GEOLOGICAL SURVEY OF ESTONIA

ENVIRONMENTAL IMPACT ASSESSMENT PROGRAMME REGARDING QUARRYING AT NAHA DOLOSTONE QUARRY IN NAHA MINERAL DEPOSIT

Draft version of a document

DEVELOPER
AS KIIRKANDUR

COMPILED BY:
OÜ Eesti Geoloogiakeskus (Geological Survey of Estonia)

RESPONSIBLE EXPERT
Ranek Rohtla
OÜ Eesti Geoloogiakeskus Tartu regional department
geologist, environmental expert, licence KMH 0142

DECISION-MAKING AUTHORITY
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1. INITIATION OF ENVIRONMENT IMPACT ASSESSMENT (EIA)

On 30 August 2013, the Environmental Board initiated an environmental impact assessment on the basis of applications from Kiirkandur AS for a permit for quarrying at Naha dolostone quarry and from Aigren Kaevandus OÜ for a permit quarrying at Kalkahju dolostone quarry. The Environmental Board believes that the potential cumulative and cross-border effects of the two quarries, which are about 1.5 kilometres distant from each other, must be considered in assessing the environmental impact. The latter effect is to be considered because it is projected that the impact associated with the planned activities will extend on to the territory of the Republic of Latvia.

2. OBJECTIVE OF PLANNED ACTIVITY AND GENERAL DATA

Kiirkandur AS wishes to prepare construction-grade aggregate at Naha dolostone quarry (figure 1) and supply it to southern Estonian construction sites. To this point, the only dolostone quarry in southern Estonia is Marinova dolostone quarry, in the south-eastern part of the region. Aigren Kaevandus OÜ wishes to produce construction-grade aggregate at Kalkahju dolostone quarry. The data for Naha and Kalkahju quarry data are provided in table 1.

Table 1

The data for Naha and Kalkahju quarry

Data	Naha quarry	Kalkahju quarry
Land ownership	State forest land	State forest land
Mining share area, hectares	23.54	77.60
Service land area, hectares	37.70	101.89
Adjoining properties	Mõniste mk 3, Leppora, Naha	Mõniste mk 1, Lubjaahju, Paepää, Soosaare
Land use in near vicinity	Mainly forest land	Mainly forest land
Dolostone reserves, thousands of m^3	1,713	4,054
Minable reserves, thousands of m^3	1,647	3,836
Volume of overburden, thousands of m^3	768	2,828
Average thickness of overburden, m	3.3	3.6
Duration of quarrying, years	25	25
Average volume quarried per year, thousands of m^3	70	160
Average thickness of dolostone, m	7.3	5.2
Ratio of overlay to useful layer	1:2.2	1:1.4
Location of reserves with respect to groundwater	100% lower	100% lower
Absolute height (m above sea level) of groundwater level on mining share area, m	81–86	79–84
Absolute height (m above sea level) of lower surface of dolostone	73–75.5	72–79
Absolute height (m above sea level) of River Peetri in area adjoining quarry, m	79	67
Extent to which water level would decline if all dolostone were extracted, m	11	10
Distance from nearest residence, m	790	160
Distance from national border, m	150	500
Distance from River Peetri, m	150	190
Distance from boundary of River Peetri nature area (Natura 2000 area), m	700	60
Distance from boundary of Melnupes mez nature area in Latvia (Natura 2000 area), m	550	950
Direction of transport of material from quarry	Vastse-Roosa–Mõniste	Kuutsi
Directing quarry water	Into River Peetri	Into River Peetri

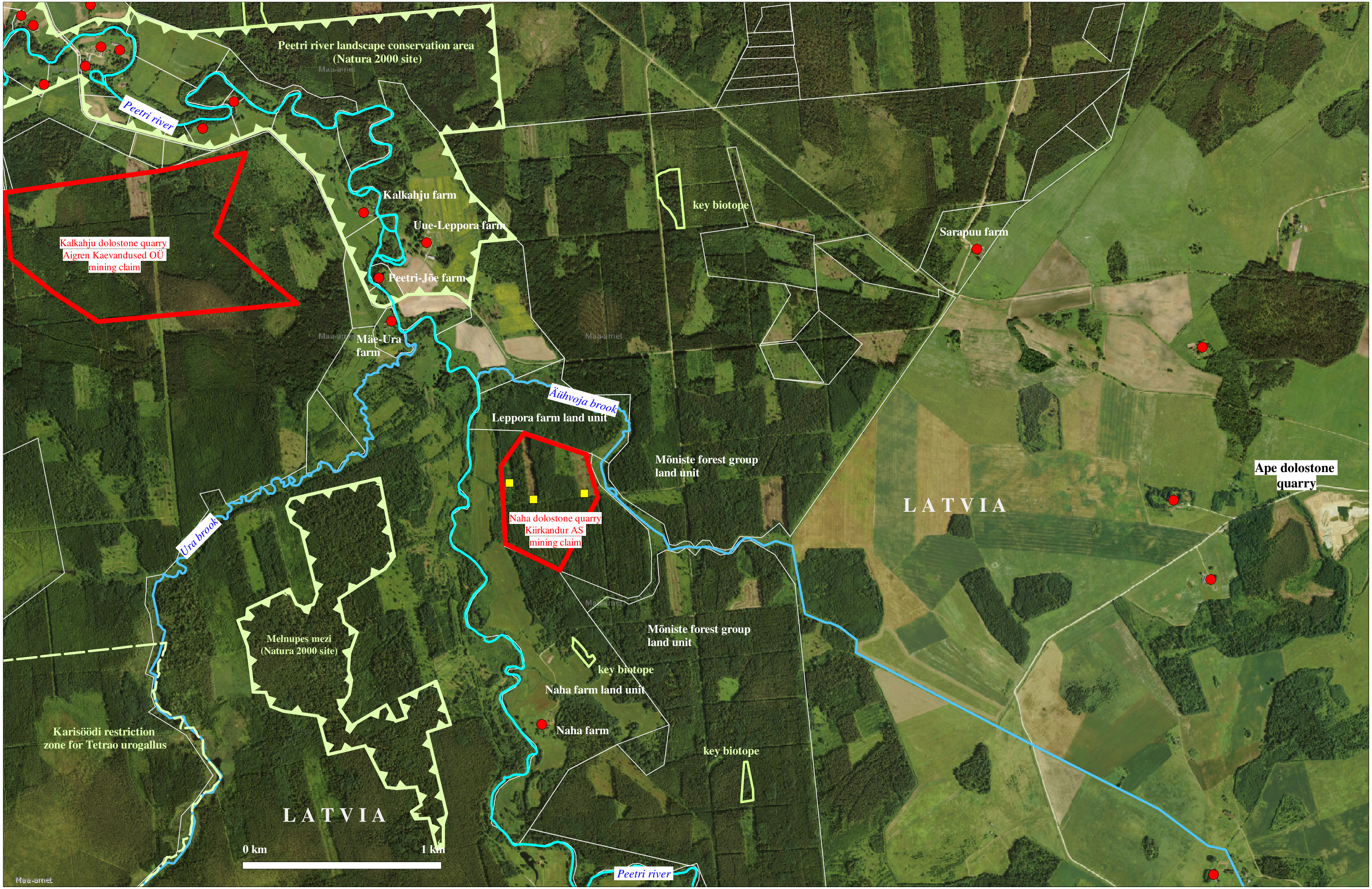

Figure 1. Location of the Naha and Kalkahju quarry on orthoimagery from 2013. Scale 1:24000.
The possible location test holes (yellow signs) on the Naha mining claim. Holes will be dig in the coarse of the EIA for monitoring the groundwater level.

