Aigren Kaevandus OÜ
Kalkahju Dolomite Quarry
Environmental Impact Assessment Programme

For public display

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CONTENTS

1 INTRODUCTION

The objective of the environmental impact assessment (EIA) is to fulfil the requirements for applying for a mining permit for construction dolomite at Kalkahju Dolomite Quarry, Mõniste rural municipality, Võru county, Estonia. Aigren Kaevandus OÜ applies for a permit for extraction of mineral resources in the extracting permit area at Kalkahju Dolomite Quarry. The planned area of activity is located in Karisöödi village, 1st land unit of Mõniste forest district (cadastral register number 49301:003:0570). The size of the extracting permit area is 77.6 ha, with a service area of 101.89 ha. The active reserves of construction dolomite in the extracting permit area amount to 4,054,000 m^3 while extractable reserves amount to 3,836,000 m^3. The planned annual average rate of extraction is 160,000 m^3.

The goal of the planned activity is to sell dolomite for use as a construction material, particularly in road construction and buildings.

The environmental impact assessment of the planned activity has been initiated with letter No. PVV 10-5/13/19212-3 of the Estonian Environmental Board of 30 August 2013. The initiation is based on § 3 (1 and 2), § 5, § 6 (1) 28) and § 11 (3) of the Environmental Impact Assessment and Environmental Management System Act (EIAEMSA). Pursuant to § 6 (1) 28) of the EIAEMSA, open-cast mining where the surface of the site exceeds 25 hectares is an activity with significant environmental impact. § 11 (3) of the EIAEMSA stipulates that in the case of activities specified in § 6 (1), environmental impact assessment of proposed activities shall be initiated without providing the reasons therefor.

The purpose of the environmental impact assessment of the dolomite quarry is to provide decision-makers and the public with information on significant environmental impacts of the proposed activities, incl.:

- evaluation of the actions required for establishing a quarry, the relevant aspects thereof ('consequences' according to EIAEMSA) and the potential impact on various elements of the environment and on the host environment;
- evaluation of the aspects and potential environmental impact associated with the running and maintenance of the quarry;
- estimating potential direct and indirect positive and negative changes in the environment;
- highlighting significant aspects and impacts and estimating their scope;
- proposing options for preventing and alleviating any negative impacts and increasing positive impacts;
- making recommendations for establishment of environmental and monitoring requirements to control and minimise any potential negative environmental impacts associated with the establishment, running and maintenance of the quarry.

The purpose of the EIA programme is to specify the scope of the environmental impact assessment, to identify any areas where impacts could potentially occur, as well as areas where assessment is not relevant.

The EIA will be conducted by Estonian, Latvian & Lithuanian Environment OÜ (ELLE) as the lead expert, having assembled and expert group consisting of experts from ELLE, the Estonian University of Life Sciences and AS Infragate Eesti. The details of the parties of the EIA and members of the expert group are listed in Chapter 6 of the programme. The environmental impact assessment will be based on the requirements for the EIA procedure and content as specified in the Environmental Impact Assessment and Environmental Management System Act and in its implementing legislation.

Environmental impact assessment is a tool in the process of making decisions on environmental permits. Pursuant to the procedure specified in EIAEMSA, the aim of the assessment is to provide decision-makers with information on potential environmental impacts of the proposed activities. The decision-maker will base the final decision on various types of information, with the EIA report and its findings being only one, and not necessarily decisive, element of the entire spectrum of information.

2 PROPOSED ACTIVITIES AND ALTERNATIVE OPTIONS

2.1 Objective and brief description of the proposed activities

The objective of the activities proposed by the developer, Aigren Kaevandus OÜ, is the sale of dolomite. To achieve this objective, the developer would like to establish a dolomite quarry on the Kalkahju mineral deposits of local importance for extracting an average of 160,000 m^3 of mineral resources per year over a period of 25 years.

The geological structure of the area in Mõniste rural municipality is suitable for establishment of a quarry. In Estonia, bedding surfaces generally have a southward inclination. This bedding also causes a similar inclination of the upper strata (Edicaran, Cambrian, Ordovician, Silurian, Devonian). The majority of carbonate minerals, which can be used as construction minerals, can be found north of the Pärnu-Peipsi line in the form of Ordovician limestone. South of the aforementioned line the bedding is covered with relatively soft Devonian sandstone (Figure 1). Limestone and dolomite, suitable for constructions, reappear as Upper Devonian carbonate banks only on limited areas in Southeastern Estonia.

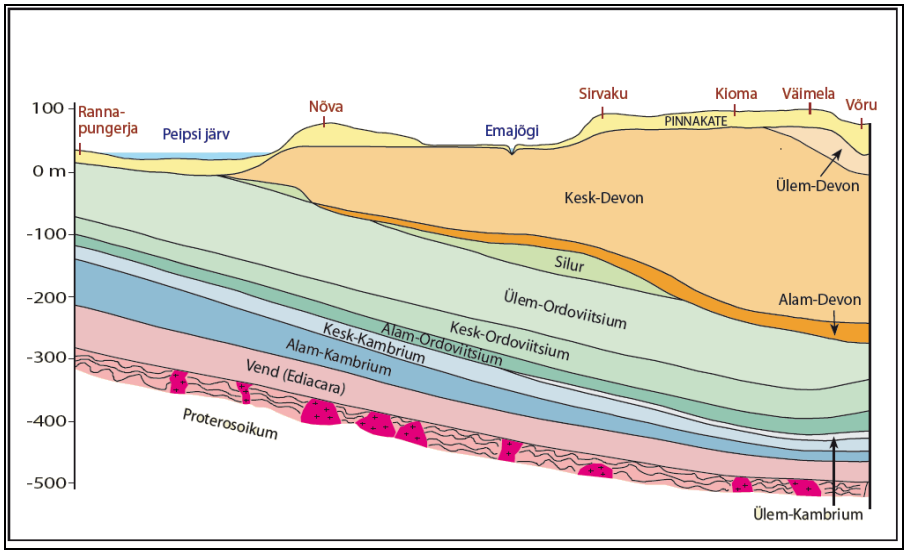

Figure 1. Geological section at Rannapungerja-Võru line (Source: Pirrus, E., *et al.* 2006[1])

Naha mineral deposit has been identified as the second usable dolomite reserve, closest to Kalkahju dolomite quarry (distance a little over 1 km), for which an extraction permit application is also being processed, and the respective environmental impact assessment has been initiated. In terms of combined impact, it is important to note that essentially the same type of construction dolomite is also extracted on the other side of the state border, in the Republic of Latvia.

The proposed activities entail sales of construction dolomite and the preceding extraction of dolomite in Kalkahju dolomite quarry at Kalkahju mineral deposits. At the time of preparation of the EIA programme, a geological survey[2] of the Kalkahju survey area of the dolomite deposits has been completed and an application for an extraction permit has been submitted to the Environmental Board. The future stages of the activities can be grouped as follows:

- environmental impact assessment and applications for activity licences, selection of the best technology;
- preparation of the quarry;
- extraction of dolomite in Kalkahju quarry;

[1] Pirrus, E., Nestor, H., Soesoo, A., Linna, A. 2006. Vend ja kambrium Eestis ning Lõuna-Soomes. GEOGuide Baltoscandia.

[2] OÜ Inseneribüroo Steiger, 2013. Kalkahju dolokivimaardla Kalkahju uuringuruumi geoloogilise uuringu aruanne (varu seisuga 01.06.2013). Töö nr 13/1089.

- decommissioning: closure and rehabilitation of the quarry.

Preparation of the quarry entails cleaning of existing trenches and digging of new trenches within the service area. Furthermore, deforestation and uprooting of stumps are required in areas where it has not been done before. Cutting will be performed gradually, i.e., through the area where extraction is planned to start within the next two years. New access routes will be built and/or the capacity of existing routes will be upgraded as necessary.

Deforestation will be followed by the removal of the upper soil layer from the extraction area. The removed soil will be used to build mounds around the extraction area.

The extraction of dolomite will comprise the following operations: blasting, crushing of dolomite blocks, screening of the resulting material and loading it on means of transport. The equipment used in the quarry will include a crusher, screening plant, hydraulic excavators and wheel loaders. The auxiliary operations to facilitate extraction and sale of dolomite will include transportation of workers, equipment, accessories and extracted material. The main envisaged outward haulage route will be the Mõniste-Tiitsa-Karisöödi secondary road with an exit to the Võru-Mõniste-Valga basic road.

As all the dolomite reserves are located below the groundwater level, extraction in the quarry requires lowering of the water level or utilisation of an underwater extraction technology.

In case of underwater extraction, blasting takes place under water. The blocks broken off under water will be lifted to drain on the surface, after which the blocks will be crushed and screened. The excess water from the extraction area will be discharged through trenches to Peetri River, but the volume of discharged water will be much lower than in case of on-land extraction.

In case of on-land extraction, the incoming groundwater will be discharged through trenches to Peetri River and blasting will take place above the water line. Other operations will be similar in case of both extraction methods.

The estimated extractable reserves of Kalkahju extracting permit area amount to 3,836,000 m^3 and the average annual rate of extraction would be 160,000 m^3. The extracted dolomite would be sold mainly as construction gravel. It is likely that the actual extracted volume will be much lower. The developer estimates that the annual average extracted volume will not exceed 80,000 m^3 during the first 5 years. However, it is known that a significant part of the investments of the EU Cohesion Fund during the programming period 2014-2020 will be allocated to improving road transportation, which could create a strong demand for construction materials used in road construction. Consequently, the exact construction volumes and material demands will depend on the investment plans of the Estonian Road Administration and local governments, which have not been finalised at this time.

After termination of extraction the quarry will be rehabilitated and redesigned as a water body. In final rehabilitation, the previously removed soil, collected in mounds, will be used as the refilling material.

The following Figure (Figure 2) shows the main inputs and outputs of the quarry.

