Code	ha affected	% of total area in 100m corridor	Note
Clayey and rock riverine vegetation with duckweed (323GE)	10.18	9.4	Natural
Tilio-Acerion forests of slopes, screes and ravines (9180GE)	1.14	1.1	Natural
Total	**109.71**		

F.2.2 Fauna

306. Mammals - Information available from references (primary and secondary data sources) have been used as a basis for description of the area.

307. According to available information there are two species (Caucasian squirrel, Eurasian otter) considered as vulnerable in Georgia (Georgian Red List) that may be found within the Project area. The Otter is also included in the IUCN red list as nearly threatened (NT). During the site visit the list of species listed above was taken as guidance. Objective of the survey was to double check available information on the site. Particular attention was paid to detection of the species listed under protected category. Therefore, specific focus was on the study of the habitats suitable for these mammals.

308. Otter (*Lutra lutra*) is known to be found in Kvirila/Dzirula river basin, however the sources does not provide any information on community structure and number of species in the area of interest. The Otter is river associated species mainly met in slow flowing sections of the streams/rivers. It isn't uncommon for them to travel great distances on land or through the water. This can be up to 26 square kilometers. However, it is important to remember that otters home range differs from their territory. The actual territory that is distinctly their own is very small. Otters mark their habitat with droppings (spraints). So, they can be registered by smell (smell of fresh cut hay). Generally the otters are not afraid of people and can be met in the limits of residential areas. The aquatic habitats of otters are extremely vulnerable to man-made changes. Canalization of rivers, removal of bank side vegetation, dam construction, draining of wetlands, aquaculture activities and associated man-made impacts on aquatic systems are all unfavorable to otter population.

309. Site surveys undertaken by local ecologists did not reveal actual evidence of otters in the Project area, such as spraints and holts, but they did identify several locations which would provide suitable habitat for otters (see Figure 71 and Figure 72 below for the locations). However, other anecdotal and photographic evidence provided by the ADB shows that otters are present within the Project area, notably at the confluence of the Rikotula and Dzirula rivers (see Figure 73).

Figure 71: Habitat Identified as Suitable for Otters in the Project Area

38 356904.35 E, 4663421.41 N

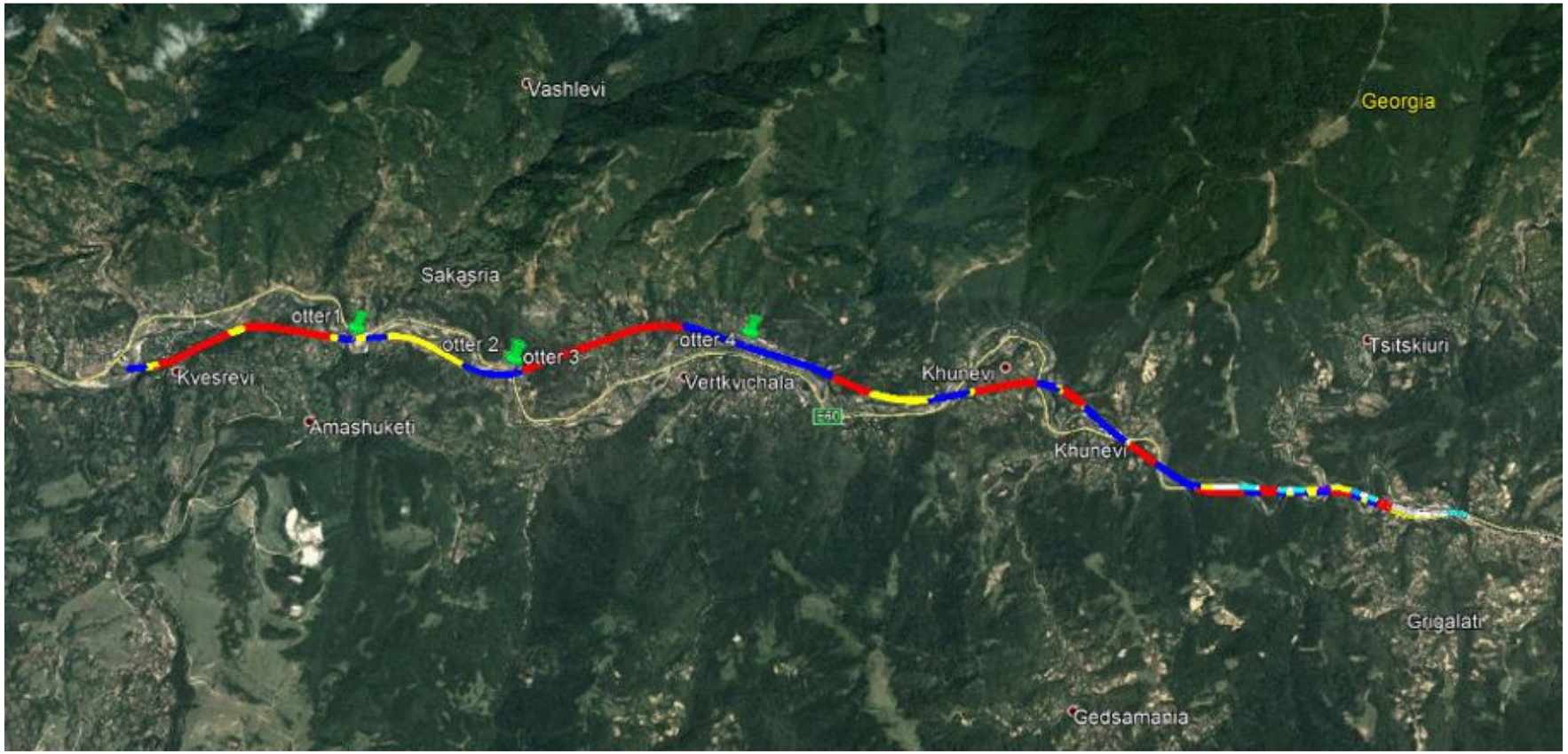
38 358819.37 m E 4663447.48 N

38 360145.62E, 4663181.88 N

38 360156.39 E, 4663157.54 N

38 362158.85 E 4663343.28N

Figure 72: Locations of Habitat Suitable for Otters



Green icons – locations of the sites (see pictures above),
Red line – tunnel
Yellow – new road
Blue – bridge
Light blue – existing bridge
White – existing road

Figure 73: Evidence of the Presence of Otters at the Confluence of Rikotula and Dzirula Rivers, April 2018

Source: Duncan Lang, ADB Environmental Specialist

310. Caucasian squirrel (Sciurus anomalus) can be met in the deciduous forest within the region. Their nests are usually found in the tree hollows, under rocks, inside heaps of stones, and in residential areas, such as graveyards and abandoned cattle sheds. They are diurnal, are not active in winter. The peak of activity is in summer Caucasian squirrels become most active during the early morning to morning and during the two hours before sunset in early summer. Like other tree squirrels, they are territorial. The animal marks territories with urine and faeces. The marks are renewed several times every day. There is no information available regarding home range. Caucasian squirrels are herbivorous; they eat seeds and fruits and therefore, likely have an important influence on the forest ecosystem as seed dispersers.

311. The habitats within the project area, where the squirrel can be found are:
(i) 9160GE Oak or oak-hornbeam forests (Quercitum -Carpinion betuli) and
(ii) 9180 GE Tilio-Acerion forests of slopes, screes and ravines.

312. The mentioned habitats are crossed in 6 locations. In these sections alignment goes mainly via tunnels, and/or run at the edge of the forested area. Presence of squirrels was checked during the range of the site surveys carried out in different hours. The surveys were carried out in August 8-9, 2017; September 22-23, 2017; March 1-2, 2018 and April 22-23, 2018. The site survey sessions included April – the period when the squirrels are most active. The surveyed corridor width was ranging from 50 to 250m depending on location. The presence of the squirrels in the direct impact zone of the project has not been registered.

313. Bats – Bats are considered as vulnerable group. They are rather limited in selection of nesting shelters. Favourable shelters are hollow trees, caves and abandoned buildings. All species of bats observed in Georgia are included in the Annex II of Bonn Convention and protected by the agreement of EUROBATS. Based on this agreement, Georgia is mandatory to protect all bats inhabiting the Project area and in its vicinities. No bat surveys

were completed as part of this EIA, however, based on literary sources the following species will possibly be found within the Project area:

(i) **Lesser horseshoe bat** (*Rhinolophus hipposideros* Bechstein – IUCN Status: LC) It forages close to ground within and along the edges of broadleaf deciduous woodland, which represents its primary foraging habitat, but also in riparian vegetation, Mediterranean and sub-mediterranean shrubland. Its prey consists mainly of midges, moths and craneflies. Foraging activities take place nearly exclusively within woodland areas, while open areas are avoided. Habitat loss and fragmentation may therefore reduce the amount of suitable habitats for the Lesser Horseshoe Bat and pose a threat to this species. Summer roosts (breeding colonies) are found in natural and artificial underground sites and in attics and buildings. In winter it hibernates in underground sites (including cellars, small caves and burrows). A sedentary species, winter and summer roosts are usually found within 5-10 km (longest distance recorded 153 km). Recommended conservation measures include protecting maternity roosting sites, hibernation caves and foraging habitats.

(ii) **Particoloured bat** (*Vespertilio murinus* – IUCN Status: LC) forages in open areas over various habitat types (forest, semi-desert, urban, steppe, agricultural land). It feeds on moths and beetles. Summer roosts tend to be situated in houses or other buildings; also rarely hollow trees, nest boxes, or rock crevices. Winter roost sites include rock fissures, often (as a substitute) crevices in tall buildings (including, or especially, in cities), occasionally tree holes or cellars. Winter roosts are usually in colder sites that are exposed to temperature changes. Migrations of up to 1,780 km have been recorded, although the species is sedentary in a large part of its range. This nocturnal species appears late in the evening, sleeping in narrow crevices during the day. It lives in small colonies and often single individuals are sighted. It hibernates throughout the winter. Young are born in June/July, generally 2 at a time, and are stuck onto the chest of the mother during flight.

(iii) **Common pipistrelle** (*Pipistrellus pipistrellus* Schreber – IUCN Status: LC) forages in a variety of habitats including open woodland and woodland edges, Mediterranean shrublands, semi-desert, farmland, rural gardens and urban areas. It feeds on small moths and flies. Summer roosts are mainly found in buildings and trees, and individuals frequently change roost site through the maternity period. Most winter roost sites are located in crevices in buildings, although cracks in cliffs and caves and possibly holes in trees may also be used. It is not especially migratory in most of its range, but movements of up to 1,123 km have been recorded. In at least parts of its range it seems to benefit from urbanization.

(iv) **Serotine** (*Eptesicus serotinus* Schreber – IUCN Status: LC) is found in a variety of habitats across its wide range including semi-desert, temperate and subtropical dry forest, Mediterranean-type shrubland, farmland and suburban areas. Favoured feeding areas include pasture, parkland, open woodland edge, tall hedgerows, gardens, and forested regions. Feeds on larger beetles, moths and flies. Most summer (maternity) colonies are in buildings and occasionally tree holes or rock fissures. In winter it roosts singly or in small numbers in buildings and rock crevices, or often in underground habitats in north central Europe. Winter roosts are usually in fairly cold, dry sites. It is a largely sedentary species, with movements to 330 km recorded.

Table 40: Mammals Identified Within the Project Area Based on Literary Sources

#	Latin name	Common name	GRL	IUCN	Other protection	Number of section
1.	*Erinaceus concolor Martin.*	Southern whitebreasted Hedgehog		LC		1/2/3/4/5
2.	*Suncus etruscus Savi.*	Pygmy whitetoothed shrew		LC	Appendix III of the Bern Convention.	1/2/3
3.	*Rhinolophus hipposideros Bechstein.*	Lesser horseshoe bat		LC	Bonn Convention (Eurobats); Bern Convention; Annex II (and IV) of EU Habitats and Species; Some habitat protection through Natura 2000	1/2/3
4.	*Pipistrellus pipistrellus Schreber.*	Common pipistrelle		LC	Bonn Convention (Eurobats); Bern Convention in parts of its range where these apply, and is included in Annex IV of the EU Habitats and Species Directive.	1/2/3
5.	*Eptesicus serotinus Schreber.*	Serotine		LC	Bonn Convention (Eurobats); Bern Convention in parts of range where these apply. It is included in Annex IV of EU Habitats and Species Directive, and there is some habitat protection through Natura 2000.	1/2/3
6.	*Vespertilio murinus Linnaeus.*	Particoloured bat		LC	Bonn Convention (Eurobats); Bern Convention, in parts of its range where these apply. It is included in Annex IV of EU Habitats and Species Directive	1/2/3//5
7.	*Dryomys nitedula Pallas.*	Forest dormouse		LC	Bern Convention (Appendix III); EU Habitats and Species Directive (Annex IV), in parts of its range where these apply.	1/2/3
8.	*Arvicola terrestris Linnaeus.*	Eurasian water vole		LC		4
9.	*Microtus arvalis Pallas.*	Common vole		LC		1/2/3/4/5
10.	*Terricola nasarovi Shidlovsky.*	Nazarov pine vole		LC		1/2/3
11.	*Sylvaemus uralensis Pallas.*	Pygmy wood mouse				1/2/3
12.	*Mus musculus Linnaeus.*	House mouse		LC		1/3/4/5
13.	*Sciurus anomalus Gmelin.*	Caucasian squirrel	VU	LC	EU Habitats Directive (92/43) IV 21/05/92; Bern Convention II 01/03/02, in parts of its range where these apply. Occurs in protected areas. Population monitoring is recommended, particularly in parts of the range where declines have been noted.	4/5
14.	*Lutra lutra Linnaeus.*	Eurasian otter, Common	VU	NT	Appendix I of CITES, Appendix II of the Bern	3

#	Latin name	Common name	GRL	IUCN	Other protection	Number of section
		otter			Convention, Annexes II and IV of the EU Habitats and Species Directives.	
15.	*Mustela nivalis Linnaeus.*	Least weasel		LC	Appendix III of the Bern Convention.	1/2/3/4/5
16.	*Felis silvestris Shreber.*	Wild cat		LC	CITES Appendix II (http://www.cites.org/eng/app/appendices.php); is fully protected across most of its range in Europe and Asia, but only some of its African range; is listed on the EU Habitats and Species Directive (Annex IV) as a "European protected species of animal"; listed in Appendix II of the Bern Convention. It is classed as threatened at the national level in many European range states (IUCN 2007).	4/5
17.	*Canis aureus Linnaeus.*	Golden jackal		LC		2/3/4
18.	*Vulpes vulpes Linnaeus.*	Red fox		LC		1/2/3/4
19.	*Canis lupus*	Wolf		LC	Bern, CITES Appendix II	2/4/5
20.	*Sus scrofa Linnaeus.*	Eurasian wild boar		LC		3/4
21.	*Martes martes*	European pine marten		LC	Appendix III of the Bern Convention and Annex V of the European Union Habitats Directive, and it occurs in a number of protected areas across its range.	4/5

GRL – Red List of Georgia; IUCN - International Union for Conservation of Nature; VU = Vulnerable; LC = Least Concern.
Note: From expert opinion the presence of Brown Bear and Lynx was considered to be unlikely

314. Avifauna - The majority of birds found on the study area are presented by forest, shrubbery and other species, birds related to rocky places and waterfowls. The list of bird species potentially available in the project area (based on the desk top analysis of available data) is given in Table 41 below. None of these species are protected. The territory is not significant habitat for birds and does not include priority habitats for avian species (see Figure 74**).**

Figure 74: Significant Bird Habitat in Georgia

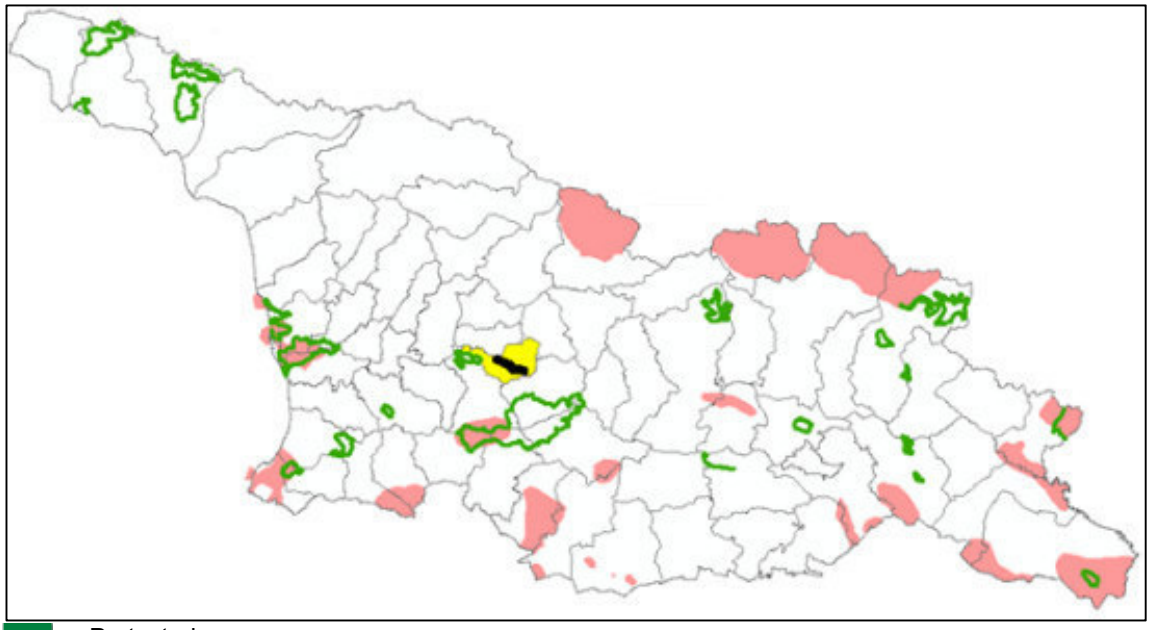


Table 41: Birds within the study area, known according to literary sources

#	Latin name	Common name	Georgian Red List	Season	IUCN	Other protection
1.	*Motacilla alba*	White Wagtail	-	YR-R, M	LC	Bern Convention
2.	*Apus apus*	Common Swift	-	BB, M	LC	Bern Convention
3.	*Merops apiaster*	European Bee-eater	-	BB, M	LC	
4.	*Corvus cornix*	Hooded Crow	-	YR-R	LC	
5.	*Garrulus glandarius*	Eurasian Jay	-	YR-R	LC	
6.	*Turdus merula*	Eurasian Blackbird	-	YR-R	LC	Bern Convention
7.	*Delichon urbicum*	House-Martin	-	BB, M	LC	Bern Convention
8.	*Sturnus vulgaris*	Common Starling	-	YR-R, M	LC	
9.	*Columba livia*	Rock Dove	-	YR-R	LC	
10.	*Columba oenas*	Stock Dove	-	YR-R	LC	
11.	*Columba palumbus*	Wood-Pigeon	-	YR-R	LC	
12.	*Hirundo rustica*	Barn Swallow	-	BB, M	LC	Bern Convention
13.	*Oriolus oriolus*	Golden Oriole	-	BB, M	LC	Bern Convention
14.	*Turdus viscivorus*	Mistle Thrush	-	YR-R, M	LC	Bern Convention
15.	*Erithacus rubecula*	European	-	YR-R	LC	Bern Convention

#	Latin name	Common name	Georgian Red List	Season	IUCN	Other protection
		Robin				
16.	*Fringilla coelebs*	Chaffinch	-	YR-R, M	LC	Bern Convention
17.	*Cuculus canorus*	Common Cuckoo	-	BB, M	LC	Bern Convention
18.	*Phoenicurus phoenicurus*	Common Redstart	-	BB, M	LC	Bern Convention
19.	*Passer domesticus*	House Sparrow	-	YR-R	LC	
20.	*Carduelis carduelis*	European Goldfinch	-	YR-R, M	LC	Bern Convention
21.	*Carduelis chloris*	Greenfinch	-	YR-R, M	LC	Bern Convention
22.	*Parus major*	Great Tit	-	YR-R	LC	Bern Convention
23.	*Parus caeruleos*	Blue tit	-	YR-R	LC	Bern Convention
24.	*Lanius collurio*	Red-backed Shrike	-	BB, M	LC	Bern Convention
25.	*Turdus philomelos*	Song Thrush	-	YR-R, M	LC	Bern Convention
26.	*Aegithalos caudatus*	Long-tailed Tit	-	YR-R, M	LC	Bern Convention
27.	*Falco tinnunculus*	Common Kestrel	-	YR-R, M	LC	Bonn Convention, Bern Convention
28.	*Buteo buteo*	Common Buzzard	-	YR-R, M	LC	Bonn Convention, Bern Convention
29.	*Ardea cinerea*	Grey Heron	-	YR-R	LC	Bonn Convention, Bern Convention
30.	*Egretta garzetta*	Little Egret	-	YR-R	LC	
31.	*Nycticorax nycticorax*	Night-Heron	-	BB, M	LC	Bonn Convention, Bern Convention
32.	*Tadorna ferruginea*	Ruddy Shelduck	-	YR-R	LC	
33.	*Anas platyrhynchos*	Mallard	-	YR-R, M	LC	Bonn Convention, Bern Convention
34.	*Milvus migrans*	Black Kite	-	YR-R, M	LC	Bonn Convention, Bern Convention
35.	*Accipiter nisus*	Sparrowhawk	-	YR-R, M	LC	Bonn Convention, Bern Convention
36.	*Accipiter gentilis*	Goshawk	-	YR-R, M	LC	Bonn Convention, Bern Convention
37.	*Larus ridibundus*	Black-headed Gull	-	YR-R, M	LC	
38.	*Upupa epops*	Common Hoopoe	-	BB, M	LC	Bern Convention
39.	*Corvus frugilegus*	Rook	-	YR-R, M	LC	
40.	*Luscinia megarhynchos*	Luscinia megarhynchos	-	BB, M	LC	
41.	*Phylloscopus collybita*	Common Chiffchaff	-	BB, M	LC	
42.	*Sylvia atricapilla*	Blackcap	-	BB, M	LC	

GRL- Red List of Georgia; IUCN - International Union for Conservation of Nature;
YR-R = nests and reproduces in the area, can be found all year round; YR-V = visitor to these areas. It does not reproduce but is here throughout the year. BB = visits the area only for reproduction
M = Migratory; it can get to the area during migration (in autumn and spring)
LC = Least Concern.

315. Surveys were carried out in: Aug 8-9 2017 - summer, Sept 22-23 2017- autumn; March 1-2 2018 – spring; April 2015 - spring (feasibility stage walkover); and April 22-23, 2018. The schedule allowed a site survey for April which is the start of the breeding period. (Note: Breeding period is April-May, for some species – end of March.). Raptors are not

registered in the area, but may be observed there while chasing a prey. Birds registered during the site surveys and information about their presence in the area is presented below.

Table 42: Birds, observed within the project area during the survey

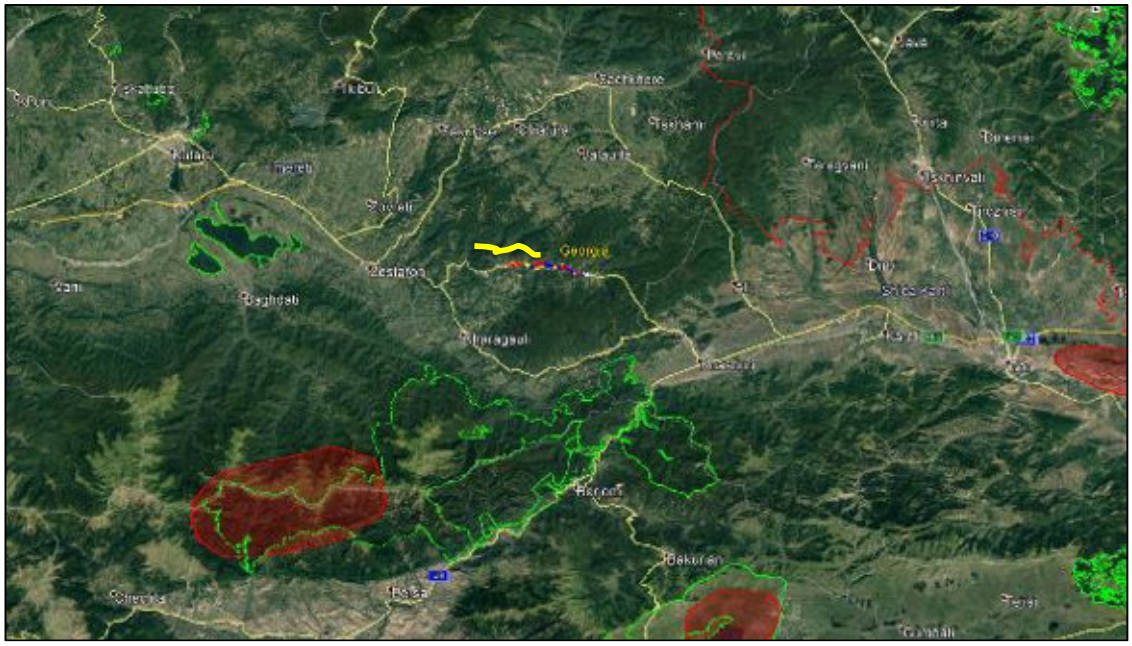
#	Latin name	Common name	Georgian Red List	Season	IUCN	Other protection
1.	*Motacilla alba*	White Wagtail	-	YR-R, M	LC	Bern Convention
2.	*Apus apus*	Common Swift	-	BB, M	LC	Bern Convention
3.	*Merops apiaster*	European Bee-eater	-	BB, M	LC	-
4.	*Charadrius dubius*	Little Ringed Plover	-	YR-R, M	LC	Bonn Convention, Bern Convention
5.	*Larus ridibundus*	Black-headed Gull	-	YR-R, M	LC	Bern Convention
6.	*Corvus cornix*	Hooded Crow	-	YR-R	LC	-
7.	*Garrulus glandarius*	Eurasian Jay	-	YR-R	LC	-
8.	*Turdus merula*	Eurasian Blackbird	-	YR-R	LC	Bern Convention
9.	*Delichon urbicum*	House-Martin	-	BB, M	LC	Bern Convention
10.	*Upupa epops*	Common Hoopoe	-	BB, M	LC	Bern Convention
11.	*Luscinia megarhynchos*	Luscinia megarhynchos	-	BB, M	LC	-
12.	*Turdus viscivorus*	Mistle Thrush	-	YR-R, M	LC	Bern Convention
13.	*Erithacus rubecula*	European Robin	-	YR-R	LC	Bern Convention
14.	*Fringilla coelebs*	Chaffinch	-	YR-R, M	LC	Bern Convention
15.	*Phoenicurus phoenicurus*	Common Redstart	-	BB, M	LC	Bern Convention
16.	*Passer domesticus*	House Sparrow	-	YR-R	LC	-
17.	*Carduelis carduelis*	European Goldfinch	-	YR-R, M	LC	Bern Convention
18.	*Parus major*	Great Tit	-	YR-R	LC	Bern Convention
19.	*Parus caeruleos*	Blue tit	-	YR-R	LC	Bern Convention
20.	*Aegithalos caudatus*	Long-tailed Tit	-	YR-R, M	LC	Bern Convention
21.	*Lanius collurio*	Red-backed Shrike	-	BB, M	LC	Bern Convention
22.	*Phylloscopus collybita*	Common Chiffchaff	-	BB, M	LC	
23.	*Turdus philomelos*	Song Thrush	-	YR-R, M	LC	Bern Convention
24.	*Sylvia atricapilla*	Blackcap	-	BB, M	LC	

GRL- Red List of Georgia; IUCN - International Union for Conservation of Nature;
YR-R = nests and reproduces in the area, can be found all year round.; YR-V = visitor to these areas. It does not reproduce but is here throughout the year. BB = visits the area only for reproduction;
M = Migratory; it can get to the area during migration (in autumn and spring)
LC = Least Concern.

316. The project area is located far from protected areas and areas important for birds (see figure below). The area is not considered as migration corridor.

Figure 75: Overwintering Sites

(Project road in yellow, overwintering sites in red)



317. Reptiles - According to the literary sources, 8 species of reptiles are known to be present in the study area, out of which 2 are lizards, 2 – turtles and 4 – snakes. The only Red-Listed Vulnerable species that is recorded on the nearby territory of the Project road is Mediterranean turtle. This species prefers dry, open scrubby habitats, meadows and pastures, sand dunes, forest, heathlands, and open habitats through its wide range, generally on a sandy-calcareous substrate. The turtle is feeding on leaves, buds, flowers, seeds and fruits of grasses, herbs and shrubs, as well as small invertebrates such as snails, arthropods, and carrion. They emerge from hibernation around March or April depending on the weather. The species are vulnerable to death/injury when in hibernation and less able to escape from disturbance. They are vulnerable to disturbance during breeding season.

Table 43: Reptiles, known within the project area based on literary sources

#	Latin name	Common name	Georgian Red List	IUCN	Other protection
1.	*Natrix natrix* Linnaeus.	Ring snake	LC	LR/LC	Bern Convention
2.	*Natrix tessellate* Laurenti.	Dice snake	LC	LC	Bern Convention
3.	*Coronella austriaca* Laurenti.	Smooth snake	LC	LC	Bern Convention
4.	*Xerotyphlops vermicularis* Strauch.	Blind Snakes	DD	LC	Bern Convention
5.	*Darevskia derjugini*	Artwin Lizard	LC	LC	Bern Convention
6.	*Testudo graeca* Linnaeus	Mediterranean turtle	VU	VU	Bern Convention, the species is included in CITES Appendix II, Habitat Directive
7.	*Emys orbicularis*	European Pond Turtle	LC	NT	Bern Convention
8.	*Lacerta strigata*	Striated Lizard	LC	LC	Bern Convention
9.	*Darevskia rudis*	Spiny-Tailed Lizard	LC	LC	Bern Convention

#	Latin name	Common name	Georgian Red List	IUCN	Other protection
10.	*Anguis colchica*	Caucasian Slow Worm	LC	LC	Bern Convention

VU = Vulnerable; NT = Near Threatened and LC = Least Concern, LR = Low risk, DD-Data Deficient

318. Site surveys were carried out in Aug 8-9 2017- summer, Sept 22-23 2017- autumn, March 1-2 2018 – spring and April 22-23, 2018. Activity of the species depends on weather. In summer, because of the hot weather activity of reptiles was low as they were avoiding overheating. In July and August they can be registered only in the morning and late evening when it is not too hot. During the August and September site survey only the Artwin lizards have been registered. The reptiles usually appear at the end of March. Peak of activity is from mid March until mid June which is the reproduction period. During the March and April surveys the snakes were not registered, however their presence in the areas where lizards are found exists. During the site survey Striated Lizard (4 units). Artwin lizard (3 units) and Slow worm (3 units) have been registered. The Mediterranean turtle was not encountered.

Figure 76: Reptiles Encountered During Site Surveys

Striated Lizard *(Lacerta strigata)*

Derjugin's Lizard/ Artwin Lizard (*Darevskia derjugini*)

Anguis colchica CamonaTvalSi ar aris

319. Amphibians - According to the literary sources, the main amphibian species present in the area include:

Table 44: Amphibians, known within the project area based on literary sources

№	Latin name	Common name	GRL	IUCN	Other protection	Section N
1.	*Hyla orientalis* Linnaeus	European Tree Frog	LC	LC	Bern Convention	4/5
2.	*Bufotes viridis*	European green toad	LC	LC	Bern Convention	4/5
3.	*Pelophylax ridibundus* Pallas.	Marsh frog	LC	LC	Bern Convention	3/4
4.	*Rana macrocnemis camerani* Boulenger.	Long-legged Wood Frog	LC	LC	Bern Convention	4/5

GRL- Red List of Georgia; IUCN - International Union for Conservation of Nature; LC = Least Concern

320. During the site survey the listed species have one individual Marsh frog, tadpole and Long-legged wood frog have been registered near the Dzirula riverbed.

Figure 77: Amphibians Identified During Sites Surveys

Marsh frog (*Pelophylax ridibundus*)

Long-legged wood frog (*Rana macrocnemis*)

321. Insects - The insects know to be present in the project area are listed below.

Table 45: Insects known within the project area based on literary sources

#	Latin Name	Common name	Georgian Red List	IUCN
1.	*Nimphalis antiopa*	Mourning-cloak butterfly	NE	NE
2.	*Lampyris noctiluca*	Glow-worm	NE	NE
3.	*Geotrupes spiniger*	Dumbledor beetle	NE	NE
4.	*Purpuricenus budensis*	Red long-horned Beetle	NE	LC
5.	*Polyommatus amandus*	Amanda's blue butterfly	NE	NE
6.	*Polyommatus corydonius*	False chalkhill blue butterfly	NE	NE
7.	*Polyommatus thersites*	Chapman's blue butterfly	NE	NE
8.	*Cercopis intermedia*	Froghopper	NE	NE
9.	*Vanessa atalanta*	Red admiral butterfly	NE	NE
10.	*Mylabris quadripunctata*	Four-spotted blister beetle	NE	NE
11.	*Dorcus parallelipipedus*	Lesser stag beetle	NE	LC
12.	*Libellula depressa*	Broad-bodied chaser	NE	NE
13.	*Pieris rapae*	European cabbage butterfly	NE	NE
14.	*Plebeius argus*	Silver-studded blue butterfly	NE	NE
15.	*Aphis urticata*	Dark green nettle aphid	NE	NE
16.	*Pieris brassicae*	Cabbage butterfly	NE	NE
17.	*Pyrrhocoris apterus*	Firebug	NE	NE
18.	*Lymantria dispar*	Gypsy moth	NE	NE
19.	*Gryllus campestris*	Field cricket	NE	NE
20.	*Decticus verrucivorus*	Wart-biter	NE	NE
21.	*Tettigonia viridissima*	Great green bush-cricket	NE	NE
22.	*Sympetrum sp.*	Meadowhawks	NE	NE
23.	*Panorpa sp.*	Scorpion-flies	NE	NE
24.	*Lampyris noctiluca*	Common glow-worm	NE	NE

GRL- Red List of Georgia; IUCN - International Union for Conservation of Nature; NE-not evaluated

322. Within the project area Red cricket, blue railed damselfly have been met. No butterflies were registered.

Figure 78: Species Encountered During Site Surveys

Meadowhawk (Simpetrum sp.)

