2 Annex - Noise dispersion maps

2.1 Maps of noise dispersion near inhabitated areas for the "zero" alternative

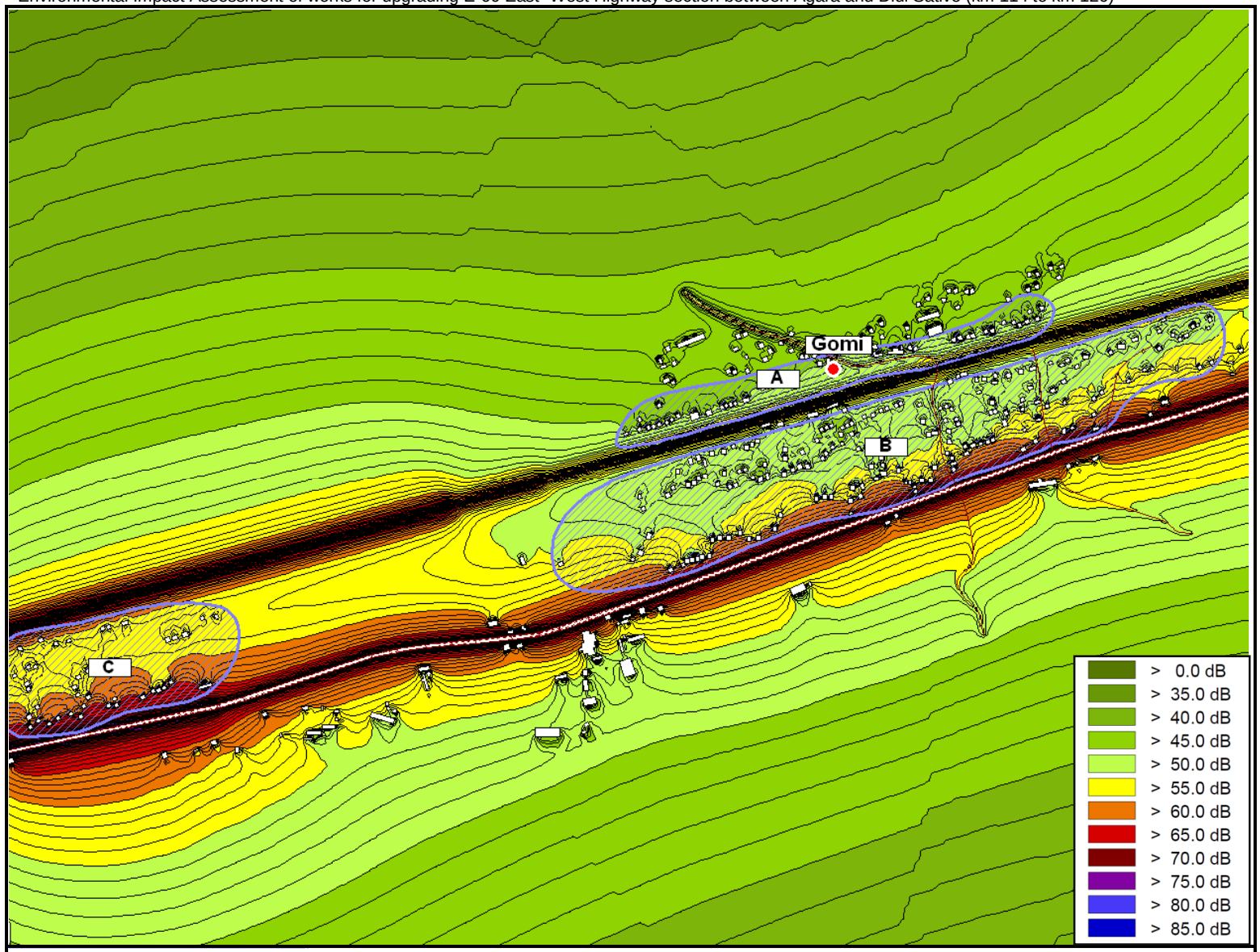


Figure 2.1.1 *Day time noise levels L_d for roads sub-section from 116.2 km to 120.8 km of the existing road*

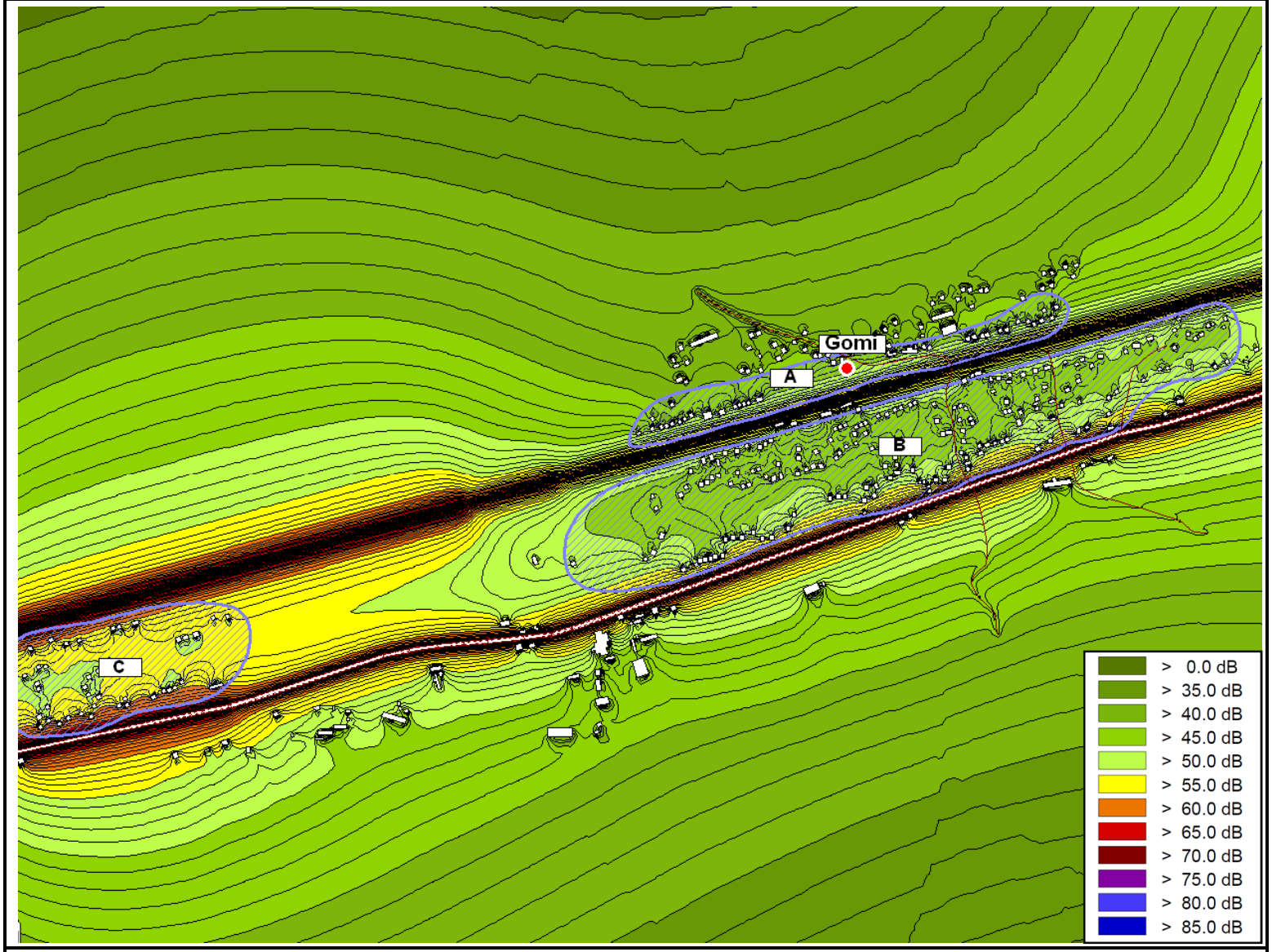


Figure 2.1.2 *Night time noise levels L_n for roads sub-section from 116.2 km to 120.8 km of the existing road*

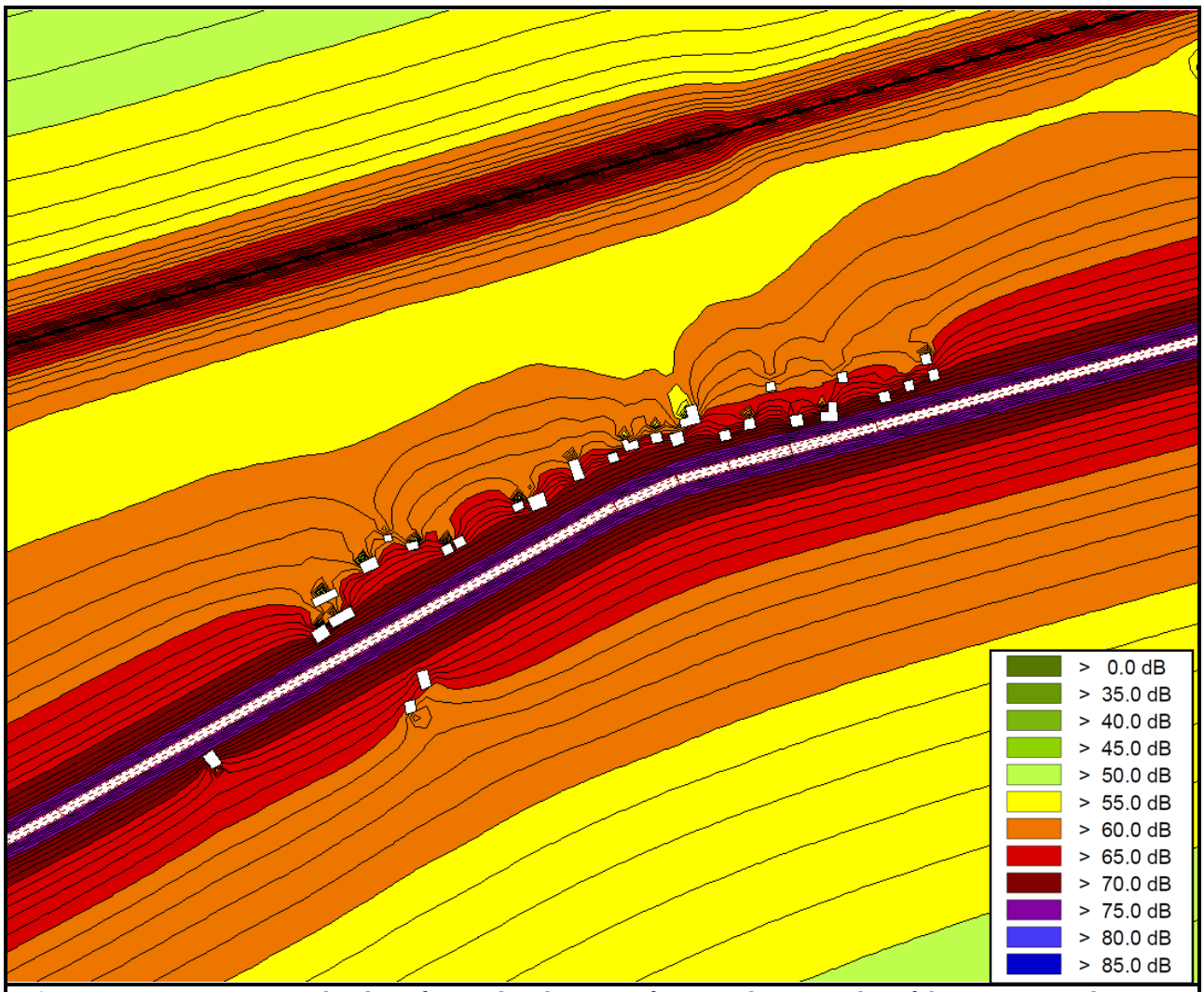


Figure 2.1.3 *Day time noise levels L_d for roads sub-section from 121 km to 122 km of the existing road*

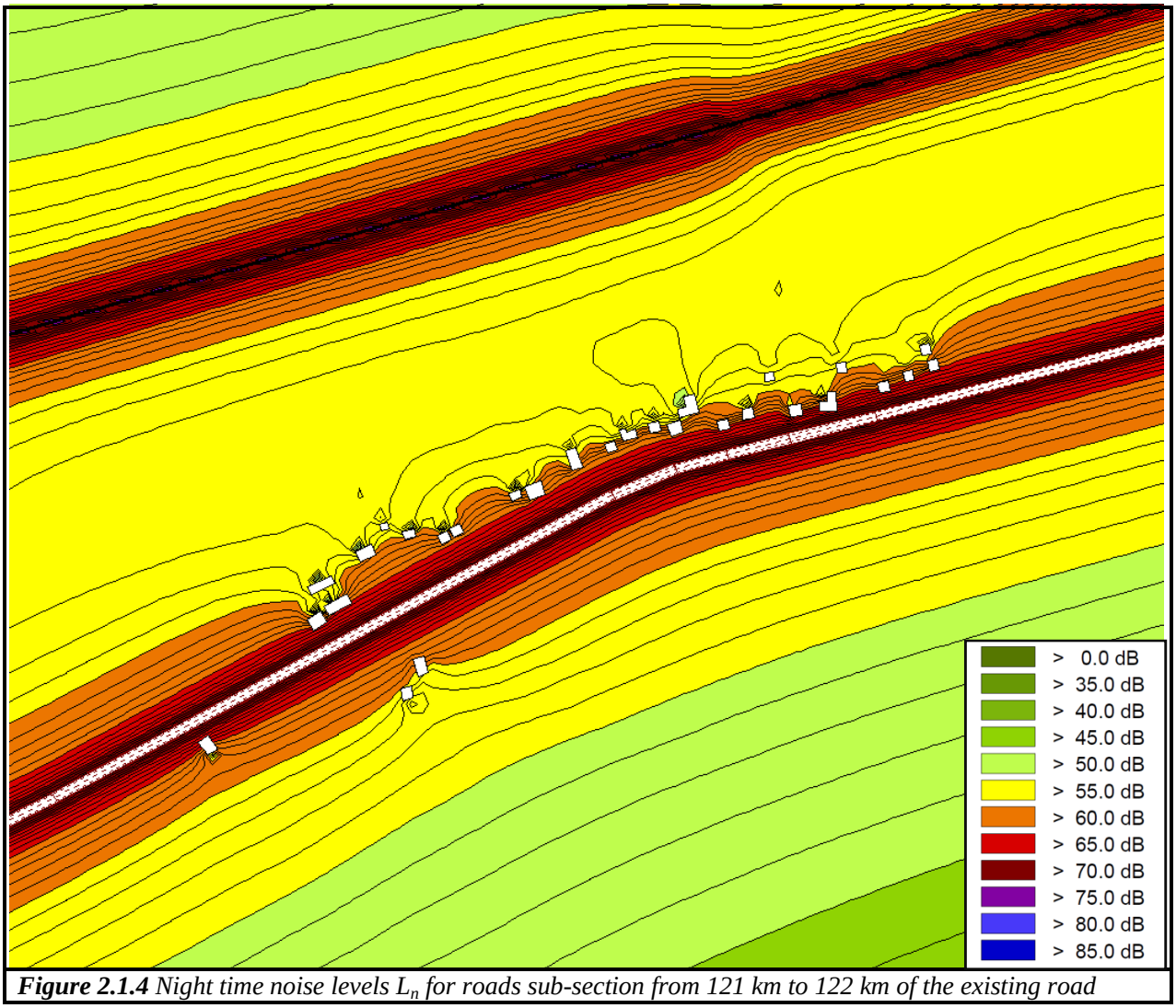


Figure 2.1.4 *Night time noise levels L_n for roads sub-section from 121 km to 122 km of the existing road*

2.2 Maps of noise dispersion for the Project alternative 1

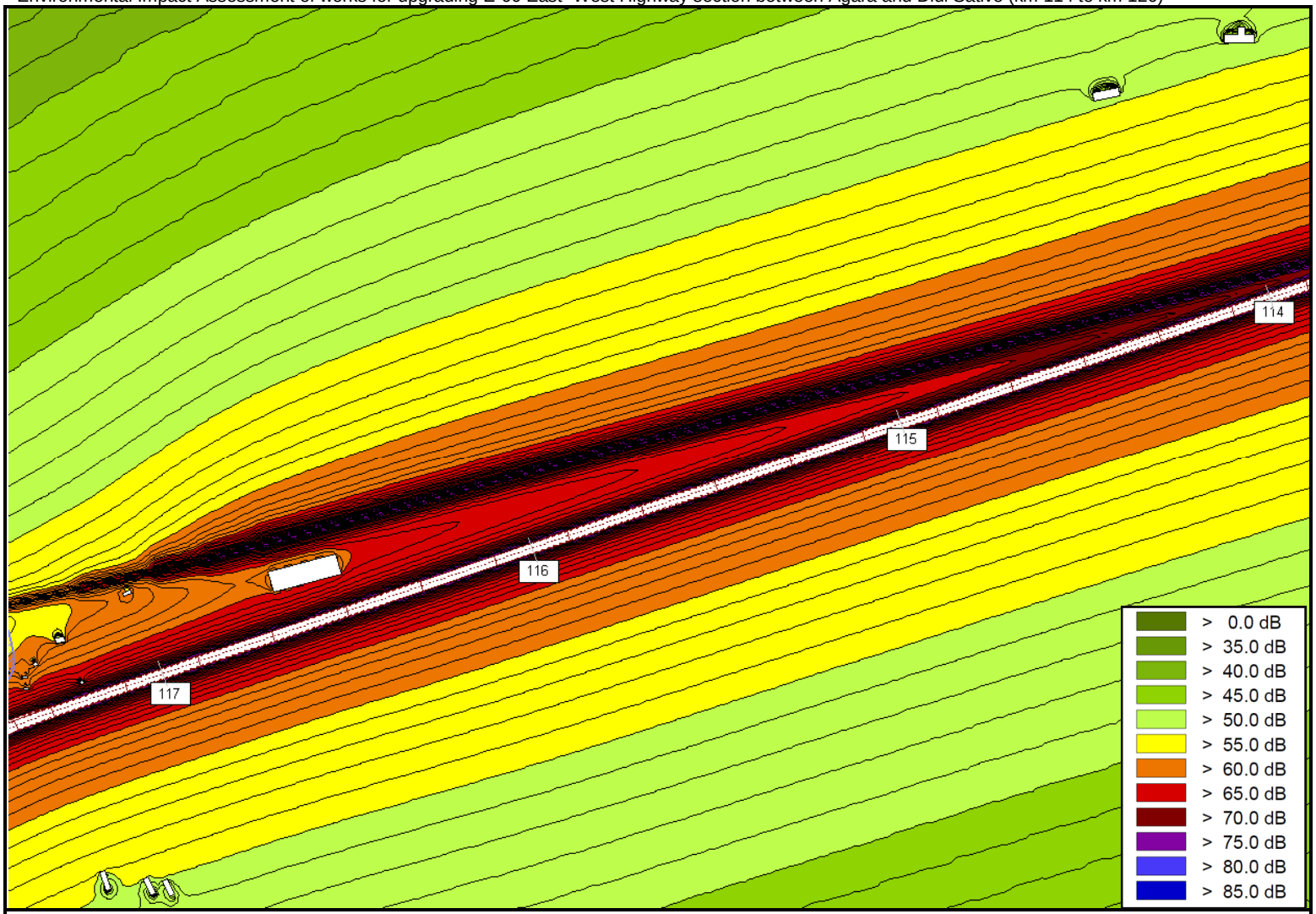


Figure 2.2.1 *Day time noise levels L_d for roads sub-section from 114 km to 117.3 km of the designed road*

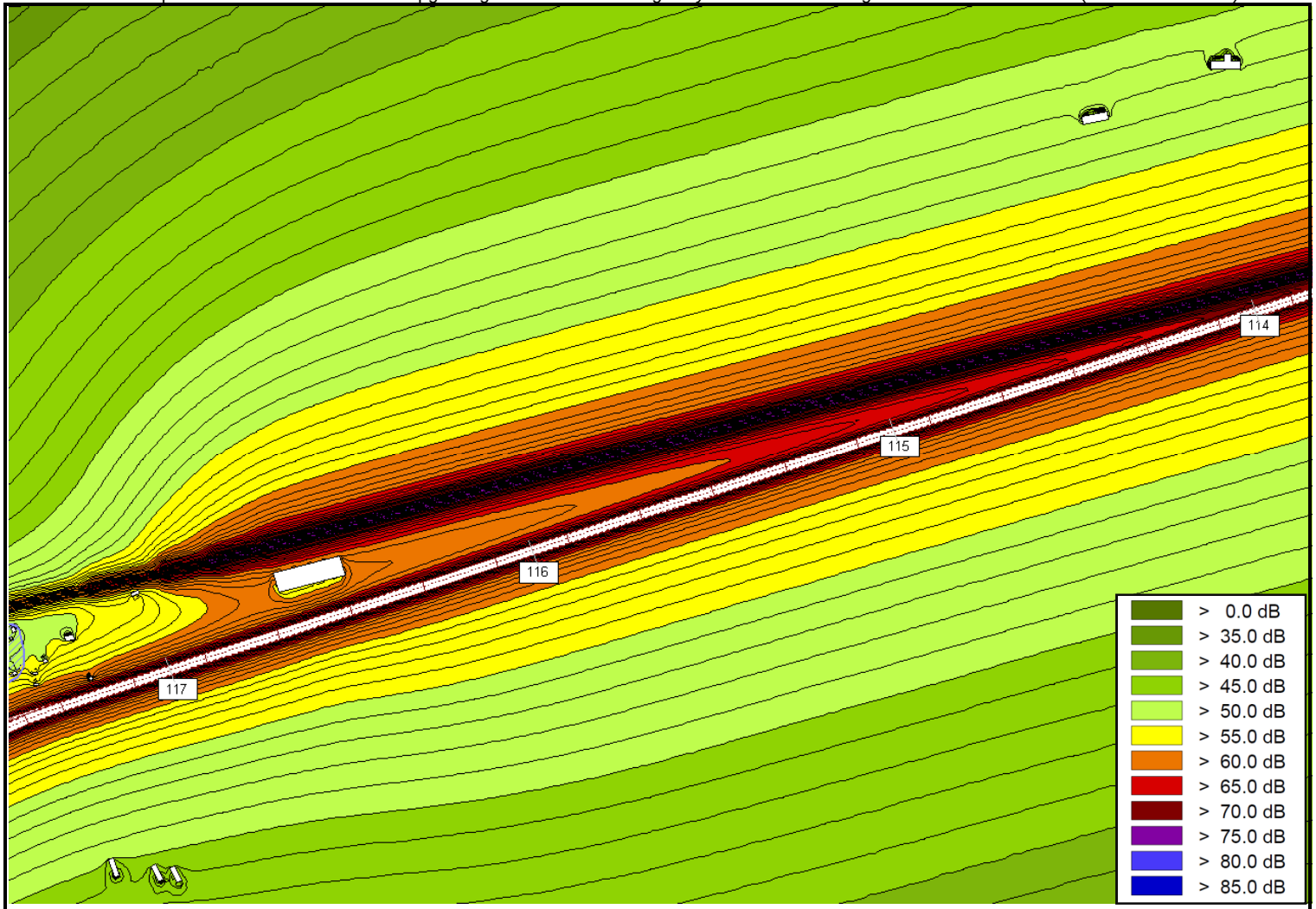


Figure 2.2.2 *Night time noise levels L_n for roads sub-section from 114 km to 117.3 km of the designed road*

