ENVIRONMENTAL IMPACT ASSESSMENT CASE STUDY OF THE CONSTRUCTION OF A MAIN GAS PIPELINE, SECTION SVETI NIKOLE-VELES

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Abstract:
The Republic of North Macedonia undertakes intensive activities aimed at replacing fuels - fossil fuels with renewable energy sources and natural gas, to monitor the modern trends of exit from the energy crisis and environmental protection. Under the efforts of the National Gasification System in the country, i.e. the development of the existing gas infrastructure, the project for construction of the gas pipeline section Sveti Nikole – Veles was developed. The route of the gas pipeline starts east of the city of Sveti Nikole and ends south of the city of Veles with characteristics: DN 200, Ø 8" and length of 27.67 km.
The Environmental Impact Assessment process is intended to serve as a primary input for the decision-making process by Macedonian authorities and the IFI in charge (EBRD in this case), which have to approve the Project before its implementation. The decision-making process includes the preparation of all documentation in accordance with the EBRD's Performance Requirement (PR), The National Legislation, and Good International Practice (GIP).
This EIA study identifies the potential negative impacts on the media in the environment from the relevant stages of the project i.e. pre-construction, construction, operations, and decommissioning and reinstatement, and proposes measures for their reduction or mitigation, i.e. improvement of the environment in the Environmental and Social Management Plan.
Keywords: *1st Environmental Impact Assessment (EIA), 2nd gas infrastructure, 3rd potential negative impacts, 4th mitigation measures, 5th decision-making process*

Received: 18.07.2022. / Accepted: 13.09.2022.
Published online: 20.12.2022.

Professional paper
DOI:10.37023/ee.9.1-2.7

1. INTRODUCTION

This Study has been prepared in accordance with national Environmental Impact Assessment (EIA) procedures and environmental standards, EU Environmental Impact Assessment (EIA) procedures and environmental standards, and in accordance with the EBRD Performance Requirements (PRs).

In the event that international funding is required for a particular project, the screening phase should be used to categorize the project so as to guide the subsequent EIA process. As this Project involves the funding of isolated sections of the pipeline, which are a greenfield facility, the EBRD has preliminarily assigned it a Category A, and has commissioned an Environmental and Social (E&S) Assessment of the Project. The ESIA process is based on environmental baseline data at an appropriate level of detail. An EIA should be seen as a process that starts at the Conceptual Design Stage of the Project and continues throughout project construction, operation, and decommissioning. It covers all relevant known direct and indirect environmental impacts and risks and foresees appropriate mitigation measures in relevant stages within the Project.

2. OBJECTIVE

An Environmental Impact Assessment (EIA) should be seen as a process that starts at the Conceptual Design Stage of the Project and continues throughout project construction, operation, and decommissioning.

During this process, several deliverables were prepared to guide the activities of the specific stage. During the scoping process potential environmental and social impacts were identified and possible alternatives to the project were evaluated. All reasonable alternatives were assessed according to their impact on the physical, biological and social environment, as well as existing cultural heritage. During the scoping phase, the content and scope of work in this EIA Study and the specialist studies, such as the Biodiversity Impact Assessment Study and Heritage Impact Assessment Study, for the selected final route of the gas pipeline section were determined. The stakeholders were

informed about the planning of a Detailed Design and the development of the EIA, and they were also involved within the decision-making process. At the end of the scoping process, as a result of baseline data gathering, the Baseline Report was prepared which is part of the EIA Study. After the scoping process, the possible positive and negative impacts on the environment and society were analyzed and estimated, and the significant impacts from the project implementation were identified. At the end of the EIA process, mitigation measures were proposed that aim to remedy or compensate for the predicted adverse impacts of this Project.

All mitigation measures are towards fulfilling the recommendations of The European Green Deal which responds to these challenges. It is a new growth strategy that aims to transform the EU into a fair and prosperous society, with a modern, resource-efficient, and competitive economy where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use.

3. METHODOLOGY

Applied approach and methodology for EIA Study preparation was as follows:

1. Baseline data gathering. It includes the Screening phase (desktop survey, field survey, and reporting stage) and Scoping phase. The Baseline Report considers the findings of the screening and scoping phases.
2. EIA process
3. Mitigation measures

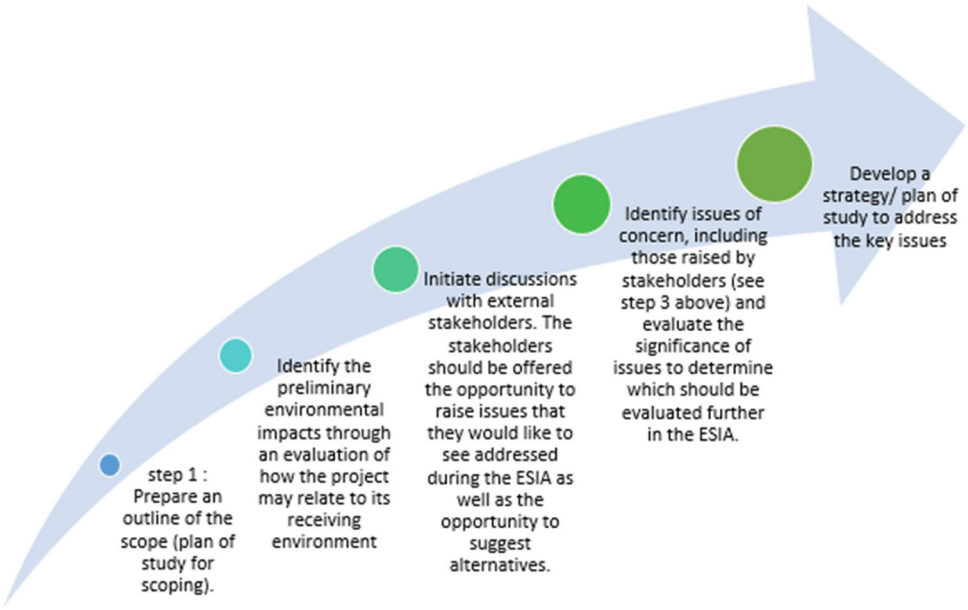

Figure 1. Steps in the scoping phase

The analysis of the environmental impacts and the impacts of the social environment takes into account potential changes in the bio-physical and socio-economic environment (given in the basic data, such as environmental media, demographic characteristics, the data relating to the health aspects of the population that lives and works in the project area, educational facilities, infrastructure, etc.), which may result from the proposed project activities. The level of change determines the significance of the change, which is assessed in terms of type of impact, reversibility, geographic extent, time when the impact occurs, duration, likelihood of occurrence, and intensity or magnitude. The overall rating refers mainly to the changes that are considered significant.

4. TECHNICAL DESCRIPTION

The route of the pipeline begins east of Sveti Nikole and north of the village Erdzelija as attachment after BS2 of the existing pipeline LOT 1 Klechovce Kavadarci continued the south-east of the region of Veles, where ends with Block Station, receptions cleaner station and MMRS Veles.

At the beginning, the Block Station (BS2) was selected at the location of the existing valve block on the gas pipeline DN500 LOT 1 Klechovce - Negotino, which Block Station was constructed specifically for the main gas pipeline in question. Besides the Block Station, at the beginning of the gas pipeline there is an Initial Cleaning Station Sveti Nikole, also at the end of the gas pipeline and in front of MMRS Veles, a Receiving Cleaning Station Veles is planned.

The project will include the following design facilities:

- Main gas pipeline DN 200, Ø 8" with a length of 27.67 km;
- Initial Cleaning Station Sveti Nikole at the beginning of the gas pipeline (km 0);
- Receiving Cleaning Station Veles at the end of the gas pipeline (km 27.5);
- From the gas pipeline, connections are predicted towards Sveti Nikole - DN 80 with a length of 387 m (km 6.39);
- The linear Block Station DN200 is predicted at km 27.5 (BS Veles);
- Block Station DN80 is predicted at the connection to Sveti Nikole;
- Cathodic protection system;
- Main measuring-regulation stations: MMRS Veles (25.000 – m^3/h), MMRS Sveti Nikole (8.000 – m^3/h).