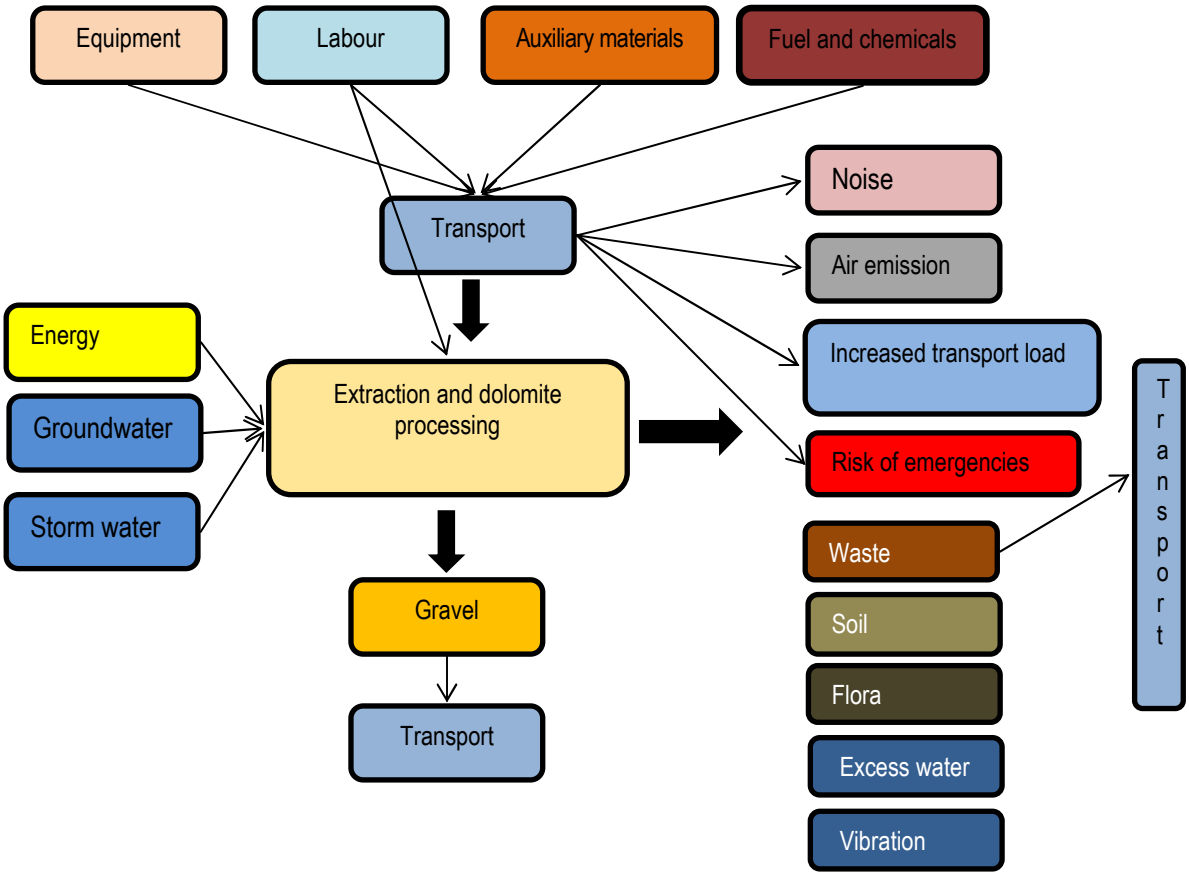

Figure 2. The main inputs and outputs of the quarry operations

2.2 Realistic alternative options

In environmental impact assessment, alternatives are understood as other options for achieving the objective established by the developer. Such options can be based on alternative locations, technologies or timeframes. To be realistic, the alternatives have to meet the following criteria:

- compliant with legislation;
- lack of unacceptable environmental impact;
- adequate for achievement of the objective (except zero alternative);
- economically feasible;
- technically feasible;
- conform to the best technical means available;
- are not clearly inferior to other alternatives;
- the developer has to be prepared to implement the alternative.

The objective of the proposed activities is the sale of dolomite and achievement of this objective requires extraction, processing and transport of dolomite. As specified in section 2.1 dolomite reserves in the area have been estimated only for Kalkahju and Naha deposits. As an application for an extraction permit has been filed for Naha mineral deposits as well, there are no feasible alternative locations within this EIA. However, a direction of extraction could be specified as a result of the EIA.

Alternative timeframes have not been specified in the course of preparation of the EIA programme, as the operating mode and extraction intensity over time will be largely determined by the demand for dolomite. If the

EIA indicates that imposing time restrictions would be the only way to alleviate the impact of the quarry, this will be specified in the EIA report and it will not constitute a separate alternative option.

The proposed quarry would be located in the immediate vicinity of the special area of conservation of Peetri River, included in the Natura 2000 network, with Peetri River envisaged as the receiving body of water for the extraction water. The majority of the mineral reserves are located below the groundwater level, which means that dry extraction of dolomite would require drainage of groundwater in addition to storm water drainage. The estimates indicate that 6,162 m^3 of water would have to be drained from the quarry on a daily basis during the snow-melting period in the spring (assuming that about half of the reserves have been extracted)[3]. The volumes of surface water and groundwater to be drained could have a significant impact on the flow rates and water regime of Peetri River.

Underwater extraction has been identified as a potential alternative options in the course of preparation of the EIA programme to reduce the drained water volumes and the consequent impact on Peetri River. This extraction method would not require drainage of the quarry, i.e., dolomite would be extracted (incl. blasting) below the water level. This would significantly reduce the volume of water drained from the quarry, with reduced potential impact on the special area of conservation of Peetri River. Another benefit of underwater extraction, in addition to lower environmental impact, would be lower operating costs associated with water drainage.

However, the advantage of on-ground extraction would be better utilisation rate of the mineral reserves, as a part of dolomite would not be extracted in the case of underwater extraction due to technical limitations on the maximum extraction depth. As both technological solutions meet the above criteria, they will be treated as equal alternative options in the EIA process.

In addition, further technological solutions could be identified during the EIA process (e.g., if a need for alleviation measures is established). Such solutions would be presented in the EIA report. For instance, alternative options can be considered for effluent treatment technology, with sediment ponds and fabric filters as potential alternatives. Any feasible alternative technical solutions and the need for such solutions will be specified in the course of further planning and the EIA.

Even though alternative volumes will not be within the scope of the EIA, the planned extraction volume could be reduced as a result of the EIA.

The above considerations indicate that there are no realistic alternatives to the proposed activity as such (the proposed activity is extraction of dolomite) and, consequently, the following aspects will be assess in the EIA process:

- **The proposed activities of the developer**, i.e., extraction of dolomite at volumes specified in the extraction permit (Alternative 1). Two technological alternatives for the activities will be assessed:
    - underwater extraction, and
    - on-ground extraction.
- **Continuation of the current situation** (zero alternative). The proposed activity will not be implemented, a quarry will not be established and dolomite will not be extracted. The zero alternative covers a situation where the type of land use in the area would remain unchanged, i.e., managed forest.

The following Figure illustrates the links and hierarchies between the alternatives and the objective and activity (Figure 3).

[3] OÜ Inseneribüroo Steiger, 2013. Kalkahju dolokivimaardla Kalkahju uuringuruumi geoloogilise uuringu aruanne (varu seisuga 01.06.2013). Töö nr 13/1089.

Objective	**Activity**	**Technological solution 1**
Sale of construction dolomite	Extraction of construction dolomite from Kalkahju quarry	On-ground extraction **Technological solution 2** Underwater extraction

Figure 3. The links between the alternatives and the objective and activity.

3 BRIEF DESCRIPTION OF THE ENVIRONMENTAL CONDITIONS IN THE PROPOSED AREA OF ACTIVITIES

The proposed area of activities, Kalkahju dolomite quarry, is located within the 1st land unit of Mõniste forest district (cadastral register number 49301:003:0570), Karisöödi village, Mõniste rural municipality, Võru county. The distance of the quarry to the nearest county capitals, the cities of Võru and Valga, is 50 km and 46 km, respectively (by road). At its closest point, the state border between Estonia and Latvia is located about 400 m from the southeastern edge of the quarry.

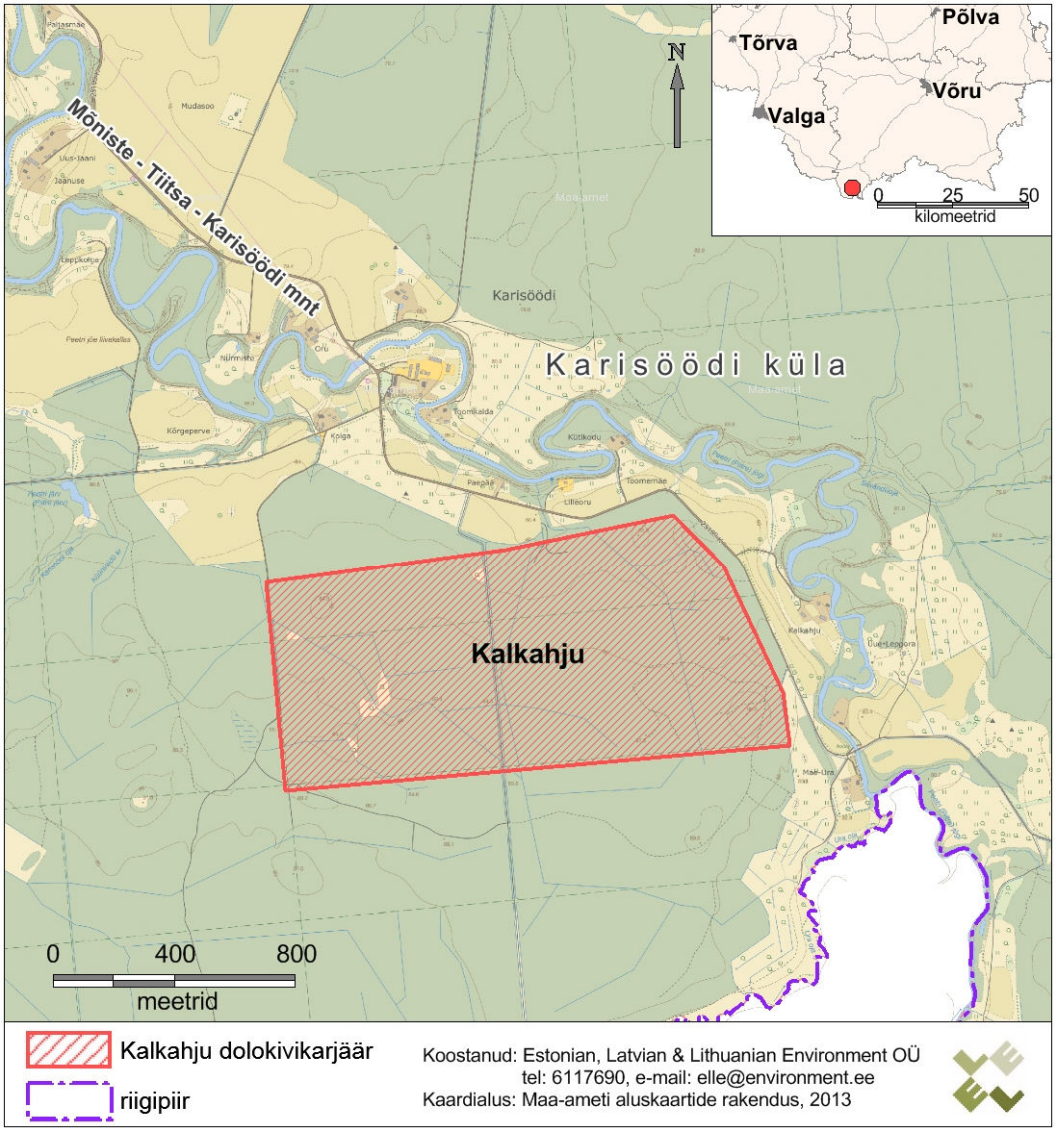

Figure 4. Proposed area of activities

The type of land use of the 1st land unit of Mõniste forest district has been specified as profit yielding land. Most of the territory of Kalkahju dolomite quarry is currently covered with forest. According to the Forest Register[4], it is mostly medium-aged forest community of the goutweed forest site type with spruces, birches and aspens as the dominant trees (Figure 5). Pines are dominant trees in the paludified central and southern areas of the territory, in the forest communities of the transitional mire and drained peatland forest site types. A part of the area has been clear-cut (Figure 6).

