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LANDSCAPE AND VISUAL IMPACT ASSESSMENT IN ESTONIAN ROAD CONSTRUCTION PRACTICE

MAASTIKU JA VISUAALSE MÕJU HINDAMINE EESTI TEE-EHITUSE PRAKTIKAS

Master's Thesis

Curriculum in Landscape Architecture

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CONTENTS

INTRODUCTION

Estonian road construction projects have recently been, mostly due to European influences, rather grandiose. The reason this thesis is directed to road design and practice is the fact that roads are built all over Estonia and therefore it has an impact on the residents of urban areas as well as rural areas. It is the rural environment that makes the transportation objects stand out. Especially, as they are often very optimistically dimensioned but poorly fit into the surrounding environment.

The pace of living is getting faster and therefore the transportation is expected to develop new speeds as well. To provide higher speed but larger safety and comfort as well, considering the increasing amount of cars, the highways are getting wider and straighter, junctions multi-level, covering larger areas ever.

Objects of this character turn out to be strange and unacceptable to human eye, especially in the natural environment. Hence the aim of this thesis - to find out if the road design and construction practice in Estonia considers the impact the designed object has on the landscape and its receptors. In doing so, the current road design practice is studied, as well as the methodology of landscape and visual impact assessment.

The overall aim of the study is to answer the following questions:

Is landscape and visual impact assessment used in Estonian road design practice?
On what basis is the assessment conducted?
Is landscape and visual impact assessment necessary in Estonian road design practice?

1. LANDSCAPE AS A RESOURCE

Although, Estonia is one of the few countries that has not ratified the European Landscape Convention, it stands for the values of the convention noting that the landscape is an important public interest in the field of culture, ecology, environment and sociology and also constitutes a resource and creates jobs (European…, 2000). Landscape, as defined by the European Landscape Convention, a definition which is widely used in many situations (Guidelines…, 2013: 14), "is an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors" (European, 2000). The inclusive nature of landscape within the ELC definition moves beyond the concept of landscape being only a matter of aesthetics. Instead, it focuses on the landscape as a resource that conceptualizes our surrounding and provides spatial framework (Guidelines…, 2013: 15). European Landscape Convention acknowledges the importance of landscape to the formation of local cultural heritage, contribution to human well-being but also the accelerated transformation taking place due to developments in agriculture and forestry, industry, regional and town planning, transportation etc (European…, 2000).

2. CONTEXT OF THE LANDSCAPE AND VISUAL IMPACT ASSESSMENT IN ESTONIAN LEGISLATION

Landscape and Visual Impact Assessment (LVIA) is a tool used to identify and assess the significance of and the effects of change resulting from development on both the landscape as an environmental resource and on people's views and visual amenity.
Landscape and Visual Impact Assessment is commonly carried out formally as a part of an Environmental Impact Assessment, or informally as a landscape appraisal for development proposal. In both cases, the principles and approach for LVIA are similar.

In Estonia, visual impact is assessed as part of an Environmental Impact Assessment (EIA) and therefore should be considered for every activity that requires a formal EIA. The necessity for an EIA is stated, since 1985, by European Union Directive (Nõukogu…, 1985) which constitutes regulations for all the member countries. The EU Directive covering EIA and related matters applies equally but is implemented through regulations that may be different in every country. Each country also has specific regulations that cover a range of activities that require an EIA. (Guidelines… 2013) In Estonia, the Environmental Impact Assessment and Environmental Management System Act states that the Environmental Impact Assessment is obligatory for developments which have significant environmental impact, such as processing oil, pit coal or oil shale, construction of a thermal power station or a nuclear power station, production of metal from ore, manufacturing chemicals on an industrial scale etc. Among others construction and exploitation of infrastructure is listed. Paragraph 20 of the Act states that the Environmental Impact Assessment report should analize the potential significant environmental impact on peoples' health, well-being and property, on plants, animals, soil and other mineral resources, landscape, air and water quality, cultural heritage etc (Keskkonnamõju… 2005).

2.1. Procedure

A manual for Environmental Impact Assessment divides the environmental components affected as follows (Randmer, A et alle 2002: 23):

3. air quality
4. noise
5. visual aspect
6. water
7. ecological aspect
8. cultural environment aspect
9. socio-economic aspect.

At first, the significance of the impact on the components of the environment is predicted to see, if the potential effects need to be assessed. Often there are no objective quantitative methods or scales to foresee and assess the impact, and subjective evaluations must be carried out. For example, the visual impact which is mostly interpreted as the aesthetic value of the landscape but can also be extended to artificial environment. When describing and assessing the visual aspect of the landscape questionnaires are used which, in addition to objective characteristics such as relief and land use, also consider the subjective evaluation (beautiful, interesting etc) of specialists and the public (Randmer, A et alle 2002: 24).

3. CURRENT SITUATION IN THE ROAD CONSTRUCTION PRACTICE IN ESTONIA

The current situation of the landscape and visual impact assessment as a methodology used in the practice on road construction in Estonia was studied having thematic conversations with specialists of this field. The subjects of the interviews were chosen to cover different aspects of the road construction project process. As all of the large road construction objects are on the major national roads, the Road Administration plays the role of a client, represented by Janar Taal (2016), Head of the Construction and Development Department of the Southern Region. According to the the Environmental Impact Assessment and Environmental Management System Act, projects of large transportation objects need to have an Environmental Impact Assessment conducted and therefore a specialist of EIA, Olavi Hiiemäe (2016), was involved. The actual design process was insighted by the CEO of an infrastructure design company, Mikk Reier (2016) and a road construction student Kristo-Martin Kermes (2016).

The outcome of the interviews was rather clear. Although, the concept of 'visual impact' is stated in legislative texts and supported by the overall landscape policy of Europe, the visual impact itself is attributed as a matter of no significant importance, depending on the development (Hiiemäe, 2016). Nevertheless, the assessment of the visual values is entirely based on the conscious of the researcher (*ibid.).* The cause to that might be the education our specialists have (Kermes, 2016), and the values of our society. Three out of four interviewees had not heard about the concept of assessing the landscape and visual effect a development might have, although the impact of a transportation objects was rather considered high, as they are the main re-designer of our landscapes (Reier, 2016). On the other hand, everybody supposed that the lack of interest lies in the economy, as the budget as well, as the standards, set quite strict boundaries (Taal, 2016). However, the tendencies show improvement when it comes to considering the impacts in the design phase rather than just rely on the means of mitigation. (For full written interviews, see the Appendixes folder, p 5-12.)

4. METHODOLOGY OF LANDSCAPE AND VISUAL IMPACT ASSESSMENT

4.1. Preface

The methodology used in the dissertation is based on "Guidelines for Landscape and Visual Impact Assessment. 3rd Edition", the practice of the United Kingdom. The Landscape Institute and the Institute of Environmental Management & Assessment have been working on developing the methodology and providing instructions for specialists for decades. "Guidelines for Landscape and Visual Impact Assessment" has been published three times, each of the new edition improving the previous. The third edition of GLVIA, published in 2013, is up to date recognizing the fast transformations taking place in the landscape as well as the importance of landscape.

"Guidelines for Landscape and Visual Impact Assessment. 3rd edition" is chosen to be the core text of the dissertation mainly because this methodology is taught to the students of the department of Landscape Architecture in the Estonian University of Life Sciences. Therefore, the material is available and acquired by the future specialists.

4.2. Assessment of Landscape Effects

4.2.1. Scoping

An assessment of landscape effects deals with the effects on the landscape as a resource, which are caused by the changes the activity evokes considering how the proposed activity affects the elements that make up the landscape.

The first step in the process is scoping. In this phase all the possible effects on landscape should be identified. It might occur, that not all of the effects are of remarkable significance and therefore need no further consideration. All other possible effects should be considered in detail in the following assessment process.

Scoping should also identify the area that needs to be considered within the assessment on landscape effects. The study area must include the site itself and also the surrounding landscape depending on the potential significance of the proposed development. The area could be identified based on the extent of the landscape character types but it might also be identified according to the area from which the proposed object is potentially visible, defined as the Zone of Theoretical Visibility. The scoping might also be a combination of the two methods.

4.2.2. Baseline Study

Second step is establishing the landscape baseline. Baseline study is necessary to identify and record the character of the landscape and its elements. It should also consider the value attached to the landscape which means the relative value that might be given to the landscape by society.

The methods used should be appropriate to the context - rural landscape, urban landscape, coastal and marine landscape, and include the characterization of historic and cultural heritage landscapes. The landscape baseline should be presented in a baseline report along with the illustrations (maps, photographs, sketches depicting the current situation).

The overview of the baseline should describe the character of the landscape, dividing it into Landscape Character Types, at an appropriate level of detail. In addition, the aesthetic and perceptual aspects of the landscape should be identified and described where necessary. Describing the condition of the landscape will also contribute into a detailed depiction of the current situation of the area of interest. The baseline study is conducted on reference literature and maps.

4.2.3. Predicting the Landscape Effects

Once the baseline information is available, it can be combined with the details of the the proposed development to describe the potential effects on the landscape. Firstly, the landscape receptors should be identified. Landscape receptors are the components of the landscape that are likely to be affected. These could be the overall character of the landscape, its key elements and specific aesthetic aspects. Having identified the landscape receptors, the possible effects set in the scoping phase can be reviewed and reconsidered if necessary. The effects on the landscape can be direct or indirect, secondary, cumulative, short-, medium- or long-term, permanent or temporary, positive or negative. Identifying the landscape effects should take account of all the types.

Effects on the landscape that are considered to likely take place need to be described as thoroughly as possible. These can be effects on individual components of the landscape, removing or adding elements, such as buildings or trees, and effects on the landscape character and condition.

The next step is to decide whether the landscape effects are positive or negative. The decision might be based on the degree to which the proposal fits to the existing landscape character and/or the contribution of the design of the proposed object has on the landscape even if it creates a strong contrast with existing situation. These suggestions may or may not be included but either way, the judgement needs to be clearly stated.

4.2.4. Assessing the Significance of Landscape Effects

According to the "Guidelines of Landscape And Visual Impact Assessment" (The identified landscape effects should be assessed to determine their significance which is calculated for each landscape receptor by judging the sensitivity of the landscape receptor and the magnitude of the effect on the landscape.

Firstly, the landscape receptor is assessed in terms of their sensitivity. This judgement is based on the susceptibility to the change proposed and the value attached to the landscape. The sensitivity of the landscape resource could be assessed through assessing the landscape designations, landscape quality, cultural heritage interest, landscape characteristics, the amount of the resource that is potentially affected, distance from the site etc (Bell, 2015). Susceptibility is the ability of the landscape receptor to accommodate the development under discussion without consequences for the existing situation.

Magnitude of landscape effects assesses the effect on landscape receptors in terms of scale, extend, duration and reversibility. The landscape effects are either dominant, conspicuous, apparent or inconspicuous (Bell, 2015).

4.2.5. Calculating the Overall Significance of Landscape Effects

After assessing the sensitivity of the landscape receptor and the magnitude of the landscape effect final judgement about the significance of impact can be made. Although, it is difficult to say which effects are significant and which not, the scale varies from major loss or irreversible negative effects to reversible negative effects of short duration. When an extensive area is affected influencing the key characteristics of a designated landscape, the effect might be considered of great significance. Where landscape effects turn out to be negative and irreversible, mitigation options should be introduced.

4.3. Assessment of Visual Effects

4.3.1. Scoping

Assessment of visual effects deals with the changes in views and the visual amenity. Scoping identifies the area which should be covered, the range on people affected and viewpoints that need to be examined. Scoping should be rational and proportioned considering the scale of the surrounding landscape as well as the essence of the development.

4.3.2. Establishing the Visual Baseline

The visual baseline helps to identify the area, the groups of people and the viewpoints that might be influenced by the development. The visual baseline is more detail than the scoping phase. First step is mapping the visibility. This can be done either by map interpretation and cross-sections or creating maps of Zone of Theoretical Visibility. The latter, although not considering buildings, forest and other objects that might influence the potential visibility, is more widespread nowadays

As the object is theoretically visible from the range of the ZTV, receptors of visual effects need to be designated, which means identifying the people who would be more likely to experience the effects of the development. These people, the visual receptors, could be working or living in the area, visiting the area or otherwise engaged.

In addition, viewpoints from which the proposed object could be seen need to be identified. These should include public viewpoints and public access buildings, roads that are used for public and private transport, places where people work. Depending on the site, sometimes considering private viewpoints is also justified. The viewpoint can be broadly divided into three categories: representative viewpoints, specific viewpoints, illustrative viewpoints. At each viewpoint photographs should be taken which are then combined with the rest of the baseline information to identify the significant visual effects.

4.3.3 Assessing the Significance of Visual Effects

As with landscape effects, assessing visual effects needs a methodical consideration of the nature of the visual receptors and the nature of the effect on the views. Firstly, the sensitivity of the visual receptors, that is the people likely to be affected in a specific viewpoint, has to be identified. The visual amenity is influenced by the activity the person is taking while experiencing the view at a particular location, and the extent of their interest and focus. The most susceptible receptors are residents at home, people engaged in an outdoor activity, landscapes with a sense of place.

When assessing the susceptibility of the landscape receptors value attached to the views has to be taken into account as well.

4.3.4. Magnitude of the Visual Effects

The visual effects identified need to be evaluated in terms of their size, scale, extend, duration and reversibility. The judgement of the magnitude of the visual effects needs to cover the scale of the change, its proportion within the view, the distance from the viewpoint etc.

4.3.4. Calculating the Overall Significance of Visual Effects

For overall judgement on the significance of visual effects the significance of visual effects and the magnitude of visual effects need to be combined. The significance is not too strictly determined since the circumstances vary for every development proposal.