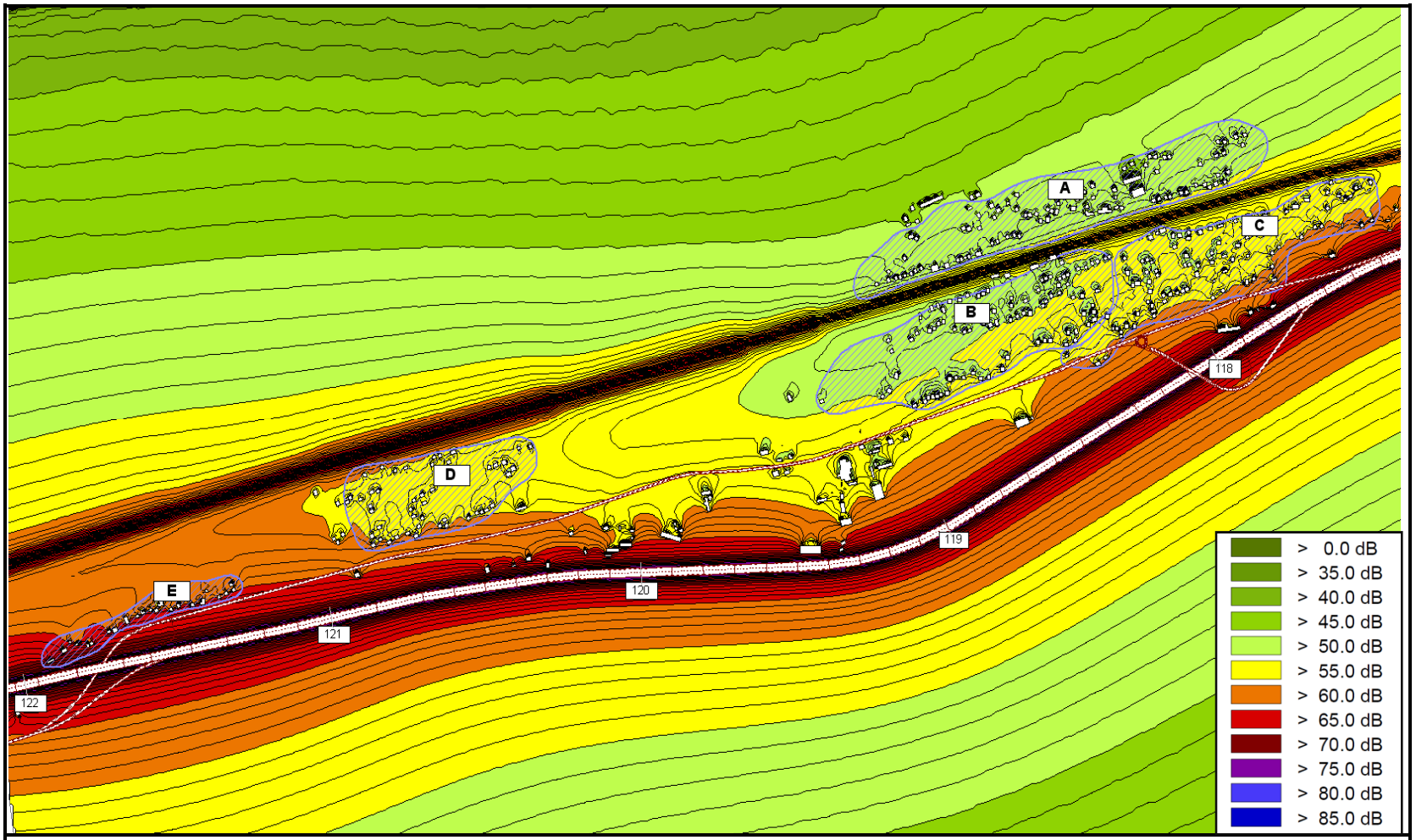


Figure 2.2.3 *Day time noise levels L_d for roads sub-section from 117.3 km to 122 km of the designed road*

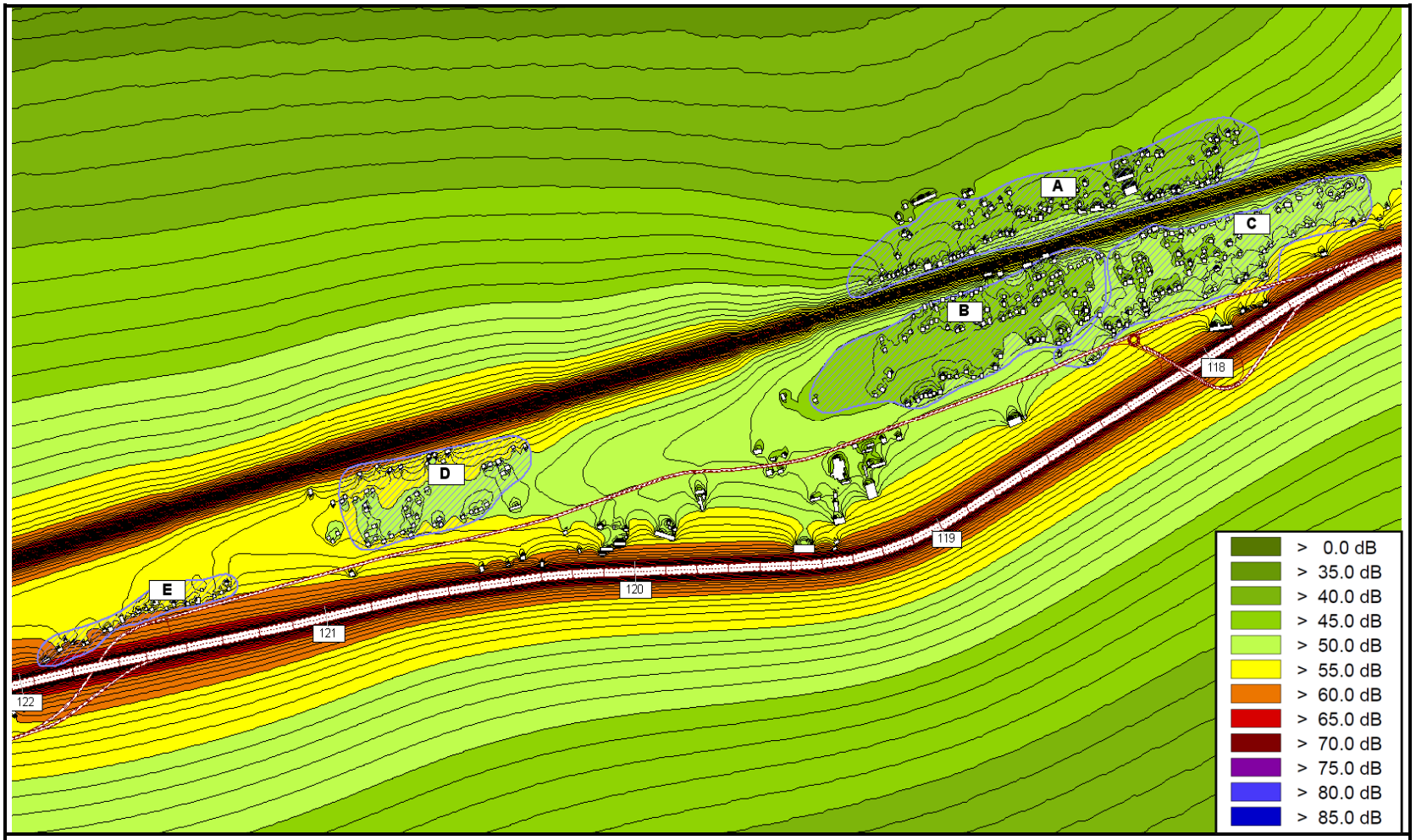


Figure 2.2.4 *Night time noise levels L_n for roads sub-section from 117.3 km to 122 km of the designed road*

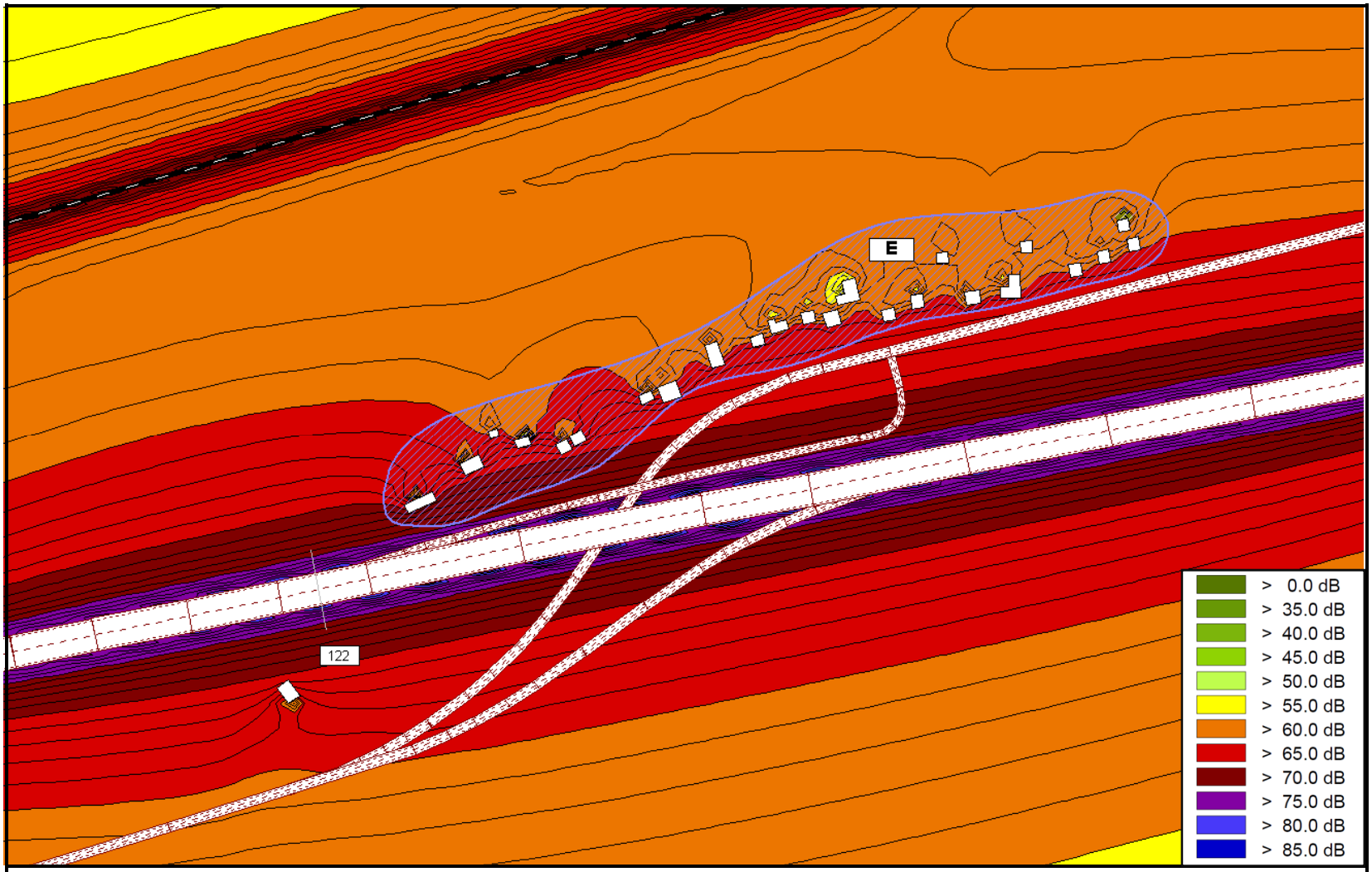


Figure 2.2.5 *Day time noise levels L_d for roads sub-section from 121.1 km to 121.6 km of the designed road*

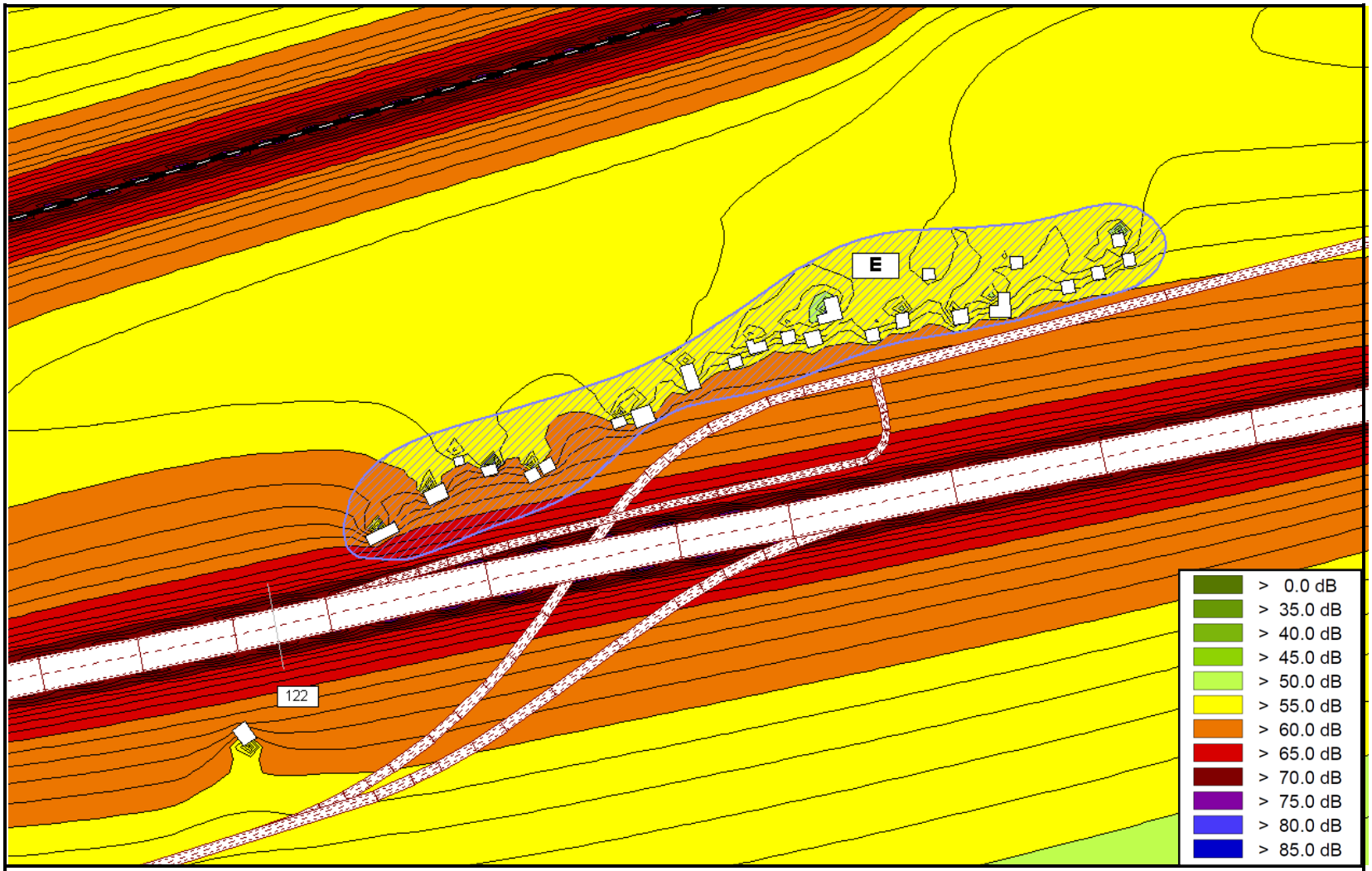


Figure 2.2.6 *Night time noise levels L_n for roads sub-section from 121.1 km to 121.6 km of the designed road*

2.3 Maps of noise dispersion for the Project alternative 2

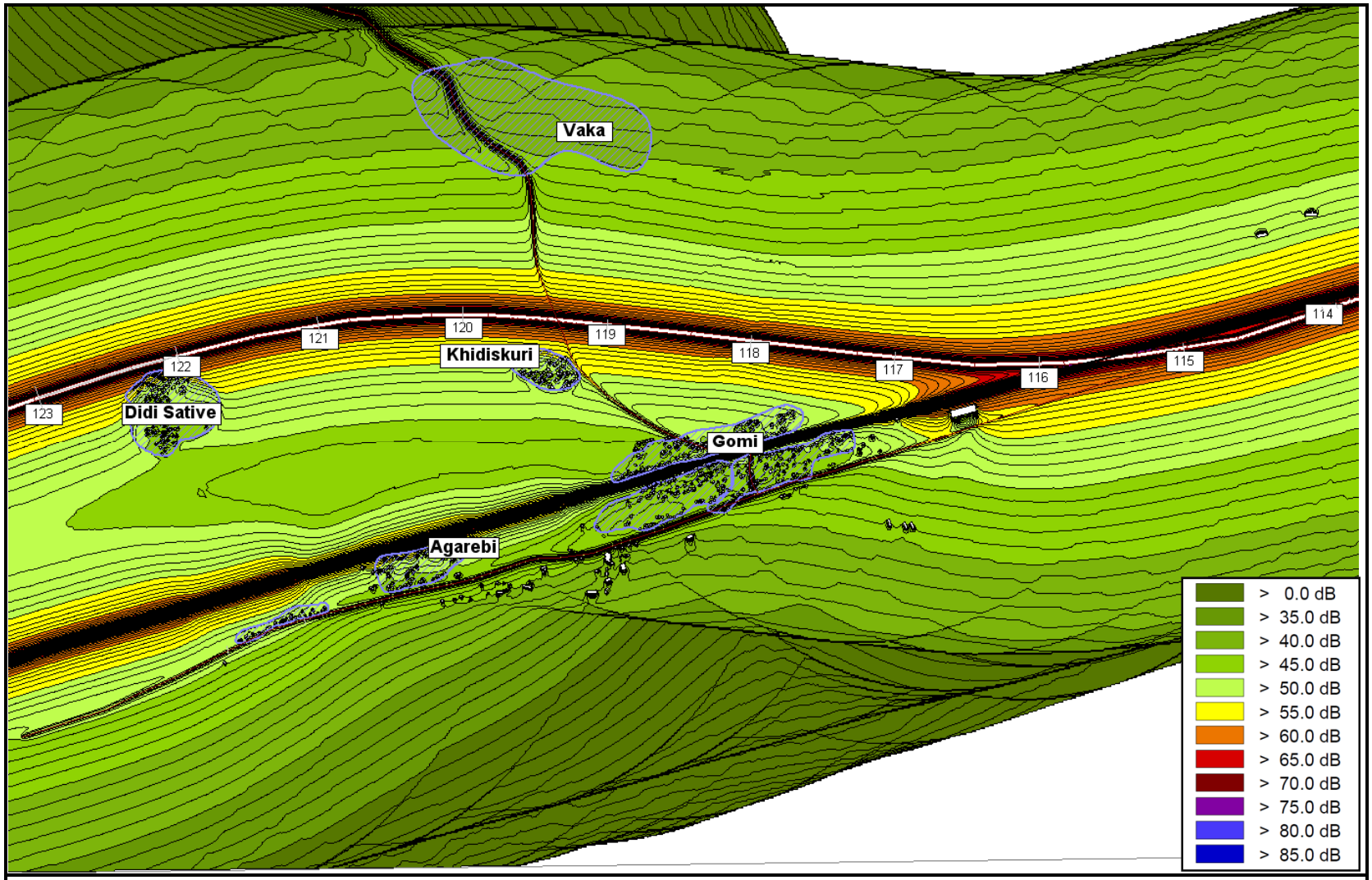


Figure 2.3.1 *Day time noise levels L_d for northern alternative (Project alternative 2)*

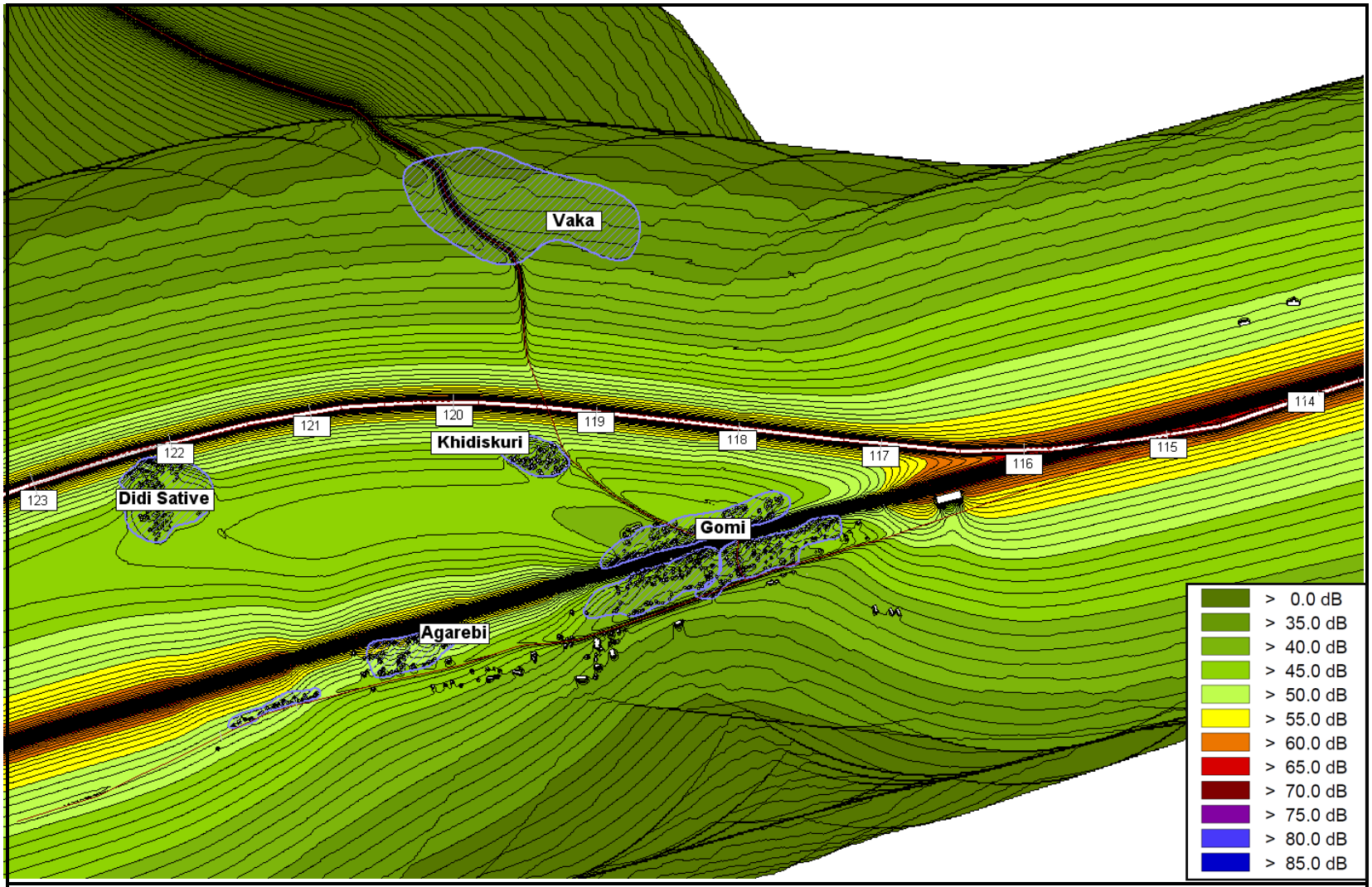


Figure 2.3.2 *Night time noise levels L_n for northern alternative (Project alternative 2)*

2.4 Noise mitigation measures for Project alternative 1

Km of the designed road	**Number of residential houses under unacceptable noise impact**	**L_d (<65dB(A))****	**L_n (<55dB(A))****	**Exceedance of L_d, dB(A)**	**Exceedance of L_n, dB(A)**	**Noise mitigation measures**	**Noise level after the implementation of noise mitigation measures****	
							L_d (<65dB(A))	**L_n (<55dB(A))**
117.2 - 118	43	54 - 63	48 - **58**	-	+3	Limit speed to 90 km/h*	53-61	47-55
121.1 - 121.6	16	60 - 65	53 - **59**	-	+4	Limit speed to 80 km/h*	55 - 62	52-55
121.6 - 122.1	8	65 - **70**	**60 - 64**	+5	+9	Limit speed to 50 km/h	58 - 62	52-55