[4] Public Forest Register, http://register.metsad.ee/avalik/ (13.12.13)

Figure 5. Forest community in the middle of the territory

Figure 6. Clear-cut area in the northeastern part

The territory has a relatively flat relief. The absolute height is generally within the range of 79-89m, with inclination towards the northeast. Soil thickness on the territory ranges from 1.2 to 8 meters and it is composed of topsoil, clay, loam and loam moraine. Under Quaternary sediments, there are dolomite rocks (layer thickness: 1.2 - 6.3 m) of the Pskov formation, Plavinas regional stage, Upper Devonian series. The bedrock of the Pskov formation is composed of clayey dolomite rock and dolomitic marlstone layers of Snetnaya Gora formation, Plavinas regional stage[5].

Kalkahju dolomite quarry is a part of the Kalkahju mineral deposit. The active reserves of high-quality construction dolomite within the 77.6 ha of the Kalkahju survey area have been estimated at 4,054,000 m^3.

There are drainage trenches and forest division lines passing through the entire territory. The territory is bisected by a local dirt road, running from north to south (Figure 7) and connecting the area with Mõniste-Tiitsa-Karisöödi secondary gravel road (Figure 8).

Figure 7. The dirt road bisecting the territory

Figure 8. Mõniste-Tiitsa-Karisöödi road

Karisöödi village is a low-density area. The proposed area of activities is mostly surrounded by forest land, natural grasslands and fields. The closest residential buildings are located 200 to 300 meters from the boundary of the proposed area of activities, on the lands at Peetri River. The Karisöödi village centre, incl. Karisöödi Park, is located about 500 m north of the territory in question. Mõniste small town, the rural municipality centre, is located 8 km from the proposed area of activities, measured on a direct line.

The proposed area of activities is located within Koiva river basin. The closest natural water body – Peetri River – passes Kalkahju dolomite quarry at about 200 m to the east and north. With the Minister of the Environment Regulation No. 73 of 15 June 2004, Peetri River has been included in the list of spawning sites and habitats of salmon, brown trout, sea trout and grayling. According to the

[5] OÜ Inseneribüroo Steiger, 2013. Kalkahju dolokivimaardla Kalkahju uuringuruumi geoloogilise uuringu aruanne (varu seisuga 01.06.2013). Töö nr 13/1089.

Koiva River Basin Management Plan[6], Peetri River has a very good ecological status. According to the River Basin Management Plan, the groundwater bodies in the area have a good ecological status.

Peetri River is also a part of the special area of conservation of Peetri River, a part of the Natura 2000 network (international code of the area: EE0080608). The special area of conservation is located to the east and north of Kalkahju dolomite quarry and its boundary is less than 100 m from the outer boundary of the quarry survey area (Figure 9).

The southern part of the special area of conservation is also protected as landscape protection area of Peetri River. The protection rules have established the following conservation objectives for the landscape protection area of Peetri River: protection of the typical canyon valley of Peetri River with its Devonian sandstone outcrops and the Devonian limestone outcrops, which are unique in Estonia; protection of lesser spotted eagle, listed in Annex I to the Council Directive 79/409/EEC on the conservation of wild birds, and included in the species of the 1st protection category; protection of the following habitat types listed in Annex I to Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora: water courses (3260), northern boreal alluvial meadows (6450), lowland hay meadows with *Alopecurus pratensis* and *Sanguisorba officinalis* (6510), old natural forests (9010*), old broad-leaved forests (9020*), herb-rich forests with *Picea abies* (9050), coniferous forests on glaciofluvial eskers (9060), forests of slopes, screes and ravines (9180*), alluvial forests (91E0*); protection of the habitats of the following species listed in Annex II to Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora: spined loach, bullhead, European river lamprey, green snaketail, which also a species of the 3rd protection category.

The northern part of the special area of conservation is also protected as conservation area of Peetri River. The conservation objective of the Peetri River conservation area is the protection of the habitat type of water courses (3260) as specified in Annex I to Council Directive 92/43/EEC, and the habitats of the following species listed in Annex II to the Directive: thick shelled river mussel (*Unio crassus*), bullhead (*Cottus gobio*), green snaketail (*Ophiogomphus cecilia*), spined loach (*Cobitis taenia*) and European river lamprey (*Lampetra fluviatilis*). The conservation area is located about 3.5 km to the northwest of kalkahju dolomite quarry.

The Peetri River landscape protection area and special area of conservation also includes Karisöödi Oak (about 0.5 km from the quarry), which is protected as an individual natural object. Mudasoo Snake Spruce (about 1.7 km from the quarry) is another protected individual natural object in the area.

No habitats of protected species have been registered on the proposed area of activities[7]. The closest known habitats of protected species area located on Peetri River landscape conservation area according to the Estonian Nature Information System (EELIS).

The areas in the vicinity of the proposed area of activities (at least within 3 km) do not include any heritage conservation objects included in the national register of cultural monuments[8].

[6] Koiva River Basin Water Management Plan. Approved by the Government of the Republic Order No. 118 of 1 April 2010.

[7] Estonian Nature Information System: Environmental Agency, 2013

[8] National register of cultural monuments, http://register.muinas.ee/

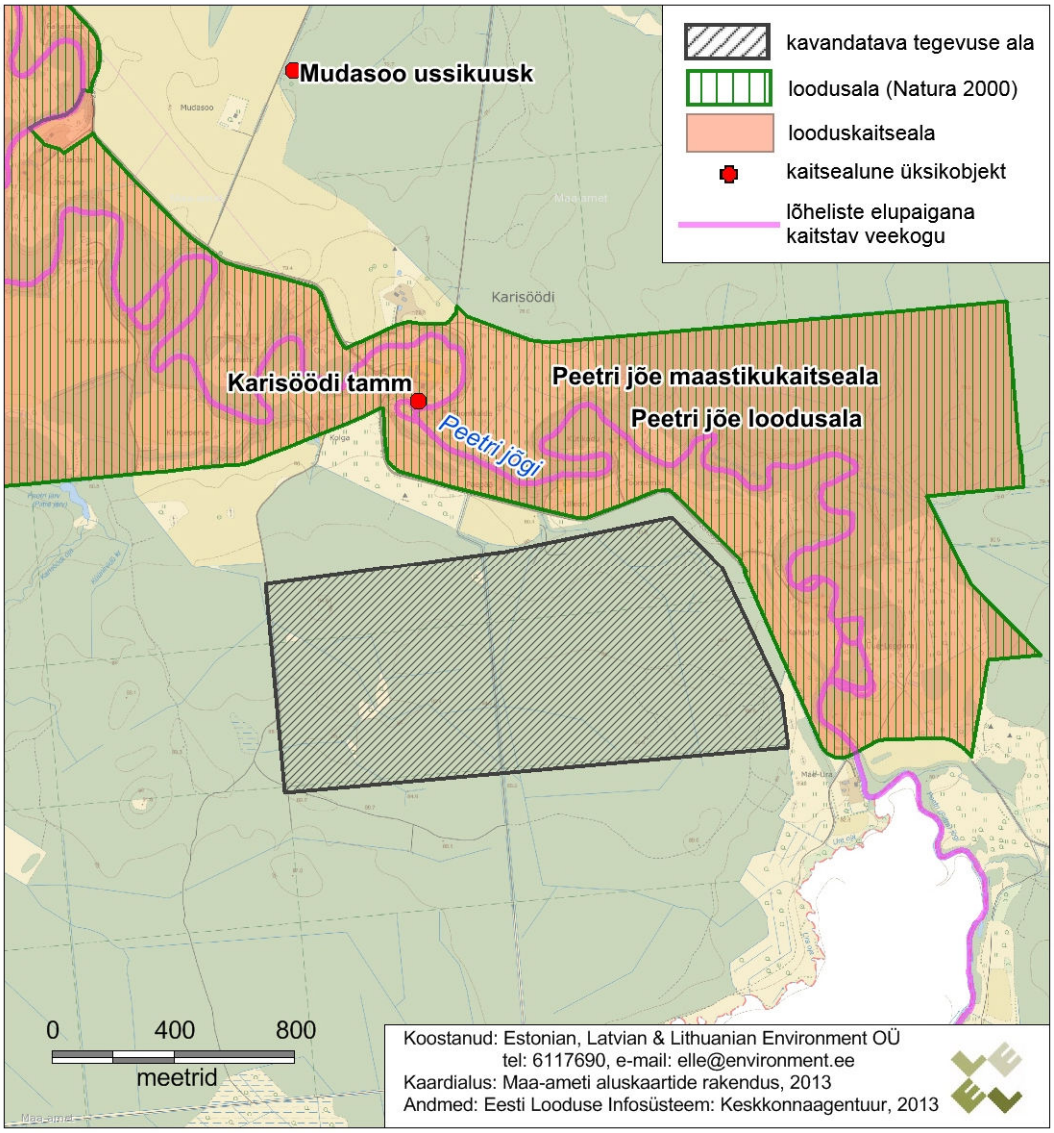

Figure 9. The closest protected natural objects

4 THE SCOPE AND CONTENT OF ENVIRONMENTAL IMPACT ASSESSMENT AND DESCRIPTION OF ASSESSMENT METHODOLOGY

The proposed activities can be grouped in three stages:

- Establishment of the quarry and any associated operations – this is a brief stage;
- Use of the quarry, i.e., extraction and processing of mineral resources, the stage with the longest impact;
- Rehabilitation of the quarry after depletion of mineral resources.

The scope of the EIA covers all three stages. All activities are considered as a single complex, i.e., the assessment covers preparatory activities, extraction, processing and transport of dolomite, and rehabilitation after depletion of resources.

The impact of the proposed activities on the environment will be assessed to the extent where it is possible to establish causal links and the impact of the quarry is potentially significant or perceptible. It is assumed that the largest impact factors of the activities will include water drainage, i.e., impact on Peetri River, and the transport servicing the quarry. The exact impact area will be identified in the course of the EIA, after a more precise estimation of the water volume to be drained from the quarry, as well as transport loads and haulage routes. Any potential activities for increasing positive impacts and reducing negative impacts will also be considered when reviewing causal links.

The assessment of the impact of decommissioning will cover all activities until the end of the works for closure and rehabilitation of the quarry. The impact of potential subsequent activities and developments (e.g., recreation on the area) will not be assessed, as the level of indeterminacy is too high at this time.

The state border of the Republic of Latvia is located about 550 km from Kalkahju dolomite quarry and, according to Annex 1 to the Agreement between the Government of the Republic of Estonia and the Government of the Republic of Latvia on Environmental Impact Assessment in a Transboundary Context, the affected country has to be notified if activities are planned within 15 km from the shared border or if the size of the planned extraction area exceeds 5 ha. The Estonian Ministry of the Environment submitted to the Latvian Ministry of the Environment an official notice of the initiation of a transboundary EIA, requesting a reply by 13 October 2013 with an indication of whether Latvia intends to participate in the procedures in question. In its letter of 16 October 2013, the Latvian Ministry of the Environment responded that they would like to participate in the EIA procedures for dolomite extraction in both Kalkahju and Naha dolomite deposits and presented their comments regarding the EIAs. Consequently, this EIA process will be treated as a transboundary process, with due regard to the provisions of § 30 of EIAEMSA.