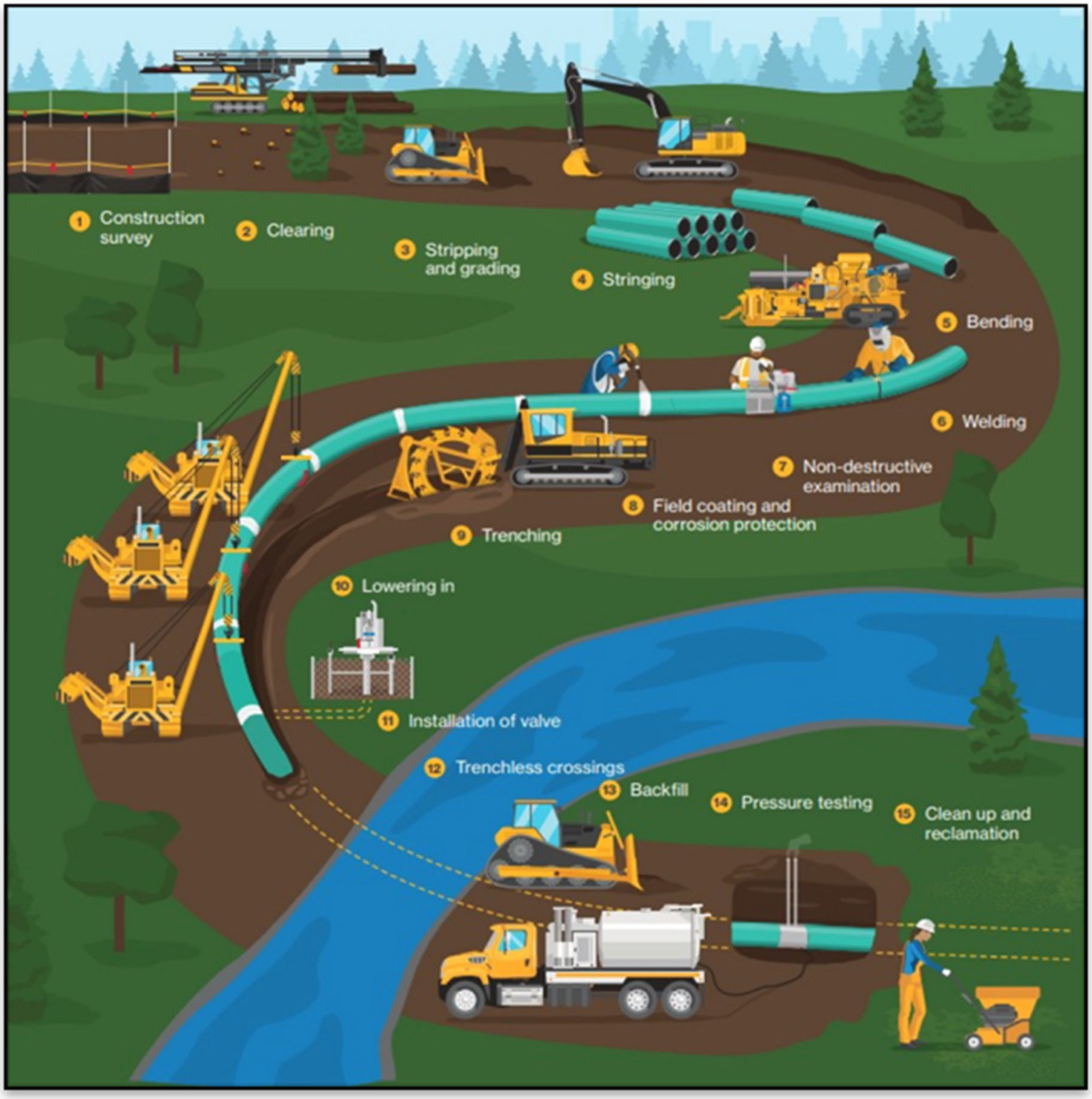

Figure 2. Gas pipeline construction phases

Figure 3. Map of the wider area of the main gas pipeline, Section Sveti Nikole-Veles

5. ENVIRONMENTAL IMPACTS ASSESSMENT AND MITIGATION MEASURES

5.1. Methodology and criteria for impact assessment and proposing mitigation measures

The structure of this chapter is focusing on the potential impacts for each project phase for the following components:

- Soil,
- Surface and groundwater,
- Air,
- Climate change,
- Waste generation,
- Noise and vibration,
- Biodiversity,
- Cultural heritage, and
- Cumulative impacts.

The impact analysis is done for two phases of the project activities:

- The construction phase of the gas pipeline section (which includes the preparatory and constructive phase), and
- The operational phase of the gas pipeline section (or operational phase).

The analysis of the environmental impacts and the impacts of the social environment takes into account potential changes in the bio-physical and socio-economic environment (given in the basic data, such as environmental media, demographic characteristics, the data relating to the health aspects of the population that lives and works in the project area, educational facilities, infrastructure, etc.), which may result from the proposed project activities. The level of change determines the significance of the change, which is assessed in terms of type of impact, reversibility, geographic extent, time when the impact occurs, duration, likelihood of occurrence, and intensity or magnitude. The overall rating refers mainly to the changes that are considered significant.

All identified impacts from the project during the designing and construction phase were taken into consideration in compliance with current standards and using best practice techniques, thus reducing the potential impacts in the construction and operational phase.

Mitigation measures aim to remedy or compensate for the predicted adverse impacts of the Project, and are in response to legal requirements. Mitigation is both a very important principle and practice. It means that the Investor (NER) will do its best to reduce, neutralize and repair the impact of its activities on people and the natural environment. All mitigation efforts should, however, focus first on how to avoid environmental impacts in the initial stages of planning. This has much greater beneficial effect than remedial action later.

5.2. Assessed potential impacts on soil and proposed mitigation measures

Table 1. Soil - Construction phase

Assessed potential impacts
The potential impacts on soil during the gas pipeline construction phase are as follows: - *Change in the soil quality as a result of the introduction (emission) of pollutants that could impair the soil quality;* - *Possible contamination of soil can result in a pollution of ground and surface water through infiltration of pollutants or through their washing from the soil surface by atmospheric water;* - *During the preparation of the terrain, a thorough clearing of the route will be performed, which includes mechanical treatment / excavation of the soil;* - *Destruction of surface fertile soil.* *The significance of the impacts on the soils as a result of possible emissions that could impair the soil quality and destruction of surface fertile soil caused during the construction phase is* ***low to moderate.***
Proposed mitigation measures
In the construction phase, in order to reduce the impacts caused by changes in soil quality as a result of pollution, to take the following measures: - *Careful planning of construction works in order to reduce the negative effects and ensure the prevention of soil pollution;* - *The excavated material, if possible, to be reused in the construction, or to be used as a layer for covering the trenches intended for the pipeline pipes. Excess material to be disposed of at a designated location / landfill designated by the Competent Authority;* - *To make the maximum possible reduction of the size of the construction sites, in order to minimize the land that suffers a negative impact, in order to reduce the destruction of the surface fertile soil;* - *Safe storage of building materials;* - *Vehicles and construction machinery are maintained in good condition to prevent unwanted leaks of fuels, oils and other pollutants;* - *Prohibits servicing of vehicles and machinery along the route of the pipeline. In case of emergency spills of fuels, oils and other harmful substances is mandatory prompt action, remediation of polluted areas and reinstatement in order to protect the soil;* - *In case of leakage of fuels, oils and other pollutants, the contaminated soil layer should be covered with absorbents, collected and disposed of and treated as hazardous waste. The Contractor to conclude a contract with a company authorized for handling hazardous waste that will take it from the site and will act further with it;* - *Refueling should be done in specially designated places away from watercourses. If this is not possible, provide portable tankers for refueling;* - *In case of a breakdown of machinery and transport vehicles, fuels, oils and other pollutants not directly discharged to the ground, but it needs to adequately collect in appropriate containers and removed from the construction site;* - *Placing mobile toilets in certain places on the site and concluding a contract with a licensed company that will install and clean;* - *Construction debris should be regularly removed from the construction site and disposed of at an appropriate landfill.;* - *Proper waste management, as provided in the appropriate subchapter (measures to improve waste management);* - *Thorough cleaning of the construction site and its rehabilitation after the construction works are completed.* *The Measures for prevention of erosion and landslides, as well as the protection of the embankments on watercourses, are given in the technical description, in the separate chapter - A set of erosion protection measures, as follows:* *I. Measures to prevent erosion and landslides* - *For securing the inner side of incisions from drained wastewater and prevention from water concentrated in them, it is required to construct drainage canals and the soil trenches need to have a cross section of not less than 0.02. Drainage canals intersected by the gas pipeline must be reinforced with crushed stone, as well as stone-filled drainage sites;* - *The protection of the inclined plane obtained by making the incision needs to be protected as soon as possible, which would prevent possible erosion caused by surface water;* - *The passages of the gas pipeline through ravines and ditches should be filled with mineral soil with appropriate consolidation, the leveled surface should be reinforced by sowing a permanent layer of plant soil. Within the boundaries of parts of active erosion of gorges and ravines should be performed protection of the incline surface by sowing grass. Within the boundaries of certain parts, appropriate partitions are constructed that prevent the occurrence of undermining of the ground, i.e. the occurrence of erosion;* *II. Protection of embankments on watercourses* - *When overcoming water obstacles, it is necessary to protect embankments as follows:* • *at the bottom of the riverbed:* - *Laying gabions* - *Filled with stone. The choice of size and weight of the stone should depend on the speed of the water* • *protection on the outside of embankments and slopes above the level protected by stone filling must be carried out with soil and plant it to grasslands;* *Riverbeds of permanent and occasional water flows, streams, canals and ditches with water velocities greater than 0.6-0.7 m/s need to be renewed and strengthened after the construction works.*