Scorpion-fly (Panorpa sp.)

Table 46: Spiders known within the project area based on literary sources

#	Latin name	Common name	Georgian Red List	IUICN
1.	*Pseudeuophrys sp*	jumping spiders	NE	NE
2.	*Trochosa sp.*	wolf spider	NE	NE
3.	*Amaurobius sp.*	araneomorph spiders	NE	NE
4.	*Argiope lobata*	Silver-faced	NE	NE
5.	*Menemerus semilimbatus*	Jumping spiders	NE	NE
6.	*Pardosa hortensis*	Wolf spiders	NE	NE
7.	*Larinioides cornutus*	Furrow orb spider	NE	NE
8.	*Misumena vatia*	Goldenrod crab spider	NE	NE
9.	*Pisaura mirabilis*	Nursery web spider	NE	NE
10.	*Micrommata virescens*	Green huntsman spider	NE	NE
11.	*Agelena labyrynthica*	Eurasian grass spiders	NE	NE
12.	*Asianellus festivus*	Jumping spiders	NE	NE

GRL- Red List of Georgia; IUCN - International Union for Conservation of Nature; NE-not evaluate

F.2.3 Aquatic Ecology

323. **Fish –** Table 47 indicates the fish species that can be found in the Project area.

Table 47: List of fish species available in the Rikotula and Dzirula River

#	Latin name	Common name	Protection status
1	Leuciscus leuciscus Linnaeus, 1758	Common dace	Low commercial value;IUCN – LC
2	Chondrostoma colchicum Derjugin, 1899 /Chondrostoma colchicum (Kessler) Derjugin	Colchic nase	Low commercial value due to limited stock. IUCN – LC
3	Capoeta sieboldi Steindachner, 1864/Varicorhinus sieboldin (Steindachner)	Colchic khramulya	GRL-VU (B2a)
4	Neogobius fluviatilis, Pallas 1814/ Gobius fluviatilis Pallas	Monkey goby	GRL-VU (B2a), IUCN – LC
5	Cobitis taenia Linnaeus, 1758	Spined loach	Bern Convention, Annex III, IUCN –LC
6	Alburnus alburnus, Linnaeus, 1758	Bleak	IUCN - LC

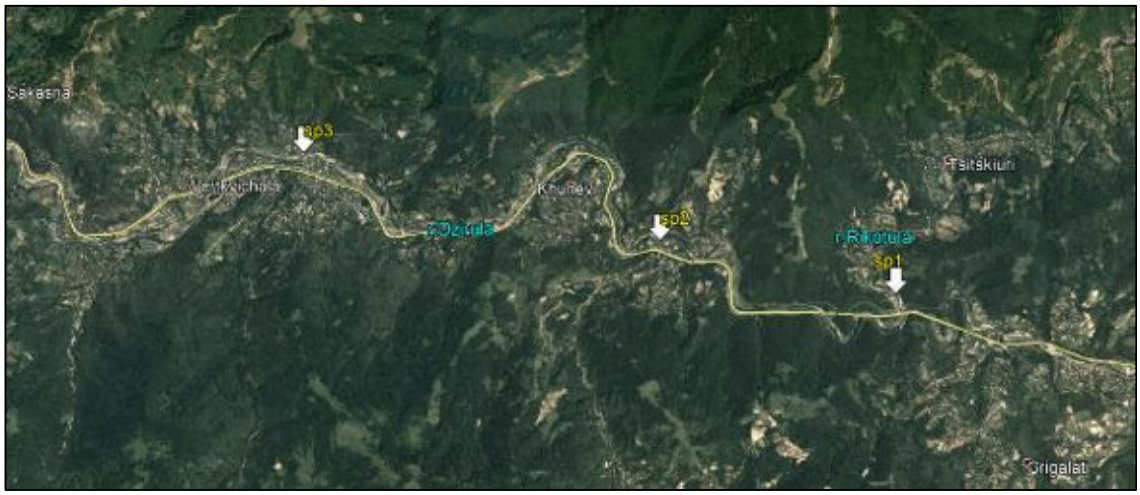
IUCN-The International Union for Conservation of Nature; GRL – Red List of Georgia
LC – Least Concern; NE - Not Evaluated; VU-Vulnerable
Source: N.Ninua, B.Japoshvili, V.Bochorishvili – Fish of Georgia, 2013/R.Elanidze, M.Demetrashvili, Animal worls of Georgia, IV, 1973

324. The active spawning periods of these fish are indicated in Figure 80.

325. Control catches have been carried out in during the March and April surveys. Three locations were checked.

(i) Sp1 - 366940.00 m E, 4662205.00 m N (r.Rikorula).
(ii) Sp2 - 365045.00 m E, 4662651.00 m N (r.Dzirula).
(iii) Sp3 - 362154.00 m E, 4663386.00 m N (r.Dzirula).

Figure 79: Control points in Dzirula and Rikotula rivers, Section F2 of alignment



326. Similarly to composition of the control catches in Section F4 the species registered in studied sections of F2 included Colchic khramulya (3 units) and Chub (2 units). Length 25-35cm, weight 230-350 grams.

Table 48: Species found as the result of fishing in the project area

Common name	Latin name	Qty	**Length, cm**	**Weight, g**	**Gender and maturity stage**	**Age**
Barbel	*Barbus tauricus rionica* Kamensky, 1899	1	14.5	52	♂ III	3+
Colchic khramulya	*Capoeta sieboldi* Steindachner, 1864	3	18.0	64	♂ III	4+
			32	372	♀ V	4+
			24	225	♂ V	3+
Common dace	*Leuciscus leuciscus* Linnaeus, 1758	1	27	358	♀ V	3
Colchic nase	*Chondrostoma colchicum* Derjugin, 1899	1	17.5	94	♂ III	3+

Figure 80: Active Spawning Periods

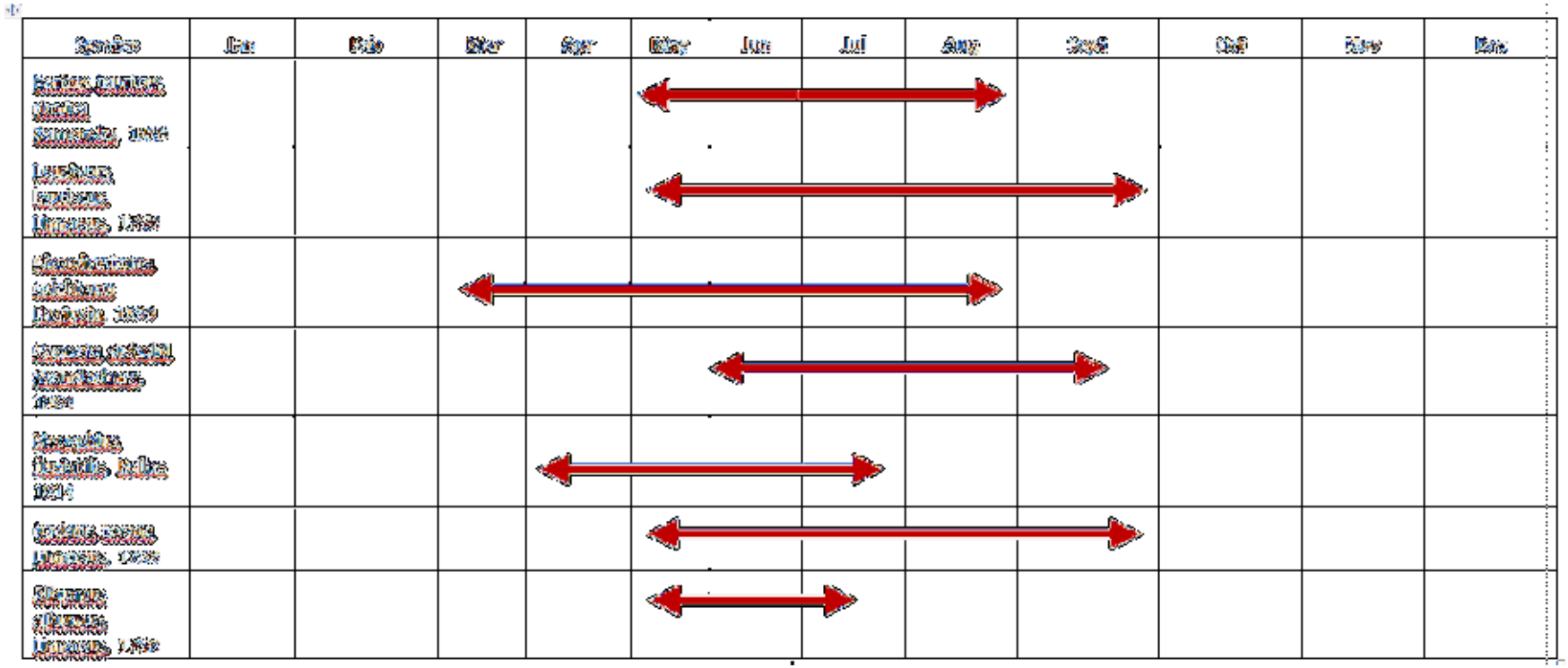


Figure 81: Controlled Catches

Barbel (*Barbus tauricus rionica* Kamensky, 1899), Colchic khramulya (*Capoeta sieboldi* Steindachner, 1864)

Colchic nase (*Chondrostoma colchicum* Derjugin, 1899)

Colchic khramulya (*Capoeta sieboldi* Steindachner, 1864)

Common dace (*Leuciscus leuciscus* Linnaeus, 1758)

327. No fish was obtained during the control catches in the Rikotula river.

328. Hydro chemical and hydro biological survey data - The survey covered locations near the river crossing sections in the Dzirula and Rikotula rivers. The basic characteristics measured on the site are listed below.

Table 49: Chemical Characteristics of the Dzirula and Rikotula Rivers

Dzirula river	
Suspended solids	14 mg/l
Dissolved oxygen	10.8 mg/l
pH	7.0
Water temperature	$+11^0$ C
Air temperature	+210 C
Rikorula river	
Suspended solids	26 mg/l
Dissolved oxygen	6.3 mg/l
pH	6,5
Water temperature	+120 C
Air temperature	+210 C

329. For assessment of availability of fish base for fish, macro-invertebrate and aquatic plants in 18 sections have been checked. On the stones within the riverbed various species were

registered (see Figure 82). The surveys allow us to say that aquatic flora is abundant, whereas colonies of macro-invertebrates are observed in fragmented areas.

Figure 82: Survey Locations

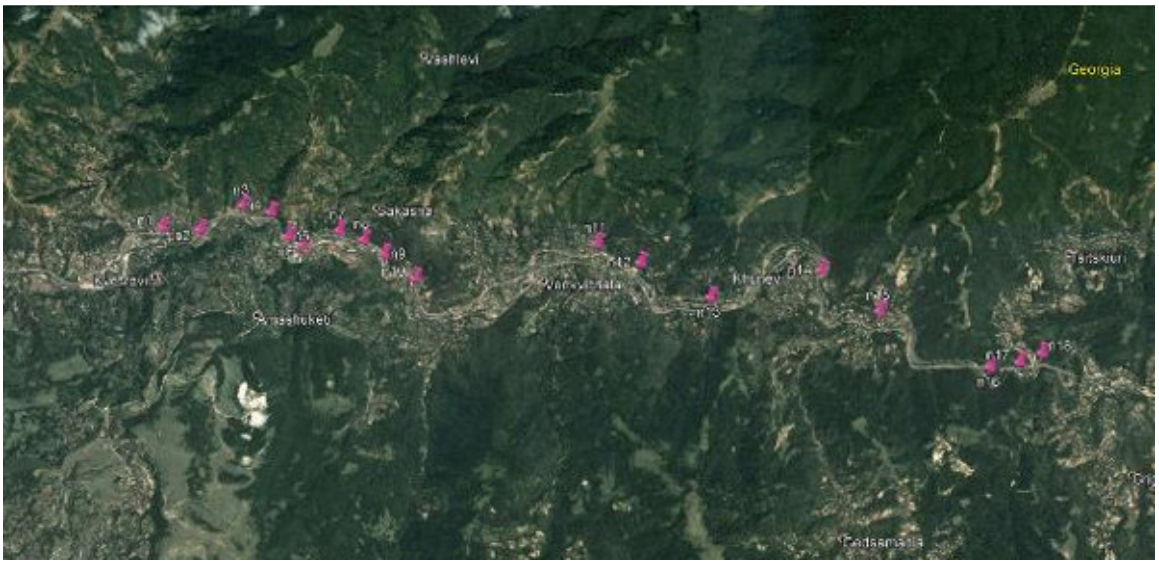
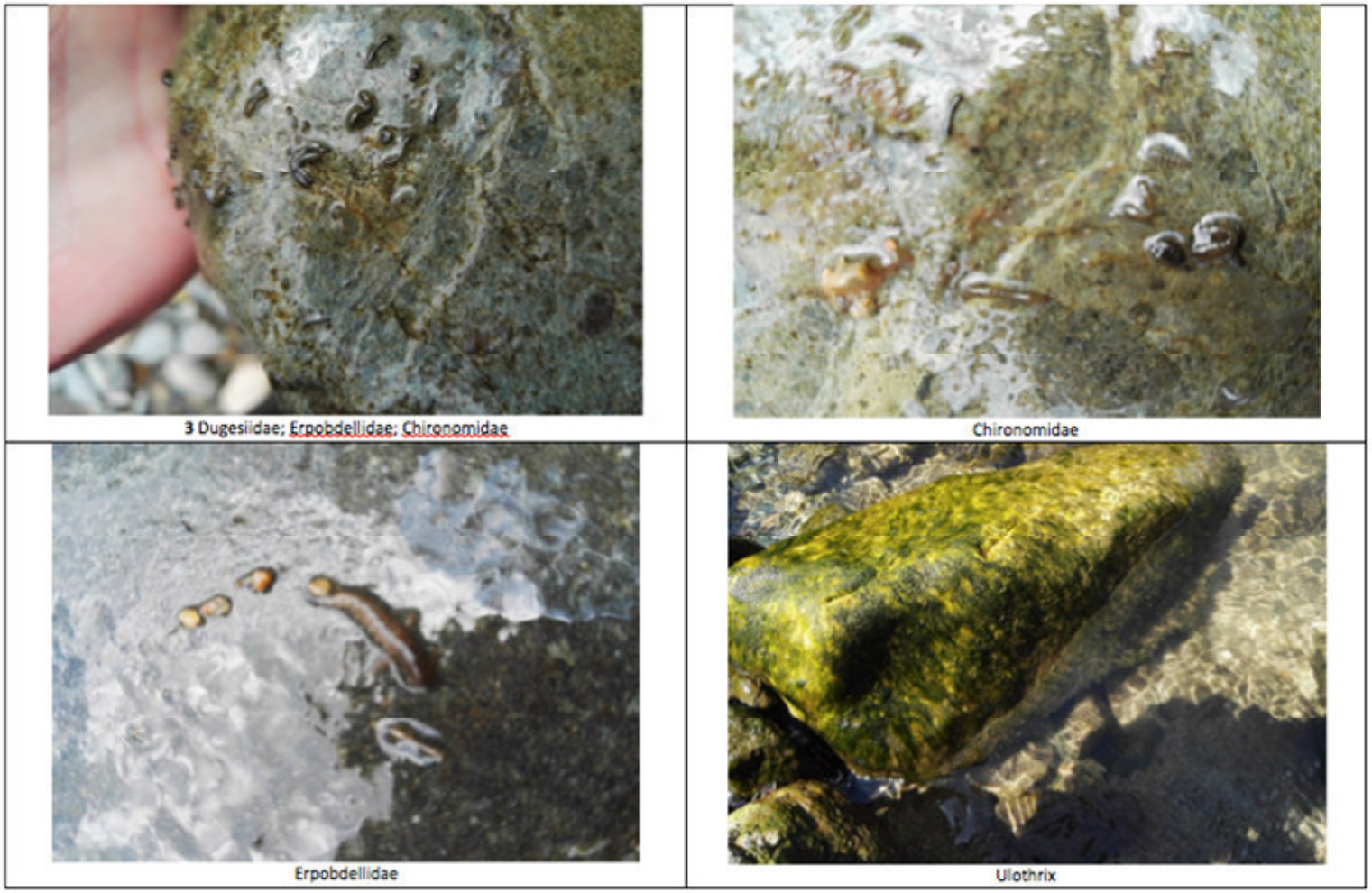


Figure 83: Aquatic Plants and Periphyton Surveyed

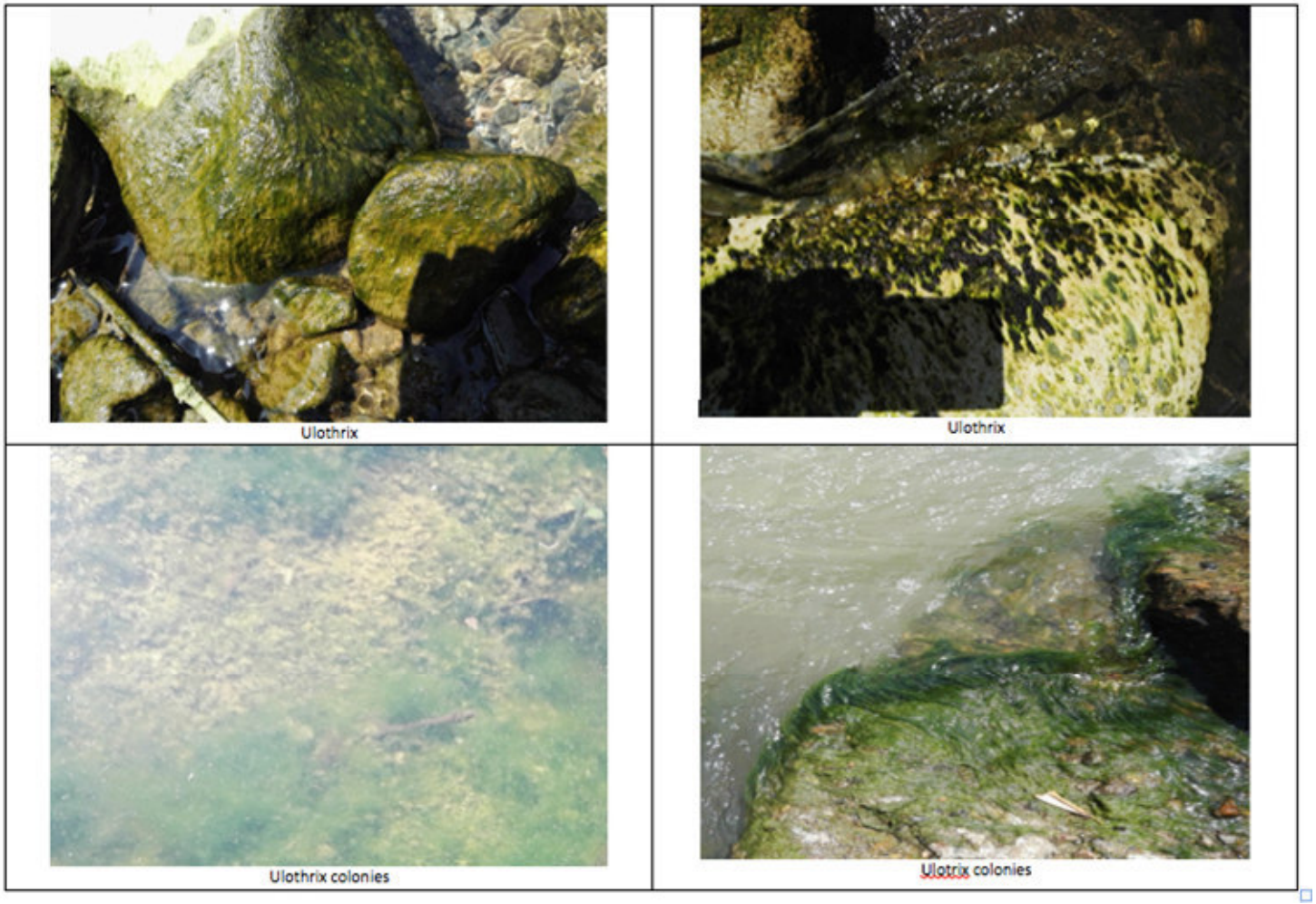


3 Dugesiidae; Erpobdellidae; Chironomidae

Chironomidae

Erpobdellidae

Ulothrix


Ulothrix
Ulothrix
Ulothrix colonies
Ulotrix colonies

F.2.4 State Forest Fund

330. The State Forest Fund (SFF) is a state-managed/controlled forest area under the management of the MoEPA but is not a protected area. Though it is not protected, for the purpose of controlling its use, the MoEPA requires all trees to be taken of the SFF registration or "de-listed" before they can be cut.

331. According to the ToR for this EIA:
"Particular attention should be given to the presence of land plots registered as the State Forest Fund (SFF). If the right of the way of the selected alignment of the road section overlaps with the territory of the SFF, The consultant should prepare:

(i) *Cadastral measurement drawing for the relevant plot of the alignment (.shp files);*
(ii) *According to the effective law, conduct preliminary inventory of timber resources existing at the territory, which should be taken of the SFF registration, or 'de-listed';*
(iii) *In accordance with the Georgian legislation, provide relevant information on obtaining a cutting permit for species included in the Red List (if any);*
(iv) *Prepare Tree Compensation Plan according to the de-listing documentation"*

332. The Project area has been surveyed to determine the extent of the SFF that will be affected by the Project.

333. An inventory of the timber resources has also been prepared which is summarized in **Appendix G**. A total of 4,896 trees more than 8cm in diameter were recorded for de-listing, including the following Georgian red-listed species:

(i) 16 Chestnut (greater than 8cm in diameter).
(ii) 2 English Walnut (greater than 8cm in diameter).

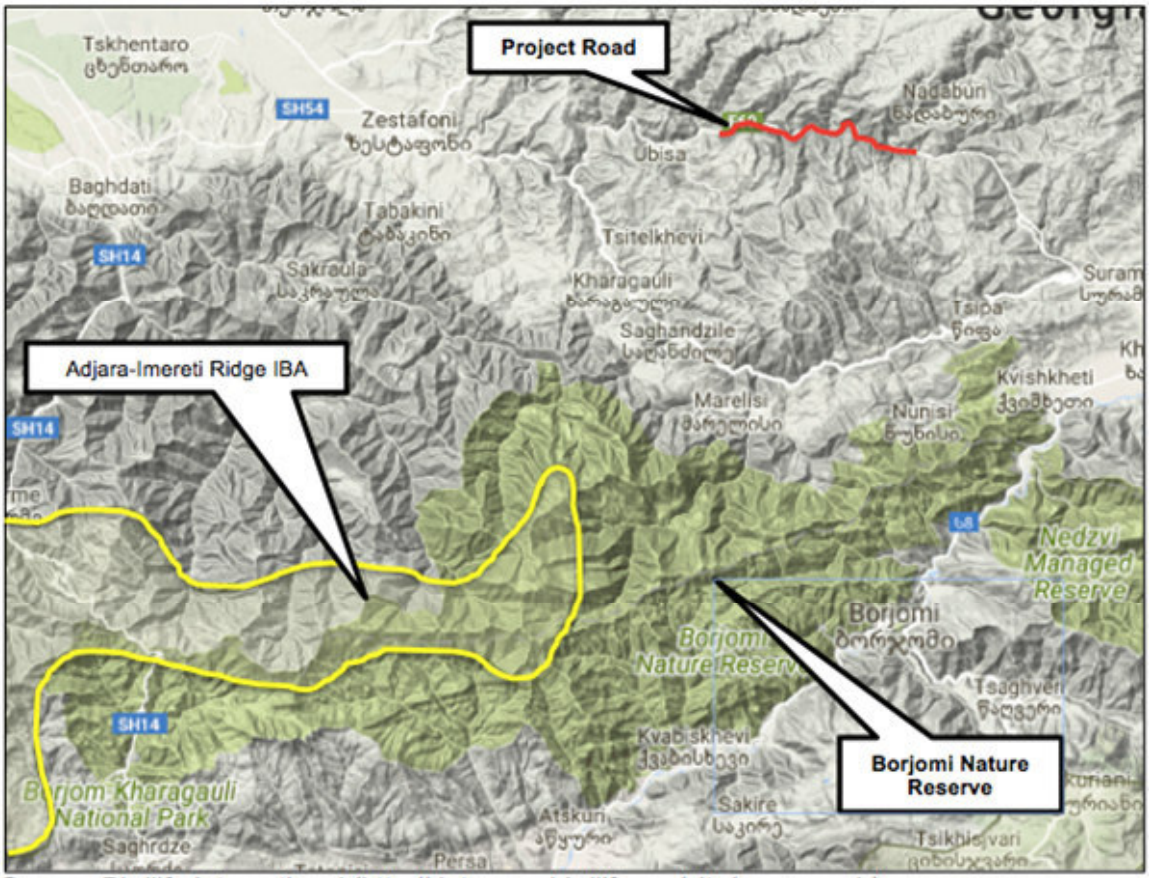
334. In addition a further 46,094 trees less than 8cm in diameter were recorded for de-listing.

335. relating to the compensation for tree cutting according to national legislation and compensation in terms of habitat restoration to achieve 'no net loss' is included in **Section G.6.1**.

F.2.5 Protected Areas

336. The nearest protected area is the Borjomi Nature Reserve which is located more than 15 kilometers south of the Project road, see Figure 84.

Figure 84: Protected Areas and IBAs Within the Vicinity of the Project Road



Source: Birdlife International (http://datazone.birdlife.org/site/mapsearch)

337. The nearest Important Bird Area (IBA) to the Project road is the Adjara-Imereti Ridge more than twenty kilometers south of the Project road which overlaps with the Borjomi Nature Reserve. The IBA comprises populations of the following IBA trigger species:

(i) Caucasian Grouse Lyrurus mlokosiewiczi (IUCN Category – NT).
(ii) Corncrake Crex crex (IUCN Category – LC).
(iii) Great Snipe Gallinago media (IUCN Category – NT).
(iv) Eastern Imperial Eagle Aquila heliaca (IUCN Category – VU).
(v) Caspian Snowcock (IUCN Category – LC).[19]

F.3 Economic Development

F.3.1 Industries, Agriculture and Businesses

338. Agriculture - 1.5% of the total area of Kharagauli municipality is used for agricultural purposes. 70.9% of this territory is occupied by pastures and 29.1% is used for ploughing and sowing, annual crops grow over 22.5% of the area, permanent plantings grow over 11,5% and perennial plants grow over 6,6% of the area. Out of agricultural branches, cattle-breeding and bee-keeping are developed the best. Kharagauli municipality is the leading municipality of bee-keeping in Georgia.

339. As part of the Projects social survey 138 families were interviewed and asked what crops they grow on their land. Table 50 provides a list of the crops grown by the households

[19] https://www.ibatforbusiness.org/kbafactsheet/m18572

interviewed. The agricultural land affected by the Project is outlined in **Section G.7.2 – Land Use**.

Table 50: Crops Grown By Households in the Project Area

Crop	Number of Families Growing the Crop
Corn	99
Fruits	106
Potato	67
Vegetables	109
Walnut/Hazelnut	77
Gripe	88
Hay	6

340. Industry - During the Soviet times, industry was well-developed in Kharagauli municipality, with food enterprises, mining industry and timber plants, wine, milk and furniture complexes of enterprises. However, industrial activity has declined in the area since then and few large scale industrial activities remain such as the mineral water company "Zvare". Folk trade is highly developed in the municipality including weave baskets, vintage baskets, flower bowls and breadbaskets with lime-tree and cherry-tree bark and nut wicker with high techniques and make pots, jugs, wine bowls and pitchers with clay. They decorate the clay ware by glazing, painting, scratching and with relief figures.

341. Within the Project area, it is important to underline the role of the restaurant and coffee shops along the alignment that, other than employing local people (both men and woman), offer important services for the national and international travellers such as parking rest areas and small workshop repairs that are very important for road safety and travellers comfort. Moreover those services represent a valuable source of income for the locals that sell their products both to the restaurants and directly to the travellers the road.

342. According to the Project social survey, it is envisaged that the road construction will bring more opportunities into the whole area. First of all to the agricultural traditional sector whose products will easily reach the main market places like Tbilisi and Kutaisi, Batumi and Poti. It's also expected a seasonal adjustment of the tourism period stretching and increasing the presence of visitors all along the year encouraging moreover the week end holidays visits. In other words thank to the time travel reduction especially from the metropolitan area of Tbilisi an increase of presence will be significant allowing the consolidation of the tourist sector enlarged industry whose boundaries are not still completely reached allowing other internal localities to be reached easily by a sustainable tourism. That means the possibility to curb the emigration toward the main town and cities encouraging the creation of stable and well remunerated jobs.

343. Finally it can be said that the realization of the Project complies with the integrated geo-tourism development approach outlined in the Strategic Environmental Cultural Heritage and Social Assessment contained in the ITDS (Imereti Tourist Development Project – funded by the World Bank) comprising multi-sectoral interventions, managed vertical investments, coordinated elaboration of tourist circuits and destination sites, targeted support to cost efficient and environment-friendly tourist packages, and protection of local communities and cultural heritage through promotion of responsible tourism.

F.3.2 Infrastructure and Transportation facilities

F.3.2.1 Road, Rail and Air

344. The road network in the Project area is dominated by the existing E-60 which links Tbilisi with Batumi. Numerous local roads feed directly onto the existing E-60 in the Project area, and these roads vary in condition from good to very poor. There are no rail networks or airports within the Project area. The nearest railway station is located in Dzirula more than ten kilometers west of the Project road.

F.3.2.2 Utilities

345. A detailed assessment of the utilities was undertaken by the design consultants. After official correspondence with the companies and utilities in the region it was established that the following companies have utilities services in the Project area:

(i) Telecoms: Delta-Comm, FOPTNET, PCMAX, Silknet.
(ii) Gas supply: Socar Georgia.
(iii) Electricity Transmission and Distribution: Energo-Pro.

346. All the companies provided drawings and information on the precise locations of the utilities to the Design consultant and the RD.

F.3.2.3 Housing Stock

347. The housing stock in the Project area comprises almost exclusively of older one or two storey houses that are distributed mainly along the valley slopes.

F.4 Social and Cultural Resources

F.4.1 Socio-economic conditions

F.4.1.1 Administrative Issues

348. The Project road is located within the Region of Imereti. Imereti occupies a territory of approximately 6,552km^2 (9.4% of Georgia's area). Imereti consists of twelve administrative districts: Kutaisi (the Capital of the region), Tkibuli, Tskaltubo, Chiatura, Baghdati, Vani, Zestaphoni, Terjola, Samtredia, Sachkhere, Kharagauli, Khoni. There are 542 settlements in the region of which: 10 cities (Kutaisi, Tkibuli, Tskaltubo, Chiatura, Baghdati, Vani, Zestaponi, Terjola, Samtredia, Sachkhere, and Khoni); 3 towns (Shorapani, Kulashi and Kharagauli); and 529 villages. The Project road is located within Kharagauli Municipality.

F.4.1.2 Demographics

349. According to the most recent census data (2014), Imereti has a population of 533,906 which is a significant decrease from the 2002 census when the population was recorded as 699,666. The population of Kharagauli was 19,473 the majority of which is classified as rural and only 1,965 as 'urban' (see Table 51 below).

Table 51: Population of Imereti and its Municipalities

	Total Population	Urban	Rural
Imereti	**533,906**	**258,510**	**275,396**
Kutaisi, City of	147,635	147,635	-
Baghdati Municipality	21,582	3,707	17,875
Vani Municipality	24,512	3,744	20,768
Zestafoni Municipality	58,401	20,917	37,124

	Total Population	Urban	Rural
Terjola Municipality	35,563	4,644	30,919
Samtredia Municipality	48,562	27,020	21,542
Sachkhere Municipality	37,775	6,140	31,635
Tkibuli Municipality	20,839	9,770	11,069
Tskaltubo Municipality	56,883	11,281	45,602
Chiatura Municipality	39,884	12,803	27,081
Kharagauli Municipality	**19,473**	**1,965**	**17,508**
Khoni Municipality	23,570	8,987	14,583

350. 99.4% of the population of Imereti are Georgians, the remaining 0.6% is made up of Abkhazians (0.1%), Russians (0.3%), Armenians (0.1%) and Osetians (0.1%). [20] There are no ethnic minorities or indigenous people in the project area.

351. Vulnerable Groups – The following data has been collected as part of the social survey (Table 52). The data indicates that nearly 10% of the households interviewed live below the poverty line.

Table 52: Vulnerable Groups Identified in the Social Survey

Village	Number of Interviewed families	Below Poverty Line		Group of disabilities		Refugees/IDP		Other	
		N of Families	N of people	N of Families	N of people	N of Families	N of people	N of Families	N of people
Makatubani	19	3	13	4	4	0	0	0	0
Sakasria	22	2	8	2	2	2	3	0	0
Vertkvichala	22	1	1	1	4	1	3	0	0
Khunevi	25	3	3	1	1	0	0	2	2
Khevi	17	0	0	1	1	0	0	0	0
Total	105	9	25	9	12	3	6	2	2

Source: Section F2 Draft LARP. March 2018.

F.4.1.3 Employment

352. According to the social survey prepared as part of the Project LARP the employment in the Imereti region is higher than the average of the country (+3.62%). The existence of a strong agricultural sector together with the remnants of industrial activities (especially manufacturing in Kharagauli) and the widespread presence of the tertiary sector (retail, bar, restaurant and cafes, workshop and ancillary services for the transport sector) is the reason of this higher level of employment.