5. LANDSCAPE AND VISUAL IMPACT ASSESSMENT

5.1. Preface

In order to determine whether Landscape and Visual Impact Assessment is an appropriate method to be used to research the significance of the landscape and visual effects, the procedure of the LVIA was carried out. The three sites of interest chosen were of different character, a site in an urban context involving a new element; a small-scale transportation object in rural landscape, and a large-scale object in rural landscape. The sites of interest are as follows:

I and II section of the Eastern Circuit of Tartu;
Mäo detour on the Tallinn-Tartu-Võru-Luhamaa road;
Aruvalla-Kose section on the Tallinn-Tartu-Võru-Luhamaa road.

What makes the process on Landscape and Visual Impact Assessment extraordinary, is the fact that all of the three object were already constructed and functioning by the time of the assessment.

The assessment started with a baseline study to identify the landscape resource which resulted in Landscape Character Assessment. The baseline study was conducted on reference literature and map analysis. After having identified the ZTV and the location of the viewpoints, fieldwork followed. The results can be seen in the Appendix folder, p 18-65.

5.2. I and II Section of the Eastern Circuit of Tartu

Tartu is the second largest town in Estonia, situated in the south-east of Estonia between the lake Peisi and the lake Võrtsjärv. Tartu is cut into two by the river Suur-Emajõgi which flows from north-west to south-east for 10 km within the town.

The Eastern Circuit of Tartu is a detour around the town which is designed to connect Tallinn-Tartu-Võru-Luhamaa major road No. 2 and Jõhvi-Tartu-Valga major road No. 3, directing the transit traffic away from the center and reducing the overall traffic load of the city center. The eastern part of the circuit is divided into three steps, two of which are already built. The first step, starting from the junction of Võru street and Ringtee street and running east until the prison of Tartu on Turu street, is 2,1 km long (Tartu idapoolse… 2010). It is the only section of the whole development that is built using the existing street corridor.

The I section consists of multi-level junction of Võru street, also known as the Postimaja junction. The junction is made up by a viaduct, four ramps, two roundabouts and collector roads.

The main road has four lanes (2+2) and junctions regulated by traffic light on Jalaka and Tähe streets. The junction on Turu street is solved with a roundabout. There are light traffic roads on both sides of the street. The construction was finished in January 2014.
The II section of the Eastern circuit starts where the I section ended, by the prison of Tartu. The road runs north along a new route, crossing the river Emajõgi, Ihaste glade and Ihaste road up to Lammi street. The lenght of the II section is 2,9 km.

The II section is mostly two lanes wide (1+1) and includes a bridge of 400 m over the river Emajõgi and Ihaste glade. The Ihaste road is overshoot with a crossing which means that there is no access from Ihaste road to the bridge to keep the traffic density in the area as low as possible due to a Natura 2000 area of the Ihaste glade where 65 species of birds appeared during a research in 2004 (Tartu idapoolse… 2010).

There are concrete walls on both ends of the bridge for noise control to block the light pollution, and an additional soil wall in front of Varsa and Salutähe streets which buffering the changes in the water level. There is a light traffic road along the bridge which is connected to the Ihaste road allowing light traffic to access the bridge from Ihaste dwelling area (Tartu idapoolse… 2010). The deadline for the second section was in April 2015 (*ibid.*).

5.2.1. Assessment of Landscape Effects

5.2.1.1. Landscape Character Assessment

Relief

Figure 1. Relief around the Postimaja junction and the Ihaste bridge.

Tartu is located on the Ugandi plateau (Arold 2005: 175) which is also known as the Southeast Estonia plateau (Arold 2005: 261). The residual soil is formed by sandy sediments and moraine (Arold 2005, 264). The relief of the Ugandi plateau is mostly flat with the exception of the primeval valleys, including the bed of the river Emajõgi (Arold 2005: 261) which strongly influences the topography of Tartu (see Figure .). Above Tartu there are two valleys of different age and origin. The ice-age created a deep canyon-like valley of primeval-Emajõgi that is 0,8-1,1 km wide. After the ice-age the valley was partly filled with sand and clay sediments which created a mature valley (Arold 2005: 269) visible today.

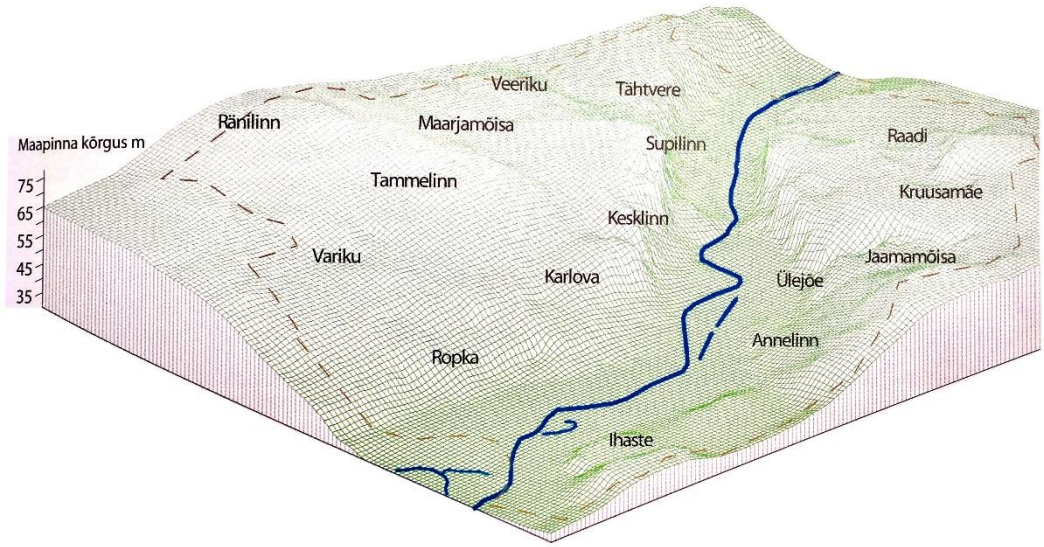

Figure 2. 3D model of the valley of river Emajõgi within the territory of Tartu. Constructed by: Kull, A. (Arold, 2005: 263).

The flat and low banks of the river are often over-flooded which makes them unsuitable for constructions but rich in wildlife. In the Aardlapalu quarry area, south-east from Tartu, the relief is altered by human. South from the river Emajõgi, the relief is gently undulating (Arold 2005: 268), whereas North-Tartu is known for its drumlins (Kaur *et alle*. 2008: 297) which have given name to the neighbouring landscape division, Vooremaa (Arold 2005: 205).

Hydrology

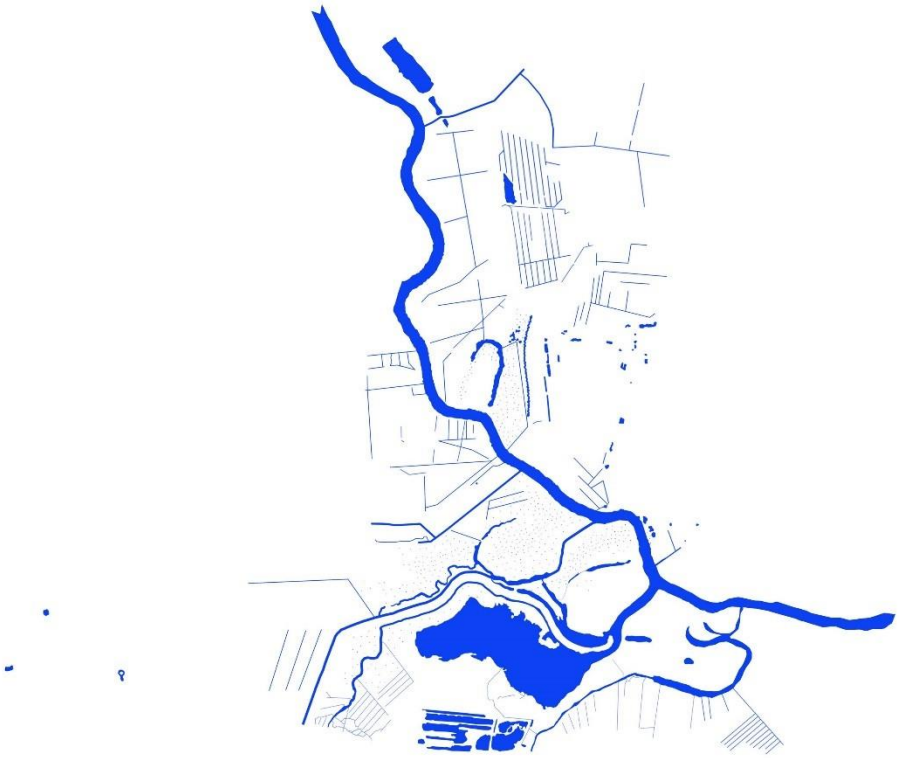

Figure 3. The water network around the Postimaja junction and the Ihaste road.

The Postimaja junction, Ringtee street and its extension to Lammi street are built near one of the largest rivers in Estonia, the river Emajõgi, also known as Suur-Emajõgi, with a total length of 101 km (Suuroja, Suuroja 2005: 26) and a catchment area of 9628 km² (EELIS 2010a). It is the longest navigable river in Estonia and therefore has a recreational importance. The river is a site of natural protection as a habitat of carps (*ibid.*) . The river Suur-Emajõgi flows west-east with the lake Võrtsjärv being its source and the lake Peipsi being the mouth of the river. The downfall of Suur-Emajõgi is approximately 4 cm per km (Suuroja, Suuroja 2005: 26). Tartu is located in the middle course of the river but the river falls 3 m before Tartu and only 0,5 m after flowing through the town (Kaivo 2012) meaning that the the second half of the river runs slower and also straighter. The longitudinal profile of the first half of the river is varied and so is the width of the river. The width of the second half of the river is 50-70 m and depth 4-9 m.

The amplitude of the water level changes is 1-3 metres. The maximum level is reached in the spring when the river over-flows its bed and floods the glades (*Ibid*.). Ihaste glade is one of the many areas over-flooded by the rising water-level.

Figure 4. High water-level on the Ihaste glade in Tartu. Source: (Tartu idapoolse...*s.a.*)

Porijõgi is a right tributary river of the river Emajõgi which starts from the Otepää highlands (Eesti jõed 2001: 364) and runs 38 km to mouth the river Emajõgi in the south from Tartu. The lower course of Porijõgi flows on the boggy plateau. The river which used to flow into the lake Aardla, emanated the lake as two different rivers, the western known as Porijõgi and the eastern known as Savijõgi. The Konsu bog around the over growing lake Aardla was drained in 1970.-1980. and Porijõgi was directed into a canal passing by the lake leaving the eastern branch, Savijõgi, which is just 3,2 km long (EELIS 2010b) try (Eesti jõed 2001: 365).

The meanders of Emajõgi, draining ditches, Porijõgi and Savijõgi, Aardlapalu sand quarry (Kaivo 2012) and water reservoir and the lake Aardla create a complicated water network on the Aardla polder. The rest of the water system of the area is made up by drainage ditches, small ponds and an artificial wetland along the Ringtee street between the Ihaste road and the bridge.

Land Use and Land Cover

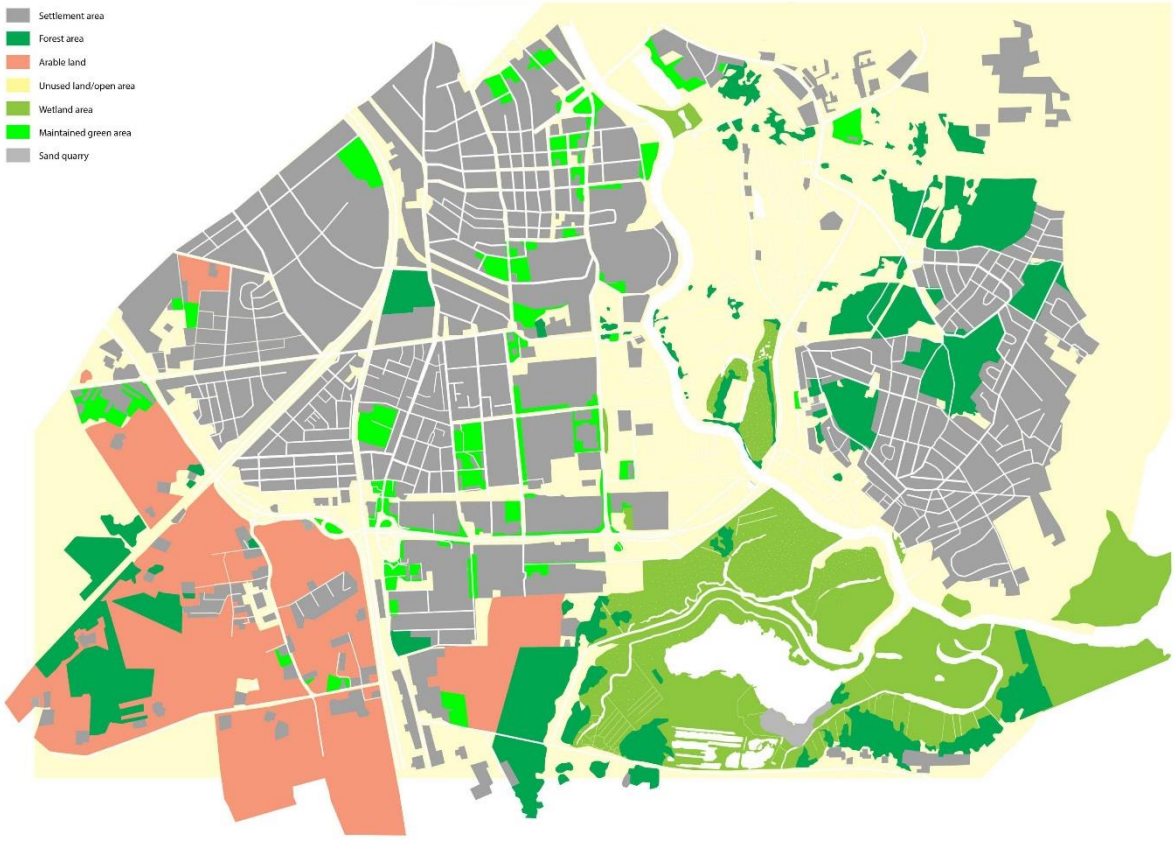

Figure 5. Land use and land cover around the Postimaja junction and Ihaste bridge.