Table 2. Soil - Operational phase

Assessed potential impacts
In normal operation of the pipeline is not expected to have impacts on soil. If defects occur in the underground part of the pipeline, the reconstruction activities will be the same as the construction activities in the construction phase. *In such a case, during the intervention of fault repair of underground facilities can lead to unwanted spillage of oils, fats and fuels from construction machinery and transport vehicles to be used on soils. In this case, a quick reaction is needed, which would collect all the toxic substances, which would not allow them to enter the soil, and thus the groundwater.* *The significance of the impacts on soils as a result of possible soil emissions caused during the exploitation phase is* ***low.***
Proposed mitigation measures
In case of leakage or damage to the underground part of the pipeline, reconstruction works will be performed to repair or replace the damaged part of the pipeline. These reconstruction works are the same as construction works in the construction phase and accordingly, such impacts on the soil will be created. It is necessary to take appropriate measures as in the construction phase.

5.3. Assessed potential impacts on surface and groundwater and proposed mitigation measures

Table 3. Surface and groundwater - Construction phase

Assessed potential impacts
The potential impact on water (surface water and groundwater) during the gas pipeline construction phase is change in the surface and groundwater water quality as a result of pollution with pollutants. *The significance of the impacts on water due to emissions in surface water or soil and indirectly in groundwater, caused in the construction phase is* ***low to moderate.***
Proposed mitigation measures
For the purposes of reducing the impact on the quality of the surface and groundwater as a result of the pollution caused by various pollutants, it is necessary to undertake the following measures: - *To set up mobile toilets in certain places on the site and to conclude a contract with a licensed company that will install and clean them;* - *To stop construction activities in case of unwanted spills of oils, fats and fuels on the soils, sprinkle with sand and remove of the contaminated soil layer, in order not to infiltrate the contaminants in the soil and reach the groundwater. Contaminated soil layer to be treated as hazardous waste;* - *To use the technical water for the sprayers for dust reduction with appropriate quality and sufficient quantity;* - *Washing of construction machinery should be done at a suitable location, outside the construction site;* - *Refueling in trucks and construction machinery, oil replacement and other things related to truck maintenance and machinery is prohibited in an area of 50 m on both sides of watercourses to which the route of the pipeline is approached or bridged;* - *Implementing measures to improve waste management;* - *The Contractor to provide water quality measurements, before and during the construction phase;* - *Crossing under rivers will be done by digging the bed of the watercourse, taking into account the results of geological investigations. The project elevation of the upper edge of the pipeline is more than 1.50 m below the river bottom;* - *If during the construction of the gas pipeline under the rivers is necessary to temporarily divert the rivers of Svetinikolska River and Sariderska River to carry out dry excavation, in order to prevent soaking and cleaning of the pipes, there will be a change in the hydrological regime, the erosive processes and turbidity of rivers, and the migration of river fauna (fish of other freshwater species) will be disrupted;* - *To prevent turbidity of the surface watercourses under which the route will pass, it will be necessary to install straw bales that will serve as a filter for purification of wastewater from digging;* - *When overcoming water obstacles, it is necessary to protect embankments as follows:* • *at the bottom of the riverbed:* - *Laying gabions* - *Filled with stone. The choice of size and weight of the stone should depend on the speed of the water* • *protection on the outside of embankments and slopes above the level protected by stone filling must be carried out with soil and plant it to grasslands;* - *Riverbeds of permanent and occasional water flows, streams, canals and ditches with water velocities greater than 0.6-0.7 m/s need to be renewed and strengthened after the construction works;* - *If the flow of the riverbed is diverted, it can be done with the help of dams or with the use of pumps. In both cases it is necessary:* - *Works to be performed in the summer and on dry days* - *Previously to get approval from authorities* - *The duration of deviations should be limited to the shortest possible time so as not to disturb the aquatic ecosystem and the migration of species across the river;* - *Riverbeds of permanent and occasional water flows, streams, canals and ditches with water velocities greater than 0.6-0.7 m/s need to be renewed and strengthened after the construction works;* - *In situations where the pipeline section crossess the small water channels the Constructor should install concrete pipe culverts for smooth water permeability during the construction and for movement of construction machinery. After the completition of the construction works these concrete pipe culverts should be removed from the site;* - *To perform the hydro test, the Contractor must:*

- *Provide water of adequate quality (in accordance with current standards). Potable water is widely accepted as hydro test water for steel pipes, provided the water is not recycled for other hydrotest and limited time of residence water within pipeline and vessel under test;* - *If the Contractor cannot provide sufficient amount of potable water for the hydro test, then the water that will be used for hydro test must be chemically treated to ensure its adequate quality. It is recommended to use as cleanest water as possible - demineralized, steam condensate, or potable treated;* - *In order to minimize the water intake, it is necessary the Contractor to use appropriate amount of water (the required quantities to be calculated and defined within the Procedures for Construction);* - *The Contractor is required to conduct a wastewater quality examination and, depending on the result, primarily to ensure its reuse for the same purpose, or, if necessary, to treat it first to ensure adequate water quality for conducting a hydro test, and then to ensure its reuse. The Contractor should provide wastewater quality examination, and if it is necessary to treat the wastewater its treatment as well, by an accredited laboratory.*

Table 4. Surface and groundwater - Operational phase

Assessed potential impacts
During the operational phase of the gas pipeline system, impacts on surface and groundwater are not expected, except in case of accident / pipeline failure. In such a case, during the intervention to eliminate the defect of the underground facilities, there may be an unwanted spill of oils, fats and fuels from the construction machinery and transport vehicles that will be used, on the soils and indirectly in the groundwater. In this case, a quick reaction is needed, which would include collection of all the toxic substances, in order not to enter the soil, and thus in the groundwater as well. *The significance of impacts on water as a result of possible emissions into soil and indirectly underground water caused in the exploitation phase is* ***low to moderate.***
Proposed mitigation measures
During the regular operation of the gas pipeline system, no impacts on surface and groundwater are expected. If during an accident/defect of the pipeline, there is an unwanted leakage of oils, fats and fuels from the construction machinery and transport vehicles that will be used, then in order to protect the soil and groundwater from potential contamination, the following measure should be applied: *To stop construction activities in case of unwanted spills of oils, fats and fuels on the soils, sprinkle with sand and remove of the contaminated soil layer, in order not to infiltrate the contaminants in the soil and reach the groundwater. Contaminated soil layer to be treated as hazardous waste.*