3. PLANNED ACTIVITY, EXPECTED SCOPE OF IMPACT, ENVIRONMENT IN IMPACT ZONE, ENVIRONMENTAL IMPACT ASSESSMENT METHODS, ALTERNATIVES

Activities related to dolostone quarrying in Naha quarry:

- Opening quarry and quarrying
- Material transport
- Reconditioning quarry

The activities for the planned Kalkahju quarry are analogous.

The planned activity and its projected impact on major environmental elements:

- The impact of the quantity and chemical composition of water pumped out of Naha quarry on the River Peetri (part of the Natura 2000 area and included on the list of salmonid habitats) water regime, water quality, aquatic life, habitat types and protected species in the vicinity of the river, outcrops in the river bed. A cumulative impact from concurrent operation of Naha and Kalkahju can be assumed. During the EIA, a Natura assessment will be conducted as well, as it is desired to divert the quarry effluent into the River Peetri, which is part of the River Peetri natural area and on the list of salmonid habitats.
- The impact of pumping water out of Naha quarry on the groundwater level and level of dug drinking water wells in the area (water consumption availability).
- The impact that the establishment of Naha quarry will cause for the quarry area and natural environment, habitat and landscape in the vicinity.
- The impact of the noise and vibration from quarrying at Naha quarry, including blasting and transport of material, on human health and the living environment.
- The impact of the air pollution and explosive products from quarrying at Naha quarry, including blasting and transport of material, on human health and the living environment.
- Impact of transport at Naha quarry on the state of the planned transport road.
- The impact of activity at Naha quarry on the socioeconomic environment.
- Impact of reconditioning Naha quarry on the natural ecosystems and the human living environment.
- Waste generation at Naha quarry and its environmental impact.
- Potential accidents (oil spills) and their environmental impact.
- The potential cross-border impact of Naha quarry activity (groundwater, noise, Malnupes mez Natura 2000 natural area, protected birds).

The EIA report shall assess if necessary the importance, extent, possibilities for alleviating impact and the need for monitoring other environmental impacts arising during the course of the work. On the basis of subsection 20 (1) of the Environmental Impact Assessment and Environmental Management System Act, the impact of the light, heat, radiation and odour related to a planned activity must be assessed in the EIA report. As dolostone quarrying involves no light, heat, radiation and odour pollution or the impact is insignificant, they are not treated.

The EIA methodology consists of comparing the forecasted environmental impacts of alternative action plans to the limits established in legal acts and issuing recommendations for implementation of the optimum i.e. the best alternative.

The significance of environmental impacts from the planned activity will be assessed individually by each environmental element impacted. The magnitude and spatial extent, duration, frequency, effect, cumulativeness and likelihood of the impact from the planned activity and its alternatives shall be analyzed, forecasted and assessed.

Environmental impacts, including in the case that alleviatory measures are implemented, are assessed on the following scale: positive, mildly positive, no impact, mildly negative, negative, significant negative. **The EIA report sets out a comparative aggregate assessment of the environmental impacts (also in the case of alternatives) both with and without implementation of alleviatory**

measures, and also specifies monitoring measures for assessing the effectiveness of implementation of alleviatory measures. If it becomes evident from the EIA that even the alleviatory measures will not prevent a significant negative environmental impact, then the planned activity is not permissible (if the decision-making authority does not decide otherwise, including under subsection 28 (5) of the Earth's Crust Act). **The comparative aggregate assessment of environmental impacts is the clearest and most comprehensible way of explaining the significance of impacts to the public.**

The structure and content of the environmental impact assessment is set forth in Section 20 of the Environmental Impact Assessment and Environmental Management System Act, which establishes requirements for the EIA report. The EIA report on the impact related to the activity planned at Naha quarry shall specify the following:

- The purpose and need for the planned activity is described.
- The planned activity and realistic alternatives are described.
- The environment that is considered likely to be impacted by the planned activity and the realistic alternatives for activity is described and the environmental state in the area is evaluated.
- The environmental impacts considered likely from the planned activity and the realistic alternatives for the activity are assessed, including the cumulative impacts from the combined effects of activity at the two quarries (Naha and Kalkahju).
- The environment that is considered likely to be impacted by the planned activity and the realistic alternatives for activity is described and the environmental state in the area is evaluated.
- The possibilities for reconditioning the mined area are assessed.
- The presumed effects of the environmental impact are assessed and measures for preventing or minimizing potential negative environmental impact are described and the presumed effectiveness of use thereof assessed.
- A reasoned proposal for establishing environmental monitoring conditions is made, based on the results of the assessment of the environmental impact of the planned activity and its realistic alternatives.
- An overview of the results of the environmental impact assessment and public comment period is presented.
- Difficulties that emerged during the EIA and preparation of the EIA report are detailed.
- Information on sources used in the EIA is presented.
- The proposals, objections and questions submitted regarding the report are treated. Copies of all of these shall be added to the report, including copies of responses sent to the persons who submitted proposals, objections and questions explaining that the proposals and objections submitted regarding the report were taken into consideration or else providing a reason as to why they were not considered, and answering the questions.
- Minutes of the public discussion on the report are treated, with a copy of the minutes appended to the report.
- A diagram and map of the area pertaining to the planned activity and its realistic alternatives is provided along with other relevant documents appended to the report.

In assessing the forecast extent of the environmental impact, the most reliable indicator is the extent of environmental impact caused by other quarries – either of analogous size or larger ones – that have operated for a longer period in similar geological and environmental conditions and for which bore and dug well water level and water quality monitoring, monitoring of quality of water directed into water courses, and monitoring of the condition of and habitats in water courses has been performed and the extent of noise and air pollution related to the blasting, operation of quarrying machinery and transport has been measured. An example that can be cited is Aru-Lõuna limestone quarry near Kunda; the area of the quarry excavations is 2 km^2, ground water has been lowered constantly by 20 m over 50 years and effluent has been discharged into the River Toolse, which is listed as a salmonid habitat and spawning area.

3.1. Quarrying in Naha quarry

Preparations for quarrying in the mining share area of Naha quarry (23.54 ha, forest land, owned by Estonian state) will take place gradually by stages as dolostone quarrying progresses. A harvester will be used to fell timber; a chipper used to make wood chips; and a bulldozer, excavator and trucks are used for moving the overburden.

The overburden, 768,000 m^3 in volume and an average of 3.3 m thick, consists mainly of clay-sand glacial till and clay. The thickness of the latter is 1.1 m and the volume, 260,000 m^3. The clay located on the mining share is not accounted for as a mineral resource, as the thickness of the clay layer and the quality of the clay is very variable, which hinders its industrial use.

The overburden will be deposited on the service land of the mining share and gradually used to reinforce the dolostone walls of the quarry (to reduce the amount of water seeping into the quarry) and the fill in the excavation, so that the area could later be partially afforested as forest land and part of it turned into a body of water.

Reserves of high-quality construction-grade dolostone in Naha quarry amount to 1,647,000 m^3 and the average thickness of the layer is 7.3 m. The dolostone in the Naha dolostone quarry mining share is in monolithic rock form and as in most Estonian dolostone and limestone quarries, it will be fragmented by blasting. The volume of dolostone to be blasted at one time is between 2,000-3,000 m^3. In order to quarry the average annual amount (70,000 m^3), blasting would have to take place 25-35 times a year. An excavator will be used to lift the blasted-apart rock into a mobile crusher hopper, and from there the material will continue on to the screening stage. Material screened into different grades will be transported to piles by a wheeled loader. An example of the crushing and screening operation is provided in figure 2, the transport of the aggregate to the piles is shown on figure 3, and blasting is depicted on figures 4 and 5. A crushing and sorting centre, excavator and wheeled loader will operate simultaneously at the quarry. The quarry operations (blasting, crushing and sorting) will take place over 5-6 months of the year.

Figure 2. Crushing and screening dolostone at Marinova dolostone quarry in Võru County.

