Chapter 9
NON-TECHNICAL SUMMARY

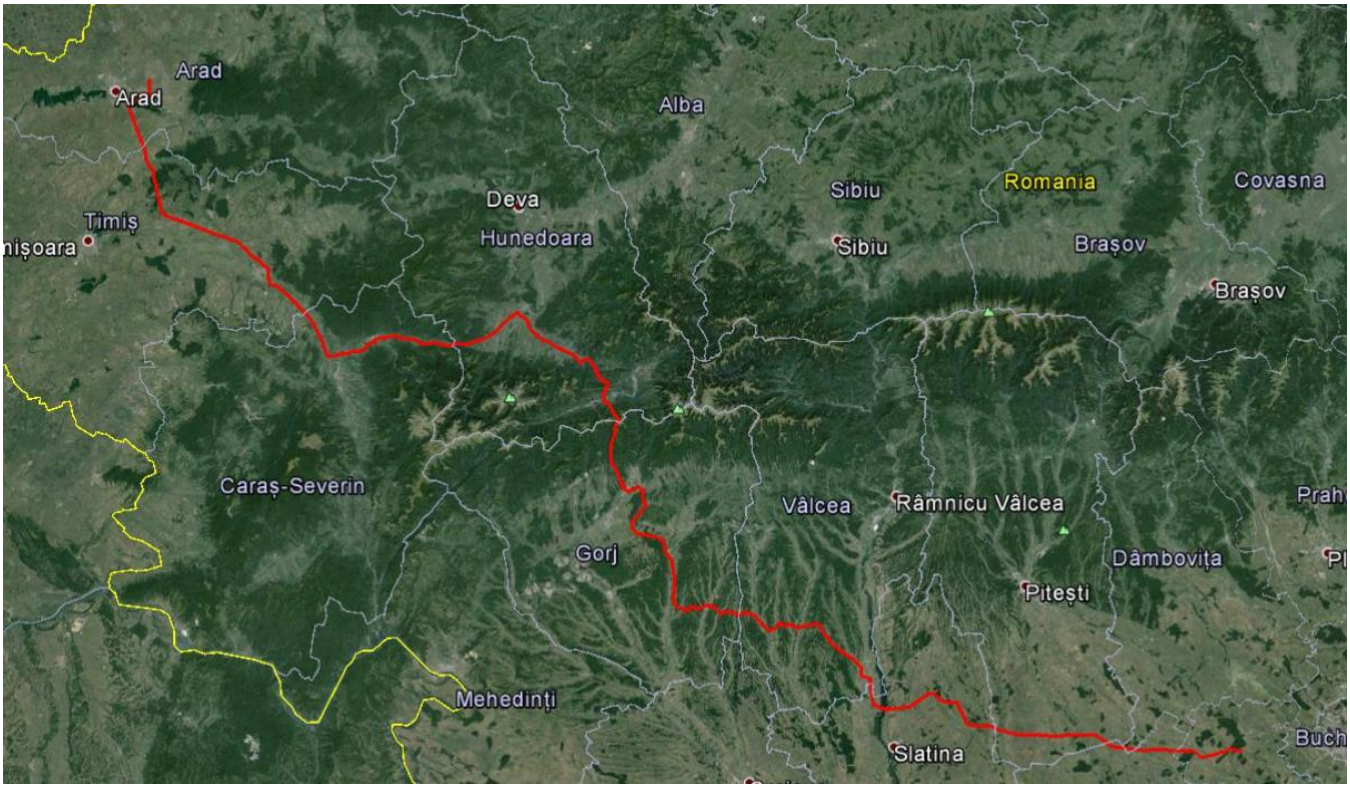
Project owner:
National Gas Transport "Transgaz" S.A.
Pța. I.C. Motaș, nr. 1, Mediaș, Romania. Sibiu, 551130
Project Manager: ing. Peter GAMEZ
Attested Environmental Assessor:
SC Unitatea de Suport pentru Integrare SRL
StrBaladei 35 street, Cluj-Napoca, jud. Cluj, Romania
Theme responsible: Dr. Sergiu MIHUȚ