* Speed limit restrictions are only applicable during night time, because L_d is not exceeded
**Only influence of the designed road was estimated (influence of the railway was excluded)

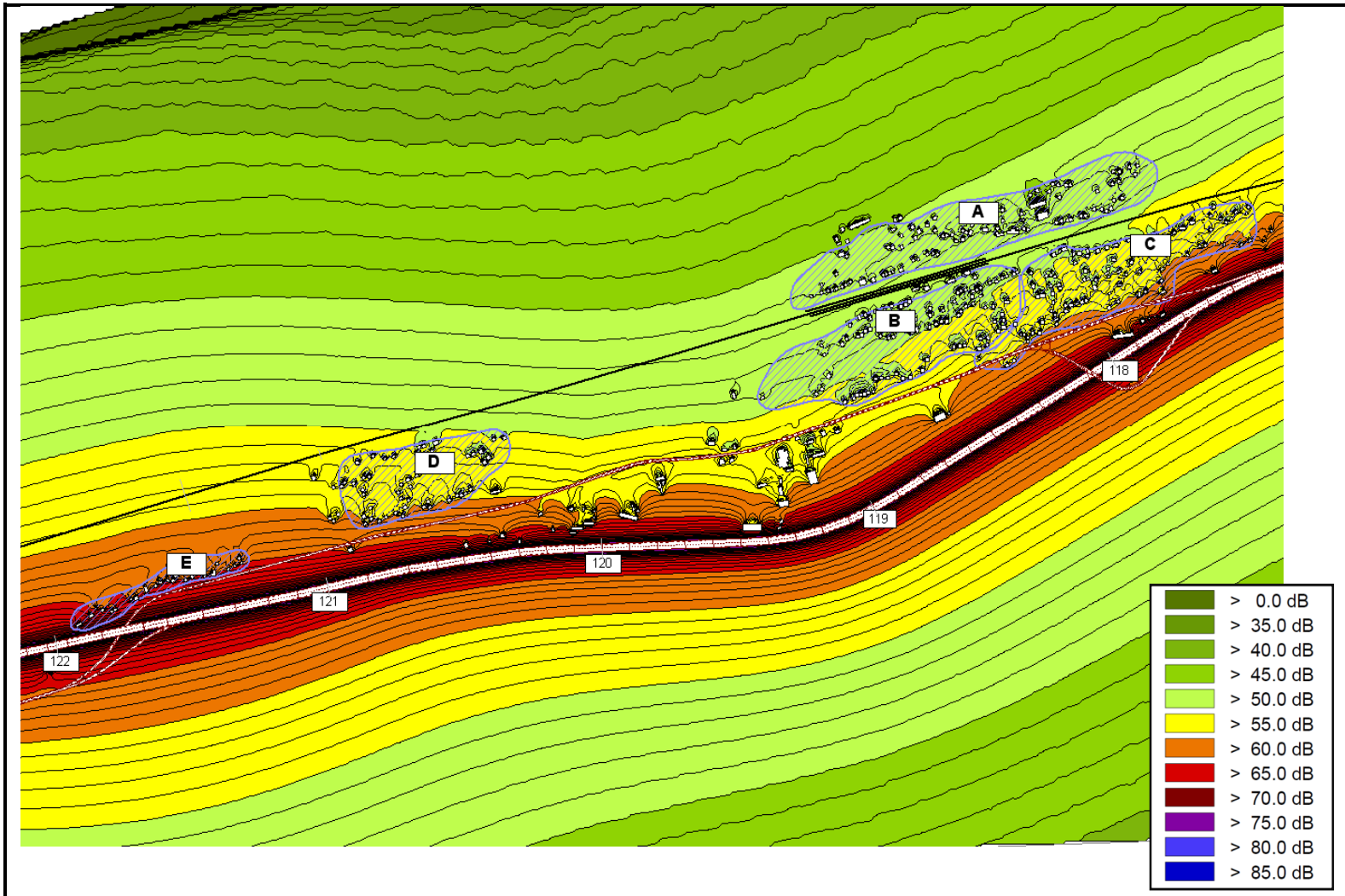


Figure 2.4.1 *Day time noise levels L_d for roads sub-section from 117.2 km to 122 km of the designed road, excluding impact of the railway noise*

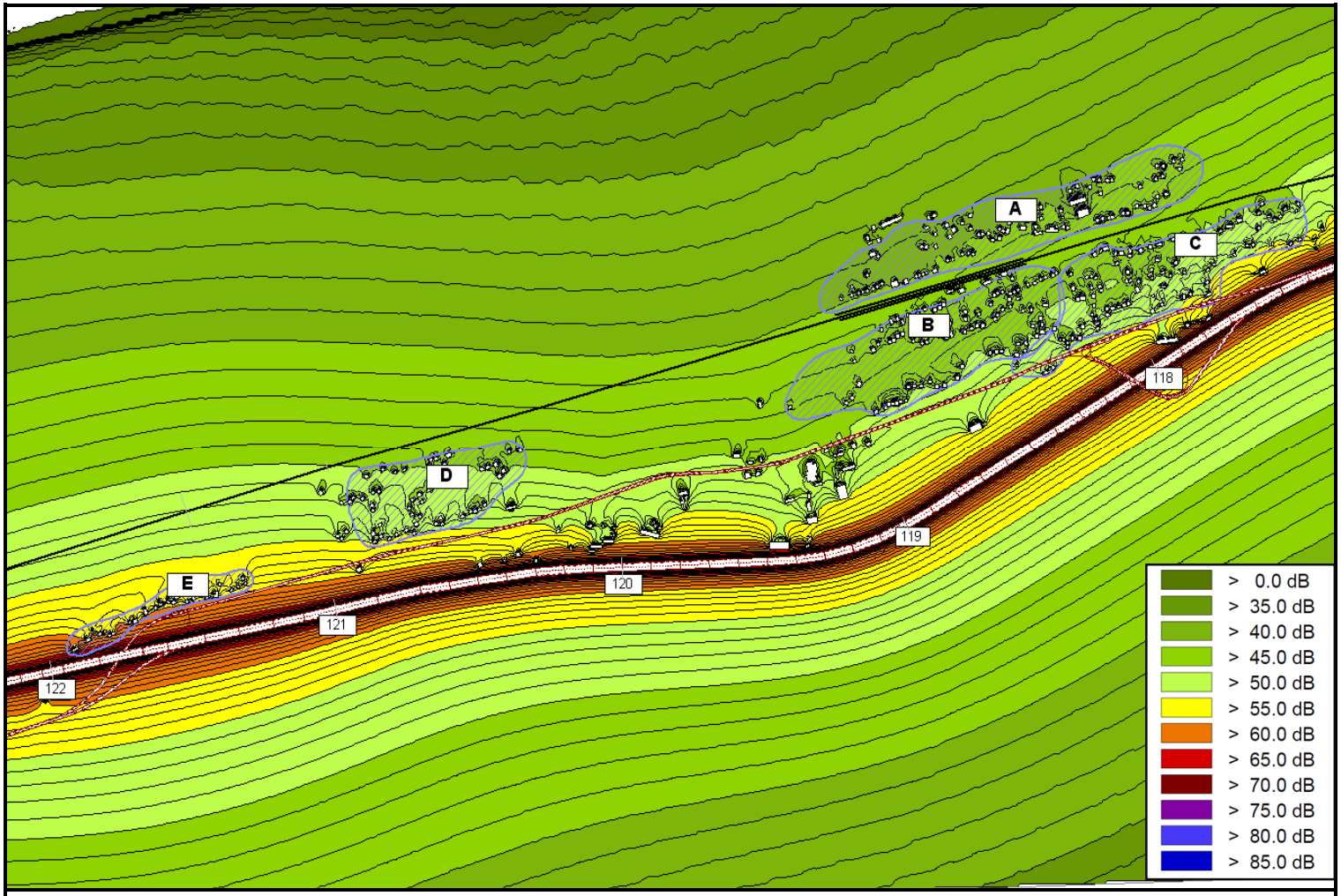


Figure 2.4.2 *Night time noise levels L_n for roads sub-section from 117.2 km to 122 km of the designed road, excluding impact of the railway noise*

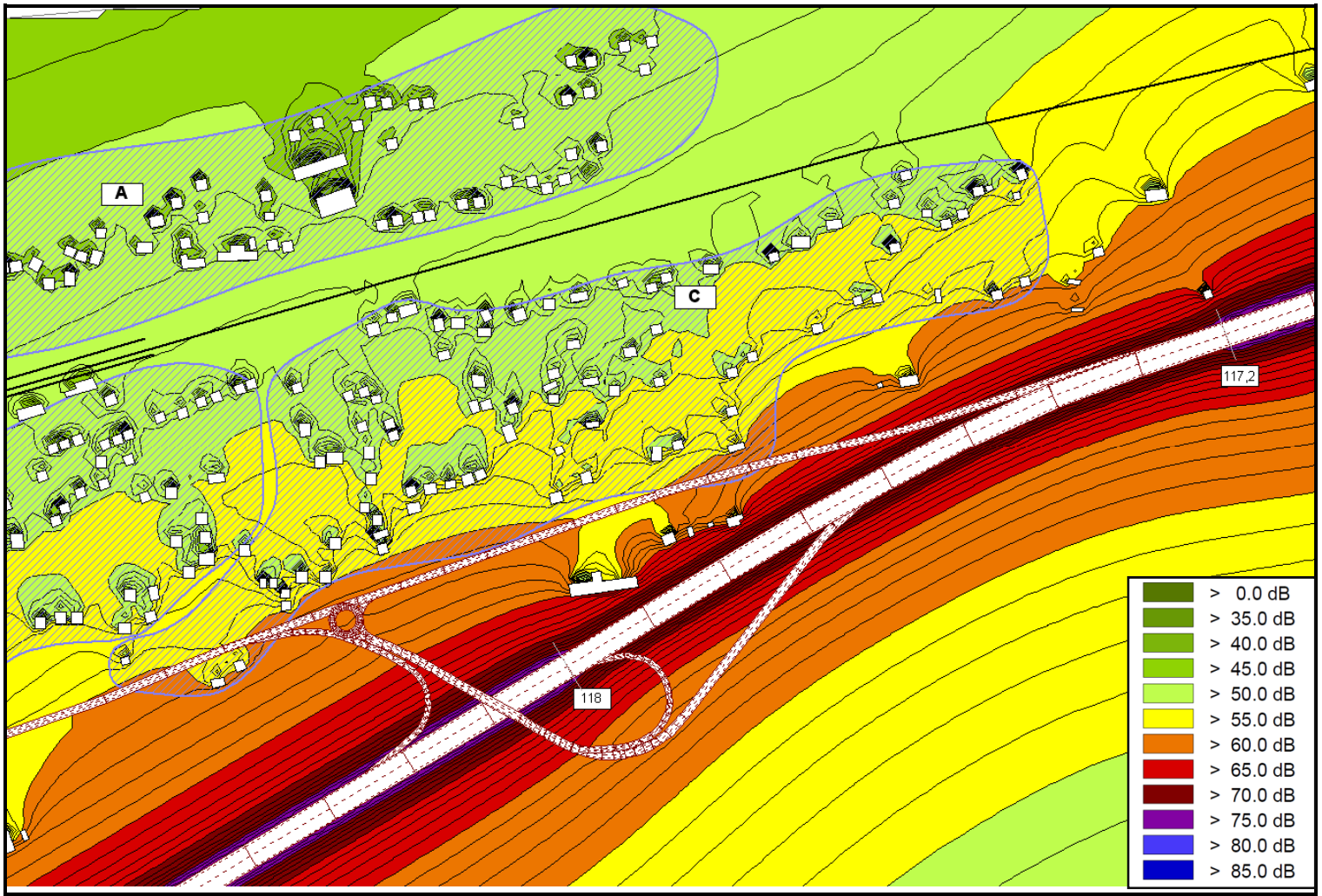


Figure 2.4.3 *Day time noise levels L_d for roads sub-section from 117.2 km to 118 km of the designed road, with reduced speed (90 km/h)*

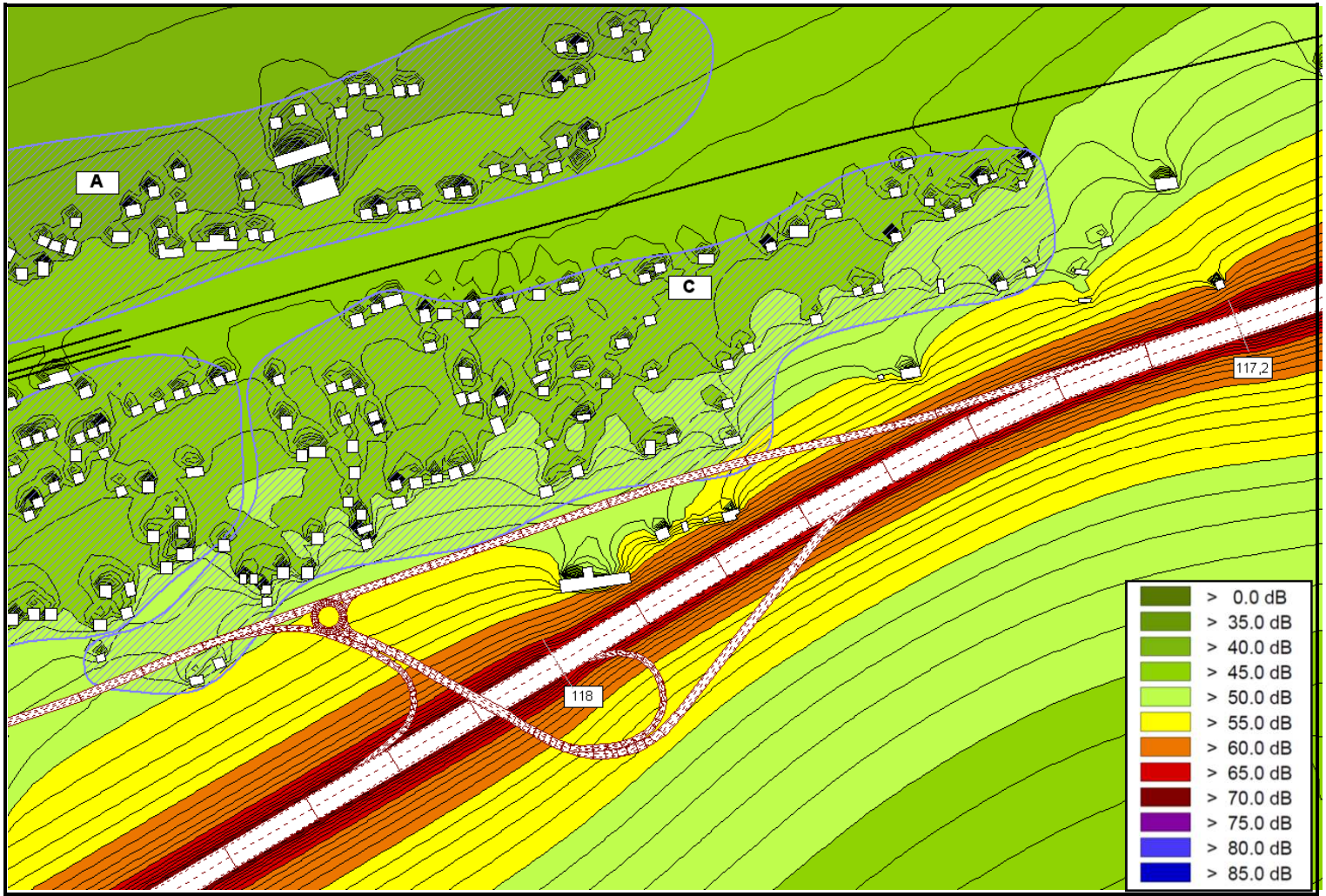


Figure 2.4.4 *Night time noise levels L_n for roads sub-section from 117.2 km to 118 km of the designed road, with reduced speed (90 km/h)*

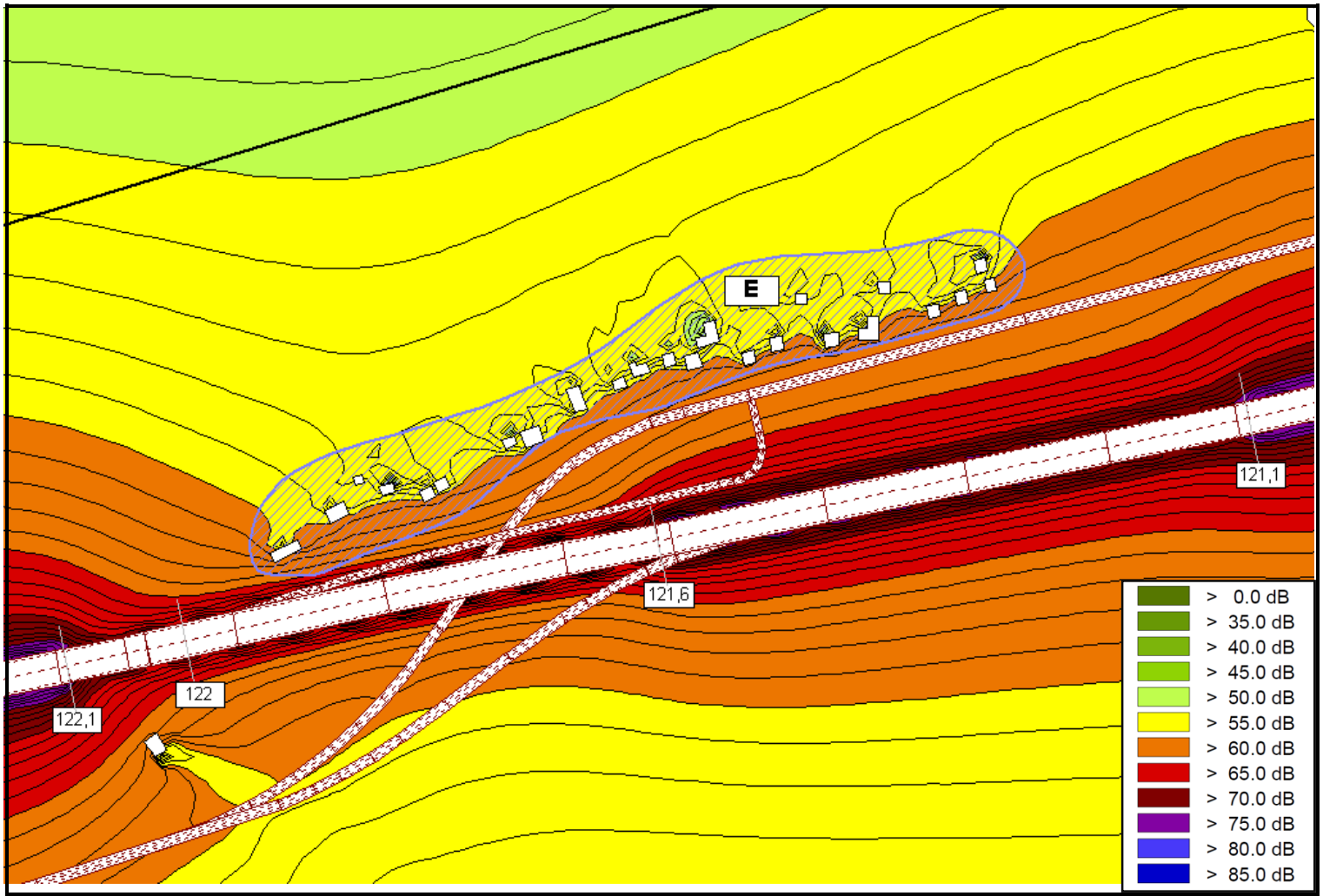


Figure 2.4.5 *Day time noise levels L_d for roads sub-section from 121.1 - 121.6 km and 121.6 - 122.1 of the designed road, with reduced speed (respectively 80 km/h and 50 km/h)*

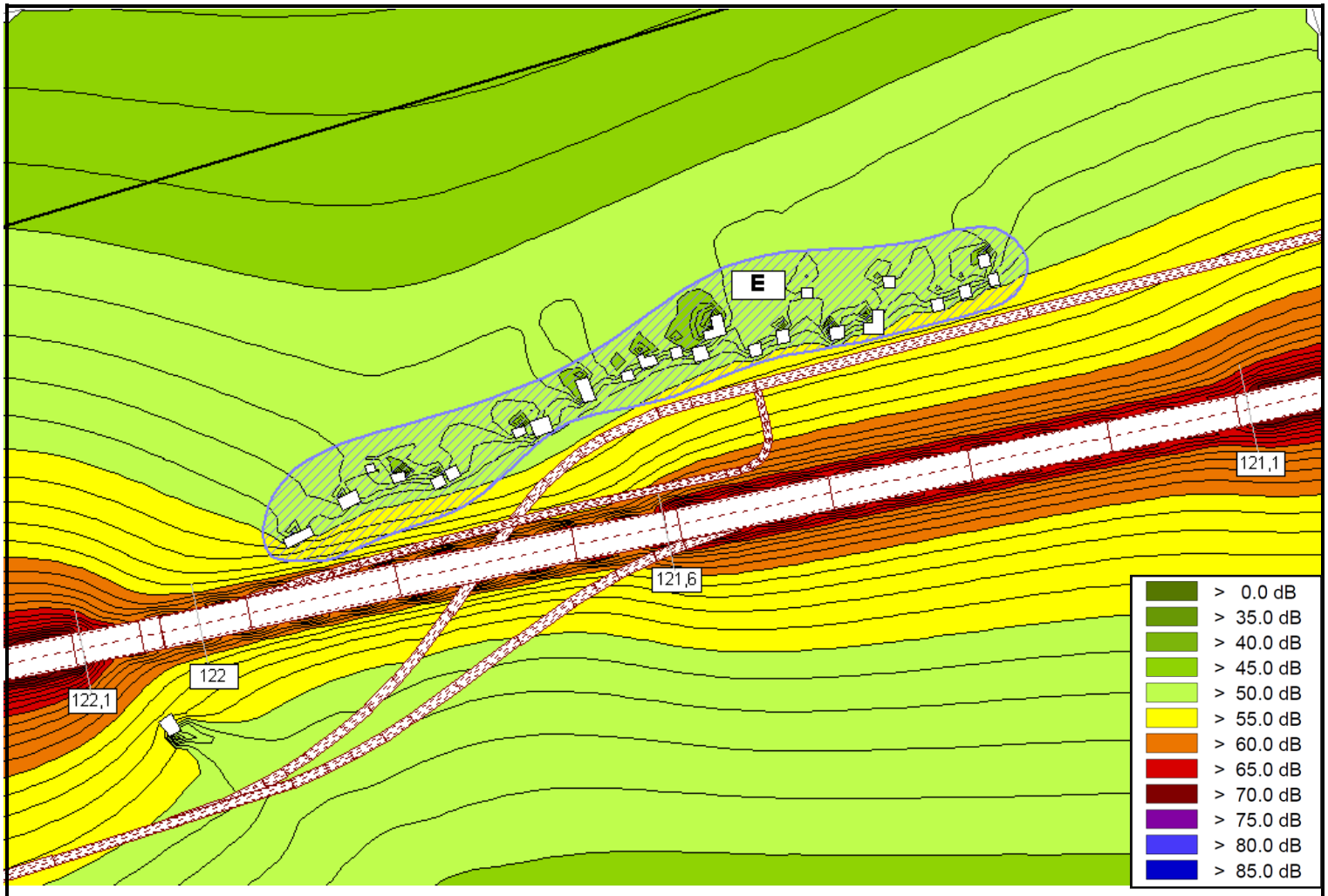


Figure 2.4.6 *Night time noise levels L_n for roads sub-section from 121.1 - 121.6 km and 121.6 - 122.1 of the designed road, with reduced speed (respectively 80 km/h and 50 km/h)*

3 Annex – Waste storage and transportation

Description of waste	Hazard class	Waste management	Safety conditions during storage and transportation	Waste processing, burial or utilization conditions
1. Hazardous class 3 and 4 waste allowed for disposal to domestic waste landfill				
Domestic and food waste	4	**Waste collection and delivery to domestic solid waste landfill** • Collection and disposition of waste – in special containers placed in operation sites. • Removal from operation grounds by municipal trucks under agreement.	• Prohibited is to put in solid domestic containers waste of 1, 2 and 3 hazard class waste, including luminescent tubes, oily waste and others, those are not allowed for disposal to domestic solid waste landfill. • To disposal site waste shall be transported by special vehicles to avoid pollution of environment.	
Waste paper, card-board, plastic bags	4 or 5			
Broken glass, plastic and rubber waste, faulty bulbs	4			
Swept waste, dead leafs	5			
Broken roofing slates, asbestos-cement waste	4	**Waste collection and delivery to domestic solid waste landfill** Collection and disposal: • broken roofing tiles, asbestos waste – to be packed in plastic bags and kept in enclosed open-air sites. • paronite, plastic and rubber pipes, glass fibre, foam plastic waste – within bounded open ground. • wood waste, chips – under shed or areas covered with plastic. • Delivery to domestic solid waste landfill	• Prohibited is placement of industrial waste in containers allocated for domestic solid waste. • Removal of 3 and 4 hazard class is done only following consent from the landfill management and availability of relevant 'control slip' • During transportation safety measures required to avoid pollution of environment must be put in place.	**Landfilling:** according to sanitary rules and domestic solid waste landfill operation rules **Responsibility** contractor
Paronite, plastic and rubber waste	4			
Paper and wooden packaging waste	4			
Wood waste, chips	4			
Plastic pipes, glass fibre, sandpaper, abrasive dust waste	4			
2. Industrial waste prohibited for disposal to domestic waste landfill				
2.1. Mercury containing waste and materials:				
Luminescent tubes	1	**Accumulation – removal to storage** Collection on operation grounds:	Burned out luminescent tubes are replaced and col-	• Shall be delivered to temporary storage facility.