Figure 3. Transport of the aggregate to the piles by a wheeled loader at Marinova dolostone quarry in Võru County.

Figure 4. Using blasting to fragment limestone in limestone quarry no. II in Otisaare in Jõgeva County. Photograph taken from 300 m away one second after blasting. The fragmented dolostone flies a few dozen meters in the direction of the quarried area.

Figure 5. Using blasting to fragment limestone in limestone quarry no. II at Otisaare in Jõgeva County. Photograph taken from 300 m away in the fifth second of the blasting. After the dolostone is fragmented, the dust disperses quickly.

During quarrying in Naha quarry, vegetation will be destroyed and the landscape is irreversibly transformed. To determine whether protected plants occur in the quarry area, a botanic inventory shall be performed in the course of the EIA in Naha quarry area.

The environmental impacts related to quarrying of dolostone and limestone (noise, vibration, air pollution) have been previously modelled and measured many times. Based on past modelling and measurements, the expected radius of the impact zone for noise and vibration related to Naha quarry activity is 0.5 km, and for air pollution and blasting products, 0.3 km (figure 6). A low cross-border impact can be presumed for noise. There are no farms within the expected impact zone. The living environments of the nearest farms – Naha and Mäe-Ura – are located approx. 0.8 and 0.85 km from the boundary of the quarry. There are no known bird and animal habitats or Natura 2000 network areas in the near vicinity of the quarry (radius of at least a half kilometre).

For the purpose of assessing the impact of noise and air pollution, including cumulative impact (Naha and Kalkahju quarry operate simultaneously) noise and air pollution modelling will be performed both with and without the implementation of alleviatory measures.

Potential alleviatory measures include establishment of overburden embankments along the boundary of the quarries, limiting work periods to daytime hours, blasting only in the daytime, and sprinkling quarry road surfaces in dry periods.

The noise impact (a cumulative effect can be presumed if the two quarries operate simultaneously) is assessed in the case of both quarries based on the target noise level established for industrial sites, which in the case of category II sites (children's and educational institutions, health care and social welfare institutions, residential areas, recreational areas and parks in cities and settlements) (Minister of Social Affairs regulation no. 42 – RTL, 14 March 2002, 38, 511) is 55 dB (7:00–23:00) and 40 dB (23:00–7:00). Blasting involves impulse noise, which can better be characterized using the corresponding noise level adjustment factor (+5 dB according to Minister of Social Affairs regulation no. 42).

The impact of air pollution (combined effect of two quarries is not assumed) is assessed based on the maximum air pollution value for solid particulates (PM-sum) 500 $\mu g/m^3$, the 24-hour average limit 150 $\mu g/m^{3,}$ and the 24-hour average limit for PM10 air pollution, 50 $\mu g/m^{3,}$, these limits being established for the protection of human health in Minster of the Environment regulation no. 43 of 8 July 2011 (Threshold and target values for ambient air pollution, other limits for pollutant content and deadlines for attaining them).

The impact of vibration related to blasting (the combined effect of two quarries is not presumed as it is unlikely that blasting will take place at both quarries simultaneously) on the environment and buildings shall proceed from standards established by Minister of Economic Affairs and Communications regulation no. 64 of 1 June 2005 (Requirements applicable to blasting operations projects). In assessing the impact of vibration related to the operation of quarry machinery on the living and working environment, the basis shall be the standards established by Minister of Social Affairs regulation no. 78 of 17 May 2002 (Limits for vibration in homes and public buildings and methods for measuring vibration) and the Government of the Republic regulation no. 109 of 12 April 2007 (Occupational health and safety requirements for work environments impacted by vibration, limits for vibration in work environments and procedure for measuring vibration).

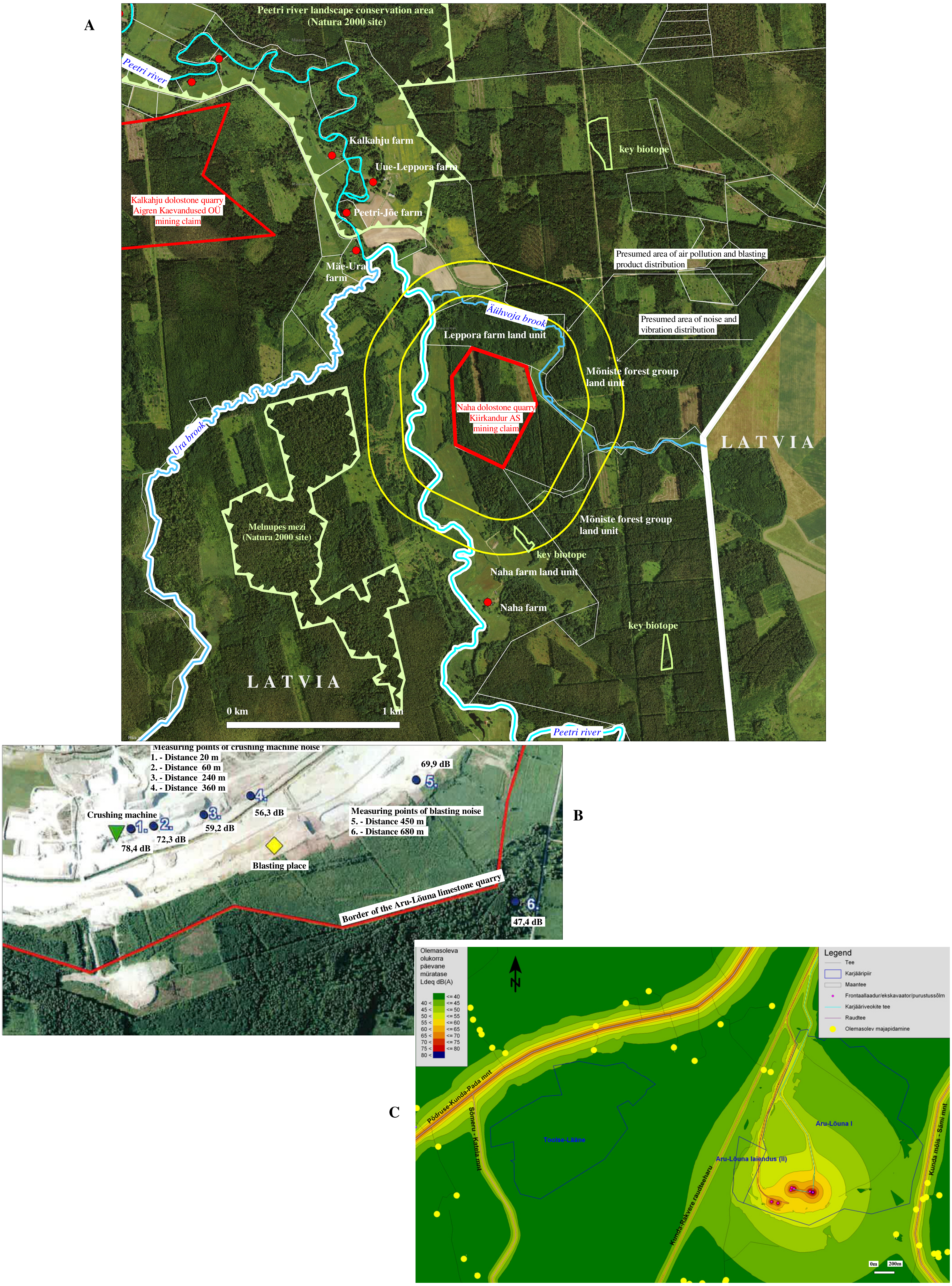

Figure 6. A - Presumed noise, vibration and air pollution zones for activities (dolostone processing and blasting) at Naha quarry based on previous modelling and actual impacts measurements at analogous quarries. Stationary crushing-sorting unit and noise from blasting was measured (B) and modelled (C) at Estonia's largest Aru-Lõuna limestone quarry at the time of the EIA of Toolse-Lääne and Aru-Lõuna quarry no. II (approved by the Ministry of Environment in 2014). In the same quarry, the Estonian Environmental Research Centre has taken random measurements of the air pollution from crushing and blasting - in each case the limits were not exceed at 300 m from the source of pollution. Measurement of the vibration of the ground caused by blasting at Aru-Lõuna quarry (a 15 m high formation was blasted; 2.5 tons of explosive was expended, 5,000 m3 of limestone was fragmented) showed that the oscillation of the vibrations was 0.4 mm per second, which was many times less than the permissible speed.