9.1. Description of the project

The proposed project involves the construction on the Romanian territory of a new natural gas transport pipeline facilitating connection between Technological Node Podișor with Gas Measuring Station Horia, having the following (main) traject: Podișor-Corbu-Hurezani-Hațeg-Recaș-Horia. The pipeline will have a total length of 535 km, a diameter of 32 inch (800 mm) and will operate at a maximum pressure of 63bars. The pipeline route follows the general direction from South-East - Westwards crossing the territory of 11: Teleorman, Dâmbovița, Giurgiu, Argeș, Olt, Vâlcea, Gorj, Hunedoara and Caraș-Severin, Timiș and Arad. On its traject, number of technological elements are designed to assist its operation, as folows:

- 3 natural gas compression stations in Podișor, Bibești and Jupa;
- 43 cutting taps;
- 20 cathodic protection stations.

The pipeline route will be generally parallel to existing pipeline sections belonging to the National System of natural gas Transportation. Some of the older segments will be replaced by the new pipeline.
In order to ensure a secure exploitation, some sections were deliberately deviated in order to avoid overlapping and parallelisms with existing pipelines, but also having in mind environmental criteria (avoidance of cumulative impacts).
Wherever possible, the route of the pipeline was optimized in such a manner to avoid sensitive areas such as natural reserves or inhabited regions.



BRUA route- *over-imposed on a GoogleEarth* image

9.2. Methods used in environmental impact assessment

Environmental impact assessment has been outlined as a basic tool in identifying and reducing negative environmental consequences due to human activities, transposing principles laying at the very basis of environmental policies such as the precautionary one or the preventive action in order to ensure in full, sustainable development. Such evaluation seeks to incorporate planning for environment of the early phases of development projects, in order to prevent or reduce the negative environmental impacts of the proposed activity.

Our endeavor, took into account national legislation transposing the legal practice at international level, in particular the European one, entailing experience from reference guides, manuals and guidance, enabling, quantification algorithms and transparent assessment of ecological footprint of the project.

In assessing environmental impact we considered the following steps:

9.2.1. Analysis of project's technical aspects details

Based on the technical documentation provided by the proprietor (SN Transgaz SA, Mediaș), alongside the body of experts within the company, it has made a thorough analysis of the project, identifying the elements relating to the construction and operation stages.

Considering technical elements, an overall assessment of impact categories for the construction and operation phases of BRUA.

9.2.2. Baseline survey

All project elements were overlapped to the cartographic supports (1:25,000 and 1:10,000 and 1:5,000 maps; ortho-photoplans, satellite images, etc.). In this manner, the first layer representing the *Footprint of BRUA* was created.
Under the BRUA Footprint, upon extensive studies, mainly on the field, the environmental conditions were assessed, on an area of about 300m. Where necessary, the area was expanded in order to get enough data to enable thorough analysis.
The whole area was investigated by field-experts, focusing on the most important spots that were analyzed in detail. Using Standard Forms for each of the 5 km sector, the following attributes were analyzed:

- geographical characterization (administrative, employment);
- characterization of the biomes;
- analysis of the proposed works, their significance;
- potential impact;
- the measures proposed for impact mitigation.

In this manner it was possible to create an image of the size and types of impact associated to the project. In equal measure, overlapped areas to natural protected sites were pinpointed. Thus it was possible to achieve a broad overview on the existing status of the environment quality within the are to be subjected to project development, obtaining an image on the pre-project status. The referential map layer was therefore created.
Overlapping project footprint to the status-map, enabled issue of the so-called CONFLICT MAP, facilitating identification of areas of potential conflict or risk where special measures for impact mitigation are expected, to be assumed by the project endorser. Using this tool, *hot spots* imposing a careful approach were identified as well..