353. The economically active population of Kharagauli municipality is mainly employed at public bodies, in education, timber industry, production, sales and processing of agricultural products and tourism.

354. As for the residents of the villages near the Project road, it's noted that the majority are self-employed and that the unemployment level is high. The main source of income is from agriculture (mostly, cattle-breeding, corn-growing and bee-keeping). The population sell their agricultural products in villages, and in some instances, as a part-time job, a certain proportion of the population sell their agricultural products according to the season at the roadsides of the highway at some public outlets located along the road (maize, honey, walnuts, nuts, strawberry etc.).

[20] www.geoxtati.ge. 2014

F.4.1.4 Settlements

355. The following settlements can be found within the Project area:

(i) Khevi - The village of Khevi is the starting point of F2 and is located on the western slope of Likhi Ridge, on the bank of river Rikotula, at 520 masl. The village comprises 243 homes with 1,349 residents. The old name of the village is Khevijvari.

(ii) Grigalati - The Village of Grigalati is located on the northern slope of the dividing ridge of the rivers Dzirula and Rikotula, at 600 masl, 48 km from Kharagauli.

(iii) Khunevi - The next settlement on the route toward Zestaponi is the village of Khunevi, 37 Km from Zestaponi and 34 from Kharagauli with a population of 436 inhabitants.

(iv) Vertkichava - The next village touched by the new road and existing alignment is the village of Vertkichava with a total population of 405.

(v) Sakastria - The village has a population of 323 inhabitants.

(vi) Boriti - The next settlements whose territory is traversed by the existing road and new alignment is the village of Boriti, 26 Km from Kharagauli, with a total of 283 inhabitants. Boriti as with other villages along the route, is mainly rural a settlement with some bed & breakfast and traditional Georgian restaurants.

F.4.2 Community Health, Safety & Education

F.4.2.1 Health

356. Dostakari-Beriti Emergency Medical Care Clinic in Boriti is located adjacent to the existing road (see Figure 85). The new alignment will pass more than 300 meters south of the hospital with a tunnel (TUN 2011 AT/TA) at KM11.5.

Figure 85: Dostakari-Beriti Emergency Medical Care Clinic

F.4.2.2 Safety

357. According to data provided by the RD, during the period 2012 – 2016 there were 2,713 collisions, 471 persons killed and 4,913 persons injured spread over the E-60 corridor, from km 18 to km 302 (284 km in total, from Tbilisi to Khobi) with some notable cluster locations. In

other words, it means 1 collision every 16 hours, 1 person killed every 4 days and 1 person injured every 9 hours.

358. Focusing the analysis on the Khevi – Argveta section, 351 collisions, 78 persons killed and 648 persons injured. Finally, along the F2 section 106 collisions occurred, with 25 persons killed and 204 persons injured. This data is summarized in Table 53, whereas Table 54 shows the collisions rates in terms of "crashes per km".

Table 53: Collisions and Casualties in the Period 2012 – 2016

E-60 Road Section	km	Collisions	Injured	Killed
Tbilisi – Khobi	284	2,713	4,913	471
Khevi – Argveta	50	351	648	78
F2	12.2	106	204	25

Table 54: Collisions and Casualties Rates in the Period 2012 – 2016 (per km)

E-60 Road Section	km	Collisions	Injured	Killed
Tbilisi – Khobi	284	9.55	17.30	1.66
Khevi – Argveta	50	7.02	12.96	1.56
F2	12.2	6.63	12.75	1.56

359. Data provided for Section F4 of the E-60 reveal that 24% of collisions involve pedestrians, thus showing that the protection of vulnerable road users is a major issue on the E-60. Regarding the causes of the crashes in section F4, according to data, the main one is defined as "wrong maneuver" (55%). It is interesting to underline that 30% of collisions are caused by dangerous overtaking and 7% by tailgating. These causes are strictly related to the type of cross-section (2 lanes) and the geometry (curvy alignment with few straight sections for safe overtaking).

F.4.2.3 Education and Educational Facilities

360. Three educational facilities are located within the Project area as listed in Table 55 below.

Table 55: Schools in the Project Area (within 1 km)

#	Name	Location	No. of Pupils	Distance (m)	
				From existing alignment	From new alignment
1	Public School of Verkvichchala	Verkvichchala	330	100m south	250m south
2	Public school of village Vashlevi	Vashlevi	150	50m east	50m south
3	Khunevi School	Khunevi	75	25m north	50m south

361. Two of the schools are located within 50 meters of the new alignment as illustrated by Figure 86 and Figure 87.

F.4.3 Waste Management

362. Waste management, in compliance with international standards, has been playing an increasingly important role for Georgia after the country signed the Association Agreement with the EU. Currently solid waste disposal at the landfill is the only form of waste management in Georgia. The situation in regards to domestic and industrial wastewater

management is complicated, as in most cases industrial and non-industrial wastewaters are discharged into surface waters without prior treatment.

363. Inert waste, including construction waste, is partially disposed at non-hazardous waste landfills and is used for filling/leveling activities in the construction of infrastructure facilities. There are no management systems for specific waste, including separated collection systems. However, recycling of specific waste, such as tires, batteries, packaging waste, etc., or disposal (such as asbestos waste) does occur in fragmented and uncoordinated way.

Figure 86: Location of Public school of village Vashlevi (approx. KM8.6)

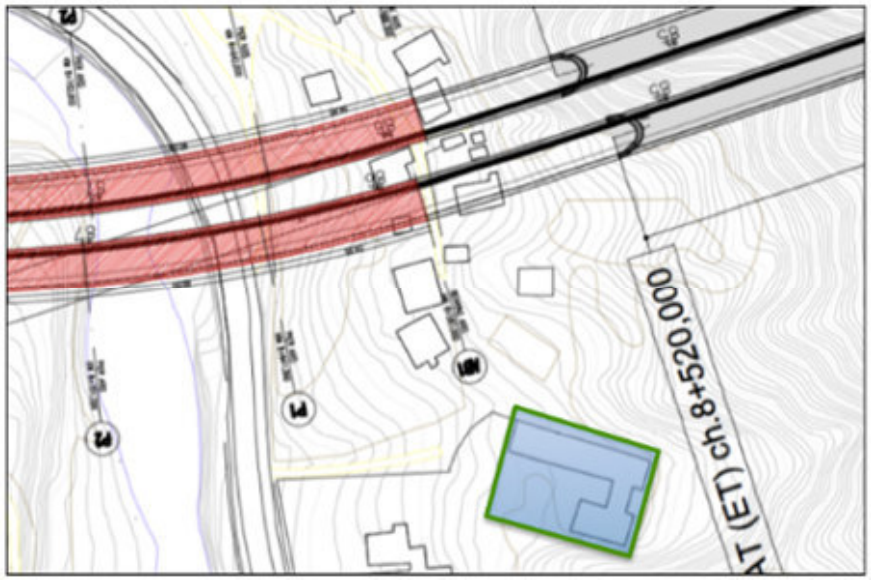


Figure 87: Location of Khunevi School (approximately KM3.5)

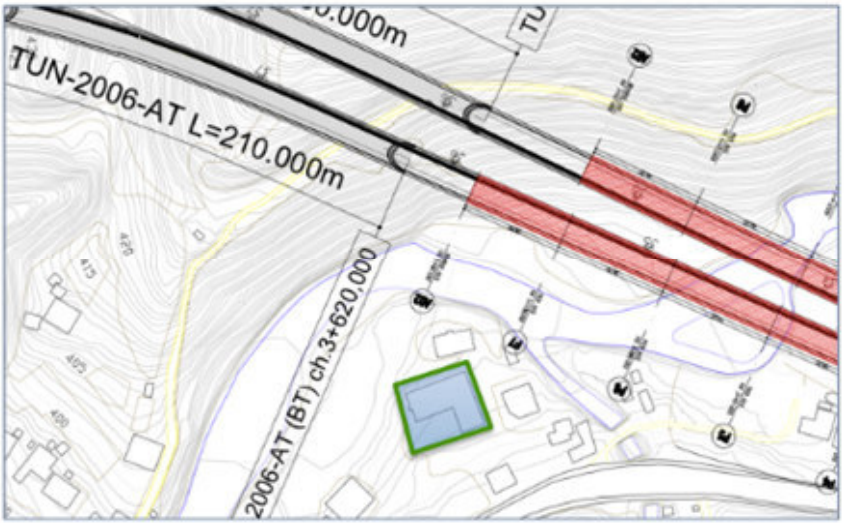


Figure 88: Khunevi School

364. Presently, 56 landfills are recorded in Georgia. Only four of them, one private and three state-owned landfills, comply with international standards and have an Environmental Impact Assessment (EIA) permit. These are; Tbilisi Norio landfill, Rustavi landfill, Borjomi landfill and Privately owned BP landfill.

365. According to the active legislation (Waste Management Code), construction and management of non-hazardous (municipal) landfills (excluding Tbilisi and Adjara Autonomous Republic landfills) is the responsibility of the Waste Management Company of Georgia owned by the Ministry of Regional Development and Infrastructure. The company conducts active measures to improve the conditions of the old/current landfills and construct new regional landfills. As of 2016, the Solid Waste Management Company manages the existing landfills. Twenty of them were closed and 30 of them were improved. The company continues work to construct new regional non-hazardous waste landfills. Tbilservice Group (municipal company established in 2007) manages Tbilisi's landfills.

366. Despite the above, the waste management problem remains very acute. There are still many illegal dumpsites in Georgia. Almost every rural settlement has one or more small dumpsites. They are often located on river banks or near the populated areas, thus posing a threat to human health and the environment.

367. One of the main causes of the above problem is related to the existing waste management system, especially in the rural areas. Specifically, no waste collection and removal services are provided in some of the rural areas, especially in remote villages located far from the municipal centers. Many villages are not equipped with waste containers, which forces local residents to dump their waste in the areas of their choosing. Around 18% of waste generated in the country is dumped into ravines, river banks and other illegal, spontaneously formed, dumpsites near residential areas.

368. Previously there was a landfill site in Zestafoni adjacent to Kvaliti village. The area of the site was 2.2 hectares and received 15,000 m^3/year of waste. However, the Solid Waste Management Company of Georgia closed the Zestaphoni municipal land fill in 2016 due to the fact that it was overloaded Kharagauli Municipality previously used Boriti landfill located in

Boriti Village. The landfill was put into operation in 2005 but is currently closed. [21]As such there appears to be no landfill within the Project area for hazardous and non-hazardous waste.

F.4.4 Physical and Cultural Resources

369. Regional Context - Imereti is an important historical and cultural region of Western Georgia. There are more than 450 historical, archaeological, architectural and natural monuments in the region, which give a full picture of ancient settlements, its cultural development and history. The region is home to 78 Churches, 13 Castles, 39 Archaeological Monuments and 27 Museums.

370. Findings of archaeological excavations show that the first human being in Imereti lived during the lower Palaeolithic period. Numerous flint and obsidian items, including cutting instruments and knives have been discovered in caves and settlements. During the VIII century Kutaisi became the capital of west Georgia and the capital of all Georgia in the X-XII centuries. It was during this period that Imereti had its renaissance. Unique masterpieces of Georgian architecture were created at this time – Bagrati Cathedral and Gelati Monastery Complex (UNESCO heritage site).

371. Project Corridor – Within the Project corridor the following key physical cultural resources have been identified:

(i) **Church** – A small church is located within 20 meters of the existing alignment (see Figure 89: Church). The new alignment will be located approximately 25 meters further south of the existing alignment at KM10.0.

(ii) **Cemetery** – The cemetery is located around 20 meters east of the existing alignment (see Figure 90). The new alignment will pass approximately 125 meters north of the cemetery at KM8.6.

Figure 89: Church

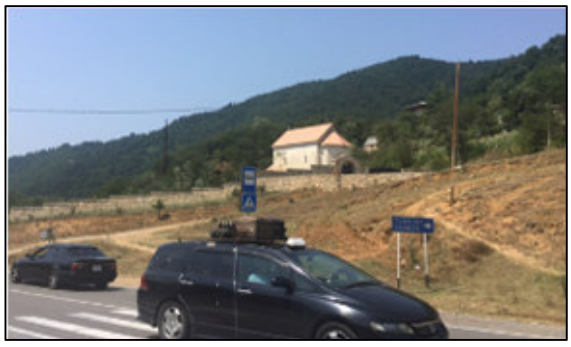


Figure 90: Cemetery

F.4.5 Noise & Vibration

F.4.5.1 General

372. Noise levels within the Project corridor are predominantly a result of vehicle traffic on the existing road. Very little commercial, residential or industrial activities can be observed in these areas that would give rise to significant noise levels.

[21] Second Regional Development Project, Imereti Regional Development Program, Imereti Tourism Development Strategy. Strategic Environmental, Cultural, Historical and Social Assessment. World Bank, 2014

F.4.5.2 Existing Noise & Vibration Levels

373. Baseline vibration monitoring was undertaken in February, 2018 at six locations indicated by Figure 91 and Table 56.

Figure 91: Noise and Vibration Monitoring Locations

Table 56: Vibration Monitoring Locations

#	Point	Coordinates	
		X	Y
1	F2-1	367851	4661799
2	F2-2	365078	4662569
3	F2-3	364623	4662883
4	F2-4	362258	4663231
5	F2-5	360268	4662822
6	F2-6	356695	4663242

374. Table 57 provides the baseline vibration monitoring results. Vibration values in the control points are currently too low to cause any structural or cosmetic damage and/or cause nuisance of the residents. According to the national standard the values are ranked as weakly perceptible.

Table 57: Vibration Monitoring Results

Time	Displacement, mm; peak values			Velocity, mm/s; true RMS/ Transversal vibration value in dBV		
	Longitudinal X	Transversal Y	Vertical Z	Longitudinal X	Transversal Y	Vertical Z
F2-V1						
Day	0.019	0.030	0.000	0.00	0.13/68.3	0.00
Night	0.005	0.002	0.000	0.00	0.05/60	0.00
F2-V2						
Day	0.000	0.000	0.001	0.00	0.06/61.6	0.00
Night	0.002	0.000	0.001	0.00	0.04/58	0.00
F2-V3						
Day	0.000	0.001	0.002	0.05/60	0.07/62.9	0.00
Night	0.000	0.000	0.000	0.00	0.00	0.00
F2-V4						
Day	0.014	0.002	0.001	0.00	0.17	0.00

Time	Displacement, mm; peak values			Velocity, mm/s; true RMS/ Transversal vibration value in dBV		
	Longitudinal X	Transversal Y	Vertical Z	Longitudinal X	Transversal Y	Vertical Z
Night	0.000	0.000	0.000	0.00	0.15/69.5	0.00
F2-V5						
Day	0.001	0.000	0.001	0.00	0.00	0.00
Night	0.000	0.000	0.000	0.00	0.02/52	0.00
F2-V6						
Day	0.001	0.000	0.003	0.00	0.05/60	0.00
Night	0.000	0.002	0.000	0.00	0.01/46	0.00

Note:

Vibration velocity level (Lv) in dB has been defined as follows:
Lv = 20 x log10(V/Vref)
Where:

Lv = velocity level in decibels, mm/s (dBV)
V = RMS velocity amplitude, mm/s
Vref = reference velocity amplitude, mm/s (Vref=0.00005 mm/s. Reference – Order #297/6 of the Minister of Labour, Health and Social Affairs on Approval of Standards of Quality of the State of Environment, Document ID 470.230.000.11.119.004.920)

Equipment – VM-6380 3-Axis 3D Digital Vibration Meter Tester VM6380
Main characteristics: Velocity:0.01-400.0 mm/s true RMS ; Acceleration:0.1-400.0 m/s² peak value; Displacement:0.001-4.000mm peak-peak ; Frequency Range for Measuring:10Hz to 10kHz

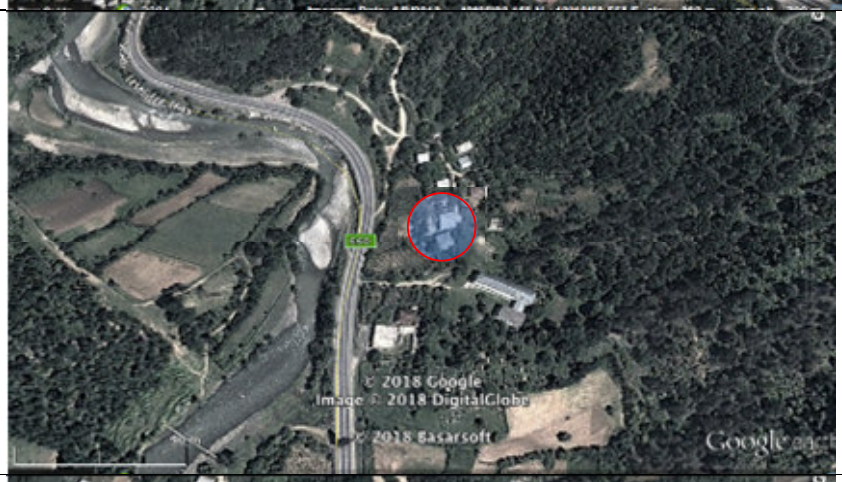
375. Noise monitoring - Baseline noise monitoring was undertaken in April and May 2018 at thirteen locations indicated by Figure 92. These thirteen receptors were chosen as they represented a good sample of residential properties along the existing and new alignment, thereby allowing the baseline measurements to also be used in the noise model prepared as part of the noise assessment.

Figure 92: Noise Monitoring Locations

Point 1 Coordinates - 42’ 05 54.00 N/ 43’24 13.20 E Noise model Ref. - Receptor R1	

Point 2 Coordinates: 42’ 05 46.86 N/ 43’ 24 07.80 E Noise model Ref. - Receptor L2	
Point 3 Coordinates: 42’06 12.14 N/ 43’22 09.91 E Noise model Ref. – Receptor L7	
Point 4 42’ 06 21.95 N/ 43’ 21 42.66 E Noise model Ref. - Receptor R14	

Point 5 42’ 06 26.61 N/ 43’ 21 22.84 E Noise model Ref. - Receptor R15	
Point 6 43’ 06 15.88 N / 43’ 20 45.31 E	
Point 7 43’ 06 33.07 N/ 43’ 20 03.43 E Noise model Ref. - Receptor L26	

Point 8 43 19 53.07 N/ 43 19 53.07 E Noise model Ref. - Receptor R28	
Point 9 42 06 27.21 N/ 43 18 35.23 E Noise model Ref. - Receptor L32	
Point 10 42 06 36.25 N/ 43 17 46.40 E Noise model Ref. - Receptor L34	

Point 11 42 06 41.42 N/ 43 17 35.21 E Noise model Ref. - Receptor R45	
Point 12 42 06 25.81 N/ 43 16 16.43 E Noise model Ref. - Receptor L36	
Point 13 42 06 31.58 N/ 43 16 06.81 E Noise model Ref. - Receptor R53	

376. Table 58 provides a summary of the baseline noise monitoring results. No clear patterns emerge from the monitoring regarding differences in daytime and nighttime noise. However, it is clear that at many locations the IFC daytime limits are met, but not the nighttime limits. As expected, the monitoring point closest to the existing alignment (point 7) and furthest from the alignment (point 12) received the highest and lowest noise levels respectively.

Table 58: Baseline Noise Monitoring Results – Hourly Leq

Point No.	1	2	3	4	5	6	7	8	9	10	11	12	13	IFC Standard
Distance from the Road	65	70	10	50	50	25	5	110	50	165	40	320	25	
7am-8am	51	53	46	50	51	51	49	53	51	50	50	47	55	55
8am-9am	55	53	53	52	51	55	51	47	55	45	56	40	52	55
9am-10am	56	53	59	51	51	56	52	53	56	50	55	48	59	55
10am-11am	51	51	56	49	50	51	59	59	51	59	52	46	56	55
11am-12am	55	57	56	55	55	55	47	59	55	55	56	46	66	55
12am-1pm	52	52	53	50	51	52	56	58	52	52	50	46	52	55
1pm-2pm	49	49	46	48	49	49	70	49	49	49	47	42	60	55
2pm-3pm	55	58	53	55	55	55	76	56	55	53	52	42	58	55
3pm-4pm	56	52	47	53	52	56	78	46	56	45	55	40	60	55
4pm-5pm	54	45	46	46	45	54	68	47	54	49	51	42	52	55
5pm-6pm	50	51	54	50	50	50	68	52	50	51	49	42	58	55
6pm-7pm	66	52	53	50	50	66	57	54	66	51	65	48	58	55
7pm-8pm	55	48	56	49	48	55	72	55	55	55	56	47	56	55
8pm-9pm	63	47	47	49	47	63	61	48	63	45	60	44	58	55
9pm-10pm	52	60	54	58	59	52	62	53	52	57	53	40	60	55
10pm-11pm	51	64	49	60	62	51	65	48	51	46	50	51	50	45
11pm-12pm	51	48	53	47	47	51	54	54	51	52	55	42	48	45
12pm-1am	59	48	59	47	49	59	72	58	59	56	57	44	48	45
1am-2am	48	50	55	45	51	48	43	53	48	53	50	46	49	45
2am-3am	55	50	49	46	58	55	58	47	55	50	53	47	51	45
3am-4am	62	50	47	50	49	62	32	49	62	49	63	43	50	45
4am-5am	49	56	51	55	55	49	32	52	49	49	47	44	58	45
5am-6am	51	47	47	48	48	51	48	47	51	48	53	40	52	45
6am-7am	54	51	52	49	50	54	56	51	54	51	52	46	53	45

377. For the noise prediction model the existing road noise was also modeled (Maps provided in **Appendix M** and iterations completed as part of the development of the model included as **Appendix P**). The following table presents the data at the receptors used as part of the model (also cross referenced in Figure 92: Noise Monitoring Locations, above).

Table 59: Modeled Noise Levels on the Existing Road

Receptor	DAY	Night
	Lg dB(A)	Ln dB(A)
L1	68.2	60.2
L2	55.8	47.8
L3	71.6	63.5
L4	71.4	63.3
L5	63.6	55.6
L6	64.4	56.3
L7	63.8	55.7
L8	63.9	55.9
L9	63.9	55.9
L10	64	55.9
L11	63.9	55.9
L12	59.3	51.3
L13	60.4	52.3
L14	60.7	52.7
L15	61.6	53.5
L16	46.1	38
L17	58.4	50.3
L18	59.3	51.3
L19	59.7	51.6
L20	60.3	52.3
L21	60.8	52.8
L22	63	54.9
L23	63.7	55.7
L24	62.6	54.5
L25	67.3	59.3
L26	65	57
L27	66	58
L28	63.5	55.5
L29	62.1	54.1
L30	61.5	53.4
L31	60.3	52.3
L32	70.1	62.1
L33	70.1	62.1
L34	70.6	62.5
L35	70.4	62.4
L36	61.8	53.8
L37	62.5	54.4
R1	52.7	44.7
R2	64.9	56.9
R3	64.8	56.8
R4	63.3	55.2
R5	61.4	53.4
R6	68.9	60.9
R7	66.2	58.1
R8	66.9	58.8
R9	72	64

Receptor	DAY	Night
	Lg dB(A)	Ln dB(A)
R10	48.5	40.5
R11	62.9	54.9
R12	62	53.9
R13	65.4	57.4
R14	60.9	52.9
R15	65.9	57.8
R16	62.4	54.4
R17	47.6	39.6
R18	44.8	36.7
R19	42.2	34.2
R20	45.8	37.8
R21	55.6	47.6
R22	57.2	49.2
R23	69.4	61.4
R24	69.6	61.6
R25	64.6	56.5
R26	65	56.9
R27	65.9	57.9
R28	64	55.9
R29	64.7	56.6
R30	67.5	59.5
R31	63.1	55.1
R32	63.5	55.5
R33	67.4	59.3
R34	67.5	59.5
R35	59.1	51.1
R36	59.9	51.8
R37	60.5	52.5
R38	58.6	50.5
R39	60.4	52.4
R40	60.5	52.5
R41	60.2	52.2
R42	59.9	51.8
R43	61.2	53.2
R44	65.7	57.6
R45	63.1	55
R46	60.3	52.2
R47	60.4	52.3
R48	53.7	45.7
R49	57.3	49.3
R50	63.2	55.1
R51	60	52
R52	61.3	53.2

G. Environmental Impacts and Mitigation Measures

G.1 Introduction

378. During the initial stage of the EIA process, several potential environmental and social impacts of the project were identified. The baseline surveys were conducted keeping in consideration the potential impacts. In this chapter, the potential environmental and social impacts are evaluated. The impacts have been identified based on consideration of the information presented in previous chapters. To avoid unnecessary repetition of supporting information, cross referencing to previous sections is given where necessary. Following the impact assessment, the mitigation measures related to each impact category is presented.

G.2 Impact Assessment Methodology

379. The general methodology used for impact assessment is described in this section. It describes the process of impact identification and definition, significance rating, the mitigation, management and good practice measures.

G.2.1 Identification of Significant Environmental Aspects

380. The description of each impact will have the following features:

(i) Definition of the impact using an impact statement identifying the Project activity or activities that causes the impact, the pathway or the environmental parameter that is changed by the activity, and the potential receptors of the impact (aspect-pathway-receptor).
(ii) Description of the sensitivity and importance value of the receiving environment or receptors.
(iii) Extent of change associated with the impact.
(iv) Rating of the significance of the impact.
(v) Description of appropriate mitigation and management measures and potential effectiveness of the proposed measures.
(vi) Characterization of the level of uncertainty in the impact assessment.
(vii) The significance of an impact is determined based on the product of the consequence of the impact and the probability of its occurrence. The consequence of an impact, in turn, is a function primarily of three impact characteristics:
    (a) magnitude
    (b) spatial scale
    (c) timeframe

381. Magnitude is determined from quantitative or qualitative evaluation of a number of criteria including:

(i) Sensitivity of existing or reasonably foreseeable future receptors.
(ii) Importance value of existing or reasonably foreseeable future receptors, described using the following:
    (a) inclusion in government policy.
    (b) level of public concern.
    (c) number of receptors affected.
    (d) intrinsic or perceived value placed on the receiving environment by stakeholders.
    (e) economic value to stakeholders

(iii) Severity or degree of change to the receptor due to impact, measured qualitatively or quantitatively, and through comparison with relevant thresholds:
   (a) legal thresholds—established by law or regulation
   (b) functional thresholds if exceeded, the impacts will disrupt the functioning of an ecosystem sufficiently to destroy resources important to the nation or biosphere irreversibly and/or irretrievably
   (c) normative thresholds – established by social norms, usually at the local or regional level and often tied to social or economic concerns
   (d) preference thresholds—preferences for individuals, groups or organizations only, as distinct from society at large
   (e) reputational thresholds—the level of risk a company is willing to take when approaching or exceeding the above thresholds

382. Spatial scale is another impact characteristic affecting impact consequence. The spatial scale of impacts can range from localized (confined to the proposed Project Site) to extensive (national or international extent). They also may vary depending on the component being considered.

383. The impact timeframe is the third principal impact characteristic defining impact consequence and relates to either its duration or its frequency (when the impact is intermittent). Impact duration can range from relatively short (less than four years) to long (beyond the life of the Project). Frequency ranges from high (more than 10 times a year) to low (less than once a year). These timeframes will need to be established for each Project based on its specific characteristics and those of the surrounding environment.

384. Once the impact consequence is described on the basis of the above impact characteristics, the probability of impact occurrence is factored in to derive the overall impact significance. The probability relates to the likelihood of the impact occurring, not the probability that the source of the impact occurs. For example, a continuous Project activity may have an unlikely probability of impact if there are no receptors within the area influenced by that activity.

385. The reversibility of each impact at the end of construction and operation are important, as these impacts may need on-going management after operation. The reversibility of each impact at the end of construction and operation will be noted and described alongside the three primary characteristics of magnitude, spatial scale and duration.

386. The characteristics are outlined in Table 60**.**

Table 60: Characteristics Used to Describe Impact

Characteristic	Sub-components	Terms Used to Describe the Impact
Type		Positive (a benefit), negative (a cost) or neutral
Nature		Biophysical, social, cultural, health or economic Direct, indirect or cumulative or induced
Phase of the Project		Construction, operation, decommissioning or post closure

Characteristic	Sub-components	Terms Used to Describe the Impact
Magnitude	Sensitivity of Receptor	High, medium or low capacity to accommodate change High, medium or low conservation importance Vulnerable or threatened□Rare, common, unique, endemic
	Importance or value of receptor	High, medium or low concern to some or all stakeholders High, medium or low value to some or all stakeholders (for example, for cultural beliefs) Locally, nationally or internationally important Protected by legislation or policy
	Severity or degree of change to the receptor	Gravity or seriousness of the change to the environment Intensity, influence, power or strength of the change Never, occasionally or always exceeds relevant thresholds
Spatial Scale	Area affected by impact - boundaries at local and regional extents will be different for biophysical and social impacts	Area or Volume covered□Distribution□Local, regional, transboundary or global
Timeframe	Length of time over which an environmental impact occurs or frequency of impact when intermittent	Short term or long term□Intermittent (what frequency) or continuous Temporary or permanent Immediate effect (impact experienced immediately after causative project aspect) or delayed effect (effect of the impact is delayed for a period following the causative project aspect)
Probability - likelihood or chance an impact will occur		Definite (impact will occur with high likelihood of probability) Possible (impact may occur but could be influenced by either natural or project related

Characteristic	Sub-components	Terms Used to Describe the Impact
		factors) Unlikely (impact unlikely unless specific natural or Project related circumstances occur)
Reversibility/Sustainability		Potential for recovery of the endpoint from a negative impact Reversible or irreversible Sustainability for positive impacts
Confidence in impact evaluation (degree of certainty in the significance ascribed to the impact)		Scientific uncertainty – limited understanding of ecosystem (or community) and processes governing change Data uncertainty – restrictions introduced by incomplete or incomparable information, or by insufficient measurement techniques Policy uncertainty – unclear or disputed objectives, standards or guidelines

G.2.2 Impact Significance Rating

387. The impact significance rating process serves two purposes: firstly, it helps to highlight the critical impacts requiring consideration in the approval process; secondly, it serves to show the primary impact characteristics, as defined above, used to evaluate impact significance. The impact significance rating system is presented in Table 61 and described as follows:

(i) **Part A**: Define impact consequence using the three primary impact characteristics of magnitude, spatial scale and duration.
(ii) **Part B**: Use the matrix to determine a rating for impact consequence based on the definitions identified in Part A; and
(iii) **Part C**: Use the matrix to determine the impact significance rating, which is a function of the impact consequence rating (from Part B) and the probability of occurrence.

388. Using the matrix, the significance of each described impact is rated.

Table 61: Method for Rating Significance

PART A: DEFINING CONSEQUENCE IN TERMS OF MAGNITUDE, DURATION AND SPATIAL SCALE			
Definition		Criteria	
MAGNITUDE		Negative	Positive
	Major	• Large number of receptors affected • Receptors highly sensitive and/or are of conservation importance • Substantial deterioration, nuisance or harm to receptors expected • Relevant thresholds often exceeded • Significant public concern expressed during stakeholder consultation • Receiving environment has an inherent value to stakeholders	• Large number of receptors affected • Receptors highly amenable to positive change • Receptors likely to experience a big improvement in their situation • Relevant positive thresholds often exceeded
	Moderate	• Some receptors affected • Receptors slightly sensitive and/or of moderate conservation importance • Measurable deterioration, nuisance or harm to receptors • Relevant thresholds occasionally exceeded • Limited public concern expressed during stakeholder consultation • Limited value attached to the environment	• Some receptors affected • Receptors likely to experience some improvement in their situation • Relevant positive thresholds occasionally exceeded
	Minor	• No or limited receptors within the zone of impact • Receptors not sensitive to change • Minor deterioration, nuisance or harm to receptors • Change not measurable or relevant thresholds never exceeded • Stakeholders have not expressed concerns regarding the receiving environment	• No or limited receptors affected • Receptors not sensitive to change • Minor or no improvement in current situation • Change not measurable • Relevant positive thresholds never exceeded No stakeholder comment expected
TIMEFRAME		Duration of Continuous Aspects	Frequency of Intermittent Aspects
	Short term / low frequency	• Less than 4 years from onset of impact	• Occurs less than once a year

	Medium term / medium frequency	• More than 4 years from onset of impact up to end of life of project (approximately 30 years)	• Occurs less than 10 times a year but more than once a year
	Long term / high frequency	• Impact is experienced during and beyond the life of the project (greater than 30 years)	• Occurs more than 10 times a year
SPATIAL SCALE		Biophysical	Socio-economic
	Small	• Within the defined 'area of influence'	• Within the defined 'area of influence'
	Intermediate	• Within the district in which is the facilities are located	• Within the municipality in which the activity occurs
	Extensive	• Beyond the district in which the facilities are located	• Beyond the municipality in which the activity occurs

PART B: DETERMINING CONSEQUENCE RATING

MAGNITUDE	TIMEFRAME	SPATIAL SCALE		
		Small	Intermediate	Extensive
Minor	Short term / low frequency	Low	Low	Medium
	Medium term / medium frequency	Low	Low	Medium
	Long term / high frequency	Medium	Medium	Medium
Moderate	Short term / low frequency	Low	Medium	Medium
	Medium term / medium frequency	Medium	Medium	High
	Long term / high frequency	Medium	High	High
Major	Short term / low frequency	Medium	Medium	High
	Medium term / medium frequency	Medium	Medium	High
	Long term / high frequency	High	High	High

PART C: DETERMINING SIGNIFICANCE RATING

		CONSEQUENCE		
		Low	Medium	High
PROBABILITY (of exposure to impacts)	Definite	Low	Medium	High
	Possible	Low	Medium	High
	Unlikely	Low	Low	Medium

G.3 Mitigation, Management and Good Practice Measures

389. Wherever the Project is likely to result in unacceptable impact on the environment, mitigation measures are proposed (over and above the inherent design measures included in the Project description). In addition, good practice measures may be proposed however these are unlikely to change the impact significance. In the case of positive impacts, management measures are suggested to optimize the benefits to be gained. Where mitigation measures are required the impact will be rated again to show the residual impact after implementation of management controls.