3.2. Pumping water out of Naha quarry

All of the dolostone in Naha quarry (average thickness 7.3 m) and a part of the overburden as well is lower than the ground water level, according to geological investigations (Tuuling et al, 2013). Thus it is likely that regardless of the technology used to extract the dolostone, the area will have to be predrained. For the purpose of the preliminary draining, an approx. 200 m long drainage ditch flowing into the River Peetri to the west of the quarry will be dredged (or a pipeline established), sedimentation basins, a water collector ditch and, if necessary, a pumping station will be built. The work will take place on the basis of the quarry project – **the preliminary project will be prepared at the time that the EIA is conducted.**

The preliminary drainage of the mining share area will take place throughout the duration of the quarrying, unless it is possible to quarry the dolostone without pumping out the water. To dredge the outflow ditch (for laying the pipeline) and establishing the sedimentation basins, an excavator shall be used, a water collector ditch will be established in the dolostone and blasting will be used to establish the ditches. Examples of the water collector ditch, the other ditches and the pump station are shown in figure 7. The drainage of the quarry area will involve lowering of the groundwater level, the projected impact of which, including on water consumption from dug wells, may, according to the geological investigation (Tuuling et al 2013) extend to a maximum 3 km (if the water level within the quarry is lowered to the level of the lowest surface of the mining share; figure 8) to the west and north, where are located the River Peetri and estuarine area of Äuhvoja stream, which have cut into the water-bearing dolostone, up to these water courses, as the water courses constantly feed the aquifers. The lowering of the groundwater level to the west of River Peetri will also reduce the amount of quarry water diverted into the river.

Figure 7. Pumping out water from the approx. 1.5 km^2 Aru-Lõuna cement limestone quarry. The amount of water pumped out of Aru-Lõuna quarry can be as much as 400 litres per second. Water collector ditch, other ditches, pump station and pipeline as seen on orthophotograph (left) and photograph (right).

The 5.8 m deep dug well of Naha farm is within the boundaries of the expected impact zone, and so are two forest key biotopes. A cross-border impact to the south can be expected if the ground water level is lowered. No combined effect with Kalkahju quarry from the lowering of the groundwater is presumed, as in addition to the River Peetri, Üra stream is also in the area between the two quarries, and this stream also feeds aquifers through its streambed.

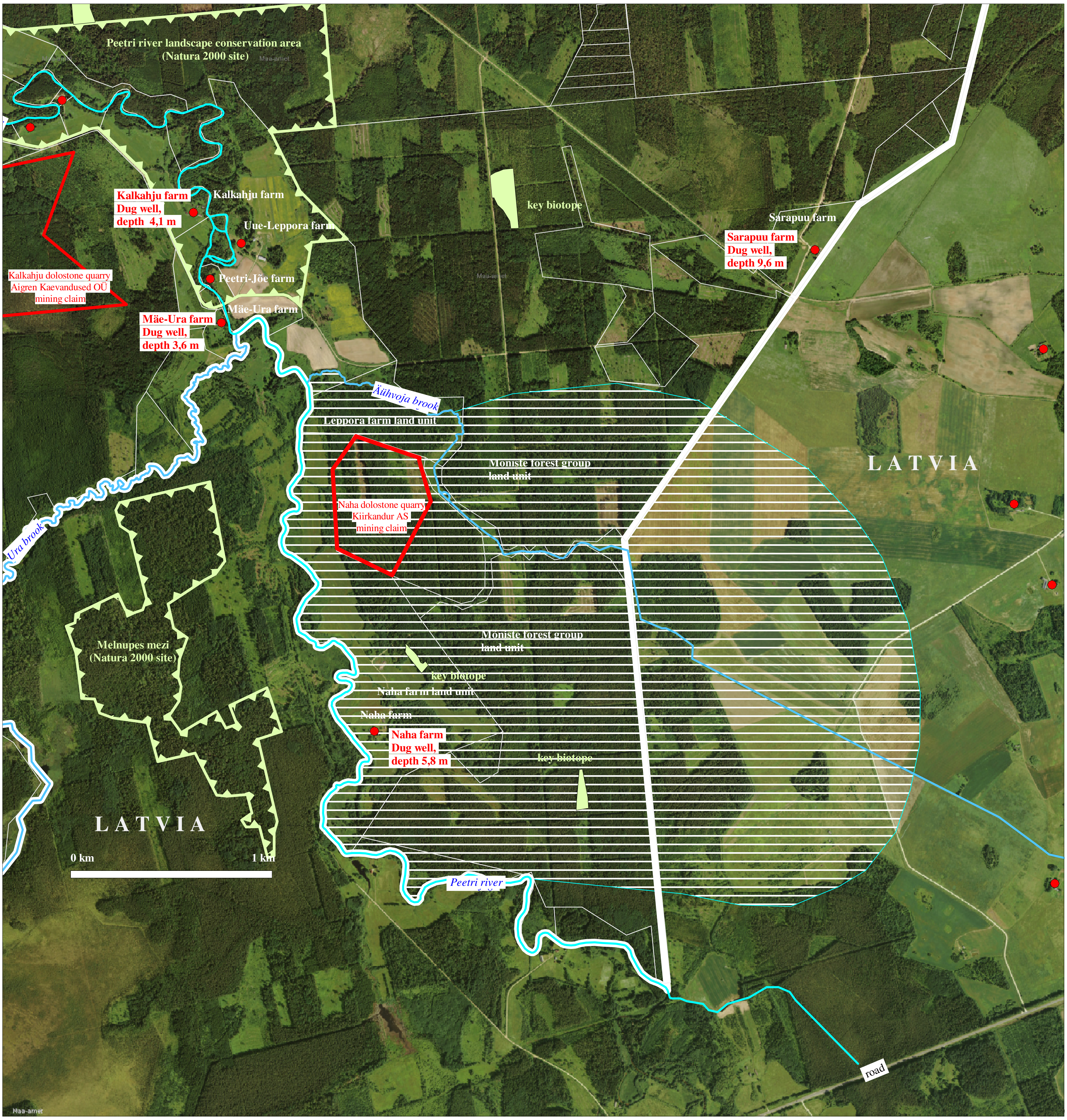

Figure 8. The expected impact zone for lowering of groundwater (marked by hatchmarks) upon pumping out ground water from Naha quarry (upon draining the quarry area to the level of the bottom on the mining claim, to the maximum amount of lowering).
The Peetri riverbed and Äuhvoja river mouth area have cut into groundwater-bearing dolostone.
The 5.8 m deep dug well at Naha farm is within the boundaries of the expected impact zone.

The determination of the surface area and vertical extent of the lowering of the groundwater and the assessment of the impact related to the lowering on water use and the natural environment also relies on data from the Kalkahju geological investigation and hydrogeological testing, water level monitoring data for dug wells in the area (the wells are dug into dolostone and their water level marks the ground water level; water level has been measured since this May at Naha, Mäe-Ura, Kalkahju and Sarapuu farm wells – the monitoring will continue once a month until autumn 2015; there are no wells at Peetri-Jõe and Uue-Leppora).