The territory around the Postimaja junction and Ihaste bridge is mostly settlement area and therefore built up. Settlement, the centre of Tartu, covers most of the right bank of the river and creates a dense patch on the left bank as well, the Ihaste dwelling area. Despite Tartu being a dense settlement area, areas of different land use and land cover stand out as well. The area south from Tartu is used as arable land. Although cut by small patches of forest and settlements, the arable land covers large areas. The open fields are mostly used for growing crops, for example rape and barley are cutivated. According to R. Kask Tartu belongs to the region of typical turf-carbonate soils which fertile and suitable for agriculture (1996: 219).

The percentage of grassland is also considerable and among maintained grasslands, vast open areas that remain uncultivated stand out, for example the natural grassland of the Ihaste glade. Another land cover type common for the banks of the river Emajõgi is wetland areas. The right bank of the river, south from Ihaste is covered by a vast wetland which is suitable for different species of wet-loving grasses and willows. The lake within the wetland is used to excavate sand.

Figure 6. Sand quarry as seen from the Tõrvandi-Roiu-Uniküla road.

Building Structure

Figure 7. Building structure around the Postimaja junction and the Ihaste bridge.

The Postimaja junction, Ringtee street and the bridge are surrounded by Variku, Jalaka and Vana-Ihaste dwelling areas and Ropka industrial area in the town of Tartu. Soinaste dwelling area belongs to the territory of the neighboring Ülenurme municipality. Due to the mixed land use areas the building structure around the object of interest is varied.

Variku and Jalaka are old garden city areas. The lots are quite small and therefore the dwellings form a dense homogeneous pattern which is only interrupted by a few larger public buildings and some block houses. Ihaste on the other hand is almost entirely made up by private houses. Although the buildings create regular street corridors, the overall pattern is rather free form. The building structure of Soinaste dwelling area is not as dense as for the latter.

The northern part of Ropka includes block houses as well as buildings for businesses and public services. The closer to the Ringtee street the larger the lots as the building structure is mostly made up by large industrial buildings and warehouses of different size, orientation and irregular position. The edge of the town of Tartu houses many car markets, car service facilities, waterworks and the jail.

Roads

Figure 8. Road system around the Postimaja junction and the Ihaste bridge.

The road system around the Postimaja junction consists of streets of Tartu and the national road No. 2. The road structure north of the junction is dense forming regular squares of private houses and gardens. The southern side of the junction is providing access for the dwelling area of Soinaste and some businesses and gas stations. The main road, road No. 2, runs towards south along with the old Tartu-Võru road (road No. 22130) that now serves local purpose as a street.

There is the Tartu-Petseri railroad between the road No. 2 and the road No. 22130 that crosses the Postimaja junction.

The Ringtee street is the main road that runs the east-west direction. There are several streets that cross the Ringtee street and connect the area to other parts of the town. Area south from the Ringtee street is built up in the extend of only a few squares of industrial buildings and therefore the street system is also sparse.

The Ihaste bridge crosses the river Emajõgi connecting Ringtee street and Lammi street north-east from the bridge. The road system on the right bank of the river is sparse with the exception of the Ihaste settlement. The streets of Ihaste form small squares of private houses.

5.2.1.2. Landscape Character Types

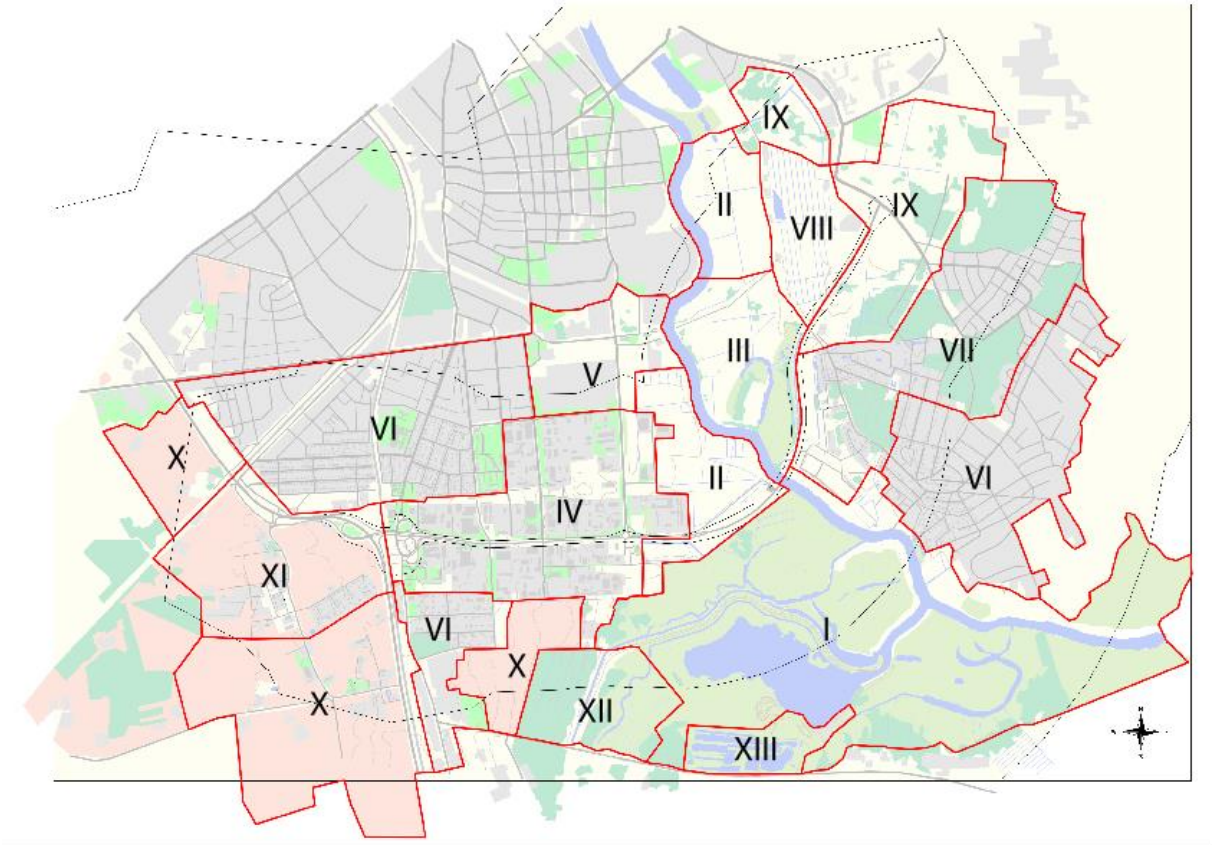

Figure 9. Landscape character types based on map analysis.

I Wetland area with dense surface water network

II Natural open glade area

III Natural glade area with forest and wetland patches

IV Built-up area for business and industry

V Natural green area with built-up sites

VI Dwelling area

VII Dwelling area with forest patches

VIII Drained natural green area with bushes

IX Open green area with forest patches

X Arable land with sparse settlement

XI Arable land with new settlement areas

XII Drained wetland and forest

XIII Technogenic landscape

Tabel 1. Sensitivity of the landscape character assessment types.

LCA type	Criteria				Sensitivity of the landscape resource
	Landscape quality	Landscape characteristics	Proportion of resource in ZTV	Distance from the site	
I	2	2	1	2	Medium
II	3	3	2	3	High
III	2	3	2	3	High
IV	2	1	2	3	Medium
V	1	0	0	1	Negligible
VI	2	3	1	2	Medium
VII	2	2	0	2	Medium
VIII	2	2	1	3	Medium
IX	2	2	1	3	Medium
X	2	3	0	2	Medium
XI	1	1	2	3	Medium
XII	3	2	0	2	Medium
XIII	0	3	0	1	Low

- given values are based on a system where 0 - negligible, 1 - low, 2 - medium, 3 – high
- for values of the sensitivity of the landscape resources see Appendix 7 in Appendix folder, p 13

5.2.1.3. Objects of Nature Protection

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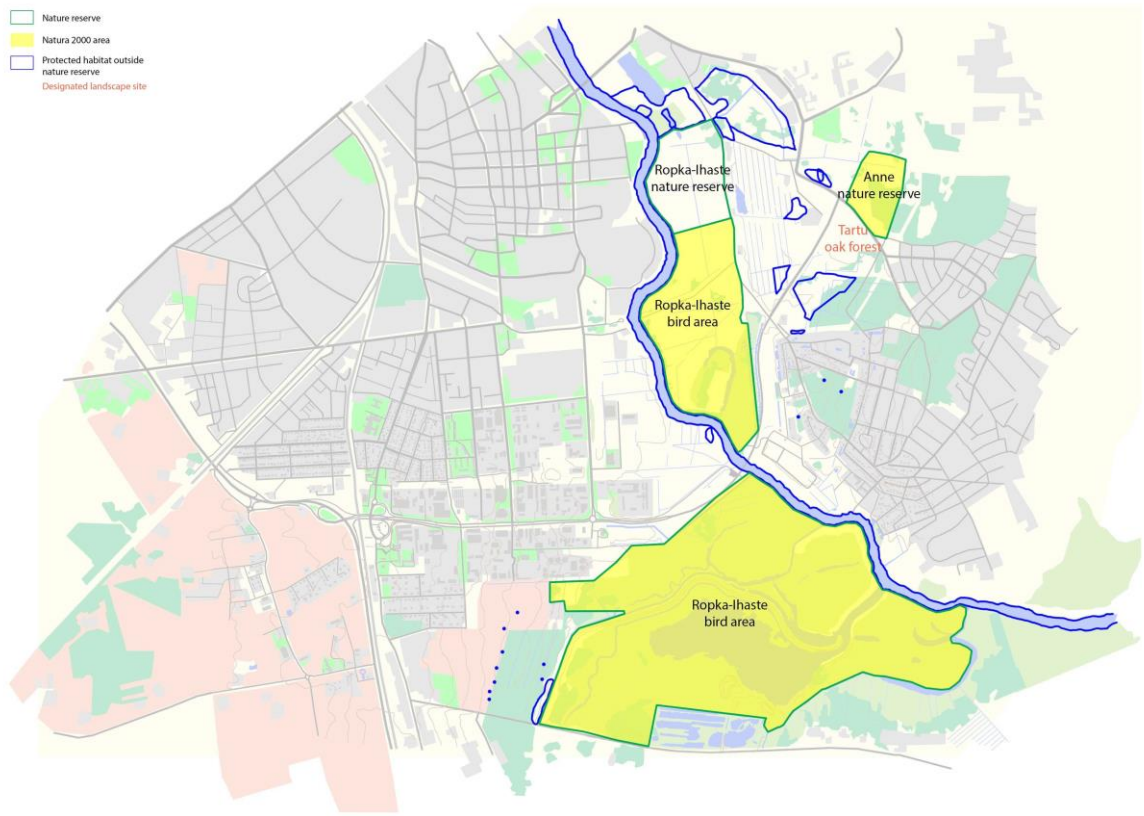

Figure 10. Nature protection areas around the I and II section of the Eastern Circuit

Tabel 2. Sensitivity of designated landscapes

Designated landscape	Criteria				Landscape receptor's sensitivity
	Landscape designations	Landscape quality	Proportion of resource in ZTV	Distance from the site	
Tartu oak forest	2	2	2	3	Medium

- given values are based on a system where 0 - negligible, 1 - low, 2 - medium, 3 – high
- for values of the sensitivity of the landscape resources see Appendix 7 in Appendix folder, p 13

Tabel 3. Sensitivity of the sites of nature protection

Reserve area	Criteria				Landscape receptor's sensitivity
	Landscape designations	Landscape quality	Proportion of resource in ZTV	Distance from the site	
Ropka-Ihaste reserve	3	3	1	3	High
Ropka-Ihaste bird area	3	2	1	3	Medium
Anne nature reserve	3	2	0	2	Medium
Protected habitats	3	3	1	2	Medium

- given values are based on a system where 0 - negligible, 1 - low, 2 - medium, 3 – high
- for values of the sensitivity of the landscape resources see Appendix 7 in Appendix folder, p 13

5.2.1.4. Overall Significance of Landscape Effects

Tabel 4. Overall significance of landscape effects.