5.4. Assessed potential impacts on air and proposed mitigation measures

Table 5. Air - Construction phase

Assessed potential impacts
The potential impacts on the air during the gas pipeline section construction phase are as follows: - *Occurrence of fugitive dust emissions from clearing the terrain and cleaning of greenery (trees and shrubs), loading and transport of waste;* - *Occurrence of fugitive dust emission during loading and unloading of construction materials, soil waste;* - *Exhaust emissions from construction machinery and transport vehicles.* *The significance of the effect - air pollution due to emission of pollutants caused by construction activity is* ***low to moderate.***
Proposed mitigation measures
The following measures, proposed for the purposes of mitigating the environmental impact, can reduce the air pollution during the construction phase of the gas pipeline: *Measures for exhaust gas reduction:* - *Use of proper construction machinery and transport vehicles with the declared emission of exhaust gases determined during their homologation;* - *Use of standardized fuels for mechanization and shutdown of mechanization engines when not in use.* *Dust reduction measures:* - *During dry periods to carry out spraying locations susceptible to emissions of fugitive dust with technical water. For this purpose, use sprayers that do not contain chemicals, and are water-based;* - *Limiting the speed of vehicles on the construction site;* - *Vehicles that will transport aggregate material and excavated soil to be permanently covered;* - *Route planning, loading and unloading factors are of great importance in reducing fuel consumption and exhaust emissions and fugitive dust emissions.*

Table 6. Air - Operational phase

Assessed potential impacts
All the possible emissions and impacts that may occur during the operational phase of the gas pipeline section are in case of malfunctions and accidents of pipeline component as follows: - *Operational emission: air emissions from normal or planned operating activities where small volumes of natural gas is possible to be released to the atmosphere from the gas network components;* - *Fugitive emissions:* *1. Fugitive emissions from permeation of pipelines;*

2. Fugitive emissions due to connections (flanges, pipe equipment, valves, joints, seals, etc.). - *Vented emissions which are usually identified during commissioning, decommissioning, renewal and maintenance of pipeline systems, regular emissions of technical devices and emissions from start-stop operations;* - *Regular emissions of technical devices i.e., from combustion of gas in boilers located in the Main measuring - regulation station (MMRS).* *The significance of the impact on air due to emission of pollutants caused in the phase of construction is* ***low to moderate.***
Proposed mitigation measures
In the phase of normal operation of the pipeline does not expect negative impacts on air. Only in case of leakage or damage to the underground part of the pipeline, reconstruction works will be performed to repair or replace the damaged part of the pipeline, which are the same as the construction works in the constructive phase. *Measures that should be taken into account to reduce fugitive emissions along the pipeline in operational phase refer to:* - *The selected equipment and design of the compressor station and metering stations to be in compliant with Best Available Techniques (BAT);* - *Make sure that valves and flanges are installed correctly;* - *Establish and follow a valve and flanges preventive maintenance program;* - *Replace old, outdated valves and flanges;* - *Install low emissions valve packing;* - *Install monitoring system for leaks;* - *Replace high-bleed pneumatic devices with low-bleed ones;* - *Implement a directed inspection and maintenance (DI&M) program at compressor stations.*

5.5. Assessed potential impacts on climate change and proposed mitigation measures

Table 7. Climate change - Construction phase

Assessed potential impacts
The potential impacts on the climate change during the construction phase of the gas pipeline section are as follows: - *Impact on the local microclimate;* - *Greenhouse gas emission from the operation of the construction machinery, equipment and transport vehicles;* - *Greenhouse gases from waste biomass.* *The significance of the impacts on climate change during the construction phase of the gas pipeline section is* ***insignificant to low.***
Proposed mitigation measures
During the construction phase, for the purposes of reducing the greenhouse gas emission from the work related to the construction machinery, equipment and transport vehicles, it is necessary to undertake the following measures: - *Application of good construction practices for a more efficient performance of the construction works, thereby reducing the fuel consumption and the greenhouse gas emission;* - *Using proper construction machinery, equipment and transport vehicles for the purposes of avoiding any increase in the fuel consumption, thereby also preventing any increase in the greenhouse gas emission.*

Table 8. Climate change - Operational phase

Assessed potential impacts
The potential impacts on the climate change during the operational phase of the gas pipeline are fugitive emissions which are as a result of leaks through the safety and exhaust valves, as well as a result of gas leakage situations due to the violation of the impermeability of the pipeline. *The significance of the impacts on climate change during the operational phase is* ***low.***
Proposed mitigation measures
During the operational phase, it will be required to conduct a regular control of the safety devices for overpressure relief, whereby natural gas discharge will be reduced. Furthermore, it is necessary to conduct regular control of the impermeability of the gas pipeline in order to minimize any undesired natural gas discharge into the atmosphere.

5.6. Assessed potential impacts from waste generation and proposed mitigation measures

Table 9. Waste generation - Construction phase

Assessed potential impacts
The potential impacts by waste generation during the construction phase of the gas pipeline section is from the following types of waste: - *Municipal waste;* - *Excess of excavated soil and sand;* - *Biodegradable waste;* - *Packaging waste;* - *Construction and demolition waste;* - *Remains of steel pipes;* - *Insignificant amounts of certain fractions of hazardous waste.* *The significance of the impacts from the generated waste on all media, caused in the construction phase is* ***moderate.***

Proposed mitigation measures
In order to improve the manner of waste management during the construction phase, in accordance with the legislation in the field of waste management, the following measures are recommended: - *Prepare a Waste Management Plan (WMP);* - *It is recommended that the inert waste will be stored at a landfill for such waste, the location of which will be determined in advance (as a possibility for the existing landfill for this type of waste to occur, or if it exists at all) manages a company for handling this type of waste, with which the Contractor of the construction activities will conclude a Contract;* - *The humus that will be removed in the thickness indicated in the project should be stored in a temporary landfill for usable material, from where it will be used in the finishing works to arrange the space of the location. The excavation of the humus should be done in favorable weather conditions, when it is not raining. It is necessary for the Operator, i.e. the Contractor of the construction activities to take care that the humus is left in a special place and to be secured from disintegration and contamination so that it can be used in the final arrangement of the space;* - *The packaging of the materials that will be used in this phase should be properly selected depending on their composition (cardboard, paper, plastic, metal, biodegradable waste, etc.) and the selection to be made at certain locations along the route, fenced, protected from external influences and adapted for storage of this type of waste. Authorized company, with which the Contractor of the construction activities will conclude a Contract, should perform their regular raising and removal;* - *As for the plastic packaging of motor oils, which is hazardous waste, it is recommended that it will be temporarily stored in a specially designated place for this type of waste and that the Contractor conclude a contract with a company authorized to handle hazardous waste to take over the site and will deal with it further. This company will have to take over and continue to deal with possibly removed contaminated soil layer with oils, fats and fuels, in case of their spill into the soil;* - *When changing the engine oil, as hazardous liquid waste, it is necessary to store the used oil in separate cans and store it until it is purchased by authorized companies, which would perform their further recycling;* - *Metal waste to be sold to purchasing companies;* - *The felled trees and biodegradable waste to be offered to the local population for heating, construction activities or as a basis for composting.*

Table 10. Waste generation - Operational phase

Assessed potential impacts
The potential impacts by waste generation during the operational phase of the gas pipeline section is from the following types of waste: - *Biodegradable waste from the maintenance of the route;* - *Waste spare parts linings and paints for maintenance of above-ground and underground facilities;* - *Waste generated in the event of failure of underground pipeline.* *The significance of the impacts by waste generation during the operational phase is* ***low.***
Proposed mitigation measures
In order to improve the manner of waste management during the operational phase, the following measures are recommended: - *The vegetation waste should be treated in the same way as during the clearing of the vegetation during the construction phase;* - *The waste that will be created from the intervention of the overhead parts of the gas pipeline (waste spare parts from the Block Stations, etc.) to be disposed of at the municipal landfill;* - *In case of leakage or damage to the underground part of the pipeline, construction works will be performed to repair or replace the damaged part of the pipeline and the generated waste should be treated the same as in the construction phase;* - *Do not dispose waste near watercourses such as rivers Svetinikolska River and Sariderska River.*

