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The decommissioning activities will be carried out on paved</td>
</tr>
<tr>
<td></td>
<td></td>
<td>surfaces and there will not be dust resuspension related to</td>
</tr>
<tr>
<td></td>
<td></td>
<td>vehicles' transit on unpaved roads.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Concentration maxima are localized in the near proximity of</td>
</tr>
<tr>
<td></td>
<td></td>
<td>the PRT site.</td>
</tr>
</tbody>
</table>

*) Mitigation measures in italic will be developed in a further stage of the project
8.5.2 Onshore - Acoustic Environment

8.5.2.1 Overview

This section assesses the potential impacts on local noise quality over the onshore Project area that may arise as a result of the Project activities.

A dedicated Noise Impact Assessment Study have been carried out by Genest und Partner Ingenieurgesellschaft mbH for each Project’s phase (construction, pre-commissioning, operation) that is likely to have an impact on acoustic environment at receptors. The impact assessment was developed using the prediction software SoundPLAN, Version 7.1. All equipment with acoustic characteristics that could influence the global noise levels in the study area were used as input for the model and simulated as noise sources.

Box 8-13 SoundPLAN Noise Propagation Model

SoundPLAN is a recognised noise prediction and presentation tool used extensively throughout the world in order to provide the values of sound pressure level in specific areas.

This software applies the "ray tracing" method. Sources are simulated as surfaces, lines or points: each source propagates sound waves. The resulting acoustic field depends on the absorption and reflection characteristics of all existing obstacles between the source and the receptor. In the area of interest, the acoustic field will be the result of the acoustic energies sum of "n" rays which reach the receiver.

Frequency dependent industry noise propagation (from point, line and area sources) is calculated and will adopt ISO 9613 Acoustics - Attenuation of Sound During Propagation Outdoors - Part 2: General Method of Calculation. The noise model will be developed by locating noisy equipment on digital plot plans for the plant. Noise propagation will be estimated according to the nature, type and sound power level of the different noise sources, as well as weather conditions and terrain.

The model will calculate area-wide and plant-wide noise metrics, and the results will be provided in the form of noise maps of equal loudness and sound pressure values at the receptors identified. The levels in the whole area are indicated by iso-phones with equivalent steps, at a conventional height (1.5 metres a.g.l.).

In the following sections a summary of the main evidences and results of the study and the mitigation measures built into the Project is reported. The complete noise study is attached in Annex 12.

Impacts on acoustic environment are likely to occur during each phase of the Project: construction and pre-commissioning, operation and decommissioning. During pipeline route development, the Project has sought to avoid, minimise and mitigate noise impacts (in line with IFC guidelines and national standards) through options appraisal, route-refinement and final assessment.

The main potential impacts during the construction phase are related to machinery noise emissions that will primarily affect the area adjacent to the construction/work sites. Noise sources in this phase will be not continuous, except during hydrotecting and microtunnelling, and will depend on the number and types of machinery used for each activity.
An increase in the noise level in the area adjacent to the PRT site is expected during the operation phase due to PRT activities.

The Box below shows the key sources of noise impact, potentially impacted resources and receptors, and baseline and project influencing factors associated with the impacts of the TAP Project on the acoustic environment.

**Box 8-14  Key Sources of Impact, Potentially Impacted Resources and Receptors**

**Sources of Impact**
- Construction Phase: preparation of the working strip; road construction; construction of micro tunnel; construction of temporary facilities (work sites); PRT construction; movements of vehicles, equipment and personnel; use of water and raw materials; waste management; operation of work sites; hydrotesting.
- Operations and Maintenance Phase: PRT activity; movement of vehicles and personnel for pipeline and PRT maintenance.
- Decommissioning Phase: movement of vehicles and personnel for dismantlement of PRT and BVS equipment.

**Potentially Impacted Resources and Receptors**
- Residential buildings located along the pipeline route and in proximity to the PRT and work sites; fauna.

**Baseline Influencing Factors**
- The noise monitoring did not highlight any criticalities in the area, characterised by agricultural activities and low vehicle traffic.

**Project Influencing Factors**
- Location of equipment in the PRT area; amount of machinery in use during the construction phase; specific techniques used for hydrotesting; water management; workers’ sites management, waste management and traffic management.

**Source:** ERM (December 2011)

*Table 8-87 below presents the key impacts of the TAP project on the acoustic environment during key Project phases.*

**Table 8-87  Key Impacts - Acoustic Environment**

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operational Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary annoyance at residential buildings closest to work sites and PRT</td>
<td>Potential annoyance at residential buildings closest to the PRT</td>
<td>Temporary annoyance at closest residential buildings</td>
</tr>
<tr>
<td>Sleep disturbance; potential stress</td>
<td>Sleep disturbance; potential stress</td>
<td>Sleep disturbance; potential stress</td>
</tr>
<tr>
<td>Potential temporary disturbance and/or displacement of fauna(e.g. reduction of usable habitat)</td>
<td>Potential permanent disturbance and/or displacement of fauna(e.g. reduction of usable habitat)</td>
<td>Potential temporary disturbance and/or displacement of fauna species (e.g. reduction of usable habitat)</td>
</tr>
</tbody>
</table>

**Source:** ERM (December 2011)

The sensitivity of the receptors identified during the field survey is reported in the following Sections, and each potential impact has been expanded upon, providing information on the magnitude and the mitigation measures built into the Project.
8.5.2.2 Description of Sensitivities for Acoustic Environment

In order to be able to evaluate the significance of the noise impact caused by the Project, it is necessary to describe the sensitivity of the acoustic environment at receptors.

Along the pipeline and in proximity of the PRT, several receptors have been identified in a corridor of 2 km centred on the pipeline route axis. Among these receptors there are principally residential buildings located in Melendugno Municipality, mainly single dwellings.

Genest und Partner Ingenieurgesellschaft mbH was commissioned by TAP to perform a noise monitoring survey to determine the acoustic environment quality in correspondence of the identified sensitive receptors. The noise survey was carried out in May – June 2013.

According to noise quality criteria described in Annex 6 and in comparison with national law and international standards, acoustic environment at the selected receptors can be considered to have a level of sensitivity proper to residential, institutional and educational areas, characterised by more stringent noise limits than industrial areas.

8.5.2.3 Construction Phase

8.5.2.3.1 Potential Impacts

Noise during the construction phase mainly comes from the equipment involved in soil movement and site preparation, from the heavy vehicles for material handling and from the vehicles used by employees (the latter occurs primarily at the beginning and end of the work day).

As far as noise emissions are concerned, construction of the onshore pipeline is divided into the following different phases:

- a moving assembly following the pipeline route and consists of the preliminary site preparation, where processes like grading, trench digging, bending and welding are involved. This activity is followed by the pipe laying and the backfilling and ends in the reinstatement of the work site. This phase will last six months.

- the intersection between onshore and offshore pipeline, located inside a microtunnel that will start upcountry. This phase is considered to last nine months. The drilling equipment will be located in a distance of approx. 600 m behind the coastline.

- the construction of the PRT that will last 18 months. The site has to be prepared (earthworks) and foundations have to be built as a basis for a proper building and gas facility construction. The installation of internal roads is considered to take place in the last year.

During construction, the main equipment used is soil moving machinery (excavators, loaders, etc.) and trucks.
In subsequent phases equipment will also be used to move materials (cranes, side-boom/pipelaying, pipe bending machine, etc.) and stationary machinery (pumps, generators, compressors, etc.).

The overall noise produced during the construction phase comes from several types of equipment and from specific activities; therefore, the noise impact related to this Project phase varies during the day and among the different operations.

Noise emissions related to the different activities have been analysed in the following paragraphs in order to evaluate the maximum anticipated impact during the construction phase.

Construction activities will occur only during the day, from morning to afternoon, usually from 8.00 until 18.00, except for micro tunnel construction for which a 24 hour activity is foreseen.

This section provides a brief description of noise legislation relating to construction activities and assessment of the noise impact during the TAP Project construction phase.

*Table 8-88* shows the limits of sound power level for the main equipment used during construction works, according to Directive 2000/14/CE.

### Table 8-88  Equipment and Related Limits of Sound Power Level According to Directive 2000/14/CE

<table>
<thead>
<tr>
<th>Type of equipment</th>
<th>Net installed power $P$ (kW)</th>
<th>Electric power $PEL$ (1)(kW)</th>
<th>Mass of appliance $m$ (kg)</th>
<th>Cutting width $L$ (cm)</th>
<th>Acceptable sound power level $(dB(A)/1,pW)$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$Stage,II$</td>
<td></td>
<td></td>
<td></td>
<td>As from 03/01/2006</td>
</tr>
<tr>
<td>Compaction machines (vibrating rollers, vibratory plates, rammers)</td>
<td>P≤80</td>
<td>105 (2)</td>
<td>80 &lt; $P$ ≤ 70</td>
<td>106 (2)</td>
<td>$P &gt; 70$</td>
</tr>
<tr>
<td>Tracked dozers, tracked loaders, tracked excavator-loaders</td>
<td>P ≤ 55</td>
<td>103 (2)</td>
<td>$P &gt; 55$</td>
<td>84 + 11 log10 $P$ (2)</td>
<td></td>
</tr>
<tr>
<td>Wheeled dozers, wheeled loaders, wheeled excavator-loaders, dumpers, graders, loader-type landfill compactors, combustion engine-driven counterbalanced lift trucks, mobile cranes, compaction machines (non-vibrating rollers), paver-finishers, hydraulic power packs</td>
<td>P ≤ 55</td>
<td>101 (2)(3)</td>
<td>$P &gt; 55$</td>
<td>82 + 11 log10 $P$ (2)(3)</td>
<td></td>
</tr>
<tr>
<td>Excavators, builders’ hoists for the transport of goods, construction winches, motor hoes</td>
<td>P ≤ 15</td>
<td>93</td>
<td>$P &gt; 15$</td>
<td>80 + 11 log10 $P$</td>
<td></td>
</tr>
<tr>
<td>Hand-held concrete breakers and picks</td>
<td>M ≤ 15</td>
<td>105</td>
<td>15 &lt; $m$ &lt; 30</td>
<td>92 + 11 log10 $m$ (2)</td>
<td>$M \geq 30$</td>
</tr>
</tbody>
</table>
# Table of Noise Emission Levels

<table>
<thead>
<tr>
<th>Type of equipment</th>
<th>Net installed power P (kW)</th>
<th>Acceptable sound power level (dB(A)/1 pW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tower cranes</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>P &lt; 2</td>
<td>95 + log₁₀ P</td>
</tr>
<tr>
<td></td>
<td>2 &lt; P ≤ 10</td>
<td>96 + log₁₀ P</td>
</tr>
<tr>
<td></td>
<td>P &gt; 10</td>
<td>95 + log₁₀ P</td>
</tr>
</tbody>
</table>
| Welding and power generators | 96 + log₁₀ P | Stage II  
|                   | 95 + log₁₀ Pel            | As from 03/01/2006                      |
| Compressors       | P ≤ 15                    | 97                                     |
|                   | P > 15                    | 95 + 2 log₁₀ P                         |
| Lawn mowers, lawn trimmers/lawn edge trimmers | 97 | 
|                   | L ≤ 50                    | 94 (2)                                 |
|                   | 50 < L ≤ 70               | 98                                     |
|                   | 70 < L ≤ 120              | 98 (2)                                 |
|                   | L > 120                   | 103 (2)                                |

### Notes:

1. PEL for welding generators: conventional welding current multiplied by the conventional load voltage for the lowest value of the duty factor given by the manufacturer.

2. PEL for power generators: prime power according to ISO 8528-1:1993, point 13.3.2

3. The figures for stage II are merely indicative for the following types of equipment:
   - walk-behind vibrating rollers;
   - vibratory plates (> 3kW);
   - vibratory rammers;
   - dozers (steel tracked);
   - loaders (steel tracked > 55kW);
   - combustion engine driven counterbalanced lift trucks;
   - compacting screed paver-finishers;
   - hand-held internal combustion engine concrete breakers and picks (15 < m < 30);
   - lawn mowers, lawn trimmers/lawn edge trimmers.

Definitive figures will depend on amendment of the Directive following the report required in Article 20, Paragraph 1. In the absence of any such amendment, the figures for stage I will continue to apply for stage II.

4. For single engine mobile cranes, the figure for stage I will continue to apply until 3 January 2008. After that date, stage II figures will apply.

The permissible sound power level will be rounded up or down to the nearest integer number (less than 0.5, use lower number; greater than or equal to 0.5, use higher number).

### Source:

Directive 2000/14/CE

As indicated by Directive 2000/14/CE, all noise emitting equipment should be properly maintained to minimise noise impact on the area and should comply with the applicable EU noise standards for such equipment.
During the preliminary site preparation, the most critical aspect is the presence of several vehicles and construction equipment (trucks, excavators, dozer, etc.) in the area at the same time; in this phase, about 230,000 m³ of soil will be moved in the site.

*Table 8-89 to Table 8-91* show a list of all the equipment involved in the different construction phases, divided into type of activity, considered in the noise model input; working hours per day and the foreseen sound power level according to Directive 2000/14/EC are reported for each type of equipment.

### Table 8-89  Equipment Involved in Onshore Pipeline Construction Phase

<table>
<thead>
<tr>
<th>Type of equipment</th>
<th>Number</th>
<th>Working hours per day; Timing (days)</th>
<th>Sound Power $L_W$ [dB(A)]&lt;sup&gt;(1)&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working Strip</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excavator</td>
<td>2</td>
<td>10 hours; 50 days</td>
<td>106</td>
</tr>
<tr>
<td>Backhoe loader</td>
<td>1</td>
<td>10 hours; 50 days</td>
<td>108</td>
</tr>
<tr>
<td>Stringing/Bending</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crane</td>
<td>1</td>
<td>10 hours; 10 days</td>
<td>98</td>
</tr>
<tr>
<td>Pipelayer</td>
<td>1</td>
<td>10 hours; 10 days</td>
<td>105</td>
</tr>
<tr>
<td>Side-boom</td>
<td>1</td>
<td>10 hours; 10 days</td>
<td>109</td>
</tr>
<tr>
<td>Pipe Bending Machine</td>
<td>1</td>
<td>10 hours; 10 days</td>
<td>94</td>
</tr>
<tr>
<td>Welding</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Side-boom</td>
<td>1</td>
<td>10 hours; 50 days</td>
<td>109</td>
</tr>
<tr>
<td>Engine driver compressor</td>
<td>1</td>
<td>10 hours; 50 days</td>
<td>110</td>
</tr>
<tr>
<td>Tracked tractor</td>
<td>1</td>
<td>10 hours; 50 days</td>
<td>109</td>
</tr>
<tr>
<td>Trench Digging</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excavator</td>
<td>2</td>
<td>10 hours; 25 days</td>
<td>106</td>
</tr>
<tr>
<td>Truck</td>
<td>2</td>
<td>10 hours; 25 days</td>
<td>107</td>
</tr>
<tr>
<td>Pipe laying and backfilling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Side-boom</td>
<td>4</td>
<td>10 hours; 25 days</td>
<td>109</td>
</tr>
<tr>
<td>Excavator</td>
<td>2</td>
<td>10 hours; 25 days</td>
<td>106</td>
</tr>
<tr>
<td>Backhoe loader</td>
<td>1</td>
<td>10 hours; 25 days</td>
<td>108</td>
</tr>
<tr>
<td>Reinstatement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excavator</td>
<td>2</td>
<td>10 hours; 20 days</td>
<td>106</td>
</tr>
<tr>
<td>Backhoe loader</td>
<td>1</td>
<td>10 hours; 20 days</td>
<td>108</td>
</tr>
</tbody>
</table>

**Notes:**

<sup>(1)</sup> Standard emission levels have been used for this type of equipment according to Directive 2000/14/EC and the Committee for European Construction Equipment

**Source:** Genest und Partner Ingenieurgesellschaft mbH

### Table 8-90  Equipment Involved in Microtunnel Construction Phase

<table>
<thead>
<tr>
<th>Type of equipment</th>
<th>Number</th>
<th>Working hours per day; Timing (days)</th>
<th>Sound Power $L_W$ [dB(A)]&lt;sup&gt;(1)&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tunnelling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engine generator</td>
<td>2</td>
<td>24 hours; 9 months</td>
<td>98</td>
</tr>
<tr>
<td>Excavator</td>
<td>3</td>
<td>10 hours; 50 days</td>
<td>106</td>
</tr>
<tr>
<td>Truck</td>
<td>1</td>
<td>10 hours; 9 months</td>
<td>107</td>
</tr>
</tbody>
</table>

**Notes:**

<sup>(1)</sup> Standard emission levels have been used for this type of equipment according to Directive 2000/14/EC and the Committee for European Construction Equipment

**Source:** Genest und Partner Ingenieurgesellschaft mbH
The predicted noise emissions generated during onshore pipeline, microtunnel and PRT construction have been assessed through SoundPLAN modelling, considering a worst case scenario:

- all equipment run full load simultaneously 10 hours during working days;
- the construction of the pipeline and the PRT is carried out only during daytime; the driving of the microtunnel will also be carried out during night time;
- the construction equipment are located at the closest possible distance to the sensitive receptor.

The predicted noise levels at each receptor identified during the field survey (Section 6.5.3.2), based on the modelling assumption outlined above, are summarized in Table 8-92 for pipeline, microtunnel and PRT construction at day time, and in Table 8-93 for microtunnel construction at night time.

### Table 8-92 Noise Pressure Levels at Receptors generated by Onshore Pipeline, Microtunnel and PRT Construction during Day time

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 South of PRT, single dwelling</td>
<td>54</td>
<td>51.1 (1)</td>
<td>55.8</td>
<td>4.7</td>
<td>70</td>
<td>no</td>
</tr>
<tr>
<td>2 West of PRT, single dwelling</td>
<td>57.6</td>
<td>42.5 (2)</td>
<td>57.7</td>
<td>15.2</td>
<td>70</td>
<td>no</td>
</tr>
<tr>
<td>3 North of PRT, single dwelling</td>
<td>62.8</td>
<td>44.4 (2)</td>
<td>62.9</td>
<td>18.5</td>
<td>70</td>
<td>no</td>
</tr>
<tr>
<td>4 North-West of PRT, single dwelling</td>
<td>46.9</td>
<td>44.4 (3)</td>
<td>48.8</td>
<td>4.4</td>
<td>70</td>
<td>no</td>
</tr>
<tr>
<td>5 Single Dwelling</td>
<td>65.8</td>
<td>52.5 (2)</td>
<td>66.0</td>
<td>13.5</td>
<td>70</td>
<td>no</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>--------------------------------------</td>
<td>------------------------------</td>
<td>-----------------------------</td>
<td>-----------------------------</td>
<td>----------------------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>6 Alba Bed &amp; Breakfast</td>
<td>63.6</td>
<td>52.5 (3)</td>
<td>63.9</td>
<td>11.4</td>
<td>70</td>
<td>no</td>
</tr>
<tr>
<td>7 Single Dwelling</td>
<td>61.9</td>
<td>47.9 (3)</td>
<td>62.1</td>
<td>14.2</td>
<td>70</td>
<td>no</td>
</tr>
<tr>
<td>8 Small residential area (several houses)</td>
<td>62.3</td>
<td>47.9 (3)</td>
<td>62.5</td>
<td>14.6</td>
<td>70</td>
<td>no</td>
</tr>
<tr>
<td>9 Single Dwelling</td>
<td>66.8</td>
<td>47.9 (2)</td>
<td>66.9</td>
<td>19.0</td>
<td>70</td>
<td>no</td>
</tr>
<tr>
<td>10 Single Dwelling, currently not inhabitable</td>
<td>65.5</td>
<td>47.9 (3)</td>
<td>65.6</td>
<td>17.7</td>
<td>70</td>
<td>no</td>
</tr>
<tr>
<td>11 Single Dwelling</td>
<td>61.2</td>
<td>47.9 (3)</td>
<td>61.4</td>
<td>13.5</td>
<td>70</td>
<td>no</td>
</tr>
<tr>
<td>12 Single Dwelling</td>
<td>58.6</td>
<td>45.2 (3)</td>
<td>58.8</td>
<td>13.6</td>
<td>70</td>
<td>no</td>
</tr>
<tr>
<td>13 Single Dwelling</td>
<td>58.1</td>
<td>45.2 (3)</td>
<td>58.3</td>
<td>13.1</td>
<td>70</td>
<td>no</td>
</tr>
<tr>
<td>14 Single Dwelling</td>
<td>69.4</td>
<td>45.2 (2)</td>
<td>69.4</td>
<td>24.2</td>
<td>70</td>
<td>no</td>
</tr>
<tr>
<td>15 Single Dwelling</td>
<td>56.1</td>
<td>45.2 (3)</td>
<td>56.4</td>
<td>11.2</td>
<td>70</td>
<td>no</td>
</tr>
<tr>
<td>16 Single Dwelling</td>
<td>54.7</td>
<td>44.0 (3)</td>
<td>55.1</td>
<td>11.1</td>
<td>70</td>
<td>no</td>
</tr>
<tr>
<td>17 Single Dwelling</td>
<td>52.2</td>
<td>44.0 (3)</td>
<td>52.8</td>
<td>8.8</td>
<td>70</td>
<td>no</td>
</tr>
<tr>
<td>18 Small residential area (several houses)</td>
<td>59.5</td>
<td>47.0 (1)</td>
<td>59.7</td>
<td>12.7</td>
<td>70</td>
<td>no</td>
</tr>
<tr>
<td>19 Single Dwelling</td>
<td>57.4</td>
<td>44.0 (1)</td>
<td>57.6</td>
<td>13.6</td>
<td>70</td>
<td>no</td>
</tr>
<tr>
<td>20 Small residential area (several houses)</td>
<td>50.4</td>
<td>44.0 (3)</td>
<td>51.3</td>
<td>7.3</td>
<td>70</td>
<td>no</td>
</tr>
<tr>
<td>21 Urban area of San Foca</td>
<td>44</td>
<td>54.8 (2)</td>
<td>55.1</td>
<td>0.3</td>
<td>70</td>
<td>no</td>
</tr>
<tr>
<td>22 Single Dwelling</td>
<td>67.5</td>
<td>47.9 (2)</td>
<td>67.5</td>
<td>19.6</td>
<td>70</td>
<td>no</td>
</tr>
</tbody>
</table>

Notes:
(1) Long term measurement value
(2) Short term measurement value
(3) Extrapolated value, considering the distance between receptor and closest available measurement point

Source: Genest und Partner Ingenieurgesellschaft mbH

Table 8-93 Noise Pressure Levels at Receptors generated by Microtunnel Construction during Night time

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>16 Single Dwelling</td>
<td>20.3</td>
<td>35.0 (3)</td>
<td>35.1</td>
<td>0.1</td>
<td>60</td>
<td>no</td>
</tr>
<tr>
<td>17 Single Dwelling</td>
<td>31.3</td>
<td>35.0 (3)</td>
<td>36.5</td>
<td>1.5</td>
<td>60</td>
<td>no</td>
</tr>
<tr>
<td>18 Small residential area (several houses)</td>
<td>40.8</td>
<td>35.0 (3)</td>
<td>41.8</td>
<td>6.8</td>
<td>60</td>
<td>no</td>
</tr>
<tr>
<td>19 Single Dwelling</td>
<td>34.3</td>
<td>35.0 (3)</td>
<td>37.7</td>
<td>2.7</td>
<td>60</td>
<td>no</td>
</tr>
<tr>
<td>20 Small residential area (several houses)</td>
<td>28.4</td>
<td>35.0 (3)</td>
<td>35.9</td>
<td>0.9</td>
<td>60</td>
<td>no</td>
</tr>
<tr>
<td>21 Urban area of San Foca</td>
<td>21.8</td>
<td>35.0 (3)</td>
<td>35.2</td>
<td>0.2</td>
<td>60</td>
<td>no</td>
</tr>
<tr>
<td>22 Single Dwelling</td>
<td>36.8</td>
<td>35.0 (3)</td>
<td>39.0</td>
<td>4.0</td>
<td>60</td>
<td>no</td>
</tr>
</tbody>
</table>

Notes:
(3) Extrapolated value, considering the distance between receptor and closest available measurement point

Source: Genest und Partner Ingenieurgesellschaft mbH

The contribution of each individual noise source and the noise contour maps for the modelled scenario are reported in the Figures below and in Annex 12.
Figure 8-17  Construction Phase Noise Contour Map. Map 1/3

Source: Genest und Partner Ingenieurgesellschaft mbH. Modified by ERM
Figure 8-18  Construction Phase Noise Contour Map. Map 2/3

Source: Genest und Partner Ingenieurgesellschaft mbH. Modified by ERM
Figure 8-19 Construction Phase Noise Contour Map. Map 3/3

Source: Genest und Partner Ingenieurgesellschaft mbH. Modified by ERM
During day time, the noise emissions generated from construction activities at receptors range from about 69 dB(A) to 44 dB(A). The cumulative noise levels, that take into account the contribution of the project construction and the background noise level monitored during the noise survey, are all in compliance with national limits (70 dB(A)). The highest value is predicted at Receptor n. 14 due to its proximity to pipeline route (approx. 60 m); here the cumulative noise impact is close to the limit value, but still below 70 dB(A).

During night time, the noise emissions are generated only by construction activities for microtunnelling and compared to the extent of the pipeline route the relevant possible noise impact due to microtunnelling activity is limited to Receptors n.16 to n.22. The predicted noise levels range from about 20 dB(A) to 37 dB(A). The noise limit of 60 dB(A) established by National legislation is fulfilled at all receptors.

In conclusion, the magnitude of noise impact is small at all receptors, in fact noise levels are below the noise limits both for daytime and night-time. Furthermore, it has to be stated that the maximum noise impact due to pipeline construction will occur only for a rather short time period of at most several days. This is the case when the machinery used during pipeline laying and back filling operates at the closest possible distance to the sensitive receptor. Accordingly the noise impact is in a small order of magnitude most of the time during pipeline construction.

**Vibrations**

Based on literature data, specific monitoring campaigns have been performed in order to evaluate the effects of the microtunnel excavation relevant to building stability. Monitoring performed in Padana Plain, in sites characterized by alluvial soils, showed that the vibrations, in terms of wave speed, are below the law threshold relevant to residential and industrial buildings. Particularly, at a distance of about 120 m, the wave speed was less than one order of magnitude with respect to the legal threshold.

In any case, TAP, considering the different soil characteristics of the work site, will monitor the microtunnel construction in order to check the compliance with law threshold.

8.5.2.3.2 Mitigation Measures

In addition to the general mitigation measures described in Section 8.1, the noise impact on receptors during the construction phase will be specifically reduced using the following measures:

- **on noise sources/equipment:**
  - switch off equipment when not in use;
  - if possible, route heavy truck traffic supporting construction activities away from noise sensitive receptors;
• on operations:
  o whenever feasible, schedule different noisy activities to occur concurrently, since the combined noise levels produced may not be significantly greater than the level produced if the operations were performed separately;
  o limit noisy construction activities to the least noise-sensitive times of day;
• on propagation path:
  o locate stationary equipment (e.g. compressors) as far as practicable from nearby receptors.

8.5.2.3.3 Residual Impacts

As above described, best practices and good management of the working site are the main mitigation measures to be taken in order to mitigate noise impacts. In any case, conservatively, residual impacts are considered equal to the above described potential impacts.

Therefore, considering the impact magnitude (small) and the sensitivity of the noise receptors (residential areas, as detailed in Section 8.5.2.2), the value of impact significance for onshore pipeline, microtunnel and PRT construction is considered to be minor in correspondence of all receptors.

Box 8-15 National Legislation for Noise Pollution Concerning Construction Activities

According to National Law on noise pollution, it’s possible to require a temporarily authorization to exceed the noise limits for construction activities established by national laws in force (70 dBA for day time, 60 dBA for night time).

As established by Law 447/95 art.6, the mayor can define, with municipal decrees, specific noise emission limits for construction activities, according to the environmental context in which the project is located and the intended use of the surrounding areas and buildings. The Proposer, if necessary, can conservatively require authorization for temporary activities to exceed the established noise limits.

The authorization request should contain the project phase duration, a list of all equipment used in the activity and all available techniques implemented in order to reduce noise impact.

The following table presents a summary of the residual impact associated with the impacts identified.
### Table 8-94 Residual Impacts - Noise. Construction and Pre-Commissioning

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Mitigation Commitments to Address the Impact</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acoustic Environment Quality – Construction Phase</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short Term Impact due to noise emission - Onshore Pipeline Construction</td>
<td>All receptors - Day time • switch off equipment when not in use; • whenever feasible, schedule different noisy activities to occur concurrently; • locate stationary equipment (e.g. compressors) as far as practicable from nearby receptors</td>
<td>Minor • Temporary disturbance • Receptors sufficiently distant from work areas</td>
</tr>
<tr>
<td>Short Term Impact due to noise emission - Microtunnelling</td>
<td>All receptors - Day time</td>
<td></td>
</tr>
<tr>
<td>Short Term Impact due to noise emission - PRT Construction</td>
<td>All receptors - Day time</td>
<td></td>
</tr>
</tbody>
</table>

8.5.2.4 Pre Commissioning - Hydrotesting Phase

During pre-commissioning phase, once the pipeline has been cleaned and gauged, it will be subject to hydrotesting. A pressurisation spread located in the pull-in area in Italy in the vicinity of the micro tunnel work site will be fed from the water winning spread and will be used to raise the pressure in the pipeline to the specified test pressure. After stabilisation, the system will undergo a 48-hr hold period with acceptance criteria in compliance with the technical standard DNV OS-F101.

Once the hydrotest has been accepted, the system will be depressurized to atmospheric pressure. Water used for the hydrotest will be discharged into the sea in Albania via the temporary discharge system. Afterwards, pipeline drying will take place.

8.5.2.4.1 Potential Impacts

In order to estimate the noise level generated during the pre-commissioning phase, a quantitative analysis of the potential Project impact was performed using SoundPLAN noise propagation software. The complete noise study is attached in Annex 12.

The area where pre-commissioning equipment will be located is a primarily rural area. The nearest receptors are Receptor n.18 and n.22 in the north and south respectively with a distance of approx. 250 m/380 m (Figure 8-20).
Precommissioning will include, among others, three different phases: flooding, hydrostatic test and dewatering and drying.

During the flooding phase three water pumps will be operated for a 2.5 day period. For the hydrostatic test (pressurisation process) four pumps will be needed. The hold period will last 48 hours. The quantity of equipment that will come into operation during these phases is small compared to the large numbers of air compressors that will be used during the dewatering phase.

During dewatering a Temporary Air Compressor Station (TACS) will be in operation. All compressors will be operated simultaneously under full load, 24 hours per day and for a continuous period of approximately 6 days.

Therefore, the most critical aspect in terms of noise impact is represented by the dewatering phase and the continuous activity of feed compressors, booster compressors and dryers during pre-commissioning activities. The noise emissions generated during this phase have been assessed.

*Table 8-96* shows the exact number of equipment used for the noise simulation.

**Table 8-96  Equipment Deployed in Dewatering Phase**

<table>
<thead>
<tr>
<th>Type of equipment</th>
<th>Number</th>
<th>Time of Operation</th>
<th>Sound Power Level [dB(A)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Booster Compressors</td>
<td>15</td>
<td>24 hours * 6 days</td>
<td>124.9</td>
</tr>
<tr>
<td>Feed Compressors</td>
<td>29</td>
<td>24 hours * 6 days</td>
<td>123.2</td>
</tr>
<tr>
<td>Dryers</td>
<td>7</td>
<td>24 hours * 6 days</td>
<td>122.7</td>
</tr>
</tbody>
</table>

Notes:

(1) Emission levels have been defined from dedicated measurements

*Source: Genest und Partner Ingenieurgesellschaft mbH. Modified by ERM*

All equipment were considered in the model as point sources and were assumed to be operating continuously and running simultaneously during both day and night under full load.
Regarding the sound power levels of the proposed equipment and the shortest distance to the nearest sensitive receptor of 250 m it can be derived that noise barriers are mandatory. Noise absorptive barriers with a minimum height of 4m surrounding all units and placed in between single units were taken into account within the sound propagation model.

The predicted noise levels at receptors near the hydrotest area are summarized in Table 8-97 and Table 8-98.

**Table 8-97  Noise Pressure Levels at Receptors generated by Pre-commissioning Phase during Daytime**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>16 Single Dwelling</td>
<td>53.8</td>
<td>44.0 (3)</td>
<td>54.2</td>
<td>10.2</td>
<td>70</td>
<td>no</td>
</tr>
<tr>
<td>17 Single Dwelling</td>
<td>64.5</td>
<td>44.0 (3)</td>
<td>64.5</td>
<td>20.5</td>
<td>70</td>
<td>no</td>
</tr>
<tr>
<td>18 Small residential area (several houses)</td>
<td>69.3</td>
<td>47.0 (1)</td>
<td>69.3</td>
<td>22.3</td>
<td>70</td>
<td>no</td>
</tr>
<tr>
<td>19 Single Dwelling</td>
<td>69.7</td>
<td>44.0 (1)</td>
<td>69.7</td>
<td>25.7</td>
<td>70</td>
<td>no</td>
</tr>
<tr>
<td>20 Small residential area (several houses)</td>
<td>66.5</td>
<td>44.0 (3)</td>
<td>66.5</td>
<td>22.5</td>
<td>70</td>
<td>no</td>
</tr>
<tr>
<td>21 Urban area of San Foca</td>
<td>55.5</td>
<td>54.8 (2)</td>
<td>58.2</td>
<td>3.4</td>
<td>60</td>
<td>no</td>
</tr>
<tr>
<td>22 Single Dwelling</td>
<td>67.7</td>
<td>47.9 (2)</td>
<td>67.7</td>
<td>19.8</td>
<td>70</td>
<td>no</td>
</tr>
</tbody>
</table>

Notes:  
(1) Long term measurement value  
(2) Short term measurement value  
(3) Extrapolated value, considering the distance between receptor and closest available measurement point  
(4) Noise limits defined by DPCM 01/03/1991 for areas classified as “all national territory” (70 dB(A)) and as “zone B” (60 dB(A))

*Source: Genest und Partner Ingenieurgesellschaft mbH.*
### Table 8-98  Noise Pressure Levels at Receptors generated by Pre-commissioning Phase during Night time

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>16 Single Dwelling</td>
<td>53.8</td>
<td>35.0 (3)</td>
<td>53.9</td>
<td>18.9</td>
<td>60</td>
<td>no</td>
</tr>
<tr>
<td>17 Single Dwelling</td>
<td>64.5</td>
<td>35.0 (3)</td>
<td>64.5</td>
<td>29.5</td>
<td>60</td>
<td>4.5</td>
</tr>
<tr>
<td>18 Small residential area (several houses)</td>
<td>69.3</td>
<td>35.0 (3)</td>
<td>69.3</td>
<td>34.3</td>
<td>60</td>
<td>9.3</td>
</tr>
<tr>
<td>19 Single Dwelling</td>
<td>69.7</td>
<td>35.0 (3)</td>
<td>69.7</td>
<td>34.7</td>
<td>60</td>
<td>9.7</td>
</tr>
<tr>
<td>20 Small residential area (several houses)</td>
<td>66.5</td>
<td>35.0 (3)</td>
<td>66.5</td>
<td>31.5</td>
<td>60</td>
<td>6.5</td>
</tr>
<tr>
<td>21 Urban area of San Foca</td>
<td>55.5</td>
<td>35.0 (3)</td>
<td>55.5</td>
<td>20.5</td>
<td>50</td>
<td>-4.5</td>
</tr>
<tr>
<td>22 Single Dwelling</td>
<td>67.7</td>
<td>35.0 (3)</td>
<td>67.7</td>
<td>32.7</td>
<td>60</td>
<td>7.7</td>
</tr>
</tbody>
</table>

Notes:
1. Extrapolated value, considering the distance between receptor and closest available measurement point
2. Noise limits defined by DPCM 01/03/1991 for areas classified as “all national territory” (70 dB(A)) and as “zone B” (60 dB(A))
3. Source: Genest und Partner Ingenieurgesellschaft mbH.

The noise contribution on receptors of the modelled scenario is reported in the tables in Annex 12; the Figures below show the A-weighted noise level contour maps for day time and night time.
Figure 8-20  Pre-Commissioning Phase Noise Contour Map. Day Time

Source: Genest und Partner Ingenieurgesellschaft mbH. Modified by ERM (2013)
Figure 8-21  Pre-Commissioning Phase Noise Contour Map. Night Time

Source: Genest und Partner Ingenieurgesellschaft mbH. Modified by ERM (2013)
Considering that compressors are in operation 24 hours, they will generate the same noise emissions both during day time and night time; in details, the predicted noise emissions generated from dewatering phase at the nearest receptors range from 53.8 dB(A) to 69.7 dB(A).

During day time, the cumulative noise levels, that take into account the contribution of the project construction and the background noise level monitored during the noise survey, are all in compliance with national limit (70 dB(A)). The highest values are predicted at Receptor n.18 and Receptor n.19 due to their proximity to the hydrotest area; here the cumulative noise impacts are close to the limit value, but still below 70 dB(A).

During night time, the cumulative noise levels are not in compliance with the noise limit of 60 dB(A) established by Italian legislation at the majority of the sensitive receptors, where an exceedance of about 10 dB(A) of the limit will be expected.

Receptor n.21 located in the residential area of San Foca, should conservatively be considered classified in “Zone B” according to DPCM 01/03/91 (i.e. it is a residential area, but figures on the degree of development, as territorial density, are not available).

Accordingly the applicable noise limits are 60 dB(A) for day time and 50 dB(A) for night time.

Considering the Noise Modelling results, for the north west portion of San Foca settlement the modelled noise pressure level generated during hydrotesting activities during night time (>55 dB(A)) are greater than the limit for Zone B (50 dB(A)) and range up to values close to the day time limit of 60dB(A). Also in this case, for Receptor n. 21 the noise limit for day time is respected, whilst there is an exceedance of the night noise limit.

As during the Flooding and Hydrotest Phase only a few pumps will be operated the noise impact is significantly lower. During the Flooding Phase the noise limits for both, day and night time period will be respected at all sensitive receptors. During the Hydrotest Phase a slight excess of the night time noise limit cannot be excluded at the two closest receptors. But these can be regarded as marginal as it amounts approximately to 1 dB(A).

In conclusion, the magnitude of the noise impact is:

- during daytime, **small** at all receptors, in fact noise levels are below the noise limits of 70 dB(A) for receptors classified as “all national territory” and below 60 dB(A) for Receptor n.21 classified in “zone B”;
- during night time, **large** for all receptors, with the exception of Receptor n.16, located further away from the hydrotest area, which are characterised by a **small** magnitude of noise impact.
8.5.2.4.2 Mitigation Measures

To reduce the noise impact during hydrotesting (pre-commissioning), noise barriers have been implemented in the Project design, as reported in Section 8.5.2.4.1.

In addition to this mitigation measures, considering the criticalities found during the pre-commissioning phase, TAP AG is committed to evaluate the possibility to further reduce the noise impact on receptors during this phase through:

- Implement other technical sound mitigation measures;
- Modify compressors operation activity during night time;
- Relocation of compressors work site.

In case these mitigation measures are not sufficient to meet the legal limits, a temporary relocation of people settled near the pre-commissioning work site would be taken into account. This mitigation measure will be discussed and agreed with the local Authorities and the affected people in a later stage of the project.

8.5.2.4.3 Residual Impacts

As above described, best practices and good management of the working site are the main mitigation measures to be taken in order to mitigate noise impacts. In any case, conservatively, residual impacts are considered equal to the above described potential impacts.

Therefore, considering the impact magnitude (small and large) and the sensitivity of the noise receptors (residential areas, as detailed in Section 8.5.2.2), the significance of impact obtained is:

- during daytime, minor at all receptors, in fact noise levels are below the noise limits of 70 dB(A) for receptors classified as “all national territory” and below 60 dB(A) for Receptor n.21 classified in “zone B”;
- during night time, major for all receptors, with the exception of Receptor n.16, located far from the hydrotest area, which are characterised by a minor magnitude of noise impact.

In this study, a conservative approach was taken in order to estimate the noise impact generated by the pre-commissioning operation. Therefore, it is plausible that the noise levels at receptors will be effectively lower than the estimated levels, with relation to the current territorial characteristics and the final localization of compressors and noise barriers. The project layout for pre-commissioning operation considered in the scenarios described above could change during project finalization. The position of the noise barriers, in fact, have to be considered as preliminary and it could be optimised in the project layout finalization. It has also to be noted that the high noise levels simulated in this study occur during dewatering process of the hydrotest that will last only 6 days.
In any case, during the pre-commissioning phase, a noise survey will be performed to monitor the noise levels currently reached at receptors.

The following table presents a summary of the residual impact associated with the impacts identified.

### Table 8-99 Residual Impacts - Noise. Hydrotesting Phase

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Mitigation Commitments to Address the Impact</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acoustic Environment Quality – Hydrotesting Phase</td>
<td>• maintenance of equipment; • noise barriers; • Further mitigation/compensation measures.</td>
<td>Minor</td>
</tr>
<tr>
<td>Short Term Impact due to noise emission - Hydrotesting</td>
<td></td>
<td>Major</td>
</tr>
<tr>
<td>All receptors - Day time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receptors within 1000 m from pre-commissioning area - Night time</td>
<td>Foreseen noise levels &lt;70 dBA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>General mitigation measures applied to reduce the noise impact</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Foreseen noise levels &gt;55/60 dBA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>General mitigation measures applied to reduce the noise impact</td>
<td></td>
</tr>
</tbody>
</table>

*Mitigation measures in italic will be developed in a further stage of the project

Source: ERM (2013)

8.5.2.5 Operations and Maintenance Phase

8.5.2.5.1 Potential Impacts

In order to estimate the noise level of the hydrotest operation, a quantitative analysis of the potential Project impact was performed using SoundPLAN noise propagation software. The complete noise study is attached in Annex 12.

The PRT area will be located in a primarily rural area. The nearest receptors are reported in the following Table, according to Section 6.5.2.3.2.

### Table 8-100 Noise Sensitive Receptors Close to the PRT Area

<table>
<thead>
<tr>
<th>Sensitive Receptor</th>
<th>Distance / Direction to the site</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 South single dwelling near Melendugno</td>
<td>460 m/south</td>
</tr>
<tr>
<td>2 West single dwelling near Melendugno</td>
<td>590 m/west</td>
</tr>
<tr>
<td>3 North single dwelling near Melendugno</td>
<td>620 m/north</td>
</tr>
<tr>
<td>4 North-West single dwelling near Vernole</td>
<td>950 m/north-west</td>
</tr>
</tbody>
</table>

Source: Genest und Partner Ingenieurgesellschaft mbH.
For the noise assessment of the planned PRT sound power data from Table 8-101 was used considering two different scenarios with all gas flow control train units operating at full capacity:

- Scenario 1: pipeline transport capacity of approx. 10 billion cubic meters / year (Development Phase I);
- Scenario 2: pipeline transport capacity of approx. 20 billion cubic meters / year (Development Phase II).

As the pipeline transport capacity will be initially approx. 10 billion cubic meters / year the first development phase (Development Phase I) comprises only part of the processing units for the 20 BCM/y case (Development Phase II). Namely these are metering sections, valve stations, filter units and heat exchanger, each in triplicate. Due to the 2+1 sparing philosophy, two units respectively have to be taken into account during normal operation. Furthermore there will be one fuel gas skid and the boiler house. Also the piping above ground and diverse operation and administration buildings have to be considered. To guarantee the final transport capacity of approx. 20 billion cubic meters / year, an extension of the receiving terminal is necessary. Thus the implementation of two additional metering, valve filter and heat exchanger units is intended in a second development phase.

**Table 8-101  Equipment Involved in PRT Operation Phase. Noise Specifications**

<table>
<thead>
<tr>
<th>Equipment/Building</th>
<th>Sound Power Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Station inlet filter, per unit (in total four filters assumed)</td>
<td>$L_{WA} \leq 76$ dB(A)</td>
</tr>
<tr>
<td>Inlet filter, pipework above ground, up and downstream</td>
<td>$L_{WA} \leq 70$ dB(A)/m</td>
</tr>
<tr>
<td>Heat exchanger, per unit (in total four units assumed)</td>
<td>$L_{WA} \leq 58$ dB(A)</td>
</tr>
<tr>
<td>Heat exchanger, pipework above ground, up and downstream</td>
<td>$L_{WA} \leq 50$ dB(A)/m</td>
</tr>
<tr>
<td>100 mm sound proof cladding, cover mass 8 kg/m² necessary</td>
<td></td>
</tr>
<tr>
<td>Flow control valves with enclosure, per valve (in total four flow control valves assumed)</td>
<td>$L_{WA} \leq 90$ dB(A)</td>
</tr>
<tr>
<td>Enclosure with a minimum noise insertion loss of IL ≥ 39 dB</td>
<td></td>
</tr>
<tr>
<td>Flow control valves, pipework above ground, upstream</td>
<td>$L_{WA} \leq 61$ dB(A)/m</td>
</tr>
<tr>
<td>100 mm sound proof cladding, cover mass 8 kg/m² necessary</td>
<td></td>
</tr>
<tr>
<td>Flow control valves, pipework above ground, downstream</td>
<td>$L_{WA} \leq 68$ dB(A)/m</td>
</tr>
<tr>
<td>100 mm sound proof cladding, cover mass 8 kg/m² necessary</td>
<td></td>
</tr>
<tr>
<td>Meter run, per unit (in total four parallel trains and one associated above ground header assumed)</td>
<td>$L_{WA} \leq 56$ dB(A)/m</td>
</tr>
<tr>
<td>100 mm sound proof cladding, cover mass 8 kg/m² necessary</td>
<td></td>
</tr>
<tr>
<td>Electrical building</td>
<td></td>
</tr>
<tr>
<td>Equipment/Building</td>
<td>Sound Power Data</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Walls - Concrete or brickwork, m ≥ 280 kg/m²</td>
<td>R'_w ≥ 48 dB</td>
</tr>
<tr>
<td>Roof - Concrete, m ≥ 210 kg/m², plus thermal insulation</td>
<td>R'_w ≥ 45 dB</td>
</tr>
<tr>
<td>Electrical building, sound pressure level inside building</td>
<td>L_{PL} ≤ 75 dB(A)</td>
</tr>
<tr>
<td>Doors, in situ</td>
<td>R'_w ≥ 20 dB</td>
</tr>
<tr>
<td>Building ventilation inlet</td>
<td>L_{WA} ≤ 80 dB(A)</td>
</tr>
<tr>
<td>Building ventilation outlet</td>
<td>L_{WA} ≤ 80 dB(A)</td>
</tr>
<tr>
<td>Air condition device outside building, each (2 devices considered)</td>
<td>L_{WA} ≤ 78 dB(A)</td>
</tr>
</tbody>
</table>

Fuel Gas Skid

| Sound pressure level inside building                                             | L_{PL} ≤ 84 dB(A) |
| Fuel gas regulation valve (2 valves assumed)                                     | L_{WA} ≤ 77 dB(A) |
| Solid or lightweight construction, walls and roof                               | R'_w ≥ 25 dB     |
| Door                                                                            | R'_w ≥ 25 dB     |

Boiler house

| Walls - Concrete or brickwork, m ≥ 280 kg/m²                                       | R'_w ≥ 48 dB     |
| Roof - Concrete, m ≥ 210 kg/m², plus thermal insulation                           | R'_w ≥ 45 dB     |
| Boiler house, sound pressure level inside building                               | L_{PL} ≤ 85 dB(A) |
| Sound power level of each boiler (2 boilers assumed in total)                    | L_{WA} ≤ 93 dB(A) |
| Sound power level of instrument air compressors                                  | L_{WA} ≤ 84 dB(A) |
| Instrument air inlet                                                            | L_{WA} ≤ 70 dB(A) |
| Doors, in situ                                                                   | R'_w ≥ 20 dB     |
| Building ventilation inlet (Within Utility Building, probably silencers at intake)| L_{WA} ≤ 71 dB(A) |
| Building ventilation outlet (Within Utility Building, probably silencers at intake)| L_{WA} ≤ 72 dB(A) |
| Stack per unit (in total two stacks assumed)                                     | L_{WA} ≤ 79 dB(A) |
| Stack, duct to stack                                                            | L_{WA} ≤ 52 dB(A) |

Uninterruptable Power Supply (125 kW) inside building or noise insulated container

| Building surface (walls, roof, door)                                             | L_{WA} ≤ 68 dB(A) |
| Stack opening                                                                    | L_{WA} ≤ 80 dB(A) |
| Room ventilation, intake                                                         | L_{WA} ≤ 71 dB(A) |
| Room ventilation, outlet                                                         | L_{WA} ≤ 82 dB(A) |
| Cooling air inlet                                                                | L_{PL} ≤ 105 dB(A) |
| Sound pressure level inside building                                             | L_{WA} ≤ 105 dB(A) |

Solid or lightweight construction, walls and roof                                | R'_w ≥ 27 dB     |
| Door                                                                            | R'_w ≥ 27 dB     |

Back-up Power Supply (1000 kW) inside noise insulated container

| Sound power level of the whole unit                                              | L_{WA} ≤ 108 dB(A) |

Administration Building, Workshop / Stores Building

It is assumed, that sound pressure levels inside these buildings are usually not higher than | L_{PL} = 85 dB(A) |

| Solid or lightweight Building construction, walls and roof                      | R'_w ≥ 37 dB     |
| Doors                                                                           | R'_w ≥ 30 dB     |
| Air condition units outdoors (4 assumed)                                        | L_{WA} ≤ 78 dB(A) |

Source: Genest und Partner Ingenieurgesellschaft mbH
The noise sources inside the PRT were assumed to be in continuous operation and running simultaneously during both day and night.

The contribution to the environmental noise produced by PRT operation is reported in Table 8-102 (Development Phase I) and Table 8-103 (Development Phase II). Assuming that all equipment are operating 24 hours, the PRT noise contribution has been compared with the noise limit for the night time, stricter than the noise limit for daytime.

The background noise levels at receptors have been monitored during the field survey of June 2013. The averaged value measured during night-time (22 p.m. to 6 a.m.) was 31.3 dB(A) at sensitive Receptor n. 1 South. To guarantee a conservative approach, instead of the averaged value the quietest hour during night-time is taken into account. For this reason the lowest measured hourly value of 26.3 dB(A) is considered as background noise level not only for the nearest sensitive receptor but also for sensitive receptors far-off.

To assess the noise impact during Development Phase II, also the noise contribution of Development Phase I have been taken into account in the definition of the background level.

**Table 8-102 Noise Pressure Levels at Receptors generated by PRT Operation during Night time. Development Phase I (10 BCM/Year)**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 South single dwelling near Melendugno</td>
<td>24.6</td>
<td>26.3</td>
<td>28.5</td>
<td>2.2</td>
<td>60</td>
<td>no</td>
</tr>
<tr>
<td>2 West single dwelling near Melendugno</td>
<td>22.7</td>
<td>26.3</td>
<td>27.9</td>
<td>1.6</td>
<td>60</td>
<td>no</td>
</tr>
<tr>
<td>3 North single dwelling near Melendugno</td>
<td>25.7</td>
<td>26.3</td>
<td>29.0</td>
<td>2.7</td>
<td>60</td>
<td>no</td>
</tr>
<tr>
<td>4 North-West single dwelling near Vernole</td>
<td>22.4</td>
<td>26.3</td>
<td>27.8</td>
<td>1.5</td>
<td>60</td>
<td>no</td>
</tr>
<tr>
<td>5 Station fence North</td>
<td>41.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>70 (1)</td>
<td>no</td>
</tr>
<tr>
<td>6 Station Fence East</td>
<td>49.1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>70 (1)</td>
<td>no</td>
</tr>
<tr>
<td>7 Station Fence South</td>
<td>32.4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>70 (1)</td>
<td>no</td>
</tr>
<tr>
<td>8 Station Fence West</td>
<td>49.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>70 (1)</td>
<td>no</td>
</tr>
</tbody>
</table>

Note:
(1) National noise limit for industrial area during night time

Source: Genest und Partner Ingenieuregesellschaft mbH. Modified by ERM
Table 8-103 Noise Pressure Levels at Receptors generated by PRT Operation during Night time. Development Phase II (20 BCM/Year)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 South single dwelling near Melendugno</td>
<td>26.8</td>
<td>26.3</td>
<td>29.5</td>
<td>3.2</td>
<td>60</td>
<td>no</td>
</tr>
<tr>
<td>2 West single dwelling near Melendugno</td>
<td>24.8</td>
<td>26.3</td>
<td>28.6</td>
<td>2.3</td>
<td>60</td>
<td>no</td>
</tr>
<tr>
<td>3 North single dwelling near Melendugno</td>
<td>27.3</td>
<td>26.3</td>
<td>29.9</td>
<td>3.6</td>
<td>60</td>
<td>no</td>
</tr>
<tr>
<td>4 North-West single dwelling near Vernole</td>
<td>23.6</td>
<td>26.3</td>
<td>28.2</td>
<td>1.9</td>
<td>60</td>
<td>no</td>
</tr>
<tr>
<td>5 Station fence North</td>
<td>41.1</td>
<td>26.3</td>
<td>41.1</td>
<td>-</td>
<td>70</td>
<td>(1) no</td>
</tr>
<tr>
<td>6 Station Fence East</td>
<td>51.4</td>
<td>26.3</td>
<td>51.4</td>
<td>-</td>
<td>70</td>
<td>(1) no</td>
</tr>
<tr>
<td>7 Station Fence South</td>
<td>34.0</td>
<td>26.3</td>
<td>34.6</td>
<td>-</td>
<td>70</td>
<td>(1) no</td>
</tr>
<tr>
<td>8 Station Fence West</td>
<td>52.0</td>
<td>26.3</td>
<td>52.0</td>
<td>-</td>
<td>70</td>
<td>(1) no</td>
</tr>
</tbody>
</table>

Note: (1) National noise limit for industrial area during night time

Source: Genest und Partner Ingenieurgesellschaft mbH. Modified by ERM

The contribution of each individual noise source and the noise contour maps for the modelled scenario are reported in the following Figures and in Annex 12.
Figure 8-22  Operation Phase Noise Contours Map. Day Time

Source: Genest und Partner Ingenieurgesellschaft mbH. Modified by ERM
Figure 8-23  Operation Phase Noise Contours Map. Night Time

Source: Genest und Partner Ingenieurgesellschaft mbH. Modified by ERM
During night time, the maximum noise emission generated from PRT operation at receptors is 27 dB(A), and 52 dB(A) at the property boundary.

