MERIDIAM S.A.S., VINCI CONSTRUCTION S.A.S., VINCI CONCESSIONS S.A.S.

NAIROBI-NAKURU-MAU SUMMIT HIGHWAY PROJECT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

KENYA - APPENDICES 7-6 TO 9-2

WSP REF.: 201-10312-00

DATE: FEBRUARY 16, 2022

APPENDIX

7-6 *FIRST ROUND INDIGENOUS COMMUNITY (VMG) CONSULTATION ACTIVITIES*

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER ENGAGEMENT ACTIVITIES – 1ST ROUND

ATTENDANCE SHEET – LIST OF PARTICIPANTS

Project: Nairobi-Nakuru-Mau Summit Highway	**Stakeholders :** Deputy County Commissioner.
Date and Time: 25/1/2021. 9 am.	**Venue:** DCC Office – Naivasha.

	Full Name	Organization and Position	Signature	Email and Phone Number
1	Kisilu Mutua	Min. of Interior		Email: Kisilumutua@gmail.(
				Phone Number: 0724432855
2	Edward Ontita	Norken/WSP		Email: egontita@gmail.com
				Phone Number: 0715766266
3	LAVINA OMONDI	NORKEN (I)		Email: lomondi@norken.co.ke.
				Phone Number: 0718830702.
4				Email:
				Phone Number:
5				Email:
				Phone Number:
6				Email:
				Phone Number:
7				Email:
				Phone Number:
8				Email:
				Phone Number:
9				Email:
				Phone Number:
10				Email:

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER ENGAGEMENT ACTIVITIES – 1ST ROUND

ATTENDANCE SHEET – LIST OF PARTICIPANTS

Project: Nairobi-Nakuru-Mau Summit Highway	**Stakeholders :** Maasai Elders.
Date and Time: 25/1/2021	**Venue:** Longonot Chief office.

	Full Name	Organization and Position	Signature	Email and Phone Number
1	STEPHEN ILIMANI N.	CHIEF		Email: STEVENJILIMANI1234@gmail Phone Number: 0724935887
2	SANCHA	Ereri village.		Email: — Phone Number: 0706776481
3	Elijah Seno	Ereri village		Email: ~~0701~~ — Phone Number: 0701778074
4	Kamamia Tinkoi	Ereri village.		Email: — Phone Number: 0714857074
5	SAMUEL NKURI	Ereri village.		Email: — Phone Number: 0796451058.
6	William Tinkoi	Ereri village.		Email: — Phone Number: 0714330709.
7	Dan Ntuntwa	EReri Village.		Email: — Phone Number: 0710503803
8	LAVINA OMONDI	NORKEN (I) LTD		Email: lomondi@norken.co.ke Phone Number: 0718830702.
9	Edward Ontita	Norken(I) Ltd		Email: eojontita@gmail.com Phone Number: 0715766266.
10				Email:

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER ENGAGEMENT ACTIVITIES – 1ST ROUND

ATTENDANCE SHEET – LIST OF PARTICIPANTS

Project: Nairobi-Nakuru-Mau Summit Highway	**Stakeholders :** Maasai Community Members – Mai Mahiu.
Date and Time: 26/Jan/2021. 1.30 pm.	**Venue:** Windy Ridge Resort – Mai-Mahiu.

	Full Name	Organization and Position	Signature	Email and Phone Number
1	LAVINA OMONDI	NORKEN (I) LTD.		Email: lomondi@norken.co.ke. Phone Number: 0718830702.
2	DENIS DIFFU	NGAO ASSISTANT COUNTY COMMISSIONER MAIMAHIU DIVISION		Email: denisdiffu@gmail.com Phone Number: 0720633539
3	MUNYIRI OLE NTIAMPAI	MAIMAHU		Email: Phone Number: 0726923333
4	Paul Rusa Teeka		✓	Email: Phone Number: 0727248509
5	Givan ole Lenku	K.F.T	✓	Email: givan002004@yahoo.com Phone Number: 0722-50-11-89
6	Kutata Lolo Simpiri	K-F.T	✓	Email: Phone Number: 0710667565
7	Dan OLEPOIS		✓	Email: Phone Number: 0111469985
8	Yohana Kaete	Pastor	✓	Email: Phone Number: 0729417573
9	Stanley Saleon	Farmer	✓	Email: Phone Number: 0728277345
10	AYUB KINUTHIA	BUSINESS MAN	✓	Email: 0723735108

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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER ENGAGEMENT ACTIVITIES – 1ST ROUND

				Phone Number:
	Full Name	Organization and Position	Signature	Email and Phone Number
11	Philip Timalo	Namcha	[signature]	Email: Phone Number: 0725613647
12	Benson Ole Kaloke	Soofelife Mag Comm.	[signature]	Email: benkol1973gm.com. Phone Number: 0721752238
13	Joshua ole Molo	" "	[signature]	Email: Phone Number: 07189 432374
14	Benson Mwima Wecke	Matrans Society	Mwima	Email: Phone Number: 0727630243
15	Jackson Kedienye	Sad/olonogot.	[signature]	Email: Phone Number: 0722208937
16	Edward Ontita	Norken(I) Ltd	[signature]	Email: egontita@gmail.com Phone Number: 0715 766266.
17				Email: Phone Number:
18				Email: Phone Number:
19				Email: Phone Number:
20				Email: Phone Number:
21				Email: Phone Number:
22				Email: Phone Number:

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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER ENGAGEMENT ACTIVITIES – 1ST ROUND

ATTENDANCE SHEET – LIST OF PARTICIPANTS

Project: Nairobi-Nakuru-Mau Summit Highway	**Stakeholders :** DCC MOLO.
Date and Time: 27/1/2021 9 am.	**Venue:** DCC MOLO OFFICE.

	Full Name	Organization and Position	Signature	Email and Phone Number
1	LAVINA OMONDI	NORKEN (I) LTD.	[signature]	Email: olavina66@gmail.com Phone Number: 0718830702.
2	DANIEL MBUGO OBUDO	OP-Interior-DCC, molo	[signature]	Email: districtcmolo@yahoo.com Phone Number: 0722268246
3	Edward Onfita	Norken (I) Ltd	[signature]	Email: egonfita@gmail.com Phone Number: 0715 766 266
4				Email: Phone Number:
5				Email: Phone Number:
6				Email: Phone Number:
7				Email: Phone Number:
8				Email: Phone Number:
9				Email: Phone Number:
10				Email:

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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER ENGAGEMENT ACTIVITIES – 1ST ROUND

ATTENDANCE SHEET – LIST OF PARTICIPANTS

Project: Nairobi-Nakuru-Mau Summit Highway	**Stakeholders :** DCC Njoro.
Date and Time: 27/1/21. 10.45 am.	**Venue:** Office of the DCC; Njoro.

	Full Name	Organization and Position	Signature	Email and Phone Number
1	LAVINA ONIONDI	Norken (1) Limited.		Email: lomondi@norken.co.ke Phone Number: 0718830702.
2	JOSEPH M. MBUGUA	INTERIOR - DCC		Email: mbuguan@yahoo.com Phone Number: 0722627778
3	Edward Onjita	Norken(1) Ltd		Email: egonjita@gmail.com Phone Number: 0715-766266
4				Email: Phone Number:
5				Email: Phone Number:
6				Email: Phone Number:
7				Email: Phone Number:
8				Email: Phone Number:
9				Email: Phone Number:
10				Email:

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER ENGAGEMENT ACTIVITIES – 1ST ROUND

ATTENDANCE SHEET – LIST OF PARTICIPANTS

Project: Nairobi-Nakuru-Mau Summit Highway	**Stakeholders :** Ogiek Council of Elders.
Date and Time: 27/1/2021	**Venue:** Mariashoni Guest House.

	Full Name	Organization and Position	Signature	Email and Phone Number
1	LAVINA OMONDI	NORKEN (I) Limited.		Email: lomondi@norken.co.ke Phone Number: 0718830702.
2	Edward Ontita	Norken(I) Limited		Email: egontita@gmail.com Phone Number: 0715766266
3	JOSEPH M. MIRINGA	Member OCE		Email: Phone Number: 0721112374
4	Martin Koptony	Vice Chair OCE		Email: martinkoptony@gmail.com Phone Number: 0725858713
5	SAMSON S. KIBERENGE	MEMBER OGIEK C.E		Email: Phone Number: 0726980815.
6	HASSAN SAUGHARE	member oce		Email: Phone Number: 0704050439
7	NABETO K. DAMEL	member oce		Email: Phone Number: 0792281814
8	JOHN W SAYAYA	Membe oce		Email: Phone Number: 0791892516
9	WILSON KISIOI	membe oce		Email: Phone Number: 0724921811
10	JOHN L. SIRONGA Chairman OCE	Chairman OCE		Email: 0723426683

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER ENGAGEMENT ACTIVITIES – 1ST ROUND

				Phone Number:
	Full Name	**Organization and Position**	**Signature**	**Email and Phone Number**
11	DAVID CHERIRO	Member C.O.E		Email: Phone Number: 0725884677
12	RISPI Kibet Ringera	member OCE		Email: Phone Number: 0720519793
13	JOSEPH K. LESINYO	MEMBER OCE		Email: Phone Number: 0724458163
14	JOSEPH BARGETUNY	MEMBER OCE		Email: Phone Number: 0726916360.
15	RICHARD BARSALOI	MEMBER OCE	RICHARD	Email: Phone Number: 0702486988
16	WILSON K. WARIONGA	MEMBER OCE		Email: Phone Number: 0725847801
17	SIMON KONANA	Member OCE		Email: Phone Number: 0715270302
18	KONINI NADEMUA	Member Ogiek CE		Email: Phone Number: 0711415750.
19	FRANCILIADO MAILU	Member Ogiek C.		Email: Phone Number: 0718897414.
20	FRANCIS KIPKECICH	Member OGIEK C.		Email: Phone Number: 0721969992
21				Email: Phone Number:
22				Email: Phone Number:

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Kenya National Highways Authority

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Meridiam supports the UN sustainable development Goals

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER ENGAGEMENT ACTIVITIES – 1ST ROUND

ATTENDANCE SHEET – LIST OF PARTICIPANTS

Project: Nairobi-Nakuru-Mau Summit Highway	**Stakeholders :** Ogiek Community Members.
Date and Time: 28/1/2021. 11 am.	**Venue:** Mariashoni Guest House.

	Full Name	Organization and Position	Signature	Email and Phone Number
1	LAVINA OMONDI	NORKEN (I) LIMITED.		Email: olavina66@gmail.com Phone Number: 0718 830702.
2	Edward Ontita	Norken (I) Limited		Email: eontita@gmail.com Phone Number: 0715 766266
3	John L. SIRONGA	CHAIRMAN C.D.E		Email: Phone Number: 0723426683
4	Martin Kiptiony	Vice Chair OCE		Email: martinkiptiony@gmail.com Phone Number: 0725858713
5	WILSON K. WARIONGA	O.C.E		Email: Phone Number: 0725847801
6	RICHARD S. BARSLOI	OCE	RICHARD	Email: Phone Number: 0702466988
7	Samson S Liberenge	O.C.E		Email: Phone Number: 0726980815
8	James KARUNA	OCE		Email: 0726210488 Phone Number:
9	HASSAN SAMSARE	OCE		Email: Phone Number: 0704050439
10	JOSEPH M. MURINGA	OCE		Email: 0721112374

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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER ENGAGEMENT ACTIVITIES – 1ST ROUND

	Full Name	Organization and Position	Signature	Email and Phone Number
11	Konini Nademya	OCE		Email: Phone Number: 0711415750
12	John W. Sayaya	C.O.E		Email: Phone Number: 0791892516
13	John mariro	C.O.E		Email: Phone Number: 0714785161
14	Stephen Lesuari	C.O.E		Email: Phone Number: 0757864225
15	Wilson Kisiol	OC.E		Email: Phone Number:
16	Zakayo Wsingo	C.F.A Logoman		Email: zakayoWsingo@gmail.com. Phone Number: 0718616801
17	Simon K. Konini	COE		Email: Phone Number: 0715270302
18	RISKI KIBET RINGASO	OCE		Email: Phone Number: 0720514793
19	MICHAEL K LANGAT	BCE		Email: Phone Number: 0711542261
20	WILSON KIPKURUI	Reverend		Email: Phone Number: 0721161316
21	STEPHEN K. LELEI	MACODEFE MEMBER		Email: lelei stephen 74@gmail.com Phone Number: 0726741739
22	JOSEPH K. SINDA	PST		Email: 0722 615 891 Phone Number:

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER ENGAGEMENT ACTIVITIES – 1ST ROUND

	Full Name	Organization and Position	Signature	Email and Phone Number
23	Hillary Kiprono Bii	Community Member		Email: Phone Number: 0700360324
24	Julius C Cheptonsech	PASTOR		Email: Jkobell.gmail Phone Number: 0723389162
25	Samuel Seriber.	Reverend		Email: Phone Number: 0703932740
26	Nelson Themosi	Reverend.		Email: Phone Number: 0724716949
27	David Sironga	Rev. (Kenya Assemblies of God		Email: davidsironga@gmail Phone Number: 0723733486
28	Francis Kipyegetich	DCE Marakwet		Email: Phone Number: 0721969992
29	Julius Ngiria	Community member		Email: 0725055504 Phone Number:
30	Simon Kimutai	Community member		Email: Phone Number: 0707945 13
31	Kenneth Kipkorir Langat	Community member		Email: Phone Number: 0798[illegible]226
32	Kimbai Collins Koseh	Ogiek Community		Email: Phone Number: 0723088389
33	Simon Sururu	OGIEK community		Email: Phone Number: 0718600[illegible]
34	Dickson Kitango	Ogiek member		Email: Phone Number: 0720091031
35	William K. Kalegu			Email: Phone Number: 0725403140

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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER ENGAGEMENT ACTIVITIES – 1ST ROUND

	Full Name	Organization and Position	Signature	Email and Phone Number
36				Email: Phone Number:
37	CHRISTOPHER M SOMUEI	OPINION Leader	[signature]	Email: Phone Number: 0726887158
38	FRANCIUMBO MAIIOI	OGIEK YOUTH	[signature]	Email: Phone Number: 0724520064.
39	MACDONALD TOWETT	OGIEK Leader	[signature]	Email: Phone Number: 0712-639-145
40	FABIAN KUBEI	OGIEK youth	[signature]	Email: [illegible]@gmail.com Phone Number: 0746 349 430
41	TANUI ISAACK	OGIEK Youth	[signature]	Email: Phone Number: 0799670837
42	AGNESS CHILILI	OGIEK women	Agnes	Email: Phone Number: 0746-779-316
43	MONICA CHEBET	OGIEK woman	[signature]	Email: Phone Number: 0725-969-405
44	SAISAITAN CHEPKORIR	OGIEK women		Email: Phone Number: 0793 271565
45	ESTHER CHEPKEMOI	OGIEK women	[signature]	Email: Phone Number: —
46	CLARE RONO	OGIEK Youth.	[signature]	Email: Phone Number: 0723071096
47	Teresa Chemutai	OGIEK vonarable group	[signature]	Email: ronoclare19@gmail.com. Phone Number: 0729523880
48	Joseph Rongeino	OGIEK leader	[signature]	Email: Phone Number: 0726916360

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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER ENGAGEMENT ACTIVITIES – 1ST ROUND

	Full Name	Organization and Position	Signature	Email and Phone Number
49				Email:
				Phone Number:
50	DENIS KONIK	PASTOR		Email: 0790598440
				Phone Number:
51	JOSEPH K. LESINYO	OCE		Email:
				Phone Number: 0724458163
52	SIMON K. MUCHURA	Ongiek kinda		Email:
				Phone Number: 0716269467
53	Moses Muraro	Ogiek elder		Email:
				Phone Number: 0754920171
54	Kimungen Alex	Youth leader		Email:
				Phone Number: 0724118907
55	DAVID ROTICH	YOUTH LEADER		Email:
				Phone Number: 0725937496
56	NAOMI K. DAVID	OCE		Email:
				Phone Number: 0792281814
57	JOHN K. KISIAMBEI	OGIEK YOUTH		Email:
				Phone Number: 0758805321
58				Email:
				Phone Number:
59				Email:
				Phone Number:
60				Email:
				Phone Number:
61				Email:
				Phone Number:

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER ENGAGEMENT ACTIVITIES – 1ST ROUND

ATTENDANCE SHEET – LIST OF PARTICIPANTS

Project: Nairobi-Nakuru-Mau Summit Highway	**Stakeholders :** Ogiek People Development Program (OPDP)
Date and Time: 29/1/2021. 10 am.	**Venue:** OPDP Offices, Nakuru.

	Full Name	Organization and Position	Signature	Email and Phone Number
1	LAVINA OMONDI	NORKEN (I) LTD		Email: olavina66@gmail.com
				Phone Number: 0718830702.
2	John Samorai	Ogiek Peoples Dev. program		Email: jsamorai@ogiekpeoples.org
				Phone Number: 0710212956
3	Samuel Kosei	OPDP		Email: skosei@ogiekpeoples.org
				Phone Number: 0722433367.
4	EDWARD ONTITA	NORKEN (I) LTD		Email: egontita@gmail.com.
				Phone Number: 0715766266.
5				Email:
				Phone Number:
6				Email:
				Phone Number:
7				Email:
				Phone Number:
8				Email:
				Phone Number:
9				Email:
				Phone Number:
10				Email:

PHOTOGRAPHIC REPORT FOR VMG MEETINGS

CONSULTATION WITH MAASAI COMMUNITY, JANUARY 25 TH AND 26 TH 2021

	
Naivasha Sub-County Deputy County Commissioner Courtesy Visit	Maasai Community Traditional Leaders Meeting, Longonot
	
Maasai Community Meeting, Mai Mahiu	Maasai Community Meeting, Mai Mahiu

PHOTOGRAPHIC REPORT FOR VMG MEETINGS

CONSULTATION WITH OGIEK COMMUNITY, JANUARY 27 TH, 28 TH, 29 TH 2021

	
Molo Sub-County Deputy County Commissioner Courtesy Visit	Njoro Sub-County Deputy County Commissioner Courtesy Visit
	
Ogiek Community Traditional Leaders Meeting, Njoro	Ogiek Community Traditional Leaders Meeting, Njoro
	
Ogiek Community Meeting, Maraishoni	Ogiek Community Meeting, Maraishoni

Ogiek Community Meeting, Maraishoni

Ogiek Community Meeting, Maraishoni

NGO Ogiek People Development Program Meeting, Nakuru

MINUTES OF MEETING

CLIENT:	Rift Valley Consortium		
PROJECT:	Rironi-Nakuru-Mau Summit Highway	**WSP Ref.:**	201-10312-00
SUBJECT:	1st Round Stakeholder Consultations Courtesy Call at Naivasha	**DATE:**	January 25, 2021
VENUE:	Office of the DCC, Naivasha.	**TIME:**	9 h 00

ATTENDEES – 3 PARTICIPANTS				
Name		**Corporation**	**Telephone**	**Email**
1	Mr. Mutua Kisilu	Ministry of Interior; Deputy County Commissioner	0724 432085	kisilumutua@gmail.com
2	Professor Edward Ontita	Norken International	0715 766266	egontita@gmail.com
3	Lavina Omondi	Norken International	0718830702	lomondi@norken.co.ke

ITEMS DISCUSSED	**ACTION BY**
1 PROJECT DESCRIPTION	
The project seeks to expand and improve the Rironi – Mau-Summit road (A8) This consists of: Widening of a 175 km section of the existing highway between Rironi and Mau Summit into a four lane dual carriageway and future augmentation into a six lane carriageway in sections depending upon traffic volumes. Rehabilitation of a 57 km section of the existing single carriageway of A8-South highway between Rironi and Naivasha via Mai Mahiu. As a legal requirement, Environmental and Social Impact Assessment is a prerequisite for such a development project. The task of the team is to engage different levels of stakeholders but specifically the indigenous communities along the proposed project corridor, the Maasai and Ogiek.	Prof Ontita
The Maasai community mainly do not live near the road. For this particular project, no acquisition is anticipated seeing that it's an already existing road, and the stretch from Mai-Mahiu to Naivasha is only being rehabilitated. The project should focus on providing crossing points for the livestock to ensure the community is served by the development project.	DCC

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ITEMS DISCUSSED	ACTION BY
2 LIVELIHOODS	
What is the active source of livelihood for the Maasai in Naivasha, Longonot extending to Mai-mahiu? The Maasai are traditionally pastoralists; they sell their cattle for income, with most of them being sold and ferried to Dagoretti Slaughterhouses in Nairobi. Some of the Masai people also slaughter their livestock and supply meat to hotels in the Rift valley and in Nairobi. Lately, their livelihoods have been greatly influenced by industrialization; power generating companies, flower farms and penetration of supply businesses where they provide basic commodities to companies. The sand-harvesting business in the region is greatly controlled by the Maasai. Evidence of the entrepreneurial activities can be seen on market days at Suswa where mostly cattle are sold. The women also sell a lot of beadwork and traditional regalia.	DCC
3 LEADERSHIP	
The Maasai have an active and informal leadership system where each village and each age group have their own leader. They are mostly very united across the greater Maasai land with informal chiefs traversing counties but have leadership wrangles when they have competing interests amongst themselves. The Christian church also provides informal leadership amongst the Maasai. There are also cooperatives around sand harvesting and ranches. There are no prominent NGOs representing them here in the County.	DCC
4 OPINION AND WAY FORWARD	
The DCC supported the project stating that it is long overdue due to the heavy traffic witnessed along the way. They will work towards ensuring: – Ease of movement for the trucks picking up luggage and containers from the dry port in Naivasha before completion of, and as a supplement of the Standard Gauge Railway. – Faster transportation of perishable export produce to the airport knowing that Naivasha is a horticultural town. – Overall reduced traffic and current disadvantages, including traders loading their products in Mai-Mahiu to travel overnight due to the severe traffic delays during the day. During engagements with the local community, the consultant should expect high expectations from the Maasai with many requests around contracts during the road construction phase. There should be no commitments to avoid future conflict over unfulfilled promises.	DCC

MINUTES OF MEETING PREPARED BY:

Lavina Omondi, Social Safeguard Expert, Norken International Limited

Prof. Ontita, Senior Vulnerable and Marginalized Groups Specialist, Norken International Limited

MINUTES OF MEETINGS REVIEWED BY:

REPRESENTATIVE OF	NAME AND TITLE	SIGNATURE	DATE
Ministry of Interior; Deputy County Commissioner – Naivasha			
Norken International			
WSP	Ghyslain Pothier, Project Director		March 23 2021

These minutes are considered to be an accurate recording of all items discussed. Written notices of discrepancies, errors or omissions must be given within seven (7) days, otherwise the minutes will be accepted as written.

MINUTES OF MEETING

CLIENT:	Rift Valley Consortium		
PROJECT:	Rironi-Nakuru-Mau Summit Highway	**WSP Ref.:**	201-10312-00
SUBJECT:	Meeting with the Maasai elders.	**DATE:**	January 25, 2021
VENUE:	Chiefs' Office in Longonot.	**TIME:**	14 h 00

ATTENDEES
Please refer to the Appendix for the attendance list (9 participants)

ITEMS DISCUSSED	**ACTION BY**
1 PROJECT DESCRIPTION.	
Under a Public Private Partnership, the Government has proposed a project with an aim to expand and improve the Rironi – Mau-Summit road (A8). The project design will widen the existing highway between Rironi and Mau Summit into a four-lane dual carriageway. The existing single carriageway section between Rironi and Naivasha via Mai Mahiu will be rehabilitated to include proper road signs, foot bridges and possible repairs of the potholes and dilapidated sections. As a legal requirement, Environmental and Social Impact Assessment is a prerequisite for such a development project. The task of the team is to engage different levels of stakeholders but specifically the indigenous communities along the proposed project corridor, the Maasai and Ogiek.	Prof. Ontita
The anticipated benefits of the project include; – Reduced road accidents; – Reduced travel time; – Increased business opportunities; – Employment opportunities during the road construction; – Improved safety on the roads. The Community participation program is to; – Inform the community of the proposed project; – Involve the community from the early stages of the project; – Discuss and seek the opinions of the community; – Legitimize the project.	Prof. Ontita

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ITEMS DISCUSSED	ACTION BY
2 REACTION FROM THE COMMUNITY.	
The Maasai elders present were thankful for the progressive project with no objections. He stressed the need of employment opportunities to be given to community members, especially on unskilled labour.	Kamamia Tinkoi
The road at Mai-mahiu towards Nairobi has a lot of traffic. Most of the time their businesses are delayed, their lives slowed down, and animal and farm produce go bad along the way. Will the steep section be expanded? Just rehabilitating it will not solve the traffic issue?	Samwel Nkuri
This reaction was noted and would be taken into account during the design drafting stage.	Prof. Ontita
3 Q & A FROM CONSULTANTS.	
How do the Maasai use the road in its present state in terms of livelihood creation? – Most of them are business men, they use the road to transport their livestock to the market; – Transport meat to the slaughter houses; and – Some have personal cars and use the road to link Longonot to Mai-mahiu and Naivasha on their personal and business trips. – Sand harvesters and loaders also use the road for transportation and movement. Do the cattle cross the road to the opposite side? – Yes, water is found across the road, therefore they cross with their cattle to the opposite side for water almost daily. Are there any under-passes? And what challenges do they face when moving with animals across the road? – There are no under-passes provided for the cattle. There have been many accidents where their livestock are knocked down due to lack of designated animal crossing paths and road signs. How would they like the project to reduce the challenges they face? These are accidents involving their cattle and community members. – The preferred option is an underground bridge for animal crossing and these should be preferably installed after every 5 kilometres. – There should be clear road signs. – Speed bumps should be installed in the centre for the safety of pedestrians and foot bridges where there are schools for the children. Any association representing their plight or rights? And do women have their specific leaders? – The Maasai operate with an informal age set chief that traverse Narok, Nakuru and Kajiado Counties, they also have chairmen leading each village. The women are nowadays involved in development, with well structured leadership but are still warming up to participate in such forums.	Prof Ontita

ITEMS DISCUSSED	ACTION BY
4 CONCLUSION	
The villages where the Maasai communities live are approximately 3-4 kilometres from the main road. They will not be affected adversely but their requests of foot bridges and animal crossing under-passes should be considered to ensure preservation of their pastoralism way of life amidst infrastructure development.	#Prof Ontita

MINUTES OF MEETING PREPARED BY:

Lavina Omondi, Social Safeguard Expert, Norken International Limited

Prof. Ontita, Senior Vulnerable and Marginalized Groups Specialist, Norken International Limited

MINUTES OF MEETINGS REVIEWED BY:

REPRESENTATIVE OF	NAME AND TITLE	SIGNATURE	DATE
Norken International			
WSP	Ghyslain Pothier, Project Director		March 23 2021

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MINUTES OF MEETING

CLIENT:	Rift Valley Consortium		
PROJECT:	Rironi-Nakuru-Mau Summit Highway	**WSP Ref.:**	201-10312-00
SUBJECT:	Consultation with the Maasai Community.	**DATE:**	January 26, 2021
VENUE:	Windy Ridge – Mai Mahiu	**TIME:**	13 h 00

Attendees
Please refer to the Appendix for the attendance list (16 participants)

ITEMS DISCUSSED	**ACTION BY**
1 PROJECT DESCRIPTION	
Under a Public Private Partnership, the Government has proposed a project with an aim to expand and improve the Rironi – Mau-Summit road (A8). The project design will widen the existing highway between Rironi and Mau Summit into a four lane dual carriageway. The existing single carriageway section between Rironi and Naivasha via Mai Mahiu will be rehabilitated to include proper road signs, foot bridges and possible repairs of the potholes and dilapidated sections. As a legal requirement, Environmental and Social Impact Assessment is a prerequisite for such a development project. The task of the team is to engage different levels of stakeholders but specifically the indigenous communities along the proposed project corridor, the Maasai and Ogiek. The project is currently at Design stage and the opinions and reactions collected during the community engagements will be taken into account. The engagements will also reduce future conflict between the client, consultant and the community as the community is involved from the project inception stage.	Prof. Ontita
The anticipated benefits of the project include; – Reduced road accidents; – Reduced travel time; – Increased business opportunities; – Employment opportunities during the road construction; – Improved safety on the roads.	Prof. Ontita

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ITEMS DISCUSSED	ACTION BY
2 REACTIONS FROM THE COMMUNITY	
The road rehabilitation is one of the major projects Mai Mahiu needs at the moment. He is part of a forest conservation project at Kijabe Forest Ranch; they take their animals to graze and for water in the forest. However, with the severe traffic, this is often not possible. The forests also act as their source of livelihoods as they source of water, firewood and grass with permits. They have also installed bee-hives in the forest. Will the road affect the forest during its expansion along the A8?	Kutata Ole Sipiri.
At the moment it is not anticipated that the road will use up part of the forest as this is an existing road.	Prof Ontita
Suggestion of two-foot bridges for the pedestrians in Mai mahiu town because one can possibly take up to 30 minutes trying to cross the road.	Ayub Kinuthia
What is the contingency plan for an alternative route for the vehicles during the construction period? He suggests diversion of traffic to Ndeiya-Canaan-Mayers farm road.	Johama Ole Kayete
The road project should consider: – Avoiding water contamination during construction at the river in Mai mahiu town as they use the river downstream; – Providing parking bays for the sand harvesters as the congestion in the entry and exits points contribute greatly to traffic.	Philip Timalo
The project will directly benefit the community, therefore: – Crossing underpasses for the animals including livestock should be provided; – The community should be involved in all the steps of the project for project sustainability; – The community should be involved in the sourcing of construction materials as they have transportation vehicles.	James Munyiri
Diversion signboards should be properly erected.	Stanley Salao
From their experience, metal posts and wooden posts are vandalised by the community when used to make road signs. He therefore asks for a possibility to use concrete posts when installing the road signs. If budget allows, the client should consider identifying gaps in the community and providing CSR projects. Speed bumps should be erected in towns to reduce accidents.	Benson Ole Kaleke
There was a previous meeting also regarding this specific project. What is the current status of the progress, and when is the road construction commencing?	Givan Leru
The project is currently at design stage. The information at the moment is that the construction is set to begin in 2022. This year will be utilised in design drafting and stakeholder consultations.	Prof. Ontita

<table>
<tr><th>ITEMS DISCUSSED</th><th>ACTION BY</th></tr>
<tr><td colspan="2">3 Q & A FROM CONSULTANTS</td></tr>
<tr><td>Are there any NGOs or CBOs in the community?</td><td>Prof Ontita</td></tr>
<tr><td>There are no NGOs at the moment.
CBOs present include;
<table>
<tr><td>CBO</td><td>Chairperson</td><td>Contact</td></tr>
<tr><td>Ilanyuak in Namcha Community</td><td>Moses Molo</td><td>0714 347362</td></tr>
<tr><td>Olonongot Maasai Community</td><td>Benson Ole Kaleke</td><td>0721 752238</td></tr>
<tr><td>Elparapuo Conservation group</td><td>Ole Simpiri</td><td>0710 607565</td></tr>
<tr><td>Community chairman - Namcha</td><td>Joseph Ole Kichao</td><td>0727 481410</td></tr>
<tr><td>Community chairman - Olonongot</td><td>Francis Kerenge</td><td>0729 319934</td></tr>
</table>
There are also a number of societies and construction supply companies in Mai Mahiu. The sand harvesters alone are a community of about 8,000 people.</td><td>All</td></tr>
<tr><td colspan="2">4 CONCLUSION</td></tr>
<tr><td>The underpass was the preferred option for the animal crossing points. It was evident from the engagement with the community that the Maasai are not only pastoralists but also an enterprising community.</td><td></td></tr>
</table>

MINUTES OF MEETING PREPARED BY:

Lavina Omondi, Social Safeguard Expert, Norken International Limited

Prof. Ontita, Senior Vulnerable and Marginalized Groups Specialist, Norken International Limited

MINUTES OF MEETINGS REVIEWED BY:

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WSP	Ghyslain Pothier, Project Director		March 23 2021

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MINUTES OF MEETING

CLIENT:	Rift Valley Consortium		
PROJECT:	Rironi-Nakuru-Mau Summit Highway	**WSP Ref.:**	201-10312-00
SUBJECT:	1st Round Stakeholders Consultations. Courtesy Call at Molo.	**DATE:**	January 27, 2021
VENUE:	Office of the DCC – Molo	**TIME:**	9 h 00

ATTENDEES – 3 PARTICIPANTS

	Name	Corporation	Telephone	Email
1	Mr. Daniel Mbogo	Ministry of Interior; Deputy County Commissioner	0722268246	districtrmolo@yahoo.com
2	Professor Edward Ontita	Norken International	0715 766266	egontita@gmail.com
3	Lavina Omondi	Norken International	0718830702	lomondi@norken.co.ke

ITEMS DISCUSSED	ACTION BY
1 PROJECT DESCRIPTION	
The project seeks to expand and improve the Rironi – Mau-Summit road (A8) This consists of: Widening of a 175 km section of the existing highway between Rironi and Mau Summit into a four-lane dual carriageway and future augmentation into a six lane carriageway in sections depending upon traffic volumes. Rehabilitation of a 57 km section of the existing single carriageway of A8-South Highway between Rironi and Naivasha via Mai Mahiu. As a legal requirement, Environmental and Social Impact Assessment is a prerequisite for such a development project. The task of the team is to engage different levels of stakeholders but specifically the indigenous communities along the proposed project corridor, the Maasai and Ogiek.	Prof. Ontita.
This is the first round of consultations and two more rounds are anticipated. The plan for this round is to meet up with the DCCs (Molo and Njoro); meet the Ogiek Council of Elders the following day and meet the Ogiek community on Friday, January 29, 2021. The exercise will help understand where the Ogiek live, their way of life and most importantly how they interact with the proposed road.	Prof. Ontita

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ITEMS DISCUSSED	ACTION BY
2 THEIR LIVELIHOOD AND INTERACTIONS WITH THE ROAD	
The Council of Elders is respected amongst the Ogiek community and they essentially give direction on development and cultural matters. The Ogiek will not be adversely affected by the project as they are based in Mariashoni and Mau forest where the lower edges of the Mau complex touch the Kericho highway. They mainly use the Olenguruone-Mariashoni-Naisuuit Road. The Ogiek are mainly hunters and gatherers but have since transformed to be involved in agriculture, with their main business being bee keeping and selling honey as cooperatives, small groups, and individually. The poor condition of the roads connecting the Ogiek to other areas is associated with the movement of the agricultural products to the market through middlemen using trucks. Transport in the Ogiek areas is mainly by motorbike and donkeys. Crossing over the highway by the Ogiek is mainly for individual needs and interaction, and mainly not as a trip to seek livelihoods. They therefore don't have any special routes across these highways.	DCC
3 CONCLUSION AND WAY FORWARD	
Due to their situation as an indigenous community, the Ogiek like attracting a lot of attention. They might come up with demands so no commitments and promises should be made on every request they make. At the end of the meeting, confirm what was discussed and agree upon to curb further conflict.	DCC

MINUTES OF MEETING PREPARED BY:

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Prof. Ontita, Senior Vulnerable and Marginalized Groups Specialist, Norken International Limited

MINUTES OF MEETINGS REVIEWED BY:

REPRESENTATIVE OF	NAME AND TITLE	SIGNATURE	DATE
Ministry of Interior; Deputy County Commissioner			
Norken International			
WSP	Ghyslain Pothier, Project Director		March 23 2021

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MINUTES OF MEETING

CLIENT:	Rift Valley Consortium		
PROJECT:	Rironi-Nakuru-Mau Summit Highway	**WSP Ref.:**	201-10312-00
SUBJECT:	1st Round Stakeholders Consultations. Courtesy Call at Njoro.	**DATE:**	January 27, 2021
VENUE:	Office of the DCC – Njoro	**TIME:**	10 h 30

ATTENDEES				
Name		**Corporation**	**Telephone**	**Email**
1	Mr. John N. Mbugua	Ministry of Interior; Deputy County Commissioner – Njoro	0722 627178	mbuguan@yahoo.com
2	Professor Edward Ontita	Norken International	0715 766266	egontita@gmail.com
3	Lavina Omondi	Norken International	0718830702	lomondi@norken.co.ke

ITEMS DISCUSSED	**ACTION BY**
1 INTRODUCTION AND PROJECT DESCRIPTION	
The project seeks to expand and improve the Rironi – Mau-Summit road (A8) This consists of: Widening of a 175 km section of the existing highway between Rironi and Mau Summit into a four lane dual carriageway and future augmentation into a six lane carriageway in sections depending upon traffic volumes. Rehabilitation of a 57 km section of the existing single carriageway of A8-South highway between Rironi and Naivasha via Mai Mahiu. As a legal requirement, Environmental and Social Impact Assessment is a prerequisite for such a development project. The task of the team is to engage different levels of stakeholders but specifically the indigenous communities along the proposed project corridor, the Maasai and Ogiek.	Prof Ontita
The Ogiek consider themselves the natives of the region. They are a marginalised community living in the Mau forest and efforts to resettle them are futile. When given land, they sell it and move back to the forest. They have an Ogiek Council of Elders who decide everything and it transcends Molo and Njoro sub-counties. Currently, the Ogiek live in Mariashoni with most of them living in Nessuit and a few in Sururu, Mau-Narok. These are both in Njoro and Molo sub-counties.	DCC

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ITEMS DISCUSSED	ACTION BY
2 LIVELIHOOD	
The Ogiek are mainly beekeepers and farmers currently growing maize, beans, potatoes, peas and vegetables. They also practice small scale livestock farming, keeping cattle and sheep.	DCC
3 INTERACTIONS AND ANTICIPATED EFFECTS.	
There are no adverse effects expected from the road construction as the Ogiek do not live adjacent to the highway. The road will however: – Open up the area by improving the businesses and facilitating influx of people into the region. – Enable easy transportation of agricultural products and movement of buyers into the farms.	DCC
4 CONCLUSION	
Besides the Ogiek Council of Elders (OCE), there is no other leadership structure amongst the Ogiek. There is however, one NGO that champions their rights and ensures the community is well engaged and involved. Ogiek People Development Program set to be consulted on Friday, January 29th.	DCCs

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Prof. Ontita, Senior Vulnerable and Marginalized Groups Specialist, Norken International Limited

MINUTES OF MEETINGS REVIEWED BY:

REPRESENTATIVE OF	NAME AND TITLE	SIGNATURE	DATE
Ministry of Interior; Deputy County Commissioner – Njoro			
Norken International			
WSP	Ghyslain Pothier, Project Director		March 23 2021

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MINUTES OF MEETING

CLIENT:	Rift Valley Consortium		
PROJECT:	Rironi-Nakuru-Mau Summit Highway	**WSP Ref.:**	201-10312-00
SUBJECT:	Meeting with the Ogiek Council of Elders	**DATE:**	January 27, 2021
VENUE:	Mariashoni Community Guest House	**TIME:**	12 h 30

ATTENDEES
Please refer to the Appendix for the attendance list (20 participants)

ITEMS DISCUSSED	**ACTION BY**
1 PROJECT PRESENTATION.	
Under a Public Private Partnership, the Government has proposed a project with an aim to expand and improve the Rironi – Mau-Summit road (A8). The project design will widen the existing highway between Rironi and Mau Summit into a four lane dual carriageway. The existing single carriageway section between Rironi and Naivasha via Mai Mahiu will be rehabilitated to include proper road signs, foot bridges and possible repairs of the potholes and dilapidated sections. As a legal requirement, Environmental and Social Impact Assessment is a prerequisite for such a development project. The task of the team is to engage different levels of stakeholders but specifically the indigenous communities along the proposed project corridor, the Maasai and Ogiek. The project is currently at design stage and the opinions and reactions collected during the community engagements will be taken into account. The engagements will also reduce future conflict between the client, consultant and the community as the community is involved from the project inception stage. Currently, the road in focus is under KENHA, but KURA and KERRA also have mandates over other roads, urban and rural roads respectively.	Prof. Ontita
The consultations were done with the Ogiek living in Eastern Mau, Nakuru County. The benefits they would get from the road expansion and rehabilitation include: – Reduced road accidents; – Employment opportunities during the road construction phase; – Reduced hustle for marketing for their agricultural products and honey.	Prof. Ontita

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ITEMS DISCUSSED	ACTION BY
2 REACTIONS FROM THE OCE	
The Ogiek partake largely in agricultural production and farm potatoes and maize. They also practice livestock keeping in small scales, bee keeping and sometimes depend on relief agricultural produce and fertilizers.	Simon Konana
They have been forced to change with the changing times. This is mainly because the forests have largely been cleared. They face challenges in transporting their agricultural produce to the markets and using middlemen always leaves them open to exploitation. The business link to the nearby town (Elburgon) is also being destroyed due to poor road links.	Joseph Kei Lesingo
The community suffers economically from the poor prices offered for their products, therefore the road will open up the region and improve their business experience. They however, need the link road from Mariashoni to Elburgon Town covering a distance of 8 kilometres improved to bitumen standards and requested a commitment for this. Can the project commit to it?	Joseph Barng'etuny
At the moment, the project is focusing on the Rironi-Nakuru-Mau Summit road and cannot make any commitments to their request.	Prof. Ontita
There is no indication of any new projects as discussed by the consultants. They are however, very grateful for this project as travel to Nairobi has been very cumbersome lately and the project will alleviate this. The traffic mostly causes trucks to use diversion routes, hence destroying the smaller feeder roads that have no capacity for huge trucks. Future consideration should be made to expand the stretch from Mau-Summit to Uganda as well.	Joseph Miringa
Involving the marginalised and vulnerable communities in public consultations is a noble thing seeing that most of their opinions are not always taken into account. The project will improve their lifestyle and act as an avenue of making them independent in business, free from middlemen.	Martin Lele
3 CONCLUSION	
In the Eastern Mau, the Ogiek Council of Elders traverse to Molo and Njoro sub counties and there are no other forms of informal leadership. For the meeting with the community members, women and youth need to be well represented. The opinions from the community members will form the basis of a report that will be used to make any decisions in the design report as well.	Prof. Ontita

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WSP	Ghyslain Pothier, Project Director		March 23 2021

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MINUTES OF MEETING

CLIENT:	Rift Valley Consortium		
PROJECT:	Rironi-Nakuru-Mau Summit Highway	**WSP Ref.:**	201-10312-00
SUBJECT:	Meeting with the Ogiek Community Members	**DATE:**	28 janvier 2021
VENUE:	Mariashoni Community Guest House	**TIME:**	11 h 00

ATTENDEES
There's a separate list of attendees.

ITEMS DISCUSSED	**ACTION BY**
1 PROJECT PRESENTATION	
Under a Public Private Partnership, the Government has proposed a project with an aim to expand and improve the Rironi – Mau-Summit road (A8). The project design will widen the existing highway between Rironi and Mau Summit into a four lane dual carriageway. The existing single carriageway section between Rironi and Naivasha via Mai Mahiu will be rehabilitated to include proper road signs, foot bridges and possible repairs of the potholes and dilapidated sections. As a legal requirement, Environmental and Social Impact Assessment is a prerequisite for such a development project. The task of the team is to engage different levels of stakeholders but specifically the indigenous communities along the proposed project corridor, the Maasai and Ogiek. The project is currently at design stage and the opinions and reactions collected during the community engagements will be taken into account. The engagements will also reduce future conflict between the client, consultant and the community as the community is involved from the project inception stage.	Prof. Ontita
The previous day the team met with the Ogiek Council of Elders to disclose and discuss the same project, so this forum is to tie in the community members and various stakeholder groups to ensure everyone is involved. Public consultation is done to: – Inform the community of the proposed project including its benefits; – Satisfy the requisite legal need by EMCA on conducting public consultations for proposed projects. There was a translation of the project details into the local language by Mr. Miringa.	Prof. Ontita

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ITEMS DISCUSSED	ACTION BY
2 INTERACTIONS AND CHALLENGES IN THE ROAD USAGE;	
The Ogiek community uses the main highway to; – Travel to schools; – To attend court proceedings whenever they have cases in court; – For personal reasons, to visit relatives and friends; – To take their produce to the market through the middlemen; – Travel to sell their traditional medicines. There are a number of challenges they face when using the roads including: – Time wasted due to severe traffic. – Fatigue due to long travelling periods – Accidents, but this is mainly due to careless driving; – Lack of clear road signs; – Poor road conditions; – Lack of road barriers especially in climbing lanes; – There's only 1 weighing bridge leading to vehicle congestion; – Too many police road blocks; – Lack of pedestrians and cycling lanes leading to scramble for the small space by all road users which lead to eventual accidents; – Lack of crossing points for animals and pedestrians; – Wildlife impact; lack of fences in conservancies along the roads; – Lack of speed bumps in market centres.	The community
Mitigation measures: – Provision of pedestrian and cyclist lanes and if possible, truck lanes in busy towns/ centres; – Visible road signage especially for the speed limits; – Construction of additional weigh bridges; – Future plans for expansion should be put in place since this is a very busy major highway; – Installation of foot bridges for pedestrians; – The weighbridges should be located further from the road to reduce congestion; – Install road barriers; – If possible, electric fences should be constructed in the wildlife conservancies and if need be, a central exit point should be considered and an underground tunnel. – Regular painting of the speed bumps and road markings.	Community

ITEMS DISCUSSED	ACTION BY
3 REACTIONS	
The youth are thankful for the sensitization and engagement of the consultation process. A number of slots should be however set aside for them during the construction period for the unskilled and semi-skilled employment opportunities.	David Rotich; Youth.
If budget allows, the link road between Mariashoni through Elburgon to the highway should be constructed, they also request Corporate Social Responsibility support for their tree nursery and bee keeping projects.	Zakayo Lesingo
The disabled in the community are very disadvantaged due to poor roads. They get a number of funds and support from organisations but their movement to the offices in Elburgon is challenging.	Teresa Chemutai; PLWD
There is a possible impersonation by other community members who pose as Ogiek. To curb this during the further consultations and construction process, the Ogiek Council of Elders should be involved to ensure they are truly represented.	Simon Muchura
The government should consider local contractors for the road construction since most projects are taken up by the Chinese and the media have evidenced their poor work ethics.	Simon Sururu
4 CONCLUSION AND WAY FORWARD	
The focus is on the two existing roads at the moment and in an event that the other mentioned roads need to be constructed or improved, the relevant authority will organise a similar forum for that. The opinions have been noted and will be taken into consideration during the report design. For future consultations, a number of organisations were fronted; Pro-Home led by Leonard Mintore; 0724 977439. Macodev CBO led by Martin Lele; 0725858713. Malando led by David Barngetuny; 0722 101146. Ogiek Pastors Council led by Reverend Onesmus Kipkurui; 0721 161316.	Prof. Ontita and Community.

MINUTES OF MEETING PREPARED BY:

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Prof. Ontita, Senior Vulnerable and Marginalized Groups Specialist, Norken International Limited

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WSP	Ghyslain Pothier, Project Director		March 23 2021

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MINUTES OF MEETING

CLIENT:	Rift Valley Consortium		
PROJECT:	Rironi-Nakuru-Mau Summit Highway	**WSP Ref.:**	201-10312-00
SUBJECT:	Meeting with the Ogiek people development program	**DATE:**	January 28, 2021
VENUE:	ODPD	**TIME:**	11 h 00

ATTENDEES – 4 PARTICIPANTS				
	Name	**Corporation**	**Telephone**	**Email**
1	Daniel Kobei	Executive Director, Ogiek People Development Program	0722 433757	dkobei@ogiekpeoples.org
2	John Samurai	Project Officer, Ogiek People Development Program	0710 212956	jsamorai@ogiekpeoples.org
3	Professor Edward Ontita	Norken International	0715 766266	egontita@gmail.com
4	Lavina Omondi	Norken International	0718 830702	lomondi@norken.co.ke

ITEMS DISCUSSED	**ACTION BY**
1 THE ORGANISATIONS PROFILE	
Ogiek People Development Program is an NGO that mainly works to fight for the rights of the Ogiek minority community. It was started in 1999, registered in 2001 and has been actively operational since 2004. It mainly deals with livelihood issues of the Ogiek community, litigation and implementation of court rulings. They are involved in working to achieve the sustainable development goals through climate change and environmental conservation and rehabilitation of the Mau forest. The work closely with other indigenous communities in the country including; Watta, Sengwer, Wayu and other coastal minority organisations.	Daniel Kobei

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ITEMS DISCUSSED	ACTION BY
2 PROJECT PRESENTATION	
The project seeks to expand and improve the Rironi – Mau-Summit road (A8) This consists of: Widening of a 175 km section of the existing highway between Rironi and Mau Summit into a four-lane dual carriageway and future augmentation into a six-lane carriageway in sections depending upon traffic volumes. Rehabilitation of a 57 km section of the existing single carriageway of A8-South highway between Rironi and Naivasha via Mai Mahiu. As a legal requirement, Environmental and Social Impact Assessment is a prerequisite for such a development project. The task of the team is to engage different levels of stakeholders but specifically the indigenous communities along the proposed project corridor, the Maasai and Ogiek.	Prof. Ontita
The project is a Private Public Partnership with the French government. The consultations have taken a deliberate step to engage the indigenous communities and their leadership. The team has met the Ogiek Council of Elders and the Ogiek community members, as well received initial courtesy calls at the deputy county commissioners' offices. The NGO came up in all the interactions with the administrators and the community, singling out the project details from land rights and human right issues.	Prof. Ontita
3 DISCUSSIONS	
The Ogiek community live approximately 20 kilometres from the main highway, but towards Mau summit, it reduces the distance up to 5 kilometres. They use the road for their personal interactions and businesses.	Daniel Kobei
This section highlights the issues and possible mitigation or negative impacts. Cutting down trees during the construction period should be followed by a remediation of tree planting for replacement. A number of employment opportunities should be given to the Ogiek community members. Also, to curb impersonation, the OPDP and Council of Elders should be involved to confirm the true identity of the members. Due to an influx of people into the community, social interactions are bound to happen. To save the community from the sexually transmitted diseases, awareness should be created, and the contractor should have stringent measures amongst his/her staff. Diversions into the nearby villages might impact the community negatively, therefore, to disseminate information on the routes prior to using them, the local structures should be utilised to consult the community. When materials are sourced from the community, rehabilitation should be done in the quarry sites and borrow pits. Payment for the extraction should disclose plans for rehabilitating the land. There is fear around the project and development generally eroding the culture and language of the Ogiek community. The young generation are already being assimilated with the neighbouring communities and are not fluent in their language from their interactions. Sale of land amongst them has increased, heightening the value of land and crimes from people moving in amidst them. Therefore, Infrastructure should be backed up with language conservation intervention and security provision.	All

ITEMS DISCUSSED	ACTION BY
4 CONCLUSION	
The director indicated that there was an initial consultation that indicated that the road would be a dual carriage of 3 lanes on both sides. The design needs to take care of the situation at Nakuru town as it is already a dual carriageway with 4 lanes but then there is always a lot of traffic. However, there is an existing Non-motorised transport Plan by KURA in town. With the new improved roads, the crime rate has escalated as thieves/criminals can escape faster with a lot of ease. For further consultations with the indigenous communities along the project corridor, another NGO can be consulted below. Narasha Community Organisation. Jackson Shah – 022 353783.	Daniel Kobei

MINUTES OF MEETING PREPARED BY:

Lavina Omondi, Social Safeguard Expert, Norken International Limited

Prof. Ontita, Senior Vulnerable and Marginalized Groups Specialist, Norken International Limited

MINUTES OF MEETINGS REVIEWED BY:

REPRESENTATIVE OF	NAME AND TITLE	SIGNATURE	DATE
Ogiek People Development Program			
Norken International			
WSP	Ghyslain Pothier, Project Director		March 23 2021

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APPENDIX

7-7 *SECOND ROUND INDIGENOUS COMMUNITY (VMG) CONSULTATION ACTIVITIES*

13

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT
MAPPING SESSION ACTIVITY – 2ND ROUND
ATTENDANCE SHEET – LIST OF PARTICIPANTS

Project: Nairobi-Nakuru-Mau Summit Highway	**Stakeholders :** Maasai Women & Traditional Practitioners.
Date and Time: 26/5/2021. 2.45 PM.	**Venue:** Maai Mahiu Chiefs Camp.