390. The following mitigation hierarchy will be utilized in selecting practical mitigation measures for unacceptable impacts as follows (in order of preference):

(i) Avoid the impact wherever possible by removing the cause(s).
(ii) Reduce the impact as far as possible by limiting the cause(s).
(iii) Ameliorate the impact by protecting the receptor from the cause(s) of the impact.
(iv) Providing compensatory measures to offset the impact, particularly where an impact is of high significance and none of the above are appropriate.

G.4 Screening of Impacts

391. Based on the impact assessment methodology discussed above, Table 62 presents the possible impacts of the proposed Project. Each impact is discussed further in this chapter.

Table 62: Impact Screening

Aspect	Phase	Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
Air Quality	C	Emissions from stationary sources	Nearby communities	L	M	L	M	MOD	H/F	SMALL	MED	DEF	M
	C	Exhaust Emissions from construction vehicles and generators	Nearby communities	M	M	L	M	MOD	H/F	SMALL	MED	DEF	M
	C	Dust from the movement of vehicles, stockpiles, etc.	Nearby communities / Agric. Crops	M	M	M	M	MOD	H/F	SMALL	MED	DEF	M
	O	Vehicle Emissions from traffic using the road.	Nearby communities	M	H	M	M	MOD	LT	SMALL	MED	DEF	M
Climate Change	C	GHG Emissions from road construction.	Global	H	L	L	-	MIN	H/F	EXT	MED	DEF	M
	O	GHG Emissions from vehicle emissions.	Global	H	L	L	-	MIN	LT	EXT	MED	DEF	M
Soils	C	Soil erosion on unstable slopes caused by poor construction works.	Nearby communities / Water bodies	L	M	M	M	MOD	M/F	INTER	MED	POSS	M
	O	Soil erosion caused by poorly designed erosion protection measures, drainage, etc.	Nearby communities / Water bodies	L	M	M	M	MOD	MT	INTER	MED	POSS	M

Aspect	Phase	Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
	C	Soil contamination via spills and leaks of hazardous liquids from construction camps.	Soil / Water bodies / Ground water	L	M	L	M	MOD	M/F	SMALL	MED	POSS	M
Hydrology	C	Flooding caused by blocking existing drainage structures.	Nearby communities	M	M	M	-	MOD	M/F	SMALL	MED	POSS	M
	O	Flooding caused by poorly designed drainage structures.	Nearby communities	M	M	M	-	MOD	LT	SMALL	MED	POSS	M
	C	Water contamination from construction camps, etc.	Nearby communities / Water bodies	M	M	L	M	MOD	M/F	INTER	MED	POSS	M
	C	Excessive water extraction affecting local water supplies.	Nearby communities / Aquatic wildlife	L	L	L	L	MIN	H/F	SMALL	MED	UNLIKE	L
	O	Ground water supply degraded by new tunnels.	Nearby communities	M	M	L	-	MOD	LT	SMALL	MED	POSS	M
Flora & Fauna	C	Degradation of habitat caused during site clearing.	Terrestrial wildlife	M	H	L	-	MOD	L/F	SMALL	LOW	DEF	L
	C	Tree cutting.	Terrestrial wildlife	H	H	L	M	MAJ	ST	SMALL	MED	DEF	M
	O	Blocking migration	Terrestrial	L	H	L	-	MOD	MT	SMALL	MED	UNLIKE	L

Aspect	Phase	Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
		routes of animals.	wildlife										
Infrastructure and Transport	C	Damage to access roads caused by construction vehicles.	Nearby communities / Road Users	M	L	M	-	MOD	MT	INTER	MED	POSS	M
	C	Traffic delays due to road works.	Nearby communities / Road Users	M	M	M	-	MOD	H/F	SMALL	MED	DEF	M
	C	Limited accessibility to properties as road works block access.	Nearby communities	M	M	L	-	MOD	MT	SMALL	MED	POSS	M
	C	Temporary disruption to utilities while they are removed to make way for construction works.	Nearby communities	M	M	L	-	MOD	MT	SMALL	MED	DEF	M
Land Use	C	Loss of land and property due to the new road.	Nearby communities	H	H	H	-	MAJ	MT	SMALL	MED	DEF	M
	C	Disruption to businesses caused by reduced access to the business.	Nearby communities	M	H	H	-	MAJ	H/F	SMALL	HIGH	POSS	H
	O	Reduced income for businesses no longer located by the road.	Nearby communities	M	H	H	-	MAJ	MT	SMALL	MED	POSS	M
	O	Induced changes.	Nearby communities	M	M	L	-	MIN	LT	SMALL	MED	UNLIKE	L

Aspect	Phase	Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
Waste	C	Pollution from hazardous waste from construction camps, etc.	Nearby communities / Water bodies	M	M	L	H	MOD	H/F	INTER	HIGH	POSS	H
	C	Pollution from inert waste from construction camps, etc.	Nearby communities / Water bodies	M	M	L	H	MOD	H/F	INTER	HIGH	POSS	H
	C	Tunnel and embankment spoil	Communities /	H	H	H	M	MAJ	ST	INTER	MED	DEF	M
OHS / Community Health and Safety	C	Accidents and injuries during the construction phase.	Communities / Contractors staff	H	H	H	H	MAJ	H/F	INTER	HIGH	POSS	H
	C	STD's contracted and spread by workers.	Nearby communities / Contractors staff	M	H	L	-	MOD	L/F	INTER	MED	POSS	M
Emergencies	C	Fires, explosions, etc, at site.	Nearby communities / Contractors staff	M	H	L	M	MOD	S/T	SMALL	LOW	POSS	L
PCR	C	Damage to PCR caused during construction.	PCR site and its users	M	M	L	-	MOD	H/F	SMALL	MED	POSS	M
	O	Effects to PCR in terms of elevated noise, dust, etc.	PCR site and its users	M	M	L	-	MOD	MT	SMALL	MED	UNLIKE	L

Aspect	Phase	Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
Noise	C	Elevated noise levels from construction equipment.	Contractors staff / Nearby communities	H	H	L	H	MAJ	H/F	SMALL	HIGH	DEF	H
	O	Elevated noise levels from vehicles using the road.	Nearby communities	H	H	M	H	MAJ	M/T	SMALL	MED	DEF	M
Vibration	C	Damage to properties caused during blasting and piling.	Nearby communities	M	H	M	H	MAJ	M/F	SMALL	MED	POSS	M
	O	Damage to properties from vehicle movement vibration.	Nearby communities	L	H	M	L	MOD	MT	SMALL	MED	UNLIKE	L

Key: H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minimum / H/F: High Frequency / M/F: Low Frequency / L/F: Low Frequency / LT: Long term / MT: Medium Term / ST: Short term / MED: Medium / DEF: Definitely / POSS: Possible: / UNLIKE: Unlikely

G.5 Physical Resources

G.5.1 Air quality

Potential Air Quality Impacts

392. The potential impacts of the Project to air quality are described as follows:

Design and Pre-construction Phase

393. The road rehabilitation works are generally intermittent and not permanent in a specific site, the works move along the Project road as work progresses and as such air quality impacts will be short term in specific locations. However, fugitive emissions will be emitted on a longer-term basis from stationary sources such as asphalt plants. These sites can however be selected prior to construction and be placed in an area where it can cause the least impact on human and ecologic receptors.

Construction Phase

394. During construction, air quality is likely to be degraded by a range of operational activities including:

(i) Exhaust emissions from the operation of construction machinery (e.g. Nitrogen Oxides (NO_X), Sulfur Oxides (SO_X) and Carbon Monoxide (CO));
(ii) Open burning of waste materials; and
(iii) Dust generated from haul roads, unpaved roads, exposed soils and material stock-piles.

395. Dust is the major air quality problem from construction sites. Dust is a problem for a variety of reasons, as outlined below:

(i) Inconvenience to local people. For example, people may have to re-wash laundry that has been put outdoors to dry, and wash windows, curtains and vehicles. Dust can contaminate meat hanging up in open-air butchers and other food that is exposed to it in homes, shops and open-air restaurants, giving food a gritty texture.
(ii) Health and safety problems. Dust may affect health by irritating eyes and worsening the health of people with asthma. Dust can reduce visibility for drivers on roads. It can also be blown for long distances by the wind.
(iii) Crop damage. Even low concentrations of dust can affect plant and fruit growth as far away as one kilometer from a construction site. Plant growth is particularly susceptible to dusts that are highly alkaline, for example limestone and cement dust. Dust deposited during light rainfall can cause the soil surface to form a crust increasing run-off.
(iv) Impact on ecology. Dust blowing onto watercourses may damage ecology by increasing sedimentation, reducing sunlight and suffocating fish. It may also affect plant growth and change the species of plants growing in an area. Dust may also damage trees and other vegetation planted as part of the construction contract.
(v) Damage to plant and equipment. Within the construction site, dust can cause mechanical or electrical problems in sensitive equipment such as computers. It can also increase abrasion of moving parts in equipment and clogging of air filters.

Operational Phase

396. The main source of air pollution during the operational phase will be vehicles moving on the highway. The main pollutants are: CO; NO_X; hydrocarbons (HC); SO_2; carbon dioxide (CO_2); and particulate matter (PM). These compounds can damage health and/or the environment. The concentration of pollutants generated by vehicles depends on factors such as the number, type and speed of vehicles. The effect of air pollution on local people depends on the distance between them and the road, wind direction, topography and other factors. The main direct effects are in the area closest to the road as the rapid dispersion and dilution of exhaust gases quickly reduces their concentrations to levels at which risks are minimal.

397. The impacts associated with air quality in the operational phase of the Project have been assessed using an air dispersion model. The findings of which are presented below.

398. Pollutants Modeled - The pollutants kept into considerations are the ones characterizing the emissions from vehicles: NO_2, NO_X, PM_{10}, $PM_{2,5}$, CO, SO_2 e C_6H_6. The below indicates the limits taken into consideration.

Table 63: Pollutants Modeled & Reference Limits

	MPC/guideline values/limits	Average period	CO, µg/m3	NO_2, µg/m3	SO_2, µg/m3	PM10, µg/m3	PM 2.5, µg/m3	TSP, µg/m3
1	National limit – max.permiss. one time (volley) concentration (MPC), µg/m^3	24 h	3000	40	50	n/a	n/a	150
		30 min	5000	200	500	n/a	n/a	500
2	IFC/WHO (updated 2016) –guideline value, µg/m3	1 year	n/a	40	50	20	10	n/a
		8h	10000	n/a	n/a	n/a	n/a	n/a
		24 h	n/a	n/a	20	50	25	120
		1h	30000	200	n/a	n/a	n/a	n/a
		30 min	60000	n/a	n/a	n/a	n/a	n/a
		10 min	100000	n/a	500	n/a	n/a	n/a
3	EU limit, µg/m3	1 year	n/a	40	n/a	40	25	n/a
		8h	10000	n/a	n/a	n/a	n/a	n/a
		24 h	n/a	n/a	125	n/a	n/a	n/a
		1h	n/a	200	350	n/a	n/a	n/a

399. Time frame of the model - The modelling has been developed for each of the below scenarios:

(i) Scenario year 2019
(ii) Scenario year 2034.

400. The number of vehicles has been divided in 24 hours according to the provided traffic flow; the results of the modelling are represented into values of concentration/time (hourly levels) for the considered pollutants in correspondence of the selected receptors.

401. Spatial domain and receptors - The model takes into consideration an area far larger than the road strips and has been enlarged according to the morphology, the distribution of settlements and potential receptors for a total of about 20 square kilometres. The domain is a rectangle having dimensions of 6 km x 3.5 km; calculations have been carried out on the basis of progressive advancements for the road. Five main receptors have been inserted at the north and south of the road. They have been used for the considerations in terms of respect or excess of allowable limits.

402. Results - The results of the modelling are organized as follows:
(i) Scenario 2019 (probable start of road service).
(ii) Scenario 2034.

403. The values of the concentration of pollutants are calculated in correspondence of the five selected sensitive receptors to act as reference points across the Project corridor for the model. Each of these five receptors are located in the main villages within the Project corridor. The average yearly values and the values considered of reference by the present day legislation are put into evidence together to verify the threshold of acceptability. It must be noted that the values only refer to the traffic in the new road, and do not consider any other external source.

Table 64: Average yearly contribution of the road traffic to the background (concentration in µg/m^3) 2019

Receptors	PM10	PM2.5	NO2	NOX	CO	SO2	C6H6
Public School of Verkvichchala	0.227	0.173	4.56	9.94	1.67	0.004	0.007
Public School of Vashlevi	0.179	0.135	3.06	7.15	1.27	0.003	0.006
Khunevi School	0.207	0.157	4.41	9.24	1.50	0.003	0.007
Boriti School	0.177	0.134	6.07	10.22	1.28	0.003	0.006
Church	0.188	0.143	6.33	10.71	1.36	0.003	0.006

404. The above values represent the contribution of the traffic to the background values in the year 2019 when the road is expected to enter in full service.

405. Scenario for the interval years 2019 to 2034 - The following estimations have been calculated according to Table 64, which reports the estimated increments/year of the average monthly concentration for the expected traffic increments. When background values are available (from the baseline monitoring undertaken as part of this EIA) they are considered into the calculations.

406. The average resulting values are presented in the below Table 65 which shows the increments, the background and the final expect values.

Table 65: PM_{10} (µg/m^3) Comparison of expected values at 2019, background and limits

Receptor	Δ estimated increment 2019 (aver.) PM10	Background level	Total	Limits (year)
Public School of Verkvichchala	0.227	17	17.227	40.0
Public School of Vashlevi	0.179	17	17.179	40.0
Khunevi School	0.207	17	17.207	40.0
Boriti School	0.177	17	17.177	40.0
Church	0.188	17	17.188	40.0

407. The data analysis confirms that the emission of PM_{10} generated by the traffic, at 2019, is very limited and even taking into account the background levels will not exceed the allowable limits. It must be taken into account that the largest part of the traffic generating the background will be diverted into the new road, for that the above scenario has to be considered very conservative.

408. The application of increment of emissions determined by the expected increase of traffic, permitted to develop the following tables (Table 66 to Table 71) where the yearly increment of pollution for the considered pollutants is put into evidence. This data is also mapped for NO_2 and PM10 in Figure 93 to Figure 104**.**

Table 66: Yearly scenario 2019 to 2034 for PM_{10} (including background at 2019)

PM10 year 2019 to 2034					
year	Public School of Verkvichchala	Public School of Vashlevi	Khunevi School	Boriti School	Church
2019	17.227	17.179	17.207	17.177	17.188
2034	17.308	17.249	17.280	17.240	17.255

Table 67: Yearly scenario 2019 to 2034 for NO_2 (No background)

NO_2 year 2019 to 2034					
year	Public School of Verkvichchala	Public School of Vashlevi	Khunevi School	Boriti School	Church
2019	4.56	3.06	4.41	6.07	6.33
2034	4.86	3.32	4.68	6.24	6.51

Table 68: Yearly scenario 2019 to 2034 for CO (No background)

CO year 2019 to 2034					
year	Public School of Verkvichchala	Public School of Vashlevi	Khunevi School	Boriti School	Church
2019	1.67	1.27	1.50	1.28	1.36
2034	2.28	1.75	2.05	1.77	1.87

Table 69: Yearly scenario 2019 to 2034 for PM2.5 (No background)

PM2.5 year 2019 to 2034					
year	Public School of Verkvichchala	Public School of Vashlevi	Khunevi School	Boriti School	Church
2019	0.173	0.135	0.157	0.134	0.143
2034	0.236	0.184	0.213	0.183	0.194

Table 70: Yearly scenario 2019 to 2034 for SO_2 (No background)

SO_2 year 2019 to 2034					
year	Public School of Verkvichchala	Public School of Vashlevi	Khunevi School	Boriti School	Church
2019	0.004	0.003	0.003	0.003	0.003
2034	0.005	0.004	0.005	0.004	0.004

Table 71: Yearly scenario 2019 to 2034 for C6H6 (No background)

C6H6 year 2019 to 2034					
year	Public School of Verkvichchala	Public School of Vashlevi	Khunevi School	Boriti School	Church
2019	0.007	0.006	0.007	0.006	0.006
2034	0.01	0.008	0.009	0.008	0.008

409. The analysis of the impact on operational phase air quality determined by the traffic on the new road suggests that there are no negative impacts on the environment. In addition to the fact that the maximum allowable limits are not surpassed, it must be taken into account that the road provides benefits in term of vehicular emission due to the smoother drive and optimized alignment.

410. The emissions of vehicles on a highway are lower than vehicles driving a urban type road as the existing one where the frequent bends, inclination and traffic congestions do not allow a fluid drive. If a similar traffic flow should transit via the existing road, the emissions would be almost 20% higher.

411. The new road will have a positive impact on the air quality in term of reduced emissions compared to a similar flow of traffic along the existing one; it can also be pointed out that no air quality limits will be exceeded even considering that the composition of the fleet of vehicles is maintained. The higher values are recorded to the south of the road due to the main wind directions and morphology, these values are anyhow lower than the limits.

Management & Mitigation Actions

Pre-construction Phase

412. Locations for rock crushing facilities, concrete batching yards and asphalt plants will require approval from the Engineer, MoEPA and the RD during the Pre-construction phase. Efforts will be made to ensure that these facilities are as near to the Project road as practical to avoid unnecessary journeys and potential dust issues from vehicle movements during construction works on unpaved roads in urban areas. Haul routes will be prepared and submitted to the Engineer as part of his Traffic Management Plan (TMP).

413. To prevent impacts arising from asphalt plants, construction camps, batching plants and rock crushing plants, they will be prohibited within 500 meters of any urban area or sensitive receptor (school, hospital, etc). The locations of these facilities will be indicated within the Contractors SEMP. Baseline air quality monitoring will also be undertaken by the Contractor during the pre-construction phase as described below under the recommended monitoring. Where practical, they should also be located as far away from agricultural plots as possible, although given the constraints of the Project area ensuring sites are not close to agricultural plots may not always be possible.

414. To adequately manage air quality impacts the Contractor will be responsible for the preparation of an Air Quality Plan, submitted to the Engineer as part of the SEMP. The plan will detail the actions to be taken to minimize dust generation (e.g. spraying un-surfaced roads with water (including the types of equipment, sources of water, locations for watering and schedule), covering stock-piles, etc) and will identify the type, age and standard of equipment to be used and will also provide details of the air quality monitoring program for baseline and routine monitoring. The Plan will also include contingencies for the accidental release of toxic air pollutants.