Landscape resource		Calculation of significance of impact		
		Sensitivity	Magnitude of impact	Significance of impact
LCA types	I	Medium	Small	Moderate/minor
	II	High	Medium	Major
	III	High	Medium	Major
	IV	Medium	Negligible	Minor
	V	Negligible	Negligible	None
	VI	Medium	Small	Moderate/minor
	VII	Medium	Small	Moderate/minor
	VIII	Medium	Medium	Major/moderate
	IX	Medium	Medium	Major/moderate
	X	Medium	Negligible	Minor
	XI	Medium	Small	Moderate/minor
	XII	Medium	Negligible	Minor
	XIII	Low	Negligible	Minor/negligible
Designated landscapes	Tartu oak forest	Medium	Small	Moderate/minor
Nature protection	Ropka-Ihaste reserve	High	Medium	Major
	Ropka-Ihaste bird area	Medium	Medium	Major/moderate
	Anne nature reserve	Medium	Small	Moderate/minor
	Protected habitats	Medium	Small	Moderate/minor

- for magnitude of landscape effects see Appendix 8 in Appendix folder, p 14
- for calculation of significance of impact see Appendix 9 in Appendix folder, p15

5.2.2. Assessment of Visual Effects

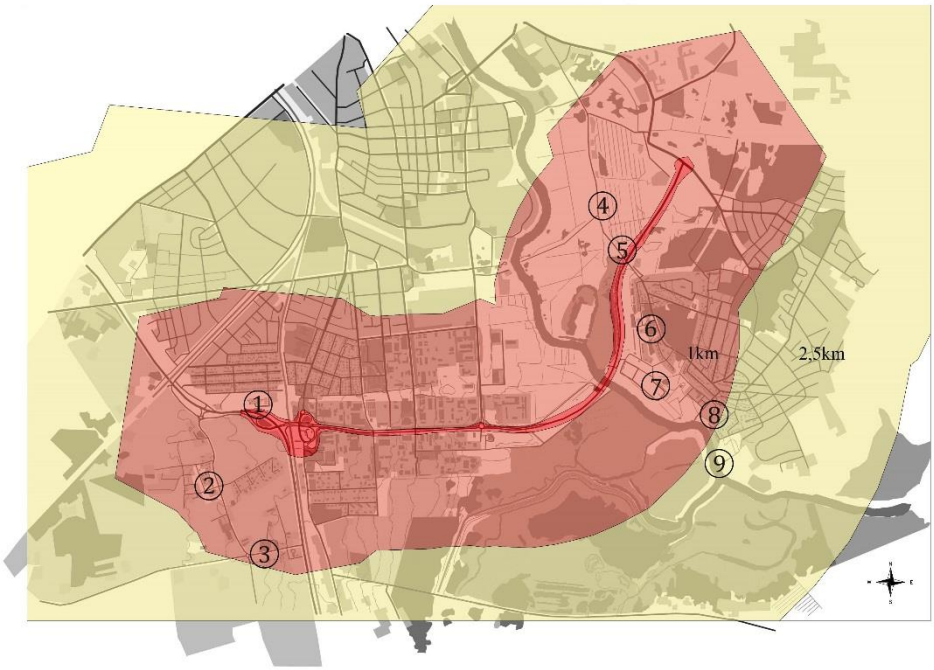

Figure 11. Zoning of theoretical visibilitiy and the location of the viewpoints.

1. Voolu street
2. Rehepapi
3. Rehe Hotel
4. Ihaste road
5. Ihaste bridge
6. Salutähe
7. Varsa
8. Riding centre
9. Ranna alley

Table 5. Visibility of particular viewpoints. See the viewpoints on the map.

Viewpoint	Visibility			
	View 1 Daylight, summer	View 2 Daylight, winter	View 3, Night	Overall visibility
1	1	1	2	Low
2	1	1	3	Medium
3	1	2	1	Low
4	1	1	1	Low
5	3	3	3	High
6	2	3	3	High
7	3	3	3	High
8	1	1	1	Low
9	0	0	1	Negligible

- given values are based on a system where 0 – negligible, 1 – low, 2 – medium, 3 – high
- for visibility see Appendix 10 in Appendix folder, p16

Table 6. Sensitivity of particular views. See the viewpoints on the map.

Viewpoint	Sensitivity of a particular view			
	Visibility	Number of viewers	Nature of viewing experience	Overall sensitivity
1	1	1	3	Medium
2	2	1	3	Medium
3	1	2	1	Low
4	1	2	1	Low
5	3	2	1	Medium
6	3	1	3	Medium
7	3	1	3	Medium
8	1	2	2	Medium
9	0	1	1	Low

- given values are based on a system where 0 – negligible, 1 – low, 2 – medium, 3 – high
- for number of viewers and nature of viewing experience see Appendix 10 in Appendix folder, p16

5.2.2.1. Overall Significance of Visual Effects

Table 7. Overall significance of visual effects.

Viewpoint	Calculation of significance of impact		
	Sensitivity	Magnitude of impact	Significance of impact
1	Medium	Small	Moderate/minor
2	Medium	Medium	Major/moderate
3	Low	Negligible	Minor/negligible
4	Low	Negligible	Minor/negligible
5	Medium	Large	Major
6	Medium	Large	Major
7	Medium	Large	Major
8	Medium	Small	Moderate/minor
9	Low	Negligible	Minor/negligible

- for magnitude of visual effects see Appendix 11 in Appendix folder, p 17
- for number of viewers and nature of viewing experience see Appendix 10 in Appendix folder, p16

5.2.3. Conclusion of the Landscape and Visual Impact Assessment

Table 8. Conclusion of the landscape and visual impact assessment

Viewpoint	LCA type	Distance from the site (ZTV)	Significance of landscape effects	Significance of visual effects
1	VI Dwelling area	1km	Moderate/minor	Moderate/minor
2	XI Arable land with new settlement areas	1km	Moderate/minor	Major/moderate
3	X Arable land with sparse settlement	1km	Minor	Minor/negligible
4	II Natural glade area	1km	Major	Minor/negligible
5	III Natural glade area with forest and wetland patches	1km	Major	Major
6	VII Dwelling area with forest patches	1km	Moderate/minor	Major
7	VII Dwelling area with forest patches	1km	Moderate/minor	Major
8	VI Dwelling area	1km	Moderate/minor	Moderate/minor
9	VI Dwelling area	1km	Moderate/minor	Minor/negligible

Overviewing the outcome leads to a conclusion that a road construction object, even a rather high-dimensional, as is the Postimaja junction and the Ihaste bridge, has no extreme landscape nor visual effects. The conclusion can be generalized stating that the effects on rural landscapes are the least significant and effects on built-up urban areas are modest on average. Whereas, the effects on natural open areas and areas of nature protection are the most significant.

The outcome of the the significance of visual effects does not draw connections of such evidence. However, it can be inferred that visual effects on natural-looking areas are more significant than those on the landscapes that have been shaped by human activity, such as dwelling areas and arable land.

5.3. Mäo Detour on the Tallinn-Tartu-Võru-Luhamaa Road

Mäo detour is the most important junction of the center of Estonia. Estonian Road Administration (Maanteeamet *s.a.*) has described the object as follows. It is a 6,4 km section between km 85-91 of Tallinn-Tartu-Võru-Luhamaa road No. 2. In addition, the project covers 2,6 km segment of Pärnu-Rakvere-Sõmeru road No.5 that crosses the road No. 2, four viaducts, a 22 m bridge across the river Vodja, 4,5 km of light traffic roads, 2,4 km of noise barriers and 11,8 km of street light lines. The road which saves 0,7 km and 1,5 minutes of travel from Tallinn to Tartu is built on a new route east of Mäo settlement and the former route. The former route was preserved for local traffic (Mäo… *s.a*).

Mäo detour, a first-class road of four lanes and a safety strip, was opened in October 2010 (*ibid*.).

5.3.1. Assessment of Landscape Effects

5.3.1.1. Landscape Character Assessment

Relief

Figure 10. The relief around the Mäo detour.

Mäo detour is located in the Central Estonia plateau (Eesti jõed 2001: 581). The Central Estonia plateau is formed on a limestone by glazier which carried along a large amount moraine. Generally, the landforms created by the sediments are situated in north-south direction. The landscape is predominantly combined by gently undulating moraine plains, small bogs and shallow river beds which structure the plateau (Arold, 2005: 256). Therefore the overall picture is rather moderate. The origin of the landscape refers to prerequisites for the development of conditions suitable for agriculture (*ibid.*).

Hydrology

Figure 11. The water network around the Mäo detour.

The surface waters of the Central Estonia plateau are mostly rivers, there a almost no lakes, and numerous draining ditches which are led into the rivers (Arold 2005).

The river Esna is a left tributary river of the river Pärnu. It starts near the settlement of Roosna-Alliku and runs 25 km through the boggy plains of the Central Estonian plateau. (Eesti jõed 2001: 584). The boggy areas are, along the river Esna, intensely drained for agricultural purposes. Driven the fact that it belongs among the Estonian melioration system combined recipients the river is strengthened and deepened almost over its full length (EELIS 2010c). The river Esna is enlisted in the list of protected habitats of salmonids and cyprinids (Lõheliste 2017) and has been considered one of the best rivers for trout (Eesti jõed 2001: 586).

The river Vodja is 19,3 km long and has a catchment area of 80 km². Its source is in Järva county, Roosna-Alliku municipality and it mouths the river Pärnu from the left (Eesti jõed 2001: 581) in Paide. The average downfall of the river is 0,9 m/km. (*ibid*.) The river Vodja

is enlisted in the list of protected habitats of salmonids and cyprinids (Lõheliste 2017). The populations of brown trout and rainbow trout probably originate from the fish ponds that were established at the end of the 19th century by the landlord of the Vodja manor nearby (Eesti jõed 2001: 583). The river Vodja belongs among the Estonian melioration system combined recipients (EELIS 2010d). Due to it being a part of the melioration system the river Vodja is deepened and strengthened in almost full length (Eesti jõed 2001: 581).

The river Pärnu is one of the longest rivers in Estonia (Eesti jõed 2001: 568). Its source is a spring near Roosna-Alliku and it mouths the Gulf of Riga (*ibid*.) in 170 km (EELIS 2010e). The downfall of the river is moderate, 0,53 m/km. The upper course of the river flows through the bogs on the Central Estonian plateau until it is expanded to a reservoir near the village Tarbja (Eesti jõed 2001: 569). Some of its most tributary rivers, Esna and Vodja are mouthing the river Pärnu (Eesti jõed 2001: 569) near the Mäo detour, on the outskirts of Paide. The river Pärnu is known for being rich in fish. (Eesti jõed 2001: 578). The river Pärnu belongs in the list of spawning areas and habitats of salmon, brown trout, sea trout and grayling and is among the protected habitats of of salmonids and cyprinids (Lõheliste 2017).

Land Use and Land Cover

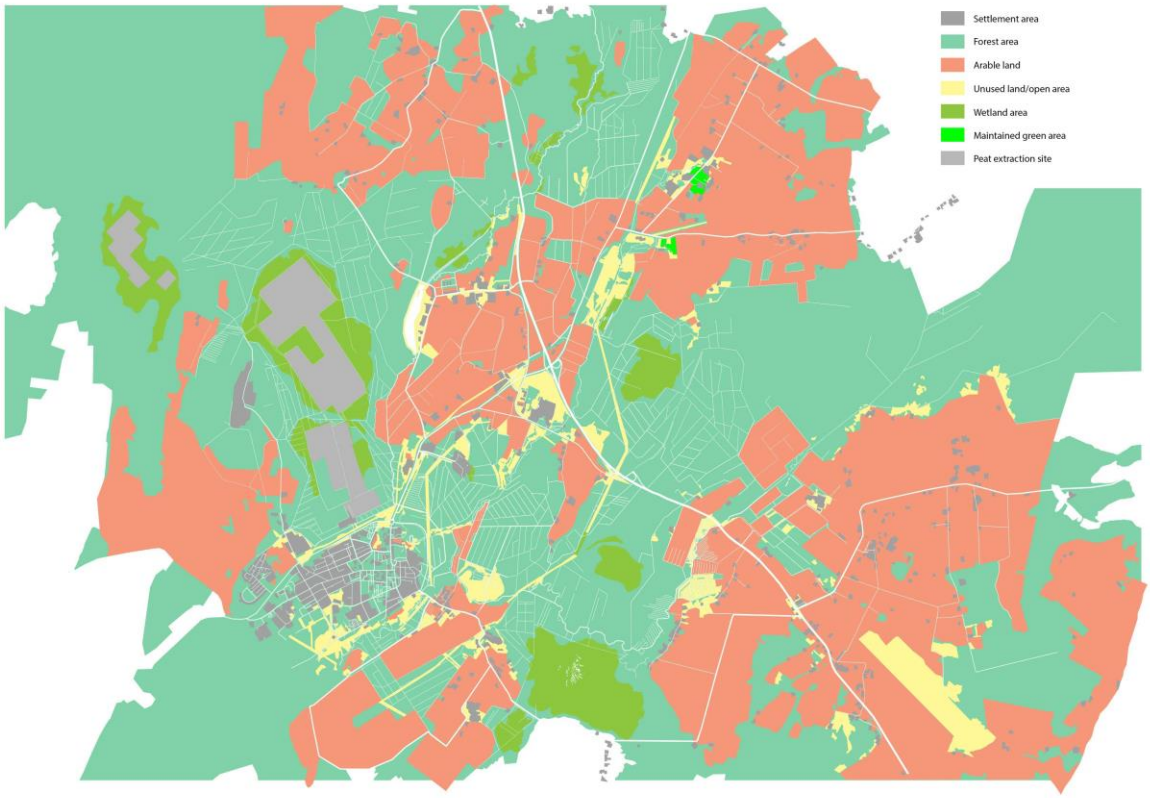

Figure 12. Land use and land cover around the Mäo detour.

The land around the Mäo detour in central Estonia is mostly covered with forest. The main species of these intensely drained forests are birch (*Betula pendula*) and spruce (*Picea abies*). The large forest areas are owned by the state and managed by the State Forest Management Centre (RMK) for economic purpose. While the percentage of the territory around the Mäo detour on the road No. 2 covered with forest is high there are also vast open areas of arable land. Fields are used for cultivating crops such as wheat, barley, rape but also as grasslands for producing silo from clover, and straw. As the majority of the land is used for sylviculture and agriculture there are only a few patches of land that are not being maintained, mainly uncultivated areas near settlements. Large bog areas west from the road have been proven suitable for peat extraction.

Settlement Structure

Figure 13. The settelment structure around the Mäo detour.