	Full Name	Organization / Position	Signature	Email and Phone Number
1	Jeniffer Kiringo	Women group.		Email: Phone Number: 0716756 97.
2	Dan mututwa	Traditional practioners		Email: Phone Number: 0710503803
3	Kutata Tole Simpini	Traditional practioners		Email: Phone Number: 0710607565.
4	Kaunda POLS	Traditional practioners		Email: 0796110907 Phone Number:
5	Johana Poreka	Traditional practioners		Email: 0711193917 Phone Number:
6	Mary Akal	women Group		Email: Phone Number: 07 00 467083
7	Janet Nasieku	women Group		Email: Phone Number: 0759512698
8	Joyce Saingi	women Group		Email: 0791794408 Phone Number:
9	Paulina Kisal	women Group		Email: Phone Number: ~~0724~~ .
10	Joyce Kishau	Women group.		Email: Phone Number: 0714538062

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

MAPPING SESSION ACTIVITY – 2ND ROUND

	Full Name	Position	Organization	Email and Phone Number
11	EMMA WAIRIMU SINTE	Women Group		Email:
				Phone Number: 0727368613
12	MONICAH MOLO	Women Group		Email:
				Phone Number: 0727090830
13	Lavina Omondi	Norken Int.		Email:
				Phone Number:
14				Email:
				Phone Number:
15				Email:
				Phone Number:
16				Email:
				Phone Number:
17				Email:
				Phone Number:
18				Email:
				Phone Number:
19				Email:
				Phone Number:
20				Email:
				Phone Number:
21				Email:
				Phone Number:
22				Email:
				Phone Number:
23				Email:
				Phone Number:

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER ENGAGEMENT ACTIVITIES – 2ND ROUND

ATTENDANCE SHEET – LIST OF PARTICIPANTS

Project: Nairobi-Nakuru-Mau Summit Highway	**Stakeholders :** MAASAI ELDERS, MAAI MAHIU.
Date and Time: 2/6/2021. 10.00 am.	**Venue:** ESIDAI HOTEL, MAAI MAHIU TOWN.

	Full Name	Organization / Position	Signature	Email and Phone Number
1	LAVINA OMONDI	NORKEN (I) LTD.	[signature]	Email: clavina66@gmail.com Phone Number: 0718830702.
2	Edward Ontita	" "	[signature]	Email: Phone Number: 0715 766266
3	Givan lemu	Kijabe forest trust Supervisor	[signature]	Email: givan4u@gmail.com Phone Number: 0722501189
4	Kutata Simpiri	Kijabe forest trust	[signature]	Email: Phone Number: 0710607565
5	Sipoi Tunkuo	secretary sand harvesting group	[signature]	Email: Phone Number: 0721424186
6	Peter Kohau	Community	[signature]	Email: Phone Number: 0706561870
7	KAWDA POIS	Traditional Herbalist.	[signature]	Email: Phone Number: 0796110907
8	Soses Sarikei	Women Group	[signature]	Email: Phone Number: 0791794408
9	PETER MBORO	[signature]	[signature]	Email: Phone Number: 0724533266
10	Jackson Kedienye	Maimahiu	Kedienye	Email: Phone Number: 0722208937

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER ENGAGEMENT ACTIVITIES – 2ND ROUND

	Full Name	Position	Organization	SIGNATURE.	Email and Phone Number
11	Johana NAPORKK	Maasai Community.	PWD		Email: 0711119 3917
					Phone Number:
12	Gidion Toris	Maasai Comm.			Email:
					Phone Number: 0700157358
13	Stanley Teekah	Community			Email: StanleyTeekah@Gmail.com
					Phone Number: 0759687655
14	Lesile ole Mumpasoi	Community.			Email:
					Phone Number: 07-9985 6039
15	Gorge Simpiri	Community.			Email:
					Phone Number: 0702556523
16	IMAN Kishau	Namuncha location.			Email:
					Phone Number: 0714338776
17	Afiai Letitoiya	Women Representative.			Email:
					Phone Number: 0702 858 397
18	JANET NKASIETCW	Women Group.			Email:
					Phone Number: 0759 5126 98
19	Joyce Kishau	Women Group.			Email:
					Phone Number: 0714 53 50 62
20	Jenifer Kiringol	Women Group.			Email:
					Phone Number: 071613 5647
21	EMMIA SINTET	Women Elder.			Email:
					Phone Number: 0727 365613
22	Mumpasoi Kishau	Women Group.			Email:
					Phone Number: 0794021405
23					Email:
					Phone Number:

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT
STAKEHOLDER ENGAGEMENT ACTIVITIES – 2ND ROUND
ATTENDANCE SHEET – LIST OF PARTICIPANTS

Project: Nairobi-Nakuru-Mau Summit Highway	**Stakeholders :** MAASAI CBO'S.
Date and Time: 2/6/2021 . 2:30 P.M.	**Venue:** ESIDAI HOTEL.

	Full Name	Organization / Position	Signature	Email and Phone Number
1	LAVINA OMONDI.	NORKEN (I) LTD	[signature]	Email: olavina66@gmail.com. Phone Number: 0718830702
2	Edward Ontita	// //	[signature]	Email: Phone Number: 0715766266
3	Givan Lemu	Riyake forest trust	[signature]	Email: Phone Number: 0722501189
4	Kutata Simpiri	ElParákuo CBO.	[signature]	Email: Phone Number: 0718607565
5	Sipoi Tunkuo	Youth representative	[signature]	Email: Phone Number: 0721424186
6	MOSES MOLO	Ilkar Ilanyuak CBO.	[signature]	Email: letunkuo@gmail.com Phone Number: 0714 347 362
7				Email: Phone Number:
8				Email: Phone Number:
9				Email: Phone Number:
10				Email: Phone Number:

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER ENGAGEMENT ACTIVITIES – 2ND ROUND

ATTENDANCE SHEET – LIST OF PARTICIPANTS

Project: Nairobi-Nakuru-Mau Summit Highway	**Stakeholders :** Community Meeting – Ogiek.
Date and Time: 3/6/2021. 10.30 am.	**Venue:** Eburru Forest Office.

	Full Name	Organization / Position	Signature	Email and Phone Number
1	LAVINA OMONDI	Norken (1) Limited.		Email: olavina66@gmail.com. Phone Number: 0718830702.
2	Edward Ontita	// // //		Email: Phone Number: 0715766266
3	~~Benson Ngugi~~ Chief			Email: Phone Number: 0720803587
4	Shadrack Tokii	KFS Eburu Station		Email: Phone Number: 0725429358
5	. JOSEPH MUCHENDUTH	YOUTH REP		Email: muchenduh@gmail.com Phone Number: 0726454458
6	. margaret wapari	ogiek		Email: Phone Number: 0717907716
7	. mary kamue	ogiek		Email: Phone Number:
8	. Rose seneiya	ogiek		Email: Phone Number:
9	. Sarah Kamue	ogiek		Email: Phone Number:
10	. Agness wapari	ogiek.		Email: Phone Number:

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER ENGAGEMENT ACTIVITIES – 2ND ROUND

	Full Name	Position	~~Organization~~ Signature	Email and Phone Number
11	John Kamamia Naren	Ogiek	[signature]	Email: Phone Number: 0115524525
12	Mary Ndari Membarre	Ogiek	[signature]	Email: Phone Number: 0704303377
13	Sigaoni Narerio	Ogiek	[signature]	Email: Phone Number: 0726696124
14	Loyce Mugure Kasen	Ogiek	[signature]	Email: Phone Number: 0743388323
15	Patrick Ole Pitirai	Ogiek Representative	[signature]	Email: 0729412909 Phone Number: ~~0743388323~~
16	Mary Wambui	Ogiek	Wambui	Email: Phone Number: 0728281803
17	Gitau Gideon Ng'ang'a	Nagum Community Representative	[signature]	Email: Phone Number: 0748759330
18	LYDIAH N. NYOTA	Community Representative ward	[signature]	Email: Lydiahnyota1@g.Mail.com Phone Number: 0721162611
19	Jeremiah Kuronoi	Chair peace comt GIL subcount	Jeremiah	Email: Phone Number: 0722865270
20	Sammy Kusen	Ogiek	[signature]	Email: Phone Number: 0799969676
21	Maseto Kusen	Ogiek representative	[signature]	Email: Phone Number: 0721165137
22	Kipakie Mokina	Ogiek	[signature]	Email: Phone Number: 0794618912
23	Saitei Ole Kuapari	Ogiek	[signature]	Email: Phone Number: 0795762450

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER ENGAGEMENT ACTIVITIES – 2ND ROUND

	Full Name	Position	Organization / Sign	Email and Phone Number
24	Ntimama Ole Kamuiye	Ogiek		Email: Phone Number: 0706160877
25	Ngokae Ole Kuapan	Ogiek		Email: Phone Number: —
26	Ngondik Ole Membarne	Ogiek		Email: Phone Number: —
27	Joseph Ngodoyo	Ogiek		Email: Phone Number:
28	JOSPHAT MUKUNA	Chairman/Secretary	Ngobit Kumi	Email: — Phone Number: 0721610564
29	Rev. Joseph Mwangi	Chairman/Nyumba 10	Pride ~~Tree~~.	Email: Phone Number: 0721302281
30	Joseph Lengetu	Chairman Ogiek		Email: Phone Number: 0719656174
31	Ruben Njuguna Kahiga	Ogiek	Ruben Njw	Email: Phone Number: 0708033684
32	Ruben Njuguna	Ogiek		Email: Phone Number: ~~0701~~ 0112683825
33	SARAH KURONDI	Maa Rep		Email: ~~0724672962~~ Phone Number: 0724672962
34	SIMON KARIUKI KIARIE	NAGUMU	SKK	Email: Phone Number: 0721162323
35	ANN NJOROGE	Asst chief Eburru	OOP	Email: Phone Number: 0712984454
36	James Tumanga.	Ogiek.	Jtumanga.	Email: Phone Number: 0757569150

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STAKEHOLDER ENGAGEMENT ACTIVITIES – 2ND ROUND

	Full Name	Position	Organization	Email and Phone Number
37	Rosemary Lekutunoi.	Ogiek.	Phelaudunai.	Email: Phone Number: 0704654811.
38	Sereiya Kusen.	Ogiek community.	~~KSO~~.	Email: – Phone Number: –
39				Email: Phone Number:
40				Email: Phone Number:
41				Email: Phone Number:
42				Email: Phone Number:
43				Email: Phone Number:
44				Email: Phone Number:
45				Email: Phone Number:
46				Email: Phone Number:
47				Email: Phone Number:
48				Email: Phone Number:
49				Email: Phone Number:

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STAKEHOLDER ENGAGEMENT ACTIVITIES – 2ND ROUND

ATTENDANCE SHEET – LIST OF PARTICIPANTS

Project: Nairobi-Nakuru-Mau Summit Highway	**Stakeholders :** Community members; Oljorai.
Date and Time: 3/6/2021. 1520hrs.	**Venue:** Lamp & Light Church - Kongasis.

	Full Name	Organization / Position	Signature	Email and Phone Number
1	Lavina Omondi	Norken (I) Ltd.	[signature]	Email: olavina66@gmail.com. Phone Number: 0718830702.
2	Edward Pntita	" " "	[signature]	Email: Phone Number: 0715766266
3	PARIT SURURU	AG. CHIEF	[signature]	Email: Paritsururu@g.mail.com Phone Number: 0720664349
4	REREU MARIPET	CHAIRMAN OLEPOLOS	[signature]	Email: Phone Number: 0714361596
5	Joram Ntari	ole-Polos village	[signature]	Email: Phone Number: 0743729712
6	LAMSON NKERE	NURSARY Village	[signature]	Email: Phone Number: 0719129026
7	PUSHATI SANGIRIAGI	NAIRSARY Village	[signature]	Email: Phone Number: 0768254243
8	Nicholas Atuko	kambi Turkana (turkana)	[signature]	Email: Phone Number: 0764690857
9	CHARLES EKENO	Karedo (Turkana)	[signature]	Email: Phone Number: 0724712472
10	DANIEL EKITELA	MORULEM (Turkana)	[signature]	Email: Phone Number: 0720341906

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER ENGAGEMENT ACTIVITIES – 2ND ROUND

	Full Name	Position	Organization	Email and Phone Number
11	MOSES LOKWAWI	Kapedo (Turkana)		Email: Phone Number: 0724978652
12	JOHN MBARAK	KAMBI SHULE (JEMPS)		Email: Phone Number: 0700492602
13	SHADRACK IKEBOKI	TAMKI MOJA (CHAIRMAN)		Email: 0725946740 Phone Number:
14	BERNARD SURURU	ILERAI (MAASAI)		Email: Phone Number: 0797053325
15	MOSES LEMARA	CENTRAL UTUT (MAASAI)		Email: Phone Number: 0723933276
16	MONICAH ESHO	KAMBI SHULE (MAASAI)		Email: Phone Number: 0713815669
17	MONICAH SINTEI	CENTRAL (MAASAI)		Email: Phone Number: 0724949803
18	REBECCA EKAMAIS	KAMBI TURKANA (TURKANA)		Email: Phone Number:
19	REBECCA LONGOLIA	KAMBI TURKANA (TURKANA)		Email: Phone Number: 0713622825
20	DANIEL NGASIKE	SUNGORDI B (TURKANA)		Email: Phone Number: 0728237493
21	MARY AKAI	Lokichoki (TURKANA)		Email: Phone Number: 0727839016
22	HANNAH NAMDANG	MURULEM (Turkana)		Email: Phone Number: 0796600183
23	AMATHE NKUNONO	MURULEM (Turkana)		Email: Phone Number: 0724204066

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER ENGAGEMENT ACTIVITIES – 2ND ROUND

	Full Name	Position	Organization	Email and Phone Number
24	SUSAN KITAIKA	OLE-POLOS (MAASAI)	[signature]	Email: Phone Number: 0713980349
25	SAMWEL LONGOLAN	BISHOP (TURKANA)	[signature]	Email: Phone Number: 0722566646
26	JOHN SKALO LESALULUNGA	KAMPI SHULE	SAMBURU [signature]	Email: Phone Number: 0700791931
27	JOSEPH EKUOM ERIGAN	REV. (TURKANA)	[signature]	Email: Phone Number: 0720495756
28	JAMES LOCHUCH LOSIKE	TURKANA	[signature]	Email: Phone Number: 0798529360
29	STEPHEN PUTUNOI	CENTRAL (MAASAI)	[signature]	Email: Phone Number: 0727965374
30	SAMWEL OLE RINKA	LERAT (MAASAI)	[signature]	Email: Phone Number: 0715897001
31	JOHN OLESITO	ELERAI MAASAI	[signature]	Email: 0712747833 Phone Number:
32	Raban Bheno	Community Policing Chairman (Turkana) Kapedo	[signature]	Email: 0728102393 Phone Number:
33	SONGOI NORKAIRISH	LERAI (MAASAI)	[signature]	Email: Phone Number: 0722323910
34	EBUWA ACHOK ARINDATIA	KAPEDO (TURKANA)	ERA	Email: Phone Number: 0715840309
35	JAMES LOGIS	MORILEM (TURKANA)	[signature]	Email: Phone Number: 0743406800
36	ARON LONGOLI	KABIKAMBI	[signature]	Email: Phone Number: 0724984468

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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER ENGAGEMENT ACTIVITIES – 2ND ROUND

	Full Name	Position	Organization	Email and Phone Number
37	JOHN NDAPASH	CENTRAL (MAASAI)		Email: Phone Number: 0701399896
38	JOSEPH Lemuna	Central (Maasai)		Email: 0796377220 Phone Number:
39	SEKI MINDILEI	KWARE (MAASAI)		Email: Phone Number: 0769343677
40	JAMES NENJORE	NURSERY (MAASAI)		Email: Phone Number: 0714128722
41	JOHANAH DIKIR	CENTRAL (MAASAI)		Email: Phone Number: 0728909132
42	FRANCIS MBOE	CENTRAL (MAASAI)		Email: Phone Number: 0706395219
43	SAITOTI SURURU	CENTRAL (MAASAI)		Email: Phone Number: 0729110543
44	PHILEMON NKOKOYOI	OLE-POLOS (MAASAI)		Email: Phone Number: 0728684699
45	JOHN LOKIZELA	CHAIRMAN (TURKANA)		Email: Phone Number: 0795159040
46				Email: Phone Number:
47				Email: Phone Number:
48				Email: Phone Number:
49				Email: Phone Number:

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER ENGAGEMENT ACTIVITIES – 2ND ROUND

ATTENDANCE SHEET – LIST OF PARTICIPANTS

Project: Nairobi-Nakuru-Mau Summit Highway	**Stakeholders :** Maasai Elders.
Date and Time: 4/06/2021. 10:45 am.	**Venue:** Chiefs Office, Longonot.

	Full Name	Organization / Position	Signature	Email and Phone Number
1	Lavina Omondi	Norken (1) Ltd.		Email: Phone Number: 0718830702.
2	Edward Ontita	Norken (1) Ltd		Email: Phone Number: 0715 766 266
3	Esther Tinkoi	Ereri (women Group).		Email: Phone Number: 32306907
4	Hellen Sitonik	Ereri (women Group).		Email: Phone Number:
5	Margaret Tinkoi	Ereri (women Group).		Email: Phone Number: 0707554406
6	Maria Tinkoi	Ereri (women Group).		Email: Phone Number: 26541290.
7	Kamamia ole Tinkoi	Ereri (Chirman)		Email: Phone Number: 0714851074
8	William Tinkoi	Ereri (MEN Group)		Email: Phone Number: 0714330709
9	Dan Mutuva	Ereri (MEN Group)		Email: Phone Number: 0710503803
10	Emannuel Sitonik.	Ereri (MEN Group)		Email: Phone Number: 0718966388

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STAKEHOLDER ENGAGEMENT ACTIVITIES – 2ND ROUND

	Full Name	Position	Organization	Email and Phone Number
11	NOAH SITONIK.	Rveri (Youth Group)		Email: Phone Number: 0751035204
12				Email: Phone Number:
13				Email: Phone Number:
14				Email: Phone Number:
15				Email: Phone Number:
16				Email: Phone Number:
17				Email: Phone Number:
18				Email: Phone Number:
19				Email: Phone Number:
20				Email: Phone Number:
21				Email: Phone Number:
22				Email: Phone Number:
23				Email: Phone Number:

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER ENGAGEMENT ACTIVITIES – 2ND ROUND

ATTENDANCE SHEET – LIST OF PARTICIPANTS

Project: Nairobi-Nakuru-Mau Summit Highway	**Stakeholders :** Maasai Community.
Date and Time: 7/6/2021. 11.30 am.	**Venue:** Hindy Ridge Resort – Maai Mahiu.

	Full Name	Organization / Position	Signature	Email and Phone Number
1	Lavina Omondi	Norken International Ltd		Email: olavina66@gmail.com Phone Number: 0718830702.
2	Edward Ontita	Norken International Ltd		Email: Phone Number: 0715 766 266
3	Simon Saitoti	Sec. Namuncha Maasai Com		Email: Sstumanka@gmail.com Phone Number: 0722529028
4	Joseph Ole Kishau	Chairman Namuncha Maasai Comm.		Email: jkishau@yahoo.com Phone Number: 0727481410
5	Sorimpan Ole Toris	Namuncha Maasai Com		Email: Phone Number: 0700157358
6	Moses Karia	ILANYUAK CBO – Namuncha Maasai Com.		Email: Phone Number: 0714347362
7	METIAKI GIDEON	ELUAI Maasai comm.		Email: Phone Number: 0792128325
8	LEAH KORIO	Oiti Maasai comm.		Email: Phone Number: 0700855942
9	ELIZABETH SUPUM	Namuncha Maasai Com.		Email: Phone Number: 0723261113
10	TOM KARBUAL	ELUAI Maasai Comm		Email: Phone Number: 0702772555

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER ENGAGEMENT ACTIVITIES – 2ND ROUND

	Full Name	Position	Organization	Signature	Email and Phone Number
11	Lewis Lenkuna Tuukuo	Oiti Community representative			Email: Phone Number: 0721424186
12	Nkoine Sipoi Tuukuo	Oiti Community rep			Email: Phone Number: 0714849149
13	Giyan ole Lemu	Kanaan			Email: sipoiole Tuukuo@4. Phone Number: 0722501189
14	Kutata ole Simpiri	Kanaan			Email: Phone Number: 0710607565.
15					Email: Phone Number:
16					Email: Phone Number:
17					Email: Phone Number:
18					Email: Phone Number:
19					Email: Phone Number:
20					Email: Phone Number:
21					Email: Phone Number:
22					Email: Phone Number:
23					Email: Phone Number:

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STAKEHOLDER ENGAGEMENT ACTIVITIES – 2ND ROUND

ATTENDANCE SHEET – LIST OF PARTICIPANTS

Project: Nairobi-Nakuru-Mau Summit Highway	**Stakeholders :** Ogiek Community Members.
Date and Time: 8/6/21. 10:45 am.	**Venue:** Mariachoni Guest House.

	Full Name	Organization / Position	Signature	Email and Phone Number
1	Lavina Omondi	Norken International.	[signature]	Email: olavina66@gmail.com. Phone Number: 0718830702.
2	Edward Ontita	Norken(I) Ltd	[signature]	Email: Phone Number: 0715766266.
3	John L Sitonga	Chairman COE	[signature]	Email: Phone Number: 0723426683
4	FRANCULADO MAILOI	OGIEK youth.	[signature]	Email: Phone Number: 0786234439
5	ISACK TANKI	OGIEK youth.	[signature]	Email: Phone Number: 0799670837
6	DAVID KIBET	OGIEK youth.	[signature]	Email: Phone Number: 0725652102
7	JOSEPH CHEMAINA	OGIEK ELDER	[signature]	Email: Phone Number: 0758920103
8	PETER K. SAWINGU	OGIEK ELDER	[signature]	Email: Phone Number: 0722893626
9	CHARLES CHOCHONGE	OGIEK ELDER	[signature]	Email: Phone Number: 0706771728
10	John mariro	OGIEK COUNCIL	[signature]	Email: Phone Number: 0714785161

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STAKEHOLDER ENGAGEMENT ACTIVITIES – 2ND ROUND

	Full Name	Position	~~Organization~~ Signatures	Email and Phone Number
11	Samson S. Kilesaiyo	ogiek council elder	[signature]	Email: Phone Number: 0726 780 815
12	DAVID SIRONGA	PASTOR-IN-CHARGE	[signature]	Email: davidsironga@gmail.com Phone Number: 0723 733486
13	KONINI NADOMULA	Ogiek Council elder	[signature]	Email: Phone Number: 0711 415750
14	ZAKAYO LESINGO	CFA LOGOMAN	[signature]	Email: zakayolesingo@gmail.com Phone Number:
15	JAMES K. WARIONGA	Community Member	[signature]	Email: Phone Number: 0729458721
16	SIMON KONANA KONIN	OGIEK COUNCIL of Elders	[signature]	Email: Phone Number: 0715270302
17	HASSAN Sangare	ogick council of elders	[signature]	Email: Phone Number: 0704050439
18	WILSON WARIONGA	ogiek concil of ELDERS	[signature]	Email: Phone Number: 0725847801
19	Simon K. Kimuchune	ogiek concil of elders	[signature]	Email: Phone Number: 0716269467
20	Joseph Barngetuny	ogiek concil of elders	[signature]	Email: Phone Number: 0726916360
21	WALER LESHWARI	Ogiek member	[signature]	Email: Phone Number: 0757864228
22	TERESA CHEMUTAI	Ogiek member	[signature]	Email: Phone Number: 0729523850
23	Alice C BARANUT	Ogiek member	[signature]	Email: Phone Number: 0726588110

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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER ENGAGEMENT ACTIVITIES – 2ND ROUND

	Full Name	Position	Organization / Signatures	Email and Phone Number
24	SELINA CHEBET	OGIEK MEMBER		Email:
				Phone Number: 0700918025
25	SARAH CGAS	OGIEK MEMBER		Email: SARAHOSASI1@GMAIL.COM
				Phone Number: 0702131621
26	EMILY C KIRUI	OGIEK MEMBER		Email: EMILYCHEPKORIRKIRUI1983@GMAIL.COM
				Phone Number: 0712029229
27	CLARE C RONO	MACODEV CBO OFFICE		Email: ronocleve@gmail.com.
				Phone Number: 0723071096.
28	KIBILO S. DENNIS	OGIEK MEMBER		Email: dennissalim43@gmail.com
				Phone Number: 0700205252
29	SIMON C. KIMUNGEN	GROUP REPRESENTATIVE		Email: SIMON KIMMUNGEN @ g mail .com
				Phone Number: 0796349291
30	DAVID ROTICH	OGIEK MEMBER.		Email: ROTICH36.gmail.com.
				Phone Number: 0725 937 496.
31	LEONARD MINDOSE	PROHOME DIRECTOR		Email: minforeindigenous@gmail.com
				Phone Number: 0724977439
32	STEPHEN LELEI	MACODEFU CBO		Email: lelestephen74@gmail.com
				Phone Number: 0726 741 739
33	KIMBAT COLLINS	OGIEK MEMBER		Email:
				Phone Number: 0723088389
34	Hillary Kipruno	Ogiek Member		Email: kiprunohill789@gmail.com
				Phone Number: 0700360324
35	Daisy Langat	Ogiek Member		Email:
				Phone Number: 0719 834021
36	Mercy chelangat	Ogiek Member		Email: chelaMercy@gmail.com
				Phone Number: 0,5725602 9

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT
STAKEHOLDER ENGAGEMENT ACTIVITIES – 2ND ROUND
ATTENDANCE SHEET – LIST OF PARTICIPANTS

Project: Nairobi-Nakuru-Mau Summit Highway	**Stakeholders :** CBO Leaders
Date and Time: 08/06/2021 (11:45–12:45)	**Venue:** Mariashoni Community Guest House Grounds

	Full Name	Organization / Position	Signature	Email and Phone Number
1	Edward Ontita	Northern International Ltd.		Email:
2				Phone Number: 0715 766266.
	David Barngetuny	Marando cop.		Email:
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	STEPHEN K. LELEI	MACODECE (CBO)		Email: lelei stephen 74@gmail.com
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				Email:
				Phone Number:

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER ENGAGEMENT ACTIVITIES – 2ND ROUND

ATTENDANCE SHEET – LIST OF PARTICIPANTS

Project: Nairobi-Nakuru-Mau Summit Highway	**Stakeholders :** Ogiek Council of Elders.
Date and Time: 8/6/2021. 12.30 PM.	**Venue:** Mariashoni Guest House. Memorandum of Agreement Disclosure.

	Full Name	Organization / Position	Signature	Email and Phone Number
1	Lavina Omondi	Norken (U) Ltd.		Email: Phone Number: 0718830702.
2	Edward Ontita	Norken (U) Ltd		Email: Phone Number: 0715 766266
3	Sarah Osas.	O.C.E.		Email: sarahosas11@gmail.com. Phone Number: 0702131621
4	John Mariko	O.C.E		Email: Phone Number: 0714 78 5161
5	Stephen Leshikari	Ogiek Council.		Email: Phone Number:
6	Zakayo Lesingo	O.C.E		Email: Zakayolesingo@gmail.com Phone Number:
7	DAVID SOLONGA	OCE		Email: davidsonga@gmail.com Phone Number: 0723 733486
8	SAMSON S. KIBERENGE	OCE		Email: Phone Number: 0726 980815
9	PETER SHWINGO	OGIEK COUNCIL		Email: Phone Number: 07 228434 26
10	Charles Sichonge.	Ogiek Council of Elders.	CHARLES	Email: Phone Number: 0706771728.

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER ENGAGEMENT ACTIVITIES – 2ND ROUND

	Full Name	Position	Organization	Email and Phone Number
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20	John L. Sitonga	O-C.E Chairman	J.L.S.	Email:
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23				Email:
				Phone Number:

PHOTOGRAPHIC REPORT FOR VMG CONSULTATIONS

MAY 26TH TO JUNE 8TH, 2021





Maasai women and traditional practitioners, Mai Mahiu, May 26, 2021:
Discussion on ecosystem services


Maasai community, Namuncha, Mai Mahiu, June 2, 2021:
Meeting including an identification of locations of community requests for improvements


Maasai Community-based Organizations (CBOs): Ilanyuak and Elparakuo Conservation Group, June 2, 2021


Ogiek Community, Eburru, June 3, 2021


Maasai Samburu and Turkana communities, Kongasis, Oljorai, June 3, 2021


MoA disclosure meeting with Maasai Elders, Ereri, Longonot, June 4, 2021


MoA disclosure meeting with Maasai Elders at Maai Mahiu, June 7, 2021

Ogiek community, Mariashoni, June 8, 2021: breakout groups to discuss the project and draft MoA requests

Ogiek Community-based Organizations (CBOs): Macodev, Prohome, and Malando, June 8, 2021

Ogiek Council of Elders, June 8, 2021: Finalization of the MoA draft

MINUTES OF MEETING

CLIENT:	Rift Valley Consortium		
PROJECT:	Rironi-Nakuru-Mau Summit Highway	**WSP Ref.:**	201-10312-00
SUBJECT:	2nd Round Stakeholders Consultations.	**DATE:**	2 juin 2021
VENUE:	Esidai Hotel.	**TIME:**	9.00 am.

ATTENDEES
This meeting was with Maasai Elders in Esidai Hotel, Mai Mahiu. **Attendance sheets have been documented separately.**

ITEMS DISCUSSED	**ACTION BY**
1 PROJECT OVERVIEW AND DESCRIPTION	
INTRODUCTION. The meeting started at 9.00 am with a word of prayer from Emma Sindet. This was followed by self-introductions from the consultants and everyone else in attendance.	All.
Project description. The project seeks to expand and improve the Rironi – Mau-Summit road (A8) This consists of: Widening of a 175 Km section of the existing highway between Rironi and Mau Summit into a four lane dual carriageway with service lanes in towns. Rehabilitation of a 57 Km section of the existing single carriageway of A8-South highway between Rironi and Naivasha via Mai Mahiu. As a legal requirement, Environmental and Social Impact Assessment is a prerequisite for such a development project. The task of the team is to engage different levels of stakeholders but specifically the indigenous communities along the proposed project corridor, the Maasai and Ogiek. There was an initial round of consultations in January of 2021 and this is a follow-up round to communicate the preliminary design and identification of impacts from the community. Translations and discussions were then done amongst the community members.	Prof. Ontita Tuukuo Sipoi

ITEMS DISCUSSED	ACTION BY
<u>Current Situation.</u> Following the first round of consultations, the main points fronted for considerations were; 1. Provision of underpasses for livestock since the Maasai are primarily pastoralists and they cross the road with their cattle. 2. Provision of pedestrian footbridges in the busy part of town because the road is very busy as the outbound route for trucks coming from Nairobi towards the Rift valley and Western Kenya. 3. Inclusion of the community members in the construction process of the road and during the operation phase. The preliminary design had neither incorporated the animal underpasses nor the pedestrian footbridges. The community insisted that this is an item that needs keen attention and consideration. The community members were then invited to give their reactions and ask questions.	Prof. Ontita
REACTIONS & OPINIONS.	
The Maasai community feed their livestock along the road and also cross the road with their livestock to water them in the forest. They have therefore suffered losses severally when their cattle are knocked down by motorists. Livestock crossing underpasses would benefit the community if incorporated in the design. Some livestock watering points are along the road and the community would request that is not fenced off or put out of bounds during the construction process.	Joyce Kishau
The Maasai community and especially the women are always forgotten during such developmental projects. If budget and design allow, the Maasai women should be provided with road side stalls to sell their produce, beadworks and artwork to help them improve their livelihoods.	Emma Sindet
In as much as the project is very positive, there should be roadside toilets constructed to be used by the road users.	Titoyia Akai
The community requests for road signs to be erected in the animal crossing points.	Janet Nasieku
The Maasai women would like to be considered for job opportunities during the road construction process.	Jenipher Kerongol

ITEMS DISCUSSED	ACTION BY
There are always other people maintaining the roads by slashing and collecting litter at the roadsides. Engaging the Maasai women and youth in doing these unskilled jobs during the operation phase will ensure the community benefits from the project even after the construction is over.	Joyce Sarinkei
The design should also incorporate pedestrian crossings since community members collect firewood across the road in the forest especially during the dry seasons.	
The community did not have a chance to propose locations for their animal crossings and pedestrian footbridges. The initial meeting with a mapping session only concentrated on Maai Mahiu town and not where they interact with the road which is about 10km from Maai Mahiu towards Rironi.	Givan Ole Lerru
Since development is finally being realised in the Maasai land, the community should be included into the road construction committees to represent their interests.	Caleb Kishau
In case there will be any stone blasting, it should be regulated and done in a sustainable manner since the forest is the water catchment area for the locality.	Gideon Torris
The road to their village is in a very poor condition, commuting is very expensive as well. They don't have access to basic facilities like hospitals and there is only one dispensary in the community. Improvement of the road from the A8 South junction will be a very positive stride.	Kaunda Ole Pois
As a motor-bike operator, they do have motor-bike sheds to act as a boarding stage and this is challenging since they are not organised. There should be a consideration to provide a motor-bike shed in town.	Stanley Taeka
During construction, the river should not be diverted since its their only source of water downstream. The stretch along the escarpment should be put under consideration in the 13km of street lighting along A8 South.	Jackson Kedienye
There should be a provision of Curio shops along the escarpment or in town to promote tourism since this is the main route followed by tourists on their way to Maasai Mara.	Ole Kutata
Sand harvesting and quarrying are the main economic activities in the locality and the contractor should consider procuring the materials from the area.	Lewis Sipoi
Steel bars should also be fitted along the escarpment to reduce the fatality of accidents.	

ITEMS DISCUSSED	ACTION BY
2 QUESTIONS AND ANSWERS	
Will there be a follow-up meeting to confirm if their contributions have been taken into account? And when? The third round of consultations will be in August and also, there will be another session to discuss a memorandum of agreement with the leaders, therefore, the discussions and consultations are still ongoing.	Givan Ole Lerru
3 CONCLUSION AND WAY FORWARD	
There will another session to disclose a Memorandum of Agreement and to document their requests to necessitate for discussions to happen. There will also be a third and last consultative meeting with the leaders to communicate the outcome of the consultations.	//

MINUTES OF MEETING

CLIENT:	Rift Valley Consortium.		
PROJECT:	Rironi-Nakuru-Mau Summit Highway.	**WSP Ref.:**	201-10312-00
SUBJECT:	2nd Round Stakeholders Consultations.	**DATE:**	2 juin 2021
VENUE:	Esidai Hotel.	**TIME:**	2.00 pm.

ATTENDEES
This meeting was with Maasai Community Based Organisations in Esidai Hotel, Mai Mahiu. Attendance sheets have been documented separately.

ITEMS DISCUSSED	**ACTION BY**
1 PROJECT OVERVIEW AND DESCRIPTION	
INTRODUCTION The project seeks to expand and improve the Rironi – Mau-Summit road (A8) This consists of: Widening of a 175 Km section of the existing highway between Rironi and Mau Summit into a four lane dual carriageway and future augmentation into a six lane carriageway in sections depending upon traffic volumes Rehabilitation of a 57 Km section of the existing single carriageway of A8-South highway between Rironi and Naivasha via Mai Mahiu. As a legal requirement, Environmental and Social Impact Assessment is a prerequisite for such a development project. The task of the team is to engage different levels of stakeholders but specifically the indigenous communities along the proposed project corridor, the Maasai and Ogiek.	Prof. Ontita

ITEMS DISCUSSED	ACTION BY
The Maasai community in Mai Mahiu has 3 CBOs working towards bettering the community; • Ilanyuak • Olonongot • Ilparkuo. There was need to have consultative discussions with the CBO officials and get insights on how the project might impact their activities in the community and also get suggestions on how these impacts might be mitigated. In attendance were Ilanyuak and Ilparkuo members.	
<u>DISCUSSIONS</u> These two CBOs are registered. Ilanyuak CBO – Chaired by Moses Molo. This means 'Hustler' in Maasai language; it was formed in 2020 and has 72 members. Their main focus is on tree nursery planting, bee keeping and livestock keeping where they train herders and also have a slaughter house. When they lose their cattle due to road accidents, it is always alleged that the zones are not animal crossing sections and they are never compensated. It is important to have speed bumps and road crossing signs. Construction material should not be sourced from the forest and the construction waste should not be dumped in the forest as well. The borrow pits should be covered after construction and trees planted around the area for restoration. The forest is not also safe, there should be a consideration to provide public toilets along the highway; recently there was an incident where a passenger was attacked and killed by a hyena. Since there isn't security in the forest, the community can be contracted as guards along the roads.	Moses Molo

ITEMS DISCUSSED	ACTION BY
Ilparkuo CBO – Chaired by Ole Simpiri This is a Community based organisation whose area of focus is in; • Forest conservation • Zero grazing • Bee keeping • Goat grazing education program • Water bottling • Table banking. The CBO requests for a weighbridge to be provided along the road to protect the road from excess heavy commercial trucks and also to provide job opportunities to the area youth. Since a lot of dust will emanate from the construction sections, water should be sprinkled to protect the nearby vegetation and other road users. Women should also be included in the road maintenance through slashing the road sides and waste collection. From the highway, there is a road through the Mayers Farm, the owner blocked the road and this has impacted the community negatively since their customers to Osotua Resort have been blocked from accessing the resort.	Givan Ole Lerru
2 CONCLUSION AND WAY FORWARD	
The meeting ended at 4pm.	

MINUTES OF MEETING

CLIENT:	Rift Valley Consortium		
PROJECT:	Rironi-Nakuru-Mau Summit Highway	**WSP Ref.:**	201-10312-00
SUBJECT:	2nd Round Stakeholders Consultations.	**DATE:**	3 juin 2021
VENUE:	Eburru Forest Office.	**TIME:**	10.00 am

ATTENDEES
This meeting was with Ogiek Community Members in Eburru, Gilgil. **Attendance sheets have been documented separately.**

ITEMS DISCUSSED	**ACTION BY**
1 PROJECT OVERVIEW AND DESCRIPTION	
<u>INTRODUCTION</u> Along the A8 highway, there are vulnerable and marginalized communities living in Gilgil, south of A8 comprising of; • Ogiek and Maasai in Eburru Location. • Maasai, Turkana, Njemps and Samburu in Oljorai Location. These areas also have people from other Kenyan tribes living there, but there were similar consultative meetings with which they had been invited for. They therefore don't form part of the target group for this specific meeting. The meeting started with a word of prayer from the area pastor. The consultants introduced themselves followed by self introductions from the community members in attendance.	All.

ITEMS DISCUSSED	ACTION BY
PROJECT DESCRIPTION. Under a Public Private Partnership, the Government has proposed a project with an aim of expanding and improving the Rironi – Mau-Summit road (A8). The project design will widen the existing highway between Rironi and Mau Summit into a four lane dual carriageway. The existing single carriageway section between Rironi and Naivasha via Mai Mahiu will be rehabilitated to include proper road signs, foot bridges and possible repairs of the potholes and dilapidated sections. As a legal requirement, Environmental and Social Impact Assessment is a prerequisite for such a development project. The task of the team is to engage different levels of stakeholders but specifically the indigenous communities along the proposed project corridor, the Maasai and Ogiek.	
2 REACTIONS	
During the project construction, the community should be given priority in job opportunities and involved as a marginalised community. There should also be a consideration to construct the road from Eburru to Gilgil. In the recent past, there have been numerous accidents along the stretch in Salgaa and this road project is a very good idea. There have however been national projects in the locality but the Ogiek are never included in any part of the process and its their hope that this time they will be involved especially in terms of job opportunities since they only depend on bee keeping and honey harvesting. The road crossings are very important and should be positioned in safe places. Underpasses could be prone to crime and the best option could be well-lit overpasses for security purposes. The project will however reduce the number of accidents. The youth in the area have academic certificates but are never considered for jobs. Gilgil being an ASAL area, a CSR project to like a water purification system will be of huge benefit to them. At the moment they source water from Lake Naivasha. The project materials engineer should visit the area to confirm the suitability of ballast and stones from the area since there are many quarries in the locality. This will bring economic benefit to the community if materials are sourced from them. The Maasai in the locality can be subcontracted to guard the toll stations. Since the Ogiek community are experts in honey harvesting, their main challenge is markets and this project will open up the area and expose them to external markets.	Patrick Kutunoi Joseph Legetu Ogiek Chairman. Maseto Kosen Joseph Muchendu – Youth Rep. Reuben Njuguna.

ITEMS DISCUSSED	ACTION BY
The experts should come up with ideas on how to conserve the storm runoff water from the roads.	Gideon Gitau
In case there will be road side kiosks to provide food for the construction workers, the process should be done in an orderly manner and the community given a number of slots.	Joseph Mwangi
The road project is a good development that will open up the area and lead to the formation of other towns. The disadvantages like deforestation, dust and increased disease transmission due to influx of construction workers should be well mitigated. The borrow pits should be rehabilitated and restored to their original state.	Josephat Wachira
In comparison, the women in urban areas and youth have access to internet services and information, while in the villages like Eburru, they are disadvantaged, most do not have formal education and therefore lack the confidence to express themselves. There should be trainings and empowerment of women, and during recruitment, organised women groups should be considered without stringent measures. There should also be awareness creation sessions with the women and girls to prevent unwanted pregnancies.	Lydia Nyota
Since there will also be diversions of traffic during the construction process, the contractor should consider improving these roads after the construction.	
3 QUESTIONS AND ANSWERS	
Due to influx of people and social cohesion, will there be programs and measures on mitigating HIV/AIDS and early pregnancies.	Gideon Gitau
There will be a sociologist and Gender expert present during the project construction to deal with the emerging social issues from the project as directed by the Environmental and Social Management Plan and also the un-anticipated impacts.	Prof. Ontita
The laws and regulations especially the sexual offenders act will be communicated to the project staff and also to the foreigners.	
4 WAY FORWARD	
There will be a session on memorandum of agreement disclosure that will be done at a later date where the leaders of the Ogiek in this community will be present to confirm that the project does not affect the community directly and also to endorse the project.	Area Chief.
The Eburru chief closed the meeting with a vote of thanks and a word of prayer from the area pastor.	Area Pastor.

MINUTES OF MEETING

CLIENT:	Rift Valley Consortium		
PROJECT:	Rironi-Nakuru-Mau Summit Highway	**WSP Ref.:**	201-10312-00
SUBJECT:	2nd Round Stakeholders Consultations.	**DATE:**	**3 juin 2021**
VENUE:	**Lamp and Light Church – Kongasis.**	**TIME:**	……..

ATTENDEES
This meeting was with Maasai, Samburu and Turkana Community Members in Oljorai, Gilgil. Attendance sheets have been documented.

ITEMS DISCUSSED	**ACTION BY**
1 PROJECT OVERVIEW AND DESCRIPTION	
INTRODUCTION Along the A8 highway, there are vulnerable and marginalized communities living in Gilgil, south of A8 comprising of; • Ogiek and Maasai in Eburru location. • Maasai, Turkana, Njemps and Samburu in Oljorai location. These areas also have people from other Kenyan tribes living there, but there were similar consultative meetings with which they had been invited for. They therefore don't form part of the target group for this specific meeting. The meeting started with a word of prayer from the church's pastor. All the community members then self introduced themselves followed by self-introductions from the consultants.	Overview

ITEMS DISCUSSED	ACTION BY
PROJECT DESCRIPTION. The Government of Kenya has proposed a project with an aim of expanding and improving the Rironi – Mau-Summit road (A8) and Rironi – Naivasha road (A8 South) Under a Public Private Partnership. The project design will widen the existing highway between Rironi and Mau Summit into a four lane dual carriageway. The existing single carriageway section between Rironi and Naivasha via Mai Mahiu will be rehabilitated to include proper road signs, foot bridges and possible repairs of the potholes and dilapidated sections. As a legal requirement, Environmental and Social Impact Assessment is a prerequisite for such a development project. The task of the team is to engage different levels of stakeholders but specifically the indigenous communities along the proposed project corridor. The consultant explained the benefits of the project & anticipated impacts. The community was then invited for a question and answer session and also give opinions on the project.	Prof Ontita
2 REACTIONS AND QUESTIONS.	
One of the benefits of the project include job opportunities to the communities living along the highway. The project should therefore consider their youth in giving them jobs in as much as they live quite some distance from the highway (approximately 25km). Underpasses should be provided in some sections of the road. There should also be foot bridges or crossing sections.	Ekero
As a minority group, they are so glad that they are being consulted for the project, in as much as the road is far from their villages, its going to open up the area and bring positivity to the community such as access to the markets.	Shadrack Kitedoki
The marginalised communities should be organised into groups and included in the overall construction committee to curb being overshadowed by the majority communities.	Harun Lomoli

ITEMS DISCUSSED	ACTION BY
Since the previous projects have not been benefiting them, the consultation process shouldn't end at opinion level but then go further and follow-up whether the community has benefited especially in terms of job opportunities.	Seki
The main economic activity in this community is maize farming and mid-scale dairy farming. The feeder roads are in a poor state and they have to use brokers to get their produce to the farm. The project should consider improving these feeder roads.	John Ole Sindo
They are glad to be considered in the project consultation process, the community however needs assurance that they will be included in the project.	Susan Kitaika.
The community normally herd their livestock along marula and its their request that the project should consider installing streetlights since its very dark and forested.	Mary Akai
The project should consider providing toilets along the highway for the road users.	Charles Ekeno
3 CONCLUSION AND WAY FORWARD	
There will be a session on memorandum of agreement disclosure that will be done at a later date where the leaders of the community will be present to confirm that the project does not affect the community directly and also to endorse the project. The meeting was closed by the area chief with a vote of thanks and a word of prayer from the church pastor.	Chief

MINUTES OF MEETING

CLIENT:	Rift Valley Consortium		
PROJECT:	Rironi-Nakuru-Mau Summit Highway	**WSP Ref.:**	201-10312-00
SUBJECT:	2nd Round Stakeholders Consultations.	**DATE:**	7 juin 2021
VENUE:	Windy Ridge Resort, Mai Mahiu.	**TIME:**	10.30 am

ATTENDEES
This was a Memorandum of Agreement disclosure with the Maasai Elders, Mai Mahiu. Attendance sheets have been documented.

ITEMS DISCUSSED	**ACTION BY**
1 MOA DISCLOSURE	
The have two rounds of consultations with the Maasai Community to fulfill the Free, Prior and Informed Consent (FPIC) process. Therefore, there is need to sign a form of aggrement with the project proponent; Memorandum of Agreement. The structure of the draft MoA was presented stating; That the Maasai community confirm that they had been fully informed about the project and consulted through public participation meetings. They had been given enough time to deliberate on their own and confirmed the project benefits and its impact to their livelihood and resources. Having confirmed that, the community listed a number of requests to be included in the Memorandum of Agreement upon discussions and negotiations and to be fulfilled during the construction process.	ACTION BY
2 DISCUSSIONS	

ITEMS DISCUSSED	ACTION BY
Requests; 1. Improvement by murraming/tarmacking of an existing 28km road (Junction-B3-Namuncha Primary School) - From the tarmac to Namuncha is about 10km but the road extends to Ewaso Kedong' in Kajiado County. 2. Formation of a community committee and 2 liaison officers from the community to represent their interests and assist in grievances redress. 3. Consideration of the community in skilled and unskilled job opportunities, about 80% of the unskilled labour should be the local community members. 4. A CSR project specifically construction of classrooms in Namuncha Primary School. 5. Provision of livestock underpasses, footbridges and speed bumps for the safety of the community and their livestock (The community members identified favorable positions within which they are currently crossing the roads at with the animals).	
3 CONCLUSION AND WAY FORWARD	
The requests will be communicated with the client, and a discussion will commence. At a later date, the community members will be invited to a negotiation / discussion meeting with RVH and a representative of GoK to discuss on the achievable requests and requests that will not be included in the MoA. A final MoA will then be drafted for signing by the community representative and the client.	All.