The cumulative noise pressure levels at all receptors are in compliance with noise standards for night time defined by DPCM 01/03/91 and IFC. The operation phase is also in compliance with the differential noise limits for day time under national standards. The minimum exceedance of night time limit, well below 1 dBA, is negligible. National law, in fact, states that in case of noise background below 25 dBA during night time “any effect of noise impact should be considered as negligible”.

In conclusion, at all sensitive receptors the magnitude of noise impact during PRT operation is classified as small.

8.5.2.5.2 Mitigation Measures

The noise contribution of the operation phase estimated through noise modelling does not have a significant impact on the acoustic environment that characterises the receptors.

Consequently no additional mitigation measures are necessary, except for the general mitigation measures described in Section 8.1.

8.5.2.5.3 Residual Impacts

As above described, best practices and good operation management of PRT are the main mitigation measures to be taken in order to mitigate noise impacts. In any case, conservatively, residual impacts are considered equal to the above described potential impacts, without considering any mitigation measures resulting from PRT best practices and good operation management.

Impact magnitude and significance for the acoustic environment are summarised below. The criteria are reported in Annex 6 - ESIA Baseline and Impact Assessment Methodology.

Therefore, considering the impact magnitude (small) and the sensitivity of the noise receptors (residential areas, as detailed in Section 8.5.2.2), the value of impact significance for PRT operation obtained is considered to be minor in correspondence of all receptors.

Also, the maintenance activities anticipated for the PRT equipment will not increase the background noise level in the surrounding areas significantly.

The following table presents a summary of the residual impact associated with the impacts identified.
Table 8-104  Residual Impacts - Noise. Operation and Maintenance Phase

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Mitigation Commitments to Address the Impact</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acoustic Environment Quality – Operation Phase</td>
<td></td>
<td>Minor</td>
</tr>
<tr>
<td>Long term Impact due to noise emission - Operation Phase</td>
<td>All receptors</td>
<td>General Mitigation Measures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>General mitigation measures applied to reduce the noise impact</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Receptors sufficiently distant from PRT</td>
</tr>
</tbody>
</table>

Source: ERM (2013)

8.5.2.6 Decommissioning

At the end of its useful life (about 50 years), the pipeline and associated facilities will be decommissioned safely and with due regard for the environment, in order to create the conditions to allow the restoration of conditions prior to the installation work within a reasonable time.

At this stage it is thought that all buildings will be taken down and the sites reinstated. The onshore pipeline will be pigged, purged and filled with suitable material (e.g. sand), to prevent subsidence when the pipeline collapses and be left in situ.

The decommissioning operation will be made with similar equipment involved in the construction phase and will include the following activities:

- dismounting and reclamation of PRT equipment;
- demolition of buildings;
- filling of the pipeline.

In this phase the potential impacts, the mitigation measures and the relative residual impact will be the same as for the Construction and Pre-Commissioning Phase (Section 8.5.2.3) for the PRT area.
8.5.3 Onshore – Freshwater Resources (Surface and Groundwater)

8.5.3.1 Overview

Throughout its design development the TAP Project has sought to avoid, minimise and mitigate impacts on freshwater resources (in line with Italian Decree 152/06, and IFC PS1) through field assessment activities, the alternative assessment process and the final impact assessment.

The following box shows the key sources of impact, potentially impacted resources and receptors, and baseline and project influencing factors associated with the impacts of the TAP Project on water quality.

**Box 8-16 Key Sources of Impact, Potentially Impacted Resources and Receptors**

**Sources of Impact**
- Construction Phase: Preparation of the working strip; construction of roads; PRT and BVS; construction of microtunnel; construction of temporary facilities (work site); movements of vehicle; equipment and personnel; use of water; waste management.
- Operations and maintenance phase: consumption of water, waste management.
- Decommissioning phase: PRT and BVS decommissioning, movements of vehicle, equipment and personnel, consumption of water; waste management.

**Potentially Impacted Resources and Receptors**
- Surface Water, Groundwater and Seawater
- Flora and Fauna
- Tourism activities along the shore (beach facilities)

**Baseline Influencing Factors**
- The marshland (Palude Punta Cassano) and interconnected aquifers
- The watercourse that drains the waters of the Palude Punta Cassano and flows into the sea.
- Lithological and morphological characteristics of the area resulting in a series of endorheic depressions, through which rainfall recharges underlying aquifers through the existence of potential sinkholes and other karst features.

**Project Influencing Factors**
- Specific techniques used for hydrotesting water management and waste management.

The following table presents the key impacts of the TAP Project on surface water during the key project phases.

**Table 8-105 Key Impacts – Freshwater**

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential contamination of water source with solid and liquid waste.</td>
<td>Potential contamination of water source with solid and liquid waste related to the PRT.</td>
<td>Potential contamination of water source with solid and liquid waste. Disruption of hydrological regime.</td>
</tr>
<tr>
<td>Potential contamination from fuels, lubricant oils and chemicals (surface water and groundwater).</td>
<td>Effects on water resources by sediment plumes.</td>
<td>Potential contamination from fuels, lubricant oils and chemicals (surface water and groundwater). Effects on water resources by sediment plumes.</td>
</tr>
<tr>
<td>Effects on water resources by sediment plumes.</td>
<td>Potential effects on hydrological and hydraulic regime in endorheic areas.</td>
<td>Potential effects on hydrological and hydraulic regime (endorheic areas). Consumption of water resources.</td>
</tr>
<tr>
<td>Potential effects on hydrological and hydraulic regime in endorheic areas.</td>
<td>Consumption of water resources.</td>
<td>Consumption of water resources.</td>
</tr>
</tbody>
</table>

...
The sensitivity of the resource water (surface and groundwater) is reported in the following Sections. Potential impacts relating to each of the 3 main project phases are then described prior to presenting the mitigation measures that will be adopted by the Project. Residual impacts are presented taking into account the application of mitigation measures.

8.5.3.2 Description of Sensitivities for Water Resources

In order to be able to evaluate the significance of each impact on water resources, it is necessary to describe the sensitivity of each water resource.

8.5.3.2.1 Sensitivity of Surface Water

The high permeability of a large part of the area’s outcropping rocks has hindered the development of extensive surface water networks. The planned route does not cross any major river or watercourse. It runs parallel to a small ditch that drains the waters of the extensive marshland (“Palude di Cassano”) 500 m Northward of the route itself. Another very small trench is mapped (WEB-GIS Apulia Region) to flow South of the route landfall at a minimum distance of 350 m with a length of 650 m. However during the field surveys carried out during the project development this trench has not been detected.

Sampling to determine water quality conditions in the Northern ditch was conducted in July 2013. The sampling point was about 20 metres from road SP 366 and approximately 300 metres from the shoreline. The scope of the sampling was to characterize the whole river basin (marshland of Punta Cassano), details are reported in Section 6.4.4.

The ditch appears as a semi dry channel. The water flow was very low and the water appeared semi stagnant. The section examined was 15 to 20 m long, 1.5 to 2 m wide and about 30 cm deep. The stream bed consists of clay and loam. Some metres downstream the watercourse flows into the sea. Parts of the channel bed are covered with reeds. Due to the medium conductivity measured in the watercourse, the surface waters were catalogued as inland waters. This confirms that there is no exchange with marine water. The results of analyses on the sample collected from the watercourse were compared to the threshold values listed in Tables 1/A and 1/B, Annex 1, Part III of D.Lgs.152/2006 and amendments (acknowledge of European Directive 2008/105/EC).

The region is characterized by a rainfall regime typical of semi-arid environments; the presence of carbonatic formations, limestone and other lithological units prone to water erosion as well as the regional morphology, facilitated the evolution of endorheic depressions. Such areas show a closed drainage network without any outflow to other external water bodies. The runoff is collected in the areas with maximum depression and seeps into the underlying aquifers through relatively permeable layers, sinkholes and other karst features.
The Base Case route intersects two endorheic areas currently under investigation by the Basin Authority, at the Kp 4.5 and 5.5. In fact, at the moment two datasets are available but the most recent one is still under finalization. The most recent one has been provided directly from the Basin Authority in order to take it into account in the ESIA.

Regarding water quality conditions of surface water, in general terms and in comparison with Water Directive (2000/60 EC), chemical water quality is considered good. Considering that the water resource:

- plays little or no role in maintaining soil quality or is effectively isolated from surrounding soils;
- supports populations of flora and fauna;
- has little or no role in terms of providing services for the local community;
- plays little or no, or at most a highly localised, regulating role in the hydrologic cycle;
- plays little or no role in matters such as amenity or recreational use

the system marshland and ditch, can be considered to have a medium level of sensitivity.

8.5.3.2.2 Sensitivity of Groundwater

The hydrogeological asset of the study area highlighted the presence of three aquifers:

- The shallow aquifer is located in the “Calcareniti del Salento” and “Sabbie di Uggiano” formations. Its charge is due almost exclusively to the precipitation falling on the outcrop in the territory. It shows a degree of permeability related to the percentage content within the sand, silt fraction and / or silty-clay. The storage capacity is generally not high. The water table is subject to seasonal variations in level;
- The subappenninic clays form an aquitard that separates the shallow aquifer from a semiconfined aquifer located in the “Calcareniti di Andrano”. It is connected with the shallow aquifer;
- The “Pietra Leccese” represents an aquiclude that separates the multilevel shallow aquifers from the deep aquifer located in the “Calcare di Altamura” formation. The deep groundwater is thus confined in these Cretaceous deposits by the overlying Miocene sediments (generally impermeable).

Regarding water quality conditions in July 2013, ERM performed groundwater sampling at 5 privately-owned wells (ref. to Section 6). Depths to groundwater are between 38.4 m below ground surface (bgs) and 6.2 m bgs. No exceedances of CSC (Threshold contamination concentration) were detected in the groundwater samples with the only exception of Tetrachloroethylene in the groundwater sample collected from well Pz2 (ref. to Section 6.4.5). According to water quality criteria (D.Lgs.152/2006), the quality of these aquifers is medium.
Considering they do not supply drinking water, and the only agricultural use of the resource the sensitivity is medium.

8.5.3.3 Impacts during the Construction and Pre-commissioning Phase

The following sources of impact have been identified for the construction and pre-commissioning phase of the project. The sources listed below could potentially cause impacts on water resources.

Table 8-106 Water Resources Impact Sources -Construction and Pre-commissioning

<table>
<thead>
<tr>
<th>Source of Potential Impact</th>
<th>Potential Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Movement of vehicles, equipment and personnel</td>
<td>Temporary effects sediment plumes on surface water, potential contamination from fuels, lubricant oils and chemicals (surface water and groundwater).</td>
</tr>
<tr>
<td>Use of water and raw materials</td>
<td>Temporary consumption of water resources (surface water and groundwater).</td>
</tr>
<tr>
<td>Production and disposal of solid and liquid wastes</td>
<td>Potential temporary contamination of water resources (surface and groundwater) by hazardous and non-hazardous liquid effluents, and contamination of water resources (surface water) by hazardous and non-hazardous wastes.</td>
</tr>
<tr>
<td>Set-up (including site preparation) of temporary facilities</td>
<td>Temporary effects of sediment plumes on surface water.</td>
</tr>
<tr>
<td>Storage and handling of fuels and chemicals</td>
<td>Potential temporary contamination of water resources (surface and groundwater) by hazardous and non-hazardous liquid effluents, and contamination of water resources (surface water) by hazardous and non-hazardous wastes.</td>
</tr>
<tr>
<td>Preparation of the working strip (topsoil removal)</td>
<td>Temporary effects of sediment plumes on surface water, potential effects on hydrological and hydraulic regime in endorheic areas.</td>
</tr>
<tr>
<td>Microtunnel</td>
<td>Potential contamination from fuels, lubricant oils and chemicals (surface water and groundwater).</td>
</tr>
<tr>
<td>Pipelines and equipment hydrotesting</td>
<td>Temporary consumption of water resources, potential temporary contamination of water resources from leakage</td>
</tr>
</tbody>
</table>

The impact assessment on water resources reported in the following sections is based on the analysis of the sources of potential impact reported in the previous Table.

8.5.3.3.1 Potential Impacts

The aim of this Section is to identify the possible impacts on water quality and hydrologic aspects deriving from the project, including onshore hydrotesting and drilling operations (microtunnel).

The potential impacts on freshwater (surface water and groundwater) will largely be confined to the area of the pipeline corridor (2 km corridor) and associated access road to PRT and to BVS.

Key potential impacts on water resources (surface water and groundwater) along the pipeline route from all phases of the Project are limited to a relatively small number of effects which may occur as a result of a wide number of sources, namely:

- Potential contamination of water resources with solid and liquid wastes;
- Potential contamination from fuels, lubricant oils and chemicals;
• Potential effects on hydrological and hydraulic regime in endorheic areas;
• Effects of sediment plumes on surface water;
• Consumption of water resources.

Potential Contamination of Water Resources with Solid and Liquid Wastes

Liquid wastes to be generated during construction will include the following:

• Industrial water (Hydrotesting, Slurry from microtunnelling);
• Sanitary Sewer (Waste Water): water coming from sanitary installations within the worksite;

Industrial water. A part of the waste water generated during the construction phase is the onshore hydrostatic testing water. The hydrostatic testing of pipelines involves pressure testing with water to detect leaks and verify equipment and pipeline integrity. For pipeline testing, test manifolds installed onto sections of newly constructed pipelines will be located outside of riparian zones and wetlands. The estimated fresh water volume for the onshore hydraulic test is 4900 m$^3$. This water will be supplied by water tanks and will not be chemically treated. At the end of the test the water will be disposed in conformity with legal requirements. During the microtunnel drilling operations, the soil cuttings are removed by means of slurry water, the soil being mixed with slurry (water) in the Microtunnel Boring Machine (MTBM) extraction chamber. Large slurry pumps in the tunnel section behind the MTBM will transport the soil/mud mixture through slurry pipes back to the surface. The mud will be de-sanded in a recycling plant, and the cleaned slurry water returned to the cutting face. The efficiency of the soil separation plant will be of major importance. Indeed, once the water in the tunnel circuit becomes saturated with fine sand or clay particles, the slurry will no longer be able to remove any soil from the machine front. The front pressure will increase and the jacking performance will drop significantly. High front pressures could produce cracks in the overburden which could lead to bentonite escape. At the end of the jacking, the re-circulated slurry will have to be treated by the filter press as well, and the dry material sent to a controlled landfill. The estimated slurry volume for the microtunnelling is 3000 m$^3$.

Sanitary Waste. Sanitary waste water is all the water coming from the sanitary installations within the PRT area. During the construction phase a maximum of 60l/person per day of sanitary waste water is expected. All the waste water produced by the Project’s construction phase will be treated in accordance with the appropriate regulations and there will be no direct discharge of waste water into water receptors.

Other wastes generated during construction are likely to be classified into the following categories:

• Inert construction site waste
• Domestic waste
• Oily and hazardous waste.

In particular, this last type of waste will inevitably be generated during construction and it requires special handling and treatment (see the following paragraph). These will include the oily waste associated with vehicle and heavy equipment maintenance (waste oil, material collected from waste water interceptors etc.); unused or waste chemicals, paints and solvents; any other waste, sludge or debris unsuitable for disposal in a municipal type landfills. Such waste will be segregated for collection and disposal by specialist contractors at sites that are equipped and approved for them.

Potential Contamination from Fuels, Lubricant Oils and Chemicals

During working strip and access roadway construction, project facilities construction, and drilling potential contamination of fresh water may arise from the transport, storage and handling of fuels, lubrication oils and chemicals.

Potential contamination may occur also at the PRT and microtunnel work sites. The PRT worksite, located at Kp 8.2, will be used also as stock and bending yard for the line pipes. The microtunnel work site will be located at Kp 0.000; within this area will be located the stockyard, the microtunnel lunch shaft and the compressor area.

The microtunnel will cross about 10 m underground, a wooded area (Mediterranean Maquis) close to the pipeline landfall, within calcarenites. The provisional dimensions of the microtunnel launch shaft are: depth: 11.0 m; length: 10.0 m and width: 12.0 m.

Within the microtunnel worksite areas the water table is found at approximately 6 m below ground surface (Pz4). The works may interfere with the shallow aquifer located in the calcarenites of the Salento and Uggiano Sand formations. This aquifer’s recharge is almost exclusively from precipitation falling on the outcrop in the territory. It shows a degree of permeability related to the percentage of sand, silt fraction and/or silty-clay content.

Inadvertent loss of very limited quantities of flocculation agents may occur during drilling. These polymers will enhance the flocculation of the suspended particles, which will be pressed together and evacuated with the dewatered silt/clay. Some extremely diluted polymers would still flow with the filtered water to the storage pool for filtered water. This will help to capture the last small particles that would remain in suspension.

Potential effects on hydrological and hydraulic regime in endorheic areas

Endorheic areas appear as depressed and relatively flat areas joined to the surroundings through gentle slopes. The rainfall runoff is collected all over the area and is concentrated by the sloping sides to the site of maximum depression.

During the construction and pre-commissioning phase, excavation for topsoil removal in the working strip can affect the hydrological and hydraulic regime of endorheic areas.
Especially on slopes, the terrain mobilisation can result in a loss of resistance against soil erosion by runoff and runout or other external agents. Topsoil alteration can influence the drainage network by changing flux lines or by facilitating the development of new sinkholes and karsts.

Areas of maximum depression are prone to flooding and are potentially connected to sinkhole and karsts networks, resulting in the most sensitive part of endorheic structures.

In areas with karstic formations and sinkholes, excavation works may cause the collapse of such structures resulting in hydrological and hydraulic effects on the adjacent areas.

Construction activities in areas with high slope rates may cause landslip phenomena and top soil erosion with consequences on the drainage network.

**Effects of Sediment Plumes on Water Resources**

Construction activities may increase suspended sediments in surface runoff; draining into surface water and leading to sediment plumes (i.e. increasing water turbidity).

This impact may occur in areas where the project worksites are located nearby surface waters. According to the project description, large earth moving machinery and other specialty plant equipment will be required to prepare the construction working strip, to excavate the trench and lay the pipeline.

Temporary exposure of surface materials to rainfall, erosion and scour may deliver coarse and fine sediment via surface runoff to water bodies, with related potential changes in the magnitude and timing of natural suspended sediment transport in surface water.

**Consumption of Water Resources**

The water consumption envisaged during the construction phase is related primarily to the watering of construction sites to reduce dust emissions during earth moving activities and for civil uses.

During the commissioning phase water consumption will be related to hydrotesting activities. Fresh water will be used for the onshore pipeline, and seawater for the offshore pipeline.

**Table 8-107 Water Consumption**

<table>
<thead>
<tr>
<th>Typology</th>
<th>Quantity</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onshore</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic Water</td>
<td>Max 12 m³/day</td>
<td>60 l/person per day</td>
</tr>
<tr>
<td>Industrial</td>
<td>5/10 m³ day</td>
<td>Watering of working strip for dust suppression</td>
</tr>
<tr>
<td>Industrial</td>
<td>4,900 m³</td>
<td>Hydrotesting</td>
</tr>
<tr>
<td>Industrial</td>
<td>3,000</td>
<td>Slurry microtunnelling</td>
</tr>
</tbody>
</table>
8.5.3.3.2 Mitigation Measures

**Potential Contamination of Water Resources with Solid and Liquid Waste**

During the construction phase no discharge of liquid waste to water resources is envisaged; all the effluents will be treated as waste. Waste management will be kept closely in line with the legal framework and best practice principles.

All waste will be collected, stored and transported separately by typology in appropriate and approved bins and containers (the waste management plan will address handling, storage and disposal of waste). This means that the liquid waste produced by the Project’s construction phase will be treated as waste, and it will not be directly discharged into water receptors during this phase.

The water used to reduce dust emissions from earthmoving activities and for domestic uses will be provided by tank.

**Potential Contamination from Fuels, Lubricant Oils and Chemicals**

The following management measures will be prepared and detailed in the Project’s environmental management plans (refer to Section 9):

- Water Management Plan;
- Waste Management Plan; and
- Pollution Prevention Plan.

The waste management plan will include procedures for the safe handling, transport, storage and disposal of fuels, oils, drilling fluids and chemicals. Measures will include:

- Fuel storage systems will be built above ground and within double-walled tanks or containment bunds. Oil spill prevention and response plans will be put in place. Temporary fuel stored along the pipeline working strip and access roads will be correctly bunded during construction.
- Procedures for vehicle/equipment refuelling will be implemented to prevent spillage, including not allowing construction vehicles and equipment to be refuelled outside dedicated areas. Appropriate spill containment equipment will be available at refuelling sites. All drivers will be trained in emergency spill response procedures.
- The washing of equipment, vehicles or machinery near or within watercourses will be prohibited.

Other measures are listed below:

- Non-equipment areas at plant facilities will be graded and sloped to allow uncontaminated storm water to drain naturally via the storm water drains prior to routing offsite;
• The excavations carried out within the work sites (at the beginning and at the end of the onshore microtunnel) will be completed with cement casings. The casing provides structural integrity and waterproofing. This barrier reduces the risk of potential contamination from fuels, lubricant oils and chemicals that may be spilled during the construction phase;

• Water Based Mud (slurry) will be used as drilling fluid;

• Polymer injection will be fully controlled. Dosage, polymer adaptation and monitoring will be followed during the complete tunnelling operations. The flocculant will be delivered on site in a powder form; and

• Particular care will be taken to ensure that land drainage infrastructure, access roads, other networks and facilities which disturbed/moved during construction will be reinstated to their former state.

Potential effects on hydrological and hydraulic regime on endorheic areas

As reported above, the project is interfering with endorheic areas. For these areas, based on the legislation in force (i.e. Territorial Hydrogeologic Planning - PAI) it is not requested to perform hydrological and hydraulic studies prior construction activities. However, as suggested by the Basin Authority, in order to minimize the potential effects on those areas due to project activities, TAP will carry out those studies in a further stage of the project and, if needed, will address further mitigation measures in order to minimize potential interferences with endorheic areas.

Considering that the topsoil removed during construction activities will be restored, vegetation will be reinstated in the project area and the drainage from the working areas will be granted, potential erosion/flood events due to rainfall runoff will be minimized.

Furthermore, the presence of sinkholes and other karstic formations will be investigated through a specific geophysical survey along all the project area. The outcomes of this study will be presented to the relevant Authorities before the conclusion of the ESIA procedure and considered in the Project Design development.

Effects of Sediment Plumes on Water Resources

The following management measures will be prepared and detailed in the project’s environmental management plans:

• Erosion and sediment control management;

• Revegetation management.

Other measures are listed below:

• After being removed, excavated topsoil and subsoil stockpiled in the proximity of the trenching will be irrigated periodically, in order to reduce its dispersion towards surface water by the action of the wind.
- Operations will be carried out in accordance with international standards;
- Maximum permitted vehicle speed will be reduced in the proximity of water courses, in order to reduce the amount of dust that potentially could sediment in the water course;
- Truckloads of sand for sand bedding will be covered; and
- Topsoil will be stripped and stored away from watercourses in designated topsoil stockpile areas.

**Consumption of Water Resources**

All water resources used during the construction and pre-commissioning phase will be provided by tanks.

8.5.3.3.3 Residual Impacts

This section assesses the residual impacts of project construction and operations on water quality after mitigation and management measures have been applied.

The following table presents a summary of the residual impacts associated with the impacts identified.
Table 8-108 Residual Impacts

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Mitigation Commitments to Address the Impact</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Freshwater – Construction Phase</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Potential contamination of water resources with solid and liquid wastes</td>
<td>No waste water will be directly discharged into water receptors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• All liquid waste will be collected, stored and transported separately in appropriate and approved bins and containers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Waste management</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Surface water: Minor</strong></td>
</tr>
<tr>
<td></td>
<td>• the mitigation measures proposed make the intensity of the impact as low, however considering the medium value of the sensitivity of the freshwater, the impact is assessed as minor.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Groundwater: Minor</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• the medium permeability of the Calcareniti and the characteristic of the karst territory may facilitate the dispersion of the contamination;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• the resource is used for irrigation and not for drinking use.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Potential contamination from fuels, lubricant oils and chemicals</td>
<td>Surface water and storm water management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Waste management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Wastewater management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Spill response plan</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Fuel storage systems will be built, above ground and within double-walled tanks or containment bunds.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Procedures for vehicle/equipment refuelling will be implemented to prevent spillage</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• The excavations carried out within the work sites will be completed with cement casings.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Water Based Mud (slurry) will be used as drilling fluid.</td>
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<td></td>
<td>• Polymer injection will be fully controlled</td>
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<td></td>
<td>• The flocculant will be delivered on site in a powder form.</td>
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</tr>
<tr>
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<td></td>
<td><strong>Surface water: Minor</strong></td>
</tr>
<tr>
<td></td>
<td>• the mitigation measures proposed make the intensity of the impact as low, however considering the medium value of the sensitivity of the freshwater, the impact is assessed as minor.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Groundwater: Minor</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• the works could interfere with the shallow aquifer;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• loss of very limited quantities of foam drilling fluids during the perforation of the calcareniti;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• the resource is used for irrigation and not for drinking use.</td>
<td></td>
</tr>
</tbody>
</table>
Impacts | Mitigation Commitments to Address the Impact | Residual Impact
--- | --- | ---
Potential effects on hydrological and hydraulic regime (endorheic areas) | hydrological and hydraulic studies prior construction activities on endorheic areas. Restoration of top soil | Surface water: Minor
- the mitigation measures proposed make the intensity of the impact as low, however considering the medium value of the sensitivity of the freshwater, the impact is assessed as minor.

Groundwater: Minor
- the groundwater network will not be directly affected by any of the activities during the Construction and Pre-commissioning phase

Effects of sediment plumes on water resources | Erosion control and sediment management, Revegetation management | Surface water: Minor
- there is no surface waters crossed by the working strip. Ditches and marshland are sufficiently distant from the working area.

Consumption of water resources | All fresh water will be provided by tanks. | Surface water: Not Significant
- the mitigation measures proposed make the impact not significant.

Groundwater: Not Significant
- the mitigation measures proposed make the impact not significant.

*) Mitigation measures in italic will be developed in a further stage of the project

The magnitude of the impacts and the value of impact significance for freshwater resources summarised in the table above is reported below. The criteria are reported in the *Annex 6 Baseline and Impact Assessment Methodology*. 


Impact magnitude is a result of the combination of the following parameters:

- **Scale**: Local. Considering the mitigation measures at the Section 8.5.3.3.2 and in particular the waste management plan and the wastewater management, the scale has been considered local. In case of contamination, the impact will affect the quality of surface water, groundwater and, indirectly, seawater.

- **Duration**: Long. In case of contamination of water resources with solid and liquid wastes, the effects will last for a time longer than the lifetime of the Project.

- **Intensity**: Low. Mitigation measures will significantly decrease the risk of contamination of water resources.

The combination of these three parameters generates an impact magnitude that can be defined as **small**.

In conclusion, considering that

- all the waste water produced by the Project's construction phase will not be discharged into water receptors during the construction phase but will be stored and transported separately in appropriate and approved bins and containers;

- the impact magnitude is **small**;

- the sensitivity of the freshwater resources (medium for the surface water and the groundwater, as detailed in Section 8.5.3.2.1 and in Section 8.5.3.2.2),

the value of impact significance obtained is considered to be **minor** for surface water and **minor** for groundwater.

**Potential Contamination from Fuels, Lubricant oils and Chemicals**

Impact magnitude is a result of the combination of the following parameters:

- **Scale**: Local. Considering the mitigation measures at the Section 8.5.3.3.2 and in particular the waste management plan, the wastewater management and the procedures for the safe handling, transport, storage and disposal of fuels, oils, drilling fluids and chemicals, the scale has been considered local. In case of contamination, the impact will affect surface water, groundwater and, indirectly, seawater.

- **Duration**: Long. Contamination from fuels, lubricant oils and chemicals could have an effect during a time longer than the lifetime of the Project.

- **Intensity**: Low. Mitigation measures will significantly decrease the risk of contamination of water resources.
Combination of these three parameters generates an impact magnitude that can be defined as small.

In conclusion, considering that:

- the depth of groundwater (more than 6 m bgs);
- the management measures prepared and detailed in the project’s environmental management plans (surface water and storm water management, waste management, wastewater management, spill response plan);
- the additional mitigation measures reported in the Section 8.5.3.3.2 and in the project description;
- the impact magnitude is small;
- the sensitivity of the freshwater resources (medium for the surface water and for the groundwater, as detailed in Section 8.5.3.2.1 and in Section 8.5.3.2.2),

the value of impact significance obtained is considered to be minor for surface water and minor for groundwater.

**Potential effects on hydrological and hydraulic regime (endorheic areas)**

Impact magnitude is a result of the combination of the following parameters:

- Scale: Local. Considering the mitigation measures reported in the Section 8.5.3.3.2 (in particular the geophysical survey and the hydraulic and hydrogeological studies), the scale has been considered local. In case of disturbance of hydrological and hydraulic regime, the impact will affect the drainage network of the endorheic areas crossed by the project area.
- Duration: Long. In case of a disturbance of hydrological and hydraulic regime in endorheic areas, the effects will last for a time longer than the lifetime of the Project.
- Intensity: Small. Mitigation measures will exclude the risk of disturbance of hydrological and hydraulic regime in endorheic areas.

The combination of these three parameters generates an impact magnitude that can be defined as small.

In conclusion, considering that:

- All the protocols planned by TAP or indicated by the Basin Authority will be fulfilled (e.g. survey activities will be carried out);
- the geophysical survey outcomes will be considered in the Project Design development;
- the impact magnitude is small;
- the sensitivity of the freshwater resources (medium for the surface water and for the groundwater, as detailed in Section 8.5.3.2.1 and in Section 8.5.3.2.2),
The value of impact significance obtained is considered to be **minor** for both surface water and groundwater.

**Effects of Sediment Plumes on Water Resources**

Impact magnitude is a result of the combination of the following parameters:

- **Scale**: Local. Considering the low water flow, the characteristics of the watercourse, and the mitigation measures the scale has been considered local. The impact will only affect the water course and indirectly the seawater.
- **Duration**: Surface water resources are expected to recover their original conditions in a short period once the origin of the impact ceases.
- **Intensity**: Low. Mitigation measures will significantly decrease the impact.

Combination of these three parameters generates an impact magnitude that can be defined as **small**.

In conclusion, considering:

- the temporary and reversible nature of the impact;
- the presence of an existing secondary road between the route and the marshland (existing barrier);
- the pipeline route is located at a minimum of 100 m from the marshland;
- the management measures will be prepared and detailed in the project’s environmental management plans (erosion and sediment control management, revegetation management);
- the additional mitigation measures reported in **Section 8.5.3.3.2**;
- the impact magnitude (**small**) and the sensitivity of the freshwater resources (**medium**, as detailed in **Section 8.5.3.2.1**),

the value of impact significance obtained is considered to be **minor**.

**Consumption of Water Resources**

As indicated in the mitigation measures, all water used during the construction and pre-commissioning phase will be provided by tanks. The value of impact significance is **not significant**.
8.5.3.4 Operations and Maintenance Phase

During the operation phase, water consumption and waste production will be related to PRT operation. The sources listed below could potentially cause impacts on water resources.

Table 8-109 Water Resources Impact Sources – Operations and Maintenance Phase

<table>
<thead>
<tr>
<th>Source of Potential Impact</th>
<th>Potential Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of water and raw materials</td>
<td>Consumption of water resources</td>
</tr>
<tr>
<td>Production and disposal of solid and liquid</td>
<td>Potential contamination of water resources (surface and groundwater) by hazardous and non-hazardous liquid effluents, and contamination of water resources (surface water) by hazardous and non-hazardous wastes</td>
</tr>
<tr>
<td>wastes</td>
<td></td>
</tr>
</tbody>
</table>

The following potential impact led assessment has been completed from the above sources for water resources where all sources of impact are grouped, so that an overall assessment can be made of the key impacts associated with the project as outlined at the beginning of the section.

8.5.3.4.1 Potential Impacts

The potential impacts to fresh water (surface water and groundwater) will largely be confined to the area of the pipeline corridor and associated access roads.

Key potential impacts to water resources (surface water and groundwater) along the pipeline route are limited to a relatively small number of effects which may occur as a result of the following sources:

- Contamination of water resources with solid and liquid waste;
- Consumption of water resources.

**Potential Contamination of Water Resources with Solid and Liquid Waste**

During the operational phase only limited amounts of waste are envisaged, due mainly to maintenance activities. The following types of wastewater were taken into consideration in developing the drainage philosophy:

- Sanitary sewage: water coming from the sanitary installations within the buildings such as Administration Building, Workshop/Stores Building and Control Building;
- Oily water: the catchment areas at the metering, reducing pressure trains and scraper traps, roads and traffic areas, etc.

For the waste water two separate drainage systems are required for the PRT:

- Process areas;
- Other areas (utilities, buildings etc.).
Their purpose is to collect and discharge the applicable waste water to the public sewage system.

Surface water from potential polluted areas will be discharged via an oil separator into the sewage system. This sewage system will also be used for the discharge of sanitary waste water of buildings. The run off of the surface water of potential polluted areas and of sanitary waste water system will be treated in a small waste sewage works and will be discharged into the public waste water network.

Effluents will comply with EU and Italian legislation and requirements. Wastewater treatment and disposal are designed to meet those requirements.

**Consumption Water**

During the operation phase water consumption will be related to PRT operation. This consumption will be very low and connected to domestic use, maintenance and irrigation. Depending on the results of future soil investigations, the system will be fed either from the existing water supply network via a dedicated supply line or from a new well on the station site or nearby. A hydrogeological survey will be carried out in order to verify if an on site ground water supply will be possible without any significant impact on groundwater bodies.

In particular the system is intended to provide potable water to the PRT buildings (such as Supervisory Control Centre, Electrical and Control Building, Workshop/Storage Building and Administration Building), to satisfy personnel needs. Furthermore the water provided by the network or the well shall supply service water to:

- the various plant areas of the PRT, for general purposes and to satisfy the equipment washout needs,
- the Fire Extinguishing Water Cistern (stored in a tank).

**Potential Contamination of Water Resources with Solid and Liquid Wastes**

Effluents will comply with IFC standards, as well as EU and Italian legislation and requirements. Wastewater treatment and disposal is designed to meet those requirements.

Oily water will be treated in a specific treatment plant, and domestic water and the first rain water will be treated in septic tanks.

**Consumption Water**

In the event that the potable and service water will be supplied by a new well on the station site or nearby, a hydrogeological survey will be carried out in order to verify if an on site ground water supply will be possible without any significant impact on groundwater bodies.
8.5.3.4.3 Residual Impacts

The following table presents a summary of the residual impact associated with the identified impacts.

Table 8-110 Residual Impacts

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Mitigation Commitments to Address the Impact*</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Freshwater – Operation Phase</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| • Potential contamination of water resources with solid and liquid wastes | • Waste water will not be directly discharged into water receptors  
  • All liquid waste will be collected, stored and transported separately in appropriate and approved bins and containers  
  • *Waste management* | **Surface water:** Minor  
  • the mitigation measures proposed make the intensity of the impact as low, however considering the medium value of the sensitivity of the freshwater, the impact is assessed as minor.  
  **Groundwater:** Minor  
  • the medium permeability of the Calcarenites and the characteristic of the karst territory may facilitate the dispersion of the contamination.  
  • the resource is used for irrigation and not for drinking use. |
| • Consumption of water resources                             | • All water provided by tanks.                | **Surface water:** Not Significant  
  • the mitigation measures proposed make the impact not significant.  
  **Groundwater:** Not Significant  
  • the mitigation measures proposed make the impact not significant. |

*) Mitigation measures in italic will be developed in a further stage of the project

Impact magnitude and the value of Impact Significance for the freshwater resources summarised in the table above, is reported below. The criteria are reported in Annex 6 ESIA Baseline and Impact Assessment Methodology.

**Potential Contamination of Water Resources with Solid and Liquid Wastes**

Impact magnitude is a result of the combination of the following parameters:

- Scale: Local. Considering the mitigation measures at the Section 8.5.3.4.2 and in particular the waste management plan, the wastewater management the scale has been considered local. The impact will affect the quality of surface water and groundwater.
• Duration: Long. The contamination of water resources with solid and liquid wastes could have an effect during a time longer than the lifetime of the Project.

• Intensity: Low. Mitigation measures will significantly decrease the risk of contamination of water resources from wastes.

The combination of these three parameters generates an impact magnitude that can be defined as small.

In conclusion, considering that

• effluents will comply with IFC standards, as well as EU and Italian legislation and requirements;
• oily water will be treated in a specific treatment plant;
• domestic water and the first rain water will be treated in septic tanks;
• the impact magnitude (small) and the sensitivity of the freshwater resources (medium for the surface water and for the groundwater, as detailed in Section 8.5.3.2.1) and in Section 8.5.3.2.2),

the value of impact significance obtained is considered to be minor for surface water and minor for groundwater.

Consumption of Water Resources

In the event that the potable and service water will be supplied from existing water network via a dedicated supply line the value of impact significance is not significant. Potable/service water will only be supplied by a well if the hydrogeological survey assures that no significant impacts are anticipated.

8.5.3.5 Decommissioning Phase

In this phase the potential impacts, the mitigation measures and the relative residual impact will be similar to the Construction and Pre-Commissioning Phase (Section 8.5.3.3) for the PRT area. For the pipeline decommissioning, considering that the pipes will remain underground and they will be only filled with a suitable substance, the related impacts on water resources will be not significant.
8.5.4 Geology, Geomorphology and Soil

8.5.4.1 Overview

The following box shows the key sources of impact, potentially impacted resources and receptors, baseline and project influencing factors associated to the impacts of the TAP Project on geology, geomorphology and soil. In particular this section addresses the principal issues (potential impacts), proposed mitigation and management measures and then discusses the residual environmental impacts of project construction, operation and decommissioning activities relating to landform and the soil.

During the development of the pipeline route, the Project has sought to avoid, minimise and mitigate impacts on landform and soil in line with the Italian Decree 152/06, and IFC.

Box 8-17 Key Sources of Impact, Potentially Impacted Resources and Receptors

<table>
<thead>
<tr>
<th>Sources of Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Construction phase: preparation of the working strip; construction of roads; PRT and BVS; construction of microtunnel; construction of temporary facilities; movements of vehicle; equipment and personnel, waste management.</td>
</tr>
<tr>
<td>• Operations and Maintenance Phase: waste management, movements of vehicle; equipment and personnel, land take by facilities.</td>
</tr>
<tr>
<td>• Decommissioning Phase: PRT and BVS decommissioning, movements of vehicle, equipment and personnel, waste management, land take by facilities.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Potentially Impacted Resources and Receptors</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Soil</td>
</tr>
<tr>
<td>• Groundwater</td>
</tr>
<tr>
<td>• Flora and Fauna</td>
</tr>
<tr>
<td>• Agricultural activity</td>
</tr>
<tr>
<td>• Landform</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Baseline Influencing Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Karst formations in the area, with potential presence of sinkholes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project Influencing Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Specific techniques used for micro tunnelling, topsoil removal, open cut, construction site management and waste management.</td>
</tr>
</tbody>
</table>

The following table presents the key impacts of the TAP project on the soil during the key project phases.
Table 8-111  Key Impacts – Soil Quality

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Potential soil contamination (potential temporary contamination of soil by hazardous and non-hazardous spill, and contamination of soil by hazardous and non-hazardous waste).</td>
<td>• Potential contamination of soil with solid and liquid waste related to the PRT Land take</td>
<td>• Potential soil contamination (potential temporary contamination of soil by hazardous and non-hazardous spill, and contamination of soil by hazardous and non-hazardous waste). Land take</td>
</tr>
<tr>
<td>• Potential disturbance and degradation during the construction (erosion, soil compaction, soil removal modification of morphology, collapse and sinkhole formation)</td>
<td>• Land take</td>
<td>• Land take</td>
</tr>
<tr>
<td>• Land take</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The sensitivity of the soil is reported in the following Sections. Then potential impacts relating to each of the 3 main project phases are described prior to presenting the mitigation measures that will be adopted by the Project. Residual impacts are presented taking into account the application of mitigation measures.

8.5.4.2 Soil Sensitivity

Along the route, the rocky formations are often outcropped or covered by thin layers of soil, sometimes artificial in order to allow cultivation. These coverings, consisting of alluvial accumulations and “terra rossa” (red soils) derived from the in situ alteration of calcareous and calcarenitic lithotypes, are mostly concentrated at the bottom of the depressions (often shaped dolina valley), and/or are more or less on the calcareous formations.

In July 2013, ERM performed soil sampling along the proposed pipeline route to determine soil quality conditions. The analyses were performed on the fine fraction of each sample (in accordance with Legislative Decree no. 152/06 and amendments).

Based on analytical results, the soil quality is generally in compliance with the threshold contamination concentration reported in Table 1, Annex 5, Part IV, Title 5 of D.Lgs. 152/2006 (one exception was found for Beryllium and a high background was found for Tin with several threshold exceedance). Details are reported in Section 6.

- In addition, it is important to consider that
- The soil of the study area is vulnerable to physical disturbance but initial conditions can be restored by mitigation measures;
- The soil represents a not favourable substrate for the development of floral habitats, invertebrates and other fauna;
- The soil plays little or no role in the hydrological cycle or regulation of water.

In conclusion the soil can be considered of low sensitivity.
8.5.4.3 Construction and Pre-commissioning Phase

Regarding the construction and pre-commissioning phase of the Project, the following impact sources have been identified. Without mitigation, the sources listed below have the potentiality to cause impacts on soil and landform.

Table 8-112 Soil Impact -Construction and Pre-commissioning phase.

<table>
<thead>
<tr>
<th>Source of Potential Impact</th>
<th>Potential Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Movement of vehicles, equipment and personnel</td>
<td>Potential contamination of soil by hazardous and non-hazardous</td>
</tr>
<tr>
<td></td>
<td>spills, and contamination of soil by hazardous and non-hazardous</td>
</tr>
<tr>
<td></td>
<td>wastes, compaction of the soil surface and potential degradation, collapse</td>
</tr>
<tr>
<td></td>
<td>and sinkhole formation</td>
</tr>
<tr>
<td>Temporary clearance of vegetation cover</td>
<td>Potential disturbance and erosion (soil exposure), soil compaction</td>
</tr>
<tr>
<td>Production and disposal of solid and liquid</td>
<td>Potential contamination of soil by hazardous and non-hazardous</td>
</tr>
<tr>
<td>wastes</td>
<td>spill, and contamination of soil by hazardous and non-hazardous</td>
</tr>
<tr>
<td></td>
<td>wastes</td>
</tr>
<tr>
<td>Set-up (including site preparation) of temporary</td>
<td>Potential contamination of soil by hazardous and non-hazardous</td>
</tr>
<tr>
<td>facilities (work sites, stockyard, block valve)</td>
<td>spill, and contamination of soil by hazardous and non-hazardous</td>
</tr>
<tr>
<td></td>
<td>wastes</td>
</tr>
<tr>
<td>Storage and handling of fuels and chemicals</td>
<td>Potential contamination of soil by hazardous and non-hazardous</td>
</tr>
<tr>
<td></td>
<td>spills, and contamination of soil by hazardous and non-hazardous</td>
</tr>
<tr>
<td></td>
<td>wastes</td>
</tr>
<tr>
<td>Preparation of the working strip (topsoil</td>
<td>Potential disturbance and degradation during construction, soil exposure,</td>
</tr>
<tr>
<td>removal)</td>
<td>potential contamination of soil by hazardous and non-hazardous</td>
</tr>
<tr>
<td></td>
<td>spills, and contamination of soil by hazardous and non-hazardous</td>
</tr>
<tr>
<td></td>
<td>wastes</td>
</tr>
<tr>
<td>Microtunnel</td>
<td>Potential contamination from fuels, lubricant oils and chemicals, collapse</td>
</tr>
<tr>
<td></td>
<td>and sinkhole formation</td>
</tr>
<tr>
<td>Subtraction of natural surface of soil (Landtake)</td>
<td>Potential occupation of soil by infrastructures with limitation of soil</td>
</tr>
<tr>
<td></td>
<td>functionalities (habitat, human activities, landscape), soil tamping,</td>
</tr>
<tr>
<td></td>
<td>increase of waterproof surface, sealing of surfaces (soil loss).</td>
</tr>
</tbody>
</table>

The impact assessment on soil reported in the following sections is based on the analysis of the sources of potential impact reported in the previous Table.

8.5.4.3.1 Potential Impacts

The aim of this Section is to identify the possible impacts on soil during the construction and pre-commissioning phase.

The potential impacts on soil will largely be confined to the area of the pipeline corridor and associated access roads, the PRT and the microtunnel worksite.

The sources of the potential impacts on soil and landform are the following:

- Potential contamination of soil;
- Potential disturbance and degradation during the construction; and
- Land take.
Potential Contamination of Soil

Soil may potentially be polluted by accidental spills from vehicles, storage tanks and chemical stores, metalworking and welding residues, process waste and effluent. As reported in Section 8.5.3.3.1 and in Section 4 Project Description, four categories of waste for disposal will be generated during the construction phase, as described below:

- Inert construction waste. This waste poses no risk of pollution, but it may be unsightly and need to be disposed at a controlled disposal site.
- Domestic Waste. This one will be transported to a controlled municipal waste disposal site.
- Oily and hazardous waste. Waste will be segregated for collection and disposal by specialist contractors at sites that are equipped and approved for them.
- Liquid waste. All liquid waste will be collected, stored and transported separately in appropriate and approved bins and containers.

The excavated material will be partially destined to be backfilled when the area will be restored. Detailed Soil management and Soil quantities are included Annex 5 "Soil management Plan" ("Terre e rocce di scavo").

Potential Disturbance and Degradation During Construction

During the onshore construction works soil movements will result from the excavation and earthworks related to:

1. the trench digging operations;
2. the PRT construction
3. the temporary worksite preparation
4. the launch shaft excavation;
5. the landfall microtunnel excavation;
1. **The trench digging operations** and pipeline assembly require the opening of a Working Strip. The overall width of the Working Strip will be 26 m; one Working Strip side approx. 11 m wide for the stockpiling of excavated trench material and on the other side, a strip of approx. 15 m wide to allow pipeline assembly and for transit of vehicles/machinery required for pipeline construction. The onshore pipeline will be laid in a trench generally around 2.6 m deep and 1.4 m wide. The excavated subsoil will be placed adjacent to the topsoil pile (separated to prevent mixing). At the end of the construction phase, backfill will normally be placed over the pipeline immediately after the pipe section has been lowered into the trench. Backfill material in the direct vicinity of the pipe will be compacted in layers. After completion of backfill, the restoration operation will begin. The removed top soil will be placed back on the working corridor. The original contours of the land will be restored as closely as possible. The estimated volume of soil to be excavated is approximately 114,300 m³ which 96,800 m³ will be relocated for backfilling or on site reused.

2. The earthworks related to the PRT construction will consist of topsoil works, site levelling (excavation/backfill), drainage works, station piping works and excavation of foundations. The material that can be reused for backfill is approximately 60% of the total excavated material. The excess material (40%) will be removed and managed in accordance with Legislative Decree 152/06 and its subsequent amendments. Additional backfill material with predefined properties (e.g. sand) will also be required for laying drainage and piping. The estimated volume of soil to be excavated is approximately 126,500 m³ which 49,800 m³ will be relocated for backfilling or reused.

3. From the landfall to Kp 0, a wooded area with a length of approximately 500 m (Mediterranean maquis) will be crossed by drilling an overall 1,500 m long microtunnel, ending offshore, with a circular section and internal diameter of 3 m. A temporary worksite will be required specifically for the construction of the microtunnel landfall. 8,000 m³ of soil will be removed during site clearance and stored in the same area and totally relocated for backfilling.

4. The **launch shaft** is needed in order to ensure the correct alignment of the microtunnel and is foreseen at the worksite at Kp 0. The provisional dimensions are 11 m x 10 m x 12 m, and the estimated volume of soil to be excavated is approximately 1,300 m³. The soil excavated will be totally relocated for backfilling.

5. The **landfall microtunnel** estimated excavated material is approximately 10,500 m³. The soil excavated will be totally relocated for backfilling.

As a consequence, during this phase the potential impacts correlated with physical disturbance and degradation are:

- Removing or burying entire soil profiles, excavating bedrock, and covering areas under soil/rock stockpiles.
Zones of soil damage caused by compaction or erosion by construction vehicles around the hard standing pads, pipelines, access roads and land drains.

Potential creation of soil erosion and non-recoverable soil compaction that leads to soil degradation.

Potential alteration of existing slopes and morphologies.

Top soil stored in stockpile could be degraded, altered or compacted.

**Land take**

Soil is a non-renewable resource that performs many vital functions: food and other biomass production, storage, filtration and transformation of many substances including water, carbon, and nitrogen. Soil has a role as a habitat and serves as a platform for human activities, landscape and heritage and acts as a provider of raw materials. For this reason the occupation of soil is considered as a potential impact.

During the construction phase, land will be taken (soil loss) for:

- access roads and site access;
- construction sites including storage and parking;
- temporary infrastructure (e.g., pipeline manufacturing plant, administration buildings, concrete plants).

During construction, a total of ~37.5 hectares (ha) will be required by the Project. The table below summarises the land use required by the construction activities, at this stage.

**Table 8-113 Landtake – Construction Phase**

<table>
<thead>
<tr>
<th>Component</th>
<th>Temporary Land Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipeline (8.2 km)</td>
<td>Working strip: max 26 m working strip → 213,200 m²</td>
</tr>
<tr>
<td>Access roads to PRT</td>
<td></td>
</tr>
<tr>
<td>New Road 1: 922 m → 6.5 m width</td>
<td>New Road 1 to access to PRT: 5,993 m² (partially included in PRT area)</td>
</tr>
<tr>
<td>New Road 2: 716 m → 6.5 m width</td>
<td>New Road 2 to access to PRT: 4,654 m² (partially included in PRT area)</td>
</tr>
<tr>
<td>Access roads to BVS</td>
<td></td>
</tr>
<tr>
<td>New Road: 98 m → 6.5 m width</td>
<td>New Road to access to BVS : 637 m²</td>
</tr>
<tr>
<td>Upgrade Road: 575 m → 6.5 m width</td>
<td>Upgrade road to access to BVS : 3,738 m²</td>
</tr>
<tr>
<td>Block valve station</td>
<td>13m x 14m = 182 m²</td>
</tr>
<tr>
<td>Construction site/ Pipeline receiving terminal</td>
<td>120,000 m² (12.0 Ha)</td>
</tr>
<tr>
<td>Worksite (1)</td>
<td>26,000 m²</td>
</tr>
<tr>
<td>Landfall</td>
<td>n/a</td>
</tr>
</tbody>
</table>
Potential Contamination of Soil

Waste management will be kept closely in line with the legal framework and best practice principles. All waste will be collected, stored and transported separately in appropriate and approved bins and containers. The waste management plan will address handling, storage and disposal of waste.

The mitigation measures for potential contamination from fuels, lubricant oils and chemicals are reported in Section 8.5.3.3.2.

Potential Disturbance and Degradation During Construction

The following mitigation measure will be undertaken and all the activities will be performed in agreement with the Traffic (ref. to Section 9) and Soil Management Plan (ref. to Annex 5):

- Before starting any construction work, topographic and photographic records will be made of the existing condition of the pipeline route and access roads. These records will be used as the standards against which the quality of the restoration work will be judged when construction work will have been completed.