The settlement around the Mäo detour is characteristic of Estonian rural areas. Single farmsteads, probably peasant holdings, are situated along the roads separated by vast open areas or forest. The farmsteads are rather modest. Small rectangular yards within arable land usually hold a house, a few outbuildings, a vegetable garden and orchard. There is a manor in Mäo which has induced slightly denser settlement and a collective farm centre in Tarbja which is still apparent nowadays due to its barns, silo storage, workshops for agricultural machinery, garages and blocks of flats.

The largest settlement near Mäo is Paide, a town of 8300 people (Paide *s.a.*). Paide, the centre of the Järva county, is approximately 5 km from Mäo.

Roads

Figure 14. The road system around the Mäo detour.

The road system of the area is generally characteristic to Estonian rural areas but on the other hand strongly influenced by the road No. 2 which passes the area from north-west to south-east and the road No. 5 which cross in Mäo. The junction of two roads of international importance means very high traffic intensity. On the other hand it complicates the access of dwellers and local businesses and therefore the junction acquires several additional access roads. On Mäo detour the former routes of both the road No. 2 and No. 5 have been used to maintain the connection to neighbouring farmsteads and businesses. The major road, support roads and secondary roads are covered with asphalt, smaller roads of local importance are often gravel roads.

5.3.1.2. Landscape Character Types

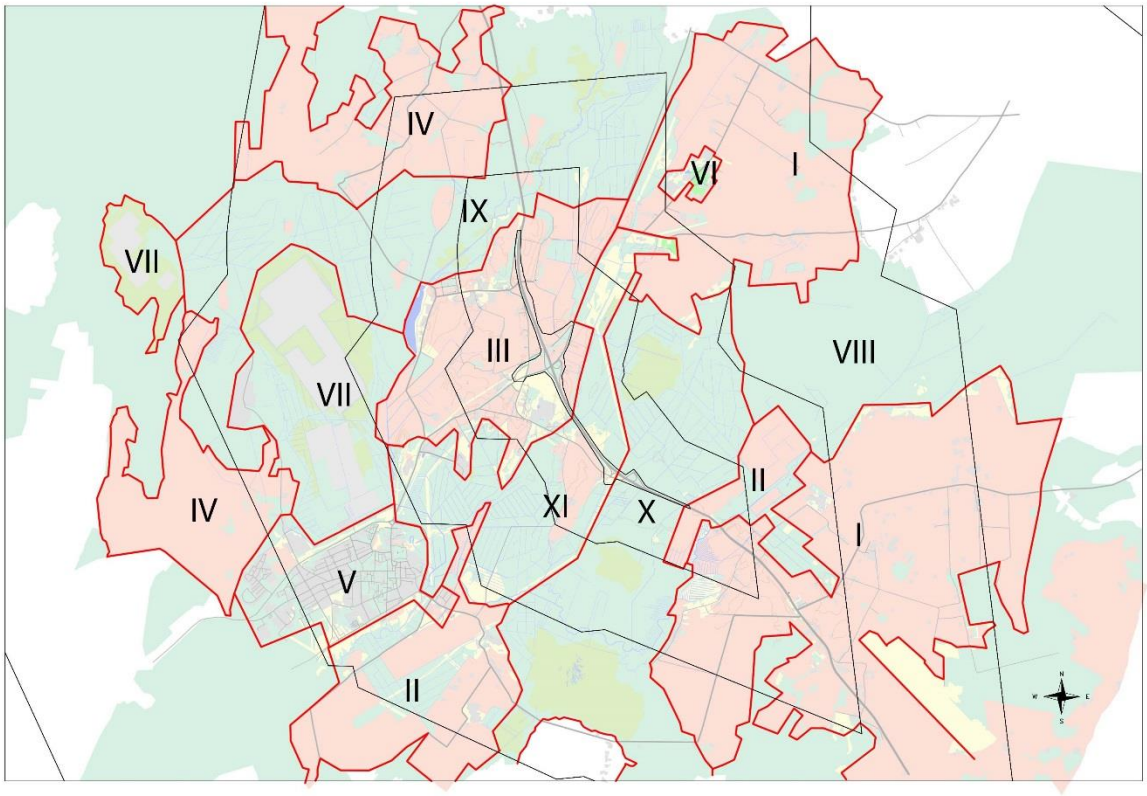

Figure 15. Landscape character types based on map analysis.

I Arable land with small patches of forest and settlement areas

II Arable land with drained forest and settlement areas

III Drained arable land with forest and settlement areas

IV Arable land with sparse settlement

V Dense settlement area

VI Settlement area

VII Peat extraction site

VIII Forest area

IX Drained forest with wetland and arable land patches

X Drained forest with arable land patches

XI Drained forest with natural open areas

Tabel 9. Sensitivity of the landscape character assessment types.

LCA type	Criteria				Sensitivity of the landscape resource
	Landscape quality	Landscape characteristics	Proportion of resource in ZTV	Distance from the site	
I	2	1	3	3	Medium
II	1	1	3	3	Medium
III	1	0	3	3	Medium
IV	2	1	0	1	Low
V	2	2	0	0	Low
VI	1	2	0	0	Low
VII	0	1	0	0	Negligible
VIII	2	3	0	0	Low
IX	3	3	1	2	Medium
X	3	3	3	3	High
XI	2	3	2	3	High

- given values are based on a system where 0 - negligible, 1 - low, 2 - medium, 3 – high
- for values of the sensitivity of the landscape resources see Appendix 7 in Appendix folder, p 13

5.3.1.3. Manor Landscapes

Mäo manor lies between the former route and the present route of the road No. 2. According to the site "Eesti Mõisaportaal" Mäo manor was first mentioned in the 16th century. Its Baroque main building was destroyed in the Great Northern War and was rebuilt in the 18th century only to be renovated in Classicist manner in the beginning of the 19th century. The building was extended and it received the arched windows and six-pillared portico visible today. The manor has been left in poor condition since the middle of the 20th century and, although its roof and ceilings were renovated in the 80-s, most of its former glory has disappeared along with the architectural details. (Praost: Mäo)

Nowadays, the manor complex is not conspicuous in the landscape. While the some of the outbuildings have been preserved, they have been readjusted as contemporary dwellings.The manor park, although recognisable, is in bad condition. The trees are old and injured, bushes over-grown and paths disappeared. The terraced relief and a small pond though still refer to its former design.

Põhjaka manor is situated next to the road No. 2 just 1 km away from the site of interest. According to "Eesti Mõisaportaal" it used to be a small side manor of the Palu manor. The main building of Põhjaka is a one-storey stone building of early Classicism. None of the outbuildings have remained. (Praost: Põhjaka) The manor is presently private property and accommodates a reputable restaurant.

There are also Vodja and Viisu manors within a 5 km radius from the Mäo detour route.

Tabel 10. Sensitvity of the manor landscapes.

Manor	Criteria				Landscape receptor's sensitivity
	Landscape designations	Landscape quality	Cultural heritage interest	Distance from the site	
Mäo	2	0	1	2	Low
Põhjaka	2	1	1	2	Medium
Vodja	2	2	1	0	Low
Viisu	2	3	1	0	Medium

- given values are based on a system where 0 - negligible, 1 - low, 2 - medium, 3 – high
- for values of the sensitivity of the landscape resources see Appendix 7 in Appendix folder, p13

5.3.1.4. Objects of Nature Protection

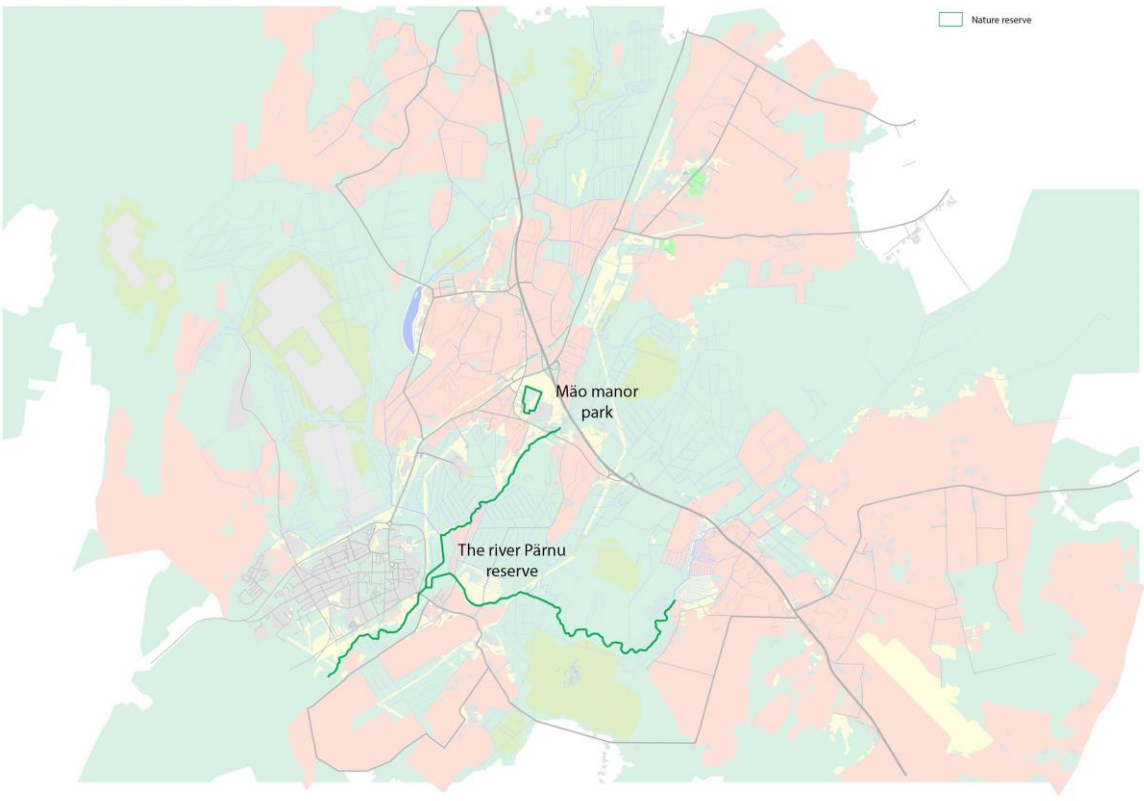

Figure 14. Objects of nature protection around the Mäo detour

Tabel 11. Sensitivity of the sites of nature protection

	Criteria				Landscape receptor's sensitivity
Reserve area	Landscape designations	Landscape quality	Proportion of resource in ZTV	Distance from the site	
Mäo manor park	3	2	2	3	High
Pärnu river reserve	3	2	1	1	Medium

- given values are based on a system where 0 - negligible, 1 - low, 2 - medium, 3 – high
- for values of the sensitivity of the landscape resources see Appendix 7 in Appendix folder, p13

5.3.1.5. Overall Significance of Landscape Effects

Tabel 12. Overall significance of landscape effects.

Landscape resource		Calculation of significance of impact		
		Sensitivity	Magnitude of impact	Significance of impact
LCA types	I	Medium	Medium	Major/moderate
	II	Medium	Small	Moderate/minor
	III	Medium	Medium	Major/moderate
	IV	Low	Negligible	Minor/negligible
	V	Low	Negligible	Minor/negligible
	VI	Low	Negligible	Minor/negligible
	VII	Negligible	Negligible	None
	VIII	Low	Negligible	Minor/negligible
	IX	Medium	Small	Moderate/minor
	X	High	Medium	Major
	XI	High	Medium	Major
Manor landscapes	Mäo	Low	Medium	Moderate/minor
	Põhjaka	Medium	Small	Moderate/minor
	Vodja	Low	Negligible	Minor/negligible
	Viisu	Medium	Negligible	Minor
Nature protection	Mäo manor	High	Small	Moderate
	Pärnu river reserve	Medium	Negligible	Minor

- for magnitude of landscape effects see Appendix 8 in Appendix folder, p 14
- for calculation of significance of impact see Appendix 9 in Appendix folder, p15

5.3.2. Assessment of Visual Effects

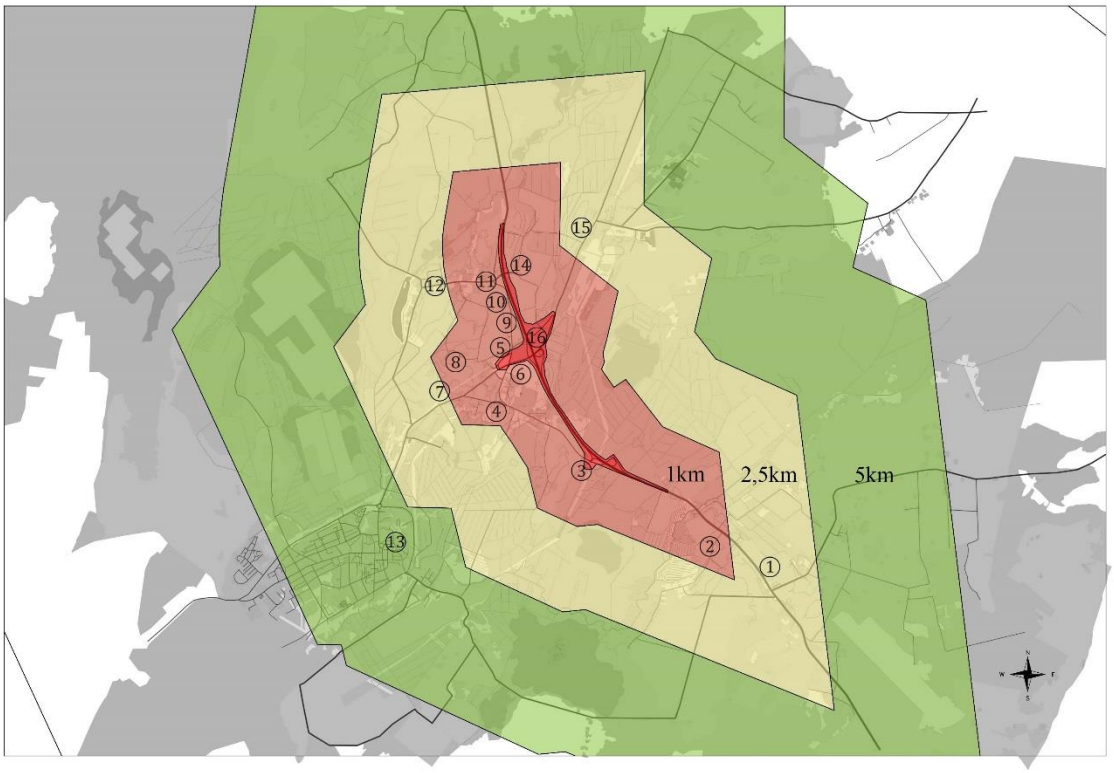

Figure 16. Zoning of theoretical visibility and the locations of the viewpoints.