MINUTES OF MEETING

CLIENT:	Rift Valley Consortium		
PROJECT:	Rironi-Nakuru-Mau Summit Highway	**WSP Ref.:**	201-10312-00
SUBJECT:	2nd Round Stakeholders Consultations.	**DATE:**	8 juin 2021
VENUE:	Mariashoni.	**TIME:**	10.00 am

ATTENDEES
This was a meeting with the Ogiek Community members. **Attendance sheets have been documented separately.**

ITEMS DISCUSSED	**ACTION BY**
1 PROJECT OVERVIEW AND DESCRIPTION	
INTRODUCTION The meeting started by a word of prayer followed by self-introductions by everyone in attendance. This being the second consultation with the Ogiek community members, a recap of the main issues was mentioned; • Consideration of the Ogiek youth in the unskilled and semi-skilled job opportunities. • Sourcing of construction materials from the locality. • Improvement of the Mariashoni – Elburgon road to indirectly connect the community to the A8 road. The community was however very pleased to be consulted for a second time and glad that the project proponent and consultants were transparent about the process.	All

ITEMS DISCUSSED	ACTION BY
PROJECT DESCRIPTION The project description was explained; Under a Public Private Partnership, the Government has proposed a project with an aim of expanding and improving the Rironi – Mau-Summit road (A8). The project design will widen the existing highway between Rironi and Mau Summit into a four lane dual carriageway. The existing single carriageway section between Rironi and Naivasha via Mai Mahiu will be rehabilitated to include proper road signs, foot bridges and possible repairs of the potholes and dilapidated sections. As a legal requirement, Environmental and Social Impact Assessment is a prerequisite for such a development project. The task of the team is to engage different levels of stakeholders but specifically the indigenous communities along the proposed project corridor, the Maasai and Ogiek.	Prof. Ontita
2 QUESTIONS AND ANSWERS	
Has the project started at this specific time? The discussions and consultations are still ongoing and the project has not yet started as its still in the design stage. **Will the displaced people be compensated?** **And can the community bee involved in the decision making of the design of the road?** The preliminary design is ready, it is an existing road with enough road reserves. There are therefore no anticipated involuntary displacements. The consultations are done during the design stage to get their opinions that can contribute to the overall design but the overall decisions are made based on engineering – viable situations by the design engineers. **In as much as they support the project, what is the role of private companies in a National government project?** The Public Private Partnership in this case means that the road is funded by private financiers who will manage and maintain the road for about 26 years. Both roads will be tolled to recover the funds and after that the private funders will leave the relevant authority then, to take over the management. **What is the procedure of material supply from the locality and how are borrow pits handled?** The materials must undergo suitability testing and the contractor will then have a contract with the land owner on material charges and he/she (contractor) will have to submit a restoration plan for the borrow pits to NEMA. The borrow pits must be restored after the material sourcing.	David Rotich Prof. Ontita Sarah Osas Prof Ontita Sironga Prof Ontita Barngetuny' Prof. Ontita

ITEMS DISCUSSED	ACTION BY
3 CONCLUSION AND WAY FORWARD	
The discussions are still ongoing and there will be a session with the Ogiek Council of Elders to disclose to them a Memorandum of Approval.	//

MINUTES OF MEETING

CLIENT:	Rift Valley Consortium		
PROJECT:	Rironi-Nakuru-Mau Summit Highway	**WSP Ref.:**	201-10312-00
SUBJECT:	2nd Round Stakeholders Consultations.	**DATE:**	8 juin 2021
VENUE:	Mariashoni Guest House.	**TIME:**	……..

ATTENDEES
This meeting was with Ogiek Community Based Organisations in Mariashoni. **Attendance sheets have been documented.**

ITEMS DISCUSSED	**ACTION BY**
1 PROJECT OVERVIEW AND DESCRIPTION	
INTRODUCTION The Government of Kenya has proposed a project with an aim of expanding and improving the Rironi – Mau-Summit road (A8) under a Public Private Partnership. The project design will widen the existing highway between Rironi and Mau Summit into a four lane dual carriageway. The existing single carriageway section between Rironi and Naivasha via Mai Mahiu will be rehabilitated to include proper road signs, foot bridges and possible repairs of the potholes and dilapidated sections. As a legal requirement, Environmental and Social Impact Assessment is a prerequisite for such a development project. The task of the team is to engage different levels of stakeholders but specifically the indigenous communities along the proposed project corridor, the Maasai and Ogiek.	Prof. Ontita
There are 3 Ogiek people CBOs working in Mariashoni focusing on different issues affecting the community; • Macodev • Prohome • Malando The 3 CBOs were all present. There was need to have consultative discussions with the CBO officials and get insights on how the project might impact their activities in the community and also get suggestions on how these impacts might be mitigated.	
2 DISCUSSIONS	

ITEMS DISCUSSED	ACTION BY
Malando CBO – chaired by David Barng'etuny This CBO focuses on; • Training and awareness creation on bee keeping • Sourcing for bee hives • Processing and marketing of honey. The CBO has been facing challenges related to poor transportation of their products to the market. They therefore support the project as this will reduce the challenges by linking them to external markets.	Barng'etuny
Macodev CBO – Chaired by Martin Lele. This is an umbrella of community groups and its main focus is on; • Environmental conservation through tree planting and nurseries • Capacity building for the bee keepers • Buying raw honey from the farmers and then processing and selling. They work with some other partners such as; • Necota Kenya • Slowfood Kenya • Ministry of Agriculture • OPDP and Prohome	Lele
Prohome CBO – Chaired by Leonard Mindore. This CBO covers Molo and Njoro sub-counties and deals with; • Advocacy on land rights • Environmental conservation • Socio-economic development through education and youth empowerment programs. Their partners include; • Kenya National Commission on Human Rights (KNCHR) • OHCHR – Nairobi • Defenders Coalition of Kenya • Global grain lands.	Leornard

ITEMS DISCUSSED	ACTION BY
The officials confirmed that the road is quite a distance from Mariashoni and the community will not be affected directly not enjoy the benefits of the road construction directly. Since they are also farmers planting cabbages, potatoes, peas, kales which are all perishable, the road network will open up the area and make it easier to get to the market. So for the community to benefit, they request to be linked to the highway through the improvement of two roads; From Nessuit to Njoro and from Mairashoni to Elburgon. Environmental conservation is key as their bee keeping economy depends primarily on the trees; so the project should avoid cutting down trees and revegetate where unavoidable. The community is interested in middle level and casual jobs from the project and would request for the youth to be considered for the same. During recruitment, it is key to involve the council of elders and the Ogiek CBOs to ensure the recruited are actually from the Ogiek community.	All.

MINUTES OF MEETING

CLIENT:	Rift Valley Consortium		
PROJECT:	Rironi-Nakuru-Mau Summit Highway	**WSP Ref.:**	201-10312-00
SUBJECT:	2nd Round Stakeholders Consultations.	**DATE:**	8 juin 2021
VENUE:	Mariashoni	**TIME:**	12.30 pm

ATTENDEES
This was a Memorandum of Agreement disclosure with the Ogiek Council of elders. Attendance sheets have been documented.

ITEMS DISCUSSED	**ACTION BY**
1 MOA DISCLOSURE.	
Following the Free, Prior and Informed Consent (FPIC) process where there has been two rounds of consultations with the Ogiek community, there is need to sign a form of approval with the project proponent. The structure of the draft MoA was presented stating; That the Ogiek community confirm that they had been consulted through public participation meetings and given enough information about the project. They had been given enough time to deliberate on their own and confirmed that the project will not affect them or their resources directly. All this was confirmed by the council of elders and the structure of the MoA agreed upon. The community however listed a number of requests to fully benefit from the project in as much as they are not affected directly by the project. Requests; 1. Improvement of either of the two roads to link them indirectly to A8 highway; • Mariashoni – Elburgon road. • Nessuit – Njoro road. 2. Consideration of the community to the job opportunities during the construction process and inclusion of the Ogiek Council of Elders and Ogiek CBOs during the recruitment for vetting purposes to avoid impersonation of the Ogiek people.	Prof. Ontita and the council of elders' members.

ITEMS DISCUSSED	ACTION BY
2 DISCUSSIONS AND WAY FORWARD	
The Ogiek council of elders were initially uncomfortable with the signing of the approval as they have some active cases and their past experience as an indigenous and marginalised community has been that they have undergone a number of consultation processes that never end well. Either they are not given full information of what they are committing to or their requests are not granted even after discussions. For transparency purposes, the memorandum of approval will be shared with the NGO that represents their interests; Ogiek People Development Program (OPDP) director; Mr. Daniel Kobei who will guide the community through the interpretation of the document. Mr. Kobei will also be the signatory of the document and a representative from the Council of elders. All this will also be adone at a later date that will be communicated in good time.	All.

CONSULTATIONS ON ECOSYSTEM SERVICES

Maasai Community – Maai Mahiu.

The main sources of livelihood for the Maasai community in Maai Mahiu include;

- Livestock keeping for meat, milk and blood
- Business specifically beadwork for the women
- Small scale poultry farming
- Bee keeping & honey harvesting.

NB****Most of the species are only known in the native Maasai language.***

What are the ecosystem services in the project area considered most important by people?	What distances do they travel to have access to the resources present? Do they use or cross the road to access them?	The community keeps livestock, they stay to the south of A8 South and they herd their livestock in the forest which is across the road. Their village is approximately 10km to the main road (Maai Mahiu – Naivasha road) and they get into the forest across the road. The forest is about 200M from the road and they get up to 4km into the forest both vertically and horizontally to the main road.
Agricultural potential and production	Location of agricultural areas (rain-fed, irrigated, market gardening) Location of off-season crops	The community does not practice agriculture apart from subsistence vegetable farming in their homes.
	Assessment of the contribution of agriculture to household food Most consumed species	They farm vegetable that they eat averagely 2 times in a week in their households. Species include; • Amaranthus locally known as (terere) • African nightshade (managu)
Livestock and forage resources	Location of forage areas Location of areas with better forage potential Location of travel corridors	The village is called Namuncha with a radius of about 5km *(1°4'14.59"S, 36°33'45.59"E)* They access the forest at different points; I have indicated their local names; Kanjo; *(1° 4'12.61"S, 36°36'6.95"E)* Koroiro; *(1° 1'48.20"S, 36°36'7.93"E)*

		Monkey Corner *(1° 0'11.85"S, 36°36'8.34"E)*
	Main type of livestock in the study area	• Cows • Goats • Sheep
	Pattern of use of forage areas in the study area (permanent, seasonal area) Daily movement of herds, distance traveled daily, factors influencing movements. How do they decide it's time to move, decision-making elements for seasonal migration?	They herd in the forest between Feb – July traveling about 25km to and fro. They do not however go to the forest daily, about 2 to three times a week. When they're not in the forest, they herd around home (Namuncha) August – January is a dry season. The heads of households organise themselves and combine their cattle then employ herdsman who move with their herds. The herdsmen travel to (Naivasha – Nakuru – Njoro – Mau Narok – Narok and back to Mai Mahiu) a total of 320km for around 5 months. Migrations is only done with cows. They have to buy supplements for goats and sheep.
	Percentage of livestock sold (selling price, factors influencing the selling price), percentage consumed, period of consumption.	They do not sell their livestock unless they need money for other needs; School fees, medical fees, transport. Theres no definite percentage as this is done on a needs basis and basic education is free, basic healthcare is also subsidized. They mostly don't need hard cash and roughly the sold livestock would be 20%. The number of livestock owned is a social status symbol and about 30% goes to consumption. They preserve this by sun drying and smoking, a slaughtered goat could be preserved to stay for 2-3 weeks.
Fishery resources	This is not applicable to this community.	
Hunting and bush meat	The community used to eat bush meat culturally especially the gazelle and antelopes, but for this specific Maasai community, this stopped around 1990 and they've since formed an association to conserve the forest and banned hunting. So there is no active hunting at the moment.	
Natural food products	Preferential picking/gathering areas What species of indigenous food products? In what natural habitat are they found? What are the priority gathering periods?	No insects are eaten in this community. They collect wild fruits and spices from the forest which are all seasonal. Orgumi Olamai – False santalwood - *Ximenia americana* Olamuriak – Natal plum - *Carissa edulis* Osinandei – used as a tea spice. Segetek – used as an oxygen supplement during marathon champions. Ormomoi.

Traditional Medicine	Preferential gathering areas	These herbs are collected from the forest and the herbalist travels to up to Samburu, Oloitoktok and Namanga to source for some specific herbs. Specific trees treat different ailments and they source roots, leaves and barks.
	Prioritization of treatments by the populations (traditional medicine vs itinerant medicines vs health center and pharmacy)	Of those present in this survey, out of 10 people, only 2 preferred modern medicine and going to hospital. Traditional medicine is still very popular amongst them, and theres only one dispensary in their village. They only go to hospital in dire cases and when traditional herbs do not heal them.
Construction Material	Preferred areas for harvesting organic materials	The community lives in thatched *manyattas.* Houses are only constructed by women and take between 1-5 months to build.  *A photo of a manyatta.*
	What materials are used and how are they retrieved? What species are fmainly used.?	They therefore use long lasting species of trees and collect them within the village. Leleshwa – camphor bush – *Tarchonanthus camphoratus* Oloirien – Brown Olive tree – *Olea africana* Osogonoi – East African greenheart, Pepper-bark tree – *Warburgia ugandensis* Orgilai – l Oiti – Honey Acacia - *Acacia mellifera*
Lumber and crafts	Collection areas for craft materials	The Maasai women make beadworks but the beads and strings are bought from Narok (90km away) or Nairobi (50km away)
Biofuels	Firewood collection areas What energy sources are used?	Firewood is mostly collected within the village and when herding in the forest, they will randomly collect dead wood. Firewood is only collected by women and female children. They do not transform wood into charcoal.

		Species mainly used for charcoal include; • *Tarchonanthus camphoratus* • *Acacia mellifera*
Water Resources	Preferred surface water supply areas	The nearby forest is the water catchement tower in the area. Theres a permanent river from the forest through their village called river Kitilikini. They use this water for all the domestic purposes including drinking and cooking. The households living far from the river use donkeys to fetch water.
Cultural Sites	Are there sacred trees/plants or animals revered by people?	They lately go to the conventional churches but also have some sacred trees within the community; Oleteti tree – *Adenium obesum.*
Recreation and Tourism	What activities? Who benefits from them? Income from these activities ?	Hiking in the hills from the Italian Catholic Church junction (0°59'37.30"S, 36°36'2.64"E) to Kamirithu (1°05'58.9"S, 36°36'31.2"E) about 20km. They receive local tourists mainly from Nairobi and charge 400 shillings per person. The forest association CBO called Ilparkuo benefits from these activities and they get an average of 10 people per month. The main challenge is security through the hills as there are wild animals like cheetahs and hyenas along the track, making people shy away from the adventure.

CONSULTATIONS ON ECOSYSTEM SERVICES.

Ogiek Community – Eburru (Gilgil)

Informant: Patrick Ole Kutunoi – Assistant chairman, Ogiek community, Eburru

The main sources of livelihood for the Ogiek community in Eburru include;

- Bee keeping & honey harvesting
- Agriculture.

Eburru center is located about 20km south of the A8. The Ogiek in Eburru were recently evicted from their ancestral land, in the nearby forest which forms part of the Eastern Mau forest. They are now living in temporarily owned farms with no forms that prove ownership; the forest section has since been fenced and forest conservation officers deployed there. Due to their high dependence on the forest for bee keeping and cultural activities, they formed a Community Forest Association to be regulating their activities and movement into and out of the forest.

They still use the traditional log hives and are allowed to install them in the forest and access the forest for maintenance of the hives and harvesting of honey.

NB*<u>***Most of the species are only known in the native Ogiek language.***</u>

What are the ecosystem services in the project area considered most important by people?	What distances do they travel to have access to the resources present? Do they use or cross the road to access them?	The Ogiek in Eburru are mainly bee keepers and farmers. They are squatters with temporary land. Their bee hives are however kept in the nearby forest. The forest is called Oldonyo Eburru which is part of the larger Eastern Mau.
Agricultural potential and production	Location of agricultural areas (rain-fed, irrigated, market gardening)	The community practices agriculture and mainly plants maize and potatoes for sale and household food as well. Their crops are largely rain-fed.
	Assessment of the contribution of agriculture to household food Most consumed species	Most of the agricultural produce is sold in markets and the money is used to cater for other household needs, only about 10% of the produce is used as food at home seeing that its only maize and potatoes.
Livestock and forage resources	Location of forage areas Location of areas with better forage potential Location of travel corridors	The community does not keep livestock, apart from a few households having up-to 4 sheep or cows. These are just reared at home, not taken to the fields to herd.

	Main type of livestock in the study area	Cows Sheep
Fishery resources		This is not applicable to this community.
Hunting and bush meat		The forest has since been fenced off and they're not allowed to hunt. So the community does not hunt or eat bush meat.
Natural food products	Preferential picking/gathering areas What species of indigenous food products? In what natural habitat are they found? What are the priority gathering periods?	They collect seasonal wild fruits from the forest; • Ngayakuj • Ormorogi • Irkinasin.
Traditional Medicine	Preferential gathering areas	Herbs are collected inside the forest from specific trees. The Ogiek vice chairman confirmed that they have upto 400 different species that they use for traditional medicine but the main ones for the common ailments include; • Oleparmunyo • Orkonyil • Olerubat.
	Prioritization of treatments by the populations (traditional medicine vs itinerant medicines vs health center and pharmacy)	The older generation (from 40 years and above) do not go to hospitals. They started taking their children to hospital in order to get the mandatory birth certificates (it's a requirement to have this to be enrolled in school and to get a National Identification and a passport.) and to get the immunization cards for their children. Traditional medicine is the preferred form of treatment. The center has one dispensary that serves the whole community.
Construction Material	What materials are used and how are they retrieved? What species are mainly used.?	Housing amongst the Ogiek in Eburru are houses made from; Bamboo Red cider and recently they make thatched walls with iron sheet roofing because of inaccessibility of the preferred tree species.
Lumber and crafts	Collection areas for craft materials	This is not applicable to this community.
Biofuels	Firewood collection areas What energy sources are used?	Their main source of fuel is firewood which is just collected in the village where they stay. This is supplemented by charcoal once in a while. The charcoal is sourced from the trees that they have planted in their temporary farms.

		Charcoal is only meant for household use and not for sale and one 90kg bag suffices for 1 month.
Water Resources	Preferred surface water supply areas	The area doesn't have any water shortage problems. Theres a geothermal company nearby (Kenya Electricity Generating Company – KENGEN) that gives them water as a CSR project, this water is not treated and they only use it for domestic chores such as cleaning. Drinking and cooking water is directly sourced from geyser steam. See this https://www.standardmedia.co.ke/rift-valley/article/2001303195/region-where-locals-tap-geysers-for-water-supply
Cultural Sites	Are there sacred trees/plants or animals revered by people?	The Ogiek in Eburru only go into the forest "culturally" during the dry season, mainly to pray for the rains. This is done under Mugumo tree – Strangler fig (*Ficus natalensis*) It is the only sacred tree for this specific community living in Eburru.
Recreation and Tourism	What activities? Who benefits from them? Income from these activities ?	They conduct eco-tourism, bee keeping and herbal medicine trips. Their clients include mainly missionaries, researchers and other local tourist. The trips are always organized by an organized group called "Ogiek Self Help Group" that charges 5,000/- per person per week.

CONSULTATIONS ON ECOSYSTEM SERVICES.

Ogiek Community – Mariashoni

Informant: Martin Lele – Assistant chairman, Ogiek Council of Elders, Mariashoni

The main economic activities for the Ogiek community in Mariashoni include;

- Agriculture; farming potatoes and maize.
- Bee keeping and honey harvesting.
- Small scale livestock keeping

CBO	Community Based Organisation
CFA	Community Forest Association
NECOFA	Network For Eco farming in Africa
MACODEV	Mariashoni Community Development

The community has both log hives and the modern hives for bee keeping. There's a Community based organization called Mariashoni Community Development (MACODEV) that operates as an umbrella for the bee keepers; buying raw honey from them, processing and selling it. The CBO collaborates with other NGOs and Ministry of Agriculture to have value addition trainings to the bee keepers as well. There have been restrictions of accessing the forest (Eastern Mau block in Mariashoni, Kiptungo and Nessuit) which led to the formation of a Community Forest Association that regulates the community' access and activities in the forest while helping to conserve the forest. They're therefore allowed to install the hives in the forest; they organize themselves as groups and identify a suitable location. They protect the bee-hives from wet conditions using the bark of the podo tree (*Podocarpus latifolius.*

What are the ecosystem services in the project area considered most important by people?	What distances do they travel to have access to the resources present? Do they use or cross the road to access them?	Mariashoni is located approximately 35KM south of the main A8 road. Their main source of livelihood is sale of honey and agricultural produce. They do not interact with the A8 road on a daily basis but only use it when on transit to other towns.
Agricultural potential and production	Location of agricultural areas (rain-fed, irrigated, market gardening) Location of off-season crops	Majority of the community depend on the rain and mainly plant maize and potatoes which are seasonal crops in Kenya.

	Assessment of the contribution of agriculture to household food Most consumed species	About 90 percent of the agricultural produce is sold to the market through middlemen/ brokers. The remainder is used at the household level for food.
Livestock and forage resources	Location of forage areas Location of areas with better forage potential Location of travel corridors	The herders within the community are conditionally allowed to herd inside the forest. Their village called Mariashoni (0°22'2.35"S, 35°49'14.15"E) is about 6km from the forest entrance, (0°24'47.18"S, 35°48'11.72"E). The only condition is to ensure that the livestock is accompanied by a herder.
	Main type of livestock in the study area	Cows Goats Sheep
	Pattern of use of forage areas in the study area (permanent, seasonal area) Daily movement of herds, distance traveled daily, factors influencing movements. How do they decide it's time to move, decision-making elements for seasonal migration?	The community herds their livestock in the forest on a daily basis, permanently. This will amount to about 15 kilometres daily movement (6 km from Mariashoni to the forest entrance)
	Percentage of livestock sold (selling price, factors influencing the selling price), percentage consumed, period of consumption.	Livestock is reared mostly for milk and meat at home. The community does not sell their livestock since they never experience dry seasons(livestock is locally mostly sold during dry seasons when the owner is not capable of providing or buying alternative feeds)
Fishery resources	This is not applicable to this community.	
Hunting and bush meat	Ogiek were traditionally hunters and gatherers. The push for forest conservation has since reduced hunting to a non-negligible percentage. Most wild animals were pushed into the game parks and the regulations by the CFA cannot allow the community to continue hunting.	
Natural food products	Preferential picking/gathering areas What species of indigenous food products? In what natural habitat are they found? What are the priority gathering periods?	No insects are eaten in this community. Wild fruits collected from the forest include; • Minjore • Ngulumai
Construction Material	What materials are used and how are they retrieved?	Traditionally, the community made houses using; • Olive tree – *Olea africana*

	What species are mainly used.?	• Bamboo – *Bambusa vulgaris.* At the moment, their houses are mainly mud-thatched walls with grass roofing or iron sheets for those who can afford iron sheets.
Biofuels	Firewood collection areas What energy sources are used?	The main source of energy in Mariashoni is firewood which the community is allowed to collect in the forest,
Water Resources	Preferred surface water supply areas	The area has no water shortages, as there are two rivers within the locality; • River Rongai • River Mau. However, due to the increased population and settlements moving far from the rivers, the County Government of Nakuru through the Member of the County Assembly (MCA) has 2 sunk boreholes for the community.
Cultural Sites	Are there sacred trees/plants or animals revered by people?	The Ogiek use caves inside the forest for prayers especially for the non-Christians. During their rites of passage (circumcision) ceremonies, they hold them under podo trees (*Podocarpus latifolius*). The trees therefore have cultural significance to the community.
Recreation and Tourism	What activities? Who benefits from them? Income from these activities ?	Pre-covid, the community had numerous ecotourism activities and clients as well. The CBO in the area (MACODEV) partners with Necofa NGO, Slow food international and Tera Mandet Tours and Travel to hosts guests in the community. Money paid by the tourists is used by the CBO to support its activities such as training the bee keepers and environmental conservation.

APPENDIX

7-8 *CONSULTATION TOOLS AND SUPPORT*

Three rounds of public consultations will be successively organized. With a social inclusion perspective, meetings with stakeholders will take into consideration specific needs of women, youth, communities, as well as vulnerable and marginalized groups.

Objectives of this 1st round of public consultations:

- Present the Project to the relevant authorities and stakeholders,
- Meet and listen to the stakeholders' questions and expectations,
- Raise awareness and encourage participation into the up-coming social surveys.

ESIA MAIN STEPS

Field surveys for the ESIA (Socio-economic, noise, air, water, fauna, flora, etc.) is a key requirement to understand the socio-economic context and the natural environment of the Project. It is the basis to evaluate the benefits and the impacts of the Project in the area and determine the adequate mitigation and optimization measures. The Socio-economic survey will be launched right after the 1st round of public consultations.

NEXT STEPS:

January - February 2021: 1st round of consultations followed by social and economic field surveys with communities and road users

1st & 2nd Quarter 2021: Biophysical Surveys

2nd Quarter 2021: 2nd round of consultations (Impact Identification)

3rd Quarter 2021: 3rd round of consultations (mitigation measures)

2021: Final Design Studies integrating ESIA benefits

2022 – 2025: Project Construction

CONTACT US:

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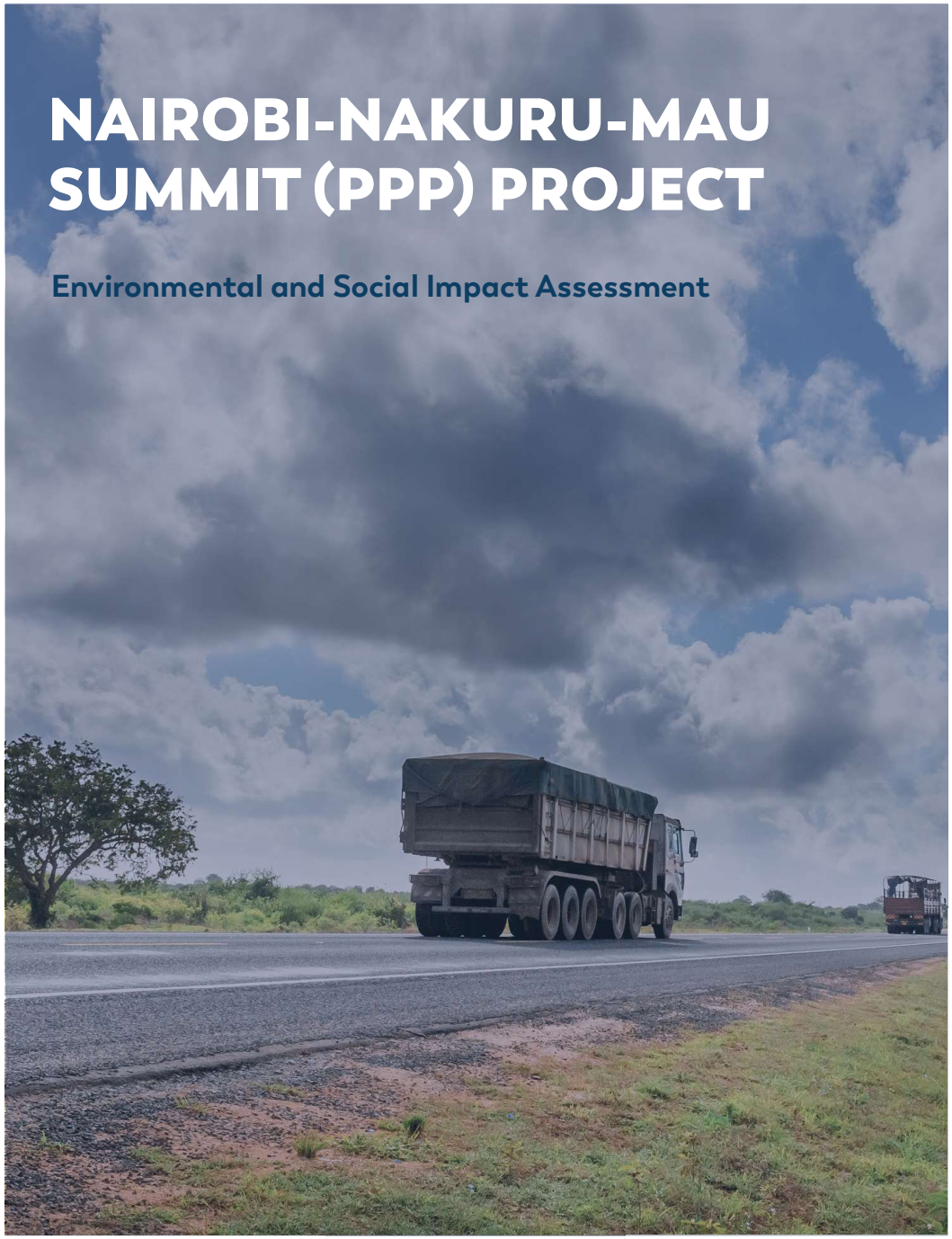
Rift Valley Highway Limited
rvc@riftvalleyhighway.co.ke

The Environmental and Social Impact Studies of the Nairobi-Nakuru-Mau Summit Highway Project, on behalf of the Project Company, was entrusted to the Canadian consulting company WSP Canada Inc.

KeNHA meridiam VINCI HIGHWAYS

NAIROBI-NAKURU-MAU SUMMIT (PPP) PROJECT

Environmental and Social Impact Assessment



KeNHA meridiam VINCI HIGHWAYS

THE NAIROBI-NAKURU-MAU SUMMIT HIGHWAY PROJECT

The Government of the Republic of Kenya, through the Ministry of Transport, Infrastructure, Housing, Urban Development and Public Works represented by the Kenya National Highways Authority (KeNHA), identified the need for the rehabilitation, improvement and expansion of the Nairobi–Nakuru–Mau Summit (A8) highway.

The A8 highway is part of the Northern Corridor which is one of the busiest and most important transport corridors in East and Central Africa, providing a gateway through Kenya to the landlocked economies of Uganda, Rwanda, Burundi, Southern Sudan and Eastern DR Congo. It serves as a transportation link for approximately 6 million Kenyans. Expanding the road capacity and improving the road quality between Nairobi and Mau Summit will thus allow to accommodate the increasing traffic in a safe and sustainable manner.

This Project largely contributes to the realization and implementation of the PPP agenda in Kenya through the delivery of first-class Infrastructure projects capable of meeting social and economic requirements of the people of Kenya in a timely, transparent and accountable manner as envisioned in the Vision 2030 blue print and The Big Four Agenda.

After an international tender and a fair and transparent selection process, the Project was awarded to an international consortium which comprises of VINCI Highways, Meridiam Infrastructure Africa Fund and VINCI Concessions and which has incorporated a dedicated company in Kenya for the Project: Rift Valley Highway Limited.

BENEFITS

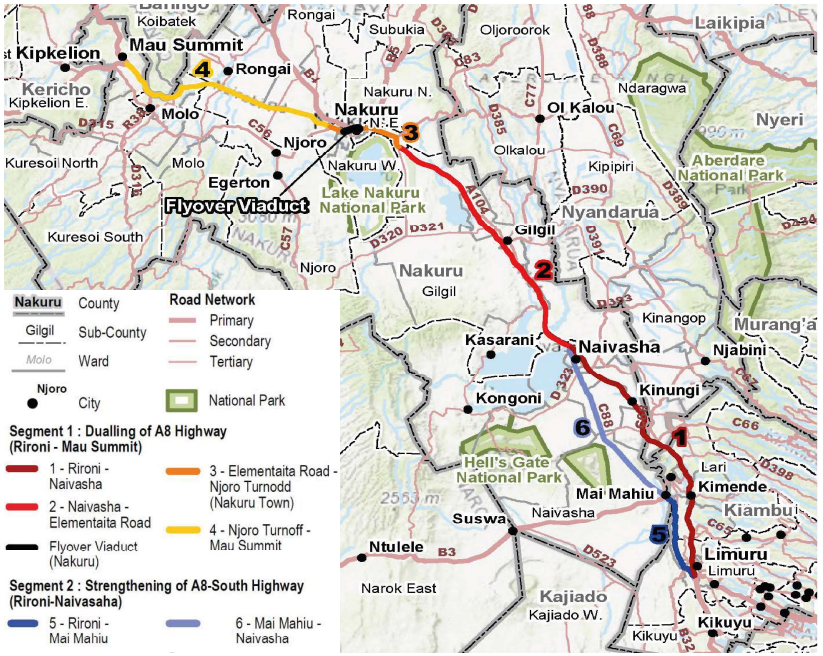
The Highway Project will:

- Reduce road accidents and improve safety,
- Reduce travel times,
- Reduced vehicle operating costs,
- Stimulate economic activity,
- Create employment opportunities,
- Improve connectivity to the Rift Valley and Western Kenya Regions,
- Provide high level of service through long term operation and maintenance (27 years),
- Allow the Government of Kenya to channel its resources to other priority projects as construction is financed via private funds.

Expanded capacity – improved quality

- Widening of a 175 km section of the existing highway between Rironi and Mau Summit into a four lane dual carriageway and future augmentation into a six lane carriageway in sections depending upon traffic volumes,
- Rehabilitation of a 57 km section of the existing single carriageway of A8-South highway between Rironi and Naivasha via Mai Mahiu,

Road Segments	Road Section	Section Number	Start-End Points	Approximate length (km)
A8 (total: 175km)	Rironi to Mau Summit	1	Rironi – Naivasha	58
		2	Naivasha – Elementaita Road	55
		3	Elementaita Road – Njoro Turnoff (Nakuru Town)	15
		4	Njoro Turnoff – Mau Summit	45
A8-South (total: 57km)	Rironi Interchange to Naivasha Interchange	5	Rironi – Mai Mahiu	19
		6	Mai Mahiu - Naivasha	37



NEW INFRASTRUCTURE AND FACILITIES TO IMPROVE MOBILITY AND QUALITY OF SERVICE

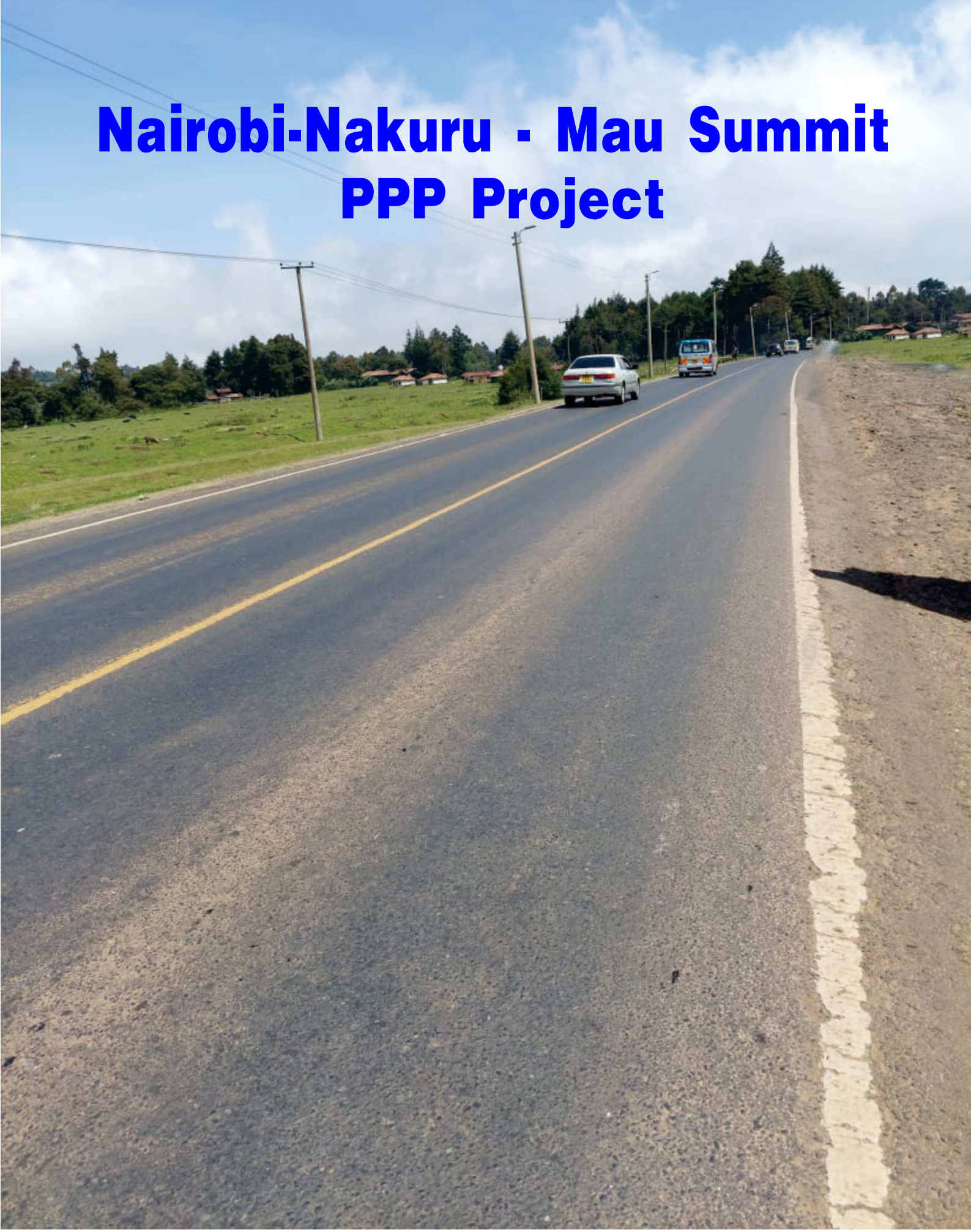
- Viaduct through Nakuru Town,
- Grade separated interchanges,
- Bridges, underpasses and overpasses for pedestrians, vehicles and the railway,
- Improvements of major and minor roads junctions,
- Livestock and wildlife crossing points and associated fencing,
- Bus bays and shelters,
- Truck lay-byes,
- Street lighting and high mast lighting facilities,
- Addition of service lanes near towns and urban stretches,
- Installation of safety barriers,
- Improved landscaping.

THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT PROCESS (ESIA):

Stakeholder participation and consultation is essential for the success of the Project. Rift Valley Highway Limited is committed to make sure that all stakeholders and communities concerned by the Project are well informed about its characteristics and impacts.

In order to mitigate the environmental and social impacts of the Project and include these mitigations measures in the Project Design, Rift Valley Highway Limited launched the ESIA in October 2020 with the assistance of WSP Canada.

Nairobi-Nakuru - Mau Summit PPP Project



KeNHA

Public Private Partnerships Unit
The centre of PPP expertise

meridiam
INVESTING FOR THE COMMUNITY

VINCI HIGHWAYS

Nairobi-Nakuru-Mau Summit PPP project

The Government of the Republic of Kenya, through the Ministry of Transport, Infrastructure, Housing, Urban Development and Public Works represented by the Kenya National Highways Authority (KeNHA), identified the need for the rehabilitation, improvement and expansion of the Nairobi–Nakuru–Mau Summit (A8) highway.

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> **The A8 highway is part of the Northern Corridor which is one of the busiest and most important transport corridors in East and Central Africa.**

BENEFITS

The Highway Project will:

- Reduce road accidents and improve safety
- Reduce travel times
- Create employment opportunities
- Stimulate economic activity
- Improve connectivity to the Rift Valley and Western Kenya Regions
- Provide high level of service through long term operation and maintenance (26,5 years)
- Savings in vehicle operating costs
- Allow the Government of Kenya to channel its resources to other priority projects as construction is financed by private funds

PROJECT DESCRIPTION

- Widening of a 175 Km section of the existing A8 highway between Rironi and Mau Summit into a four lane dual carriageway and future augmentation into a six lane carriageway to be triggered when traffic volumes increase.
- Rehabilitation of a 57 Km section of the existing single carriageway of A8-South highway between Rironi and Naivasha via Mai Mahiu.
- Operation and maintenance of the Project Road

ROAD SEGMENTS	ROAD SECTION	SECTION NUMBER	START-END POINTS	APPROXIMATE LENGTH (KM)
A8 175 km	Rironi to Mau Summit	1	Rironi – Naivasha	58
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		6	Mai Mahiu - Naivasha	37

NEW INFRASTRUCTURES AND FACILITIES TO IMPROVE MOBILITY AND QUALITY OF LIFE		
	A8 (175 km) Rironi to Mau Summit	A8 South (57 km) Rironi to Naivasha
Interchanges (major junctions	14	-
Nakuru viaduct	1	-
Vehicle overpasses	26	-
Vehicle underpasses	16	-
Pedestrian overpasses	50	-
Pedestrian underpasses	56	-
Livestock crossing	45	-
Railway crossing	5	3
River bridge	4	-
Wildlife crossing	15	-
Truck bays (both sides)	25	9
Bus bays (both sides)	43	17
Length of street lighting	73 km	13 km

MAIN ENVIRONMENTAL AND SOCIAL ISSUES AND CONCERNS
A8 and A8 South
- Traffic /fluidity (Urban areas/population, agricultural activities, Livestock, Vulnerable groups, Road users, Tourists)
- Safety (urban areas/population, agricultural activities, Livestock, Road users)
- Highway users' services/needs (rest areas, public toilet, Others)
- Storm water management (flooding)
- Vegetation and visual environment
- Ecosystem services (natural resources)
- Nuisance control (noise, dust, etc.)
A8
- Wildlife movement (presence of endangered species)
- Mobility/crossing (urban areas/population, agricultural activities, Livestock, Vulnerable groups, Road users)
- Access (Institutions, Businesses / Market, Touristic facilities)
- Local economy (agriculture, street vendors and kiosks)
- Social cohesion

THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT PROCESS (ESIA): FOR THE TERRITORY, WITH THE COMMUNITIES

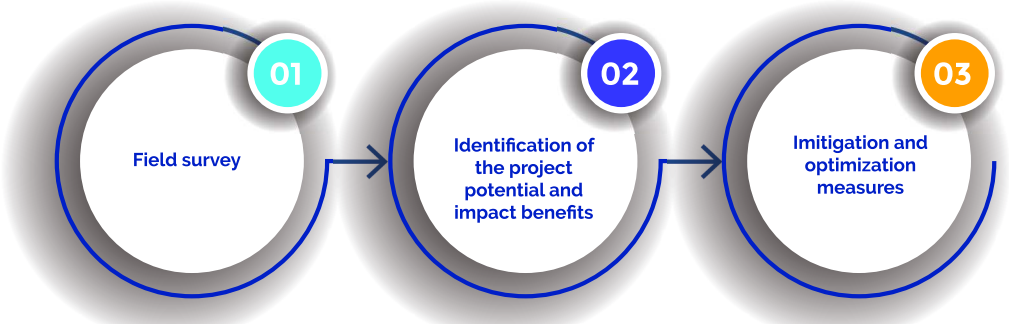
Stakeholder participation and consultation is essential for the success of the Project. Rift Valley Highway is committed to make sure that all stakeholders and communities concerned by the Project are well informed about its characteristics and impacts.

In order to mitigate the environmental and social impacts of the Project and include these mitigations measures in the Project Design, Rift Valley Highway launched the ESIA in October 2020 with the assistance of WSP Canada.
Three rounds of public consultations will be successively organized. With a social inclusion perspective, meetings with stakeholders will take into consideration specific needs of women, youth, communities, as well as vulnerable and marginalized groups.

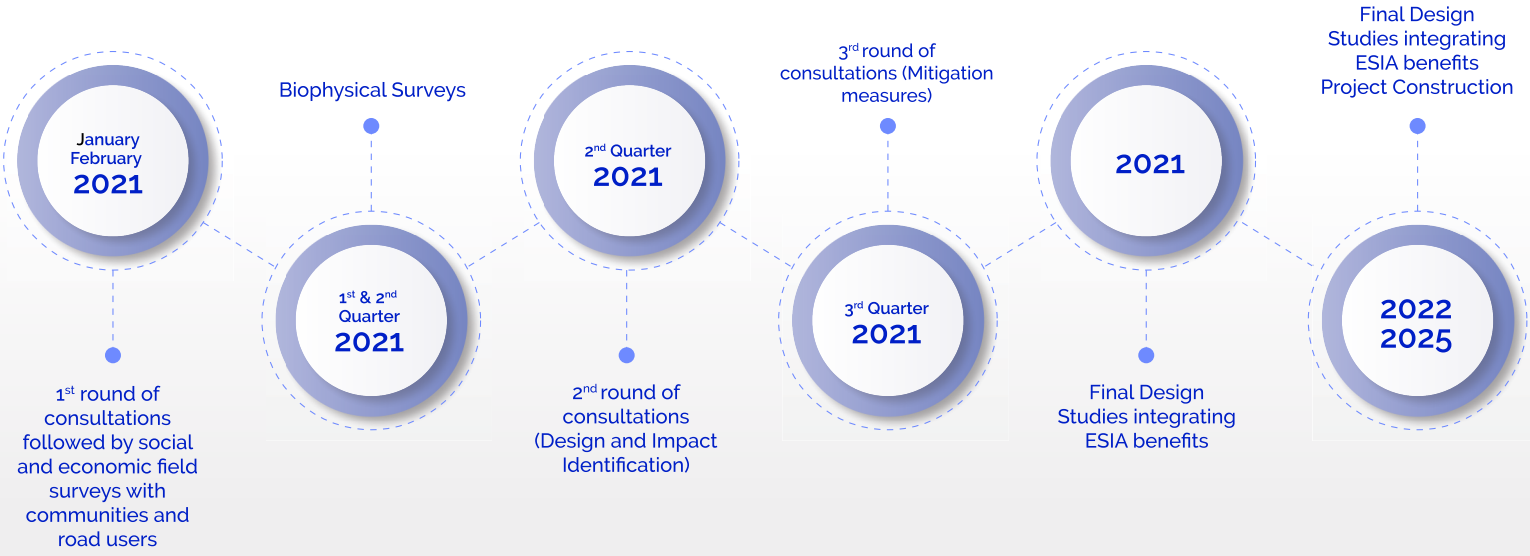
OBJECTIVES OF THIS 2nd ROUND OF PUBLIC CONSULTATIONS:

- Present the project progress and details to relevant stakeholders
- Identify the main environmental and social issues and concerns
- Collect stakeholders' comments, apprehensions and recommendations
- Engage participation around the proposed design

ESIA MAIN STEPS



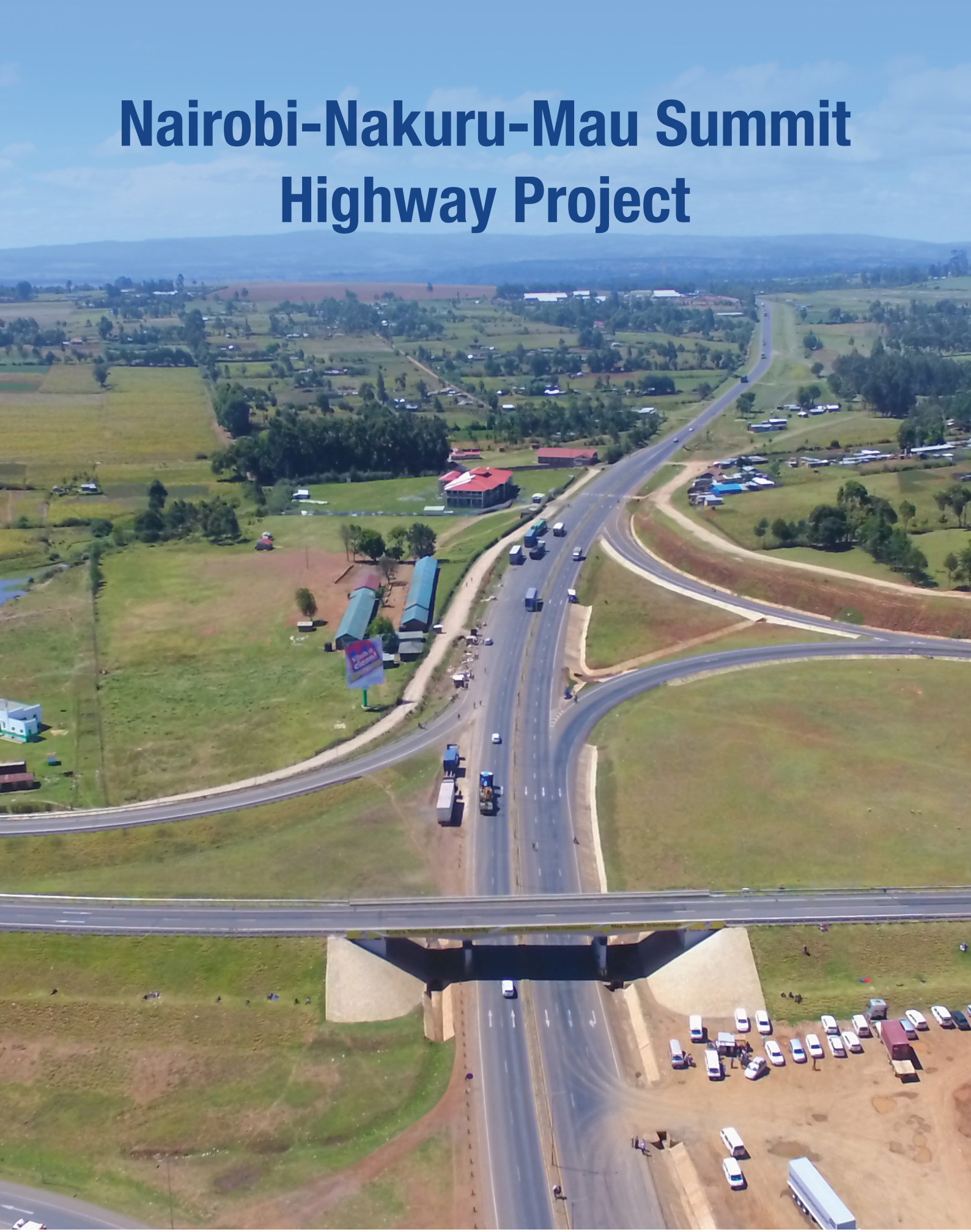
NEXT STEPS



The Environmental and Social Impact Studies of the Nairobi-Nakuru-Mau Summit PPP Project on behalf of the Project Company, Rift Valley Highway Limited, was entrusted to the Canadian consulting company WSP Canada Inc.

CONTACT US: Rift Valley Highway Limited | kenneth. kamau@riftvalleyhighway.co.ke | WSP | Ghyslain.Pothier@wsp.com

Nairobi-Nakuru-Mau Summit Highway Project



KeNHA

RIFT VALLEY HIGHWAY

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Meridiam for people and the planet

VINCI HIGHWAYS

NAIROBI-NAKURU-MAU SUMMIT HIGHWAY PROJECT

The Government of the Republic of Kenya, through the Kenya National Highways Authority (KeNHA), identified the need for the rehabilitation, improvement and expansion of the Nairobi–Nakuru–Mau Summit (A8) highway.

The A8 highway is part of the Northern Corridor which is one of the busiest and most important transport corridors in East and Central Africa. It serves as the primary road transportation link for over 6 million Kenyans. Expanding the road capacity and improving the road quality between Nairobi and Mau Summit will accommodate the increasing traffic in a safe, efficient and sustainable manner.

This Project largely contributes to the realization and implementation of the Public Private Partnership (PPP) agenda in Kenya through the delivery of first-class Infrastructure projects capable of meeting social and economic requirements of the people of Kenya in a timely, transparent and accountable manner as envisioned in the Vision 2030 blue print and The Big Four Agenda.

