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ABBREVIATIONS

PEA	Planned Economic Activity
EIA	Environmental Impact Assessment
LNG	Liquefied Natural Gas
LNGRT	Liquefied Natural Gas Receiving Terminal
LNG Carrier	Ship Transporting LNG
APS	Air Pollution source
GMS	Gas Metering Station
GP	Gas Pipeline
NG	Natural Gas
HDD	Horizontal Directional Drilling
RAAD	Regional Environmental Protection Department
SPZ	Sanitary Protection Zone
SEA	Strategic Environmental Assessment

1.1. INTRODUCTION

FLUOR S.A., a US company providing the project management services to Klaipėdos Nafta AB, has hired Sweco Lietuva UAB, which is responsible for the preparation of the environmental impact assessment (EIA) documentation, to carry out an EIA for the planned economic activity (PEA) and to prepare a programme and a report on the impact of the construction and operation of a floating liquefied natural gas storage and regassification unit ("the LNG terminal") and related infrastructure upon the environment. Under the agreement, Sweco Lietuva UAB will also arrange a public discussion of the EIA documentation, obtain agreements of stakeholders, and submit the documentation to the Klaipėda Regional Environmental Protection Department under the Ministry of Environment (REPD) for consideration and approval. Furthermore, Sweco Lietuva UAB undertook to carry out the PEA EIA evaluation, publicity and agreement procedures in transboundary context.

In December 2011, Sweco Lietuva UAB prepared a programme on the assessment of the impact of the construction and operation of the LNG terminal and related infrastructure upon the environment ("the EIA Programme"). Agreements on the EIA programme were obtained from the stakeholders according to the procedure prescribed by the law, after which the Klaipėda REPD approved it on 24 February 2012. Publicity procedures were carried out as required by the law.

In May 2012, Sweco Lietuva UAB completed an EIA for the LNG terminal and prepared a report on the impact of the construction and operation of the LNG terminal and related infrastructure upon the environment ("the EIA Report").

The EIA was carried out and the EIA Report was prepared in accordance with the provisions of the Republic of Lithuania Law on Assessment of the Impact of Planned Economic Activities on the Environment. The EIA Report was prepared on the basis of the Programme on the Assessment of the Impact of the Construction and Operation of the LNG terminal and Related Infrastructure on the Environment", the Regulations on the Preparation of the Environmental Impact Assessment Programmes and Reports approved by order of the Minister of Environment No. D1-636 of 23 December 2005 as amended and the Methodological Guidance on the Assessment of the Impact on Public Health, taking account of the specific characteristics of the facilities and the results of the direct investigations carried out. The background information on the planned economic activity was provided by the PEA organiser and its consultants.

Information on the proposed design concepts for the LNG terminal project and their alternatives was prepared by the following international and Lithuanian engineering consultancies: FLUOR S.A. (USA) – LNG transportation, transfer, storage and regassification technologies, ALATEC (Spain) – offshore structures and installations; Hoegh LNG (Norway) –

floating liquefied natural gas storage and regasification unit; Ardynas UAB – high-pressure gas pipeline and gas metering station; NACAP (Holland) and Bohlen Doyen (Germany) – horizontal directional drilling (HDD) pipeline construction.

The underlying provisions of the EIA are as follows:

- The EIA was carried out in accordance with the provisions of the current Lithuanian and the European Union legislation, guidance and methodologies;
- The EIA was carried out in a comprehensive manner, i.e. it covered the impact of both the LNG terminal with the related infrastructure (point facility) and the gas pipeline (linear facility), with the assessment results presented in the same EIA Report and with the common EIA publicity and agreement procedures carried out;
- The EIA covered the construction and operation phases of implementation of the EIA. No period of decommissioning has been defined in the PEA, therefore, no assessment of this phase was carried out.
- The PEA assessment areas can be divided in two parts according to the location of the facilities and the related specific characteristics of the investigations and assessment: offshore (including areas of the Baltic Sea and the Curonian Lagoon) and inland. The offshore part is mainly related to the construction of the LNG terminal and the related infrastructure, whereas the inland part with the construction of gas pipelines required for the connection to the gas mains. The contact area of the two parts is highly relevant to the assessment as well.
- The current environmental condition means the 2010 situation, which is considered to be a “zero“ condition, i. e. the environmental indicators would be the same as in 2010 if no PEA was implemented. The 2011 was not selected as it will not be possible to obtain all the required summarised information for the preparation of the EIA report.
- Two main location alternatives were considered in the assessment (Figure 1). These alternatives were identified for further assessment in the LNG Terminal Development Plan and assessed in the Report on the Strategic Consequences Assessment:
- Alternative I (at the Kiaulės Nugara Island) – the LNG Terminal constructed in the southern part of the Klaipėda State Seaport at the Kiaulės Nugara Island (co-ordinates of the conventional centre (LKS94) X = 6173708, Y = 319918) and the gas pipeline constructed from the terminal up to the connection point, i.e. the Klaipėda-Jurbarkas main gas pipeline that has already been designed and will be built in 2013 in Kiškėnai village, Dovilai ward, Klaipėda municipality (approximate co-ordinates LKS94: X = 6174948; Y = 330498);

Alternative II (at Būtinge) - the LNG Terminal constructed in the Baltic Sea near Būtingė (co-ordinates of the conventional centre (LKS94) X = 6213347, Y = 308380), and the gas pipeline constructed from the terminal up to the connection point, i.e. the Šiauliai-Klaipėda main gas pipeline in the Saulažolės village, Dauparai – Kvietiniai ward, Klaipėda district municipality (approximate co-ordinates LKS94: X – 6181337; Y – 334859);

Options within the said Alternatives I and II as well as local sub-alternatives for individual sections of the gas pipeline to be constructed were analysed based on the results of investigations and assessments.

- Alternative 0: the PEA design concepts will not be realised
- All the field investigations required for the EIA have been completed prior to the preparation of the EIA Report and the start of the publicity measures. The scope of the investigations was sufficient to ensure high quality of the EIA;
- the EIA relies on the assessments made or being made by third parties, in particular those related to the dredging in the Klaipėda Seaport water area and the impact of such works upon the environment;
- the EIA takes account of the transboundary impact as well; the requisite publicity and agreement procedures aimed at the Latvian public and stakeholders were carried out.

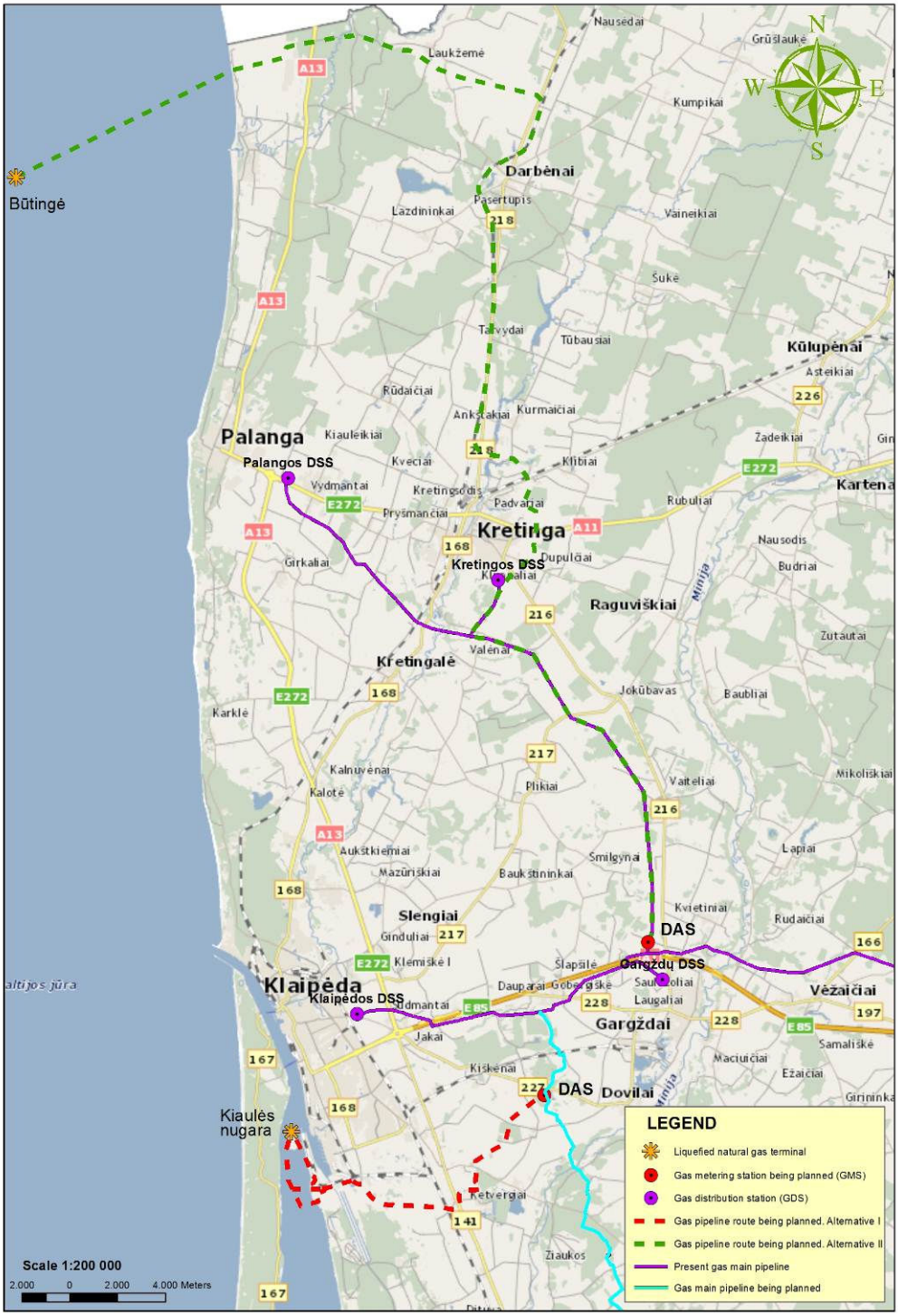


Fig. 1. The LNG Terminal Location Alternatives I and II

The EIA Report consists of two volumes: Volume 1 (Text of the Report) and Volume 2 (Annexes to the Report).

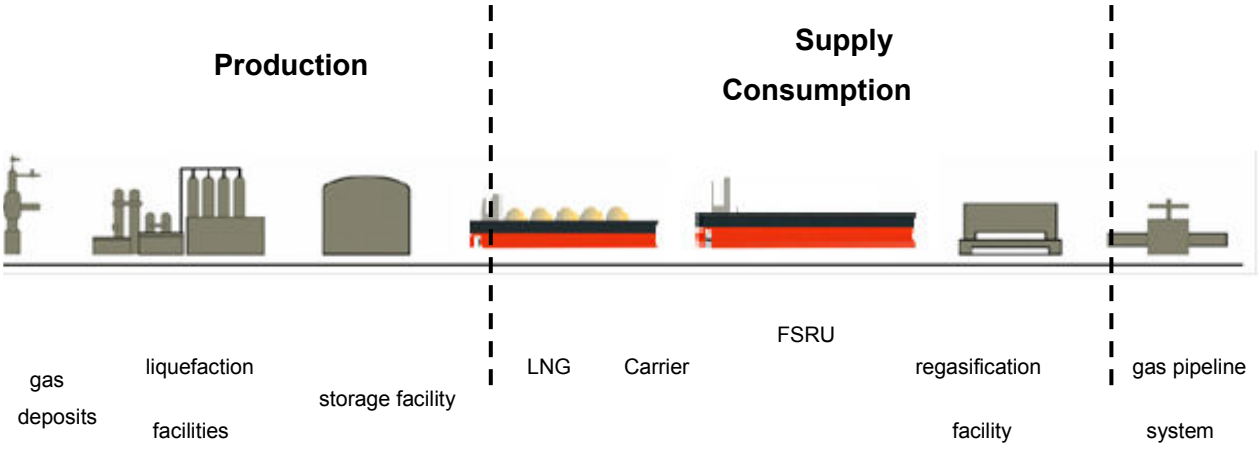
This report presents a summary of EIA report of the planned economic activity including the findings on assessment and generalized impact assessment of the planned economic activity on social and natural environment in the territory of the Republic of Latvia. According to the developed EIA report of the planned economic activity, for implementation of the planned economic activity it is recommended to select Option I (at the Kiaulės Nugara Island in the territory of Klaipėda state sea port). In case the mentioned option is approved, construction of the facilities for the planned economic activity and during its operation will not have any impact on the territory of the Republic of Latvia and its social and natural environment.

1.2. PLANNED ECONOMIC ACTIVITY

1.2.1. DESCRIPTION OF THE PEA TECHNOLOGICAL PROCESSES AND EQUIPMENT

An indicative chart of the LNG production and supply is presented in Fig. 2. The second part of the chart – supply and consumption – is directly related to the planned economic activity.

Fig. 2. LNG production and supply chain



The PEA will comprise construction of the following facilities and installations:

- the LNG terminal including the floating liquefied natural gas storage and regasification unit and a jetty for its servicing including the required vessel mooring and LNG transfer equipment;
- a breakwater (in case of Alternative II);
- a gas pipeline (from the LNG terminal to the gas mains network).

The annual capacity of the LNG terminal will be about 2.0-3.0 bn Nm^3 of natural gas, or up to 11 m Nm^3 daily capacity. The design load of the LNG terminal is 30 to 100%. Key technical parameters of the PEA facilities are presented in Table 1.

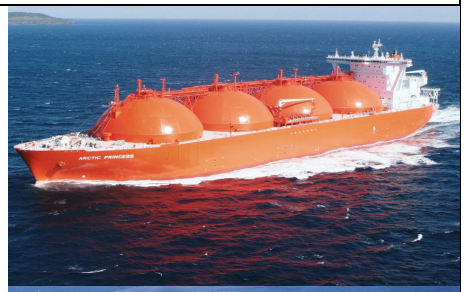
The PEA will be implemented in two phases:

- construction and installation of facilities;
- operation of facilities.

The operating phase includes the following main production processes:

- transportation of LNG to the terminal;
- transfer of LNG from the LNG tanker to the FSRU;
- temporary storage of LNG in the FSRU;
- LNG regasification and supply to the gas mains network;
- maintenance and servicing of all the above facilities and processes.