- Topsoil, which supports plant life and contains seed stock, will be removed from the Working Strip by suitable earth moving equipment and stockpiled in the form of a continuous ridge along the edge of the strip. The topsoil stockpile will be typically no higher than 2 m to prevent depredation of the soil and will be kept free from disturbance to reduce the possibility of physical damage and compaction.

- Topsoil will be deposited on one side of the working corridor where it will be stored in such a way that it is not mixed with other trenched materials or trafficked over by vehicles. If topsoil requires long-term storage, then aeration and raking up will be carried out regularly to avoid compaction.

- The removed topsoil will be placed back on the working corridor. The original contours of the land will be restored as closely as possible.

- Attention will be paid to the latter operation on route sections running through arable land and permanently cultivated fields, which are essentially flat with a good pedogenic substrate. Stone removal activities will be required as well, where necessary.

- No machinery will be allowed to leave the working strip or access roadways.

- At the end of this phase, a shallow tillage of the soil will be realized through mechanical agitation with the aim of aerating the top layer of soil compacted by machinery.

- The excavated material from the jacking shaft will be treated in accordance with the relevant legislation:
• if the material is suitable for reuse, the Project will reuse the material or transfer it to facilities capable of reuse; and

• if the resulting material is contaminated and thus not suitable for reuse, it will be transported to disposal, according to the legislative framework.

Following the pipeline backfilling operation, prior to the completion of the above-mentioned restoration works, a preliminary phase involving general tidying up of the line will be carried out. The activity consists of levelling the area affected by the works, restoring pre-existing slopes and the original morphology of the ground, proceeding to the re-activation of ditches and channels, as well as of pre-existing flow lines. During ground levelling, particular care will be taken in order not to leave holes or depressions that could create problems for subsequent farming activities.

Some foreseen mitigation measures for erosion and sediment control are reported below:

• Reduction of stockpiling spoil and soil materials close to water bodies;

• Control of sediment runoff from stockpiles; and

• Installation of diversion drains to intercept uncontaminated surface runoff around facilities and away from construction areas.

All geological and geotechnical aspects will be further investigated in a detailed survey of the proposed route; which will involve a range of standard geophysical and geotechnical survey techniques.

**Land take**

The following mitigation measures will be undertaken:

• No machinery will be allowed to leave the access roadways or the working strip.

8.5.4.3.3 Residual Impacts

The following table shows a summary of the residual impact associated with the identified impacts.
The impact magnitude and the value of impact significance for soil summarised in the table above is reported in the following section. The criteria are reported in the Annex 6 *Baseline and Impact Assessment Methodology*.

**Potential Soil Contamination**

Impact magnitude is a result of the combination of the following parameters:

- **Scale:** Local. The impact could affect the quality of soil in proximity of the potential spillage. Indirectly could affect the surface water and groundwater.

- **Duration:** Long. The potential contamination of soil with waste or accidental spills could have an effect during a time longer than the lifetime of the Project.

- **Intensity:** Low. Mitigation measures will significantly decrease the risk of contamination of soil from potential contamination.

### Table 8-114 Residual Impacts

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Mitigation Commitments to Address the Impact*</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Quality</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| • Potential contamination of soil            | - No waste will be directly discharged into the soil or water  
|                                             | - All liquid waste will be collected, stored and transported separately in appropriate and approved bins and containers  
|                                             | - *Waste management*                              | Not Significant |
|                                             | - The mitigation measures proposed make the impact not significant.  
|                                             | - The impact could affect the quality of soil in proximity of the potential spillage. |                 |
| • Potential disturbance and degradation during construction | - Top soil will be removed and stored  
|                                             | - The topsoil stockpile will be typically no higher than 2 m to prevent depredation of the soil and will be kept free from disturbance to reduce the possibility of physical damage and compaction  
|                                             | - Top soil will not be mixed with other trenched materials or trafficked over by vehicles  
|                                             | - The removed top soil will be placed back on the working corridor. The original contours of the land will be restored as closely as possible  
|                                             | - At the end of this phase, will be done a shallow tillage of the soil by mechanical agitation at the scope to aerate the top layer of soil compacted by machinery. | Minor |
| • Landtake                                   | - No machinery will be permitted to leave the pipeline working strip or access roadways. | Minor |
|                                             | - the soil disturbance and displacement are localised within a 26 m corridor ;  
|                                             | - the mitigation measures will decrease significantly the risk of degradation and soil compaction, the original contours of the land will be restored as closely as possible. |                 |

*) Mitigation measures in italic will be developed in a further stage of the project
The combination of these three parameters generates an impact magnitude that can be defined as **small**.

Potential soil contamination associated with waste handling/disposal practices and potential spillage and/or leaks during the course of the construction activities is considered unlikely and in any case with a limited/local impact on the soil. However, with the waste management plan, the spill response plan and the measures of mitigation reported in Section 8.5.3.3.2, the potential impact will be controlled and/or minimized. In conclusion considering the impact magnitude (**small**) and the sensitivity of the soil quality (**low**, as detailed in **Section 0**), the obtained value of impact significance is considered to be **not significant**.

### Potential Disturbance and Degradation During Construction

Impact magnitude is result of a combination of the following parameters:

- **Scale**: local. The impact will only affect the soil in the working strip;
- **Duration**: Long. The potential physical alteration of landform and soils will be long-term in nature; and
- **Intensity**: Low. Mitigation measures will decrease significantly the risk of degradation and soil compaction, the original contours of the land will be restored as closely as possible.

The combination of these three parameters generates an impact magnitude that can be defined as **medium**.

In conclusion, considering that soil disturbance and displacement are localised within a 26-m corridor, the presence of different stockpiles for soil and topsoil, all the mitigation measures to prevent soil compaction, physical degradation and alteration of soil and topsoil, the original contours of the land will be restored as closely as possible. Considering the impact magnitude (**small**) and the sensitivity of the soil quality (**low**, as detailed in **Section 0**), the value of impact significance obtained is considered to be **minor**.

### Landtake

Impact magnitude is a result of the combination of the following parameters:

- **Scale**: Local. The infrastructures are planned within the study area.
- **Duration**: Medium. The impact has an effect during the lifetime of the Project.
- **Intensity**: Medium. In this phase the total occupied area will be approximately 37.5 ha. It’s important underline that during this phase there will be interactions with agricultural activities, with tourism activities and there will be changes of land value (impacts analysed in Section 8.7).

The combination of these three parameters generates an impact magnitude that can be defined as **small**.
Considering that most sites will be restored to their original condition, that the activities will be focus within the pipeline working strip –(26 m wide), and considering that the working strip will be restored to their original condition and the only structures presence will be the PRT (120,000 m²) and the BVS (182 m²), the significance of this impact is classified as minor. The impacts on tourism, agricultural activities, tourism activities and change of land value due the landtake, are reported in Section 8.7.

8.5.4.4 Operations and Maintenance Phase

During the operation phase, landtake and waste production will be related to PRT and Block Valve operation. The sources listed below could cause potential impacts on soil.

Table 8-115 Soil Impact – Operation and Maintenance Phase

<table>
<thead>
<tr>
<th>Source of Potential Impact</th>
<th>Potential Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production and disposal of solid and liquid wastes</td>
<td>Potential contamination of soil by hazardous and non-hazardous spilt, and contamination of soil by hazardous and non-hazardous wastes</td>
</tr>
<tr>
<td>Subtraction of natural surface of soil (Landtake)</td>
<td>Potential occupation of soil by PRT with limitation of soil functions (habitat, human activities, landscape), soil tamping, increase of waterproof surface.</td>
</tr>
</tbody>
</table>

From the above sources, the following potential impact-led assessment has been completed for the soil where all sources of impact are grouped so that an overall assessment can be made of the key impacts associated with the project as outlined at the beginning of this section.

8.5.4.4.1 Potential Impacts

The potential impacts on soil will largely be confined to the PRT and block valve areas.

Key potential impacts on soil and landform along the pipeline route from all phases of the Project are the following:

- Potential soil contamination;
- Land take.

**Potential Soil Contamination**

During the operational phase only limited amounts of waste are expected, due mainly to maintenance activities. In this phase there will be a specific drainage and effluent treatment at the PRT. Effluents will comply with IFC standards, as well as EU and Italian legislation and requirements. Wastewater treatment and disposal is designed to meet those requirements.

**Land take**

During operation, a total than approximately 13.5 ha will be required by the Project. The Table 8-116 below summarises the land use required by the Operation activities.
### Table 8-116 Permanent Land take and Permanent Constraints in Operation Phase

<table>
<thead>
<tr>
<th>Component</th>
<th>Permanent Land Take</th>
<th>Permanent Constraints</th>
</tr>
</thead>
</table>
| Pipeline (8,200 km) | - | 40 m → 328,000 m²  
(no single building allowed) |
| Access roads to PRT | New Road 1 to access to PRT: 5,993 m²  
(partially included in PRT area) | 200 m → 1,640,000 m²  
(no cluster building allowed) |
| New Road 1: 922 m → 6.5 m width | New Road 2 to access to PRT: 4,654 m²  
(partially included in PRT area) |
| New Road 2: 716 m → 6.5 m width | New Road to access to BVS: 637 m² |
| Upgrade Road: 575 m → 6.5 m width | Upgrade road to access to BVS: 3,738 m² |
| Block valve station | 182 m² (13 m x 14 m)² | - |
| Pipeline receiving terminal | 120,000 m² (12° Ha) | - |

During the operations phase, land will be rehabilitated but a few activities will be restricted. Indeed in the study area the presence of the pipeline determines a safety zone, as reported in the column **Permanent Constraints** in the above table. In this corridor (20 meters per side) no constructions will be allowed. In addition no construction of clusters of houses will be allowed in a strip of 100 meters in both sides of the pipeline.

#### 8.5.4.4.2 Mitigation Measures

**Potential Soil Contamination**

All the effluents will be treated as liquid waste, and the mitigation measures will be, where applicable, the same as those used during the construction phase. In particular oily water will be treated in a specific treatment plant, and domestic water and the first rain water will be treated in septic tanks.

**Land take**

No mitigation will be undertaken during the operations and maintenance phase.

#### 8.5.4.4.3 Residual Impacts

The following table presents a summary of the residual impact associated with the impacts identified.
Table 8-117  Residual Impacts

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Mitigation Commitments to Address the Impact</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Quality</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| • Potential contamination of soil | • No waste will be directly discharged into the soil or water  
• All liquid waste will be collected, stored and transported separately in appropriate and approved bins and containers  
• Waste management | Not significant  
• the mitigation measures proposed make the impact not significant;  
• the impact could affect the quality of soil in proximity of the potential spillage. |
| • Landtake | • No mitigation foreseen | Minor  
• approximately 13.5 ha will be impacted;  
• there will be interactions with agricultural activities, with tourism activities and there will be changes of land value. |

*) Mitigation measures in italic will be developed in a further stage of the project

Impact magnitude and the value of impact significance for soil summarised in the table above is reported in the following sections. The criteria are reported in Annex 6 Baseline and Impact Assessment Methodology.

Potential Soil Contamination

Impact magnitude is a result of the combination of the following parameters:

• Scale: Local. The impact could affect the quality of soil in proximity of the potential spillage. Indirectly could affect the surface water and groundwater.

• Duration: Long. The contamination of soil with wastes or accidental spills could have an effect during a time longer than the lifetime of the Project.

• Intensity: Low. Mitigation measures will significantly decrease the risk of contamination of soil from potential contamination.

The combination of these three parameters generates an impact magnitude that can be defined as small.

In conclusion, the potential soil contamination in this phase may be associated with waste handling/disposal practices. However, with the waste management plan and the measures of mitigation reported in Section 8.5.3.3.2, the impact could be controlled and/or minimized. Considering the impact magnitude (small) and the soil sensitivity (low, as detailed in Section 0), the value of impact significance obtained is considered to be not significant.
**Land take**

The impact magnitude is result of the combination of the following parameters:

- **Scale**: Local. The PRT and the BVS are planned within the study area. The constraints are applicable on the RoW.

- **Duration**: Medium. The impact has an effect throughout the lifetime of the Project.

- **Intensity**: Medium. In this phase approximately 13.5 ha will be impacted. It’s important to underline that during this phase there will be interactions with agricultural activities, with tourism activities and there will be changes of land value (impacts analysed in Section 8.7).

The combination of these three parameters generates an impact magnitude that can be defined as **small**.

Considering the areas occupied by the project and the permanent constraints above detailed, the duration of the effect (throughout the lifetime of the Project), the value of impact significance is considered to be **minor**. The impacts on tourism, agricultural activities, tourism activities and change of land value due to the landtake are reported in **Section 8.7**.

8.5.4.5 Decommissioning Phase

In this phase the potential impacts, the mitigation measures and the relative residual impact will be the same as for the Construction and Pre-Commissioning Phase (**Section 8.5.4.3.2**) for the PRT area. For the pipeline decommissioning, considering that the pipes will remain underground and they will be only filled with a suitable material, the related impacts on soil resources will be **not significant**.
8.5.5 Landscape and Visual Amenity

8.5.5.1 Introduction

This section of the ESIA contains the results of the evaluation of the project’s impact on the landscape component and evaluates the project’s effects on two aspects:

- **landscape characteristics and resources**: the analysis considers the effects on the aesthetic values of the landscape, caused by changes in the character and quality of the actual elements of the landscape itself;

- **the visual attractiveness of the landscape**: the analysis evaluates the effects on the landscape’s potential users, caused by changes in the appearance of the landscape, as a result of the realization of the TAP project in Italy.

The landscape features and resources are therefore considered important for their intrinsic characteristics, regardless of whether or not there are people who can enjoy their view, while the visual attractiveness is an indicator of how the population perceives and appreciates the landscape.

The graphs related to this section are contained in Annex 8. The site of the intervention, with the exception of part of the pipeline route from Kp 6.4 to Kp 8.2 and the area of the PRT, is included in areas of scenic interest protected by law in accordance with Legislative Decree 42/2004 and subsequent amendments, articles 136 and 142. According to art. 146 of this Legislative Decree, a specific Landscape Impact Assessment was drawn up (see Annex 8).

In detail, the onshore section of the pipeline originates north of San Foca, in San Basilio, where it reaches the landfall area through a microtunnel. The microtunnel will terminate in an area cultivated with olive trees near which the work site is planned to be located, with a surface area of 26,000 m², with the BVS located near Kp 0.1. Moving West, the onshore pipeline section, laid through a trench excavation up to 0.6 Kp, is still located in an area cultivated with olive trees followed by an uncultivated area up to Kp 1.0. Beyond the uncultivated area, the pipeline lies adjacent to the municipal road of San Niceta, up to Kp 5.8, in an area containing only olive trees bordered by dry-stone walls and characterized by the presence of “pagghiare” (traditional barns).

Near Kp 5.8, the pipeline runs along the south-west affecting almost exclusively olive groves except for two uncultivated areas, the first from Kp 6.0 to Kp 6.15 and the second from Kp 7.2 to Kp 7.25, ending in arable land area, with a “pagghiara” and a topographic depression, where the PRT is expected to be built up.

The following box shows the key impacts associated with the project, the potentially impacted resources and receptors and the characteristics of the environmental context and the project that could have an effect on the impacts.
Box 8-18  Key Sources of Impact, Potentially Impacted Resources and Receptors

Sources of Impact
- Construction Phase: presence of work sites, machinery, vehicles and storage of materials and excavated subsoil, lighting impact, vegetation cutting.
- Operations and Maintenance Phase: presence of PRT and Blockvalve, lighting impact.
- Decommissioning Phase: similar sources of impact as for the PRT construction phase are expected.

Potentially Impacted Resources and Receptors
- Panoramic views.
- Landscape elements which have symbolic value for the local community.
- Tourists and inhabitants.

Baseline Influencing Factors
- Historical and cultural values near the Study Area.

Project Influencing Factors
- Volumes and elements position.

The following table presents the key impacts of the TAP project on landscape and visual amenity during the key project phases.

Table 8-118  Key Impacts – Landscape and Visual Amenity

<table>
<thead>
<tr>
<th>Construction phase</th>
<th>Operation Phase</th>
<th>Decommissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary visual impacts due to the presence of worksites for the PRT and the Microtunnel Construction activities.</td>
<td>Visual impacts due to the presence of the Pipeline Receiving Terminal</td>
<td>Potential impacts are expected to be similar to those of the construction phase for the PRT area</td>
</tr>
<tr>
<td>Temporary visual impacts along the pipeline route associated with earthworks and the presence of machinery and vehicles</td>
<td>Visual impacts due to the presence of the Blockvalve</td>
<td></td>
</tr>
<tr>
<td>Impacts due to physical changes of elements that constitute the landscape</td>
<td>Lighting impact during the night period due to the presence of the Pipeline Receiving Terminal</td>
<td></td>
</tr>
</tbody>
</table>

In the following Sections, each potential impact has been expanded giving information on how each source is likely to have an impact on receptors and the mitigation measures that TAP AG intends to adopt. Furthermore, the residual impacts were analysed by taking mitigation measures into account.

As for the project's compliance with current legislation, refer to Chapter 3 – Legislative Framework. In particular, with regard to the analysis of the Thematic Territorial Urban Planning (PUTT/p) in force and the new Regional Landscape and Territorial Plan (PPTR) adopted, reference is made to Sections 3.3.4.4 and 3.3.4.5 of this ESIA.
8.5.5.2 Construction Phase

8.5.5.2.1 Potential Impacts

The present section of the assessment addresses the construction impacts of the proposed pipeline works and related elements on landscape and visual amenity, along the length of the pipeline. The potential direct impacts, during the construction phase, are reported below.

**Physical changes to elements that constitute the landscape**

The physical changes to the elements that constitute the landscape are related to:

- Pipeline construction activities, including the loss of cultivated land and vegetation. These direct changes will be applied to a corridor with a width of 26 metres. In fact, the Working Strip will be on one side approximately 11 m wide, to allow the excavation materials from the trench to be accumulated, and on the other side it will be approximately 15 m wide, to allow the assembly of the pipeline and the transit of the vehicles / machinery necessary for the construction of the pipeline;

- The construction activities of new roads at specific points along the route of the pipeline. At the intersection points between the pipeline and secondary roads, the crossing will be built according to open cut methods, with a protective casing; and

- Direct changes to the receiving landscape, due to the introduction of temporary structures and equipment for the start-up of construction work. These include a main work site at the end of the onshore route where the PRT will be built, and the temporary work site for the construction of the landfall microtunnel up to Kp 0.

Field works conducted in July 2013 revealed that the construction work involves:

- about 120 dry stone walls. During the field activities (July 2013), a team of archaeologists mapped out and surveyed the dry stone walls inside the 30 metre corridor of the Base Case (*Appendix 5 of Annex 7*);

- olive trees of various sizes identified in the number of about 1,900 olive trees with a diameter greater than 30 cm inside the areas where construction operations are expected to take place, about 1,650 of which with diameter between 30 cm and 70 cm, about 200 with a diameter between 70 cm and 100 cm and about 50 cm with a diameter greater than 100. In this regard it is noted that the final list of monumental olive trees, approved by Resolution No. 357 of the Regional Council of 7 March 2013, does not identify any monumental olive trees within areas affected by the construction operations.

- n. 5 wells.

**Visual Impact**

The visual impact is generated by the presence of stationary or moving plants, machinery and vehicles related to the construction phase.
The construction site of the PRT is located between the towns of Melendugno and Vernole. The site of the PRT and the adjacent areas are mainly characterised by the presence of trees (especially olive) with the exception of the southern part with the presence of arable, non-irrigated land.

The visual basin related to interventions in the project is very small because they can only be perceived from a few hundred meters away. The most extensive visible area is near the San Basilio marshland (Palude di San Basilio).

**Light Impact**

For safety reasons, during the construction phase, that will last for about 3 years, with the interruption of operations during the summer, all the construction sites will be illuminated during night time, even when they are not operating. Table 8-119 shown below summarizes the planned timing for the construction of the main components of the project.

**Table 8-119 Duration of Construction of Project Components**

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Duration of Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction site and work sites</td>
<td>1 month</td>
</tr>
<tr>
<td>Landfall micro-tunnel</td>
<td>9 months</td>
</tr>
<tr>
<td>Offshore pipeline</td>
<td>2 months</td>
</tr>
<tr>
<td>Pre-trench excavation</td>
<td>2 months</td>
</tr>
<tr>
<td>Pre-trench backfilling</td>
<td>1 month</td>
</tr>
<tr>
<td>Post–laying Gravel dumping</td>
<td>1 month</td>
</tr>
<tr>
<td>Pipeline Receiving Terminal</td>
<td>18 months</td>
</tr>
<tr>
<td>Landscaping/Reinstatement and Road Construction</td>
<td>6 - 12 months</td>
</tr>
<tr>
<td>Onshore pipeline and Block valve station</td>
<td>6 months</td>
</tr>
<tr>
<td>Pre commissioning</td>
<td>5 months</td>
</tr>
</tbody>
</table>
8.5.5.2.2 Mitigation Measures

**Physical changes to landscape features**

Below is a list of mitigation measures that will be adopted in order to limit the physical changes to the elements that constitute the landscape:

- A working strip is to be set up before the construction work is completed. This consists of the **levelling of the area affected** by the works and the **reconfiguration of pre-existing slopes**, by **restoring the original morphology** of the ground and re-activating the ditches and channels, as well as pre-existing flow lines. During ground levelling, particular care will be taken to avoid leaving holes or depressions that could create problems for subsequent farming activities.

- The **top soil will be placed on top of the pipeline**. Where necessary, the removal of stones will be performed;

- To complete the construction work, all the necessary **environmental rehabilitation work** must be completed. The purpose of this work is to restore the natural setting that previously existed in the area;

- Concerning **dry stone walls**, as was shown earlier, during the construction phase, approximately n. 120 will be removed while the easement area is set up. During the restoration process, they will be re-installed in accordance with their original size, using original stone materials that were duly set aside before the installation work of the pipeline (*Figure 10 in Appendix 3 of Annex 7*);

- With regard to the presence of other structures of scenic interest, the actual interference will be considered on a case by case basis and any need for restoration will be discussed with the authorities/owners;

- In terms of the road crossings, once the pipeline is installed, the trench will be refilled and compacted in layers, according to current specifications provisioned by relevant regulations. The road surface will then be restored over the compacted trench. The final choice of the crossing methods will be made in consolation with the competent road management authorities;

- Although there are no monumental olive trees included in the regional list of Monumental Olive Trees (approved by resolution of the Regional Council no. 357, 7 March 2013) that could potentially be affected by the construction activities, olive trees of significant size and age are positioned along the working strip. Upon the completion of the construction activities, TAP AG pledges to restore the sites to their pre-construction state by replanting the olive trees. If requested by the owners, in agreement with the competent authorities, alternative methods of compensation will be provided. The following operations will be performed:
  - pruning (reduction of approximately 50% of the foliage);
o disinfection of cut areas with fungicides;

o wrapping of trunks, if necessary, with burlap or other similar material;

o finish the surface with grass turf installed with a digging machine; the grass turf will be held in place with a wire net and anti-algae tarp.

In order to ensure the perfect reinstatement of the area, before any construction work has begun, topographic and photographic records will be made of the existing conditions of the terrain where the pipeline and access roads run. These records will be used as the standard against which the quality of the restoration work will be judged once the construction work is complete.

**Visual Impact**

Construction work will be carried out taking into account the importance of the tourist season, and taking care not to interfere with it. To do this, the work in the coastal area will be interrupted during the summer to avoid interference with the activities related to tourism.

Mitigation measures include restoration of soil cover with what was originally removed and properly stored.

**Lighting Impact**

A lighting scheme will be formulated, for the construction phase, in order to reduce the impacts related to the lighting of the construction sites during night time. The lighting of the construction sites will be in compliance with the main recommendations stated by the Apulia Region in the *Regional Law No. 15, dated November 23, 2005, "Urgent measures for the containment of light pollution and saving energy", art. 5.*

Generally, a reduction of obtrusive light is possible through the following solutions (Institute of Lighting Engineers, 2005):

- Do not "over" light. There are published standards for most lighting tasks, adherence to which will help minimise upward reflected light.

- Dim or switch off lights when the task is finished. Generally a lower level of lighting will suffice to enhance the night time scene than that required for safety and security.

- Use specifically designed lighting equipment that minimises the upward spread of light near to and above the horizontal.

- Keep glare to a minimum by ensuring that the main beam angle of all lights directed towards any potential observer is not more than 70°.
8.5.5.2.3 Residual Impacts

The following table presents a summary of the residual impacts associated with the impacts identified.

Considering the foreseen mitigation measures during the construction phase, the residual impacts on Landscape are estimated as Moderate.

**Table 8-120 Residual impacts – Construction and Pre-Commissioning Phase**

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Mitigation Commitments to Reduce the Impact</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Landscape</strong></td>
<td></td>
<td>Moderate</td>
</tr>
</tbody>
</table>
| Physical changes to landscape features | • Careful planning of the construction period to avoid interfering with the summer season.  
• Restore the original conditions and the structures interfered by the Project  
• Restore the sites to their conditions before the construction work by replanting the olive trees. If requested by the owners, in agreement with competent authorities, an alternative form of compensation may be offered |                |
| **Visual Impact**               | • Construction work will be carried out taking into account the importance of the summer season;  
• the work site equipment that will be installed during the construction phase, due to their moderate height, will not significantly alter the characteristics of the landscape. | Moderate        |
| **Light impact**                | • Use of lighting fixtures with minimal upward lighting;  
• The construction site will be illuminated in accordance with the recommendations provided by the Region of Apulia in Regional Law n. 15 of 23 November 2005, "Urgent measures for the containment of light pollution and saving energy ". art. 5 | Moderate        |

The following paragraphs contain a detailed analysis of each potential impact, with information both on the mitigation commitments adopted and on the magnitude in the construction site phase.
Physical changes to landscape features

Considering that:

- the construction phase will be carefully planned. Activities will be suspended near coastal areas during the summer season to avoid interference with tourism-related activities;
- the affected dry stone walls will be restored to their original condition at the end of the construction phase;
- in case of interference with other landscape elements, the need for any restoration measures will be evaluated on a case by case basis with the authorities/owners
- the soil and all the vegetation affected will be restored to its original condition at the end of the construction phase;
- upon the completion of the construction activities, TAP AG is committed to restore the sites to their pre-construction state by replanting olive trees. If requested by the owners, in agreement with the competent authorities, alternative methods of compensation will be provided;

the impact magnitude due to the construction phase is considered to be Medium, within both the coastal territory and the agricultural plain area.

By comparing the impact magnitude within the coastal area (rated as Medium), with the landscape sensitivity of the coastal territory, rated as High, the significance is classified as Moderate.

By comparing the impact magnitude on the agricultural plain area (rated as Medium) with the landscape sensitivity of the agricultural plain area, rated as Medium, the significance of the impact is classified as Moderate.

**Visual impact**

Considering that:

- the work site equipment that will be installed during the construction phase, due to its moderate height, will not significantly alter the characteristics of the landscape;
- the area will only be occupied temporarily;
- at the end of this phase, the construction site equipment will be removed and restoration activities of the area will start;

the impact magnitude due to the construction phase is considered to be Medium.

By comparing this value with the landscape sensitivity of the agricultural plain area in question, which is also estimated to be Medium, the significance of the impact is classified as Moderate.

By comparing the value of the impact magnitude (Medium) with the landscape sensitivity of the coastal territory, considered to be High, the significance of the impact is classified as Moderate.
Light Impact

Considering that:

- Throughout the construction phase, lighting systems to be installed will comply with European standards and Italian regulations reducing the night-time light impact;

- In order to reduce the night-time light impact, the lighting of the construction sites will be in compliance with the main recommendations stated by the Apulia Region in the Regional Law No. 15, dated 23 November 2005, "Urgent measures for the containment of light pollution and saving energy";

the impact magnitude due to the construction phase is considered to be Medium.

By comparing this value with the landscape sensitivity of the agricultural plain area in question, which is also estimated to be Medium, the significance of the impact is classified as Moderate.

By comparing the value of the impact magnitude (Medium) with the landscape sensitivity of the coastal territory, considered to be High, the significance of the impact is classified as Moderate.

8.5.5.3 Operating Phase
8.5.5.3.1 Potential Impacts

This paragraph of the study concerns the potential impacts on landscape during the operation phase.

Physical changes to landscape features

During the operating phase, in the coastal territory, the presence of the microtunnel will not have any effect on the landscape, while the Block Valve Station (BVS), consisting of a small electrical substation surrounded by a fence inside a total area of about 13 x 14 m, located along the pipeline at Kp 0.100, will occupy an area currently cultivated with olive trees. Considering its reduced dimensions, it will have a minor and localised impact on the landscape.

The main sources of impact on the landscape will be related to the agricultural plain area, particularly near the area from the Pipeline Receiving Terminal (PRT). The onshore pipeline will be underground. Land cover, vegetation and dry stone walls will be completely restored once the pipeline is installed. In the event of interference with elements that constitute the landscape, the eventual need for restoration measures will be evaluated on a case by case basis with the authorities/owners.

Visual Impact

Only Block Valve Station (BVS), positioned along the pipeline, at Kp 0.100 in the coastal territory area, and the Pipeline Receiving Terminal (PRT), at the end of the gas pipeline, at approximately 8 km from the coast of the agricultural plain area, will be visible.
The **Block Valve Station** is a small electrical substation located inside an area surrounded by a fence (total surface area of approx. 13 x 14 m); since it is positioned in an area cultivated with olive trees, it will only be visible a few dozen metres away.

The **Pipeline Receiving Terminal**, on the other hand, will consist of larger and higher structures. However, the presence of the PRT will be a visual obstacle only from viewpoints that are closest to the area (closer than 500 m), while from the other viewpoints the olive trees and forest, together with the drainage morphology, located east of the area, will hide the structures on the project (see Table 9 “Analysis of Visual Conditions” of *Annex 8*).

### Light Impact

The area where the Pipeline Receiving Terminal (PRT) will be located currently presents no night-time light pollution at all. The construction of the Pipeline Receiving Tunnel (PRT) includes the installation of a lighting system that ensures an excellent level of security and a constant control of the operating area.

8.5.5.3.2 Mitigation Measures

#### Physical changes to landscape features

The mitigation measures also include works to protect and recover constructions that, in accordance with the Technical Rules for Implementation of the PUTT/P in force in Puglia, are considered "widespread assets of the territory" (art. 3.14). In the specific case, the "pagghiara" (conical-shaped dry stone shelter often made by the farmer himself using the stones on his land) located inside the area of the PRT will be recovered. As well as pagghiara recovery, reinstating existing roads is included.

#### Visual Impact

As for the structures of the Pipeline Receiving Terminal (PRT) an environmental mitigation project was also set up, preliminarily presented to the Superintendence for Architectural and Landscape Heritage for the provinces of Lecce, Brindisi and Taranto (see *Appendix 1 of Annex 8*). The proposed works include a series of mitigation measures, listed here below, that will not entail making evident changes to the consolidated landscape and its perception and that will reduce the visual impacts both at ground level and zenithal.
Reduction of daytime and night-time overhead visual impacts:

- **colour and material camouflage of the areas not paved or covered by vegetation.** The area around the two cold vent stacks, equivalent to 60% of the entire work site, is identified as a "sterile area". For technical and safety reasons, no trees or shrubs may be planted in this area within a radius of 90 m from each vent stack. As this concerns an area of almost 7 hectares, the measures proposed to mitigate the overhead view were to deposit on it a layer of assorted crushed stone taken from quarries in the area, distributing it in a non-uniform way so as to create an irregular pattern, using various colours resembling those of the tuff topsoils present in the province of Lecce.

- **reduction of light pollution created by artificial light and assessment and control of light indices towards the outside environment.** The work site currently presents virtually no night-time pollution at all. The construction of the PRT includes the installation of a lighting system that ensures an excellent level of security and a constant control of the operating area. With a view to attenuating and limiting the amount of pollution, the project adopts lighting with an indirect downward beam and low-energy consumption for the roads. For the pathways, the proposal consists of hooded side lighting that serves the specific purpose of marking the way; again to mitigate the visual impact, pole lighting is only used in areas where strictly necessary while, in the remaining areas, the lights will be applied directly to the buildings to be constructed.

- **elimination of reflective surfaces.** In order to reduce the impacts on the overhead views (commonly used when navigating with a web browser) "green roofs" will be installed so as to mitigate the effects of these horizontal surfaces. They will be applied exclusively in the office area, while the remaining stone surfaces will be of a colour similar to green so that they fit well into the overhead setting. These solutions will be adopted instead of installing photovoltaic panels, as laid down by the legislation in force.

- **colour camouflage of road surfaces.** The internal road surfaces, even if limited to the areas adjacent to the administrative buildings and the plant area, were mitigated using asphalt of colours resembling those of the tuff topsoils typical of the province of Lecce. For the external road surfaces (security boundary road) use will be made of stabilized stone, duly steamrolled, so as to reproduce the type of farm roads already present all over the surrounding countryside.

- **irregular, natural-looking planting.** In order to make the area as natural as possible, new groves will be planted with a density of 110/120 trees per hectare with an irregular layout. In the area to the north, along the incoming route of the underground pipeline, the trees will be planted in such a way as to be compatible with the pipeline itself.
Reduction of planimetric and altimetric visual impacts (daytime and night-time):

- **reduction of the height of the new constructions.** Following the topographical survey that was conducted to determine the morphology of the ground, the actual impacts of the constructions were analysed and assessed in relation to the existing surroundings. The lie of the land, which slopes slightly downwards from North to South, with a difference in level of about 4 m, enabled the buildings to be positioned below the level of the horizon, by taking advantage of this slope. In addition, for the technical facilities (fire protection water storage tank), the part protruding above ground will be camouflaged by a soil embankment on which grass will be sown and shrubs planted.

- **mitigation of critical views with shielding vegetation.** The critical views were analysed (see **Appendix 1** of this Chapter) in order to estimate the actual impacts of the constructions and to drive the choice of the most appropriate mitigation measures. Both for the view identified as "1 bis" and that identified as "3 bis" below, the same mitigation measures were taken, using shielding trees (for the former view point) or multi-level terraces with shielding plants (for the second critical view point). The photo simulations shown below enabled a comparison to be made between the places as they appear today and how they will appear following the mitigation measures using natural elements (olive trees) characteristic of the existing countryside. The site has a fair basic visual absorption capacity due to the presence of the eucalyptus woodland. The olive trees completed the shielding effect, thus almost entirely cancelling out the impact of the new constructions.

- **contextualization of property boundaries.** In order to fit well the Project into the environment, dry stone wall will be used as property boundary in order to establish a philological link between the recognized rural landscape and the new structures, respecting the traditional construction techniques.

- **naturalization of new security fences.** The PRT design includes a second inner type of fencing characterized by a higher level of security and protection. The proposal made to reduce its visual impacts was to turn it into a natural barrier by planting climbing plants at its base;

- **use of finishing materials of the surfaces typical of rural architecture.** Materials normally used in rural architecture will be adopted for new building hosting the administrative offices, technical and security rooms. In particular, projecting walls will be covered with natural rough-cut stone while rendered walls will be finished with hydraulic lime render as it is a natural material that ensures a high degree of breathability and strength and a limited need for maintenance;
• colour camouflage of the technological elements of the plant (horizontal pipes, cold vent stacks, safety valves, etc.). In the PRT area, behind the "boiler house", there will be an area with overhead gas pipes and their safety valves. Also in this case, the aim of the mitigation measures is to minimize the visual impacts of the pipes by using colours similar to the surrounding vegetation in order to obtain a camouflaging effect and a limited impact;

• use of native tree and shrub species. For all the mitigation measures in which tree and/or shrub species are to be used, these species will be chosen from the native ones listed in the analytical documents annexed to this report. Naturally, the choice of the species will depend upon the use. Tall trees, such as eucalyptus, will be used as natural shielding barriers; medium-height species, such as olive trees, will be used both as natural shielding barriers and to reduce the overhead visual impacts by planting the trees in an irregular layout;

• assessment and reduction of the light impact. The light impacts to the ground level views were also assessed. The measures described in the "Reduction of the light impact" section above are also valid for this case.

Protection of existing features:

• conservation of the "pagghiara" inside the intervention area. The mitigation measures also include actions to protect and recover constructions that, in accordance with the Technical Rules for Implementation of the PUTT/P in force in Apulia Region, are considered "widespread assets of the area" (art. 3.14). In particular, the "pagghiara" (conical-shaped dry-stone shelter often made by the farmer himself using the stones on his land) will be recovered in order to preserve one of the most important elements of the rural culture of Salento.

• recovery of existing rural roads network. Closely linked to the previous action is the recovery of the existing roads, which is also aimed at conserving the traces of the traditional rural civilization;

• protection of the existing vegetation. Construction of both the PRT and the underground pipeline also involve small areas with olive groves. The principle of conservation and protection will also be adopted to safeguard the tree species by removing the trees situated on the work site and replanting them in an alternative location.
Light Impact

A reduction of light impact will be made possible by adopting specially designed lighting systems that comply with European standards and Italian regulations.

At regional level, Regional Law No. 15 dated 23 November 2005, "Urgent measures for the containment of light pollution and saving energy", establishes the technical requirements and methods for using the lighting systems (art. 5). In particular, it requires that buildings must be illuminated from the top downwards, and that the lighting systems are equipped with devices that allow power to be switched off or reduced by at least 30% by midnight.

Considering the PRT facilities, in order to attenuate and limit the amount of light pollution, light fixtures with an indirect, downward beam of light and with low energy consumption systems for driveways will be provisioned.

8.5.5.3.3 Residual Impacts

The application of the previous mitigation measures will minimize the residual impact on the landscape due to the Project.

Table 8-121 presents a summary of the residual impacts associated with the impacts identified above.

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Mitigation Commitments to Reduce the Impact</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landscape</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical changes to landscape features</td>
<td>• In the PRT the “pagghiara” will be recovered to preserve one of the most important elements of rural culture of Salento;   • The recovery of existing roads is closely linked to the previous measure.</td>
<td>Moderate • It won’t be possible to recover certain existing dry stone walls in the PRT area;   • The impacts will be reduced by burying the gas pipeline and completely restoring the land cover and vegetation.</td>
</tr>
<tr>
<td>Visual Impact</td>
<td>• Set up a landscape mitigation project for the PRT area.</td>
<td>Moderate • The addition of new trees and the creation of terraces will prevent the PRT from being seen by potential observers   • The impacts will be reduced by burying the gas pipeline and completely restoring land cover and vegetation</td>
</tr>
<tr>
<td>Light Impact</td>
<td>• Use of lighting fixtures with minimal upward lighting;  • Reduction of light pollution created by artificial light and the assessment and control of light indices towards the outside environment.</td>
<td>Moderate • The use of lighting equipment in compliance with EU standards and Italian legislation will reduce the night-time light impact</td>
</tr>
</tbody>
</table>
The following paragraphs contain a detailed analysis of each residual impact, with information on the magnitude and on mitigation measures adopted by the Project.

**Physical changes to landscape features belonging to the coastal territory**

Considering that the portion of the onshore pipeline, the microtunnel and the Block Valve Station (BVS) affect the coastal territory, which has been assigned a sensitivity value of High, and that the impact magnitude of the gas pipeline and the BVS on the landscape elements is considered Very small, since only a few olive trees cannot be replanted due to the presence of the BVS, the level of significance of the impact is Low.

**Visual Impact on the coastal territory**

In the coastal territory, the presence of the microtunnel and the portion of the onshore pipeline will not have any visual impact considering that the onshore pipeline will be underground and that the land cover and vegetation will be restored after the pipeline has been installed, while the Block Valve Station (BVS), consisting of a small electrical substation surrounded by a fence inside a total area of about 13 x 14 m and, located along the pipeline at Kp 0.100 in an area currently cultivated with olive trees will have a minor impact due to the fact that the currently existing olive grove will be restored.

Therefore, considering the portion of the pipeline and the Block Valve Station (BVS) located in the coastal territory, which has been assigned a sensitivity value of High, and the impact magnitude of the pipeline and the BVS on the landscape considered Very small, the level of significance of the impact is Low.

**Light Impact on the coastal territory**

During the operation phase, no lighting system is planned to be installed near the BVS. Consequently, this type of impact can be excluded.

**Impact on the landscape in the agricultural plain area**

Below is a summary of the results of the analysis on the impacts of the 3 landscape components being considered (morphologic and structural component, visual component and symbolic component) in the agricultural plain area related to the presence of the PRT:

- **Morphologic and structural impact:** the new structures of the PRT are located in an area where similar systems are not currently located; these could alter the continuity of the relationship between historical and cultural elements. However, considering the limited height of the planned buildings and the foreseen mitigation measures that limit the alteration of the site’s morphological characteristics, the impact magnitude on the morphologic and structural component is considered Medium.
• **Visual impact:** the presence of the PRT will only constitute a visual obstacle for those views close to the area (less than 500 m), while from the other viewpoints the structures will be hidden by the olive trees, the forest and the morphological drainage located east of the area,. Therefore, the overall magnitude of the visual impact is classified as Medium. Moreover, the PRT, operating 24 hours a day, will also be illuminated at night, causing a potential light impact. Considering that the structures of the PRT are relatively low (the highest is about 10 m), not be visible from the town of Melendugno and all necessary mitigation measures will be taken to reduce the night-time light impact, it is confirmed that the magnitude of the visual impact shall be **Medium**.

• **Symbolic impact:** the agricultural plain area is characterised by the presence of historical and archaeological evidence dating back to ancient settlements in Salento. The project does not interfere directly with the aforementioned historical and archaeological sites. Structures of the PRT will be only marginally visible from the surrounding areas, since they are partially hidden by vegetation. In conclusion, the impact magnitude on the symbolic component is classified as **High**.

The impact on landscape deriving from PRT is evaluated by comparing the landscape value (the **Sensitivity of the agricultural plain area**) with the value of the impacts on landscape associated with the presence of the PRT (the **Impact Magnitude**).

The results of this analysis take into account the Sensitivity of the agricultural plain area and the Magnitude of the previously evaluated impact. Overall, the Sensitivity of the agricultural plain area is **Medium** and the Impact Magnitude due to the presence of the PRT is considered **Medium**.

Therefore, according to the applied methodology listed in Annex 6 (**Methodology of the ESIA**) and discussed in detail in Annex 8 (**Landscape Impact Assessment**) the impact is classified as Moderate, or rather considered tolerable.

### 8.5.5.4 Decommissioning

Potential impacts during decommissioning phase are likely to be similar to impacts during the construction phase (for PRT and BVS areas).

For the pipeline decommissioning, considering that the pipes will remain underground and they will be only filled with a suitable material (e.g. sand), the related impacts on Landscape will be **not significant**.
8.6 Onshore Biological Environment

8.6.1 Flora and Vegetation

8.6.1.1 Overview

Potential impacts to flora and vegetation will include various degrees of disturbance as a result of construction and operation of the TAP Project. It will potentially impact these two natural components through loss of habitats upon which they rely. Flora and vegetation will be also affected by possible changes to their environment including:

- Degradation of water quality;
- Soil degradation;
- Deposition of dust and exposure to atmospheric pollutants.

Habitat fragmentation will be another source of possible changes in the long term. Furthermore the introduction or range expansion of alien species may also have wider secondary impact.

The following box shows the key sources of impact, the potentially impacted resources and receptors, the baseline influencing factors and the project influencing factors associated with the impacts of the TAP Project on flora and vegetation.

**Box 8-19 Key Sources of Impact, Potentially Impacted Resources and Receptors**

**Sources of Impact:**
- Temporary land-take for Project construction activities of a total 37.5 ha (pipeline working strip; work sites, access roads, temporary infrastructure and safety zones around work areas).
- Permanent land-take for Project operation
- Environmental pollutants from Project areas

**Potentially Impacted Resources and Receptors:**
- Native plant species
- Native plant communities
- Abiotic factors in ecosystems

**Baseline Influencing Factors**
- A large number of species with high conservation value
- Occurrence of natural vegetation, especially near the coastline
- A locally important wetland (Palude di Cassano)
- A relevant group of alien species

**Project Influencing Factors:**
- Location of RoW and other work sites; amount of machinery in use during the construction phase; water management; work site management, waste management and traffic management.

The following table presents the key potential impacts of the TAP Project on flora and vegetation.
**Table 8-122  Key Impacts – Flora and Vegetation**

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Loss of natural vegetation (and secondary plant species)</td>
<td>• Local and minor emissions from PRT</td>
<td>• Same potential impacts as during construction</td>
</tr>
<tr>
<td>• Degradation of abiotic components in ecosystems (water, soil and air)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Invasion of alien species</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Impacts relating to each of the three main Project phases (first construction, subsequently operation and maintenance, and finally decommissioning) are described below prior to presenting any mitigation measures to be adopted by the TAP Project. A summary of residual impacts is shown in a table taking into account the application of mitigation, where necessary.

8.6.1.2  Construction Phase

Most direct impacts on flora and vegetation are likely to take place during the construction period, when land areas need to be occupied by several project operations:

- about 21 ha for the pipeline working strip (8.2 km length of open trench, considering microtunnel; conservatively 26 m wide);
- about 2.6 ha for the microtunnel worksite;
- about 12 ha for the PRT construction site;
- 182 m² for the Block Valve Station (BVS, 13x14 m);
- about 1.5 ha for the access roads to PRT and BVS (2,311 m length, assuming a 6.5 m wide road);

During construction, a total of about 37 ha will be required by the TAP Project. Figure 8-24 provides a geographic overview of impacts in relation to the importance of each plant communities (see Table 8-123).

Project construction is expected to last 6 months (plus 3 months for pre-commissioning) for onshore pipeline construction activities and 18 months for construction of the Pipeline Receiving Terminal (PRT).

8.6.1.2.1  Potential Impacts

**Loss of Natural Vegetation**

Temporary or permanent occupation of the soil will result in the complete removal of vegetation and then of plant species that grow in the 37 hectares of land required by the TAP Project. There are two types of impact which, without mitigation, can be described as follow:

- Loss of natural or semi-natural communities - Small magnitude;
- Loss of plants of conservation interest - Small magnitude.

Loss of natural or semi-natural plant communities

Based on the criteria defined in Annex 6, the plant communities are classified as in Table 8-123.

**Table 8-123 Classification of Plant Communities in Relation to Importance and Sensitivity Criteria**

<table>
<thead>
<tr>
<th>Communities</th>
<th>Natural -ity</th>
<th>Fragility</th>
<th>Representative -ness</th>
<th>Species rarity</th>
<th>Species richness</th>
<th>Maturity</th>
<th>European Habitat</th>
<th>Overall Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coastal communities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sand dune vegetation</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Cliff vegetation</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>Coastal garrigues and maquis</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>Juniper shrubland</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Pine shrubland</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>Coastal woodland</td>
<td>Pine</td>
<td>High</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Continental communities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Swamp</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Pseudo-steppe</td>
<td>Medium</td>
<td>High</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Continental garrigues and maquis</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
<td>Medium</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Rosemary shrubland</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
<td>Medium</td>
<td>Low</td>
<td>Medium</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>Inland shrubland</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>Medium</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>Continental woodland</td>
<td>Holly Oak</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Synanthropic communities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weed communities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arable field</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Tree plantation</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Ruderal vegetation</td>
<td>Medium</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>IAL00-ERM-643-Y-TAE-1008</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Project Title:** Trans Adriatic Pipeline – TAP
**Document Title:** ESIA Italy - Section 8 Assessment of Impacts and Mitigation Measures

**Figure 8-24** Quality/Importance of the Community Types within the 2 km Corridor

Source: ERM (2013)

*Figure 8-24* provides a geographic overview of impacts in relation to quality/importance of the community types within the 2 km corridor (Study Area). Characteristics of the plant communities are described below:
**Pipeline Corridor** – About 95% of the pipeline corridor exhibits a low priority level in plant communities, which are mainly represented by olive plantations (89%) (However monumental olive trees are considered of high value for CH and Landscape aspect, as discussed in Sections 8.8 and 8.5.5). Weed communities (*Stellarietea*) are the only spontaneous “vegetation” in these cultivated areas. Medium or high priority areas, respectively Rosemary scrubland and pseudo-steppes, are barely affected by the pipeline corridor (as they cover 0.5% and 4.1% of the pipeline working areas, respectively). However, these medium/high priority communities are scarcely representative of typical Rosemary scrubland and pseudo-steppes (i.e. orchids were not recorded in those areas), because they mainly derived from arable fields recently abandoned. In the case of the removal of natural vegetation (medium priority lands) the impacts could likely extend until the natural vegetation layer is reinstated. Microtunnelling will be used in the landfall area to avoid any impact on the shoreline, where medium-high important plant communities occur widely; as a result, those communities will not be directly affected.

**Figure 8-25 Pseudo-steppe (Kp 7.250)**

Source: ERM (April 2013)

**Work Sites** – The location of the main construction site (approximately 12 ha in size) is planned at the end of the route, in an arable field where the PRT will later be built. This area will also be used as the sole stockyard for the entire section of pipeline. The area exhibits a low priority level for natural vegetation.

**Construction work sites, laydown areas and other temporary infrastructure** – A temporary worksite is planned for the landfall microtunnel end (Kp 0) and BVS location. It will be situated in an olive plantation which hosts vegetation with a low priority level.
Access Roads – Existing roads will be used to access construction areas where possible, to minimize disturbance to the land surface. However, two new short roads will be built (respectively from Melendugno-Vernole road and Melendugno-Martignano road) to provide access to the main construction site (PRT) and one new road will be built to provide access to BVS area. All new roads will be located in arable fields and olive plantations.

In conclusion, temporary impacts will arise from the working strip, construction sites which will be reinstated to pre-construction conditions once construction is completed. Permanent impacts will arise from the PRT and BVS, which will have to be cleared of vegetation. The overall magnitude of the impacts on vegetation will be Small and in accordance with the average sensitivity value (i.e. Medium), the evaluation of impact significance will be Minor.

Loss of conservation interest species

Based on the criteria defined in Annex 6, 47 plant species of conservation interest are classified as in table below.