9.2.3. Evaluating magnitude of the impact

A measurement of the magnitude of the impact was achieved using the CONFLICT MAP as a referential tool.. Applying broadly acknowledged methodologies and techniques, widely used in comparing project phases or its dynamic (in time), a scaling of impact was possible. We used the following techniques:
- a complex approach of impact categories evaluation, using as a model the LEOPOLD MATRIX[1]. The impact categories defined for Natura 2000 sites were considered (from the perspective of interaction of the project with a number of such protected areas). The impact score was calculating under the estimation of the *magnitude* and *importance of* each category of impact associated with it;
- using the ILLUSTRATIVE METHOD ROJANSCHI[2], we were able to measure the overall size of the impact subsequent an analytical method of geometric figures supra-imposed;
The impact extent of impact was measured for each environmental factor (water, air, soil, geology and subsoil, biodiversity, landscape, social and economic environment). Reasonable alternatives of the project were also considered.
After completion of the analytical phase, based on EXPERT ANALYSIS, it was determined the relevance of the categories of impact on each of the seven factors of environment.

9.2.4. Impact mitigation solutions

The baseline study enable characterization of the status of environmental factors in pre-project phase. Starting from this image terms of reference were defined in order to establish the dimension of the environment responsibility to be engaged by the proponent. These obligations were then become part of the project itself.
Based upon the scale of the impact two distinct ways for impact mitigation were proposed:

9.2.4.1. General solutions

They comprised a set of general measures, relevant for the most parts of the project, focusing on BRUA's two major phases: construction phase and operation phase.

9.2.4.2. Tailored solutions, adapted to specific conditions

Detailed site analysis conducted for each section of the project, revealed specific needs to reduce local impacts. Such distinctive tasks are covering all major categories of biomes, and, where necessary, an in-depth detailed study, taking into account the local elements and circumstances were conducted. Specific set of measures in order to address the negative impact were proposed.

For the whole set of mitigation activities, a financial and logistical assessment was made, to be regulated subsequent the specific administrative path to be completed for the formal approval of the project.

9.2.5. Monitoring

Based on attributes characterizing environmental factors identified during baseline survey and including assumed impacts along solutions to mitigate them, there were defined the elements in position to validate the success of efforts to extinguish the generated impact.

Monitoring protocols were defined, based upon standard forms, in order to ensure a transparent and objective monitoring process.

During construction phase, the following parameters will be monitored:

- directly and indirectly affected areas;
- noise level;

In the post-implementation (operation) phase, the key element to be monitored was put in relation to plant communities. The tasks will cover the following topics:

- overall plant coverage;
- the structure of the plant coverage; dynamics of penetration of invasive species and weeds;
- specific diversity (biodiversity);
- degree of similarity between foregoing biocoenosys and reinstalled ones subsequent project implementation;

Based upon the monitoring program, considering these themes, an assessment on the degree of restitution of land-surfaces to natural or agricultural purpose, will be made.

The monitoring program is proposed to cover at least 36 month during operation phase (after project implementation phase). Based upon annual reports an assessment on the remnant impact will be made which of the negative effects were addressed and which actions to undertake in order to ensure a total ecological recovery of the impacted areas.

9.3. Prognosis of the environemnt impact

Making appeal to the environment assessment procedure (see section 9.2.), the amount of the projected environmental impacts was quantified establishing terms of spatial and temporary comparisons between its phases.

The impact on the projected was analyzed for each environmental factor in part, as follows: water, air, soil, geology and subsoil, biodiversity, landscape, social and economic environment.

Based upon expert-assessments that have concluded the analytical quantification of the impact on each of the seven environmental factors the following outcomes resulted:

9.3.1. For the Water

Given that the main water courses crossing was made using the technique of conducted-drilling, excavation of soil has been extremely limited. Therefore the extremely fragile wet-lands and riparian biomes were impacted on a very limited scale.
Smaller water courses or torrential (temporary) ones were crossed after a diversion channel was constructed. Therefore pollution risks were eliminated.
For all the construction sites and permanent locations to be occupied by project structures, progressive discharge polders were proposed in order to diminish the impact on downstream waters.
Such structures ensure sequestration of particles, confinement of pollutants, replicating the functioning of the highly productive natural wet-lands. Progressive discharge polders are representing a materialization of the precautionary principle, of the preventive action principle as well as of the principle that environmental damage should, as a priority, be rectified at source.
During project implementation there were not used important volumes of water from natural streams and the water is not necessary for any construction or technological-flow phase.
In the early stages of testing on certain welded pipes sections, the water will be used in order to determine the insulation. In these cases, the water will be pumped from nearby water-bodies. It should be noted that the pipeline is treated so as to neutralize any physical and chemical reaction, the pipes being inert from this point of view. Waters taken from the environment will be then returned in the same water bodies, without being necessary any kind of additional measures for the protection of environmental factors, other than usual ones.
During operation no water is needed for gas transportation processes. For the major objectives (compression stations) serving BRUA, legal requirements will be applied in order to ensure linkage to drinking water networks.
In these circumstances it was considered that impact upon water is situated within permitted limits, without leading to any damage of the groundwater or surface waters: on short/medium/long term, directly or indirectly, single or combined with other categories of impact.
Impact mitigation measures proposed are deriving mainly from the precautionary principle and addressing all potential risks deriving from the construction and operation of BRUA.