To determine the possibility of quarrying dolostone from under water without lowering the ground water level by pumping, two to three caverns (figure 1) will be established on the area of Naha quarry using an excavator. The caverns will extend up to the upper surface of the dolostone or to the top part of the dolostone deposit. Measurement bars will be installed in the caverns and once a month (up to the autumn of the next year) the water level will be measured as long as the groundwater level is higher than the bottom of the cavern. If it turns out that the top of the dolostone is higher than the groundwater level, it will be possible to use only an underwater quarrying method, as the thickness of the dolostone layer is low (average of 7.3 m). The establishment of caverns and later closure (reconditioning) will be coordinated with the State Forest Management Centre.

If possible, the water level of the operational Ape quarry and the water level of bore wells and dug wells in the area will be measured to assess the actual extent of water lowering in quarrying operations in similar hydrogeological conditions (Naha and Ape quarries are located in the Upper Devonian carbonaceous rock water stratum).

To reduce the extent of the ground water lowering, the possibility of using the overburden (clay soil) to reinforce the walls of the quarry is analyzed and two alternatives will be assessed:

- The ground water level will be lowered to a level that allows blasting, natural resource extraction and processing to be carried out on a dry surface, on the ceiling of the dolostone layer.
- Groundwater level is lowered to the level of the bottom of the quarry (figure 8).

Figure 9 shows an example of the first alternative; figure 10, the second alternative.

Figure 9. The underwater dolostone in Marinova quarry in Võru County is blasted to a depth of 6 m. On the left, we see the fragmented dolostone lifted from under the water and on the right is the body of water in the quarry.

Figure 10. At Aru-Lõuna quarry in Lääne-Viru County, the limestone is blasted “dry,” as the water level has been lowered to the level of the bottom of the quarry. The height of the quarry wall is approximately 15 metres. In the background under the wall, we see how far the pieces of rock are strewn during blasting – up to 50 metres.

It is planned to channel the water pumped out of the quarry (if pumping is necessary), after it passes through sedimentation basins, via a forest drainage ditch (or pipeline) into the River Peetri (figure 11).

To assess the impact of the water pumped out of the quarry on the Peetri River’s water level and the aquatic life, the river’s water level is to be measured at two monitoring points – the thresholds (figure 11) located near the bridges (bridge located on the southern boundary of the river Peetri landscape protection area and Karisöödi bridge) once a month up to next autumn. Since May this year, the water level of the river has been measured at these monitoring points. More frequent measurement of water level is not justified as the expected impact of introducing quarry water on the water level is very low and aquatic life has adapted to the seasonal fluctuations in water level (including spring floods and summer low periods).

The River Peetri landscape protection area has been established for the protection of River Peetri, the river flora and fauna and landscapes; it is also a Natura 2000 nature area with a number of Natura 2000 habitats, and the River Peetri special conservation area. One of the conservation objectives of the special conservation area of River Peetri is to protect the habitats of thick-shelled river mussel, European bullhead, green snaketail, spined loach and river lamprey. River Peetri is on the list of spawning areas and habitats of salmon, river trout, sea trout and grayling. A transitional area between the sandstone and carbonaceous rock of the Devonian period is seen in the valley of River Peetri. Sandstone and dolomite rock is exposed in the cliffs along a relatively short stretch of just a few kilometres. Near Naha quarry, the absolute height of the water level in the River Peetri is about 79 m above sea level, near Kalkahju quarry it is about 67 m. The river bed height declines 12 metres over a stretch of nearly 3 km. An overview of the River Peetri as one of the most important environmental elements potentially impacted is set forth in figures 12 and 13.

On the basis of the Naha quarry geological investigation report (Tuuling et al 2013) the maximum amount of water pumped out of the quarry in the final years of the quarrying is 9,565 m^3 per day – which is about 110 litres per second. If such a quantity of water was introduced to the river, the water level would rise just a few centimetres, which could have a slight effect only on aquatic life and habitat types that protect aquatic life located directly along the low floodplain along the riverbed (figure 14). The riparian flora and fauna could also be impacted by water diverted into the river from the quarry if the chemical composition of the water does not meet the requirements for water in salmon rivers. As it is desired to divert the quarry water into the River Peetri and the water level could rise just a few centimetres if the water were added, the following habitat types and species will be found in the expected impact zone: water courses of plain to montane levels (3260), alluvial meadows (6450), alluvial forests (91E0*), natural old broad-leaved deciduous forests (9020*), calcareous and siliceous rocky slopes (8210; 8220), spined loach, European bullhead, river lamprey, green snaketail, thick-shelled river mussel, and *Berula erecta*. Other Natura habitat types are located at higher elevations and will not be located in the impact zone of the planned activities.

To assess the potential impact of the quarry water on habitat types and species, an aquatic life study (figure 11) will be performed in the course of the EIA, to give an overview of the past and current status of the river, habitats and species:

- Bacterial plankton (three times during the vegetative growth period along three segments of river): BHT_5, Saprobacteria abundance, total count;
- Phytoplankton (three times during the vegetative growth period along three segments of river): species, status indexes, abundance, biomass, chlorophyll *a* content ;
- Zooplankton (three times during the vegetative growth period along three segments of river): species, status indexes, abundance, biomass;
- Macroscopic plants (once per vegetative growth period): species, abundance of groups, depths of range, assessment of status on the basis of dominant biota;
- Zoobenthos (once per vegetative growth period): species, status indexes;
- Fish (once per vegetative growth period): species, biomass, status assessment.

A botanic inventory of the land vegetation habitat types within the expected impact zone will also be performed.

Monitoring of physicochemical indicators of the river water (three times per vegetative growth period along three segments of river):

water colour,
alkalinity,
electrical conductivity,
water transparency;
pH,
oxygen level,
temperature distribution,
suspended solids,
nutrient concentration (NH_4 , N-NO_3, total N, PO_4, total P),
dissolved organic matter
BHT_7 and KHT-Cr from surface layer samples

to be performed upstream of the inlet of the river (background level; monitoring point 1 figure 11); downstream of the inlet flowing into the river by Leppura bridge (monitoring point 2); near the mouth of the River Peetri near Tiitsa bridge (monitoring point 3). The location of these monitoring points would allow assessment of whether the addition of quarry water would have an impact, whether the impact would be local, extend downstream to a moderate distance or have such an impact that the impact extends to the river mouth. On the basis of the monitoring data, the combined effect of the water diverted from Naha and Kalkahju quarry into the river Mustjõe can be assessed, and from there on to the Gauja river in Latvia – the latter is also listed as a salmonid river.