The proposed development can be associated mainly with the following significant impacts:

- Changes in the status of Peetri River and the special area of conservation of Peetri River due to water pumped out of the quarry and discharged into Peetri River;
- Changes in the water regime (incl. water level) of Peetri River due to water pumped out of the quarry and discharged into Peetri River;
- Lowering of the groundwater level and the associated impacts;
- Impacts on species and habitats;
- Emission, spread and deposition of pollutants (incl. dust) in ambient air;
- Noise and vibration emissions (incl. due to blasting);
- Increased transportation load and the associated impacts;
- Impacts of creation and/or deepening of trenches;
- Environmental impact of potential emergency situations.

The strength, extent and importance of these and other, less important impacts, as well as alleviation options for negative impacts will be assessed and discussed in the environmental impact assessment report.

In assessing the environmental impact and preparing a report, the expert will be guided by the Environmental Impact Assessment and Environmental Management System Act (RT I 2005, 15, 87) and its implementing provisions, and will follow the good practice of environmental impact assessment. The EIA will be conducted in keeping with applicable legislation, strategic development documents and any restrictions specified therein.

Environmental impact assessment is based on the principle that one should assess the changes in the environment, caused by the implementation of the proposed activities. This requires knowledge of the consequences (aspects) of the activities, which can lead to changes in environmental elements (e.g., emission of pollutants into ambient air is a consequence and the resulting impact is the change in the quality of ambient air). Finally, the changes in the environmental elements (ambient air, surface water, etc.) will be observed in the context of the recipient. For instance, noise emission into ambient environment does not have a significant impact if there is no recipient. Environmental impact assessment is based on the assumption that potential recipients include:

- human beings, i.e., impacts on human health;
- wildlife, incl. natural communities, biodiversity, nature conservation areas and Natura network sites;
- socio-economic environment, incl. assets and well-being of persons.

The aforementioned principles are summarised on the following Figure (Figure 10).

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Figure 10. The principles of environmental impact assessment

Impact assessment utilises available measurement results, if accessible and usable. If no measurement results are available, impacts are assessed according to guidelines and methodologies or, in the absence thereof, on the basis of an expert judgment. Expert judgments generally assume the "worst possible scenario", i.e., assessment is based on indicators with the worst possible consequences for the environment.

Environmental impact assessment is a public process. The EIA process is open for contributions, reasoned recommendations, proposals and comments by all stakeholders, who feel that the proposed activities could have an impact on their interests, at least during the publication of the EIA programme, the assessment process, and publication of the report. Any suggestions, objections or questions can be addressed to the developer, decision-maker or the expert who assesses environmental impact.

An EIA report should cover at least the following areas of impact:

- *Impact on human health:* The impact on human health is assessed as an aggregate assessment based on expert judgements, applicable legislation and relevant guidelines, taking into account changes in various environmental elements (the respective methodologies of impact assessment are described below). Assessment is based on the assumption that if a disturbance caused by the proposed activities remains under the thresholds specified in the corresponding EU, Estonian and Latvian legislation, there is not direct threat to human health. However, a negative impact on well-being of local residents is also possible if values remain below thresholds; such disturbances are discussed under socio-economic environmental impacts.
- *Impact on the socio-economic environment (incl. human well-being and assets):* Consideration will be given to the location of the quarry and haulage routes. It can be assumed that human well-being will be primarily affected by the noise and air pollution (fine solid particles) caused by production and transport operations. Furthermore, possible lowering of the groundwater level could have an impact on the closest wells. Human well-being could also depend on the condition of local roads, which could deteriorate due to the movement of heavy vehicles. The assessment of impact on the economic environment will cover the impact of mineral resource extraction, the impact of the change in land use (from forest land to mining land), the impact of employment dynamics, etc. In addition to the aforementioned factors, the aggregate assessment will also include other direct and indirect impacts. Impact will be assessed as an expert judgment. The results of calculations and modelling will be used as tools, if possible, for assessing the impacts, which manifest through various environmental elements (noise level, ambient air pollution level, etc.). More detailed explanations are given below under relevant sections.
- *Impact on biodiversity, populations, flora and fauna:* Assessment will be based on the fact that, in the current situation, most of the quarry area is covered with profit yielding forest. The environmental status will be assessed on the basis of existing databases (e.g., the Estonian Nature Information System, Forest Register) and information collected during site inspections. Impact will be assessed as an expert judgment.

- *Impact on protected areas, protected individual objects and species:* The quarry is in the immediate vicinity of the Peetri River landscape protection area and, consequently, the impact of extraction will be assessed in relation to that protected area. Impact will be assessed with regard to the habitats of the species of the 2nd and 3rd protection categories according to the environmental register. The main impact will be caused by the drainage of excess water to Peetri River. Impact will also be assessed through other direct and indirect impacts. Impact will be assessed as an expert judgment, using information collected during Natura assessment and other available information.

- *Impact on Natura 2000 sites:* The special area of conservation of Peetri River, largely overlapping with the Peetri River landscape protection area, is located to the north in the immediate vicinity of the quarry. The special area of conservation includes habitat types listed in Annex I to the Habitats Directive as well as species listed in Annex II. The main impact on the assets of the special area of conservation could be caused by the drainage of quarry water to Peetri River. As the probability of the impact is high, the EIA will include a full Natura assessment ('appropriate assessment'). The methodology of Natura assessment, main impact factors and the studies to be conducted are specified in Annex 1 to the programme.

- *Impact on landscape and soil:* Impact will be assessed under the assumption that establishment of a quarry requires landscape redesign and soil removal. The impact on landscape and soil will be assessed as an expert judgment.

- *Impact on groundwater and surface water:* The assessment will cover the impact of Kalkahju quarry on the groundwater, surface water and residential water supply of the surrounding areas, projecting the development of the water level drop funnel during various stages of earthmoving. The methods for establishing the current situation will include direct measurements (water levels and water quality indicators within an area of up to 2 km from the centre of the proposed quarry in case of on-land extraction), analytical calculations and modelling (projection of the extent of the groundwater drop funnel), surveys (fluctuations in well water levels) and data from past studies. A hydrodynamic method will be used – both analytical calculations and mathematical modelling. The drops in water levels due to extraction will be calculated using analytical methodology and modelling, with an assessment of divergence of the results obtained by different methods in terms of significance for the final result. Options for the various stages of dolomite extraction will be elaborated. The stages could be based on four phases of extraction: the 1st, 6th and 10th year of operation, plus the stage of full depletion of the quarry. A hydro-geological model will be developed using information from geological and hydro-geological mapping, other hydro-geological special surveys and geological survey of the mineral deposits, measurements on hydrometric thresholds, well audit data and data from long-term weather observations (precipitation, air temperature, evaporation) and on infiltration. The hydro-geological parameters identified during the geological survey will be specified. A model database will be created for geological structure, hydro-geological parameters, water levels, precipitation, hydrology and quarry seepage. A hydro-geological model will be developed. The results of modelling will be presented on the drawings of options, using contour lines to mark the drop of the water level from the initial state. A reasoned proposal will be made for establishing conditions for environmental monitoring, based on the results of the environmental impact assessment of the proposed activities and any feasible alternatives. The EIA will be based on the requirement that the status of water bodies cannot be lowered.

- *Impact on ambient air quality:* The impact on ambient air status will be assessed with regard to both quarry and transport operations. Emissions will be determined by calculation, using various methodologies as specified in Annex 2 to the programme. The calculated emissions will be used to determine the rate of pollutant dispersal in ambient air. The calculations for pollutant dispersal and pollution in the air layer near the surface will be made using computer software. The selected software will be the Air Dispersion Modelling Software (ADMS), created by Cambridge Environmental Research Consultants (CERC), United Kingdom. The model has been developed in the United Kingdom in cooperation between the researchers at Cambridge University and large industries. In addition to the United Kingdom, the software is used in many other countries. In Estonia, the requirements for dispersion modelling software have been established by a regulation of the Minister of the Environment[9]. ADMS complies with these requirements. Computer modelling will help to create dispersal charts and the subsequent pollutant dispersal maps.

- *Impact on noise levels:* The establishment of the noise level will be based on the industrial sources of noise in the quarry and on the means of transport servicing the quarry. Generation of industrial noise will

[9] Procedure for determination of ambient air pollution level. Minister of the Environment Regulation No. 120 of 22 September 2004.

be determined in accordance with existing guidelines, methodologies or previous measurements of similar equipment. The noise generated by transport will be calculated using the IMMI modelling software. The number and speed of vehicles, road characteristics and other important aspects will be taken into consideration when assessing noise generation. Noise propagation will be modelled using the IMMI software. Propagation of industrial noise will be calculated according to the ISO 9613 standard on industrial noise and calculations of transportation noise will be based on the French methodology NMPB-Routes-96 and the French XP S 31-133 standard.

- *Impact on vibration levels:* Vibrations will be generated during establishment, use (incl. blasting) and rehabilitation of the quarry. The movement of heavy vehicles will also cause vibration. The levels of vibration will be determined according to existing guidelines, methodologies or previous measurements of similar quarries. The level of vibration will be assessed through calculations or as an expert judgment.
- *Impact on cultural heritage:* The impact area of the quarry does not include any protected cultural monuments and, consequently, impact on heritage conservation objects will not be assessed. The impact on landscape assets, traditional culture objects, etc., will be assessed, to a relevant extent, as an expert judgment.
- *Impact of emergency situations:* References will be made to potential risks and emergencies and risk management measures will be highlighted. The impact of emergency situations will be presented as an expert judgment.
- *Indirect impact:* Indirect impact means impacts of career operations that manifest in a different location. It also includes impacts that have transferred from one environmental to another and become apparent through the second element. As all potential indirect impacts cannot be foreseen at the time of drafting of the programme, it is appropriate to cover them in the EIA report. Indirect impacts will be assessed as an expert judgment.
- *Combined impact with other activities:* The assessment will also consider the fact that, in addition to Kalkahju quarry, a proposal for Naha quarry in the same region also exists, which could lead to a combined impact. More detailed specifications for the assessment of combined impact will be stipulated during subsequent stages of the EIA processes and in association with the EIA for Naha quarry. Furthermore, there are dolomite quarries in Latvia and their location, nature of operations and potential overlapping of impact areas will be clarified in the course of the EIA. If there is an overlap of impact areas, the assessment of combined impact will also include the operations of those quarries.