Table 8-124 Species Evaluated Accordingly their Priority Importance

<table>
<thead>
<tr>
<th>Species</th>
<th>Common name</th>
<th>Habitats dir.</th>
<th>IUCN Status</th>
<th>End.</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aldrovanda vesiculosa L.</td>
<td>waterwheel plant</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
<td>high</td>
</tr>
<tr>
<td>Anthemis chia L.</td>
<td>-</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>low</td>
</tr>
<tr>
<td>Anthemis hydruntina H. Groves</td>
<td>-</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>low</td>
</tr>
<tr>
<td>Aurinia leucadea (Guss.) Koch</td>
<td>-</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
<td>high</td>
</tr>
<tr>
<td>Baldellia ranunculoides (L.) Parl.</td>
<td>lesser water-plantains</td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>medium</td>
</tr>
<tr>
<td>Bassia hirsuta (L.) Asch.</td>
<td>hairy smotherweed</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>low</td>
</tr>
<tr>
<td>Campanula versicolor Andrews</td>
<td>-</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>low</td>
</tr>
</tbody>
</table>
## Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Common name</th>
<th>Habitats dir.</th>
<th>IUCN Status (CR or EN)</th>
<th>End.</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carum multiflorum (Sibth. et Sm.) Boiss. subsp. multiflorum</td>
<td>-</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>low</td>
</tr>
<tr>
<td>Centaurea leucadea Lacaita</td>
<td>-</td>
<td>no</td>
<td>no</td>
<td>yes</td>
<td>low</td>
</tr>
<tr>
<td>Centaurea nobilis (H. Groves) Brullo</td>
<td>-</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
<td>high</td>
</tr>
<tr>
<td>Centaurea subtilis Bertol.</td>
<td>-</td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>medium</td>
</tr>
<tr>
<td>Convolvulus sabatius Viv. subsp. sabatius</td>
<td>-</td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>medium</td>
</tr>
<tr>
<td>Cressa cretica L.</td>
<td>-</td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>medium</td>
</tr>
<tr>
<td>Dianthus japonicus Bianco et Brullo</td>
<td>-</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
<td>high</td>
</tr>
<tr>
<td>Carum multiflorum (Sibth. et Sm.) Boiss. subsp. multiflorum</td>
<td>-</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>low</td>
</tr>
<tr>
<td>Echinops spinosissimus Turra subsp. spinosissimus</td>
<td>-</td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>low</td>
</tr>
<tr>
<td>Ephedra foemina Forssk.</td>
<td>-</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>low</td>
</tr>
<tr>
<td>Erica forskali Vitm.</td>
<td>-</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>low</td>
</tr>
<tr>
<td>Hydrocotyle vulgaris L.</td>
<td>marsh</td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>medium</td>
</tr>
<tr>
<td>Ipomoea sagittata Poir.</td>
<td>saltmarsh morning glory</td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>medium</td>
</tr>
<tr>
<td>Isoëtes todaroana Troia &amp; Raimondo</td>
<td>-</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>low</td>
</tr>
<tr>
<td>Limonium monopetalum (L.) Boiss.</td>
<td>-</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>low</td>
</tr>
<tr>
<td>Limonium bellidifolium (Gouan) Dumort.</td>
<td>-</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>low</td>
</tr>
<tr>
<td>Limonium japonicum (Groves) Pign.</td>
<td>-</td>
<td>no</td>
<td>no</td>
<td>yes</td>
<td>low</td>
</tr>
<tr>
<td>Marsilea strigosa Willd.</td>
<td>water clover</td>
<td>yes</td>
<td>no</td>
<td>no</td>
<td>medium</td>
</tr>
<tr>
<td>Micromeria microphylla (d’Urv.) Benth.</td>
<td>-</td>
<td>no</td>
<td>no</td>
<td>yes</td>
<td>low</td>
</tr>
<tr>
<td>Nymphaea alba L. subsp. alba</td>
<td>white water lily</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>low</td>
</tr>
<tr>
<td>Ophrys fuciflora (Crantz) Moench subsp. candida Nelson</td>
<td>-</td>
<td>no</td>
<td>no</td>
<td>yes</td>
<td>low</td>
</tr>
<tr>
<td>Ophrys fuciflora (F.W. Schmidt) Moench subsp. apulica O. &amp; E. Danesch</td>
<td>-</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>low</td>
</tr>
<tr>
<td>Ophrys fuciflora (F.W. Schmidt) Moench subsp. parvimaculata O. &amp; E. Danesch</td>
<td>-</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>low</td>
</tr>
<tr>
<td>Ophrys oxyrrhynchos (Tod.) Soó subsp. celiensis O. et E. Danesch</td>
<td>-</td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>medium</td>
</tr>
<tr>
<td>Ophrys tinvard O. Danesch &amp; E. Danesch</td>
<td>-</td>
<td>no</td>
<td>no</td>
<td>yes</td>
<td>low</td>
</tr>
<tr>
<td>Orchis palustris Jacq.</td>
<td>lax-flowered marsh orchid</td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>medium</td>
</tr>
<tr>
<td>Ornithogalum adalgisae H. Groves</td>
<td>-</td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>medium</td>
</tr>
<tr>
<td>Periploca graeca L.</td>
<td>silk vine</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>low</td>
</tr>
<tr>
<td>Pilularia globulifera L.</td>
<td>pillwort</td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>medium</td>
</tr>
<tr>
<td>Plantago subulata L. var. grovesii Beg.</td>
<td>-</td>
<td>no</td>
<td>no</td>
<td>yes</td>
<td>low</td>
</tr>
<tr>
<td>Potamogeton filiformis Pers.</td>
<td>slender-leaved pondweed</td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>medium</td>
</tr>
<tr>
<td>Quercus ithaburensis Decne. subsp. macrolepis (Kotschy) Hedge et Yalt.</td>
<td>-</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>low</td>
</tr>
<tr>
<td>Senecio gibbosus (Guss.) DC. subsp. gibbosus</td>
<td>-</td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>medium</td>
</tr>
<tr>
<td>Serapis orientalis Nelson subsp. apulica Nelson</td>
<td>-</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>low</td>
</tr>
<tr>
<td>Stipa austroitalica Martinovský subsp. appendiculata (Celak.) Moraldo</td>
<td>-</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
<td>high</td>
</tr>
<tr>
<td>Triticum biunciale (Vis.) K. Richter</td>
<td>-</td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>medium</td>
</tr>
<tr>
<td>Triticum uniaristatum (Vis.) K. Richter</td>
<td>-</td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>medium</td>
</tr>
<tr>
<td>Umbilicus chloranthus Heldr. et Sart. ex Boiss.</td>
<td>green Venus’ navel</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>low</td>
</tr>
<tr>
<td>Urginea fugax (Moris) Steinh.</td>
<td>-</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>low</td>
</tr>
</tbody>
</table>
According to Table above, eight species are probably present in the Study Area (Low Interest species: *Anthemis hydruntina*, *Nymphaea alba*; Medium Interest species: *Hydrocotyle vulgaris*, *Ipomoea sagittata*, *Orchis palustris*, *Ornithogalum adalgaee*, *Periploca graeca*; High Interest species: *Stipa austroitalica*), and eight species are certainly present in the Study Area (Low Interest species: *Erica forskalii*, *Isoëtes todaroana*, *Ophrys fuciflora* subsp. *apulica*, *Ophrys fuciflora* subsp. *candica*, *Ophrys fuciflora* subsp. *parvimaculata*, *Ophrys tardans*, *Plantago subulata* var. *grovesii* and *Serapias orientalis* subsp. *apulica*). It is notable that all the latter species are of Low Interest. All the species grow in natural (sea cliffs, wetlands, garrigues, maquis and woodlands) or semi-natural (pastures and pseudo-steppes) vegetation. However, the community types affected by the TAP Project are mostly synanthropic and therefore the impact on the plant species of conservation interest are limited to small patches in which natural or semi-natural vegetation occurs. According to species ecology and local distribution, species of conservation value do not occur in the patches directly affected by the project.

In conclusion, the overall magnitude of the impacts on flora will be Small and, in accordance with the average sensitivity value (i.e. Medium), the evaluation of impact significance will be **Minor**.

### Degradation of abiotic components in ecosystems

Three abiotic components in ecosystems may potentially affect flora and vegetation. Without mitigation, they can be described as follow:

- degradation of soil: Small magnitude;
- alteration of water quality: Small magnitude;
- modification of air quality: Small magnitude.

Modification of topsoil characteristics (fertility, texture, etc.) greatly affects plant growth, especially in natural habitats. However, TAP Project earthworks are limited to strips and small areas where natural or semi-natural habitats are very limited in extension. Thus, soil degradation will be unlikely to occur.

The RoW will cross an artificial drain of “Palude di Cassano”, where some water organisms (including plants, although of negligible conservation value) are present along its banks and riverbed. Furthermore, the pipeline will be located near the “Palude di Cassano” basin, a locally important wetland lacking protection status. Sediment plumes from working strip and access roads due to rainwater runoff may reach the water basin (and the channel), as well as accidental spill of oil and chemicals from machinery. Thus, the water quality of the basin systems may be potentially affected by the TAP Project (see section 8.6.1.2.2).
The dust generated from earth movement, excavation, vehicle movement, stockpiles, unpaved surfaces, etc. along the working strip and access roads and in work sites could be deposited on plants, reducing photosynthetic capacity of leaves. If dust deposition occurs during the growing season, the impact can be particularly significant, although concentrated in a short time period (about 6 months). However, due to the typical climatic conditions, the growing season is limited to wetter periods (from autumn to spring), when some precipitation is expected to wash dust from leaves, greatly reducing the loss of photosynthetic capacity.

Atmospheric emissions from machinery and vehicles (i.e. generators, excavators, bulldozers, side booms, trucks, cars, hydrotesting compressors, etc.) will be another source of potential effects on air quality for plants. Limits on the emissions, in particularly on NOx (the most important gas impacting on vegetation, because SO2 emission will not occur from the TAP Project), are reported in the in Legislative Decree 155/2010, in which the allowed annual average concentration is set to 30 µg/m³.

Best practices and good management of the working sites are the main mitigation measures to be taken in order to mitigate impacts on air quality arising from the Project construction phase. The impact on air quality will be localized to the TAP Project work sites and their surroundings, where the emissions (CO – NOx – PM10) will be well below the extent permitted by law (see section 8.5.1). It must be noted that the TAP Project activity will not emit SO2 in the atmosphere as sulphur free fuel will be used. Both the amount of the emissions and the extent of the Project are limited; thus, the impact on flora and vegetation appears to be small.

In accordance with the average sensitivity value (i.e. Medium), the evaluation of impact significance is expected to be Minor, as follow detailed:

- soil degradation: Minor;
- alteration of water quality: Minor;
- modification of air quality: Minor.

**Alien plants**

According to the IUCN (International Union for Conservation of Nature and Natural Resources), invasive alien species are the second worldwide leading cause of decline of biological diversity, after the alteration of natural habitats. Article 8 of the Convention on Biological Diversity advocates the prevention of new introductions and the control or eradication of invasive species already established.
Linear infrastructures (such as pipelines and roads), possibly near uncultivated lands, are one of the sources of the spread of alien plants. Road improvements may facilitate the accessibility and subsequent deliberate introduction (i.e. planting alien trees for ornamental or forestry purpose) or accidental spread (e.g. seeds in the soil attached to vehicle tyres) of exotic plants. In the Study Area several alien species are already present, even in natural communities. However, the majority of aliens are common weeds, especially in farmlands. According to the potential impact on plant communities from the TAP Project and ecological and biological characteristics of the most invasive alien species occurring in the Study Area, only *Ailanthus altissima* is expected to be able to expand its range in the natural habitats altered by the TAP Project.

In conclusion, the impact magnitude is Small. In accordance with the average sensitivity value of the natural vegetation (i.e. Medium), the evaluation of impact significance will be Minor.

8.6.1.2.2 Mitigation measures

**Loss of Natural Vegetation**

It is noticeable that no woodland transformation is required by the TAP Project, because construction techniques alternative to open cut trenching and backfilling will be used where the RoW crosses the woodlands (i.e. Mediterranean maquis in the landfall area).

The Ministerial Decree 18 May 2001, n. 227 (Paragraph 6, article 2) quoted that "pending the publication of regional regulations referred to in paragraph 2, and unless otherwise already defined by the regions themselves, woodlands are considered areas covered by forest vegetation with or without trees and shrubs occurring naturally or artificially, at any stage of development, and including chestnut woods, cork oak woods and Mediterranean maquis". The Apulia Region approved a Forest Law of detail (Regional Law 30 November 2000, no. 18 and later Regional Law 25 May 2012, no. 12) that has not established a minimum area defined as forest nor a minimum percentage of crown cover in establishing "Mediterranean maquis". A small patch of Rosemary and Rock roses scrubland will be located within the pipeline corridor. However, that community is physiognomically a garrigue, not a maquis, recently originated from abandoned fields and in view of that it should not be considered as a woodland.

Two monitoring plans, pre-construction and post-construction, must be performed to verify the effect of the use of microtunnelling, road improvement and other constructions on flora and vegetation at the end of each growing season. The post-operam surveys will be carried out after the end of the works, for a period of 1-3 years. Any dead tree must be replaced with plants of the species listed in Table 8-125 below, especially with holly oak trees (*Quercus ilex*).
Before the start of TAP Project works, a Biodiversity Action Plan (BAP) will be developed. The BAP will include a monitoring plan for the plant species to collect information about local populations of priority importance species, especially orchids and endemic species. The floristic surveys are planned in spring (April-May), when the majority of species is flowering. If a population of priority important species is directly affected by works in the Project, the plants will be transplanted to a new area at the end of the growing season. If this is not possible (e.g. the transplant is technically impracticable), a conservation plan on the species will be required to grow a nearly equivalent number of plants, by methods such as reproduction ex situ (i.e. out of the natural habitat) for subsequent transplanting in situ (within the natural habitat).

**Degradation of Abiotic Components of Ecosystems**

According to Italian established practice, standard onshore pipeline construction has the following main elements:

- The working strip requires a width of 26 m maximum. Fertile top soil (typically 0.3-0.5 m thick) shall be stripped off over this strip. Top soil is temporarily stored on one side of the working strip.
- Non-fertile “subsoil” obtained from pipeline trench excavation shall be stored on the opposite side of the working strip.
- Fertile top soil must be promptly re-deposited on top of the non-fertile soil to ensure adequate crop or vegetation growth.

This practice appears adequate to minimize soil degradation and therefore plant and vegetation recovery. In addition, revegetation (i.e. the sowing of native herbaceous species on top soils and/or the planting of native shrubs/trees, see table above) will be generally more suitable to reduce soil degradation in or close to natural habitats.

To reduce possible impact from modification of water quality in the “Palude di Cassano”, potential preventive/mitigation measures will be properly undertaken as reported in the Section 8.5.3 Impact Assessment on Water Environment.
Alien Plants

The BAP will include a monitoring plan for the most invasive alien species, to record their populations in the Study area. The results of the ante and post-operam monitoring will allow to define an eradication plan aimed at removing new populations potentially spreading throughout the Project areas. In addition, prompt revegetation (i.e. sowing native herbaceous species and/or planting native shrubs/trees) on bare soil with natural or semi-natural vegetation will reduce the spread of alien species.

The following table presents a summary of the assessment on potential impacts on flora and vegetation during the construction phase.

### Table 8-126 Evaluation of Impact Significance for Flora and Vegetation - Construction Phase

<table>
<thead>
<tr>
<th>Potential impact</th>
<th>Magnitude</th>
<th>Sensitivity</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of natural vegetation:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss of natural or semi-natural communities</td>
<td>Small</td>
<td>Medium</td>
<td>Minor</td>
</tr>
<tr>
<td>Loss of plants of conservation interest</td>
<td>Small</td>
<td>Medium</td>
<td>Minor</td>
</tr>
<tr>
<td>Degradation of abiotic components in ecosystems:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degradation of soil</td>
<td>Small</td>
<td>Medium</td>
<td>Minor</td>
</tr>
<tr>
<td>Alteration of water quality</td>
<td>Small</td>
<td>Medium</td>
<td>Minor</td>
</tr>
<tr>
<td>Modification of air quality</td>
<td>Small</td>
<td>Medium</td>
<td>Minor</td>
</tr>
<tr>
<td>Alien plants</td>
<td>Small</td>
<td>Medium</td>
<td>Minor</td>
</tr>
</tbody>
</table>

8.6.1.2.3 Residual impacts

Temporary impacts will arise from the land takes (working strip, work sites), which will be reinstated to pre-construction conditions once construction is completed. At a limited number of sites permanent impacts will arise from the installation of above ground structures like the PRT and block valve station, where existing vegetation will need to be cleared. However, the land takes will be mainly located in artificial habitats (e.g. olive plantations), and marginally in natural and semi-natural vegetation. Before the start of TAP Project works, a Biodiversity Action Plan will be developed which will include a monitoring plan for the plant species to collect information about local populations of orchids and endemics; if a population of these species is directly affected by Project works, a conservation plan will be implemented.

Modifications in abiotic components of ecosystems will possibly arise from the TAP Project. However, the works in the Project will be limited to strips and areas where natural or semi-natural plant communities are very limited in extension and the recovery of the fertile top soil will be carried out properly. Furthermore, the pipeline will be located near the “Palude di Cassano” water basin, a locally important wetland lacking protection status, where actions are taken to prevent alteration in water quality.
The TAP Project may directly or indirectly facilitate the spread of alien plants. However, most aliens are common weeds, especially in farmlands. A monitoring plan on the most invasive alien species and prompt revegetation (i.e. sowing native herbaceous species on top soils, planting native shrubs/trees) on exposed soil in natural or semi-natural vegetation will also reduce their spread.

If carried out properly, the mitigation commitments, including the BAP and associated monitoring plans and the resulting actions (e.g. conservation plans on priority species), are regarded as more than sufficient to reduce the potential impacts on flora and vegetation. All residual impacts must be considered not significant and therefore no further mitigations/compensations are required.

The following table presents a summary of the residual impact.

### Table 8-127 Residual Impacts on Flora and Vegetation - Construction Phase

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Mitigation Commitments to Address the Impact / Risk *</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flora and Vegetation – Construction Phase</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Loss of natural vegetation | • Minimisation of natural habitat loss in locating TAP work sites  
• Microtunnelling method adopted when crossing natural habitats  
• Monitoring plan to verify the effect of the TAP Project on vegetation  
• Monitoring plan to record populations of species of priority importance  
• Translocation of target populations or conservation plan of species of priority importance | Not Significant  
• Work sites need to be cleared of spontaneous natural vegetation  
• Mitigations ensure a complete recovery of natural plant communities and target plant populations |
| Degradation of abiotic components in ecosystems | • Recovery of top soil in the trench  
• Avoidance of displacement of pollutants in the wetland  
• Revegetation in or close to natural habitats  
• Monitoring plan to record water quality in the wetland | Not Significant  
• Degradation of soil, water and air quality are limited to the work sites and the close surroundings  
• Mitigations will minimize the risk of accidental discharge and the related potential effects on the biotic components |
| Alien plants | • Monitoring plan to record populations of invasive alien species  
• Eradication plan to remove new populations  
• Revegetation with native species | Not Significant  
• The TAP Project may enhance the spreading of alien plant species  
• Mitigations will avoid the spreading of alien species |

* Mitigation measures in italic will be developed in a further stage of the project
8.6.1.3 Operation Phase

During project operations, no significant impacts on flora and vegetation are expected. Impacts will be limited to permanent land take, as a result of the PRT and BVS. The total land take caused by the Project operation phase, will be approximately 14 ha and connected with the following project components:

- about 13.5 ha: PRT and related access road; and
- 182 m²: Block Valve Station (BVS).

8.6.1.3.1 Potential Impacts

Loss of natural vegetation

Permanent occupation of the soil will result in the complete removal of vegetation and then of plant species that grow on the lands required over the long term by the PRT, BVS and new road. However, these areas will be without spontaneous plant communities, which are removed during the previous phase (construction phase). In that phase the mitigations are considered necessary and sufficient to reduce the impacts, so that the residual impacts will be minimized.

The impact magnitude is therefore Small during the operation phase. In accordance with the average sensitivity value (i.e. Low), the evaluation of impact significance is Not Significant.

Habitat Fragmentation

Habitat fragmentation is not an important impact on flora and vegetation in the Study Area. Natural or semi-natural plant communities are only marginally affected by the TAP Project. Therefore, typical effect of habitat fragmentation (i.e. the emergence of discontinuities in an organism's preferred environment) will not occur even in the natural plant communities directly affected by the TAP Project.

The impact magnitude is therefore Small. In accordance with the average sensitivity value (i.e. Low), the evaluation of impact significance is Not Significant.

Degradation of abiotic components in ecosystems

During the operation phase, the PRT will not produce significant emissions, as the only emissions into the atmosphere will be related to the activity of the PRT heaters, which have a minor impact on local air quality.

The air emissions will be therefore not significant during the operation phase (impact magnitude: Small). The receptor sensitivity is Low; therefore the impact evaluation is Not Significant.

The following table presents a summary of the assessment on the potential impacts on flora and vegetation during the operation phase.
8.6.1.3.2 Mitigation Measures

**Loss of natural vegetation**

The impact evaluation is considered Not Significant; thus, no mitigation measures will be necessary.

**Habitat fragmentation**

The evaluation of habitat fragmentation on flora and vegetation is considered Not Significant; thus, no mitigation measures will be necessary.

**Degradation of Abiotic Components in Ecosystems**

The evaluation of this impact is considered Not Significant; thus, no mitigation measures will be necessary.

8.6.1.3.3 Residual impacts

Residual impacts on flora and vegetation are considered to be **Not Significant**.

The permanent occupation of the soil will result in the complete removal of vegetation and then of plant species that grow on the areas permanently required by the PRT, BVS and by the new roads. However, all these areas mostly lack natural vegetation.

As already stated in the **Section 8.6.1.3.1**, Habitat fragmentation is not considered an important impact on flora and vegetation in the Study Area.

As reported above, emissions will not be significant during the operation phase; therefore no residual impacts are recognized during the operation phase.

The following table presents a summary of the potential impacts during the operation phase.

<table>
<thead>
<tr>
<th>Potential impact</th>
<th>Magnitude</th>
<th>Sensitivity</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of natural vegetation:</td>
<td>Small</td>
<td>Low</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Habitat fragmentation:</td>
<td>Small</td>
<td>Low</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Degradation of abiotic components in ecosystems:</td>
<td>Small</td>
<td>Low</td>
<td>Not Significant</td>
</tr>
</tbody>
</table>
Table 8-129  Residual Impacts on Flora and Vegetation - Operation Phase

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Mitigation Commitments to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flora and Vegetation – Operation Phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss of natural vegetation</td>
<td>• None</td>
<td>Not Significant</td>
</tr>
<tr>
<td></td>
<td>• Spontaneous plant communities are removed in the construction phase; in that phase the mitigations are considered necessary and sufficient to reduce further impacts</td>
<td></td>
</tr>
<tr>
<td>Habitat fragmentation</td>
<td>• None</td>
<td>Not Significant</td>
</tr>
<tr>
<td></td>
<td>• Natural or semi-natural plant communities are only marginally affected by the TAP Project</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Typical effect of habitat fragmentation (i.e. the emergence of discontinuities in an organism's preferred environment) will not occur</td>
<td></td>
</tr>
<tr>
<td>Degradation of abiotic components in ecosystems</td>
<td>• None</td>
<td>Not Significant</td>
</tr>
<tr>
<td></td>
<td>• Low level of emissions into the atmosphere will be related to the activity in the PRT</td>
<td></td>
</tr>
</tbody>
</table>

8.6.1.4  Decommissioning Phase

The expected lifetime of the TAP project is about 50 years. Decommissioning of the onshore pipeline will be undertaken in accordance with the legislation prevailing at that time, in liaison with the relevant regulatory authorities. The potential environmental effects related to the disturbance of flora and vegetation (indirect impact) will be due to the PRT and BVS decommissioning only, considering that the pipes will remain underground and they will be only filled with a suitable material (e.g. sand). Potential impacts will be therefore similar to those described for the construction phase, but with a smaller magnitude.

8.6.1.4.1  Potential Impacts

Loss of Natural Vegetation

The PRT and BVS areas will be planted with native trees and shrubs and also sowed with native herbaceous species. Thus, no impacts will be identifiable (impact evaluation: Not Significant).

Degradation of Abiotic Components in Ecosystems

During the decommissioning phase, the demolition operations will not produce any significant emission, as the only emissions into the atmosphere will be related to the temporary activity, which have a negligible impact on local air quality (small amount of dust emission).
The emission will therefore not significant during the decommissioning phase (impact magnitude: Small). The receptor sensitivity is Low; therefore, the evaluation of impact significance is **Not Significant**.

The following table presents a summary of the assessment of potential impacts on flora and vegetation during the decommissioning phase. The following table presents a summary of the assessment of potential impacts on flora and vegetation during the decommissioning phase.

Table 8-130  **Evaluation of Impact Significance for Flora and Vegetation - Decommissioning Phase**

<table>
<thead>
<tr>
<th>Potential impact</th>
<th>Magnitude</th>
<th>Sensitivity</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of natural vegetation:</td>
<td>Small</td>
<td>Low</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Degradation of abiotic components in ecosystems:</td>
<td>Small</td>
<td>Low</td>
<td>Not Significant</td>
</tr>
</tbody>
</table>

8.6.1.4.2  **Mitigation Measures**

**Loss of Natural Vegetation**

The evaluation of this impact is considered Not Significant; thus, no mitigation measures will be necessary.

**Degradation of Abiotic Components in Ecosystems**

The evaluation of this impact is considered Not Significant; thus, no mitigation measures will be necessary.

8.6.1.4.3  **Residual impacts**

As stated in the previous sections and summarized in the table, the potential impacts in the decommissioning phase will be not significant. Indeed the decommissioning phase will involve the above-ground buildings only (PRT and BVS areas), where natural vegetation (the interfered areas will be planted with native trees and shrubs, and sowed with native herbaceous species) and / or olive trees are to be reinstated.

In the decommissioning phase, other potential impacts, such as the emission of pollutants, will be extremely low, considering the size of the buildings to be demolished, the number of vehicles, etc. As reported above, air emissions will be non significant during the decommissioning phase. Therefore, because of the limited areas and the constrained time, no significant impacts associated with a small magnitude and receptors with low sensitivity will be generated.

Residual impacts on flora and vegetation are considered **Not Significant**.

The following table presents a summary of the potential impacts in the decommissioning phase.
Table 8-131 Residual Impacts on Flora and Vegetation - Decommissioning Phase

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Mitigation Commitments to Address the Impact / Risk *</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of natural vegetation</td>
<td>• PRT and BVS areas will be planted with native trees and shrubs</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Degradation of abiotic components in ecosystems</td>
<td>• None</td>
<td>Not Significant</td>
</tr>
</tbody>
</table>

*) Mitigation measures in italic will be developed in a further stage of the project

8.6.2 Fauna and Habitats

8.6.2.1 Overview

Potential impacts on wildlife species will include various degrees of disturbance as a result of construction and operation of the TAP Project, including noise, human traffic and the movement of vehicles; fauna may also suffer direct physical injuries.

Wildlife species will also be impacted by loss of habitat, upon which they rely, and the introduction of barriers to movement.

Fauna will thus be impacted by changes to their environment including:

- Noise, light and visual impacts (during construction and to a lesser degree during operation);
- Water quality degradation;
- Soil degradation;
- Barrier effects (during construction);
- Habitat Fragmentation;
- Direct incidental loss of wildlife populations during construction (from road traffic accidents or other);
- Physical changes to soil structures and the local hydrological cycle;
- Deposition of dust and exposure to atmospheric pollutants.

Secondary impacts may occur from increased accessibility (from road improvements) resulting in increased recreational disturbance.
The significance of these potential impacts will be assessed according to the importance of the species involved and the magnitude of the impacts will be predicted on the basis of previous experiences.

The following box shows the key sources of impact, the potentially impacted resources and receptors, the baseline influencing factors and the project influencing factors associated with the impacts of the TAP Project on flora and vegetation.

**Box 8-20 Key Sources of Impact, Potentially Impacted Resources and Receptors**

**Sources of Impact:**
- Temporary land-take for Project construction activities of a total 37.5 ha (pipeline working strip, work sites, access roads, construction sites, temporary infrastructure and safety zones around work areas)
- Permanent land-take for Project operation
- Other physical alteration of ecosystems
- Environmental pollutants discharged into the ecosystems

**Potentially Impacted Resources and Receptors:**
- Wildlife species
- Wildlife communities
- Abiotic factors in ecosystems

**Baseline Influencing Factors:**
- A great number of conservation value species (e.g. freshwater turtles)
- Occurrence of natural vegetation, especially near the coastline
- A locally important wetland (Palude di Cassano)

**Project Influencing Factors:**
- Location of RoW and other work sites; amount of machinery in use during the construction phase; water management; work site management, waste management and traffic management

The following table presents the key potential impacts of the TAP Project on fauna during the project phases.

**Table 8-132 Key Impacts – Fauna**

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Loss of natural vegetation, refuge areas for feeding and reproduction (dry stone walls, maquis, etc.);</td>
<td>• Local and minor emissions from PRT</td>
<td>• Same potential impacts as during construction</td>
</tr>
<tr>
<td>• Home range reduction, decrease in features of ecological networks, habitat fragmentation, and isolation (presence of fences, artificial surfaces, increased traffic, etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Degradation of abiotic components in ecosystems (water, soil and air)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Noise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Light pollution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Increased mortality of wildlife, caused by accidents (collisions with vehicles)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
8.6.2.2 Construction Phase

8.6.2.2.1 Potential Impacts

**Loss of Natural Habitats**

The TAP Project will generate temporary removal of natural or anthropogenic habitats, due to the land take of the soil strip that will be altered and compacted during the works (RoW). As presented in the *Section 8.6.1* (Flora and Vegetation), the work areas will be mainly located in agricultural lands (i.e. olive plantations). The TAP Project will occupy an uncultivated area characterised by olive plantations and dry stone walls, with a potential impact on wildlife communities (particularly birds and reptiles) settled in these habitats. For example, among the species potentially impacted there are: *Otus scops, Parus caeruleus, Parus major, Fringilla coelebs, Certhia brachydactyla, Carduelis chloris* and *Serinus serinus*, as well as some reptiles more typically associated with dry stone walls, such as several species of lizards (*Podarcis muralis* and *Lacerta bilineata*), snakes and geckos, for which the dry stone walls are important for shelter and also act as ecological corridors for dispersal.

The PRT area will be located partially in uncultivated land, where natural and semi-natural vegetation, potentially of high importance, currently grows. This land take will possibly affect species such as *Upupa epops, Galerida cristata, Cisticola juncidis, Lanius minor, Lanius senator*.

The impact caused by the land take, even if characterized by a Medium magnitude (due to the extent of the impacts), has Minor significance, because the impacts will be mainly localized in anthropogenic habitats inhabited by non-priority wildlife species distributed widely in Apulia.

**Alteration of Abiotic Components in Ecosystems**

**Atmospheric emissions and pollutant dispersion**

The digging and handling of top soil, and particularly the increase in vehicular traffic, will cause an increase of dust and gas pollutants. This pollution will be minimized by dust suppression and washing of road surfaces and/or the work areas.
This type of impact will occur mostly at the PRT, as well as along the roads where vehicles pass toward yard areas. Specific attention should be placed in the microtunnel worksites that will be near the sea coast and the Palude di Cassano, where all required environmental safeguards to prevent any leakage of pollutants will be implemented. In these two natural areas there are habitats of some of the most sensitive species included in the present study (i.e. *Emys orbicularis*, *Tachybaptus ruficollis*, *Cettia cetti* and also numerous bats that use the marsh as trophic area). TAP works will not be carried out during the birds’ nesting period, if technically feasible, in order to reduce impacts on wildlife in these two natural areas.

**Noise**

The noise produced by both machinery and vehicles will be a source of impact caused by construction operations.

Wildlife responds to noise by altering activity patterns, such as an increase in heart rate and increased production of stress hormones (Algers et al., 1978). In laboratory animals subjected to severe noises, these effects appear at values between 85 and 89 dB. These levels will not be reached outside the work areas, even though they may be exceeded where there is intense traffic or during hydrotesting activities.

In addition to harmful effects on health, communication problems may occur occasionally. Sometimes animals get used to the increased levels of noise and then apparently return to normal activities (Bomford & O’Brien, 1990), but birds and other wildlife species that communicate using sound signals may be affected by the proximity of noise sources.

Excessive noise levels may also affect the reproductive behaviour of several species, as shown for some species of amphibians (Barrass, 1985). Although the effects of noise disturbance are more difficult to measure than other types of pollution, such as air pollution, acoustic disturbance is considered one of the main causes of environmental pollution in Europe (Vagent & Rietveld, 1993; Lines et al., 1994).

Studies have been performed to identify the species most strongly affected by noise pollution, as well as critical thresholds of disturbance in relation to specific noise sources. The species characterised by the following characteristics should be considered the most vulnerable to disturbance (Hill et al., 1992): large size, long lifespan, with relatively low reproductive rates; especially specialists to particular habitats, such as exposed (e.g. wetlands) or covered habitats (e.g. forests); rare, with populations concentrated in a few key regions.

In relation to the TAP Project, the main disturbance to wildlife from noise/vibration during construction will fall mainly into the following categories:

- Habitat suitability will decrease in the work areas and nearby areas, and could also lead to a temporary redefinition of areas used for nesting and/or reproduction by wildlife species; and
- Wildlife movement may be reduced because of physical barriers, but also to a lesser extent, due to noise and visual impacts.
The TAP Project is expected to potentially affect wildlife species (especially birds and small mammals) that will be displaced from the work areas to new home ranges. This may result in an alteration of the wildlife communities, in which opportunistic and ubiquitous species are less affected.

During the construction phase transport and work equipment will be a noise source and, therefore, potential for nuisance to wildlife. Similarly, the realization of microtunnel operations will be a source of noise and vibrations.

The construction activity will be temporary and will be performed only during daytime (so, there is no potential noise impact during the night), while some of the most impacted species perform breeding calls at night (e.g. amphibians, some birds) or around dawn (e.g. many birds), and mostly during spring / summer. Therefore, the noise impact during the construction phase will be minor at almost all the receptors, where the cumulative noise pressure level will be always below the standard level (see section 8.5.2). However during the hydrotesting phase, the noise limit for night is exceeded, but only at distance less of about 500 m from the hydrotesting area. The magnitude of impact on wildlife populations will be Small. Wildlife sensitivity is considered to be Low. Therefore, the impact will be Minor.

**Light Pollution**

Light pollution is defined as "Any alteration in the amount of natural light present at night and in outdoor environments due to light from anthropic sources". In Italy, ten regions have produced standards on this subject; in Apulia, the regional law is the No. 15, dated November 23, 2005, and named "Urgent measures for the containment of light pollution and saving energy". Artificial lighting may have a negative impact on wildlife and ecosystems. Alteration in day/night equilibrium, caused by direct artificial light could cause substantial harm, especially to animals (i.e. disorientation of nocturnal birds and mammals, death of moths or butterflies caused by the heat produced from the light sources).

Butterflies, and more generally the order Lepidoptera, suffer from disorientation under artificial light conditions. It is well known that moths set their migration route on the moon or very bright stars. Individual light sources or even concentration of artificial lighting, such as in urban areas, may disorient and attract moths. As a consequence, the migration swarm is dispersed, moths may be not able to reach suitable habitats and may be decimated. Hausmann (1992) conducted research in which he found that the number of moths killed by semi-industrial lamps in areas of southern Italy was considerably high.

Some species of birds (such as some passerines) using the astronomical orientation in their nocturnal migrations may be affected by the presence of artificial light sources. The effects of light pollution also have an impact on many species of birds (especially forest species) that use morning song to attract specimens of the opposite sex (Kempenaers et al, 2010). In some of these species, the males nearby to the artificial light began to sing well ahead of the normal time, as compared to males located within the forest, away from sources of artificial light.
The works of the TAP Project, which will not be carried out in woodlands, will not produce significant impacts in terms of light pollution in the Study Area. However, the artificial illumination at the PRT and BVS may produce limited impact on nocturnal moths.

In conclusion, the impact magnitude is Small. In accordance with the average sensitivity value on wildlife (i.e. Medium), the impact significance will be Minor.

Modification of the Ecological Network

Fragmentation of ecosystems due to linear infrastructure occurs widely in Europe (Prillevitz, 1997). In Italy, it has been the subject of various environmental investigations in the last decade, concerning not only fauna (Perco et al. 1977; Malcevschi et al., 1996; Santolini et al. 1997, 2000, Battisti 2004).

Landscape fragmentation may promote a process of progressive isolation caused by the lack of ecological permeability to movement and also intra-and interspecific interactions, leading to a high reduction in favourable habitats for many species, particularly in terrestrial vertebrates. The consequences on wildlife and ecosystems were reported on different spatial scales by Canters et al. (1997). Overall, landscape fragmentation may lead to (Santolini, 1996, Battisti 2004):

- Isolation and fragmentation of populations, especially if associated to specific habitats;
- Increase of ubiquitous and synanthropic species, and depletion or even extinction of the most-demanding species;
- Increase of edge effect, which reduces the availability of habitats with suitable features for habitat specialists (“interior species”);
- Higher reproductive costs and higher risks of death (e.g. nest predation);
- Higher sensitivity of ecosystems to future alterations;
- Loss of genetic diversity because of genetic drift and inbreeding, which may cause loss of fitness in fragmented populations; and
- Local extinction of one or more species, which may cause further fragmentations of populations; this process becomes irreversible in case of extinction of small and isolated habitats characterised by lower resistance.

The potential effects of habitat fragmentation are related to the ecological requirements of species, such as the home range needed to sustain a minimum viable population, and the habitat area necessary for its reproduction (Andrén 1994, Santolini et al. 2003, Battisti 2004).

Ecosystem fragmentation occurs not just directly, for example because of buildings, fences or the mere presence of artificial surfaces (pavestone, bare soil, etc.), but also indirectly through noise emissions that could be spread even at a considerable distance from the source.
Building areas are potential pollution sources (see previous paragraphs) that may act as barriers due to the enclosed area: this may preclude the wildlife movement and modify their normal biological cycle. The impact acts through a decrease of natural habitats, namely in terms of connectivity and opportunities for interaction and exchange with other habitats within their home range. The impact is particularly severe for specific types of habitat, such as near woodlands and wetlands. When the distances between the habitats become too large and the area of the remaining available habitats becomes too small to support populations, local extinction of the species is a real threat. This threat is higher for amphibians breeding in wetlands, which perform annual migrations between their wetland and upland habitats. Analogous effects have been observed also for other species of terrestrial vertebrates, particularly in reptiles, small mammals and carnivores (Battisti 2004).

However, the TAP Project will overcome this impact by using microtunnelling where the RoW crosses valuable areas (Mediterranean maquis and the coastline). In this way, habitat fragmentation and noise will be extremely reduced, because the works are adequately restricted in terms of both space (linear extension of fences) and time (extent of the construction phase).

In conclusion, the impact magnitude is Small. In accordance with the average sensitivity value in the wildlife (i.e. Medium), the impact significance will be Minor.

**Increasing Collision Rate From Traffic**

The "road mortality", i.e. the mortality rates due to collision, is a negative effect of the increased vehicular traffic, which has been greatly increased in the recent decades and is now the top source of wildlife mortality directly caused by humans. The main reasons causing wild animals to cross roads include voluntary crossing, unintentional incursion on the road, feeding on the remains of animals killed by traffic, and seeking micro thermal conditions, nesting sites or shelter.

All wildlife species may be victims of traffic, although reptiles and some mammals are at higher risk than other species. The highest risk situations occur when biological corridors, along which the animals move, cross roads (e.g. roads that interrupt the annual migration of amphibians between feeding, wintering and reproduction areas).

The construction works of the TAP Project will increase vehicular traffic. The traffic analysis showed that there would be an average increase of traffic estimated in 40 vehicles per day during the construction activities, with a peak of 60 vehicles per day during the excavation and the laying of the pipeline, due to the soil removal from excavation site and the transport of sand used to protect the pipeline.

Even though the traffic is highly relevant, it will be necessary to pay particular attention nearby the Palude di Cassano. In this wetland, the presence of important populations of amphibians (Rana klepton hispanica, Bufo bufo, etc.) and reptiles (e.g. Emys orbicularis) will require special awareness (for example, the potential interference of traffic with the migration of amphibians).
The impact of the slightly increased traffic in the construction phase will be of little consequence on wildlife. In conclusion, the impact magnitude is Small. In accordance with the average sensitivity value in wildlife (i.e. Medium), the impact significance will be **Minor**.

The following table presents a summary of the assessment on the potential impacts on wildlife during the construction phase.

**Table 8-133 Evaluation of Impact Significance for Fauna - Construction Phase**

<table>
<thead>
<tr>
<th>Potential impact</th>
<th>Magnitude</th>
<th>Sensitivity</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of natural habitats</td>
<td>Medium</td>
<td>Low</td>
<td>Minor</td>
</tr>
<tr>
<td>Alteration of abiotic components in ecosystems</td>
<td>Small</td>
<td>Medium</td>
<td>Minor</td>
</tr>
<tr>
<td>Light pollution</td>
<td>Small</td>
<td>Medium</td>
<td>Minor</td>
</tr>
<tr>
<td>Modification in the Ecological Network</td>
<td>Small</td>
<td>Medium</td>
<td>Minor</td>
</tr>
<tr>
<td>Increasing collision rate from traffic</td>
<td>Small</td>
<td>Medium</td>
<td>Minor</td>
</tr>
</tbody>
</table>
8.6.2.2.2 Mitigation Measures

In order to minimize impacts on wildlife, and particularly on species of conservation interest, the definition of an environmental restoration program in which mitigations and compensations are the main necessary actions. In order to properly design the program and before the beginning of the construction phase, it is important to monitor several wildlife species of conservation interest.

The TAP Project will take into account the environmental complexity, to avoid causing additional fragmentation of the limited natural resources within the Study Area. In this view, environmental restoration will address habitat recovery from the ecological point of view and, where possible, to the previous condition.

The main actions are the following:

- Programs to monitor target wildlife species (i.e. amphibians, reptiles, small mammals and birds);
- The disruption of soil horizons resulting from excavation will be avoided by using adequate storage systems of soils that separate fertile layers from deep ones;
- The risk of accidental pollution and pollution due to runoff outside the work areas will be mitigated through the study and implementation of an adequate system for the separation and drainage of the wastewater;
- Enhancement of the recovery of vegetation along roadsides, i.e. planting of hedges, trees and interlayer shrubs, consisting of native species that can increase both the availability of nest sites, shelter and trophic resources for many vertebrate species;
- Planting native tree species on sites previously selected for intervention by compensation for the loss of vegetation during the construction phase, including tree-shrub hedges and dry stone walls. The above-described actions will increase ecological suitability for wildlife;
- Visual inspection of work areas for trapped fauna and their retrieval;
- Capping open pipe sections;
- In order to mitigate light pollution on wildlife and to preserve the view of the night sky, artificial lighting (e.g. in the PRT) will be limited in compliance with best practices;
- Implementation of a Traffic Management Plan; and
- A post-operam monitoring program will allow to ascertain that populations have not been affected by any potential impact, and to identify eventual compensation actions that might be required.
8.6.2.2.3 Residual Impacts

The TAP Project will occupy an uncultivated area characterised by olive plantations and dry stone walls affecting wildlife communities (particularly birds and reptiles) settled in these habitats. The impact caused by the Project land take, even if characterized by a Medium magnitude (due to the extent of the impacts), has Minor significance, because the impacts will be mainly localized in anthropogenic habitats occupied by non-priority wildlife species distributed widely throughout Apulia. To mitigate this impact, the TAP Project will include the plantation of native tree species on sites previously selected for intervention as compensation for the loss of habitats that occurred during the construction phase; tree-shrub hedges and dry stone walls will be also introduced. These actions will contribute to the increase of the ecological suitability for wildlife.

During the construction phase, transport and work equipment will be a noise source with, therefore, potential nuisance to wildlife. The noise could modify the distribution of wildlife species in the surrounding areas. This will result in an oversimplification of the wildlife communities, in which opportunist and ubiquitous species are the least affected. Specific attention will be paid to the microtunnel worksites that will be near the sea coast and the Palude di Cassano, where all necessary environmental safeguards to prevent any leakage of pollutants must be implemented. The risk of accidental pollution and pollution due to runoff from the work areas will be mitigated through the study and implementation of an adequate system for the separation and drainage of waste water.

The TAP Project works will not produce significant impacts in terms of light pollution in the Study Area. However, the artificial illumination at the PRT will produce moderate impacts on nocturnal moths. In order to mitigate light pollution on wildlife and to preserve the view of the night sky, artificial lighting will be limited to critical areas (e.g. for safety).

The TAP Project will avoid modification to the ecological network by using microtunnelling where the RoW crosses valuable areas (the Mediterranean maquis and the coastline). In this way, the habitat fragmentation and noise will be extremely reduced, because the works are adequately restricted in terms of both space (linear extension of fences) and time (extent of the construction phase).

The construction works of the TAP Project will slightly increase road traffic. Even though the traffic increase is modest and not considered of significance in terms of impact, it will be necessary to pay particular attention nearby the Palude di Cassano, where the presence of important populations of amphibians, reptiles and birds will require special awareness.

As reported in the previous sections and summarized in the table below, during the construction phase all the potential impacts will be Minor. If carried out properly, the mitigation commitments, including motoring plans and the resulting actions, are regarded as more than sufficient to reduce potential impacts on wildlife species and their habitats. All the residual impact will be still considered Minor. No further mitigations/compensations are required.
The following table presents a summary of the residual impact associated to the impacts identified.

**Table 8-134 Residual Impacts – Fauna - Construction Phase**

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Mitigation Commitments to Address the Impact / Risk *</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fauna and habitats – Construction Phase</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss of natural vegetation</td>
<td>• Minimisation of natural habitat loss in TAP work sites</td>
<td>Minor</td>
</tr>
<tr>
<td></td>
<td>• Microtunnelling method adopted when crossing natural habitats</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Reconstruction of dry stone walls</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Planting trees and shrubs in hedges</td>
<td></td>
</tr>
<tr>
<td>Alteration of abiotic components in ecosystems</td>
<td>• Avoid alteration of abiotic components through adequate safety facilities</td>
<td>Minor</td>
</tr>
<tr>
<td></td>
<td>• Visual inspection of work areas for trapped fauna and their retrieval;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Capping open pipe sections;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Planting trees and shrubs</td>
<td></td>
</tr>
<tr>
<td>Light pollution</td>
<td>• Lighting in compliance to the best practices</td>
<td>Minor</td>
</tr>
<tr>
<td></td>
<td>• Use of lights limiting the diffusion of light upwards</td>
<td></td>
</tr>
<tr>
<td>Modification in the ecological network</td>
<td>• Microtunnelling technique adopted when crossing natural habitats</td>
<td>Minor</td>
</tr>
<tr>
<td></td>
<td>• Reconstruction of dry stone walls</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Planting trees and shrubs in hedges</td>
<td></td>
</tr>
<tr>
<td>Increasing collision rate from traffic</td>
<td>• Reconstruction of dry stone walls</td>
<td>Minor</td>
</tr>
<tr>
<td></td>
<td>• Planting trees and shrubs in hedges</td>
<td></td>
</tr>
</tbody>
</table>

*) Mitigation measures in italic will be developed in a further stage of the project

8.6.2.3 Operation Phase

During project operations, few potential impacts on fauna and habitats are expected.

8.6.2.3.1 Potential Impacts

The impacts generated during the operation phase will be the same type as those reported for the construction phase and described above. However, during the operation phase impacts will have a lesser magnitude.

**Loss of Natural Habitats**

Loss of natural habitats will occur in the areas permanently occupied by the PRT, BVS and the new roads; this area is of approximately 14 ha.
Alteration of Abiotic Components in Ecosystems

Under the noise limits defined by DPCM 01/03/91, the PRT cumulative noise pressure levels at all receptors (see Section 8.5.2) are in compliance with national legislation for day and night. Also, the maintenance activities anticipated for the PRT equipment will not increase the background noise level in the surrounding areas significantly.

During the operation phase, the PRT will not produce any relevant emission, which have a minor impact on local air quality. Moreover, general pipeline operational maintenance during the operation phase will produce minor emissions that will have negligible atmospheric impacts.

The impacts will be not significant.

Light Pollution

During the operating phase, the light pollution will be due to the PRT illumination. The impact is evaluated less harmful than during the construction phase, because it will affect a smaller area, it will require a lower use of lights and will be in agreement with the current regulations.

For these reasons, the PRT artificial lighting systems do not generally affect wildlife and ecosystems. The radiation from artificial light is limited and will not change the day/night balance of the most vulnerable wildlife species (e.g. disorientation of birds and nocturnal mammals); thus the significance of the impacts caused by artificial lighting is not significant. However, the significance of impacts on moths caused by the heat produced by lights, is classified as minor.

Modification in the Ecological Network

Considering the reinstatement proposed in the construction phase, impacts on the ecological network will be substantially removed.

Increasing Collision Rate From Traffic

The traffic generated during the operation phase will be very low and essentially related to the movement of workers, by minivans or cars, for the PRT operation, planned maintenance and inspection of the pipeline. Accordingly, the impacts will be not significant.

The following table presents a summary of the assessment on the potential impacts on wildlife during the operation phase.
Table 8-135 Evaluation of Impact Significance for Fauna - Operation Phase

<table>
<thead>
<tr>
<th>Potential impact</th>
<th>Magnitude</th>
<th>Sensitivity</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of natural habitats</td>
<td>Small</td>
<td>Low</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Alteration of abiotic components in ecosystems</td>
<td>Small</td>
<td>Low</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Light pollution</td>
<td>Small</td>
<td>Low</td>
<td>Minor</td>
</tr>
<tr>
<td>Modification in the Ecological Network</td>
<td>Small</td>
<td>Low</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Increasing collision rate from traffic</td>
<td>Small</td>
<td>Low</td>
<td>Not Significant</td>
</tr>
</tbody>
</table>

8.6.2.3.2 Mitigation measures

Although the total potential impacts are Not Significant or Minor, it will be important to implement the following measures to maximise the protection of wildlife:

- Monitoring programs for target wildlife species (i.e. amphibians, reptiles, small mammals and birds); and
- Maintenance of the areas planted with native species during the construction phase.

8.6.2.3.3 Residual impacts

Permanent occupation will result in the complete removal of vegetation and of plant species that grow on the 14 hectares of land permanently required by the PRT, BVS and by the new roads.

The Project operation phase will produce low traffic volumes. Emissions from permanent sources (i.e. PRT) will be minor and well below the legal limits.

Light pollution during the operation phase will be due to the security lighting of the PRT. The impacts will be minor and affecting exclusively nocturnal moths.

Considering the proposed restoration in the construction phase, there will not be substantial impacts on the ecological network.

The following table shows a summary of the residual impact associated with the potential impacts.

Table 8-136 Residual Impacts – Fauna - Operation Phase

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Mitigation Commitments to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fauna and habitats – Operation Phase</td>
<td></td>
<td>Not Significant</td>
</tr>
<tr>
<td>Loss of natural vegetation</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>• Spontaneous plant communities are removed in the construction phase; in that phase the mitigations are considered necessary and sufficient to reduce forthcoming impacts</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
8.6.2.4 Decommissioning Phase

The expected lifetime of the TAP project is 50 years. Decommissioning will be undertaken in accordance with the legislation prevailing at that time, in liaison with the relevant regulatory authorities. The potential environmental effects will be only due to the PRT and BVS decommissioning (the pipes will remain underground and they will be only filled with a suitable material, e.g. sand). Potential impacts will be the same type of those described for the operation phase, but with a smaller magnitude.

8.6.2.4.1 Potential Impacts

The decommissioning phase will involve the above-ground buildings only. The decommissioning will be made with equipment similar to the ones anticipated for the construction activities. Therefore, it can be estimated that the potential noise impacts will be similar to the ones foreseen during the construction phase and related to the closest receptors only.

The small areas and the limited time involved by works will generate Minor or Not Significant impacts associated with a small magnitude to and receptors of low sensitivity.

The following table shows a summary of the assessment of potential impacts on wildlife during the decommissioning phase.
Table 8-137 Evaluation of Impact Significance for Fauna - Decommissioning Phase

<table>
<thead>
<tr>
<th>Potential impact</th>
<th>Magnitude</th>
<th>Sensitivity</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of natural habitats</td>
<td>Small</td>
<td>Low</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Alteration of abiotic components in ecosystems</td>
<td>Small</td>
<td>Low</td>
<td>Minor</td>
</tr>
<tr>
<td>Light pollution</td>
<td>Small</td>
<td>Low</td>
<td>Minor</td>
</tr>
<tr>
<td>Modification in the Ecological Network</td>
<td>Small</td>
<td>Low</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Increasing collision rate from traffic</td>
<td>Small</td>
<td>Low</td>
<td>Minor</td>
</tr>
</tbody>
</table>

8.6.2.4.2 Mitigation Measures

The evaluation of the impacts is considered Minor or Not Significant; thus, mitigation measures are not considered necessary.

8.6.2.4.3 Residual Impacts

As stated in the previous sections and summarized in the table, the potential impacts during the decommissioning phase will be not significant or minor. Indeed the decommissioning phase will involve only the above-ground buildings (the PRT and BVS areas), where natural vegetation and/or olive trees are to be restored.

During the decommissioning phase, additional potential impacts (emissions of pollutants, noise, possible collisions, potential fragmentation of ecological corridors, etc.) will be extremely low, considering the size of the buildings to be demolished, the number of vehicles, etc. Therefore, because of the small areas and limited time involved by works, no significant impacts will be generated.

The following table presents a summary of the residual impact associated with the potential impacts.

Table 8-138 Residual Impacts – Fauna - Decommissioning Phase

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Mitigation Commitments to Address the Impact / Risk *</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fauna and habitats – Decommissioning Phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss of natural vegetation</td>
<td>• PRT and BVS areas will be planted with native trees and shrubs</td>
<td>Not Significant</td>
</tr>
<tr>
<td></td>
<td>• Native plant communities are recovered in the work sites</td>
<td></td>
</tr>
<tr>
<td>Alteration of abiotic components in ecosystems</td>
<td>• None</td>
<td>Minor</td>
</tr>
<tr>
<td></td>
<td>• Wildlife species (especially birds and small mammals) will move from the work sites to new home ranges</td>
<td></td>
</tr>
</tbody>
</table>
**Impact / Risk** | **Mitigation Commitments to Address the Impact / Risk** | **Significance of Residual Impact / Risk**
--- | --- | ---
Light pollution | • None | Minor
  *not significant impacts on vertebrates
  Minimal impacts on invertebrates (moths).
Modification in the ecological network | • None | Not Significant
  *Considering the restorations proposed for the loss of natural vegetation, impacts on the ecological network are substantially absent
Increasing collision rate from traffic | • None | Minor
  *Death of wildlife specimens

*) Mitigation measures in italic will be developed in a further stage of the project

### 8.6.3 Protected Areas

#### 8.6.3.1 Overview

Potential impacts on protected areas will include various degrees of disturbance as a result of construction and operation of the TAP Project, especially on species (flora and fauna) and habitats (habitats of community interest and habitats for wildlife) in SCI and SPA. Therefore, species and habitats will be affected by possible changes to their environment including:

- Water quality degradation;
- Soil degradation;
- Deposition of dust and exposure to atmospheric pollutants.

Habitat fragmentation will be another source of possible changes in the long term. Furthermore, the introduction or the range expansion of alien species may also have wider secondary impact.