1. Mäeküla
2. Valgma
3. Cuppps
4. Police memorial
5. Mäo Statoil
6. Mäo manor
7. Sillaotsa
8. War monument
9. Tarbja I
10. Tarbja II
11. Tarbja III
12. Tarbja school
13. Vallitorn
14. Pääsukese
15. Vodja
16. Jaanuse

Table 12. Visibility from particular viewpoints. See the viewpoints on the map.

Viewpoint	Visibility			
	View 1 Daylight, summer	View 2 Daylight, winter	View 3, Night	Overall visibility
1	0	0	0	Negligible
2	1	1	0	Low
3	2	2	3	Medium
4	2	2	1	Medium
5	3	3	3	High
6	3	3	3	High
7	1	1	2	Low
8	0	1	3	Low
9	1	1	1	Low
10	2	2	1	Medium
11	2	2	1	Medium
12	1	1	0	Low
13	0	0	1	Negligible
14	2	2	1	Medium
15	0	0	0	Negligible
16				

- given values are based on a system where 0 – negligible, 1 – low, 2 – medium, 3 – high
- for visibility see Appendix 10 in Appendix folder, p16

Table 13. Sensitivity of particular views. See the viewpoints on the map.

Viewpoint	Sensitivity of a particular view			
	Visibility	Number of viewers	Nature of viewing experience	Overall sensitivity
1	0	3	1	Low
2	1	1	3	Medium
3	2	2	1	Medium
4	2	2	1	Medium
5	3	3	1	Medium
6	3	1	1	Medium
7	1	1	3	Medium
8	1	0	0	Negligible
9	1	1	3	Medium
10	2	1	3	Medium
11	2	1	3	Medium
12	1	2	3	Medium
13	0	2	1	Low
14	2	0	2	Low
15	0	1	1	Low
16	3	0	3	Medium

- given values are based on a system where 0 – negligible, 1 – low, 2 – medium, 3 – high
- for number of viewers and nature of viewing experience see Appendix 10 in Appendix folder, p16

5.3.2.1. Overall Significance of Visual Effects

Tabel 13. Overall significance of visual effects.

Viewpoint	Calculation of significance of impact		
	Sensitivity	Magnitude of impact	Significance of impact
1	Low	Negligible	Minor/negligible
2	Medium	Small	Moderate/minor
3	Medium	Medium	Major/moderate
4	Medium	Small	Moderate/minor
5	Medium	Large	Major
6	Medium	Large	Major
7	Medium	Small	Moderate/minor
8	Negligible	Negligible	None
9	Medium	Small	Moderate/minor
10	Medium	Small	Moderate/minor
11	Medium	Medium	Major/moderate
12	Medium	Negligible	Minor
13	Low	Negligible	Minor/negligible
14	Low	Small	Minor
15	Low	Negligible	Minor/negligible
16	Medium	Large	Major

- for magnitude of visual effects see Appendix 11 in Appendix folder, p 17
- for number of viewers and nature of viewing experience see Appendix 10 in Appendix folder, p16

5.3.3. Conclusion of the Landscape and Visual Impact Assessment

Table 14. Conclusion of the landscape and visual impact assessment

Viewpoint	LCA type	Distance from the site (ZTV)	Significance of landscape effects	Significance of visual effects
1	I Arable land with small patches of forest and settlement areas	2,5km	Major/moderate	Minor/negligible
2	I Arable land with small patches of forest and settlement areas	1km	Major/moderate	Moderate/minor
3	XI Drained forest with natural open areas	0km	Major	Major/moderate
4	III Drained arable land with forest and settlement areas	1km	Major/moderate	Moderate/minor
5	III Drained arable land with forest and settlement areas	0km	Major/moderate	Major
6	III Drained arable land with forest and settlement areas	1km	Major/moderate	Major
7	III Drained arable land with forest and settlement areas	2,5km	Major/moderate	Moderate/minor
8	III Drained arable land with forest and settlement areas	1km	Major/moderate	None
9	III Drained arable land with forest and settlement areas	1km	Major/moderate	Moderate/minor

Viewpoint	LCA type	Distance from the site (ZTV)	Significance of landscape effects	Significance of visual effects
10	III Drained arable land with forest and settlement areas	1km	Major/moderate	Moderate/minor
11	III Drained arable land with forest and settlement areas	1km	Major/moderate	Major/moderate
12	III Drained arable land with forest and settlement areas	2,5km	Major/moderate	Minor
13	V Dense settlement area	5km	Minor/negligible	Minor/negligible
14	III Drained arable land with forest and settlement areas	1km	Major/moderate	Minor
15	III Drained arable land with forest and settlement areas	2,5km	Major/moderate	Minor/negligible
16	III Drained arable land with forest and settlement areas	0km	Major/moderate	Major

The outcome of the landscape and visual impact assessment on Mäo detour on the Tallinn-Tartu-Võru-Luhamaa road leads to no evident conclusions. It can be stated that the effects are more significant on landscapes of natural characteristics that lay in the close proximity of the object. The significance of visual effects decrease over distance but there are also no evident extremes, probably due to a small amount of visual receptors.

5.4. Aruvalla-Kose Section of The Tallinn-Tartu-Võru-Luhamaa Road

The Aruvalla-Kose section is located on the 26,6-40,0 km of the road No. 2. The site of interest is situated in the Harju county, Rae and Kose municipality. The whole section was turned into a first class road of four lanes and all of the crossings were solved as multi-level junctions. The project also covered 20,1 km of access roads, 7,1 km of light traffic roads, 6,9 km of noise barriers, bridges on the main road and access road, new street light systems and vegetation. (Aruvalla…*s.a.*). The project also includes Estonia's first eco-duct for large wild animals, and tunnels for the amphibians (*ibid.*).

5.4.1. Assessment of Landscape Effects

5.4.1.1. Landscape Character Assessment

Relief

Figure 17. Relief near the Aruvalla-Kose section of the road No. 2.

The Aruvalla-Kose section the road No. 2 is situated on Harju plain which was strongly worn by the continental glazier and the Baltic Sea. The landscape is knobbly and structured by curvy river beds (Arold 2005: 236) which is especially evident for the bed of the river Pirita. The river Pirita divides the overall picture as the northern part seems to have a rather open relief with the horizontal lines standing apart. Whereas for the southern part the relief is more varied with sinuous horizontal lines standing rather close and creating small local depressions and mounds.

Hydrology

Figure 18. Water network near the Aruvalla-Kose segment of the road No. 2.

The water network around the Aruvalla-Kose road is influenced by the largest river of the Harju county, the river Pirita, and one of its most important tributary rivers, Kuivajõgi (Eesti jõed 2001: 485).

The river Pirita is 105 km long with a catchment area of 799 km². Near Kose and Saula settlements the river flows in a bed of high banks which was created by the edge of the continental glazier (Eesti jõed 2001: 485). The average downfall of the river is 0,72 m/km but the lower course is full of rapids. The plain middle course of the river is flows past several settlements, such as Kose, Kose-Uuemõisa, Vaida and several districts of Tallinn. The lower course creates a scenic landscape which is a site of natural protection. Before the river mouths the Gulf of Finland some of its water is directed into the lake Ülemiste (Eesti jõed 2001: 485). The river Pirita is rich in fish. It is enlisted as a spawning area or habitat of salmon, brown trout, sea trout and grayling and is among the protected habitats of salmonids (EELIS 2010f)).

The river Kuivajõgi is a left tributary river mouthing the river Pirita in the middle course. It is 31 km long and flows over 2 km underground disappearing into a swallow hole in Kuivajõe village to emerge through several exsurgences near Kose-Uuemõisa. The underground section of the river is known as Salajõgi. (Eesti jõed 2001: 490). Although the river Kuivajõgi is not a habitat of many different species of fish, its last 1,5 km belongs in the list of spawning areas and habitats of salmon, brown trout, sea trout and grayling (EELIS 2010g).

Land Use and Land Cover

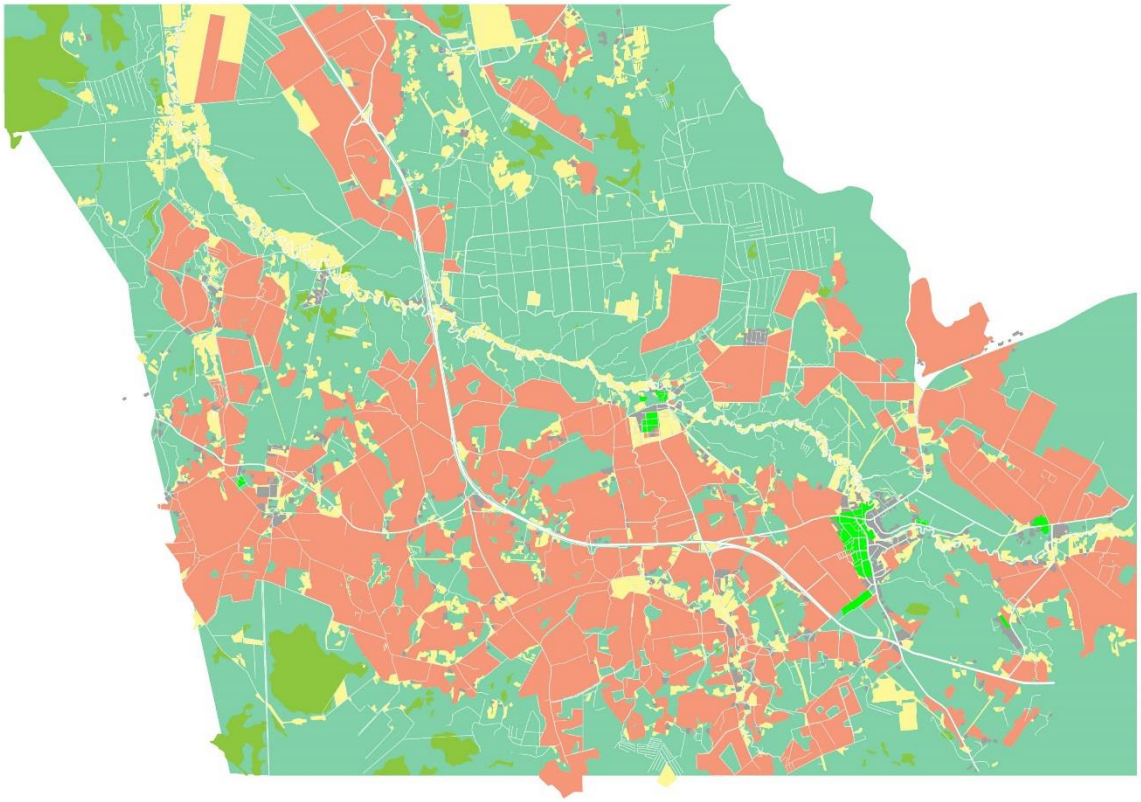

Figure 19. Land use and land cover around the Aruvalla-Kose section of the road No. 2.

The varied relief of the southern half of the Aruvalla- Kose section of the road No. 2 has resulted in varied scenery. The territory south of the river Pirita is mostly used as arable land. The fields, although are not large-scale but rather a mosaic of small forest patches, drainage ditches, farmsteads and access roads. Smaller patches are used grassland for gathering silo and straw, whereas larger fields are used to cultivate crops. The forests are mostly mixed forests of deciduous trees and spruce (*Picea abies*). The main species are birch (*Betula pendula*) and alder (*Alnus incana*, *Alnus glutinosa*) but also maple (*Acer platanoides*) and ash (*Fraxinus excelsior*). The bushes along the ditches are a mixture of different willows (*Salix* L.). On higher, sandy mounds, pine (*Pinus sylvestris*) is also represented in the composition of the mixed forest.

The continuous forest area along the river Pirita is owned by the state. These are mixed forests of mainly birch (*Betula pendula*), pine (*Pinus sylvestris*) and spruce (*Picea abies*). Most of it is managed by the State Forest Management Centre (RMK) for economic

purpose but some of it under natural protection to preserve valuable associations and protect endangered species (EELIS 2010h).

North of the river Pirita the forest is patched by small open areas of natural grassland and large fields of agricultural purpose. Here the forest is drained with ditches and arable land, based on the map of restrictions by the Estonian Land Board probably by under-ground melioration system. Arable land is used for cultivating crops and straw.

Settelment

Figure 20. Settlement structure around the Aruvalla-Kose segment of the road No.2

The settlement is quite evenly distributed across the site of interest, with the exception of a few dense settlement areas and the forest corridor along the river Pirita which has almost no built-up sites. The overall picture is quite characteristic of rural areas in Estonia. Single households are situated in arable land distant from each other.
Each farmstead consists of a small yard, a house, a few outbuildings, a vegetable garden and orchard. Due to the proximity of Tallinn and good access, the estates are in good condition and some hold small businesses.

The largest dense settlement area nearby is Kose with the population of 2100 (Kose… *s.a.*). The road No. 2 pervades Kose from the south creating mutual influences such as density of population, services such as dining, gas station etc. Kose is mainly a settlement of private houses but there is also a distinguished district of block houses and public institutions such as a cultural centre, a sports centre and a stadium, a school, a library etc.