  The assessment of combined impact will cover at least the impact on Peetri River, the protected species and habitats, the level of environmental noise due to quarry operations and transport, and impact on groundwater. The method of combined impact assessment will depend on the particular environmental elements and recipients subject to assessment. The assessment will be carried out in case of assumed overlapping of impact areas, using available data and methodologies as described above under relevant environmental elements. For instance, when modelling noise propagation and dust dispersion, the potential sources of combined impact will also be included in the model, if possible. Subject to availability of data, the assessment of the impact on groundwater will also include data on groundwater level changes from other quarries, enabling to make calculations of the groundwater level within the shared impact area of the quarries. When assessing the cumulative impact on the protected species of Peetri River, any additional flow rates, sediments and groundwater level changes from other Estonian mines will be taken into account, and an expert judgment will be issued on such additional impacts for each protected species.
- *Impact on the mineral resources:* The impact on the mineral resources will be assessed as an expert judgment.

Due to assumed lack of significant environmental impact, this EIA report will not cover the following impact areas:

- *Impact on light, heat and radiation levels:* The proposed activities will not lead to emissions of light, heat or radiation at a rate that could have a significant impact. Consequently, the environmental impact assessment expert does not consider it necessary to assess the impact on light, heat and radiation levels.
- *Impact on climate:* It is assumed that the climate impact of the proposed activities, incl. the impact on local climate, will not be significant within the meaning of the EIAEMSA due to the predicted volumes and, consequently, the impact on climate will not be assessed in the EIA.

5 SCHEDULE OF PUBLIC DISCLOSURE OF THE EIA PROCESS AND THE RESULTS THEREOF

The following Table (Table 1) provides an overview of the EIA process and the approximate schedule as envisaged at the time of drafting the programme. The schedule is subject to modifications due to circumstances beyond the control of the expert or increased volume of assessment tasks.

Table 1. Approximate schedule of the EIA

Activity, person with the main responsibility for implementation	2013		2014												Notes
	November	December	January	February	March	April	May	June	July	August	September	October	November	December	
Drafting of the EIA programme *EIA expert*															
Public display of the EIA programme *Decision-maker*															Duration: at least 14 days.
Public consultation regarding the EIA programme *Developer*															
Inclusion of proposals received / giving reasons for rejection, modification of the EIA programme and submission for approval *EIA expert in cooperation with the developer*															
Approval of the EIA programme *Supervisory authority*															Within 30 days from receipt of the programme
Conducting additional surveys, incl. fieldwork, required in the EIA programme *EIA expert*															
Drafting the EIA report *EIA expert*															

Activity, person with the main responsibility for implementation	2013		2014												Notes
	November	December	January	February	March	April	May	June	July	August	September	October	November	December	
Translation and submission of the report to the Latvian party															
Public display of the EIA report and coordination with the Republic of Latvia *Decision-maker*															Duration: at least 14 days in the Republic of Estonia. Duration: at least 30 days in the Republic of Latvia.
Public consultation regarding the EIA report *Developer*															1 consultation in the Republic of Estonia 1 consultation in the Republic of Latvia
Inclusion / reasoned rejection of proposals made for the report *EIA expert in cooperation with the developer*															
Submission of the modified report for approval and establishment of environmental requirements *Developer*															
Approval of the report *Supervisory authority*															Within 30 days from receipt of the report

6 PARTIES OF THE EIA

Pursuant to the Environmental Impact Assessment and Environmental Management System Act, the parties of the EIA process include the developer, the expert, the decision-maker and the supervisory authority (Table 2). It is expected that the proposed activities will lead to a transboundary environmental impact. The Latvian Ministry of the Environment has expressed its intention to participate in the EIA for Kalkahju dolomite quarry. Consequently, the Republic of Latvia constitutes a party of the EIA process and consultations between the countries have to be held as necessary.

Table 2. Parties of the EIA

Developer	EIA expert	Decision-maker	Supervisory authority
Aigren Kaevandus OÜ Räpina mnt 22b 65606 Võru Contact person:	ELLE OÜ Tõnismägi 3a-15 10119 Tallinn Contact person: Toomas Pallo Tel.: 6117691 e-mail: toomas@environment.ee	Environment Board, Valga-Võru region Karja 17a 65608 Võru Contact person: Tel.: 786 8364 e-mail: voru@keskkonnaamet.ee	Ministry of the Environment Narva mnt 7a 15172 Tallinn Contact person: Tel.: 6262 802 e-mail: keskkonnaministeerium@envir.ee

The environmental impact assessment will be conducted by an expert group comprising experts from Estonian, Latvian ja Lithuanian Environment OÜ, AS Infragate Eesti and the Estonian University of Life Sciences. The expert group will be managed by ELLE, with Toomas Pallo as the lead expert (EIA personal licence number KMH 0090, incl. for the activity of "extraction of mineral resources and ore processing, incl. enrichment").

The expert group will include at least the following members:

- Toomas Pallo – environmental expert, licence no. KMH0090. Specialisation: soil and landscape, water pollution and water level, air pollution, waste generation, heat, radiation, odour, land flora, land fauna, protected natural objects, comparison of alternatives.
- Luule Sinnisov – environmental expert, licence no. KMH0129. Specialisation: water pollution and water level, waste generation, radiation, flora, fauna, aquatic biota, protected natural objects, social environment, comparison of alternatives.
- Marit Abiline – environmental expert. Specialisation: water pollution and water level, air pollution and odour, human health, waste generation, comparison of alternatives.
- Pille Antons – environmental expert. Specialisation: soil and landscape, water pollution and water level, noise and vibration, flora, fauna, forests, protected natural objects, cultural heritage, geology, mineral resources, comparison of alternatives.
- Indrek Tamberg – geologist. Specialisation: impact of extraction on groundwater.
- Raul Hansen – environmental engineer. Specialisation: possibilities for treatment of extraction water.
- Helena Metspalu – environmental engineer. Specialisation: assessment of the impact of drainage.
- Karel Saar – road engineer. Specialisation: impact of transport on roads and potential alleviation measures.
- Tõnu Feldman – biologist. Specialisation: Natura assessment, impact of extraction on flora on Natura sites.
- Arvo Tuvikene – biologist. Specialisation: Natura assessment, impact of extraction on fish resources on Natura sites.

Additional experts can be invited to participate in the EIA process as required.

Any interested persons and institutions are involved in the EIA process through public disclosures. The main stakeholders include the following groups:

- Non-governmental environmental organisation – representing the public interest in the field of the environment;
- Owners of neighbouring immovable properties – interest in the impact on property;
- Residents of the area – interest in the impact on the living environment;
- Companies within the assumed impact area – interest in the combined impact of the operations of facilities;
- Mõniste Rural Municipality Government – interest in development activities in the rural municipality;
- Võru County Government – interest in development activities in the county;
- Environmental Inspectorate – interest in environmental monitoring of the activities;
- Ministry of Culture and/or its subsidiary bodies (National Heritage Board) – interest in the protection of cultural monuments;
- Ministry of Social Affairs and/or its subsidiary bodies (Health Board) – interest in the protection of public health;
- General public – various potential areas of interest;
- Ministry of the Environment – transboundary combined effect and coordinator of the transboundary EIA process in Estonia;
- Ministry of the Environment of the Republic of Latvia – transboundary combined effect and coordinator of the transboundary EIA process in Latvia;
- Residents of Ape rural municipality (Apes Novads) – interest in combined impact of the quarries.

7 ANNEXES

1. Natura assessment methodology
2. Methodology for assessment of pollutant emissions
3. Proposals, objections, questions and answers regarding the EIA programme
4. Report on public consultation regarding the EIA programme and the list of participants

ANNEX 1. NATURA ASSESSMENT METHODOLOGY

1. Description of the special area of conservation of Peetri River

The proposed site of Kalkahju dolomite quarry is located in the immediate vicinity of Peetri River. Peetri River belongs to the Natura 2000 network as part of the special area of conservation of Peetri River (international code: EE0080608). Mustjõgi River, the receiving water course of Peetri River, belongs to the network of Natura 2000 sites as part of the special area of conservation of Koiva-Mustjõe meadow (EE0080421) and Koiva-Mustjõe special protection area (EE0080471).

The special area of conservation of Peetri River has been included in the Natura network with the Government of the Republic Order No. 615-k of 5 August 2004, "List of Natura 2000 sites to be submitted to the European Commission". The special area of conservation is located in the villages of Karisöödi, Tiitsa, Tursa and Villike in Mõniste rural municipality and has a total area of 400.8 ha according to the environmental register. The territory of the special area of conservation is divided between two protected areas with two protection regimes: Peetri River landscape protection area in the southern part and Peetri River conservation area in the northern part (Figure 11). The protection of the areas is organised according to "The Peetri River Landscape Protection Area Management Plan 2012-2021" and "The Peetri River Conservation Area Management Plan 2014-2023". The management plans specify the objectives of management periods and the respective action plans.

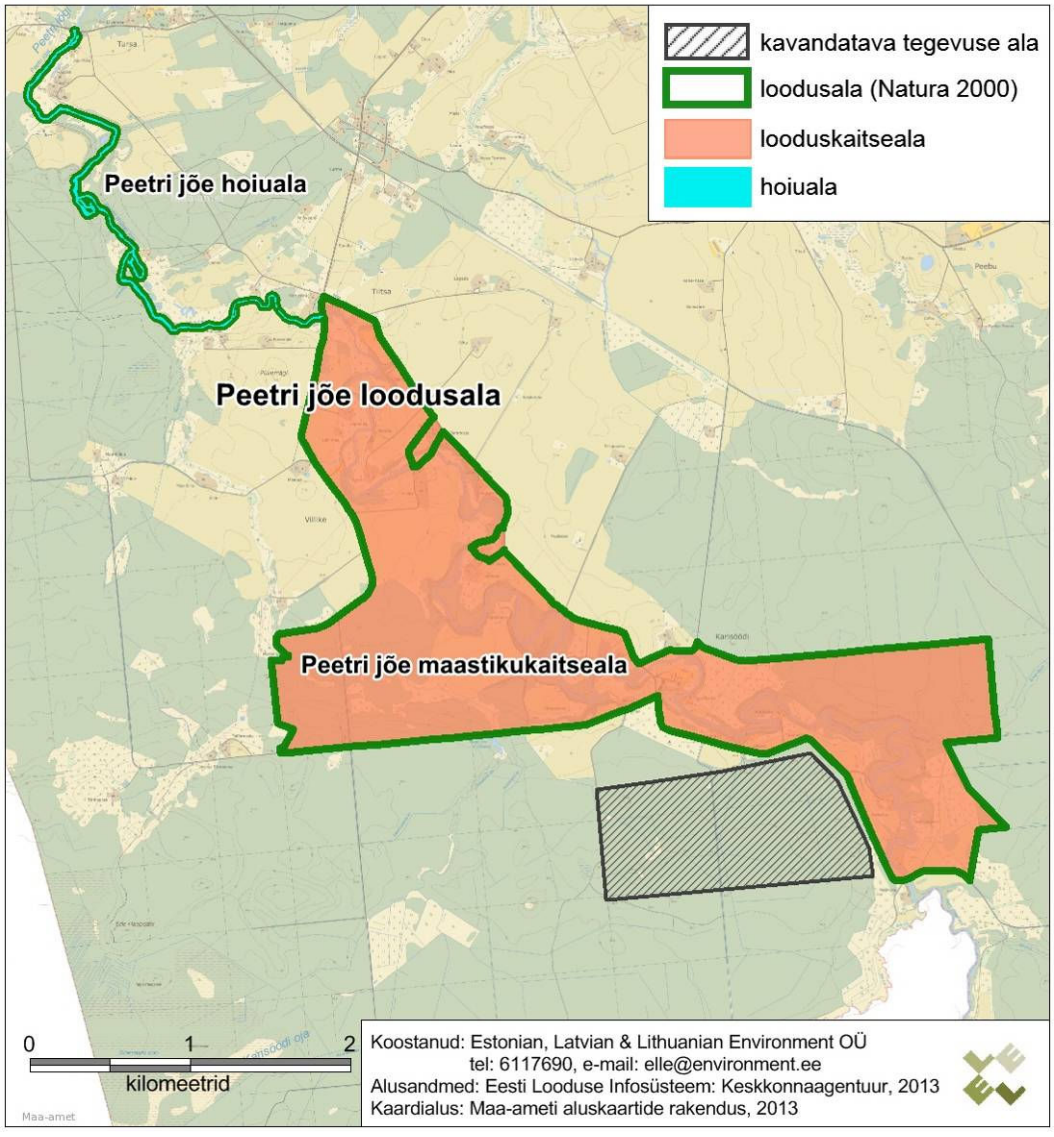

Figure 11. Location and protection regimes of the special area of conservation of Peetri River