After a competitive international tender process, the Project was awarded to an international consortium comprising of VINCI Highways, Meridiam Infrastructure Africa Fund and VINCI Concessions which has now incorporated a dedicated company in Kenya to deliver the Project, Rift Valley Highway.

> **The A8 highway is part of the Northern Corridor which is one of the busiest and most important transport corridors in East and Central Africa.**

BENEFITS

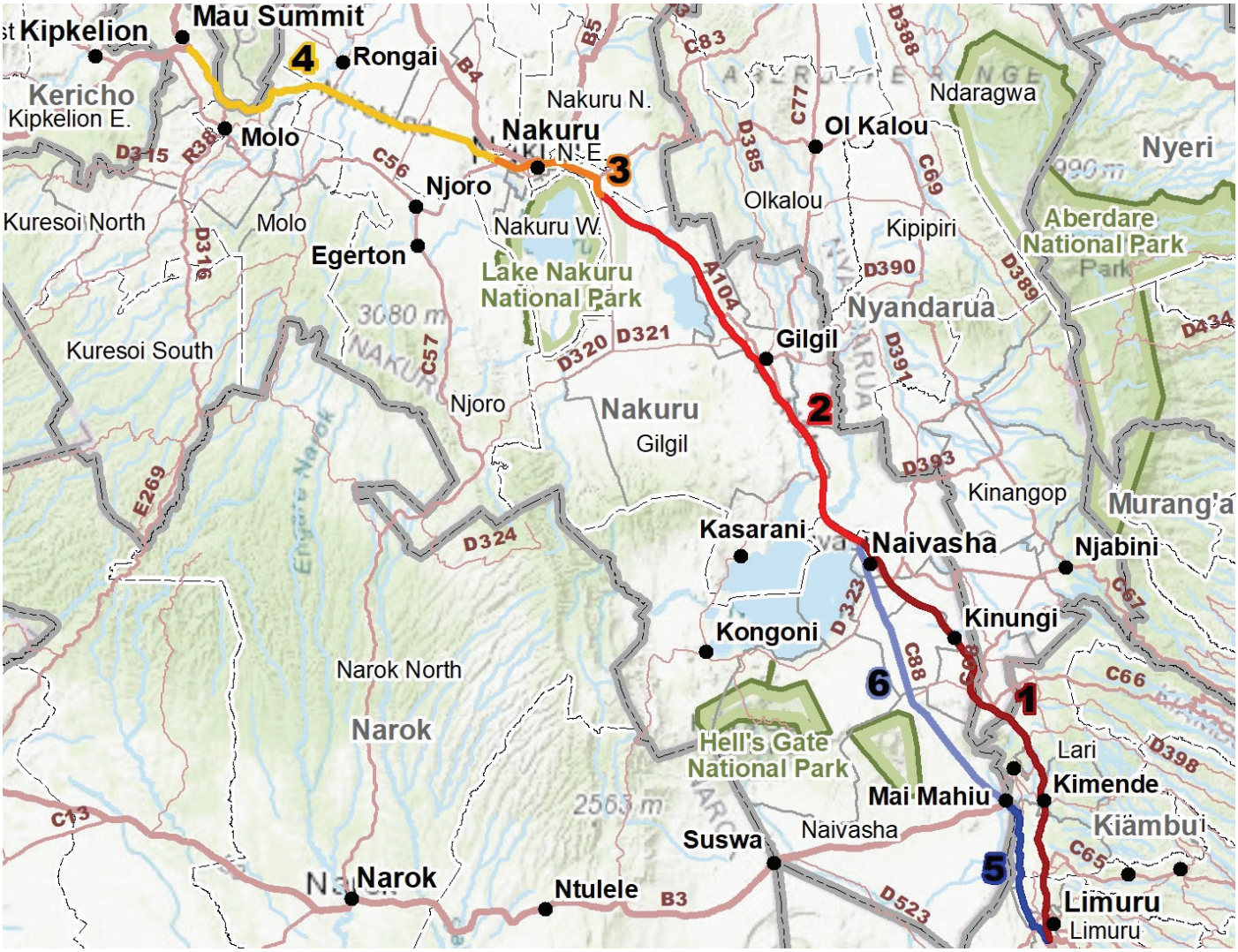
The Highway Project will:

1. Reduce road accidents and improve safety
2. Reduce travel times
3. Create employment opportunities
4. Stimulate economic activity
5. Improve connectivity to the Rift Valley and Western Kenya Regions
6. Provide high level of service through long term operation and maintenance (26,5 years)
7. Enhance savings in vehicle operating costs
8. Allow the Government of Kenya to channel its resources to other priority projects as construction is financed by private funds

PROJECT DESCRIPTION

- Widening of a 175 Km section of the existing A8 highway between Rironi and Mau Summit into a four-lane dual carriageway and future augmentation into a six lane carriageway to be triggered when traffic volumes increase.
- Rehabilitation of a 57 Km section of the existing single carriageway of A8-South highway between Rironi and Naivasha via Mai Mahiu.

ROAD SEGMENTS	ROAD SECTION	SECTION NUMBER	START-END POINTS	APPROXIMATE LENGTH (KM)
A8 175 km	Rironi to Mau Summit	1	Rironi – Naivasha	58
		2	Naivasha – Elementaita Road	55
		3	Elementaita Road – Njoro Turnoff (Nakuru Town)	15
		4	Njoro Turnoff – Mau Summit	45
A8-South 57 km	Rironi Interchange to Naivasha Interchange	5	Rironi – Mai Mahiu	19
		6	Mai Mahiu - Naivasha	37



THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT PROCESS (ESIA): FOR THE TERRITORY, WITH THE COMMUNITIES

Stakeholder participation and consultation is essential for the success of the Project. Rift Valley Highway is committed to make sure that all stakeholders and communities concerned by the Project are well informed about its characteristics and impacts.

In order to mitigate the environmental and social impacts of the Project and include these mitigations measures in the Project Design, Rift Valley Highway launched the ESIA in October 2020 with the assistance of WSP Canada.

Two rounds of public consultations have been successfully held with a third scheduled to take place from 25 October. The meetings with stakeholders take into consideration specific needs of women, youth, communities, as well as vulnerable and marginalized groups. stakeholders will take into consideration specific needs of women, youth, communities, as well as vulnerable and marginalized groups.

OBJECTIVES OF THIS 3RD ROUND OF PUBLIC CONSULTATIONS:

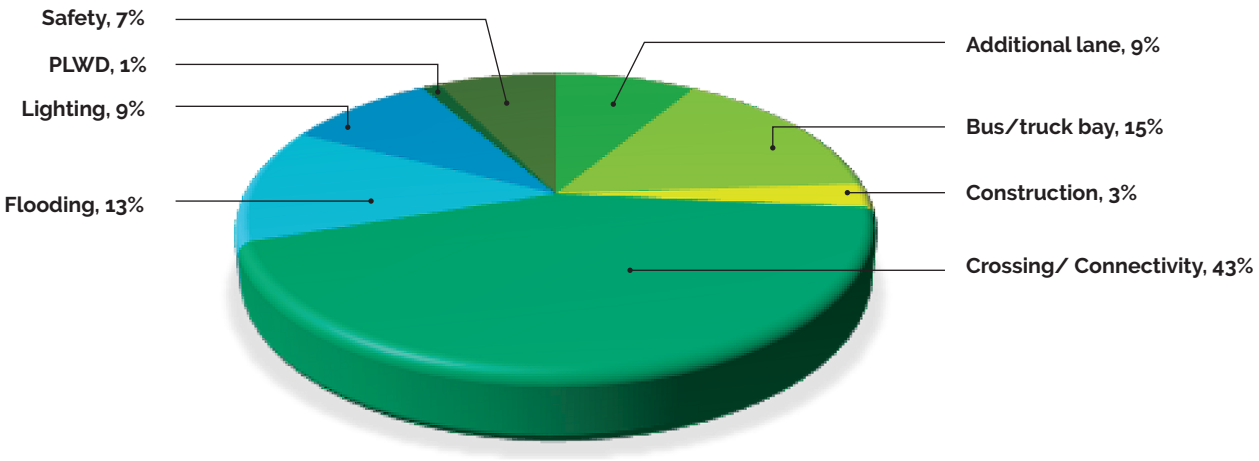
- Present potential social and environmental impacts of the project and the proposed mitigation measures and management plans
- Collect stakeholders' additional comments, concerns and recommendations

ESIA MAIN STEPS

STAKEHOLDERS ENGAGEMENT AND PUBLIC CONSULATION

Following the 2 first rounds of consultation, many inputs were made by stakeholders, enabling the Project design to be improved by incorporating the feedback received. A total of 80% of the inputs were totally or partially integrated into the updated design of the Nairobi-Nakuru-Mau Summit Highway Project.

INPUTS BY TOPIC



POTENTIAL IMPACTS	PROPOSED MITIGATION MEASURES
Physical Environment	
Degradation of local air quality **(C)**	Avoid vehicle idling. Maintain vehicle/machinery. Limit speed at work sites. Use water sprays as dust abatement. Use tarpaulin when transporting fine granular material.
Rise of local noise levels **(C/O)**	Maintenance of vehicles/machinery. Limit speed at work sites. Limit use of motor brakes. Monitor noise levels (construction). Install noise barriers where required. Develop/implement a Grievance Reporting and Redress mechanism.
Modification to surface water flow and quality **(C/O)**	Maintain minimal waterflow at all time. Maintain vehicles/machinery. Avoid storage of granular material near watercourses. Upgrade water crossing infrastructures to avoid flooding. Install silt screens. Keep spill kits available. Adequate storage of hazardous material/wastes. Control efficiency of water treatment installations. Develop/Implement a Grievance Reporting and Redress mechanism.
Modification to Groundwater quality and quantity **(C)**	Apply measures proposed for surface water quality. Limit groundwater use to essential needs. Maintain infrastructure/equipment using water to eliminate leaks. Consider using captured rainwater.
Increase in soil erosion **(C)**	Minimize disturbance to existing vegetation. Conduct regular slope stability assessments. Revegetate rapidly cleared areas
Modification to soil and sediment quality **(C/O)**	Implement applicable surface water quality measures. Manage contaminated soils/sediments through authorized companies/disposal sites.
Biological Environment	
Loss of habitat and flora **(C)**	Limit vegetation clearing to construction area. Revegetate after work. Manage cleared invasive species. Compensate vegetation losses with indigenous species.
Loss/modification of habitat, limitation of movement and potential mortality of fauna **(C)**	Implement measures associated with noise levels, water quality and flora. Prohibit hunting by workers. Stop or limit work in sensitive bird breeding area (breading season). Implement wildlife crossing points Develop/apply a roadkill monitoring program.
Modification to freshwater ecology **(C/O)**	Implement applicable surface water quality measures. Ensure upstream/downstream connectivity for fish. Restore shores and riverbeds after construction. Prohibit fishing by workers.
Loss of ecosystem services **(C)** (flora use as traditional medicine)	Implement measures associated with habitat/flora. Compensate vegetation losses with indigenous species traditionally used by communities.
Human Environment	
Loss of land – potential land requirements outside the ROW **(C/O)**	Develop / implement a resettlement action plan
Loss of community well-being and safety **(C/O)**	Implement air quality and noise mitigation measures. Ensure drivers are licenced and trained. Develop/implement a traffic management plan, a stakeholder engagement plan and a worker's Code of conduct. Organize trainings on various health and safety topics.
Modification to living condition, social amenities and community assets **(C/O)**	Implement noise related mitigation measures. Develop/implement a traffic management plan. Maintain and improve highway crossing capacity (pedestrian and vehicular).
Modification to livelihood strategies and economic activities **(C/O)** - (potential effect on VMGs)	Implement air quality, noise reduction, surface and groundwater quality as well as freshwater ecology mitigation measures. Develop/implement a traffic management plan. Maintain access to commercial/industrial sites along highway. Maintain capacity of crossing the road by Cattle owners.
Modification of Labour conditions **(C/O)** (may affect VMGs and Gender aspects).	Develop/implement clear hiring guidelines. Include labour/Health Safety and Environment criteria in contractual documents. Monitor contractors/subcontractors activities. Develop/implement a grievance mechanism for workers. Maximise hiring of local labour (social inclusion). Ensure equality of opportunity/treatment for employees. Develop/apply a Gender and Social Inclusion Policy.
Degradation/perturbation of public infrastructure services **(C)**	Develop/implement a traffic management plan. Maintain good communication to minimize disruption of services. Location adequately underground services prior to excavation.
Damage/destruction of archaeological/cultural sites **(C)**	Develop/apply a chance-find procedure. Maintain secure access to the Sachangwan memorial site
Modification to the visual environment **(C/O)**	Consider developing an architectural design well integrated in its visual environment. Include vegetation to beautify.

C = during construction / **O**= during operation

NEXT STEPS

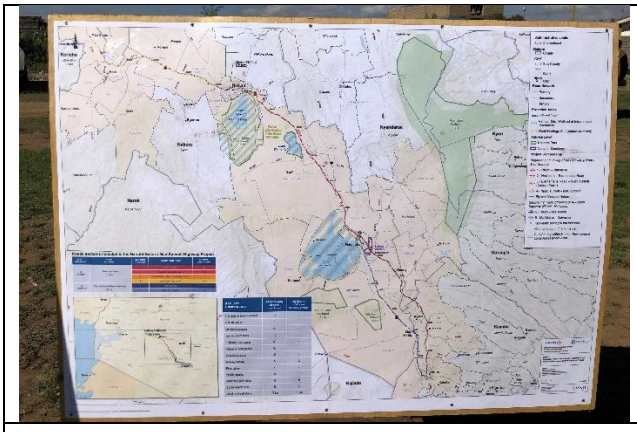
November 2021:	3rd round of consultations (Mitigation measures)
December 2021	Submission of complete ESIA
2022	Final Design Studies Integrating Esia Requirement
2022 –2025:	Project Construction

The Environmental and Social Impact Studies of the Nairobi-Nakuru-Mau Summit Highway Project, on behalf of the Project Company, was entrusted to the Canadian consulting company **WSP Canada Inc.**

CONTACT US: Rift Valley Highway Limited. | Kenneth.Kamau@riftvalleyhighway.co.ke | WSP | Ghyslain.Pothier@wsp.com

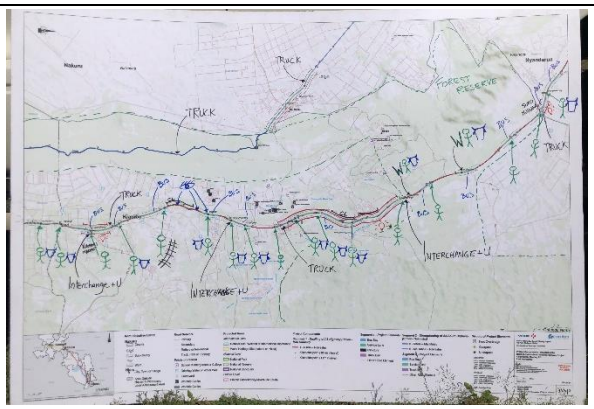
TOOLS AND SUPPORT

PUBLIC CONSULTATION
MAP

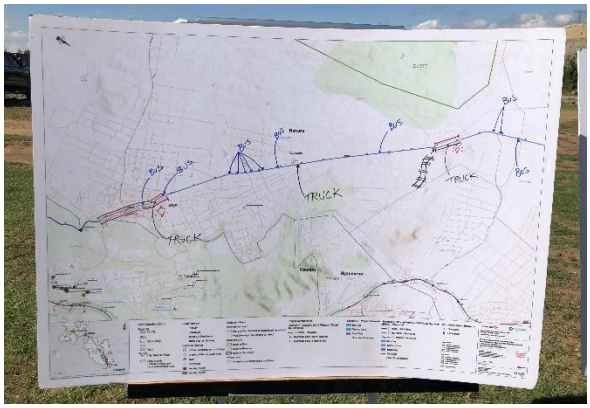


General Project Map

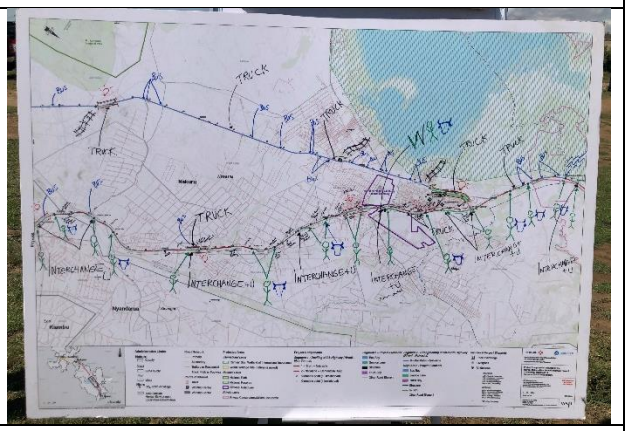
Limuru Sub-County Map Section



Lari Sub-County Map Section



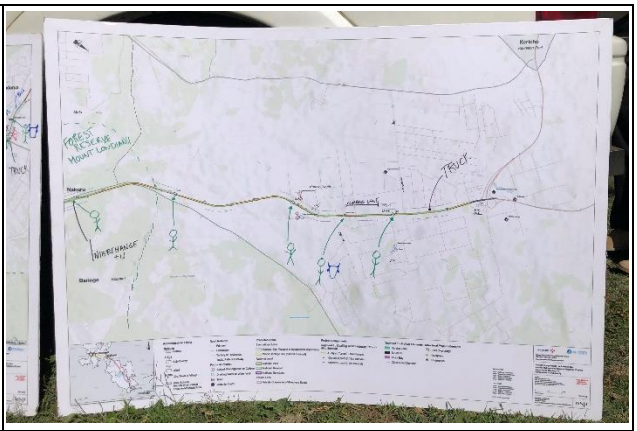
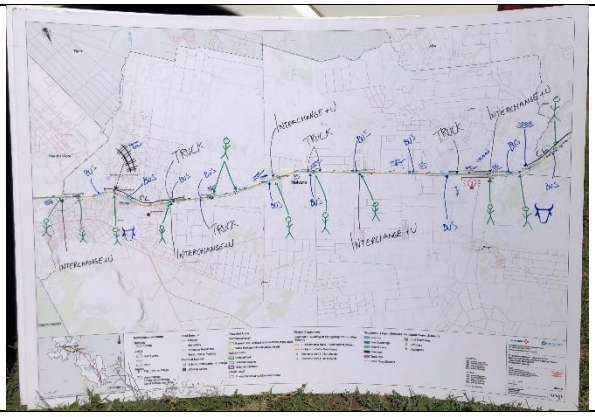
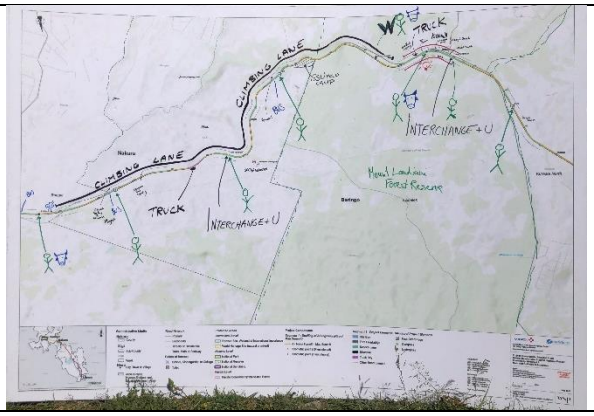
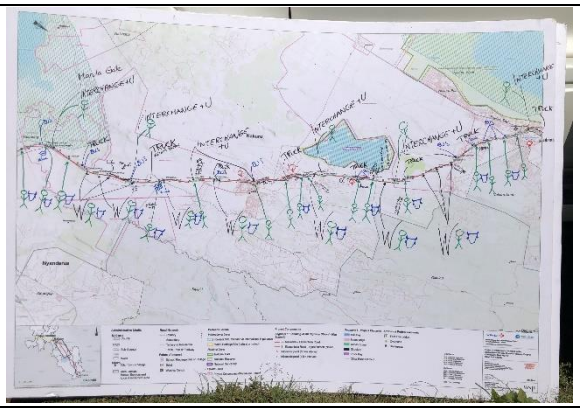
Naivasha Sub-County Southern Map Section



Naivasha Sub-County Northern Map Section

TOOLS AND SUPPORT

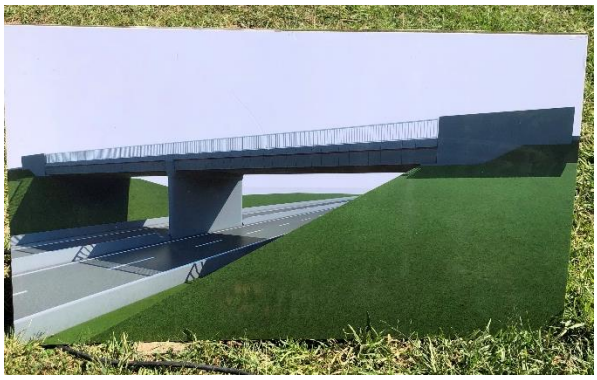
PUBLIC CONSULTATION
MAP

	
Kinangop Sub-County Map Section	Kuresoi North Sub-County Map Section
	
Rongai Sub-County Map Section	Molo and Koibatek Sub-Counties Map Section
	
Gilgil Sub-County Map Section	Nakuru East and Nakuru West Sub-Counties Map Section

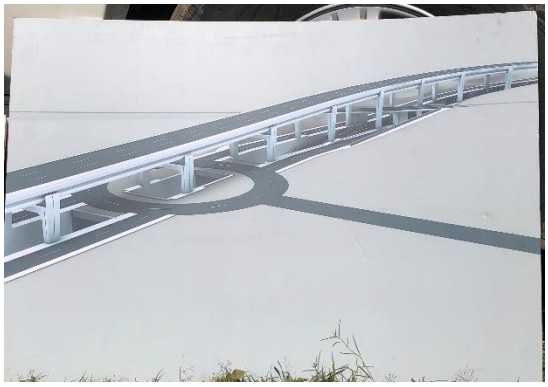
TOOLS AND SUPPORT

PUBLIC CONSULTATION
INFRASTRUCTURE VISUAL IMAGES

Underpass example

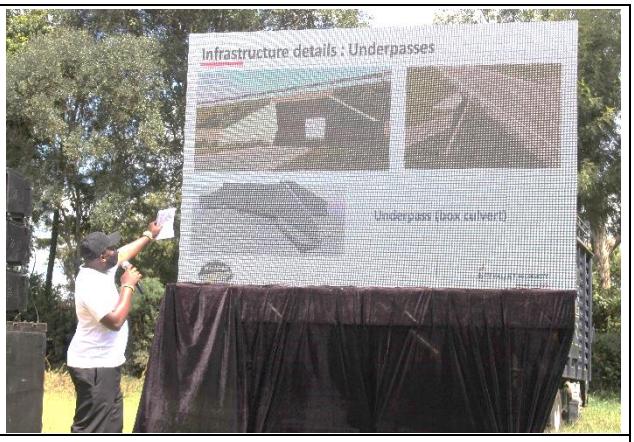


Overpass example



Nakuru Flyover concept

Nakuru Flyover concept



Power Point screen presentation

Nairobi – Nakuru – Mau Summit PPP Project

Project Overview

KeNHA

Public Private Partnerships Directorate

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VINCI HIGHWAYS

A STRATEGIC GATEWAY

Part of the Northern Corridor &

The Trans Africa Highway Network

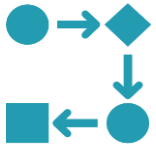
- **Provides a gateway through Kenya to Uganda, Rwanda, Burundi, Southern Sudan and Eastern DR Congo**

- **Serves as a transportation link for approximately 6 Million Kenyans**

WHY THIS PROJECT?

An urgent need for the rehabilitation, improvement and expansion of a key transport infrastructure project

- **To accommodate the increasing traffic in a safe and sustainable manner, an expansion of the road capacity and improvement of the road quality between Nairobi and Mau Summit is required**
- **One of the busiest and most dangerous road in Kenya**



- **The Government of the Republic of Kenya decided to implement this key infrastructure project through the Private Public Partnership (PPP) model**

- **The Project largely contributes to the realization and implementation of the PPP agenda in Kenya through the delivery of first-class Infrastructure projects capable of meeting social and economic requirements of the people of Kenya in a timely, transparent and accountable manner as envisioned in the Vision 2030 blueprint and The Big Four Agenda**

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VINCI HIGHWAYS

A CLEAR TIMETABLE

Rehabilitation, improvement and expansion of the Nairobi–Nakuru–Mau Summit Highway (A8 & A8 South)

Project

- Widening 175 Km (A8) into a four-lane dual-carriageway
- Future augmentation into a six-lane dual-carriageway to meet traffic volumes demand
- Rehabilitation of 57 Km section (A8 South)

- Feasibility study conducted by KeNHA confirmed the development of the Project through a PPP model
- International competitive bid process launched with final bids submitted in 2018
- Project Agreement (Contract) executed in September 2020

30 Years' Partnership

- 3.5 years: Design and construction of the Project road
- 26.5 years: Maintenance and operation of the Project road with a high level of service
- After 30 years: Hand back of the Project road to KeNHA

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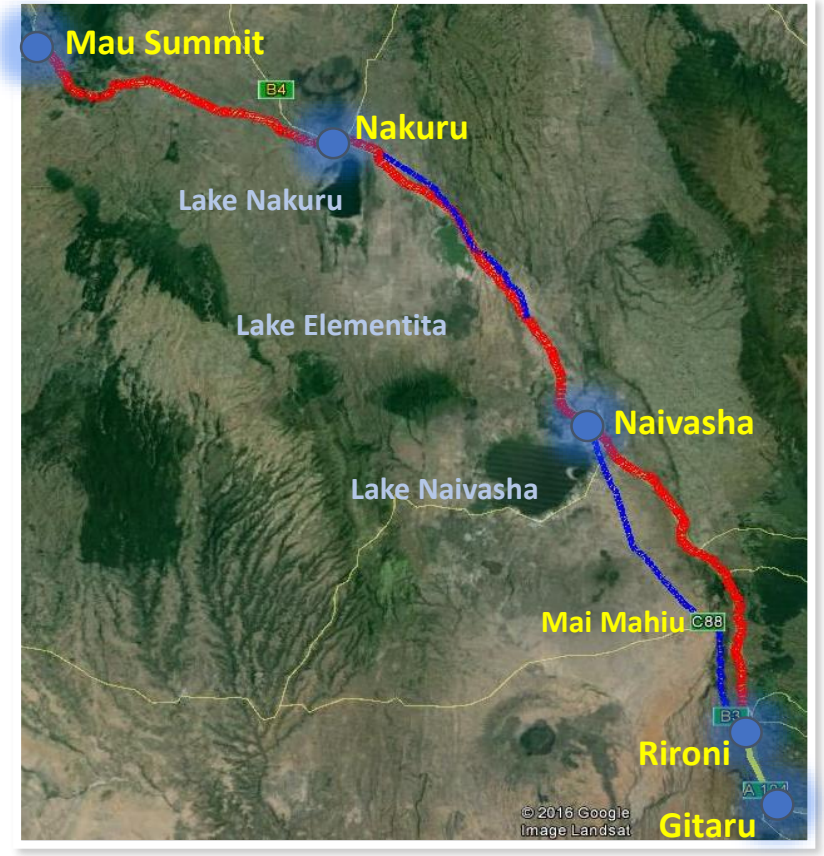
VINCI HIGHWAYS

A CADENCED ACTION PLAN



Road Segments	Road Section	Section Number	Start – End Points	Approximate Length (KM)	Scheduled Completion Date
A8 (Total: 175km)	Ririoni to Mau Summit	1	Ririoni – Naivasha	58	3 years, 1 month
		2	Naivasha - Elementaita Rd. (A8)	55	2 years, 7 months
		3	Elementaita Rd. - Njoro Rd. (A8)	15	3 years, 6 months
		4	Njoro Rd. - Mau Summit (A8)	45	2 years, 1 month
A8 – South (Total: 57km)	Ririoni Interchange to Naivasha Interchange	5	Ririoni-Mai Mahiu (A8-South)	19	13 months
		6	Mai Mahiu-Naivasha (A8-South)	37	13 months

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VINCI HIGHWAYS

STRONG AND LONG-TERM PARTNERSHIP

Kenya National Highways (KeNHA): Contracting Authority

- Created through the Roads Act, 2007
- Mandated to construct and maintain National Trunk Roads
- Responsible for approximately 18,000km of National Trunk Roads

Rift Valley Highway: Project Company (VINCI & MERIDIAM)

- Formed by 2 international firms with large experience in infrastructure projects across the World.
- Committed to delivering the project with strong and positive environmental and social legacy

National Treasury – PPP Directorate

- Control and Oversight of the PPP process
- Provide Advisory and Support to KeNHA (Technical, Financial & Legal)
- Interface to the support function of the National Treasury to the Project

Supported by:

KeNHA

Public Private Partnerships Directorate

meridiam INVESTING FOR THE COMMUNITY

VINCI HIGHWAYS

CLEAR ALLOCATION OF RESPONSIBILITIES

KeNHA

Contracting Authority

- ✓ **Control and audit of the Project Company activities toward the requirements of the Project Agreement**
- ✓ **Provision of a unencumbered Right of Way for the construction of the road (Implementation of the project's Resettlement Action Plan)**

Rift Valley Highway

Project Company

- ✓ **Design, build, finance, operate and maintain the Project Road for 30 years with the highest performance standards**
- ✓ **Management of the environmental and social issues during the design, construction and operation periods.**

National Treasury/PPP Directorate

- ✓ **Provide supporting instruments to lower premiums factored for political risks in order to reduce cost & ensure bankability of the project**
- ✓ **Ensure direct & contingent financial commitments arising from the project are affordable and sustainable.**

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VINCI HIGHWAYS

BALANCED RISK ALLOCATION

Risk Allocation	Project Company	GoK (KeNHA)
Design	✓	
Land Acquisition		✓
Necessary Consents & Permits	✓	
Construction (Quality & Timely Completion)	✓	
Financing (Debt and Equity)	✓	
Force Majeure	✓	✓
Axle Overloading Enforcement		✓
Project Road Revenue		✓
Operations & Maintenance of Project Road	✓	
Performance of the Project Road	✓	
Kenya Inflation & Forex		✓
Local Currency Interest Rate		✓
Political Risk		✓

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VINCI HIGHWAYS

The strong Benefits of the Road Project

KeNHA

Public Private Partnerships Directorate

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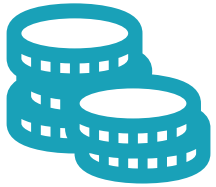
VINCI HIGHWAYS

POSITIVE MOBILITY

- Improve connectivity to Rift Valley and Western Kenya Regions
- Reduce road accidents and improve safety

- Reduce travel times and vehicle operating costs
- Provide high level of service



- Stimulate economic activity sustainably
- Create employment opportunities

- Allow the Government of Kenya to channel its resources to other priority projects as construction is financed with private funds (loans and equity)

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Public Private Partnerships Directorate

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VINCI HIGHWAYS

TANGIBLE PROGRESS

High-quality highway

- Dual carriageway
- Improvements on major junctions
- Connection of minor roads through service roads;
- Grade separated interchanges;
- Variable message signs – to guide road users

Safety upgrades

- Improved geometrics
- Street lighting
- Service lanes in town
- Climbing lane at steep gradient locations
- Improvement of existing U-Turn facilities
- Truck lay-bye
- Metal guard rail and breast at escarpment locations
- Non-motorized transport facilities

Multi-modality

- Bus bays and shelters
- Pedestrian underpasses & overpasses
- Train & vehicles underpasses and overpasses

Environment in action

- Landscaping
- Wildlife and livestock crossing point
- Extensive Biodiversity Studies carried out
- Stakeholder and community engagement
- Vulnerability and Social Inclusion
- Adherence to international best practices

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VINCI HIGHWAYS

A CONSULTATIVE APPROACH – “PEOPLE FIRST”

A comprehensive Stakeholder Engagement and Public Consultation Process

Field Surveys

Stakeholders Consultation

Social & Environmental Assessment

Action Plan for Social & Environmental Legacy

ADDRESSING SOCIAL & ENVIRONMENTAL EFFECTS

Preparation of an Environmental and Social Impact Assessment (ESIA) for the Project

- **Update of the preliminary ESIA prepared by KeNHA**
- **Development of an ESIA in accordance with international best practices**
- **Review and analysis of all social and environmental impacts of the Project**
- **Mitigation of the impacts during the construction and operation of the Project Road through adapted project design and appropriate environmental and social measures**

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VINCI HIGHWAYS

POLICY ON EMPLOYMENT & LOCAL CONTENT

- **Target local employment as much as possible, depending on the qualifications needed and available.**

- **Training and skill development of workers**

- **Construction materials, Goods and services to be sourced locally as much as possible**

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VINCI HIGHWAYS

RESETTLEMENT POLICY

Key Concern	Response
• When will land & property owners/communities receive their compensation for displacement of their houses/ structures/ business?	KeNHA is in charge of the compensation and resettlement of people affected by the Project
• Will additional people be displaced by the Project?	At this stage, the Project alignment will remain within the existing Right of Way hence no additional displacement of people is anticipated
• How will those who have not been identified as impacted by the Project and who believe that are impacted, be eligible for compensation?	KeNHA has developed a grievance redress platform. Such cases should be escalated to KeNHA for review

Why tolling on the highway?

KeNHA

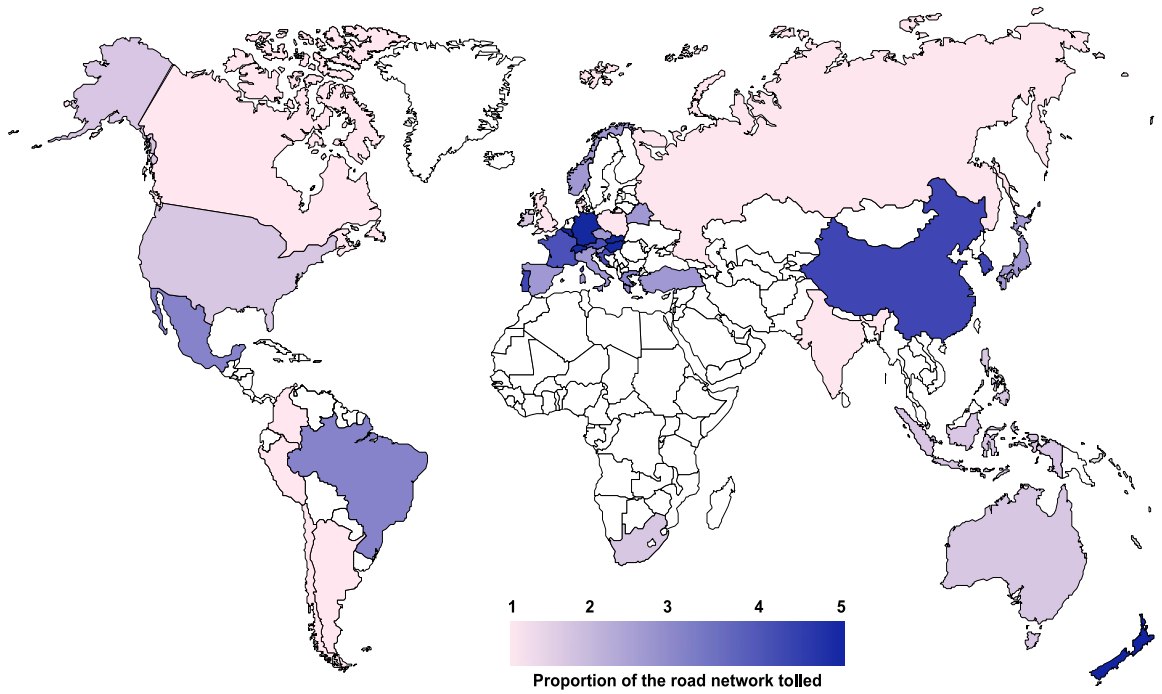
Public Private Partnerships Directorate

meridiam INVESTING FOR THE COMMUNITY

VINCI HIGHWAYS

BRIDGING THE GAP & IMPROVING MOBILITY

Road tolling is becoming global and progressing fast



Tolling of the Project Road will pave the way to a more connected & competitive country

Proposed Toll Tariff

KES 6

per Km/PCU.

- Develop, rehabilitate and maintaining Kenya's national road network
- Benefit from quality highway
- Save time and costs

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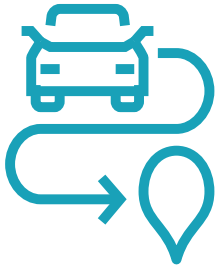
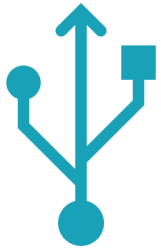
A FAIR & EQUITABLE POLICY



Discounts for repeated users

Waiver of tolls for certain vehicles & short trips



Electronic toll payments through technologies & payment systems to allow for quicker processing of payments at toll stations and later migrate to a free-flow system

Equitability of toll tariffs among different classes of vehicles & road users

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TOLL TARIFFS & SYSTEMS

The policy proposes toll tariffs to be based on:

- **The cost of developing, rehabilitating and maintaining Kenya's national road network**
- **Road user benefits that will accrue from reduced vehicle maintenance costs and time saved from use of tolled roads.**
- **The impact different vehicle types have on road asset construction and maintenance costs**
- **External impacts of road use, including congestion and pollution**
- **Policy objectives, including those related to balancing different modes of transport and spatial development**

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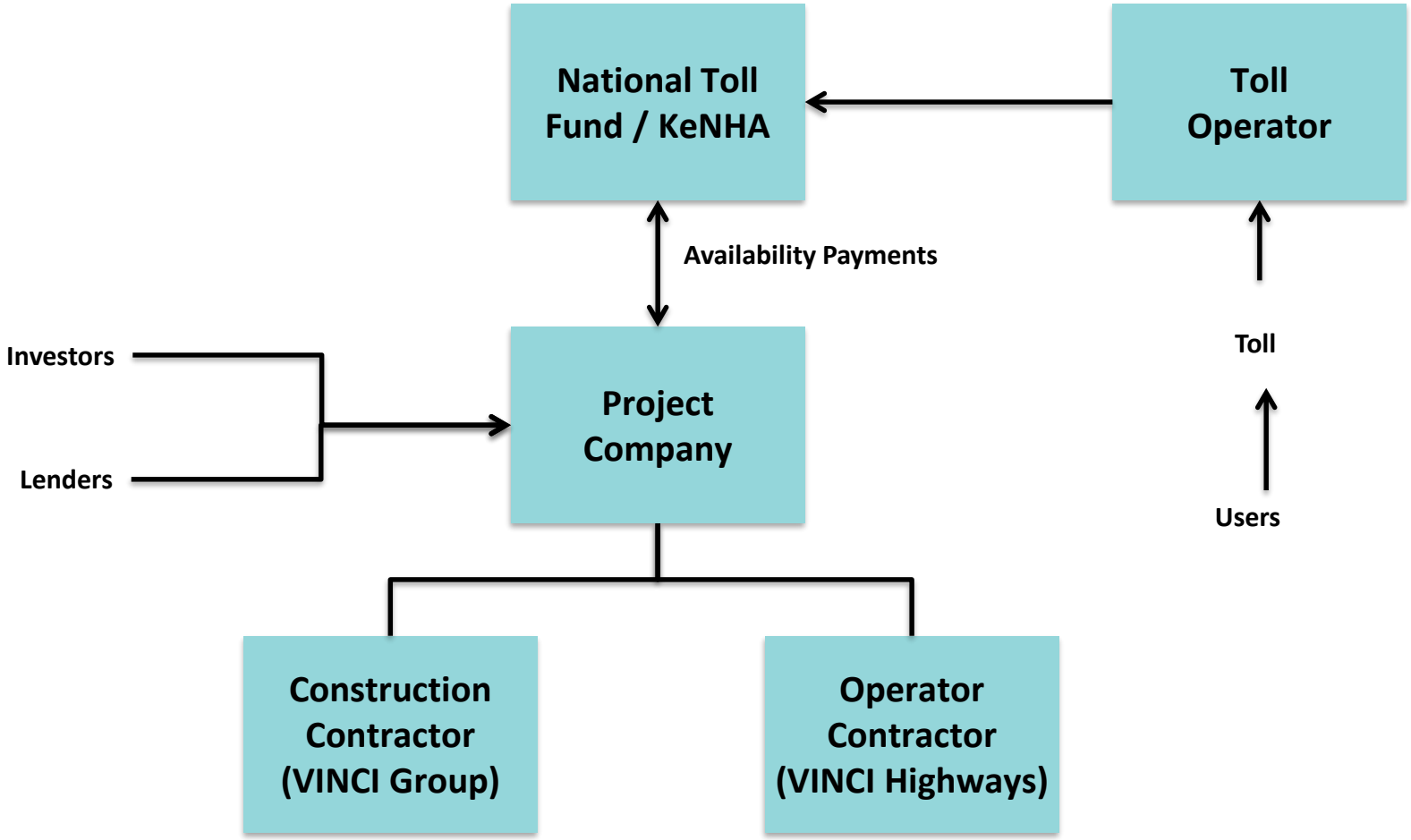
TOLLING SYSTEMS

The Tolling systems includes:

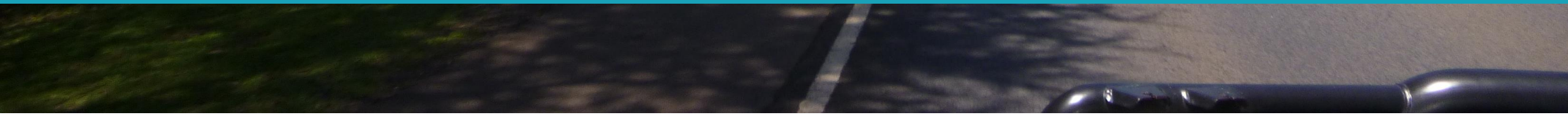
- **Open System**
- **Toll Technology - RFID**
- **Toll Plazas**
- **Toll Rates**
- **Discounts & Exemptions**
- **Sensitization**

COST RECOVERY PLAN

- Toll Revenues channeled into a national toll fund
- Additional Budget appropriation
- Advertisements
- Roadside stations



Conclusion



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Driving Sustainable Investments

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PROJECT IN A NUTSHELL

30-year project:

- **A8: 175Km (Rironi to Mau Summit)**
- **A8-South: 57 KM (Rironi – Mai Mahiu - Naivasha)**

Benefits:

- **Improve connectivity to Rift Valley and Western Kenya regions**
- **Provide high quality works that emphasize and improve on road safety**
- **Stimulate economic activity and create employment and trade opportunities**
- **Provide high level of service through long-term operation and maintenance**

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NEXT STEPS

Q4 2020
Signing of the Project Agreement between KeNHA and Rift Valley Highway

1st & 2nd Quarter

Biophysical Surveys

2nd Quarter 2021

2nd Round Consultations (Impact Identification)

3rd Quarter 2021

3rd Round Consultations (Mitigation Measures)

Final Design Studies integrating ESIA Benefits

Project Construction begins (3.5 years)

Project Maintenance (26.5 years)

Project Handover to Public Authority

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QUESTIONS?