9.3.2. For the Soil

The extent of the construction site will cover a strip of 21m wide. From this strip, the entire vegetal-soil will be bulldozed to a depth of 30 cm, in order to avoid any possible damage by trampling, accidental pollution (oil spills), erosion, washing, etc. The topsoil will be temporarily stored in a pile located at the site. The soil excavated from the trench of the pipeline will be placed in close proximity. After pipeline instalation, the excavated soil will be used to cover the trench, the remaining being neaten on the entire surface, then covered with topsoil. The resulting difference in level, of about 3-6 cm, is remaining insignificant in terms of ecological and/or economical functions for the majority of locations. In certain cases, requiring an exact preservation of the geometry of the emplacement, the excess of soil was used to fill some erroded areas, identified in collaboration with local authorities (Mayoralties and local councils).
In these circumstances it was considered that impact upon soil is situated within permitted limits, without leading to any important damage except the short-term impact during construction phase; a long-term impact is improbable all mitigation solutions leading toward a complete recovery of all areas and their restitution within natural or agricultural primarily use.
Impact mitigation measures proposed are deriving mainly from the precautionary principle and addressing all potential risks deriving from the construction and operation of BRUA.

9.3.3. For the Undersoil and Geology

During implementation of BRUA no deep excavations of drillings leading to alterations in the geological strata, mixing bed and horizons or other effects with potential impact geology are foreseen. In these circumstances it was considered the impact factor for undersoil and geology being neutral,

9.3.4. For Biodiversity

Some natural protected areas will be crossed by BRUA. In consequence, impact on biodiversity was assessed with a special emphasis. All criteria elements (habitat and species) were carefully analyzed and their prerequisite requirements were evaluated from the perspective of BRUA construction and operation phases. The main set of measures targeted a tuning of activities in order to avoid an overlapping to the most sensitive periods for these elements.
In these circumstances it was considered that impact upon biodiversity is situated within permitted limits, without leading to any important damage except the short-term impact during construction phase; a long-term impact is improbable all mitigation solutions leading toward a complete recovery of all areas subsequent efforts to steer dynamic ecological succession towards a natural one enabling re-instalation of ecological equilibrium in quite a short period of time (foreseen period: less than 24 months) for all the sites.
In consequence, the project is not in a position to significantly affect biodiversity, directly; indirect effects are much limited and long-term effects, due to fragmentation or simplification of certain biocoenosys, are immediately removed subsequent swift and active measures, of ecological restoration.
Impact mitigation measures proposed targeted mainly cancelation of direct impact and limitation of indirect impact categories on biodiversity.

9.3.5. For the Landscape

The impact of the project on the landscape remains extremely limited. Most of the project entails the realization of gas transport infrastructure buried, leading to a cancellation of any impact on the landscape.
On the short term, construction organizations and work fronts will generate a contrasting landscape, locally altering its quality. Objectives to serve the project BRUA (compression stations, taps, etc.) will adopt constructive and architectural solutions that will ensure a good integration into the landscape and a minimized (by camouflaging with green curtains and corridors) visual impact.
Some sectors will impose, limited terracing works to ensure structural stability of BRUA. These solutions will generate a local visual impact. But since these sectors are adjoining pre-existing elements (road transport networks, electricity, etc.) we cannot speak about a compromising the quality of the landscape.
Local materials (boulders, rocks, etc.) to be used for the stabilization of structures, use of nets that allow a rapid re-vegetalization are representing key solutions dedicated mitigate visual impact and enabling reintegration of artificial structures within landscape matrix.
In these circumstances it was considered that impact upon landscape is situated within permitted limits, without leading to any important damage except the short-term impact during construction phase; a long-term impact is improbable all mitigation solutions leading toward a complete recovery of all areas.
It is foreseen that natural vegetation succession will lead towards a swift restoration (in less than 24 months) of the sites. In consequence, the project will not affect in a significant way the landscape.