The protection objectives for the special area of conservation of Peetri River include the following protected habitat types as specified in Annex I to Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (Habitats Directive): water courses (3260), species-rich dry to mesic grasslands (6270*), northern boreal alluvial meadows (6450), lowland hay meadows with *Alopecurus pratensis* and *Sanguisorba officinalis* (6510), calcareous rocky slopes (8210), siliceous rocky slopes (8220), old natural forests (9010*), old broad-leaved forests (9020*), herb-rich forests with *Picea abies* (9050), coniferous forests on glaciofluvial eskers (9060), forests of slopes, screes and ravines (9180*), and alluvial forests (91E0*). The protection objectives of the area also include the protection of the habitats of the following species listed in Annex II to the Habitats Directive: spined loach (*Cobitis taenia*), bullhead (*Cottus gobio*), European river lamprey (*Lampetra fluviatilis*), green snaketail (*Ophiogomphus cecilia*), thick shelled river mussel (*Unio crassus*), and lady's slipper orchid (*Cypripedium calceolus*).

The following Figure (Figure 12) shows the habitats covered by protection objectives in the area of Kalkahju mineral deposits according to the Estonian Nature Information System. The habitats of species covered by the protection objectives have not been included in the Figure, as they partially belong to the 2nd protection category.

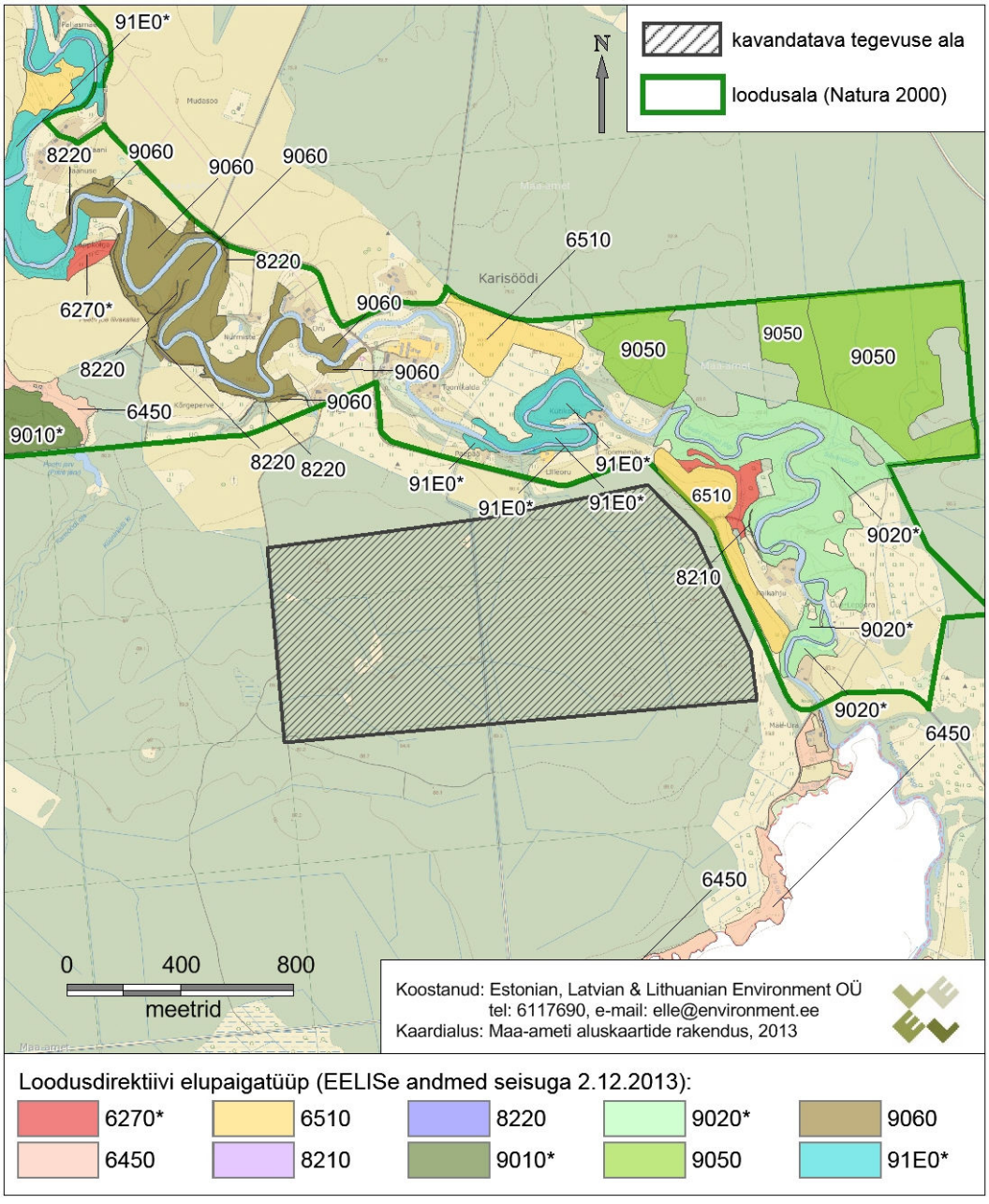

Figure 12. Assets in the special area of conservation in the assumed immediate impact area of the proposed activities

2. Necessity of Natura assessment and identification of probable impacts

The proposed activities include extraction of dolomite from Kalkahju quarry and relevant auxiliary activities. The activities are not directly linked to or required by the protection regime of the special area of conservation of Peetri River.

Peetri River will be the recipient of the excess water to be drained in the course of extraction (surface water and ground water collected in the quarry). When initiating the environmental impact assessment, the Environmental Board noted that lowering of the groundwater level and drainage of water to Peetri River can be expected to have a significant impact on the habitats and species in the special area of conservation of Peetri River, with a possible indirect impact on the habitats and species in the conservation area and special protection zone of Koiva-Mustjõe.

As the proposed activities could cause a significant impact on a Natura 2000 site, an appropriate Natura assessment will be conducted as part of the EIA for Kalkahju dolomite quarry. The following Table provides an overview of the potential impacts of proposed activities on the protection objectives of the special area of conservation.

Table 3. Identification of probable impacts of the proposed activities

Protection objective	Protection category	Present in the assumed impact area of the proposed activities	Potential negative impact on an asset	Activities or aspects, which could have an impact on the protection objective	Additional collection of source data in the framework of Natura assessment
Habitats					
Water courses (3260)	LoD I	Yes	Yes	Drainage of excess water to Peetri River, pumping of groundwater, creation or cleaning of trenches, pollutant emissions to ambient air, noise and vibration from extraction	Complex survey of aquatic biota
Species-rich dry to mesic grasslands (*6270)	LoD I	Yes	Yes	Pumping of groundwater, creation or cleaning of trenches, pollutant emissions to ambient air	Survey
Northern boreal alluvial meadows (6450)	LoD I	Yes	Yes	Drainage of excess water to Peetri River, pumping of groundwater, creation or cleaning of trenches, pollutant emissions to ambient air	Survey
Lowland hay meadows with *Alopecurus pratensis* and *Sanguisorba officinalis* (6510)	LoD I	Yes	Yes	Pumping of groundwater, creation or cleaning of trenches, pollutant emissions to ambient air	Survey
Calcareous rocky slopes (8210)	LoD I	Yes	Yes	Drainage of excess water to Peetri River, pumping of groundwater, pollutant emissions to ambient air, noise and vibration from extraction	- (Natura assessment on the basis of existing data)
Siliceous rocky slopes (8220)	LoD I	Yes	Yes	Drainage of excess water to Peetri River, pumping of groundwater, creation or cleaning of trenches	- (Natura assessment on the basis of existing data)
Old natural forests (*9010)	LoD I	Yes	Yes	Pumping of groundwater, pollutant emissions to ambient air, creation or cleaning of trenches	- (Natura assessment on the basis of existing data)
Old broad-leaved forests (*9020)	LoD I	Yes	Yes	Pumping of groundwater, pollutant emissions to ambient air, creation or cleaning of trenches	- (Natura assessment on the basis of existing data)
Herb-rich forests with *Picea abies* (9050)	LoD I	Yes	Yes	Pumping of groundwater, pollutant emissions to ambient air, creation or cleaning of trenches	- (Natura assessment on the basis of existing data)
Coniferous forests on glaciofluvial eskers (9060)	LoD I	No	-		- (Natura assessment on the basis of existing data)

Protection objective	Protection category	Present in the assumed impact area of the proposed activities	Potential negative impact on an asset	Activities or aspects, which could have an impact on the protection objective	Additional collection of source data in the framework of Natura assessment
Forests of slopes, screes and ravines (*9180)	LoD I	Yes	Yes	Drainage of excess water to Peetri River, pumping of groundwater, creation or cleaning of trenches	- (Natura assessment on the basis of existing data)
Alluvial forests (*91E0)	LoD I	Yes	Yes	Drainage of excess water to Peetri River, pumping of groundwater, creation or cleaning of trenches	- (Natura assessment on the basis of existing data)
Species					
Spined loach (*Cobitis taenia*)	LoD II, LKS III	Yes	Yes	Drainage of excess water to Peetri River, pumping of groundwater, creation or cleaning of trenches, pollutant emissions to ambient air	Complex survey of aquatic biota
Bullhead (*Cottus gobio*)	LoD II, LKS III	Yes	Yes	Drainage of excess water to Peetri River, pumping of groundwater, creation or cleaning of trenches, pollutant emissions to ambient air	Complex survey of aquatic biota
European river lamprey (*Lampetra fluviatilis*)	LoD II	Yes	Yes	Drainage of excess water to Peetri River, pumping of groundwater, creation or cleaning of trenches, pollutant emissions to ambient air	Complex survey of aquatic biota
Green snaketail (*Ophiogomphus cecilia*)	LoD II, LKS III	Yes	Yes	Drainage of excess water to Peetri River, pumping of groundwater, creation or cleaning of trenches, pollutant emissions to ambient air	Complex survey of aquatic biota
Thick shelled river mussel (*Unio crassus*)	LoD II, LKS II	Yes	Yes	Drainage of excess water to Peetri River, creation or cleaning of trenches, pollutant emissions to ambient air	Complex survey of aquatic biota
Lady's slipper orchid (*Cypripedium calceolus*)	LoD II, LKS II	Yes	Yes	Pumping of groundwater, creation or cleaning of trenches, pollutant emissions to ambient air	Survey
Water parsnip (*Berula erecta*)	LK II	Yes	Yes	Drainage of excess water to Peetri River, pumping of groundwater, creation or cleaning of trenches, pollutant emissions to ambient air	Survey

3. The main surveys and methodologies used in Natura assessment

3.1. Goal and schedule of the proposed surveys

The special area of conservation of Peetri River, which will be the main area of impact of the proposed activities, has been set up to protect Peetri River as a habitat. According to the Natura 2000 standard database, the habitat type of water courses (3260) in the special area of conservation of Peetri River has a very high level of representativity (A), very good conservation status (A) and very high global conservation value (A). A fuller dataset for assessing the status of the Natura habitat and species was published in the collection "Eesti jõed" (*Estonian Rivers*)[10] and the most recent data from complex survey of biota were collected in 2009[11].