Table 1. Key technical parameters of the PEA facilities

<table>
<tr><td colspan="3">The main function of the LNG receiving terminal is to accept LNG from LNG carriers for temporary storage, perform regasification and supply the LNG to the system of main gas pipelines. The design load of the LNG terminal is 30 to 100%.
The LNG receiving terminal and the related infrastructure consist of:
• Floating storage and regasification unit (FSRU);
• Berthing and mooring platforms;
• Catwalks interconnecting facilities;
• Unloading platform of high pressure NG;
• Service platform;
• Breakwater (in case of Option II);
• Connective gas pipeline.
Estimated capacity of the LNG receiving terminal: estimated annual gas turnover in the LNG receiving terminal will be about 2.0 – 3.0 bn Nm^3;
• estimated daily gas turnover in the LNG receiving terminal will be up to 11 m Nm^3 (more detailed information in the EIA report Ist book chapter 3.3)</td></tr>
<tr><td>LNG Carriers</td><td>LNG carriers do not form a component part of the LNG receiving terminal – these are vessels delivering LNG to the terminal from any gas supplier under the contract.
LNG carriers are specially equipped vessels with double hull which protects the cargo and the environment in case of external damage to the vessel. Their dimensions depend on the size.
The length of LNG carriers is up to 345 m, width up to 53.8 m, and hull draught about 12 m. LNG carriers can transport from 89,000 to 267,000 m^3 of LNG.
The capacity of LNG carriers to be serviced by the LNG terminal is about 140,000 – 150,000 m^3.
LNG carriers of two types are used most often:
a) with spherical storage (“moss carriers“), usually 4 or 5 tanks. The spherical component is installed on the double hull in such a way that the metal cylinder supports it at half height. The cover surrounding the spherical component can collect any gas vapor and return it into the storage or use it as the vessel‘s fuel.
b) with membrane storage (storage with prismatic tanks and internal partition). Such storages form part of the hull. Stainless steel partitions and insulation are placed in a “case“ formed within the hull.</td><td>a)
 
b)
  </td></tr>
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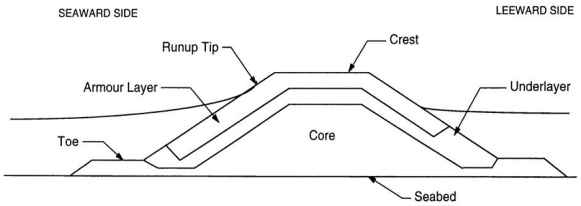
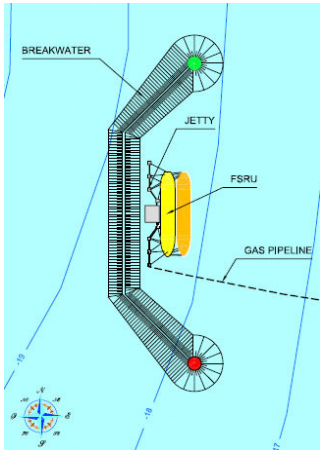
Floating LNG storage and regasification facility (FSRU)	FSRU most often represents a modernised LNG carrier that has been permanently fixed to the pier. Such technical solution allows building LNG terminals at locations with limited shore development opportunities. The FSRU would be berthed to the jetty, whereas incoming LNG carriers would be secured alongside the FSRU by means of mooring lines. Parameters of the FSRU: • total storage capacity **170,000 m^3** • length **294 m** • width **46 m** • hull draught **12.6 m** The estimated maximum capacity of the pump used for the transfer of LNG from carriers into the FSRU – **6,000 m^3/h** (at this rate, a carrier would be emptied in 24-28 h). 
LNG regasification unit and regasification technologies	The estimated design capacity of the LNG regasification unit – about **460,000 Nm^3/h**, pressure to the gas pipeline **60 bar.** Regasification unit is installed on the deck of FRSU. Regasification process may run in a closed, open or combined loop. When the regasification unit operates in an open loop and uses surface water (lagoon or sea water), the amount of usable water would make 10500 m3/h. Temperature at which the regasification process may start shall not be lower than 10^0C. A preliminary plan is to use a combined-loop regasification system for FRSU, i.e. for 6 months it will be run by applying a close loop system and for 6 months – an open loop system (depending on meteorological conditions and temperature of surface water).
Fixing equipment of high pressure NG unloading and service platform of FRSU	**High pressure NG unloading platform** is designed to transfer natural gas from FRSU to the gas pipeline. High pressure NG unloading platform will consist of two stages: • The first stage of the platform shall be constructed in such a height (round +6,5 m above sea level) as it could be possible to interlink the platform and other facilities by bridges. The platform will contain a control building and auxiliary equipment (more detail information is provided in chapter 3.3.4, Book I of EIA report). • The second stage is intended for direct transfer of natural gas, i.e. this stage will be used for access to high pressure gas oading sleeve. Other equipment on the platform of high pressure unloading platform: bridges, 2 high pressure gas loading sleeves, 2 cranes for technical maintenance with lifting capacity of 2,2 t each, gas pipeline cleaning devices, place for wharfing of service ships, fire foam production and

	supply system. **Service platform** is designed to provide service to FRSU. Equipment of the service platform: electrical power distribution equipment, emergency and standby generators, 5 tanks of 5 m^3 each for diesel storage, 4 diesel fire water pumps. Structural parameters of high pressure NG unloading and service platforms: dimensions of a concrete platform arranged on piles driven into the seafloor are: width 24 m; length 33 m, area 792 m^2. The main objects interlinking the platform and FRSU: bearing mooring piles and the pile system; fixing piles and their system with hooks for quick disconnection; pipe rack, bridges between the facilities and a trap.	
Breakwater	**<u>For Alternative II only:</u>** If Alternative II is selected, an offshore LNG receiving terminal would be constructed in the Baltic Sea. To protect the terminal from the waves, about 1.28 km breakwater will be constructed. The structure will rest on concrete plates of different sizes and shapes, protective layer, bed underneath the protective layer, and bed under layer. Base for a standard breakwater is constructed of massive crude stone, on which a sublayer of course stone is laid and finally a protective layer of massive boulders or concrete blocks is constructed. Width of a breakwater: along the base it is round 110 m, at the ends broadens up to 200 m, length – 1280 m, width above water – round 10 m, area – round 19300 m2. Equipment installed in this breakwater – signal lighthouses.	 

Gas pipeline and Gas metering station	External diameter of the gas pipeline connecting the terminal with the main gas pipeline: **711 mm**. Gas flow: approx. **460,000 Nm^3/h** (11,000,000 Nm^3/day); Max pressure from the LNG terminal: **60 bar**; Max pressure in the gas pipeline: **54 bar**; Min pressure in the gas pipeline: **25 bar**; Design gas temperature: **5^0 C** **Alternative I:** Length of the gas pipeline: about **18 km;** **Alternative II:** Length of the inland gas pipeline about **60 km;** offshore gas pipeline about **10 km.** A gas metering station will be installed at the connection point to the main gas pipeline in order to meter and record an account of supplied gas. The designed minimum throughput through the pipes in this station is 25 000 nm^3/h, maximum – 500 000 nm^3/h. The main equipment in the gas metering station: • Cutoff fittings; • Ultrasound and turbo metering devices; • Amount controller; • Gas chromatograph.

1.3. POSSIBLE IMPACT OF THE PLANNED ECONOMIC ACTIVITY ON DIFFERENT COMPONENTS OF THE ENVIRONMENT AND MEASURES TO REDUCE THIS IMPACT

1.3.1. IMPACT UPON WATER

During operation of the LNG terminal water will be used for the needs of the employees, the production processes (cooling of engines and auxiliary equipment, regasification and replenishment of hot water boilers, formation of water curtain during the LNG transfer, replenishment of the vessel‘s ballast water), and as fire water. No water consumption is planned for the gas pipeline operation purposes, except for the use of water for domestic and fire extinction purposes in the gas metering station (GMS). An artesian well will be drilled in the GMS area for this purpose.

Domestic wastewater, surface wastewater and industrial wastewater will be generated during the operation of the LNG terminal. Domestic wastewater will be generated in the sanitary facilities of the FSRU. It is estimated that it will amount approx. to 19 m^3/d. Prior to transfer to the operator servicing the terminal, the domestic wastewater will be temporarily stored in a designated tank. Production wastewater (about 10 m^3/d) generated in the rooms of the FSRU‘s engines and auxiliary equipment will be stored in a designated tank. The larger part of the surface wastewater generated in the FSRU is considered to be relatively clean and will be discharged directly into the environment. Wastewater from the potentially polluting areas of the FSRU deck will be collected and will flow to a production wastewater tank. The estimated amount of contaminated surface wastewater is about 100 m^3 per year. The accumulated wastewater will be transferred to the servicing operator every 14 days.

No generation of wastewater is anticipated in the operation of the gas pipeline. Domestic and surface wastewater will be generated at the gas metering station. The domestic wastewater will be treated in the local wastewater treatment facilities and released into the nearest surface water body. Surface wastewater will be released into the same water body without treatment.

1.3.1.1. IMPACT OF THE PEA ON THE HYDRODYNAMIC CONDITIONS AND CHANGES IN THE SEDIMENTS FLOW AND BALANCE IN THE KLAIPĖDA STRAIT AND THE NEAR-SHORE BALTIC SEA AREA

MIKE 21 digital model systems were used to assess the impact of the PEA on the hydrodynamic conditions and changes in the sediments flow and balance in the Klaipėda Strait and the near-shore Baltic Sea area for both Alternative I and Alternative II. For Alternative I, the capacity of the Klaipėda Strait, the flow velocity structure and the motion of sediments were calculated for the following options of the strait‘s conditions:

- Option 0: current condition of the strait (piers of the port were reconstructed, the approach channel up to Berth 10, port berths and piers constructed and reconstructed, widening and dredging (to 14.5 m depth) of the strait, which is currently underway, assessed);
- Option 1: strait dredging works to prepare the area for the turning of LNG tankers (depth 14.5 m) and the terminal site (depth 16 m);
- Option 2: the strait dredging as described in Option 1 and the LNG terminal constructed. This option corresponds to the situation in the operation phase.

In case of Alternative I, construction of the LNG terminal at the Kiaulės Nugara Island, i. e. the dredging, will slightly (up to 0.2 – 0.3%) increase the capacity of the Klaipėda Strait. Upon completion of construction, the capacity of the Klaipėda Strait will be reduced 1.0 – 1.5%. This change is favourable to the water circulation processes in the Baltic Sea and the Curonian Lagoon, which will be intensified as a result of the dredging.

The changes in the Klaipėda Strait flow structure as a result of the construction of the LNG terminal manifest themselves in the increased average flow rates at the shore of the Curonian Spit and at the strait‘s embankments. However, the construction will cause only very slight flow rate changes at the shores of the Curonian Spit (at the 20 -30 m distance from the shore), i. e. just 1 to 7 %.

The LNG terminal will have an impact upon the sediment motion and accumulation processes in the water area of the Klaipėda seaport. Upon construction of the LNG terminal (Option 2), the accumulation of carried sediments (sand) will be reduced, whereas that of suspended sediments (sludge) will be increased in the terminal‘s environment. During the construction of the LNG terminal (Option 1) the accumulation of suspended sediments will be reduced as compared with Option 0.

The total amount of sediments in the environment of the LNG terminal will not differ much from option to option and will depend on the annual abundance of water. In years with high abundance of water, 107,230 m^3 of sediments will be accumulated for Option 0, 101,740 m^3 of sediments for Option 2, and 96,810 m^3 of sediments for Option 1. In years with average abundance of water, the estimated respective amounts are 78,160 m^3, 79,650 m^3 and 71,340 m^3. In the water area of the Klaipėda Strait, which is at the distance of 3.5 km from the Kiaulės Nugara Island, the sediment flows are the same for all the options; reallocation of the bottom sediments will take place in the environment of the terminal.

It has been established for Alternative II that the breakwater to be constructed will protect the water area of the LNG terminal from high waves. At the distance of 1 km from the breakwater,

the height of the waves toward the shore will be 1.8 m at NW wind, 1.0 m at W wind, and 2.0 m at SW wind. If the breakwater is not constructed, the wave heights would be 3.4 m, 3.8 m and 3.6 m respectively. Changes in the flow rates and sediment flows near the shores in the Baltic Sea, resulting from the construction of the breakwater have been assessed for the nearest environment of the breakwater under the conditions of SW, W and NW winds of 20 m/s. Two options were examined: Option 0 – condition of the existing littoral at the Baltic Sea; option 1 – a breakwater built in the littoral of the Baltic Sea.

The extent of deformations of the bottom near the Baltic Sea shores will depend on the direction of strong winds, however, benthal erosion and the accumulation of sediments will occur only in the environment nearest to the breakwater. Construction of the breakwater will not cause any shore deformations as no changes in the flow rates and sediment flows in the near-shore areas have been determined (Fig. 3-5).

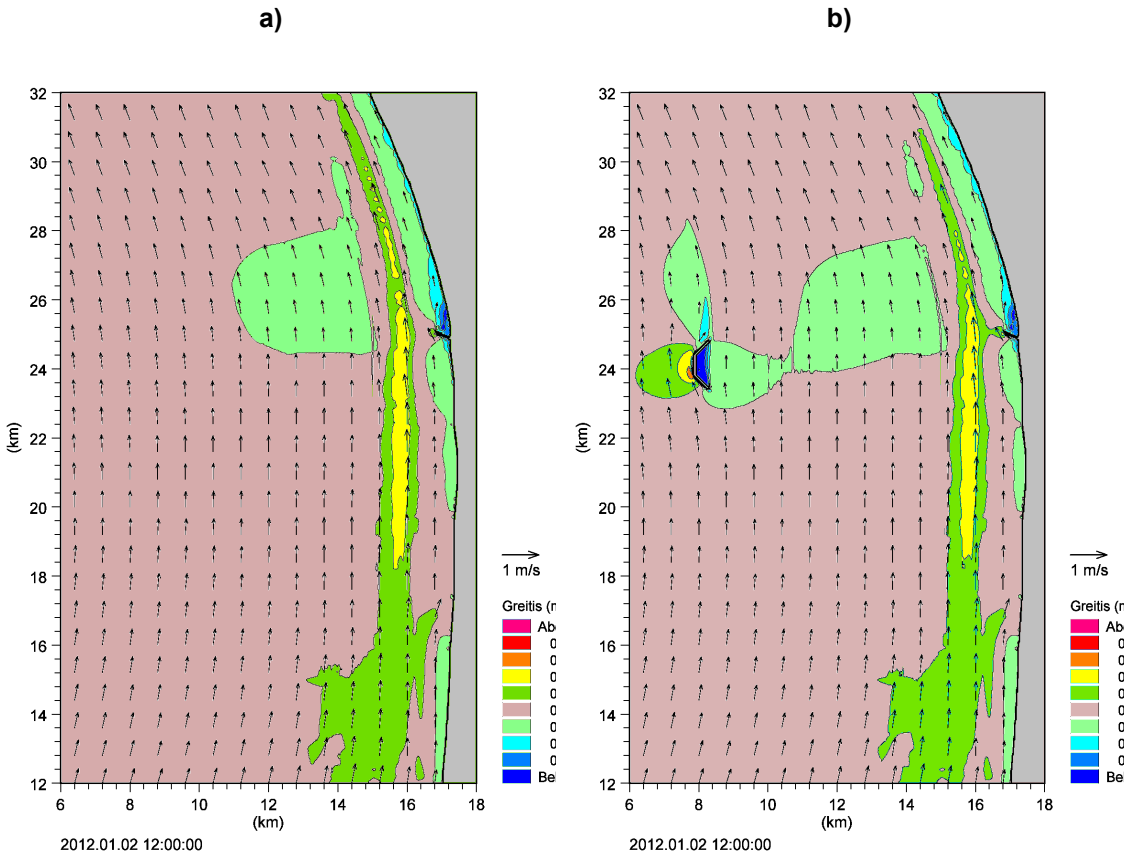


Fig. 3. Flow structure of the littoral in the Baltic Sea, when velocity of the southwest wind is 20 m/s: a) option 0, b) option 1