Figure 93: NO_2, 2019

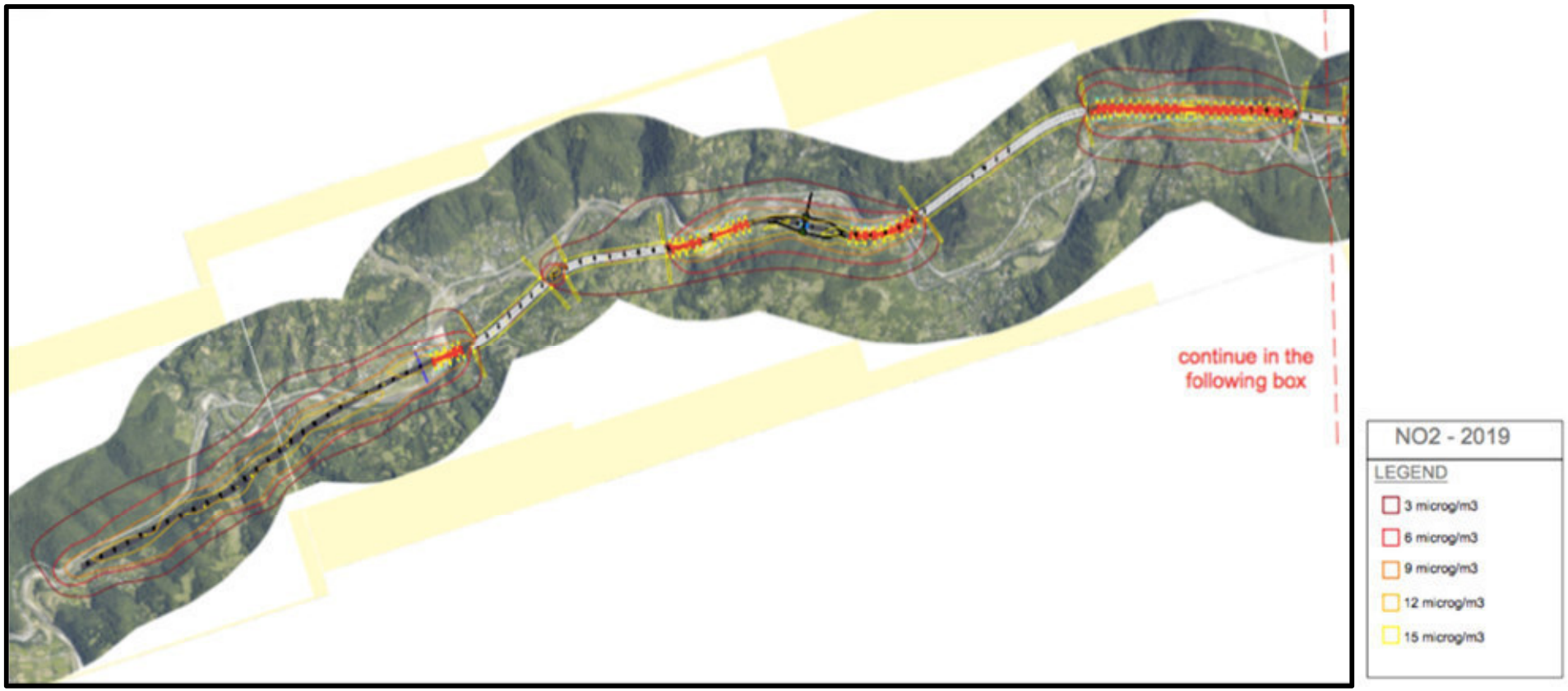


Figure 94: NO_2, 2019

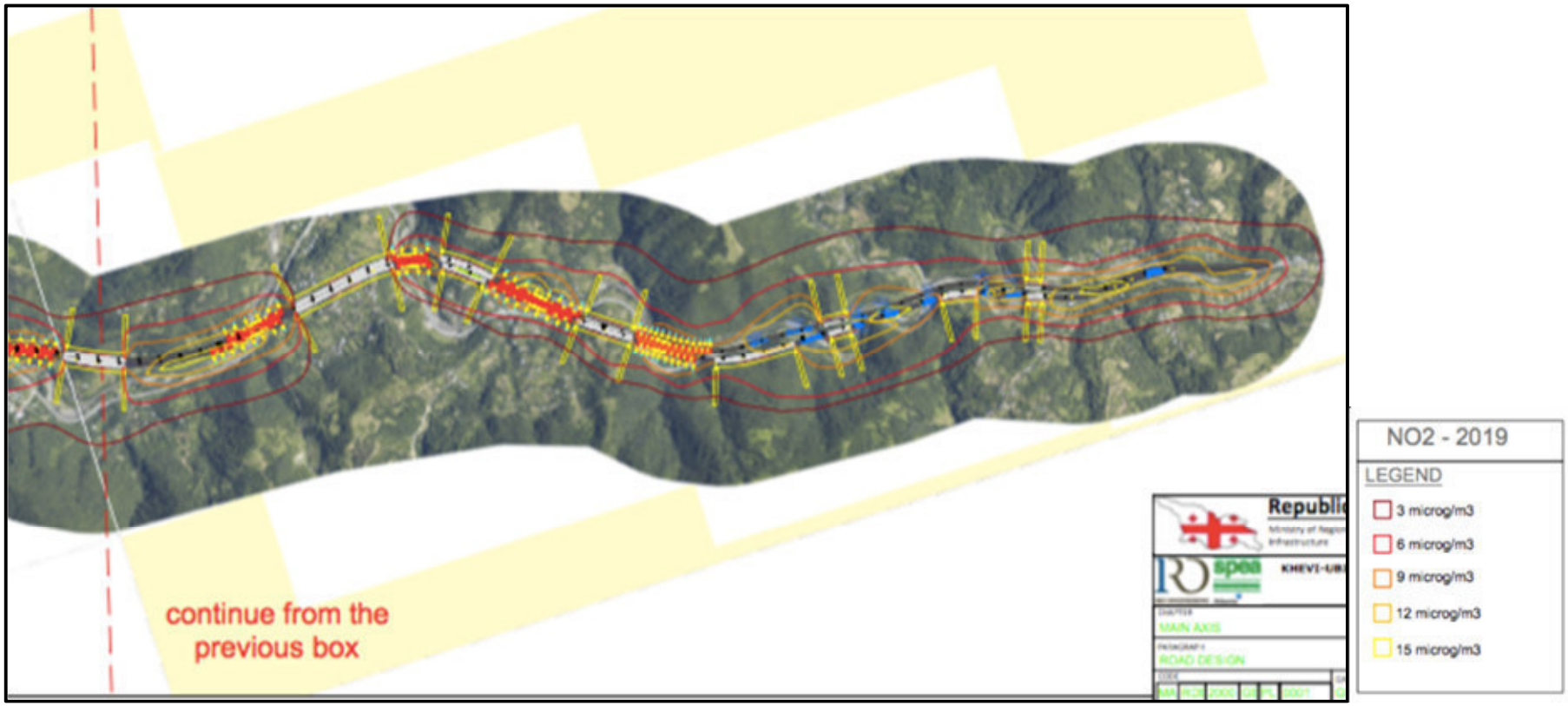


Figure 95: NO_2, 2034

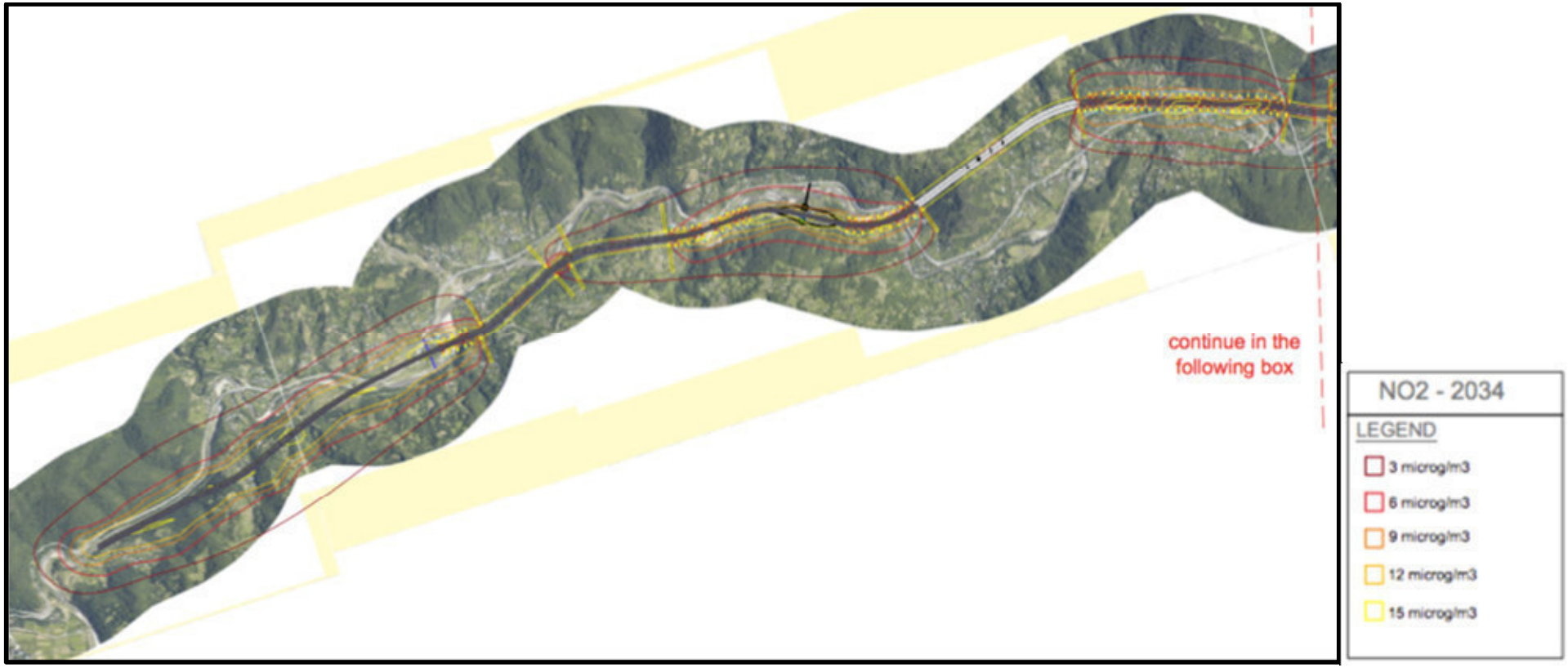


Figure 96: NO_2, 2034

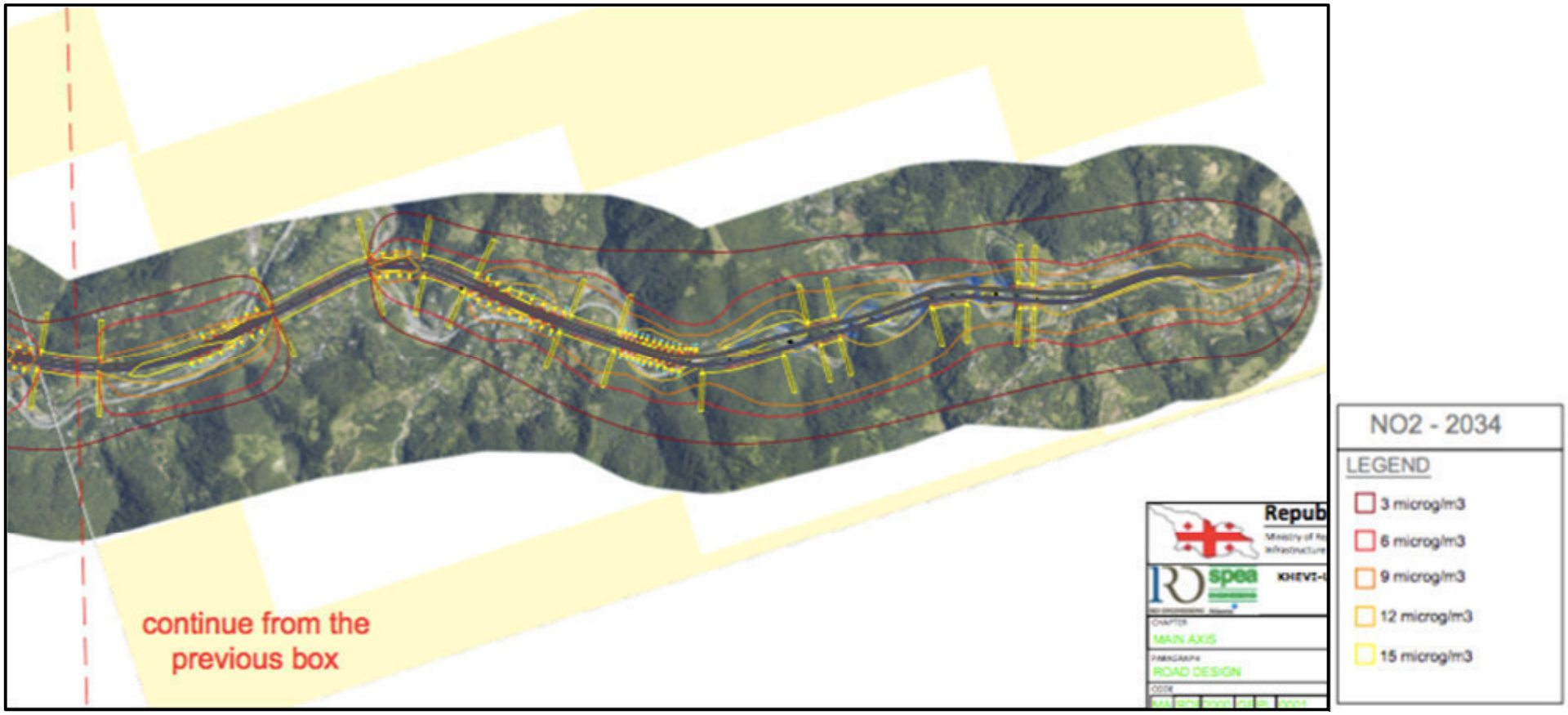


Figure 97: PM10, 2019

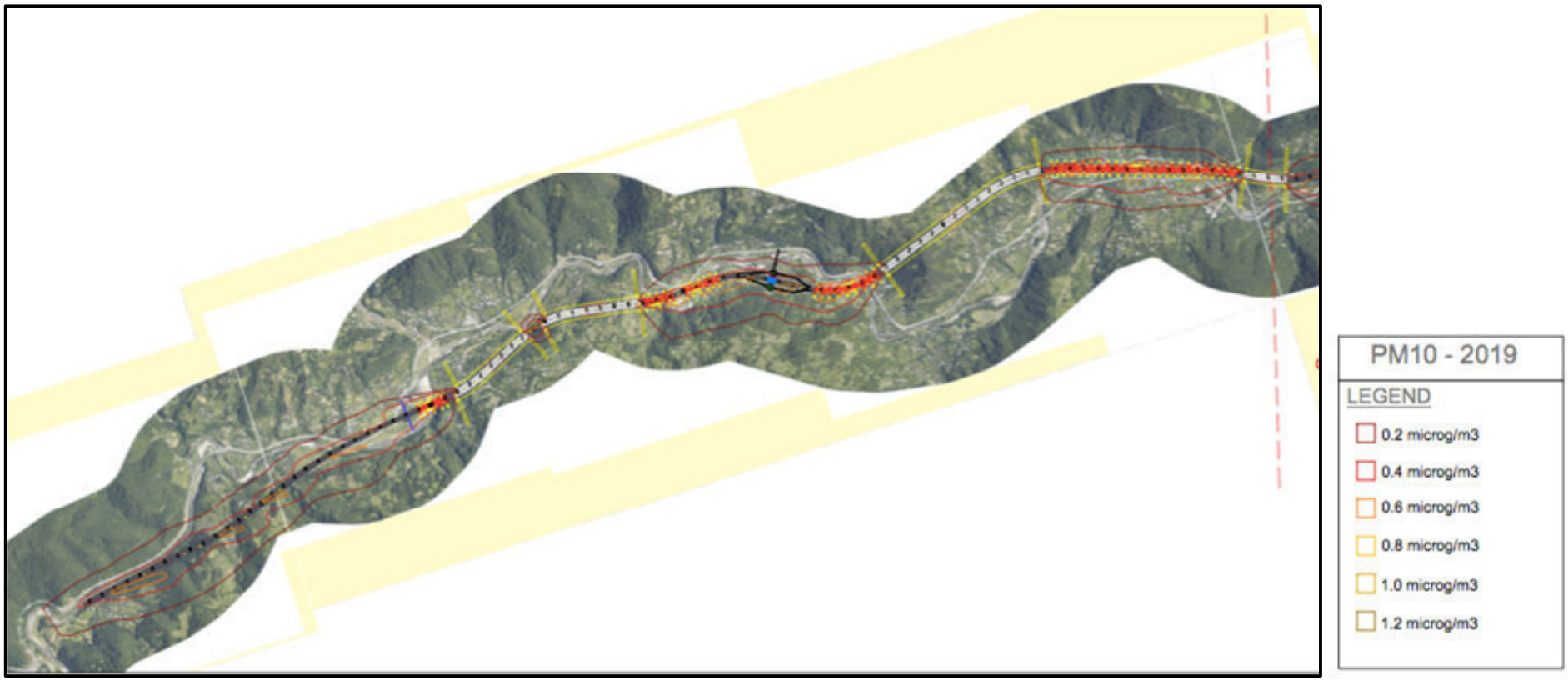


Figure 98: PM10, 2019

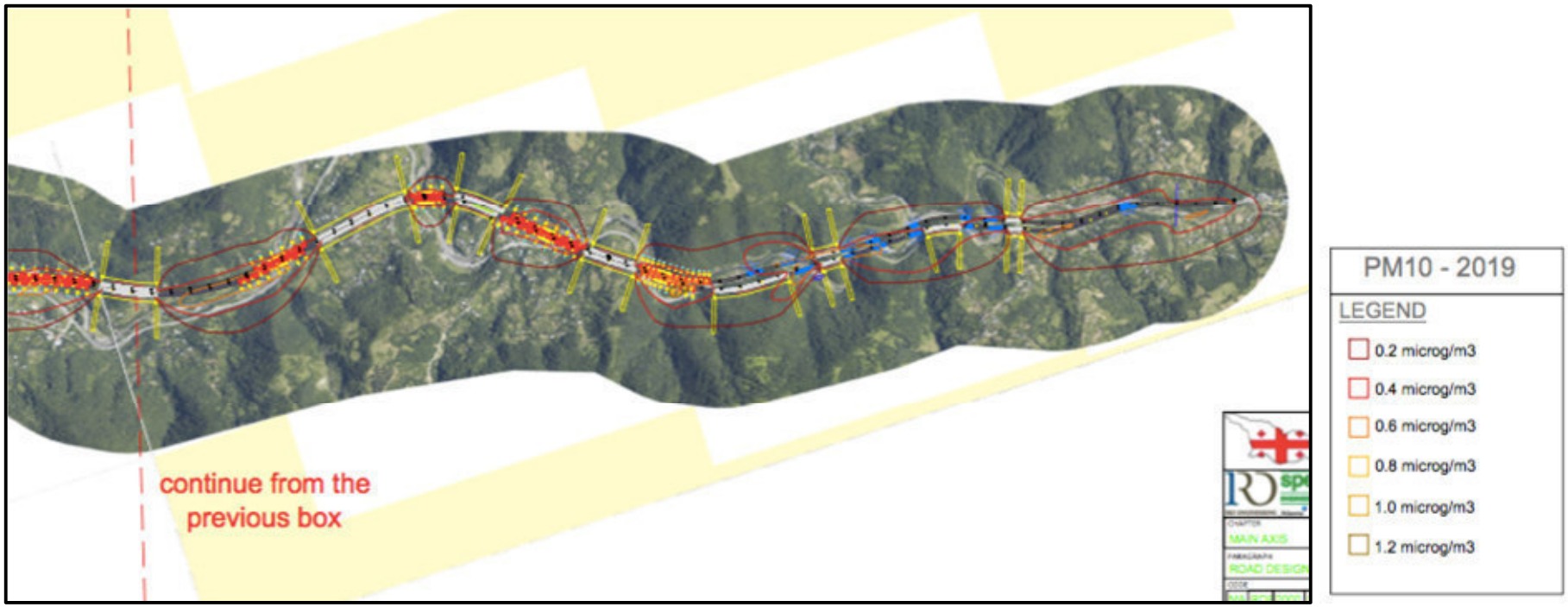


Figure 99: PM10, 2034

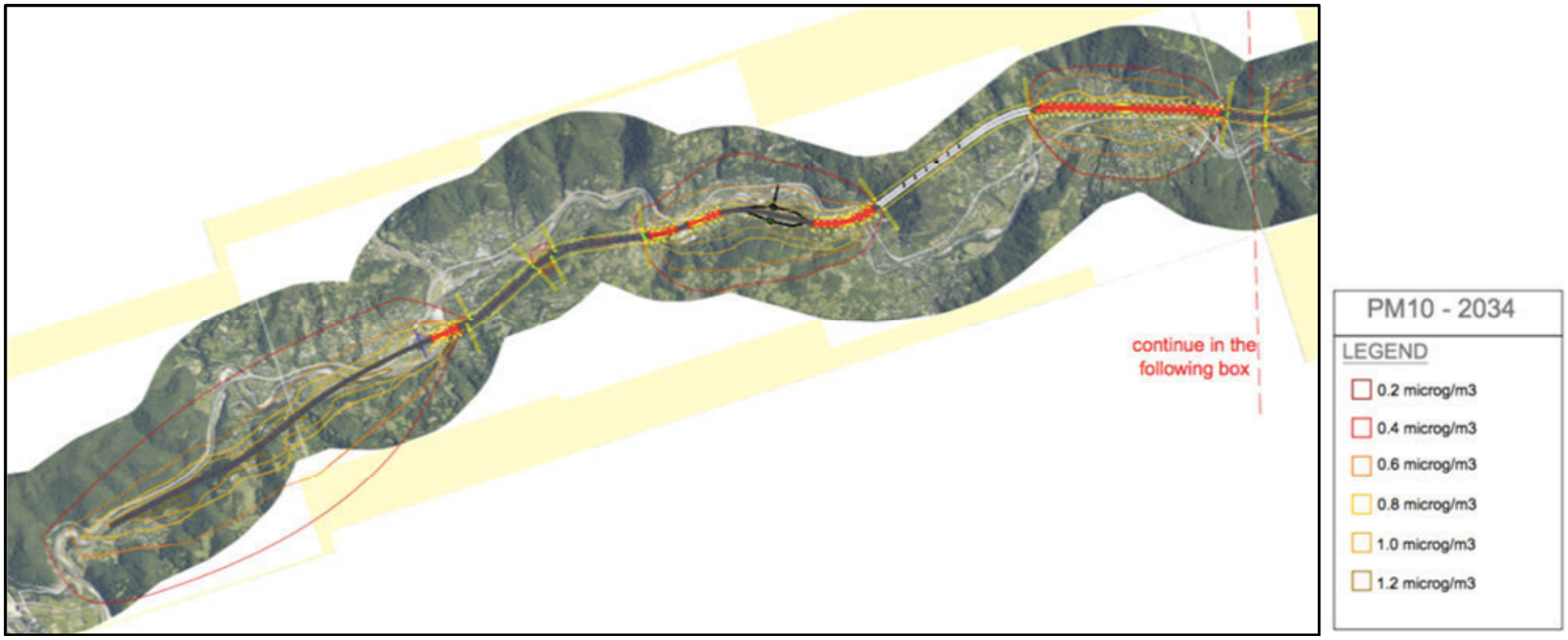


Figure 100: PM10, 2034

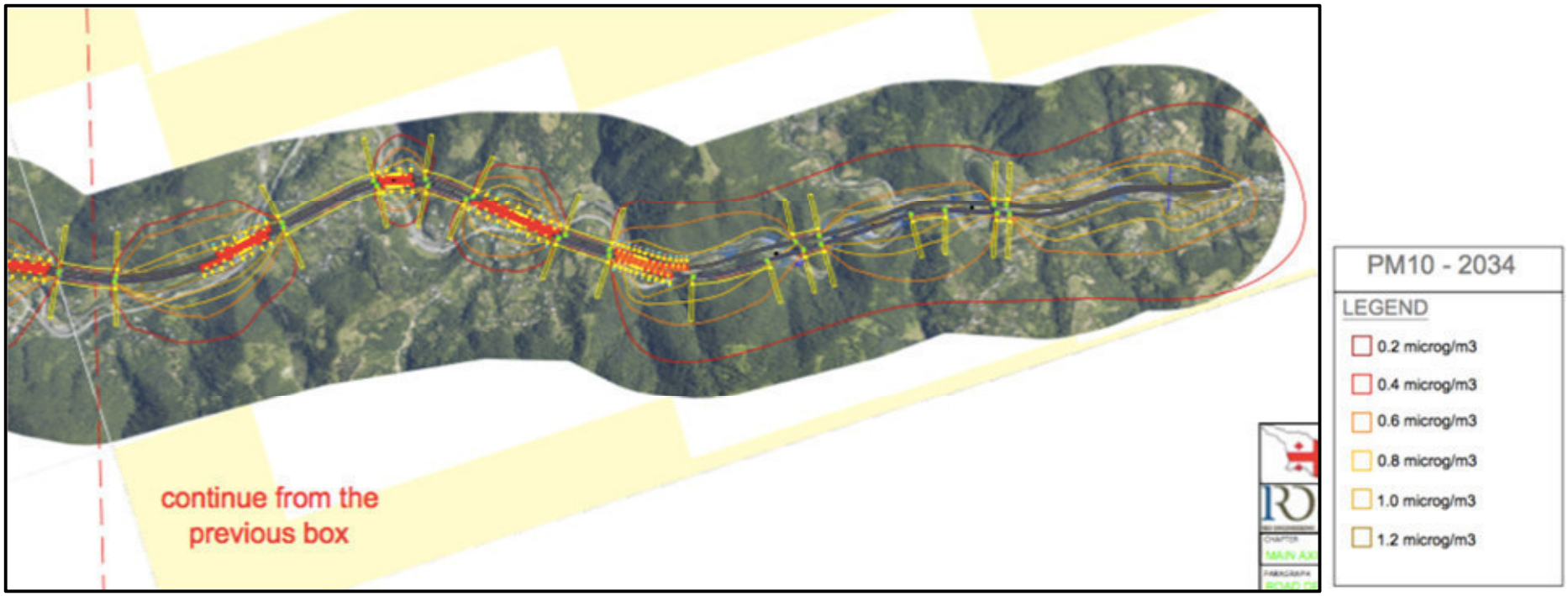


Figure 101: SO_2, 2019

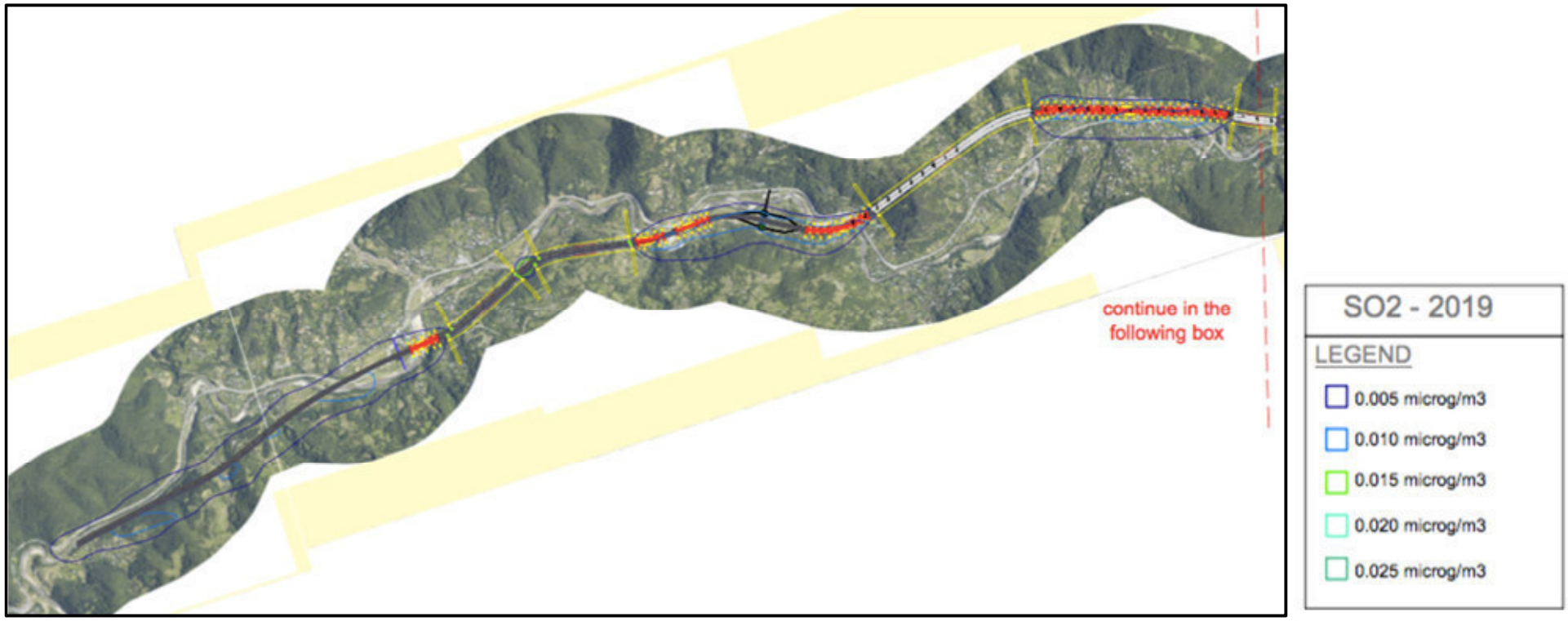


Figure 102: SO_2, 2019

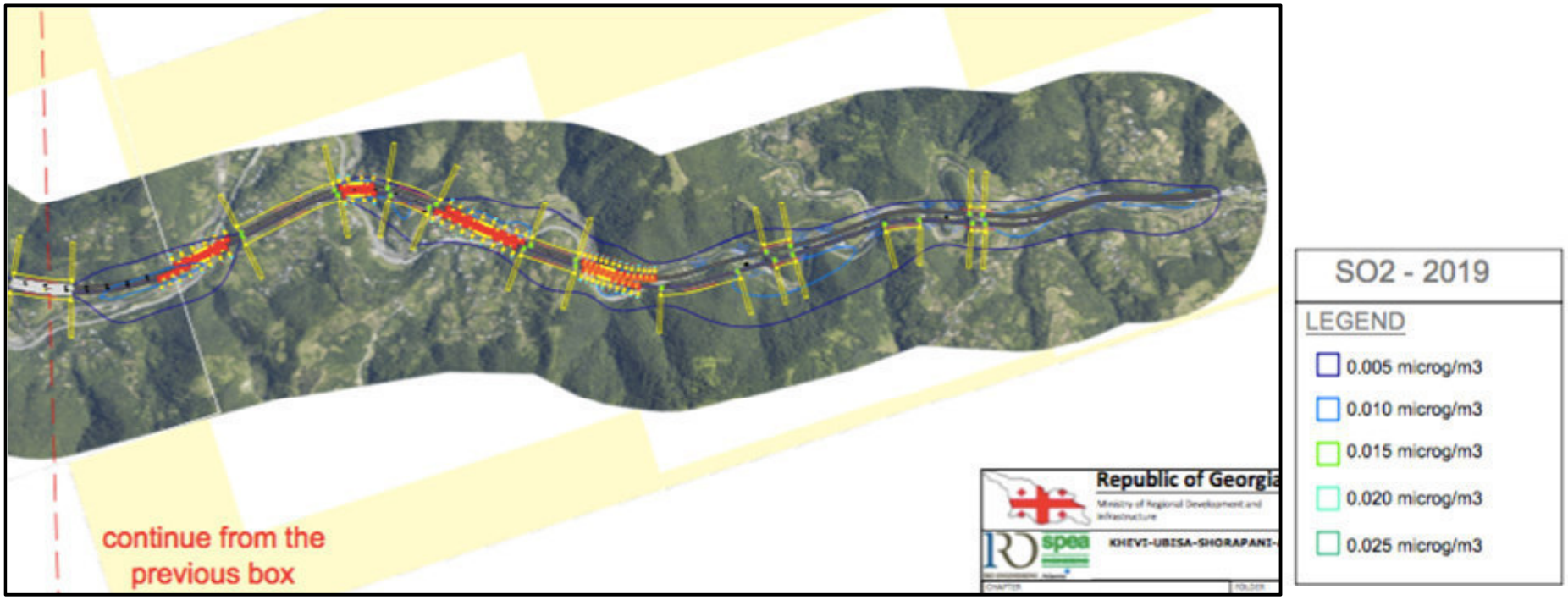


Figure 103: SO_2, 2034

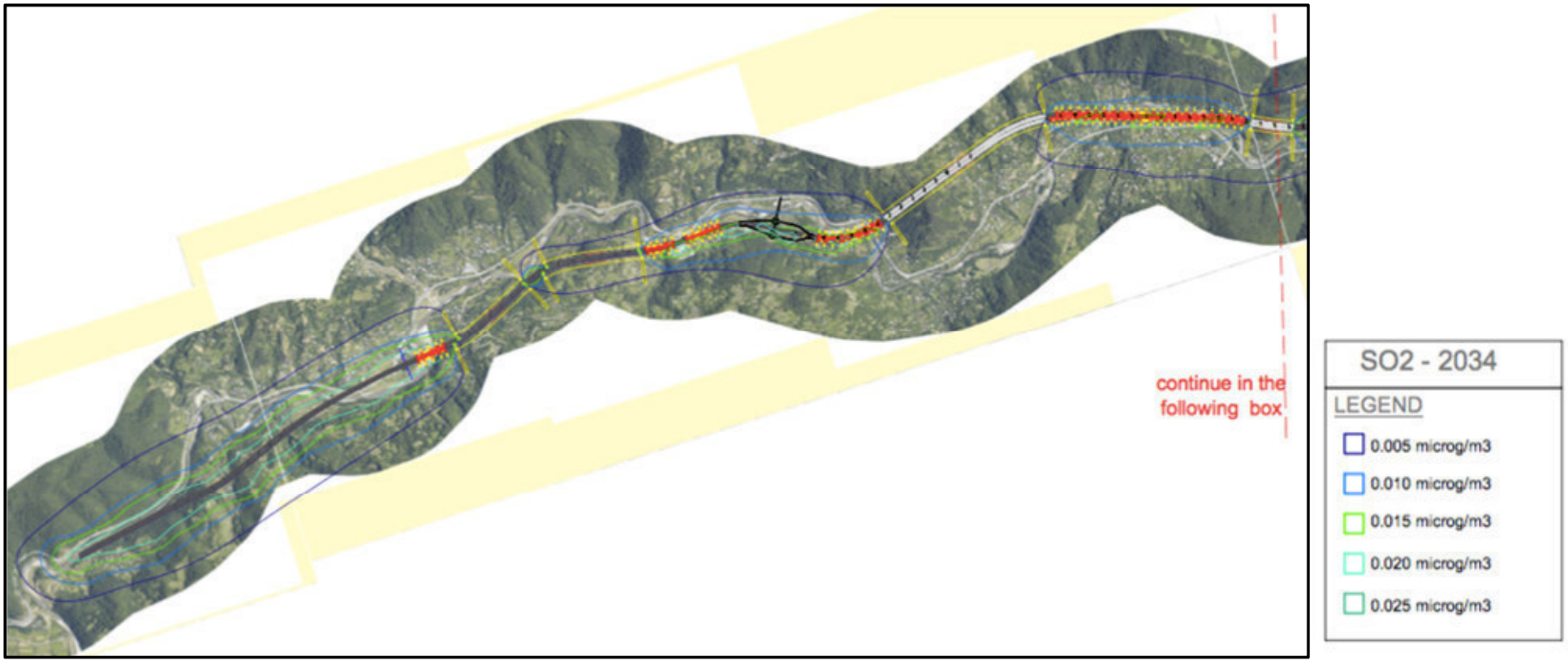
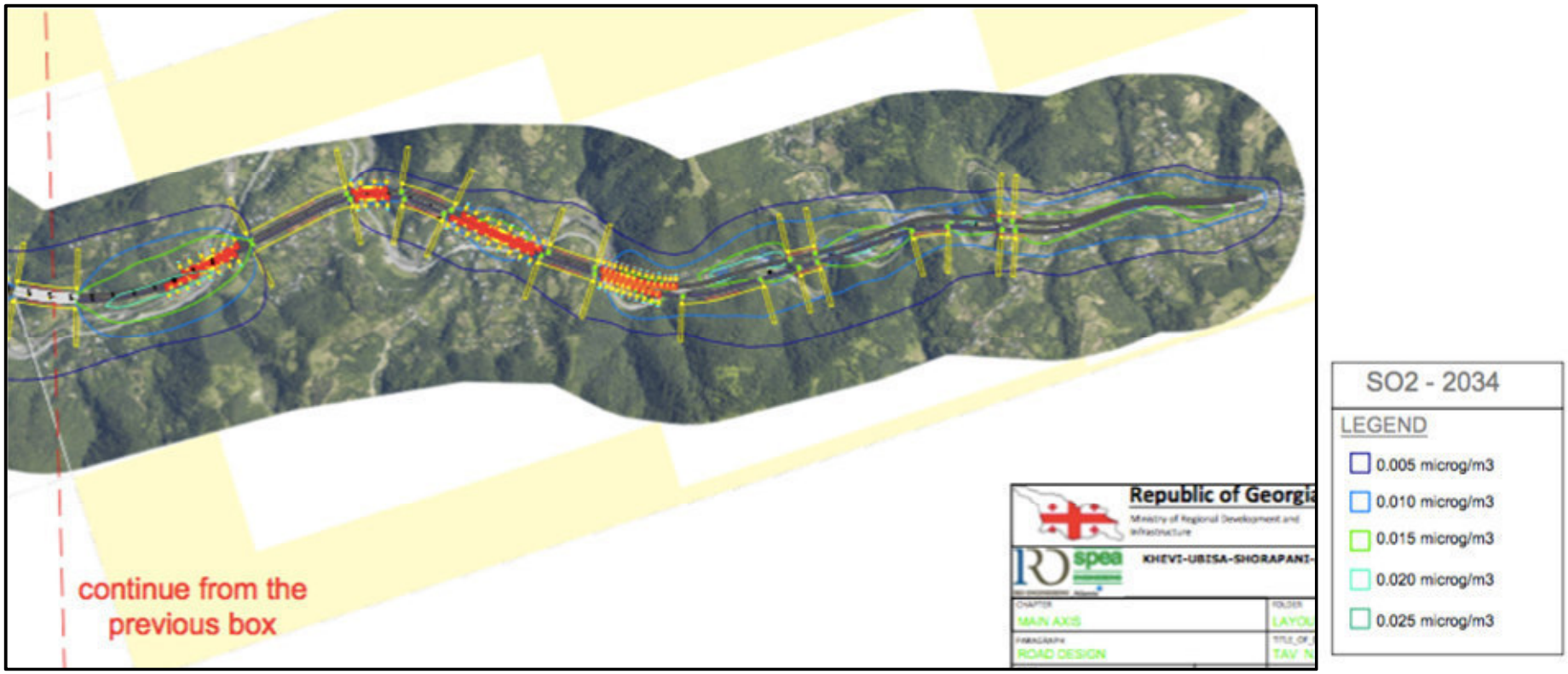


Figure 104: SO_2, 2034



Construction Phase

415. The Contractor will be responsible, through compliance with this EMP and his SEMP, for the following;

(i) Exhaust emissions - No furnaces, boilers or other similar plant or equipment using any fuel that may produce air pollutants will be installed without prior written consent of the Engineer. Construction equipment will be maintained to a good standard and fitted with pollution control devices regularly monitored by the Contractor and Engineer.

(ii) Open burning of waste materials - No burning of debris or other materials will occur on the Site.

(iii) Dust generated from haul roads, unpaved roads, material stock piles, etc:

(a) The Contractor will ensure and that material stockpiles will be located in sheltered areas and be covered with tarpaulins or other such suitable covering to prevent material becoming airborne.

(b) All trucks used for transporting materials to and from the site will be covered with canvas tarpaulins, or other acceptable type cover (which will be properly secured) to prevent debris and/or materials from falling from or being blown off the vehicle(s).

(c) Hard surfaces will be required in construction areas with regular movements of vehicles.

(d) Effective use of water sprays will be implemented (e.g., Carry out watering for dust control at least 3 times a day: in the morning, at noon, and in the afternoon during dry weather with temperatures of over 25°C, or in windy weather. Avoid overwatering as this may make the surrounding muddy). All water used for controlling dust will be free of odor and pollution.

(e) Earthwork operation to be suspended when the wind speed exceeds 20 km/h in areas within 500 m of any community.

416. In addition, any new concrete batching plant, rock crushing facility and asphalt mixing plant will be the subject of separate environmental application under the responsibility of the Contractor. The Engineer will ensure that no such facility becomes operational without the required permits.

417. The Contractor is also responsible for the preparation of a Health and Safety Plan. The Plan, required as part of the SEMP, will include contingencies for the accidental release of toxic air pollutants.

418. Emissions from on-road and off-road vehicles should comply with national or regional programs. In the absence of these, the following should be considered:

(i) Regardless of the size or type of vehicle, owners / operators should implement the manufacturer recommended engine maintenance programmes.

(ii) Drivers should be instructed on the benefits of driving practices that reduced both the risk of accidents and fuel consumption, including measured acceleration and driving within safe speed limits.

(iii) Implement a regular vehicle maintenance and repair program.

Operational Phase

419. Ensure continued maintenance of tunnel ventilation system.

Residual Impact Significance

Construction Phase – ***MINOR***

If the mitigation measures suggested are implemented, the residual impacts of the Project will be minor.

Operational Phase – ***LOW***

Air quality during the operational phase will not be significantly impacted by the Project road.

G.5.2 Climate Change

Potential Impacts Caused by the Project

420. Greenhouse Gas (GHGs) Emissions – The Greenhouse Gas (GHG) emissions resulting from road construction have been estimated to be 2.14 ktCO2/km for a 26m wide road. Including operational and maintenance issues over a 40 year period this figure rises to 3.94 ktCO2/km. Given a road length of 12.2 km, this would result in 48,068 tCO2 of GHG emissions from the construction and O&M phases of the Project over a 40 year period.

Table 72: Estimated Energy Consumption, CO2 Emissions and GHG Emissions for a Concrete Pavement 13 m wide.

Phase	Energy Consumption, TJ/km (26m pavement)	CO_2 Emissions $ktCO_2$/km (26m pavement)	All GHG Emissions $ktCO_2$/km (26m pavement)
Construction	11.51 (23.02)	1.00 (2.00)	1.07 (2.14)
Maintenance – 40 years	2.99 (5.98)	0.19 (0.38)	0.20 (0.40)
Operation – 40 years	12.60 (25.20)	0.66 (1.32)	0.70 (1.40)
Total	27.09 (54.18)	1.85 (3.70)	1.97 (3.94)

Methodology based on IEA ETSAP – Technology Brief T14 –August 2011

421. GHG emissions from traffic using the road have been calculated using the traffic forecasts presented in **Section B**. The existing road traffic is estimated to generate around 259 tons of CO_2 per day, or 94,661 tons of CO_2 per annum. A decrease of 13% of GHG emissions can be achieved when driving at 90 km/h as opposed to transient driving at 60 km/h. If we apply this condition to the traffic forecasts in 2037 a figure of approximately 186,000 tons of CO_2 would be generated by traffic using the road per year. However, this figure could reduce dramatically over the coming years as the performance of cars increase including the use of electric cars running of renewable energy.

Potential Impacts Upon the Project

422. The following section is extracted from the Climate Risk and Vulnerability Assessment & Independent Proof Check prepared by the ADB in April 2018.

Components at High- and Moderate-Risk from Climate Impacts

423. **Bridges** – By 2050, precipitation is expected to decrease by 4.5%, and by 2100, it will decrease by 13%. At the same time, extreme rainfall events are projected to become

more frequent and intense. This may lead to increased scouring and riverbank erosion. In addition, the bridge deck drainage capacity may be overwhelmed and create unsafe driving conditions.

424. By 2100, annual river runoff may decrease by about 13%, and normal water levels in the river channels may be lower by as much as -1.1 m. Water level and flow fluctuations may lead to changes in sub-surface conditions that could affect foundation settlement and pier bearing capacity.

425. By 2050, summer (July – September) temperatures are projected to increase by up to 4.5°C, and the number of consecutive hot days (i.e., days with maximum temperature over 25°C, and days with daily minimum temperatures over 20°C) will become more frequent, which may impact bridge structure and bridge deck paving material.

426. The expected changes in temperatures will stress the bridge deck paving material, which is expected to be a BM. The increase in maximum air temperatures may soften the BM, and the likelihood of shorter winters will reduce the service life of the BM mixture due to abrasion and wear.

427. In addition, an increase in the number, duration and extent of wildfires in the surrounding vegetated and forested areas is expected. The ambient heat generated from these may also affect bridge structures and materials, bridge deck conditions, and may also create unsafe driving conditions.

428. **Tunnels** – By 2050, precipitation is expected to decrease by 4.5%, and by 2100, it will decrease by 13%. At the same time, extreme rainfall events are projected to become more frequent and intense. This may affect overflow drainage capacity and create unsafe driving conditions.

429. By 2050, summer (July – September) temperatures are projected to increase by up to 4.5°C, and the number of consecutive hot days (i.e., days with maximum temperature over 25°C, and days with daily minimum temperatures over 20°C) will become more frequent. While droughty conditions are projected to occur more frequently, it is possible that an additional increase of at least 2% in relative air humidity may occur due to changes on the frequency of extreme rainfall events. This may impact tunnel waterproofing, tunnel lining and ambient air temperatures within the tunnels.

430. In addition, an increase in the number, duration and extent of wildfires in the surrounding hill slopes is expected. The ambient heat generated from the wildfires may affect conditions within the tunnels, and may also create unsafe driving conditions.

431. An increase in droughty conditions combined with more frequent extreme rainfall events will increase risk of flash floods, mudflows and landslides on the surrounding slopes. For F2, the projected risk range for landslides is between 94% in the west and 143% in the east, while the projected risk range for mudflows and flash-floods is between 15% in the east and 23% in the west. An increase in debris flows along the road corridor is likely. These may impact access to the tunnels.

Cut Sections

432. By 2050, precipitation is expected to decrease by 4.5%, and by 2100, it will decrease by 13%. At the same time, extreme rainfall events are projected to become more frequent and intense. Changes to ground water levels and flows may also lead to changes in sub-surface conditions.

433. By 2050, summer (July – September) temperatures are projected to increase by up to 4.5°C, and the number of consecutive hot days (i.e., days with maximum temperature over 25°C, and days with daily minimum temperatures over 20°C) will become more frequent, which will lead to an increase in the number, duration and extent of wildfires in the surrounding vegetated and forested areas.

434. An increase in droughty conditions combined with more frequent extreme rainfall events will increase risk of flash floods, mudflows and landslides on the surrounding slopes. For F2, the projected risk range for landslides is between 94% in the west and 143% in the east, while the projected risk range for mudflows and flash-floods is between 15% in the east and 23% in the west. An increase in debris flows and drainage obstructions is likely.

435. **Surface Water Management** - By 2050, precipitation is expected to decrease by 4.5%, and by 2100, it will decrease by 13%. At the same time, extreme rainfall events are projected to become more frequent and intense. Intense and long-duration rainfall can be regarded as the most critical loading condition. The frequency of such events is projected to increase, which may create loads that exceed the original design parameters.

436. By 2100, annual river runoff may decrease by about 13%, and normal water levels in the river channels may be lower by as much as -1.1 m. In addition, an increase in the number, duration and extent of wildfires in the surrounding vegetated and forested areas is expected. This will likely increase the debris load near drainage channels and openings. Because of changing climatic conditions, projected debris loads, changing land use patterns, and uncertainties in hydrologic estimates, culvert size and capacity should be expansive.

437. An increase in droughty conditions combined with more frequent extreme rainfall events will increase risk of flash floods, mudflows and landslides on the surrounding slopes. For F2, the projected risk range for landslides is between 94% in the west and 143% in the east, while the projected risk range for mudflows and flash-floods is between 15% in the east and 23% in the west. An increase in debris flows and drainage obstructions is likely.

Components at Low-Risk from Climate Impacts

438. **Road Surface** - Nearly all climate parameters affect the road surface. Even under normal climate change conditions, rigid pavements suffer from thermal-expansion stresses.