Kose-Uuemõisa is a settlement established around the heart of a manor. The settlement of 900 people is located approximately 2km off of the Tallinn-Tartu-Võru-Luhamaa road. Kose-Uuemõisa displays well-preserved examples of manor-architecture and landscapes.

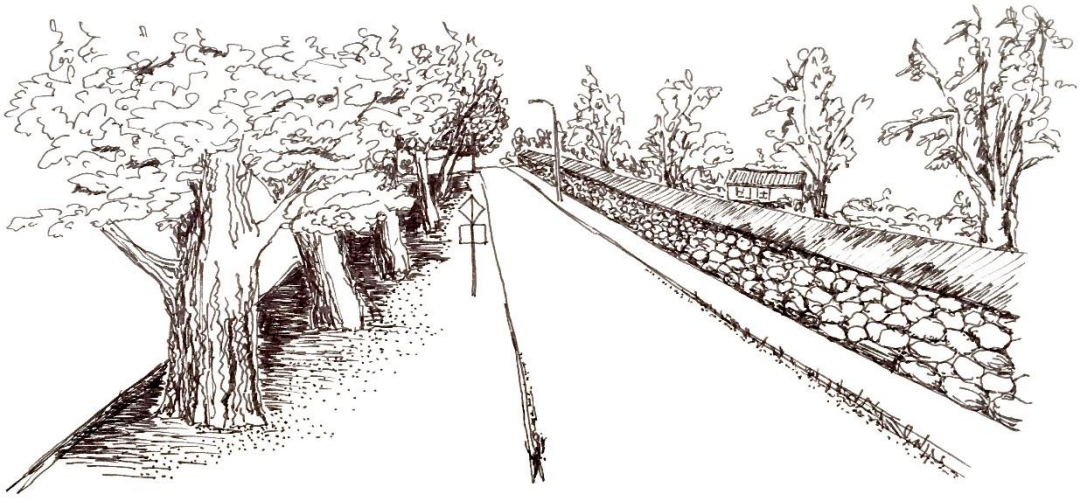

Figure 21. Alley and stone wall of the Uuemõisa manor combined with contemporary infrastructure.

Roads

Figure 22. Road system near the Aruvalla-Kose section of the road No. 2.

The road system of the area around Aruvalla and Kose is quite dense. It is made up by the national major road of Tallinn-Tartu-Võru-Luhamaa, support roads which connect Kose to the major road and neighbouring settlements, several secondary roads and numerous local and private access roads. Vast forest areas are serviced using forest roads.

The section from Aruvalla to Kose on the major road No. 2 is a four lane road of first class. The other larger roads, the support roads and secondary roads are covered with asphalt, as well as the main streets of Kose and Kose-Uuemõisa. Small roads are usually covered with gravel.

5.4.1.2. Landscape Character Types

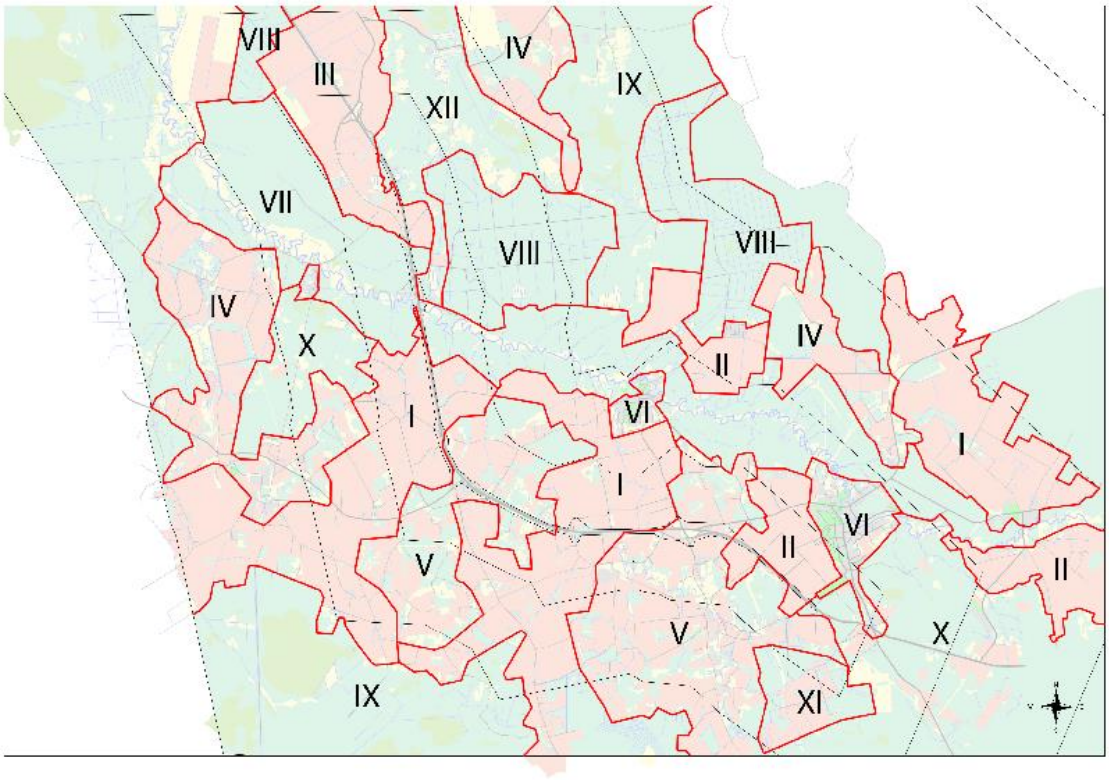

Figure 24. Landscape character types based on map analysis.

I Open arable land with small patches of forest and sparse settlement

II Open arable land

III Open arable land with sparse settlement

IV Mosaic landscape of forest and arable land with sparse settlement

V Mosaic arable land with small patches of forest and settlement

VI Dense settlement area

VII Forest with open glade areas

VIII Drained forest

IX Forest with wetland patches and open areas with settlement

X Forest with open landscape patches and settlement areas

XI Drained forest and arable land

XII Forest with grassland patches and sparse settlement

Tabel 15. Sensitivity of the landscape character assessment types.

LCA type	Criteria				Sensitivity of the landscape resource
	Landscape quality	Landscape characteristics	Proportion of resource in ZTV	Distance from the site	
I	2	2	3	3	High
II	1	1	1	3	Low
III	1	1	1	3	Low
IV	2	2	0	1	Low
V	2	3	3	3	High
VI	1	2	0	1	Low
VII	2	3	1	2	Medium
VIII	2	2	0	1	Low
IX	1	2	0	1	Low
X	2	2	0	1	Low
XI	1	1	0	1	Low
XII	2	1	1	3	Medium

- given values are based on a system where 0 - negligible, 1 - low, 2 - medium, 3 – high
- for values of the sensitivity of the landscape resources see Appendix 7 in Appendix folder, p13

5.4.1.3. Manor landscapes

Uuemõisa manor perhaps has a controversial name as it is one of the oldest manors in Harju county. According to the site "Eesti Mõisaportaal" it was first mentioned in the 14th century. The main building was first built as a stronghold which was ravaged during the Livonian War. The main building that is preserved until the present day was erected in the middle of the 19th century on the walls of the former stronghold. The Neo-Renaissance building accommodates a school and a muuseum (Praust: Uuemõisa).
The manor complex is rather well preserved, there are several outbuildings, stone walls, obelisks, manor park and alleys still visible today.

Ravila manor is situated approximately 3 km north-east from a bird's eye view from the site of interest. Its one-storey Baroque main building was destroyed in a fire in 1905 and the new building which was erected 5 years later has two storeys. The Neo-Baroque building which is also visible today used to accommodate a nursing home but is now private property. The manor complex is rich in remarkable and well-preserved outbuildings such as a castle for live stock, a distillery, a dairy and barns (Praust: Ravila).
The manor had a large park which stretched out to the river Pirita in the south (*ibid.*). The park is still recognisable nowadays.

Oru manor stands about 4 km south-west from the road No. 2. The humble manor has had many owners over the centuries. The main building has a stone ground floor and wooden first floor which was probably built on the stone walls after the riot of 1905. Several outbuildings are also extant although they have been readjusted. (Praust: Oru).
The manor is surrounded by a park and limestone walls.

Tabel 16. Sensitivity of the manor landscapes.

Manor	Criteria				Landscape receptor's sensitivity
	Landscape designations	Landscape quality	Cultural heritage interest	Distance from the site	
Kose-Uuemõisa	2	3	3	1	Medium
Ravila	2	3	3	0	Medium
Oru	2	2	3	0	Medium

- given values are based on a system where 0 - negligible, 1 - low, 2 - medium, 3 – high
- for values of the sensitivity of the landscape resources see Appendix 7 in Appendix folder, p13

5.4.1.4. Objects of Nature Protection

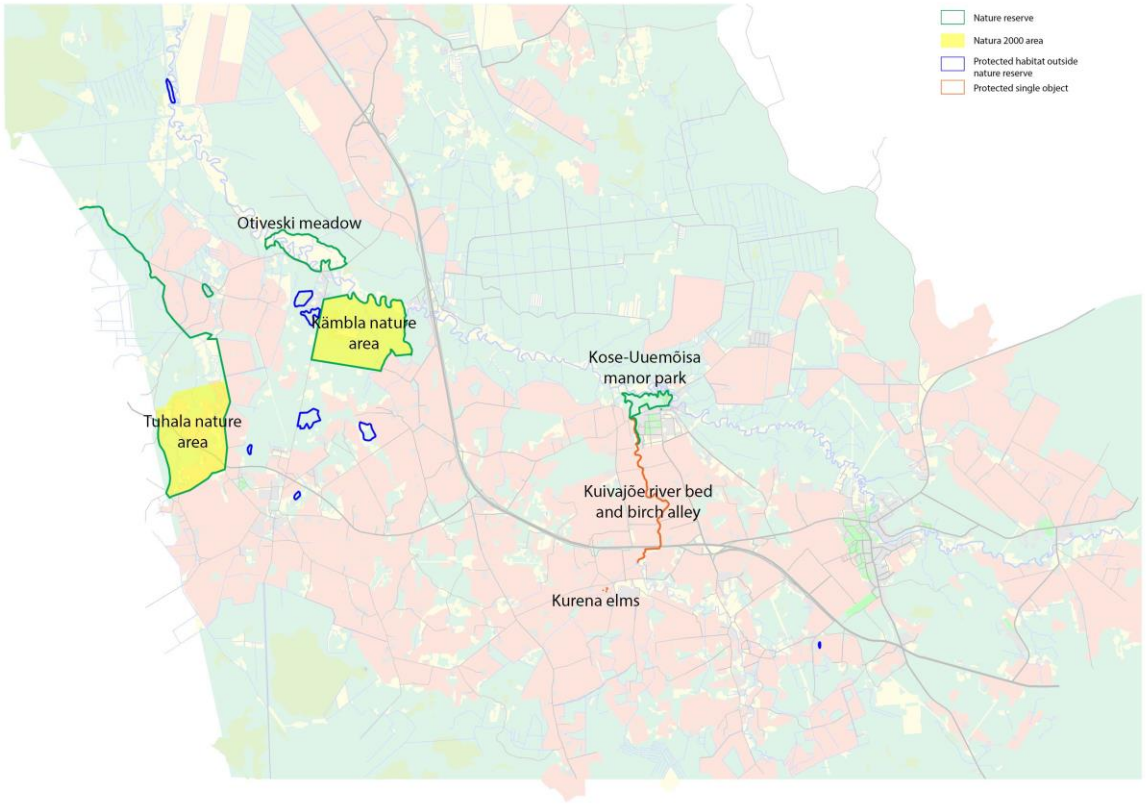

Figure 23. Sites of natural protection around the Aruvalla-Kose section of the road No.2.

Tabel 17. Sensitivity of the sites of nature protection

Reserve area	Criteria				Landscape receptor's sensitivity
	Landscape designations	Landscape quality	Proportion of resource in ZTV	Distance from the site	
Kämbla nature reserve	3	3	0	1	Medium
Otiveski meadow	3	3	0	1	Medium
Tuhala nature reserve	3	2	0	0	Low
Kose-Uuemõisa manor park	3	2	0	1	Low
Kuivajõe river bed	3	3	3	2	High
Kurena elms	3	3	0	2	Medium
Protected habitats	3	1	0	1	Low

- given values are based on a system where 0 - negligible, 1 - low, 2 - medium, 3 – high
- for values of the sensitivity of the landscape resources see Appendix 7 in Appendix folder, p13

5.4.1.5. Overall Significance of Landscape Effects

Tabel 18. Overall significance of landscape effects.