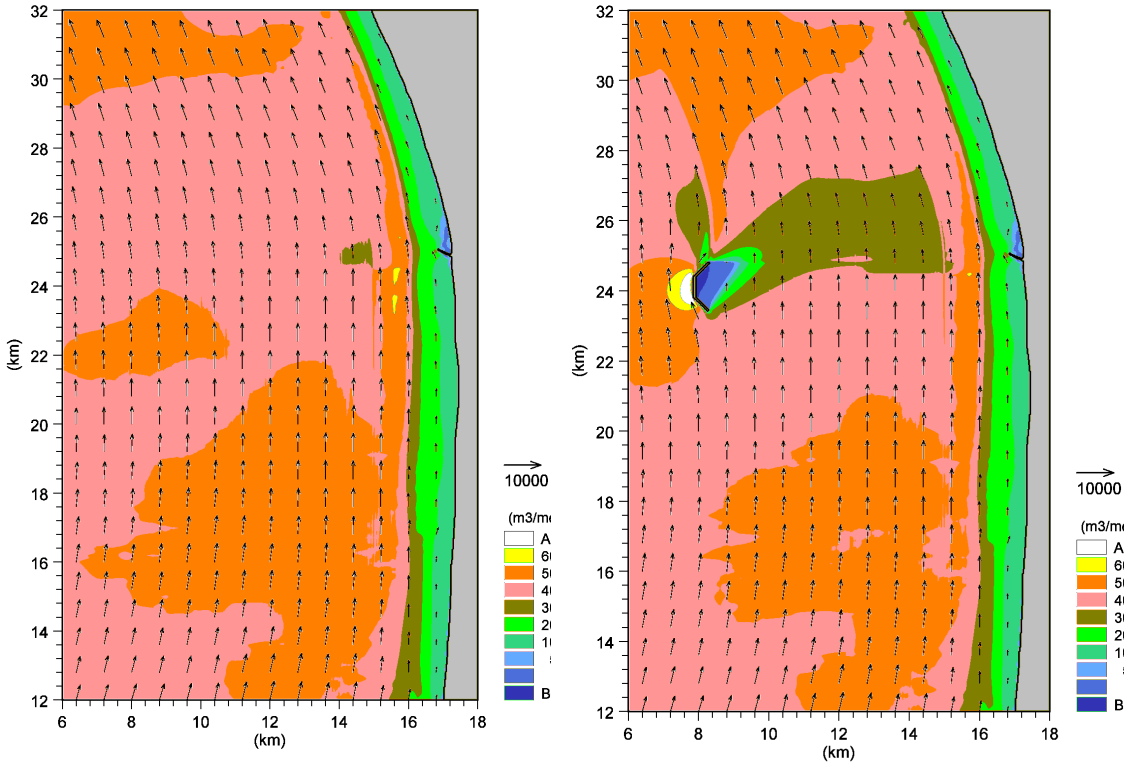
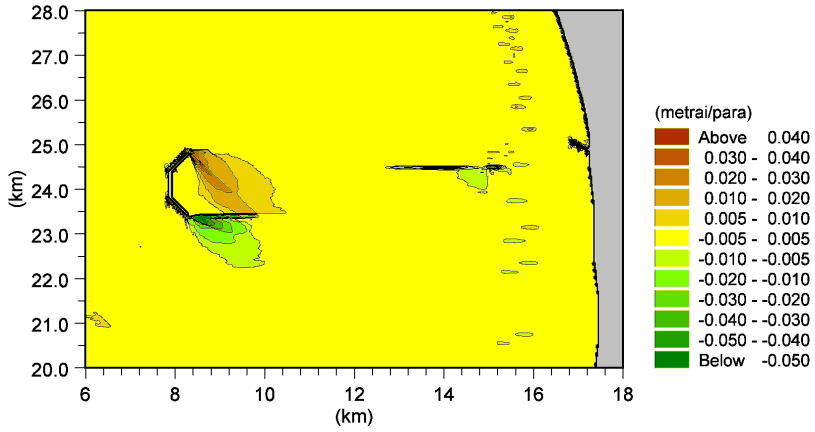


Fig. 4. Distribution of sediment yield (m^3/metai/m) in the littoral in the Baltic Sea, when velocity of the southwest wind is 20 m/s a) option 0, b) option 1

a)



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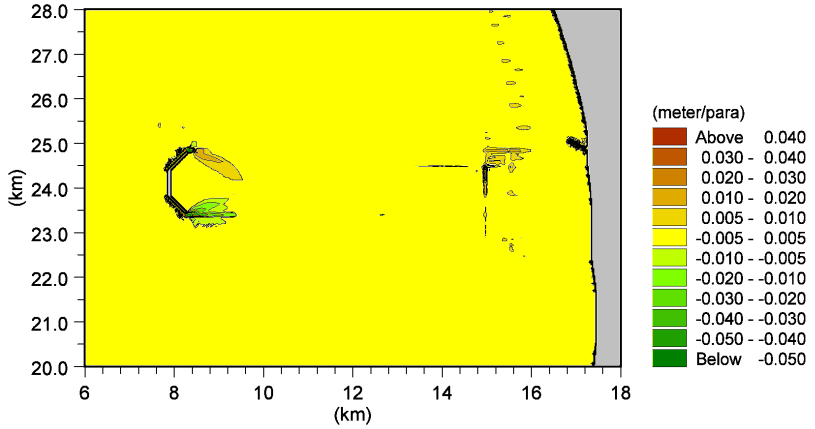

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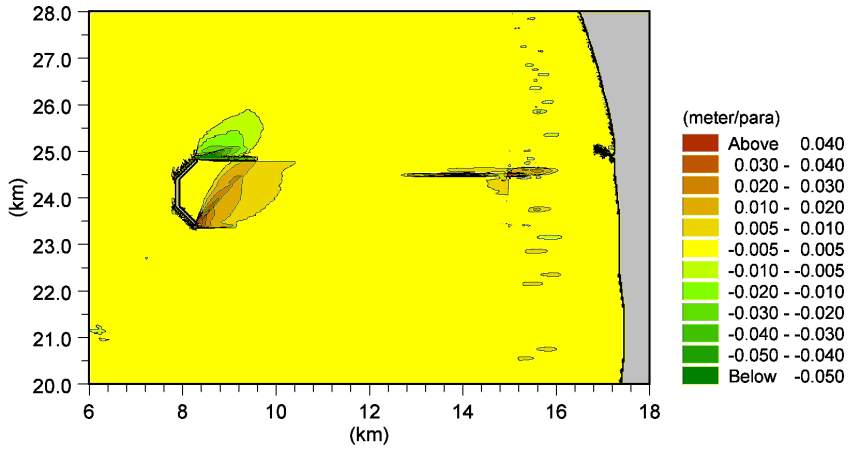

Fig. 5. Changes in the seafloor (erosion – green colour, accumulation – brown) exposed under northwest (a), west (b) and southwest (c) winds and when a breakwater is built

1.3.1.2. IMPACT UPON WATER SALINITY

The impact of the Klaipėda Strait dredging necessary for the functioning of the LNG terminal on the salinity of water in the Curonian Lagoon was measured using a 3-D hydrodynamic model. The full scope of the dredging works consists of two phases, the first of which (dredging and widening of the waterway) is a phase of the scheduled development of the port; even though it has not yet been implemented, it is not included in the scope of this EIA. The second dredging phase, covering an area of approximately 20 ha to the north from the Kiaulės Nugara Island, is related to this project, therefore, the impact of the PEA on the water salinity is considered to be the impact that would result from completion of the second phase of the dredging works, assuming that the first phase was completed. Apart from this main assessment, an assessment of the impact of Phase 1 of the dredging works on the salinity of water in the Curonian Lagoon and an assessment of the total impact of both dredging phases was made. The Curonian Lagoon being the subject of the assessment, the impact on the Klaipėda Strait was assessed as well. The relative change in the annual average salinity was selected as the criterion for the impact upon water salinity. In order to determine the impact on the vertical distribution of salinity, the impact on the salinity of the upper and the near-bottom layers of water was assessed along with the vertical average salinity. The results were also used to analyse the feasibility of reducing salinity of the Curonian Lagoon‘s water. The findings are described below.

- Impact of the PEA on the salinity of the Curonian Lagoon. On completion of Phase 2 dredging works, the vertical average salinity of the water within an approx. 1 km section in the western part of the Curonian Lagoon, to the south from the Kiaulės Nugara Island, will increase 1 to 2%. In all other areas of the Curonian Lagoon, changes in the vertical average salinity would not exceed 1%. There would be a maximum 1% increase in the salinity of the surface layer in the Curonian Lagoon as a whole; 1 to 2% changes in the salinity of near-bottom water would be observed within the section of approx. 1.5 km in the western part of the Curonian Lagoon, to the south from the Kiaulės Nugara Island, whereas in the remaining part of the lagoon such changes would not exceed 1%.
- Impact of the PEA on salinity of the Klaipėda Strait. On completion of Phase 2 dredging works, the vertical average salinity of the water in the dredged area in the Klaipėda Strait would increase from 2 to 26%, in the western by-channel - by 1 to 2%, and in the remaining part of the strait the increase would not exceed 1%.
- Total impact of both phases of the dredging works on the Curonian Lagoon. On completion of all the dredging, the vertical average salinity of water would increase 1

to 2% within an approx. 1 km section in the western part of the Curonian Lagoon, to the south from the Kiaulės Nugara Island. In the remaining part of the lagoon, the increase in the salinity of the vertical average and the surface layer would not exceed 1%. Salinity of the near-bottom layer within an approx. 1.5 km section in the same area would increase from 1% to 5%; in the remaining part of the lagoon, the increase in the salinity of the near-bottom layer would not exceed 1%.

- Total impact of both phases of the dredging works on the Klaipėda Strait. On completion of both phases of dredging works, the vertical average salinity at the place of Phase 2 dredging in the Klaipėda Strait would increase 5 to 27%, and in the western by-channel 1 to 5%. Salinity of the surface layer right at the terminal would increase 1 to 2%, in the remaining part of the strait maximum 1%. Salinity of the near-bottom water layer at the place of Phase 2 dredging would increase 5 to 48%, whereas in the western by-channel and the remaining part of the strait 2 to 10%.
- The main and probably the only measure to stop/reduce, to some extent, any further increase in the Curonian Lagoon‘s salinity would be to reduce the capacity of the water areas on both sides of the Kiaulės Nugara Island (in particular, the western one). However, prior to implementing this measure, detailed investigations and hydrodynamic as well as sediment motion calculations have to be carried out as the capacity reduction can increase the flow rates as well as bottom/shore erosion.

1.3.2. IMPACT ON SHORES

Neither dredging of the water area, nor potential slight changes in currents and waves in the Klaipėda Strait will have any adverse impact on the shores of the Curonian Lagoon during the construction and operation of the LNG import terminal.

As opposed to the Curonian Spit‘s shores, stability of the northern shores of the Kiaulės Nugara Island will be adversely affected by the dredging of the nearby water area to 14.5 m (and to 16 m in the terminal area). The slope of the excavation will be unstable due to the looseness of the bottom sediments. On the other hand, considerable increase in the depth of this near-shore area will result in higher waves (caused by N winds) and water levels. Even though strong (14-22 m/s) N winds in the Klaipėda Strait are relatively very rare, i.e. 2.1% of the year (Kriaučiūnaitė et al 2006), and their runway is very short, in some cases, when the flow rates in the strait are high, the can increase the wave intensity and affect stability of the northern shores of the Kiaulės Nugara Island at the same time. Furthermore, stability of the subwater slope of the island can also be affected by the currents caused by the screws of vessels. Therefore, shore reinforcement will be required in this area, in order to protect the shores against erosion and the dredged area from sediments.

In case of Alternative II, the LNG terminal will be constructed at the distance of nearly 8 km from the shoreline (at the depth of 18-19 m), therefore, neither construction nor operation will have any impact on the geodynamic situation of the area. The shore will be “damaged“ only during the construction of the gas pipeline at the point where it reaches the sea, covering a shore section 5 to 10 m wide. The negative impact on the shore will arise from the moving, during the excavation works, of the shoreline sediments that have adapted to the prevailing hydrodynamic conditions (including wave transformations, water level dynamics, groundwater filtration etc.) over time. Therefore, temporary local wash of the shore is probable.

Compensatory measures proposed:

Alternative I

- no compensatory measures will be required if the designed distance from the shores of the Curonian Spit to the dredged water area (to 14.5 m; in the terminal area to 16 m) is maintained;
- it is recommended that the northern part of the Kiaulės Nugara Island is stabilised by the sheet piling wall (at the slope that will be formed nearshore after the dredging);
- the monitoring points forming the current network of monitoring of the Klaipėda port shore dynamics must be densified in the section between the end of the embankment and the southern end of the Kiaulės Nugara Island.

Alternative II

- appropriate shore maintenance by competent bodies during the construction of the gas pipeline in the coastal area;
- rehabilitation and reinforcement of the damaged shore section must be performed on completion of the gas pipeline construction;
- establishing a network of monitoring points for the shore dynamics monitoring, covering a shore section from the Lithuanian-Latvian border to the southern border of the Būtingė geomorphologic reserve (about 2 km long).

The adverse impact of the construction and operation of the LNG terminal on the shores‘ condition could be practically neutralised if the shore management and protection requirements are complied with. The alternatives, however, differ from the shore protection standpoint:

- Alternative I (at the Kiaulės Nugara Island) can pose a threat of erosion of the northern shores of the island, unless they are reinforced;
- Alternative II (at Būtinge) can pose a threat of erosion of the Baltic Sea shores, unless appropriate shore management supervision is exercised during the gas

pipeline construction in the shore area and the damaged shore section is rehabilitated on completion of the works.

A comparison of the alternatives reveals another aspect relevant to the operation of the LNG terminal, i.e. gas pipeline security. While in Alternative I only a minimal adverse impact can be produced upon the gas pipeline by the long-term changes on the bottom of the Curonian Lagoon, such impact can be considerable in Alternative II. This is because the shore erosion will be markedly intensified after the reconstruction of the Šventoji harbour.

1.3.3. IMPACT UPON THE ATMOSPHERE

During construction of facilities, the atmosphere will be polluted by mobile air pollution sources (APS), i.e. fuel combustion products from the installations' internal combustion engines and pollutants released in the pipe welding process. In the facilities' operation phase, the atmosphere will be polluted by permanent APS such as fuel combustion installations (boilers, vessel engines, generators). In this phase the atmosphere will also be polluted by mobile APS, i. e. combustion products from internal combustion engines of LNG tankers. Both permanent and mobile APS will discharge pollutants (depending on fuel type) such as carbon monoxide, nitrogen oxides, sulphur dioxide, volatile organic compounds and solid particles.

The EIA Report assesses the air pollutants for each Alternative, divided by the construction and operation phases.

The amounts of pollutants released into the atmosphere in the construction phase would be larger In Alternative II compared to Alternative I (about 47%), which is determined by the larger scope of construction works such as construction of the breakwater and longer gas pipeline. The amounts of pollutants will be more or less equal in both alternatives in the operation phase.

The pollutant dispersion modelling was performed using the ISC-AERMOD View software package – the AERMOD mathematical model intended for the imitation of the environmental dispersion of pollutants emitted by industrial sources.

Mathematical modelling of the pollutants' dispersion in ambient air for Alternative I (without background pollution) has shown that the impact of the LNG terminal on the quality of ambient air is relatively weak. The highest determined concentrations of nitrogen dioxide account for 9.6% to 19.2 % of the limit value established for living environment; concentrations of other pollutants were lower and accounted for 0.2 to 1 % of the limit value. For Alternative II, the highest determined concentrations of nitrogen dioxide account for 10.9% to 19.5 % of the limit value; other pollutants – 0.2% to 1.1 % of the limit value.