439. Thermal-expansion stresses, such as scaling, D-cracking, pumping, faulting, curling, corner cracking and ‘punch-outs, are the primary concern due to air temperatures, including absolute yearly maximal and the number of heat days. Curling deformation, resulting in thermal-expansion stresses in the concrete slab, is a characteristic phenomenon under environmental and repeated vehicle loads. Distortion of the slab, due to both upward and downward curling, may occur when the top surface of the slab is cooler than the base course, and also when there is a higher temperature on the top surface, leading to separation of the base course from the concrete. Distress of the pavement in the form of joint deterioration, or cracking, also contributes to void formation by allowing moisture infiltration. The combination of distress and layer voids will further reduce the pavement load carrying capacity. Changes in the capacity of the base course, or subgrade, as a second-order response may also add new stresses to the road surface.

440. While an overall increase in temperature is projected, these are not expected to severely impact the road surface since the projected temperatures are within the German Pavement Design Guideline (RStO 12) reference temperature range (-20°–50°C) used in the pavement design.

441. The increase in the number of consecutive hot days (i.e., days with maximum temperature over 25°C, and days with daily minimum temperatures over 20°C), and the increase in the number, duration and extent of wildfires on the surrounding slopes, may require second level responses.

442. **Interchanges and Access Roads** - There is insufficient information to properly assess climate risks to the interchanges, and the approach and connecting roads.

443. The majority of climate parameters affect BM surfaces, though the increase in the number of hot days and nights is of particular concern. As BM surfaces have a short design life and can be replaced relatively easily, they are not considered a medium- or high-risk component. Changes in air and ground temperatures may also affect the subgrade of the approach and connecting roads, but not to an extent that would result in medium- or high-risk component.

444. **Road Embankment and Road Base** - Most climate events affect the road embankment to some degree. The climate load includes changing ground water levels, that can induce consolidation settlement; ground temperature; ground water regimes; snow cover; and surface vegetation that can reduce their service life. By 2050, precipitation is expected to decrease by 4.5%, and by 2100, it will decrease by 13%. Increasing temperatures and changes in precipitation patterns may impact ground and surface water flows, leading to consolidation settlement.

445. By 2050, summer (July – September) temperatures are projected to increase by up to 4.5°C, and the number of consecutive hot days (i.e., days with maximum temperature over 25°C, and days with daily minimum temperatures over 20°C) will become more frequent, may accelerate soil warming, and in some soil types, creating soil heave.

446. In contrast to the road embankment, the road base is not directly exposed to the atmosphere, and therefore is less impacted by short-term climate events. Changes in the road base capacity would mostly result from loss in strength or formation of voids due to internal erosion, especially if the road surface is cracked.

447. Changes in surface and ground water levels and their impact on the road base and the road embankment, as a second-order response to changes in precipitation levels are difficult to predict, but should be considered.

Management Actions

448. A number of recommendations were made as part of the climate risk assessment. The following table provides those recommendations along with the responses of the Detailed Design Consultant.

Table 73: Climate Change Recommendations and Responses

Recommendation	Detailed Design Consultant Reply
Bridges	
A review of the bridge pier design parameters in light of the potential changes in in soil conditions, with implications for foundation settlement, should be undertaken prior to finalization of the Design Reports.	All piers are designed in order to avoid settlements on the long run and plinths are generally in the floodplain. Plinths in the flowing section of the river, whenever unavoidable, are founded on piles and with the upper face below the riverbed level, as per best practice; the risk of foundations being exposed is consequently minimum. Intervention of protection of the plinths in the floodplain in case of future river bed changes is quite simple and not expensive, so we suggest to monitor this aspect and act

Recommendation	Detailed Design Consultant Reply
	accordingly just in case. Recommendations for the Employer will be included in the "Recommendations for the management of the highway" document, in order to give an instrument of monitoring and managing the maintenance.
The recurrence interval for the bridge drainage system should be upgraded to a 50-year recurrence interval, and the drainage calculations revisited, to ensure concurrency with the other elements of the drainage system.	The shown value "30 years" at paragraph 4.5 of the Design Report is a typo mistake, indeed as you can check the discharge per unit area considered is that effectively used for all other drainage elements. i.e. 50 years (50,5 m3/s/km2).
As part of road maintenance and key indicator monitoring, bridge deck retrofitting trigger levels – to recognize the point at which impacts are beginning to be experienced at specific locations – should be developed for initiation of management responses.	Bridge deck retrofitting trigger levels will be included in the "Recommendation for the management of the highway" document
Tunnels	
Verify that the parameters for the waterproofing and ventilation systems include potentially higher humidity values.	Waterproofing inside a tunnel is designed to prevent water circulating in the rocks from entering the tunnel, and, if properly executed, it should not be considered as a main humidity values rise driver. The humidity values are not a problem for these tunnels since they are unidirectional, so they do not affect the ventilation system or the smoke.
A 50-year recurrence interval for the tunnel drainage system should be used for consistency with other drainage system parameters, and all design calculations reviewed.	Highway platform drainage inside tunnels is designed to manage possible accidental losses of hazardous liquids from trucks as a consequence of an accident. In fact this is a close system, with "no-fire-inlet" manholes to avoid the spread of the flame and a storage tank at the lower portal. Tank that won't discharge on the rivers but will be emptied by means of pumps. Having neither direct precipitation nor runoff inflow in the tunnel, the relevant drainage is not an issue and it is not correlated to any specific hydrological return period.
The potential for higher levels of channel obstruction should be explicitly integrated into the drainage system design, due to increased mass movement and erosion activities.	See above. Moreover, at each portal there is a drainage system collecting water coming both from the platform and from the slope and discharging it in the river, by means of pipes or culverts, before entering the tunnel. In any case sediments are not expected to enter in a significant amount the tunnel drainage system.
The design of the tunnel portals and wing walls should be reviewed for suitability for higher levels of mass movement and erosion activities.	All the slopes at the portal, when not covered with material coming from excavation (slope 7 on 4), are protected with net, dimensioned case by case, based on the geotechnical conditions.
Cut Sections	
A decrease in the cut slope gradient, and a concurrent increase in the overall slope buffer area, is recommended.	The choice of the cut slope is a compromise between the geotechnical constraints and the occupation of land. Reducing the slope of the cuts in many cases will cause larger road footprint (often more than a hundred meters), which would not acceptable for its landscaping and resettlement impacts and for the volumes of spoil material generated. In any case the geotechnical verification (not present in the draft) have been carried out with conservative safety coefficient.

Recommendation	Detailed Design Consultant Reply
Increased use of hydro seeding on all the cut slopes, not just their upper most area, is recommended.	The steepness of the slope (almost vertical) and the presence of rock don't allow the use of hydro seeding. This would more be the case of a "vertical garden", which is not a technology practiced in Georgia. That's why the designer's choice was the more industrial, but effective steel net protection.
Surface Water Management Structures	
A consistent 50-year recurrence interval for the road drainage system should be used throughout the design, and all design calculations reviewed.	50 years return period is used as clearly stated in the design documents (check paragraphs 4.1, 4.2, 4.3 and 4.4; statement at paragraph 4.5 about the 30 years RP is, again, only a typo mistake).
Assumptions and calculations for areas with high degree of mass movement and high potential for channel obstruction should be explicitly integrated into the drainage system design.	Mass movements are mostly unpredictable, as well as the yearly amount of debris flow. We only can suggest to the Employer to monitor these phenomena and to act accordingly, in case of event. Monitor of mass movement will be included in the "Recommendation for the management of the highway" document.
Use of box culverts, which are better at managing debris flows and related obstructions than pipe-based systems, is recommended.	Indeed, only box culverts are adopted all along the motorway for hill slope water (see table 3.7.1. of the hydraulic report). Further, given that a design solution with external ditches has been chosen for both embankment/fill and cut section, the motorway platform always lies higher than external ditches, so that drainage pipes are not expected to convey significant debris flow.

449. Given the above, no mitigation or management measures are required other than ensuring the items outlined above are included in the "Recommendations for the management of the highway" document.

Residual Impact Significance

Construction Phase – ***MINOR***

Operational Phase – ***LOW/MEDIUM***

Residual impacts from the generation of GHGs will remain throughout the lifecycle of the Project. This is an unavoidable consequence of the Project, but as noted in other sections of this report, the growth of the electric car market and more fuel efficient cars may, in the future lead to a decrease in the emissions generated on the Project road. The Detailed Design Consultant have considered the recommendations of the climate risk assessment and will add them to the "Recommendation for the management of the highway" document where applicable. No other actions are considered necessary to address climate change issues.

G.5.3 Soils

Potential Impacts

450. Potential impacts to soils include:

(i) Loss of Topsoil - Several impacts to topsoil may occur during the construction phase, including; removal of top soil for construction outside the ROW; compaction of topsoil; loss of top soil by wind and water erosion and covering of top soil by project works.

(ii) Erosion - It is possible, that without adequate protection measures soil erosion could occur on road embankments and bridge embankments. It is also possible, that stockpiles of soil located close to surface waters could infiltrate the water courses during heavy rainfall and cause siltation of the rivers.

(iii) Borrow Pits – No borrow pits are required under this Project as the quality and quantity of spoil material from tunnels and other cuts is suitable for construction purposes.

(iv) Induced Changes - It is possible that construction of the new road could induce development along the corridor to some extent, but in general the purpose of the Project is to improve the existing E-60 corridor to provide safer and quicker journey times which will help facilitate the movement of people and goods locally and regionally. It is considered unlikely that significant new commercial, industrial or residential developments would arise along this portion of the corridor as a result of the Project that in turn may lead to conversion of agricultural land or other impacts to productive soils.

(v) Contamination Due to Spills or Hazardous Materials - Potential soil contamination is a possibility resulting from poorly managed fuels, oils and other hazardous liquids used during the project works.

Management & Mitigation Actions

Construction Phase

451. Potential adverse impacts will be avoided or otherwise mitigated by ensuring the Contractor complies with the following:

(i) Erosion - During construction, the Contractor will be responsible for ensuring material that is less susceptible to erosion will be selected for placement around bridges and culverts. In addition, he will ensure re-vegetation of exposed areas including; (i) selection of fast growing and grazing resistant species of local grasses and shrubs; (ii) immediate re-vegetation of all slopes and embankments if not covered with gabion baskets; (iii) placement of fiber mats to encourage vegetation growth. The Engineer and the Contractor will both be responsible for ensuring that embankments are monitored continuously during construction for signs of erosion. These actions and activities will be included in the Contractors Clearance, Re-vegetation and Restoration Management Plan.

(ii) Topsoil – To reduce impacts to topsoil the following measures will be employed by the Contractor; locate topsoil stockpiles outside drainage lines and protect stockpiles from erosion; construct diversion channels and silt fences around the topsoil stockpiles to prevent erosion and loss of topsoil; rip ground surface prior to the spreading of topsoil; and remove unwanted materials from topsoil such as roots of trees, rubble and waste etc. Specifically regarding soil compaction, the Contractor will confine operation of heavy equipment within the ROW, as much as possible, to avoid soil compaction and damage to privately owned land. If in case private lands are disturbed, the contractor should promptly inform the owner and agree on the ways to remedy the situation.

(iii) Contamination Due to Spills or Hazardous Materials. The Contractor, with oversight from the Engineer, will ensure that:

(a) All fuel and chemical storage (if any) will be sited on an impervious base within a bund and secured by fencing. The storage area will be located away from any watercourse or wetlands. The base and bund walls will be impermeable and of sufficient capacity to contain 110% of the volume of tank (or one tank if more than one tank is located in the bund).

(b) The construction camp maintenance yard will be constructed on impervious hardstanding with adequate drainage to collect spills, there will be no vehicle maintenance activities on open ground.
(c) Filling and refueling will be strictly controlled and subject to formal procedures. Drip pans will be placed under all filling and fueling areas. Waste oils will be stored and disposed of by a licensed contractor.
(d) All valves and trigger guns will be resistant to unauthorized interference and vandalism and be turned off and securely locked when not in use.
(e) The contents of any tank or drum will be clearly marked. Measures will be taken to ensure that no contaminated discharges enter any soils.
(f) No bitumen drums or containers, full or used, will be stored on open ground. They will only be stored on impervious hardstanding.
(g) Areas using bitumen will be constructed on impervious hardstanding to prevent seepage of oils into the soils.
(h) No bitumen drums or containers, full or used, will be stored on open ground. They will only be stored on impervious hard standing.
(i) Areas using bitumen will be constructed on impervious hard standing to prevent seepage of oils into the soils.

Residual Impact Significance

Construction Phase – ***MINOR***

If the mitigation measures suggested are implemented, the residual impacts of the Project will be minor.

Operational Phase – ***LOW***

The erosion protection measures outlined above will prevent impacts occurring into the operational phase of the Project.

G.5.4 Hydrology

Potential Impacts

Pre-construction Phase

452. The following potential impacts to hydrological conditions exist within the Project corridor:

(i) Drainage & Flooding - Inadequate assessment of the hydrological conditions in the Project Area and poor design could result in damage to Project structures, including bridges and culverts. This in turn would result in several impacts including cost to rebuild the structures, potential flooding of agricultural land and property and impacts to surface water quality.
(ii) Construction Camps – Improper siting and design of construction camps can have negative impacts to hydrology, both surface and groundwater, through improper disposal of liquid waste and spills of hazardous liquids.

453. The span of the bridges is designed to avoid, as far as possible, the presence of foundation piles in the riverbed. That said, it is important to point out that the intervention is located in a complicated orography (a narrow valley with a central stream) and that the

geometric standards of the route have imposed strong constraints that oblige to pass over the river, to have no greater environmental impact on forests or populated areas.

Construction Phase

454. Bridge Construction - Bridge construction activities may increase silt load in the river during construction at bridge sites and may result in accidental spillage of concrete and liquid waste into the river. This may impact upon the biodiversity of the rivers. Excavation of river bed materials will be required during the construction of the bridge piers (Approximately 56 piers out of around 160 in total will be constructed within the river itself).

455. Hazardous Liquids - From the construction activities, there will be significant use of fuel and lubricant and other hazardous liquids such as paints. Without standardized materials handling and storage protocol in place, spills and contamination of groundwater and soils is possible. Other impacts to groundwater could occur from the washing out of concrete mixers onto bare soils and a lack of oil and grease interceptor tanks in camp drainage systems.

456. Water Use – Technical water may be sourced from the Dzirula and Rikotula rivers. The required amounts, potentially 200 m^3 per day (0.002 m^3/s) are insignificant given the flow rates of these major rivers (The lowest flow in the Dzirula is during August with a flow of approximately 3.445 m^3/s). However, where necessary the relevant permits will be obtained for surface water abstraction.

457. Tunnel Construction – Impacts associated with tunnel construction are discussed under **Section G.7.5** below.

458. No fisheries have been identified within the Project area, or residents that rely on fishing as a livelihood. As such no impacts to livelihoods or fisheries or activities downstream are anticipated. Recreational fishing was noted in the Dzirula river during site visits. Impacts to recreational fishing are anticipated to be short term and minor.

Operational Phase

459. In rare circumstances there could be a major spill of oil / fuel from tanker trucks. Such spills could impact significantly on the Dzirula and Rikotula rivers given the proximity of the road to these surface water courses in many locations along the alignment.

460. Drainage of run-off from bridge decks could flow directly to the rivers if correct drainage is not installed on the bridges. This could be a problem if the bridges have accumulated oils and grease during dry periods and they are suddenly washed out during heavy rainfall.

Management & Mitigation Actions

Pre-construction Phase

461. Drainage and Flooding - Consideration in the design phase has be given to the issue of drainage and culverts to ensure that drainage patterns are improved from the existing conditions and that increased run-off does not occur or result in flooding of areas previously undisturbed. During design, all drainage works have been designed based on the historical flood data and flood forecasting. A design discharge of 50 years return period is considered for culverts, and 100 years of bridges.

462. It is also strongly recommended that the RD considers including the use of oil separators within the road drainage system to capture any spills of oil / fuel and also to filter hydrocarbon run-off from the road in general.

463. Bridges - All bridges will be designed for the life expectancy of 100 years. The design loading and design of all structural components will conform to the bridge design standards provided in the Employer's Special Requirements.

464. The bridges shall be designed with dry paths under the bridge on either side of the streams to facilitate movements of people, livestock and wildlife, the latter primarily at night when people are not around.

465. Bridge designs will ensure that drainage from bridge decks over 50 meters do not discharge directly to the watercourses beneath the bridges. The bridge run-off waters will lead to an interceptor tank, or filter pond adjacent to the bridge in order to trap oil and grease run-off so that it cannot enter any portion of the Dzirula and Rikotula rivers. The bridge design and layout must also be aesthetically pleasing and in harmony with the existing environment. Finally, the Contractor, through his Environmental Manager, will be responsible for consulting with MoEPA to confirm the fish spawning period (see Table Figure 80) in relation to the bridge construction works to ensure that all works are scheduled to take place periods least likely to affect the fish spawning period. The Contractor shall also prepare a Bridge Construction Plan prior to the starting of works at any bridge construction site. The Plan shall include items relating to the construction schedule, construction techniques, work areas, equipment use, siting of hazardous liquids and waste materials, provision of coffer dams, fish spawning periods, results of any other fauna surveys, e.g. for otters, procedures for fueling of vehicles, sediment management, methods to reduce turbidity, OHS measures, etc.

466. Construction Camps – In the first instance, no construction camp, permanent or temporary, will be located within 500 meters of any river, or irrigation channel (not including drainage channels) identified in this report, including the Dzirula and any of its tributaries. The Contractor will also be responsible for the preparation of a Construction Camp Site Plan which will form part of the SEMP. The Plan will indicate the system proposed and the locations of related facilities in the site, including latrines, holding areas, septic tanks, etc. The Contractor will ensure the following conditions are met within the Plan:

(i) Wastewater arising on the site will be collected, removed from the site via a suitable and properly designed temporary drainage system and disposed of at a location and in a way that will cause neither pollution nor nuisance.
(ii) There will be no direct discharge of sanitary or wash water to surface water, including the surface water courses identified in this report, including the Dzirula and its tributaries. Disposal of materials such as, but not limited to, lubricating oil and onto the ground or water bodies will be prohibited.
(iii) Liquid material storage containment areas will not drain directly to surface water (including wetlands).
(iv) Lubricating and fuel oil spills will be cleaned up immediately and spill cleanup materials will be maintained (including spill kits) across the Contractors construction camp and ancillary facilities, e.g. asphalt plant.
(v) Construction and work sites will be equipped with sanitary latrines that do not pollute surface waters.
(vi) Discharge of sediment-laden construction water directly into surface watercourses or wetlands will be forbidden. Sediment laden construction water will be discharged into settling lagoons or tanks prior to final discharge.
(vii) Spill cleanup equipment will be maintained on site. The following conditions to avoid adverse impacts due to improper fuel and chemical storage:
(viii) Fueling operations will occur only within containment areas.

(ix) All fuel and chemical storage (if any) will be sited on an impervious base within a bund and secured by fencing. The storage area will be located away from any watercourse or wetlands. The base and bund walls will be impermeable and of sufficient capacity to contain 110% of the volume of tanks.
(x) Filling and refueling will be strictly controlled and subject to formal procedures and will take place within areas surrounded by bunds to contain spills / leaks of potentially contaminating liquids.
(xi) All valves and trigger guns will be resistant to unauthorized interference and vandalism and be turned off and securely locked when not in use.
(xii) The contents of any tank or drum will be clearly marked. Measures will be taken to ensure that no contaminated discharges enter any drain or watercourses.
(xiii) Disposal of lubricating oil and other potentially hazardous liquids onto the ground or water bodies will be prohibited.
(xiv) Should any accidental spills occur immediate cleanup will be undertaken and all cleanup materials stored in a secure area for disposal. Disposal of such was will be undertaken by a waste management company contracted by the Contractor. The waste management company must have the required licenses to transport and dispose of hazardous waste before any such waste is removed from the site. The Contractor will keep copies of the company's licenses and provide waste transfer manifests at his camp site for routine inspection by the Engineer.

Construction Phase

467. Construction Camps and Storage Areas – The Engineer will undertake regular monitoring of the Contractors construction camp and storage areas to ensure compliance with the SEMP and the Contractors Construction Camp Site Plan.

468. Site plans will be devised to ensure that, insofar as possible, all temporary construction facilities are located at least 100 meters away from any surface water course. If determined warranted by the Engineer, the Contractor will provide a wash pit or a wheel washing and/or vehicle cleaning facility at the exits from the Contractors camp sites. If so requested, the Contractor will ensure that all vehicles are properly cleaned (bodies and tires are free of sand and mud) prior to leaving the site areas. The Contractor will provide necessary cleaning facilities on site and ensure that no water or debris from such cleaning operations is deposited off-site.

469. Bridge Construction - Concerning bridge construction works, the Contractor will:
(i) Divert the water flow near the bridge piers.
(ii) Provide coffer dams, silt fences, sediment barriers or other devices to prevent migration of silt during construction within streams.
(iii) Perform dewatering and cleaning of cofferdams to prevent siltation by pumping from cofferdams to a settling basin or a containment unit.
(iv) Carry out bridge construction works without interrupting the traffic on the Project Road with the provision of suitable diversions.
(v) Ensure no waste materials are dumped in the river, including re-enforced concrete debris.
(vi) Place generators more than 20 meters from the river.
(vii) Ensure that no concrete waste is dumped in the river.
(viii) Carefully collect all polystyrene (from expansion joints) so that it does not litter the local environment.
(ix) Ensure that no hazardous liquids are placed within 10 meters of the river.

(x) Provide portable toilets at bridge construction sites to prevent defecation by workers into the river.
(xi) Ensure that workers are provided with correct PPE including harnesses.
(xii) During piling works ensure that pumped water is filtered through a silt trap before being discharged to the river.
(xiii) Provide areas where concrete mixers can wash out leftover concrete without polluting the environment. This may be in the form of a lined settling pond at each bridge site. Drivers will be informed of these locations and the requirements to use these settling ponds on a routine basis by the Engineer. Dried waste from the settling ponds can be used as backfill for culverts, etc.

470. Drainage and Flooding - During the construction phase the Contractor will be required to construct, maintain, remove and reinstate as necessary temporary drainage works and take all other precautions necessary for the avoidance of damage to properties and land by flooding and silt washed down from the works. Should any operation being performed by the Contractor interrupt existing irrigation systems, the Contractors will restore the irrigation appurtenances to their original working conditions within 24 hours of being notified of the interruption. The Contractor will also be responsible for ensuring that no construction materials or construction waste block existing drainage channels within the Project corridor. The Engineer will be responsible for routine monitoring of drainage channels to ensure they remain free of waste and debris.

471. Tunnel Construction - Mitigation associated with tunnel construction are discussed under **Section G.7.5** below.

Operational Phase

472. During the operational phase of the Project, the RD will be responsible for monitoring drainage along the road to ensure that it does result in increased run-off and flooding. The RD will be responsible for rectifying this issue if it occurs.

473. During routine maintenance, the Contractor shall:
(i) Perform maintenance paving of the road sections and bridge decks only in dry weather to prevent runoff contamination.
(ii) Use staging techniques to reduce the spread of paving materials during the repair of potholes and worn pavement. These can include covering storm drain inlets and manholes during paving operations, using erosion and sediment controls to decrease runoff from repair sites, and using drip pans, absorbent materials and other pollution prevention materials to limit leaks of paving materials and fluids from paving machines.
(iii) Comply with mitigation measures defined for water protection during construction.
(iv) Remove all waste, material, machinery and tool from the area after completion of works.
(v) Reinstate disturbed areas – if the case.

Residual Impact Significance

Construction Phase – ***MINOR***

If the mitigation measures suggested are implemented, there will be no significant residual impacts.

Operational Phase – ***LOW/MEDIUM***

It is noted that the Project requires interceptor tanks for bridge run-off and this could also be applied to the road drainage network in general, if not residual impacts will occur during the operational phase as polluted road water run-off drains directly into surface water courses.

G.5.5 Natural Hazards

Potential Impacts

474. No significant issues have been identified relating to landslides that cannot be managed by incorporation of the design measures outlined in **Section F.1.4 Natural Hazards.**

475. The project is located in a seismically active area. The Detailed Design Consultants have experience of designing roads in seismically active areas and have ensured that all designs are compliant with the relevant seismic standards of the GoG.

476. Potential flood events are discussed above under **Section G.5.4 - Hydrology**) and increased precipitation is discussed above under **Section G.5.2 Climate Change.**

Management & Mitigation Actions

477. None required.

Residual Impact Significance

Construction Phase – ***NONE***

No residual impacts are anticipated.

Operational Phase – ***NONE***

G.6 Ecological Resources

G.6.1 Biodiversity

Potential Impacts

478. The main concerns for impacts on ecological receptors are disturbances caused by site clearance/preparation, the spread of invasive species and contamination of feeding, breeding and resting habitats. Another concern is poaching due to a lack of regulation.

479. **Site Clearance** - The main effects of site clearance/preparation and movement of equipment include loss of habitat. The ecological receptors most affected include those that have limited mobility such as terrestrial flora, reptiles and amphibians. Loss of habitat can also affect more mobile species which lose breeding, nesting and feeding sites. The spread of invasive plant species is facilitated by disturbances such as site clearance and this results in a risk to the native, endemic and relict flora.

480. The removal of vegetation, including up-rooting of shrubs and cutting of trees, will result in loss of plants, contributing to a decline in their numbers, as well as loss of habitat for species of mammals, birds, insects and herpetofauna that they provide. Fauna with limited mobility, such as reptiles, are at a greater risk of direct mortality due to Project- related activities such as movement of equipment.

481. Site clearance/preparation and movement of equipment results in the removal of top soil which can negative influence several soil functions which are relevant in nature and environmental protection, e.g. carbon storage, and a decrease in biological activity.

482. Reptiles and amphibians have limited ranges and are unable to travel long distances unlike birds and mammals. As a result any individuals found within the Project area are at risk of either being killed by Project-related activities, or having suitable habitat destroyed and perishing as a result of their inability to re-locate.

483. Loss of habitat results in the loss of breeding, feeding and nesting sites for all species including highly mobile ones.

484. **A number of trees will need to be cut within the Project area, both on private land and within State Forest Fund areas. Other trees (potentially including Georgian red-listed species) are located adjacent to the boundary of the site and may be damaged accidentally by construction works.**

485. The Project road has been designed in such a way that will be no significant fragmentation of habitat during the operational phase of the Project. The majority of the roads alignment traverses either bridges or tunnels, meaning that wildlife can easily pass above the road, or under it to access the Rikotula and Dzirula rivers. However, during the construction there may be some minor, short term fragmentation of habitat caused by access roads and other temporary facilities.

486. **Pollution and Waste Generation** - Pollution and improper disposal of waste, generated during construction activities, poses a threat to surrounding fauna. The ecological receptors at risk are not only those that have limited mobility but also more mobile receptors, such as fish and bird fauna which pass through the Project area. Improper waste disposal can result in dumping on vegetation and contamination of soil which can result spread of contaminants into the ecosystem. Water bodies can also be contaminated. Both land and water pollution can result in contamination of the food chain. Pollution of water channels can put at risk both aquatic and terrestrial ecosystems. Pollution from noise and dust from construction activities will result in presently suitable habitat nearby becoming uninhabitable. It can also cause loss of suitable foraging and breeding sites.

487. Pollution of the Dzirula river can result in contamination of sites that may currently be suitable habitat for feeding and breeding of fish species.

488. Work Sites in and around Rivers – A number of bridges will be constructed across the Dzirula and Rikotula rivers. Works involve the construction of bridge abutments and bridge piers which in many instances will be undertaken in the river itself or on the river banks. Temporary impacts on fish may result from sedimentation and water turbidity in the immediate vicinity of the construction work area (especially around the bridge construction zones), and the potential for minor introduction of pollutants from construction operations.

489. **Light Pollution** - Light pollution may have impact on bats. Since these species are nocturnal light may disrupt bat commuting routes or deter bats from feeding areas. Besides the light may cause delay in emerging from the roosts in the evening and reduce foraging ability. On the other hand light can be beneficial for insectivorous species, since light attracts insects. However, it can also make them more vulnerable to predation by nocturnal birds such as owls.

490. **Lack of Regulation** - Staff involved on-site, such as workers and site managers, can engage in poaching and illegal exploitation of wildlife. This can result in the targeting of

species of conservation importance including those currently under legal protection from hunting and exploitation.

491. **Impacts on Ecosystems** – Ecosystems can be divided into terrestrial and aquatic ecosystems.

(i) The impact on terrestrial ecosystems will be limited, with the main one being due to loss of habitat from construction of the Project.

(ii) The spread of invasive species, however, if not prevented, will have an impact on the terrestrial ecosystem, especially on the composition of native flora. Under disturbed conditions invasive species will be able out-compete native flora and alter the plant community composition permanently.

(iii) Irresponsible waste disposal will result in impacts on both terrestrial and aquatic ecosystems. Dumping on soil will reduce soil quality and inhibit biological activity, whilst dumping in water bodies will reduce water quality, which will impact the aquatic ecosystem. Contamination of both ecosystems will result in adverse impacts on the food chain for both terrestrial and aquatic organisms.

492. **Impacts on Wildlife Habitat** - Impacts on wildlife habitat include habitat loss and pollution from noise, dust and irresponsible dumping of waste.

(i) Site clearance carried out for the Project will result in loss of habitat that is presently being used by wildlife.

(ii) Construction activities will result in generation of noise and dust which will drive wildlife away from areas surrounding the Project site.

(iii) Improper waste disposal will result in pollution which will contaminate soil and water resulting in a reduction in quality of habitat available for wildlife.

493. Regarding aquatic habitat, the actual area in the river to be lost from bridge piers or retaining walls will be minimal compared to the wider aquatic habitat available in the Dzirula River, well below 1% of the habitat available. While habitat loss will cause local impacts to aquatic flora /fauna as rivers are dynamic systems it is expected that the river will make a full recovery following construction.

494. **Protected Species -** The following species IUCN Red-list Species (VU, NT, EN, CR) and Georgian Red list species have been identified that are, or may be present within the Project area:

(i) *Testudo graeca* Linnaeus - Mediterranean turtle (IUCN / GRL – VU)

(ii) *Emys orbicularis* - European Pond Turtle (IUCN – NT)

(iii) *Sciurus anomalus Gmelin – Caucasian Squirrel (GRL – VU)*

(iv) *Lutra lutra Linnaeus – Eurasian Otter (GRL – VU)*

495. Site clearance activities, pollution and waste generation can have significant negative impacts to these species and therefore requires careful mitigation. However, review of the habitat along the alignment indicates it is not optimum for existence of the Caucasian squirrel. Therefore construction and subsequent presence (operation) of the highway is not anticipated to change the population trend.

Mitigation Measures

496. General Tree Protection - Prior to the commencement of works the Contractor shall stake the boundary of the entire work site, including intersections and areas under bridges (this excludes within rivers and tunnels, but not tunnel portals). The Contractor shall then identify through a site survey if any Georgian Red-listed tree species are located within 5 meters of the site boundary. This survey will form part of the Contractors Clearance, Re-vegetation and Restoration Management Plan. If any of these trees are identified the

contractor will be required to place wood fencing around the tree in order to protect the tree during construction works, including its root zones. The Engineer will inspect all of the tree protection measures on a regular basis.

497. Cutting of Trees on Private Land - Compensation shall be paid to all affected tree owners as per the Project LARP.

498. Cutting of Trees in State Forest Fund Land – An inventory of the species to be de-listed has been prepared as part of this EIA and is provided in full as part of **Appendix G**.

499. A total of 4,896 trees over 8cm in diameter have been identified in State Forest Fund areas and a further 40,094 under 8cm in diameter. Of these, 16 are Georgian Red-listed species greater than 8cm in diameter. The trees cut in these areas will need to follow the procedures for de-listing, cutting and removal as described below.

500. The RD is responsible for supplying the inventory of the species to be de-listed to the National Forest Agency in writing in order to complete the de-listing process. The RD shall also apply to the MoEPA in writing regarding the identified Red-List species in the project area so that they may also be de-listed from the SFF. Compensation payments for the tree cutting in SFF areas will paid to the Government as follows:

(i) User (RD) shall pay onetime payment for the use of forest land during implementation of land activities. The payment shall be paid according to Table 2 of Appendix 7 of The Resolution No.242 of Government of Georgia on Approval of Rules for Forest Use taking into account the area of used land.
(ii) User (RD) shall pay compensation for cutting the trees according to the Table 1 of Appendix 7 of The Resolution No.242 of Government of Georgia on Approval of Rules for Forest Use.
(iii) In case of cutting the red list trees the user (RD) shall pay compensation four times as great than the amount shown in the table 1 of Appendix 7 of The Resolution No.242 of Government of Georgia on Approval of Rules for Forest Use.
(iv) The payment shall be made before beginning of forest usage.

501. The National Forest Agency provides free service for special marking and issuing timber origin certificate for transportation of timber resources. The timber resources obtained as a result of cutting of the trees from the SFF, shall be sorted out according to species by the Contractor and collected at the area indicated by National Forest Agency and transferred to the National Forest Agency by the Contractor to a specified state property land plot.

502. No compensation in the form of re-planting is required under this resolution unless specified by the MoEPA in the Conclusion of Ecological Expertise. Nevertheless, for ADB, compensation planting will be required to meet requirements set out in SPS (2009) regarding the loss of natural habitat and that projects should cause 'no net loss' to biodiversity

503. Habitat – The Project will clear approximately 33 hectares of natural habitat. The EIA has identified the different habitats affected and the size of each habitat to be cleared. To mitigate this impact the Project shall undertake a three phase approach.

(i) Firstly, the Contractor, as part of his Clearance, Re-vegetation and Restoration Management Plan, shall prepare a Biodiversity Action Plan for the restoration of habitat within the Project corridor to include the impacted habitat identified in this report. This is of particular importance in the riparian environments where bridge construction occurs. The plan should be prepared by qualified national biodiversity specialists.
(ii) Secondly, the Contractor shall prepare, as part of his Clearance, Re-vegetation and Restoration Management Plan, a Biodiversity Action Plan to

restore habitat at his spoil disposal sites, including, if practical the spoil site identified close to Boriti. It is important that, whatever site is chosen as a spoil location site, further natural habitat is not degraded. If this is the case additional habitat restoration will be required according to point 3 below.