Considering the age of the available datasets, a new complex survey is required. The importance of a survey is highlighted by the fact that, according to the monitoring website of the Environmental Agency (data as of 2013), no national hydro-biological monitoring has been conducted in Peetri River in the past eight years.

Based on the principle of integrity of an ecosystem, the envisaged survey would cover the majority of organism groups found in rivers, as well as physical and chemical water indicators. The purpose of the surveys described below is to provide a complex overview of the current status of the biota of the water body, as well as of the representation and status of the habitat and protected species. The collected data will be used as a basis for the assessment of the impact factors of extraction, particularly the impact of drainage of groundwater to the river. The goal is to assess the impact on the Natura habitat type and species based on qualitative and quantitative indicators of extraction water.

The methodologies for the complex survey have been selected on the basis of a complex and seasonal approach to aquatic biota. The data to be collected with the envisaged surveys will be used as a basis for assessing the impact of any risk factors caused by extraction to the Peetri River habitat type of water courses (3260) and the protected species: bullhead (*Cottus gobio*), spined loach (*Cobitis taenia*), European river lamprey (*Lampetra fluviatilis*), green snaketail (*Ophiogomphus cecilia*), and thick shelled river mussel (*Unio crassus*).

The selection of sampling sites will be based on the upstream and downstream river sections in relation to the section closest to the extraction site.

The surveys, to be conducted twice during the vegetation period, will be conducted immediately after ice melting in the spring and then during the peak of vegetation at the end of July or beginning of August. Non-recurrent biota surveys will also be conducted in the second period.

3.2. Surveys to be conducted twice in two different river sections during the vegetation period

a) <u>Surveys of physical and chemical water properties</u>

The analyses of the following indicators will be ordered from the Tartu branch of Eesti Keskkonnauuringute Keskus OÜ:

- water colour,
- alkalinity,
- suspended solids,
- nutrient (NH_4, $N\text{-}NO_3$, N_{tot}, PO_4, P_{tot}) concentrations,
- dissolved organic matter,
- BHT_7 and KHT-Cr.

A Secchi disk will be used to assess water transparency, while electrical conductivity, pH, oxygen content and temperature distribution will be established with portable meters manufactured by YSI Incorporated and Marvet Junior.

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[10] Järvekülg, A. 2001. Eesti jõed.

[11] Järvekülg, R., Luig, J. 2009. Elustiku kompleksuuringud Vaidava, Peeli ja Peetri jõgedel. Ökokonsult OÜ (manuscript in the Environmental Board)

In the absence of previous reliable data, flow rate measurements will be conducted concurrently with the surveys.

3.3. Surveys to be conducted once in two river sections or suitable river areas during the vegetation period

a) Bacterial plankton

Biochemical oxygen demand (BOD_5) will be determined by measuring the concentration of dissolved oxygen with Marvet Junior 2000 (Elke Sensor) oximeter at the beginning and end of a five-day incubation period. Biochemical oxygen demand will be assessed in accordance with the Minister of the Environment Regulation No. 44 of 28 July 2009[12]. The prevalence of saprophytic bacteria will be determined by direct counting of the colonies grown on the standard medium (SMA) on the seventh day of incubation. The total bacterial plankton will be assessed with the direct counting method using the Zeiss Axiovert S100 inverted fluorescence microscope. The assessment of total bacteria count and prevalence of saprophytic bacteria in the rivers will be based on the scale proposed by S. Lokk, R. Laugaste and M. Leinsalu[13].

b) Phytoplankton

Chlorophyll *a* concentration. Water samples will be taken at a depth of 50 cm from the main stream of the river section. The samples will be kept cool and the pigment content will be determined by filtering plankton on glass fiber filters GF/F (Whatman ®). The pigment content will be determined by spectrophotometry in two parallels in 96% ethanol extract and calculated according to the formulas by Jeffrey and Humphrey (1975)[14], Lorenzen (1967)[15] and Strickland and Parsons (1972)[16]. Quantitative phytoplankton samples will be collected in 500 ml plastic bottle. The samples will be fixed immediately in Lugol's solution (iodine and potassium iodine solution). The numbers will be estimated using the Utermöhl (1958)[17] method. Depending on sample density, 10 or 50 ml samples will be settled in a counting chamber and counted under an inverted microscope (Nikon Eclipse Ti-S/L100) with 10x40 magnifications. The biomasses of the main algae groups (blue algae, green algae, diatoms, golden algae, euglenophyta, haptophyta and cryptophyta) with the specific mass of algae assumed to be 1. A phytoplankton community index (PCI) will be calculated, biomass dominants (species with biomass constituting at least 25% of total phytoplankton biomass) will be determined and the phytoplankton community will be assessed. Qualitative samples for obtaining a better overview of the species structure of phytoplankton will be taken using a conical plankton net (30 µm mesh size).

Components to be analysed:

- PBM – biomass, g m^{-3}
- PSC – plankton species count in the sample
- PDOM – dominant species
- CY – blue algae biomass, g m^{-3}
- BAC – biomass of diatoms, g m^{-3}

[12] Procedure for establishing surface water bodies and the list of surface water bodies subject to determination of status class, status classes of surface water bodies and values of quality indicators corresponding to status classes, and procedure for determination of status classes. Minister of the Environment Regulation No. 44 of 28 July 2009.

[13] Lokk, S., Laugaste, R., Leinsalu, M., 1988. Peipsi-Pihkva järve suubuvate jõgede vee hüdrobioloogilistest ja hüdrokeemilistest näitajatest 1985-1987. a. Rmt: Kaasaegse ökoloogia probleemid. Eesti siseveekogude kasutamine ja kaitse. Tartu. 31-34.

[14] Jeffrey, S.W. & Humphrey, G.F., 1975. *New spectrophotometric equations for determining chlorophylls a, b, c1 and c2 in higher pants, algae and natural phytoplancton. Biochem. Physiol. Pflanz*. Vol. 167: 191-194.

[15] Lorenzen, C.J., 1967. *Determination of chlorophyll and pheopigments: Spectrophotometric equations. Limnol. Oceanogr*. Vol 12: 343-346.

[16] Strickland, J. D. H. & Parsons, T. R., 1972. *A practical handbook of seawater analysis, second edition. Bull. Fish*. Res. Bd Can. Vol 167: 1–310.

[17] Utermöhl, H., 1958. *Zur vervollkommung der quantitativen phytoplankton methodik Mitt*. Int. ver. Theor. Angew. Limnol. 9, 1–38.

- CHL – green algae biomass, g m^{-3}
- CHR – golden algae biomass, g m^{-3}
- CRYP - cryptomonads biomass, g m^{-3}
- DINO – biomass of dinophyta or dinoflagellata, g m^{-3}
- PCI – phytoplankton community index[18]
- Chl*a*JH - chlorophyll a concentration (according to Jeffrey-Humphrey's formula), mg m^{-3}
- Chl *a* L - chlorophyll a concentration (according to Lorenzen's formula), mg m^{-3}
- Phaeop. – phaeeopigments concentration, mg m-3

c) <u>Zooplankton</u>

The assessment of the zooplankton community will be based on the following indicators:

- community structure;
- proto- and metazooplankton percentages;
- species diversity;
- ratio of Maxillopoda, Cladocera and Rotifera in the community;
- presence of dominants;
- sensitivity of dominants to changes in environmental conditions;
- average size of metazooplankton.

The zooplankton community structure enables to describe the nutrition chain in a water body. Nutrition chains form the basis of matter circulation in a water body. It is important to know whether the water body is dominated by the 'classical' linear nutrition chain (algae – metazooplankton – fish) or 'microbial' chain (bacteria – protozooplankton – metazooplankton – fish). This provides important information on the functioning of the entire ecosystem and vulnerability of the community. Zooplankton samples will be collected integrally (at one meter intervals) using Rutner's bathometer. Protozooplankton samples will be fixed immediately in Lugol's solution while metazooplankton samples will be first filtered through a 48 µm plankton net before fixing. The samples will be kept in 200 ml bottles. The samples will be analysed with a stereo microscope. The zooplankton count and biomass in water column will be calculated, dominants and dominant groups will be determined. A species will be classified as dominant if it constitutes at least 20% of the zooplankton count or biomass.

d) <u>Macrophytes</u>

Macrophytes will be surveyed in river sections of 100 m in length. The following indicators will be used: species composition, number of species, dominants, total coverage (%), coverage by taxons (%). The total macrophyte coverage will be determined visually by aggregating the coverage over the entire section. Assessment will be based on the Polish 9-point scale, enabling to establish individual coverage by species. The macrophyte river index (MIR) of Estonian rivers will be calculated by taking into account 93 indicator species, including Tracheophyta, Bryophyta and macroalgae. Each species is assigned the following values:

- trophic value (L) – ranging from 1 (hypertrophic) to 10 (oligotrophic);
- tolerance value (W) – ranging from 1 (wide tolerance species, eurytopic – tolerating a wide range of habitats) to 3 (narrow tolerance species, stenotopic – tolerating only small changes to habitat).