An assessment including background pollution for Alternative I has shown that the highest concentration of solid particles (KD_{10}) accounts for 56.3 % of the limit value and that of

nitrogen dioxide – 46.1 % of the limit value. Concentrations of other pollutants were lower and accounted for 3.9 % to 9.5% of the limit value. For Alternative II, the highest concentration of solid particles ($KD_{2,5}$) was 37.9 %, whereas that of solid particles (KD_{10}) – 29.4 % of the limit value. Concentrations of other pollutants were lower and accounted for 6.8 % to 21.9% of the limit value.

The impact of the PEA on ambient air would be acceptable in both Alternative I and Alternative II: no air pollution limit values set for living environment are exceeded.

From the standpoint of impact on ambient air, the LNG terminal could be constructed and used for the operations as described in the EIA Report in either location: at the Kiaulės Nugara Island (Alternative I) or at Būtingė (Alternative II).

1.3.4. IMPACT UPON SOIL

The fertile soil layer (about 0.2 m) in the gas pipeline route will be pushed away or excavated and temporarily stored near the excavation or transported to temporary storage sites. The maximum amount of the removed soil would be: for Alternative I up to 25.7 ha, for Alternative II up to 102.1 ha. On completion of the gas pipeline construction, the removed soil would be used for site management works. The areas of potentially damaged soil due to the manoeuvring of heavy vehicles near the route would amount up to 19.7 ha for Alternative I and up to 60 ha for Alternative II. The estimated total area of damaged soil during the gas pipeline construction is up to 45.4 ha for Alternative I and up to 162.1 ha for Alternative II. If HDD technology is applied in some sections, the scope of damage would be smaller. Up to 1 ha of fertile soil layer in the GMS area would removed permanently (the area would be covered with a solid layer such as asphalt, concrete slabs, crushed stone and built up.

The total maximum area of temporarily damaged soil would be 3.6 times larger for Alternative II compared with Alternative I, therefore, Alternative I would be more environmentally friendly in this respect.

1.3.5. IMPACT UPON THE EARTH INTERIOR

Construction of a berth for the FSRU in the Curonian Lagoon (Alternative I) or in the Baltic Sea (Alternative II) will involve constructing 81 concrete poles about 1.2 m in diameter. The designed length would be 36 to 38 m from the water surface. About 2,800 m^3 of soil would be removed in the pole installation process.

If water-bearing sand layers occurring between moraine layers are damaged during dredging in the water area to the north from the Kiaulės Nugara Island, engineering measures should be applied in order to stop the flow of water from the artesian aquifer to the surface of the bottom.

The inland gas pipeline will be constructed using both the open excavation and HDD methods. The latter will be employed at the points where the gas pipeline route crosses some surface water bodies and infrastructure facilities (roads, railways etc.). If only the open excavation method is applied for the pipeline construction, the temporary impact can be as follows: for Alternative I – about 50,500 m^3 of soil excavated within the area of up to 4.6 ha, for Alternative II- about 200,100 m^3 of soil excavated within the area of up to 18 ha.

Open excavation or HDD methods can be used for the construction of the gas pipeline in the Curonian Lagoon depending on the selected sub-alternative. The HDD method could be employed to the route subalternatives IAa, IAa1 and IAb that cross the lagoon. In case of subalternative IAa1, the drilling would cover a section of about 2.8 km and about 2,000 m^3 of core would be cut. In case of sub-alternative IAb, which is 3,738 m long, about of 56,000 m^3 of soil would be excavated.

The gas pipeline would be constructed on the Baltic Sea bottom from the LNG terminal to the shore by the open excavation method, i.e. by digging a trench in the bottom and laying the pipes into it. The length of the trench would be about 10 km. In this case about 150,000 m^3 of soil would be excavated.

Impact upon resources of the Earth interior

The LNG terminal would not have any significant impact on the resources of the Earth interior in any phase of either Alternative 1 or 2.

In case of Alternative I, the gas pipeline would cross, in the Curonian Lagoon, the territory of Gintaras I amber deposit (No. 1651), which has been identified but is not being exploited as yet, whereas the inland section of the pipeline would cross the southern part and the eastern edge of Toleikiai II sand deposit (No. 2271), which is not in use. If another route sub-alternative (IAj), which bypasses the deposit, is selected, any impact would be avoided. In case of Alternative IIm the gas pipeline would cross the territory of the Kretinga oil deposit, which is under exploitation. If the HDD method is selected, there will be no impact on the amber deposit either in the construction or operation phase. If the pipeline is constructed beneath the deposit and a protection zone is established, interdepartmental agreement procedures will be required prior to the start of exploitation of the deposit.

Impact upon groundwater resources

In case of Alternative I, the gas pipeline would cross a section of the Karalius Vilhelmas Canal which falls within Belts II and III (restrictions on bacteriological and chemical pollution) of the sanitary protection zone (SPZ) of Klaipėda City Wellfield III. It is planned that the gas pipeline section crossing the canal and Belt II of the wellfield SPZ will be constructed by the HDD method, with the drilling under the canal bottom. Based on an assessment of the local geological and hydrogeologic conditions, if a large-diameter (about 1 m) borehole crosses the

water-bearing layer in the area of SPZ Belt II, this could potentially pose a threat to the groundwater quality and affect the hydrodynamic conditions (using large amounts of drilling mud and water). The following preventive measures are recommended in order to avoid the potential impact on the quality of water in the wellfield:

- the drilling site as well as drilling and auxiliary equipment must be located beyond the boundaries of the wellfield's SPZ Belt II;
- the wellfield's SPZ Belt II must be passed by drilling into the waterlogged layer at the depth of about 12 to 15 m and coming back to the surface in the area of SPZ Belt III. The approximate length of drilling would be 750 to 800 m (to be determined only upon selection of technologies and equipment);
- the water-bearing layer has to be crossed at a right angle as far possible (depending on technology);
- the drilling must not damage the waterlogged layer and must not be carried down into the underlying aquifer;
- the drilling works must be performed strictly in accordance with environmental and health and safety at work regulations.

Provided that the mandatory environmental and health and safety at work regulations are complied with, the gas pipeline will not have any adverse impact on other wellfields (of the Klaipėda City Wastewater Treatment Facilities and Gargždai (Laugaliai)) which exploit the Upper Jurasic (J_3) aquifer and the SPZs of which would be crossed by the gas pipeline. This applies to both construction and operation phases (LNG would not pose a threat to the groundwater quality even in case of an emergency and potential leakage).

1.3.6. IMPACT UPON FLORA

Impact upon inland flora

In both Alternative I and Alternative II, the gas pipeline will be constructed in the areas overgrown with natural flora and flora planted by man. Natural flora forms an important part of the very vulnerable ecosystems of the coastal phytogeographic region. In case of both Alternatives, the projected construction areas cover valuable flora systems including habitats of Community importance and plant populations included in the Lithuanian Red Book.

Four valuable flora contours have been identified in the route of main option IA of Alternative I:

- in Contour 1, significant adverse impact of the PEA on habitats of Community importance is anticipated, however, the habitats can be restored on completion of construction works;

- in Contours 2 and 3, adverse impact of the PEA on habitats of Community importance is anticipated; the impact could be avoided by the habitat protection measures;
- in Contour 4, adverse impact of the PEA on habitats of Community importance is anticipated; the impact could be mitigated by minimising forest cutting within the route of the gas pipeline.

No valuable flora contours have been identified in the routes of supplementary options IB and IC of Alternative I and the impact of the PEA on the plant cover is not significant.

Five valuable flora contours have been identified in the route of main option IIA of Alternative II:

- in Contours 5 and 6, significant adverse impact of the PEA on habitats of Community importance or populations included in the Lithuanian Red Book is anticipated; however, they can be restored on completion of construction works;
- in Contours 7 and 9, adverse impact of the PEA on habitats of Community importance is possible; the impact could be mitigated by minimising forest cutting and by selecting appropriate location for the pipeline;
- in Contour 8, significant adverse impact of the PEA on habitats of Community importance is anticipated; an extra route alternative is proposed in order to avoid it.

Two valuable flora contours have been identified in the routes of supplementary options IIB and IIC of Alternative II:

- in Contour 10, significant adverse impact of the PEA on habitats of Community importance and populations included in the Lithuanian Red Book is anticipated is anticipated; however, they can be restored on completion of construction works;
- in Contour 11, significant adverse impact of the PEA on habitats of Community importance is anticipated; an extra route alternative is proposed in order to avoid it.

An assessment of the above findings shows that lesser adverse impact of the PEA on the diversity of plant cover in the region is anticipated in case of supplementary options IB and IC or subalternatives of individual routes (bypassing the valuable flora areas) in option IA of Alternative I.

The greatest impact of the PEA is anticipated during the construction of the gas pipeline only.

No adverse impact of the PEA on the diversity of the plant cover in the Curonian Spit and its valuable components is anticipated.

Impact upon aquatic flora

Flora of the Curonian Lagoon and the Baltic Sea at Būtingė is unique in Lithuania as it is specific to these water areas and completely different between themselves. The lagoon flora in the area of potential impact of the LNG terminal is characterised by considerably greater diversity of species as well as systemic and ecological plant groups; the habitats of protected species are much closer to the impact area. In this respect, Alternative II is more favourable than Alternative I.

An assessment of the potential direct destruction and the impact of the increased water turbidity on aquatic plants in the water bodies related to the PEA during the LNG terminal's construction and operation period has shown that Alternative II is more favourable in terms of the impact on hydrophytes.

The impact on the flora in moving water bodies during the pipeline construction and operation period would be the same for both Alternatives, however, in case of Alternative II the route crosses a larger number of water streams, therefore, Alternative I would be more appropriate in this respect.

Overall, Alternative II is more suitable in terms of impact on aquatic flora during the construction and operation of the LNG terminal and related infrastructure.

Impact on the flora cannot be avoided or mitigated during dredging works at the Kiaulės Nugara Island – the flora would be irreversibly destroyed. The impact on the Curonian Lagoon's flora would be minimised by constructing the gas pipeline by the HDD method under subalternative IAa1.

1.3.7. IMPACT UPON FAUNA

1.3.7.1. IMPACT UPON INVERTEBRATES, AMPHIBIA, BIRDS AND MAMMALS

All the PEA alternatives being considered will have some impact upon invertebrates, amphibia, birds and mammals including protected species. The impact, however, will be insignificant in both cases and can be minimised by applying the compensatory or mitigation measures provided for in this Report. In case of Alternative I, appropriate management of the area could even produce an opposite effect, i. e. more favourable conditions for the propagation and wintering of water birds could be created.

In general, Alternative I provides for the gas pipeline locations in the areas of nature that have been transformed by humans, as a result of which they have lost their natural features. Therefore, impact upon fauna (both protected and not protected species) will have no significance, even though, locally, the state of the remaining invertebrates and birds could become worse. However, if the proposals are taken into account and the relevant location alternatives are selected, with no additional cutting of forests, which are already small and

fragmented, the impact will be minimal including the impact on game. Alternative I is more acceptable from the standpoint of protection of invertebrates, birds and mammals, as the larger part of the gas pipeline route would extend along the existing infrastructure such as roads, railways, high-voltage overhead power transmission lines etc.; at other places, the route would cross agrarian areas.

Construction works will pose the greatest threat to amphibians and birds, in particular if the works are carried out in spring (April – May) and in the second half of summer and early autumn. Migration of amphibians from wintering places to spawning areas and migration of the young to wintering places or habitats near spawning areas take place in spring and autumn. Whereas birds are particularly vulnerable in the breeding period lasting from March until July. In this period noisy construction works at places of breeding of protected species must be avoided. Those places where the gas pipeline extends along water bodies, temporary pools, quarries, boggy areas or in woody areas need particular attention. Furthermore, no gas pipeline construction works and tree cutting works should be carried out during the bird breeding period (April – June) near the Kiaulės Nugara Island. There are no other special restrictions in case if Alternative I (near the Kiaulės Nugara Island) is selected.

No significant impact on invertebrates (non-marine species), amphibia, reptiles, birds and mammals is anticipated during the construction and operation of the LNG terminal for Alternative I or Alternative II. However, the impact on biological diversity as well as protected and disappearing fauna species would be less significant in case of Alternative I, in particular, its supplementary option IB. When planning the main pipeline route option IA, the proposed subalternatives should be selected for its individual sections.

1.3.7.2. IMPACT UPON ICHTHYOFAUNA

44 fish species were recorded in the Klaipėda Strait and the nearest water areas of the Curonian Lagoon during investigations carried out in 1984 – 2011. Freshwater species prevail in these areas, such as carps, pikes, breams, roaches, perches etc. In the water areas close to the LNG terminal, perch and roach spawning places were found in the western part of the strait and in the SE part of the Kiaulės Nugara Island. Migrationary species such as European smelts, twait shads, vimbas, salmons, sea trouts and whitefish are found in migration season. The main migration path near the Kiaulės Nugara Island lies in the waterway at the western shore (vimbas, twait shads, salmons, sea trouts, carps, pikes). Intense migration of smelts only has been observed at the eastern shore.

No spawning places have been recorded in the water area near the LNG terminal berth to be designed. Only the spawning places of roaches and perches were found at the Kiaulės Nugara Island, however, it is unlikely that they would be affected by the construction and

operation of the terminal as the prevailing currents in April – May are those flowing from the lagoon to the sea.

In order to minimise the impact of the port excavation and dredging works on migrating fish, restrictions on such works have been established for certain periods of the year. There are the following restrictions on excavation and dredging works in the Klaipėda Strait: from 1 January until 15 February, from 15 April until 15 June, and from 15 August until 31 of October. At present the rates of compensation for the damage done to fish resources and fish migration by the dredging works in the Klaipėda Port are set depending on the part of the port and also based on rates established by the Ministry of Environment.

The above restriction periods must be taken into consideration in the construction of the LNG terminal‘s berth. Damage caused by the dredging works at the Kiaulės Nugara Island carried out in the determined migration periods will be assessed at the current rates. In terms of migration of passing fish, the gas pipeline subalternative IAa is more acceptable than subalternative IAb as soil would be excavated in the strait and the pipeline would be operated in a water area where migration of only part of smelts takes place. The larger part of migration takes place in the waterway at the western shores of the lagoon and the western part of the Kiaulės Nugara Island, therefore, subalternative Ia would not have any significant impact on fish migration. Any impact would be avoided if subalternative IAa1 is selected.

10 species protected under the EU Habitats Directive, 12 – protected under the Bern Convention, and 1 – included in the Lithuanian Red Book have been recorded in the Curonian Lagoon and the Baltic Sea. 9 fish species are species protected in Lithuania.

Most of the protected cephalaspidomorphi and fish species (lamprey eels, twait shads, salmons, sea trouts, vimbas, whitefish etc.) migrate to the Baltic Sea during the same periods as most passing-by fish, therefore, the above mentioned restrictions on the construction, soil excavation and treatment works, and operations would help preserve these fish resources. The gas pipeline subalternatives IAa or IAa1 are more acceptable in terms of migration of cephalaspidomorphi and fish species compared with subalternative IAb.

In recent years, fish biomass in the strait water area has been 125 kg/ha on average, which is much less that the biomass in the central part of the Curonian Lagoon, therefore, losses inflicted on fisheries due to the loss of the fish recovery areas should not be significant.

It has been established that the rate paid for the dredging/cleaning of the bottom in the western near-shore area of the Klaipėda Strait, the port‘s navigation channel, the Sea Ferry manoeuvring area, and the western water passage at the Kiaulės Nugara Island is LTL 0.06 per m^3 of excavated soil. As large scope dredging works are planned at the LNG terminal, and sediment accumulations will increase (Kriaučiūnienė, 2012), the terminal construction cost can be increased by the compensation rates applicable to the dredging and soil cleaning

works during the fish migration periods. The best option would be to carry out such works at times other than the main fish migration periods.