9.3.6. Factor of the economic and social environment

The project need for work-force is limited. There is no need of ample workers ' colonies leading to a potential alteration of social, ethnic, cultural, or any other feature of local communities. In addition to the jobs provided by the expert technical staff participating in the stages of realization of the project it is expected a certain demand for a significant number of jobs in the short and medium term associated to the construction works to be held in subcontracts-short term.

During operation of BRUA an important number of trained specialist will be enrolled in order to assist the technical flux.
In these circumstances the potential impact on social and economic environment, was evaluated as positive and therefore impact mitigation activities are not needed.

9.3.7. Overall Analysis

Overall analysis of the impact associated to BRUA project lead to the conclusion that the environmental impact is situated in permitted limits, most of the major categories of impact, associated to the construction phase, fading away in a short period of time (on an estimated period of 24 months).
There were not identified potential effects of impact driving to medium- or long-term effects and entailing a special significance, directly or indirectly, on the environmental factors. Potential cumulative effects to other existing projects and/or activities shall be maintained within lower limits due to the low interactivity of BRUA with environmental factors. Therefore potential impact of exploitation, generated by built structures (pipe, industrial targets), are keeping limited impact significance.
The measures proposed in order to mitigate impact has been designed to exceed legal requirements and foreseen impact, meeting the requirements of the principles underlying environmental policies:

- the principle of preventive action;
- the principle of retention of pollutants at source;
- the principle of the conservation of biodiversity and natural ecosystems within their specific biogeographic range;
- the precautionary principle.

9.4. Identification of the areas subjected to impact

During environmental impact assessment, for each type of area to be impacted, an analytical approach was proposed in order to evaluate the categories of impact and quantifying magnitude.
A summary is presented in a synthetic matrix below:

Area	Impact level		Discussion
	Stage of construction	Operating stage	
Cultivated Agroecosystems	directly within working sites	neutral	Effects of impact during the construction phase are a result of the works of bulldozing the topsoil (on a working width: 21 m), excavation (trench ~ 1 m wide; depth of the trench: ~ 2 m) and materials transport activities. Post construction phase stage: the impact is off in max 24 months, the land being rendered in the natural/agricultural circuit.
Pastures	directly within working sites	neutral	Effects of impact during the construction phase are a result of the works of bulldozing the topsoil (on a working width: 21 m), excavation (trench ~ 1 m wide; depth of the trench: ~ 2 m) and materials transport activities. Post construction phase: the impact is off in max 24 months, the land being rendered in the natural/agricultural circuit.
Natural	directly within	neutral	Effects of impact during the construction phase are a

Area	Impact level		Discussion
	Stage of construction	Operating stage	
grasslands	working sites		result of the works of bulldozing the topsoil (on a working width: 21 m), excavation (trench ~ 1 m wide; depth of the trench: ~ 2 m) and materials transport activities. Post construction phase: the impact is off in max 24 months, the land being rendered in the natural/agricultural circuit.
Woods	directly within working sites	medium	Effects of impact during the construction phase are a result of the works of clearcuttings, removal of stumps and bulldozing the topsoil (on a working width of: 14 m), excavation (trench ~ 1 m wide; depth of the trench: ~ 2 m) and materials transport activities. Post construction phase: the impact is lessened by ensuring the installation of a sequence of natural vegetation, while maintaining a technological protection of 12 m. Fragmentation of habitats is induced
The main rivers of the whites	directly within working sites	neutral	The steered drilling technique will cancel all potential impact.
Whites secondary rivers	directly within working sites	neutral	Effects of impact during the construction phase are a result of diversion of water courses, the excavation (on a working width of: 21 m), excavation (trench ~ 1 m wide; depth of the trench: ~ 2 m) and materials transport activities. Post construction phase: the impact is off in max 24 months, the land being rendered in the natural circuit.
Anthropic and/or anthropogenic Ecosystems	directly within working sites	neutral	The areas concerned retain a limited significance in the bio-eco-coenotic context.
Routes of communication	directly within working sites	neutral	The steered drilling technique will cancel all potential (socio-economic) impact. No impact on natural ecosystem is expected.
Protected areas	directly within working sites	neutral	Effects of impact during the construction phase are a result of diversion of water courses, excavation (on a working width of: 21 m), excavation (trench ~ 1 m wide; depth of the trench: ~ 2 m) and materials transport activities. Post construction phase: the impact is off in max 24 months, the land being rendered in the natural circuit.