Magnitude of impact Magnitude of impact		Significance of impact		
		Significance of impact	Magnitude of impact	Significance of impact
LCA types	I	High	Large	Severe
	II	Low	Small	Minor
	III	Low	Medium	Moderate/minor
	IV	Low	Small	Minor
	V	High	Large	Severe
	VI	Low	Small	Minor
	VII	Medium	Small	Moderate/minor
	VIII	Low	Medium	Moderate/minor
	IX	Low	Small	Minor
	X	Low	Small	Minor
	XI	Low	Negligible	Minor/negligible
	XII	Medium	Medium	Major/moderate

- for magnitude of landscape effects see Appendix 8 in Appendix folder, p 14
- for calculation of significance of impact see Appendix 9 in Appendix folder, p15

Landscape resource		Calculation of significance of impact		
		Sensitivity	Magnitude of impact	Significance of impact
Manor landscapes	Kose-Uuemõisa	Medium	Medium	Major/moderate
	Ravila	Medium	Small	Moderate/minor
	Oru	Medium	Negligible	Minor
Nature protection	Kämbla nature reserve	Medium	Small	Moderate/minor
	Otiveski meadow	Medium	Small	Moderate/minor
	Tuhala nature reserve	Low	Negligible	Minor/negligible
	Kose-Uuemõisa manor park	Low	Small	Minor
	Kuivajõe river bed	High	Large	Severe
	Kurena elms	Medium	Medium	Major/moderate
	Protected habitats	Low	Small	Minor

- for magnitude of landscape effects see Appendix 8 in Appendix folder, p 14
- for calculation of significance of impact see Appendix 9 in Appendix folder, p15

5.4.2. Assessment of Visual Effects

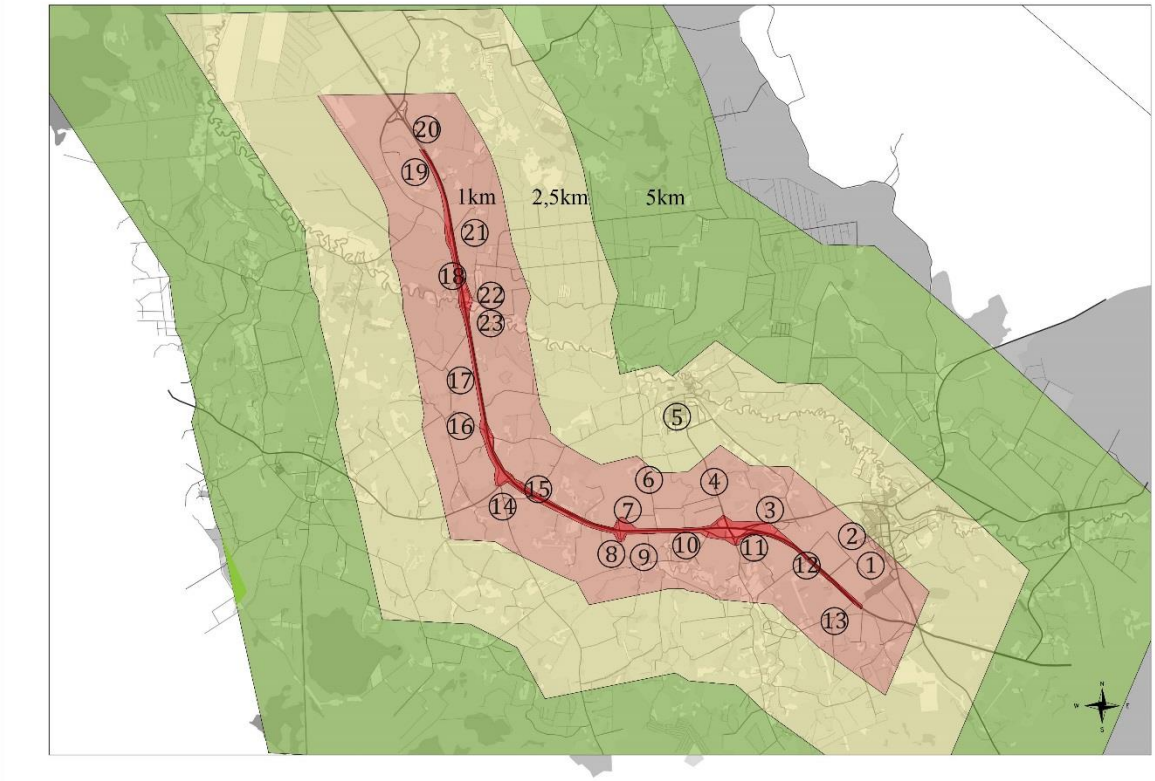

Figure 25. Zoning of theoretical visibility and the locations of the viewpoints.

1. Kose I
2. Kose II
3. Kose III
4. Väljataguse
5. Kose-Uuemõisa
6. Vana-Nõmme
7. Kurgemäe
8. Tündersepa
9. Kurena
10. Kuivajõe
11. Karla
12. Liiva I
13. Liiva II
14. Kolu
15. J. Lauristin
16. Salu
17. Lõuna-Karja
18. Viking Village
19. Uuela
20. Tossi
21. Ikaspalu
22. Siniallika
23. Saula Spring

Table 26. Visibility from particular viewpoints.

Viewpoint	Visibility			
	View 1 Daylight, summer	View 2 Daylight, winter	View 3, Night	Overall visibility
1	1	1	0	Low
2	1	1	0	Low
3	3	3	3	High
4	1	1	2	Low
5	0	0	0	Negligible
6	1	1	1	Low
7	3	3	3	HIgh
8	1	1	1	Low
9	1	1	1	Low
10	1	1	1	Low
11	1	1	2	Medium
12	3	3	2	High
13	2	1	2	Medium
14	1	0	0	Negligible
15	2	2	3	Medium
16	1	1	2	Low
17	1	1	1	Low
18	3	3	3	High
19	1	1	1	Low
20	3	3	3	High
21	3	3	3	High
22	2	3	1	Medium
23	3	3	3	High

- given values are based on a system where 0 – negligible, 1 – low, 2 – medium, 3 – high
- for values of visibility see Appendix 10 in Appendix folder, p16

Table 27. Sensitivity of particular views. See the viewpoints on the map

Viewpoint	Sensitivity of a particular view			
	Visibility	Number of viewers	Nature of viewing experience	Overall sensitivity
1	1	1	3	Medium
2	1	2	3	Medium
3	3	0	1	Low
4	1	1	2	Low
5	0	1	0	Negligible
6	1	0	3	Low
7	3	0	3	Medium
8	1	0	3	Low
9	1	0	1	Low
10	1	1	3	Medium
11	2	0	2	Low
12	3	1	3	Medium
13	2	0	2	Low
14	0	0	2	Negligible
15	2	0	0	Negligible
16	1	1	3	Medium
17	1	0	2	Low
18	3	2	1	Medium
19	1	0	2	Low
20	3	0	3	Medium
21	3	0	1	Low
22	2	2	1	Medium
23	3	1	1	Medium

- given values are based on a system where 0 – negligible, 1 – low, 2 – medium, 3 – high
- for number of viewers and nature of viewing experience see Appendix 10 in Appendix folder, p16

Tabel 28. Overall significance of visual effects

Viewpoint	Calculation of significance of impact		
	Sensitivity	Magnitude of impact	Significance of impact
1	Medium	Small	Moderate/minor
2	Medium	Small	Moderate/minor
3	Low	Large	Moderate
4	Low	Small	Minor
5	Negligible	Negligible	None
6	Low	Small	Minor
7	Medium	Large	Major
8	Low	Medium	Moderate/minor
9	Low	Small	Minor
10	Medium	Small	Moderate/minor
11	Low	Medium	Moderate/minor
12	Medium	Large	Major
13	Low	Small	Minor
14	Negligible	Negligible	None
15	Negligible	Medium	Minor/negligible
16	Medium	Small	Moderate/minor
17	Low	Small	Minor
18	Medium	Large	Major
19	Low	Small	Minor
20	Medium	Large	Major
21	Low	Large	Moderate
22	Medium	Medium	Major/moderate
23	Medium	Large	Major

- for magnitude of visual effects see Appendix 11 in Appendix folder, p 17
- for number of viewers and nature of viewing experience see Appendix 10 in Appendix folder, p16

5.4.3. Conclusion of the Landscape and Visual Impact Assessment

Table 29. Conclusion of the landscape and visual impact assessment

Viewpoint	LCA type	Distance from the site (ZTV)	Significance of landscape effects	Significance of visual effects
1	VI Dense settlement area	1km	Minor	Moderate/minor
2	VI Dense settlement area	1km	Minor	Moderate/minor
3	V Mosaic arable land with small patches of forest and settlement	0km	Severe	Moderate
4	I Open arable land with small patches of forest and sparse settlement	1km	Severe	Minor
5	VI Dense settlement area	2,5km	Minor	None
6	V Mosaic arable land with small patches of forest and settlement	1km	Severe	Minor
7	I Open arable land with small patches of forest and sparse settlement	0km	Severe	Major
8	I Open arable land with small patches of forest and sparse settlement	1km	Severe	Moderate/minor
9	I Open arable land with small patches of forest and sparse settlement	1km	Severe	Minor

Viewpoint	LCA type	Distance from the site (ZTV)	Significance of landscape effects	Significance of visual effects
10	V Mosaic arable land with small patches of forest and settlement	1km	Severe	Moderate/minor
11	V Mosaic arable land with small patches of forest and settlement	1km	Severe	Moderate/minor
12	V Mosaic arable land with small patches of forest and settlement	1km	Severe	Major
13	V Mosaic arable land with small patches of forest and settlement	1km	Severe	Minor
14	V Mosaic arable land with small patches of forest and settlement	1km	Severe	None
15	V Mosaic arable land with small patches of forest and settlement	1km	Severe	Minor/negligible
16	I Open arable land with small patches of forest and sparse settlement	1km	Severe	Moderate/minor
17	I Open arable land with small patches of forest and sparse settlement	1km	Severe	Minor
18	VII Forest with open glade areas	0km	Moderate/minor	Major
19	III Open arable land with sparse settlement	1km	Moderate/minor	Minor

Viewpoint	LCA type	Distance from the site (ZTV)	Significance of landscape effects	Significance of visual effects
20	III Open arable land with sparse settlement	1km	Moderate/minor	Major
21	III Open arable land with sparse settlement	1km	Moderate/minor	Moderate
22	XII Forest with grassland patches and sparse settlement	0km	Major/moderate	Major/moderate
23	VII Forest with open glade areas	1km	Moderate/minor	Major

In conclusion to the landscape and visual impact assessment it can be said that the significance of landscape effects of large transportation objects within small-scale rural landscape is even severe. The closed spaces of mosaic landscapes created by irregular patches of forest, arable land and rather sparse settlement are sensitive towards high-dimensional linear objects that create open spaces, but also borders of unnatural shape and extent. The significance of landscape effects decrease with distance and so does the significance of the visual effects.

The site displays examples of the objects, such as high embankments and viaducts being built very close to peoples' homes. With this close proximity even the noise barrier walls became unwanted and distressing. Nevertheless, the situation has not affected the significance of visual effects to reach extremes due to the small amount of visual receptors.

CONCLUSION

As the road construction projects carried out in Estonia appear to be influenced by the example of Europe rather than the local context, it seemed to be rational to research the impacts these objects have on our landscape and visual receptors, the people.

The first aim of the thesis was to find out if the methodology of landscape and visual impact assessment, or similar, is being used during the process of a road design project. The conversations with specialists of this field in Estonia led to an understanding that the interest in the methodology as such has been rather small so far, but there are signs of improvement.

As it turned out, the market of road construction in Estonia is too small and economic aspects over-weigh the visual ones, the second aim of the thesis – to identify the basis on which the effects have been assessed so far, was very briefly included.

The third aim of the thesis, to determine, if landscape and visual impact assessment could be necessary in Estonia, on the other hand, created premises for practical approach – landscape and visual impact assessment was conducted on three road construction objects of different character. Although, the results of the landscape and visual impact assessments did not highlight evident connections between the magnitude of effects, landscape resources, visual receptors' sensitivity etc, the transportation objects of large scale clearly have an apparent effect on the surrounding landscape.

In conclusion, I find the thesis fulfilled its aim by leading to an understanding that a methodology, although adapted to the research subject might not lead to evident proof of the matter. Hence, it can be stated that the impact of the large-scale infrastructure objects should be assessed preceding or during the design process in Estonia, yet the methodology should be developed to meet the peculiarities of road construction.

ÜLDKOKKUVÕTE

Maastiku ja visuaalse mõju hindamine Eesti tee-ehituse praktikas

Teemavaliku aluseks on mulje, et uuemad ja suuremad tee-ehituse ja rekonstrueerimise projektid lähtuvad pigem Euroopa eeskujust, kui kohalikust kontekstist. Sellest lähtuvalt on magistritöö eesmärk uurida, kas Eesti tee-ehituse praktikas arvestatakse objektide mõjuga maastikule ja vaadetele, kui arvestatakse, siis millistele põhimõtetele toetude, ning kas Eesti kontekstis oleks kasu Ühendkuningriikudes juurutatud maastiku ja visuaalse mõju hindamise metoodikast.

Eesti tee-projekteerimise hetkeolukorra välja selgitamiseks läbi veetud intervjuudest spetsialistidega selgus, et taolise metoodikaga pole kokku puututud. Seega magistritöö teine eesmärk, selgitada välja, millistel põhimõtetel on tee-objektide mõju maastikule hinnatud, kajastamist ei leidnud.

Magistritöö kolmas eesmärk oli välja selgitada, kas Eestis võiks kasutada maastiku ja visuaalse mõju hindamist, et ennetada maanteede potentsiaalset negatiivste mõju maastikele. Selle jaoks on töös lahti seletatud juhend maastiku ja visuaalse mõju hindamiseks ning seda rakendatud kolmel erineval objektil – Postimaja ristmik ning Ihaste sild Tartus, Mäo möödasõit Kesk-Eestis Tallinn-Tartu-Võru-Luhamaa maanteel ning sama maantee lõik vahemikus Aruvalla-Kose.

Maastiku ja visuaalse mõju hindamine tugineb kaardianalüüsil, mille põhjal on tehtud kindlaks objektide teoreetilise mõju ulatus, maastiku omadused piirkonnas ning valitud välja punktid, mis esindavad vaadete mõju inimestele. Maastiku ja visuaalse mõju hindamise kokkuvõtteks võib öelda, et mõju maastikele ning sellest lähtuvalt ka vaadetele on olemas ning kohati päris tõsine, ent metoodikale põhinevaid üldistusi teha ei saa. Mistõttu oleks vajalik kohandada metoodikat sobituma maanteede erisustega.

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APPENDIXES

See the Appendix folder.