The increased amounts of sediments in the LNG terminal's water area will pose the biggest problem in the LNG terminal operation period. The continuous bottom dredging and cleaning works must be performed taking the seasons of the year into consideration so that the impact on all fish migrations is minimised.

According to the results of investigations carried out in 2000 – 2011, fish of 31 species were caught in the Baltic Sea near Būtingė. The prevailing species include the European flounder, cod, turbot, the Baltic herring, vimba, smelt, lesser sand eel, perch and pike.

The water areas related to the planned location of the LNG terminal at Būtingė does not contain many turbot spawning places, however, such places are abundant in the water areas crossed by the gas pipeline. The latter areas are also abundant in the young of sprats, Baltic herrings, turbots and flatfish. The main spawning period for turbots is the end of May – June, therefore, gas pipeline construction works should not be performed in this period in order to avoid losses for fisheries. Construction of a 1.28 km breakwater would inflict considerable losses on fisheries. A large part of the water area abundant in fish, in particular cod and European flounder will be used for the construction of the berth and the breakwater. The fish biomass in the water area of the projected LNG terminal has varied from 60 to 140 kg/ha, with the annual average being 95 kg/ha. The potential loss of fishing areas has to be assessed for compensation purposes. In this case, the amount of financial compensation for the construction of the LNG terminal and the breakwater at Būtingė would be much larger than that for the construction at the Kiaulės Nugara Island.

The gas pipeline route at Būtingė crosses the water areas with intense migration of passing-by fish, in particular smelt, vimba, salmon, sea trout and lamprey eel. Part of the fish migrate also to the Šventoji River. The main smelt migrations take place earlier than the migration in the Klaipėda Strait. The period of most intense migration for smelt is from 15 December until 15 of February, whereas for salmon, vimba, sea trout and lamprey eel – in September-November. The construction of the gas pipeline would have minimal impact on both passing-by and protected fish species if it is planned beyond the period of turbot spawning (20 May – 30 June) and the period of migration of main passing-by fish species (September-November).

A wide diversity of ichthyofauna is observed in most of the river basins analysed. The abundance of fish species varied from 22 to 35 (Minija River). The range of fish biomass is very wide (13-205 kg/ha). In case of Alternative I, the length of the inland gas pipeline would be only about 16 km, in case of Alternative II it would be about 63 km. The impact on ichthyofauna will be much weaker in Case of Alternative I compared to Alternative II. In order to minimise the negative impact on ichthyofauna, the pipeline construction should be planned

so as to avoid the periods of migration and spawning of most passing-by and protected fish species (May and September-November).

Impact on zoobenthos and other benthal communities and habitats

Both Alternatives pose a threat of destruction of part of biocenoses. This is an unavoidable result of nearly all waterwork constructions. In case of Alternative I, the dredging of the strait would have the greatest impact as part of the biocenoses would be removed together with soil. If Alternative II is selected, part of the biocenoses would be flooded during the construction of the breakwater.

The impact cannot be avoided in both Alternatives; on the other hand, there will be no change in the overall state of the biocenoses as the area to be destroyed is relatively not large. In case of Alternative II, only the layout of the biocenoses will be changed because of their mosaic characteristics in the planned construction area. Destruction of part of the biocenoses that have adapted to the hard bottom will be partially compensated by the construction of the breakwater, which would serve as an artificial reef. In case of Alternative I, partial changes should take place as a result of the increased salinity at the place of dredging.

There will be a constant impact of the operations of the LNG terminal on the biocenoses. In case of Alternative I, frequent (at least yearly) bottom cleaning works will be performed, resulting in the destruction of part of the biocenoses. This will prevent formation of abundant biocenoses based on the ichthyofauna species. Local discharges of water used in the LNG regassification process and released after some cooling should not have a significant impact due to the high flowrates in the Strait and the water mixing. In case of Alternative II (at Būtingė), constant changes in the sediment accumulation and erosion will take place depending on the direction of the currents. These changes will also prevent the formation of stable biocenoses in both hard and sandy soils. However, due to low activity of drift/sediment processes at such depths the impact will be limited to a small area around the breakwater.

A comparison of both location alternatives leads to a conclusion that selection of Alternative II would result in a smaller scope of impact on the biocenoses. However, Alternative II poses an important threat in case of hurricane winds, even though such winds are rare. If larger areas of hard bottom are covered by sediments in such cases, destruction of biocenoses can be quite significant. The risk would be particularly high if the sediments cover the aquatic plant colonies important for the Baltic herring. In such a case the losses would be considerable, in particular if the impact reaches the territory of the Republic of Latvia. In case of Alternative I (at the Kiaulės Nugara Island), the impact would be stronger, however, it is related not only to the construction of the LNG terminal but also with the dredging of the Klaipėda port area. Furthermore, in Alternative I the impact of natural factors can be weaker and serious unforeseen consequences are unlikely.

1.3.8. IMPACT UPON LANDSCAPE

The potential total impact of the LNG terminal and its infrastructure on landscape will depend on the selected construction sites and the structure of landscape in the areas of the gas pipeline. The following aspects of landscape have been considered: a) morphologic; b) geoecological; c) conservational; and d) perceptual.

The LNG terminal located either in the Curonian Lagoon (Alternative I) or the Baltic Sea (Alternative II) will have no direct physical impact on the morphologic structure of the region‘s landscape (neither terrain nor woods).

In case of Alternative I, impact upon terrain is possible in two areas: the area of the Klaipėda moraine ridge (Kasparišk ės environs) and the Kiškūnai kame area. The projected construction of the gas pipeline will have an impact on three tracts of wood in the environs of Toleikiai, Lėbautai and Galčiai villages. In case of Alternative II, there are three potential areas of impact on terrain related to the construction of the gas pipeline across the Būtingė coastal dune ridge and the valleys of the Šventoji and Darba rivers. In this case a considerable impact on the tracts of wood is unavoidable; as many as six sections of the impact have been identified.

In case of Alternative I, the most important area of potential geoecological impact on landscape is the fragment of the Minija-Dangė (Akmena) geoecological divide in the Lingiai-Lėbartai-Galčiai section dividing the Minija and Smentalė river basins, where construction of the LNG terminal‘s infrastructure would weaken this important component of the coastal natural frame, which, unfortunately, has already been considerably damaged by agrarian and urban activities. In case of Alternative II, the most important areas of geoecological impact on landscape include the Būtingė coastal water area (the location of the offshore LNG terminal) and the Laukžemė-Šventoji tract of forests (the northern part of which will be crossed by the pipeline). These two components form the geoecological divide of the Baltic seaside of European significance. Construction of the offshore LNG terminal would potentially impact the geoecological state of landscape to a larger extent only in case of emergency, whereas location of several kilometres of the pipeline in the inland areas of the natural frame (the northern and the middle sections of the route) would increase the degree of technogenicity of the landscape and diminish its natural features. In this way the ecological compensatory functions of these areas of the natural frame will be affected to a smaller or larger extent.

From the standpoint of conservation, carrying out of works under Alternative I would pose a threat to the fragile ecosystem of the nearby Smeltė botanical reserve; in case of emergency certain impact is also possible upon the shoreline of the Alksnynė landscape reserve within the Kuršių Nerija (Curonian Spit) National Park.

Realisation of Alternative II does not give rise to any substantial issues in terms of protected areas because only one section of the pipeline crosses the Šventoji River valley which is important for the protection of habitats. Still, in the context of the cultural and historical framework certain conflicts are possible when the pipeline axis crosses the cultural heritage sites in the Laukžemė-Darbėnai and Daubėnai-Tūbausiai-Kurmaičiaiai areas.

From the landscape perception standpoint, if the LNG terminal is constructed at the Kiaulės Nugara Island (Alternative I), the technogenic landscape would visually "approach" the shores of the Curonian Spit, thus reducing its aesthetic and recreational potential. On the other hand, marine technogenisation of this area does not change the landscape identity of the eastern shore of the Lagoon (the port and its infrastructure) and it is not perceived as foreign to this space. In case of Alternative II, the anticipated intense visual impact (visual prevalence) area and even extensive psychological impact area will not reach the sea shore, i.e. there should not be any pronounced adverse impact upon the landscape and the current identity will not be changed. The gas pipeline route should extend along the areas having no distinctive visual structure; the issue of the impact on the perception of landscape is relevant to just few areas. As regards recreational potential, analogous situation is observed as the location of the terminal and its infrastructure does not affect the main areas intensively used for recreation.

The assessment of the offshore and inland alternatives for the construction of the LNG terminal has shown that, from the landscape protection standpoint, priority is given to the marine part of Alternative II and the land part of Alternative I. A general comprehensive comparison made in terms of the impact upon landscape does not give an unconditional priority to any of the Alternatives, therefore, they are considered to be equivalent. Both Alternatives are equivalent and could be realised. The following measures to reduce the impact upon landscape are proposed:

- for Alternative I, it is recommended that the gas pipeline routes should be selected in an optimal way in terms of landscape. This would be subalternative IAa for the connection of the gas pipeline with the existing gas mains; optimisation of the pipeline route itself should be considered, using the route options identified in the Report on Strategic Assessment of Consequences for the Environment. It would be expedient to design high-voltage overhead transmission line in the Curonian Spit, which would compensate for the adverse negative visual impact on the Spit upon construction of the LNG terminal;
- for Alternative II, it is recommended to abandon the proposal for crossing the Padvariai pond, which is valuable from the recreational and aesthetic point of view, and to bypass the pond;
- on completion of the gas pipeline construction, any damaged soil cover must be recultivated by reinforcing it with perennial grass plants, which would form green

areas and make the soil surface stronger. It is especially important that pipeline building works are carried out responsibly in the areas where the pipeline crosses valleys and ridges – the scope of earthworks must be minimised there and attention focussed on recultivation measures.

1.3.9. IMPACT UPON CULTURAL HERITAGE SITES

No PEA facilities are being planned in the areas of registered cultural heritage sites and their protection zones.

Exploratory archaeological investigations were carried out in the routes of the projected gas pipeline for both Alternative I and Alternative II. It has been established that, in terms of preservation of archaeological heritage, Alternative I is better than Alternative II. Its area does not contain archaeological heritage sites to be protected; investigations into the pipeline route would last 2 to 3 months and would cost around LTL 130,000. The probability of finding any new archaeological values during earthworks is minimal. The pipeline route in Alternative II crosses archaeological sites that must be preserved, or extends very close to them. The investigations would last 2 years/seasons and would cost about LTL 4 to 8 millions (the northern option is particularly costly). It is probable that new archaeological values will be found as the gas pipeline would cross areas that have been densely populated for a very long time.

1.3.9.1. IMPACT OF THE PEA ON THE CURONIAN SPIT AS A UNESCO WORLD HERITAGE SITE

In 2000, the entire Curonian Spit peninsula including its northern part belonging to Lithuania and the southern part belonging to the Russian Federation was included in the UNESCO World Heritage List by joint application of both states. National parks were established in both parts in order to enable the preservation of the Curonian Spit as a cultural landscape reflecting the interaction between man and nature.

The LNG terminal will be established at a distance of approximately 200 m to the east from the boundary of the Curonian Spit National Park.

The impact of the PEA on the integrity and authenticity of the national park could manifest itself in the following direct and/or indirect aspects:

- impact on the ecosystem of the Curonian Lagoon;
- impact on the landscape of the Curonian Spit and its visual quality;
- impact of potential emergencies and incidents on the Curonian Spit National Park (CSNP), in particular its northern part;
- impact on the interstate relations in the field of maintenance of a World Heritage Site.

It has been established that the PEA:

- would cause changes in the ecosystem of small scale;
- the visual quality of the landscape as assessed from the CSNP embankment would be reduced by more than 4 points, however, this will not change the category of the visual value of the landscape. As viewed from the CSNP embankment, the LNG terminal situated at the northern end of the Kiaulės Nugara Island would merge with the facilities of the Sea Ferry Terminal and the Klaipėda State Seaport as well as the urban environment as a whole;
- a set of environmental measures has been proposed; the implementation of the measures would reduce the impact of the construction and operation of the LNG terminal on the CSNP value parameters from low or medium to insignificant or low, however, there would remain the necessity to design and implement, based on international best practice, measures to prevent emergencies and incidents .

Proposed measures to mitigate the potential adverse impact of the PEA:

- construct a stable, hydraulically calculated subwater threshold at the boundary of the area of the Klaipėda Strait to be dredged to the depth of 14.5 m. The threshold would prevent the washing out of the Curonian Lagoon‘s bottom and the accumulation of sediments in the Klaipėda Strait and would help preserve the stability of the Curonian Lagoon‘s ecosystem as well as the integrity and authenticity of the CSNP as a World Heritage Site. Upon construction of such threshold, the impact of the PEA on the Curonian Lagoon‘s ecosystem would be reduced from low to insignificant;
- the subwater gas pipeline installed by the HDD method would pose lower threat to the CSNP if its route extends toward the land facilities of the Sea Ferry Terminal rather than along the western nearshore area of the Klaipėda Strait;
- the time necessary for the FSRU to leave its permanent mooring place must be minimised;
- the design height of the FSRU must be minimised;
- in order to reduce visual pollution, paint the FSRU in grey or greyish blue;
- avoid installing viewing points on the eastern shore of the CSNP;
- design and implement, based on international best practice, measures to prevent emergencies and incidents during construction and operation of the LNG terminal in order to avoid the fire hazard in the northern part of the CSNP.

If all the above measures are implemented, no issues should arise concerning the LNG terminal‘s impact on a UNESCO World Heritage Site in the interstate relations with the Russian Federation.

In case of Alternative II, the impact on the Curonian Spit National Park – a World Heritage Site would be insignificant or very slight.

1.3.10. IMPACT UPON SOCIAL ENVIRONMENT

An assessment of the LNG terminal‘s impact on the socio-economic environment has shown that the terminal will have positive impact on the country‘s economy. The operations of the terminal will lead to annual savings of about LTL 350 million. The saved funds will be used in the sectors not related to the gas supply and will increase their competitiveness. In case of Alternative I, the impact on the Klaipėda State Seaport could be two-faceted: the port would earn additional income due to increased scope of cargo handling but would incur losses due to temporary restrictions on navigation. The net impact would be positive (up to 4%). If an appropriate subalternative (e.g. IAa1) is applied in case of Alternative I, any potential land use restrictions on the port’s development would be eliminated. In case of Alternative II, the operation of the LNG terminal will have no adverse impact on the Šventoji port and Būtingė terminal.

The impact of the LNG terminal (excluding the gas pipeline) on the land use structure, material values, and values of property would be greater in Alternative I. However, as the investment costs related to Alternative II are considerably higher (due to the construction of the breakwater), its advantages seem to be less significant and Alternative II should be considered equal to Alternative I or even worse. Where the Alternatives are assessed according to the impact of the gas pipeline on the land use structure, material values, and values of property, the adverse impact is greater in Alternative II (due to the nearly 4 times longer route). To sum up, priority should be given to Alternative I. A slight positive impact on the local labour market would be observed in both cases No negative demographic effects are anticipated. The LNG terminal‘s operations will not have any negative impact on tourism and recreation in both cases. The construction and operation of the LNG terminal will affect commercial fishing: the estimated losses due to lost or temporarily restricted fishing areas could reach LTL 0.03 million/year.