9.5. Mitigation measures proposed

Starting from the conflict map analysis, evaluation of the magnitude and relevance of impact categories for all construction and operation phases, in accordance to data obtained during baseline surveys, a quantification of the environmental responsibility was established.
In sizing the measures to be undertaken, we take consideration of the following aspects:

- identification of risks as early as the design stage, unfolding it recommendations and solutions to optimize the project in order to obtain an as low as possible impact to a minimization of the impact;
- implementation of best available technologies and practices in the field of execution and operation of infrastructure projects;
- integration concepts that define *Green-Infrastructure*;
- monitoring schemes enabling compliance to standards of protection regarding environment conservation and restoration;

In implementing the project, measures were proposed to reduce the impact in a general approach. Precautionary principle was considered even during environment assessment procedures and quantification of impact categories. Therefore, even if there was not evaluated a potential impact for certain phases, a basic precautionary set of mitigation was proposed.
Such measures, generally valid are presented below:

9.5.1. For the Soil

In order to mitigate impact on soil, the following measures were proposed:

- technological roads shall not be positioned on the line of greatest slope; in this manner is avoided surface leakage, erosion, ravines and formation of ditches;
- it is recommended to avoid works during rainy weather;
- all the equipment to be used will be thoroughly checked from a technical point of view, in order to avoid all possible accidents and spills leading to potential pollution (mainly with oils and fuels);
- all works to repair and maintenance activities shall be carried out only in specialized establishments outside, working sites;
- washing the machineries shall be prohibited within working areas; such activities will take place only on insulated platforms, equipped with drainage systems and provided with silting pools and oil separator;
- waste will be collected in a selective manner and stored in containers or dedicated bins, located within working sites; waste management will be carried out through local contracts;
- temporary accesses roads will be restored to their original status. Actions such as backfilling, soil improvements (plough, seeding, etc.) will be performed where necessary;
- limitation of transport routes;
- prior improvent and systematization of the roads and permanent maintenance;
- start of the construction works from the farthest point towards the proximal point in order close the roadways that will not be used anymore;
- proper organization of soil deposits: for the topsoil at the edge of the working place; for the excavated soil in the close vicinity of the trench;
- immediate cover of the trench subsequently pipeline laying;
- where the trench is left opened for more then 24 hours, springboards of soil with a maximum inclination of 45^{O} will be made in order to permit species of fauna to evade;
- compacting the soil strata coverage, by hand-tools, in successive 20-30 cm beds;
- application of blankets of strwas and hay from the close proximity in order to ensure: superficial strata of soil reinforcement, input of organic matter, plant germ (and microfauna species), enabling avoidance of superficial erosion;

- overseeding of spontaneous local flora species;
- supply of the working areas with specific materials necessary for the intervention in case of accidental pollution (oil spills).

During operating phase, intervention is not required, excepting those areas retaining a residual impact (erosions, etc.) from construction phases. In such areas punctual interventions to correct the situation will be conducted.

9.5.2. For the Air

In order to reduce the impact on air, during construction phase, the following measures have been proposed:

- control of handling excavated volumes; watering (where appropriate) of working fronts- ensuring a humidity of 40% of the excavated/transported material could lead to a reduction of emissions by 40%;
- during dry periods, routes will be sprinkled;
- transport excavated volumes will be made only with trucks equipped with tarpaulins to protect the excavated material;
- machines to be used will be permanently checked from the technical point of view;
- in case of sensitive receptors (proximity of inhabited areas, natural protected sites, etc.), protective screens will be placed during working phases, so that noise pollution to be cancelled;
- correct management of waste in order to avoid any odor stress ;
- development of green curtains for the objectives developed along BRUA;

During operation phase there has not been evaluated a significant impact on the air, therefore impact mitigation measures are approached in a general manner which are sufficient enough in order to tackle expected potential impact.