The following box shows the key sources of impact, potentially impacted resources and receptors, baseline and project influencing factors associated with the impacts of the TAP Project on species and habitats.
Box 8-21  Key Sources of Impact, Potentially Impacted Resources and Receptors

Sources of Impact:
- Temporary and permanent land-take for Project operation
- Other physical alteration in ecosystems
- Environmental pollutants

Potentially Impacted Resources and Receptors:
- Native plant and wildlife species
- Native plant and wildlife communities
- Abiotic factors in ecosystems

Baseline Influencing Factors
- A great number of conservation value species
- Occurrence of natural habitats, especially near the coastline

Project Influencing Factors:
- Location of RoW and other work sites; amount of machinery in use during the construction phase; water management; work sites management, waste management and traffic management

The following table presents the key potential impacts of the TAP project on species and habitats.

Table 8-139  Key Impacts – Species and Habitats

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of refuge areas for feeding and reproduction (dry stone walls, wastelands,</td>
<td>Local and minor emissions from the PRT</td>
<td>Same potential impacts as during construction</td>
</tr>
<tr>
<td>etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home range reduction, decrease in features of ecological networks, habitat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>fragmentation, and isolation (presence of fences, artificial surfaces, increased</td>
<td></td>
<td></td>
</tr>
<tr>
<td>traffic, etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Invasion of alien species</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degradation of abiotic components in ecosystems (water, soil and air)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light pollution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased mortality of wildlife, caused by accidents (collisions with vehicles)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Impacts relating to each of the three main project phases (first construction, then operation and maintenance, finally decommissioning) are described below prior to presenting any mitigation measures that will be adopted by the TAP Project. A summary of residual impacts is shown in a table taking into account the application of mitigation, where necessary.
Annex 9 reports the Appropriate Assessment on Natura 2000 sites located within 5 km from the Project Area.

8.6.3.2 Construction Phase

8.6.3.2.1 Potential Impacts

No direct impacts will be detected, because Protected Areas do not occur in the TAP Project work areas. (The nearest, namely SCI IT9150032 “Le Cesine”, is located at about 2 km from the RoW.)

The impacts on air quality related to the construction phase are mainly short term impacts, due to the relatively temporary nature of construction activities. Best practices and good management of the working site are the main mitigation measures to be taken in order to mitigate impacts on air quality arising from the Project construction phase. The impact on air quality will be localized to the TAP work sites and the surroundings, where the emissions (CO – NOx – PM10) will be well below the extent permitted by law (see Section 8.5.1). It must be noted that the TAP activity will not emit SO2 in the atmosphere as sulphur free fuel will be used.

Taking into account that the construction activity will be temporary and will be performed only during the day, the noise impact during the construction phase will be minor at almost the receptors, where the cumulative noise pressure level will be always below the standard level (see Section 8.5.2). However, in the hydrotesting phase (foreseen also during night time), there may be significant noise pressure levels around the hydrotesting area.

The analysis for the construction phase showed that the impacts generated from construction activities are confined close to the TAP Project work areas. As a result, degradation of abiotic components in ecosystems (e.g. air and water pollutants, noise) will be well below the extent permitted by law. For this reason, the biological components of Protected Areas (SCI / SPA), located at more than 2 km, will not be affected.

The following table presents a summary of the assessment on the potential impacts on species and habitats during the construction phase.

<table>
<thead>
<tr>
<th>Potential impact</th>
<th>Magnitude</th>
<th>Sensitivity</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of refuge areas for feeding and reproduction</td>
<td>Small</td>
<td>Low</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Home range reduction</td>
<td>Small</td>
<td>Low</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Invasion of alien species</td>
<td>Small</td>
<td>Low</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Degradation of abiotic components in ecosystems</td>
<td>Small</td>
<td>Low</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Noise</td>
<td>Small</td>
<td>Low</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Light pollution</td>
<td>Small</td>
<td>Low</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Increased mortality of wildlife</td>
<td>Small</td>
<td>Low</td>
<td>Not Significant</td>
</tr>
</tbody>
</table>
8.6.3.2.2 Mitigation Measures

The impact evaluation is considered Not Significant; thus, no mitigation measures will be necessary.

8.6.3.2.3 Residual Impacts

The analysis for the construction phase showed that the impacts generated from construction activities are confined close to the TAP Project work areas. For this reason, the biological components of Protected Areas (SCI/SPA) located at more than 2 km will not be affected.

The following table presents a summary of the residual impacts associated with the potential impacts.

**Table 8-141 Residual Impacts – Species and Habitats - Construction Phase**

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Mitigation Commitments to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protected Areas – Construction Phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss of refuge areas for feeding and reproduction</td>
<td>• None</td>
<td>Not Significant</td>
</tr>
<tr>
<td>• Direct impacts are not possible because Protected Areas do not occur in the TAP Project work areas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home range reduction</td>
<td>• None</td>
<td>Not Significant</td>
</tr>
<tr>
<td>• Direct impacts are not possible because Protected Areas do not occur in the TAP Project work areas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Invasion of alien species</td>
<td>• None</td>
<td>Not Significant</td>
</tr>
<tr>
<td>• Direct impacts are not possible because Protected Areas do not occur in the TAP Project work areas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degradation of abiotic components in ecosystems</td>
<td>• None</td>
<td>Not Significant</td>
</tr>
<tr>
<td>• Degradation of abiotic components are restricted to the TAP work sites and their closest surroundings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Protected areas are located at a distance at more than 2 km</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise</td>
<td>• None</td>
<td>Not Significant</td>
</tr>
<tr>
<td>• Noise is restricted to the TAP work sites and their closest surroundings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Protected areas are located at a distance at more than 2 km</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light pollution</td>
<td>• None</td>
<td>Not Significant</td>
</tr>
<tr>
<td>• Direct impacts are not possible because Protected Areas do not occur in the TAP Project work areas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased mortality of wildlife</td>
<td>• None</td>
<td>Not Significant</td>
</tr>
<tr>
<td>• Direct impacts are not possible because Protected Areas do not occur in the TAP Project work areas</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
8.6.3.3 Operation Phase

8.6.3.3.1 Potential Impacts

Under the noise limits defined by DPCM 01/03/91, the PRT cumulative noise pressure levels at all receptors (see Section 8.5.2) are in compliance with national legislation for day and night. Also, the maintenance activities anticipated for the PRT equipment will not increase the background noise level in the surrounding areas significantly.

During the operation phase, the PRT will not produce any significant emission which have a minor impact on local air quality. Moreover, general pipeline operational maintenance during the operation phase will produce minor emissions that will have negligible atmospheric impacts.

As result, degradation of abiotic components in ecosystems (e.g. air pollutants, noise) will be well below the extent permitted by law. For this reason, the biological components of Protected Areas (SCI / SPA), located at more than 2 km, will not be affected.

The following table presents a summary of the assessment of potential impacts on species and habitats during the operation phase.

**Table 8-142 Evaluation of Impact Significance for Species and Habitats - Operation Phase**

<table>
<thead>
<tr>
<th>Potential impact</th>
<th>Magnitude</th>
<th>Sensitivity</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degradation of abiotic components in ecosystems</td>
<td>Small</td>
<td>Low</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Noise</td>
<td>Small</td>
<td>Low</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Light pollution</td>
<td>Small</td>
<td>Low</td>
<td>Not Significant</td>
</tr>
</tbody>
</table>

8.6.3.3.2 Mitigation Measures

The impact is considered Not Significant; thus, no mitigation measures will be necessary.

8.6.3.3.3 Residual Impacts

The analysis for the operation phase showed that impacts are confined close to the PRT and BVS (see previous Sections). For this reason, the biological components of Protected Areas (SCI/SPA) located at more than 2 km will not be affected.

The following table presents a summary of the residual impacts associated with the potential impacts.
3.4 Decommissioning Phase

3.4.1 Potential Impacts

During the decommissioning phase, the demolition operations will not produce any significant emission, as the only emissions into the atmosphere will be related to the temporary activity, which have a minor impact on local air quality (small amount of dust emission).

The decommissioning will be made with equipment similar to the ones anticipated for the construction activities. Therefore, it can be estimated that the potential noise impacts will be similar to the ones foreseen during the construction phase and related only to the closest receptors.

As result, degradation of abiotic components in ecosystems (e.g. air pollutants, noise) will be well below the extent permitted by law. For this reason, the biological components of Protected Areas (SCI / SPA), located at more than 2 km, will not be affected.

The following table presents a summary of the assessment of potential impacts on species and habitats during the decommissioning phase.

Table 8-143 Residual Impacts – Species and Habitats - Operation Phase

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Mitigation Commitments to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degradation of abiotic components in ecosystems</td>
<td>None</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Noise</td>
<td>None</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Light pollution</td>
<td>None</td>
<td>Not Significant</td>
</tr>
</tbody>
</table>

8.6.3.4 Decommissioning Phase

8.6.3.4.1 Potential Impacts

During the decommissioning phase, the demolition operations will not produce any significant emission, as the only emissions into the atmosphere will be related to the temporary activity, which have a minor impact on local air quality (small amount of dust emission).

The decommissioning will be made with equipment similar to the ones anticipated for the construction activities. Therefore, it can be estimated that the potential noise impacts will be similar to the ones foreseen during the construction phase and related only to the closest receptors.

As result, degradation of abiotic components in ecosystems (e.g. air pollutants, noise) will be well below the extent permitted by law. For this reason, the biological components of Protected Areas (SCI / SPA), located at more than 2 km, will not be affected.

The following table presents a summary of the assessment of potential impacts on species and habitats during the decommissioning phase.

Table 8-143 Residual Impacts – Species and Habitats - Operation Phase

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Mitigation Commitments to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degradation of abiotic components in ecosystems</td>
<td>None</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Noise</td>
<td>None</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Light pollution</td>
<td>None</td>
<td>Not Significant</td>
</tr>
</tbody>
</table>

8.6.3.4 Decommissioning Phase

8.6.3.4.1 Potential Impacts

During the decommissioning phase, the demolition operations will not produce any significant emission, as the only emissions into the atmosphere will be related to the temporary activity, which have a minor impact on local air quality (small amount of dust emission).

The decommissioning will be made with equipment similar to the ones anticipated for the construction activities. Therefore, it can be estimated that the potential noise impacts will be similar to the ones foreseen during the construction phase and related only to the closest receptors.

As result, degradation of abiotic components in ecosystems (e.g. air pollutants, noise) will be well below the extent permitted by law. For this reason, the biological components of Protected Areas (SCI / SPA), located at more than 2 km, will not be affected.

The following table presents a summary of the assessment of potential impacts on species and habitats during the decommissioning phase.

Table 8-143 Residual Impacts – Species and Habitats - Operation Phase

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Mitigation Commitments to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degradation of abiotic components in ecosystems</td>
<td>None</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Noise</td>
<td>None</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Light pollution</td>
<td>None</td>
<td>Not Significant</td>
</tr>
</tbody>
</table>

8.6.3.4 Decommissioning Phase

8.6.3.4.1 Potential Impacts

During the decommissioning phase, the demolition operations will not produce any significant emission, as the only emissions into the atmosphere will be related to the temporary activity, which have a minor impact on local air quality (small amount of dust emission).

The decommissioning will be made with equipment similar to the ones anticipated for the construction activities. Therefore, it can be estimated that the potential noise impacts will be similar to the ones foreseen during the construction phase and related only to the closest receptors.

As result, degradation of abiotic components in ecosystems (e.g. air pollutants, noise) will be well below the extent permitted by law. For this reason, the biological components of Protected Areas (SCI / SPA), located at more than 2 km, will not be affected.

The following table presents a summary of the assessment of potential impacts on species and habitats during the decommissioning phase.

Table 8-143 Residual Impacts – Species and Habitats - Operation Phase

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Mitigation Commitments to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degradation of abiotic components in ecosystems</td>
<td>None</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Noise</td>
<td>None</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Light pollution</td>
<td>None</td>
<td>Not Significant</td>
</tr>
</tbody>
</table>

8.6.3.4 Decommissioning Phase

8.6.3.4.1 Potential Impacts

During the decommissioning phase, the demolition operations will not produce any significant emission, as the only emissions into the atmosphere will be related to the temporary activity, which have a minor impact on local air quality (small amount of dust emission).

The decommissioning will be made with equipment similar to the ones anticipated for the construction activities. Therefore, it can be estimated that the potential noise impacts will be similar to the ones foreseen during the construction phase and related only to the closest receptors.

As result, degradation of abiotic components in ecosystems (e.g. air pollutants, noise) will be well below the extent permitted by law. For this reason, the biological components of Protected Areas (SCI / SPA), located at more than 2 km, will not be affected.

The following table presents a summary of the assessment of potential impacts on species and habitats during the decommissioning phase.

Table 8-143 Residual Impacts – Species and Habitats - Operation Phase

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Mitigation Commitments to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degradation of abiotic components in ecosystems</td>
<td>None</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Noise</td>
<td>None</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Light pollution</td>
<td>None</td>
<td>Not Significant</td>
</tr>
</tbody>
</table>
Table 8-144 Evaluation of Impact Significance for Species and Habitats - Decommissioning Phase

<table>
<thead>
<tr>
<th>Potential impact</th>
<th>Magnitude</th>
<th>Sensitivity</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of refuge areas for feeding and reproduction</td>
<td>Small</td>
<td>Low</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Home range reduction</td>
<td>Small</td>
<td>Low</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Invasion of alien species</td>
<td>Small</td>
<td>Low</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Degradation of abiotic components in ecosystems</td>
<td>Small</td>
<td>Low</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Noise</td>
<td>Small</td>
<td>Low</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Light pollution</td>
<td>Small</td>
<td>Low</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Increased mortality of wildlife</td>
<td>Small</td>
<td>Low</td>
<td>Not Significant</td>
</tr>
</tbody>
</table>

8.6.3.4.2 Mitigation Measures

The impact is considered Not Significant; thus, no mitigation measures will be necessary.

8.6.3.4.3 Residual Impacts

The analysis for the decommissioning phase showed that impacts are confined close to the PRT and BVS (see previous Sections). For this reason, the biological components of Protected Areas (SCI/SPA) located at more than 2 km will not be affected.

The following table presents a summary of the residual impacts associated with the potential impacts.

Table 8-145 Residual Impacts – Species and Habitats - Decommissioning Phase

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Mitigation Commitments to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protected Areas – Construction Phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss of refuge areas for feeding and reproduction</td>
<td>None</td>
<td>Not Significant</td>
</tr>
<tr>
<td></td>
<td>• Direct impacts are not possible because Protected Areas do not occur in the TAP Project work areas</td>
<td></td>
</tr>
<tr>
<td>Home range reduction</td>
<td>None</td>
<td>Not Significant</td>
</tr>
<tr>
<td></td>
<td>• Direct impacts are not possible because Protected Areas do not occur in the TAP Project work areas</td>
<td></td>
</tr>
<tr>
<td>Invasion of alien species</td>
<td>None</td>
<td>Not Significant</td>
</tr>
<tr>
<td></td>
<td>• Direct impacts are not possible because Protected Areas do not occur in the TAP Project work areas</td>
<td></td>
</tr>
<tr>
<td>Degradation of abiotic components in ecosystems</td>
<td>None</td>
<td>Not Significant</td>
</tr>
<tr>
<td></td>
<td>• Degradation of abiotic components are restricted to the TAP work sites and their closest surroundings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Protected areas are located at a distance at more than 2 km</td>
<td></td>
</tr>
<tr>
<td>Impact / Risk</td>
<td>Mitigation Commitments to Address the Impact / Risk</td>
<td>Significance of Residual Impact / Risk</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------------------------------------------</td>
<td>---------------------------------------</td>
</tr>
<tr>
<td>Noise</td>
<td>• None</td>
<td>Not Significant</td>
</tr>
<tr>
<td></td>
<td>• Noise is restricted to the TAP work sites and their closest surroundings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Protected areas are located at a distance at more than 2 km</td>
<td></td>
</tr>
<tr>
<td>Light pollution</td>
<td>• None</td>
<td>Not Significant</td>
</tr>
<tr>
<td></td>
<td>• Direct impacts are not possible because Protected Areas do not occur in the TAP Project work areas</td>
<td></td>
</tr>
<tr>
<td>Increased mortality of wildlife</td>
<td>• None</td>
<td>Not Significant</td>
</tr>
<tr>
<td></td>
<td>• Direct impacts are not possible because Protected Areas do not occur in the TAP Project work areas</td>
<td></td>
</tr>
</tbody>
</table>
8.7 Onshore Socioeconomic Environment

8.7.1 Economy and Employment

8.7.1.1 Overview

This section presents the potential impacts on the existing Economy and Employment as a result of Project-related activities. Potential economic impacts to local livelihoods are covered separately in Section 8.7.2. Where significant impacts are foreseen, measures to prevent or mitigate adverse impacts or to enhance positive impacts are included in this report and will be implemented. Based on an assessment of potential impacts, after these measures are implemented, a summary table of residual impact designations is provided for each area of impact. In the case of unforeseen impacts the Project will implement mitigation measures as needed to reduce impacts to acceptable levels.

TAP AG has designed grievance mechanisms in line with the latest EBRD requirements and international best practices (see Section 7). These mechanisms will be monitored and revised during the Project’s lifetime.

The Project Description and the baseline information about the environmental, social, and economic conditions (see Section 6.6) have been used to assess the possible socioeconomic impacts. The box below shows the key sources of potential impacts, resources and receptors, baseline and Project influencing factors associated with the impacts of the TAP Project on the existing Economy and Employment.
Box 8-22  Key Sources of Impact, Potentially Impacted Resources and Receptors

Sources of Impact

- Labour demand during construction, operation and decommissioning of the Project: An independent economic impact assessment (Nomisma Energia 2013) suggests that during the three years construction phase in Puglia TAP will directly support 150 jobs per year (part-time and full-time) as well as 640 indirect jobs (part-time and full-time) via local companies working for TAP. During the 50 year operation phase TAP will support directly 32 and indirectly 150 jobs per year (part-time and full-time). The offshore construction activities will require 400 direct workers. However, given the highly specialized nature of such activities, it is unlikely that these workers will be hired locally.
- Procurement of local goods and services in nearby settlements – Melendugno, Vernole, San Foca, Borgagne, Acquarica
- Spending at national and local level of those directly and indirectly employed

Potentially Impacted Resources and Receptors

- Project workers and their households
- Local, regional and national companies
- Job seekers in the Apulia region and Italy
- The economy of the Apulia region and Italy

Baseline Influencing Factors

- Education and Skills: Literacy, higher education and skills achievement are below national averages in Melendugno and Vernole. There is limited access to higher education in Melendugno and Vernole and low levels of existing skills and experience in a related industry for local job seekers.
- Economy and Employment: Employment is currently a prominent issue in the province of Lecce with 21% of the total population. In Melendugno and Vernole the 50% of young people (60% of young women) are unemployed.
- Availability of goods and services for purchasing/expenditure: The services industry is a major employer at local/provincial level. However, a larger range of services can be found in the provincial capital city of Lecce (100,000 inhabitants, 30 km away from the Study Area) or in the region within a short distance to the pipeline corridor.

Vulnerable Groups

- Unemployed (Youth and Women): High levels of unemployment, especially for young women, in the Province of Lecce
- Low Income Households: Low-income households have fewer resources to rely on and are less likely to have savings and/or access to credit, which make them vulnerable to shocks and change.

Project Influencing Factors

- Number of expatriates and locals employed by the Project
- Wage levels and benefits paid by TAP AG and contractors
- Accommodation strategy for the construction phase
- Duration of employment contracts offered by TAP and contractors
- Effort demonstrated by the Project to enhance opportunities to the local community
- Duration of Onshore construction activities

The following table presents the key potential impacts of the TAP project on the economy and employment during the key Project phases.

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1 These figures are averages calculated over a 4 year period (2015-2018).
### Table 8-146  Key Potential Impacts – Economy and Employment

<table>
<thead>
<tr>
<th>Pre-Construction and Construction</th>
<th>Operations</th>
<th>Decommissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Temporary direct and indirect employment opportunities</td>
<td>• Long-term employment in maintenance, monitoring and security positions</td>
<td>• Temporary direct and indirect employment opportunities near the construction sites</td>
</tr>
<tr>
<td>• Temporary economic impact from taxes and fees, procurement and worker spending</td>
<td>• Economic impact of taxes paid to the national government and to the municipality of Melendugno (TARES/TIA and IMU).</td>
<td>• Temporary induced economic impact from worker spending in the local area</td>
</tr>
<tr>
<td>• Long-term benefits of capacity enhancement (on-the-job and formal training opportunities)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 8.7.1.2 Construction and Pre-commissioning Phase

#### 8.7.1.2.1 Potential Impacts

The existing Economy and Employment could be affected by Project construction activities, in the following positive ways:

- **Macro-level**: Economic opportunities for individuals and companies through direct, indirect and induced employment associated with Project activities.
- **National-level**: Payments of revenues by employees and contractors to the Government of Italy; and
- **Micro-level**: Payment of local taxes (waste management - TIA/TARES, and real estate - IMU) by TAP to the Municipality of Melendugno

Project construction factors that could have an impact on Economy and Employment are the length of the construction phase and the number of Project workers. Construction of TAP Project facilities and PRT, including site preparation activities, will last approximately 3 years. An independent economic impact assessment (Nomisma Energia 2013) suggests that during the three years construction phase in Puglia TAP will directly support 150 jobs per year (part-time and full-time) as well as 640 indirect jobs (part-time and full-time) via local companies working for TAP. During the 50 year operation phase TAP will support directly 32 and indirectly 150 jobs per year (part-time and full-time).

**Economic Impacts During Construction**

The local economy is likely to benefit from an increase in spending and earning of personnel employed by the Project or of households and individuals owning services and facilities in the area surrounding the Project. Increases in spending and earning will most likely occur during the construction phase and are likely to be localised and short-term.
There may also be induced impacts on the Economy and Employment as a result of the Project. It is likely that additional employment opportunities will result from spending by employees hired by TAP AG or by contractors during the construction period. Local and non-local workers are likely to spend part of their income on local accommodation, goods, services and facilities in general, particularly since they will be housed in towns near the Project. Their integration into nearby communities could elicit indirect growth and local development of municipalities surrounding the Study Area.

Economic impacts during pipeline construction will stem from procurement of goods and services by the Project, induced economic effects of spending by Project employees, and payment of taxes and fees to the government and the municipality of Melendugno.

National and regional level companies will be included in the opportunity to tender for construction contracts. A study has been performed by Nomisma Energia showing detailed benefits at a regional level which are expected to be a direct contribution of € 290 million per year to the GDP of the Apulia region during the construction phase. The figure includes direct, indirect and induced impacts.¹

TAP commissioned another study to Nomisma Energia to evaluate the correlation between tourism flows and the presence of high pressure pipelines in other areas of the Adriatic coast with the Bandiera Blu (Blue Flag). In this study, Nomisma provides evidence that the presence of a high pressure pipeline bears no significant impact on tourism flows.² However, local communities have raised the issue as a primary source of concern. Potential impacts on loss of livelihoods at local level are dealt with in the Section Land and Livelihoods.

The economic impact from purchase of goods and services will primarily accrue at a regional or national level rather than at the municipal level unless local community procurement is specifically targeted by the Project. The economic impact of spending in the local economy by Project employees is expected to be short but significant, due to the absence of self-sufficient construction camps.

**Temporary Employment Impacts**

As a pipeline scheme, most of the employment impacts from the Project can be expected to accrue during the pre-construction and construction phases. It is during this period that the Project will need to hire and accommodate workers and purchase goods and services, potentially resulting in positive impacts on the local communities. Temporary employment during the construction phase includes people directly employed by the primary contractor for the construction and upgrading of roads and infrastructure (pre-construction) and construction of the pipeline and other project components. It also includes jobs supplying the goods and services needed to support the construction process, including food and transport services and support staff in construction camps.

¹ Nomisma Energia, *Economic Impact Study - Italy* (2012)
² Nomisma Energia, *Analysis of Gas Pipelines Landfalls on the Adriatic Coast of Italy* (2012)
Due to the specialised nature of the Project, employed workers can be divided into three categories: unskilled, semi-skilled, and skilled. The percentage of Italian national staff hired will depend on the availability of human resources as well as specialities and expertise. In accordance with EU regulations regarding competition and procurement, the Project cannot preferentially hire Italian nationals. Hence, no targets for Italian nationals as a percentage of the workforce have been set. However, TAP AG and Contractor support services will hire locally where possible, on a competitive basis. Moreover, TAP AG is committed to implement a policy of involvement for the local business community (Local Content) in order to identify, evaluate and, where possible, develop their skills in relations to Project needs.

Employment figures for the construction are only preliminary at this stage and will be further refined during detailed design and following selection of contractors.

Direct employment by TAP AG and indirect employment through contractors and suppliers could have a positive impact on people employed, their households and their local communities from wages and their increase in disposable income.

Generally speaking, the duration of employment for the construction workforce will be limited. The longest-term assignments will be for work at the Pipeline Receiving Terminal site (i.e. 18 months). Of the amount of onshore construction workers, it is estimated that 20-30% will be filled by unskilled workers. This percentage will be refined after completion of the Project’s supply side analysis and elaboration of a procurement plan.

Despite the presence of construction workers and contractors at both the regional and provincial level in the Study Area, a large proportion of skilled positions on the Project will require specific technical experience in pipeline construction. Given the global nature of the industry, it is expected that a number of skilled positions during pipeline construction will most likely be filled by international workers.

In addition to engineering works, the types of goods and services required will include:

- Transport, catering, laundry, food supply, security and safety services; supply of construction vehicles and equipment; provision of construction materials including aggregates/sand, concrete, and building materials.

**Skills Enhancement during the Pre-Construction and Construction Phase**

During the pipeline pre-construction and construction phase, there will be a possibility for unskilled workers to develop skills needed by the Project. It is expected that there will be greater opportunities for on-the-job training and learning for the workforce on civil works during the construction of the pipeline receiving terminal.
TAP AG will also train local people for the pipeline construction and thereby enhance their chances to be employed by the Project. The recruitment for the training programme will follow a transparent procedure in line with TAP policies.

In addition to training and experience at the level of individual workers, the Project will also present an opportunity for Italian companies to tender for work on components of pipeline construction. Those who win the contracts will have the possibility for capacity enhancement and reputational benefits from contributing to a major international project.

8.7.1.2.2 Mitigation Measures

TAP AG’s Policy on Corporate Social Responsibility (CSR) contains the commitment that – where possible, and on a competitive basis - “TAP AG and its sub-contractors will recruit and source locally, work with local businesses and give preference to both.”1

The following measures will be implemented to minimise any potential adverse impact on Economy and Employment and enhance any positive ones.

**Sourcing Local Goods and Services**

In line with TAP’s CSR Policy, “TAP AG and its sub-contractors will recruit and source locally, work with local businesses and give preference to both if they have equal qualifications compared to other suppliers and comply with TAP’s requirements. The potential for local involvement during construction and operation will be discussed with the communities prior to the commencement of such activities and compliance documented through a transparent system of the bidding and selection process”.

In order to enhance the chances for local companies to win tenders related to TAP AG (incl. contracts as subcontractors), TAP has identified – in cooperation with local business organizations - relevant local companies and assessed their capabilities against TAP requirements. In order to allow them to overcome identified gaps – if any - TAP will invite them to capability enhancement programs. This does not guarantee consideration in TAP’s tendering process, but experience from similar projects show that such training enhances the chances for local companies and therefore local content significantly.

**Integrity of Recruitment Process**

As part of TAP AG’s Corporate Social Responsibility (CSR), Code of Conduct and Local Content Policies and Strategies, hiring guidelines for recruitment will be in place to promote transparency of the recruitment process. Equal opportunities and non-discrimination will be guaranteed in the recruiting process.

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1 TAP Policy on CSR (2011) (TAP-HSE-PO-0002)
There will be no distinction, exclusion or preference in the recruitment made on the basis of “race, colour, gender, religion, political opinion, marital status, national extraction or social origin, disability, age, sexual orientation, and/or HIV status.”

Selection criteria will include minimum age and skills requirements.

All contractors will be required to implement the hiring guidelines.

All job vacancies will be listed clearly with skills and experience required to fill the position, as well as the duration of the employment contract.

Clear information on the recruiting process and the selection criteria will be publically available and easy to access to promote transparency of the process.

**Managing Public Expectations**

The Project will provide clear information on the number and timescales of employment opportunities. Information on the employment strategy will be disclosed at municipality level, at all settlements within the 2 km corridor, and in the communities hosting non resident workforce.

**Enhancement of Supplier Capacities**

- In order to identify and quantify local potential content, identify potential employees, contractors and suppliers and obtain information on their capacity to comply with TAP’s performance requirement, TAP AG will conduct a comprehensive demand and supply side analysis;

- TAP AG will implement a phased capacity building programme that will enable local companies to achieve qualifications and potentially certifications with the relevant standards and requirements well in advance of tendering process.

- TAP AG will engage with local government, industry and other organisations to determine opportunities for targeted training. As part of TAP AG’s Local Content Strategy, primary contractors will disseminate procurement requirements as early as possible to local and national businesses, to increase the number of workers that could be hired locally.
### 8.7.1.2.3 Residual Impacts

The following table presents a summary of the residual impact associated with the impacts identified.

#### Table 8-147 Residual Impacts – Economy and Employment – Construction Phase

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Construction Phase</strong></td>
<td></td>
<td>(green shading denotes a ‘positive’ residual impact)</td>
</tr>
</tbody>
</table>
| Temporary employment opportunities—national level                           | - The Employment Strategy will outline and require a fair and transparent recruitment process for all openings.  
- The Project will identify female employment opportunities where possible and advertise them accordingly. | Minor (Positive)  
- Approximately 70-80% of labour positions will be filled by skilled workers.  
- Most construction jobs on the project will be short-term (max. 36 months).  
- TAP cannot hire local or national workforce in case better qualified workers are running for the same position. |
| Temporary employment opportunities—local level                              | - TAP AG will enhance national supplier capacity through a comprehensive demand and supply side analysis, phased capacity building program, targeted training agreed with local government, industry and other organisations. (TAP AG Local Content Strategy (2010) (TAP-HSE-ST-0007)).  
- TAP AG will agree an Employment Strategy with Primary Contractors to outline and require a fair and transparent recruitment process for all openings.  
- The Employment Strategy will require contractors to advertise skilled and unskilled openings thoroughly and well in advance of hiring and – where possible – to hire at local level. This will apply to both construction jobs and supporting services. TAP will monitor these efforts prior to and during construction. The Employment Strategy will define target locations at the local level for recruiting skilled and unskilled labour.  
- The Project will provide clear information on the number and limited timescales of employment opportunities.  
- Where TAP AG’s supply and demand analysis demonstrates existing capacities in the study area – the Primary Contractor will be required to reach out to these groups when advertising work opportunities on the Project. | Minor (Positive)  
- Approximately 70-80% of labour positions will be filled by skilled workers.  
- Most construction and service jobs on the project will be short-term (max. 36 months).  
- The Project cannot preferentially hire locals or nationals over other equally qualified applicants.  
- Employment impacts will be slightly higher in communities near the pipeline receiving terminal due to the larger workforce and longer duration of work.  
- Transparent hiring practices and clear information on employment opportunities will help to manage stakeholder expectations. |
| Temporary employment – vulnerable groups                                    | - TAP AG will identify and work with local organisations and community leaders to develop explicit strategies to ensure that all members of the community can access information on employment opportunities. This includes young people, unqualified job seekers and low-income families. | Not Significant  
- The limited number of low-skilled jobs available at a local level is unlikely to have a significant impact on low-income families or the large number of young unemployed residents. |
<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary economic impact – national level</td>
<td>TAP AG will enhance national and regional supplier capacity and has conducted a comprehensive demand and supply side analysis, phased capacity building program, targeted training agreed with local government, industry and other organisations. (TAP Local Content Strategy (2010) (TAP-HSE-ST-0007)) As part of the tendering process contractors will be required to develop a purchasing strategy that stipulates how national and local purchase of goods and services will be optimised. Agreed targets will be monitored.</td>
<td>Minor (Positive) Due to the brief construction period and the uncertainty of local procurement estimates at this time, the economic impact of sourcing goods and services relative to the national economy are estimated to be minor positive. The Project will pay taxes during the construction phase, but these will be relatively minor positive.</td>
</tr>
<tr>
<td>Temporary economic impact – local level</td>
<td>Immediately upon opening a tender the Project (TAP AG or the Primary Contractor) will make information on tendering opportunities available to local businesses. Contractors will be required to adhere to TAP AG purchasing strategy to optimize the purchase of services and goods at a national and local level. Agreed targets will be monitored.</td>
<td>Minor/Moderate (Positive) Temporary impact Absence of self-sufficient accommodation camps will create opportunities for local economic operators to enhance the volume of their business. Local purchasing by employees expected to be minor compared to the annual flow of tourist arrivals (and related induced business) in Melendugno The impact will occur mostly during the low season;</td>
</tr>
<tr>
<td>Skill and Capacity Enhancement</td>
<td>TAP AG will enhance regional and local supplier capacity and has undertaken a comprehensive demand and supply side analysis, phased capacity building program, targeted training agreed with local government, industry and other organisations. (TAP Local Content Strategy (2010) (TAP-HSE-ST-0007)) TAP AG will carry out training of contractors on Project HSE and social policies prior to the start of construction. (TAP Local Content Strategy (2010) (TAP-HSE-ST-0007))</td>
<td>Minor (Positive) Long-term impact Significant benefit for companies and individuals associated with the project Relatively limited training opportunities given the short duration of construction</td>
</tr>
</tbody>
</table>
8.7.1.3 Operations Phase

8.7.1.3.1 Potential Impacts

**Economic Impacts During Operations Phase**

During the Project operation phase, revenues generated by the Project are likely to have a positive impact on the economy both at national and local level.

The primary economic impact during the operations phase will be the payment of taxes to the Italian government and the municipality of Melendugno and the induced effect on the economy from spending for the infrastructure in the operation phase.

Nomisma Energia has estimated as part of their study that over the lifetime of the Project the Italian GDP will benefit from €8 million per year, including national tax contributions. At local level, the municipality of Melendugno will receive – according to current national legislation - approximately €400,000 per year as a result of TAP AG paying local taxes (IMU on real estate properties and TIA/TARES on waste management).¹

**Permanent Employment Impacts**

The employment opportunities created by the Project during operation (approximately 32 workers) will have a limited impact on employment. Employees will be mostly needed for the following areas:

a. Operation and maintenance of the PRT, BVS and pipeline
b. Monitoring
c. Security

8.7.1.3.2 Mitigation Measures

As in the construction phase, TAP AG will undertake measures in order to optimise national and local level employment opportunities, maintain the integrity of the recruitment process and where possible source goods and services locally. See Section 8.7.1.2 for more detail.

TAP AG will also disclose taxes and payments made as part of its annual reporting.

¹ Nomisma Energia (2012), ibid.
8.7.1.3.3 Residual Impacts

The following table presents a summary of the residual impact identified.

Table 8-148 Residual Impacts – Economy and Employment – Operation Phase

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk (green shading denotes a ‘positive’ residual impact)</th>
</tr>
</thead>
</table>
| Permanent Employment Opportunities (national and local) | • The Project will provide clear information on the limited number and skills requirements of employment opportunities.  
  • The Employment Strategy will outline and require a fair and transparent recruitment process for all openings  
  • TAP AG will advertise all openings in ways that are accessible to local communities. | Not Significant  
  • Limited permanent opportunities – particularly unskilled - available on the project (max. 32)  
  • Transparent hiring practices and clear information on employment opportunities will help to manage stakeholder expectations |
| Economic impacts from taxes (national and local) | Minor/Moderate (Positive)  
  • Taxes will generate a long-term (project duration) impact  
  • The fees represent a small proportion of government revenue but are a significant sum for a single project.  
  • The financial contributions to the municipality of Melendugno will result in a significant and stable increase in the budget of the local administration. |  

8.7.1.4 Decommissioning Phase

8.7.1.4.1 Potential Impacts

Potential impacts will need to be reassessed given the period of time that will pass before decommissioning activities are expected to take place. Decommissioning activities performed will apply to the PRT and the BVS only. TAP AG will source locally as much as possible. Thus potential impacts during Project decommissioning are likely to be similar to impacts during construction in terms of employment opportunities but less significant than during the construction phase due to the smaller affected area.

8.7.1.4.2 Mitigation Measures

Mitigation measures are expected to be similar to construction, with the benefit of being improved based on lessons learned during construction. Additionally, TAP will prepare a Preliminary Decommissioning Plan (which will be a ‘living document’) that will be developed further during field operations and fully defined in advance of the end of field life.
8.7.1.4.3 Residual Impact

The residual impacts are likely to be similar to construction, with the benefit of being improved mitigations based on lessons learned during construction. However, residual impacts depend on the outcome of potential impacts during construction and the effectiveness of mitigation measures. As such, residual impacts could be rated differently approaching the time period of Project decommissioning.

8.7.2 Land and Livelihoods

8.7.2.1 Overview

This section presents the potential impacts on land and livelihoods as a result of Project related activities. For this section of the Project, potential impacts include impacts on:

- Livelihoods and Household Income (particularly from agricultural and tourism activities)
- Physical Structures
- Land Value

During construction, a total of ~38 hectares (ha) will be required by the Project. During operations, the Project will need a total of ~12 hectares (ha) in addition to a right of way established on a corridor of 32 hectares (40 meters wide).

The box below shows the key sources of potential impacts, resources and receptors, baseline and Project influencing factors associated with the impacts of the TAP Project on land and livelihoods.

**Box 8-23 Key Sources of Impact, Potentially Impacted Resources and Receptors**

**Sources of Impact**

- Temporary Land-take – about 38 hectares which include the pipeline working strip (26m large in normal conditions – 22m for the reduced working strip) in the construction phase, and the permanent restrictions imposed on the safety zone for the right of way of the pipeline (40 meters wide) during the operations phase.

- Permanent Land-take of about 14 hectares for Project operation (PRT and BVS) and access roads construction and enlargement.

- During the operation phase, land restrictions will apply to a buffer of 40 meters (32 ha). An additional safety zone of up to 100 meters (164 ha) will apply to the constructions of residential complexes or industrial buildings.

**Potentially Impacted Resources and Receptors**

- Households owning or working on land with parcels that cross into Project land areas
- Tourism activities in the municipality directly and indirectly affected by the Project
- Tourism business related activities
- Physical structures such as Pagghiare, water wells and dry stone walls
Baseline Influencing Factors

- **Land Use**: Approximately 1,474 ha (79% of land in the Study Area) is used for cultivation – most of which is represented by olive groves (73% of the Study Area). Urban land is limited to 42.8 ha (2.3% of land in the Study Area) and industrial, commercial and transport land use amounts to 47.5 ha (2.5% of land in the Study Area).
- **Livelihoods**: Main livelihood activities include crop production, livestock rearing, and tourism (i.e. agricultural and beach sightseeing). Tourisms and agriculture are considered main drivers for economic development in the Study Area.
- **Land Ownership**: High levels of private land ownership are recorded in the study area. Average total land per household is approximately 3ha -8ha, typically fragmented into several lots. The cadastre acknowledges more than 100 different landowners in the pipeline corridor.

Project influencing factors

- Pipeline corridor and construction constrains
- Work sites, laydown areas and other temporary infrastructure
- Main construction site and work sites during construction
- PRT and BVS during operation

Vulnerable Groups

- Households with low income, depending on small scale agriculture or tourism as main economic activity, owning/using land or tourism activities in the pipeline corridor.
- Farmers who have been adversely affected by past infrastructure projects
- Households with low savings or who are exposed to financial institutions

The following table presents the key potential impacts of the TAP Project on land and livelihoods during the Project phases.

**Table 8-149  Key Potential Impacts – Land and Livelihoods**

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary loss of livelihoods and household income</td>
<td>Permanent loss of livelihoods and household income</td>
<td>Temporary use of land due to decommissioning activities</td>
</tr>
<tr>
<td>Displacement of non-residential physical structures</td>
<td>Changes in land values post construction</td>
<td>Restoration of land use</td>
</tr>
<tr>
<td>Disturbance to/interruption of permanent crop production</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disturbance to animal grazing activities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss of livelihoods from severance between different land areas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impacts on collection of forest products and animal grazing from site clearing in mountainous areas</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
8.7.2.2 Construction and Pre-commissioning Phase

8.7.2.2.1 Potential Impacts

Most direct impacts on Land and Livelihoods are likely to take place during the construction period when certain onshore areas will be temporary taken up by the Project.

Potential Project impacts are as follows:

- Potential impacts on household livelihoods from temporary loss of land and reduced crops productivity due to the land clearing.
- Potential impacts on household livelihoods from a temporary decrease of tourists visiting the area as result of Project construction activities along the coast and land clearing in the pipeline route and PRT site.

During construction, a total of about 22 hectares (ha) will be required by the Project broken down into the following table:

**Table 8-150  Land Use – Construction and Pre-Commissioning Phase**

<table>
<thead>
<tr>
<th>Component</th>
<th>Temporary Land Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipeline (8.2 km)</td>
<td>Working strip: max 26 m working strip → 213,200 m²</td>
</tr>
<tr>
<td>Access roads to PRT</td>
<td>New Road 1 to access to PRT: 5,993 m² (partially included in PRT area)</td>
</tr>
<tr>
<td>New Road 1: 922 m → 6.5 m width</td>
<td>New Road 2 to access to PRT: 4,654 m² (partially included in PRT area)</td>
</tr>
<tr>
<td>New Road 2: 716 m → 6.5 m width</td>
<td></td>
</tr>
<tr>
<td>Access roads to BVS</td>
<td>New Road to access to BVS: 637 m²</td>
</tr>
<tr>
<td>New Road: 98 m → 6.5 m width</td>
<td>Upgrade road to access to BVS: 3,738 m²</td>
</tr>
<tr>
<td>Upgrade Road: 575 m → 6.5 m width</td>
<td></td>
</tr>
<tr>
<td>Block valve station</td>
<td>13 m x 14 m = 182 m²</td>
</tr>
<tr>
<td>Construction site/ Pipeline receiving terminal</td>
<td>120,000 m² (12.0 Ha)</td>
</tr>
<tr>
<td>Worksite (1)</td>
<td>26,000 m²</td>
</tr>
<tr>
<td>Landfall</td>
<td>n/a</td>
</tr>
<tr>
<td>Road crossings</td>
<td>n. 9 Included in pipeline land use</td>
</tr>
</tbody>
</table>
The use of land in the Project footprint has been calculated through satellite imagery and is reported in the table below:

**Table 8-151  Land use calculated in the PRT, BVS, ROW (Right of Way), new roads and work site**

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Composition %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roads</td>
<td>0.49%</td>
</tr>
<tr>
<td>Arable land (non-irrigated)</td>
<td>24.69%</td>
</tr>
<tr>
<td>Olive groves</td>
<td>70.22%</td>
</tr>
<tr>
<td>Pasture areas (natural grassland)</td>
<td>4.58%</td>
</tr>
<tr>
<td>Bushes and shrubs</td>
<td>0.01%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>

The construction of the onshore pipeline is expected to last approximately 6 months (including onshore microtunnelling and the BVS). The construction of the Pipeline Receiving Terminal (PRT) is expected to last approximately 18 months. Project Pre-commissioning is expected to last approximately 5 months.

**Temporary Loss of Livelihoods and Household Income – Agriculture**

The vast majority of land in the Study Area is used for olive tree cultivation (see *Figure 6-39 Extent of Olive Groves* in the Social Baseline section). The remaining land is non-irrigated arable land, pastureland and natural forested areas and a small percentage of land used for growing fruit trees and raising livestock (see *Figure 8-28*).
During field observations, the team identified 4 farms and 1 vegetable garden located in the Study Area. Farms are defined as modern residential structures where landowners usually reside and conduct agricultural economic activities. These structures are summarised in **Table 8-152**.

**Table 8-152  Farms in the Study Area**

<table>
<thead>
<tr>
<th>Name</th>
<th>Municipality</th>
<th>Position</th>
<th>Distance from centreline</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Le Paesane</td>
<td>Melendugno</td>
<td>Kp 3.5</td>
<td>about 300 m</td>
<td>Farm with olive trees</td>
</tr>
<tr>
<td>Le Sarei</td>
<td>Melendugno</td>
<td>Kp 5</td>
<td>about 100 m</td>
<td>Cattle farm</td>
</tr>
<tr>
<td>Scalilla</td>
<td>Melendugno</td>
<td>Kp 3.5</td>
<td>about 700 m</td>
<td>Farm and agritourism</td>
</tr>
<tr>
<td>Vegetable Garden Mancini</td>
<td>Melendugno</td>
<td>Kp 4</td>
<td>about 400 m</td>
<td>Vegetable garden</td>
</tr>
<tr>
<td>Masseria II Capitano</td>
<td>Melendugno</td>
<td>Kp 8.2</td>
<td>about 500 m</td>
<td>Farm with olive trees</td>
</tr>
</tbody>
</table>

*Source: ERM satellite research and field study (July 2013)*
Loss of temporary livelihoods also applies to those landowners who reside in urban areas (Vernole, Melendugno), but conduct primary or secondary economic activities in the pipeline corridor. Although only a few of them are registered as official agricultural businesses, all affected landowners are subject to Project impacts, thus eligible for compensation under the Livelihood Restoration Framework.

The field team also identified “Masseria” (traditional – and usually fortified - rural buildings) within the corridor using satellite imagery. Field observations confirmed type of use (e.g. tourism business, agricultural business) and status (e.g. inhabited, vacant, abandoned) of the buildings. A summary of these findings is provided in Table 8-153.

**Table 8-153  Masseria in the Study Area**

<table>
<thead>
<tr>
<th>Name</th>
<th>Municipality</th>
<th>Position</th>
<th>Distance from centreline</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Masseria “Capitano”</td>
<td>Melendugno</td>
<td>Kp 8</td>
<td>about 500 m</td>
<td>Inhabited, farm</td>
</tr>
<tr>
<td>Masseria “Lizza”</td>
<td>Melendugno</td>
<td>Kp 6</td>
<td>about 200 m</td>
<td>Inhabited</td>
</tr>
<tr>
<td>Masseria “Monaco”</td>
<td>Melendugno</td>
<td>Kp 4</td>
<td>about 700 m</td>
<td>Uninhabited</td>
</tr>
<tr>
<td>Masseria “Scalilla”</td>
<td>Melendugno</td>
<td>Kp 3.5</td>
<td>about 700 m</td>
<td>Inhabited, farm and agritourism</td>
</tr>
<tr>
<td>Masseria “Carleo”</td>
<td>Melendugno</td>
<td>Kp 2.5</td>
<td>about 700 m</td>
<td>Uninhabited (for sale)</td>
</tr>
<tr>
<td>Masseria “Bosco”</td>
<td>Melendugno</td>
<td>Kp 1</td>
<td>about 900 m</td>
<td>Uninhabited</td>
</tr>
<tr>
<td>Masseria “Incioli”</td>
<td>Melendugno</td>
<td>Kp 0.5</td>
<td>about 900 m</td>
<td>Uninhabited</td>
</tr>
<tr>
<td>Masseria “San Basilio”</td>
<td>Melendugno</td>
<td>Kp 0</td>
<td>about 300 m</td>
<td>Uninhabited (historical building)</td>
</tr>
</tbody>
</table>

Source: ERM satellite research and field study (July 2013)

From the analysis of the cadastral sheets in the Project footprint, the number of affected landowners is expected to be approximately 130 individuals. However, the cadastral sheets also include public authorities (State properties, Puglia region, the Municipality of Melendugno, the Province of Lecce, etc.), other private businesses (i.e. Europark) and religious entities (i.e. Confraternita dell’Assunta of Vernole).

Only a limited number of these landowners are likely to be permanently impacted by the land acquisition process – estimates for this study are limited to less than 10 landowners. The cadastral information will have to be confirmed during the Land Easement and Acquisition process.
Project construction activities that could have temporary impacts on agriculture activities and livelihoods are mainly due to the construction of the pipeline:

- Land take for the pipeline corridor is limited to a maximum 26 m Working Strip. The pipeline is planned to be built along existing rural roads, in order to reduce potential impacts on crop production in nearby agricultural fields. A reduced Working Strip, 22 m wide, will be applied where requested in the pipeline design due to technical reasons (i.e. connection to access roads). However, sections of the pipeline route are planned to cross agricultural fields. Along the majority of the existing rural roads, olive groves exist on both sides of the route. The locations of olive trees have been identified and mapped through a field survey. The area considered by the survey includes Pipeline Receiving Terminal property boundaries, Block Valve Station site, entry-point worksite and a corridor of 30 meters along the route of the pipeline. The Regional List of Monumental Olive Trees is enacted in the Regional Law 357 of 7 March 2013.

- Field surveys confirmed the presence of approximately 1,900 olives trees with a trunk diameter larger than 30 cm within the working strip of the pipeline. The trunk diameter of approximately 1,650 olive groves is comprised between 30 and 70 cm, for other about 200 olive trees the diameter is calculated between 70 and 100 cm. Finally, approximately 50 olive groves have a trunk diameter of above 100 cm. In the official census of “monumental” olive groves of the Apulia region, none of the trees identified is acknowledged as “monumental”.

Although construction activities do not interfere with any tree included in the regional list of “monumental olive trees” (approved by the Regional Council with resolution n. 357 of 7 March 2013), there are olive groves of significant age and size along the working strip. TAP AG commits to restore the conditions of the land to the ante-operam status through the reinstatement of the olive groves. Upon request of the landowner, and in agreement with the relevant authorities, alternative compensation measures could apply.

The Project will take into consideration that specific levels of impact among household livelihoods are dependent on the following:

- proportion of productive land temporarily lost per household;
- the household's current level of income;
- level of dependence on the land;
- alternative livelihood options; and
- the length of time it takes to restore soil quality post construction.

TAP AG will restore (and ideally enhance) all affected livelihoods to pre-project levels and all losses of assets will be compensated at full replacement cost. While the general provisions are outlined in the Livelihood Restoration Framework, the detailed compensation and livelihood restoration measures will be specified in the Livelihood Restoration Plan.
Both documents will be established in close collaboration with all stakeholders and disclosed to the public and specifically to all affected households.

The value of compensation for the removal of individual trees, when this cannot be avoided within the 22 m wide reduced working strip will be calculated according to the methodology for ornamental plants.

Agricultural incomes depend on several factors such as the size and quality of harvests, demand and selling price, and labour and equipment costs. Impacts on crops may also decrease farming incomes for a number of harvesting periods while crops are in the process of returning to pre-Project productivity. According to farmers living in the area, olives are sold locally at around €16 per quintal (1 quintal = 100 kilograms) and local olive production can be about 14 - 15 quintals per hectare in a good season. Any costs for machinery and other equipment and upkeep must also be factored into understanding and determining appropriate compensation for any impacts. Information concerning landowner and worker income levels will be considered to understand potential economic displacement and restore livelihoods.

Most of the olive farmland in the Study Area is cultivated using traditional techniques with irregular planting distances. Olive groves in the Study Area were observed to have trees of different ages and different sizes which can make olive harvesting difficult to mechanise and inefficient to manage. As such, existing methods of planting, cultivating and harvesting need to be considered when determining compensation and other support to farmers to minimise or mitigate any loss of assets due to the Project.

Consultation with each impacted household will continue throughout the life of the Project to ensure the improvement or restoration of livelihoods of all affected parties. Special attention will be given to the most vulnerable households. The restoration of livelihoods will be designed to meet the needs of affected stakeholders and established with their involvement.

In some instances land may be orphaned during the construction phase. Orphan land is when a section of a plot becomes too small to be economically viable for agricultural production and/or cannot be accessed during construction. In most cases these small sections are located either side of the construction corridor. Whether a parcel qualifies as orphan land will be reviewed by TAP AG on a case by case basis.

**Temporary Loss of Livelihoods and Household Income – Tourism**

The service industry (which includes tourism) is the largest generator of total added value, representing about 75% of all economic activity in the Apulia Region. Analysis of primary data gathered during field work indicates that tourism and associated activities represent an employment sector where a consistent number of inhabitants are employed or would like to be employed.
During construction, impacts on tourism activity will be temporary in nature and reversible. These impacts are expected to occur primarily from noise and pollution emissions and general visual impact of construction equipment.

Tourism activities could be affected by Project construction and pre-commissioning activities, in the following ways:

- Temporary impacts on the income of households owning beach facilities and other beach workers in the Study Area.
- Temporary impacts on the income and quality of life of households owning B&B and tourist Masserias in the Study Area also due to the noise and visual disturbance caused by the Project.

Construction activities near the coastline will be suspended during the summer period in order to avoid interference with tourism related activities.

National regulations on pollution and noise limits control and Project mitigation measures will be in place to minimise any impact on economy and quality of life of affected households (see Sections 8.5.1 – 8.5.2).