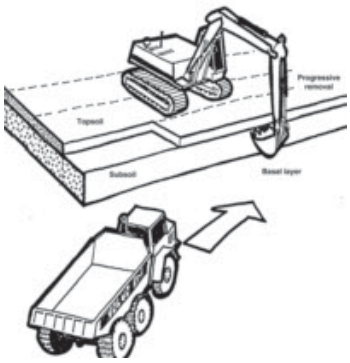
		• Placement in dry, integer packaging, which exclude the risk of any damage during transportation; • Damaged or broken lamps must be placed in plastic bags, tied up and placed in cardboard boxes. Premises – ventilated. • Accumulation of this type of waste on operation ground is prohibited.	lected by adequately trained staff. Prohibited is: • storage in the open air ; • storage in open premises; • storage unpacked; • piling; • placement on the ground; • handing over to organization not authorized for processing of this type of waste. • During transportation safety measures required to avoid pollution of environment must be put in place.	• Handed over authorized contractor for subsequent utilization.
2.2. Waste chemicals				
Residues of liquid chemicals	2	**Collection –onsite accumulation – neutralization – discharge to sewage system** • Shall be kept in glass container with tight glass-lid Containers to be labelled indicating substance name, pH and inscription 'Toxic – Acid or Alkali!' • Storage – in premises with adequate ventilation. Relevant record made in register. • Neutralisation of chemical solutions: pH of solution to be reduced to 6.5 – 7. • Discharge into drainage system: neutralised chemical solutions are placed in plastic containers and discharged into industrial/storm water drainage system on accumulation. Relevant record made in register.	Prohibited is: • mixing acid and alkaline solutions prior to neutralisation. • discharge into the drainage system without neutralisation. • scattering/pouring around. • Neutralisation of chemical solutions is done by adequately trained staff. • Prior to discharge pH is to me checked.	• Discharge into drainage system after pH =6.5-7 achieved.
2.3. Lead containing waste				
Waste lead accumulators (drained of accumulator acid)	2	**Collection- Accumulation- removal to storage** • Collection – on vehicle ground, in ventilated premises. • Accumulation- in ventilated premises, in	Prohibited is: • placement of waste in containers allocated for domestic waste disposal • disposal of accumulator	• Is subject to removal to temporary storage facility. • Handed over authorized contractor for subsequent utilization.

		wooden boxes, located on a metal support. • removal - storage in compliance with the completed document.	acid into sewer. • mechanical processing of accumulators. • long-term storage on the spot of generation (>1 week).	
2.4. Waste slightly contaminated with oil (oil content <15%)				
Oily rags	4	**Accumulation – removal for utilisation** • accumulation – in special labelled container, on the spot of generation. • removal for utilisation (incineration) under agreement with contractor.	Prohibited is: • placement of oily waste in containers allocated for domestic waste disposal • scattering around • during transportation safety measures required to avoid pollution of environment must be put in place.	Handed over authorized contractor for subsequent utilization.
Used oil filters	4	**Accumulation - removal to waste storage** • accumulation – on the spot of generation, in plastic bags placed in cardboard boxes • removal to waste storage in compliance with the completed document.	Prohibited is: • placement of oily waste in containers allocated for domestic waste disposal • scattering around • during transportation safety measures required to avoid pollution of environment must be put in place.	• Is subject to removal to temporary storage facility. • Handed over authorized contractor for subsequent utilization.
2.5. Waste oil and petroleum products				
Used industrial oils and lubricants	3	**Accumulation – removal to waste storage** • accumulation - on the spot of generation, in closed plastic or metal containers. • removal to waste storage in compliance with the completed document.	Prohibited is: • spillage of oil. • disposal into industrial-storm water drainage system, pouring on soil or disposal into water body.	• Is subject to removal to temporary storage facility. • Handed over authorized contractor for subsequent utilization.
Used transformer (no POPs, e.g. PCB containing) oil, (generated only in emergency situations/accidents).	3	**Accumulation – removal to waste storage** • accumulation – on the spot of generation, in closed plastic or metal containers. • removal to waste storage in compliance	Prohibited is: • spillage of oil. • disposal into industrial-storm water drainage sys-	• Is subject to removal to temporary storage facility. • Handed over authorized contractor for subsequent utilization.

		with the completed document.	tem, pouring on soil or disposal into water body. • transportation of oil together with other materials or waste.	
2.6. Plastic and rubber waste				
Waste tyres	4	**Accumulation – removal to waste storage** • collection – on the spot of generation, • accumulation- not recommended. • removal to waste storage in compliance with the completed document.	Burning of rubber articles is strictly prohibited.	
2.7. Waste paint and paint cans				
Waste paint and waste material tins/drums.	2 and/or 3	**Accumulation – removal of waste to the storage** • collection – in wooden boxes, on the spot of generation. • accumulation – on the spot of generation, in closed premise or under a shed on solid base, until completion of works. • removal - to long-term waste storage facility based on relevant documents.	Prohibited is: • placement of paint and metal drums in containers allocated for domestic waste disposal. • scattering/spilling around.	• Is subject to removal to temporary storage facility. • Handed over authorized contractor for subsequent utilization.
2.8. Scrap metal				
Ferrous and non-ferrous scrap metal	5	**Accumulation – removal of waste to the storage** • collection – within specially allocated area on the spot of generation. • accumulation - within specially allocated area on the spot of generation. The area must be sloped towards industrial-storm water collector well. • removal – to waste storage based on relevant documents.	Prohibited is: • placement of metal waste in containers allocated for domestic waste.	• Is subject to removal to temporary storage facility. • Handed over authorized contractor for subsequent utilization.
Waste welding electrodes	5	**Accumulation – removal of waste to the storage** • collection – on the spot of generation. • accumulation – in metal drums or wooden boxes, on the spot of generation up to completion of maintenance works.	Prohibited is: • placement of metal waste in containers allocated for domestic waste.	• Is subject to removal to temporary storage facility. • Handed over authorized contractor for subsequent utilization.

		• removal – to waste storage based on relevant documents.		
2.9. Wood waste				
Wooden pieces	5	**Accumulation – removal by private persons** • collection – in situ, at certain places • removal – delivery to pre-agreed place using the company's or rented vehicles	Prohibited is: • placement of wood waste in domestic waste containers During transportation – spill prevention measures put in place.	• Handed over private persons on contractual basis or terms established by the company
2.10. Waste heavily contaminated with oil				
Contaminated soil and sand	3	**Accumulation – removal of petroleum-contaminated soil to temporary storage** • collection – in metal tanks (on the spot of generation). • accumulation - on the site of generation is not recommended. • placement – in temporary storage of petroleum-contaminated soil, based on relevant documents.	Prohibited is: • placement on soil or open ground. • discharge into collecting system. • pouring on the ground or discharge into the water body. During transportation – spill prevention measures put in place.	• Is subject to removal to temporary storage of contaminated soil. • Handed over authorized contractor for subsequent utilization.
Contaminated sawdust	3	**Accumulation – removal of contaminated soil to temporary storage** • collection – on the spot of generation, in metal barrel. • accumulation - on the site of generation is not recommended. • removal and placement – in temporary storage of contaminated materials, based on relevant documents.	Prohibited is: • placement of unpacked waste on soil or open ground. • discharge into the water body. During transportation – spill prevention measures put in place.	• Is subject to removal to temporary storage of contaminated soil. • Handed over authorized contractor for subsequent utilization.

4 Annex – Topsoil and subsoil management recommedations



Topsoil must be removed prior to commencement of works until reintroduction during revegetation of disturbed sites,
Stripping should be undertaken by the excavator standing on the surface of the topsoil, digging the topsoil to its maximum depth and loading into site or off-site transport vehicles.

Appropriate equipment and work practices must be used to avoid adverse effect on the topsoil properties. Topsoil will normally be stripped to a thickness defined by depth below the surface and/or a distinct colour change. Mixing topsoil with subsoil must be avoided to reduce impact on quality and fertility of the topsoil.

Special attention is to be paid to topsoil storage. The way topsoil is handled (collected and stored) can also affect soil characteristics and reduce its revegetation value. For instance, reduction of oxygen content in the stockpiled topsoil reduces its quality; soil structure deteriorates if topsoil is collected when saturated or if the soil is compacted during handling.

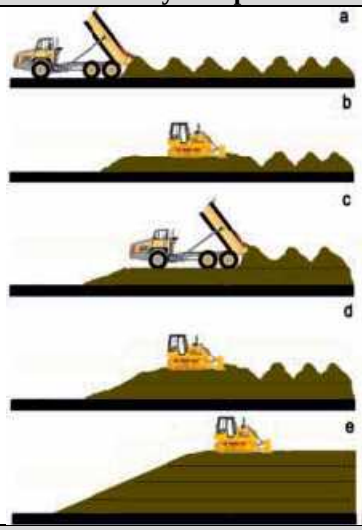
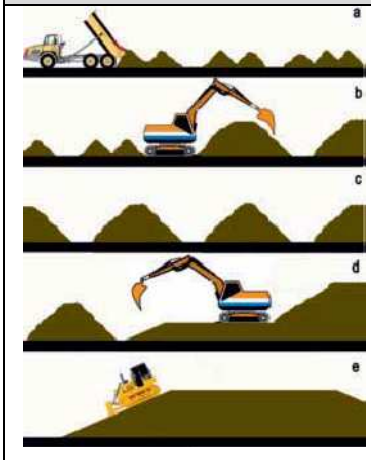
Recommended universal practice for topsoil management applicable to all sites.

- Avoid stripping topsoil when it is saturated or when very dry.
- Stockpile must not exceed two metres in height
- Minimise handling of topsoil.
- Keep topsoils separate from overburden, gravel and other materials.
- Protect topsoil stockpiles from erosion.
- Avoid burying topsoil.
- Store topsoil above or beside the excavation, depending on which direction the deposit is being worked, to allow for easier respreading.
- Avoid long term stockpiling of topsoil by using it to rehabilitate worked out areas immediately.
- Locate topsoil stockpiles away from traffic, waterways and sources of pollution.
- Install drainage measures to allow drainage through or around large soil stockpiles.
- Grow vegetation on stockpiles (shrubs and grasses) – for long term stockpiles.
- Avoid driving on stockpiles and compaction. (Soil in a dry and non-plastic state is less prone to compaction, tends to retain a proportion of its structure.)

Good, reusable natural topsoil

Damaged, heavy clay natural topsoil

Stockpile heights of 3-4m are commonly used for topsoil that can be stripped and stockpiled in a dry state. The heights may need to be greater where storage space is limited. Management of dry non-plastic and wet plastic soil can be done as described below:

Method 1– Dry non-plastic soils	
	(a) The soil is loose-tipped in heaps from a dump truck, starting at the furthest point in the storage area and working back toward the access point. (b) When the entire storage area has been filled with heaps, a tracked machine (excavator or dozer) levels them and firms the surface in order for a second layer of heaps to be tipped. (c) and (d) This sequence is repeated until the stockpile reaches its planned height. (e) To help shed rainwater and prevent ponding and infiltration a tracked machine compacts and re-grades the sides and top of the stockpile to form a smooth gradient**.**
Method 2 – Wet plastic soils	
	(a) The soil is tipped in a line of heaps to form a 'windrow', starting at the furthest point in the storage area and working back toward the access point. (b) Any additional windrows are spaced sufficiently apart to allow tracked plant to gain access between them so that the soil can be heaped up to a maximum height of 2m. (c) (d) To avoid compaction, no machinery, even tracked plant, traverses the windrow. Once the soil has dried out and is non-plastic in consistency (this usually requires several weeks of dry and windy or warm weather), the windrows are combined to form larger stockpiles, using a tracked excavator. **(e)** The surface of the stockpile is then regraded and compacted by a tracked machine (dozer or excavator) to reduce rainwater infiltration.

Site selection for topsoil and surplus soil disposal must be selected carefully. Recommendations for site selection are as follows:

- Seek a stable site where sediment cannot reach the stream during any high water event.
- Avoid riparian corridors or any area within the 100-year floodplain.
- Avoid all wetland sites
- Avoid placing spoil on unstable slopes, where the added weight could trigger a land movement. Excessive loading of clay or silt soils could also trigger a failure.
- Use wide, stable locations (eg. rock pits, ridges, benches) as places to dispose of fill.
- Avoid locations where ground water emerges or a thick organic layer is present.
- Avoid sites of archaeological importance and the areas with endangered or threatened plant species.
- Consult biologist and archaeologist prior during site selection

5 Annex – Recommendations for selection and management of camp site

An approximate area for a camp is from about 3ha to 5ha. Selection of the site must be done in consideration of land ownership/land use and environmental aspects.

Several possibilities can be looked into:

Alternative 1. Temporary land take of cultivated land for camp and equipment stationing area	
Advantage	Disadvantage
Enough space for the camp The area is flat Distant from the river,- i.e. less risk of water pollution	Temporary loss of arable land for the camp and road accessibility Loss of crops/harvest and related income of the owner Potential impact on soil Need for compensation Technical water to be carried in by tank-cars – increased traffic and related impacts
Alternative 2. Setting up an equipment yard, instead of a camp. Workers moving daily to and from the operation ground	
Advantage	Disadvantage
Less space required, i.e. less impact on the environment Less water required – no need of the onsite canteen, showers If the personnel is stationed in the settlement, additional income for the residents.	Will depend on the site selection of the equipment stationing yard.

Keeping in mind that offsetting up a camp and an equipment yard is not related to any serious earthworks/excavations and any permanent buildings or structures Alternative 2 may be less damaging on condition that the sites will be managed with strict adherence to all environmental requirements by the contractor. Prior to final decision-making, the site specific advantages and disadvantages of identified sites must be carefully rated.

The following requirements must be taken into account:

- The site must be located not closer than 100m from the riverbed;
- Sites considered as sensitive from the viewpoint of archaeological importance must be avoided;
- Maximum preservation of vegetation must be ensured;
- Erosion control must be put in place where appropriate;
- Water drainage and treatment facilities must be provided;
- In case waste water discharge into a surface water body is planned, the effluents must not be discharged into the river without treatment.

Prior to the camp site selection and setting up a temporary access roads by the contractor, special attention must be given to the landuse and available vege-

tation of uncultivated areas. The site/route must be selected so as to minimize impact on vegetation. As far as feasible, the plot devoid of trees and shrubs must be given a priority. The site must be cleared of vegetation.

Should any trees be cut, timber may either be used during the construction or given to the community as fire wood. Procedure includes - handing over the timber to the Ministry of Economy and Sustainable Development by the RD, in case deemed appropriate, signing a takeover certificate allowing the municipality to dispose of the timber locally. Following to that the timber can be given to community at discretion of the local authorities. Should some of the tree belt be damaged, it must be restored after completion of the works. Same species of the trees should be planted to 'offset' the loss. Two and a half amount of the felt trees must be planted to mitigate the impact.

Top soil must be removed and temporarily stockpiled in a preselected area. (Topsoil and subsoil management recommendations are given in Chapter 4.6.4.) The amount of the topsoil with consideration of the area required for the camp/yard (3-5 ha, top soil thickness about 0.25m) will be about 750 – 1,250m^3. Adequate measures for protection of the top soil storage area from runoff and wind must be provided until subsequent reintroduction after completion of works, removal of all temporary facilities and waste from the site. After the works are finished and topsoil 'returned', the site must be restored to the status close to the initial.

With consideration of the landform and location of the selected site, the runoff management and discharge options must be looked into and agreed with the Ministry of Environment Protection. If there is a risk of soil pollution with spilled fuel/oil, the storm water drainage system must be equipped with an oil trap.

Use of bio-toilets is recommended for the sewage management.

All other wastewater (eg. effluents from showers, canteen, etc) must be collected, settled and treated prior to discharge.

For onsite storage of fuel/oil in case planned to be arranged on the site, special precautions must be undertaken. The storage area must be protected with impermeable layer to avoid percolation into the ground. The secondary containment capable to retain the amount stored in the fuel/oil tank should provided. The fuel dispatch point must be equipped with a drip tray. The installation of fuel storages and fuelling/maintenance of machinery closer than in 50m from the riverbed is prohibited.

Domestic waste generated at the camp site must be temporarily stored in containers fitted with lids to avoid attraction of scavengers or scattering around by wind. An agreement with a waste collection service must be reached. Waste must be regularly removed to agreed landfill under the mentioned contract and agreement with local municipality.

Separate area should be provided for the collection of other waste. Waste must be separated. Scrap metal, if any - subsequently delivered to scrap metal collection points in the area. Inert waste may be reused for the needs of the project or under agreement with relevant authorities elsewhere in the region. The rest – disposed to the landfill as agreed with the local municipality.

Access roads must be routed so as to avoid unnecessary damage of vegetation, soil. Existing roads must be used to the possible extent. As soon as defined, the route should be strictly kept to. No shortcuts should be allowed.

Responsibility for proper environmentally sound management of the sites (camp, yard, operation ground, access roads) and implementation of mitigation measures must be defined in the contract between the Roads Department and the contractor.

Water supply and waste water management

According to technical specifications prepared for the tender, construction contractor is responsible for provision of technical water, lighting, power supply for the project and pays relevant fees. Contractor is to ensure portable water supply – including temporary reservoirs, and pipes, which, upon the completion of work, will be removed from the area.

Contractor is obliged to develop and agree work organization plan which is to cover main units/facilities such as fuel and material storage, concrete mixer, car wash, etc. (whichever available).

Water supply

Water is used for drinking and industrial purposes. Drinking and domestic water source depends on the construction camp location.

At the moment, exact number of staff and the number of personnel to be accommodated in the camp is unknown. Base on experience from other similar project we can suppose that the total number of employees will be about 200. In case construction contact will be given to a foreign company we can assume that around 70% of the employed will be local. The local staff living close to the project site, there will be no need to provide accommodation. Although, the calculation presented below is done with consideration of 200 'water users'.

Due to the fact that the territory is an inhabited zone, the nearest water supply can be used for drinking-household purposes. In case a portable water reserve is needed reservoirs made of material allowed for use in contact with food products can be used, for technical water – metal reservoir can be provided.

Assuming 200 employees in the camp and 25 litres per capita per day consumption rate, water demand calculated for 250 business days a year totals:

$$200 \times 25 \times 250 = 1250\ m^3/sec,\ 5\ m^3/day$$

Water will also be needed for operating showers. According to the construction norms and rules, the rate per person per day totals 500 litres. In case of three showers, the needed amount of water per year will be:

$$3x500x250=375\ m^3/sec,\ 1.5m^3/day$$

The total amount of portable water per year consumed during construction phase will be 495 m^3/y, 1.95 m^3/day

Surface water (Mtkvari River) can be used for industrial purposes. The river is fed by glaciers, atmospheric water (snow, rain) and ground water. Seasonal changes in water level are observed - high water is registered in spring, low water level – in winter and summer. Water is used for irrigation, power generation and industrial water supply.

The camp will presumably be equipped with proper infrastructure, including: parking lots for cars and equipment, concrete unit (possibly), technical workshops, wood processing unit (possible), storages for construction materials, etc. Priority will be given to commercial car washing facility, however, if a car wash is arranged onsite, 5 units of construction machinery will be possible to wash every day. Assuming that to wash one vehicle 350 litres of water is used, with consideration of 250 operation days, amount of water needed for washing vehicles will be:

$$5x350x250=12.5m^3/sec,\ 0.25\ m^3/day$$

For operating a concrete factory, the needed amount of water depends on the volume of production. On average concrete unit with capacity $50m^3$/h uses $0.3m^3$ water per cubic metre mixture of concrete. Considering that the concrete factory will work one shift, 160 day a year, which means that amount of concrete will be 160x8x50=64,000 m^3/year. Accordingly, required water volume will be

$$64,000x0.3=19,200\ m^3/sec.$$

Hence, the estimate amount of technical water needed for technical water supply of the construction camp will be 19212.5 m^3/sec.

Sanitary and other waste waters

Volume of sanitary waste water is estimated as volume of consumed portable water, minus 5% loss, i.e. sanitary waste water volume will be around 470 m^3/y, 1.9 m^3/day.

Due to the fact that there are no sewage systems in villages, bio toilets or collector pits (considering the volume of waste water) will be designated on the site. Collected waste water will be removed according to the agreement made with the local municipality.

Water used in concrete production will be fully consumed in technological processes. In case decision is made to arrange car wash area on the site, generated waste water volume will be 95% of the total used water (5% difference is due to evaporation or other reasons). Correspondingly, the amount of waste water will be 11.9 m^3/year, 0.05 m^3/day. For treatment of the car wash waste

waters, special area with drainage system, settling unit and compact oil trap must be installed. However, as already mentioned above, preference will be given to washing vehicles at a commercial car wash.

Waste water treatment

Composition of sanitary waste water generated at the camp site must comply with the 91/271/EEC (May 21, 1991) requirements for urban waste water, in particular:

- Suspended solids - 30mg/l
- Biological oxygen demand (BOD) - 25mg/l
- Total nitrogen-15 mg/l
- Total phosphorus- 2mg/l

The oil trap (removal of oil products and suspended solids) must provide a total petroleum hydrocarbon concentration <0.3 mg/l, suspended particle concentration-30 mg/l.

Waste water will not be discharged into the surface water body.

Power Supply

According to the technical specification prepared for the tender, contractor is responsible for provision of power supply for the object and is entitled to pay relevant fees. Power supply will be from the state network.

6 Annex – Chance find procedure

Chance find procedure

Legal background

According to the national legislation everybody is responsible to protect natural and cultural heritage of the state. As set in the Criminal law of Georgia any deliberate/undeliberate damage of the cultural heritage is punishable.