1.3.10.1. IMPACT ON PUBLIC HEALTH

The following risk factors have been identified on completion of the assessment of the PEA‘s effect on public health: vehicles and construction mechanisms may cause noise, pollution of ambient air and vibration during the construction of the LNG terminal and the gas pipeline; in the operations period, pollution of ambient air and noise caused by installations. The LNG

terminal and the gas pipeline are classified as dangerous facilities: there exist gas leakage, explosion and fire hazards.

No significant adverse psychoemotional impact is expected during the construction and operation of the LNG terminal.

The negative psychoemotional impact is possible in the gas pipeline planning phase in case if land owners are not satisfied with the compensation offered for the land use restrictions in the pipeline protection zone. Such risk is higher in Alternative II due to longer pipeline route and, therefore, the larger number of private land lots crossed.

Modelling of potential environmental pollution has shown that the noise generated by the PEA facilities excluding background noise (noise caused by nearby industries and vehicles) will not exceed the limit values set for the nearest living environment. The maximum ambient air pollution will not exceed the limit values for the living environment either. The over-the-norm noise zone of the LNG terminal would be 170 m based on the night-time noise limit value. In case of Alternative I, it will not exceed the boundaries of the seaport‘s SPZ and will not reach the living environment. In case of Alternative II, it will not reach the shore.

The established over-the-norm noise zone of the gas metering station (GMS) would be 122 m. In case of Alternative I, the zone does not reach the living areas, whereas in case of Alternative II, the GMS territory borders the nearest farmstead, therefore, the noise-generating GMS equipment must be designed in a building with the insulation limiting the sound dispersion, ensuring that the noise does not exceed the night-noise limit value at the boundary with the farmstead‘s plot.

It has been determined upon assessment of the environmental pollution modelling results that the SPZ of the LNG terminal (based on pollution of ambient air and noise) is up to 170 m from the external side of the FSRU and will not exceed the boundaries of the SPZ established for the Klaipėda seaport. There are no residential or public buildings within this zone.

On completion of the environmental pollution modelling and the risk analysis of the planned facilities, it has been established that the protection zone for emergencies is 125 m for Alternative I. There are no residential or public buildings within this zone. No protection zone is calculated for Alternative II as the consequences area does not reach any inland or other objects.

The gas pipeline protection zone, established on the basis of government resolution No. 343 on the conditions of land and forest use, is 25 m. There are no residential or public buildings within this zone.

1.4. ANALYSIS OF ALTERNATIVES

The EIA is being made for the following main alternative locations of the PEA:

- Alternative I (at the Kiaulės Nugara Island) – the LNG Terminal constructed in the southern part of the Klaipėda State Seaport at the Kiaulės Nugara Island
- Alternative II (at Būtinge) - the LNG Terminal constructed in the Baltic Sea near Būtingė.

These alternatives are related to the implementation of the PEA. The EIA Report contains a brief overview of Alternative 0 as well, i. e. the situation if the PEA is not implemented.

Upon completion of assessment of the Alternatives, corrections were made taking account of the assessment results and proposals by experts (subalternatives for individual sections of the gas pipeline route), a comparative analysis of the Alternatives was made, and the optimal PEA alternative was selected.

Realisation of each location alternative is closely related to other subalternatives of different types, such as:

- time;
- location;
- technology;
- environmental subalternatives.

The PEA location alternatives were analysed on several levels of detail:

- Level I – the assessment was made for the two main location alternatives (Alternative I and Alternative II), which were identified for further assessment in the Liquefied Natural Gas Import Terminal Development Plan and were assessed in the relevant Report on Strategic Consequences for the Environment. The alternatives can be conventionally divided into groups by the PEA facilities: a) the LNG terminal being planned; b) the gas pipeline and the gas metering station (GMS) being planned. It should be noted that the identified locations of the LNG terminal did not change in the course of the EIA process, as distinct from the gas pipeline routes and the GMS. The locations of the latter PEA facilities were analysed on several levels and adjusted on the basis of more detailed location analyses and proposals by the assessors of the PEA‘s impact upon the environment;
- Level II - the assessment was made for individual options of the gas pipeline route of the two main location alternatives (main option (IA, IIA) and supplementary options (IB, IC, IIB, IIC);

- Level III – the assessment was made for the subalternatives of individual sections of the gas pipeline route in the selected option of the relevant Alternative (Fig. 6, Fig.7.1. and Fig 7.2.).

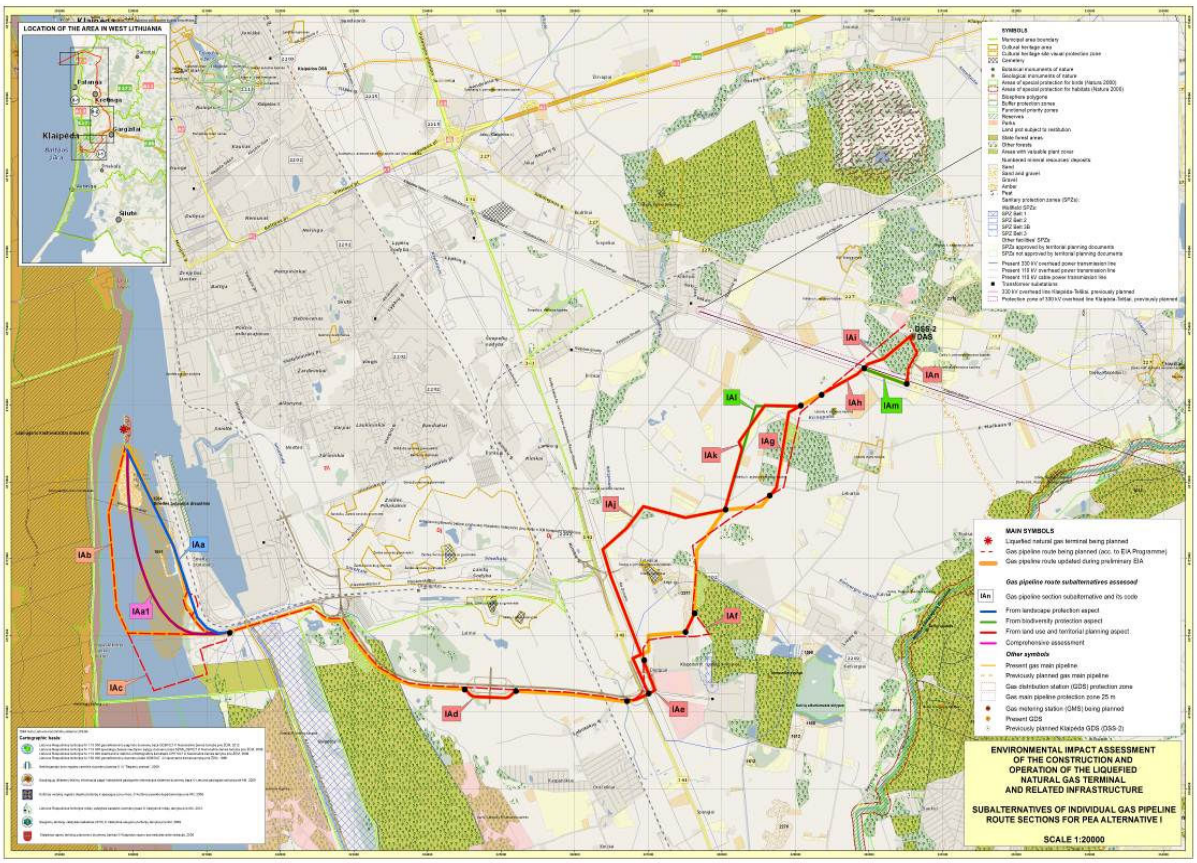

Fig. 6. Subalternatives of individual sections of the main gas pipeline option IAS for Alternative I

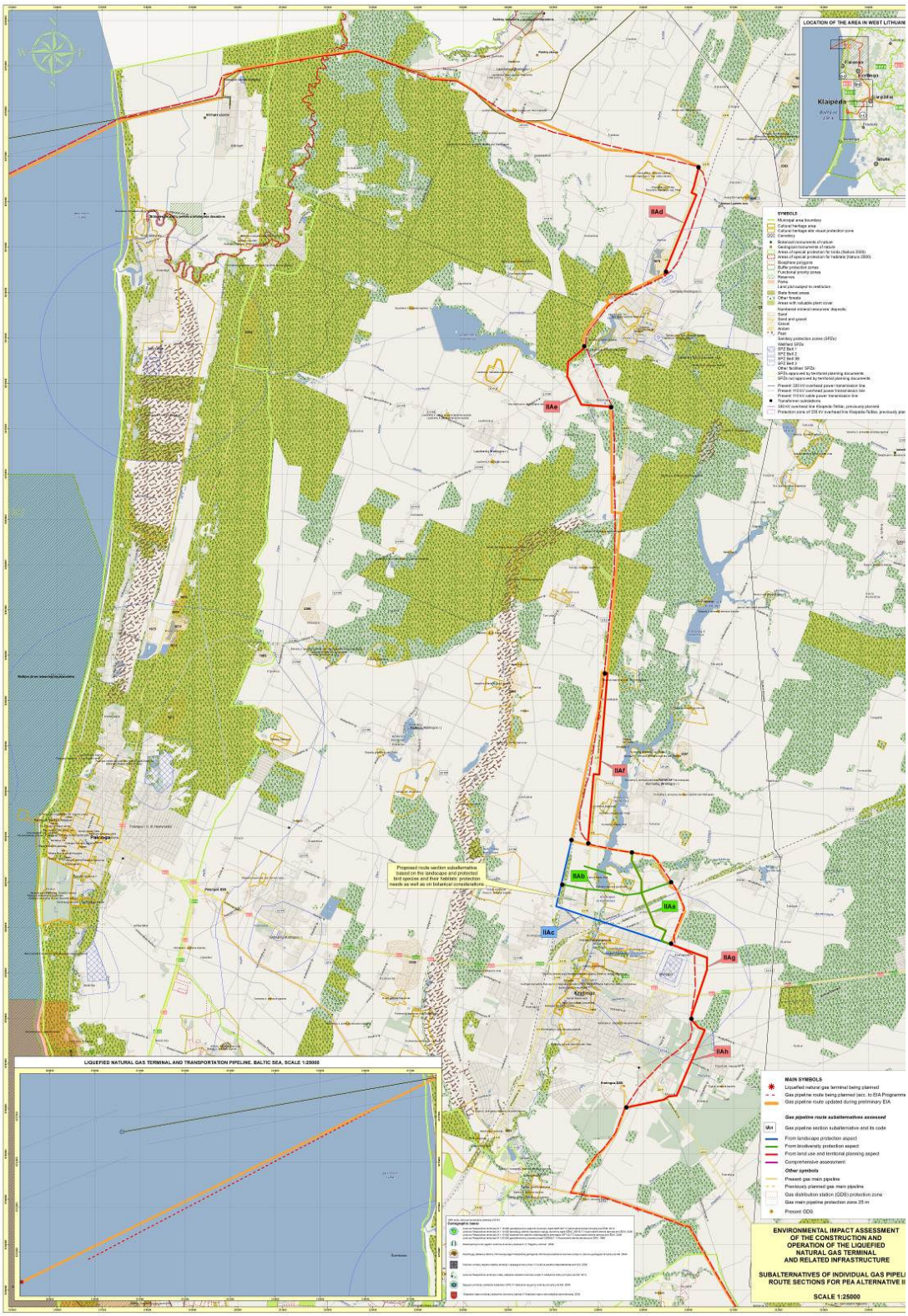

Fig. 7.1. Subalternatives of individual sections of the main gas pipeline option IIA for Alternative II

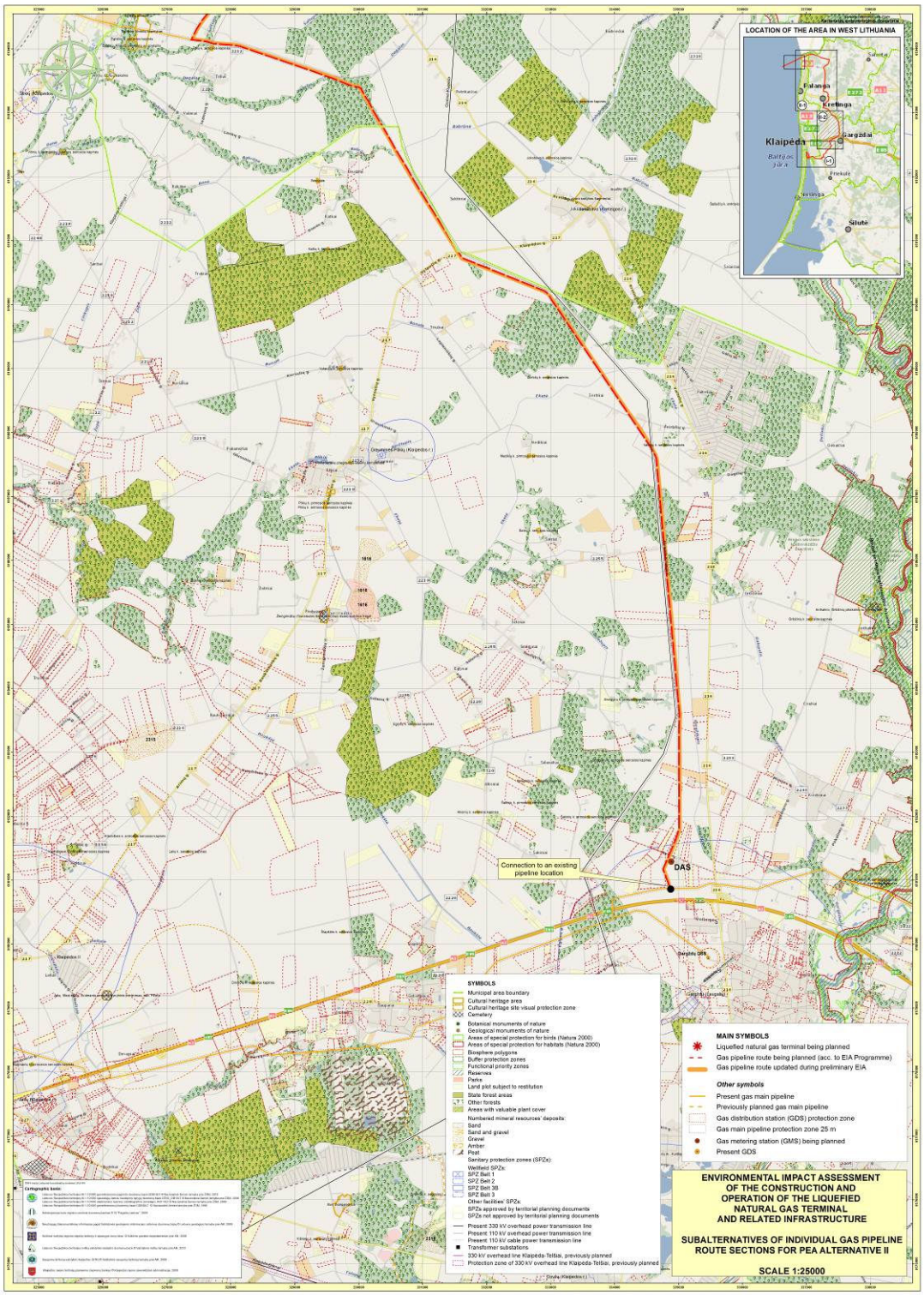

Fig. 7.2. Subalternatives of individual sections of the main gas pipeline option IIA for Alternative II

It has been concluded, on completion of a joint analysis of individual pipeline options and an assessment of potential impact on different aspects of the environment (biodiversity, landscape, living environment, territorial planning, land use), that the optimal main pipeline options are IA and IIA. In addition, individual pipeline route subalternatives related to the reduction of the impact on biodiversity and landscape and the territorial planning aspects are proposed for consideration.