(iii) Third and finally, the Contractor will consult with MoEPA to identify potential areas within the vicinity of the Project area where habitat restoration programs would be beneficial.

(iv) Plant maintenance as part of such programs will be carried out for at least two years in the plantation areas. The Contractor will be responsible for the maintenance of these areas. If the maintenance period extends after the completion of the Contractors contract period the RD will be responsible for contracting an operator to maintain the trees for the remaining period. During the Construction phase the Engineer will undertake monthly monitoring of the re-planted areas and report on the success rate of the re-planted trees, which should be above 80%. If the success rate falls below 80% the Contractor will re-plant on a 1:1 basis to compensate for losses. The Contractor will be responsible for paying for any compensational re-planting. In summary, the Project shall ensure no net loss of habitat occurs by restoring, reinstating or replanting at least the following area of habitat:

Table 74: Habitat to be Restored, Reinstated or Replanted

Code	hectares to be restored, reinstated or replanted
Oak or oak-hornbeam forests (Quercitum -Carpinion betuli) (9160GE)	12.14
Alluvial forest with Adler trees and Ash (910EO)	9.45
Clayey and rock riverine vegetation with duckweed (323GE)	10.18
Tilio-Acerion forests of slopes, screes and ravines (9180GE)	1.14

504. IUCN / GRL Species - Mitigation Measures are proposed in Table 75 below.

Table 75: IUCN / GRL Species Mitigation Measures

Species	Mitigation
Lutra lutra Linnaeus – Eurasian Otter	Prior to the start of construction in river beds, or close to river embankments (within 10 meters), the Contractor shall undertake a site survey (using a local ecologist) to ensure that there are no otter holts in these areas. If holts are found in these areas the Contractor will prepare a method statement for the management of these areas which will be sent to the Engineer for review and approval. The method statement should included at least the following measures: • Marking the areas where otters are registered. • Implementation of works so to retains otter habitats in the water body and bank where feasible. • Constructing artificial holts to replace those that will be damaged or removed. • Implementation of works at daylight to allow a separation of human activity from the main peaks of otter activity (dawn/dusk). • Implementation of pollution prevention measures (soil and water) such as - arrangement of temporary surface water run-off control system consisting of settling ponds and drainage ditches, as well as other measures for soil, water, vegetation/flora and fauna impact mitigation listed in the EIA. • Avoiding significant change in lighting. This can be achieved by retaining the bank-side vegetation. In case necessary, additional planting along the

	bank-top to provide further screening to reduce light impact. Note: This will also work during operation. In addition to planting, to reduce impact during operation of the road location of the poles on design and construction stage should be selected so to be at a distance from the riverbed. • Arranging barriers in the sensitive areas to avoid accidental road kills (using otter-proof fences to stop otters getting into development sites) Note: The otter fence shall consist of a post, mesh and wire and ply board. The posts shall be ≥ 1.5m high, spaced at 2m intervals. Netting shall be mounted onto the supporting wire (welded wire mesh (2.0mm wire)) – gauge 50x50mm and 2000mm wide. The mesh shall be buried to 300mm and at top turned out at 45 degrees to the outrigger line. This mesh will thus be resistant to animal activity from the river side. On the upper slope side of the fence 10mm ply boards (1500 wide) shall be nailed to the support posts to provide damage protection and screening. • Tool-box briefings to contractors prior to those works commencing. • If live otters are encountered contractor is to cease work and contact the ecologist who will then liaise with the appropriate regulatory officers to discuss the encounter and how best to proceed from that point. • Mitigation relating to noise, air quality and water pollution are addressed under their specific headings within this section of the report.
Sciurus anomalus Gmelin – Caucasian Squirrel	Although squirrels are not anticipated to be found in the Project area, as a precaution measure the construction contractor must be aware of the need to follow requirements listed below: • Checking all mature trees scheduled removal and other potential nest areas for the presence of dreys . (Survey must be done shortly before operations to locate active dreys). • Before commencing of works, obtaining evidence that the drey (if any) is no longer in use. • Felling and removal of trees in a manner that minimises the likelihood of killing adult squirrels. • Implementation of works in the period when likelihood of encountering dependent young is the least. • Max preservation of vegetation - keeping to the boundaries of the RoW and worksites; fencing of sensitive areas bordering the RoW to reduce the risk of impact and land take required for vehicular movements and construction works. • Adoption of best practices to avoid light pollution, emissions/dust, ensure compliance with good waste management practices. • It should be taken into consideration that the degree of disturbance is likely to be greatest for dreys where young squirrels are present. • If the area around the drey tree is cleared it is likely that the drey will no longer be suitable. Adults can move readily but young squirrels may not be old enough to move. If mother moves them herself it is rather stressful and sometimes risky process. • It should be taken into consideration that the degree of disturbance is likely to be greatest for dreys where young squirrels are present. • If the area around the drey tree is cleared it is likely that the drey will no longer be suitable. Adults can move readily but young squirrels may not be old enough to move. If mother moves them herself it is rather stressful and sometimes risky process. • As mentioned above, presence of squirrel in the project impact zone has not been observed. Given that the forest zones are mainly bypassed by means of the tunnels and that a part of the road coincides with existing road sections, the new infrastructure will not cause fragmentation.
Testudo graeca Linnaeus - Mediterranean turtle	If turtles are found within the work site, individuals must be removed to a safe distance (not less than 50m) from the works area. Eggs/hatchlings must be placed in a box (Note: sand substrata in the box must be provided) and moved to suitable nearby habitat where a nest will be created.
Emys orbicularis - European Pond	

Turtle	

505. Other Fauna - Table 76 below provides mitigation measures for other species

Table 76: Other Species Mitigation Measures

Species	Mitigation
Fish	• Use of sites designated for dumping to avoid polluting ecologically important aquatic habitat. • Use of sites designated for dumping will also prevent contamination of the aquatic food chain. • Hunting and poaching should be prevented to protect species of conservation importance and minimize loss of wildlife, which will already be undergoing habitat loss due to the Project. • The Contractor shall consult with the MoEPA to determine when works in rivers should be suspended in order to limit impacts to fish spawning periods. In addition, mitigation measures outlined in **Section G.5.5 – Hydrology**, will reduce the potential for impacts in surface waters.
***Reptiles & Amphibians (*herpetofauna)**	• Re-plantation will result in some habitat restoration. Reptile and amphibian species that will re-locate may return once planted vegetation is established. • Any herpetofauna species observed during construction activities should be re-located with assistance from a biodiversity expert to ensure proper handling. • Use of sites designated for dumping to avoid polluting ecologically important areas such as habitat for wildlife. • Use of sites designated for dumping will also result in prevention of contamination of the food chain. • Noise pollution should be minimized to reduce the disturbance to herpetofauna species as far as possible. • Dust pollution should be minimized to reduce disturbance to herpetofauna species as far as possible. • Hunting and poaching should be prevented to protect species of conservation importance and minimize loss of wildlife, which will already be undergoing habitat loss due to the Project.
Birds	• Re-plantation will result in some habitat restoration. Wildlife that will re-locate may return once planted vegetation is established • Use of sites designated for dumping to avoid polluting ecologically important areas such as habitat for wildlife • Use of sites designated for dumping will also result in prevention of contamination of the food chain, especially of water bodies which are very important for bird fauna in and around the Study Area • Noise pollution should be minimized to reduce the disturbance to birds as far as possible • Dust pollution should be minimized to reduce disturbance to birds as far as possible • Hunting and poaching should be prevented to protect species of conservation importance and minimize loss of wildlife, which will already be undergoing habitat loss due to the Project

506. In addition to the above species specific measures, the following shall apply:

(i) Site Surveys – Prior to the clearing of vegetation at any site (and prior to works in in existing tunnels and at bridge sites) the Contractor will undertake site surveys of the area to be cleared using national biodiversity specialists. The findings of the surveys and the proposed mitigation and management measures will be included in the Contractors Biodiversity Action Plan. Depending upon the results of the surveys the following shall apply:

(a) Re-location of any specimens found during the surveys will be provided with the help of biodiversity experts to ensure proper

handling. This is especially important for species of conservation importance. The practice will provide the best possible chance of survival for wildlife. The Biodiversity experts shall devise effective relocation plans, taking species-specific factors into consideration, to maximize the chances of success.

(b) If herpetofauna species are observed in the Project area during the surveys, they should be removed to other suitable habitat, with the help biodiversity experts to ensure proper handling. Herpetofauna species are most at risk because of their limited ability to re-locate. These species are at higher risk because of their limited ranges.

(c) If bird nests are observed during the site surveys (and also during construction), they should be carefully removed and placed in suitable habitat, with the help of biodiversity experts to ensure proper handling. An expert can help identify the species the nests belong to. If it is a species of conservation importance, special care should be taken. This will reduce the risk of mortality faced by them as a result of Project-related activities.

(d) If roosting sites for bat species are identified, first priority needs to be given to protecting the roosting sites. Since the majority of roosts are used only on seasonal basis, the most common/effective method of avoiding the impact is planning of works for less sensitive period of time. Optimum time for implementation of works in the area where hibernation roosts are found is May-October. However, in the absence of this option, biodiversity experts should be consulted and if required the bats should be re-located with the help of experts to ensure proper handling and development of a plan for relocation that maximizes chances of its success. Research into relocation of bats is limited with documented success of relocations even more so. It is recommended that the following characteristics be taken into consideration for the species being relocated, to both assess feasibility and develop an effective relocation protocol:

- Dispersal from the release site.
- Size of the founder group.
- Habitat quality at the release site.
- Disease transmission.
- Anthropogenic effects on the founder population.
- Post-release monitoring.

Bat boxes can be considered as mitigation measure. However, it should be taken onto account preferences – for instance Lesser horseshoe bat can not use bat boxes whereas Common pipistrelle can use tree crevice-type box with 25-35 crevices and or tree hollow-type box (note: the latter type is rarely used as maternity roost).

(ii) Bridges should be designed with dry paths under the bridge on either side of the streams to facilitate movements of livestock and wildlife, the latter primarily at night when people are not around.

(iii) Poaching of wildlife shall be strictly prohibited.

(iv) The Contractor will be responsible for providing training sessions to his workers relating to environmental protection (including the ban on poaching).

(v) Ensure that lower wattage lamps are used in street-lights which direct light downwards to reduce glare.

(vi) Waste should be disposed without dumping on vegetation or allowing it to contaminate waterways. This will prevent contamination of habitat and the spread of pollution through the food chain.

(vii) Noise and dust pollution should be managed using the specific noise and air quality mitigation measures outlined in this EIA.

Operational Phase

507. During the operational phase of the Project, the RD shall:
   (i) Register and analyze road kills. Develop additional mitigation measures if found to be necessary.
   (ii) During maintenance works strictly comply with wildlife/vegetation impact mitigation measures set for construction stage.
   (iii) Prohibit poaching (ensure that tunnel operator staff is aware of the ban).

Residual Impact Significance

HABITAT

Construction Phase – ***MODERATE/MAJOR***

The clearing of a large portion of natural habitat will have significant impacts to biodiversity in the area. The restoration and re-planting programs should go a long way to mitigating these impacts, but in some locations, such as river banks, residual impacts will remain. In addition, short term fragmentation of habitat maybe caused by access roads and other temporary construction facilities. In addition, the Clearance, Re-vegetation and Restoration Management Plan and its Biodiversity Action Plan will help manage potential impacts to habitat.

Operational Phase – ***MEDIUM/HIGH***

In the short term the residual impacts will be medium/high as the habitat is cleared. It will take a number of years for the habitat to be restored and for re-planted areas to develop into something similar to the habitats they are replacing. However, in the longer term, the significance of the impacts will reduce as these areas mature.

Residual Impact Significance

FAUNA

Construction Phase – ***MINOR/MEDIUM***

Site clearance will impact upon fauna in the Project corridor, including, for instance Otters. Further surveys of fauna prior to the start of construction to identify potentially affected species and action plans to manage these issues will help reduce the residual impacts.

Operational Phase – ***LOW***

Accidents involving wildlife are likely to be minor given the fact that animals will be able to cross above and below the road for most of its extent.

Residual Impact Significance

AQUATIC FLORA & FAUNA

Construction Phase – ***MODERATE***

A number of bridge piers will be constructed within the Dzirula and Rikotula rivers. In addition bridge abutments will also encroach into the river in some locations. Even though mitigation measures outlined above will help reduce the significance of the impact, residual impacts will still remain as aquatic flora and fauna are disturbed by the Project works.

Operational Phase – ***LOW/MEDIUM***

The actual area in the river to be lost from bridge piers or retaining walls will be minimal compared to the wider aquatic habitat available in the Dzirula River, well below 1% of the habitat available. While habitat loss will cause local impacts to aquatic flora /fauna as rivers are dynamic systems it is expected that the river will make a full recovery following construction.

G.6.2 Forest Reserves and Protected areas

Potential Impacts

508. No protected areas or forest reserves are located within the Project area, or within the vicinity of section F2. No induced impacts are anticipated.

Management & Mitigation Actions

509. Despite the fact no protected areas or forest reserves are located within the vicinity of the Project road and it is unlikely that haul routes would traverse such areas, it is still considered prudent to include a condition within this EIA that no construction activities, including camps, haul routes, etc will be allowed within, or through protected areas, or reserves.

Residual Impact Significance

Construction Phase – ***NONE***

No residual impacts are anticipated if the mitigation measures outlined above are implemented correctly.

Operational Phase – ***NONE***

G.7 Economic Development

G.7.1 Transportation Facilities & Utilities

Potential Impacts

Transportation Facilities

Construction Phase

510. Two of the main impacts resulting from Project works will be short term road diversions and some temporary blocking of access to properties during the construction phase.

511. In some locations closure of access roads will be needed and may occur for periods between one and two hours and as such is not a significant issue as long as the local population are given notice of the delays and suitable detours are provided. Longer-term road closures maybe required while the new road is constructed across existing roads. This issue is discussed above under section **B.13 – Temporary Roads**.

512. Blocking of access to properties will be temporary while structures, such as side drains and culverts, are constructed, however alternative access to properties will be provided at all times by the Contractor.

Operational Phase

513. The road has been designed in a way so that it has relatively little impact upon the existing road, or other local roads due to the fact that it is a new alignment often passing through tunnels and over bridges. Where the new alignment does interfere with the existing road, new local roads have been designed (see **Appendix F**) along with several interchanges to ensure that access to the existing road remains open.

514. Notwithstanding the above, the potential beneficial impacts to transport are significant. The road, when complete, will offer reduced travel times to major urban areas, smoother ride (resulting in less vehicle maintenance and less damage to perishable goods) and safer driving conditions. In addition, the traffic volumes on the existing road will reduce significantly resulting in less accidents on the existing road.

Utilities

515. Electricity transmission and distribution lines, gas pipes and telecoms lines are located within the Project corridor as noted in **Section F.3.2.2**. All of the companies have provided drawings and information on the location of the utilities. This information will be provided to the Contractor for coordination of with the relevant utility operator.

Management & Mitigation Actions

Transportation

Pre-construction Phase

516. To mitigate the potential impacts the Contractor will:

(i) Submit a Traffic Management Plan to local traffic authorities prior to mobilization and include the plan as part of his SEMP. The TMP shall include plans of haul routes and access roads used for construction traffic which will be strictly adhered to with oversight from the Engineer;

(ii) As part of his TMP, the Contractor shall provide haul routes to spoil disposal sites which, as far as is practical, avoid populated areas.

517. The volume of construction traffic is considered to be intensive truck traffic and will need to be managed both in terms of surface damage. A road condition survey of all roads included in the Contractors TMP will be conducted by the Engineer prior to construction in order to gauge any damage to the road as a result of the intensive heavy traffic during the

construction phase. Before completion of the Project the Engineer shall repeat the survey to determine which, if any roads need to be repaired by the Contractor.

Construction Phase

518. The Contractor shall:

(i) Provide information to the public about the scope and schedule of construction activities and expected disruptions and access restrictions at least 24 hours before the disruptions;
(ii) Allow for adequate traffic flow around construction areas via diversions or temporary access roads;
(iii) If temporary access roads are to be constructed with a gravel surface they shall be routinely watered by the Contractor during dry weather to reduce dust impacts; and
(iv) Provide adequate traffic signs, appropriate lighting, well-designed traffic safety signs, barriers and flag persons for traffic control.
(v) Access roads for batching plants, etc, should be maintained during the construction phase and rehabilitated at the end of construction.

Utilities

Construction Phase

519. During construction all gas supply and electricity networks in the Project area shall be kept operational, particularly during the winter months. Some lines and pipes may require temporary relocation during the construction phase and as such the Contractor will be responsible for liaising with the relevant utilities operators to ensure they remain operational. Should utilities need relocating in a different location the Contractor will consult with the relevant utilities and local community to ensure that there is no change in supply as a result of these changes.

Residual Impact Significance

Construction Phase – ***MINOR***

No residual impacts are anticipated if the TMP and the other mitigation measures outlined above are implemented correctly.

Operational Phase – ***LOW***

If the mitigation measures suggested are implemented, the residual impacts of the Project will be low. As noted above, the Project road has been designed in such a way that access to the existing road will be more or less maintained into the operational phase of the Project (with the exception of the start of the road which overlaps with the existing E-60) and where the new road crosses local roads new roads will be constructed.

G.7.2 Land use

Potential Impacts

520. The Project road passes through a rural landscape for most of its extent and also through numerous tunnels. However, a number of private properties and land parcels will be impacted many of which are used for agricultural purposes.

521. A Draft Land Acquisition and Resettlement Plan (LARP) has been prepared according to Georgian Laws, the ADB SPS (2009) and the Resettlement Policy Framework of the East West Highway Improvement Corridor Project which was prepared by the RD with support from the World Bank (developed and disclosed in 2016 under the parent EWHCI Project).

522. The affected areas, structures, trees and agricultural plots identified by the Draft LARP are summarized below (Table 77**).** According to the draft LARP there is no business under impact of Project and the Project will not impact on objects of public or cultural importance. 36 vulnerable families will be directly affected by the Project and provisions for these families have been included in the LARP.

Table 77: Summary of Impacts According to the Draft LARP

#	Impacts	Unit	Amount
Land Tenure Patterns			
1	**Total Land parcels affected**	**№**	307
2	**Total land Area to be acquired**	**Sq.m**	283,889
3	**Category 1**. Private Registered Plots	**№**	218
		Sq.m	198,285
4	**Category 2.** Private Legalizable	**№**	87
		sq.m	84,260
5	**Category 3.** State Owned Illegally Used by Private Users (Non-legalizable)**.**	**№**	N/A
		Sqm	N/A
6	**Category 4.** State Owned (Not Used by Private Users)	**№**	2
		Sq.m	1,344
Agricultural Patterns			
7	Beans	**Sq.m**	147673
8	Corn	**Sq.m**	151346
9	Pumpkin	**Sq.m**	123272
10	Soybean	**Sq.m**	124424
11	Other vegetables	**Sq.m**	6105
12	Affected Trees	**№**	5772
Affected Structures			
13	Residential houses	**№**	39
14	Auxiliary buildings	**№**	9
Affected Households			
15	Severely affected Households	№	161
16	Vulnerable Households	№	53
17	Resettled households	№	39
18	AHs losing non-legalizable land plots	№	N/A
19	AH losing Jobs	№	0
20	Total AH	№	217
21	Total Affected Persons	№	976

523. The draft LARP estimates the total cost of resettlement and compensation to be around 10.7m Gel. Table 78 below provides a breakdown of the costs.

Table 78: Resettlement and Compensation Budget

Name	Unit cost	Amount	Total cost (Gel)
Land parcels	Various	283,889	4,659,475
Structures	Various	-	3,963,000
Trees	Various	5,772	561,298
Crop	Various	552819	193,179
Severe impact allowance	Subsistence minimum for 3 months (349.5x3)	161	168,808.50
Relocation/Shifting allowance	Subsistence minimum for 3 months (349.5x3)+ Transportation cost (200 Gel)	39	48,691.50
Vulnerability allowance	Subsistence minimum for 3 months (349.5x3)	53	55,571
External and Internal monitoring	-		120,000
Sum			**9,770,023**
Unexpected costs	10%		977002.25
Total			**10,747,025**

524. The time bound implementation schedule of the LARP has been prepared in consultation with the RD. All activities related to the LARP have been planned to ensure that compensation is paid prior to displacement and commencement of civil works construction. Payment of compensation and allowances under LARP will commence after a number of preparatory tasks have been completed. These tasks are:

(i) Signing of contracts with APs.
(ii) Disclosure and consultation.
(iii) Capacity building training of LAR institutions, APs and NGOs.
(iv) Grievance resolution.
(v) Requisition to ETCIC for payment of compensation and allowances.
(vi) Transfer of compensation and allowance to APs' bank account and registration of land in PR on RD name.
(vii) Relocation of affected structures/ assets.
(viii) Compliance review and reporting.
(ix) Notice to proceed for Civil works construction.
(x) Monitoring.

525. The RD is the Executing Agency and has the lead responsibility for road construction, as well as the implementation of the LARP. In addition to the RD, a number of other government departments and private agents will play an instrumental role in the design, construction and operation of the project. Pursuant to the active legislation, the MoEPA is responsible for environmental issues. The Ministry of Justice is responsible for legal matters regarding land ownership, and National Agency of Public Registry (NAPR) within the Ministry of Justice is in charge of the registration of land ownership and its transfer through purchase agreement from landowners to the RD. The local government at Sakrebulo and village level will also be involved.

526. Livestock and Agriculture – As noted in the draft LARP, a number of agricultural plots will be affected by the Project. In addition to this the Project road could also result in other impacts to agricultural land during the construction phase, these include:

(i) Dust – This issue and its impacts on crops are discussed above under **Item G.5.1 Air Quality**. Mitigation suggested involves correct siting of dust producing areas, such as batching plants, away from agricultural land and dampening of stockpiles and access roads during construction. Implementation of the mitigations measures in this EIA relating to facilities such as batching plants, will further reduce the possibility of significant impacts arising.

(ii) Temporary Land Take – Apart from the areas identified in the draft LARP, land for access roads, construction camps and temporary storage areas will also be required.

(iii) Accidents involving livestock – In most portions of the site herding of livestock along the road will not be possible as access to these areas will be extremely difficult. In addition, most livestock can be herded either above tunnels, or below bridges. Two underpasses are also proposed along the route which can also be used by livestock.

Management & Mitigation Actions

527. The key mitigation for land use is implementation of the LARP. Regarding temporary land take for areas such as construction camps, the Contractor will pay the rates specified in the LARP to landowners for the use of these areas. In addition, where practical all additional construction related areas such as construction camps, etc, should, as far as possible, avoid being site on agricultural land.

Residual Impact Significance

Construction Phase – ***MINOR/MODERATE***

No residual impacts are anticipated if the LARP is implemented correctly. However, there will still be disruption to the local community during the LARP implementation process. A GRM has been prepared to manage complaints received during this process.

Operational Phase – ***NONE***

No residual impacts are anticipated if the LARP is implemented correctly.

G.7.3 Waste Management

Potential Impacts

528. General Construction Waste - Road construction will inevitably generate solid and liquid waste products including:

(i) Inert waste – for example, concrete, metal, wood and plastics.

(ii) Hazardous waste – acids and alkaline solutions, waste oils and oily sludge, batteries, and bitumen.

529. In addition, uncontrolled discharges of sewage and ‘grey water’ (e.g. from washrooms and canteens) from construction sites and worker’s camps may also cause odors and pollute local water resources. As well as being a cause of complaints by the local population, this may lead to contravention of local regulations and fines being imposed on the Contractor.

530. The main construction waste produced will waste concrete (solid and sludge) and possible asphalt, depending upon how much can be re-used as sub-base material. Table 79 indicates the main types of waste and an estimate of volumes (based on similar road construction projects).

Table 79: Waste Types and Estimated Volumes

#	Waste Type	Hazardous	Estimated Volume
1	Concrete	No	200 m^3
2	Asphalt	No	Currently unknown
3	Bituminous Mixtures	Yes	1 t
4	Wood	No	10 t
5	Uncontaminated Metal	No	5 t
6	Uncontaminated Plastic	No	1 t
7	Contaminated metal (paint tins, etc.)	Yes	2 t
8	Contaminated plastic (oil containers)	Yes	3 t
9	Domestic waste (food stuffs)	No	5 t
10	Domestic Waste (non-foodstuff)	No	40 t
11	Sewage Water	Yes	150 m^3
12	Tyres	Yes	150 t
13	Hazardous liquid waste	Yes	20 m^3
14	Hazardous solid waste	Yes	10 t

531. It is noted that the waste management situation in Georgia is still developing, and that the waste management facilities in the Project area have been closed. Accordingly, the Contractor needs to ensure that waste materials are disposed of in a manner that does not cause pollution to the environmental or result in potential health impacts.

532. Tunnel and Other Spoil Material – a large volume of spoil material will be generated from the tunneling works. Estimates provided by the Consultant indicate that the following amounts of spoil material will be generated:

(i) Portal – 161,000 m^3
(ii) Tunnel – 935,000 m^3
(iii) Earthworks – 1,010,000 m^3
(iv) Local roads and interchanges – 135,000 m^3
(v) Total: 2,241,000 m^3

533. Where practical the spoil will be re-used as embankment material. Estimates indicate that approximately 327,959 m^3 can be re-used as embankment material, which would leave approximately **1,913,050 m^3** as static balance.

Management & Mitigation Actions

534. To ensure waste management is adequately controlled during both the construction and operational phase of the Project, the Contractor shall be responsible for ensuring that the waste hierarchy is followed including prevention, minimization, reuse and recycling. Specifically the Contractor will be responsible for the following measures:

(i) Waste Management Plan (WMP) – The WMP shall include items relating to the safe handling and management of:
    (a) Domestic waste
    (b) Food waste
    (c) Recycled Waste
    (d) Plastic
    (e) Metals

(f) Wood
(g) Construction Waste
(h) Hazardous Waste
(i) Liquid Waste

(ii) Recycling and Reuse – Where possible, surplus materials will be reused or recycled – this should include asphalt, concrete, wood, plastic, metal and glass. A plan for the recycling of materials should be included in the WMP. As noted above, 327,959 m^3 of spoil material will be re-used for embankments thereby eliminating the requirement for the use of borrow pits and quarries under the Project.

(iii) Storage of Hazardous Wastes – Oils, fuels and chemicals are substances which are hazardous to human health. They need to be stored properly in correctly labeled containers, both within the construction camp and also at construction areas. Oil and fuel should be stored in tanks with lined bunds to contain spillage (the bund should be able to contain at least 110% of the volume of the largest storage tank within the bund).

(iv) Waste Disposal – Waste, both hazardous and non-hazardous, shall be collected and disposed of by a licensed waste management contractor. The Contractor will keep copies of the waste management company's licenses on file at his site office. The Contractor shall also keep a record of the waste volumes and types removed from the site and the waste transfer notes provided by the waste management contractor.

Waste Spoil Material – A screening exercise has been undertaken to identify suitable disposal locations for the 1,913,050 m^3 of spoil material. A preferred site has been identified close to Boriti. It is recommended that the Contractor uses this site for the disposal of spoil material as it is considered to be the most suitable option from and environmental, social and financial perspective. However, it is noted that the Contractor does have the choice to select other spoil locations.

If the Contractor intends to use this site there are several actions he must follow:

(a) Complete the Spoil Disposal Site Assessment attached as **Appendix O**.
(b) Submit the assessment to ADB and RD for review and approval.
(c) Upon approval of the site from ADB and RD, in line with the Georgian EIA regulation, the spoil storage areas shall be agreed with the local municipality and MoEPA.
(d) As soon as agreements are provided MoEPA will request an EIA for the Project.
(e) The Contractor will prepare and submit an EIA to MoEPA for review and approval. The EIA will need to be compliant with the national regulations and will include all necessary studies and surveys to meet this requirement, e.g. biodiversity surveys, archaeological survey, etc.
(f) In addition to the EIA, the Contractor shall prepare a Spoil Disposal Plan for Arrangement of Spoil Disposal Area and a Re-cultivation Plan. This plan shall be prepared in accordance with regulation N 424 on Approval the Rules for Removal, Storage and Use of Topsoil and Re-cultivation. The plan shall be based upon the findings and information contained in the Spoil Disposal Site Assessment.
(g) The plan will indicate:

- The location of disposal area (layout, coordinates etc).
- Agreement with the land owner.
- Category of the land.
- Distance from the surface water source.
- Prepare a route Risk Assessment (Providing information on route of spoil transportation and means of transport (including routes avoiding, where possible, sensitive receptors)).
- Schedule of the timing of material transport (excluding night-time transport on local roads (but not the existing E-60) between 10pm and 6am).
- Any necessary improvements to local roads to cater for the increased level and types of trucks using the roads.
- The measures for stripping and storing of topsoil.
- The scheme of dumping.
- The maximum height of disposed soil and anti erosion measures.
- Describe re-cultivation of disposal area.
- Provide coordinates of the spoil area.
- Provide profile drawings of the spoil area.
- Provide time stamped photographs of the pre-disposal site conditions.

(h) The Plan will also be provided to the RD and the Engineer as part of his SEMP. No spoil storage will be allowed until the RD and the Engineer have approved the plan and all licenses and approvals have been received from MoEPA.

If the Contractor wished to use an alternative site he will be responsible for following the same procedures above. No spoil storage will be allowed until the RD and the Engineer have approved the plan and all necessary permits and approvals have been received from MoEPA.

Transport of Spoil from Tunnels - Tunnels TUN-2001 TA/AT, TUN-2002 TA/AT, TUN-2003 TA/AT, TUN-2004 TA/AT, TUN-2005 TA/AT and TUN-2007 TA/AT shall start at portals located adjacent or within 25 meters to the existing E-60 road and as such materials can be moved directly from the portals to the disposal areas using the existing road. Tunnels TUN-2006 TA/AT, TUN-2008 TA/AT, TUN-2009 TA/AT (eastern portal only), TUN-2010 TA/AT and TUN-2011 TA/AT are located on the other side of the Dzirula river to the existing E-60 road, or a long distance from the E-60. Materials from these tunnels will need to be transported along local roads, some of which may need to be upgraded to accommodate the trucks using these roads. The Contractor will be responsible for upgrading any local roads and ensuring that they are maintained to acceptable levels to allow local traffic to continue to use these roads during all weather. If any access roads are gravelled they will be regularly sprayed with water during the construction phase to limit the impacts of dust.

(v) Liquid Waste – The issue of liquid waste, including concrete sludge, camp run-off water, vehicle washing water, batching plant wastewater, etc., is discussed above under item G.5.5 – Hydrology and G.7.4 Construction Camps.

Operational Phase

535. The RD shall:
- (i) Install waste collection bins in technical buildings area.
- (ii) Use garbage bins fitted with lids to avoid scattering around and attraction of scavengers.
- (iii) Segregate hazardous, non-hazardous and reusable waste streams.
- (iv) Manage and dispose hazardous waste according to the type and the class of hazard. Note: for hazardous waste removal licensed company must be contracted.
- (v) Until removal (temporarily) waste must be stored within secure facilities with weatherproof flooring and roofing.
- (vi) Dispose garbage according to agreement with licensed waste management contractors.

Residual Impact Residual Impact Significance

Construction Phase – ***MINOR/MODERATE***

In general, if the mitigation measures suggested are implemented residual impacts will be minor. However, restoration of any spoil disposal area will take a number of years and as such the residual impacts for the spoil disposal areas are considered minor/medium.

Operational Phase – ***NONE***

There will be no residual impacts in the operational phase as long as the Contractor follows his reinstatement plans for the spoil disposal sites.

G.7.4 Construction Camps, Asphalt Plants, Batching Plants & Temporary Storage Sites

Potential Impacts

536. Construction camps constitute a temporary land use change and raise issues related to activities such as impacts to air quality; poor sanitation arrangement and improper methods used for disposal of solid wastes and effluent; and transmission of communicable diseases to the local people by the construction workers due to inappropriate health monitoring facilities. Specific issues may arise as a result of the following:

537. Design and Siting - Improper siting and design of construction camps can have negative impacts to hydrology through inappropriate disposal of liquid waste and spills of hazardous liquids. Poor management of sanitary waste and accidental spills of hazardous liquids from construction camps can also have negative impacts on ground and surface water. Rock crushing plants and concrete batching plants can also have impacts on sensitive receptors located downwind of the sites if the plants are too close to the urban areas.

538. Concrete Batching Plants - Potential pollutants in batching plant wastewater include cement, sand, aggregates and petroleum products. The main sources of wastewater at batching plants are; contaminated storm water runoff, dust control sprinklers, the agitator washout station, the agitator charging station, the slumping station, and cleaning and washing areas. These substances can adversely affect the environment by:
- (i) Increasing water pH.
- (ii) Increasing the turbidity of waterways (turbidity is a measure of the cloudiness of a suspension).

539. Asphalt Plants – Several impacts are associated with asphalt plants:

(i) Emissions – including dust from the transport and handling of aggregates and emissions from the combustion process in the dryer.
(ii) Noise - Noise occurs at different places in the process for examples in the conveyor belts, dryer and mixer drum, internal and external traffic. The noise is estimated to be in the range of 90 to 100 dBA (Leq) at a few metres from the equipment.
(iii) Storage of Bitumen – Drums of bitumen will be stored safely and securely to prevent accidents and pollution.
(iv) Storage and Use of Hazardous Materials – Some materials used during asphalt production, such as Kraton, can be explosive or a fire hazard. These materials need to be stored and managed appropriately.
(v) Health and Safety - Asphalt Plants can be very dangerous, accidents may occur at any time. Hence it is important to have a proper policy for the Health and Safety Issues.
(vi) Vehicle Movement – a large number of trucks will be required to transport the hot asphalt from the plant to the work site, this may be a distance of up to 25 kilometers.