There are 14 tourism businesses within the 2 km pipeline corridor which may be directly affected by the Project. Specifically, there are 3 private beach businesses (beach side bars, food stands, chair/umbrella rentals, etc.) 6 B&B, 2 agritourism businesses, 2 resorts and 1 camping/guesthouse (see Figure 8-29).
Figure 8-29  Tourism businesses in the Study area

Source: ERM (2013)

Beach Businesses

There are 3 beach businesses in the proximity of the land-fall point. These are: “La Caciulara”, “Lido San Basilio” and “Chicalinda.”

These businesses provide umbrella and beach chair rentals as well as other services (e.g. food and drinks) on a daily basis to tourists on the coast. The table below lists each business and its distance from the pipeline.

Table 8-154  Beach Businesses and Proximity to the Pipeline

<table>
<thead>
<tr>
<th>Name</th>
<th>Municipality</th>
<th>Position</th>
<th>Distance from centreline</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lido San Basilio</td>
<td>Melendugno</td>
<td>Landfall</td>
<td>about 100 m</td>
<td>Beach facility</td>
</tr>
<tr>
<td>La Caciulara</td>
<td>Melendugno</td>
<td>Landfall</td>
<td>about 300 m</td>
<td>Beach facility</td>
</tr>
<tr>
<td>Chicalinda</td>
<td>Melendugno</td>
<td>Landfall</td>
<td>about 100 m</td>
<td>Beach facility</td>
</tr>
</tbody>
</table>

Source: ERM field survey (July 2013)
During the construction phase, the Project could generate a temporary interference with users of beach facilities.

Given the fact that construction activities will be suspended in the summer season near the coastline, and taking into consideration the short duration of the construction activity and the use of microtunnelling technology to minimise visual and long term interferences with the coastline, impacts are likely to be not significant.

**B&B, Agritourisms, Resorts, Masseria**

There are 11 accommodation facilities that are located within the pipeline corridor and are likely to be impacted by the Project due to their proximity. Table below provides the location of these tourism businesses in relation to the pipeline corridor.

**Table 8-155 Accommodation Facilities and Proximity to the Pipeline**

<table>
<thead>
<tr>
<th>Name</th>
<th>Municipality</th>
<th>Position</th>
<th>Distance from centreline</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>B&amp;B Alba</td>
<td>Melendugno</td>
<td>Kp 6.5</td>
<td>about 200 m</td>
<td>B&amp;B</td>
</tr>
<tr>
<td>B&amp;B Paradise</td>
<td>Melendugno</td>
<td>Kp 5</td>
<td>about 800 m</td>
<td>B&amp;B</td>
</tr>
<tr>
<td>B&amp;B Giardino dei Suoni</td>
<td>Melendugno</td>
<td>Kp 4.5</td>
<td>about 700 m</td>
<td>B&amp;B</td>
</tr>
<tr>
<td>Residence Alba de Rio</td>
<td>Melendugno</td>
<td>Kp 4.5</td>
<td>about 800 m</td>
<td>B&amp;B</td>
</tr>
<tr>
<td>B&amp;B San Basilio</td>
<td>Melendugno</td>
<td>Kp 0</td>
<td>about 900 m</td>
<td>B&amp;B</td>
</tr>
<tr>
<td>Villa Nike</td>
<td>Melendugno</td>
<td>Kp 0</td>
<td>about 1,000 m</td>
<td>B&amp;B</td>
</tr>
<tr>
<td>Scalilla</td>
<td>Melendugno</td>
<td>Kp 3</td>
<td>about 700 m</td>
<td>Agritourism</td>
</tr>
<tr>
<td>Tenuta Antares</td>
<td>Melendugno</td>
<td>Kp 2.5</td>
<td>about 700 m</td>
<td>Agritourism</td>
</tr>
<tr>
<td>Euro Garden Village</td>
<td>Melendugno</td>
<td>Kp 0</td>
<td>about 900 m</td>
<td>Resort</td>
</tr>
<tr>
<td>Residence Punta Cassano</td>
<td>Melendugno</td>
<td>Kp 0</td>
<td>about 500 m</td>
<td>Resort</td>
</tr>
<tr>
<td>Masseria Le Sciare</td>
<td>Melendugno</td>
<td>Kp 0</td>
<td>about 700 m</td>
<td>Camping/ guesthouse</td>
</tr>
</tbody>
</table>

*Source: ERM field survey (July 2013)*

Project construction and pre-commissioning activities that could have impacts on tourism operators owning and working in the mentioned accommodation facilities are the following:

**Overall Duration and Timing:** Temporary disturbance during the construction phase will be in terms of visual aesthetic, noise and pollution. Duration of works is reported in *Table 8-160*.

**Work sites, Engine generators:** Engine generators will be used to provide electricity for construction activities in this area during the day for a period of approximately 18 months (non-consecutive).

**Hydrotesting:** During the pre-commissioning phase, the main noise sources are compressors and pumps foreseen for the hydrotesting activities (see Section 8.5.2).
Disturbance to Animal Grazing

During field surveys, the team identified one cattle farm along the route of the pipeline. The Project engaged with the cattle farm owners at an early stage. Reportedly, animals (around 300 goats and 100 sheep) do not use Project impacted grazing land, therefore this study does not foresee any impact to the economic activities of the cattle farm.

Temporary Loss of Livelihoods due to Severance

Construction works along the strip of the pipeline cross some agricultural properties limiting the accessibility from one side of the property to the other.

The project design took avoiding severance of agricultural activities into consideration during the process of route refinement. Where this could not take place for technical reasons, mitigation measures will be established.

Displacement of Physical Structures

Due to health and safety requirements, land clearing for a 26 m wide corridor (in case of standard working strip) is necessary for pipeline construction. Any structures located within this corridor will need to be temporarily relocated. The social survey identified local water wells, dry stone walls and Pagghiare within a 30 metre corridor along the 8.2 km pipeline route. Where possible, the Project will seek to conduct micro-refinement of the pipeline route to minimize impacts on physical structures.

Local Water Wells

As discussed in the baseline, the primary method for irrigating crops in the Study Area is by accessing water from these local wells to water fields (Figure 8-30). Field observations have confirmed the presence of 4 water wells in a corridor of 30 metres from the pipeline.
Potential impacts on water availability in wells from disruptions in the groundwater table are possible. It will be decided on a case to case basis the possibility to restore the use of the water wells once the construction phase is completed.

**Pagghiare**

“**Pagghiare**” are considered aspects of cultural heritage since they are historical structures that were constructed by hand using traditional methods. The pipeline track does not interfere with any of these structures.

**Dry Stone Walls**

Dry stone walls are agricultural structures and serve as markers to indicate boundaries between various parcels of land as well as along roads. These structures were built using stone materials of a calcareous and/or calcarenitic nature, found *in situ* and often deriving from the removal of stones from adjacent fields (see **Figure 8-31**).
The potential impacts of Project construction on these dry stone walls will be temporary and reversible. The construction of the pipeline is expected to interfere with approximately 130 dry stone walls. In this case dry stone walls need to be temporarily removed for construction, the Project is responsible for engaging with relevant stakeholders and rebuilding these walls to stakeholder satisfaction. Moreover, walls will be disturbed by the minimum amount necessary for safe working and wall material will be carefully dismantled and stored for reuse. According to Italian Regional Departments for Environment, Agriculture and Fisheries, the value of rebuilding dry stone walls is 70 €/m³.
8.7.2.2.2 Mitigation Measures

TAP AG has developed a *Land and Easement Acquisition Strategy* (*TAP-HSE-ST-0002*), which commits TAP AG to mitigate adverse social and economic impacts from land acquisition or restrictions on affected persons’ use of or access to land. There are several key elements to this mitigation approach including:

- Providing compensation for loss of assets at replacement cost;
- Ensuring that displacement of economic activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected;
- Improving or, at a minimum, restoring the livelihoods and standards of living of displaced persons to pre-Project levels, so as to facilitate sustainable improvements to socioeconomic status; and
- Paying particular attention to the needs of vulnerable groups.

In order to realise these objectives, the Project has established a *Livelihoods Restoration Framework* (LRF) in line with the EBRD Performance Requirements, an overview of which is provided in the box below.

**Box 8-24 Overview of Livelihoods Restoration Framework**

The LRF establishes the entitlements of affected persons or communities and ensures that compensation is provided in a transparent, consistent, and equitable manner. In line with the EBRD requirements the LRF will include the following:

- A detailed and comprehensive description of the project and all its components and associated facilities, including the land/easement to be acquired.
- A description of the legal framework and legal and customary procedures of private land/easement acquisitions.
- A description of measures taken to avoid physical displacements and to minimise economic displacements.
- A comprehensive assessment of the impacts of the economic displacement.
- An entitlement matrix, defining for each of the identified losses the compensation needed to assure that livelihoods and standards of living of all affected people are restored to levels they will have achieved in a non-TAP scenario and that the living conditions and livelihoods of vulnerable groups are improved.
- A description of mechanisms for addressing grievances, complaints and appeals taking into account the availability of judicial recourse as well as traditional conflict resolution mechanisms.
- An outline of the monitoring, which will be conducted by TAP AG as well as by independent evaluators to ensure that complete and objective information are available for the participatory performance monitoring system.

A summary of the LRF must be available to the public to ensure that affected people understand the compensation procedures and know what to expect at the various stages of the project.
Once the LRF is finalised a Guidance Leaflet on Acquisition and Compensation (GLAC) will be developed, which summarises the key elements of the LRF, including the type of impact from land and easement acquisition and provides guidance on how stakeholders should be compensated. This document also draws on principles outlined in several policy documents including: TAP AG’s Policy on Corporate Social Responsibility (TAP-HSE-PO-0002), the Land and Easement Acquisition Strategy (TAP-HSE-ST-0002) and the Draft Land Access Plan (TAP-HSE-MO-0004). The GLAC, as well as the Policy documents, serve as reference for the description of mitigation measures in the paragraphs below.

**Temporary Loss of Household Income and Livelihoods – Agriculture**

- TAP AG will begin identifying individual landowners as soon as possible.
- In accordance with the LRF, should landowners not be in possession of official land title, they will be assisted by the Project in securing these documents.
- A reduced working strip (22 m) will be implemented as required (and technically feasible), in order to minimize impact, especially on olive trees.
- TAP AG commits to restore the conditions of the land to the ante-operam status through the reinstatement of the olive groves. Upon request of the landowner, and in agreement with the relevant authorities, alternative compensation measures could apply.
- Affected landowners and/or rights-holders\(^1\) are entitled to compensation at replacement value for the lost income opportunities i.e. the revenue the land could have produced.
- Affected land and asset owners are entitled to the restoration of all assets to its pre-project condition and/or the total costs to restore all damaged assets to pre-Project conditions.
- Affected landowners and/or rights-holders are entitled to compensation for reduced income during the recovery period.
- Prior to commencing preparations for the construction phase TAP AG will investigate possibilities for minor re-routes in smallholder areas in order to minimize impacts on vulnerable households (i.e. avoid cutting through areas of small plots, utilising agricultural roads or plot boundaries instead).
- Land owners will receive timely and clear information on timing of construction works in the course of community liaison activities so that they become fully aware of the exact time for start of construction and of the duration of interruption of agricultural activities.
- Compensation for orphan land, once recognised, will be based on the same entitlements as the main affected piece of land.

\(^1\) Rights-holders include leaseholders and usufruct land users.
TAP AG will be sensitive to the additional concerns of landowners that have previously been affected by past or concurrent infrastructure projects and will ensure that they are provided with information on how the Project will address these concerns.

TAP AG will identify farmers receiving agricultural subsidies during the Land and Easement process. TAP AG will fully compensate these farmers in the event of loss of subsidies during the construction phase.

Affected agricultural workers including seasonal workers will be entitled to compensation for temporary loss of income. The Project will work with local authorities, community groups and farmers to understand how this group can be included in the engagement and compensation process.

Temporary loss of livelihoods due to severance

In rural areas crossings over the pipeline construction area will be provided where possible to avoid any impacts associated with severance to grazing or agricultural land. The location of such crossings will be agreed between the contractor and local farmers as part of the consultation on the construction management plan. TAP AG will ensure that clauses are included in contractor agreements to ensure that this is carried out where necessary. Where crossings are not possible and farmers will experience a loss of grazing or additional journey times during the construction period, compensation will be provided.

When access roads are blocked during construction the Project will establish alternative routes to allow those affected to access fields and other places of work. Should this not be possible for any reason, this will be agreed with users and compensation provided if required.

Temporary loss of Household Income and Livelihoods – Tourism

Construction activities near the coastline will be suspended during the summer period in order to avoid interference with tourism related activities.

As part of TAP AG’s Stakeholder Engagement Strategy and Grievance Mechanism, the Project will:

- Continue informing/ updating local tourism businesses about planned construction (duration, number of workers, activities and locations) as well as operation activities to manage expectations by providing clear information regarding the extent of Project activities and associated risks to the community and environment.
- Consult with all affected tourism businesses on an ongoing basis during construction to monitor relevant impacts and outcomes to tourism businesses and to resolve any issues that may arise concerning the Project.
When possible, combine non-resident workforce needs with available tourism facilities (hotels, B&B, restaurants, etc.), especially during the winter season.

Enable a timely and appropriate response to any stakeholder concerns that are communicated throughout the life of the Project.

To minimise the temporary impact on the quality of life of the households living close to the entry point site due to noise emission (hydrotesting activities), the following mitigation measures will take place:

- Installation of noise barriers (see Paragraph 8.5.2.4.1).
- Use of further noise mitigation techniques (e.g. relocalization of the compressors area, modification of the compressors operations during night time)
- In case the above mitigation measures will not be sufficient, TAP AG will evaluate as a last resort solution the temporary relocation of the people residing in the proximity of the pre-commissioning area. These measures will be discussed with local authorities and impacted households at a later stage of the Project.

While the Project does not foresee any economic displacement impacts on owners and workers of tourism businesses from routine construction or operations, any unforeseen impacts (through routine or non-routine circumstances) will be compensated in accordance with Italian legal requirements and in line with the EBRD requirements.

**Restoration of dry stone walls**

- As part of TAP AG’s Strategy for Cultural Heritage Management, the Project:
  - Will avoid displacing wherever possible dry stone walls.
  - Has conducted topographic surveys on the physical structures identified on the pipeline route;
  - Will rebuild any demolished dry stone walls according to their original dimensions and using the original stone materials upon completion of construction activities

**Land Value**

- As part of the Project’s Stakeholder Engagement Strategy and Livelihoods Restoration Framework and Plan, the Project will:
  - Check in with relevant stakeholders following re-construction of physical structures to make sure these structures are built to expectations.
  - Ensure that women have equal access to project information, TAP AG will continue to engage directly with women throughout all project phases.
### 8.7.2.2.3 Residual Impacts

The following table presents a summary of the residual impact associated with the impacts identified.

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land and Livelihoods</strong></td>
<td>Livelihoods Restoration Framework</td>
<td>Moderate</td>
</tr>
<tr>
<td>Temporary Loss of Livelihoods and Household Income – Agriculture</td>
<td>• TAP AG to identify land owners and land users (e.g. leaseholders) within the pipeline corridor.</td>
<td>• Changes to land will impact about 130 landowners.</td>
</tr>
<tr>
<td></td>
<td>• Affected land owners or users will be compensated for temporary loss of access rights, for any structures or developments on land that the land owner or land user can demonstrate ownership of; (and any standing annual or perennial crops at the replacement value. In line with LEA procedures TAP AG will provide compensation prior to construction.</td>
<td>• Approximately 1,900 olive groves with a trunk diameter larger than 30cm are potentially impacted by the Project.</td>
</tr>
<tr>
<td></td>
<td>• Affected landowners and/or rights-holders are entitled to compensation at replacement value for the lost income opportunities and for reduced income during the recovery period.</td>
<td>• Impacts to land will, at best, cause a disruption to livelihood activities.</td>
</tr>
<tr>
<td></td>
<td>• Affected land and asset owners are entitled to the restoration of all assets to its pre-project condition and/or the total costs to restore all damaged assets to pre-project conditions;</td>
<td>• Impacts experienced in the short term by seasonal crop owners. Permanent crop holders will be affected in the medium-term until trees re-establish.</td>
</tr>
<tr>
<td></td>
<td>• TAP AG will be sensitive to the additional concerns of landowners that have previously been affected by concurrent infrastructure projects and will ensure that they are provided with information on how the Project will address these concerns.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• TAP AG will be sensitive to the additional concerns of landowners that have previously been affected by concurrent infrastructure projects and will ensure that they are provided with information on how the Project will address these concerns.</td>
<td>• Clear and timely information will be provided to land owners on the exact timing of construction works, so that landowners are fully aware of the time of start and the period of duration of construction</td>
</tr>
<tr>
<td></td>
<td>• TAP AG will compensate for any temporary loss of agricultural subsidies as a result of Project.</td>
<td>• Affected agricultural workers including seasonal migrants are entitled to compensation for temporary loss of income and the Project will work with authorities, community groups and farmers to identify affected individuals and groups.</td>
</tr>
<tr>
<td></td>
<td>• Clear and timely information will be provided to land owners on the exact timing of construction works, so that landowners are fully aware of the time of start and the period of duration of construction</td>
<td>• TAP AG commits to restore the conditions of the land to the ante-operam status through the reinstatement of the olive groves. Upon request of the landowner, and in agreement with the relevant authorities, alternative compensation measures could apply.</td>
</tr>
<tr>
<td></td>
<td>• Affected agricultural workers including seasonal migrants are entitled to compensation for temporary loss of income and the Project will work with authorities, community groups and farmers to identify affected individuals and groups.</td>
<td>• Upon request, and where technically possible, a reduced working strip of 22 metres could be considered to reduce impacts, especially on olive trees.</td>
</tr>
</tbody>
</table>
8.7.2.3 Operations Phase

8.7.2.3.1 Potential Impacts

During Project operations, it is not expected that there will be many significant impacts on Land and Livelihoods with the exception of the permanent land take, due to the presence of the PRT and BVS.

Land will be acquired for permanent project structures and to allow for operations, maintenance and emergency access throughout the operational life of the project.
A major criterion of the project design has been that, as far as is practical, permanent infrastructure should be sited on unused land of no particular ecological or cultural value. Where this has not been possible, effort has still been made to avoid land on which there are dwellings or public infrastructure, or which is of high value as a habitat or for agriculture.

A Right of Way (RoW) is foreseen along the pipeline route. Regarding permanent constraints, no construction activities will be allowed in the 20 metres of the RoW in both the side of the pipeline (40 m strip), no clusters of houses construction activities will be allowed in a strip of 100 metres on both sides of the pipeline (200 m strip).

The Table 8-156, below, summarises the land use required by the Operation activities.

### Table 8-157 Permanent Land Use in Operation phase

<table>
<thead>
<tr>
<th>Component</th>
<th>Permanent Land Take</th>
<th>Permanent Constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipeline (8,200 km)</td>
<td>None</td>
<td>40 m 0 m (no single building allowed)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>200 m 00 m² (no cluster building allowed)</td>
</tr>
<tr>
<td>Access roads to PRT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Road 1: 922 m</td>
<td></td>
<td>New Road 1 to access to PRT: 5,993 m² (partially included in PRT area)</td>
</tr>
<tr>
<td>New Road 2: 716 m</td>
<td></td>
<td>New Road 2 to access to PRT: 4,654 m² (partially included in PRT area)</td>
</tr>
<tr>
<td>Road 2:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access roads to BVS</td>
<td></td>
<td>New Road to access to BVS: 637 m²</td>
</tr>
<tr>
<td>New Road: 98 m</td>
<td></td>
<td>Upgrade road to access to BVS: 3,738 m²</td>
</tr>
<tr>
<td>Upgrade Road: 575 m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Block valve station</td>
<td>182 m² (13 m x 14 m)²</td>
<td>N/A</td>
</tr>
<tr>
<td>Pipeline receiving terminal</td>
<td>120,000 m² (12” Ha)</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### Permanent Loss of Livelihoods and Household Income – Agriculture

Following construction, land will be reinstated and returned to its original use, where possible. The land use for operations is significantly less than the area needed during construction activity. Only the aboveground installations land, such as the PRT and BVS will be purchased by TAP AG after an extensive consultation with landowners.
Agricultural activity will be allowed on the safety zone and no long-term impact is foreseen on agriculture and household income and livelihoods. However, impacts from lost time and additional time and effort needed to develop crops temporary affected by the Project from construction activity are a concern for local farmers and will be taken into consideration in the Livelihood Restoration Plan. Following construction activity, it will be important that the Project continues to consult with affected households during soil and land surface rehabilitation activities to determine appropriate compensation and support for returning to pre-Project crop production and the restoration (or improvement) of livelihoods to pre-Project levels.

At this stage it is not clear how many different landowners and users will be affected or the proportion of household livelihood and income this represents. Detailed information will only be available once the Land and Easement team has confirmed all property ownership and updated cadastre information throughout the pipeline corridor. However, for the purpose of this study the number of households interested by permanent land takes is estimated to be under 10.

Box 8-25 Masseria il Capitano

Masseria il Capitano

As the figure below shows, there is a permanently inhabited Masseria (called “Il Capitano”) in the proximity of the PRT site. Masseria il Capitano is surrounded by 23 hectares of agricultural land (mostly olive groves and arable land), which the landowner uses to conduct agricultural activities and agro-tourism.

One third of the current PRT design (12 ha of total area) overlaps with the properties of the Masseria, triggering an economic resettlement obligation towards the owner. Impacted land in the PRT footprint is uncultivated for over 90%, while approximately 7% is occupied by olive groves.

The buildings of the Masseria are very close to the PRT fence lines (i.e. approx. 50 metres), but they are almost 500 metres away from the main PRT structures. Section 8.7.2 and 8.7.4 assess the impacts and propose mitigation measures for effects related to loss of livelihoods (8.7.2) and environmental health and wellbeing (8.7.4).

Despite mitigation measures, the impacts on the people living in the Masseria are expected to be long term and irreversible. During the Land Easement and Acquisition process, TAP AG will determine – in consultation with the affected household - whether their livelihoods can continue at the present location and document it in the Livelihood Restoration Plan.

Should this be the case, in line with EBRD Performance Requirement 5, TAP AG commits to draft a Resettlement Action Plan and to: “(i) offer displaced persons choices among feasible resettlement options, including adequate replacement housing or cash compensation where appropriate; and (ii) provide relocation assistance suited to the needs of each group of displaced persons, with particular attention paid to the needs of the poor and the vulnerable. Alternative housing and/or cash compensation will be made available prior to relocation. New resettlement sites built for displaced persons will offer improved living conditions.”(EBRD, PR 5)
Permanent Loss of Livelihoods and Household Income – Tourism

Permanent visual disruptions from the PRT, BVS are expected to do not interfere with long-term tourism activity and household income and livelihoods.

With this regard, TAP commissioned a study to Nomisma Energia to evaluate the correlation between tourism flows and the presence of high pressure pipelines in other areas of the Adriatic coast with the Bandiera Blu (Blue Flag). In this study, Nomisma provides evidence that the presence of a high pressure pipeline bears no significant impact on tourism flows.¹

Changes in Land Use and Land Value

Most of the land in the Study Area is privately owned agricultural land. Land value might change due to perceived risks or perceived impacts.

The risk of degradation of the soil is foreseen as not significant, as the original contours of the land will be restored and appropriate mitigation measures will be utilised by the Project (see Environmental Impact). Potential impacts on land value and use will be limited to restrictions in land development within the Safety Zone of 20 metres. For instance, no houses will be allowed within the corridor. The risk of permanent loss of productivity due to land use restrictions will be limited as agricultural activity will be allowed on the working strip.

Following construction, land will be reinstated and returned to its original use, where possible. There will be no permanent change in land ownership associated with the pipeline because only areas around the PRT and BVS, will be purchased by TAP after an extensive consultation with landowners.

8.7.2.3.2 Mitigation Measures

The LRF, GLAC and other TAP AG policy documents outlined above have been designed to address impacts resulting from changes to land and livelihoods. These documents specifically address mitigation of impacts during the operation phase and are presented below.

Permanent Loss of Livelihoods and Household Income - Agriculture

- As part of TAP AG’s Strategy for the Acquisition of Land and Easement and Livelihoods Restoration Framework and Plan, land value impact considerations will be incorporated into compensation frameworks for each impacted household.
- As part of TAP AG’s Strategy for Grievance Redress, the Project will facilitate proactive communication to enable a timely and appropriate response to any stakeholder concerns that are communicated throughout the life of the Project.

¹ Nomisma Energia, Analysis of Gas Pipelines Landfalls on the Adriatic Coast of Italy (2012)
Land Use and Value

- As part of TAP AG’s Strategy for the Acquisition of Land and Easement and Livelihood Restoration Framework and Plan, the Project will:
  - Assess the productivity of land being crossed by the Project to understand variations in land value and associated productivity.
  - Incorporate land value impact considerations into compensation frameworks for each impacted household.

8.7.2.3.3 Residual Impacts

The following table presents a summary of the residual impact associated with the impacts identified.

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
</table>
| Land And Livelihoods | Livelihoods Restoration Framework  
- Compensation at replacement values for loss of income from permanent crops.  
- Compensation at replacement values for lost lands.  
- Compensation at replacement values for lost land rights.  
- Compensation at replacement values for lost assets  
- In line with EBRD guidelines TAP will provide compensation prior to construction | Minor  
- A small number of households (less than 10) will be affected by the permanent loss of their assets/crops.  
- Crop loss will affect a small proportion of farmers (approx. 90% of grazing land).  
- Compensation should re-establish lost livelihood. |
| Potential impact on Livelihoods and Household Income – Tourism (Visual Impacts) | Micro-tunnelling to avoid visual impacts for beach tourism. | Minor – PRT/BVS  
- Permanent visual disruptions from the PRT, BVS (very small) are expected to bear minimal impacts on long-term tourism activity. These areas are inland and surrounded by trees, as a result it is not easy to spot them from the road. |
| Changes in land values post construction - Restrictions on change of use from agricultural to residential structure/land in the safety zone. | Systematic engagement with local authorities in order to cover the entire range and all levels of local and regional planning which will be affected by the Project  
- Affected land owners and/or right holders are entitled to cash compensation at replacement values for the reduced opportunities to use the land most productively (lost stumpage value). | Minor  
- It is unclear how many landowners will be affected by changes to land value, although it is likely to be a relatively small number, depending on size and location of each property.  
- Changes to land value will be permanent. |
8.7.2.4 Decommissioning Phase

8.7.2.4.1 Potential Impacts

Potential impacts will need to be reassessed given the period of time that will pass before decommissioning activities are expected to take place. Decommissioning activities performed will apply to the PRT and the BVS only. Thus potential impacts during Project decommissioning are likely to be less significant than during the construction phase due to the smaller affected area.

8.7.2.4.2 Mitigation Measures

TAP AG will prepare a Preliminary Decommissioning Plan (which will be a ‘living document’) that will be developed further during field operations and fully defined in advance of the end of field life.

8.7.2.4.3 Residual Impact

Residual impacts could be rated differently approaching the time period of Project decommissioning.

8.7.3 Infrastructure and Public Services

8.7.3.1 Overview

This section presents the potential impacts on existing infrastructure and public services as a result of project related activities.

The box below shows the key sources of impact, potentially impacted resources and receptors, baseline and project influencing factors associated with the impacts of the TAP project on infrastructure and public services.

**Box 8-26 Key Sources of Impact, Potentially Impacted Resources and Receptors**

**Sources of Impact**
- Construction of 8.2 km pipeline in the Municipality of Melendugno (from the landfall to the PRT station)
- Temporary construction workers housed in nearby towns: An independent economic impact assessment (Nomisma Energia 2013) suggests that during the three years construction phase in Puglia TAP will directly support 150 jobs per year (part-time and full-time) as well as 640 indirect jobs (part-time and full-time) via local companies working for TAP. During the 50 year operation phase TAP will support directly 32 and indirectly 150 jobs per year (part-time and full-time).
- Set-up of temporary constructions sites (construction camps, pipe yards, lay down areas) along the pipeline route
- Increased Project traffic (discussed in the Human Health section)
- Small portions of road closures during construction and possible damage to existing road surfaces from heavy traffic loads.
- Upgrade of existing secondary roads and creation of new small access roads in the proximity of the main working sites.

**Potentially Impacted Resources and Receptors**
- Community and Worker Road Users and communities nearby by the Project
- Brindisi Harbour (discussed in the Offshore Section)
- Emergency services and hospitals
- Local accommodation facilities
The following table presents the key impacts of the TAP Project on infrastructure and public services during the key Project phases.

**Table 8-159  Key Potential Impacts – Infrastructure and Services**

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Temporary disruption of roads and other infrastructure and hindrance of utility services during pipeline construction and access road upgrades</td>
<td>• Improved driving conditions on upgraded access road sections</td>
<td>• Decommissioning activities performed will apply to the PRT and the BVS only. Potential impacts will need to be reassessed given the period of time that will pass before decommissioning activities are expected to take place</td>
</tr>
<tr>
<td>• Increased demand for local services: restaurants, laundries, etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Increased demand for local accommodation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Potential increased demand of health services</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Increased demand of local utilities and services (e.g. electricity, waste sanitation)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
8.7.3.2 Construction and Pre-commissioning Phase

Most direct impacts on local infrastructure and services are likely to take place during the construction and pre-commissioning period given the nature of activities and size of the workforce. During Project construction the following aspects will be developed and/or used by the Project:

**Roads**

- New Roads (Total): around 1736 m (922 and 716 for the PRT access and 98 for the BVS access)
- Road Upgrade (Total): 575 m (for the BVS access)

**Services and Utilities**

- Services (i.e., water supply, wastewater and sanitation services, electricity supply, potable water supply, and solid waste management) will be procured locally, where possible. During the construction phase, water tanks will bring water to the working site. The most appropriate water source will be identified with relevant authorities at a later stage.

**Brindisi Harbour**

- Brindisi Harbour is likely to be the base for Project marine vessels (see Section 8.4).

**Accommodation facilities**

- Project employees will be hired locally where possible and will not need accommodation. However, a percentage of non-resident project employees will reside close to the site in nearby villages.

**Health facilities**

- While Project employees will be provided with a health clinic at the Main Construction site, they may utilise local health facilities for specific health services located in nearby towns.

8.7.3.2.1 Potential Impacts

**Potential Impacts from Project Road Development and Use**

A number of activities will take place in preparation for pipeline construction and pre-commissioning:

- Construction of two New Roads to connect the PRT Area: one of 5,993 m² (partially included in PRT area) and one of 4,654 m² (partially included in PRT area);
- New Road to access to BVS: 637 m²
- Upgrade Road to access to BVS: 3,738 m²
A single storage area for the line pipes and other working materials will be located in the western side of the PRT footprint (Kp 8.2). It will be easily accessible through the existing road network (SP 29 and connected asphalt roads) and two new access roads.

The whole extent of the land parcels affected presumably amounts to:

- 33 hectares (0.33 km²) as land-easement for pipeline safety zone (including 21 ha for temporary construction);
- 12 hectares (0.12 km²) as land acquisition for the permanent receiving terminal (including 5 ha for fabrication and material storage).

A temporary worksite is foreseen specifically for the construction of the offshore microtunnel and it will occupy an area of 26,000 m². The microtunnel launch shaft will be located here (Kp 0.000).

In the Project area, provincial and municipal roads are paved and generally in good condition, frequently bounded by dry stone walls. Roads likely to be most impacted by the Project during construction and pre-commissioning are Municipality Road S. Viceta, SP2 Provincial Road Lecce-Melendugno and a small municipal road.

In addition to the one provincial road and one minor asphalt road crossing by landfall microtunnel upstream of Kp 0 there is one provincial road crossing at Kp 6.5 and eight minor municipality road crossings. Details of all the asphalt road crossings are provided in the table below (excluding microtunnel road crossings).

**Table 8-160 Crossings**

<table>
<thead>
<tr>
<th>Nr</th>
<th>Crossing Category</th>
<th>Kp</th>
<th>Municipality</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Seasonal road</td>
<td>0.601</td>
<td>Melendugno</td>
</tr>
<tr>
<td>4</td>
<td>Secondary road</td>
<td>1.131</td>
<td>Melendugno</td>
</tr>
<tr>
<td>5</td>
<td>Secondary road</td>
<td>2.027</td>
<td>Melendugno</td>
</tr>
<tr>
<td>6</td>
<td>Secondary road</td>
<td>4.012</td>
<td>Melendugno</td>
</tr>
<tr>
<td>7</td>
<td>Secondary road</td>
<td>4.620</td>
<td>Melendugno</td>
</tr>
<tr>
<td>8</td>
<td>Secondary road</td>
<td>5.611</td>
<td>Melendugno</td>
</tr>
<tr>
<td>9</td>
<td>Secondary road</td>
<td>5.906</td>
<td>Melendugno</td>
</tr>
<tr>
<td>10</td>
<td>SP 02</td>
<td>6.542</td>
<td>Melendugno</td>
</tr>
<tr>
<td>11</td>
<td>Secondary road</td>
<td>7.602</td>
<td>Melendugno</td>
</tr>
</tbody>
</table>

The Main Construction site (and future PRT) is planned to be located within the territory of the municipality of Melendugno. The terminal will be located in an uncultivated area about 8.2 km inland from the seashore. This area has been selected after consultations with the stakeholders and it is easily accessible through the existing road network (SP 29 and connected asphalt roads) and two new access roads.
The level of traffic along these roads is expected to increase to and from the construction site. Thus, it will be important for the Project to monitor road conditions and associated traffic risks to minimise any impacts.

**Potential Impacts on Infrastructure and Services**

The Project will purchase services (i.e., wastewater and sanitation services, electricity supply, potable water supply, and solid waste management) from local suppliers. Only during the construction phase, water supply will be provided by tankers. An adequate source of water supply will be identified with the relevant authorities in a later phase. The table below provides the details of the quantity of water needed by the Project during construction phase.

<table>
<thead>
<tr>
<th>Table 8-161 Water Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Typology</strong></td>
</tr>
<tr>
<td>Offshore</td>
</tr>
<tr>
<td>Seawater</td>
</tr>
<tr>
<td>Domestic water</td>
</tr>
<tr>
<td>Industrial water</td>
</tr>
<tr>
<td>Industrial water</td>
</tr>
<tr>
<td>Onshore</td>
</tr>
<tr>
<td>Domestic Water</td>
</tr>
<tr>
<td>Industrial water</td>
</tr>
<tr>
<td>Industrial water</td>
</tr>
<tr>
<td>Industrial water</td>
</tr>
</tbody>
</table>

During construction, the Project will source electricity from the local power grid as well as from engine generators, particularly at the smaller work site where micro-tunnelling construction activities will take place. Households in the area are not likely to be impacted since it is estimated that the local public grid can provide sufficient capacity for the Project needs.

**Potential impacts from Project workers residing in local accommodations**

No accommodation for workers is considered at the work site, this means that non-resident construction workers will be accommodated in nearby settlements and towns such as Acquarica, Torre Specchia Ruggeri, San Foca, Vernole or Melendugno. Use of local accommodations will depend on the percentage of non-local workers hired by the Project during construction. However, from the data collected on the nearby communities, the capacity, the volume and quality of the housing stock is expected to be sufficient to accommodate non-resident workers $^1$. The use of local accommodation by the Project will have positive impacts on local accommodation business owners and related services (i.e. increased income during autumn, winter and spring season, when these services are not requested by tourists).

Potential Impacts on Health Infrastructure

Potential increased demand for community health services may occur as a result of the influx of Project workers. While workers will be provided with a small health clinic, in case of more specific health needs they may access local public health infrastructure. In this case, they may place a strain on existing public health infrastructure, which is already considered to have limited capacity based on stakeholder indications of limited health staff and hospital beds and corresponding long waiting times at public hospitals. Any impacts from reduced access to health infrastructure will be localised, short term and limited due also to the number of Project workers.

8.7.3.2.2 Mitigation Measures

TAP AG’s Policy on Corporate Social Responsibility (Doc.Ref. TAP-HSE-PO-0002) contains the commitment to avoid, minimise, mitigate, offset and/or compensate all adverse impacts resulting from project development. TAP AG is committed to building its own project related infrastructure, such as access roads, camps, and sewage systems in a way which allows neighbouring communities to benefit from them on a permanent basis where that is possible. Moreover, TAP AG is committed to enhancing local development through social and environmental investments (SEI) of living conditions in neighbouring communities (Strategy for Social and Environmental Investments, Doc.Ref. TAP-HSE-ST-0006).

TAP AG also has a Stakeholder Engagement Strategy (TAP- EXT-ST-0006) in place, which commits TAP AG to continue effective engagement with stakeholders in particular those in the immediate vicinity of the construction works through providing up-front information and communication avenues to raise any concerns and grievances, and in particular by having community liaison personnel on site for direct contact with stakeholders:

- Community liaison officers will be present at work fronts to ensure that impacts from planned disruptions are minimised and that any unplanned disruptions are properly managed (see also Section 8.7.6).
- A Grievance Mechanism is in place so that affected stakeholder concerns are addressed promptly and effectively, using an understandable and transparent process that is culturally appropriate and readily accessible to all segments of the affected parties at no cost and without retribution. Access of affected stakeholders to a compensation process in case any unplanned disruption results in loss of livelihoods is also part of that Grievance Mechanism.

Particular mitigation measures to address impacts to infrastructure as mentioned above in the impact discussion are summarised in the following Sections.
Project Title: Trans Adriatic Pipeline – TAP
Document Title: ESIA Italy - Section 8 Assessment of Impacts and Mitigation Measures

Potential disruptions to road infrastructure

- For all road crossings, agreements will be made with the public or private owners and in consultation with local municipalities and regional road agencies and public notice of construction activities and implications will be locally made available.

- The Project will employ a community liaison officer(s) to be a resource at work sites and along the pipeline route for local stakeholders.

- Crossings of secondary rural roads can typically be accomplished within a short time so that road passage at these locations usually will be interrupted for no longer than 1–3 days. Temporary diversions will be established where no reasonable alternative local access exists. After the pipeline is installed at the crossing, all damage to public or private roads will be repaired and the conditions prior to pipeline construction will be reinstated in agreement with local authorities and infrastructure owners.

- As a general commitment of TAP AG, finance the repair/upgrade work on roads required prior to heavy transportation, maintenance of access roads during construction and reinstatement works after completion of the pipeline construction will be financed by TAP AG.

- The project, known as ‘Regional Road n.8’, plans to facilitate the mobility of Lecce citizens towards the coast. The new road will consist of a two lane carriageway. The works for this new infrastructure could overlap with those of the TAP Project. However, although the public administrations have already notified expropriation decrees to some landowners for the construction of the new road, the road stretch included in the municipality of Melendugno is temporarily suspended with no final route definition. No further information on this project is known at the time of writing this report.

In case the Regional Road n.8 is constructed during TAP construction period, TAP AG will inform and where possible coordinate actions, with the authorities and companies responsible for the regional road n°8 project design and implementation in order to avoid cumulative impacts, where possible.

Potential disruptions in Infrastructure and Services

- The Project will develop an Infrastructure and Utilities Management Plan prior to implementing works. TAP AG’s contractors will conduct an assessment as part of the detailed engineering process to determine whether to invest in public utilities or be self-sufficient.

- The Project will engage with local authorities and utilities companies to ensure continuity of supply of utilities to communities.
As part of TAP AG’s Strategy for Stakeholder Engagement and Grievance Redress, the Project will include specific commitments to rapid response times for infrastructure and utility grievances and requests.

The Project will proactively engage with local utilities so that in the case of any unplanned events (e.g., power outages) that may be linked to the Project can be quickly resolved.

The Project aims to respond proactively to any service problems connected with Project activities.

Develop infrastructure upgrade program so that all communities benefit from targeted upgrade.

Main construction site facilities will produce civil waste that will be transported to a controlled municipal waste disposal site. The Project taking into consideration the capacity of municipal services and infrastructure (including existing waste handling) will design waste management planning accordingly.

**Project workers residing in local accommodations**

The Project will prepare an accommodation plan to quantify and define specific accommodation needs for the non-resident workforce. A comprehensive survey of all available accommodation structures – especially during the low season – will precede the accommodation plan.

As part of TAP AG’s Strategy for Stakeholder Engagement and Grievance Redress, establish a community procedure to quickly respond to accommodation business owners that will accommodate workers.

**Temporary risk of Pressure on Community Health Infrastructure**

The Project will pursue a prevention strategy to reduce the needs for clinic/medic consultations. All workers will receive health and safety trainings to raise their awareness on health and safety risks and correct behaviours.

Workers will be provided with primary health care and basic first aid at construction camps / worksites. This should be done in line with the IFC / EBRD guidelines on worker accommodation summarised below.
Box 8-27 Medical Facilities

The guidance states that:

The availability or level of medical facilities provided in workers’ accommodation is likely to depend on the number of workers living on site, the medical facilities already existing in the neighbouring communities and the availability of transport. However, first aid must always be available on site.

The guidelines provide the following benchmarks:
1. A number of first aid kits adequate to the number of residents are available.
2. First aid kits are adequately stocked. Where possible a 24/7 first aid service/facility is available.
3. An adequate number of staff/workers is trained to provide first aid.
4. Where possible and depending on the medical infrastructures existing in the community, other medical facilities are provided (nurse rooms, dental care, minor surgery).

The contents of the first aid kits depend on the needs of the workplace but should include individually wrapped sterile adhesive dressings, individually wrapped eye pads, individually wrapped sterile wound dressings of various sizes, bandages, safety pins and sterile gloves.

First Aid Rooms should include:
- hot and cold running water;
- drinking water and disposable cups;
- soap and paper towels;
- a store for first aid materials;
- foot-operated refuse containers, lined with disposable yellow clinical waste bags or a container for the safe disposal of clinical waste;
- a couch
- a telephone or other communication equipment; and
- a registration log for recording incidents where first aid has been given.

Source: IFC/EBRD guidelines on worker accommodation August 2009

- TAP AG will undertake a capacity / needs assessment of equipment and personnel of hospitals along the route to determine if facilities have sufficient resources and equipment to deal with emergencies. Agreements will be entered into with suitable hospitals to provide health care in emergency situations. These agreements will include provision of additional equipment or training for staff if required by TAP AG.

- TAP AG will develop Emergency Response Plans (ERPs). These will be developed in consultation with national emergency providers and local health care facilities and will cover all contractors and subcontractors as well as consideration of the local community.

- TAP AG will monitor the emergence of major pandemics through WHO alerts. When the WHO Pandemic Alert Scale reaches level 4 TAP will implement the relevant ERPs.

The Project will provide health care for any member of the community injured as a result of Project activities.
8.7.3.2.3 Residual Impacts

The following table presents a summary of the residual impact associated to the impacts identified.

### Table 8-162 Residual Impacts – Infrastructure and Public Services - Construction and Pre-Commissioning

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Infrastructure &amp; Public Services</strong></td>
<td>- Disruption and potential damage to infrastructure during construction (including road upgrade activities)</td>
<td><strong>Minor</strong></td>
</tr>
<tr>
<td></td>
<td>• Employ a community liaison officer (s) to be a resource at work fronts and along the pipeline route for local stakeholders.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Prior to any significant road activity, conduct focused consultation with specific stakeholders whose livelihood activities are in close proximity to areas that will experience heavier road use or development activities to discuss any concerns and appropriate compensation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Fix any roads damaged as a result of Project vehicle movements.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Increased demand for local accommodation.</td>
<td><strong>Moderate (Positive)</strong></td>
</tr>
<tr>
<td></td>
<td>• The capacity of the nearby communities and the volume and quality of the housing stock is expected to be sufficient.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Positive impacts on local accommodation business owners and related services from increased demand for accommodation facilities, during low season when usually there is no demand of these facilities.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Use of local accommodations will depend on the percentage of non-local workers hired by the Project during construction.</td>
<td></td>
</tr>
</tbody>
</table>
### Impact / Risk | Measures to Address the Impact / Risk | Significance of Residual Impact / Risk
---|---|---
Disruptions or pressures on local utilities and public services (e.g., electricity, waste sanitation). | Assessment of local utilities and waste management services.  
Project specific waste management procedures.  
Engage with local utilities so that in the case of any unplanned events (e.g. power outages) that may be linked to the Project can be quickly resolved.  
Respond proactively to any service problems connected with Project activities.  
Develop infrastructure upgrade program so that all communities benefit from targeted upgrade. | Not Significant

Increased pressure on public health infrastructure from non-local workers accessing services not provided by Project health clinic. | Develop and implement an emergency response plan to minimise real impacts on community health infrastructure from any worker health emergencies.  
A primary health service will also be available at the main construction site.  
Deliver trainings on health and safety risks and preemptive measures to reduce workers’ risky behaviours. | Minor

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
</table>
Utilities Services and Infrastructures |  
Localised temporary disruptions | Continued use of roads and other infrastructure benefits by local communities. | Not Significant

#### 8.7.3.3 Operations Phase

During operation and maintenance no significant adverse impacts on infrastructures and utilities are anticipated.

Localised temporary disruption of supply lines could occur in case of repairs of the pipeline system. However, these should be very rare, since the pipeline integrity will be protected by a range of measures and high security standards (see Section 4). Mitigation measures for such cases will be planned and implemented in consultation with local authorities and infrastructure owners.

Residual adverse impacts from operation and maintenance are thus **Not Significant**, and there is little positive spin-off potential either.

#### Table 8-163 Residual Impacts - Infrastructure and Services- Operation Phase

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
</table>
Utilities Services and Infrastructures |  
Localised temporary disruptions | Continued use of roads and other infrastructure benefits by local communities. | Not Significant |
8.7.3.4 Decommissioning Phase

8.7.3.4.1 Potential Impacts

Potential impacts will need to be reassessed given the period of time that will pass before decommissioning activities are expected to take place. Decommissioning activities performed will apply to the PRT and the BVS only. Thus potential impacts during Project decommissioning are likely to be less significant than during the construction phase due to the smaller affected area.

8.7.3.4.2 Mitigation Measures

TAP will prepare a Preliminary Decommissioning Plan (which will be a ‘living document’) that will be developed further during field operations and fully defined in advance of the end of field life.

8.7.3.4.3 Residual Impact

Residual impacts could be rated differently approaching the time period of Project decommissioning.

8.7.4 Community Health & Safety

8.7.4.1.1 Overview

The realization of the Project could affect the health and safety of the communities along the pipeline route and close to pipeline receiving terminal stations as a result of worker-community interactions, the risk of injury associated with construction activities and competition for access to health care resources. Any community concerns or perceptions with regard to reduced health and physical safety by the community also need to be addressed.

The following box shows the key sources of impact, potentially impacted resources and receptors, baseline and project influencing factors associated to the impacts of the TAP Project on worker health and safety.

**Box 8-28 Key Sources of Impact, Potentially Impacted Resources and Receptors**

**Sources of Impact**
- Potential increased disease transmission due to the interaction between national and international workforce
- Communities and stakeholders concern around the safety of the pipeline once it is operational
- Changes to the environment due to increased noise, decreased air quality and changes to the visual environment due to construction and operation activities.
- Increased number of vehicles in the area and traffic might lead to a higher number of road accidents and injuries.

**Potentially Impacted Resources and Receptors**
- Communities centrally located within Melendugno and Vernole municipalities
- Land owners and land users of areas that cross into or are adjacent to the Project site
- Road users in Melendugno and Vernole
- Health care facilities

**Baseline Influencing Factors**
- Low levels of STDs reported
- Hospitals exist in larger cities but local access to public health services is not always satisfactory (e.g. long waiting lists, resulting reliance on private health clinics for care)
Vulnerable Groups

- Children & Elderly – these groups are traditionally more vulnerable to decrease of wellbeing and quality of life in the community

Project Influencing Factors

- Type and management of construction area.
- Presence of non resident workforce
- Numbers and Movement of Project vehicles

The following table presents the key impacts of the TAP project on human health during the key project phases.

### Table 8-164  Key Potential Impacts – Community Health and Safety

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Potential traffic safety risks from increased traffic and the presence of heavy vehicles on roads, degraded roads by increased heavy vehicles traffic.</td>
<td>• Very low likelihood of safety risks from unplanned events.</td>
<td>Potential impacts are expected to be similar to construction phase also if less impact is foreseen due to the fact that works will be performed on a limited area (PRT and BVS).</td>
</tr>
<tr>
<td>• Potential increased transmission risks of communicable diseases and temporary pressure on local sanitation and health infrastructure.</td>
<td>• Disturbance to environmental health, quality of life and wellbeing.</td>
<td></td>
</tr>
<tr>
<td>• Potential disturbance to environmental health, quality of life and wellbeing.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Site trespass and injury</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8.7.4.2  Construction and Pre-commissioning Phase

8.7.4.2.1  Potential Impacts

The potential impacts on Community Health, Safety & Security (CHSS) are likely to relate to traffic risks, public health, safety and security concerns from a construction workforce as well as potential impacts from unplanned events and unauthorised access to work areas. These potential impacts are expected to be of limited severity due to the average number of Project workers foreseen during the construction phase, the number of Project vehicles and the number of trip foreseen per day on public roads and the Project health and safety measures (Traffic Management Plans) that will be in place during the construction and pre-commission phase.
Temporary Traffic Safety Risks

Project construction activities that could have a potential impact on traffic safety are the following:

**Numbers and Movement of Project vehicles:** An average number of 40 vehicles per day are estimated along the construction working corridor during pipeline construction activities with a peak of 60 movements per day during excavation and pipe-laying activities. As discussed in the Project Description section, a number of heavy equipment vehicles will be used such as bending machines, pipe layers, excavators (3 in total) and trucks (2 in total). Heavy vehicles will mostly travel along the construction corridor to reduce heavy vehicle movement on public roads.

**Workers movements:** Light vehicle (minivan and car) movements during construction for the transportation of workers and light materials to and from construction site areas are foreseen. It is very likely that workers will travel to the city of Lecce (~13 km from the pipeline route) or other city centres nearby during their off time, as night life (e.g., bars) in the area surrounding the pipeline route is very limited.

Given the length of the pipeline corridor (8.2 km), the number of project workers expected, the number of trips foreseen per day on public roads, and the “Code of Conduct” to which Project workers will be instructed, the impact on traffic safety is likely to be minor.

Temporary community health risk from communicable disease

The presence of a workforce could potentially lead to the increased transmission of communicable diseases within these communities. The profile of these diseases will be influenced by the existing health profile of communities in the area and that of the workers, however, risks associated with these impacts will be controlled by the preparation and implementation of the H&S and Community Health Management Plans.

Diseases that may be of concern include sexual transmission diseases. Their prevalence is currently low in Italy and therefore the potential for transmission will be influenced by the behaviour of the workforce.

Potential risks for community health will be addressed through the implementation of appropriate mitigation in consultation with the relevant authorities and local administrations.

Site Trespass and Accidents

There is a potential risk of site trespassing at work fronts for the duration of construction of the pipeline and all the facilities. Signage will be erected, and where necessary, temporary fencing will be installed along the pipeline route during the construction. The risk of trespassing is highest when work fronts are located closest to isolated houses or communities. Site trespassing could result in accidents leading to injuries or even fatalities since the presence of large pieces of machinery and open trenches for the construction of the pipeline, pose a particular risk if they were to become part filled with water.
Environmental Health and Quality of Life

The construction of the pipeline, of the BVS and the PRT will determine some changes to the physical environment. This could potentially influence the environmental health and the psychological wellbeing of the local community.

Changes to the visual environment are likely to be minor during the construction phase. The increase in dust is predicted to have a minor negative impact following mitigation but may still result in some increased annoyance and decreased wellbeing especially for residences closest to construction site e.g., less than 200 m from the construction and close to the main working sites and roads.

The construction of the pipeline and the compressor station is likely to result in some temporary increased noise, mainly for residents within 150 m of construction sites. More details can be found in the Section 8.5.1.2.