On completion of a joint analysis of individual pipeline route subalternatives and an assessment of potential impact on different aspects of the environment (biodiversity, landscape, living environment, territorial planning, land use), the following pipeline route subalternatives of Alternative I are proposed as the optimal ones: IAa1, IAd, IAe, IAf, IAh, IAj, IAl, and IAn.

These subalternatives are proposed to be applied if the gas pipeline is constructed by the open excavation method. If the HDD method is applied in individual sections, provided that the relevant legal issues are resolved (changing of the purpose of land use: from forest land to “other land use purposes“; management of the gas pipeline protection zone), the pipeline could be constructed based on the main route option of Alternative I, upon slight adjustments in territorial planning terms.

For Alternative II, the following pipeline route subalternatives are proposed as the optimal ones: IIAd, IIAe, IIAf, IIAg, IIAh.

In case of Alternative I, if the gas pipeline route is adjusted according to the subalternatives proposed, the length of the route would be 17.81 km (in the Curonian Lagoon and inland), in case of Alternative II – 70.09 km (in the Baltic Sea and inland). The gas pipeline in Option IIA of Alternative II is 3.9 times longer than Option IA of Alternative I.

Selection of the optimal PEA alternative

The following final conclusions have been drawn on assessment of the results of the PEA alternatives‘ analysis and comparison:

- Both PEA alternatives that are based on location and technological choices are feasible, however, the conditions of their realisation and their potential impact are different.
- The strongest adverse impact on the environment would be produced in the PEA construction and installation phase, however, the impart would be a short-term one in many cases. In Alternative I, if the proposed subalternatives for the locations of individual route sections and technologies are selected, the impact would be weaker than in Alternative II.

- In the operation phase, there would be no adverse impact on most of the components of the environment, provided that the construction is carried out in line with the proposed preventive and mitigating measures. In this phase, the PEA can have certain impact on ambient air and quality of surface water bodies, however, the limit values would not be exceeded. A comparison of both Alternatives shows that both Alternatives are very similar by their summary impact, however, Alternative I stands out more by the sensitivity of the present social environment;
- Alternative I is more favourable than Alternative II based on the facilities planned and their projected parameters;
- Alternative I is more favourable than Alternative II based on the time needed for realisation;
- Alternative I is more favourable than Alternative II based on the necessary realisation costs;
- to sum up, the results of the assessment and comparison of the PEA Alternatives (from the environmental, technical and economic standpoints) show that Alternative I (at the Kiaulės Nugara Island) is optimal, with the main gas pipeline route option IA selected and with the individual gas pipeline routes' subalternatives IAa1, IAd, IAe, IAf, IAh, IAj, IAl and IAn applied (Fig. 8).

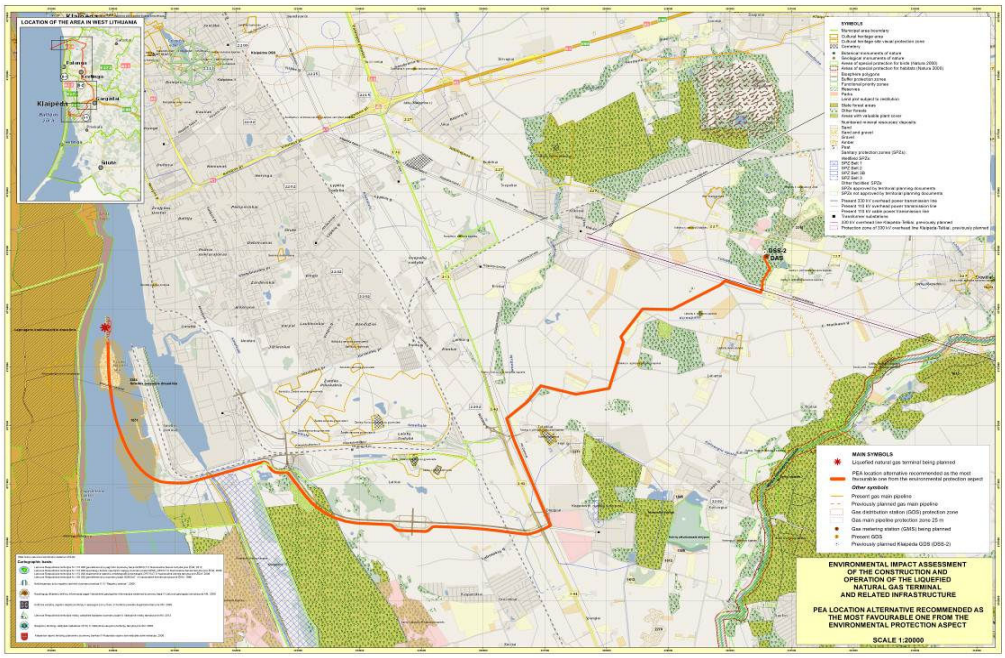

Fig. 8. Optimal Alternative proposed for the implementation of the PEA

1.4.1. ANALYSIS OF POTENTIAL EMERGENCY RISKS

In order to make a comprehensive assessment of consequences and risks of potential emergencies and incidents in the LNG terminal, a set studies are prepared: (1) analysis of ship collision risk, (2) conceptual risk assessment (CRA), (3) hazard identification study (HAZID), (4) qualitative assessment of risks for nearby areas and facilities (QRA), (5) safety report; and (6) risk management plan. Fluor S.A. has commissioned these studies to ERM (Environmental Resources Management Southwest, Inc.) with a vast international experience in this kind of work.

The first four documents were prepared during the EIA. Their results show that:

- in case of construction of an offshore LNG terminal, there is no risk to the adjacent areas because the consequences area would not reach the shore even in case of worst emergencies;
- in case of construction of an inland LNG terminal, the determined consequence areas in case of accidental collision with a LNG carrier show that the nearby Curonian Spit and Klaipėda port areas as well as surrounding areas could be affected, however, the probability of such an incident is very low due to the navigation speed limitations in the port, the mandatory use of tugboats, and restrictions on other large vessels traffic in the port during the LNG tanker‘s transit;
- the maximum calculated LSIR for the underground inland pipeline (at the depth of 1 m) is $8.45 \cdot 10^{-8}$, which is less than the universally accepted risk (LSIR=$1 \cdot 10^{-7}$).

In order to reduce the probability of ship collisions, to better control access to the area of the LNG terminal, to separate the LNG terminal from other port users, to maintain a safe distance to non-controlled ignition sources and reduce the probability of the vapour cloud‘s ignition in case of accidental leakage, and to protect the facility against terrorist acts, a special protection zone is proposed: restricting navigation of other ships within the distance of 125 m from the LNG terminal and 125 m from the moored LNG tanker.

1.4.2. MONITORING

The necessity for and application of the PEA monitoring is governed by the Regulations on Environmental Monitoring by Economic Entities.

Monitoring of ambient air pollution sources

Monitoring of the following pollutants emitted from permanent pollution sources into ambient air would be required during the LNG terminal‘s operations: carbon monoxide, nitrogen oxides

and solid particles (for both Alternatives). Frequency of pollutants' monitoring – at least once in a year.

Furthermore, monitoring of the nitrogen oxides concentrations in ambient air should be conducted as well. It is recommended that this monitoring is conducted by the mathematical modelling method.

No monitoring of the PEA's impact on surface waters, soil, the Earth interior and biodiversity is provided for.

Monitoring of impact on the shores

It is recommended that the network of monitoring points used for the monitoring of dynamics of the Klaipėda port's shores should be made denser in the section from the end of the embankment until the southern end of the Kiaulės Nugara Island.

1.5. TRANSBOUNDARY IMPACT OF PEA

1.5.1. LEGAL REGULATION

EIAs of planned economic activities in a transboundary context are governed by a number of legal acts. The following legal acts are relevant to the PEA:

- Republic of Lithuania Law on the Ratification of the 1991 Convention on Environmental Impact Assessment in a Transboundary Context (Official Gazette, 1999, No. 92-2687);
- Convention on Environmental Impact Assessment in a Transboundary Context (ESPOO, 1991) (Official Gazette, 1999, No. 92-2688);
- Agreement by and between the Government of the Republic of Lithuania and the Government of the Republic of Poland on the Implementation of the Convention on Environmental Impact Assessment in a Transboundary Context (Official Gazette, 2004, Nr. 92-3353).

According to the Procedure for the Examination of the Environmental Impact Assessment Documentation by the Ministry of Environment and Subordinate Institutions (Official Gazette, 2006, No.75-2882; 2008, No.143-5749; 2010, No.59-2939, No.89-4731; 2011, No.118-5582), the Ministry of Environment must inform the EU Member State and/or a foreign state – a contracting party to the 1991 UN Convention on Environmental Impact Assessment in a Transboundary Context ("the Convention") (Official Gazette, 1999, No. 92-2688) that can suffer an adverse environmental impact, of any planned economic activity with a potential transboundary impact, specifying the nature of the decision to be adopted on the activity and the time limit within which a notice of the expected time of completion of the Report can be given. On receipt of a reply from such EU Member State or such foreign state – a contracting

party to the Convention, informing about a wish to take part in a transboundary environmental impact assessment, the Ministry of Environment must organise interstate consultations on the potential transboundary impact of the PEA and the measures to mitigate or avoid the impact. The Ministry of Environment must provide to the EU Member State or the foreign state that can suffer an adverse environmental impact the information about the EIA procedures and must specify the time limit for the submission of proposals. Furthermore, the Ministry of Environment must submit the text of the decision adopted, accompanied by a statement of reasons and motives for the decision and an explanation of how the results of the consultations were taken into consideration. The Ministry of Environment is responsible for the coordination of consultations with the EU Member States and/or foreign states – the contracting parties according to the provisions of Article 6(3) of the Convention.

1.5.2. OBJECT OF POTENTIAL IMPACT

An assessment of the environmental impact of the planned economic activity, i. e. the construction and operation of the LNG terminal and related infrastructure was made for the following location alternatives:

- Alternative I (at the Kiaulės Nugara Island) – the LNG Terminal constructed in the southern part of the Klaipėda State Seaport at the Kiaulės Nugara Island and the gas pipeline constructed from the terminal up to the connection point, i.e. the Klaipėda-Jurbarkas main gas pipeline that has already been designed and will be built in 2013 in Kiškėnai village, Dovilai ward, Klaipėda municipality;
- Alternative II (at Būtingė) - the LNG Terminal constructed in the Baltic Sea near Būtingė and the gas pipeline constructed from the terminal up to the connection point, i.e. the Šiauliai-Klaipėda main gas pipeline in the Saulažolės village, Dauparai – Kvietiniai ward, Klaipėda district municipality.

If Alternative II is selected, the distance separating the location of the LNG terminal from the Lithuanian – Latvian border would be over 4 km in the Baltic Sea and 10.5 km inland (Fig. 9). The Latvian territory near the border is the territory of the Papė Nature Park (the southern boundary of the protected area almost coincides with the state border).

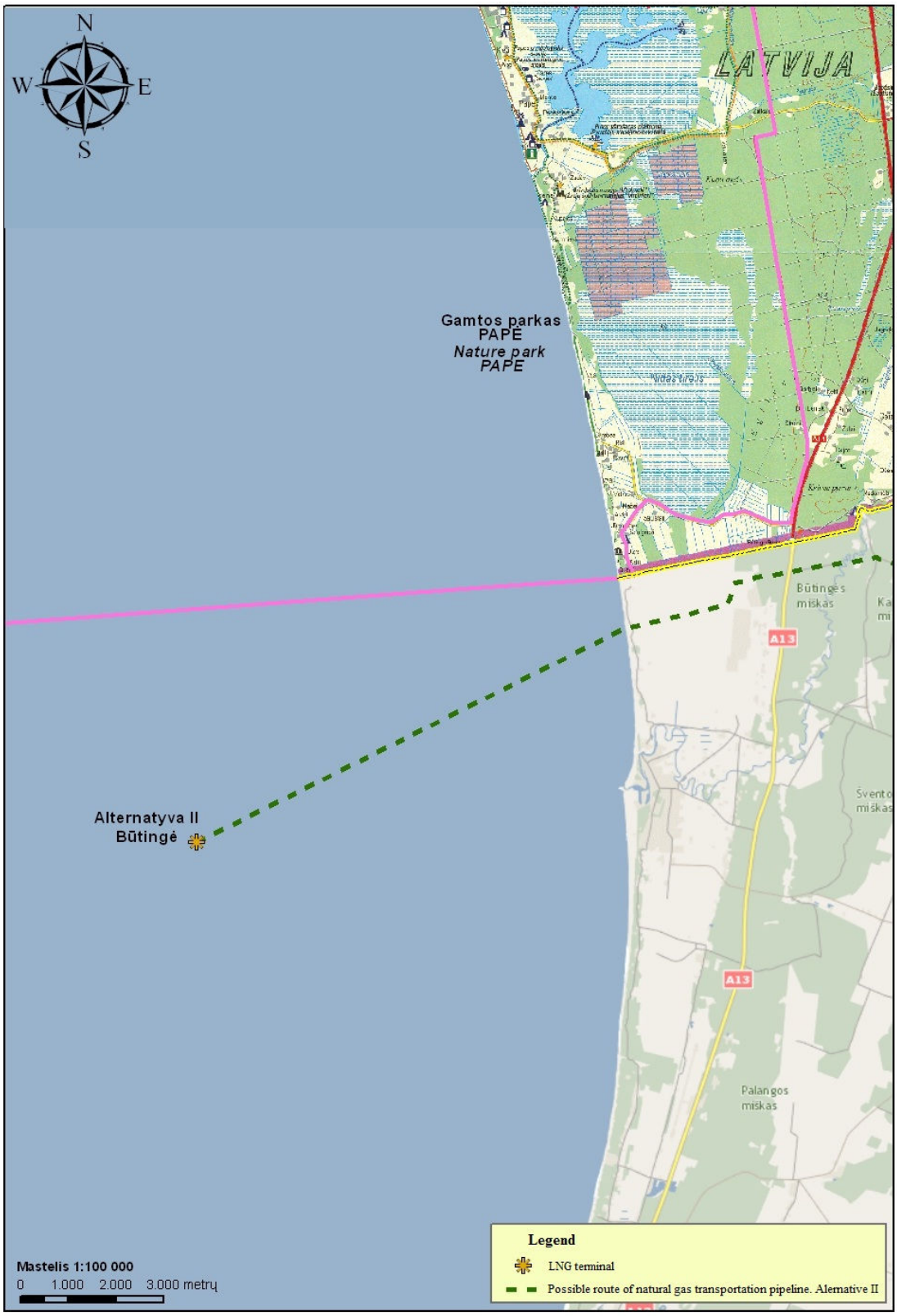

Fig. 9. Location of the PEA Alternative II with respect to the territory of the Republic of Latvia

Description of the Papė Nature Park

The Papė Nature Park extends in the western part of Latvia. It starts near the border with Lithuania and ends at Jurmalciems village in Liepoja county. The 51,777 ha area includes coastal meadows, the Papė lake, boglands, and a number of historical and architectural monuments. Visitors can have an opportunity to observe wild horses and rare bull herds. The Papė region was designated as a protected nature park in 2002, and in the same year the park was included in the Ramsar Convention, the main purpose of which was to ensure rational use of natural resources and to protect the boglands important for the survival of our plant. In 2004, the Papė Nature Park became a territory protected on the Community scale as it was included in Natura 2000.