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Driving Sustainable Investments

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Nairobi – Nakuru – Mau Summit PPP Project

ESIA and Design update – 08.10.2021

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AGENDA

01 ESIA-ADDRESSING E&S IMPACTS

02 DESIGN UPDATE–ESIA OUTCOME

03 DESIGN UPDATE - SUMMARY

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ESIA – ADDRESSING E&S IMPACTS

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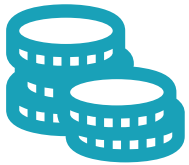
PROJECT MAIN GOALS : POSITIVE MOBILITY

- Improve connectivity to Rift Valley and Western Kenya Regions
- Reduce road accidents and improve safety

- Reduce travel times and vehicle operating costs
- Provide high level of service



- Stimulate economic activity sustainably
- Create employment opportunities

- Allow the Government of Kenya to channel its resources to other priority projects as construction is financed with private funds (loans and equity)

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A CONSULTATIVE APPROACH – “PEOPLE FIRST”

A comprehensive Stakeholder Engagement and Public Consultation Process

Field Surveys

Stakeholders Consultation

Social & Environmental Assessment

Action Plan for Social & Environmental Legacy

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ADDRESSING SOCIAL & ENVIRONMENTAL EFFECTS

- **Update of the preliminary ESIA prepared by KeNHA**
- **Development of an ESIA in accordance with international best practices**
- **Review and analysis of all social and environmental impacts of the Project**
- **Mitigation of the impacts through adapted project design and appropriate environmental and social measures**

AN UPDATED DEDIGN TO ENSURE:

1- COMPLIANCE WITH HIGHEST E&S STANDARDS AND APPROVAL OF THE ESIA

2- ACCEPTABILITY OF THE PROJECT BY ITS STAKEHOLDERS, IN PARTICULAR THE LOCAL COMMUNITIES

DESIGN UPDATE – ESIA OUTCOME

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KEY DRIVERS OF THE DESIGN

High-quality highway

- Dual carriageway
- Improvements on major junctions
- Connection of minor roads through service roads;
- Grade separated interchanges;
- Variable message signs – to guide road users

Safety upgrades

- Improved geometrics
- Street lighting
- Service lanes in town
- Climbing lane at steep gradient locations
- Improvement of existing U-Turn facilities
- Truck lay-bye
- Metal guard rail and breast at escarpment locations
- Non-motorized transport facilities

Multi-modality

- Bus bays and shelters
- Pedestrian underpasses & overpasses
- Train & vehicles underpasses and overpasses

Environment in action

- Landscaping
- Wildlife and livestock crossing point
- Extensive Biodiversity Studies carried out
- Stakeholder and community engagement
- Vulnerability and Social Inclusion
- Adherence to international best practices

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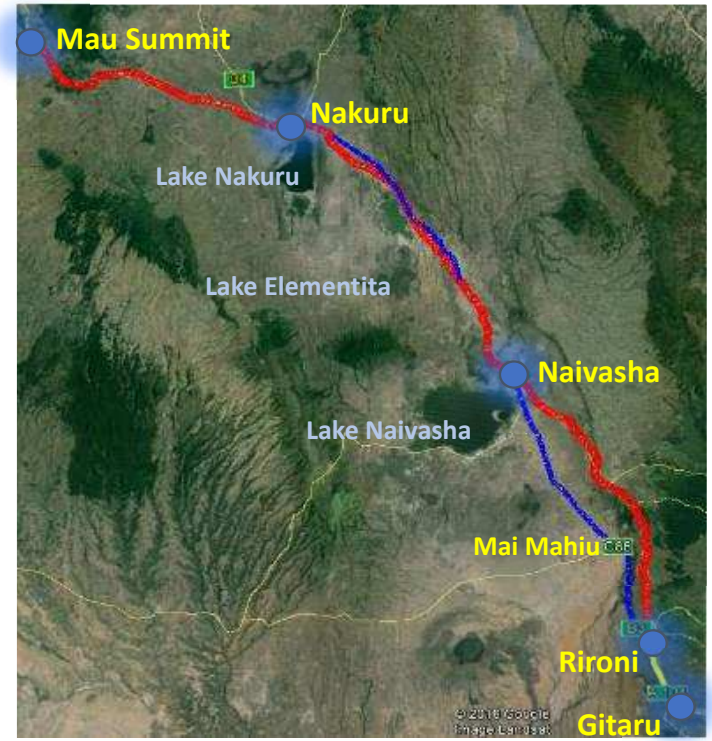
SECTIONS OF THE PROJECT ROAD



Road Segments	Road Section	Section Number	Start – End Points	Approximate Length (KM)	Scheduled Completion Date
A8 (Total: 175km)	Ririoni to Mau Summit	1	Ririoni – Naivasha	58	3 years, 1 month
		2	Naivasha - Elementaita Rd. (A8)	55	2 years, 7 months
		3	Elementaita Rd. - Njoro Rd. (A8)	15	3 years, 6 months
		4	Njoro Rd. - Mau Summit (A8)	45	2 years, 1 month
A8 – South (Total: 57km)	Ririoni Interchange to Naivasha Interchange	5	Ririoni-Mai Mahiu (A8-South)	19	13 months
		6	Mai Mahiu-Naivasha (A8-South)	37	13 months

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- **Third round consultation:**

Monday 18/10 – Political meeting in Nairobi

19/10 – Kiambu technical meeting with CJV

20/10 – Public holiday

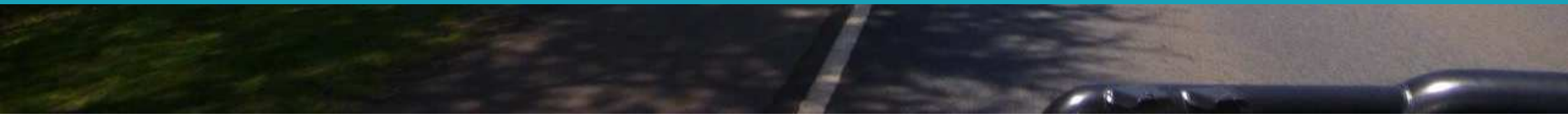
21/10 – Nyandarua technical meeting with CJV

22/10 – Nakuru technical meeting with CJV

25/10 to 02/11 (7 days – 7 meetings) – Community meetings with CJV

SPV to complete

DESIGN UPDATE - SUMMARY



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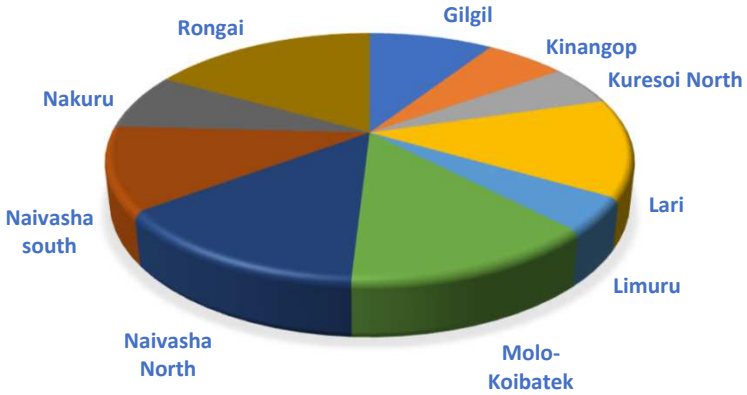
1. Design update further to ESIA process

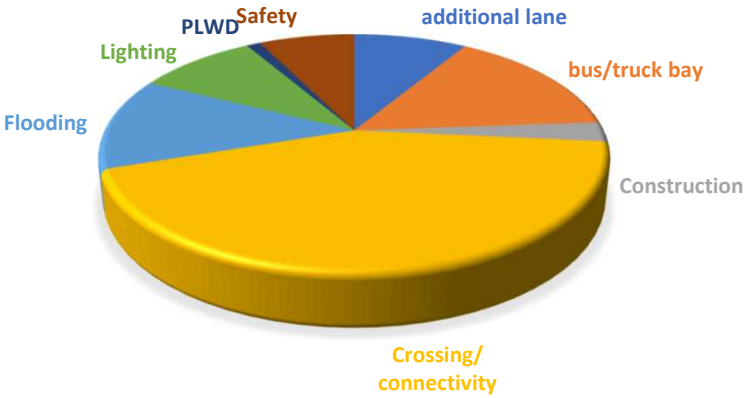
1.a Public Consultation

Summary of the requests:

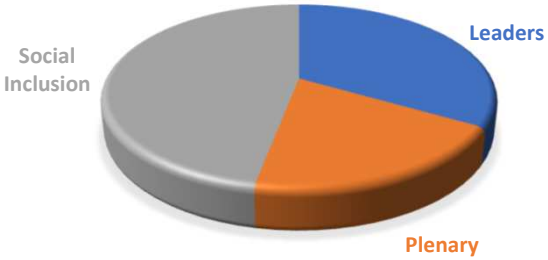
SPLIT OF THE REQUEST BY SUB-COUNTY



SPLIT OF THE REQUEST BY TOPIC



SPLIT OF THE REQUEST BY ORIGINATOR



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1. Design update further to ESIA process

1.a Public Consultation

Integration into the design:

The integration of the public requests has led to:

- **Relocation of some functionalities to better address the public need,**
- **Additional functionalities to improve the overall level of service of the Highway,**

The additional functionality compared to the second round of public consultation are mainly:

- **Additional grade separated crossings (+12 crossings)**
- **Additional service lanes (+1900 m)**
- **Additional bus bays (+26 bus bays)**
- **Additional lighting (+200 m of lighting along the road + lighting provided in specific points : memorial, urban pedestrian underpasses…)**

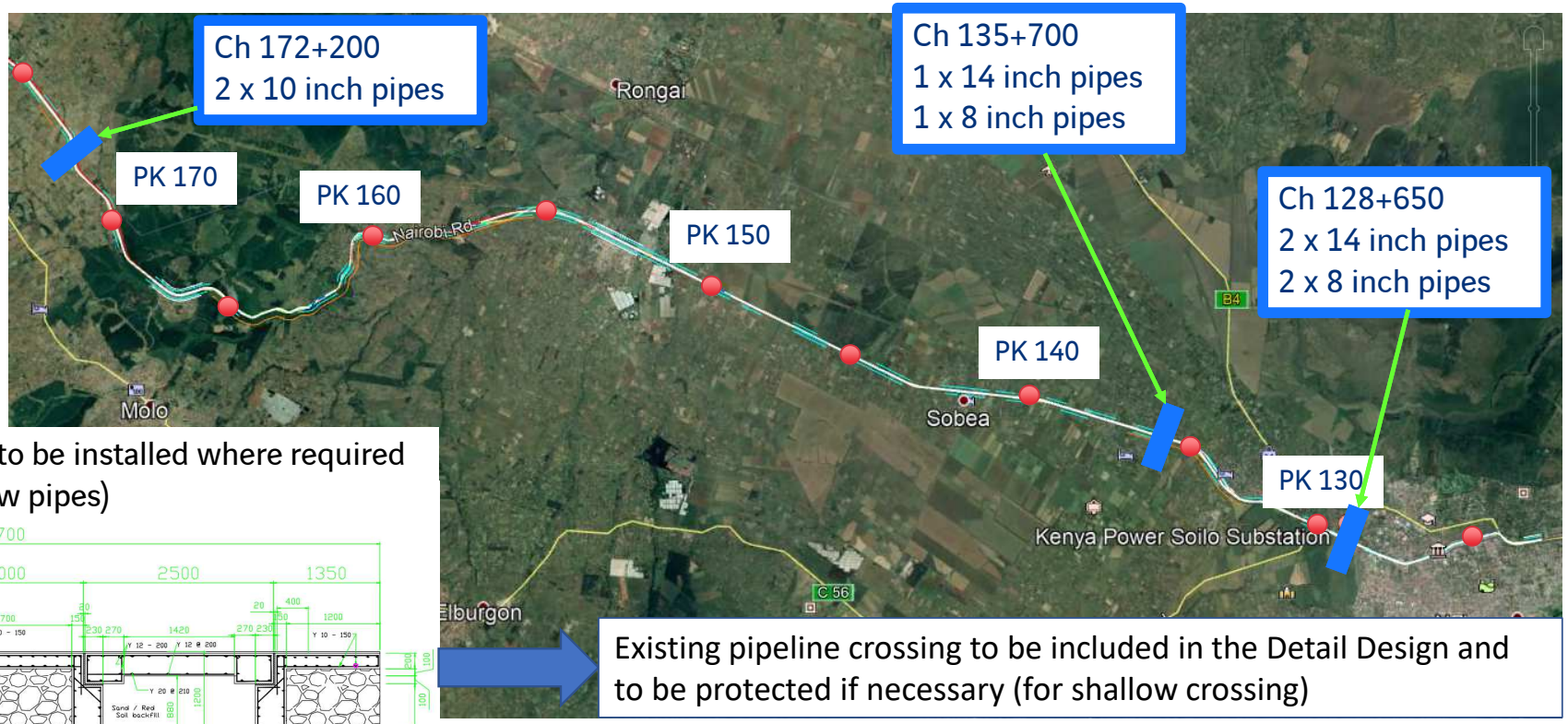
1. Design update further to ESIA process

1.b Comments from KeNHA during the Concept Design presentation on the 12/05/2021

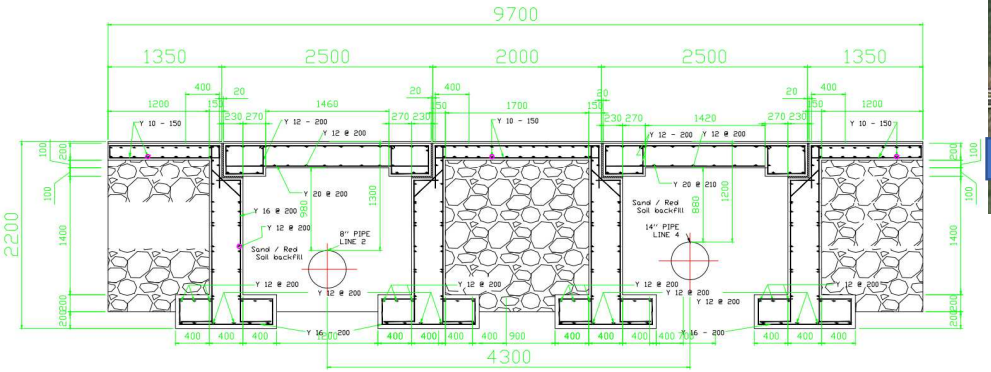
KeNHA's questions	RVH Responses
Explanation of the design speed limit	The speed limits are detailed further in this presentation
Clarification on the geometry of the Nakuru viaduct. In particular the transition between the six lane at grade section and the three lane on viaduct on top of the three lane at grade on a 3D view	The issue does not occure with the new improved solution
Have you implemented a Non Motorized Traffic study in Nakuru?	The Non motorized traffic study has been implemented by a local design office. The conclusions of the NMT are detailled in this presentation
Have you done a checking of Wildlife crossing location in PA against real crossing of animals	A wildlife crossing study has been carried out as part of the ESIA process by WSP. It includes data collecting with Conservancies, large scale migration study, animal counting... The conclusions of this report will be available in a short period of time
Which return period have you taken into account for hydraulic studies? Have you taken Climate change in account in Drainage Design? Could you provide the current output of the hydraulic studies	The return periods are in compliance with the Road Design Manual: - 50 year return period for major catchement discharge - 10 year return period for minor culvert A methodology for taking into account the climate change will be proposed in the Design Criteria at Reference Design stage.
Could you justify the choice of a central median with a central road concrete divider instead of a large central median	The choice of central jersey barriers was driven by the following inputs: - The Inherited stretches (both Underpasses and Overpasses) are not designed for wide central median, - Even with central jersey barriers, many sections are already at the limit of the RoW, - Safety in Maintenance : The central median needs to be regularly maintained (grass cutting, hedge clipping etc). Each maintenance operation requires traffic management and is at risk - Safety in service: wide central median encourages pedestrian to cross at grade as they can wait in the median instead of using dedicated grade separated crossings
Could you justify the design of a 2 m wide hard shoulder for emergency and breakdown purpose? Which input have you considered for Hard shoulders structure	The shoulder width has been corrected to 2,5 m minimum in rural area in compliance with the Design Manual for Rural Roads
A8 south is a class A road according to the official gazette	As per KeNHA's comment, the class A has been considered for the design of the A8 South. However, a few items are not in compliance with a class A road (width of RoW between ch 0 and ch 18, radius of some curves...). As per footnote 2 of table 2 of section 3 of Schedule 2 of the PA, these will result in departure to the standard

1. Design update further to ESIA process

1.b Comments from Kenya Pipeline Company during the State Agencies presentation (29/06/21) and common site visit on the 17/05/21



Typical detail of Pipe protection to be installed where required (for shallow pipes)



Existing pipeline crossing to be included in the Detail Design and to be protected if necessary (for shallow crossing)

RIFT VALLEY HIGHWAY

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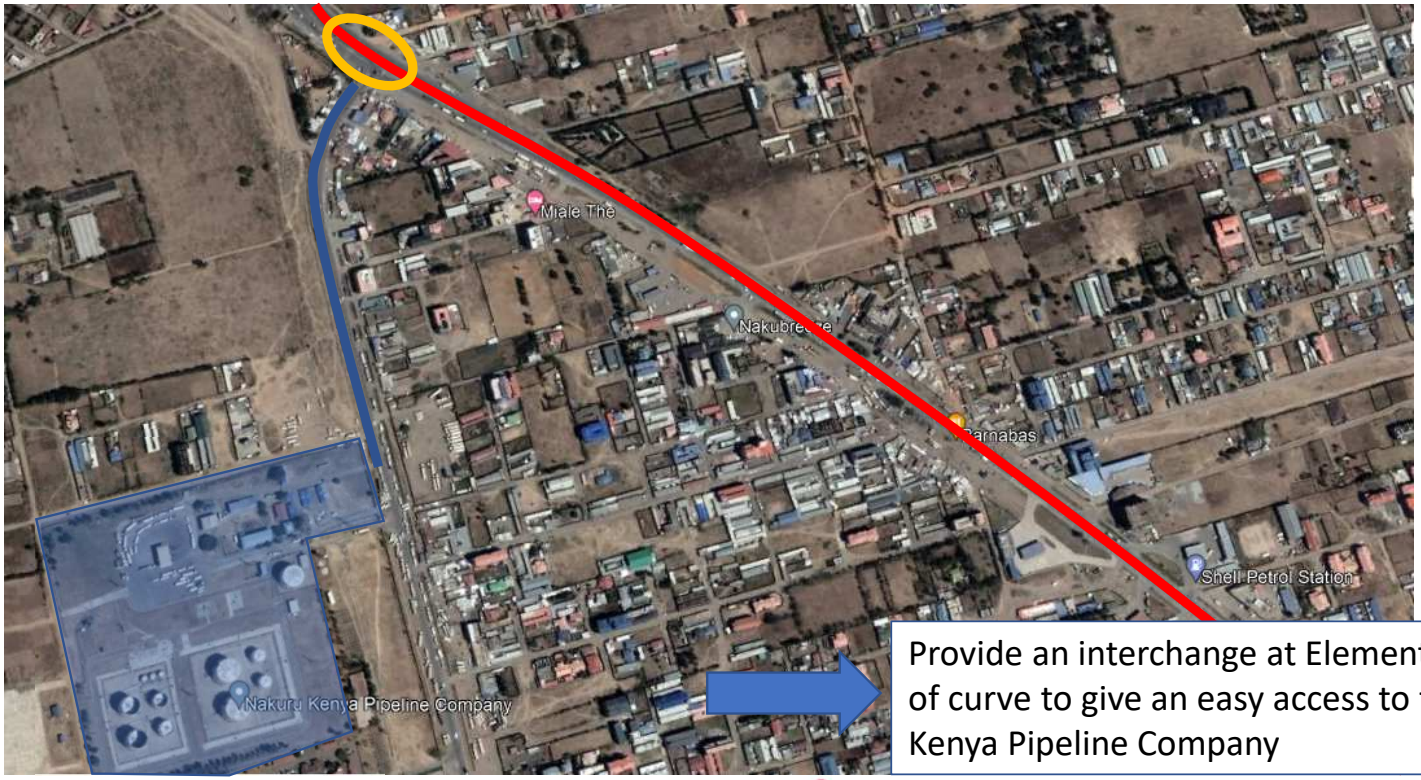
1. Design update further to ESIA process

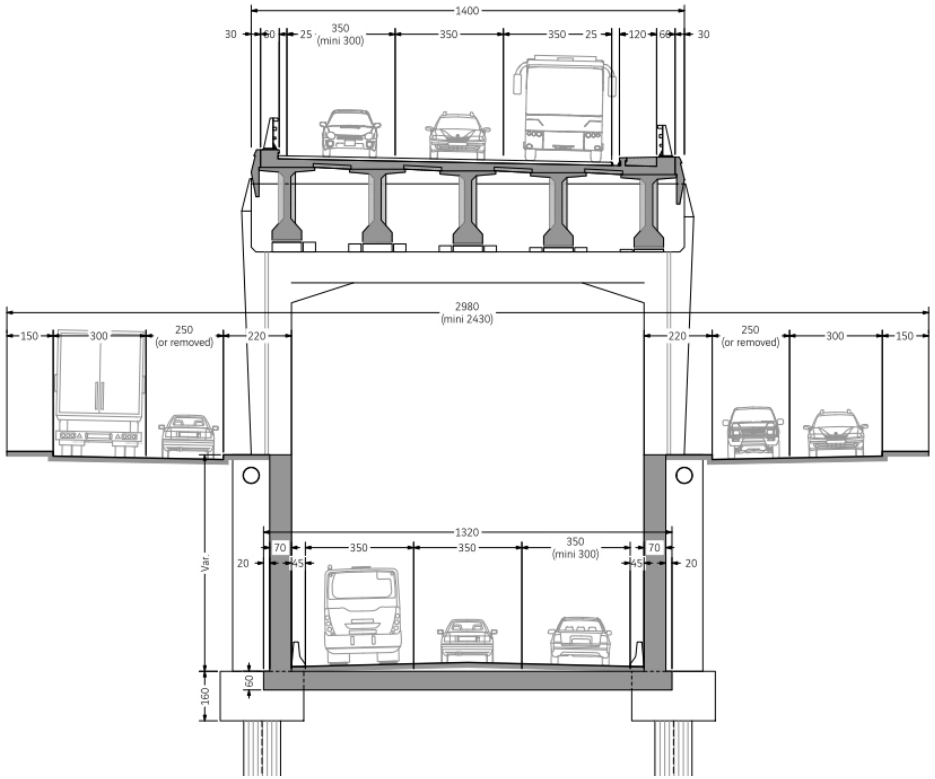
1.b Comments from Kenya Pipeline Company during the State Agencies presentation (29/06/21) and common site visit on the 17/05/21

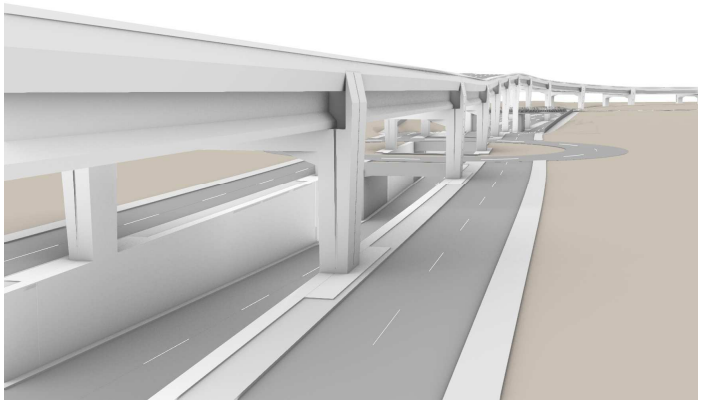


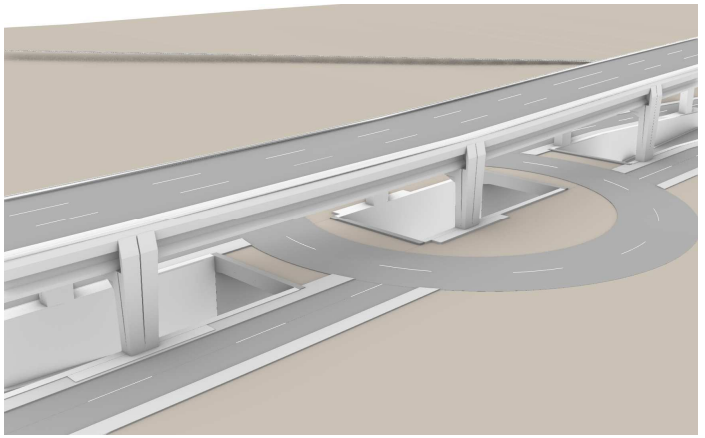
Provide an interchange at Elementaita Road with a proper radius of curve to give an easy access to the truck coming from / going to Kenya Pipeline Company

1. Design update further to ESIA process

Reminder: Duplex solution presented at Round 2 of public consultation







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1. Design update further to ESIA process

Comments received during second round in the Viaduct area in Nakuru (duplex solution):

- Flooding issues:
  - Ch 120+800 to 124+100: social inclusion: « Flooding plain enhanced by development in the area and poor drainage along the road corridor"
  - Ch 124+100: social inclusion "Flooding due to poor drainage "
  - Ch 123+800 to 124+100: Leaders: « Flooding area »

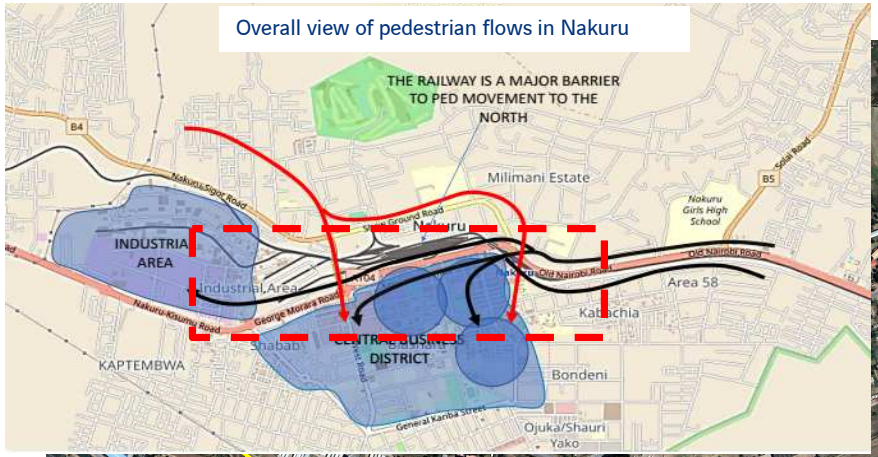
Cut and cover sections (duplex solution) generate low point along the project : to be avoided in flood prone areas

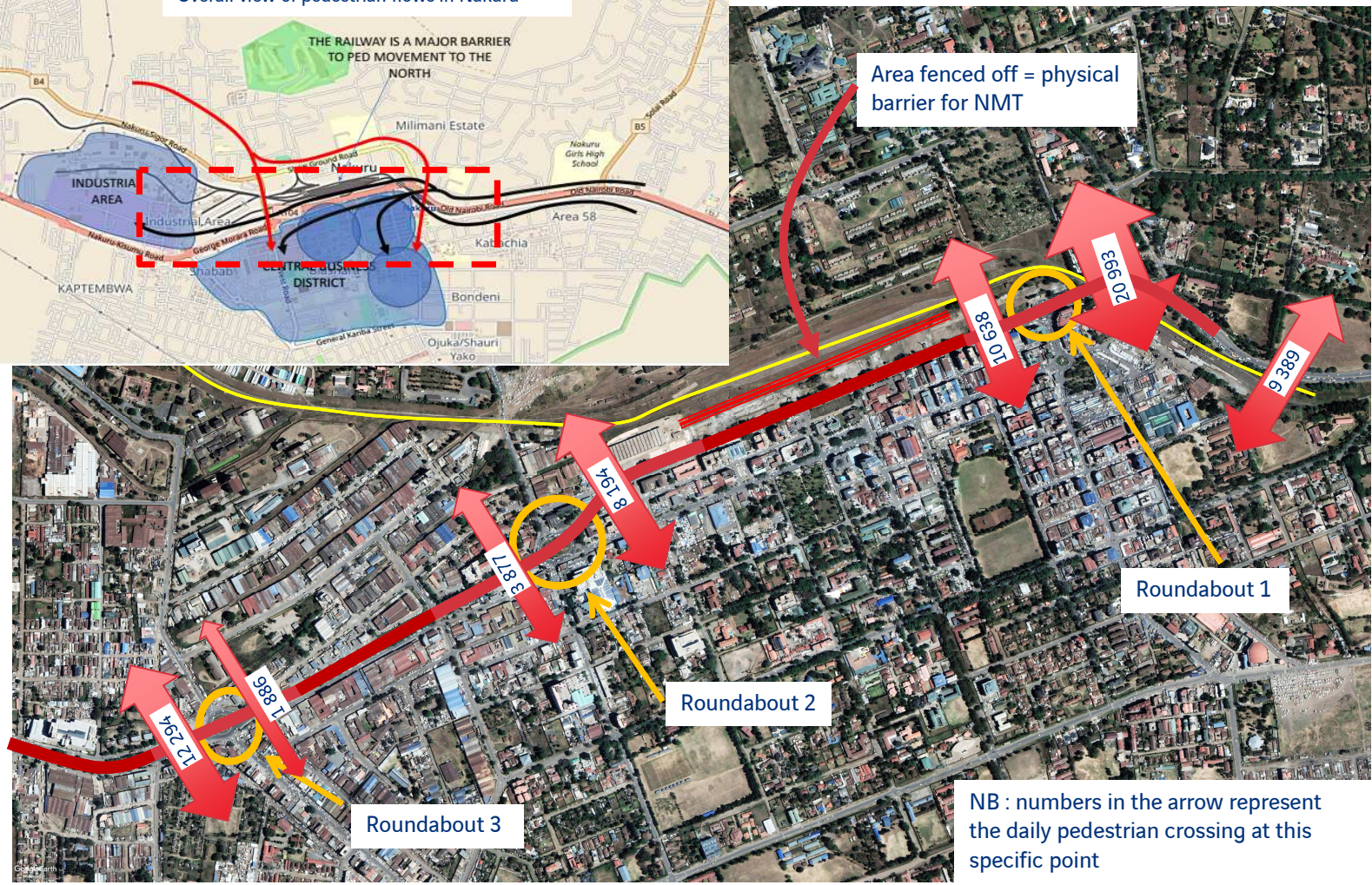
- Pedestrian Crossing issues:
  - Ch 123+100 : Social Inclusion : Accidents black spot – Pedestrians are crossing the road from Nakuru War memorial hospital, Menengai high school and businesses including Nakuru city center
  - Ch 125+750 : Leaders Add footbridge for hospital and people arriving from bus
  - Ch 126+600 : Social Inclusion Accidents black spot. Pedestrian crossing from CMC motors, Egerton University, hotels etc. and buses stopping to pick pedestrian yet there is no bus bay.
  - Ch 126+900 : Leaders Add footbridge for schools and clinics (Shaabab area)

Transparency to pedestrian crossing will be improved with additional and safer crossings

1. Design update further to ESIA process

Pedestrian crossing issue confirmed by the crossing counting carried out in June 2021 showing a huge quantity of daily crossing in the section…

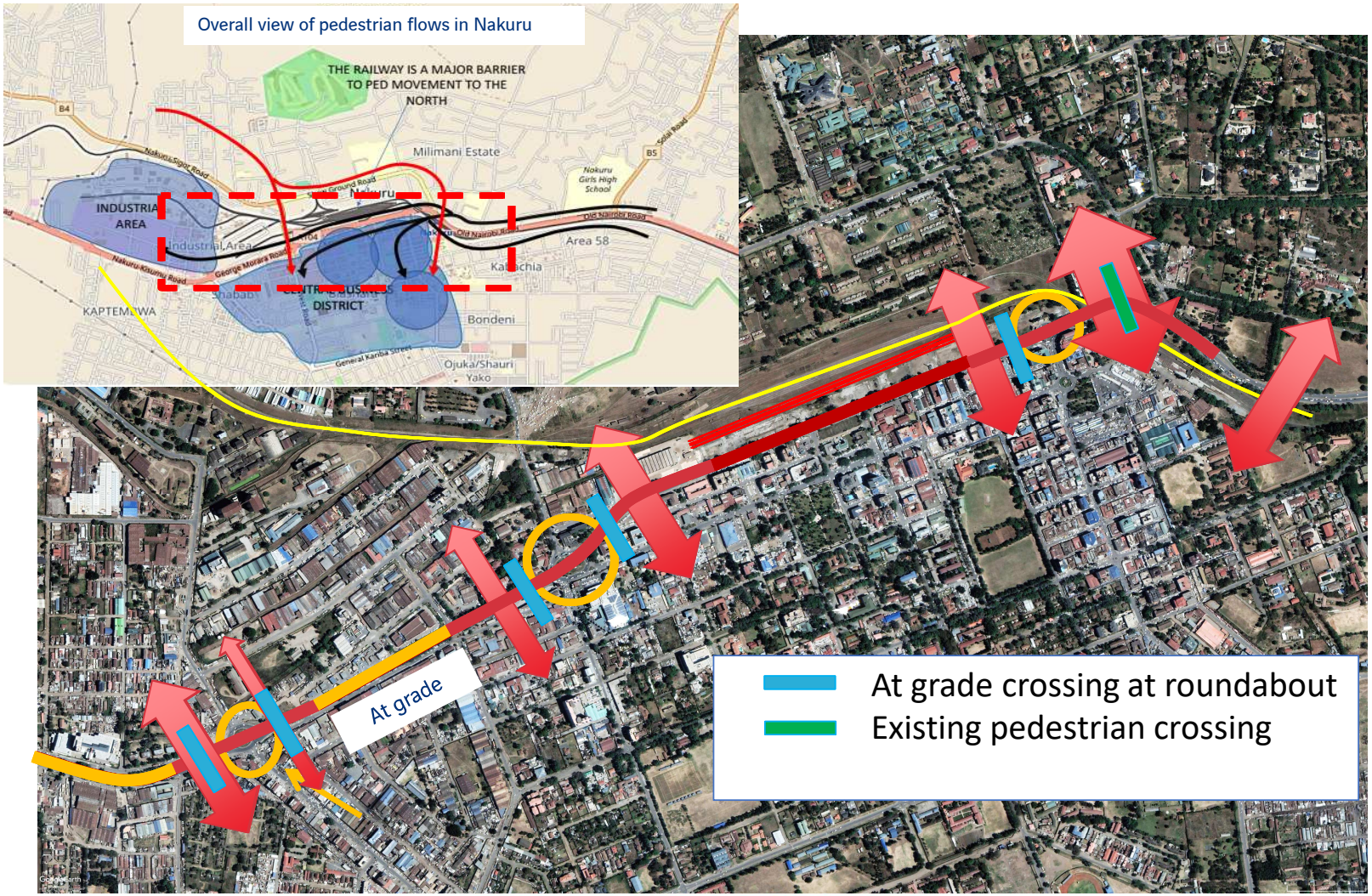




1. Design update further to ESIA process

Issue of pedestrian crossings is only partially adressed by the Duplex solution.

- Insufficient number of crossing
- Safety of crossing to be improved



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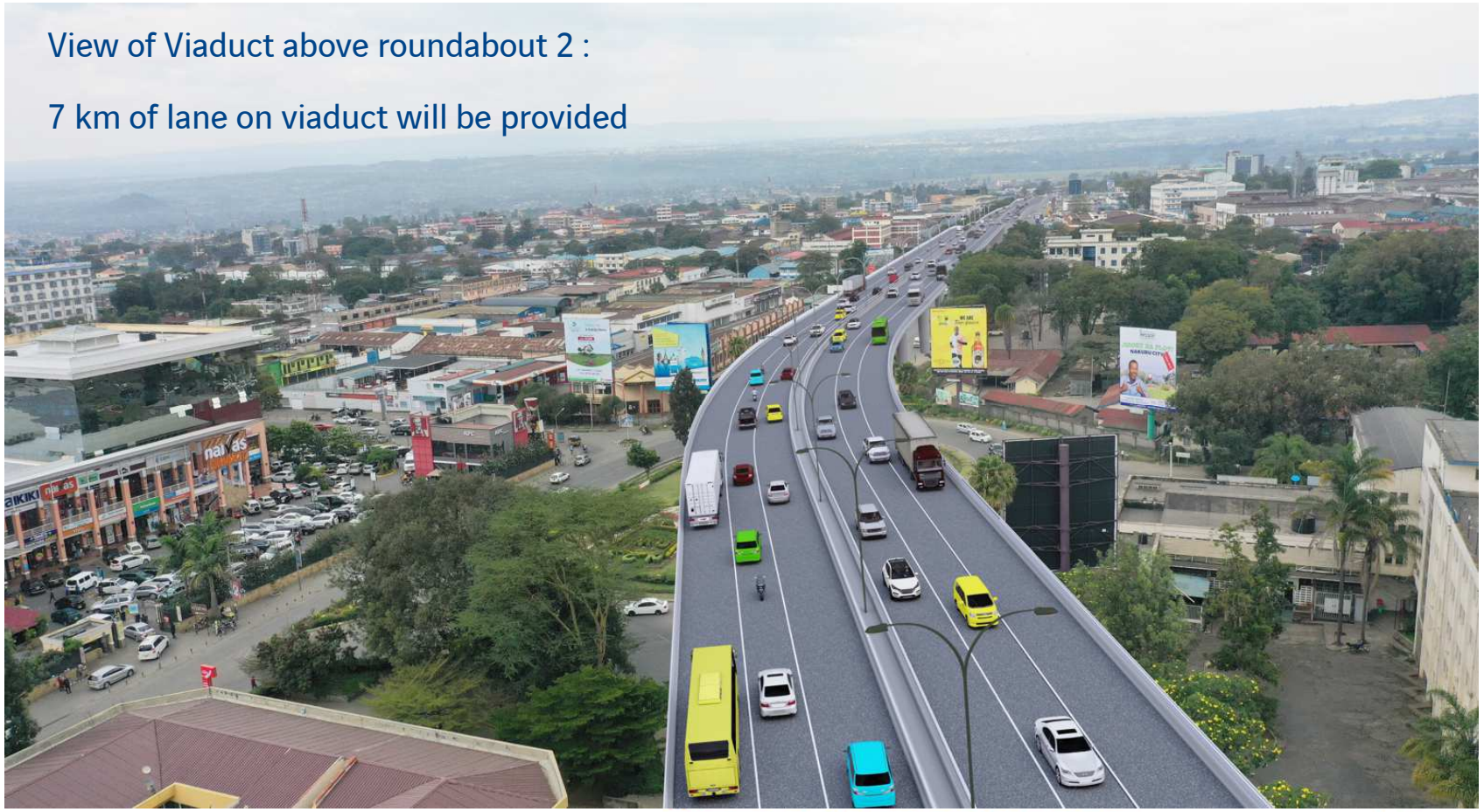
1. Design update further to ESIA process

Optimized solution further to the public consultation : Viaduct Solution



1. Design update further to ESIA process

Viaduct alternatives

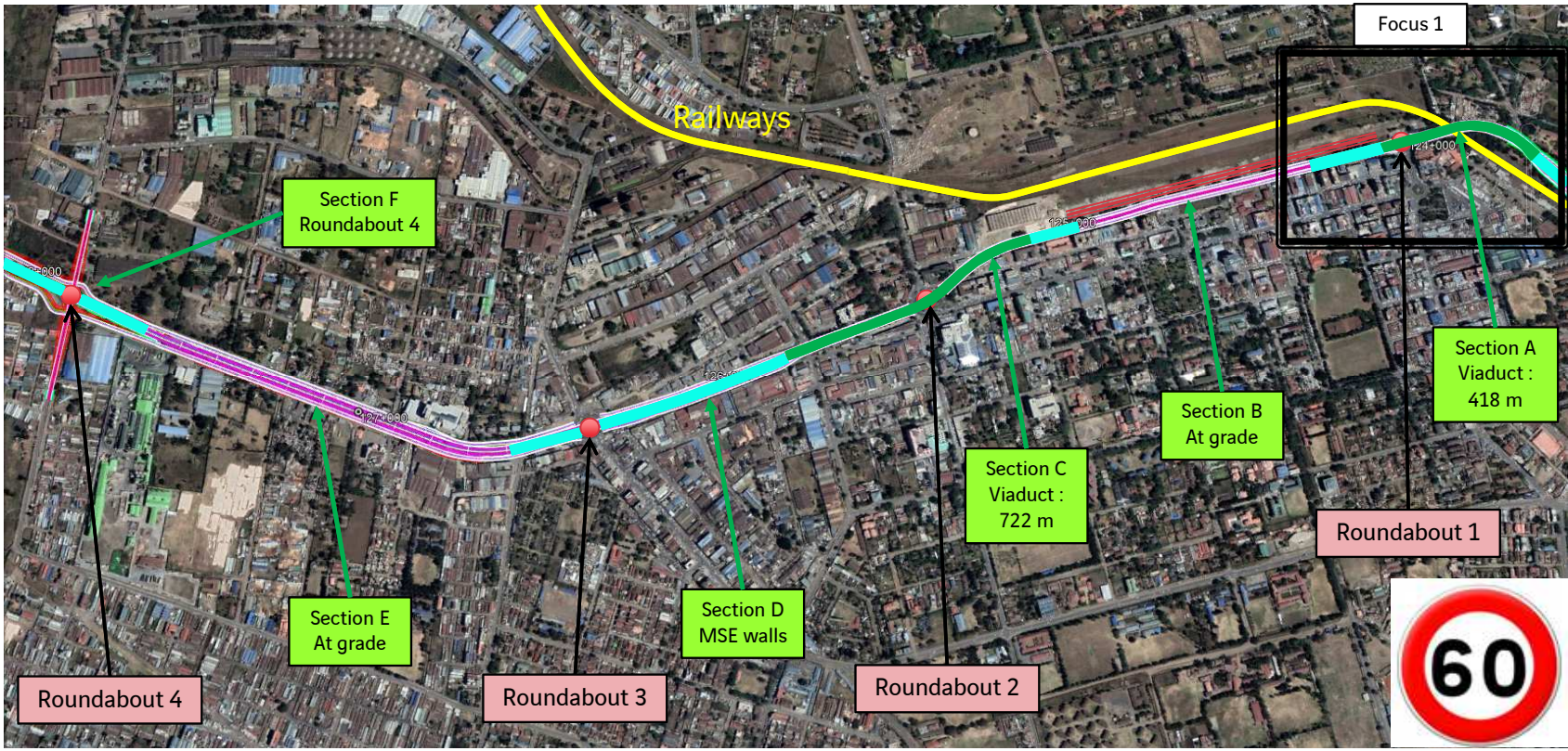
View of viaduct over the railway bridge (view backward)

1. Design update further to ESIA process

Viaduct alternative

General layout

- MSE wall section
- Viaduct section
- At grade section
- Roundabout



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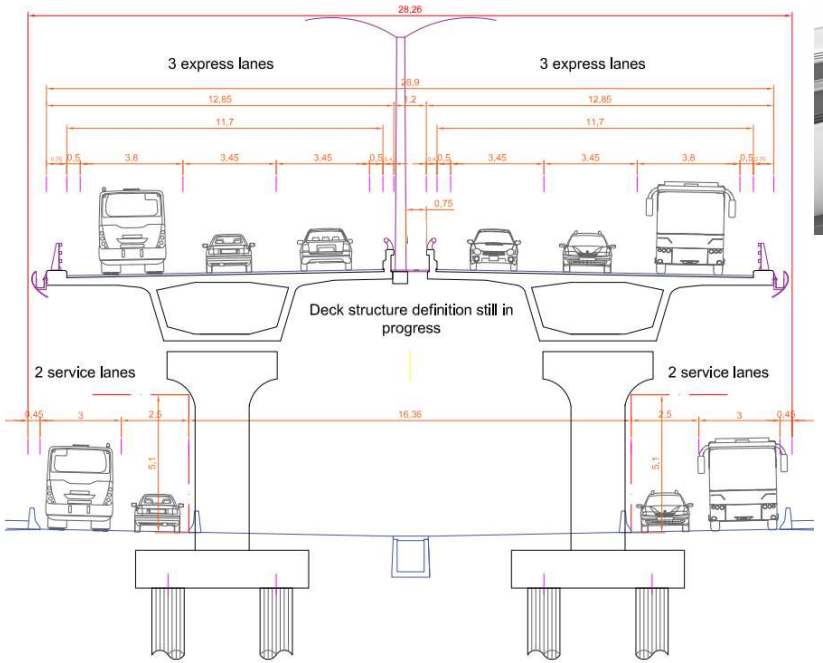
1. Design update further to ESIA process

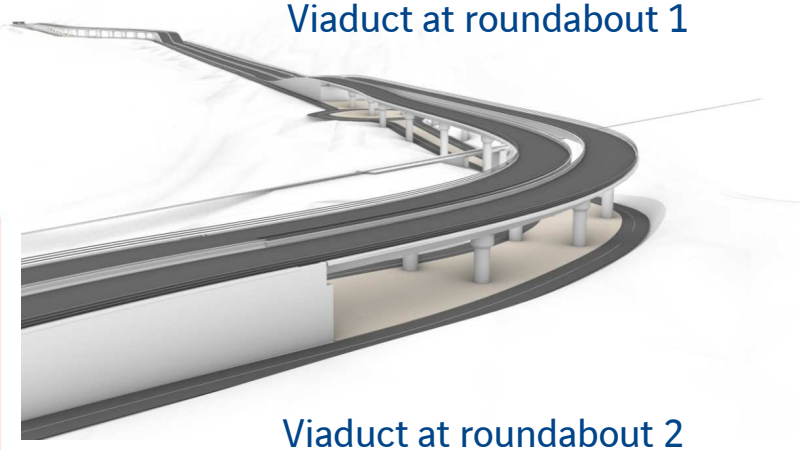
Viaduct alternative

Cross section and 3D views

Typical cross section



Viaduct at roundabout 1



Viaduct at roundabout 2

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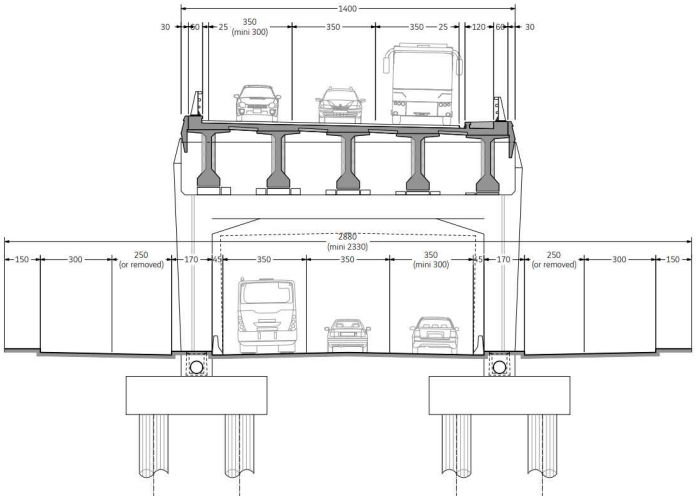
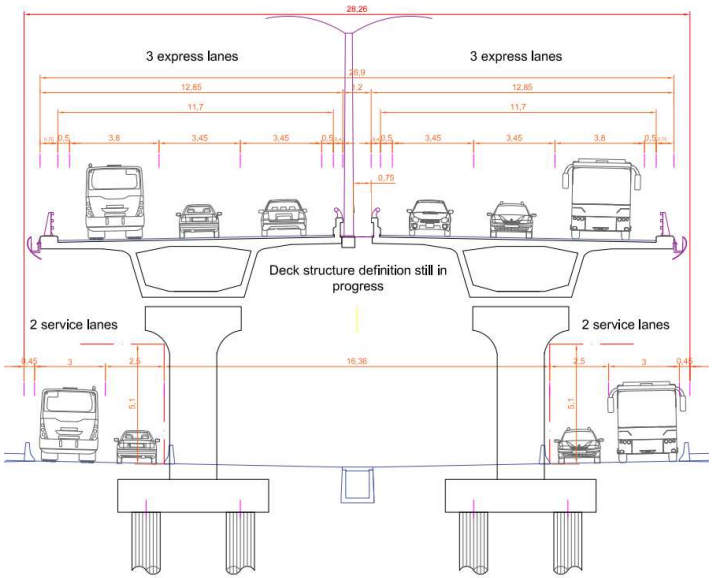
1. Design update further to ESIA process

Viaduct alternative : comparison of the solutions' cross section



Duplex solution



viaduct solution

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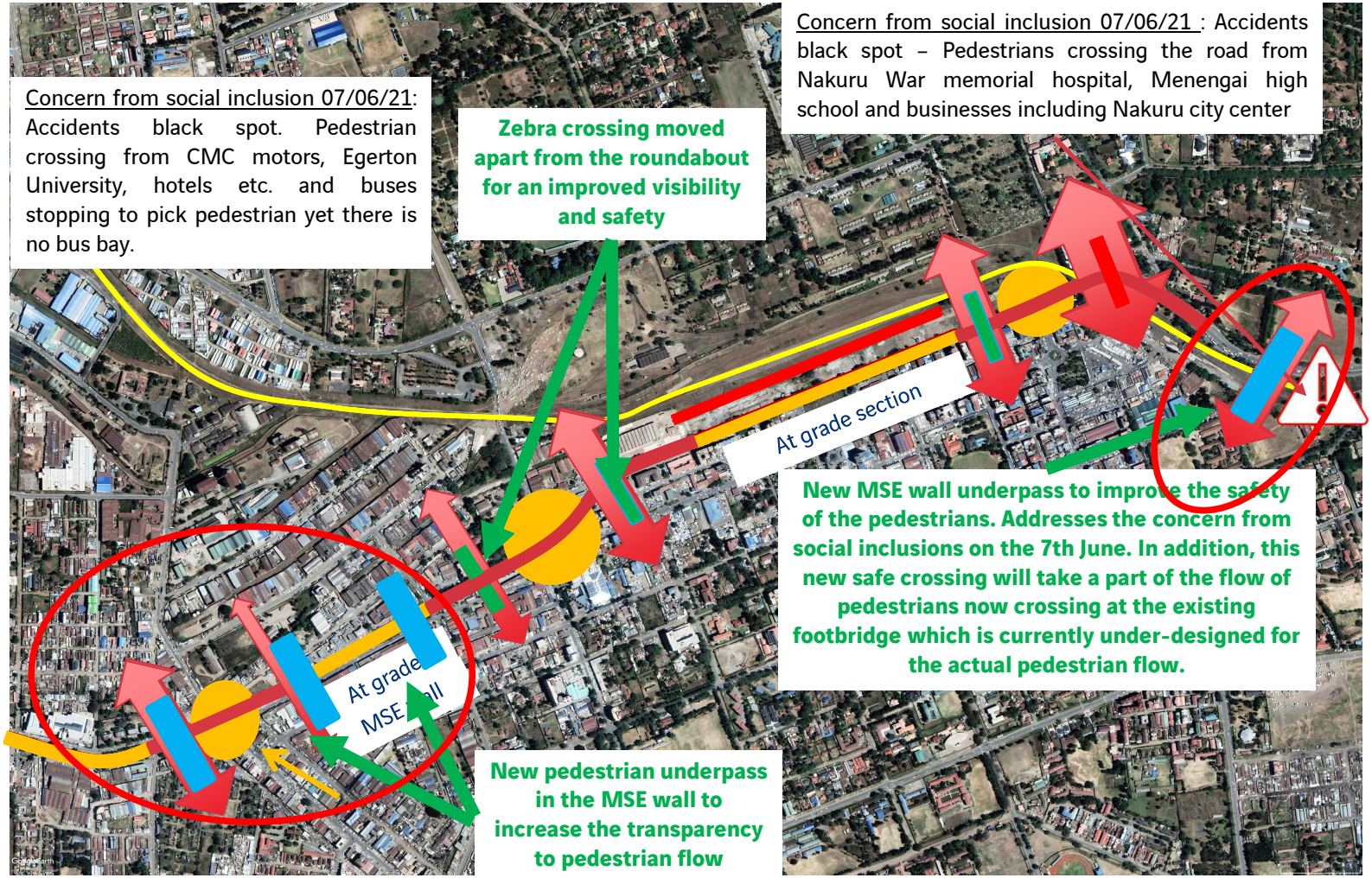
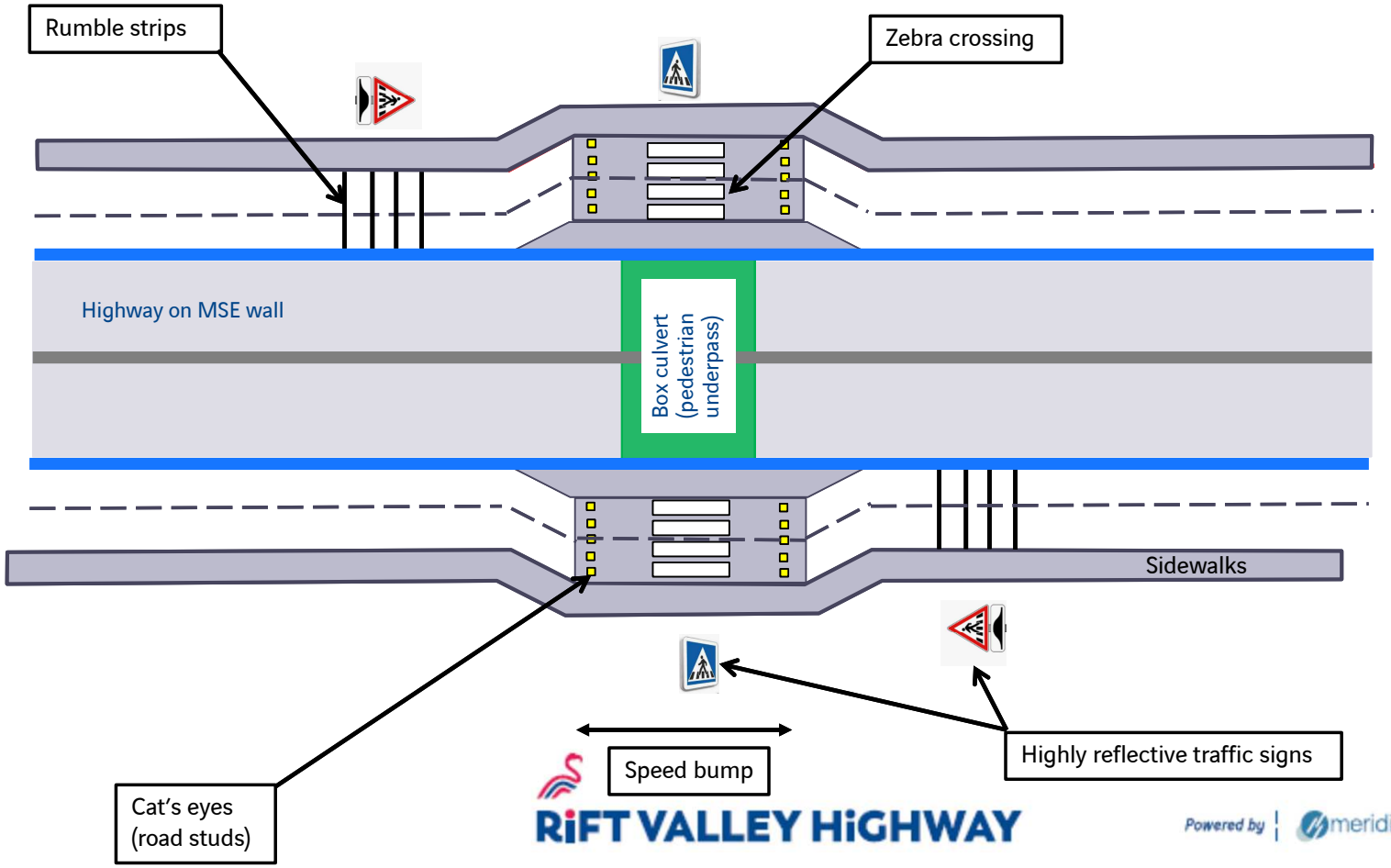
1. Design update further to ESIA process