Table 8-165  Human receptors in the 500 m corridor

<table>
<thead>
<tr>
<th>Way Point</th>
<th>Description</th>
<th>Buffer</th>
<th>Distance from pipeline (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOC14</td>
<td>Villa Elena and Villa Teresa (3 families, inhabited houses)</td>
<td>500 m</td>
<td>0.244 (entry point)</td>
</tr>
<tr>
<td>SOC15</td>
<td>Country house and fields</td>
<td>500 m</td>
<td>0.201 (entry point)</td>
</tr>
<tr>
<td>SOC20</td>
<td>House for sale</td>
<td>500 m</td>
<td>0.264</td>
</tr>
<tr>
<td>SOC21</td>
<td>Inhabited house</td>
<td>500 m</td>
<td>0.178</td>
</tr>
<tr>
<td>SOC22</td>
<td>Inhabited house</td>
<td>500 m</td>
<td>0.119</td>
</tr>
<tr>
<td>SOC30</td>
<td>Azienda Agricola Le Sarei</td>
<td>500 m</td>
<td>0.021</td>
</tr>
<tr>
<td>SOC33</td>
<td>Inhabited house</td>
<td>500 m</td>
<td>0.127</td>
</tr>
<tr>
<td>SOC34</td>
<td>B&amp;B Alba</td>
<td>500 m</td>
<td>0.246</td>
</tr>
<tr>
<td>SOC36</td>
<td>Inhabited house (Masseria Lizza)</td>
<td>500 m</td>
<td>0.213</td>
</tr>
<tr>
<td>SOC37</td>
<td>Inhabited house (Andrea Camassa)</td>
<td>500 m</td>
<td>0.069</td>
</tr>
<tr>
<td>SOC38</td>
<td>Inhabited house (Masseria Capitano)</td>
<td>500 m</td>
<td>0.476 (PRT)</td>
</tr>
<tr>
<td>SOC48</td>
<td>Azienda Agricola Le Paesane</td>
<td>500 m</td>
<td>0.079</td>
</tr>
</tbody>
</table>

The human receptors of Table 8-165 can be visualized in Figure 8-32, Figure 8-33, Figure 8-34.
### Project Title:
Trans Adriatic Pipeline – TAP

### Document Title:
ESIA Italy - Section 8 Assessment of Impacts and Mitigation Measures

#### Figure 8-32 Location of Human receptors - PRT and western sector of the pipeline

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Source: ERM 2013
Figure 8-33  Location of Human receptors - central sector of the pipeline

Source: ERM 2013
8.7.4.2.2 Mitigation Measures

**Temporary traffic safety risks**

- Plan traffic routes to limit road use by the Project (particularly along public transport route) during high public traffic periods in order to reduce traffic risks to the community and the workers.
- Assess local road conditions and be responsible for road maintenance during Project construction to minimise traffic risks associated with possible deteriorated roads (as a result of heavy traffic on local roads).
- As part of the Project's Code of Conduct and HSE policy, the Project will require and provide driver training to promote safe and responsible driving behaviour.
- To minimise the risk of incidents, all activities will be notified to local authority in advance of the activity taking place.
Temporary community health risk from communicable disease

- As part of the TAP AG’s HSE Policy and Quality Risk Management, the Project will:
  - Monitor local health trends during Project construction (and operations) in order to be aware of and respond appropriately to any negative health trends that may be linked to the Project and its workers.
  - Conduct regular worker training and community awareness campaigns to promote awareness of risks.
  - Conduct voluntary pre-employment screening and ongoing screening for STDs.

Site Trespass and Accidents

- TAP AG will undertake a programme of stakeholder engagement and consultation to inform local communities of the risks of trespassing onto sites.
- As part of TAP AG’s Strategy for Grievance Redress, establish a community grievance procedure to promote protection of community rights and livelihoods, track complaints and respond appropriately to community issues.
- As part of the TAP AG’s Code of Conduct, the Project will maintain policies to minimise the impact of unacceptable behaviour by Project workers on nearby communities.
- The Project will develop and implement an emergency response plan specific to construction to prepare personnel and local emergency response crews to effectively handle pipeline emergency situations and to ensure public safety.
- As part of TAP AG’s External Relations Communications Strategy and Stakeholder Engagement Strategy, the Project will provide information to the local community prior to and during construction activity to promote awareness and understanding of safety risks associated with the Project.
- TAP AG will ensure that signs are put up around work fronts and construction sites advising people of the risks associated with trespassing. All signs should be in Italian or in diagram form to ensure a universal understanding of the signs.
- TAP AG will ensure that there is adequate fencing around pipe yards and other similar facilities to minimise the risk of trespassing.
- When work fronts are within 100 m of an inhabited building, all equipment will be parked overnight in a demarcated area.
Security arrangements will be based on the UN Voluntary Principles for Security and Human Rights which represents international best practice. This involves e.g. selection based on a careful background screening of security forces, their training with regards to Human Rights and careful monitoring of their services. TAP AG will make security arrangements transparent to the local communities and consult with them regularly about the impact of arrangements on communities.

In all contractor contracts the Project will make explicit reference to the need to abide by the national law and policies.

Environmental Health and Quality of Life

To minimise the temporary impact on the quality of life of the households living close to the entry point site due to noise emission (hydrotesting activities), the following mitigation measures will take place:

- Installation of noise barriers (see Paragraph 8.5.2.4.1).
- Use of further noise mitigation techniques (e.g. relocalisation of the compressors area, modification of the compressors operations during night time.
- In case the above mitigation measures will not be sufficient, TAP AG will evaluate as last resort solution the temporary relocation of the people residing in the proximity of the pre-commissioning area. These measures will be discussed with local authorities and impacted households at a later stage of the Project.

TAP AG will undertake stakeholder engagement with affected communities and other stakeholders on a range of issues including changes to the visual environment, noise and social concerns. This engagement will take place during ESIA disclosure and prior to the commencement of construction activities. Engagement will also take place during construction and prior to the commencement of operations. The stakeholder engagements activities and requirements are described in detail in the Stakeholder Engagement Plan.

TAP AG will implement a Grievance Mechanism to address stakeholder concerns related to the Project in a timely manner.

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1A set of voluntary principles established to guide companies in maintaining the safety and security of their operations within an operating framework that ensures respect for human rights and fundamental freedoms.
8.7.4.2.3 Residual Impacts

The following table presents a summary of the residual impact associated with the impacts identified.

Table 8-166 Residual Impacts – Human Health - Construction and Pre-Commissioning

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Commitments to Address the Impact</th>
<th>Significance of Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Human Health</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| • Temporary community traffic safety risks from increased traffic and the presence of heavy vehicles on roads. | • Plan traffic routes to limit road use by the Project (particularly along public transport route) during high public traffic periods in order to reduce traffic risks to the community.  
• Assess local road conditions and be responsible for road maintenance during Project construction to minimise traffic risks associated with potential deteriorated roads.  
• Provide driver training to promote safe and responsible driving behaviour. | Minor  
• Heavy vehicles will mostly travel along the construction corridor to reduce heavy vehicle movement on public roads. |
| • Temporary community health risks from exposure to communicable diseases. | • Monitor local health trends during Project construction (and operations) in order to be aware of and respond appropriately to any negative health trends that may be linked to the Project and its workers.  
• Conduct regular worker training and community awareness campaigns to promote awareness of risks.  
• Conduct voluntary pre-employment screening and ongoing screening for STDs. | Minor  
• Potential risks to community health from exposure to disease may be minor, or could be more significant, but this depends on the origin (and behaviour) of the workforce. |
| • Environmental Health and Quality of Life  
(impact on wellbeing, quality of life and health caused by noise, waste, air pollution, dust, and change of landscape) | • TAP AG will install noise barriers.  
• TAP AG will use of further noise mitigation techniques (e.g. relocalization of the compressors area, modification of the compressors operations during night time.  
• In case the above mitigation measures will not be sufficient, TAP AG will evaluate as last resort solution the temporary relocation of the people residing in the proximity of the pre-commissioning area. These measures will be discussed with local authorities and impacted households at a later stage of the Project. | Minor (entire community)  
• Mitigation developed to minimise environmental impacts will equally minimise impacts to health. Engagement activities will ensure that communities are kept informed. As such, residual impacts to wellbeing and quality of life will be minor. |
| | | Major (receptors in the proximity of working sites)  
• High levels of noise during hydro-testing activities – continued impacts (24 h) but short term (20 days). |
8.7.4.3 Operations Phase

8.7.4.3.1 Potential Impacts

**Pipeline Safety Risks from Unplanned Events**

Communities along the pipeline route have expressed concerns over safety issues associated with the pipeline once it is operational. Particular concerns included risk of explosions, pipeline ruptures and gas leaks. While such concerns are generally unfounded due to the design of the pipeline (i.e. buried underground, restrictions along the working strip, safety measures and use of block valve stations) these could affect community wellbeing and their perception of the safety of the area.

Undetected leaks are now a rare occurrence in modern gas pipelines, as leak detection systems allow immediate notification and action in an emergency. However, the pipeline will be monitored by a Leak Detection System (LDS) that operates on the basis of flow, pressure and temperature monitoring, thereby detecting losses on an automatic basis. In addition Controlled Emergency Operation Shut Down (COESD) procedures will be developed, which define the particular operational measures to be taken in case of leak or threat of any kind at each location of the entire pipeline system.

Additionally, a number of activities will be prohibited along the pipeline route following construction in order to protect community health and safety such as horizontal and vertical drilling, driving posts, stakes or anything other than fencing into the ground, erection of structures including poles, towers, concrete slabs, buildings, etc., or blasting within a certain distance of the pipeline.

Furthermore, other risks that are outside the control of the Project, such as severe weather events or terrorist activity, could pose risks to community health and safety. Thus, emergency response procedures will be developed and implemented to minimise risks to community health and safety in the unlikely event that this occurs.
Environmental Health and Wellbeing

During the operational phase of the Project the pipeline receiving terminal station will maintain low noise levels, and effects on the local air quality will be limited (see Sections 8.5.1 and 8.5.2). At the noise and emissions levels predicted, impacts to health are likely to be not significant. Changes to the visual environment associated with the presence of the pipeline receiving terminal station may also affect the mental wellbeing of residents of nearby communities. Landscape preservation mitigation measures will mitigate the visual negative impact (see Section 8.5.5), however impacts on households living in the proximity of the pipeline receiving station are expected to be moderately significant.

The operation of the pipeline and BVS will not generate any significant air or noise emissions. Long-term changes to the landscape and visual amenity along the pipeline route will be limited to the presence of the aboveground, permanent structures (i.e. BVS). However, it is not expected that these will have any major impact on the wellbeing of residents of nearby communities.

8.7.4.3.2 Mitigation Measures

Pipeline Safety Risks from Unplanned Events

- As part of TAP AG's External Relations Communications Strategy and Stakeholder Engagement Strategy, the Project will promote public awareness of the pipeline and provide information to community members on prohibited or restricted activities along the pipeline route.
- As part of TAP AG's HSE Policy and Risk Management process, the Project will implement an emergency response plan specific to pipeline operation to prepare personnel and local emergency response crews to effectively handle pipeline emergency situations and secure the safety of the local community.
- Emergency response procedures will be developed and implemented to minimise risks to community health and safety in the unlikely event that severe weather events or terrorist attacks occur.
Environmental Health and Wellbeing

- TAP AG will undertake stakeholder engagement with affected communities and other stakeholders on a range of issues including changes to the visual environment, noise and social concerns including human trafficking. This engagement will take place during ESIA disclosure and prior to the commencement of construction activities. Engagement will also take place during construction and prior to the commencement of operations. The stakeholder engagements activities and requirements are described in detail in the Stakeholder Engagement Plan.

- TAP AG will implement a Grievance Mechanism to address stakeholder concerns related to the Project in a timely manner.

- TAP AG will implement mitigation measures to reduce the visual impact of permanent structures and to integrate the PRT and BVS in the local environment (e.g. limited height of the structure and use of typical Lecce stone “pietra leccese”).
8.7.4.3.3 Residual Impacts

The following table presents a summary of the residual impact associated with the impact identified.

### Table 8-167 Residual Impacts – Human Health - Operation

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact/ Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community Health and Safety</td>
<td>TAP AG will undertake a community information programme on pipeline safety to alleviate concerns.</td>
<td>Minor</td>
</tr>
<tr>
<td></td>
<td>TAP AG will guard the pipeline receiving terminal and patrol the pipeline route to deter deliberate damage or vandalism.</td>
<td>The health impact is based around a perceived risk. Following education and the safe operation of the pipeline these concerns are likely to be reduced to a minor level.</td>
</tr>
<tr>
<td></td>
<td>TAP will establish a ERP to respond to manage unplanned events.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TAP AG will maintain the Grievance Mechanism.</td>
<td></td>
</tr>
<tr>
<td>Pipeline Safety</td>
<td></td>
<td>Minor</td>
</tr>
<tr>
<td></td>
<td>TAP AG will undertake stakeholder engagement around the long term impacts of the pipeline receiving terminal.</td>
<td>Not Significant (entire community)</td>
</tr>
<tr>
<td></td>
<td>TAP AG will maintain the Grievance Mechanism.</td>
<td>Only the PRT and the BVS will be visible during the operations phase</td>
</tr>
<tr>
<td></td>
<td>Landscape mitigation measures to reduce the impact (e.g. limited height of the building and use of typical Lecce stone “pietra leccese”)</td>
<td>Low emissions of pollutants and noise unlikely to cause any significant effect on human health</td>
</tr>
<tr>
<td>Environmental Health and</td>
<td></td>
<td>Moderate/Major (receptors in the proximity of permanent facilities)</td>
</tr>
<tr>
<td>Quality of Life</td>
<td></td>
<td>Low and rare emissions of pollutants and noise unlikely to cause any significant effect on human health</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Change of landscape is permanent and irreversible.</td>
</tr>
</tbody>
</table>

8.7.4.4 Decommissioning Phase

8.7.4.4.1 Potential Impacts

Potential impacts will need to be reassessed given the period of time that will pass before decommissioning activities are expected to take place. Decommissioning activities performed will apply to the PRT and the BVS only. Thus potential impacts during Project decommissioning are likely to be similar to impacts during construction but less significant than during the construction phase due to the smaller affected area.
8.7.4.4.2 Mitigation Measures

Mitigation measures are expected to be similar to construction, with the benefit of being improved based on lessons learned during construction. Additionally, TAP will prepare a Preliminary Decommissioning Plan (which will be a ‘living document’) that will be developed further during field operations and fully defined in advance of the end of field life.

8.7.4.4.3 Residual Impact

The residual impacts are likely to be similar to construction, with the benefit of being improved mitigations based on lessons learned during construction. However, residual impacts depend on the outcome of potential impacts during construction and the effectiveness of mitigation measures. As such, residual impacts could be rated differently approaching the time period of Project decommissioning.

8.7.5 Worker Management and Rights

8.7.5.1 Overview

This section includes an analysis of potential impacts on worker health, safety and security, including an assessment of occupational health and safety issues relating to the workforce as well as workforce issues that may impact community health (e.g. Main Construction site, conduct and use of public infrastructure). These issues should be considered not only for those who are directly employed by TAP, but also its contractors (including sub-contractors) and within the supply chain.

The box below shows the key sources of impact, potentially impacted resources and receptors, baseline and project influencing factors associated with the impacts of the TAP project on working conditions.

Box 8-29 Key Sources of Impact, Potentially Impacted Resources and Receptors

<table>
<thead>
<tr>
<th>Sources of Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of contractors and subcontractors.</td>
</tr>
<tr>
<td>Project construction areas</td>
</tr>
<tr>
<td>Hazardous conditions during Project construction activities</td>
</tr>
<tr>
<td>Presence of Project workforce during construction: An independent economic impact assessment (Nomisma Energia 2013) suggests that during the three years construction phase in Puglia TAP will directly support 150 jobs per year (part-time and full-time) as well as 640 indirect jobs (part-time and full-time) via local companies working for TAP. During the 50 year operation phase TAP will support directly 32 and indirectly 150 jobs per year (part-time and full-time)</td>
</tr>
<tr>
<td>Accidents/Injuries</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Potentially Impacted Resources and Receptors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project workers, contractors and management staff</td>
</tr>
<tr>
<td>Project partners</td>
</tr>
<tr>
<td>Project suppliers</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Baseline Influencing Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local job seekers – Employment is currently a prominent issue in the province of Lecce with 21% of the total population. In Melendugno and Vernole the 50% of young people (60% of young women) are unemployed.</td>
</tr>
</tbody>
</table>
The following table presents the key impacts of the TAP Project on working conditions during the key Project phases.

Table 8-168  Key Potential Impacts – Working Conditions

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Temporary risks to worker rights during hiring process and employment (e.g. compliance with Project standards and contractor management).</td>
<td>- Very localised risks to worker rights, health and safety during employment.</td>
<td>Potential impacts are expected to be similar to construction phase also if less impact is foreseen due to the fact that works will be performed on a limited area (PRT and BVS).</td>
</tr>
<tr>
<td>- Temporary worker health and safety risks from construction activities and construction site conditions.</td>
<td>- Very low likelihood of safety risks from unplanned events.</td>
<td></td>
</tr>
</tbody>
</table>

8.7.5.2  Construction and Pre-commissioning Phase

8.7.5.2.1  Potential Impacts

TAP will abide by all relevant legislation related to labour and working conditions and implement appropriate standards and policies related to workers conditions. These requirements will be included in all contractor agreements and will refer to national and international framework, including the relevant Performance Requirement of the EBRD (PR2) and reflect the relevant sections of TAP’s CSR policy that contain the commitment to assure compliance with core labour standards of the International Labour Organisation (ILO) and the voluntary principles of security and human rights.

Due to the nature of construction activities, the standards / policies that will be in place during the construction and pre-commissioning phase potential impacts on right, health and safety of workers have a low probability of occurrence.
Worker Health and Safety

Impacts could include worker illness or accidents from unsafe or unsanitary facility conditions.

The Project will implement worker Health and Safety measures in line with Italian Law and Internationally Recognised Practices to avoid or minimise these risks. This will include monitoring contractors’ activities to ensure their compliance with the international standards.

Worker Rights

Potential risks to worker rights could include unhealthy or even corrupt worker-management relationships, unfair treatment, discrimination, unequal opportunity for workers and lack of access to collective bargaining and dispute resolution.

The labour laws in Italy are in line with international labour laws. The Italian Constitution attributes a specific importance to the right to work of all citizens (articles 1, 8, 35-47). Additionally, Italy has ratified the eight core ILO conventions:

1. Freedom of Association and Protection of the Right to Organize, 1948 (No. 87)
2. Right to Organise and Collective Bargaining Convention, 1949 (No. 98)
3. Forced Labour Convention, 1930 (No. 29)
4. Abolition of Forced Labour Convention, 1957 (No. 105)
5. Minimum Age Convention, 1973 (No. 138)
6. Worst Forms of Child Labour Convention, 1999 (No. 182)
7. Equal Remuneration Convention, 1951 (No. 100)
8. Discrimination (Employment and Occupation) Convention, 1958 (No. 111)

However, there are still some issues in Italy, including evidence that women are paid less and that migrants are more likely to be employed as day labourers or in temporary employment. There are signs that suggest that unemployed people, due to the economic crisis, might be prone to accept jobs with lower standards of social safeguards and legal protection, including unreported employment. In Italy, there are also issues related to some forms of forced labour (“caporalato”). These are often connected to organized crime and exploitation of immigrant, mostly clandestine, workers.

Taking into consideration the specific issues of Italy, TAP AG will be applying strict policies in order to avoid any kind of these risks.

8.7.5.2.2 Mitigation Measures

Mitigation measures are drawn from TAP workers management and social responsibility policies. A summary of these documents is reported in Table 8-169:
Table 8-169 outlines the specific mitigation outlined in TAP policies.

**Table 8-169 Worker Management and Rights**

<table>
<thead>
<tr>
<th>Policy Reference</th>
<th>Statements/ Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAP Health, Safety and Environment (HSE) Policy (2011) (TAP-HSE-PO-0001).</td>
<td>Sets out a clear commitment to ensuring the health and safety of TAP personnel encompassing contractor personnel through proactive risk management. TAP AG is committed to internationally recognised health, safety and environment standards. Facilities and operations will be developed, planned and maintained such that robust barriers are in place to prevent accidents. All employees have the duty to stop any works if adequate systems to control risks are not in place.</td>
</tr>
<tr>
<td>HSE Risk Management for TAP (TAP-HSE-PR-0006)</td>
<td>Surveillance programs for health status shall be established and implemented.</td>
</tr>
<tr>
<td>TAP Code of Conduct (2008) (TAP-GEN-PO-0001)</td>
<td>TAP strives to create a safe and healthy working environment. TAP works continuously on improving the Employee’s occupational health and safety conditions and the safety of its operations. Health and safety of Employees have priority and are a prerequisite for performing a good job. The Code of Conduct is designed to preserve and foster the integrity and reputation of TAP and to help its employees and others who work for TAP to avoid misconduct. TAP promotes equal opportunity and diversity. No TAP employee or job applicant will be discriminated against on the basis of his or her gender, marital status, nationality, age, religion or sexual orientation.... TAP strongly encourages its contractors to apply the same principles. The Code of Conduct includes an explicit commitment to full compliance with the International Labour Organisation Standards.</td>
</tr>
<tr>
<td>TAP Local Content Strategy (2010) (TAP-HSE-ST-0007)</td>
<td>Construction and Operation of TAP, in line with the highest health, safety, social and environmental standards, requires that all employees, contractors and suppliers comply with international best practice and performance requirements outlined in TAP AG’s governing documents.</td>
</tr>
<tr>
<td>TAP Policy on CSR (2011) (TAP-HSE-PO-0002)</td>
<td>TAP states an explicit commitment to comply with ‘international standards on transparency, accountability, anti-corruption, human rights and national laws and regulations.’</td>
</tr>
<tr>
<td>TAP Strategy for the implementation of TAP CSR Policy under the TSP Model (TAP-HSE-ST-008)</td>
<td>TAP assures throughout the supply chain full compliance with the core labour standards as defined by the International Labour Organisation. TAP AG’s workforce will benefit in addition from equal opportunities, a non-discriminatory workplace, best practice on human resource management, occupational health and safety.</td>
</tr>
</tbody>
</table>

**Worker Health and Safety**

- As part of the TAP’s HSE Policy and Risk Management, the Project will:
  - Develop construction site management measures which detail commitments to best practice standards for worker facilities;
  - Implement Project worker H&S management programs;
  - Evaluate contractor performance on worker welfare and implement penalties for non-compliance; and
  - Provide on-site health facility for workers and conduct regular health checks among workers.
• Carry out TAP’s Strategy for the implementation of TAP’s Corporate Social Responsibility (CSR) policy under the TSP model, which includes:
  o Best practice in human resource management including equal opportunities and a non-discriminatory workplace throughout the supply chain; and
  o Best practice in occupational health and safety throughout the supply chain.
• Implement TAP’s Code of Conduct and HR policy for all workers (including contractors and subcontractors) and maintain policies to minimise potential negative impacts on worker welfare.

Worker Rights

• A Human Rights Impact Assessment (HRIA) – which includes sections on labour and working rights - was undertaken to assess risks to human rights through the contracting chain; further assessment of human rights related risks may be determined in the future. The HRIA will made be available to the public as soon as possible.
• TAP AG will define a management plan to mitigate potential impacts on workers human rights. A summary of the HRIA is provided in this Report (see Annex 13).
• As part of the Project’s Code of Conduct, the Project will:
  o Promote compliance with national labour and employment laws and the fundamental principles and key regulatory standards embodied in the ILO conventions that are central to the worker-management relationship.
  o Implement human resources policies that promote positive worker-management relationships and protect worker rights.
  o Set out specific rights and responsibilities of workers and managers for all those working on site. This includes the right to be treated fairly and to complain in the case of unfair or discriminatory treatment, and the freedom of association and collative bargaining. Establish clear expectations of contractors regarding the standards, laws and regulations with which they are expected to comply, including EBRD and ILO requirements.
• As part of the Project’s Human Resource Plan, all workers employed by TAP as well as hired contractors and subcontractors must have a contract prior to movement from home location.

8.7.5.2.3 Residual Impacts

The following table presents a summary of the residual impact associated with the impacts identified.
### Table 8-170 Residual Impacts – Working Conditions - Construction and Pre-Commissioning

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Mitigation Commitments to Address the Impact</th>
<th>Significance of Residual Impact</th>
</tr>
</thead>
</table>
| **Temporary worker health and safety risks from construction activities and construction area conditions (e.g. unsuitable conditions at worker sites, inappropriate worker conduct, hazardous conditions or unsafe behaviours at work areas).** | • Provide on-site basic health facility for workers and conduct regular health checks among workers.  
• Evaluate contractor performance on worker welfare and implement penalties for non-compliance  
• Implement Project worker H&S management programs;  
• Develop construction site management measures which detail commitments to best practice standards for worker facilities.  
• Best practice in occupational health and safety.  
• HR policy for all workers (including contractors and subcontractors) and maintain policies to minimise negative impacts on worker welfare.  | Minor/Moderate
| • Workers will be provided with access to health care for both basic conditions and emergencies.  
• The Project area will be well managed and maintained to promote safe and healthy working conditions and practices.  
• Despite mitigation measures, the risk of incidents cannot be completely ruled out.  
• The impact is temporary and focused on a small-scale territory. |
| **Temporary risks to worker rights during hiring process and employment (e.g. unsuitable working conditions, insufficient protection of worker rights).** | • Promote compliance with national labour and employment laws and the fundamental principles and key regulatory standards embodied in the ILO conventions.  
• Promote positive worker-management relationships and protect worker rights.  
• Establish clear expectations of contractors regarding the standards, laws and regulations with which they are expected to comply, including EBRD and ILO requirements.  
• All workers employed by TAP as well as hired contractors and subcontractors must have a contract prior to movement from home location.  
• Equal opportunities and a non-discriminatory workplace. | Minor
| • TAP will assure compliance of labour related topics by all contractors through monitoring.  
• Local employment in construction works will regard 20-30% maximum of local workforce.  
• Presence of reports showing that unfair treatment of workers is an issue in the region. |
8.7.5.3 Operations Phase

The Italian section of the TAP Project will employ approximately 32 permanent employees in the PRT. However, there is the potential for unlikely, but potentially significant, safety risks during pipeline operation under non-routine circumstances. Operational workers will be responsible for pipeline inspection and maintenance activities which include:

- pipeline monitoring;
- route surveillance possibly with road vehicles;
- special crossing inspections;
- monitoring of population and third-party activities in close proximity to the pipeline;
- functional operational checks and verification of plant and equipment; and
- routine maintenance of plant and equipment at pre-defined intervals.

Potential risks to worker rights during the operations phase may include unacceptable worker-management relationships, unfair treatment, discrimination and unequal opportunity of workers and lack of access to collective bargaining and dispute resolution.

The Project will manage these risks through grievance procedures and by communicating expectations regarding and monitoring adherence to the Project’s Code of Conduct, HSE Policy, Risk Management and other relevant policies.

8.7.5.3.1 Mitigation Measures

As part of TAP AG’s HSE Policy and Risk Management, the Project will implement management procedures and regular monitoring to minimise risks to workers during operation.

- Project employees will continue to be expected to adhere to the Project’s Code of Conduct; the Project will monitor employee conduct.
- The Project will promote compliance with national labour and employment laws and the fundamental principles and key regulatory standards embodied in the ILO conventions.
- The Project will continue to operate its grievance process to identify and appropriately and effectively respond to any worker issues.

8.7.5.3.2 Residual Impact

The following table presents a summary of the residual impact associated with the impacts identified.
### Table 8-171 Residual Impacts – Working Conditions- Operation

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Mitigation Commitments to Address the Impact</th>
<th>Significance of Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Working Conditions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Very low likelihood of safety risks from unplanned events.</td>
<td>• Implement management procedures and regular monitoring to minimise risks to workers during operation.</td>
<td>Not Significant</td>
</tr>
<tr>
<td>• Very localised risks to worker rights during employment (e.g. unsuitable working conditions, insufficient protection of worker rights).</td>
<td>• Monitor employee conduct. • Promote compliance with national labour and employment laws and the fundamental principles and key regulatory standards embodied in the ILO conventions.</td>
<td>Not Significant</td>
</tr>
</tbody>
</table>

#### 8.7.5.4 Decommissioning Phase

**8.7.5.4.1 Potential Impacts**

Potential impacts will need to be reassessed given the period of time that will pass before decommissioning activities are expected to take place. Decommissioning activities performed will apply to the PRT and the BVS only. Thus potential impacts during Project decommissioning are likely to be similar to impacts during construction but less significant than during the construction phase due to the smaller affected area.

**8.7.5.4.2 Mitigation**

Mitigation measures are expected to be similar to construction, with the benefit of being improved based on lessons learned during construction. Additionally, TAP AG will prepare a Preliminary Decommissioning Plan (which will be a ‘living document’) that will be developed further during field operations and fully defined in advance of the end of field life.

**8.7.5.4.3 Residual Impact**

The residual impacts are likely to be similar to construction, with the benefit of being improved mitigations based on lessons learned during construction. However, residual impacts depend on the outcome of potential impacts during construction and the effectiveness of mitigation measures. As such, residual impacts could be rated differently approaching the time period of Project decommissioning.
8.7.6 Community Cohesion

8.7.6.1.1 Overview

The term community cohesion refers to the quality and quantity of interactions between members of a community (intra-community) and between different communities (inter-community). Community cohesion has to be considered as a continuous process interweaving a broad background fabric of issues such as access to education and employment, poverty and social inequalities, social and cultural diversity, access to communication and information. A high level of community cohesion implicates respect for persons as individuals, sensitiveness to ethnic and social differences and a sense of belonging to the community/to a local set of communities.

A change in the overall socioeconomic setting of an area by a new project is likely to influence relationships among community members and between different communities, resulting in, for example, heightened tensions which will affect the complex fabric of community cohesion on the community and inter-community level. The following box shows the key sources of impact, potentially impacted resources and receptors, baseline and project influencing factors associated to the impacts of the TAP Project on community cohesion.

**Box 8-30 Key Sources of Impact, Potentially Impacted Resources and Receptors**

**Sources of Impact**
- Estimated temporary construction workforce, a percentage of whom will be non-resident and housed within nearby towns: An independent economic impact assessment (Nomisma Energia 2013) suggests that during the three years construction phase in Puglia TAP will directly support 150 jobs per year (part-time and full-time) as well as 640 indirect jobs (part-time and full-time) via local companies working for TAP. During the 50 year operation phase TAP will support directly 32 and indirectly 150 jobs per year (part-time and full-time)
- Project employment and local expectations; competition for jobs between local residents and non-resident workers
- High community expectation of project benefits and unlikely to match the reality
- Presence of conflicting views on the Project within the community

**Potentially Impacted Resources and Receptors**
- Local job seekers, particularly those with construction and industry experience
- Households owning and using land within the Study Area
- Communities located adjacent to the Project site
- Local social networks, within and among local households

**Baseline Influencing Factors**
- High unemployment Employment is currently a prominent issue in the province of Lecce with 21% of the total population. In Melendugno and Vernole the 50% of young people (60% of young women) are unemployed. Limited levels of local skills and experience in project related activities
- Literacy, higher education and skills achievement are below national averages in Melendugno and Vernole
- Limited access to higher education in Melendugno and Vernole
- Strength of community network
- Current reports that local fishermen are not getting adequate governmental support
- Average annual income levels from about 17,500 Euros (in Melendugno) to about 18,600 Euros (in Vernole)
- Low income levels for certain groups (i.e. small-scale fishermen and some subsistence farmers)
- Feelings of scepticism towards the public system and private sector which stems from past experience;

**Project Influencing Factors**
- Origin, size and behaviour of workers and level of interaction with the local community
• Type and relative standard of local housing that non-resident workers will reside in during construction and disposable income of workers compared to local living standards; visible differentiations in the standard of jobs not enjoyed by local residents
• Project local content goals and contractor selection
• Manner in which the Project determines and executes compensation activities for impacted households

Vulnerable groups
• Low-income households

The following table presents the key impacts on TAP Project activities during the key Project phases.

Table 8-172 Key Potential Impacts – Community Cohesion

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Influx of workers</td>
<td>• Reduced risks of heightened tensions within and between communities</td>
<td>• Potential impacts are expected to be similar to construction phase also if less impact is foreseen due to the fact that works will be performed on a limited area (PRT and BVS).</td>
</tr>
<tr>
<td>• Potential unmet expectation for benefits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Risk of heightened tensions within and between communities</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: ERM (2012)

8.7.6.2 Construction and Pre-commissioning Phase

8.7.6.2.1 Potential Impacts

Most direct impacts on community cohesion are likely to take place leading up to and during the construction period when local hiring and contractor selection activities and initial consultation and compensation activities are taking place. During construction, additional potential impacts on Community Cohesion could stem from interactions between local stakeholders and the Project workforce, as well as from differences in job and income standards between Project and non-Project workers.
Influx of Workers

Workers will be selected through a transparent process of recruitment. They will mostly be accommodated in nearby urban areas and will be subject to a Code of Conduct with regard to their behaviour and conduct towards local people.

In addition to the directly hired project labour, it is also possible that people could move towards project locations in the hope of finding work directly with the Project or to gain benefit from the indirect economic opportunities that the Project may bring, such as selling goods or services to the Project. If unmanaged, such influx may potentially put pressure on the services and infrastructure in the local settlements, inflate prices of goods and housing and, in the worst case scenario, generate social frictions. However, such a scale of influx will be unlikely for a project such as TAP with its relatively short construction phase and proactive recruitment and local content measures.

Unmet Expectations for Benefits

There is a certain degree of expectation that the Project will bring local, as well as national level benefits to the country. The main expectations for benefit include employment, access to gas and social investment projects from the Project. However, there is some scepticism due to previous negative experience regarding the capacity of the public and private sectors to meet local expectations. In addition, not receiving adequate compensation for loss of livelihoods, landuse restrictions are matters of concern.

TAP AG has committed through its policy on Corporate Social Responsibility (TAP-HSE-PO-0002) to optimise the benefits that may be brought by the Project through improvement of rural roads used by the Project, enhancement and local content and through the delivery of a Social and Environmental Investment Program. To define the above mentioned plans, TAP AGs will use a participatory approach. Although the statements embedded within these documents demonstrate a high degree of Project commitment in the delivery of benefits, there remains a likelihood of unmet expectations in the local communities due to the following:

- **The timing of information provision**: A participatory approach requires more time to be developed. Details regarding Project benefits will only be defined after the submission of the ESIA.

- **The scale of impacts**: The level and duration of employment during construction and operations, will be limited. With regard to social and environmental investment, whilst a well implemented program should provide some tangible improvements, they may not fully satisfy all the expectations of local communities.

- **Access to gas**: The Project is not currently planned to provide gas to the local market.
• **Confusion between compensation for assets and social investments:** In line with national regulations and EBRD requirements, TAP AG will compensate for loss of livelihoods. In addition, TAP AG is voluntarily committing to establish a social and environmental investment plan.

**Tensions within and between Communities**

Infrastructure projects often raise tensions within communities (intra-community tension) or between communities (inter-community tension). The causes of such tensions may be many, but commonly include the following:

- Poor leadership, which at its worst may consist of fraudulent behaviours by those with power, but more commonly consists of poor communication of information with regard to the Project and lack of engagement with the community;
- Inequitable distribution of benefits, or a perception of this; or inequitable distribution of negative impacts, or perception of this;
- Changes in services, infrastructure and other resources (e.g. forest resources) which may be altered by the Project or by indirect effects such as in-flux (as discussed above); and
- The simple stress of change and of interacting within the community and with the Project. Often factors such as short timelines for decisions, lack of information, or lack of clarity of such information can be a source of tensions.

In the context of Italy, the level of existing stress is set as already high, due to the overall political and economic situation of the country. Community cohesion is generally good throughout the study area, with conflicts within settlements and between communities being rare. However, consultations with stakeholders and local communities reflected very conflicting views on the Project. While in most cases tensions are directed against the Project, in the worst case scenario, intra-community tensions might arise.

**8.7.6.2.2 Mitigation Measures**

The effective management of the impacts of the Project is the fundamental basis for minimizing the potential for impacts to community cohesion. The following measures, which are mainly drawn from the TAP Strategy for Stakeholder Engagement (TAP-HSE-ST-0009), seek to provide an effective two way channel of communication between the Project and the local communities during the construction period. They are underpinned by the TAP Policy on Corporate Social Responsibility (TAP-HSE-PO-0002) which is summarized in *Box 8-31*. 
Box 8-31 TAP AG Commitments to Transparency, Accountability and Stakeholder Engagement

1. TAP AG complies with international standards on transparency, accountability, anti-corruption, human rights and national laws and regulations

2. TAP AG identifies individuals, households, communities and other entities that may be affected by the project as well as other stakeholders (Regulative bodies, local governments, NGOs, etc.).

3. TAP AG engages these stakeholders in discussions on social, environmental, safety, security and other relevant issues such as regular, free, prior and informed consultations. TAP pays particular attention to disadvantaged, marginalised, vulnerable and/or poor populations and tailors the consultation process around their preferences.

4. Relevant project information in particular those related to environmental and social impacts, health and safety hazards emergency management will be disclosed at the local level in a manner that is accessible, understandable and culturally appropriate for those affected.

5. TAP AG assures through the supply chain full compliance with the core labour standards as defined by the International Labour Organisation. TAP AG’s workforce will benefit in addition from equal opportunities, a non-discriminatory workplace, and best practice on human resource management, occupational health and safety.

6. TAP AG will establish an independent grievance redress mechanism to address grievances, complaints and reports of non-compliance in a timely, impartial and transparent manner.

Compiled by ERM (2011)

Stakeholder Engagement during the Construction Phase

Through different communication and engagement methods, stakeholders in the immediate vicinity of the construction works will be kept informed about the planned activities, timelines, potential impacts and changes to schedules, if any. Stakeholders should be made aware of whom to address and how to raise any concerns or grievances. This will include the following:

- The ESIA, Livelihoods Restoration Framework and Social and Environmental Investment Plan will be publicly disclosed and discussed at the settlement level providing information with regard to impacts and benefit.

- These information releases will emphasise the limited nature of employment and the recruitment processes and the progress of the Social and Environmental Investment Plan. Oral presentations of updates by the community liaison officers will be held in order to address community members.

- TAP AG will maintain a community relations team that will include one community liaison officer at each workfront during construction activities. They will commence, proactively and regularly engaging with the local stakeholders prior to construction activities, providing updates and answering their queries. They will be present on the ground during the whole construction process and available to the affected communities.

- The grievance mechanism will be adjusted to the Project construction phase with the relevant contractor and sub-contractor staff fully aware of their roles in third party grievance resolution process so that quick and effective response is provided to the concerns raised by local stakeholders.
• The Project will communicate to affected stakeholders the progress on meeting the Project’s environmental and social commitments during the construction phase through, as a minimum, the release of reports which will be posted on the Project website.

• The Project will develop a third party monitoring, which might involve local stakeholder representatives, in assessing whether social and environmental impact mitigation measures and other intended benefits are as effective as anticipated. The reports of the third party monitoring will be made available to the public through the TAP AG website.

• Communities will be engaged in the preparation of the social and environmental investment activities to be taken forward in the vicinity of their communities. They will then be kept informed on the progress of such activities and opportunities for their involvement will be maximised.

8.7.6.2.3 Residual Impacts

The following table presents a summary of the residual impact associated with the impacts identified.

Table 8-173 Residual Impacts – Onshore Community Cohesion - Construction and Pre-Commissioning

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact/ Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influx of workers</td>
<td>As for economy and employment mitigation:</td>
<td>Not Significant</td>
</tr>
<tr>
<td></td>
<td>• The Employment Strategy will define target locations for recruiting local unskilled labour.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• The Employment Strategy will outline and require a fair and transparent recruitment process for all openings.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• The Project will provide clear information on the number and limited timescales of employment opportunities.</td>
<td></td>
</tr>
<tr>
<td>Unmet Expectations for Benefits</td>
<td>Realisation of the TAP Social and Environmental Investment Strategy in line with CSR Policy objectives.</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>• Communities will be engaged in the preparation of the social and environmental investment activities to be taken forward in the vicinity of their communities. They will then be kept informed on the progress of such activities and opportunities for their involvement will be maximised.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• The Project will release project update leaflets. These information releases will emphasise the limited nature of employment and the recruitment processes and the progress of the Social and Environmental Investment Plan.</td>
<td></td>
</tr>
</tbody>
</table>
8.7.6.3 Operations Phase

8.7.6.3.1 Potential Impacts

Considering that Project operations are largely unmanned, with an operation workforce of approximately 32 persons, it is likely that there will be a reduced potential impacts on community cohesion related to employment issues.

As the Project transitions to operations, the causes of impacts to community cohesion will subside as most Project related activities cease in areas other than around the PRT. However, the transition period from the construction to the operations phase requires careful management in order to maintain a continuous dialogue with stakeholders despite possible change of community liaison personnel and reduction in overall workforce. The perception of exclusion from project benefits (i.e. local taxes paid to the Municipality of Melendugno) might generate resentment between local communities. After completion of construction works, the employment opportunities will be reduced during the operation phase.
8.7.6.3.2 Mitigation Measures

TAP will implement and conduct the following stakeholder engagement measures during operations:

- Reduction and / or replacement of community liaison officers will be carefully managed during the transitioning of construction to operation in order to maintain the knowledge and relationships built between project representatives and local stakeholders until this point and ensure continuity. Stakeholders will be kept informed about changes that will impact them due to transfer to the operations phase. Commitments made to stakeholder relevant to the operations phase will be integrated into operations phase management systems and functions.

- The Project will continue to engage with stakeholders through a combination of meetings, focus groups, questionnaires, etc. The plan for stakeholder engagement for the operations phase will be finalised prior to the transition to operations and shared with key stakeholders. The plan will also be posted on the Project website.

- Stakeholder information will be reviewed to reflect Project developments and related feedback.

- The communications mechanisms and success of these will be reviewed regularly for effectiveness and the stakeholder engagement plan will be revised to take into account the results of the review.

- A publicly disclosed report will be prepared that will include meeting ESIA and other commitments, changes to Project design or operational procedures, any unforeseen changes, regular maintenance procedures, emergency response plans and safety and security requirements, and social and environmental investment activities and outcomes. The coverage of different issues will be proportionate to the extent of Project impacts and stakeholder interests.

- The grievance mechanism will remain in place and regularly communicated to stakeholders.

- The Project will involve project affected stakeholders or third party representatives in monitoring of the Project’s social and environmental performance for issues of great interest to the public.
8.7.6.3.3 Residual Impacts

**Table 8-174 Residual Impacts – Community Cohesion – Operation Phase**

<table>
<thead>
<tr>
<th>Impact / Risk</th>
<th>Measures to Address the Impact / Risk</th>
<th>Significance of Residual Impact/ Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Community Cohesion</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Perception of the community of inequitable distribution of stakeholder engagement activities | • Commitments made to stakeholders relevant to the operations phase will be maintained and integrated into operations phase management systems and functions.  
• The Project will continue to engage with stakeholders through a combination of meetings, focus groups, questionnaires, etc.  
• The plan for stakeholder engagement for the operations phase will be finalized prior to the transition to operations and shared with key stakeholders. The plan will also be posted on the Project website.  
• Publicly disclosed reports will be prepared that will include meeting ESIA and other commitments, changes to project design or operational procedures with potential impacts on certain stakeholder groups, any unforeseen changes, regular maintenance procedures, emergency response plans and safety and security requirements, and social and environmental investment activities and outcomes.  
• The grievance mechanism will remain in place and updates will be regularly communicated to stakeholders.  
• The Project will involve project affected stakeholders or third party representatives in monitoring of the Project’s social and environmental performance. | Minor  
• Continuity of relations between the community and community liaison personnel will be ensured  
• The stakeholder engagement plan for the operations phase will help to build trust in continuity of engagement activities  
• The grievance mechanism will remain in place, and, well managed, should assist in identifying and resolving problems |
| Perception within the community of inequitable provision of local employment | • The Project will continue to engage with stakeholders through a combination of meetings, focus groups, questionnaires, etc.  
• The Project will release information with a focus on the coming end of construction with clear explanation of the respective consequences for local construction workforce.  
• Clear and transparent communication of the limited local employment options for the operation phase.  
• The grievance mechanism will remain in place and regularly communicated to stakeholders. | Minor  
• Local community will receive information regularly  
• Employment opportunities for the operation phase will be limited  
• The grievance mechanism will remain in place, and, well managed, should assist in identifying and resolving problems |

8.7.6.4 Decommissioning Phase
8.7.6.4.1 Potential Impacts

Potential impacts will need to be reassessed given the period of time that will pass before decommissioning activities are expected to take place. Decommissioning activities performed will apply to the PRT and the BVS only. Thus potential impacts during Project decommissioning are likely to be similar to impacts during construction but less significant than during the construction phase due to the smaller affected area.
8.7.6.4.2 Mitigation Measures

Mitigation measures are expected to be similar to construction, with the benefit of being improved based on lessons learned during construction. Additionally, TAP will prepare a Preliminary Decommissioning Plan (which will be a ‘living document’) that will be developed further during field operations and fully defined in advance of the end of field life.

8.7.6.4.3 Residual Impact

The residual impacts are likely to be similar to construction, with the benefit of being improved mitigations based on lessons learned during construction. However, residual impacts depend on the outcome of potential impacts during construction and the effectiveness of mitigation measures. As such, residual impacts could be rated differently approaching the time period of Project decommissioning.
8.8 Onshore Cultural Heritage

The onshore cultural heritage impact assessment includes, in particular, the archaeological impact assessment. The archaeological impact assessment must be understood as a process that is designed to identify in advance what kind of project related changes may occur in the archaeological environment. The archaeological component, therefore, must be understood as part of the environmental system and not as an evaluation object (Campeol et al., 2007). The phases of archaeological impact assessment can be constructed as follows Task No.s 1, 2 and 3 performed defining the baseline studies are described in Baseline Section 6.7):

- **Task 1: Analysis** of the territorial characteristics and their archaeological evidence according to the methods and techniques of archaeological discipline (Section 6.7);
- **Task 2**: The importance of the archaeological component through the definition of environmental sensitivity based on findings and information in the literature, considering the value of the different historical eras (Section 6.7);
- **Task 3**: The identification of archaeological risk areas, as a probability that a project might interfere and generate a negative impact on the presence of objects and artefacts of archaeological interest not previously identified;
- **Task 4**: Assessment of impacts generated by the project.

8.8.1 Archaeological Environment Assessment

The area affected by this Project extends from the Adriatic coast to the modern settlement of Melendugno and it is characterised by an uneven distribution of different types of resources.

All the evidence suggests that there are no significant areas of archaeological risk within or near the Project area. The limited evidence near the pipeline route includes rural buildings (barns and small houses), dry stone walls and scattered pottery fragments. Barns in particular, known in the area as “Pagghiare”, represent an important piece of evidence regarding the agricultural organisation of the Salentino territory. However their chronology is difficult to ascertain, as often happens in rural architecture in which the use of the dry technique determines the need for repeated reconstruction and some of them are partially destroyed. Moreover, scattered pottery fragments identified in the field seems to be more related to rural activities and not to buried archaeological stratigraphy reducing the archaeological risk to a low to medium level only in very small sections of the pipeline and with a limited extent.
### Project Title:
Trans Adriatic Pipeline – TAP

### Document Title:
ESIA Italy - Section 8 Assessment of Impacts and Mitigation Measures

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**Figure 8-35** **Rural Buildings**

Source: ERM Field Survey (July 2013)
Based on these results, it appears that the most sensitive area of the TAP Project is represented by the three archaeological risk areas identified in the baseline section (ref. Section 6.7) and marked as AR1, AR2 and AR3.

The following paragraphs present a detailed description of potential impacts, mitigation measures and residual impacts deriving from the analysis resulting from the archaeological assessment.
8.8.2 Archaeological Impacts

Box 8-32 shows the key sources of impact, potentially impacted resources and receptors, and baseline and Project influencing factors associated with the TAP Project impacts on cultural heritage sites.

Box 8-32 Key Sources of Impact, Potentially Impacted Resources and Receptors

Sources of Impact

- Construction Phase: Ground-disturbing activities, including land clearing and site preparation activities associated with Project facilities, excavation of the pipeline trench, construction or renovation of roads; construction of PRT, construction of tunnel, construction of temporary facilities such as work sites and pipeyards; pollution; vibration; movement of vehicles, equipment and personnel.
- Operation Phase: Pollution; vibration; movement of vehicles, equipment and personnel.
- Decommissioning Phase: Demolition of structures.

Potentially Impacted Resources and Receptors

- Archaeological sites, monuments, sites with ICH (Intangible Cultural Heritage) value.

Baseline Influencing Factors

- Presence of known cultural heritage sites on landscape; potential for unknown subsurface archaeological sites.

Project Influencing Factors

- Microtunnelling construction; trenching, Cultural Heritage Management Plan, Chance Finds Protocol.

Table 8-174 presents the key impacts of the TAP Project on archaeological and historic sites during the key Project phases.

Table 8-175 Key Potential Impacts – Cultural Heritage

<table>
<thead>
<tr>
<th>Construction Phase</th>
<th>Operations Phase</th>
<th>Decommissioning Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of the scientific, cultural, or historical value of cultural heritage sites due to direct physical disturbance or damage to the sites;</td>
<td>Degradation or damage to above-ground structures due to pollution or vibration;</td>
<td>Degradation or damage to aboveground structures due to demolition activities.</td>
</tr>
<tr>
<td>Degradation or damage to aboveground structures due to pollution or vibration;</td>
<td>Blockage of access to cultural heritage sites;</td>
<td>Blockage of access to cultural heritage sites;</td>
</tr>
<tr>
<td>Blockage of access to cultural heritage sites;</td>
<td>Negative effects on the setting or ambience of cultural heritage sites.</td>
<td>Negative effects on the setting or ambience of cultural heritage sites.</td>
</tr>
<tr>
<td>Negative effects on the setting or ambience of cultural heritage sites.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The following sections expand on each potential impact and provide information on how each source is likely to have an impact on receptors. The mitigation measures built into the Project will also be discussed.
8.8.2.1 Construction and Pre-commissioning Phase

8.8.2.1.1 Potential Impacts

**Loss of the Scientific, Cultural, or Historical Value of Cultural Heritage Sites due to Direct Physical Disturbance or Damage to the Sites**

The key sources of impact on cultural heritage will result from ground-disturbing activities, *i.e.* those involving land clearing, site preparation, topsoil removal and excavation. The movement of heavy equipment and vehicles may also compress or otherwise alter subsurface resources. These activities may physically damage or disturb sites. Physical damage to a site usually results in loss of scientific, cultural or historical value.

Site preparation and construction works will result in the disturbance of topsoil and subsurface soil within a 26 m wide working strip around the base case route centreline. Additionally, disturbance or damage to cultural heritage sites can occur where roads are either upgraded or new roads are constructed in areas required for the permanent structures associated with the PRT, the micro tunnel, and areas where temporary structures are required, such as storage yards and work sites. The disturbance of a site may also occur adjacent to work areas. Impacts in adjacent areas are likely to be less severe and would mostly be related to pollution and vibration.

Even if no significant sites have been identified inside the working strip, potential known evidences should be relatively easy to avoid by the Project, substantially reducing potential impacts to these sites. Known evidences are visible above ground and have been identified. Unknown sites, on the other hand, are likely to exist, but their presence may only be revealed by ground-disturbing activities. The Project area includes areas that range from low to medium potential for undiscovered sites (Appendix 5 of Annex 7).

**Degradation or Damage to Aboveground Structures Due to Pollution or Vibration**

Aboveground portions of archaeological sites and monuments are subject to impact from air pollutants and vibration from construction and vehicles. These impacts are primarily related to free-standing sites such as ruins, monuments, and historic buildings, which are a risk of degradation or collapse due to vibration or from air pollutants that can collect on their outer surface, causing discoloration or erosion.

This type of impact may occur near roads that will receive increased heavy vehicle traffic and areas near the Project corridor where heavy machinery operates.

Based on the inventory reported in Section 6.7, three known sites could be potentially affected by this type of impact: 1) remains of masonry structures, of a tank and of a floor screed still in situ, mostly hidden by the overgrown vegetation attesting the presence of rural Hellenist-roman settlement (*Bibliographical Sheet nr 19 in Appendix 5 of Annex 7*), 2) the chapel of S. Niceta (*Bibliographical Sheet nr 20 in Appendix 5 of Annex 7*) and 3) the “Gurgulante” Dolmen (*Bibliographical Sheet nr 22 in Appendix 5 of Annex 7*).
Blockage of Access to Cultural Heritage Sites

In some cases, Project activities may cause difficulties in accessing important cultural heritage sites. Depending on the site, this impact may affect tourists, researchers, or ICH users. This impact would mainly affect important monuments and tourist sites that receive visitors, sites where research is being conducted, and sites with ICH value. Construction activities may require temporary blockage of roads or protective measures, such as fencing off cultural sites, which would block or deter visitors.

This type of impact is most likely to occur near roads that intersect the construction phase pipeline corridor. At this time, TAP knows of no sensitive cultural heritage sites who’s access will be restricted during the project’s construction phase. However, if such impacts become more evident as the project design matures, TAP will communicate with the relevant authorities to define approaches to minimize the access limitations.

Negative Effects on the Setting or Ambience of Cultural Heritage Sites

Cultural heritage sites are closely related to the surrounding landscape and viewshed. The atmosphere of a cultural heritage site often has bearing on its cultural value. Impacts on the setting or ambience of a cultural heritage site can affect its value to visitors. This is particularly true for monuments and sites with ICH value. In some instances, this can be a permanent impact if the landscape has been substantially altered enough to change its visual character. An example of this would be the construction of large, permanent structures adjacent to a cultural heritage site. In other instances, the impacts may be a temporary if they are related to construction activities or non-permanent structures. Examples of temporary impacts are the placement of equipment near a monument, or Project-related noise near a place of worship.