5.7. Assessed potential impacts from generation of noise and vibration and proposed mitigation measures

Table 11. Noise and vibration - Construction phase

Assessed potential impacts
The potential impacts from noise during the gas pipeline construction phase will occur as a result of the work of construction machinery, transport vehicles that will be engaged, as well as the equipment used on construction sites. *The significance of the impact - increased noise, vibration and non-ionizing radiation in the construction phase is* ***low to moderate.***
Proposed mitigation measures
The mitigation measures for the impacts caused by noise and vibration during the construction phase comprise the following: - *Careful planning of construction activities (to take place only during the day from 7am to 5pm and with a certain time dynamics) and application of the principles of good construction practice which practically means efficient operation and shortening the duration of construction activities, accompanied by increased noise, as little as possible, so that these negative impacts are as short as possible;* - *Control of construction methods, used mechanization and regular maintenance of equipment in order to minimize possible noise levels (avoid equipment that emits noise above 90 dB) and use sophisticated equipment;*

- *Use of modern "quiet" work equipment that meets the requirements of Directive 2000/14/EC of the European Union on the emission of noise from the use of work equipment in outdoor conditions;*
- *Proper maintenance of compressors, ventilation fans with their lubrication and installation of parts for sound deadening;*
- *Turn off the construction machinery when not in use;*
- *Avoiding the use of loud beeps and restricting the speed of vehicles carrying some building materials and equipment;*
- *Activities such as demolition, excavation and operations affecting the terrain to plan not occur in the same time period. Unlike noise produced total level of vibration can be significantly less when every source of vibration is separate;*
- *Monitoring vibrations during the performance of critical business processes. In case of damage to nearby buildings as a result of vibrations created by construction works, the damaged buildings should be repaired or compensation should be paid.;*
- *The surrounding population should be informed about the activities that will generate noise, in order to reduce the anxiety of the people;*
- *Workers who operate equipment that generates noise levels greater than 80 dBA permanently within 8 hours or more should use earmuffs.*

Table 12. Noise and vibration - Operational phase

Assessed potential impacts
The potential impacts by noise and vibrations during the operational phase of the gas pipeline are not expected to occur in normal operation. In case of leakage or damage to the underground part of the pipeline, construction works will be performed to repair or replace the damaged part of the pipeline. In that case, the construction activities are the same as the activities in the construction phase. *The significance of the impact - increased noise, vibrations and non-ionizing radiation in the operational phase is* ***low.***
Proposed mitigation measures
In case of leakage or damage to the underground part of the pipeline, construction works will be performed to repair or replace the damaged part of the pipeline. These construction works are the same as in the construction phase and accordingly, they will create such noise and vibration. It is necessary to take appropriate measures as in the construction phase.

5.8. Assessed potential impacts on biodiversity and proposed mitigation measures

Table 13. Biodiversity - Construction and Operational phase

Assessed potential impacts
The potential impacts on biodiversity are as follows: *IMPACTS ON THE HABITATS* *Construction phase:* - *habitat loss (direct destruction) –* ***low to moderate significance*** *Operational phase:* - *habitat fragmentation –* ***low significance*** *IMPACTS ON FLORA AND FAUNA* *Construction phase:* - *Disruption of the nesting cycle (birds) –* ***moderate significance*** - *Alteration, impairment or destruction of the habitat of amphibians and reptiles –* ***low significance*** *Operational phase:* - *Access to natural resources –* ***insignificant*** *IMPACTS ON PROTECTED AND DESIGNATED AREAS* *Construction phase:* - *Impact on habitat fragmentation and bird disturbance –* ***low to moderate significance*** *Operational phase:* - *Impact on habitat fragmentation and bird disturbance –* ***insignificant*** *IMPACTS ON BIOCORRIDORS* *The gas pipeline route does not intersect with any of the core areas, but it does cross the steppe like corridor Ivankovci-Karatmanovo.* *IMPACTS ON CRITICAL HABITATS* *Construction impacts to CH (pseudo-steppe) may impact 1.63 ha, which represents ≈ 0.006% of the habitat's EAAA (25,225 ha). This impact is not considered likely to compromise the habitat's integrity across the EAAA given the relatively small area.* *There are no global estimates for 6220* available, but the habitat occurs mainly in Europe. European estimate (EU only) of 6220* – 706,122 ha. Mediterranean estimate (EU only) – 693,747 ha (98% of EU total), there is no National estimate of 6220*. Habitat of pseudo-steppe vegetation in AoI is approximately 1.63 ha, which is 0.2% of the European estimate. This impact is not considered likely to compromise the habitat's integrity. The impact magnitude is therefore considered to be low.* *Considering the very high sensitivity attributed to the pseudo-steppe EAAAs and the low impact magnitude expected, the overall significance to this habitat will be* ***moderate.*** *IMPACTS ON PRIORITY BIODIVERSITY FEATURES* *Construction impacts to hill pastures and riparian belt (PBF) are expected to result in a loss of 18.5 ha, which represents ≈ 0.4% of the habitat's EAAA. This impact is not considered likely to compromise the integrity of habitat across the EAAA given these low losses. The impact magnitude to this PBF is therefore considered to be low.*

Considering the high sensitivity attributed to the hill pastures EAAAs and the low impact magnitude expected, the overall significance to this habitat will be low.
Construction impacts to riparian willow belts (PBF) are expected to have impact of 1.65 ha, which represents ≈ 0.1% of the habitat's EAAA. This impact is not considered likely to compromise the integrity of habitat across the EAAA given these relatively low losses. The impact magnitude to this PBF is therefore considered to be low.
Considering the high sensitivity attributed to the riparian belt EAAAs and the low impact magnitude expected, the overall significance to this habitat will be ***low.***
9 species were assessed as being Priority Biodiversity features in line with PR6. Impacts identified include direct mortality from the construction works, from fragmentation of habitats, visual and noise disturbance and impacts from pollution.

Proposed mitigation measures

I. Pre-construction phase
Before the start of the construction activities the route must be fully surveyed for the up-to-date baseline condition and to identify the presence / potential presence of notable species.
SPECIFIC MITIGATION FOR PBF/CH HABITATS
- *Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea Grasslands & Hill Pastures with Sparse Shrubs*

Pre-construction surveys in Spring to Autumn will determine/confirm the extent of these habitats.
Because it is habitat with grass (steppe vegetation), after construction it is best to be left on the natural regeneration - local species of steppe plants to settle instead to be planted by the man.
- *Riparian Willow - Poplar belts*

There would be re-planting of scrub in some areas or vegetation would be allowed to colonize naturally as appropriate. All riparian works and river crossing should follow the prescriptions of the water chapter of the ESIA.
SPECIFIC MITIGATION FOR PBF ANIMAL SPECIES
- *Agile Frog (Rana dalmatina)*

If the ponds are to be destroyed, drainage should be conducted via pumping with a suitable pump filter (to prevent animals and debris being drawn into the pump).
Translocation of amphibians away from works area. All animals present within the pond should be moved to appropriate habitats away from the works. If possible, pond drainage should be avoided April-September. The translocation of specimens identified in work zone into favorable habitat areas identified adjacent to the works. Checks to be conducted by Biodiversity Specialists ahead of the excavation. Routes will be maintained properly in order to avoid creation of puddles capable of attracting amphibians; Conduct standard measures to limit water pollution and soil.
- *Yellow-Bellied Toad (Bombina variegata)*

Identification and mapping of areas occupied by this species prior to the commencement of clearance. River drainage to be avoided April-September where possible. Checks to be conducted by Biodiversity Specialist ahead of excavation. the active working corridors will be maintained properly in order to avoid creation of puddles capable of attracting amphibians; Conduct standard measures to limit water pollution.
Prohibition of access to Nezirlik Ardi of all workers.
- *European Pond Turtle (Emys orbicularis)*

The working areas should be carefully searched by the Biodiversity Specialist prior to the commencement of the work; any individuals found to be carefully transported outside risk areas in habitats matching their ecological requirements; any individuals found on site to be relocated to favorable habitats.
- *Common tortoise (Testudo graeca) and Hermann's Tortoise (Testudo hermanni)*

A morning trench check should be performed, if trapped tortoises are found, a ramp should be installed within open trenches to allow these species to escape.
- *Imperial eagle (Aquila helica) and Egyptian vulture (Neophron perconopterus)*

Given that the pipeline is envisaged to traverse the feeding habitats of all three bird species and that it is in close proximity to a handful of established nests of Eastern Imperial Eagles, it is imperative to monitor the impact of disturbance and potential changes to feeding areas for the priority species during the breeding season (from March till September for the Lesser Kestrel and the Egyptian Vulture), and throughout the year for the Eastern Imperial Eagles (juveniles and immature birds tend to stay close to their nests all over the year before undertaking any migration route). This monitoring ought to be implemented in the entire area of Ovche Pole IBA, and it should survey nesting territories (occupancy, breeding success) and feeding range (especially if there are any changes).
Felling of trees should be undertaken between September and February inclusive, felling of trees during the breeding bird season (March to August inclusive is to be avoided). Noisy work (i.e. hammering is not permitted in these areas from March to August inclusive). Dead wood should be retained on site. RoW to be permitted to be colonized naturally.
Check for nest must be done prior to construction work.