Viaduct alternatives : Safer and additional crossing possibilities



1. Design update further to ESIA process

Viaduct alternative : Focus on the MSE wall underpass



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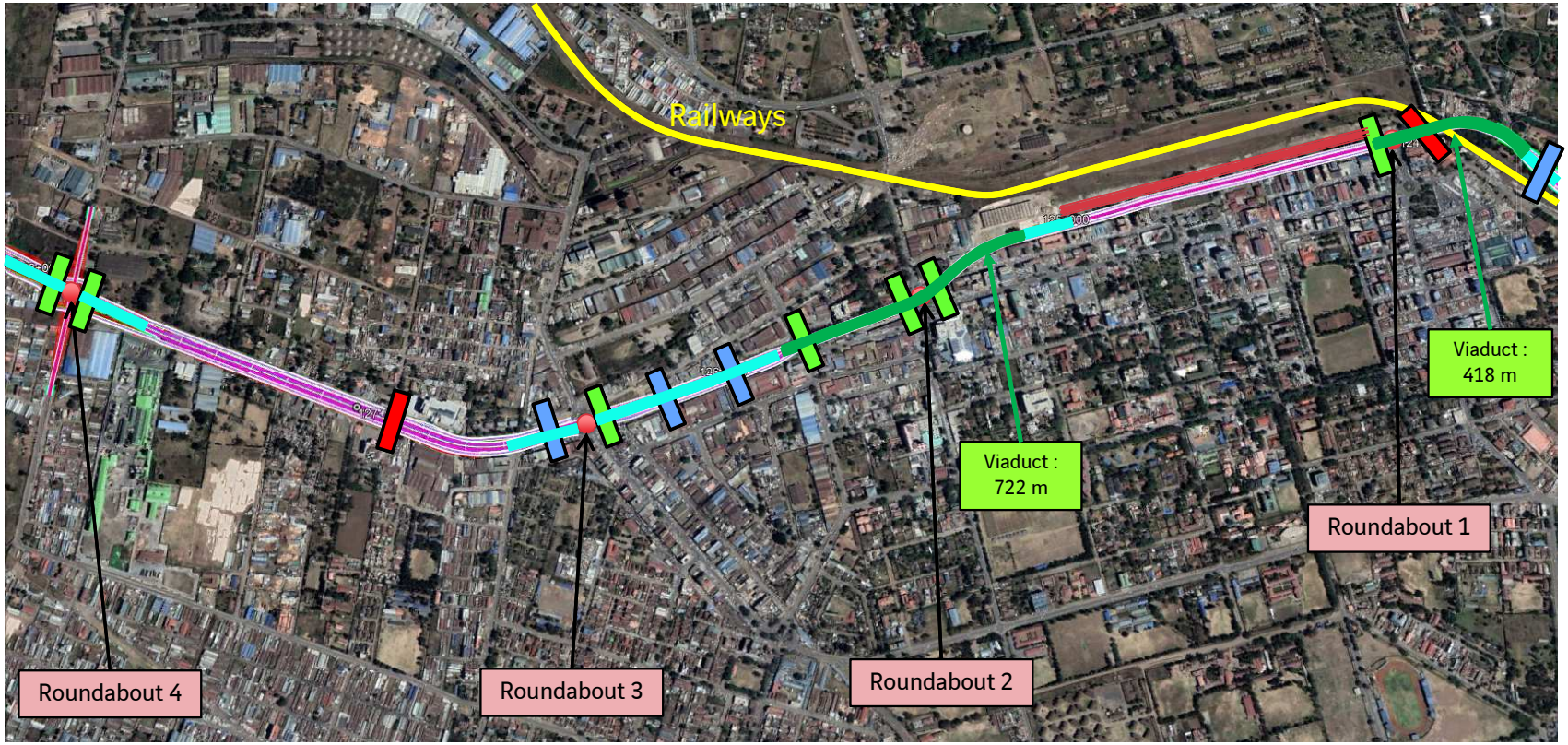
1. Design update further to ESIA process

Viaduct alternative : overview of crossings between roundabout 1 and roundabout 4



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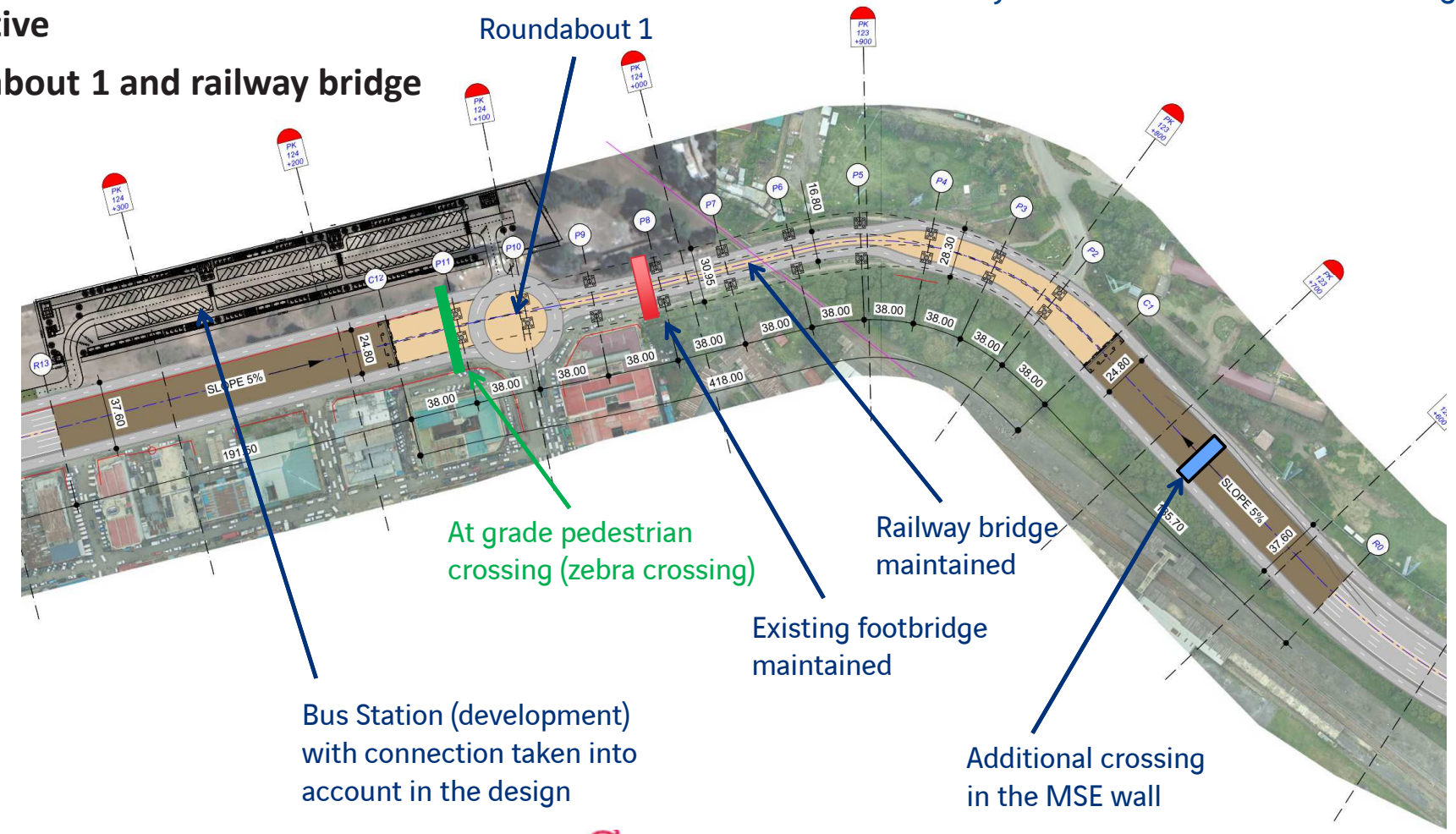
1. Design update further to ESIA process

Viaduct alternative

Focus 1: Roundabout 1 and railway bridge



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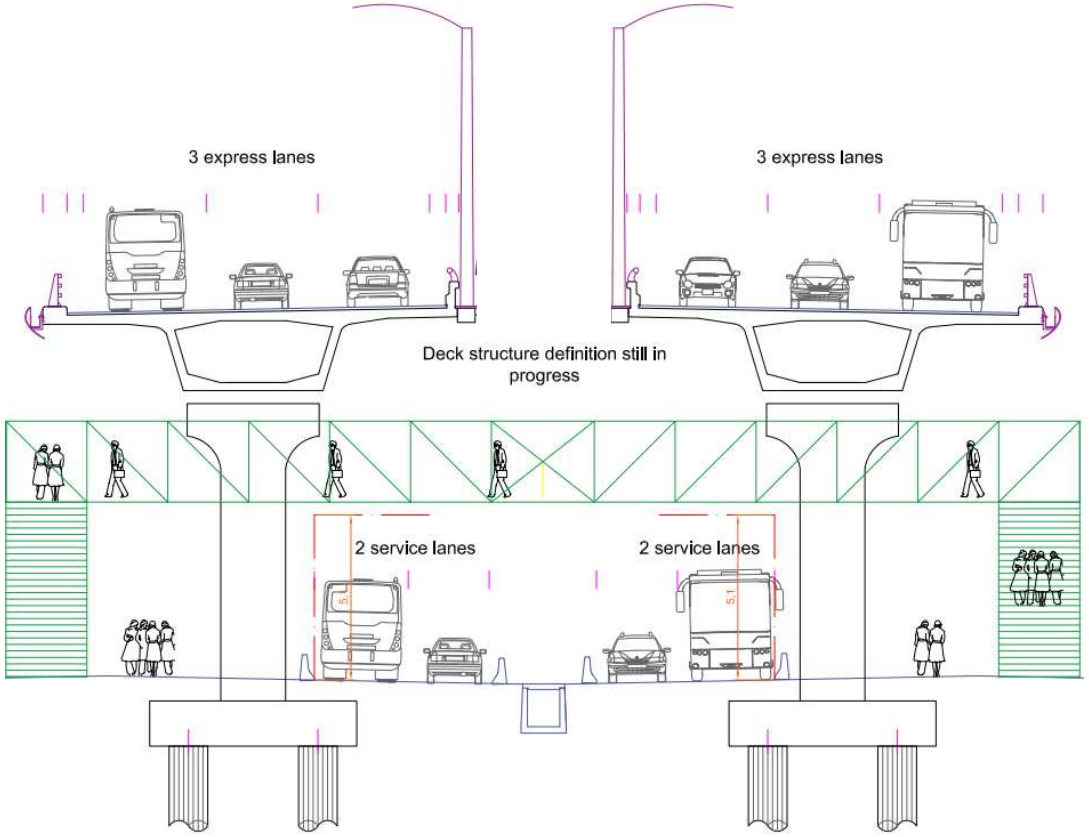
1. Design update further to ESIA process

Viaduct alternative

Cross section at the pedestrian crossing :
The pedestrian will be maintained in the viaduct solution



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1. Design update further to ESIA process

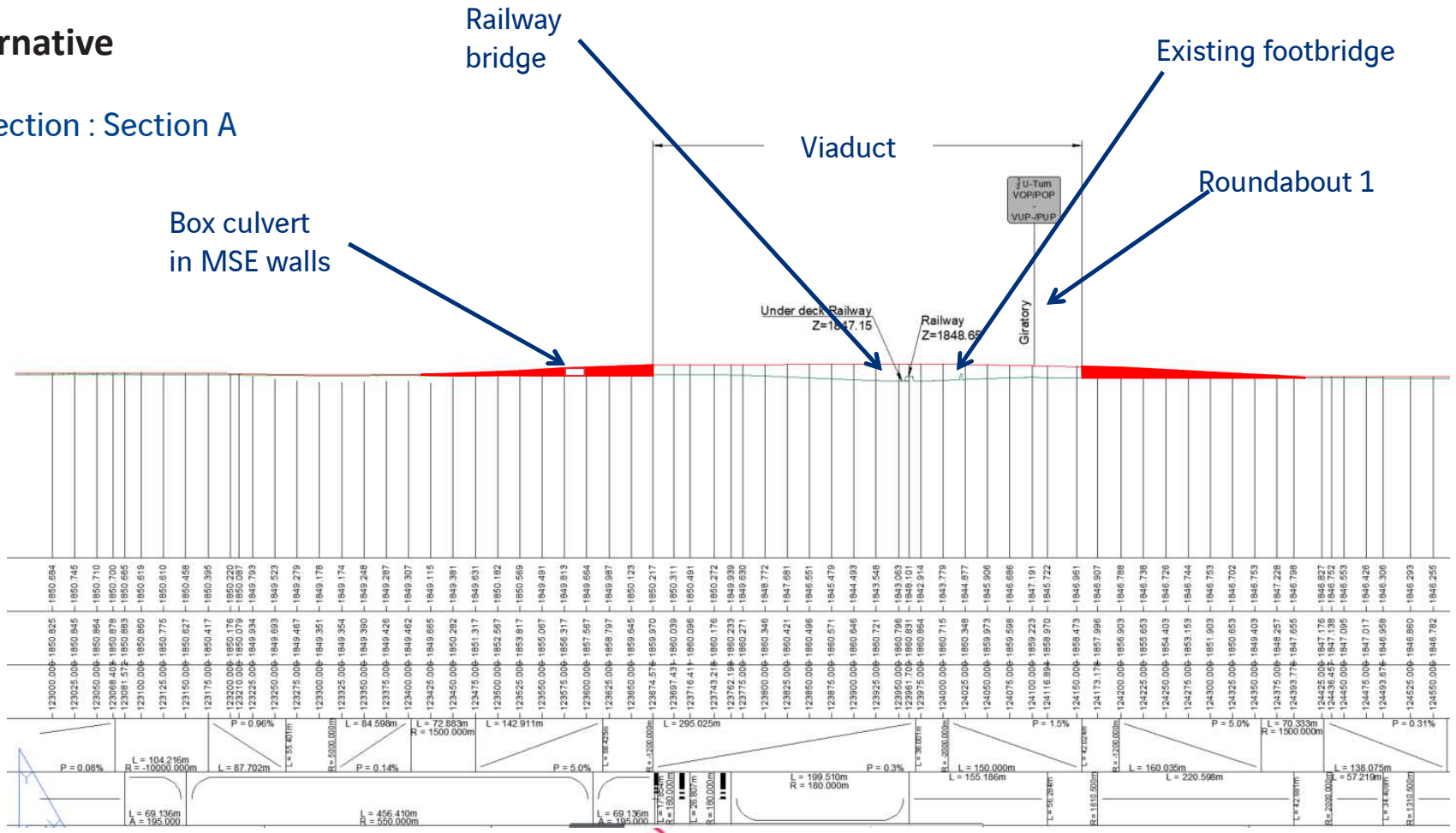
Existing railway bridge in cut section : to be maintained in the viaduct option

	Option 1: Duplex	Option 2: 2 Viaducts
Railway bridge	Demolished and rebuilt	Maintained
Pedestrian crossing	Demolished	Maintained
Existing road	Mostly demolished and rebuilt due to cut and cover	Mostly maintained and reinstated => service lanes
Bus station development	Interface managed in the design	Interface managed in the design

1. Design update further to ESIA process

Viaduct alternative

Longitudinal section : Section A



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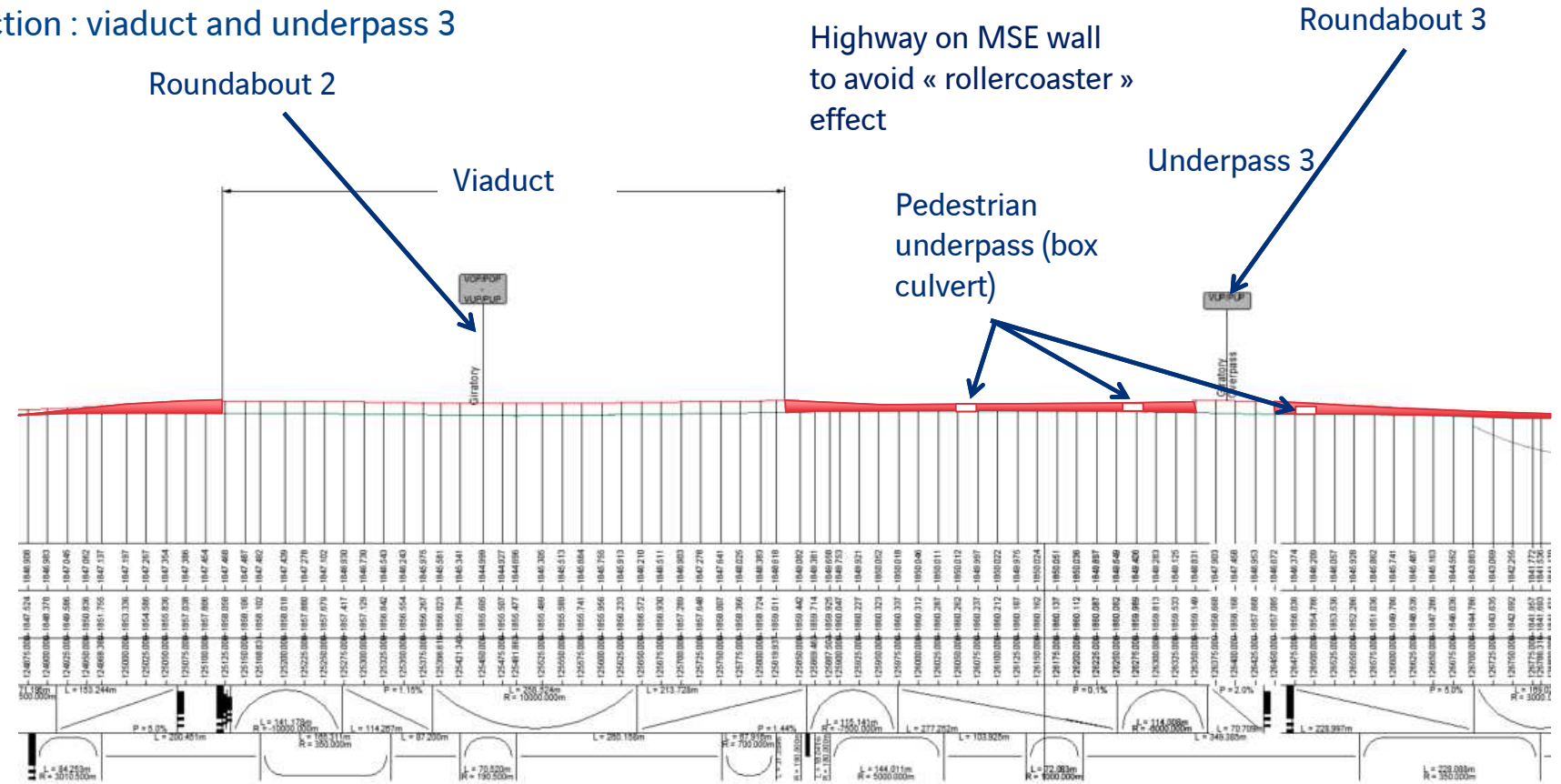
1. Design update further to ESIA process

Viaduct alternative

Longitudinal section : viaduct and underpass 3



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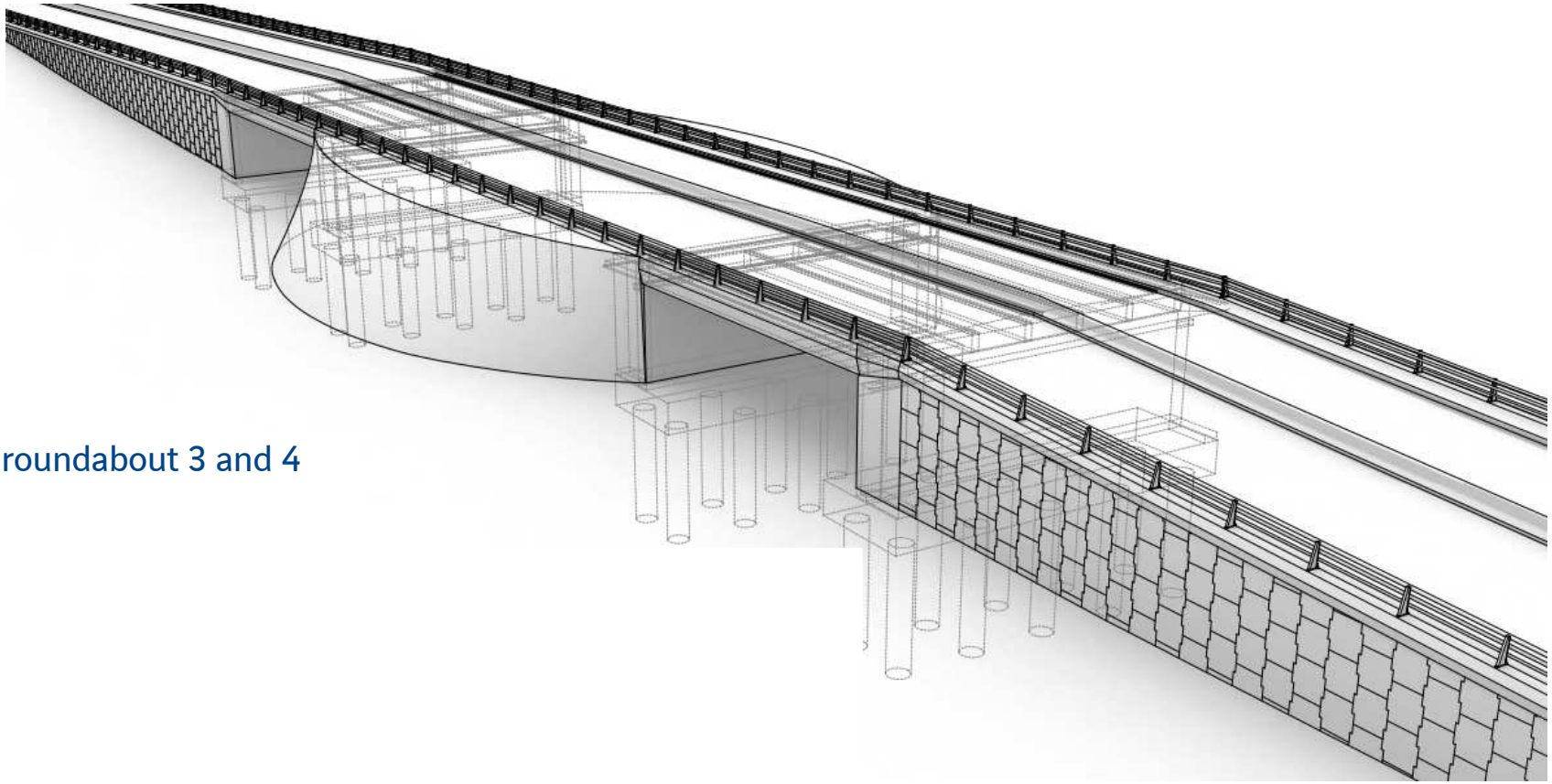
1. Design update further to ESIA process

Viaduct alternative



3D of the bridges at roundabout 3 and 4

1. Design update further to ESIA process

c. Outcome of E&S Impact Assessment

c.i Impact of the project

Slide by SPV

Example of propose noise mitigation measure at the beginning of the project (approx. ch 0+600 to 0+900)

1. Design update further to ESIA process

c. Outcome of E&S Impact Assessment

c.ii Mitigation measures : Noise Mitigation Measures

As per IFC standards, a Noise propagation modelling has been carried out to compare the theoretical noise level with and without the project. Wherever the noise level with project is greater than the level without project + 3 dBA, some mitigation measures have to be provided.

Noise barriers to be provided on the left hand side to protect schools, churches and houses

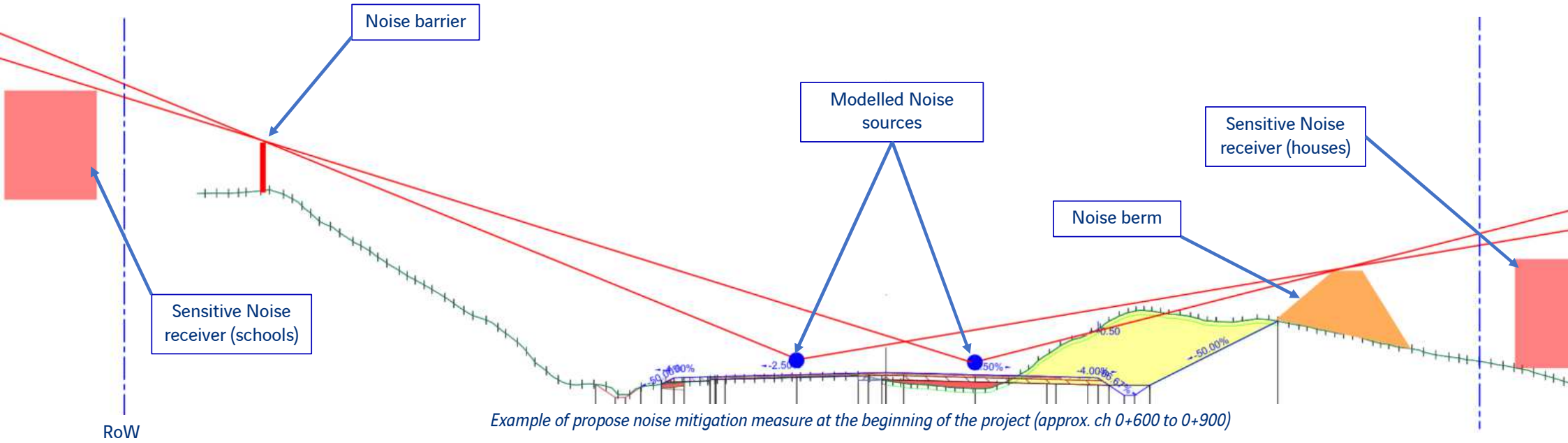
Noise barriers to be provided on the left hand side to protect houses

Example of propose noise mitigation measure at the beginning of the project (approx. ch 0+600 to 0+900)

1. Design update further to ESIA process

c. Outcome of E&S Impact Assessment

c.ii Mitigation measures : Noise Mitigation Measures

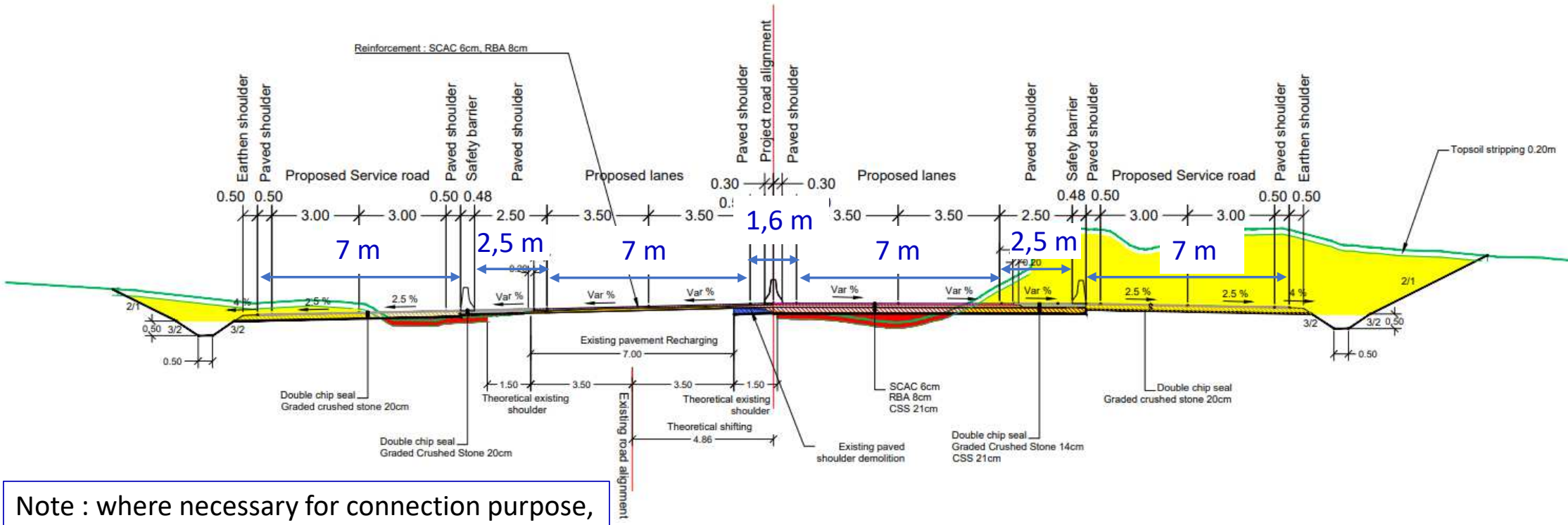


Example of propose noise mitigation measure at the beginning of the project (approx. ch 0+600 to 0+900)

In total 2,4 km of noise screen (either noise barrier or noise berm) have been designed along the project to protect sensitive receivers

2. Design update summary

a. A8 typical cross sections : typical section with service lane in rural area and rolling terrain



Note : where necessary for connection purpose, the service lane will be separated (both in plan view and elevation) from the main carriageway

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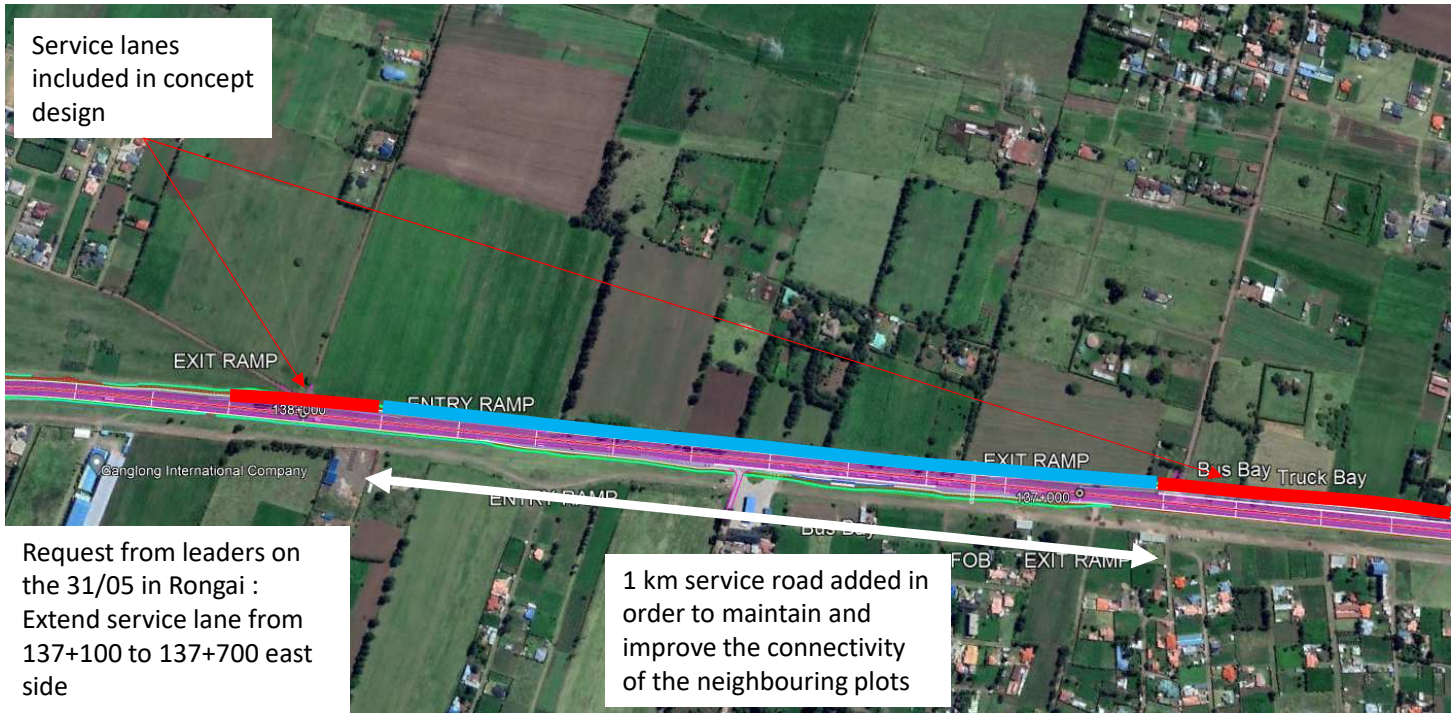
2. Design update summary

Service Lanes

- Service lanes are designed
  - along all urban areas defined in the Project Agreement
  - and developed to connect all the minor junctions recorded in the Project Agreement



Example of mitigation measure addressing public concerns with regards to service lane

The integration of the public requests has led to an extra 2 km of service lane along the A8 in order to improve the connectivity at critical stretches

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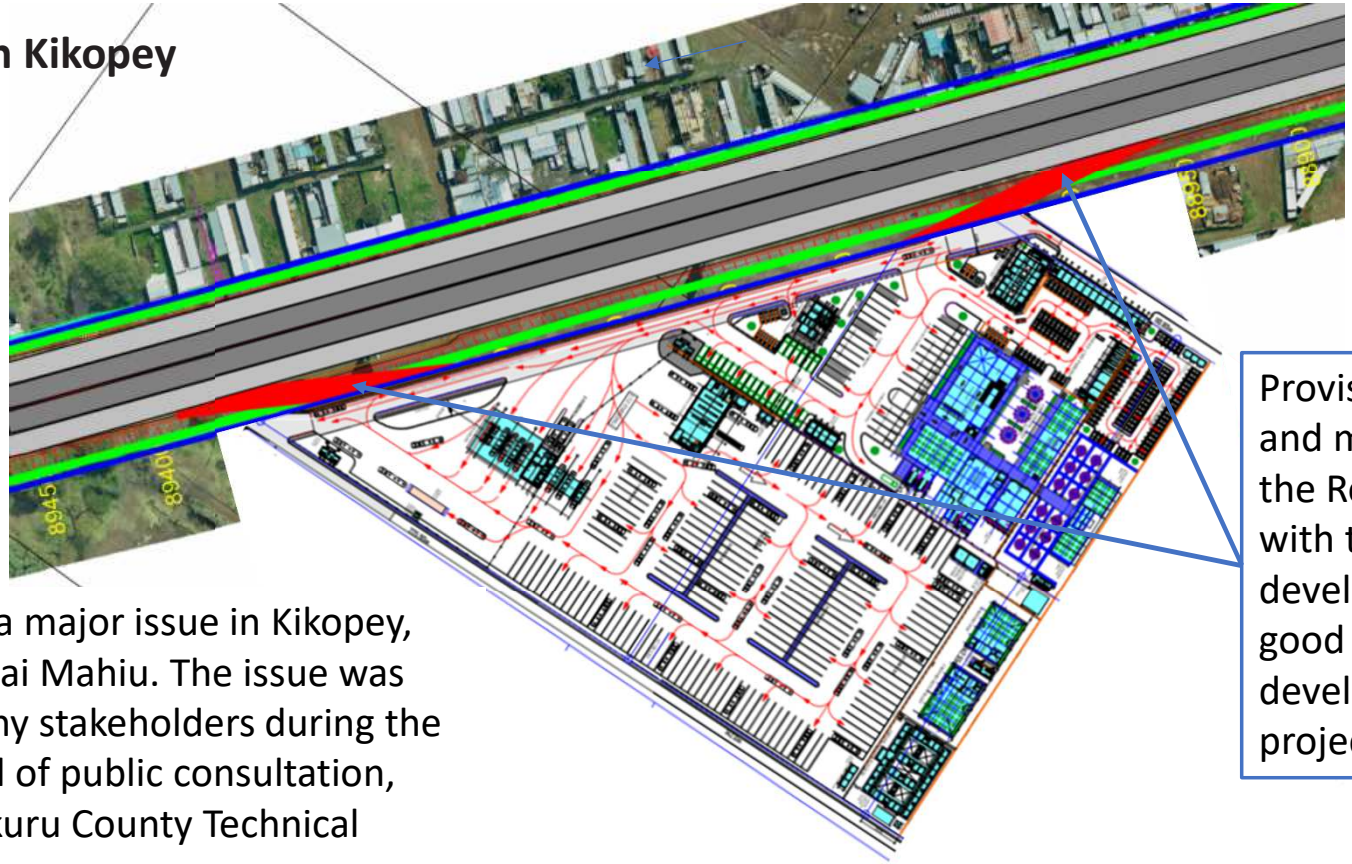
2. Design update summary

Truck Parking in Kikopey



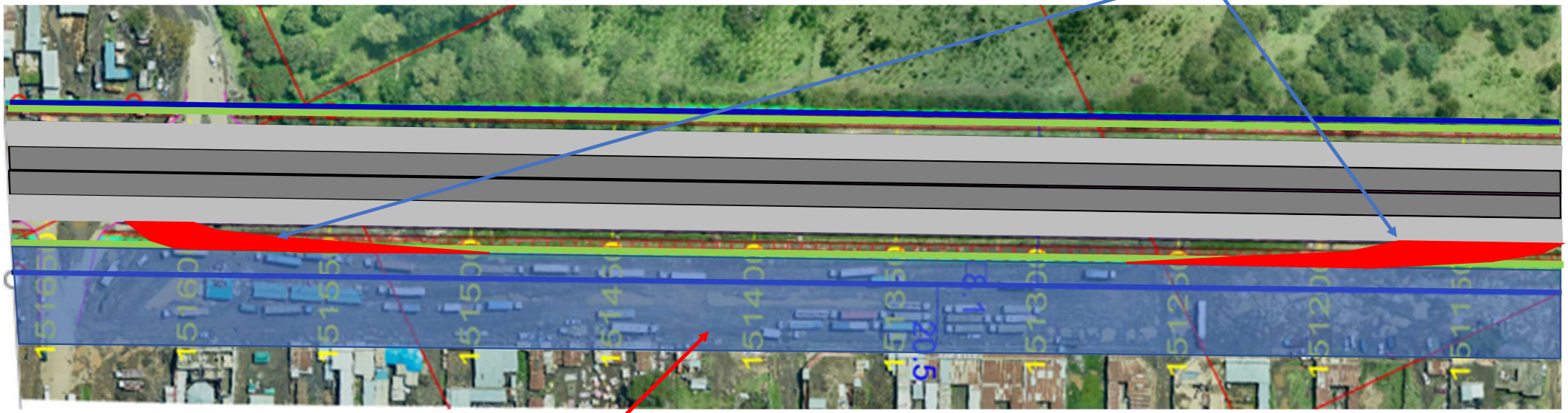
Provision of a diverge and merge lane within the RoW in consultation with the Truck Park PPP developer to ensure a good connectivity of the development to the project

Truck park is a major issue in Kikopey, Salgaa and Mai Mahiu. The issue was raised by many stakeholders during the second round of public consultation, including Nakuru County Technical Team, Truck company owners…

2. Design update summary

Truck Parking in Salgaa

Provision of a diverge and merge lane within the RoW if necessary



Possibility for developer to provide a truck parking in this area (approx. 10 m within the RoW and 20 m outside of the RoW)?

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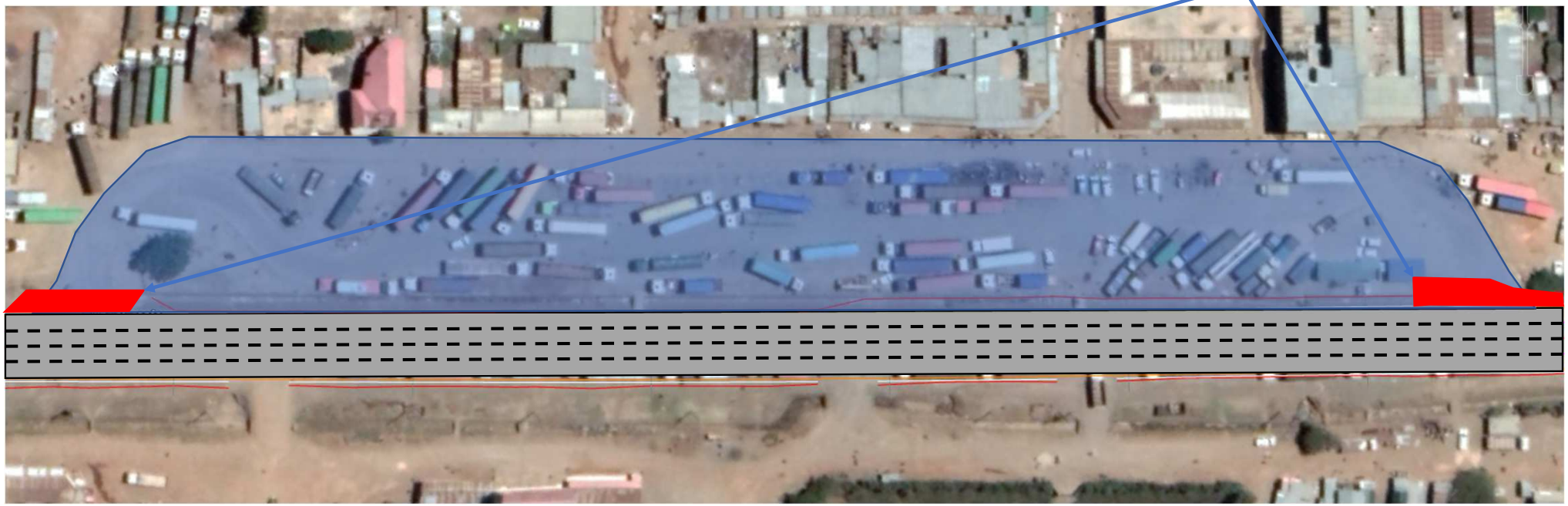
2. Design update summary

Truck Parking in Mai Mahiu



In Mai Mahiu, no impact of the project on the existing Truck Park

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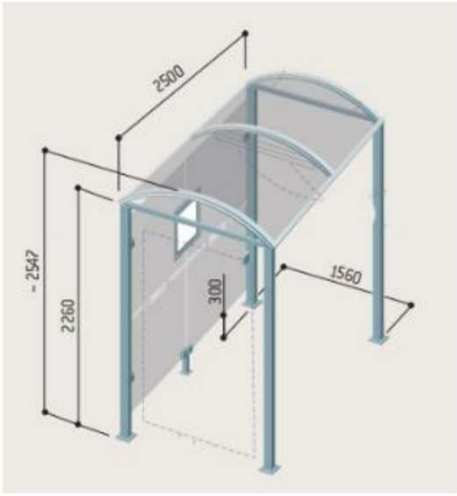
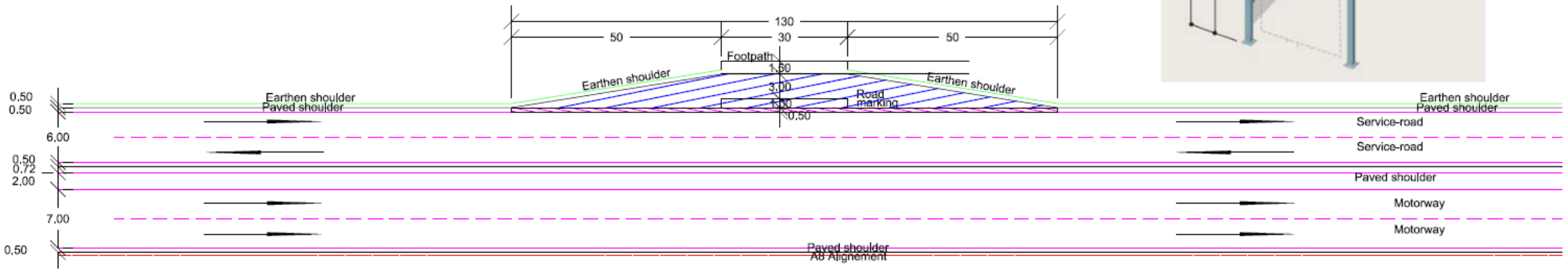
2. Design update summary

Bus Bays





Bus bay + bus shelter are provided along the project at existing bay => 87 bus bays on A8 and 35 on A8 south

Many requests for additional bus bays were raised during the second round of consultation resulting in 26 additional bus bays on the project (24 in A8 and 2 in A8 south). In total, 111 bus bays will be provided along the A8 and 37 along the A8 south

RIFT VALLEY HIGHWAY

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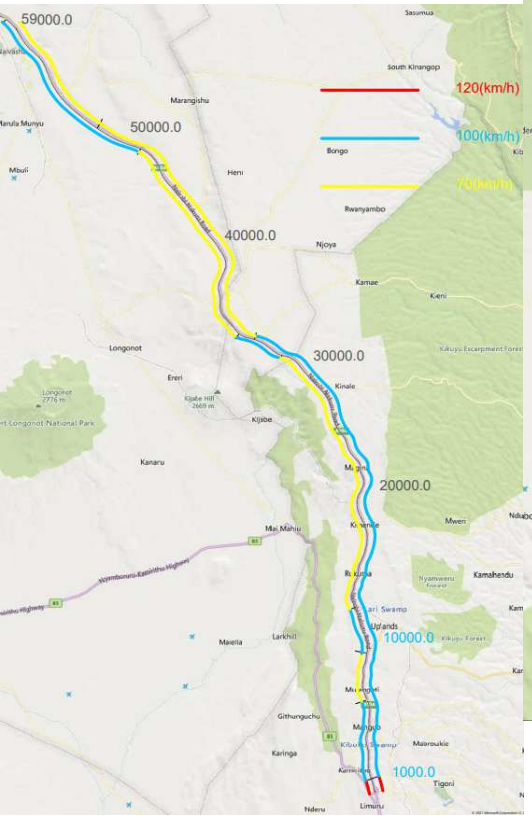
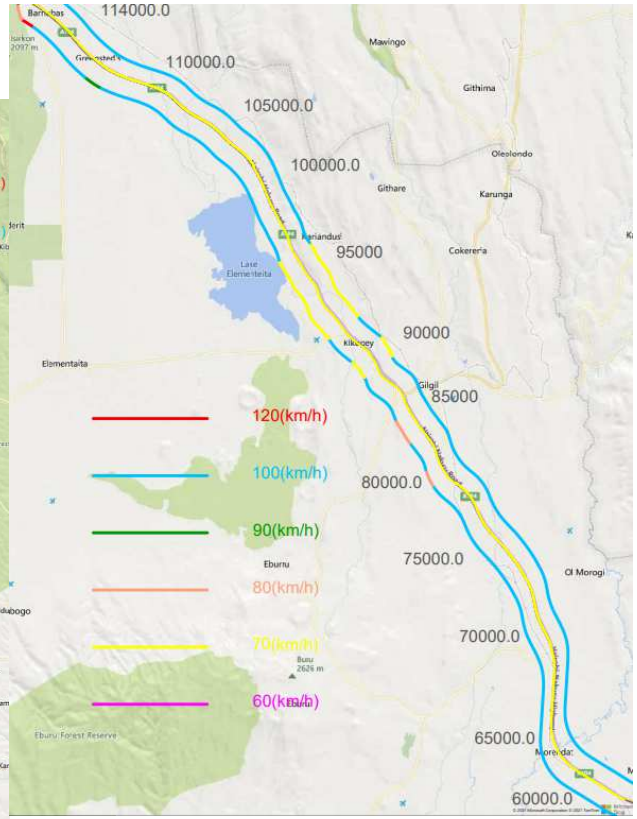
2. Design update summary

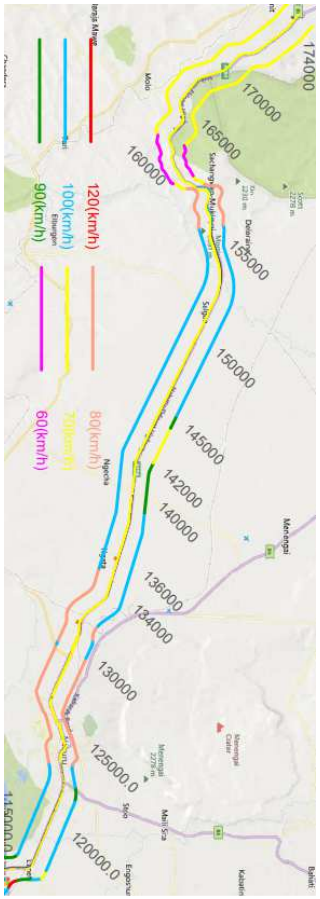
Road speed Map



Design speed along HS1



Design speed along HS2



Design speed along HS3-4

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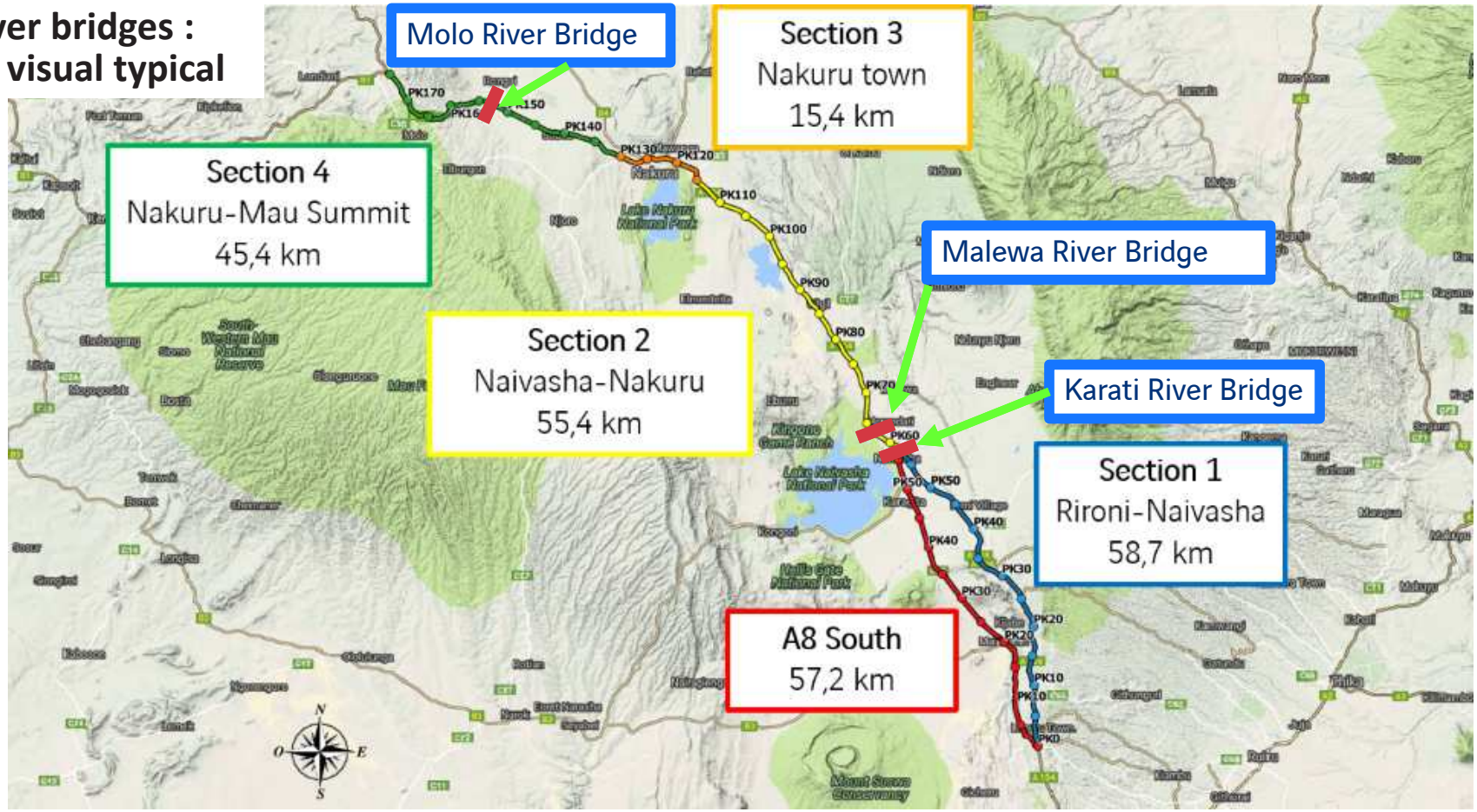
2. Design update summary