The state is owner of antiquities in Georgia. At the same time, under the Concordat (signed 2000), the state recognizes all Orthodox temples, monasteries (both open and closed), their sites and land where they are located, as the property of the Church. The state also recognises, as the property of the Church, the ecclesiastic cultural objects kept in the National Museums, stocks and depositories, except for the objects which are kept in private collections. The Concordat outlines the obligations of the state and the church in respect of the joint trusteeship, protection and defence of the ecclesiastic cultural objects. Under the agreement with the church, the state shall establish the legal conditions of ecclesiastic objects kept in the museums and depositories, as well as the terms and conditions of the projects of restoration, conservation and maintenance of temples of cultural and historic importance.

Responsibility for protection of the cultural heritage of the state, according to the law on Cultural Heritage, 2007) is shared between the Ministry of Culture and Monument Protection, Ministry of Justice, local self-governance authorities and other state, public and private juridical persons. In compliance with the law (Chapter 2, Article 9, point b) any chance finds should be immediately reported to the Ministry and other state authorities responsible for cultural heritage protection. The Chapter III, Article 10 describes procedure to be followed in case on a chance find.

Purpose of the chance find procedure

The chance find procedure is a project-specific procedure that outlines actions required if previously unknown heritage resources, particularly archaeological resources, are encountered during project construction or operation. A Chance Find Procedure, as described in the law on Cultural Heritage of Georgia, is a process that prevents chance finds from being disturbed until an assessment by a competent specialist is made and actions consistent with the requirements are implemented.

Scope of the chance find procedure

This procedure is applicable to all activities conducted by the personnel, including contractors, that have the potential to uncover a heritage item/site. The procedure details the actions to be taken when a previously unidentified and potential heritage item/site is found during construction activities. Procedure outlines the roles and responsibilities and the response times required from both project staff, and any relevant heritage authority.

Induction/Training

All personnel, especially those working on earth movements and excavations, are to be inducted on the identification of potential heritage items/sites and the relevant actions for them with regards to this procedure during the Project induction and regular toolbox talks.

Chance find procedure

If any person discovers a physical cultural resource, such as (but not limited to) archaeological sites, historical sites, remains and objects, or a cemetery and/or individual graves during excavation or construction, the following steps shall be taken:

Stop all works in the vicinity of the find, until a solution is found for the preservation of these artefacts, or advice from the relevant authorities is obtained;

Immediately notify a foreman. The foreman will then notify the Construction Manager and the Environment Officer (EO)/Environmental Manager (EM);

Recerd details in Incident Report and take photos of the find;

Delineate the discovered site or area; secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be arranged until the responsible local authorities take over;

Preliminary evaluation of the findings by archeologists. The archaeologist must make a rapid assessement of the site or find to determine its importance. Based on this assessement the approriate strategy can be implemented. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage such as aesthetic, historic, scientific or research, social and economic values of the find;

Sites of minor significance (such as isolated or unclear features, and isolated finds) should be recorded immediately by the archaeologist, thus causing a minimum disruption to the work schedule of the Contractor. The results of all archaeological work must be reported to the Ministry/Agency, once completed.

In case of significant find the Agency/Ministry (Agency for Protection of National Heritage or Archeological Reserach Centre, hereinafter referred to as Heritage team) should be informed immediately and in writing within 7 days from the find (ref.law on heritage protection).

The onsite acrchaeologist provides the Heritage team with photos, other information as relevant for identification and assessment of the significance of heritage items.

The Ministry must investigate the fact within 2 weeks from the date of notification and provide response in writing.

Decisions on how to handle the finding shall be taken by the responsible authorities. This could include changes in the layout (such as when finding an irremovable remain of cultural or archaeological importance) conservation, preservation, restoration and salvage;

Construction works could resume only after permission is granted from the responsible authorities.

In case no response received within the 2 weeks period mentioned above, this is considered as authorisation to proceed with suspended construction works.

One of the main requirements of the procedure is record keeping. All finds must be registered. Photolog, copies of communication with decision making authorities, conclusions and recommendations/guidance, implementation reports – kept.

Appendix
Management options for archaeological site
Site avoidance. If the boundaries of the site have been delineated attempt must be made to redesign the proposed development to avoid the site. (The fastest and most cost-effective management option)

Mitigation. If it is not feasible to avoid the site through redesign, it will be necessary to sample it using data collection program prior to its loss. This could include surface collection and/or excavation. (The most expensive and time-consuming management option.)

Site Protection. It may be possible to protect the site through the installation of barriers during the time of the development and/or possibly for a longer term. This could include the erection of high visibility fencing around the site or covering the site area with a geotextile and then capping it with fill. The exact prescription would be site- specific.

A1 Management of replicable and non-replicable heritage
Different approaches for the finds apply to replicable and non-replicable heritage.

A1_1.1 Replicable heritage
Where tangible cultural heritage that is replicable[1] and not critical is encountered, mitigation measures will be applied.

The mitigation hierarchy is as follows:
- Avoidance;
- Minimization of adverse impacts and implementation of restoration measures, in situ;
- Restoration of the functionality of the cultural heritage, in a different location;

[1] Replicable cultural heritage is defined as tangible forms of cultural heritage that can themselves be moved to another location or that can be replaced by a similar structure or natural features to which the cultural values can be transferred by appropriate measures. Archaeological or historical sites may be considered replicable where the particular eras and cultural values they represent are well represented by other sites and/or structures.

- Permanent removal of historical and archaeological artefacts and structures ;
- Compensation of loss - where minimization of adverse impacts and restoration not feasible.

A1_1.2. Non-replicable heritage

Most cultural heritage is best protected by in situ preservation, since removal is likely to result in irreparable damage or even destruction of the cultural heritage.

Nonreplicable cultural heritage[2] must not be removed unless all of the following conditions are met:
There are no technically or financially feasible alternatives to removal;
The overall benefits of the project conclusively outweigh the anticipated cultural heritage loss from removal; and

Any removal of cultural heritage must be conducted using the best available technique advised by relevant authority and supervised by archaeologist.

A1_2 Human Remains Management Options

The handling of human remains believed to be archaeological in nature requires communication according to the same procedure described above.

There are two possible courses of action:
Avoid. The development project is redesigned to completely avoid the found remains. An assessment should be made as to whether the remains may be affected by residual or accumulative impacts associated with the development, and properly addressed by a comprehensive management plan.

Exhumation. Exhumation of the remains in a manner considered appropriate by decision makers. This will involve the predetermination of a site suitable for the reburial of the remains. Certain ceremonies or procedures may need to be followed before development activities can recommence in the area of the discovery.

EMERGENCY CONTACTS

Ministry of Culture and Monument Protection
Address: 4 Sanapiro Street, 0105, Tbilisi, Georgia; Fax: 995 32 2999966, 2932235;
E-Mail: culturegovge@gmail.com

[2] Nonreplicable cultural heritage may relate to the social, economic, cultural, environmental, and climatic conditions of past peoples, their evolving ecologies, adaptive strategies, and early forms of environmental management, where the (i) cultural heritage is unique or relatively unique for the period it represents, or (ii) cultural heritage is unique or relatively unique in linking several periods in the same site. Examples of non-replicable cultural heritage may include an ancient city or temple, or a site unique in the period that it represents.

National Agency for Cultural Heritage of Georgia
27 Atoneli street, 0105 Tbilisi, Georgia: tel/fax: +(99532) 2932411
E mail: info@heritagesites.ge

Archaeological Research Centre under the Georgian National Museum
3, Rustaveli Avenue0105 Tbilisi, Georgia
Tel: +(995 32) 2998022; Fax: +(995 32) 2982133
E-Mail: info@museum.ge

7 Annex – Road elements and construction technology

Junctions and bridges

Overpasses are made to ensure the smooth movement on the project road and for regional and among regional needs.

Table 1 *Junction – road to Gomi*

#	Location km+	Purpose of Intersection	Crossing angle with highway (α)
1	235+12.4	Two level intersection	60°
2	272+55.86	Crossing Tbilisi- Khashuri road	44^0
3	289+13	Railroad crossing	90^0
4	298+44.07	Overpass	

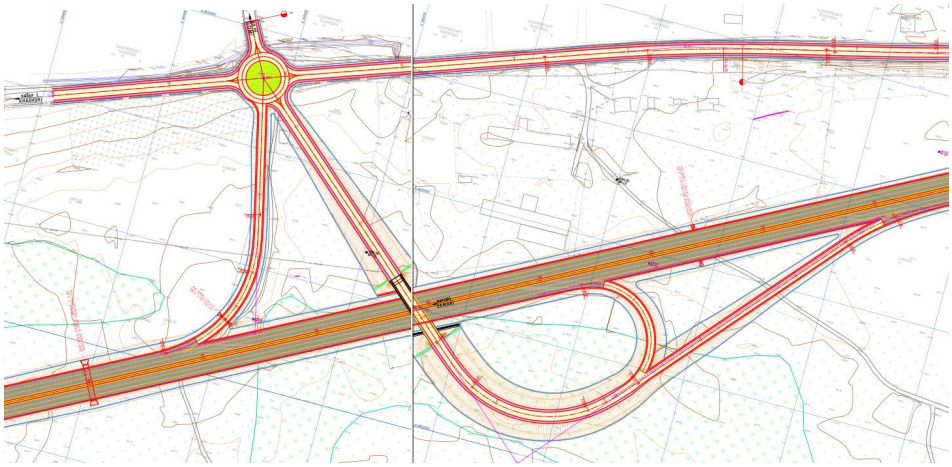


Figure 1 a. *Gomi junction*

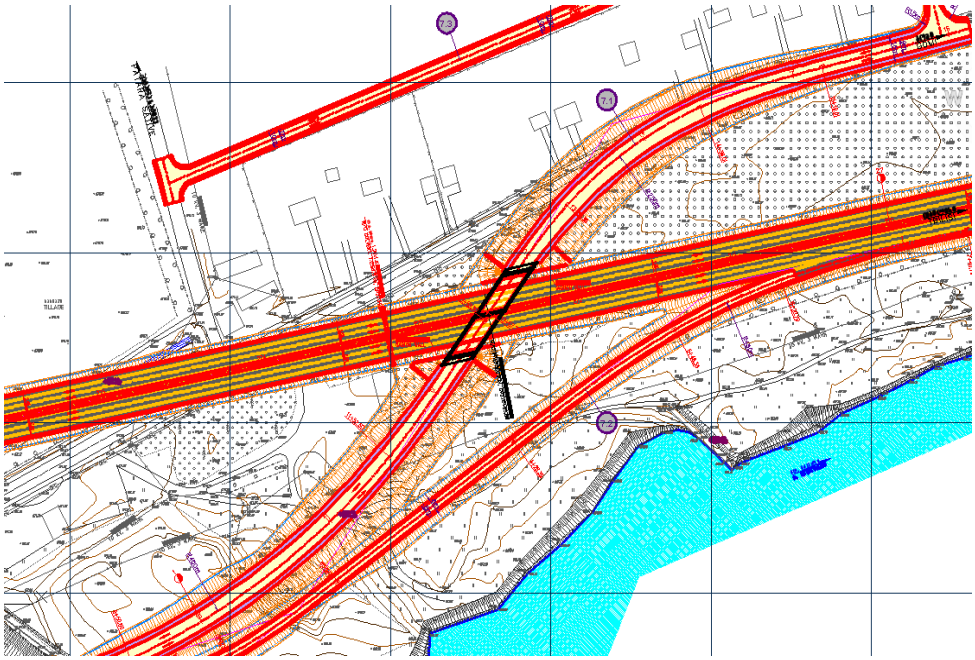


Figure 1 b. *Underpass 272+55.86*

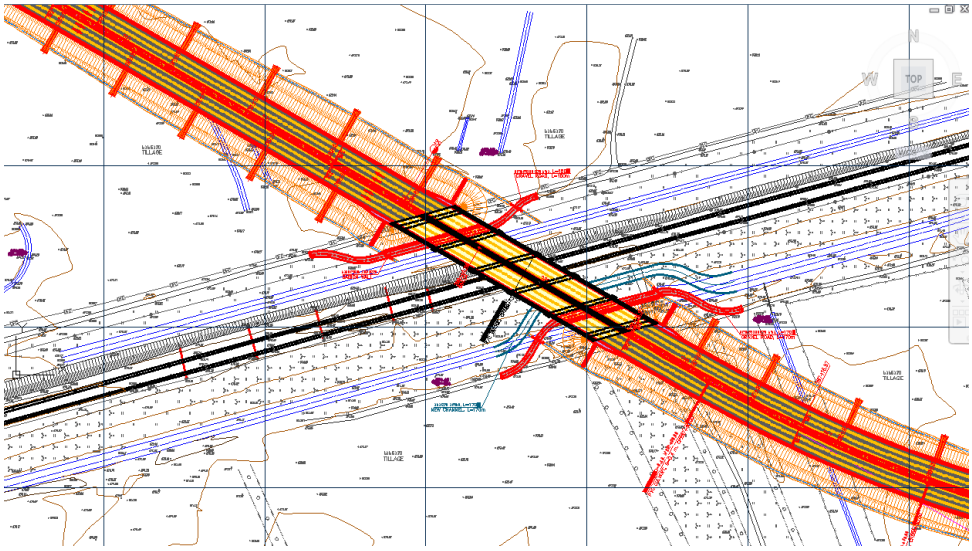


Figure 1 c. *Railway overpass (289+13.00)*

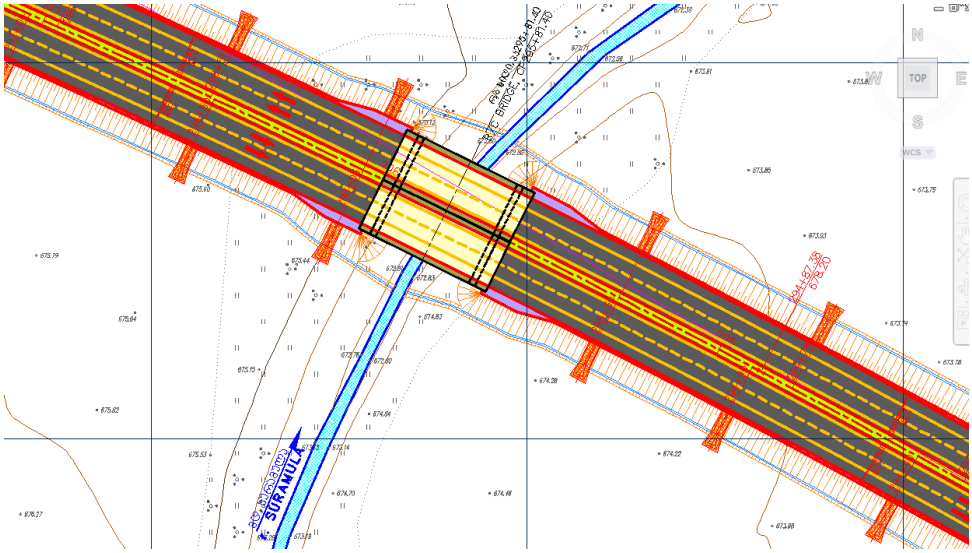


Figure 1 d. *Suramula river crossing (295+81.59)*

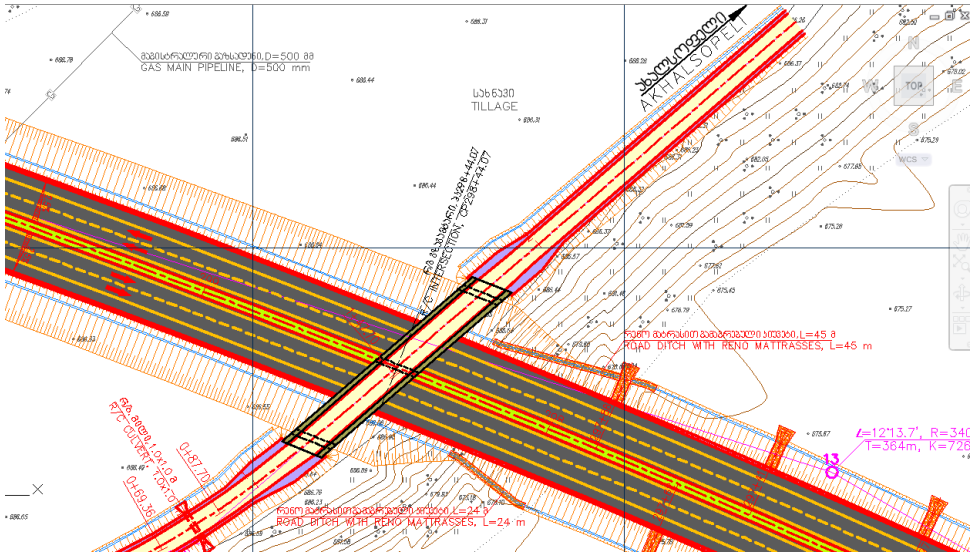


Figure 1 e. *Underpass (298+44.00)*

Design of the overpasses was developed with consideration of Snip 2.05.03-84 “Bridges and Tunnels. Designing Norms”, adopted by the Order #1-1/251 (February 18, 2011) of the Ministry of Economy and Sustainable Development of Georgia, other normative documents in force in Georgia, topographic and engineer-geological field research materials. Location is agreed with the local government and the leadership of the Roads Department of Georgia.

Bridges will be constructed mainly from Reinforced Cement Concrete (RCC), with gabions, brick and stone facing. Most bridges will consist of two decks,

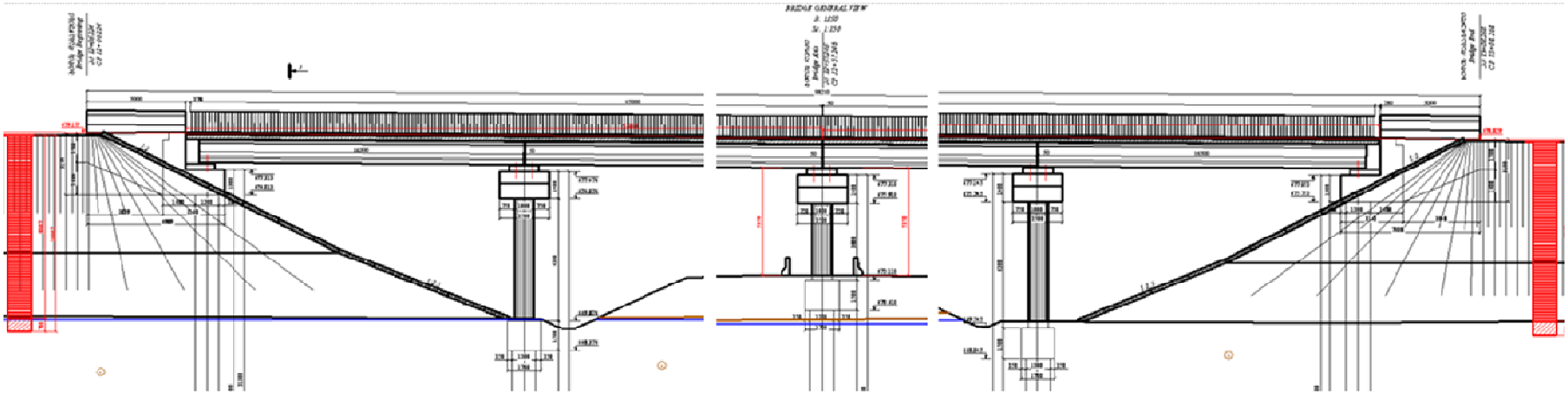


Figure 2.a. *272+55.8 overpass*

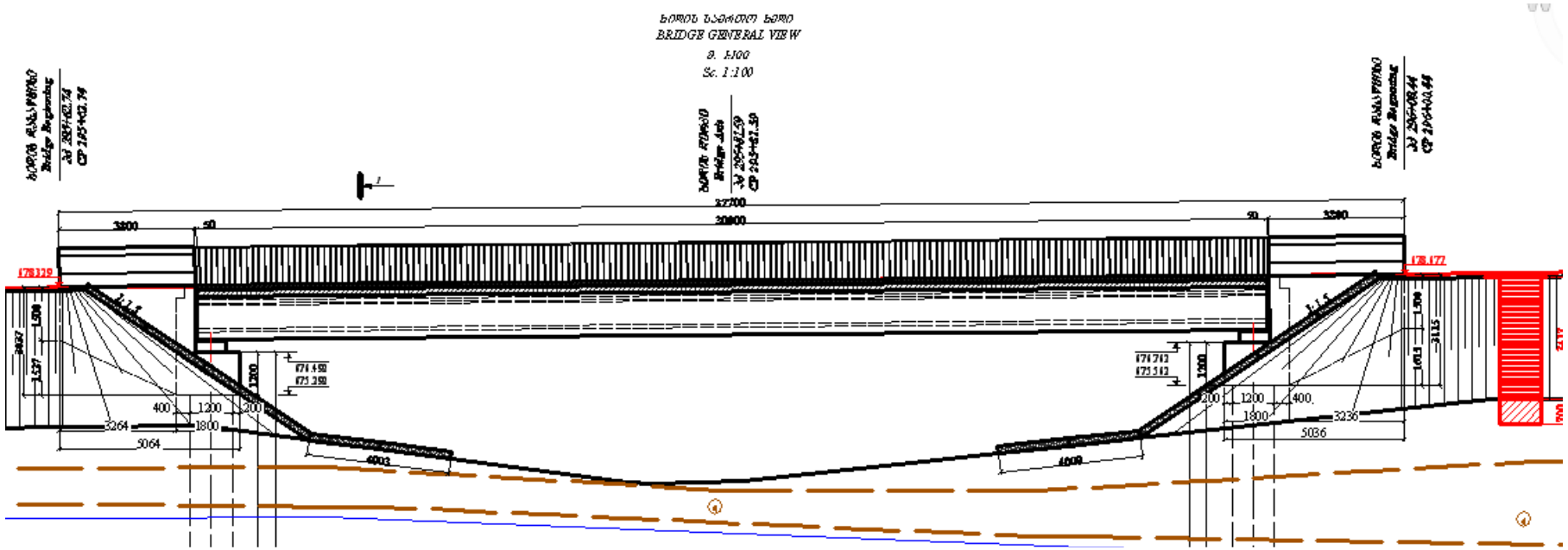


Figure 2.b *Bridge over Suramula river*

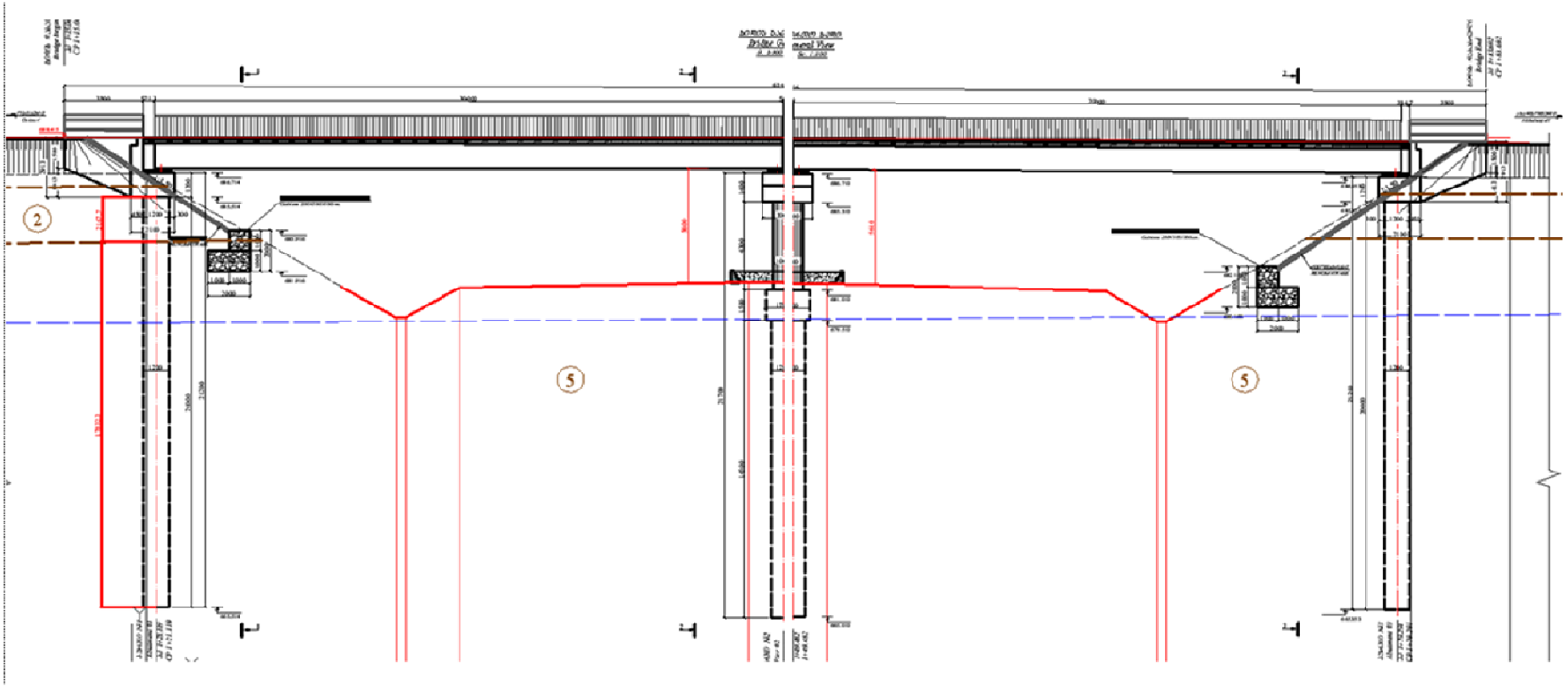


Figure 2.c. *Underpass (bridge over the new section of the road)*

each 14.5 m in width, comprising: two 3.75 m carriageways; a central safety strip of 2 m; and a sidewalk of 1.5 m on either side, with a concrete barrier and handrail. Where bridges cross an existing road or rail-line, there will be a 40 m width between two struts.