II. Construction phase
- *Prohibition of access to Nezirlik Ardi (near km 21+500.00)*
- *Plan to avoid disturbing pseudo-steppe habitat EUNIS Code E1.3, N2000 code 6220* at Kanda Geoglyph (near km 8+000.00)*

As a general rule, traditional extensive management systems aimed at maintaining a mosaic-like landscape pattern are suitable for most plant and animal species linked to the 6220 habitat type (González & San Miguel 2004, Pardini et al. 2004, Alrababah et al. 2007).*
During operational phase NER have a responsibility to ensure it doesn't cause further harm to the environment. Leaks, emissions, and other damage from pipelines can destroy vegetation, harm local wildlife, and add to local water and air pollution levels. Operators can help avoid these issues by strict inspection and maintenance routines.
- *River protection measures for all stream crossings*

In order to preserve the riverine and aquatic habitats, and maintain water quality in the river as far as possible, the following provisions should be included in the construction contract documentation:
- *No access or works in any river channel or dry watercourse unless absolutely necessary to construct the works;*

- *No parking or storage of any equipment within 100 m of river channels or dry watercourses;*
- *Stabilize construction entrance to prevent the transport of sediment from the work site;*
- *Preparation of the Revegetation and Rehabilitation Plan of riverine habitat;*
- *Revegetation to be conducted with willow and poplar trees which are an effective ecological restoration, in both structure and function to stop erosion processes of the riverbed slopes;*
- *River flow must be maintained at all times. If access is required to the flow channel, measures should be taken to divert the flow in order to bypass the works;*
- *No storage or discharge of any wastewater, effluent, excavation soil or any other material may be made to the river channels or watercourses;*
- *All measurements given in the Detailed Design, in order to prevent any kind of possible pollution of the riverbeds and contact with groundwater, should be fully respected and implemented during construction;*
- *Contractor should be prepared for unlike events like fires; and*
- *Any incident pollution event in the watercourses that could be made by the Contractor, will be supervised by PIU/Supervising Engineer and MoEPP.*

The Contractor should be required to prepare a detailed method statement for working in all watercourses, for approval by the PIU/Supervising Engineer.

In addition, a Biodiversity Specialist should be engaged to monitor the vegetation clearance/excavation works. The Biodiversity Specialist should supervise a pre-construction clearance of any mobile animals (e.g. tortoises) which should occur immediately before the beginning of the construction activities in the area.

The success of these measures will be captured through ongoing water quality monitoring.

- *Protection measures at IBA*

As noted, the IBA is important for trigger species. In order to minimize damage to nesting birds at the IBA, the Contractor should follow these activities along this stretch:

- *Engaging experienced ornithologist to monitor;*
- *Construction work to be done from September till May (to avoid breeding period);*
- *Prohibition of removal of vegetation during the breeding period of Imperial Eagle in the spring, from the end of May to the middle of June;*
- *No entering of any forested areas except those strictly necessary for construction of the permanent works;*
- *No clearing any forest vegetation except within the working corridor;*
- *No excavating any material for fill or aggregate, or any other purpose except within the corridor of the permanent works; and*
- *Not allowing construction workers to enter the forested areas for any purpose, or to search for nests or eggs.*

III. Operational phase

- *Rehabilitation and restoration measures*

Rehabilitation and restoration actions are taken to assist in the recovery of a feature that has been degraded, damaged, or destroyed.

- *Rehabilitation at river crossings, especially Svetinikolska River crossing*

Once the construction works in the river channels are complete, the areas should be rehabilitated by the placement of soil, willow/poplar trees to allow regrowth of natural vegetation. The assistance of Botanical Specialists and a Forestry Expert should be sought to guide the rehabilitation works.

The area should be monitored quarterly following site handover, to establish whether regrowth of vegetation is occurring. If not, additional measures: seeding, transplanting of saplings, import of additional topsoil, etc. should be taken to encourage regrowth of riverine vegetation.

Afforestation activities to be performed in line with the No net loss principle, i.e. preparation of LALRP. Riparian vegetation along the Svetinikolska River to be restored, in order to achieve No Net Loss.

Re-planting of the PBF riparian habitats will take place within and around the EAAAs (cannot be re-planted directly on top of the pipeline for safety reasons). The materials required for replanting will be included in the Bill of Quantities. The land required for replanting will be secured by NER, and will be maintained as the specified habitat type in the long-term (i.e. for the lifetime of the Project), through commitments secured from the landowners by NER. The Detailed Design will include sufficient land for revegetation at a minimum of 2:1 revegetation ratio. This includes Priority Biodiversity Feature species.

- *Rehabilitation at other areas*

The Contractor should consult Public Enterprise ''Nacionalni Shumi'' for the trees from field-protective belts in the vicinity of Sveti Nikole that will be removed. Due to their ecosystem services, these belts need to rehabilitated.

All other areas where vegetation was cleared, should be soiled and rehabilitated by planting with appropriate native vegetation or left for natural regrow (especially at certain location as mentioned above). Area should be monitored quarterly for following site handover, to establish whether regrowth of vegetation is occurring. If not, additional measures: seeding, transplanting of saplings, import of additional topsoil, etc. should be taken to encourage regrowth of vegetation.

A Biodiversity Specialist should oversee this.

- *Plan to control invasive species*

Within the expropriation area, all individual trees and saplings of Robinia pseudoacacia will be located and cut, with the stumps killed. Fallen trunks and branches will not be removed, to provide micro-habitats to specialized species. This work will be overseen by a Biodiversity Specialist. When cutting trees, the best season to do so is in August which gave the lowest volume of sprouts.

The tree of heaven (Ailanthus altissima) and the indigo bush (Amorpha fruticosa) were also observed along the pipeline corridor.

Invasive Ailanthus altissima trees (including saplings) should be eliminated (uprooting all individuals) when clearing vegetation prior to construction works. Indigo bush (Amorpha fruticosa) can be controlled by repeated defoliation and digging and severing the root 3 to 4 inches below the crown.

Monitoring post-construction by NER will ensure that newly restored areas are not inundated with non-native species from adjacent areas.