Impacts on the setting or ambience of sites are likely to occur only in places within the Project area which involve the construction of temporary or permanent structures. Those sites most at risk for this kind of impact would be located in areas near the PRT, since a large industrial complex would change the character of the site and its associated landscape. Based on the inventory and the results of landscape and visual amenity impact assessment, the known sites potentially affected could be the dolmen areas located SSE from the PRT including Gurgulante Dolmen, Colaresta Dolmen and La Placa Dolmen (Bibliographical Sheet nr 22, 23,24 in Appendix 5 of Annex 7).
8.8.2.1.2 Mitigation Measures

**Loss of the Scientific, Cultural, or Historical Value of Cultural Heritage Sites due to Direct Physical Disturbance or Damage to the Sites**

- Avoid Project encroachment on known sites. Avoidance is the preferred method and should be considered along with the mitigation measures below.

- Identify boundaries of known sites that are between 100 and 150 m from the Project construction footprint and mark the boundaries of the site using highly visible coloured tape, flagging or posts.

- Sites that lie between 50 and 100 meters from the Project construction footprint should be conspicuously marked by erecting temporary barriers such as a plastic or mesh wire fence with highly visible flagging or tape attached to it.

- Sites that lie within 50 metres of Project construction footprint should be fenced off as described above. In addition, if the site consists of any standing structures, regular monitoring of the structures’ condition should be conducted. The working strip should be reduced as much as possible where a cultural heritage site is located within 50 m of the centreline or other Project component.

- A Chance Finds Protocol must be implemented for all construction fronts. This includes monitoring of construction activities by a professional archaeologist and implementation of a stop work protocol if a site is discovered. Work would resume after the implementation of government-approved mitigation measures.

- If a chance find of high importance is discovered during construction, rescue procedures should be conducted as outlined by international and Italian national standards.

- Continuation of construction at an important chance find should only resume once the rescue excavation is complete.

- Inclusion of guidelines in the workers’ Code of Conduct to restrict employee activities that might interfere with nearby cultural heritage sites.

- Wherever needed, dry stone walls reconstruction will be performed in order to maintain a peculiar characteristic of the human environment.

**Degradation or Damage to Aboveground Structures Due to Pollution or Vibration**

- Sites with aboveground components that lie within 50 m of the Project footprint should be monitored periodically during the construction phase for signs of pollution resulting from the Project (most commonly in the form of dust) and possible physical damage caused by vibration from heavy machinery.
• If sites are discovered to be at risk of pollution or vibration, they should be monitored appropriately.

• Should a site of high scientific or cultural value be damaged due to pollution resulting from the project, it should be cleaned by professional conservators and protected from further damage.

• Should a site of high scientific or cultural value be at risk of structural damage caused by Project-related vibration, protective measures should be taken.

• If a portion of a site of high scientific or cultural value collapses due to excessive Project-related vibration, in agreement with the CH Superintendence archaeological conservators should be called in immediately to repair the damage and to reinforce the rest of the structure with conventional archaeological conservation techniques (i.e. aggressive structural bracing, and, in severe cases, cement reinforcement).

**Blockage of Access to Cultural Heritage Sites**

• The Project should be aware of cultural heritage sites and their access as well as set up Project equipment and activities so that access to sites is not restricted.

• If ICH users’ access to a site with ICH value is blocked, the Project should engage with stakeholders to resolve the issue and provide an alternate means of access to the site.

**Negative Effects on the Setting or Ambience of Cultural Heritage Sites**

• Inclusion of guidelines in the workers’ Code of Conduct to restrict employee activities that might interfere with nearby cultural heritage sites.

• Use proper siting and location to maximize the use of vegetation to screen development.

• The Project will be aware of cultural heritage sites and position Project equipment and activities in ways that interfere the least with cultural heritage sites.
8.8.2.1.3 Residual Impacts

Table 8-175 presents a summary of the residual impact associated with the impacts identified.

Table 8-176 Summary of the residual impact associated with the impacts

<table>
<thead>
<tr>
<th>Impact/Risk</th>
<th>Mitigation Commitments to Address the Impact/Risk*</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultural Heritage</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Loss of scientific, cultural, or historical value due to direct physical disturbance or damage | • Avoidance of cultural heritage sites by Project design.  
• Use of a Reduced Working Strip where construction zones are in close proximity to sensitive areas.  
• Fencing and/or signage around sites.  
• Removal of resources by rescue excavations and associated studies  
• Use of special low impact construction techniques where complete avoidance (e.g. rerouting) is not feasible.  
• Implementation of archaeological monitoring and a “chance finds” procedure with special focus on high potential archaeological areas. | Minor  
• Avoidance is the most important mitigation measure and the method that works the best to reduce impact on archaeological sites.  
• Marking and fencing off site boundaries will limit much of the impact.  
• Even if all known cultural heritage sites are avoided, unknown subsurface archaeological remains may still be damaged. Therefore, archaeological monitoring of construction activities and a Chance Finds Protocol are crucial to mitigate impacts on unknown archaeological resources during construction.  
Based on our background research there is a high likelihood of chance finds during construction. Most likely these finds will not be of major significance. Impacts would therefore be minor. It is possible, however, that an important chance find will be made during construction, changing this assessment. |
| Pollution and vibration         | • Use of a Reduced Working Strip where construction zones are in close proximity to sensitive areas.  
• Additional protection measures in cases of sites with excessive pollution (i.e. dust) related to the Project activities.  
• Structural reinforcement of sites suffering from potential damage due to the Project activities.  
• Monitoring of at risk sites.  
• All measures to be included in the CH Management Plan. Periodic cleaning and conservation of eventually polluted sites due to Project activities. | Minor  
• Some forms of pollution and vibration can affect stone architecture. The famous stone of Lecce of the region is very soft, and sensitive to structural damage.
8.8.2.2 Operations and Maintenance Phase

8.8.2.2.1 Potential Impacts

**Degradation or Damage to Cultural Heritage Sites Due to Pollution or Vibration**

Aboveground archaeological sites and monuments are subject to impact from air pollutants and vibration from daily operation of maintenance. These impacts are primarily related to free-standing sites such as ruins, monuments, and historic buildings.

This type of impact during the operations phase may come from the operation of machinery and maintenance of PRT and block valve systems, the pipeline, or other associated operations phase Project facilities.

**Blockage of Access to Cultural Heritage Sites**

In some cases, Project activities may cause difficulties in accessing important cultural heritage sites. Depending on the site, this impact may affect tourists, researchers, or ICH users. This impact would mainly affect monuments and tourist sites that receive visitors, sites where research is being conducted, and sites with ICH value. Maintenance and repair activities during the Operation Phase may require temporary blockage of roads or protective measures, such as fencing off cultural sites, which would block or deter visitors.
This type of impact during the Operations Phase may result from repairs or maintenance to PRT and block valve systems, the pipeline, or other associated Operations Phase Project facilities.

**Negative Effects on the Setting or Ambience of Cultural Heritage Sites**

Cultural heritage sites are closely related to the surrounding landscape and viewshed. The atmosphere of a cultural heritage site often has a bearing on its cultural value. Impacts on the setting or ambience of a cultural heritage site can affect its value to visitors. This is particularly true for monuments and sites with ICH value. In some instances, this can be a permanent impact if the landscape has been substantially altered enough to change its visual character. An example of this would be the construction of large, permanent structures adjacent to a cultural heritage site. In other instances, the impacts may be a temporary if they are related to construction activities or non-permanent structures. Examples of temporary impacts are the placement of equipment near a monument or Project-related noise near a place of worship.

During the operations phase, impacts on the setting and ambience of sites are likely to occur in places within the Project area which require maintenance and repairs. Since the pipeline will be underground, most sites in the Project area are not at risk for permanent impacts.

8.8.2.2.2 Mitigation Measures

**Degradation or Damage to Cultural Heritage Sites Due to Pollution or Vibration**

- If sites are discovered to be at risk of pollution or vibration, those sites should be monitored appropriately.
- If a site of high scientific or cultural value is damaged due to Project related pollution, it should be cleaned by professional conservators and protected from further damage.
- If a site of high scientific or cultural value is at risk of structural damage caused by vibration produced by the Project activities, protective measures should be taken.
- If a portion of a cultural heritage site collapses due to excessive Project related vibration, restoration should be performed on the site. If the site is an archaeological site or historic monument, archaeological conservators should be called in immediately to repair the damage and reinforce the rest of the structure with conventional archaeological conservation techniques (*i.e.* aggressive structural bracing, and, in severe cases, cement reinforcement).

**Blockage of Access to Cultural Heritage Sites**

- The Project will be aware of cultural heritage sites as well as means of access to them and set up Project repairs and maintenance activities in a way that does not restrict access.
- If access to an important cultural heritage site becomes blocked from a certain road or trail for an extended period of time, temporary signs should be placed along the route to help visitors take the easiest possible detour.
Negative Effects on the Setting or Ambience of Cultural Heritage Sites

- Inclusion of guidelines in workers’ Code of Conduct to restrict employee activities that might interfere with nearby cultural heritage sites during operation phase activities.
- The Project will be aware of cultural heritage sites and position Project equipment and activities in ways that least interfere with cultural heritage sites.
8.8.2.2.3 Residual Impacts

Table 8-176 presents residual impacts related with operations and maintenance phases.

### Table 8-177 Summary of the residual impact associated with the impacts

<table>
<thead>
<tr>
<th>Impact/Risk</th>
<th>Mitigation Commitments to Address the Impact/Risk*</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultural Heritage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pollution and vibration</td>
<td>• Monitoring of at risk sites.</td>
<td>Minor</td>
</tr>
<tr>
<td></td>
<td>• Use of a Reduced Working Strip if maintenance and repairs are in close proximity to sensitive areas.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Periodic cleaning and conservation of polluted sites, in case of impacted areas in the vicinity of aboveground infrastructure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Additional protection measures of sites with excessive pollution, in case of impacted areas in the vicinity of aboveground infrastructure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Structural reinforcement of sites suffering from damage from vibrations, in case of impacted areas in the vicinity of aboveground infrastructure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Measures to be included in CH Management Plan.</td>
<td></td>
</tr>
<tr>
<td>Blockage of access</td>
<td>• All measures to be included in the CH Management Plan.</td>
<td>Not Significant</td>
</tr>
<tr>
<td></td>
<td>• Stakeholder engagement with local ICH users.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Creation of alternative access routes.</td>
<td></td>
</tr>
<tr>
<td>Negative effects on the setting or ambience</td>
<td>• All measures to be included in the CH Management Plan. Maximum upkeep of vegetation to screen development</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>• Positioning of Project equipment and activities away from cultural heritage sites.</td>
<td></td>
</tr>
</tbody>
</table>

*Mitigation measures in italic will be developed in a further stage of the project

The PRT is a large, above-ground facility. It will be difficult to retain the visual appearance and character of the landscape around cultural heritage sites located in the PRT area. This need to be an ongoing concern, and efforts should be made to maintain vegetation used to conceal PRT from the viewsheds of cultural sites.
8.8.2.3 Decommissioning Phase

8.8.2.3.1 Potential Impacts

**Disturbance or Damage to Cultural Heritage Sites Due to Demolition of Structures**

The disturbance or damage of cultural heritage sites may occur from the demolition of structures, leading to loss of value. Impacts in adjacent areas are likely to be less severe than the ones discussed for the Construction phase and are mostly related to pollution and vibration.

Known sites should be fairly easy to avoid by the Project, thus drastically reducing impact. These sites are above ground and have been accurately mapped.

8.8.2.3.2 Mitigation Measures

**Disturbance or Damage to Cultural Heritage Sites Due to Demolition of Structures**

- Avoid Project encroachment on known sites. Avoidance is the preferred method and should be considered along with the mitigation measures below.
- Inclusion of guidelines in the workers’ Code of Conduct to restrict employee activities that might interfere with nearby cultural heritage sites.
- The condition of sites with aboveground components that lie within 50 m of the Project footprint should be recorded before and after demolition activities begin.
- If a site is identified as being at risk for impacts, protective measures should be put in place before demolition.
- If the condition of a cultural heritage site has been affected by demolition activities, restoration should be performed on the site. If the site is an archaeological site or historic monument, archaeological conservators should be called in immediately to repair the damage and reinforce the rest of the structure with conventional archaeological conservation techniques (*i.e.* aggressive structural bracing, and, in severe cases, cement reinforcement).
### 8.8.2.3.3 Residual Impacts

**Table 8-178 Summary of the residual impact associated with the impacts**

<table>
<thead>
<tr>
<th>Impact/Risk</th>
<th>Mitigation Commitments to Address the Impact/Risk*</th>
<th>Significance of Residual Impact / Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultural Heritage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disturbance or damage</td>
<td>• Avoidance</td>
<td>Minor</td>
</tr>
<tr>
<td></td>
<td>• Make records of existing conditions before and after</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Protective measures</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Restoration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Guidelines in the workers’ Code of Conduct</td>
<td></td>
</tr>
</tbody>
</table>

*Mitigation measures in italic will be developed in a further stage of the project*
8.9 Cumulative Impacts

Based on the available information, no other activities have been formalised in the area near the site where the TAP Project will be built. It is known that a plan has been proposed to expand the existing road network connecting Lecce to San Foca, through the municipalities of Lecce, Lizzanello, Vernole and Melendugno. The project, known as ‘Regional Road n.8’, plans to facilitate the mobility of Lecce citizens towards the coast. The new road will consist of a two lane carriageway.

The works for this new infrastructure could overlap with those of the TAP Project. However, although the public administrations have already notified expropriation decrees to some landowners for the construction of the new road, the road stretch included in the municipality of Melendugno is temporarily suspended with no final route definition. No further information on this project is known at the time of writing this report.

Therefore no cumulative environmental and social impacts in the Project area are foreseeable at the present.

Notwithstanding the above, if and when the final route of Regional Road n. 8 is defined, cumulative impacts shall be properly assessed provided there is possible overlapping between the projects.

8.10 Transboundary Impacts

The proposed TAP Project is planned to run from Greece through Albania and across the Adriatic Sea to Italy. In line with best practice for developing such large pipeline projects potential transboundary impacts due to the Project shall be considered.

TAP AG as the Project proponent is aware of the requirements of the ESPOO Convention on Environmental Impact Assessment in a Transboundary Context, which has been ratified by Italy with Law n.640 dated 3 November 1994. Furthermore, the two other countries involved in the TAP Project, Greece and Albania, are both ESPOO signatories as well. In addition, standards of international financing institutions require that the topic is appropriately addressed in the process of environmental and social impact assessment (ESIA) for the overall project.

In recent European practice, in the case of a transnational pipeline project, usually all countries crossed can be considered to be a Country (Party) of origin under the ESPOO convention.

All data concerning Project phases, equipment and related emissions for the Italian section of the Project are based on information and assessments included and described in detail in current Section and Section 4. Information and assessments concerning the Albanian offshore section of the Project are based on information available in the Albanian ESIA (Section 4 – Project Description, Section 8 – Assessment of Impacts and Mitigation Measures).
8.10.1 Policy And Legal Context

The Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention 1991), known as the Espoo Convention, establishes a procedure to manage transboundary impacts. The Convention was ratified in 1991 in the Finnish city of Espoo – hence the "Espoo Convention", with the support of the United Nations Economic Commission for Europe (UNECE), and entered into force in 1997. The general aim of the Convention is to “ensure environmentally sound and sustainable development” through international cooperation, particularly in a transboundary context.

Under the terms of the Espoo Convention on Environmental Assessment, a transboundary impact is defined as "any impact not exclusively of a global nature, within an area under the jurisdiction of a Party caused by a proposed activity the physical origin of which is situated wholly or in part within the area under the jurisdiction of another party". This definition deals with both projects and impacts that cross boundaries and therefore does not limit in scope the effect of the Convention to a consideration of projects that are in close proximity to a boundary.

The Espoo Convention widened and strengthened the requirements for consultation on transboundary impacts provided for in Directive 85/337/EEC, amended by Directive 97/11/EC, including additional project types in Annex I to which the Convention applies and modifying consultation procedures defined in Articles 7 and 9. Gas pipeline projects are included on the list of projects to which the Convention applies.

The general aim of the Espoo Convention is to “ensure environmentally sound and sustainable development” through the prevention, reduction and control of significant adverse transboundary environmental impacts from proposed activities. More specific objectives are to “enhance international co-operation in assessing environmental impact in particular in a transboundary context,” and “to give explicit consideration to environmental factors at an early stage in the decision-making process” (Espoo Convention 1991). This latter objective recalls the concept of prevention, a core value in ESIA.

In order to achieve its objectives, the Espoo Convention established certain mechanisms or measures: some of the Espoo Convention mechanisms include the requirement to undertake an ESIA process, consultation between countries, and facilitation of public participation for all the stakeholders.

The main mechanisms of the Espoo Convention intended to achieve its objectives are summarised as follows:

- Obligation to carry out an ESIA procedure. ESIA should be undertaken before decision-making is done;
- Consultations among countries. Consultations should occur throughout the whole Espoo procedure at different times (notification, preparation of the ESIA documentation, consultations on the basis of the ESIA documentation, final decision, post-project analysis).
• Public participation. Public participation in both the affected party and the party of origin should be facilitated throughout the Espoo process.

• Bilateral and Multilateral agreements.

• Settlement of disputes.

The Espoo Convention requires that if the proposed activity is found to cause significant adverse transboundary impact, the ‘Party of origin’ i.e. the Government of the Country undertaking the activity, shall notify any other ‘affected Party’ (other Country’s Government) for the purposes of ensuring adequate and effective consultations, which it considers may be affected by the activity as early as possible and no later than when informing its own public about the proposed activity.

8.10.2 Potential Environmental Transboundary Impacts

The potential transboundary impacts generated in Albanian territory from Project-related activities arising in Italy have been identified to comprise:

• Hydrotest water discharge in Albanian territory during the offshore pipeline pre-commissioning phase (hydrotesting phase).

• Air emissions from vessels used during the construction phase of the Italian offshore pipeline.

• Solid and liquid waste generation and wastewater discharge from vessels operations during the construction phase of the Italian offshore pipeline.

Potential transboundary impact scenarios are discussed in the following Sections.

8.10.2.1 Water Discharge due to Offshore Pipeline Hydrotesting

Once the offshore pipeline has been laid between Italy and Albania, hydrostatic testing will be performed in order to confirm the integrity of the offshore pipeline. The intention is for the offshore pipeline to be filled (mainly with seawater) from the Italian end, integrity tested, and water then discharged into the sea at the Albanian end. In Albania, approximately 130,000 m$^3$ of seawater and 2,000 m$^3$ of freshwater will be discharged during pre-commissioning (cleaning and hydrotesting: two filling rounds, one for cleaning and one for hydrotesting).

The water will be filtered (to remove particles greater than 50 micron) prior to injection in Italy and will not be chemically treated. There is a very remote possibility that should the pipeline be exposed to raw seawater for more than 60 days then inhibitors will need to be added. If this occurs, then pipeline will be re-filled with inhibited seawater including up to 19 m$^3$ of oxygen scavenger (average concentration of 285 ppm) and 20 m$^3$ of biocide (average concentration of 300 ppm). This will then be discharged as part of the total discharge in Albania.
Since the pipeline is equipped with flow coating, it is expected that the liquids discharged in Albania will contain only small amounts of corrosion material (dust) from the pipeline. The cleaning water will also be filtered at the discharge point to remove remaining solids drawn from the pipe interior. The discharged water, even if filtered, may still have a grey and/or rust colour, but this is not predicted to have environmental effects. This coloured water will only be present for the slug of water between the first two pigs of the cleaning operation.

In detail, the cleaning and hydrotesting phases will be undertaken through the following steps:

- **Flooding the Offshore Pipeline.** The pipeline will be flooded by injecting seawater drawn from the Italian nearshore. This water will not need to be chemically treated at all, given the relatively short period that the water will remain in the pipeline. This water will be filtered to 50 micron before being injected into the pipeline. Approximately 65,000 m$^3$ of water is needed to fill the pipeline on one occasion.

- **Cleaning and Gauging the Offshore Pipeline.** Once the pipeline has been flooded, a cleaning and gauging pig train will be launched into the system from Italy. The pig train shall be propelled through the pipeline by a pumping spread located in Italy. The water ahead of the pig train and the water between the pigs shall be discharged into the sea in Albania through a temporary discharge system, consisting of a 12"-diameter flexible or rigid plastic pipe connected to the temporary pig receiver. The pipe will be placed in the cofferdam, already built for pipeline installation, and the discharge point will be located 200 metres offshore at 5-6 metres water depth. The water will be filtered before discharge to capture any entrained material from the pipe interior coating.

- **Hydrotesting the Offshore Pipeline.** Once the pipeline has been cleaned and gauged, it will be subjected to a hydrotest operation as per DNV OS-F101, with the purpose of assessing its integrity and safety. The pipeline will be filled a second time with seawater. A pressurization spread located in the pull-in area in Italy will be fed with seawater and used to raise the pressure in the pipeline to the specified test pressure.

- **Dewatering the Offshore Pipeline.** Upon completion of the hydrotest operation, the pipeline will be dewatered. An eight-pig dewatering pig train will be launched from the temporary pig launcher in Italy. The pigs in the pig train will be separated by a 119 m$^3$ slug of freshwater. Water will be discharged into the sea via the temporary discharge system as described in the “Cleaning and Gauging” phase.

- **Drying the Offshore Pipeline.** Once the pipeline has been depressurised, dry air with a dew point lower than -40º Celsius will be injected into the pipeline in Italy, and dew point of the air being discharged in Albania will be monitored.
8.10.2.1.1 Vessels Air Emission

A support port is needed for offshore pipeline construction activities as a stockyard for pipe and to sustain the marine spreads. Taking into account the needs of the project, the port of Brindisi was considered suitable in terms of position and capacity for all the activities foreseen in the construction of both the Italian and Albanian offshore pipeline sections.

It will be used as the base for the vessels, and will be the yard for the pipe joints and all the materials and supplies needed for the Italian nearshore and offshore construction activities, that is all the marine construction activities except those related to the Albanian landfall. All the materials and crew for the vessels will be transported through this port, and all the waste and waste water will be unloaded to Brindisi port and transported onward to suitable facilities.

In terms of transboundary effects from Italy to Albania related to vessels air emissions, these impacts will depend on local conditions at the time of the emission, but, given the height and characteristics of such, it is expected that they will be limited to the vicinity of the accepted marine boundary between Italian and Albanian waters. Given the expected rate of advance of pipe installation, vessels will be operating in this area for an order of magnitude of days.

An estimate of the vessels likely to be used during the offshore (including landfall) construction activities and the number of trips during the pipelaying activities are shown in Table 8-10.

8.10.2.1.2 Vessels Liquid and Solid Waste Generation and Discharge

During construction there may be the following routine and occasional discharges from support and installation vessels/barges to the marine environment that may locally affect water quality:

- Treated sewage;
- Grey water;
- Kitchen waste;
- Open drainage systems and bilge water potentially containing traces of hydrocarbons.

Liquid and solid waste will be discharged into the water or taken onshore for treatment depending on distance to coast.
8.10.3 Impacts Assessment

8.10.3.1 Water Discharge due to Offshore Hydrotesting

In the pre-commissioning phase, seawater consumption is foreseen for hydrotesting activities related to the offshore pipeline. A potential transboundary impact is represented by the water discharge in Albanian territory originated in Italy and with materials and energy from Italy.

Impacts on the Albanian marine ecosystem are limited to a potential change in water quality and associated effects, and depend on which substances are added to the seawater following intake (and run off from the pipe interior). Seawater intake will take place at the Italian landfall, with seawater being filtered; as indicated previously it is intended that no treatment chemicals of any nature will be added. Under this scenario impacts could only arise from the discharge of materials cleaned from the interior of the pipe with the first batch of pigs pushing pressure test water along the pipe. These materials are chemically inert and will be filtered at the pig receiver before getting into the temporary discharge pipe to remove remaining solids drawn from the pipe interior, so that the only release to the Albanian Adriatic Sea will be Adriatic Sea water from the Italian coast, with broadly similar physic-chemical and biological composition (i.e. no alien organisms). The discharged water, even if filtered, may still have a grey and/or rust colour. It is anticipated that this coloured water will only be present for the slug of water between the two first pigs of the cleaning operation; this is not expected to have environmental effects.

8.10.3.2 Contingency Addition of Chemicals to test water

As reported in Section 8.10.2.1, in the remote possibility that the pipeline should be exposed to raw seawater for more than 60 days, chemical treatments of the seawater used for hydrotesting are expected.

The inhibitors added could constitute an oxygen scavenger and a biocide, chosen in order to prevent internal corrosion of the pipelines and minimise any potential impact on the marine environment due to pressure-testing. Of all the commercially available chemical substances used in contingency pressure-test water, the Project will select low toxicity additives in order to minimize the impact from this potential operation.

On discharge, these substances will rapidly degrade and break down in the water column though hydrolysis, oxidation, photo degradation and biodegradation.

Results of near-field modelling of similar situations elsewhere on similar projects show that the extent of dilution of discharged pressure-test water close to the discharge point is 15-40 m. Other similar far-field modelling show that discharged pressure-test water is easily diluted by up to 10 times within a few hundred metres of the discharge point. A dilution ratio of 50 will be evident at an order of magnitude of one to few kilometres from the discharge point. The situation is expected to return to normal (dilution factor of 100) within 24 hours after the discharge has stopped.
Based upon the extent and duration of dilution, the impact on water quality (negative and direct) of the discharge of pressure-test water in case of contingency is expected to be local, of temporary duration and of low intensity.

8.10.3.3 Vessels Air Emission

Vessel operations during offshore pipeline construction phase will result in emissions of pollutant gases.

On a regional scale, emissions of NO$_x$, SO$_2$ and CO contribute to acidification which can damage sensitive ecosystems in both terrestrial and marine environments. Due to the high water exchange, the Adriatic Sea is moderately susceptible to the impacts of acidification. Also on a regional scale, NO$_x$ emissions can contribute to eutrophication due to increased nutrients in the water, and this could ultimately lead to oxygen depletion and suffocation of fish and other marine life forms. Shipping, road transportation and energy combustion are the main sources of nitrogen oxide emissions in the region.

Emissions associated with the TAP Project (based on offshore marine activities only) are predicted to be most intense during the construction phase. Vessels emissions during the maintenance phase will be similar in nature but much more limited in quantity.

The potential for these gases to result in transboundary impacts is dependent upon the residence time (atmospheric lifetime), and the atmospheric residence time following release is one or two days for the majority of gases emitted by vessels (in fact, the dispersion of these emissions is rapid in an offshore environment, and background levels are reached close to the source).

Ship transport emissions caused by vessels engaged in Project activity are reported in Table 8-16.

In terms of air quality, the dispersion of these emissions is rapid in an offshore environment, and background levels are reached close to the source. Additionally, emissions from vessels will be mobile which will increase the dispersion of pollutants. Based on this, no local air quality effects in Albanian territory are expected from emissions generated in Italy and the impact is assessed as not significant.

Moreover, in quantitative terms, the predicted pollutant emissions are not significant if compared with the general emissions from maritime traffic in this area; therefore, no significant transboundary impacts are expected from activities of vessel involved in the offshore pipeline construction for the Italian sector.
8.10.3.4 Vessels Liquid and Solid Waste Generation and Discharge

Liquid and solid waste disposal systems of vessel operations may generate a transboundary impact due to the release of solid and liquid waste in sea water.

Brindisi Harbour is likely to be chosen as the location of the laydown yard for piping and other materials and supplies needed for offshore construction for both Italian and Albanian offshore Sectors. The offshore materials and crew will be transported through Brindisi harbour, and the waste and waste water will be unloaded to the port and transported onward to suitable facilities.

During offshore pipeline construction, occasional and limited discharges from support and installation vessels/barges to the marine environment may locally affect water quality. In this case, water discharge will be conducted according to MARPOL requirements, as detailed below:

- **Treated sewage, grey water and kitchen waste.** Treated sewage will be discharged into the water or taken onshore for treatment depending on distance to coast and according to MARPOL regulations. Macerated food wastes will also be disposed overboard beyond 12 nautical miles from the coast or taken onshore for treatment. These streams will introduce small quantities of nutrients and organic material to well-mixed, well-oxygenated surface open waters. Grey water (water from showers, baths, washbasins and the galley) is disinfected prior to disposal overboard. All discharges will be carried out in accordance with relevant legislation (relevant MARPOL requirements and provisions specified in its Annex IV – Sewage – and Annex V – Garbage);

- **Drainage and bilge water.** The drainage systems will collect water generated from washing and the storage areas. These with bilge water will enter a drainage system where the effluent will be treated to be discharged with less than 15 ppm oil in water (in accordance with MARPOL Annex I).

Due the unloading of wastewater to the port of Brindisi in suitable facilities and the limited magnitude and duration of potential increased contaminant concentration levels in the offshore deepwater environment due to occasional discharges, the impact of the release of contaminants is expected to be of temporary duration and of low intensity. Impacts will be reversible within a few days. **No significant transboundary impacts are expected from wastewater from vessel operations during offshore construction for the Italian sector.**
8.10.4 Conclusions

In order to apply to the ESPOO Convention guidance that requires the assessment of potential transboundary impacts in the ESIA process, the present report focused on the potential transboundary impacts generated from Italy to Albania caused by the TAP Project.

The potential transboundary impacts analysed in this study concerning:

- Water discharge in Albanian territory during the pre-commissioning phase (hydrotesting phase);
- Air emissions from vessels used during the construction phase of the Italian offshore pipeline;
- Waste and wastewater generation and wastewater discharge from vessels during the construction phase of the Italian offshore pipeline.

Regarding the water discharge produced by hydrotesting, it is noted that:

- Under the planned hydrotesting regime, no treatment chemicals of any nature are expected to be added to the seawater following intake (and run off from interior of pipe);
- Materials cleaned from the interior of the pipe are chemically inert and will be filtered before getting into the sea;
- No environmental effects on water turbidity, contaminant and nutrients concentration levels are expected.

In conclusion, transboundary impacts from the discharge of hydrotesting on seawater quality are not expected to be significant. There is a remote possibility that should the pipeline be exposed to sea water for more than 60 days, then chemical treatment of seawater will be required. If this eventuates, the Project will select low toxicity additives in order to minimize the impact from this potential operation.

Regarding air emissions produced by vessels operating between the port of Brindisi and the Italian-Albanian border, it is noted that:

- The pipe laying operation is typically carried out at a rate of 2 - 3 km of pipe laid per day and it is possible to assume vessels will operate near the international boundary at most for 2 to 3 days;
- The potential for these gases to result in transboundary impacts is dependent upon the residence time (atmospheric lifetime), and the atmospheric residence time following release is one or two days for the majority of gases emitted by vessels (in fact, the dispersion of these emissions is rapid in an offshore environment, and background levels are reached close to the source).

In conclusion transboundary impact from vessels air emissions is not expected to be significant.
Regarding waste and wastewater produced by vessels operating in the Adriatic Sea during the construction of the offshore pipeline, it is noted that:

- the waste and wastewater from vessel operations are generally expected to be unloaded at Brindisi harbour and transported onward to suitable facilities;
- occasional and limited wastewater may be discharged into the water, according to MARPOL regulations. This discharge will be limited in quantities and duration.

In conclusion, transboundary impacts from wastewater discharge from vessels involved in the offshore pipeline construction are expected to be not significant.

It highlights that the ESIA procedure on the Albanian section of the project was completed with a positive opinion of the Albanian national authorities on April 3, 2013.

8.11 Summary of Impacts and Mitigation Measures

Annex 11 reports a summary table of the impacts on each Environmental, Socioeconomic and Cultural heritage Component and the related foreseen mitigation measures.
8.12 Pipeline Safety

8.12.1 Overview

The TAP system will be transporting natural gas which is a highly flammable substance. Due to the high levels of European and international safety standards and established state-of-the-art technology, transportation of natural gas can be considered a highly safe operation. Over the past decades, incidents have been reduced to very low levels through continuous improving of standards and norms and practices for pipeline design and operation and maintenance. This is demonstrated by the following statistical data.

In Europe (European Gas Market - 17 members) alone, the natural gas transmission network in 2006, had a length of over 220,000 km (source: Technical Association of the European Natural Gas Industry, 2006 Statistics). The European Gas Pipeline Incident Data Group (EGIG) collects data of about 135,000 km transmission pipelines every year (representing roughly 50% of gas transmission pipelines in Europe). EGIG is a co-operation between a group of fifteen major gas transmission system operators in Western Europe to gather data on the unintentional releases of gas in their pipeline transmission systems.

The 8th EGIG Report (2011) is presenting long term statistical pipeline incident data over the period 1970 – 2010 and analyses failure frequencies and main causes in six categories:

- External interference (i.e. third party ground works, digging, piling etc.),
- Corrosion,
- Construction defect / material failure,
- Hot tap made by error,
- Ground movement, and
- Other and unknown.

EGIG’s statistical database contains information about failure frequencies (including analysis by size of leak categories, i.e. pinhole/crack, hole, rupture) and the main causes of incidents, but not quantitative information on consequences.

The statistical analysis of EGIG inter alia shows that:

- The long term incident data (1970 - 2010) indicate a steady drop in incidents and have a trend to stabilise at very low level
- External interference remains the main cause of incidents.

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3. [http://www.egig.eu/reports](http://www.egig.eu/reports)
4. The term “hot tap made by error” means that a tie-in connection to the transmission line was mistakenly attempted.
Also external interference is the cause that results in the bigger leaks, such as rupture (i.e. a leak that has a size bigger than pipeline diameter) and holes (larger than 2 cm but smaller than the pipe diameter), followed by ground movement as second cause.

The EGIG database describes the relation external interference and pipeline diameter as well as the relation external interference and wall thickness.

**Figure 8-37  Relation External Interference and Pipeline Diameter (d)**

![Diagram showing relation between external interference and pipeline diameter](http://www.egig.eu/)

Source: EGIG (2012)
The EGIG data shows, that the failure frequency is mostly related to small diameter pipeline systems with less wall thickness (see Figure 8-37 and Figure 8-38). The TAP will have a diameter of 36” and a wall thickness of 26.8mm for the onshore part and between 20.6 and 34mm for the offshore part. Comparing TAP’s technical design parameters with the EGIG statistic, the failure frequency is close to zero.
8.12.2 Safety Measures

The TAP Project has been designed according to the following hierarchy of safety measures to prevent non-routine and potentially hazardous situations occurring:

- **Eliminate**: wherever possible, hazards are designed out to make the site inherently safe, e.g. by using less hazardous materials;

- **Prevent**: where it is not possible to eliminate a hazardous material or process, measures are taken to ensure that the hazard cannot be realised, e.g. by ensuring adequate containment;

- **Detect**: if a hazardous event occurs, the design ensures that it will rapidly be detected, e.g. by process trip or flame detection;

- **Control**: measures will be in place to control a hazardous event, e.g. by isolating affected parts of the facility; and

- **Mitigate**: suitable measures will be incorporated into the design to mitigate the effect of a hazardous event where such measures are effective and appropriate, e.g. depressurisation of inventories.

The main safety measures for the PRT, the offshore and the onshore pipeline are described in the following sections.

8.12.2.1 Safety measures for Pipeline Receiving Terminal (PRT)

The safety measures for the PRT are basically relevant to the integrity of mechanical and process equipment, to the prevention of leaks, ignition, and to the mitigation of fire and explosion.

8.12.2.1.1 Integrity of mechanical and process equipment / prevention of leaks

All plant and equipment supplied to the TAP Project will be designed, manufactured, delivered, installed and operated in accordance with the relevant sections of the European, National and International Codes, Standards and Regulations.

The integrity of the equipment is assured by the corrosion protection system and by a regular program of inspection and maintenance.

**Corrosion Protection**

Underground installed pipes inside the PRT will be protected against corrosion by the usage of EP/PUR plastic insulation. Above-ground installed pipes are protected by corrosion resistant coatings.

Beside these corrosion resistant coatings a local cathodic corrosion protection will be installed at the terminal. The design of the local cathodic corrosion protection is based on the European standard EN 14505 “Cathodic protection of complex structures” and in accordance with EN 1594.
PRT Inspection and Maintenance

The design is optimised to support the inspection activities and in order to minimise operational shutdowns. Inspection requirements are established in parallel with detailed engineering considering regulatory and maintenance requirements.

It is necessary that units, section of piping, items of equipment or groups of equipment can be isolated, in order to facilitate shutdown for maintenance, inspection, tie-ins, loss prevention and purging prior to bring unit back in service.

Sufficient isolation valves, blinds, vent and purge connections, and / or other measures are provided to ensure:

- An entire system including equipment items, associated pipe work and instruments (where necessary) may be taken out of service for maintenance while other systems continue to function normally.
- Local physical and visual proof that an item of equipment is safely isolated from all possible sources of inflow before maintenance activities can take place.
- Temporary supports where items are to be disconnected from piping
- Means to safely reinstate equipment following removal from service.

Appropriate preparations for inspection shall be made to enable a safe inspection or examination to be conducted.

This shall include at least the following:

- Obtaining the necessary PTW & Isolation certificates.
- Isolation.
- Opening up.
- Cleaning.
- Removal of internal fittings or components as appropriate.
- Provision of facilities for access, both internal and external.
- Removal of insulation, passive fire protection and any other form of covering.
- Provision of correct tools required
- Provision of personnel aids such as lights or lighting, ropes, gangways, breathing apparatus, etc. in accordance with the requirements of the PTW and site safe working instructions.
- Provision of test equipment.
- Provision of the necessary utility services.
8.12.2.1.2 Prevention of ignition

**Fire and Gas Detection and System**

The main purpose of the detection system is to detect in due time fire scenarios and possible releases of flammable substances with the aim of implementing effective automatic and/or manual actions (including alarms), to protect personnel, plant equipment and environment.

In case of fire or gas detection, an acoustic and visual alarm system (AVAS) shall be triggered in the area where the hazard occurs, in the neighbouring areas and in the station control room.

The type and location of detectors will be based on typical leakage calculations, taking into account plant and equipment layout. Prevailing wind speed and direction and local atmospheric conditions will be considered, too.

The areas for the gas detectors are listed below:

- Gas Inlet Filter Cover:
- Gas Inlet Filter:
- Flow Metering:
- Pig Launcher and Receiver:
- Unit Piping Area
- Gas Heater Area
- Fuel Gas Skid
- Machine Halls

All the electrical equipments will be certified Ex.

Small gas leakages will normally dilute in air without forming an explosive atmosphere. Inspection for leakage in designated places, especially in open areas, shall be part of routine maintenance inspections.

Monitored buildings for the fire detection system will be:

- Grid Connection Building
- Firewater Pump Building
- Supervisory Control Centre (part of the Administration Building)
- Administration Building
- Workshop Building
- Stores Building
- Electrical Building
- Boiler House
- Fuel Gas Skid
• Gas Analysis
• Diesel Generators
• Heat Exchangers
• Filter Separator Area
• Scraper Area

**Lightning Protection**

Electrical surge caused by lightning or other events must not affect humans health or cause damages to buildings or equipment of the PRT.

In order to avoid these impacts all buildings and electric actors / sensors outside of buildings will be protected by lightning conductors. In addition all electrically conductive lines are integrated into the station protection potential equalization.

All foundations and all metallic equipment inside of buildings will be equipped with foundation earth electrodes and integrated into the station protection potential equalization as well.

The design of the lightning protection system is based on the European standard EN 62305 1-4 “

8.12.2.1.3 Mitigation of fire and explosion

In order to mitigate fire and explosion, dedicated systems are foreseen for fire fighting and for keep under control accidental releases of hydrocarbons. This system consists of an Emergency Shutdown System and a Blow Down System.

**Fire fighting system**

The PRT Fire extinguishing facilities comprises of two systems, a fire water system and a gas extinguishing system.

The fire water system is equipped with ring mains and pillar hydrants according to UNI EN 14384 (“Idranti a colonna soprasuolo”).

The system also contains valves, pumps, pipes and headers to divide the water flow.

This water tank will be filled with water from the public potable water supply. If this system is not available, it also can be filled by Lorries with a tank. It is planned to use treated water only.

The other system is based on fire extinguishing gas (quenching gas), stored in bottles. This system is determined for false floor areas in switch gear rooms of the electrical and control building. All rooms are separated from each other and the corridor by fire barrier walls.

Penetrations of walls for pipes and cables will be shut by fire protection systems, sufficient for fire resistance time of 90 minutes.
The system will be equipped with gas extinguishing bottles, installed in a separate room.

The details will be finalized with the assistance of the local fire protection department.

The gas extinguishing system is activated by the automatic fire alarm system varied for each false floor area by zone valves or separated bottles. The filling time for each zone is calculated for a complete exchange of air to extinguishing gas within 10 seconds.

**Emergency Shutdown System (ESD)**

The function of the emergency shutdown system (ESD) will be to protect personnel, equipment and the environment from the consequences of an accidental or an uncontrolled release of hydrocarbons and/or any other process media.

The ESD System for the facilities will be divided into three different levels of shutdown as follows:

- ESD 0, total facilities shutdown;
- ESD 1, single compressor unit shut down, not available in PRT;
- ESD 2, shutdown systems for closed process facilities.

The basic system philosophy will be that a shutdown on a certain level will never initiate a shutdown on a higher level, but will always include shutdowns on a lower level.

The ESD level 0 is executed by the ESD system base of certified safety PLC’s for the station. The system will be designed such that cascading effects due to a partial shutdown within a process shutdown will be avoided, i.e. the shutdown signals trip all affected systems so that upset conditions will be not developed as a result of the initial action.

All safety valves will be operated from the Station ESD System for safety purpose and from SCS for routing purpose via two separate solenoid valves.

**Blow Down System**

For emergency depressurisation the terminal will be equipped with a blow down system which is able to reduce the operation pressure in the trapped section to 6.9 bar (g) within 15 minutes as per international standard. The blow down system is designed to vent a constant mass flow to the two vent stacks. This will be achieved by a controlled release of the blow down lines close to the vents.

In addition to the emergency blow down system several manual vents are connected to the blow down system as well. These manual vents are used for maintenance venting. Due to the limitation in height for the vent stacks the depressurisation has to be done via two separate vent stacks.

The entire blow down system has been designed according to the DIN EN ISO 23251 standard “Petroleum, petrochemical and natural gas industries - pressure-relieving and de-pressuring systems”.
Power Generator

In addition to the public grid which supplies the station, one power generator set, driven by a diesel-operated motor, will be installed.

In the event of a failure in the public grids, the diesel generators in a standby power mode will be automatically started and, no later than after 45 s, assume the station load.

To ensure that, in the event that the main power system fails, the UPS consumers, like the ESD-system, can continue to be powered at their rated power for a period of 4 hours and more, two redundant 125 kVA emergency diesel generators will be provided.

8.12.2.2 Safety measures for Offshore Pipeline

Safety measures for the Offshore Pipeline are relevant to the maintenance of the integrity, through a correct protection from corrosion and from 3rd party interactions. Moreover, a regular program of inspection is foreseen to check the integrity of the offshore pipeline.

8.12.2.2.1 Corrosion protection

Pipeline shall be protected against corrosion using both the following corrosion protection systems:

- A passive protection, consisting for example of an outside pipeline coating made of high-density extruded polyethylene tape, minimum 3 mm thick, applied directly in factory. Welding joint shall be coated with heat-shrinkable sleeves.
- An active protection, consisting of a cathodic protection system, by means of sacrificial anodes. The design of the cathodic protection complies with the standard DNV RP F103. The sacrificial anodes consist of an Aluminium/Zinc alloy.

8.12.2.2.2 Protection measures for the offshore pipeline due to 3rd party interaction

The need of specific protection measures for the pipeline due to 3rd party interaction has been evaluated through an Offshore Pipeline Damage Assessment (ref. doc. OPL00-SPF-150-G-TRX-0002).

Principally hazards to pipeline integrity were identified from the following nine Sources:

- Dragged anchor;
- Dropped anchor;
- High holding anchors and dredging activities;
- Grounding ship;
- Sinking ship;
• Impact from fishing equipment;
• Geo hazards;
• Dumped munitions; and
• Military activities.

The study identified that non-routine events associated with the operation of the offshore pipeline, that could cause a pipeline failure, are very unlikely.

8.12.2.2.3 Pipeline Controls and Inspections

Controls and inspections will be performed in order to guarantee the safety and the efficiency of the pipeline. Following a general description of the activities of inspection is reported.

The controls typically foreseen for the offshore pipelines are the following:

• External survey:
  o ROV (Remote Operated Vehicle) survey,
  o Cathodic protection measurement;

• In-line inspection with intelligent pig:
  o wall thickness measurement;
  o features / geometry of the pipe;
  o mechanical damage and defects.

The external survey on the offshore pipeline typically uses remote operated vehicles (ROV) and is managed by a specific vessel. Depending on the inspection and monitoring requirements the ROVs can be equipment with specific equipment, like manipulator arms, visual control, environmental sensors, etc. The typical activities performed by the ROV are:

• Identification and localization of the pipeline;
• Visual inspection to search external damages;
• Verification of the external coating of the pipeline;
• Monitoring and measurement of the free span;
• Measurement of the potential of the cathodic protection;
• Identification of the leaks.

The internal inspections are generally performed using intelligent pig able to monitor the corrosion, the conditions of the coating, the pipe features and wall thickness. The type of pig is chosen on the basis of the required analysis. It is important to note that the inspection can be conducted also on pipeline in operation.
8.12.2.3 Safety measures for Onshore Pipeline

The safety measures for the onshore Pipeline are relevant to its integrity, to the interference with existing buildings and human settlements and to control of accidental leaks on the atmosphere.

8.12.2.3.1 Pipeline integrity

**Design factor**

The calculations of the thickness and the steel grade, structural analyses of the pipeline are made by regarding international specifications. Pipeline thickness is based on D.M. 17.04.2008.

The selection of the material is based on actual European Standard and international approved calculation methods. Due to these calculations pipeline with appropriate steel grade and thickness for the relevant diameters is chosen.

The pipeline and its thicknesses are designed for the maximum overpressures and design temperatures, also considering an allowance for potential corrosion.

Design data are the following:

- Type of gas pipeline: Type 1
- Design pressure (DP): 145 bar
- Utilization factor (f) adopted: 0.57
- Nominal pipeline diameter: DN 900 (36”)
- Internal diameter: 871 mm
- Material: Steel – Grade X65/450
- Wall Thickness: 26.8 mm (DM 17/04/2008)
Corrosion protection

Pipeline shall be protected against corrosion using both of the following corrosion protection systems:

- A passive protection, consisting of an outside pipeline coating made of high-density extruded polyethylene tape, minimum 3 mm thick, applied directly in factory, in combination with an inner epoxy coating. Welding joint shall be coated with heat-shrinkable tape.

- An active cathodic protection (a technique used to control the corrosion of a metal surface by making it the cathode of an electrochemical cell), through the impression of an electric flux by means of devices located along the line, which keep the steel pipe at a potential lower than the surrounding soil and water. Cathodic protection system is realized at the same time of the pipeline laying, connecting it to one or more cathodic protection plants, consisting of equipments which automatically keep the pipe at a negative or at -1 V potential lower than the reference electrode (Cu-CuSO₄).

Burial depth

The Ministerial Decree 17/04/2008 prescribes a minimum pipeline cover not less than 0.9 m and 0.4 in rocky soil from the top of the pipe. In TAP Project the pipeline is laid with a minimum cover of 1.5 m, in order to provide the maximum guarantees of safety from possible interference with human activities (excavating, ground-breaking for agricultural purposes etc.).

Marker Sign

Once the construction of the pipeline will be completed, a series of marker sign will be installed at regular distance on the axis of the pipe, in order to indicate the presence of the conduct and to avoid potential accidents due to agricultural or other works.
Pipeline Controls and Inspections

Controls and inspections will be performed in order to guarantee the safety and the efficiency of the pipeline. Following a general description of the activities of inspection is reported.

The controls typically foreseen for the onshore pipelines are the following:

- **External survey:**
  - Route survey;
  - Cathodic protection measurement;

- **In-line inspection with intelligent pig:**
  - Wall thickness measurement;
  - Features / geometry of the pipe;
  - Mechanical damage and defects.

The internal inspections are generally performed using intelligent pig able to monitor the corrosion, the conditions of the coating, the pipe features and wall thickness. The type of pig is chosen on the basis of the required analysis. It is important to note that the inspection can be conducted also on pipeline in operation.

### 8.12.2.3.2 Safety distances in respect of buildings

The onshore pipeline route has been designed taking into account a service easement area of 20 m from the pipeline axis.

Following figure illustrates the distances between the pipeline and nearby houses. The blue line represents the pipeline route from the landfall (on the right hand side) to the PRT (on the left hand side). The red lines marks the safety zone of 20 m to each side of the pipeline centreline, within no housing is supposed to be located, in accordance to Italian regulation (DM 17/04/2008). In addition to the 20 m safety zone, no clusters of houses should be identified within a range of 100 m to the pipeline. The figure shows, that these limitations are met.

### 8.12.2.3.3 Valves

According to Italian regulation (DM 17/04/2008) Block Valves Stations in high pressure natural gas pipelines are to be installed every 15 km.

Even if there is no regulative requirement, it’s a good engineering practice to foresee a coastal shut-off facility as close as possible to landfall, in order to guarantee higher safety and easier maintenance.

For this reason, a Beach Valve Station (BVS) has been designed at Kp 0.100, immediately after the starting point of the microtunnel.
8.12.2.3.4 Pipeline Leak detection

The pipeline is monitored by a leak detection system, in the event of a pressure drop, the block valves will be closed to isolate the section where the leak has occurred. In addition there is surface inspection of the pipeline corridor. TAP AG will respond to any detected leaks through the implementation of its emergency response procedures, including emergency shut down, that will be set out in the Emergency Response Plan (ERP).
8.12.2.4 Protection and safety measures during the construction period

During the project execution (construction period) several working practices/procedures will be used to regulate the following project activities:

- Site preparation;
- Fire prevention and protection;
- Housekeeping;
- Warning signs; optical and acoustical alarm systems will be installed
- Warning tape around the working areas
- Control and use of equipment;
- Personal protective equipment;
- Road traffic safety;
- Hazardous materials;
- Temporary electrics;
- Noise;
- Heat stress;
- Portable tools;
- Dust control;
- Permit to Work system; including conditions for fire protection
- Accident Investigation, Follow-up Procedure;
- Hazard analysis and control;
- Impact Assessment Tool;
- Discipline Procedure;
- Inspection and internal Audit;
- Leading indicators system;
- Training;
- Lighting for work execution work task, access and emergency lighting.
- Portable fire extinguishers to be used by craftsmen at every workplace

These procedures will be included in the Site HSE Plan that represents the principal document for provide a description on how TAP intends to provide the Health, Safety and Environment strategy during the construction phase.

The application for the technical evaluation of the project by the Fire Brigade of Lecce is currently ongoing.
The HSE Plan will also include the Emergency plan, which will be prepared before the Project execution.

These are the minimum contents of the Emergency Plan:

- Layout of Work Site and camp;
- Emergency service provisions;
- Access/escape provisions;
- Alarms and assembly points;
- First aid and medical treatment;
- Emergency phone numbers;
- Nomination of persons responsible for implement the Emergency Plan;
- Nomination of persons responsible for management of an emergency situation;
- Development of procedures for declaring, communicating and controlling during the emergency;
- Evacuation provisions of site working areas and facilities area;
- Monitoring, testing and maintenance of alarm systems and early warning devices;
- Designation of emergency teams and the definition of duties of other key personnel;
- Liaison with external services (Police, Ambulance services, Hospitals, Fire Station and other governmental agencies);
- Training and realistic exercises for emergencies;
- Effect the rescue and treatment of casualties;
- Contain and bring the incident under control.
8.12.2.5 Plan of Periodic Control Systems

The Policy of the inspection and maintenance activities for the pipeline and the stations is to ensure safe and economical gas transportation without interruptions over the planned lifetime of the system. The system depends on the reliability of the individual components, therefore it is necessary to monitor its condition, to execute planned maintenance and to resolve incidents and failures which could be reasonably anticipated to occur.

The following main principles will be followed:

- All maintenance activities shall be carried out in accordance with the maintenance procedures, Health & Safety Management System and safe working instructions to ensure that all risks to personnel are avoided, harm to the environment and damage to equipment are avoided or reduced to as low as reasonably practicable.
- Maximum use of easily maintained equipment
- Standardisation of the design of process facilities, instrumentation, procedures and documentation
- Maintaining spares inventory at suitable locations
- Training of the personnel to be available to effect a timely repair of failed equipment
- Vendor support, with maintenance contracts to be in place for critical components to ensure that expert advice is available when required
- A regular preventive maintenance program will be set up based on maintenance manuals received from equipment suppliers. Any Maintenance program should also recognise and be based upon internationally accepted procedures and standards.

In summary, the maintenance activities comprise all scheduled and unscheduled work or interventions performed on equipment installed in the pipeline system, in order to maintain & increase its reliability and availability, thus ensuring the continuity of operation and reducing the number and duration of failures.