Spam structures of overpass are of building-monolithic constructions, which are made of 27.0 m or 30.0 m pre-stressed concrete beams, interconnected 20 cm thickness monolithic reinforced concrete plate. On abutment, according to the interface, monolithic reinforced concrete plate is sidelong cut off on vertical cross. 22 ropes of pre-stressed rope armature of low relaxed ASTM A416-8 brand with 0,6" 270 K with Ap=1.394 cm2 area section and 194.66 kN stretch force are used for pre-stressing. For main constructions and monolithic plate and beam connector anchors is used armature rods various diameter of A500 grade. Concrete class according on durability to compression for beams is B40 and for monolithic plate is B40 and B30. respectively

Overpass piers are made as three-rack-mount frame. Frame racks are united by 13.0 m long reinforced concrete crossbar with 1.2x1.4 m profile which decreases in height up to 0,6 m at the end. Racks and girders are 9.80x2.0x1.5 m which unites three 20 m long (diameter 1.5m) drilled-break piles .

For overpass located on km 0+059.00 and km 3+516.30 piles are sink in solid and semi solid in clay with gravel and macadam tabs and on km 3+516.30 located overpass is mainly in ground with clay and sand with gravel tabs.

Abutments are designed as three 20 m length and 1.5 m diameter drilled-break piles that from the top are united as case wall, wings and under farm piles made in solid capping length 12.7m and height 1.2m and thickness 1.92m. Wings are 3.3 m length and thickness varies between 0.3-0.5 m. Armature is - A500 class and concrete class on compression according to its durability B40.

Elastomers are used for reclining span structure beams (reclining materials of rubber-steel). From bank on span structure construction for providing steeples pass on pass road props between wings are placed typical concrete passing piles.

For deformation between abutments and span structure is juncture attachment construction.

Overpass passing a part with 8.5 m width is designed for double line movement. Along roadway on both sides are made sidewalks of 1.0 m width which have standard steel railing and concrete curbs.

Cover of passing a part is made of 7 cm thick asphalt concrete layer.

For the removal from passing a part atmospheric precipitation water is foreseen arrangement with double longitudinal and cross-sectional inclination.

At the angles of overpass arrangement of concrete stairs on the ground bulk is foreseen.

Underpass (culverts)

To ensure the smooth movement on the designed roads and for local (village) movement needs underpass are made.

Design of the underpasses is done with consideration of SNIP 2.05.03-84 "Bridges and Tunnels. Designing Norms" adopted by the Order #1-1/251 (February 18, 2011) of the Ministry of Economy and Sustainable Development of Georgia, other normative documents in force in Georgia, topographic and engineer-geological field research materials. Location of underpasses is agreed with local government and leadership of Roads Department of Georgia.

Constructions of underpass mainly are similar. Underpass is building monolithic reinforced concrete construction with rectangular profile. Structure are on sand grit cover, which is 1.5 m thick, and on which is arranged monolithic reinforced plate at the heading and at the end where is arranged tooth against slipping. Two section reinforced concrete constructions are placed directly on base plate.

Monolithic reinforced concrete culvert section is a closed rectangular section with holes it 8.0x4.5 meters. In the middle of the culvert, arrange sections joining lateral seam. The thickness of a sidewall and also the upper and lower walls' thickness are 70 cm. For reinforcement of structure used AIII grade bars with different diameter. 1.0 cm thick sand concrete equalizer layer made on reinforced concrete construction of the culvert. Walls are covered with waterproofing layer which is guarded from sides with half brick sequence wall and from above with 6 cm guard layer of fine-grained reinforcement concrete and is reinforced with 6 mm diameter AI grade armature with 15x15 cm unit steel grillage. Structure's concrete class on compression according to durability is B25.

Heads arranged on the top and the bottom consist of sidewalls, and, if it's necessary, the portal wall. Variable sidewalls heights in vertical and horizontal section have trapezium shape. Walls are reinforced from the spatial steel Skeleton AIII grade Ø12 mm steel bar. The concrete grade of wall on compressive according to strength is B25.

At the underpass is covered with 4.0 cm thick asphalt concrete layer.

Between slope walls on the bottom on sand-grit base that is of 30 cm thick is arranged monolithic concrete plate is of 20 cm thick.

At the ultimate sections at the top of the wall will made monolithic reinforced concrete parapet to restrain base ground of the road.

In total, along the design section 7 cattle crossings, 15 reinforced concrete culverts and 11 plastic pipes (for surface water drainage) will be arranged.

Cattle crossings - The design of cattle crossings was done with consideration of the SST Roads:2009, and SNIP 2.05.03-84 "Bridges and Tunnels. Design-

ing Norms" accepted by the Order #1-1/251 (February 18, 2011) of the Ministry of Economy and Sustainable Development of Georgia, topographic and engineering-geological field study material. Location of the underpasses is agreed with the local Government and the Roads Department of Georgia.

Cattle pass construction placed on different pickets is similar.

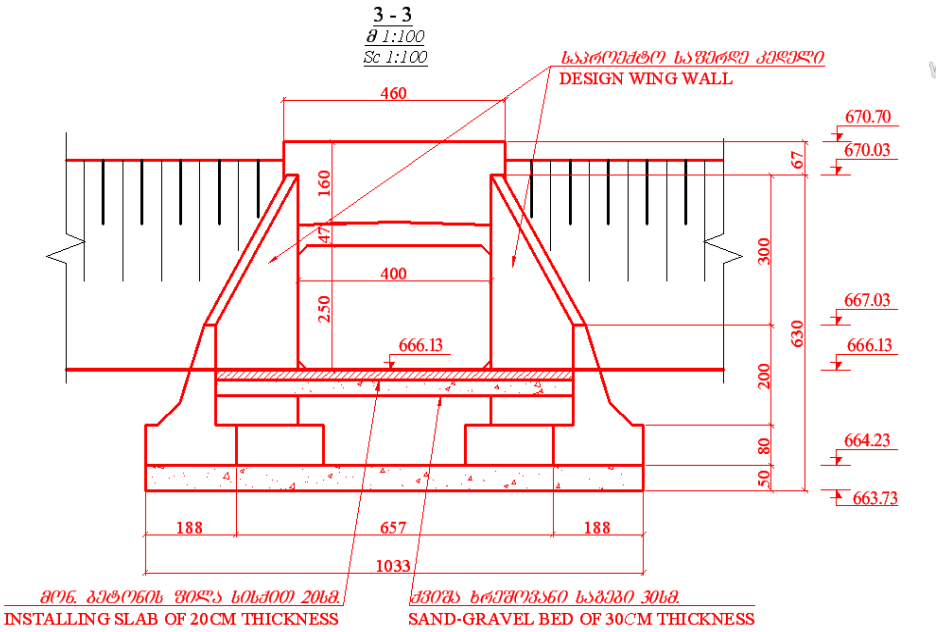


Figure 3. *Cattle crossing design*

Monolithic reinforced concrete cattle crossing section is a closed rectangular section with internal space dimensions 4.0x2.5 meters. In the middle the structure has sections joining lateral seam. The sidewall is 30 cm thick, while the thickness of the upper and lower walls' totals 40 cm. For reinforcement of the section AIII grade bars with different diameter. 1.0 m thick sand concrete equalizer layer made on reinforced concrete structure are used. Walls are covered with waterproofing layer which is guarded from sides with half brick sequence wall and from above with 6cm guard layer of fine-grained reinforcement concrete and is reinforced with 6mm diameter AI class armature with 15x15sm unit steel grillage.

Heads arranged on the top and the bottom of the cattle crossing consist of sidewalls, and, where appropriate, a portal wall. The sidewalls have trapezium shape and form 20° angle with longitudinal axis .Walls are reinforced with the spatial steel Skeleton AIII grade Ø12 mm steel bar. On 30 cm thick sand-grit base between the slope walls 20 cm thick monolithic concrete plate is arranged.

The table below provides a list of cattle crossings and their locations within the road alignment of interest.

Table 2 *Location of cattle crossings*

#	Location km+	Purpose of Intersection	Crossing angle with highway (α)	Underground dimensions (m)
1	196+40	Box culvert for cattle	90°	4X2.5
2	227+60			
3	238+00			
4	247+60			
5	267+10			
6	284+20			
7	293+40			

Culverts

To guard road from surface water and flooding and arrangement of culverts is planned. The design of the culverts is developed with consideration of SNIP 2.05.03-84 "Мосты и трубы. Нормы проектирования" approved by the Order #1-1/251(February 18, 2011) of the Ministry of Economy and Sustainable Development and other normative documents that are in force in Georgia.

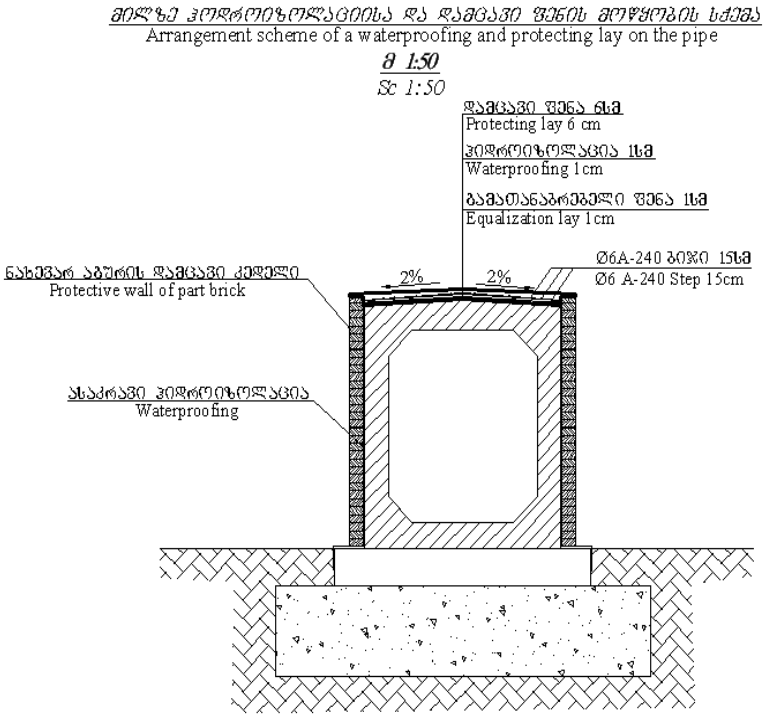


Figure 4.a *Culvert design*

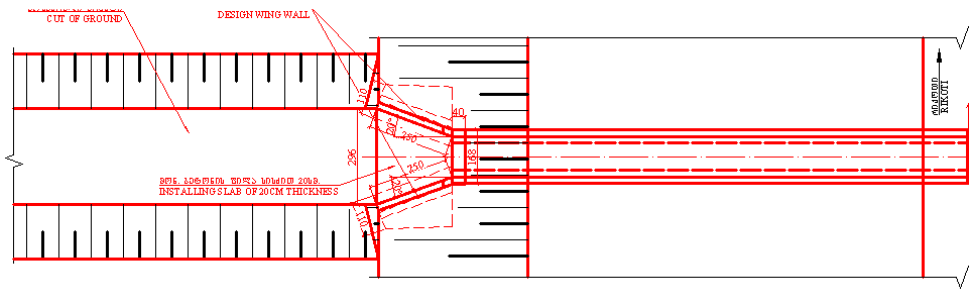


Figure 4b. *Culvert pipe (from the centreline to the end of the shoulder. The right side is similar to this design)*

The design of the culverts is similar, the difference is in entrance head which is arranged as a well. The well represents rectangular shape construction in the overhang sections, which from the three sides on the top part of wall has arranged trapezium shape water intake hacks. On the bottom of well is arranged variable thickness reinforced concrete base with thickness from 0.2 m to 0.4 m. For the well construction B25 grade concrete, for the reinforcement - class AIII steel rods will be used.

Culverts represent rectangular section construction consisted of two- three monolithic r/c sections. Culvert is based on 30 cm thick monolithic concrete slab placed on 0.4 ÷1.2 m thick sand – grit bottom..

Monolithic reinforced concrete culvert section is a closed rectangular section with inner dimensions 1.25x1.50 meters. In the middle of the culvert, sections joining lateral seam is arranged. The sidewall and the upper and lower wall are 20 cm thick, to haunch – 40 cm. For reinforcement of the culvert AIII grade bars with Ø12 work bars and AI grade with Ø8 – for constructive bars are used. 1.0 cm thick sand concrete equalizer layer is made on the reinforced concrete construction of the culvert. Walls are waterproofed, the water insulating layer is guarded with half brick sequence wall from sides and 6 cm guard layer of fine-grained reinforcement concrete from above and reinforced with 6mm diameter AI grade armature with 15x15 cm unit steel grillage.

On the top and bottom of culvert heads are arranged. The heads consist of sidewalls, and, where appropriate, the portal wall. Sidewalls have trapezium shape. Walls are reinforced with the spatial steel Skeleton AIII grade Ø12 mm steel bar. Between the sidewalls 20 cm thick monolithic concrete slab is arranged.

Table 3 *Location of culverts*

#	Location (CP+)		Location (CP+)
1	191+32.00	9	239+90.00
2	201+60.00	10	245+62.35
3	205+20.80	11	246+65.00
4	210+20.00	12	251+80.00
5	215+20.00	13	256+80.00

6	222+80.00	14	260+50.00
7	225+40.00		
8	232+60.00		

Drainage ditches

In order to protect embankment from erosion drainage ditches (on both sides of the road).

Calculations on the design stage were done in compliance with the Guideline for hydrotechnical calculations for small artificial structures, 1974.

Engineering-geological investigation of the site proved that the clay lining is the best suitable solution for ditches. Keeping in mind this fact and with consideration of the results of Q_{100} discharge calculation there is no risk of ditch washing out. This enables to conclude that there is no need in reinforcement of the structure.

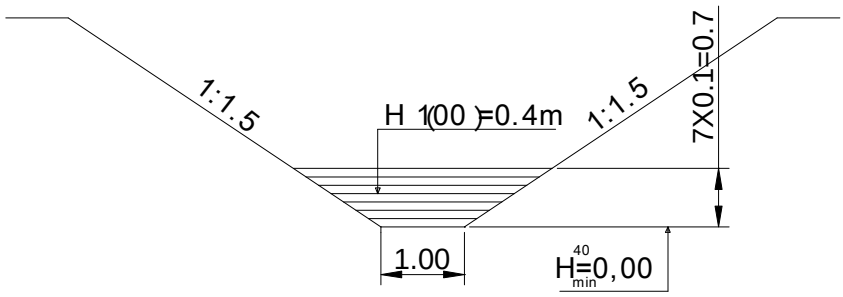


Figure 5*. Cross section of the ditch with indication of water level*

In the turn areas water from the carriageway or one part of it will be drained through water wells and plastic pipes into the ditches.

Table 4 *Location and description of the plastic pipes*

#	CP+	Length of pipe, m	Horizontal incline °	Reinforcement of slope with Reno mattress, m	Note
1	244+00	15	90°	6	Right
2	245+40	15	90°	6	Left
3	246+80	15	90°	6	Left
4	248+20	15	90°	6	Left
5	256+00	15	90°	6	Right
6	257+30	15	90°	6	Right
7	281+80	15	90°	6	Left
8	283+30	15	90°	8	Left
9	284+80	15	90°	10	Left
10	286+80	15	90°	18	Left
11	287+80	15	90	22	Left

In ‘cuts’ the pipes will drain into ditches. In ‘fills’ – the pipe will ‘discharge’ water on the Reno mattress arranges on the slope of embankment.

Quantity and parameters of the water wells designed for alignment under consideration have been determined according to the German standard Richtlinien fur die Anlage von Strafen. 2005 The document sets an average distance between the wells as L=215m. The distance fixed in national regulations L= 190m is of the same range. With consideration of increase in rainfall observed in the recent past, the project envisages arrangement of 6 wells.

As stipulated by the project, the ditches will be equipped with stone filters. In compliance with ,,Subsurface drainage in industrial and urban construction" the filter must be not more than 0.15m thick. Granulometric composition of the filter material is as follows:

Table 5 *Granulometric composition of the filter material*

Diameter, D (mm)	0.5-1	1-2	2-3	3-5	5-7	7-10	10-20
Percent, P%	-	8	18	18	24	22	10

The filter will consist of three 0.15m thick layers: 1) D_{aver}_=6.1mm, 2) D_{aver}=6.1/2=3.1mm and 3) D_{aver}'=3.1/2=1.6mm. Total 'height' of the filter installed on geo textile layer (TERRAM 1000) is H =0.45m. The filters will be arranged in predefined sections of the drainage system. Average distance between the filters will be L=140 m, total quantity of filters - 80 units.

Table 6 *Location of the filters*

#	Location of the filters (CP+)	#	Location of the filters (CP+)
1	192+70	21	220+70
2	194+10	22	222+10
3	195+50	23	223+50
4	196+90	24	224+90
5	198+30	25	226+30
6	199+70	26	227+70
7	201+10	27	229+10
8	202+50	28	230+50
9	203+90	29	231+90
10	205+30	30	233+30
11	206+70	31	234+70
12	208+10	32	236+10
13	209+50	33	237+50
14	210+90	34	238+90
15	212+30	35	240+30
16	213+70	36	241+70
17	215+10	37	243+10
18	216+50	38	244+50
19	217+90	39	245+90
20	219+30	40	259+90

2. Design parameters of the road

Design speed. In the design of the road, according to road classifications, the following projected speeds are used:

Flat and slightly notched relief 120 km/h

Hilly relief 100 km/h

Cross section parameter. According to the Georgian standards, the geometrical parameters of the project road section are as follows:

Design speed = 120 km/h	Design speed = 100 km/h
• Number of lanes: 4 • Lane width: 3.75 m • Carriageway width: 2 x 7.50 m • Shoulder width : 3.00 m (paved) and 0.75 m berm (unpaved) • Median width: 5.00 m (including barriers and paved shoulder) • Total road width 27.50 m	• Number of lanes: 4 • Lane width: 3.50 m • Carriageway width: 2 x 7.00 m • Width of shoulder: 2.75 m (paved) and 0.75 m berm (unpaved) • Median width: 5.00 m (including barriers and paved shoulder) • Total road width 26.00 m

The minimum cross fall in the carriageway is 2.5 % with an unpaved shoulder inclination of 4 % for all design speeds.

Horizontal and vertical alignment parameters. Considering the design solution adopted for the road section, the main design parameters are as follows:

Design elements	**Design Speed**	
	100 km/h	**120 km/h**
Min. horizontal curve radius	450 m	700 m
Max. inclination	5 %	4 %
Min. incurved curve radius	10,000 m	15,000 m
Min. whipped curve radius	3,000 (1,500) m	5,000 (2,500) m
Note: Values (volumes) in parenthesis are allowed only in hilly reliefs		

Sight Distance. For safety of the traffic the sight distance of stopping (braking) shall provide the visibility of any object higher than 0.20 m above the surface in traffic lane. The height of the eye of the driver is considered to be 1.2 m above the surface of carriageway. The required distance between driver and object depending on the design speed – as given in Table.

Design speed (km/h)	100	110	120
Sight distance of stopping (meters)	200	225	250

The sight distance of decision making is relative long in distance, which allows the driver to perceive the whole direction of road safely and get ready promptly and carry out manoeuvres necessary for driving (speed increase, speed reduction, change of line etc.).

The design parameters for sight distance of decision making are given in Table

Design speed (km/h)	100	110	120
Sight distance of stopping (meters)	300	325	350

Value of bend on horizontal curves. The minimum value of radius in horizontal curves with cross slope of 2.5 % depends on the design speed. The radiuses corresponding to minimum values of bend are presented in the Table

Design Speed (km/h)	100	110	120
Horizontal curve radius (meters)	2300	2700	3300

Carriageway expansion. Curve widening is required if the curve radius is less than 1,000 m. (The widening will always be developed at the inside of the curve.) The recommended widening amount is shown in:

Radius (m)	>850	650	575	425	325	225	140	95	80	70	60	50	40
Expansion W(m)	0,4	0.5	0.6	0.7	0.8	0.9	1.2	1.4	1.5	1.6	1.7	1.8	2.0

Traffic signs and sign arrangement works. Road signs of individual designing and pillars' constructions are elaborated by taking into account Construction norms and rules 2.03.01-84, 2.05.02-85, II-23-81, III-18-75, State standards (GOST) 10 8.7, 8713-79, 5264-806, 23457-86 and TEM standards requirements.

Selection of road signs and types and sizes of marking has been carried out by taking design speeds into account: on the highways – 120 km/h, at the road's junctions with the local (secondary) roads – 60 km/h. Respectively, the sizes of marking (layout) lines and road signs on the highway exceed their analogues at the junctions destined for local roads.

According to standards, security barriers (guardrails) will be installed on straight paths in the plan and on all embankments having big radiuses, working marks of which are equal or exceed 3.0 m. On those curves, radius of which is less than 600 m, barriers will be installed on every embankment, working marks of which are equal or exceed 2.0 m.

According to the technical standards in Georgia, which are in accordance with international requirements, guide posts along the whole length of the road, on straight paths in the plan and curves, radiuses of which exceed 600 m will be installed. On the curves, radiuses of which are less than 600 m, intervals l_0, l_1, l_2, l_3, l_4 will be taken according concrete values relevantly to the table below.

R	l_0	l_1	l_2	l_3	l_4
80	5	15	20	30	40
120	10	25	35	45	50

The guide posts will be located also on both sides of culverts 5 pieces on each side according to the following scheme: 1,5m interval on the axis, 2,10m –within the interval of 2 m.

Pavements. Two different pavement structures will be used:

- Concrete pavement structure for the motorway
- Asphalt pavement structure for all Slip Roads and all Minor Roads

The following shall apply to the motorway, concrete pavement structure, construction category I:

28 cm	Concrete;
30 cm	Crushed Aggregate Course ;
27 cm	Granular Base Course;
85 cm	Total Pavement Construction.

The following shall apply to slip roads and minor roads, asphalt pavement structure, construction category III

4 cm	Asphalt Wearing Course;
4 cm	Asphalt Binding Course;
14 cm	Asphalt Bearing Course;
58 cm	Granular Base Course;
80 cm	Total Pavement Construction.