The central area of the park (5664 ha) including the Papė Lake with boggy shores, an extraordinary ecosystem of the Nida bog, and an imposing Baltic Sea coast is the most important and most beautiful part of the Papė Park. The Nida bog is closest to the Baltic Sea among similar natural formations in Latvia. The unique location of the bog has resulted in the nearby sea waters washing vast bog areas rather than sandy beaches. In this territory, 22 biotopes of Community significance have been recorded including 11 priority biotopes and 14 biotopes under special protection.

There are several settlements – former fishermen‘s villages in the Papė Nature Park: Prediengalciems, Papės Kanuciems and Nidasciems. The majority of the houses have been reconstructed into summer cottages but some remain neglected.

The Papė Nature Park is an important birds‘ migration area. 2478 bird species, 1298 butterfly species, 376 other invertebrates species, 11 reptiles and amphibian species, 34 mammal species, and 21 freshwater and 32 saltwater fish. The Papė Lake and the sandy beaches of the Baltic Sea are places where birds like to rest. The park also boasts rich flora: 632 plant species have been recorded. They are divided into five groups: dune, meadows, forest, bog and water plants.

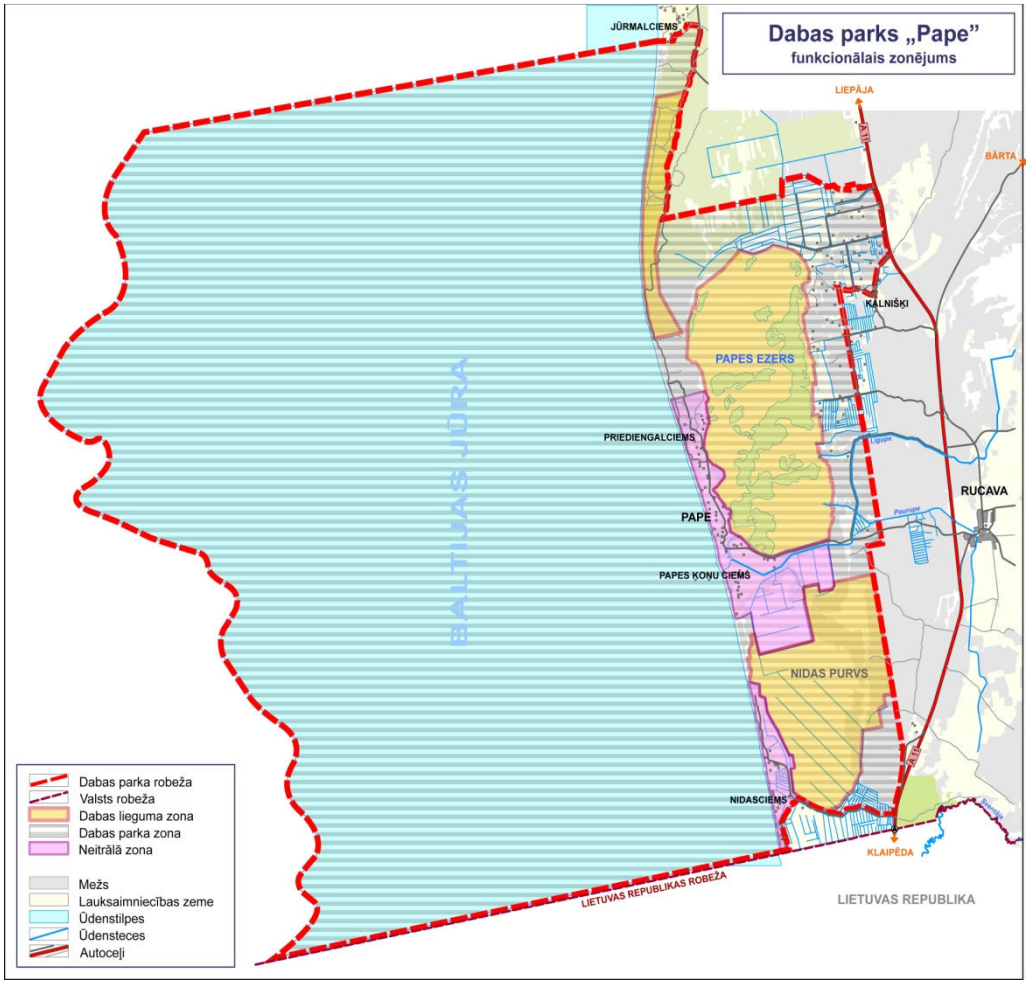

Fig. 10. Papė Nature Park in Latvia

(Source: http://www.pdf-pape.lv/uploaded_files/Zonejums.pdf

1.5.3. FACILITIES ALREADY OPERATING AND PLANNED IN THE PEA AREA

Būtingė Oil Terminal

The Būtingė Oil Terminal, which was put into operation in 1999, and the Mažeikiai Oil Refinery operated by ORLEN Lietuva is connected by a 91.5 km oil pipeline. The annual import capacity of the terminal is up to 12 million tons of oil. Tankers of up to 150,000 tons capacity can be serviced by the Būtingė Oil Terminal. After supply of oil via the Druzhba oil pipeline was stopped in 2006, ORLEN Lietuva uses tankers to deliver raw materials to the oil refinery. The tankers are moored at the single point mooring buoy (SPM) located offshore, at the distance of 7.5 km from the shore. Oil is transferred from the tanker via the SPM to an oil pipeline constructed on the sea bed, for further delivery to the tanks on the shore. According to Alternative II, the location of the LNG terminal would be at the distance of about 4 km to the SW from the SPM.

On 1 June 2012, the Būtingė Oil Terminal owned by ORLEN Lietuva will service the 800th tanker since the start of the terminal‘s operations and the 35th tanker this year. In 2011, the Būtingė Oil Terminal handled over 9 million tons of oil and serviced 90 vessels.

The Būtingė Oil Terminal employs state-of-the-art technologies including an oil leakage detection system. A stringent environmental monitoring programme was approved based on the environmental impact assessments carried out by international and Lithuanian experts. The programme is being used for the continuous environmental monitoring of the terminal. The results of the monitoring are published on an annual basis.

Šventoji State Seaport

The Šventoji State Seaport is located in the Šventoji River delta, near the northern part of the Lithuanian-Latvian border. At present the port is used very rarely due to its technical capacities and natural conditions. The Klaipėda State Seaport Authority (KSSA), however, considers that the port has good prospects and is currently examining the opportunities for its reconstruction. The impact of the port operations on the environment is being considered as well. The KSSA has asked the Hydrological Laboratory of the Lithuanian Energy Institute to carry out an environmental impact assessment. The EIA Report was prepared [1] and its results were communicated to the Latvian public. The EIA Report examines different alternatives for the reconstruction and development of the Šventoji State Seaport, including subalternatives, and the impact of their realisation on the environment (including the territory of the Republic of Latvia). The assessment has led to the conclusions on the impact on the environment in the Republic of Latvia: if the port reconstruction alternative 2B is implemented, changes in the flow structure and sediment motion in the near-shore areas will be minimal; the 3E alternative can cause significant changes in the sediment motion and accumulation processes in the near-shore area. Considering this conclusion and the need to minimise the impact on the near-shore area of the neighbouring state, it is proposed that the sand excavated from the approach channel should be used for the feeding of the beaches to the north from the port.

Deep-water Harbour

At a meeting held on 16 September 2011, the Port Development Council gave its approval to the construction of an external deep-water harbour in Būtingė. In 2012-2013, the special plan for the harbour will be prepared and a strategic assessment of consequences for the environment will be made. Later, in 2014-2015, an EIA for the Būtingė deep-water harbour will be prepared in order to make a detailed assessment of the impact of this facility and to plan measures to mitigate any negative impact.

Should it be established, during the EIA for the Būtingė deep-water harbour, that the facility id acceptable from the environmental point of view, the preparation of the detailed plan and the

technical design for the construction of the harbour will be started in 2015–2016. However the start of the construction will depend on the development in the global and local marine markets. It is expected that the first terminal will be put into operation in the Būtingė harbour around 2020.

Potential impact of the PEA

The potential impact of the PEA on a transboundary level (upon the Republic of Lithuania) can only be related to the PEA Alternative I (Fig. 1). The LNG terminal could have a potential impact on the Baltic Sea during the construction of the berth, the breakwater, and the subwater gas pipeline. The construction and operation of these facilities could cause local changes in the hydrodynamic processes, shore formation, benthal flora and water fauna, and these changes can potentially reach the territory of the Republic of Lithuania. The PEA impact in case of potential emergencies should be considered as well.

Considering the above, the following actions of transboundary information on the PEA and the initiation of the EIA procedures were taken:

- information on the PEA and the EIA procedures intended for the Republic of Latvia was prepared in Lithuanian, Latvian and English;
- the information was agreed upon with the Ministry of Environment of the Republic of Lithuania and submitted to it;
- by its letter No. (10-3)-D8-972) of 30 January 2012, the Ministry of Environment of the Republic of Lithuania informed the Ministry of Environmental Protection and Regional Development of the Republic of Latvia about the PEA and the EIA procedures, requesting to provide, by the end of February 2012, a reply on the willingness to take part in the EIA process.

The Ministry of Environmental Protection and Regional Development of the Republic of Latvia expressed its willingness to take part in the EIA process and presented relevant proposals in its letter No. 2/8-7/2008/4988 of 26 March 2012 (Annex 1).

Sweco Lietuva UAB, a company responsible for the preparation of the EIA documentation, completed the EIA for the PEA and prepared the EIA Report. The assessment was made for the construction and operation phases for both location alternatives identified. On completion of detailed EIA for each Alternative, they were compared and the optimal Alternative was selected. It has been established, based on the results of expert assessment, that **Alternative I (at the Kiaulės Nugaros Island within the area of the Klaipėda State Seaport) is optimal from the standpoint of impact on the environment.** In this case the location of the LNG terminal being planned would be at the distance of about 46 km from the

territory of the Republic of Latvia. The EIA has shown that, in case if Alternative I is selected, there will be no impact on the territory of the Republic of Latvia and its natural and social environment during the construction and operation of the PEA facilities (Table 2).

Different aspects of potential impact in case of Alternative II are presented in Table 2. It should be noted that the PEA would not have any significant adverse impact on the territory of the Republic of Latvia and its natural and social environment in this case, either.

Table 2. Comparison of the PEA location Alternatives I and II in terms of potential impact on the natural and social environment in the territory of the Republic of Latvia

Item No	Object of impact	Potential impact on the natural and social environment in the territory of the Republic of Latvia	
		Construction and operation phases	
		Alternative I	Alternative II
1	2	3	4
1	Inland surface water bodies:	No impact on the natural and social environment in the territory of the Republic of Latvia if this PEA Alternative is realised	No impact
1.1	Curonian Lagoon (impact upon water)		-
1.2	Baltic Sea (impact upon water)		The breakwater will protect the LNG terminal's water area against high waves. The height of waves toward the shore at the distance of 1 km from the breakwater will be 1.8 m with the NW wind, 1.0 m – W wind, and 2.0 m – SW wind; if no breakwater is built, the wave heights would be 3.4 m, 3.8 m and 3.6 m respectively. Changes in the flow rates and sediment motion in the near-shore area in the Baltic Sea, caused by the construction of the breakwater, have been determined only in the nearest vicinity of the breakwater, with the 20 m/s SW, W and NW winds. The extent of deformations of the bottom near the Baltic Sea shores will depend on the direction of strong winds, however, benthal erosion and the accumulation of sediments will occur only in the environment nearest to the breakwater. Construction of the breakwater will not cause any shore deformations as no changes in the flow rates and sediment flows in the near-shore areas have been determined (more detailed information provided in the EIA report I book Chapter 4.1.5.).
2	Shores		In case of Alternative II, the LNG terminal will be constructed at the distance of nearly 8 km from the shoreline (at the

Item No	Object of impact	Potential impact on the natural and social environment in the territory of the Republic of Latvia	
		Construction and operation phases	
		Alternative I	Alternative II
			depth of 18-19 m), therefore, neither construction nor operation will have any impact on the geodynamic situation of the area. The shore will be “damaged“ only during the construction of the gas pipeline at the point where it reaches the sea, covering a shore section 5 to 10 m wide. The negative impact on the shore will arise from the moving, during the excavation works, of the shoreline sediments that have adapted to the prevailing hydrodynamic conditions (including wave transformations, water level dynamics, groundwater filtration etc.) over time. Therefore, temporary local wash of the shore is probable.
3	Atmosphere	No impact on the natural and social environment in the territory of the Republic of Latvia if this PEA Alternative is realised	No impact
4	Soil		No impact
5	Earth interior		No impact
6 6.1	Flora: Inland flora		 No impact
6.2	Water flora		No impact
7 7.1	Fauna: Mammals		- No impact
7.2	Invertebrates, reptiles		No impact
7.3	Ornithofauna		No impact
7.4	Ichthyofauna		There are no significant Baltic herring spawning place in the water area near Būtingė, however, there is one near Palanga. Larger Baltic herring spawning places occur in Latvia, at Papė settlement. Therefore, Latvian environmentalists have raised the issue during the construction of

Item No	Object of impact	Potential impact on the natural and social environment in the territory of the Republic of Latvia	
		Construction and operation phases	
		Alternative I	Alternative II
			the Būtingė terminal and subsequently due to emergencies in the terminal. So it is very likely that similar conflicts may arise during the construction of the LNG terminal at Būtingė. The modelling has shown that sediments should not reach the Baltic herring spawning places in Papė during the construction of the berth and the breakwater.
7.5	Zoobenthos, benthal habitats		There is a threat in case of hurricane winds, even though such winds are rare. If larger areas of hard bottom are covered by sediments in such cases, destruction of biocenoses can be quite significant. The risk would be particularly high if the sediments cover the aquatic plant colonies important for the Baltic herring. In such a case the losses would be considerable, in particular if the impact reaches the territory of the Republic of Latvia.
8	Landscape		No impact
	Components of social environment		
9	Cultural heritage sites		No impact
10	Socio-economic environment		No impact
11	Public health		No impact
12	Impact of emergencies		No impact In case of fire and accidental leakage in FRSU, heat radiation zone would reach approximately 1,5 km from the leakage place. FRSU is planned in a distance of 10 km off the shore, therefore, a risk to other facilities and territories, etc. and to the territory of the Republic of Latvia shall be

Item No	Object of impact	Potential impact on the natural and social environment in the territory of the Republic of Latvia	
		Construction and operation phases	
		Alternative I	Alternative II
			considered insignificant (more detail information is presented in the report of concept of risk assessment (CRA) chapters 10.4 and 14.1).

The results of expert assessment show that Alternative I (in the territory of the Klaipėda State Seaport, at the Kiaulės Nugara Island) is optimal in terms of the EIA's impact upon the environment. In such a case the distance between the LNG's terminal site and the Lithuanian-Latvian border would be about 46 km. The EIA has shown that, if Alternative I is selected, the construction and operation of the PEA facilities will have no impact on the territory of the Republic of Latvia and its natural and social environment.

1.6. CONTACT DETAILS

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ANNEXES