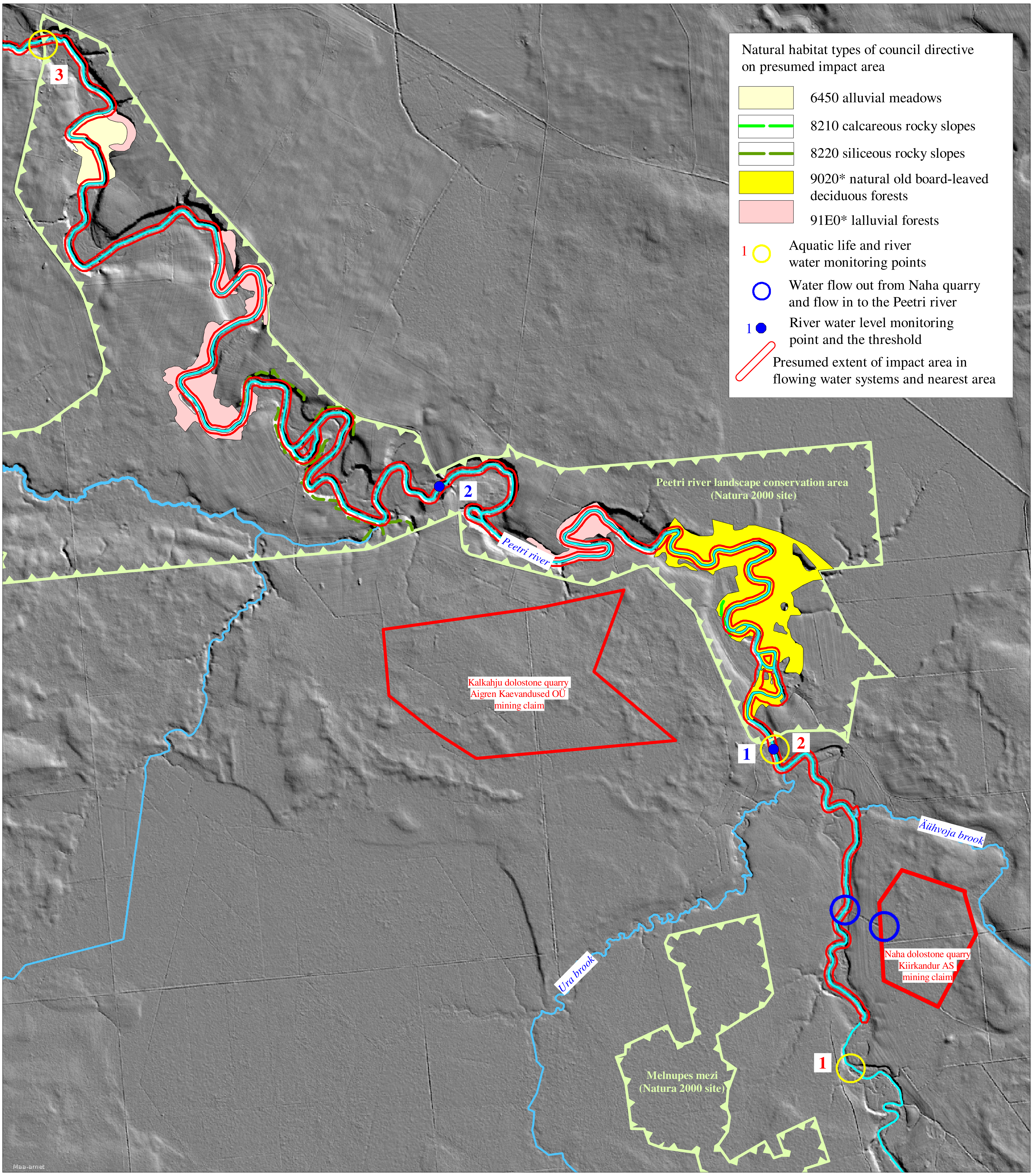

Figure 11. Overview of the presumed impact area in the case of pumping water out of Naha quarry into River Peetri, aquatic life and river water monitoring points, water level monitoring points. Scale 1:20 000. Basis: shaded relief map from the Estonian Land Board map application.

Figure 12. Peetri river at Mäe-Ura farm in March 2012 during spring flooding.

Figure 13. Peetri river at Mäe-Ura farm in July 2013 during the summertime low water level.

If possible, the quantity of water pumped out of Ape quarry (photo 14) is measured to obtain a realistic idea of the volume of water to be pumped out of Naha quarry – both of the quarries are located in the same hydrogeological conditions, Ape quarry is deeper (approx 17 m and currently also smaller - about 8 hectares; figure 15 and 16). The planned depth of Naha quarry is about 10 m and the area is approx. 23.5 hectares. This April, a general analysis of the water flowing out of Ape quarry was conducted, and it showed that the suspended solids are low (7.4 mg/litre) and comparable with the analysis of River Peetri water (suspended solids 5.7 mg/l). A water sample was taken from River Peetri by the southern bridge on the same day – 14 April. If possible, a water sample will also be taken from the outlet of Ape quarry to determine components on the basis of which the water of salmonid rivers is standardized.

Figure 14. The end of the outlet pipe that flows from Ape quarry to the outlet ditch. The diameter of the pipe is about 30 cm. Off in the distance are embankments of quarry overburden. Sample for general water analysis was taken 14 April 2014 directly from the outflow.

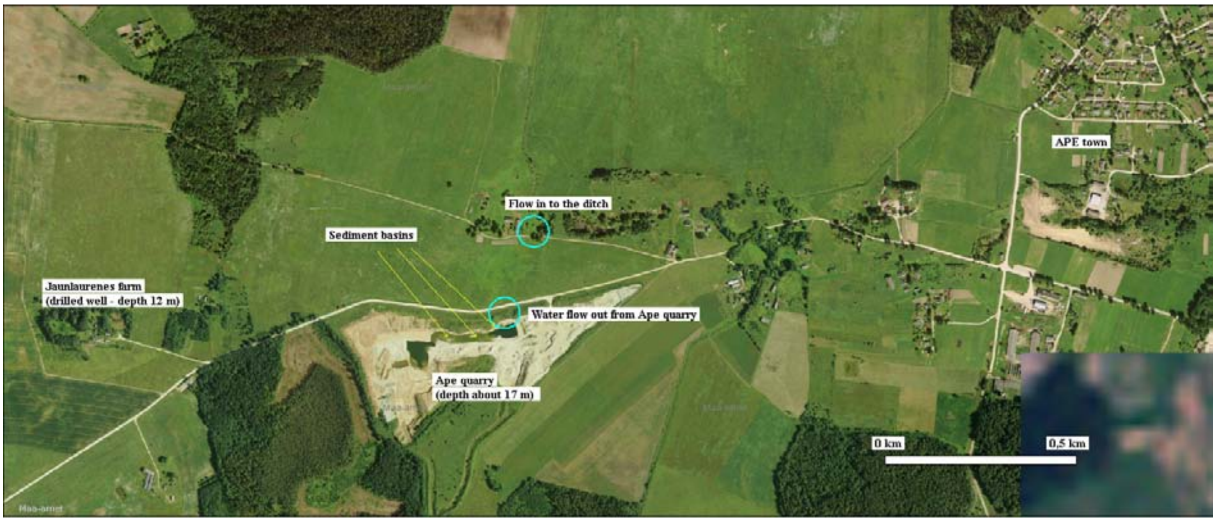

Figure 15. The approx. 8 hectare Ape quarry is surrounded by farms. Ape town is about 1.5 km away. Settling basins can be seen on the orthophotograph. Basis: 2013 orthophotograph from the Land Board map application.

Figure 16. Ape quarry in April 2014. Despite the fact that the dolostone is covered by a thick clay layer, the sedimentation basins in the quarry allow to pump out water which content of suspended solids is low.

To reduce the impact of water diverted from the quarry into the River Peetri, it will be important already during the EIA to develop, in the preliminary design for the quarry, an effective water treatment system that would ensure that carbonaceous suspended solids and suspended solids from clay overburden sediment before the solids reaches the river. The closest example is the water treatment system at Ape quarry, which has three sedimentation basins and overflows (figure 16).

The impact of the water diverted into River Peetri will be assessed first and foremost based on the requirements set forth in the Minister of the Environment regulation no. 58 of 9 October 2002 (List of bodies of water protected as salmonid and cyprinid habitats and water quality and monitoring requirements for these bodies of water and national environmental monitoring stations for salmonids and cyprinids).

As there will likely be an impact on the natural assets in the River Peetri nature protection area, a Natura assessment (a so-called appropriate assessment) will be performed.

3.3. Material transport from Naha quarry

The annual average output from Naha quarry is planned to be 70,000 m^3, which is about 190,000 tonnes, which is a realistic estimate as a maximum of 66,000 m^3 has been extracted from the Marinova dolostone quarry located in eastern Võru County. During a given year, transport of aggregate will take place mainly over 10 months – about 200 working days. If a truck has a load of an average 25 tonnes, that would mean three round trips an hour (6 lengths total) in the course of a day (7:00-20:00; one hour for lunch break).