The macrophyte river index (MIR) should be calculated according to the following formula:

$$MIR = \frac{\Sigma L_i * W_i * P_i}{} * 10$$

[18] The PCI has been developed for the status assessment of Estonian small lakes where the numerator of the formula includes eutrophic and denominator includes oligotrophic numbers of species (Ott & Laugaste, 1996). The formula estimates the number of species in the corresponding taxon.

$$\Sigma W_i * P_i$$

L – trophic value

W – tolerance value

P – species coverage according to the scale

The calculated index value will be used to assess the ecological status of the surveyed river section.

e) Bottom fauna

Samples will be collected according to Swedish and European standard EN 27828. A complex of six partial samples will be used – 5 kick samples and one qualitative sample. The kick sample entails mixing the bottom sediment with a foot in front of a scoopnet positioned upright in the stream. Samples will be taken from a random river section with uniform bottom structure. Preference is given to a bottom in a rapid flow section, covered with rocks or gravel, or in the absence thereof, the best available local bottom. The sixth sample will be a qualitative species panel, covering all the main riverbed types and habitats in the sampling area. Five comparable samples will be used to assess the average count of species and taxons on an area unit and taxon diversity; the qualitative sample will be taken into account for other parameters. The following indicators will be used to describe the bottom fauna: taxa richness (T), Shannon's diversity index (H), the ASPT index, the Danish Stream Fauna Index (DSFI), and the EPT index or Ephemeroptera, Plecoptera and Trichoptera taxon counts in the sample. Furthermore, the average number of individuals per square meter (abundance) will be assessed in all cases. Taxa richness means the total taxon count in all six partial samples. Shannon's diversity depends on the total taxons count as well as their mutual domination ratios. The ASPT index shows the average sensitivity of a taxon. The DSFI was designed to assess organic pollution. The EPT index shows the number of taxons in sensitive groups (Ephemeroptera, Plecoptera and Trichoptera).

f) Fish fauna

The surveys of fish fauna will be based on the recommendations in the EN standards: EN 14962:2006 "*Water quality – Guidance on the scope and selection of fish sampling methods*" ja EN 14011:2003 "*Water quality – Sampling of fish with electricity*".

The species composition, species sizes and age structures of fish fauna will be determined by sample fishing. An electrical sampling device running with direct pulse current, adjustable voltage, pulse duration and frequency will be used. The preferred monitoring sections will be rhtithral river sections where fish species diversity and the number of disturbance-sensitive species is higher than in pothamal river sections. Depending on the size and hyrdomorphological properties of the river, a monitoring section in rhtithral sections is usually 60-120 m in length with a fishing area of 200-1000 m^2.

Registered fish species are divided in three groups: indicator species (typical species for this river section, sensitive to disturbances, with priority status in assessing the status of fish fauna; the absence of such species usually indicates significant negative impacts); type-specific species (typical species for this river section but less sensitive to disturbances than indicator species, the presence of absence of such species has lower informative value compared to indicator species); non-type-specific species (the presence of such species in this river section cannot be assumed; they are usually random visitors; these species will not be considered in the status assessment of fish fauna).

The fish fauna status will be assessed as follows:

- Very good - $S \geq 0.75$
- Good - $S = 0.74 – 0.4$
- Poor - $S = 0.39 - 0$
- Bad - $S < 0$
- Very bad - no fish

$$S = (2*I_1 + I_2 – I_3 – 2*I_4 + T_1 + T_2/2 – T_3/2 – T_4) / (L_1 + L_2)$$

I_1 – number of registered indicator species (abundance and age structure in line with the habitat value of the river section)

I_2 – number of registered indicator species (abundance and age structure not in line with the habitat value of the river section)

I_3 – number of indicator species not found in sampling (it is likely that the species is present but its abundance is too low for detection during monitoring)

I_4 – number of indicator species not found in sampling (the species is probably extinct in this river section)

T_1 – number of registered type-specific species (abundance and age structure in line with the habitat value of the river section)

T_2 – number of registered type-specific species (abundance and age structure not in line with the habitat value of the river section)

T_3 – number of type-specific species not found in sampling (it is likely that the species is present but its abundance is too low for detection during monitoring)

T_4 – number of type-specific species not found in sampling (the species is probably extinct in this river section)

L_1 – number of indicator species typical for this river section

L_2 – number of type-specific species typical for this river section

ANNEX 2. METHODOLOGY FOR ASSESSMENT OF POLLUTANT EMISSIONS

1. Methodology for calculating dust emissions from the extraction and crushing process

Estonia has no nationally approved methodology for calculating the pollutant emissions to ambient air from extraction operations. Consequently, the direct emissions from extraction operations and dolomite crushing will be assessed according to the guidance document AP-42, issued by the US Environmental Protection Agency (USEPA). The USEPA has studied air emissions from extraction operations and has presented the results in the methodological document *"Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources. AP 42, Fifth Edition. Chapter 11.9.2 Crushed Stone Processing and Pulverized Mineral Processing. August 2004"*[19].

This methodology covers rock crushing and screening. In addition, the methodology establishes emission factors for rock and gravel loading.

Blasting. The aforementioned methodology does not provide special emission values for rock-blasting in a quarry, because the tests used for the development of the methodology have been infrequent and the results are unreliable. Consequently, the impact of blasting on ambient air will not be assessed.

The emission of pollutants (NOx, CO and dust) will take place over a very short period of time, with provisional pollutant source properties, which enables to treat blasting operations as instances of technological flash emissions.

Crushing and screening. The emissions of solid particles originate from different stages of material processing. The extent of emissions depends on the size of the processed material, its moisture content, process productivity rate, equipment and techniques used, as well as topographic and climatic conditions.

Emission factors (kg/t) are established for total solid particles (PM_{SUM}, aerodynamic diameter: 10-100 μm), fine solid particles (PM_{10}) and, in some cases, ultra-fine solid particles ($PM_{2.5}$).

The special emission values specified below characterise the solid emissions from dolomite processing.

Table 4. Special emission of solid particles from crushing and screening

Stage[20]	Specification	Solid particles, PM_{sum} (kg/t)	Fine solid particles, PM_{10} (kg/t)	Ultra-fine solid particles, PM2.5 (kg/t)
Third crushing	Product diameter: 0.5-2.5 cm	0.0027	0.0012	-
Third crushing (verified)		0.0006	0.00027	0.00005
Fine crushing	Fraction diameter under 0.5 cm	0.0195	0.0075	-
Fine crushing (verified)		0.0015	0.0006	0.000035
Screening	-	0.0125	0.0043	-
Screening (verified)	-	0.0011	0.00037	0.000025
Fine particle screening	-	0.15	0.036	-
Fine particle screening (verified)	-	0.0018	0.0011	-
Conveyor transition point	-	0.0015	0.00055	-
Conveyor transition point (verified)	-	0.00007	0.000023	0.0000065

There are no data available on the first and second crushing stages but the special emission value of the third stage can be used as the potential maximum value.

Loading. The aforementioned methodology also provides special emission values for loading operations.

The following table specifies special emission values of solid particles from loading.

[19] http://www.epa.gov/ttn/chief/ap42/ch11/final/c11s1902.pdf (22.11.2013)

[20] Verified source means that the stage is performed using wet suppression technology.

Table 5. Special emission of solid particles from loading

Stage	Solid particles, PM_{sum} (kg/t)	Fine solid particles, PM_{10} (kg/t)	Ultra-fine solid particles, PM2.5 (kg/t)
Loading of blasted dolomite	-	0.000008	-
Loading of dolomite gravel	-	0.00005	-

The instantaneous emission is found by dividing the annual emissions (t/a) by hours of work:

instantaneous emission (g/s9 = annual emission (t/a) x 1,000,000 / (working hours x 3,600)

Wet drilling PM10 – 0.00004 kg/t.

2. Methodology for calculating dust emissions to ambient air from gravel roads

The calculation of dust emissions to ambient air from gravel roads will be based on the US Environmental Protection Agency (USEPA) guidelines on *"Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources. AP 42, Fifth Edition. Chapter 13.2.2 Unpaved roads. November 2006"*[21].

According to the methodology, the following formula is used to calculate the special emission of solid particles from gravel roads used for industrial purposes:

$$\mathbf{E = k \times (s/12)^a \times (W/3)^b}$$

According to the methodology, the following formula is used to calculate the special emission of solid particles from gravel roads in public use:

$$\mathbf{E = k \times (s/12)^a \times (S/30)^d/(M/0{,}5)^c - C}$$, where

E = special emission (lb/VMT), 1 lb/VMT = 281.9 g/VKT

s – silt concentration, %

W – average vehicle weight, t

M – moisture content of riad surface, % (average is 0.5%)

S – average vehicle speed (mph), 1 mph = 1.60934 km/h

C – emission factor based on exhaust gas and wear of breaks and tyres in vehicles built in the 1980s

The values of constants k, a, b, c and d are provided in the following table:

Table 6. Constants k, a, b, c and d

Constant	Gravel roads in industrial use			Gravel roads in public use		
	$PM_{2.5}$	PM_{10}	PM_{30}*	$PM_{2.5}$	PM_{10}	PM_{30}*
k (lb/VMT)	0.15	1.5	4.9	0.18	1.8	6.0
a	0.9	0.9	0.7	1	1	1
b	0.45	0.45	0.45	-	-	-
c	-	-	-	0.2	0.2	0.3
d	-	-	-	0.5	0.5	0.3

* equivalent with total solid particles (PM_{sum})

"-" = not used in the formula for emission factor calculation

The emission factor calculation formula enable to obtain a result of specified quality under the following conditions (the conditions used for the development of the calculation formula for special emissions).

[21] http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s0202.pdf (25.11.2013)

Table 7. The conditions used for the development of the calculation formula for special emissions

Emission factor	Silt concentration, %	Average vehicle weight		Average vehicle speed		Average number of wheels	Road surface moisture content, %
		Mg	ton	km/h	mph		
Gravel roads in industrial use	1.8-25.2	1.8-260	2-290	8-69	5-43	4-17	0.03-13
Gravel roads in public use	1.08.1935	1.4-2.7	1.05.2003	16-88	10-55	4-4.8	0.03-13

Emission factors (C) based on exhaust gas and wear of breaks and tyres in vehicles built in the 1980s are presented as follows:

Table 8. Emission factors based on exhaust gas and wear of breaks and tyres in vehicles built in the 1980s

Aerodynamic diameter of particles	C, emission factor based on exhaust gas and wear of breaks and tyres in vehicles built in the 1980s, lb/VMT
PM2.5	0.00036
PM10	0.00047
PM30*	0.00047

* equivalent with total solid particles (PM_{sum})

The annual average emission, adjusted for local meteorological conditions, is calculated as follows:

$E_{ext} = E \times ((365 - P)/365)$, where

P – the number of days per year with precipitation exceeding 0.254 mm

3. Assessment of dust emissions from the engines of the vehicles on roads

The main pollutants in the exhaust gases of vehicle internal combustion engines include nitric oxides, carbon oxide, volatile organic compounds and fine particles. The emissions from vehicle exhaust gases will be calculated using the ADMS Roads dispersal calculation model, taking into account the traffic intensity and average speed on the road.

ANNEX 3. PROPOSALS, OBJECTIONS, QUESTIONS AND ANSWERS REGARDING THE EIA PROGRAMME

To be added after public display.

ANNEX 4. REPORT ON PUBLIC CONSULTATION REGARDING THE EIA PROGRAMME AND THE LIST OF PARTICIPANTS

To be added after public consultation.