Concrete pavement **:** Concrete pavements are already constructed on preceding sections of the highway. The pavement designs for the constructed sections were carried out in accordance to the German pavement design standard RStO 01. Due to the good performance of the constructed concrete pavement, RD requested a rigid pavement design alternative in accordance to the German RStO 01. Unreinforced concrete pavement structures are suitable in normal applications except where differential movement, subsidence or appreciable settlements are expected.

The proposed pavement structure was designed according to "AASHTO, Guide for Design of Pavement Structures" and according to "RStO 01 the German Guideline for determination of Pavement Structures". Traffic load and other design parameters were evaluated for a 20 year design life cycle. At this stage of the project the pavement design and determination of the layer thicknesses aims at a constant pavement structure along the full length of the road which is suitable for the varying traffic loads.

The recycling and reuse of the old asphalt pavement material is considered a basic requirement and will also add to the reduced need of new material. The cold mix recycling method should be considered for the whole length of the existing road.

Bank protection structure

Bank protection structure will be arranged to ensure safety of the road. The structure will starts from about 23.4+27.2 (Figures 4.6 a-4.6c). The bank protection facility represents up to 2m thick riprap. Diameter of the stone material has been estimated as described below.

Determining the diameter of the stone material

The calculating size of the stone diameter according to one of the recommended formulae is determined in the following manner:

$$dcalc_g = 0.087 \frac{V^2}{\gamma st - \gamma wat} = 0.087 \frac{3{,}5^2}{2.20 - 1.02.} = 0.903\ m$$

Where d_{calc} is the calculation size of the stone

V – is the water speed (m/sec)

y_{st} – is the water dimensional weight in the structure (t/m³). It is considered that the stones are brought from Marneuli open pit mine and its volumetric weight is no less than 2.6t/m³.

y_{wat} – specific weight of the water (t/m³).

After establishing the dimensions of the installation, the calculation diameter of the stones in the upper layer of the barrage should be confirmed with the following formulae:

$$d_{calc} = 1.25 \left(\frac{q}{m_{below}} \right)^{2/3}$$

where d_{calc} – is the calculation size of the stone diameter (m)

q – specific water outflow (m³/sc), dependant on the dimensions of the installation.

m_{below} – is the inclination of the installation surface in the below pond.

Out of the abovementioned formulae values determining the calculation size of the stone, we should pick the biggest.

If the stone order has approximately 10% of worn stones in the total mass, with the maximum diameter $d_{max} = 1.5\ d_{calc}$, equally distributed on the whole area of the installation, then the diameter of the 90% of the remaining stone mass may be $d = (0.8\text{-}1.2)\ d_{calc}$, the percentage distribution of which should be selected for certain installation. Definitely, it is better to have homogenous worn stone order, if mine and installation dimensions permit.

Based on this calculation diameter of the stone should be in the range of (0.9-1.0m). Typical cross section of the stricture is given in Figure 6. Along the riprap, after backfill, a service road will be formed. Minimum distance of the road from the 'outer' edge of the riprap is 34.3m. (see the chart overleaf)

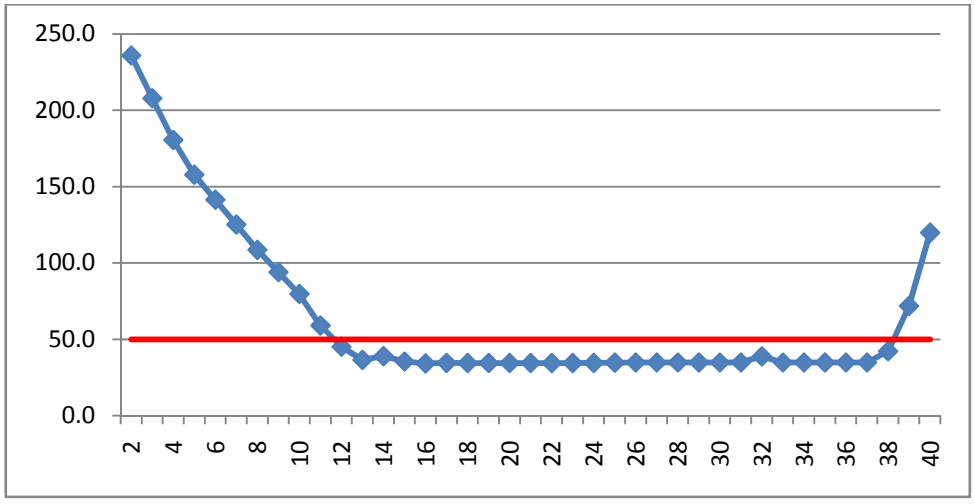


Figure 6. *Distance of the new embankment from the outer edge of the bank protection structure by pk-s of the bank protection facility (red line indicates distance recommended as protection zone under the law on Water for rivers longer than 75km)*

However, it must be noted that even in case of the high water level (659.51) it is still lower than the crest of the bank protection facility (660.01).

The structure will be built in low water period to avoid contact with water.

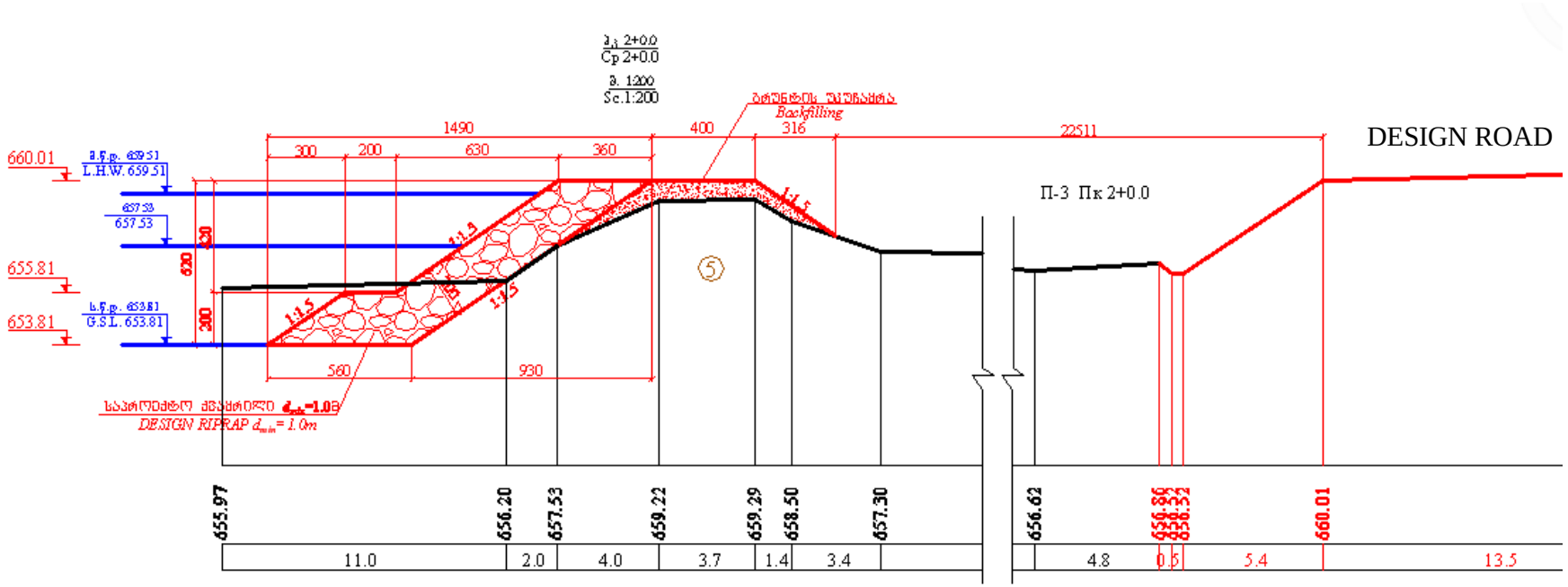


Figure 7. *Typical section - riprap*

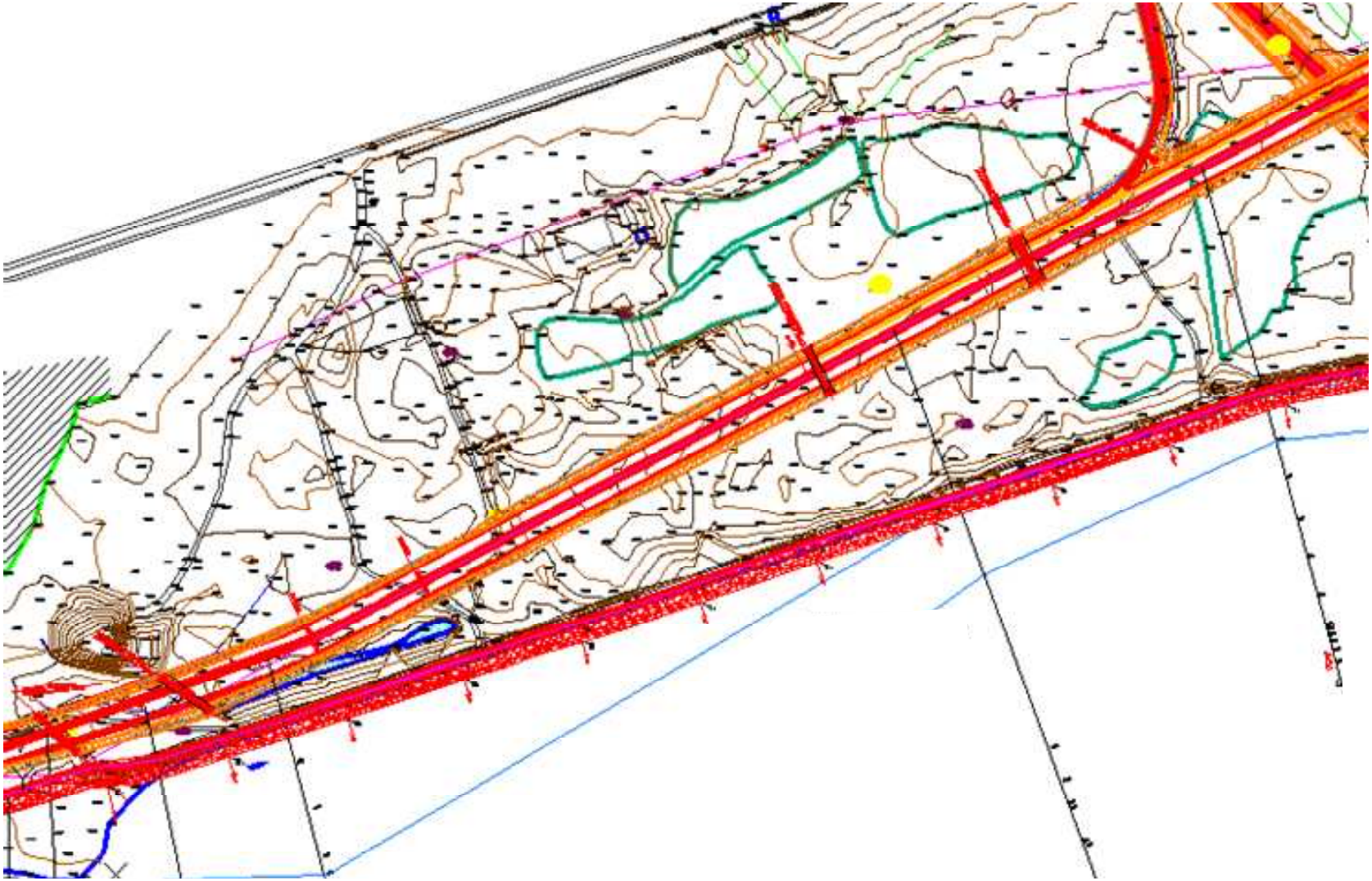


Figure 8.a. Bank protection strtucture

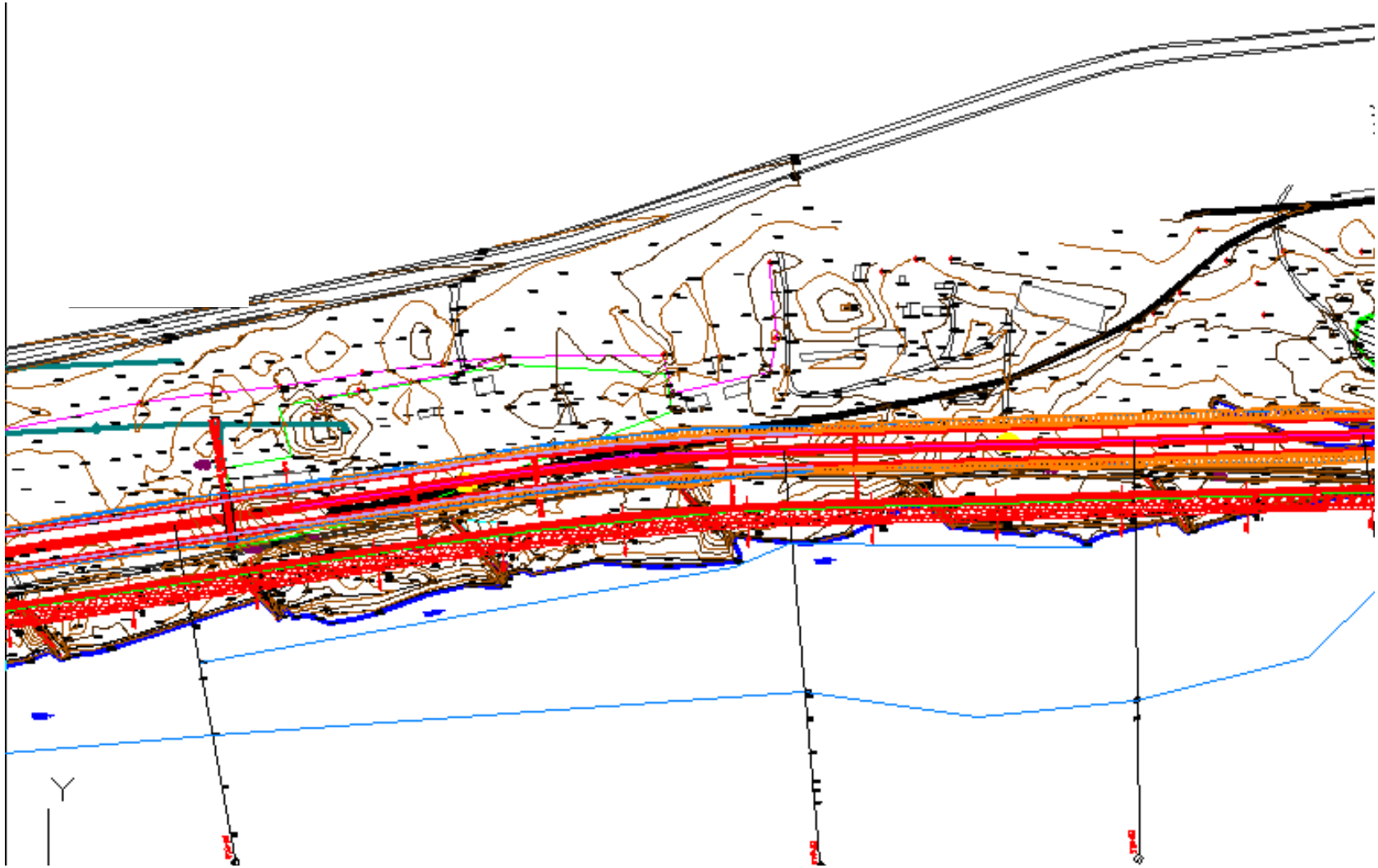


Figure 8.b Bank protection structure

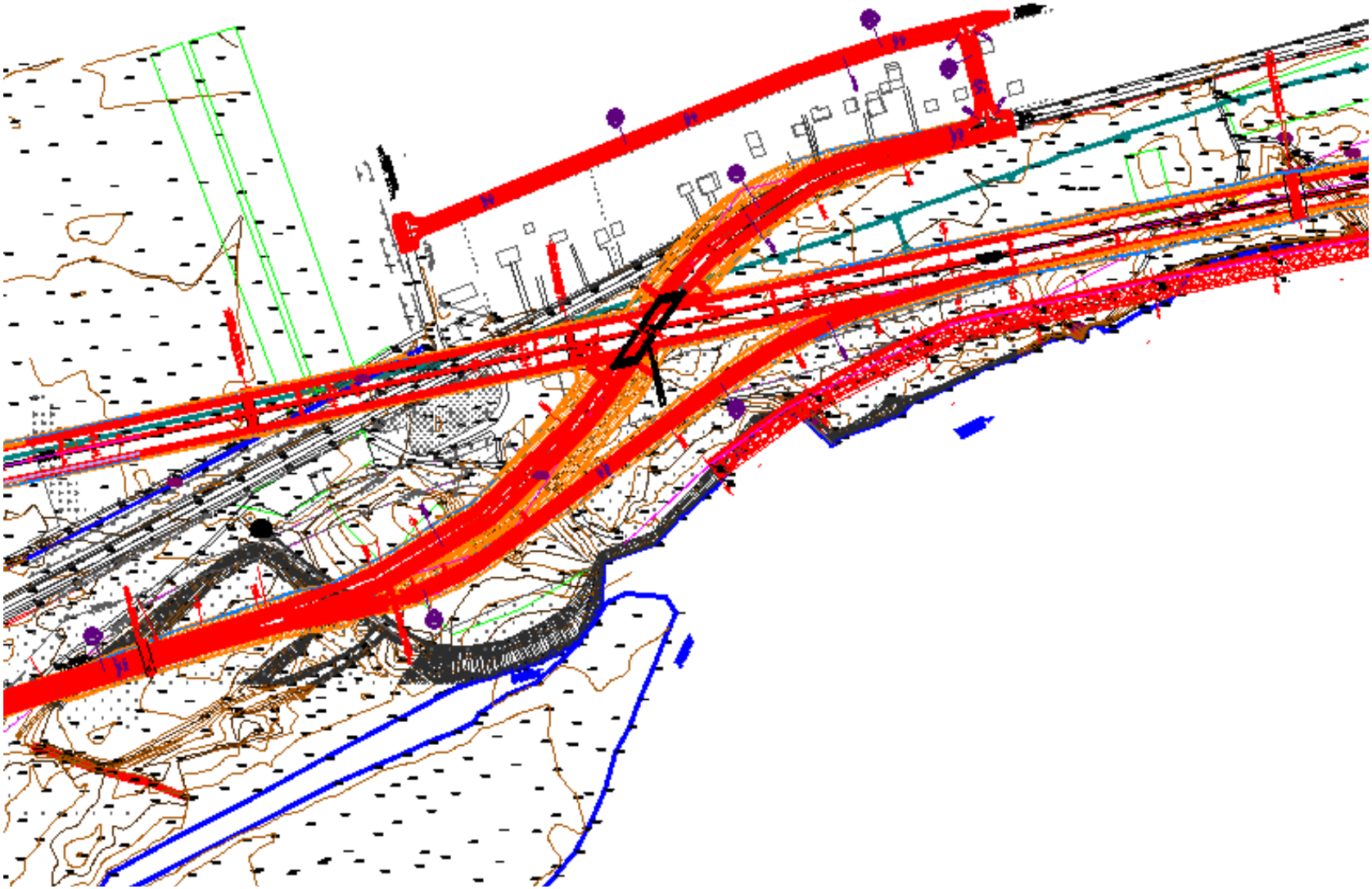


Figure 8c Bank protection structure

8 Annex - Hydraulic characteristics of river Mtkvari

Maximum Water Levels

In order to determine the values of maximum water outflows of the river Mtkvari at the project sight, we pictured the transverse crossings of the river-bed, based on which we determined the hydraulic elements of the river. Considering the named hydraulic elements we established a $Q = f(H)$ relation curve for the maximum water outflows and levels, interrelated with the method of selecting the hydraulic inclination between the two value intersections. The average speed of the flow at the intersection in calculated with the help of the famous Chezy-Maning formulae:

$$V = \frac{h^{2/3} \cdot i^{1/2}}{n}$$

where h – is the average depth of the stream in meters;

i – is the hydraulic inclination between two value intersections;

n – is the river-bed roughness coefficient, with value received via special calculations for the river-bed 0,040, for the grove – 0,067.

Table A7.1 presents different level values for different repetitive maximum water outflow at Urbnisi-Rikoti modernization sector

Table A7.1 *Maximum water levels in the Mtkvari*

Cross #	Distance between crosses in m	Mark of water bank m. abstract	Lower marks of bottom m. abstract	Max. Water level			
				$\tau =$ 100 years Q=1415 m^3/sec	$\tau = 50$ years Q=1285 m^3/sec	$\tau = 20$ years Q=1045 m^3/sec	$\tau =$ 10 years Q=900 m^3/sec
1		656.62	655.65	659.05	658.90	658.65	658.45
2	200	656.78	654.58	660.00	659.80	659.55	659.35
3	128	657.20	656.03	660.60	660.40	660.15	660.00
4	296	659.65	659.02	662.00	661.85	661.55	661.40
5	57	660.07	659.40	662.35	662.20	661.95	661.80
6	56	660.48	659.78	662.75	662.60	662.35	662.20
7	59	660.53	659.40	662.95	662.80	662.55	662.40
8	164	660.60	658.90	663.60	663.40	663.10	662.90
9	102	661.60	660.14	664.10	663.95	663.65	663.45
10	133	662.35	661.75	664.80	664.65	664.35	664.20
11	236	663.30	662.25	666.00	665.90	665.60	665.45
12	335	664.20	662.80	667.50	667.35	667.05	666.80
13	189	665.95	665.15	668.30	668.20	667.90	667.70

The hydraulic elements of the river, used for the creation of the curve for maximum water outflows and maximum water levels $Q = f(H)$ interrelation.