Bridges – River bridges : number and visual typical



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2. Design update summary

Bridges – River bridges : number and visual typical

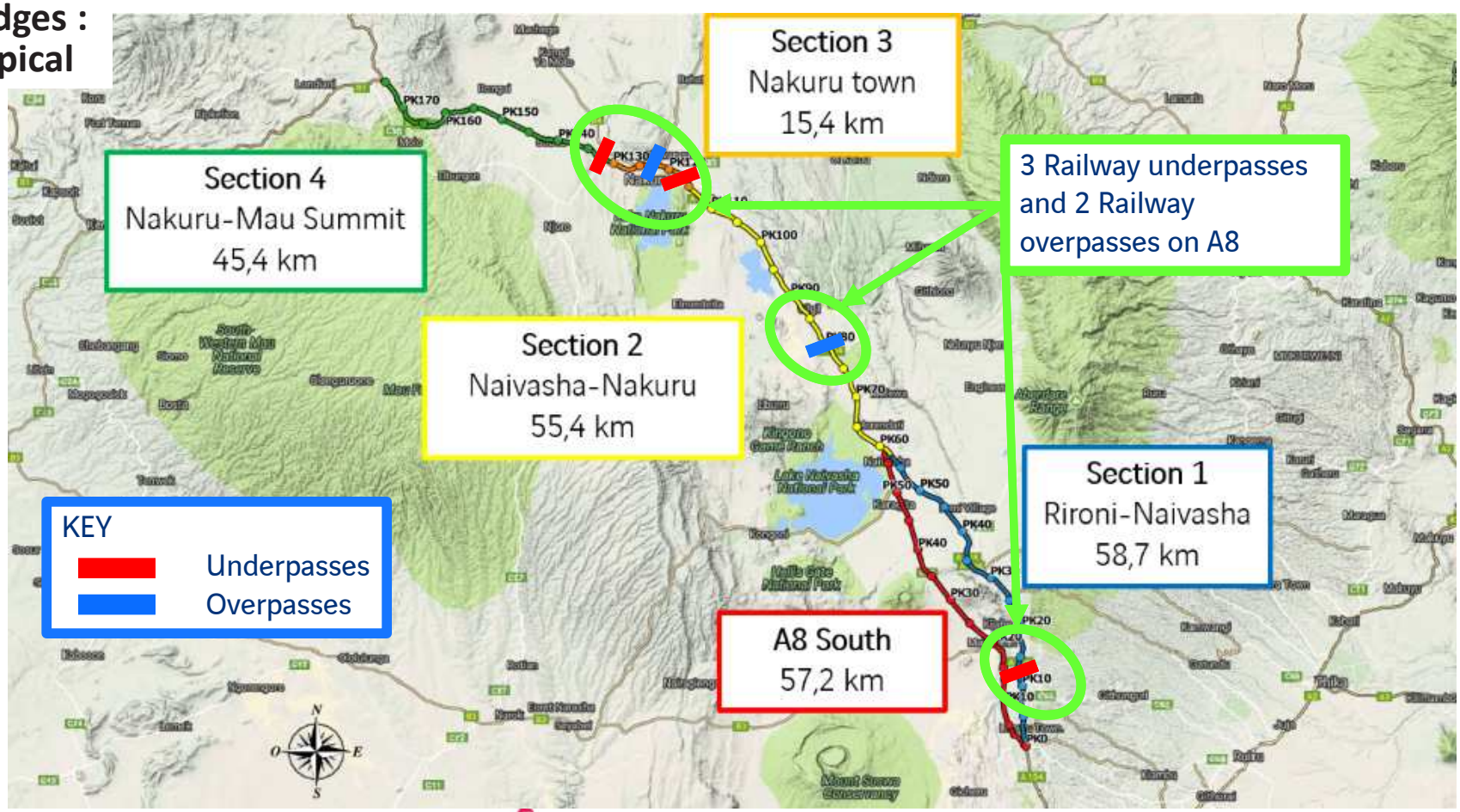
Views subject to update during detail design

Example of Malewa River Bridge

- Piers aligned with existing to avoid disturbance of the waterflow
- Piers founded on piles to take account of scouring

2. Design update summary

Bridges – Railway bridges : number and visual typical



RIFT VALLEY HIGHWAY

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2. Design update summary

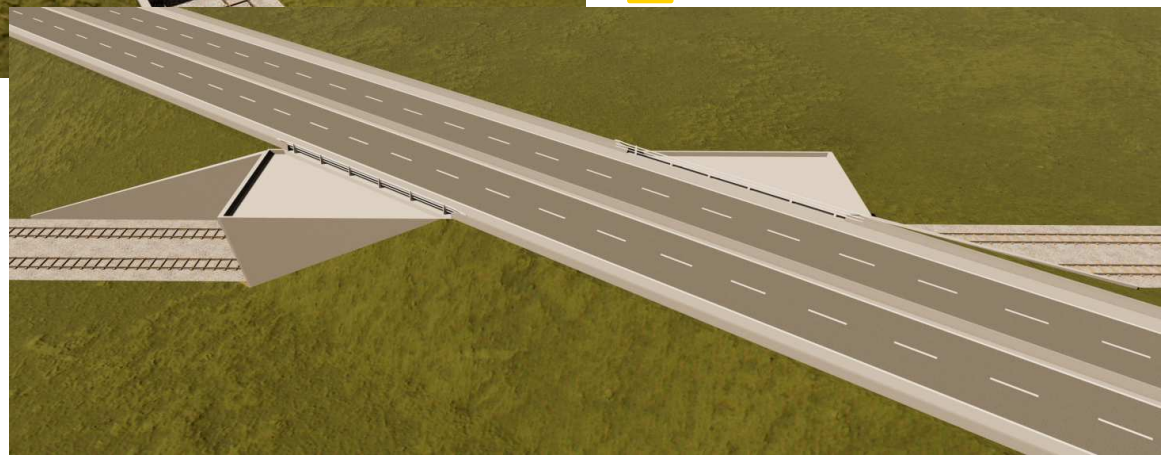
Bridges – Railway bridges : number and visual typical

Views subject to update during detail design

Railway Underpasses

- Minimal horizontal clearance : 11,25 m
- Minimal vertical clearance : 7,01 m

Extension of existing railway bridges



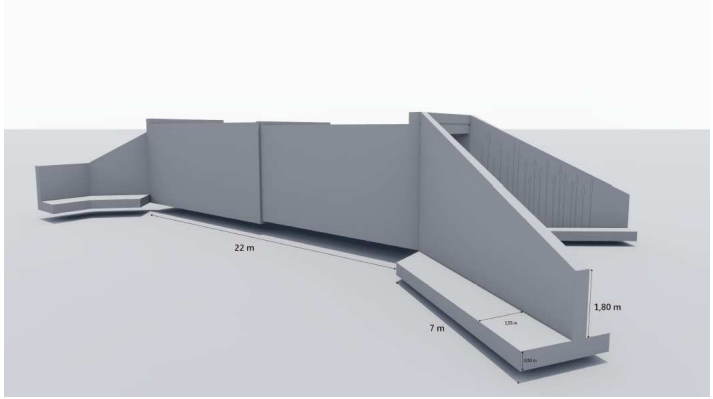
2. Design update summary

Bridges – Road bridges : number and visual typical

Views subject to update during detail design

Overpass : 22 new vehicular overpass on the project

Box culvert : approx 50 box culvert either to be extended or to be demolished and rebuilt



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2. Design update summary

Bridges – Footbridges : visual typical

Views subject to update during detail design

Footbridge with stairs

Footbridge with stairs and ramps

Further to the second round of public consultation, 10 additional crossing for pedestrian will be provided along the project which takes the number of pedestrian crossing to 116 along the project

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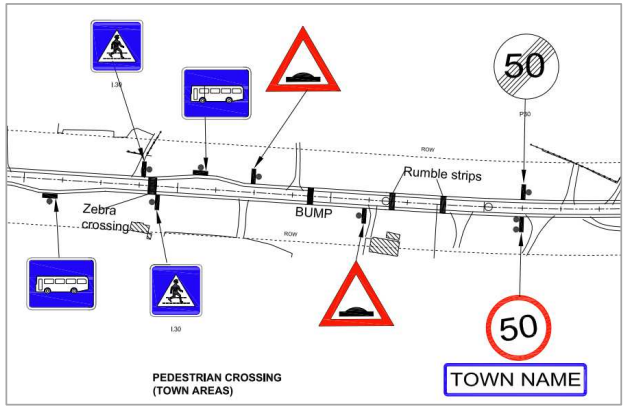
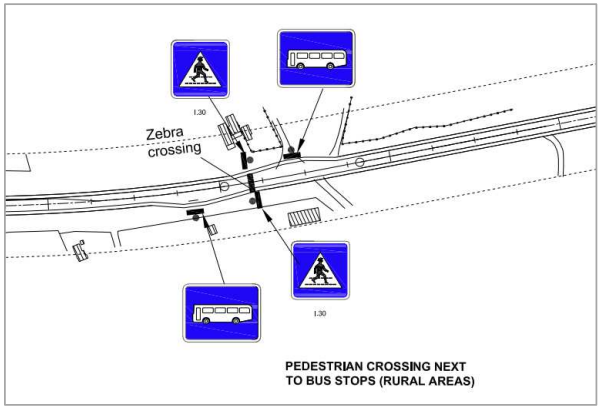
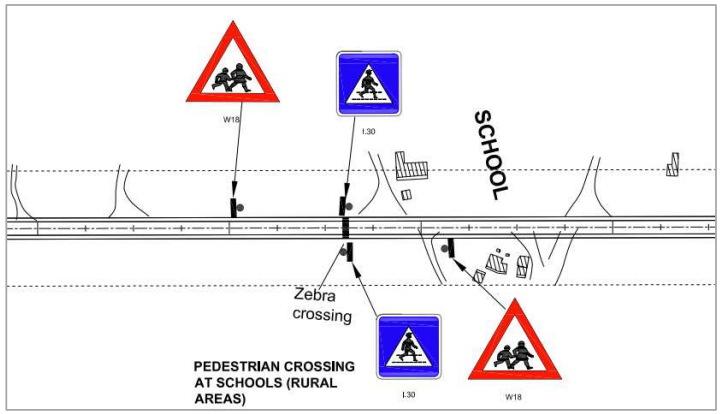
2. Design update summary

At grade pedestrian crossing on A8 south

Existing at grade crossing will be maintained at same location and improved with signs, speed bumps and rumble strips. Additional at grade crossing will be provided at location identified during public consultations.







Specific accident black spots have been identified along the A8 south. For these positions, grade separated crossing will be provided (2 footbridges).

Additional signage, road marking, speed bump and rumble strip will be provided to improve the safety of the at grade crossings and foot overbridges for grade separated crossings

QUESTIONS?

KeNHA

Public Private Partnerships Directorate

Driving Sustainable Investments

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Agenda

Schedule	Activity	Details
9h00am-9h45am (45min)	Arrival and reception of participants	▪ Registration/signing of attendance sheets ▪ Distribution of information documents
9h45am-10h00am (15 min)	Opening Word / Blessing Prayer	▪ Subcounty Officials
10h00am-10h15am (15 min)	Project Overview	▪ KeNHA / PPP Unit
10h15am-10h45am (30 min)	Results of the 2nd round of consultation and revised design for the Nairobi-Nakuru-Mau Summit Highway Project	▪ WSP
10h45am-11h15am (30 min)	ESIA process, main environmental and social impacts and proposed mitigation measures	▪ WSP
11h15am-12h30pm (75 min)	Questions and Answers	▪ KeNHA / Rift Valley Highway / WSP
12h30pm-12h45pm (15 min)	Closing Remarks and Prayer	▪ Subcounty Officials

KeNHA

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Nairobi – Nakuru – Mau Summit Highway Project

Environmental and Social Impact Assessment

Stakeholders Engagement Activities

3RD ROUND : November 2021

KeNHA

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- Presentation INDEX

01 • Project Review

02 • Environmental and Social Impact Assessment (ESIA) and Stakeholders Engagement Activities

03 • Revised Design

04 • Environmental and Social Impacts and Proposed Mitigation Measures

05 • Next Steps

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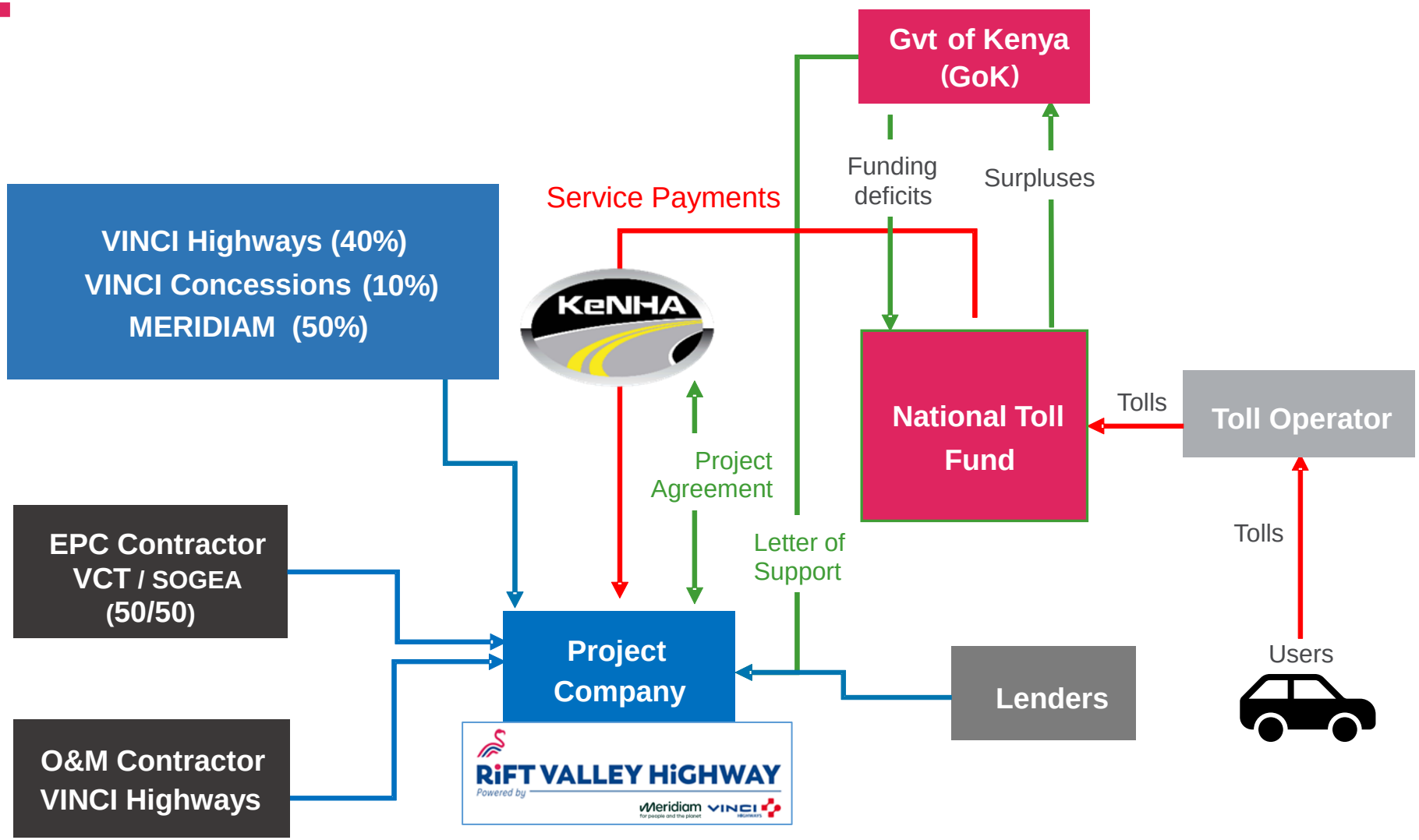
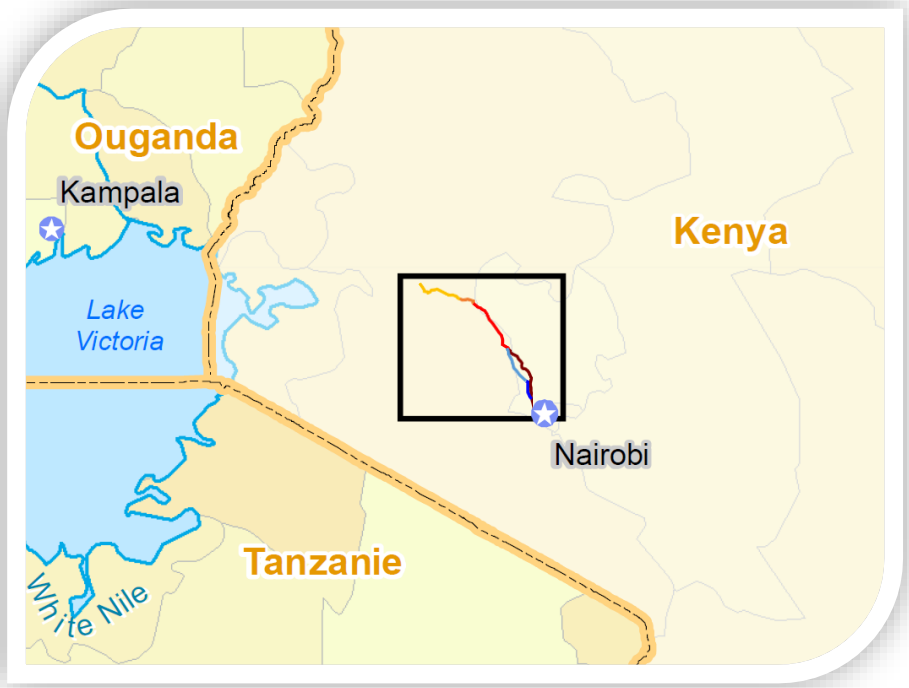
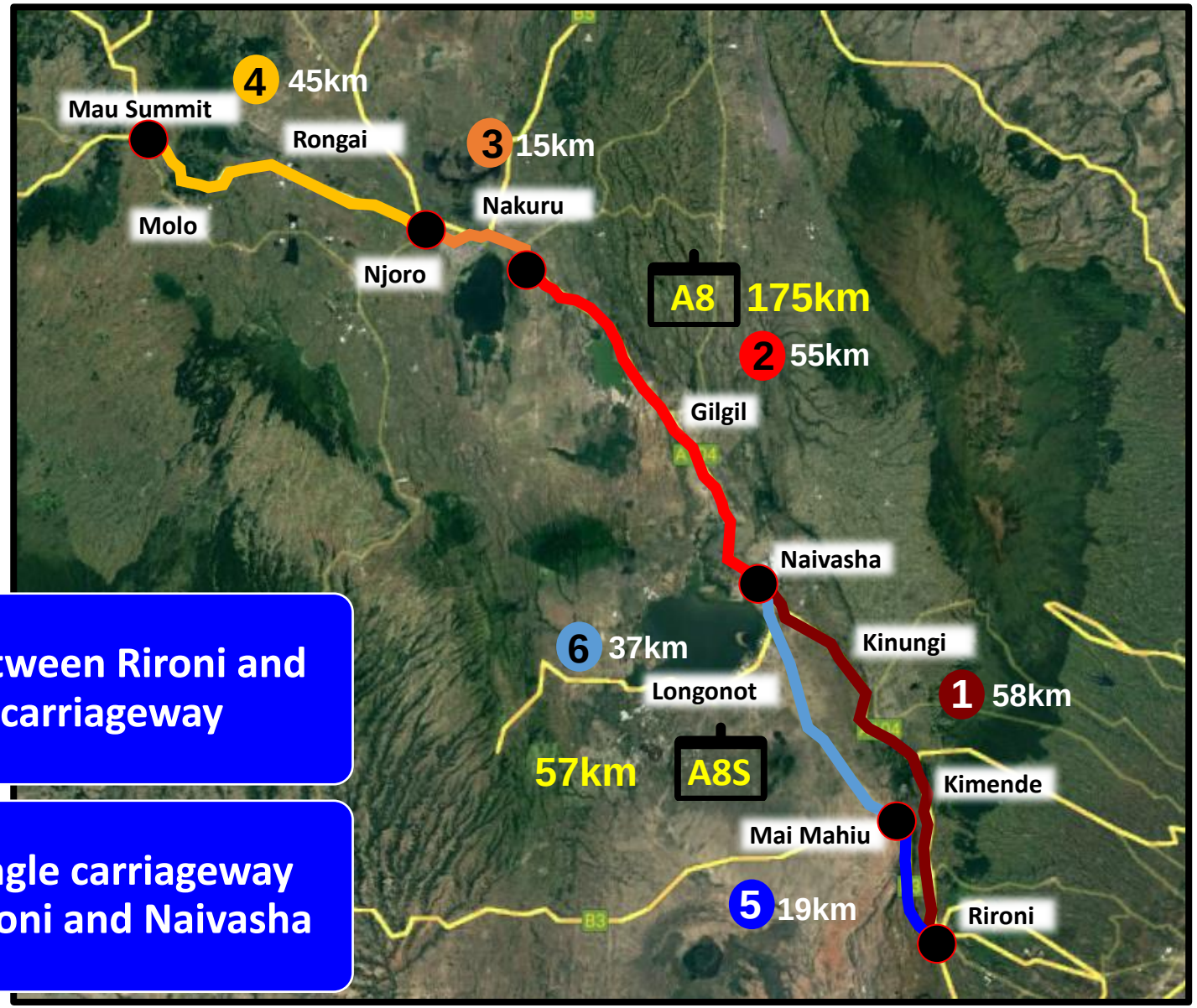
Project Structure



Project localisation





A8

Widening of the existing 104 between Ririoni and Mau Summit into a 4 lanes dual carriageway

A8S

Rehabilitation of the existing single carriageway of Mai-Mahiu road between Ririoni and Naivasha

Key elements of the design

High quality | Safety | Multi modality | Environment

BOTH A8 and A8 South

- Improved geometrics and landscaping
- Pedestrian and livestock crossings points
- Railway bridges
- Bus bays and shelters
- Truck lay-bye
- Street lighting and service lanes in town
- Improvements on major junctions
- Connection of minor roads through service roads
- Variable message signs – to guide road users

ONLY A8

- Dual carriageway
- Grade separated interchanges
- Improvement of existing U-Turn facilities
- Vehicle's underpasses and overpasses
- River bridges and wildlife crossings
- Climbing lane at steep gradient locations

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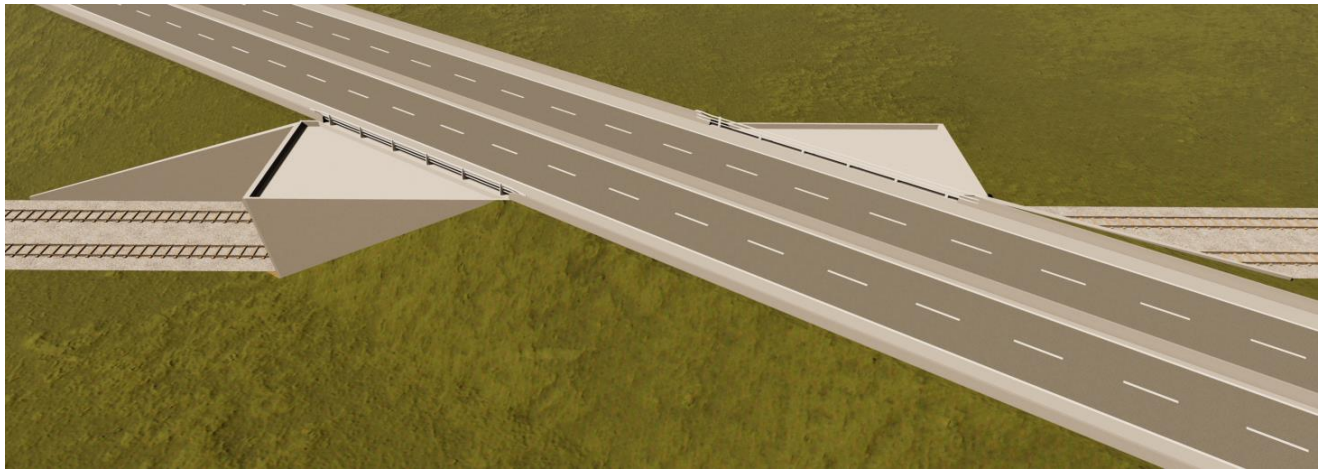
Infrastructure details : Railway crossings

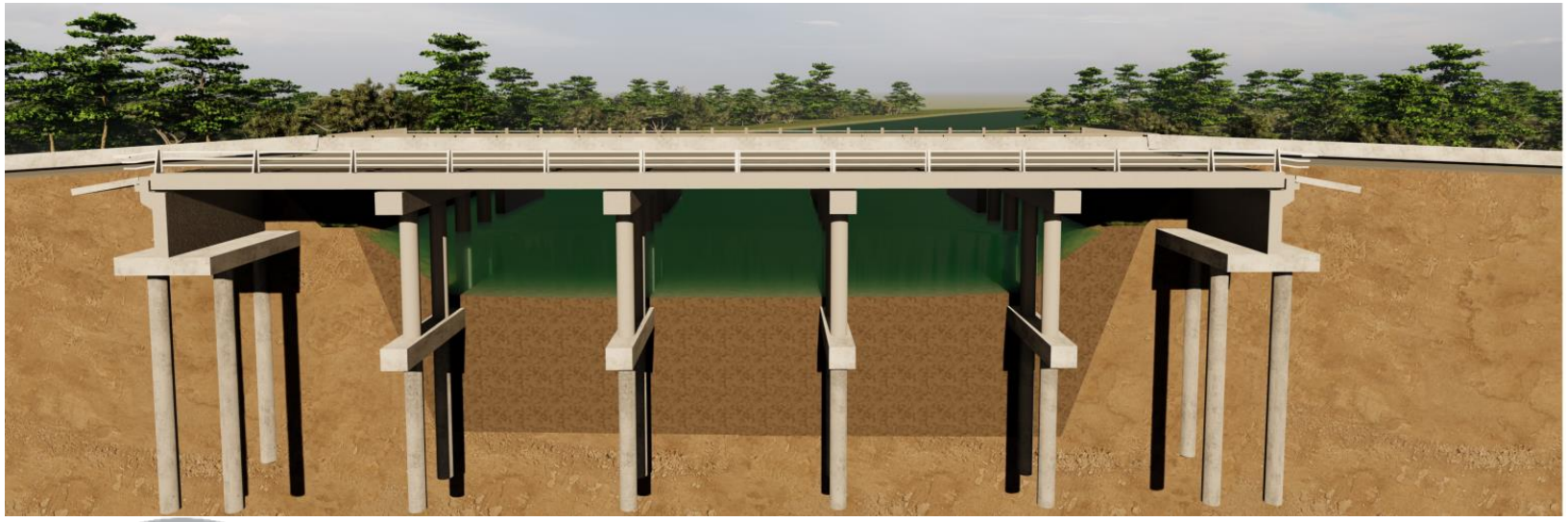
Railway underpass



Extension of the existing railway bridge

Infrastructure details : River bridges

Example of Malewa River



Piers aligned with existing to avoid disturbance of the waterflow

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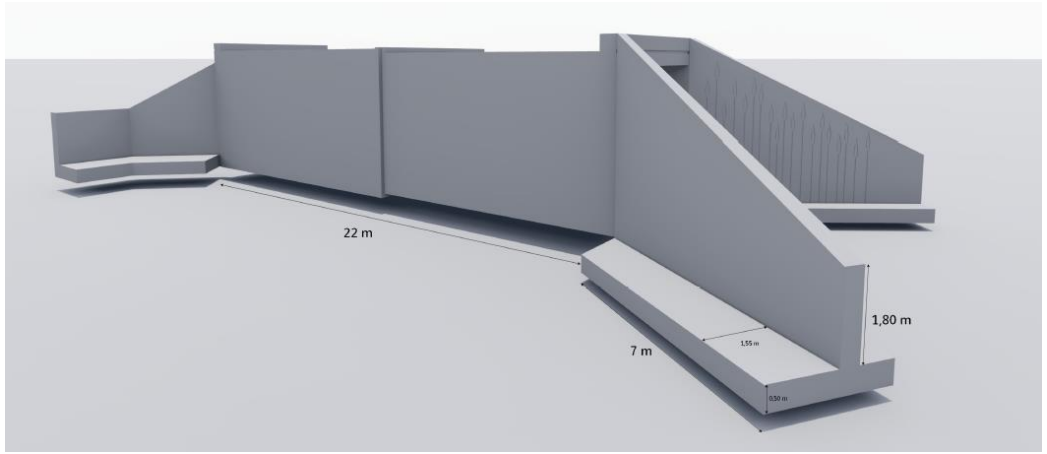
Infrastructure details : Underpasses



Underpass (box culvert)

Infrastructure details : Overpasses

Vehicular overpasses

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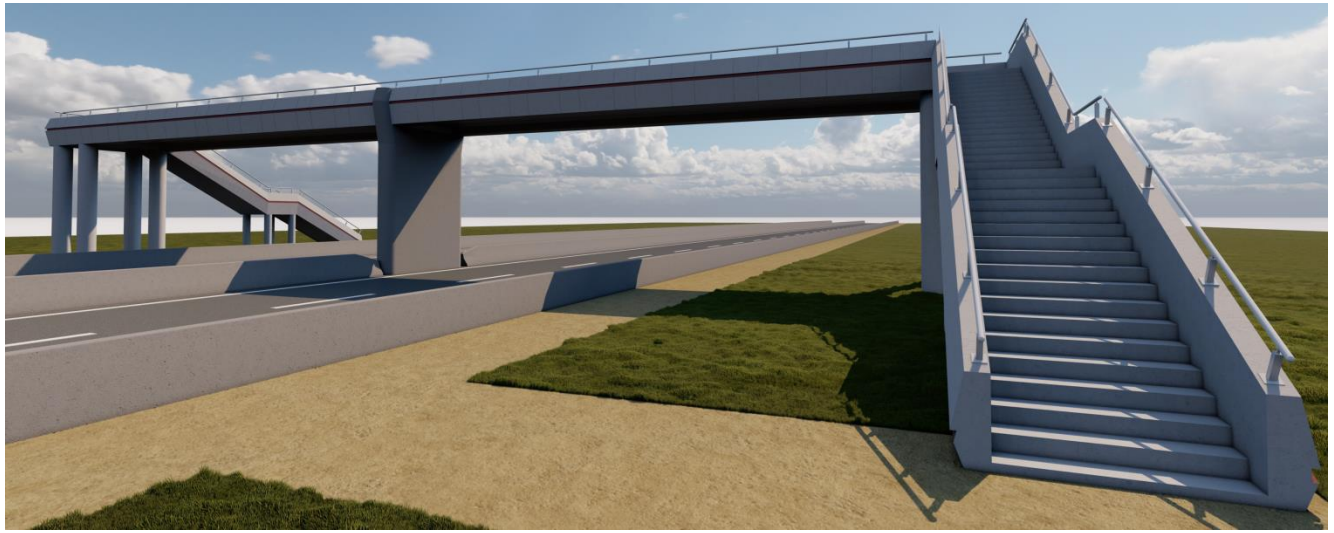
Infrastructure details : Footbridges



Footbridge with stairs

Footbridge with stairs and ramps

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Infrastructure details : Wildlife crossings

View of the overpasses for wildlife

ESIA AND STAKEHOLDERS ENGAGEMENT ACTIVITIES

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Environmental and Social Impact Assessment (ESIA)

ESIA

- Project Description
- Baseline Studies
- Identification of potential impact
- Proposed mitigation and enhancement measures
- Environmental and Social Management Plan (ESMP)

STAKEHOLDERS PARTICIPATION

- ESIA presentation to lenders
- ESIA presentation to stakeholders

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Stakeholders participation

2 types of activities

Baselines related meetings

- Present project
- Exchange/collect data for baselines studies
- Perform surveys

Consultations

1st round

- Present project
- Present steps of the impact study
- Inform about upcoming surveys

2nd round

- Present project design
- Perform group activity to revise the design in a participative approach
- Collect concerns and recommendations

3rd round

- Present results of the ESIA
- Collect additional concerns and recommendations

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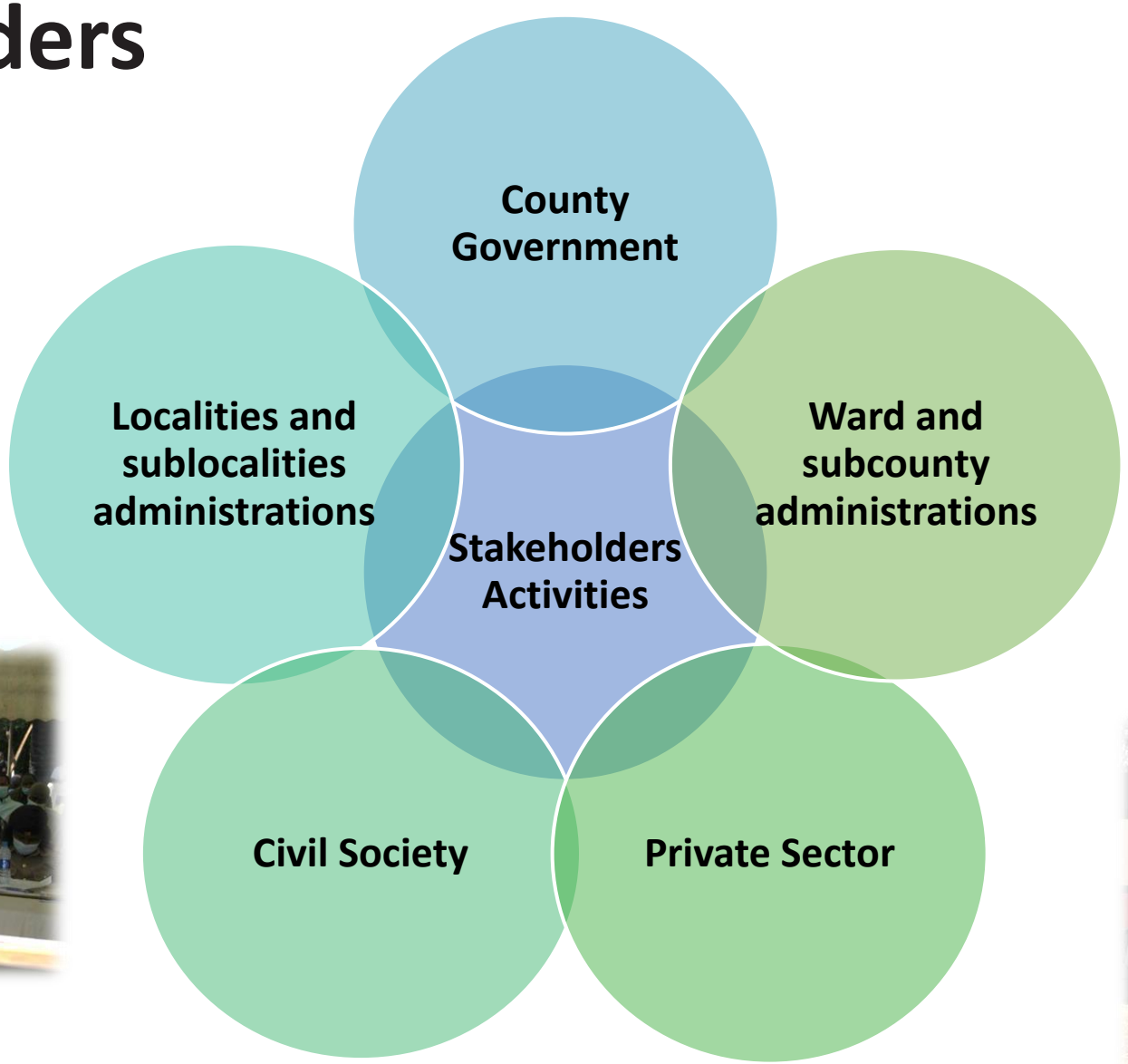
Main stakeholders



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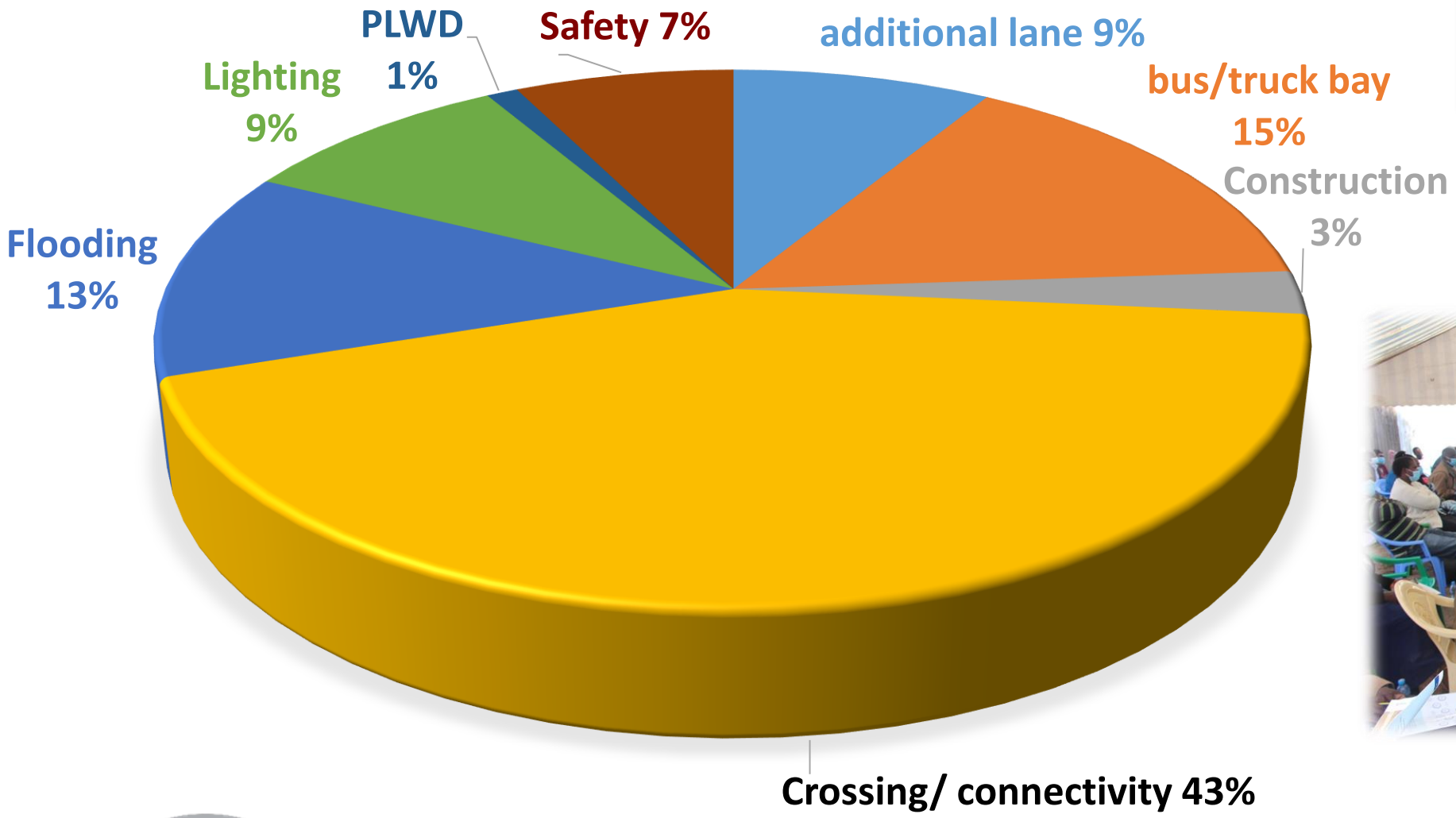
Main results and inputs



Statistics

- Around 65 meetings
- Over 3000 participants

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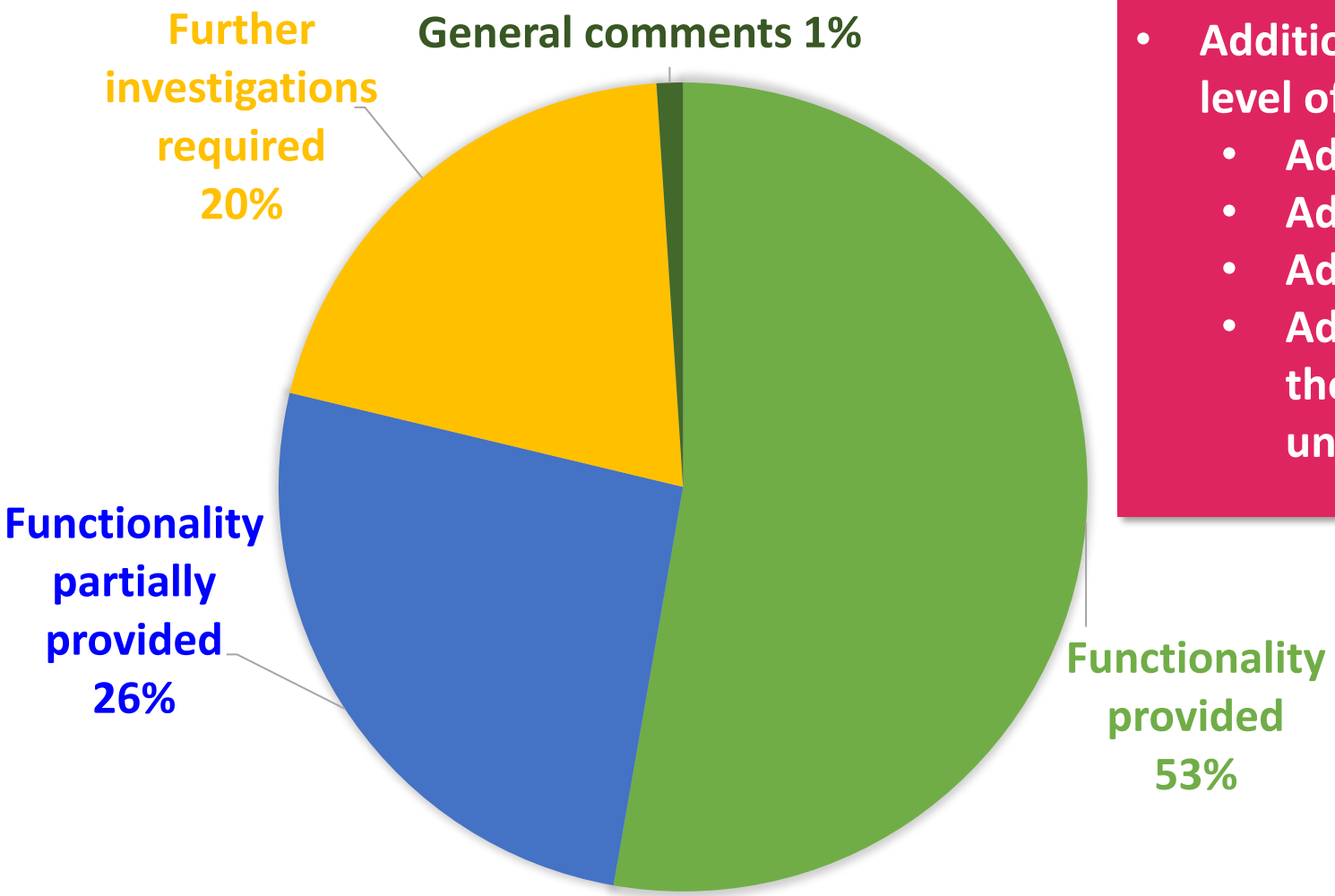
Inputs integration



Integration actions

- Relocation of some functionality to better address population needs
- Additional functionality to improve the overall level of service of the Highway
  - Additional pedestrian crossings (+14)
  - Additional service lanes (+1900 m)
  - Additional bus bays (+26 bus bays)
  - Additional lighting (+200 m of lighting along the road, memorial, urban pedestrian underpasses, etc.)