9.5.3. For the Water

In order to reduce the impact on the water, during construction phase, the following measures have been proposed:

- creation of a network of ditches and gutters around all objectives in order to catch all volumes of able to catch all volumes of rainwater; before discharge in natural waterbodies, progressive discharge polders were proposed will be set into place in order to retain silt and accidental pollutants;
- direct crossing of waterbodies will be avoided;
- realization of cofferdams and diversion works to water courses, where crossing of waterbodies will be made by excavation;
- swift restoration of affected locations;

During operation phase there has not been evaluated a significant impact on the water, therefore impact mitigation measures are approached in a general manner which are sufficient enough in order to tackle expected potential impact.

For technological objectives to serve the project BRUA (compression stations, taps, etc.), progressive discharge polders will be set in place in order to avoid any possible pollution of waterbodies.

9.5.4. For the Undersoil and Geology

Since works and exploitation of BRUA do not affect significantly this environmental factor no exceptional measures in order to reduce the impact were proposed.

9.5.5. For the Biodiversity

In order to reduce the impact on biodiversity, the following measures were proposed:

- translocation of the valuable species of conservative interest from the project footprint to some close vicinity areas, before work starts and their relocation (if applicable) back into their initial areal, immediately after the termination of the works and closing of sites;
- connection of the works calendar to the periods of maximum sensitivity of species, so as to avoid damage to local populations;
- in order to illuminate the working areas, only sodium vapor bulbs, which do not have UV emission will be used. These sources do not attract nocturnal species and therefore any concentration and increase of incidental killing is avoided;
- areas to be bulldozed will be previously mowed. The vegetal material will be preserved in haystacks, to be used during ecological restoration actions (mixed with the topsoil);
- creation of microhabitats from natural materials (stumps, boulders, branches, etc.) and artificial shelters, in order to improve support capacity of habitats and therefore counterbalancing impact and supporting recovery of the functions of the areas subjected to impact;
- maintaining as brief as possible periods of works on each sectors in order to limit perturbation of habitats and fragmentation of populations;

During operation phase there has not been evaluated a significant impact on biodiversity, therefore impact mitigation measures are approached in a general manner which are sufficient enough in order to tackle expected potential impact.

For technological objectives to serve the project BRUA (compression stations, taps, etc.), additional green areas, green-belts and curtains along to microhabitats and artificial shelters will be set into place in order to reduce impact.

9.5.6. Factor of the economic and social environment

During project implementation and operation no negative impact on socio-economic environment can be observed. On the contrary, the project will create a large amount of jobs and will provide a whole range of services able to boost socio-economic development, locally and on a wide regional scale. Therefore the impact of the project has been estimated as being positive.

9.6. major Conclusions resulted in environmental impact assessment

From the analysis of the levels of impact for each environmental factor and by quantifying the significance and magnitude of the effects resulting from the implementation of measures (construction) of the project, as well as from the stage of operation, using the methodology of calculation of INDEX OF GLOBAL POLLUTION (IPG), overall impact is situated within the permitted limits, reversible, for the most consistent component of the project. Mitigation measures considered, where necessary, were taken in a broad perspective addressing also historical and cumulative predicted impact and in a distinctive approach to balance the permanent occupied areas (e.g. structures of the industrial type, related project: compression stations, taps, etc.).

[1] Leopold, L. B., F. E. Clarke, B. B. Hanshaw, and J. E. Balsley (1971): "**A procedure for evaluating environmental impact**". U.S. Geological Survey Circular 645, Washington, D.C.
[2] Rojanschi, V. (1991): "**Posibilități de evaluare globală a impactului poluării asupra calității ecosistemelor**" Mediul Inconjurător, abordări sistemice, Vol. II nr. 1-2 (45-52)