The developer wishes to transport material along the Vastse-Roosa – Mõniste route, using the Naha, Sarapuu, Tikuti and Mehka–Vastse-Roosa road (figure 17). The 12,4 km long route does not pass through high-density settlement areas and 7.5 km goes through forest. There are five farmhouses near the road, 40-70 m away (Mõtuskonnu, Tikuti, Peebu, Mäe-Lustoja and Suure-Tamme).

The planned road is not adapted for heavy truck traffic. The southern part of the road (Naha and Sarapuu road, figure 18) crosses land administered by the State Forest Management Centre. The width of the road is 4 metres, with a sandy soil surface and clay soil subgrade. The road is used mainly for forest maintenance. The Tikuti road segment is in an analogous state. The Mehka–Vastse-Roosa side road (figure 19) is wider (6 m), with a gravel surface, but it, too, would not tolerate heavy truck traffic, as the surface in this area consists mainly of clay.

Transportation will produce noise, air pollution and vibration. Noise and air pollution modelling was performed in 2014, for instance as part of EIA for the quarries in the Helmi-Aakre deposit (figure 17). If we presume the traffic density for transporting material from Naha quarry, plus ordinary traffic is 8 vehicles per hour (according to Road Administration 2013 traffic census, the traffic density on Mehka – Vastse-Roosa road is 24 cars per day) then traffic noise target level during daytime (60 dB) may extend to a distance of 10 m from the road (expected impact zone 20 m). At this traffic density on an unsurfaced dusty gravel road, the air pollution standards would be exceeded for a distance of about 70 m (expected impact zone approx. 100 m).

As the planned transport road is not meant for intensive heavy-truck traffic, **a preliminary project for transport road renovation will be prepared in the course of conducting the EIA;** the project will include economic calculations and deal with hiker safety, as Naha and Sarapuu roads are part of the State Forest Management Centre hiking trail network.

In the course of the EIA; a noise and dust modelling will be performed with regard to the planned transport route and alleviatory measures for lessening impact will be presented. Already at the time that the EIA programme was prepared, it was clear that without rendering the transport route dust free on the segments adjoining farms, the planned activity would not be permissible.

Impact of noise will be assessed based on the target level for highway noise, which in category II (children's and educational institutions, health care and social welfare institutions, residential areas, recreational areas and parks in cities and settlements) (Minister of Social Affairs regulation no. 42 – RTL, 14 March 2002, 38, 511) is 60 dB (7:00–23:00) and 50 dB (23:00–7:00).

The impact of air pollution will be assessed based on the maximum air pollution value solid particulate (PM-sum) established as the maximum air pollution limit, 500 µg/m3, the 24-hour average limit 150 $\mu g/m^3$, and the 24-hour average limit for fine particle air pollution (PM10), 50 $\mu g/m^3$, these limits being established for the protection of human health in Minister of the Environment regulation no. 43 of 8 July 2011 (Threshold and target values for ambient air pollution, other limits for pollutant content and deadlines for attaining them).

In assessing the impact of vibration related to movements of heavy trucks on the living and working environment, the basis shall be standards established by Minister of Social Affairs regulation no. 78 of 17 May 2002 (Limits for vibration in homes and public buildings and methods for measuring vibration).

3.4. Naha quarry recultivation

The quarry area will start to be reconditioned based on a recultivation project as soon as this is technologically possible. As the dolostone reserve is located at lower than groundwater level, the predominant focus of the recultivation effort will be the body of water. The body of water will diversify the landscape in the area and create recreational opportunities. The overburden removed from the natural resource will be used to shore up the slopes of the quarry and incrementally fill in the quarried area. The area higher than the ground water level will be reconditioned as forest land. The machinery used to recondition the quarry (excavators, loaders and trucks) are the same that will be used to mine and transport the natural resource and the environmental impact caused by them (noise, air pollution) are low and short in duration compared to the quarrying itself.