540. Temporary Storage Sites – These areas will be used to store materials and equipment on a temporary basis as an alternative to storing materials at the camp. Materials may also need to be stored close to work sites to allow quick and easy access to these materials, e.g. stockpiles of aggregates, pre-cast culverts, etc. None of the materials stored in these areas will be hazardous materials.

Management & Mitigation Actions

541. Construction Camps – The location of construction camps and facilities is not known at this stage of the Project and will be a decision for the Contractor to make based on a range of issues, such as availability of land, cost, access, etc, as well as environmental and social issues. However, a range of good practices measures can be applied to these sites to ensure that they have minimal impacts on the environment and the local communities.

542. Prior to commencement of works, the contractor must identify the location of the camp and undertake environmental and social screening of the site to ensure that no significant environmental or social issues will arise as a result of the use of the site. The results of the screening will be provided to the Engineer and RD for their review and approval. If the Engineer and RD are satisfied with the results of the screening exercise the Contractor shall then agree on/receive a permit for its use from the state or the land owner. No construction camp will be located within one kilometer of an urban area and at least 50 m from any surface water course.

543. The Contractor will be responsible for the preparation of a Construction Camp Site Plan which will form part of the SEMP. The Plan will indicate the system proposed and the locations of related facilities in the site, including latrines, holding areas, etc. The Contractor will ensure the following conditions are met within the Plan:

(i) Rain-water run-off arising on the site will be collected, removed from the site via a suitable and properly designed temporary drainage system and disposed of at a location and in a manner that will cause neither pollution nor nuisance. The drainage system will be fitted with oil and grease interceptors.
(ii) There will be no direct discharge of sanitary or wash water to surface water.
(iii) In the absence of functioning sewerage and sewage treatment facilities it is recommended that the Contractor provides his own on-site septic tanks.

There will be no direct discharge of untreated sanitary or oily wastewater to surface water bodies.

(iv) Licensed contractors will be required to collect and disposal of liquid waste from the septic tanks on regular basis.

(v) Disposal of materials such as, but not limited to, lubricating oil and onto the ground or water bodies will be prohibited.

(vi) Liquid material storage containment areas will not drain directly to surface water.

(vii) Waste water from vehicle washing bays will be free of pollutants if the wash bay has been constructed correctly.

(viii) Lubricating and fuel oil spills will be cleaned up immediately and spill cleanup materials will be maintained at the storage area.

(ix) Construction and work sites will be equipped with sanitary latrines that do not pollute surface waters and are connected to septic tanks, or waste water treatment facilities.

(x) Discharge of sediment-laden construction water directly into surface watercourses will be forbidden. Sediment laden construction water will be discharged into settling lagoons or tanks prior to final discharge.

(xi) Washing out concrete trucks at construction sites will be prohibited unless specific concrete washout areas are provided for this purpose at the construction site (e.g. a bridge site). The washouts will be impermeable and emptied when 75% full.

(xii) Spill cleanup equipment will be maintained on site (including at the site maintenance yard and vehicle fueling areas). The following conditions to avoid adverse impacts due to improper fuel and chemical storage:

  (a) Fueling operations will occur only within containment areas.

  (b) All fuel and chemical storage (if any) will be sited on an impervious base within a bund and secured by fencing. The covered storage area will be located away from any watercourse or wetlands. The base and bund walls will be impermeable and of sufficient capacity to contain 110% of the volume of tanks.

  (c) Filling and refueling will be strictly controlled and subject to formal procedures and will take place within areas surrounded by bunds to contain spills / leaks of potentially contaminating liquids.

  (d) All valves and trigger guns will be resistant to unauthorized interference and vandalism and be turned off and securely locked when not in use.

  (e) The contents of any tank or drum will be clearly marked. Measures will be taken to ensure that no contaminated discharges enter any drain or watercourses.

  (f) Disposal of lubricating oil and other potentially hazardous liquids onto the ground or water bodies will be prohibited.

  (g) Should any accidental spills occur immediate cleanup will be undertaken and all cleanup materials stored in a secure area for disposal to a site authorized to dispose of hazardous waste.

544. If determined warranted by the Engineer, the Contractor will provide a wash pit or a wheel washing and/or vehicle cleaning facility at the exits from the sites. If so requested, the Contractor will ensure that all vehicles are properly cleaned (bodies and tires are free of sand and mud) prior to leaving the site areas. The Contractor will provide necessary cleaning facilities on site and ensure that no water or debris from such cleaning operations is deposited off-site. The Engineer will undertake regular monitoring of the construction camps to ensure compliance with the SEMP and the Construction Camp Site Plan.

545. The Contractor will be responsible to maintain and cleanup campsites and respect the rights of local landowners. If located outside the ROW, written agreements with local landowners for temporary use of the property will be required and sites must be restored to a level acceptable to the owner within a predetermined time period.

546. The Contractor will also ensure that potable water for construction camps and workers meets the necessary water quality standards of the GoG. If groundwater is to be used it will be tested weekly to ensure that the water quality meets the GoG drinking water standards specified in **Section D**.

547. Concrete Batching Plants – The following measures will be followed to limit the potential for pollution from batching plants:

(i) To limit impacts from dust, the following conditions will apply:

- (a) Batching plants will be located downwind of urban areas and not within one kilometer of any urban area.
- (b) The entire batching area traversed by vehicles – including driveways leading into and out of the area – will be paved with a hard, impervious material.
- (c) Sand and aggregates will be delivered in a dampened state, using covered trucks. If the materials have dried out during transit they will be re-wetted before being dumped into the storage bunker.
- (d) Sand and aggregates will be stored in a hopper or bunker which shields the materials from winds. The bunker should enclose the stockpile on three sides. The walls should extend one metre above the height of the maximum quantity of raw material kept on site, and extend two metres beyond the front of the stockpile.
- (e) The hopper or bunker will be fitted with water sprays, which keep the stored material damp at all times. Monitor the water content of the stockpile to ensure it is maintained in a damp condition.
- (f) Overhead storage bins will be totally enclosed. The swivel chute area and transfer point from the conveyor will also be enclosed.
- (g) Rubber curtain seals may be needed to protect the opening of the overhead bin from winds.
- (h) Conveyor belts which are exposed to the wind and used for raw material transfer will be effectively enclosed, to ensure dust is not blown off the conveyor during transit. Conveyor transfer points and hopper discharge areas will be fully enclosed.
- (i) Conveyor belts will be fitted with belt cleaners on the return side of the belt.
- (j) Weigh hoppers at front-end loader plants will be roofed and have weigh hoppers shrouded on three sides, to protect the contents from the wind. The raw materials transferred by the front end loader should be damp, as they are taken from a dampened stockpile.
- (k) Store cement in sealed, dust-tight storage silos. All hatches, inspection points and duct work will be dust-tight.
- (l) Silos will be equipped with a high-level sensor alarm and an automatic delivery shut-down switch to prevent overfilling.
- (m) Cement dust emissions from the silo during filling operations must be minimised. The minimum acceptable performance is obtained using a fabric filter dust collector.
- (n) Totally enclose the cement weigh hopper, to ensure that dust cannot escape to the atmosphere.
- (o) An inspection of all dust control components will be performed routinely – for example, at least weekly.

(ii) All contaminated storm water and process wastewater will be collected and retained on site.

(iii) All sources of wastewater will be paved and bunded. The specific areas that will be paved and bunded include; the agitator washout area, the truck washing area, the concrete batching area, and any other area that may generate storm water contaminated with cement dust or residues.

(iv) Contaminated storm water and process wastewater will be captured and recycled by a system with the following specifications:
   (a) The system's storage capacity must be sufficient to store the runoff from the bunded areas generated by 20 mm of rain.
   (b) Water captured by the bunds will be diverted to a collection pit and then pumped to a storage tank for recycling.
   (c) An outlet (overflow drain) in the bund, one metre upstream of the collection pit, will divert excess rainwater from the bunded area when the pit fills due to heavy rain (more than 20 mm of rain over 24 hours).
   (d) Collection pits should contain a sloping sludge interceptor, to separate water and sediments. The sloping surface enables easy removal of sludge and sediments.
   (e) Wastewater will be pumped from the collection pit to a recycling tank. The pit will have a primary pump triggered by a float switch and a backup pump which automatically activates if the primary fails.
   (f) Wastewater stored in the recycling tank needs to be reused at the earliest possible opportunity. This will restore the system's storage capacity, ready to deal with wastewater generated by the next rainfall event. Uses for recycling tank water include concrete batching, spraying over stockpiles for dust control and washing out agitators.

548. Asphalt Plants – the following measures will be applied by the Contractor:

(i) Emissions & Noise:
   (a) Asphalt plants will be located downwind of urban areas and not within one kilometer of any urban area.
   (b) Adequate Personal Protective Equipment (PPE) will be provided to staff working in areas of high noise and emissions.

(ii) Storage and Use of Hazardous Materials (including bitumen):
   (a) Ensure all hazardous materials are stored (including within suitable sized bunds for liquids), handled and disposed of according to their Material Safety Data Sheet (MSDS).
   (b) Copies of MSDS will be kept on site with all hazardous materials.
   (c) The Contractor will keep a log of the type and volume of all hazardous wastes on site.
   (d) The Contractor will keep a plan of site indicating where all hazardous materials are stored.

(iii) Vehicle Movement:
   (a) The Contractor will include the asphalt plant in his Traffic Management Plan, including haul routes from the plant.

(iv) Health and Safety:
   (a) To prevent bitumen burns it will be compulsory for the workers handling hot bitumen to wear full-body protection.
   (b) All transportation, handling and storage of bitumen will be handled safely by experienced personnel.
   (c) The dust from the manufacturing process may pose respiratory hazards, hence protective air mask will be provided to the operators for the loading and unloading of aggregates.
   (d) Ear-muffs will be provided those working on the plant.

(e) First Aid kit will be available on site for the workers in case of emergency.
(f) The MSDS for each chemical product will be made accessible onsite and displayed.

549. Temporary Storage Areas – The Contractor will be responsible for preparing a method statement for the opening, operation and reinstatement of any temporary storage area he uses. The method statement shall be prepared and submitted to the Engineer for approval before any such site can be used. Many of these sites will be located close to rivers, and as such the Contractor will ensure that the method statements include specific measures to ensure no pollution of the rivers, including banning of the storage of hazardous liquids in these areas. The method statement shall also clearing illustrate the conditions of the site prior to its clearing and use, so that it can be fully re-instated to its former conditions. The method statement shall also indicate what type of vegetation has been cleared at the site, and where this has occurred, the Contractor shall be responsible for replanting of any trees cut in these areas on a 1:3 basis.

Residual Impact Significance

Construction Phase – ***MINOR***

If the mitigation measures suggested are implemented residual impacts will be minor

Operational Phase – ***LOW***

If the mitigation measures suggested are implemented residual impacts will be low as long as reinstatement plans are followed correctly.

G.7.5 Tunnels

Potential Impacts

550. The main typical environmental problems linked to the construction of underground works are listed below:
(i) Triggering of surface settlements, structures collapses and slope instabilities
(ii) Drying up of springs and groundwater alterations
(iii) Storage and use of excavated materials (Addressed in **Section G.7.3 – Waste Management** above).
(iv) Noise & Vibration (Addressed in **Section G.8.7 – Noise and Vibration** below).
(v) Pollution of groundwater, mainly after the realization of stabilization works by injections.

551. Surface Settlements - The opening of underground works can lead to a deformation of the soils and rocks around the excavation area in some instances. Such deformations may trigger sudden collapses, subsidence and sinking that can damage both the work under construction and pre-existing nearby structures. The extent of settlements depends on the following elements:
(i) Excavation technique.
(ii) Dimension and geometry of the excavation.
(iii) Type of excavated material.

552. Analysis undertaken by the Design Consultants have indicated that settlement of less than 5mm will occur above the tunnels in the F2 section. The analysis indicates that

settlement will not impact upon structures above these tunnels and structural damage is not to be expected unless some unforeseen situation occurs or unless the Contractor doesn't work properly. It is however possible that cosmetic damage could occur such as small cracks in plaster in wall joints.

553. Dewatering - A key aspect of dewatering systems for tunnel and shaft construction is that they will generate water from pumped wells or from sumps and drains within the tunnel. Some of this water, particularly from sumps, will be 'dirty water' and will require some form of treatment (most commonly to remove suspended solids) before it can be disposed of. Some of the water may be 'clean water' (particularly from dewatering wells or tunnel drains) that may require little or no treatment.

554. Drying up of Groundwater – Tunnels located below the water table can seep into excavations that are below the water table, which can result in groundwater drawdown around the structures during construction and operation. This in turn may impact upon water levels in wells and natural springs (or artesian wells). Drawdown can also potentially impact the flow of rivers, although in the case of the Dzirula and Rikotula rivers this is not likely to be significant due to their high discharge rates. These phenomena can persist even after the tunnel construction if the final alignment is not completely waterproof.

555. Site visits were undertaken in the Project area by the LCF to determine what the status of ground water use was in the local community. The results of the site visits indicated that few groundwater wells are located in the Project area and that most water is supplied to homes and businesses through a piped system which transfers groundwater from several kilometers away further up in the mountains. Accordingly, it appears that tunnel construction is unlikely to have any significant impacts on the local community in terms of groundwater depletion.

Management & Mitigation Actions

556. Drying up of Groundwater – Although site visits have indicated that there are few wells in the Project area and that most of the community receive water from a piped network it is still considered prudent to monitor the status of groundwater drawdown during the construction phase.

557. The Contractor will be responsible for the development of a ground water management plan for each tunnel which shall be submitted for approval by the Engineer at least four weeks prior to the start of tunnelling works.

558. The plan shall include a map of all ground water wells within the Project area that maybe affected by each tunnel.

559. The Plan shall include routine monitoring of the groundwater levels in wells against baseline water levels (measured by the Contractor before the start of tunnel works) in the Project area which will be undertaken on a weekly basis by the Contractor within the vicinity of each tunnel he is excavating. If drawdown levels in wells are significant the Contractor will provide a temporary source of potable water to the affected persons until the construction works are finished. The Contractor shall continue to monitor the water levels in the affected wells for a period of 12 months after construction is completed at the tunnel sites. If the wells begin to recharge to their pre-construction levels no further actions will be necessary. However, if the water fails to re-charge to pre-construction levels alternative water supply will be provided to the affected parties, this may include for example, increasing the depth of their wells, or piped water from another location, which, as noted above, appears to be a fairly effective option.

560. Dewatering – The Contractor will pass all drainage water from the tunnel through a settlement tank. Weekly monitoring of the water quality from the tank will be undertaken by the Contractor to assess for any pollution. If the drainage water meets drinking water standards it can be considered for re-use in any potentially depleted wells during the construction phase.

Residual Impact Significance

Construction Phase – ***MINOR***

If the mitigation measures suggested are implemented residual impacts will be minor.

Operational Phase – ***LOW***

It is possible that the construction of tunnels could depleted groundwater and affect groundwater users. If this is the case affected villagers will be supplied with an alternative source of potable water if this occurs.

G.8 Social and Cultural Aspects

G.8.1 Employment Creation, Skills Enhancement and Local Business Opportunities

Potential Impacts

561. The Project is expected to generate positive impacts on the local economy and livelihoods in terms of employment and skills enhancement and local business opportunities through the procurement of goods and services.

562. Positive impacts will be primarily associated with the construction phase and therefore temporary in nature. The termination of construction contracts will occur once construction activities are completed. Workers who have relocated to the area for the Project are likely to leave the area in search of other opportunities, especially if they are permanent employees of Contractors and subcontractors.

563. Those who have worked on the Project will have an advantage when seeking alternative jobs on similar projects due to the experience and any training received through this Project.

564. The construction phase will last approximately 30 months and it is expected that approximately 600 direct employment opportunities will be available during the peak of construction. The breakdown of skills required during the construction phase will be as follows:

(i) Skilled labour: 58%;
(ii) Semi-skilled labour: 20%; and
(iii) Unskilled labour: 22%.

565. Local procurement will benefit the hospitality and service industries primarily, such as catering, cleaning, transport and security services. Local businesses will benefit during the construction phase as there will be increased spending within the area by the wage labor who will have improved buying power while employed by the Project.

566. According to the Project social survey, it is envisaged that in the long term, the Project will bring more opportunities into the whole area. First of all to the agricultural traditional sector whose products will easily reach the main market places like Tbilisi and Kutaisi, Batumi and Poti. It is also expected a seasonal adjustment of the tourism period stretching and increasing the presence of visitors all along the year encouraging moreover the week end holidays visits. This in turn could possibly curb the emigration toward the main town and cities through the creation of stable and well remunerated jobs. It can also be said that the realization of the Project complies with the integrated geo-tourism development approach outlined in the Strategic Environmental Cultural Heritage and Social Assessment contained in the ITDS (Imereti Tourist Development Project – funded by the World Bank) comprising multi-sectoral interventions, managed vertical investments, coordinated elaboration of tourist circuits and destination sites, targeted support to cost efficient and environment-friendly tourist packages, and protection of local communities and cultural heritage through promotion of responsible tourism.

567. During the operational phase of the Project diversion of traffic from the existing road to the new alignment may affect some roadside business in the Project areas including small roadside shops and restaurants. The level of trade with road users will fall, but they will still be able to provide their services to the local community. Access to the existing road will be provided by two interchanges in section F2 along with the intersection in Boriti allowing road users to visit restaurants along the old alignment.

Residual Impact Significance

Construction Phase – ***NONE***

If the mitigation measures suggested are implemented residual impacts will be minor.

Operational Phase – ***LOW/MEDIUM***

After the Project construction phase many local workers may be without employment. However, the Project will have provided them, in many instances, with additional skills and experience to work on similar projects in other locations. Local businesses supplying the Contractors and their staff may also see a fall in trade, this is an unavoidable consequence of the Project.

G.8.2 Community Health and Safety

Potential Impacts

568. The presence of the Project could affect the health, safety and security of the communities in the area of influence as a result of worker-community interactions, in-migration to the area, increased incomes in the local community that may be used for drugs, alcohol and prostitution, the risk of injury associated with construction and operational activities, increased pressure on health care resources and changes to the environment.

Construction Phase Impacts

569. Potential impacts due to the proposed construction can be identified as follows:

(i) Workforce, Jobseekers and Social Conflict. In some instances the local population may not be able to provide the necessary skilled workers for the Project. In such cases workers from other regions, or other countries may be employed by the Contractor. This could lead to social tensions and potential conflict if these workers are not aware of local customs and practices. An

increase in disposable income within the Project area (among Project workers, both local and external) may also result in a change in spending habits and behavior resulting in increase in alcohol and drug abuse, increased incidences of prostitution and casual sexual relations, which poses a threat to community health and safety.

(ii) Pressure on Social Infrastructure and Services. During the construction phase workers will be accommodated on-site and as such there will be no pressure on local housing stock. In addition, the Contractor will also have his own on-site medical facilities. Any serious injuries will be treated in Zestaphoni.

(iii) Road Safety. Construction of the Project Road will require a large amount of vehicle movements, locally and regionally. These could potentially result in road traffic accidents between vehicles, pedestrians and vehicles and livestock and vehicles if suitable plans and mitigation is not in place. This is especially relevant around the first intersection close to Boriti public school.

(iv) Air quality and noise. Potential air and noise issues and their impacts to the local population are discussed above under items **G.5.1 – Air Quality**, **Item G.7.4 – Construction Camps and Batching Plants** and **Item G.8.7 – Noise.**

(v) Blasting - Depending in the rock type and explosive strength, rocks can fly up to 50m and can potentially damage structures. For the above reason, surface blasting or blasting near the mouth of the tunnel is not recommended.

Operational Phase Impacts

570. Road Safety. The road has been designed in such a way that locals will not need to cross the new alignment on foot, as they do with the existing road. Access will be maintained to the existing road and people will be able to pass beneath bridges or above tunnels. Accidents involving collisions between pedestrians and vehicles are therefore likely to be rare. The geometry of the new road, improved drainage and two-lanes will also provide safer driving conditions for road users, although as traffic volumes increase the total number of vehicle accidents may increase, especially as average speeds are likely to increase.

571. Khunevi and Vashlevi schools are located very close to the new alignment and the existing road. The majority of the traffic using the existing road will be transferred to the new alignment which means that traffic on the existing road will be reduced leading to safer conditions for children coming to and from the schools which are accessed via the existing road.

572. Community Severance. In general, the new alignment traverses a series of tunnels and bridges, thereby limiting the potential for community severance. In addition, new access roads have been provided in the design to ensure that locals can still navigate easily to the existing road. At the start of the Project road three houses on the north side of the road (KM0.6 - KM0.7) will be expropriated as the design was unable to accommodate access to these properties. .

573. In addition, a number of small vehicle / pedestian bridges can be noted crossing the Dzirula river beneath planned bridge structures, notably at KM3.2, KM6.6 and KM9.9 (pedestrian only). None of these bridges are planned to be removed as part of the Project.

574. Air Quality & Noise – These issues, including the impacts to Boriti public school, are discussed in detail under items **G.5.1 – Air Quality** and **Item G.8.7 – Noise.**

Management & Mitigation Actions

Pre-construction Phase

575. Prior to start of site works residents, business representatives in the project area, local authorities and other stakeholders, including NGOs, who are likely to be affected by the project or are interested in the project) shall be informed on the construction schedule and activities, potential environmental impacts and mitigation measures through public meetings at each affected community.

Construction Phase Mitigation

576. Mitigation measures to limit community health and safety impacts include:

577. Road Safety – The Contractor will be responsible for preparing a traffic management plan (TMP) for the construction phase of the Project. Special attention should be given in the TMP to the Public School of Verkvichchala, Public school of village Vashlevi and the Khunevi School, including speed restrictions for construction traffic outside the schools (50 kph). Drivers operating in these areas will be given specific instruction and toolbox training sessions reminding them not to exceed this speed limit in these areas. In addition, School Safety Sessions will be completed by the Contractors H&S team and community liaison on 6-month basis throughout construction and an initial session prior to start of works to provide road safety awareness to children. During these sessions the school children shall also be provided with reflective badges to fit to clothing or school bags. Lastly, construction traffic will not be allowed to park within 100 meters of the entrance of the schools.

578. Blasting - The Project will conduct construction blasting consistent with Georgian and international safety standards. Blasting will be conducted using standard mining industry practices and procedures to ensure safety of personnel and equipment. This includes establishing a safety zone around the blast area, say to a distance of 500 m (actual distance will be established by the Contractor and approved by the Engineer based on the safety standards) and evacuating it. Prior to blasting works properties located in potential impact zone will be checked. The status – recorded. Inspection will also help to determine blasting method and dosage. Type, 'size' of the charge, selection of time between detonations, design (e.g. closer hole spacing, smaller diameter holes), presplitting blasting, perimeter blasting and millisecond blasting technique can be used in sensitive locations to minimize blasting effect.

579. Community Severance - The Contractor will ensure that all access bridges remain open during the Construction phase, or if this is not practical for safety reasons, he shall provide alternative crossing in these areas.

580. Social Conflicts. The Contractor shall provide regular health and safety training to their workers which will include sessions on social and cultural awareness. The Contractor will also sub-contract an organization to develop and implement an HIV/AIDS policy and information document for all workers directly related to the Project. The information document will address factual health issues as well as behavior change issues around the transmission and infection of HIV/AIDS. In addition, the Contractor shall develop an induction program, including a Code of Conduct, for all workers directly related to the Project. A copy of the Code of Conduct is to be presented to all workers and signed by each person. The Code of Conduct must address the following aspects:

(i) Respect for local residents and customs;
(ii) Zero tolerance of bribery or corruption;
(iii) Zero tolerance of illegal activities by construction personnel including:
    (a) unlicensed prostitution;

(b) illegal sale or purchase of alcohol;
(c) sale, purchase or consumption of drugs; and
(d) illegal gambling or fighting.

(iv) No alcohol and drugs policy during working time or at times that will affect ability to work; and

(v) Description of disciplinary measures for infringement of the Code and company rules. If workers are found to be in contravention of the Code of Conduct, which they signed at the commencement of their contract, they will face disciplinary procedures that could result in dismissal.

(vi) In addition, Project security guards shall not to violate the safety of local residents or other individuals involved in the project.

581. In addition, the Contractor will be responsible for holding monthly community meetings within the Project area throughout the construction period. The monthly meetings will be held in the villages along the alignment and will provide a forum for locals to discuss specific issues, such as noise and dust, with the Contractor before making complaints formal through the Grievance Redress Mechanism. The minutes of meetings shall be recorded and a list of participants prepared (including signatures). Photos of each event shall be taken (with timestamps). The Contractor shall prepare a short monthly summary of the meetings including all of the above information and submit it for review to the Engineer and RD within a week of the meeting.

Residual Impact Significance

Construction Phase – ***MINOR***

If the mitigation measures suggested are implemented residual impacts will be minor.

Operational Phase – ***LOW***

The main residual risks associated with the Project on the local community relate to noise which are discussed below. From the perspective of the schools, they should benefit from decreased traffic volumes on the existing road which will lead to increased road safety in the areas outside of the schools.

G.8.3 Workers' Rights & Occupational Health and Safety

582. Occupational Health and Safety - Accidents are common during a project of this size and scale. Accidents can occur if workers are not adequately trained or qualified for the job or if they have incorrect safety equipment and clothing.

583. Sexually Transmitted Diseases – See **Section G.8.2** above for impacts and mitigation relating to STDs.

584. Worker Rights - Workers' rights including occupational health and safety need to be considered to avoid accidents and injuries, loss of man-hours, labor abuses and to ensure fair treatment, remuneration and working and living conditions. These issues need to be considered not only for workers who are directly employed by the Project but also sub-contractors.

Potential Impacts

585. The Project is expected to create more than 600 direct employment opportunities during the peak of the construction period, which will be approximately 36 months in duration. The majority of workers will be engaged by the Contractor and will consist of a semi-skilled to skilled workforce.

586. The expected impacts on worker rights and H&S as a result of construction, activities and Project operation are as follows:

(i) Risk to workers H&S due to hazardous construction activities and other general construction activities, e.g. traffic accidents; and
(ii) Violation of workers' rights.

587. Construction activities will involve the operation of heavy equipment and trucks, working at height, construction traffic, use of electric devices, handling of hazardous materials and other hazardous activities. Due to the nature of the activities being undertaken during construction, worker H&S is a key risk with the potential for accidents that may result in injuries and fatalities as well as lost man-hours. It is also important to ensure that workers have access to safe water supplies.

Management & Mitigation Actions

588. 712. An OHS Plan will be prepared by the Contractor to manage worker safety. The Plan will include the following items:

(i) Safety Training Program. A Safety Training Program is required and will be delivered by a qualified H&S expert. The program will consist of:
    (a) Initial Safety Induction Course: All workmen will be required to attend a safety induction course before they are allowed access to the Site.
    (b) Periodic Safety Training Courses: Period safety course will be conducted not less than once every six months. All Contractor (and any sub-contractor) employees will be required to participate in relevant training courses appropriate to the nature, scale and duration of the works. Training courses for all workmen on the Site and at all levels of supervision and management. A list of training participants names and time-stamped photographic evidence of the training will be provided by the Contractor to the Engineer for his records.
    (c) Safety Meetings. Regular safety meetings will be conducted on a monthly basis. The Engineer will be notified of all safety meetings in advance. The Engineer may attend in person or by representative at his discretion. The minutes of all safety meetings will be taken and sent to the Engineer within seven (7) days of the meeting and will include a list of participants names and time-stamped photographic evidence of the training.
    (d) Safety Inspections. The Contractor will regularly inspect, test and maintain all safety equipment (including firefighting equipment), scaffolds, guardrails, working platforms, hoists, ladders and other means of access, lifting, lighting, signing and guarding equipment. Lights and signs will be kept clear of obstructions and legible to read. Equipment, which is damaged, dirty, incorrectly positioned or not in working order, will be repaired or replaced immediately by the Contractor.
    (e) PPE – Workers will be provided (before they commence works) with of appropriate PPE suitable for electrical work such as safety boots, helmets, gloves, protective clothes, goggles, and ear protection at no

cost to the workers. Life vests will be provided for all staff working around, or above rivers.

(ii) The Contractor shall keep a log of both training records and safety incidents including near misses.

(iii) All construction plant and equipment used on or around the Site will be fitted with appropriate safety devices. These will include but not be limited to:
- Effective safety catches for crane hooks and other lifting devices, and
- Functioning automatic warning devices and, where applicable, an up-to-date test certificate, for cranes and hoists.

(iv) Zones with noise level above 80 dBA must be marked with safety signs and appropriate PPE must be worn by workers.

(v) Portable toilet facilities for workers at road work sites will be provided.

(vi) Fencing on all areas of excavation greater than 2 m deep will be installed along with warning signs.

(vii) Ensure sufficient fresh air supply to confined work spaces.

(viii) Keep air inlet filters clean and free of dust and microorganisms.

(ix) Ensure reversing signals are installed on all construction vehicles.

(x) Implement fall prevention and protection measures whenever a worker is exposed to the hazard of falling more than two meters, falling into operating machinery or through an opening in a work surface. Note: fall prevention/protection measures may include installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area, proper use of ladders and scaffolds by trained employees, use of fall prevention devices, including safety belt and lanyard travel limiting devices to prevent access to fall hazard, fall protection devices such as full body harnesses, etc.

(xi) Mark the areas where risk of injuries from falling objects exist with rope or flagging to minimize risks and injuries.

(xii) Provide spotters. Employ flag persons to control traffic when construction equipment is entering or leaving the work area.

589. All Project sub-contractors will be supplied with copies of the SEMP. Provisions will be incorporated into all sub-contracts to ensure the compliance with the SEMP at all tiers of the sub-contracting. All subcontractors will be required to appoint a safety representative who will be available on the Site throughout the operational period of the respective sub-contract unless the Engineers approval to the contrary is given in writing. In the event of the Engineers approval being given, the Engineer, without prejudice to their other duties and responsibilities, will ensure, as far as is practically possible, that employees of sub-contractors of all tiers are conversant with appropriate parts of the SEMP. To implement the above items the Contractor will designate a qualified environmental, health and safety personnel.

590. Water supply – If groundwater is to be used as potable water it will be tested weekly to ensure that the water quality meets the GoG drinking water standards specified in **Section C**.

Residual Impact Significance

Construction Phase – ***MINOR***

If the mitigation measures suggested are implemented residual impacts will be minor.

Operational Phase – ***NONE***

G.8.4 Emergency Response Planning

Potential Impacts

591. Emergency situations may arise during the construction phase of the Project, for example, fires and explosions (through poor management and storage of fuels and chemicals).

Management & Mitigation Actions

Construction Phase

592. The Contractor will be responsible for preparation of an Emergency Response Plan (ERP) which will include sections relating to:

(i) Containment of hazardous materials;
(ii) Oil and fuel spills;
(iii) Fire, gas leaks and explosions;
(iv) Work-site accidents;
(v) Community /civil unrest and strike action; and
(vi) Earthquake and other natural hazards.

593. The plan will detail the process for handling, and subsequently reporting, emergencies, and specify the organizational structure (including responsibilities of nominated personnel). The plan will be submitted to the Engineer for approval. Implementation of the plan will be monitored by the Engineer. Any emergencies, and how they were handled, will be reported in monthly progress reports by the Contractor to the Engineer. The Engineer will also provide periodic monitoring of the Contractors works throughout construction to ensure the ERP is implemented effectively.

Residual Impact Significance

Construction Phase – ***MINOR***

If the mitigation measures suggested are implemented residual impacts will be minor.

Operational Phase – ***NONE***

G.8.5 Physical and Cultural Resources

Potential Impacts

594. As noted by **Section F.4.4** no physical cultural resources have been identified within the Project corridor that are likely to be impacted by Project works except for the small church at KM10.0 and the Cemetery at KM8.6. Ias noted in the section on Alternatives, a small cemetery was also noted close to the access road for the spoil disposal site. As part of the assessment for this spoil disposal site, potential impacts to this site assessed and mitigated. It is possible, given the rich cultural heritage of Georgia, that chance finds could occur during excavation works.

Management & Mitigation Actions

595. During the construction phase works shall be schedule that no works occur within 250 meters of the Church on Sundays, or during religious holidays. Fencing around the cemetery shall also be provided throughout the construction phase to ensure there is no encroachment into this area.

596. In the event of any chance finds during the construction works procedures shall apply that are governed by GoG legislation and guidelines. A chance finds procedure shall also be developed by the Contractor. **Appendix E** provides a sample chance find procedure which the Contractor could adopt.

Residual Impact Significance

Construction Phase – ***MINOR***

If the mitigation measures suggested are implemented residual impacts will be minor.

Operational Phase – ***NONE***

No impacts in terms of noise or air quality are anticipated given the mitigation measures outlines as part of this EIA.

G.8.6 Visual Impact

Potential Impacts

597. Visual impacts are the effects on people of the changes in available views through intrusion or obstruction and whether important opportunities to enjoy views may be improved or reduced. Visual impact to nearby receptors of the Project include:

(i) Degradation of aesthetic value of the area due to construction activities; and
(ii) Permanent change in visual character due to proposed Project.

598. The Project Area largely consists of valleys with large trees and bushes of heights greater than 2 m. The hilly landscape greatly restricts visibility to a less than one km at receptor locations.

599. The construction phase visual impact will be local and temporary. The activities during construction that will affect the aesthetics of the area include excavation, and storing of material in stockpiles and dumping at the waste disposal areas.

600. However, when in place, the new alignment will change the landscape substantially as shown by Figure 105 below. The elevated interchanges and retaining walls in some sections, along with areas of cut slopes will impact upon the view along the valley.