Table A7.2 *Hydraulic Elements of the River Mtkvari*

Marks m.abs	Section elements	Section Area ωMm^2	Width of flow B m	Average deep h m	Flow fall I	Average speed v m/sec	Water flow Q m^3/sec

Cross #1							
656.62	Canal	41.9	64.5	0.65	0.0048	1.30	54.5
657.50	Canal	100	68.3	1.46	0.0048	2.23	223
657.50	Right grove	113	188	0.60	0.0048	0.73	82.5
	∑	213	256				306
658.50	Canal	169	69.5	2.43	0.0048	3.14	531
658.50	Right grove	313	205	1.53	0.0048	1.38	432
	∑	482	274				963
659.50	Canal	241	74.0	3.26	0.0048	3.82	921
659.50	Right grove	518	205	2.53	0.0048	1.93	1000
	∑	759	279				1921
Cross #2 L=200 m.							
656.78	Canal	56.7	38.5	1.47	0.0008	0.92	52.2
657.50	Canal	89.9	53.8	1.67	0.0022	1.65	148
658.50	Canal	152	70.0	2.17	0.0038	2.59	394
658.50	Right grove	50.9	142	0.36	0.0038	0.46	23.4
	∑	203	212				417
659.50	Canal	224	73.0	3.07	0.0044	3.52	788
659.50	Right grove	214	177	1.21	0.0044	1.12	240
	∑	438	250				1028
660.00	Canal	261	75.0	3.48	0.0046	3.91	1020
660.00	Right grove	302	177	1.71	0.0046	1.45	438
	∑	563	252				1458
Cross #4 L=424 m.							
659.65	Canal	48.2	134	0.36	0.0068	1.04	50.1
660.50	Canal	166	142	1.17	0.0052	2.00	332
661.50	Canal	313	152	2.06	0.0048	2.81	880
661.50	Left grove	117	110	1.06	0.0048	1.08	126
	∑	430	262				1006
662.00	Canal	390	155	2.52	0.0047	3.18	1240
662.00	Left grove	173	115	1.50	0.0047	1.34	232
	∑	563	270				1472
Cross #6 L=113 m.							
660.48	Canal	39.0	83.1	0.47	0.0073	1.29	50.3
661.50	Canal	143	121	1.18	0.0075	2.42	346
661.50	Right grove	13.4	51.5	0.26	0.0075	0.52	6.97
661.50	Left grove	49.9	60.5	0.82	0.0075	1.13	56.4
	∑	206	233				409
662.50	Canal	264	121	2.18	0.0066	3.42	903
662.50	Right grove	70.1	68.0	1.03	0.0066	1.24	86.9
662.50	Left grove	145	101	1.44	0.0066	1.55	225
	∑	479	290				1215
Cross #8 L=223 m.							
660.60	Canal	84.3	74.0	1.14	0.0005	0.61	51.4
661.50	Canal	163	101	1.61	0.0017	1.42	232
662.50	Canal	280	134	2.09	0.0029	2.21	619
662.50	Right grove	18.1	44.2	0.41	0.0029	0.44	7.96

	∑	298	178				627
663.50	Canal	418	141	2.96	0.0035	3.06	1279
663.50	Right grove	66.1	56.3	1.17	0.0035	0.98	64.8
	∑	484	197				1344
Cross #10 L=235 m.							
662.35	Canal	47.0	117	0.40	0.0074	1.16	54.5
663.50	Canal	194	139	1.40	0.0059	2.41	468
664.50	Canal	334	142	2.35	0.0053	3.23	1079
664.50	Right grove	57.0	68.9	0.83	0.0053	096	54.7
664.50	Left grove	19.0	27.4	0.69	0.0053	0.85	16.2
	∑	410	238				1150
665.00	Canal	405	143	2.83	0.0050	3.55	1438
665.00	Canal	91.8	70.2	1.31	0.0050	1.26	116
665.00	Right grove	34.4	34.0	1.01	0.0050	1.06	36.5
	∑	531	247				1590
Cross #11 L=236 m.							
663.30	Canal	41.0	58.3	0.70	0.0040	1.25	51.2
664.50	Canal	137	102	1.34	0.0054	2.24	307
664.50	Right grove	4.30	21.5	0.20	0.0054	0.37	1.59
	∑	141	124				309
665.50	Canal	240	105	2.28	0.0054	3.19	766
665.50	Right grove	159	164	0.97	0.0054	1.07	170
665.50	Left grove	5.36	8.50	0.63	0.0054	0.80	4.29
	∑	404	278				940
666.00	Canal	293	108	2.71	0.0054	3.58	1049
666.00	Right grove	242	170	1.42	0.0054	1.39	336
666.00	Left grove	22.2	28.0	0.79	0.0054	0.94	20.9
	∑	557	306				1406
Cross #12 L=335 m							
664.20	Canal	42.1	44.9	0.94	0.0027	1.25	52.6
665.50	Canal	106	53.9	1.97	0.0036	2.36	250
666.50	Canal	162	57.2	2.83	0.0040	3.17	514
666.50	Right grove	175	153	1.14	0.0040	1.03	180
	∑	337	210				694
667.50	Canal	221	61.7	3.58	0.0044	3.90	862
667.50	Right grove	330	156	2.12	0.0044	1.64	541
667.50	Left grove	15.6	16.0	0.98	0.0044	0.98	15.3
	∑	567	234				1418
Cross #13 L=189 m							
665.95	Canal	35.0	65.4	0.54	0.0092	1.59	55.6
667.00	Canal	110	78.5	1.40	0.0055	2.32	255
667.00	Right grove	175	273	0.64	0.0055	0.82	144
	∑	285	352				399
668.00	Canal	193	88.0	2.19	0.0043	2.77	535
668.00	Right grove	450	276	1.63	0.0043	1.36	612
	∑	643	364				1147
669.00	Canal	285	96.0	2.97	0.0034	3.02	861
669.00	Right grove	728	280	2.60	0.0034	1.65	1201

	∑	1013	376				2062

Maximum depth of the general river-bed washing

Possible maximum depth of the Mtkvari bed washing at the project sight is identified by the method given in "the guidelines for the calculation of steady river-bed in the process of planning hydro tectonic installations in the alluvium beds of the Mountain Rivers". According to the method from these instructions, general washing depth is calculated with the following equation

$$H_{\max} = \frac{0.5}{i^{0.03}} \left(\frac{Q_{p\%}}{\sqrt{g}} \right)^{0.4} \text{ m}$$

Where *i* is the hydraulic inclination at the project sight, which in our case is equal to 0,0048;

g – Acceleration of gravity;

$Q_{P\%}$ - maximum outflow of the calculation supply water. In our case, the maximum outflow of the 1% of the supply water of River Mtkvari is 1415m³/sc;

Putting the named numeric values in the abovementioned formulae gives the maximum washing of the alluvium bed of the river Mtkvari, which is equal to 6,80m.

In order to verify the accuracy of the received value a calculation method is used provided by the "manual on researches and design of railway and road bridge crossings through waterways". According to the named method the average depth of possible general washing of the river-bed is calculated according to the following formulae

$$H_{monthly.washout} = \left(\frac{Q_{P\%}}{B \cdot 0{,}68 \cdot d_{ave}^{\,0{,}28} \cdot \beta} \right)^{Y} \text{ m}$$

where $Q_{P\%}$ is the maximum water outflow for the calculation supply water in m³/sc, which in our case is equal to 1415 m³/sc;

B – is the width of the steady river-bed in meters. Its value is calculated with the following formulae

$$B = A \cdot \frac{Q_{p\%}^{\,0{,}5}}{i^{0{,}2}}$$

Where *A* is a dimension coefficient, with value ranging between 0,9 to 1,1. In our case the value is equal to 1,1;

$Q_{p\%}$ – here is the maximum supply water outflow, equal to 1415m³/sc;

i – is the stream hydraulic inclination at the project sight, equal to 0,0048;

d_{sash} _is the average diameter of the river-bed construction ground fractions in mm-s. Its value is calculated with the following formulae

$$d_{ave} = d_{dan} \cdot \left(\frac{Q_{1\%} - Q_0}{Q_{10\%} - Q_0} \right)^{0{,}9} \text{ m}$$

Where d_{dan} is the average diameter of the solid materials settled on the river-bed. Its value is determined with the formulae

$$d_{dan} = K \cdot i^{0,9} \cdot \left(\frac{Q_{10\%}}{\sqrt{g}} \right)^{0,4} \text{ m}$$

Here K is the coefficient, which considers the non-homogenous nature of the water outflow and solid materials in it. Its value, dependent on the amount of the solid materials floating in the water (μ g/l), is taken from the special list and in our case is equal to 2;

Q_0 is the amount of the outflow, which causes the movement of the solid materials on the bottom during flow. $Q_0 = 0{,}1 \cdot Q_{10\%}$

$Q_{1\%}$ and $Q_{10\%}$ - 1% and 10% maximum supply water outflow.

Out of these, the average diameter of the solid materials on the bottom of the Mtkvari river bed is equal to 250 mm, average diameter of river-bed construction ground is equal to 160mm.

β - is a non-dimensional parameter, with value dependant on the maximum outflow support. Its value is taken from the special table in the same manual and in case of 1% outflow the result is equal to 1;

Y - is the indicator of the reduction level of in-depth washing. Its value, dependant on the average diameter of the river-bed construction grounds, is taken from the special table in the same manual and in our case is equal to 0,805.

Putting given numeral values in the abovementioned formulae we receive the average depth of Mtkvari river-bed washing, equal to 2,86m.

The maximum depth of the general river-bed washing is calculated according to the dependence

$$h_{tv.gar} = K_B \cdot H_{Tv.gar}$$

Where K_B is a coefficient, which considers the width of the river flow movement. In our case this value is equal to 2.

Stemming out of this, the maximum depth of general washing of Mtkvari river-bed is equal to 5,70m, which is accepted as a calculation value for the project sight.

The maximum depth of the possible washing of the Mtkvari river-bed ($H_{\max}$ =5,70m) should be calculated from maximum water outflow of 100 year repetition and below.
River flow modulus in the midstream and peripheries is 4-5 l/sec and 10-12 l/sec from square kilometre respectively.

In the limits of the study area, north periphery of the terrace I, small seasonal (spring, autumn) impoundments have been registered. They are formed by excessive rainfall.

As mentioned above the river is characterized by high flows in spring as a result of snow melting and high flows in autumn from seasonal rain, with stable low flows in winter and unstable low flows in summer, depending on the incidence of rain. Some areas are at risk of flooding, particularly in spring, when flash-floods can overrun the floodplains affecting agricultural land and infrastructure, including the E-60 in places.

9 Annex - Physical and mechanical properties of soil

Physical and mechanical properties of soil

##	BH #	Sample #	Depth, m	GE #	Physical Properties												Mechanical Properties								
					Moisture Content, **W** %	Plasticity			Density, g/cm³			Porosity, **n** %	Voids Ratio, **e**	Total Moisture Capacity, **Wsat** %	Degree of Saturation, S_r	Liquidity Index, I_L	Compression		Shear Properties				Unconfined Compressive Strength, Natural, R_c Mpa	Unconfined Compressive Strength, on Saturation, R_c^w Mpa	Softening Coefficient
						Liquid Limit, WL %	Plastic Limit, WP %	Plasticity Index, IP	Particle, ρs	Bulk, **ρ**	Dry, ρ_d						Total Deformation Modulus, Natural, E_0 kPa	Total Deformation Modulus, on Saturation, E_0 kPa	Natural		On Saturation				
																			Internal Friction Angle, φ^0	Cohesion, C kPa	Internal Friction Angle, φ^0	Cohesion, C kPa			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1	104	1	3.0-3.2	2	23.4	39.2	23.7	15.5	2.70	1.94	1.57	41.77	0.717	26.57	0.88	-0.02	25593	16467	-	-	-	-	-	-	-
2	105	1	2.0-2.2	2	23.1	38.8	24.1	14.7	2.70	1.94	1.58	41.63	0.713	26.42	0.87	-0.07	-	-	21.8	35.5	19.8	24.4	-	-	-
3	118	1	1.5-1.8	2	20.1	37.5	22.6	14.9	2.70	1.94	1.62	40.17	0.671	24.87	0.81	-0.17	-	-	-	-	-	-	-	-	-
4	126	2	4.0-4.3	2	21.6	38.9	21.8	17.1	2.70	1.95	1.60	40.61	0.684	25.32	0.85	-0.01	27686	15424	-	-	-	-	-	-	-
5	127	2	4.0-4.5	2	22.2	38.5	22.1	16.4	2.71	1.95	1.60	41.12	0.698	25.77	0.86	0.01	-	-	23.2	36.5	20.1	23.2	-	-	-
min					**20.1**	**37.5**	**21.8**	**14.7**	**2.70**	**1.94**	**1.57**	**40.17**	**0.671**	**24.87**	**0.81**	**-0.17**	**25593**	**15424**	**21.8**	**35.5**	**19.8**	**23.2**	**-**	**-**	**-**
max					**23.4**	**39.2**	**24.1**	**17.1**	**2.71**	**1.95**	**1.62**	**41.77**	**0.717**	**26.57**	**0.88**	**0.01**	**27686**	**16467**	**23.2**	**36.5**	**20.1**	**24.4**	**-**	**-**	**-**
Average					**22.1**	**38.6**	**22.9**	**15.7**	**2.70**	**1.94**	**1.59**	**41.06**	**0.697**	**25.79**	**0.86**	**-0.05**	**26640**	**15946**	**22.5**	**36.0**	**20.0**	**23.8**	**-**	**-**	**-**
Quantity					**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**2**	**2**	**2**	**2**	**2**	**2**	**0**	**0**	**0**
6	123	1	2.0-2.3	3	29.8	37.2	17.4	19.8	2.71	1.94	1.49	44.85	0.813	30.01	0.99	0.63	-	-	13.5	37.80	11.5	29.80	-	-	-
7	130	1	1.1-1.3	3	30.2	40.1	16.5	23.6	2.70	1.95	1.50	44.53	0.803	29.73	1.02	0.58	23597	10939	-	-	-	-	-	-	-
8	131	1	1.0-1.2	3	28.5	38.1	16.8	21.3	2.72	1.95	1.52	44.21	0.792	29.13	0.98	0.55	-	-	-	-	-	-	-	-	-
min					**28.5**	**37.2**	**16.5**	**19.8**	**2.70**	**1.94**	**1.49**	**44.21**	**0.792**	**29.13**	**0.98**	**0.55**	**23597**	**10939**	**13.5**	**37.80**	**11.5**	**29.80**	**-**	**-**	**-**
max					**30.2**	**40.1**	**17.4**	**23.6**	**2.72**	**1.95**	**1.52**	**44.85**	**0.813**	**30.01**	**1.02**	**0.63**	**23597**	**10939**	**13.5**	**37.80**	**11.5**	**29.80**	**-**	**-**	**-**
Average					**29.5**	**38.5**	**16.9**	**21.6**	**2.71**	**1.95**	**1.50**	**44.53**	**0.803**	**29.62**	**1.00**	**0.59**	**23597**	**10939**	**13.5**	**37.8**	**11.5**	**29.8**	**-**	**-**	**-**
Quantity					**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**0**	**0**	**0**
9	119	1	2.5-2.8	3a	27.4	36.9	19.1	17.8	2.72	1.96	1.54	43.44	0.768	28.24	0.97	0.47	-	-	-	-	-	-	-	-	-
10	128	4	9.5-10.0	3a	25.6	37.2	18.9	18.3	2.71	1.94	1.54	43.00	0.755	27.84	0.92	0.37	18259	9983	16.2	37.50	13.1	22.5	-	-	-
11	129	3	9.7-10.0	3a	26.8	39.6	17.9	21.7	2.71	1.94	1.53	43.54	0.771	28.46	0.94	0.41	19756	10478	16.5	37.80	13.6	23.1	-	-	-
min					**25.6**	**36.9**	**17.9**	**17.8**	**2.71**	**1.94**	**1.53**	**43.00**	**0.755**	**27.84**	**0.92**	**0.37**	**18259**	**9983**	**16.2**	**37.50**	**13.1**	**22.5**	**-**	**-**	**-**

max					**27.4**	**39.6**	**19.1**	**21.7**	**2.72**	**1.96**	**1.54**	**43.54**	**0.771**	**28.46**	**0.97**	**0.47**	**19756**	**10478**	**16.5**	**37.80**	**13.6**	**23.1**	-	-	-
Average					**26.6**	**37.9**	**18.6**	**19.3**	**2.71**	**1.95**	**1.54**	**43.33**	**0.765**	**28.18**	**0.94**	**0.41**	**19008**	**10231**	**16.4**	**37.7**	**13.4**	**22.8**	-	-	-
Quantity					**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**0**	**0**	**0**
12	88	1	1.4-1.6	4	17.2	21.2	15.3	5.9	2.66	1.77	1.51	43.22	0.761	28.62	0.60	0.32	10828	8281	-	-	-	-	-	-	-
13	89	1	1.5-1.8	4	16.7	20.9	15.4	5.5	2.65	1.78	1.53	42.44	0.737	27.83	0.60	0.24	-	-	24.5	15.7	23.1	13.2	-	-	-
14	99	1	2.5-3.0	4	16.9	19.8	14.9	4.9	2.67	1.73	1.48	44.57	0.804	30.12	0.56	0.41	11561	9772	-	-	-	-	-	-	-
15	101	1	1.5-1.8	4	17.5	20.2	14.7	5.5	2.66	1.74	1.48	44.33	0.796	29.93	0.58	0.51	-	-	24.1	15.2	22.8	12.4	-	-	-
16	115	2	1.5-1.8	4	16.8	20.1	14.9	5.2	2.66	1.72	1.47	44.64	0.806	30.31	0.55	0.37	-	-	-	-	-	-	-	-	-
17	116	1	1.0-1.3	4	17.1	19.5	15.1	4.4	2.65	1.78	1.52	42.64	0.743	28.05	0.61	0.45	-	-	-	-	-	-	-	-	-
min					**16.7**	**19.5**	**14.7**	**4.4**	**2.65**	**1.72**	**1.47**	**42.44**	**0.737**	**27.83**	**0.55**	**0.24**	**10828**	**8281**	**24.1**	**15.2**	**22.8**	**12.4**	-	-	-
max					**17.5**	**21.2**	**15.4**	**5.9**	**2.67**	**1.78**	**1.53**	**44.64**	**0.806**	**30.31**	**0.61**	**0.51**	**11561**	**9772**	**24.5**	**15.7**	**23.1**	**13.2**	-	-	-
Average					**17.0**	**20.3**	**15.1**	**5.2**	**2.66**	**1.75**	**1.50**	**43.64**	**0.775**	**29.14**	**0.59**	**0.38**	**11195**	**9027**	**24.3**	**15.5**	**23.0**	**12.8**	-	-	-
Quantity					**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**2**	**2**	**2**	**2**	**2**	**2**	**0**	**0**	**0**
18	84	1	3.5-4.0	5*	16.9	25.1	17.6	7.5	2.66	1.79	1.53	42.44	0.737	27.71	0.61	-0.09	-	-	-	-	-	-	-	-	-
19	87	1	2.8-3.0	5*	17.2	23.8	16.7	7.1	2.65	1.81	1.54	41.72	0.716	27.02	0.64	0.07	-	-	-	-	-	-	-	-	-
20	90	1	3.0-3.2	5*	17.8	28.8	21.1	7.7	2.64	1.78	1.51	42.76	0.747	28.30	0.63	-0.43	-	-	-	-	-	-	-	-	-
21	93	1	1.8-2.0	5*	17.5	22.1	17.3	4.8	2.66	1.79	1.52	42.73	0.746	28.05	0.62	0.04	-	-	-	-	-	-	-	-	-
22	96	1	3.5-4.0	5*	17.6	22.7	15.8	6.9	2.65	1.79	1.52	42.56	0.741	27.96	0.63	0.26	-	-	-	-	-	-	-	-	-
23	98	2	4.0-4.5	5*	18.2	29.1	19.8	9.3	2.65	1.77	1.50	43.49	0.770	29.04	0.63	-0.17	-	-	-	-	-	-	-	-	-
24	103	2	4.0-4.3	5*	18.7	22.9	16.4	6.5	2.66	1.78	1.50	43.62	0.774	29.09	0.64	0.35	-	-	-	-	-	-	-	-	-
25	105	2	4.3-4.5	5*	19.1	22.5	16.3	6.2	2.64	1.8	1.51	42.75	0.747	28.29	0.68	0.45	-	-	-	-	-	-	-	-	-
26	124	4	9.3-9.5	5*	17.8	30.1	20.1	10.0	2.65	1.79	1.52	42.66	0.744	28.07	0.63	-0.23	-	-	-	-	-	-	-	-	-
27	125	4	8.0-8.3	5*	19.4	22.4	17.5	4.9	2.64	1.78	1.49	43.53	0.771	29.20	0.66	0.39	-	-	-	-	-	-	-	-	-
28	132	3	6.0-6.2	5*	19.2	23.1	18.6	4.5	2.66	1.82	1.53	42.60	0.742	27.90	0.69	0.13	-	-	-	-	-	-	-	-	-
min					**16.9**	**22.1**	**15.8**	**4.5**	**2.64**	**1.77**	**1.49**	**41.72**	**0.716**	**27.02**	**0.61**	**-0.43**	-	-	-	-	-	-	-	-	-
max					**19.4**	**30.1**	**21.1**	**10.0**	**2.66**	**1.82**	**1.54**	**43.62**	**0.774**	**29.20**	**0.69**	**0.45**	-	-	-	-	-	-	-	-	-
Average					**18.1**	**24.8**	**17.9**	**6.9**	**2.65**	**1.79**	**1.52**	**42.81**	**0.749**	**28.24**	**0.64**	**0.07**	-	-	-	-	-	-	-	-	-
Quantity					**11**	**11**	**11**	**11**	**11**	**11**	**11**	**11**	**11**	**11**	**11**	**11**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
29	94	2	5.3-5.5	8	26.1	50.3	28.4	21.9	2.62	1.94	1.54	41.28	0.703	26.83	0.97	-0.11			22.8	205.0	20.3	188.0	0.95	0.73	0.77
30	112	3	6.0-6.3	8	29.1	51.8	30.1	21.7	2.61	1.92	1.49	43.02	0.755	28.93	1.01	-0.05	-	-	-	-	-	-	-	-	-

31	113	3	8.2-8.5	8	27.8	52.9	31.1	21.8	2.60	1.92	1.50	42.22	0.731	28.10	0.99	-0.15	-	-	24.0	195.0	22.2	181.0	1.11	0.80	0.72
32	114	3	8.3-8.3	8	27.9	52.6	29.7	22.9	2.61	1.93	1.51	42.18	0.730	27.96	1.00	-0.08	-	-	-	-	-	-	-	-	-
min					**26.1**	**50.3**	**28.4**	**21.7**	**2.60**	**1.92**	**1.49**	**41.28**	**0.703**	**26.83**	**0.97**	**-0.15**	**-**	**-**	**22.8**	**195.0**	**20.3**	**181.0**	**0.95**	**0.73**	**0.72**
max					**29.1**	**52.9**	**31.1**	**22.9**	**2.62**	**1.94**	**1.54**	**43.02**	**0.755**	**28.93**	**1.01**	**-0.05**	**-**	**-**	**24.0**	**205.0**	**22.2**	**188.0**	**1.11**	**0.80**	**0.77**
Average					**27.7**	**51.9**	**29.8**	**22.1**	**2.61**	**1.93**	**1.51**	**42.18**	**0.730**	**27.95**	**0.99**	**-0.10**	**-**	**-**	**23.4**	**200.0**	**21.3**	**184.5**	**1.03**	**0.77**	**0.74**
Quantity					**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**0**	**0**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
33	94	3	9.0-9.2	9	20.3	-	-	-	2.62	2.01	1.67	36.23	0.568	21.68	0.94	-	-	-	29.3	410	24.6	274	2.61	2.1	0.80
34	94	4	11.8-12.0	9	21.5	-	-	-	2.61	1.98	1.63	37.56	0.602	23.05	0.93	-	-	-	28.7	395	23.8	282	2.42	1.95	0.81
35	106	4	8.0-8.4	9	21.1	-	-	-	2.63	2.01	1.66	36.89	0.585	22.23	0.95	-	-	-			-	-	-	-	-
36	107	4	13.0-13.2	9	20.4	-	-	-	2.62	2.02	1.68	35.96	0.562	21.44	0.95	-	-	-			-	-	-	1.90	-
37	108	4	13.5-13.8	9	19.7	-	-	-	2.62	2.03	1.70	35.27	0.545	20.80	0.95	-	-	-			25.6	280	-		-
min					**19.7**	**-**	**-**	**-**	**2.62**	**2.01**	**1.63**	**35.27**	**0.545**	**20.80**	**0.93**	**-**	**-**	**-**	**28.7**	**395**	**23.8**	**274**	**-**	**1.90**	**0.80**
max					**21.1**	**-**	**-**	**-**	**2.63**	**2.03**	**1.70**	**37.56**	**0.602**	**23.05**	**0.95**	**-**	**-**	**-**	**29.3**	**410**	**25.6**	**282**	**-**	**2.10**	**0.81**
Average					**20.4**	**-**	**-**	**-**	**2.62**	**2.02**	**1.67**	**36.38**	**0.572**	**21.84**	**0.94**	**-**	**-**	**-**	**29.0**	**403**	**24.7**	**279**	**-**	**1.98**	**0.81**
Quantity					**3**	**0**	**0**	**0**	**3**	**3**	**5**	**5**	**5**	**5**	**5**	**0**	**0**	**0**	**2**	**2**	**3**	**3**	**0**	**3**	**2**
Total Quantity					**35**	**32**	**32**	**32**	**35**	**35**	**37**	**37**	**37**	**37**	**37**	**32**	**7**	**7**	**11**	**11**	**12**	**12**	**2**	**5**	**4**

Note: * Values are given for soil filling

10 Annex – Minutes of Meetings