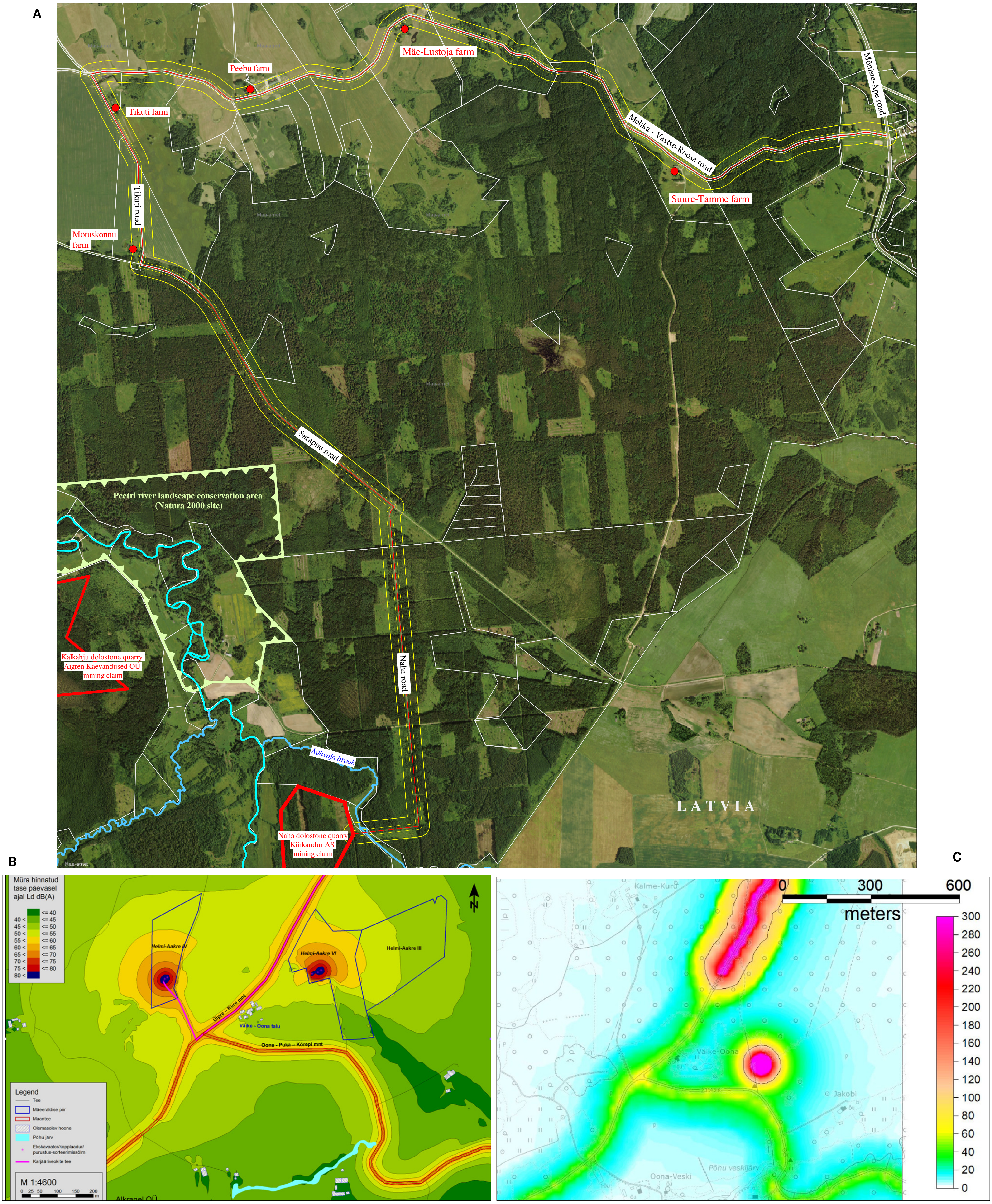

Figure 17. A - Expected noise and air pollution impact area around Naha quarry transport road, provided that the traffic density with regard to transporting material from the quarry, including ordinary traffic, is 8 trips per hour, at a speed of 70 km/h. At this traffic density, 60 dB noise level (daytime target level) would extend up to 20 m from the road (marked by the yellow lines closest to the road) and the level of air pollution in excess of the limits on an unsurfaced gravel road would extend 70 m from the road (marked with the yellow lines further from the road). Five homes and yards are located near the road.
Example of modelling the range of the noise from the crushing and transport of gravel from Helmi-Aakre gravel quarry no. 4 (B) and modelling of the range of air pollution (C) in the course of an EIA conducted in 2014. At a traffic density of 10 trips per hour (speed 70 km/h) the 60 dB noise limit extends a maximum of 10 m from the road (transport route to the north). On the other road segments, ordinary traffic takes place (52 vehicles per day).
The figure showing the range of air pollution points to the maximum 24 hour average concentration of total solid particulate matter (limit 150 mcg/m3) in a situation ordinary traffic (52 vehicles per day) on an unsurfaced gravel road on most road segments and the northern road segment in a situation where the dump trucks carrying material from Helmi-Aakre quarry no. 4 are also travelling along the road. Together with quarring machinerytraffic on unsurfaced roads tha 24-hour limit for total solid particulate matter would be exceeded until 60-70 m from the road.

Figure 18. View to the Naha road heading toward the north, from the crossroad of forest roads northeast of Naha quarry. The road has a low embankment and a sandy surface.

Figure 19. View of Mõniste–Ape blacktop side road to the Mehka–Vastse-Roosa gravel side road.

3.5. Alternatives

To achieve the planned objective, production and sale of aggregate from Naha quarry, the overburden must be removed, the quarry area has to be drained either to the dolostone ceiling or bottom, the dolostone has to be fragmented and processed and the quarry must be reconditioned during the validity of the quarrying permit.

Dolostone has been registered as an active proved mineral resource only in Naha and Kalkahju deposit. As quarrying permit applications have been submitted for both deposit areas, there are no realistic alternatives for carrying out the planned activity.

The overburden will be removed using modern heavy machinery (bulldozers, excavators, loaders, trucks). There are no other realistic alternatives for accessing dolostone that have a lower environment impact and are economically justified.

After pumping water out of the quarry, it is diverted into the River Peetri. There are no other realistic alternatives in the case of Naha quarry.

Blasting is the predominant method used in Estonian quarries to fragment dolostone. There are no other realistic alternatives for fragmenting dolostone that have a lower environment impact and are economically justified.

The dolostone reserve is located lower than groundwater level. After the mineral is extracted, the quarry area will be reconditioned as a body of water and forest land. There are no other realistic alternatives.

It is expected that the ground water level will have to be lowered in order to quarry the dolostone. There are two realistic alternatives considered for lowering ground water level for dolostone quarrying.

- The ground water level will be lowered to a level that allows blasting, natural resource extraction and processing to be carried out on a dry surface, on the ceiling of the dolostone layer.
- Groundwater level is lowered to the level of the bottom of the quarry.

One road is being assessed as a transport route for finished product; it does not pass through a high-density area and mainly passes through forest.

As alternative 0, a situation ´where the planned activity does not take place and the current activity continues` is being assessed. Commercial forest grows on the mining share being applied for and its service land; the forest is administered by the State Forest Management Centre. Alternative 0 assesses the environmental impact of the forest management activity to this point on both nature and the economy. Alternative 0 also assesses the current state of the planned transport road and the use of the road. Alternative 0 also assesses the current state of the River Peetri as a salmonid river.

4. EIA PROCESS TIMETABLE AND PUBLICATION

Public disclosure of the EIA programme, including to the Latvian side – October-November 2014;
Supplementation of the EIA programme on the basis of the results of public disclosure – December 2014;
Submission of the EIA programme for approval – December 2014;
Public disclosure of the EIA programme, including to the Latvian side – September-October 2015.
Supplementation of the EIA programme on the basis of the results of public disclosure – November 2015;
Submission of the EIA programme for approval – December 2015

5. DATA DEVELOPER, DECISION-MAKING AUTHORITY, SUPERVISIORY AUTHORITY, EXPERT GROUP AND INVOLVED PERSONS

Developer:
AS Kiirkandur, Järvekalda tee 1, Harku municipality, 76902 Harju County. The developer is represented by Tiit Ploom, telephone 5013667; e-mail: info@warren.ee.

Decision-making authority:

Environmental Board Põlva–Valga–Võru region, Karja 17a, 65608 Võru. Contact person Siret Punnisk, telephone 7990913, e-mail: siret.punnisk@keskkonnaamet.ee.
Supervision:
Ministry of the Environment, Narva mnt 1, 15172 Tallinn. Contact person Maris Malva, telephone 6260742, e-mail: maris.malva@envir.ee.

Expert:
OÜ Eesti Geoloogiakeskus (Geological Survey of Estonia), Kadaka tee 82, Tallinn, 12168. Responsible expert Ranek Rohtla, licence KMH0142, tel. 5071545, e-mail: ranekrohtla@egk.ee.

The following members are in the working group:

Geological Survey of Estonia

- Ranek Rohtla – environmental expert, licence KMH0142. Area of activity: 1) mining of mineral resources reserves and processing of mineral, including enrichment or concentration. Area of impact: 1) mineral resource; 2) air pollution related to mining of mineral resources reserves and processing of mineral, including enrichment of concentration; 3) noise and vibration related to mining of mineral resources reserves and processing of mineral, including enrichment of concentration; 4) soil and landscape; 5) water pollution and water level related to mining of mineral resources reserves and processing of mineral, including enrichment/concentration.
- Ain Põldvere – environmental expert, licence KMH0137. Area of activity: 1) mining of mineral resources reserves and processing mineral, including enrichment of concentration; 2) land improvement. Area of impact: 1) mineral resource; 2) water pollution and water level; 3) noise and vibration; 4) air pollution; 5) soil and landscape.
- Rein Ramst – environmental expert, licence KMH0146. Areas of activity: 1) mining of mineral resources reserves and processing mineral, including enrichment of concentration. Impact areas: 1) mineral resources; 2) water pollution and water level; 3) terrestrial plant life; 4) protected natural objects. Natura assessment.
- Rein Perens – adviser on hydrogeological matters.
- Valeri Savva – senior hydrogeologist, hydrogeological modelling.
- Leonid Savitski – lead hydrogeologist, hydrogeological and applied geological investigations, geotechnical site work, geotechnical site investigations.
- Sten Suuroja – specialist responsible for preparation of project for mining and secondary use of the working, certificate of competence no. VP-003-12.
- Mati Lelgus – hydrogeologist. Holds Ministry of Environment sample taker certificate no. 997/11 for conducting water investigations (waste water sediment, surface water, ground water, effluent and waste water). Holds Ministry of Social Affairs drinking water sample taker certificate no. 469.

Alkranel OÜ

- Tanel Esperk – noise range modelling expert.

University of Tartu Institute of Physics Atmospheric Physics laboratory

- Marko Kaasik, senior researcher, air pollution range modelling expert.

Estonian University of Life Sciences Institute of Agricultural and Environmental Sciences

- Arvo Tuvikene – biologist, expert on aquatic life, Natura assessment, impact of mining on fish fauna in Natura areas.
- Tõnu Feldmann – biologist, expert on aquatic life, Natura assessment, impact of mining on flora in Natura areas.

If necessary, additional experts will be included (such as an expert on bird life) in the course of the EIA.

Other persons involved:

Residents and land owners on farms within the expected impact zone of the planned activity in both Estonia and Latvia, Võru County Government, Mõniste and Ape municipality governments, State Forest Management Centre, Road Administration, Environmental Inspectorate, Ministry of the Environment of the Republic of Latvia, environmental NGOs, the public.

Programme compiled by:

Ranek Rohtla

Ain Põldvere