5.9. Assessed potential impacts on archaeological and cultural-historical heritage and proposed mitigation measures

Table 14. Cultural heritage - Construction phase

Assessed potential impacts
The potential impacts on cultural heritage during the gas pipeline section construction phase are as follows: *IMPACTS ON CHANCE FINDS AND KNOWN ARCHAEOLOGICAL SITES* - *Potential Loss or Partial Damage to Chance finds and Undiscovered Below-Ground Heritage Assets as a result of the construction activities –* ***moderate significance*** - *Potential Loss and Partial Damage to known archaeological sites as a result of the construction activities –* ***moderate significance*** - *Access to the archaeological sites –* ***insignificant*** *IMPACTS ON BUILDINGS AND COMPLEXES WITH CULTURAL HERITAGE VALUE* - *Potential Loss or Partial Damage to the Buildings and cultural heritage Complexes in the AoI of the projected gas pipeline –* ***insignificant*** - *Access to the cultural buildings and complexes –* ***insignificant*** *IMPACTS ON CULTURAL LANDSCAPES* - *Partial Defragmentation of the integrity of the visual effects, of the cultural landscapes- Change in the elements, characteristics, character, and qualities of the landscape as a result of development –* ***moderate significance*** - *Deteriorated panoramic views of the cultural heritage monuments –* ***low significance*** *IMPACTS ON INTANGIBLE CULTURAL HERITAGE AND ASSOCIATIONS* - *Potential Loss or Partial Loss to the intangible cultural heritage and associations (religious rites, tradition, living cultural heritage) in the AoI of the projected gas pipeline –* ***insignificant*** - *Access to the churches and church complexes for religious rites and traditions –* ***insignificant***
Proposed mitigation measures
In the pre-construction and constructive phase, in order to reduce the impacts caused by potential loss or partial damage to chance finds and known archaeological sites, the following measures will be implemented: - *Before the construction of the gas pipeline section, qualified Cultural Heritage Expert team from authorized institution to make survey of the planned route of the gas pipeline section (as stated in the Report No. 08-73/3 from 25th March 2021 from the National Conservation Center of Cultural Heritage-Skopje, North Macedonia);* - *Qualified Cultural Heritage Expert from authorized institution to be present during the construction activities, especially during the activities near the archeological site Kula (km 24+000.00) which is placed on the route of the planned gas pipeline (according to Report No. 08-73/3 from 25th March 2021 from the National Conservation Center of Cultural Heritage-Skopje, North Macedonia);* - *Careful planning of construction works in order to reduce the negative effects and ensure the prevention of damage of the chance finds and known archaeological sites;* - *To make the maximum possible reduction of the size of the construction sites, so the negative impact will be minimized, in order to reduce the loss or partial damage to chance finds and known archaeological sites;* - *To make demarcation of known archaeological sites as required, to avoid indirect disturbance;* - *To develop a Plan for Protection of Cultural Heritage;* - *To make the maximum possible reduction of vehicle and machinery activities, as limited to the areas that have been subject to heritage clearance or previous disturbance;* - *To make the maximum possible reduction of earthworks in the AoI, as limited to the areas that have been subject to clearance or previous disturbance;* - *Workers should undergo basic training on the procedure for the cultural value of the AoI and the region, in order to identify the chance finds and archeological sites assets during the construction works;* - *Implementation of the Law on Protection of Cultural Heritage ("Official Gazette of the Republic of Macedonia" No. 20/04, 71/04, 115/07, 18/11, 148/11, 23/13, 137/13, 164/13, 38/14, 44/14, 199/14, 104/15, 154/15, 192/15, 39/16, and 11/18), Article 49-a, related to management of monumental units and cultural landscapes (in accordance with the Macedonian legislation and EBRD PR8 requirements).* *In order to reduce the impacts caused by potential loss or partial damage to buildings and complexes in the AoI of the projected gas pipeline section to take the following measures:* - *Careful planning of construction works in order to reduce the negative effects and ensure the prevention of damage of the buildings and complexes;* - *To make the maximum possible reduction of the size of the construction sites, so the negative impact of the cultural heritage assets that suffers will be minimized, in order to reduce the loss or partial damage to buildings and complexes with cultural value;* - *To make demarcation of cultural heritage sites as required, to avoid indirect disturbance;* - *Qualified Cultural Heritage Expert from authorized institution to be present during the construction phase;* - *To make the maximum possible reduction of vehicle and machinery activities, as limited to the areas that have been subject to heritage clearance or previous disturbance;* - *To make maximum possible reduction of generation of dust and vibration by operation of heavy machinery, to make ongoing monitoring of dust and vibration levels and inspection of heritage places in proximity;*

- *Implementation of the Law on Protection of Cultural Heritage ("Official Gazette of the Republic of Macedonia" No. 20/04, 71/04, 115/07, 18/11, 148/11, 23/13, 137/13, 164/13, 38/14, 44/14, 199/14, 104/15, 154/15, 192/15, 39/16, and 11/18), Article 49-a, related to management of monumental units and cultural landscapes (in accordance with the Macedonian legislation and EBRD PR8 requirements);*
- *Workers should undergo basic training on the procedure for the cultural value of the AoI and the region, in order to identify the cultural heritage assets during the construction works.*

For prevention and reduction of negative effects with the appearance of the gas pipeline section in the line of the view and to reduce the impacts caused on cultural landscapes in the AoI of the projected gas pipeline section the following measures will be implemented:

- *Low-profile constructions, use of environmental coloration or advanced camouflage techniques to limit visual effects, screening, proper sighting and location to maximize the use of topography and vegetation;*
- *The alternative route is analyzed as to make less impact on the cultural landscape;*
- *Careful planning of construction works in order to reduce the negative effects and ensure the prevention of the loss and defragmentation of the visual effects on the cultural landscapes;*
- *Workers should undergo basic training on the procedure for the cultural value near the AoI and the region, in order to identify the cultural heritage assets and landscapes during the construction works;*
- *After the construction, to carry out the activities for rehabilitation of the site, excavations, sand loans and access roads, by planting grass and trees or other appropriate measures;*
- *Implementation of the Macedonian legislation and EBRD PR8 requirements.*

During the pre-construction and constructive phase, the responsible persons should take care to give clear instructions to the involved workers, on how to behave towards tradition, religious rites and living cultural heritage in the region. For that purpose, before preparation of the field starts, it is necessary to observe the given measures. In the construction phase, in order to reduce the impacts caused by potential loss to intangible cultural heritage (traditions, religious rites, living cultural heritage) in the AoI of the projected gas pipeline section the following measures will be implemented:

- *Restrict the timing of construction and demolition activities, so as not to disturb the use of religious cultural heritage sites (churches). Stop work at certain times when sites are in use, such as during significant events (weddings, funerals and religious festivals);*
- *The workers will avoid disturbance of the religious rites and tradition;*
- *The access in the churches and church complexes for religious rites and traditions will not be affected during the construction activities of the gas pipeline section;*
- *Implementation of the Macedonian legislation and EBRD PR8 requirements;*
- *The workers who come from other places of residence will get acquainted with the culture, customs, habits, and everyday life of the local population. It is especially important to consider the preservation of the living cultural heritage, as part of the customary and ritual practices of the project AoI;*
- *It is also necessary to prepare a Plan for project activities for a certain time interval, and to distribute (disseminate) it. The emphasis in this Plan should be on the project activities that create more noise and dust emissions. The increased noise level of the project activities, as well as the higher emission of dust, may prevent the performance of certain religious practices, which in turn will cause certain tension among the population in the affected settlements. The implementation of the Plan for project activities will avoid possible tensions among the local population.*

Table 15. Cultural heritage - Operational phase

Assessed potential impacts
In normal operation of the gas pipeline section is not expected to have negative impacts on the cultural heritage assets. However, some potential impacts on cultural heritage during the gas pipeline operational phase are as follows: *IMPACTS ON THE ARCHAEOLOGICAL SITES* - *Potential Loss or Partial Damage to Chance finds and Undiscovered Below-Ground Heritage Assets as a result of the operational activities or hazards –* ***low significance*** - *Partial Damage to known archaeological sites as a result of the operational activities or hazards –* ***low significance*** - *Access to the archaeological sites –* ***insignificant*** *IMPACTS ON THE BUILDINGS AND COMPLEXES* - *Potential Loss or Partial Damage to the Buildings and cultural heritage Complexes in the AoI of the projected gas pipeline –* ***insignificant*** - *Access to the cultural buildings and complexes –* ***insignificant*** *IMPACTS ON CULTURAL LANDSCAPES* - *Partial Defragmentation of the integrity of the visual effects, of the cultural landscapes- Change in the elements, characteristics, character, and qualities of the landscape as a result of development –* ***moderate significance*** - *Deteriorated panoramic views of the cultural heritage monuments –* ***low significance*** *IMPACTS ON INTANGIBLE CULTURAL HERITAGE AND ASSOCIATIONS* - *Potential Loss or Partial Loss to the intangible cultural heritage and associations (religious rites, tradition, living cultural heritage) in the AoI of the projected gas pipeline –* ***insignificant*** - *Access to the churches and church complexes for religious rites and traditions –* ***insignificant***
Proposed mitigation measures
In the operational phase, in order to avoid unnecessary potential or partial loss of the archaeological assets, it is proposed: - *Qualified Cultural Heritage Expert from authorized institution to be present during some reconstruction or activities connected with hazards that might occur during the regular operation of the gas pipeline section;* - *Careful planning of operational works in order to reduce the negative effects and ensure the prevention of damage of the chance finds and known archaeological sites;*

- *To make the maximum possible reduction of vehicle and machinery activities, as limited to the areas that have been subject to heritage clearance or previous disturbance;*
- *Workers should undergo basic training on the procedure for the cultural value of the AoI and the region, in order to identify the chance finds and known archaeological sites during the operational works;*
- *To be implemented Chance Find Procedure (the same as in the construction phase).*

In the operational phase, in order to reduce the impacts caused by potential loss or partial damage to buildings and complexes with cultural heritage value near the AoI of the projected gas pipeline section the following measures will be implemented:

- *Careful planning of operational works in order to reduce the negative effects and ensure the prevention of damage of the buildings and complexes;*
- *To make the maximum possible reduction of the size of the reconstruction sites, so the negative impact of the cultural heritage assets that suffers will be minimized, in order to reduce the loss or partial damage to buildings and complexes with cultural value;*
- *To make the maximum possible reduction of vehicle and machinery activities, as limited to the areas that have been subject to previous disturbance;*
- *To make maximum possible reduction of generation of dust and vibration by operation of heavy machinery, to make ongoing monitoring of dust and vibration levels and inspection of heritage places in proximity;*
- *To make demarcation of cultural heritage sites as required, to avoid indirect disturbance;*
- *Qualified Cultural Heritage Expert from authorized institution to be present during some reconstruction or activities connected with hazards that might occur during the regular operation of the gas pipeline section;*
- *Implementation on the Macedonian legislation and EBRD PR8 requirements.*

In the operational phase, for prevention and reduction of the aesthetic negative effects which mean changed panoramic image and defragmentation with the appearance of the gas pipeline section near the AoI, to take the following measures:

- *Careful planning of reconstruction works in hazard events in order to reduce the negative effects and ensure the prevention of the loss and defragmentation of the visual effects on the cultural landscapes;*
- *Workers should undergo basic training on the procedure for the cultural value of the AoI and the region, in order to identify the cultural heritage assets and landscapes during the reconstruction works;*
- *After the reconstruction, to carry out the activities for rehabilitation of the site, excavations, sand loans and access roads, by planting grass and trees or other appropriate measures;*
- *Implementation of the Macedonian legislation and EBRD PR8 requirements.*

During the operational phase, the responsible persons should take care to give clear instructions to the involved workers, on how to behave towards tradition, religious rites and living cultural heritage in the region. In the operational phase, in order to reduce the impacts caused by potential loss to intangible cultural heritage (traditions, religious rites, living cultural heritage) near the AoI of the projected gas pipeline section the following measures will be implemented:

- *Restrict the timing of activities, so as not to disturb the use of religious cultural heritage sites (churches). Stop work at certain times when sites are in use, such as during significant events (weddings, funerals and religious festivals);*
- *The workers will avoid disturbance of the religious rites and tradition;*
- *The access in the churches and church complexes for religious rites and traditions will not be affected during the activities connected with hazard events of the gas pipeline section;*
- *Implementation of the Macedonian legislation and EBRD PR8 requirements;*
- *The workers who come from other places of residence will get acquainted with the culture, customs, habits, and everyday life of the local population. It is especially important to consider the preservation of the living cultural heritage, as part of the customary and ritual practices of the project AoI;*
- *It is also necessary to prepare a Plan for project activities for a certain time interval, and to distribute (disseminate) it.*

5.10. Assessed cumulative impacts and proposed mitigation measures

Table 16. Cumulative impacts - Construction phase

Assessed potential impacts
I. Cumulative impacts with existing installations or objects
It is important to see the crossings of the gas pipeline section under the following excisting roads:
- Motorway A4 "Miladinovci – Shtip"
- Regional Road R1204 "Sveti Nikole – Kadrifakovo"
- Local Asphalted Road "Milino – Lozovo"
- Regional Road R1312 "Milino – Karatmanovo"
- Regional (Expressway) Road R1312 "Veles – Kadrifakovo"
- Motorway A1 "Skopje – Gevgeija"
At the crossings of the gas pipeline section under those roads, is expected to occur the following cumulative impacts:
- exhaust gases;
- dust (PM10);
- noise and vibrations.
II. Cumulative impacts with planned installations or objects
There are possible cumulative impacts of the gas pipeline section project activities and other planned project activities in the surrounding area if the construction phases overlap. The planned projects near the gas pipline section Project area are: Future solar power plant, Wind Park Bogoslovec and Regional landfill Mechkuevci.
The possible cumulative impacts of the gas pipline section and those planned projects are the following:
- generation of fugitive emissions of dust and exhaust gases;

- *alteration of surface and groundwater quality due to input of pollutants and pre-existing contamination or as a result of leakage or spills;* - *noise emissions from construction vehicles and machinery;* - *pressure on local and regional waste infrastructure and facilities, due to the generated waste from all project activities;* - *another potential source of additional waste from excavated materials (from planned projects), if not adequately managed;* - *increased demand for communal services, such as drinking water and wastewater disposal, and increased traffic on local roads;* - *increased habitat fragmentation and vegetation removal;* - *increased biodiversity disturbance due to all construction activities;* - *landscape and visual changes will be caused;* - *increased opportunities for businesses to increase sales revenue and overall viability through the supply of goods and services;* - *existing businesses may expand, and new businesses are likely to move to the region at least temporarily to provide services to projects under construction;* - *the employment rate in the area is anticipated to increase.* *The cumulative impacts during construction are expected to be of* ***insignificant to low*** *significance.*
Proposed mitigation measures
I. Mitigation measures for cumulative impacts with existing installations or objects *With implementation of all proposed mitigation measures to reduce the air pollution and mitigation measures for the impacts caused by noise and vibration in construction phase, the cumulative impacts that are expected to occur at the crossings of the gas pipeline section under the existing roads will be minimized, and will occur only in limited time.* ***II. Mitigation measures for cumulative impacts with planned installations or objects*** *If the construction phases of the gas pipeline section and other planned projects overlap, than the following mitigation measures should be implemented:* - *The Contractor for the pipeline Project will be required to communicate with the Contractors of the other planned Projects that are identified for cumulative impacts, and together ensure that mitigation for their respective projects minimizes the potential for cumulative effects;* - *The potential impacts that will occur in the construction phase, will be managed and mitigated though implementation of the ESMPs for these Projects;* - *All identified ongoing projects should be designed and constructed in compliance with current standards and using best practice techniques, thus reducing the potential for cumulative impacts in construction phase.*

Table 17. Cumulative impacts - operational phase

Assessed potential impacts
It is assumed that the cumulative impacts in operational phase will be ***insignificant*** *if all projects are designed and constructed in compliance with national standards and using best practice techniques.* *It is likely that a beneficial effect will occur as a result of the operation of the ongoing projects and the gas pipeline Project itself.*
Proposed mitigation measures
I. Mitigation measures for cumulative impacts with existing installations or objects *With implementation of all proposed mitigation measures to reduce the air pollution and mitigation measures for the impacts caused by noise and vibration in operational phase, the cumulative impacts that may occur at the crossings of the gas pipeline section under the existing roads will be minimized, and will occur only in limited time.* ***II. Mitigation measures for cumulative impacts with planned installations or objects*** *All identified ongoing projects should be designed and constructed in compliance with current standards and using best practice techniques, thus reducing the potential for cumulative impacts in operational phase.*

6. CONCLUSIONS

In general, the construction of the main gas pipeline, Section Sveti Nikole-Veles, is not expected to have significant negative impacts on the quality of the environment. The potential impacts that will occur in the construction phase, will be managed and mitigated through the implementation of the ESMP's for these Project.

The Contractor is required to implement all precautionary measures as outlined in this EIA Study and the Environmental and Social Management Plan, to consistently apply them in practice, in order to eliminate possible disturbances in the quality of the environment.

Funding information*:* The Project involves the funding of a greenfield gas pipeline section and is a part of the larger A-category regional gas project considered by the EBRD for funding Authors should clearly state funding information.

Conflict of interest: There is no any conflict of interest.

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