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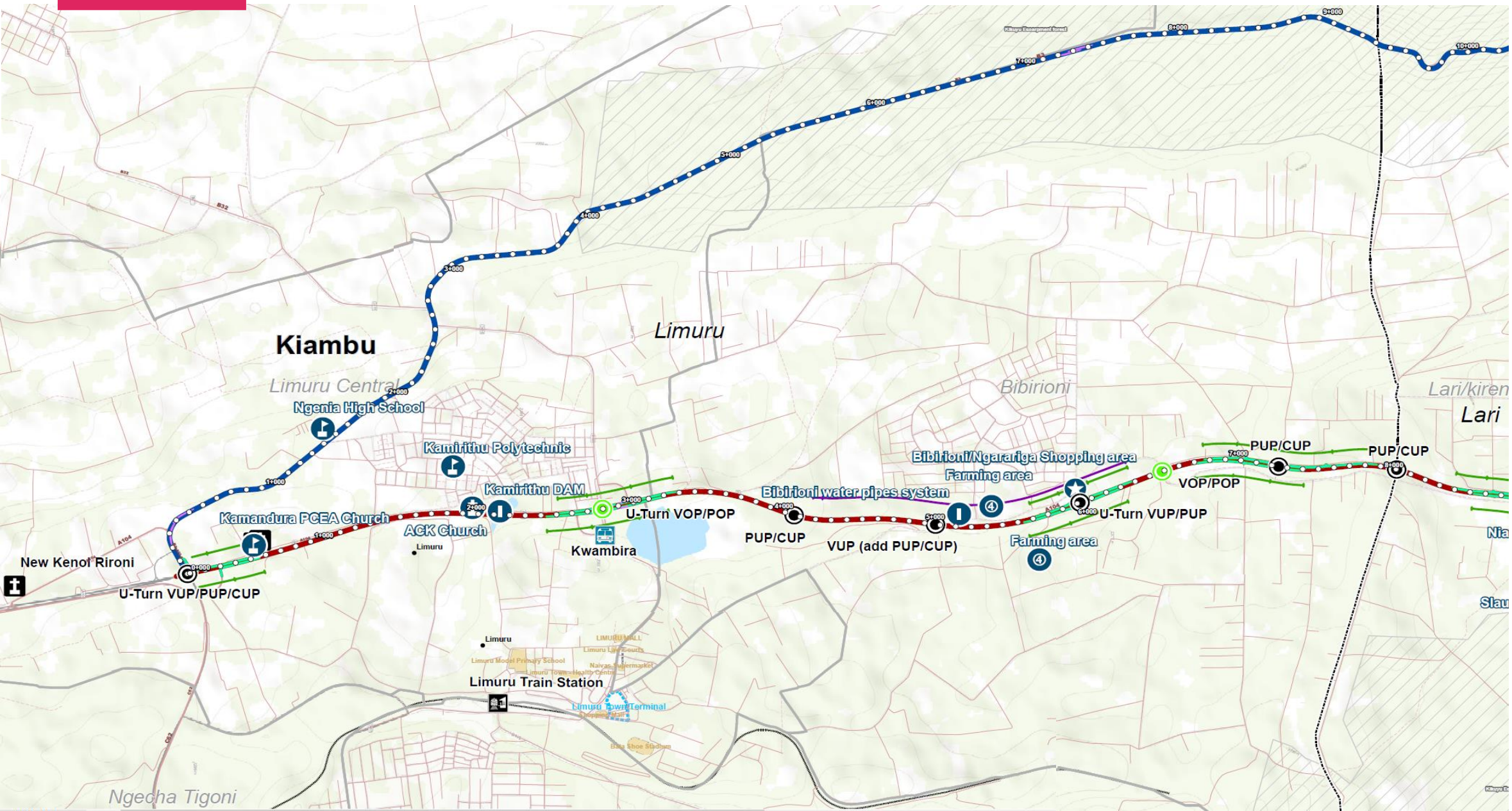
Design review - LIMURU



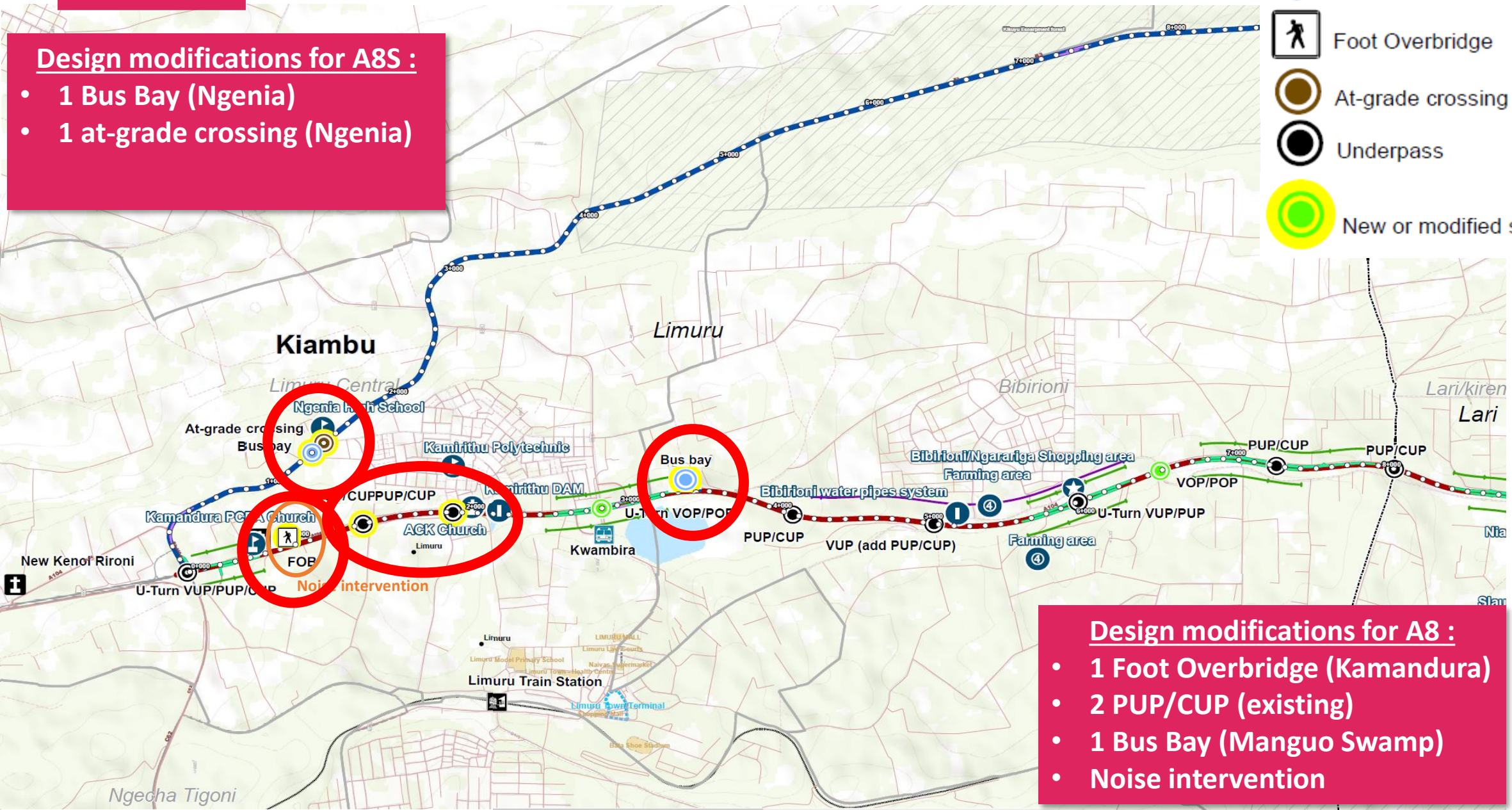
Design review - LIMURU

Design modifications for A8S :

- 1 Bus Bay (Ngenia)
- 1 at-grade crossing (Ngenia)

LEGEND

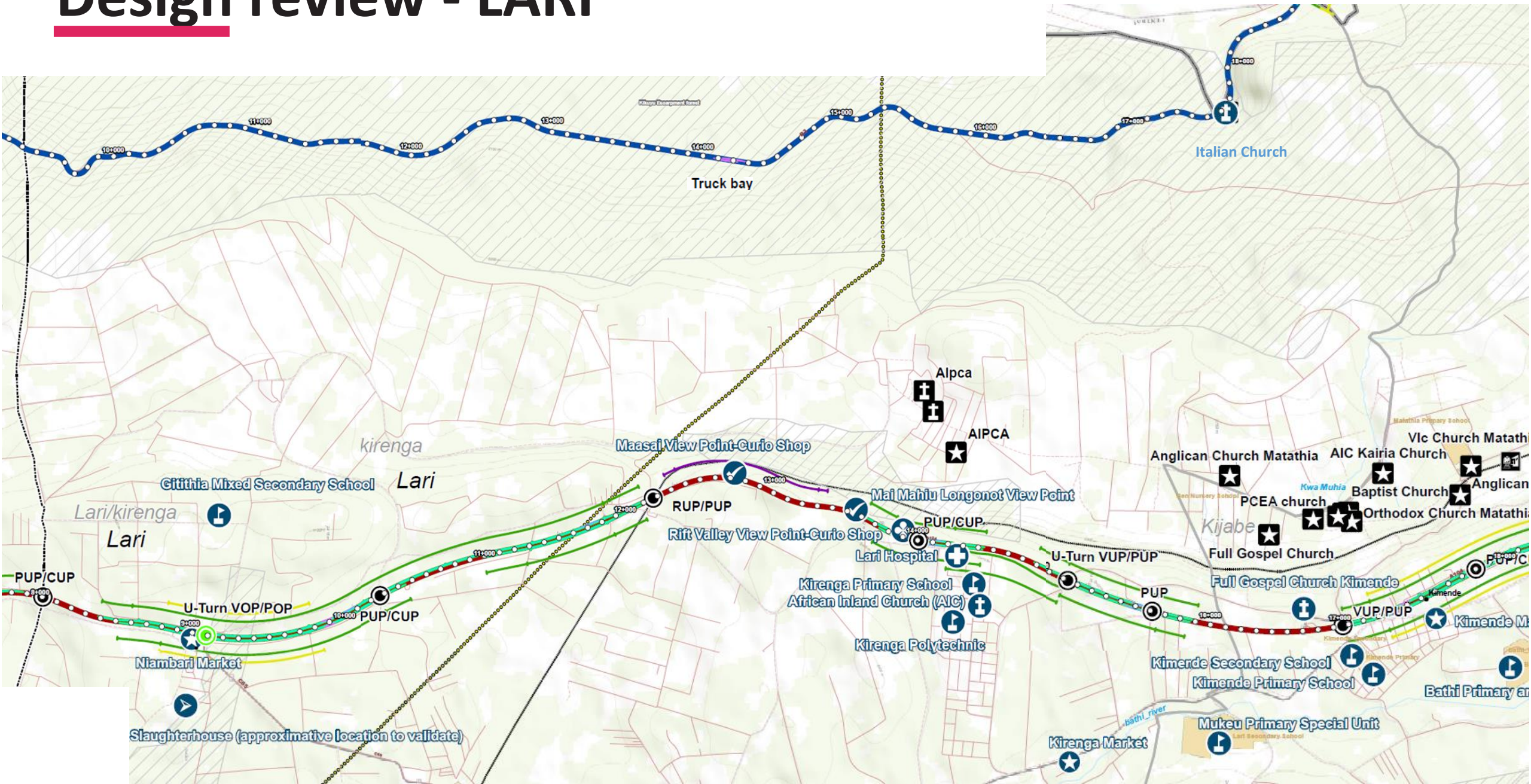
- Bus bay
- Foot Overbridge
- At-grade crossing
- Underpass
- New or modified structure



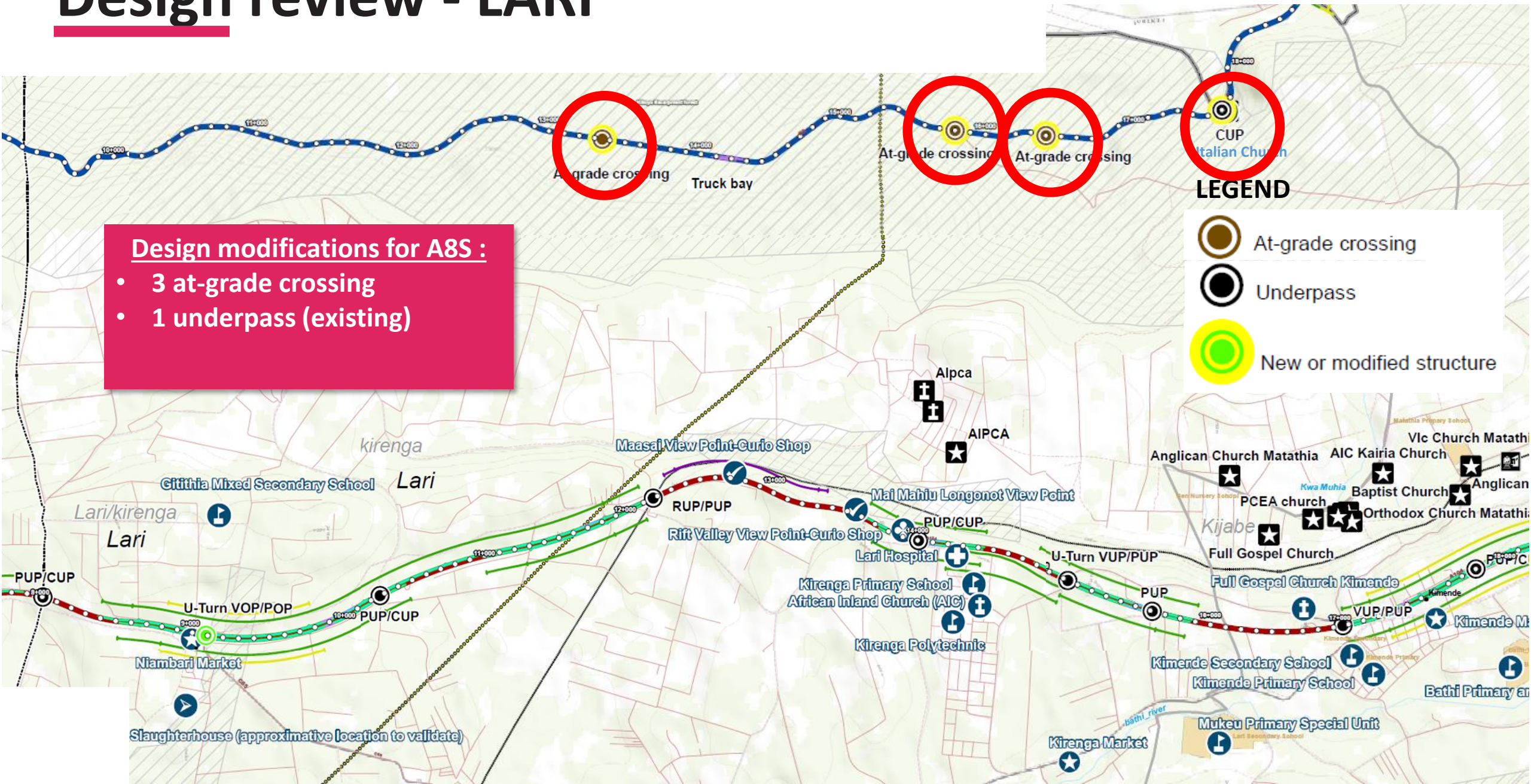
Design modifications for A8 :

- 1 Foot Overbridge (Kamandura)
- 2 PUP/CUP (existing)
- 1 Bus Bay (Manguo Swamp)
- Noise intervention

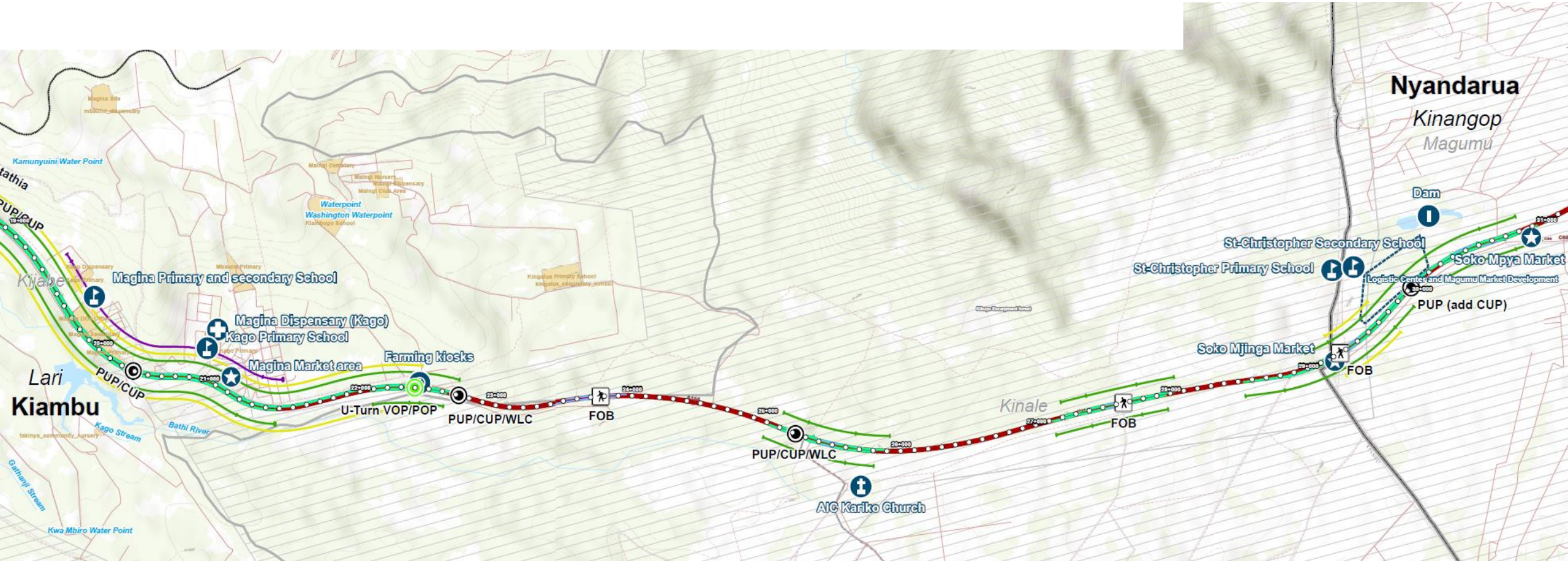
Design review - LARI



Design review - LARI



Design review - LARI



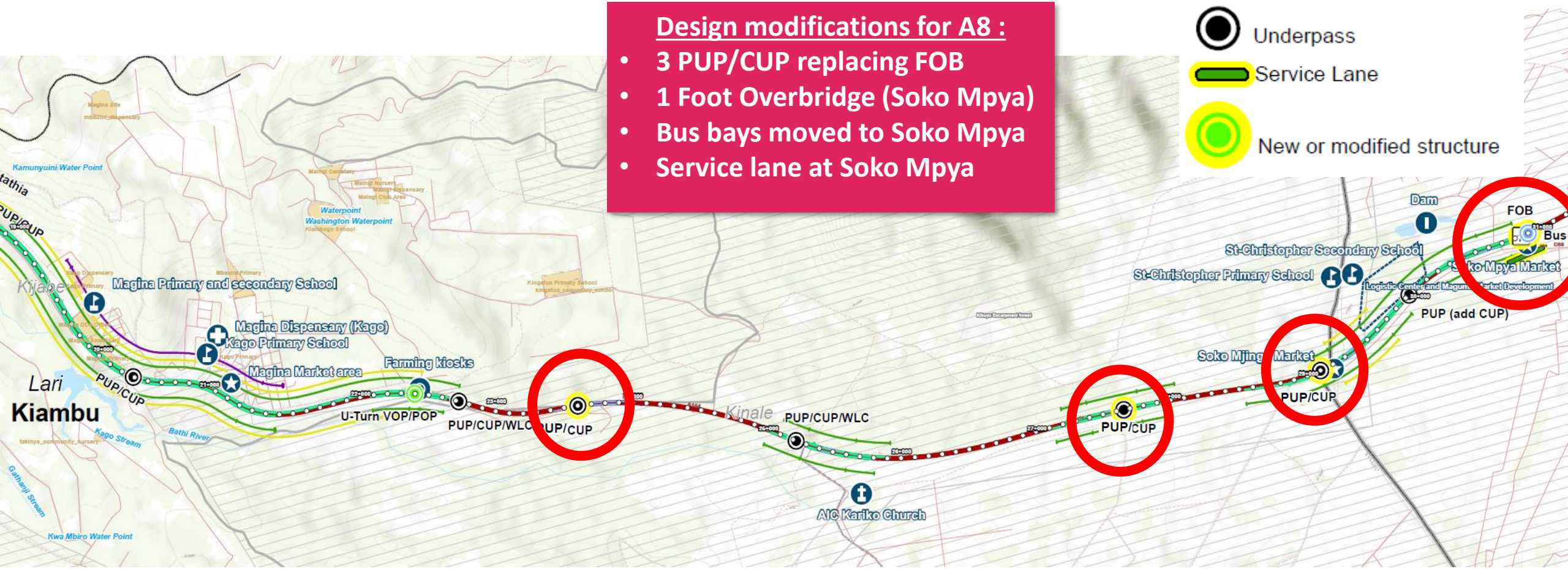
Design review - LARI

Design modifications for A8 :

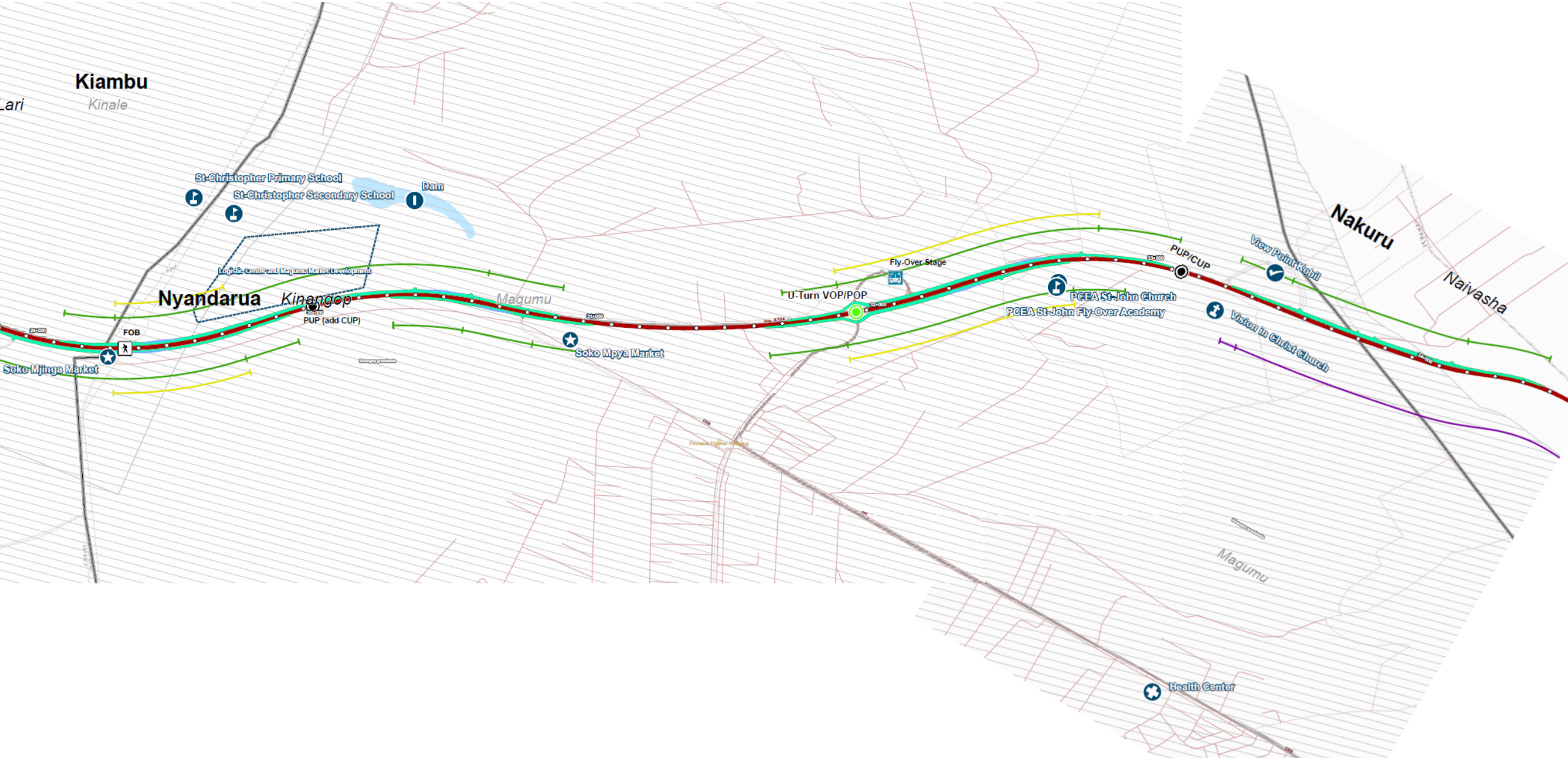
- 3 PUP/CUP replacing FOB
- 1 Foot Overbridge (Soko Mpya)
- Bus bays moved to Soko Mpya
- Service lane at Soko Mpya

LEGEND

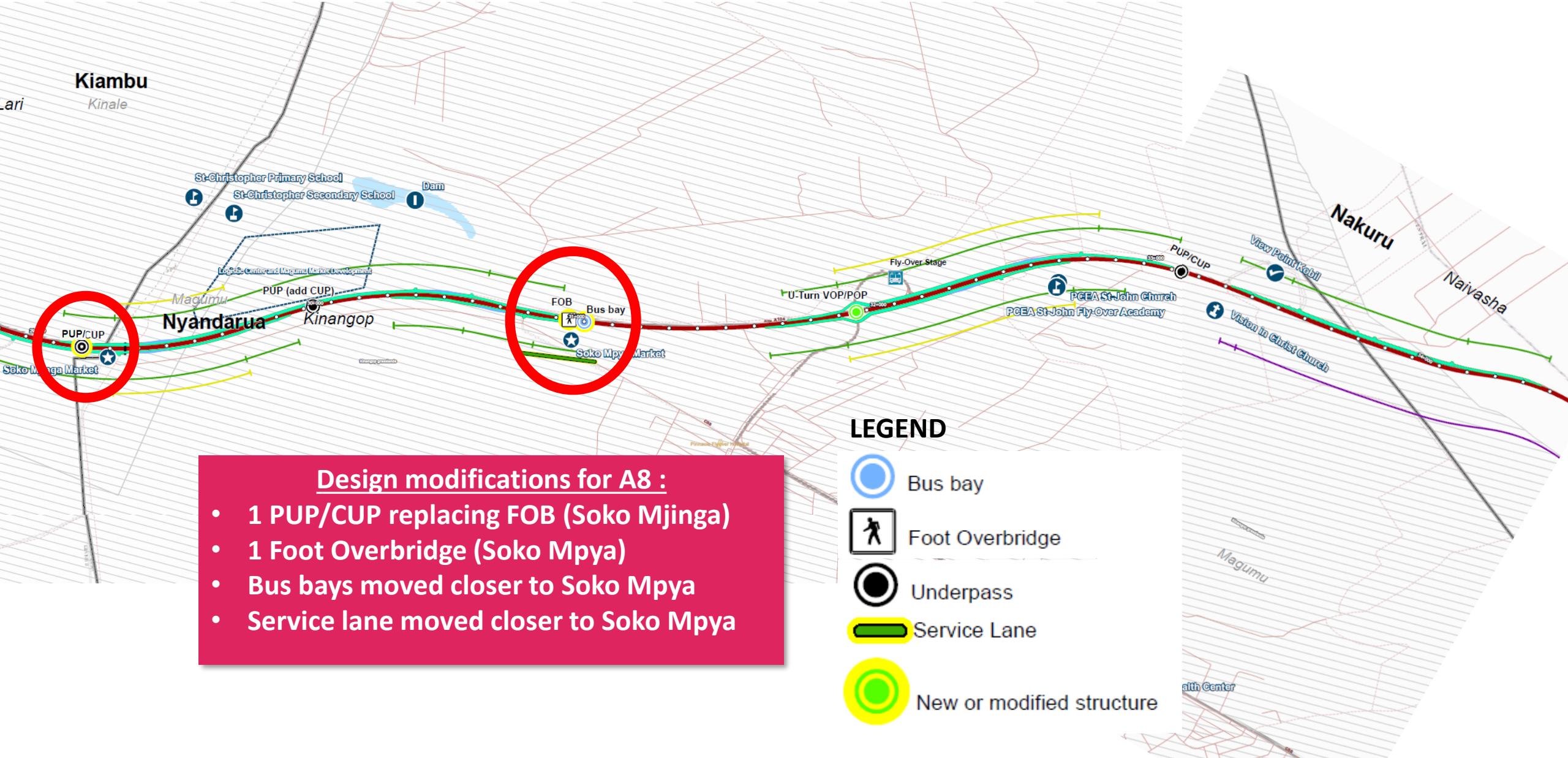
- Bus bay
- Foot Overbridge
- Underpass
- Service Lane
- New or modified structure



Design review - KINANGOP



Design review - KINANGOP



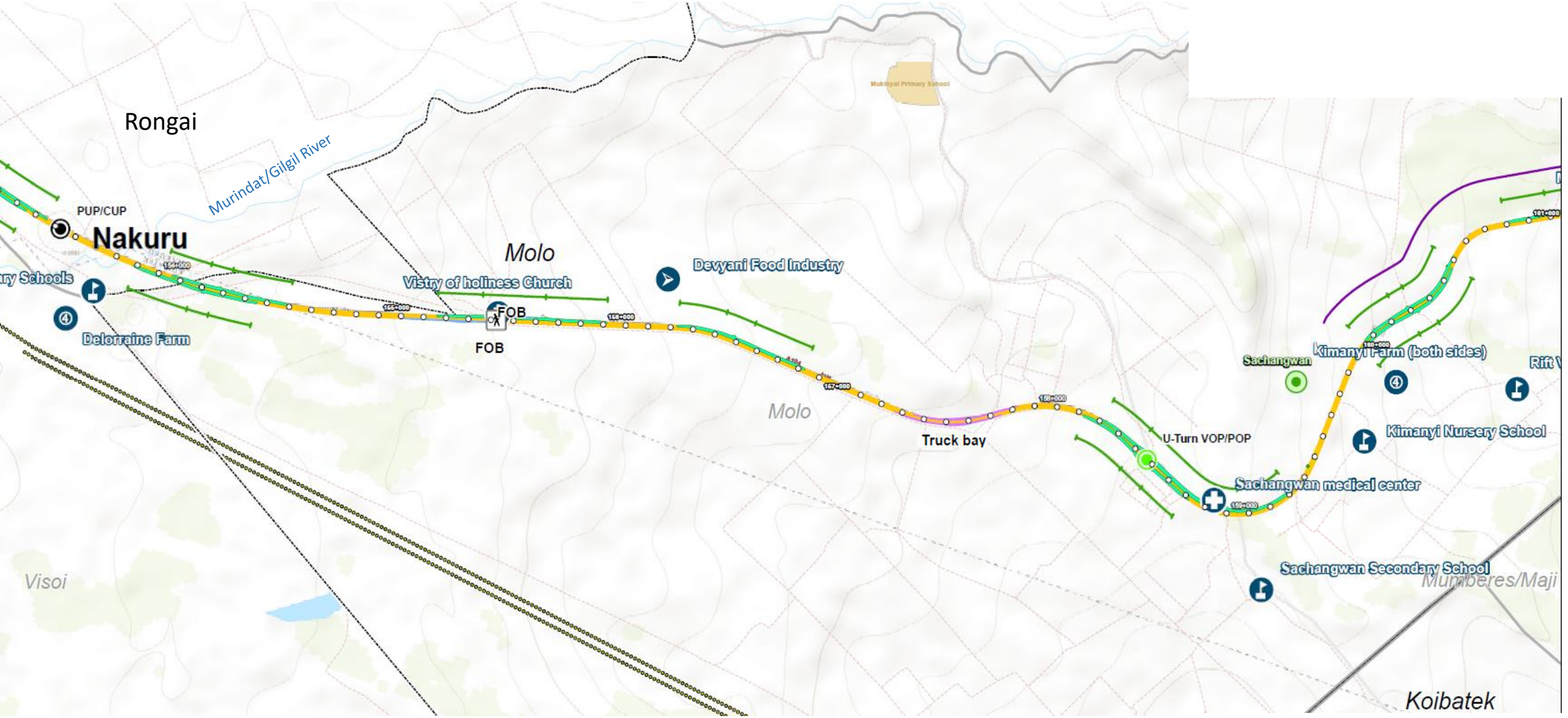
Design modifications for A8 :

- 1 PUP/CUP replacing FOB (Soko Mjinga)
- 1 Foot Overbridge (Soko Mpya)
- Bus bays moved closer to Soko Mpya
- Service lane moved closer to Soko Mpya

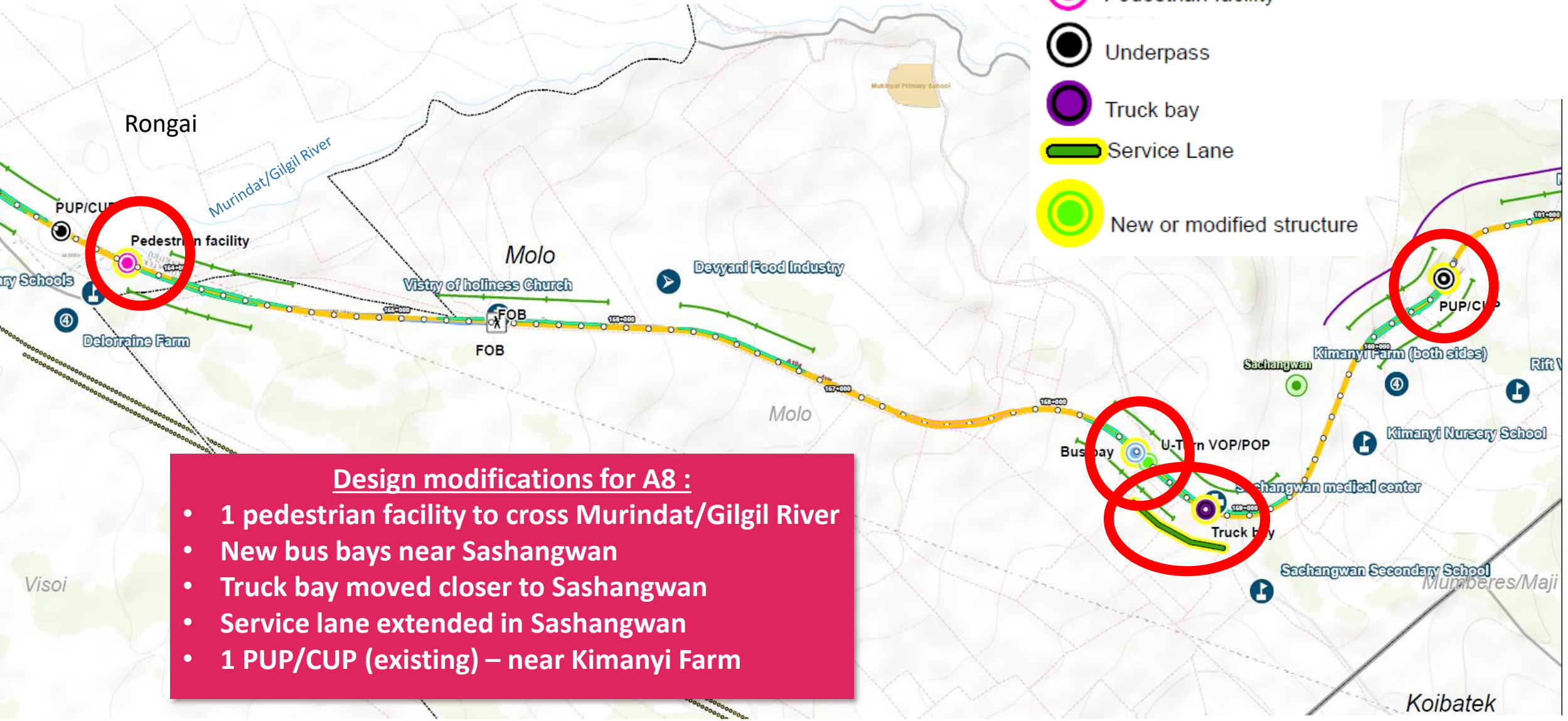
LEGEND

- Bus bay
- Foot Overbridge
- Underpass
- Service Lane
- New or modified structure

Design review - MOLO



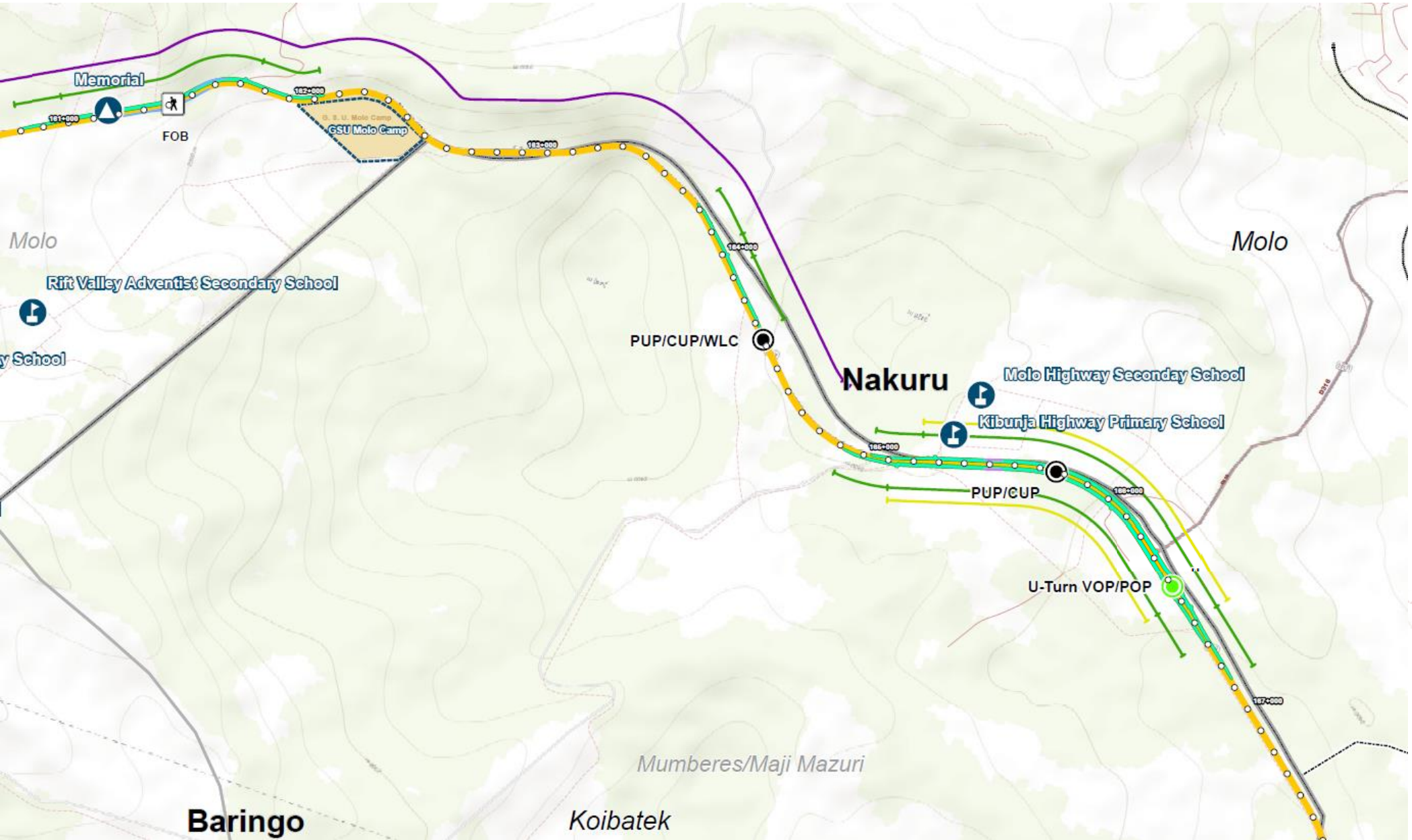
Design review - MOLO



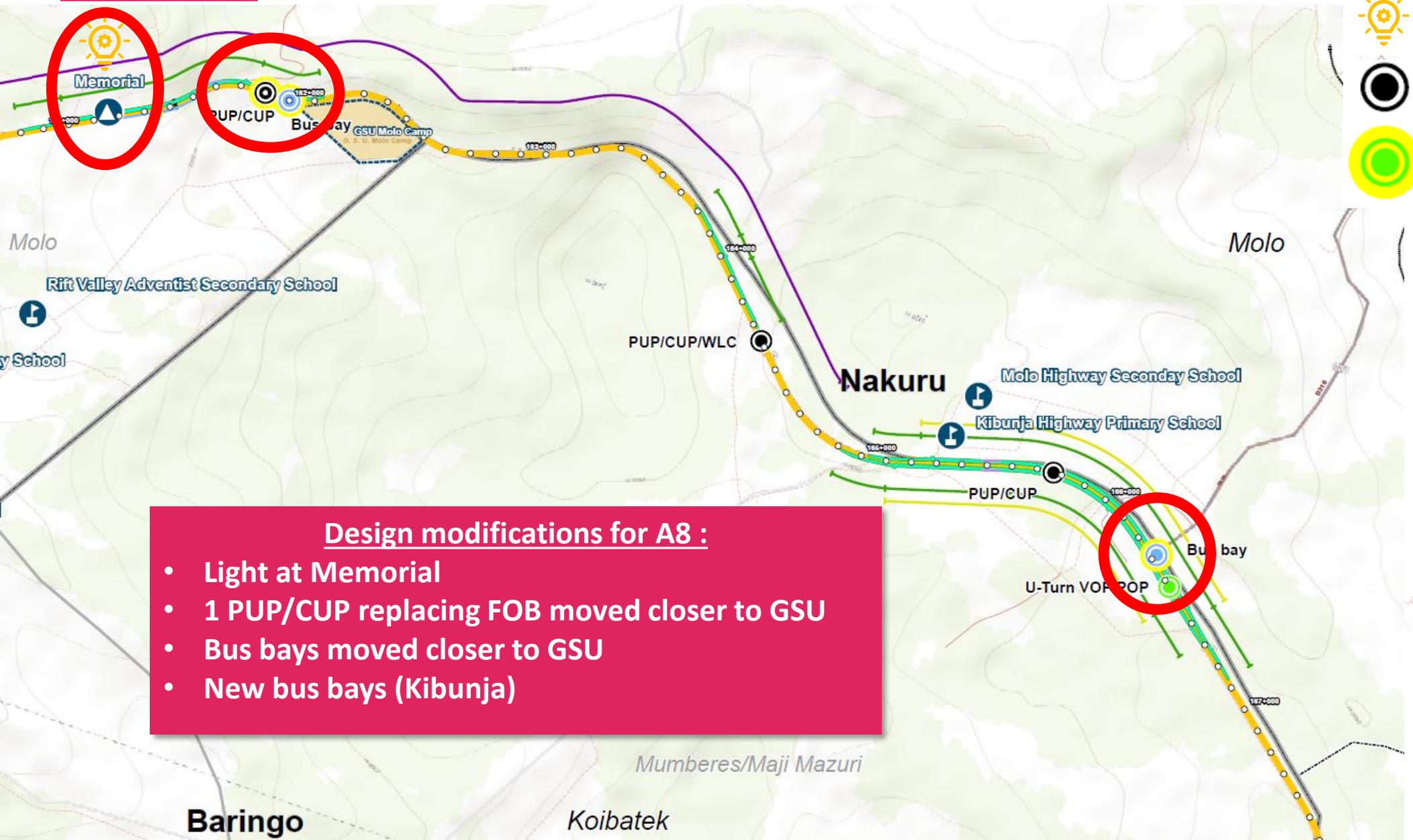
Design modifications for A8 :

- 1 pedestrian facility to cross Murindat/Gilgil River
- New bus bays near Sashangwan
- Truck bay moved closer to Sashangwan
- Service lane extended in Sashangwan
- 1 PUP/CUP (existing) – near Kimanyi Farm

Design review - KOIBATEK



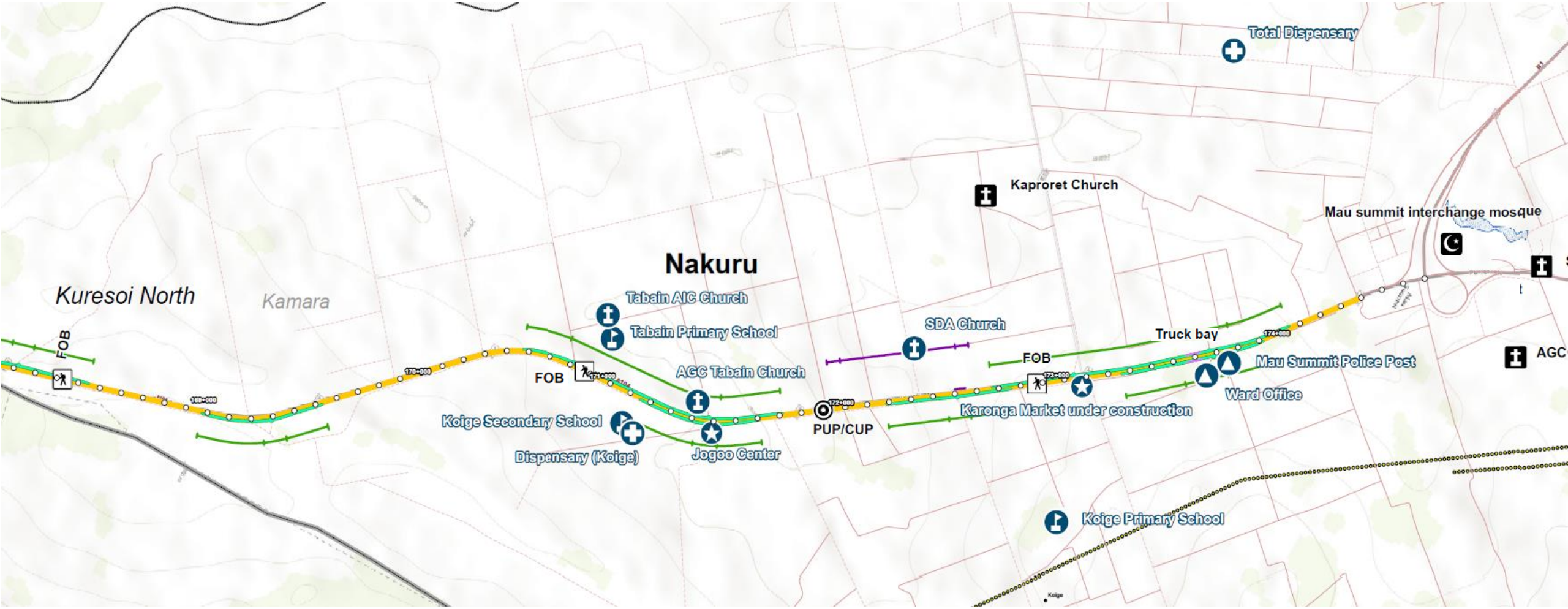
Design review - KOIBATEK



Design modifications for A8 :

- Light at Memorial
- 1 PUP/CUP replacing FOB moved closer to GSU
- Bus bays moved closer to GSU
- New bus bays (Kibunja)

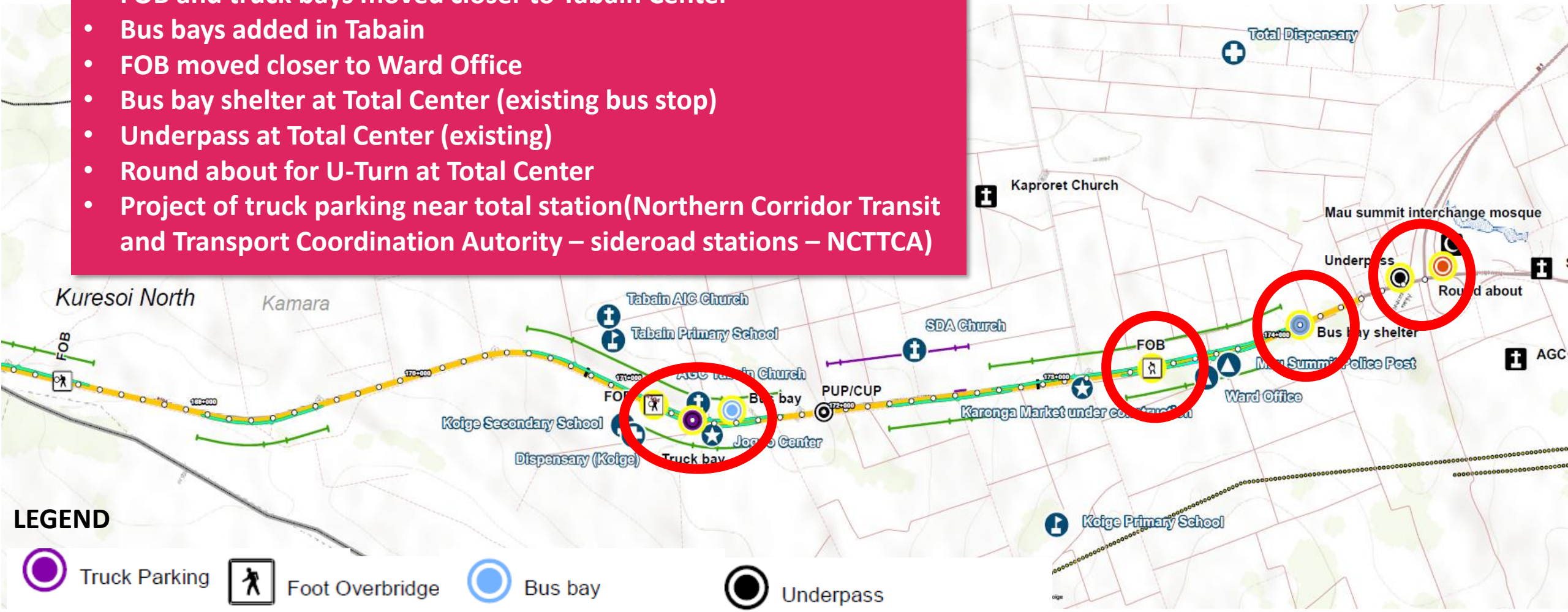
Design review – KURESOI NORTH



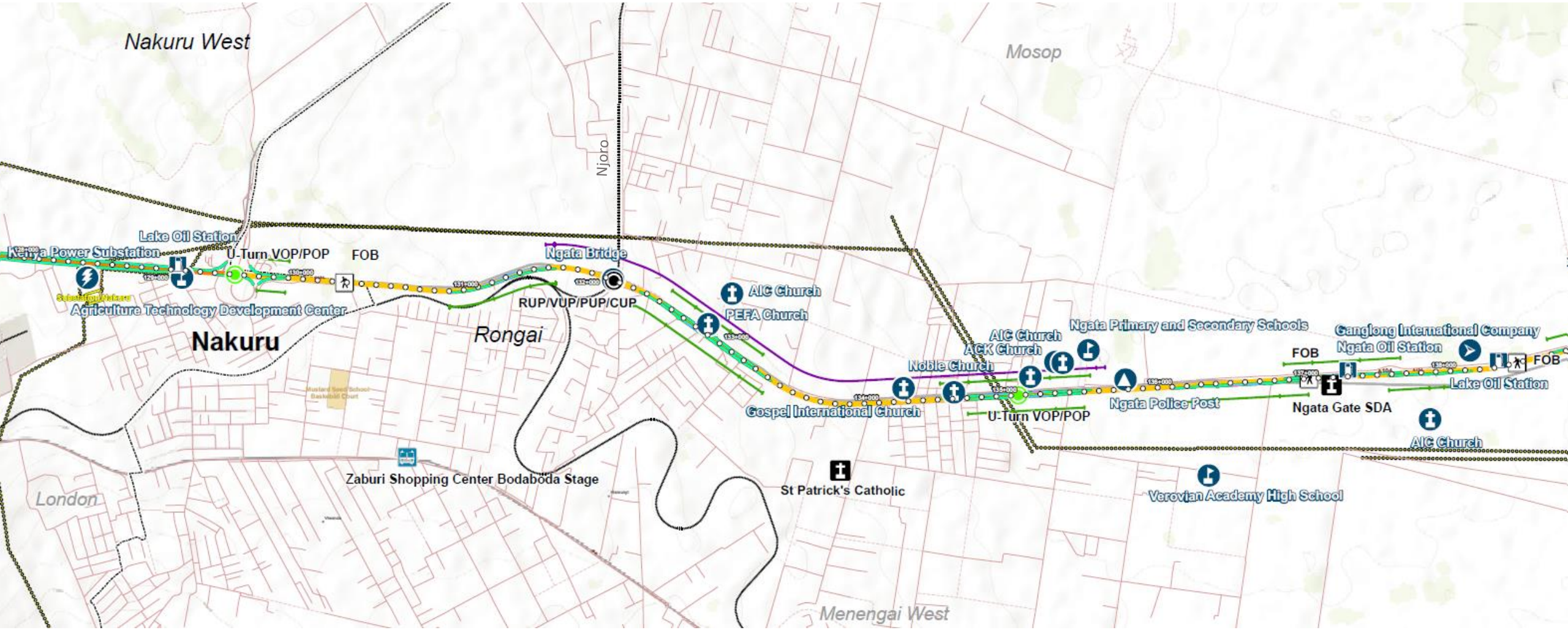
Design review – KURESOI NORTH

Design modifications for A8 :

- FOB and truck bays moved closer to Tabain Center
- Bus bays added in Tabain
- FOB moved closer to Ward Office
- Bus bay shelter at Total Center (existing bus stop)
- Underpass at Total Center (existing)
- Round about for U-Turn at Total Center
- Project of truck parking near total station(Northern Corridor Transit and Transport Coordination Autority – sideroad stations – NCTTCA)



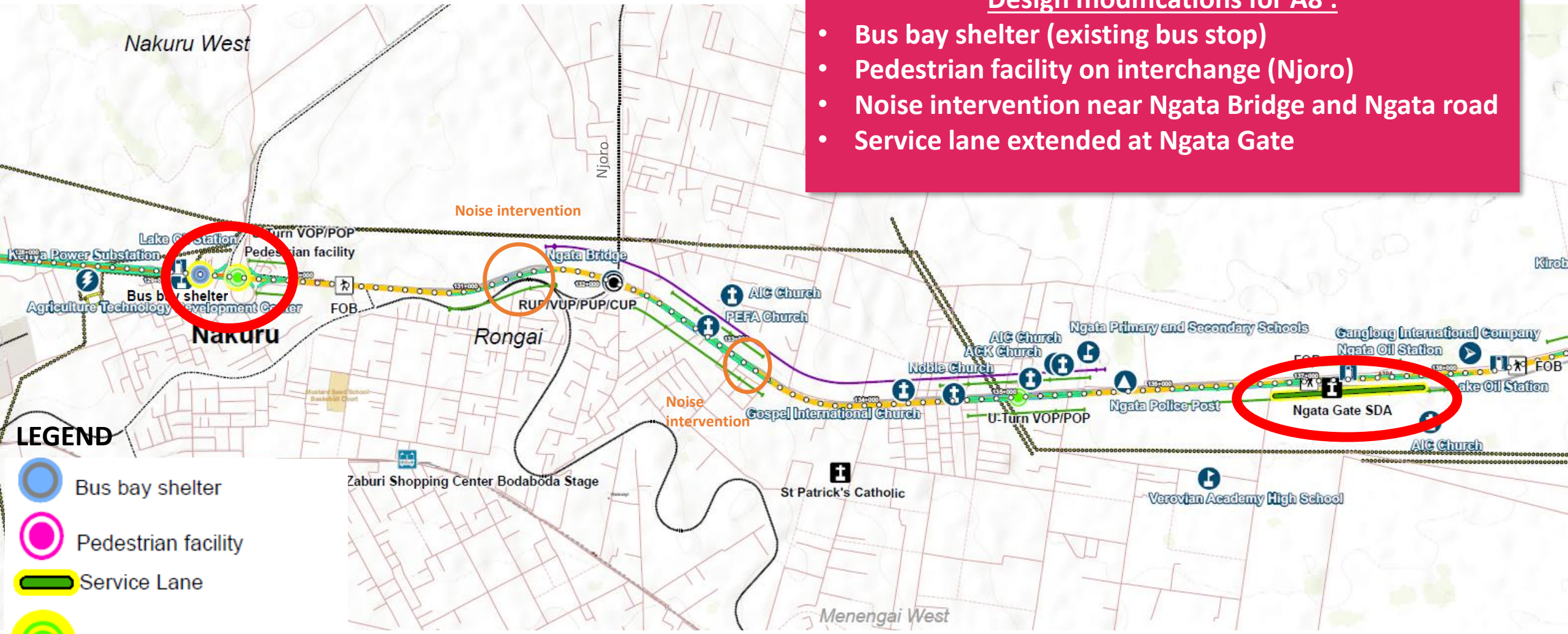
Design review – RONGAI



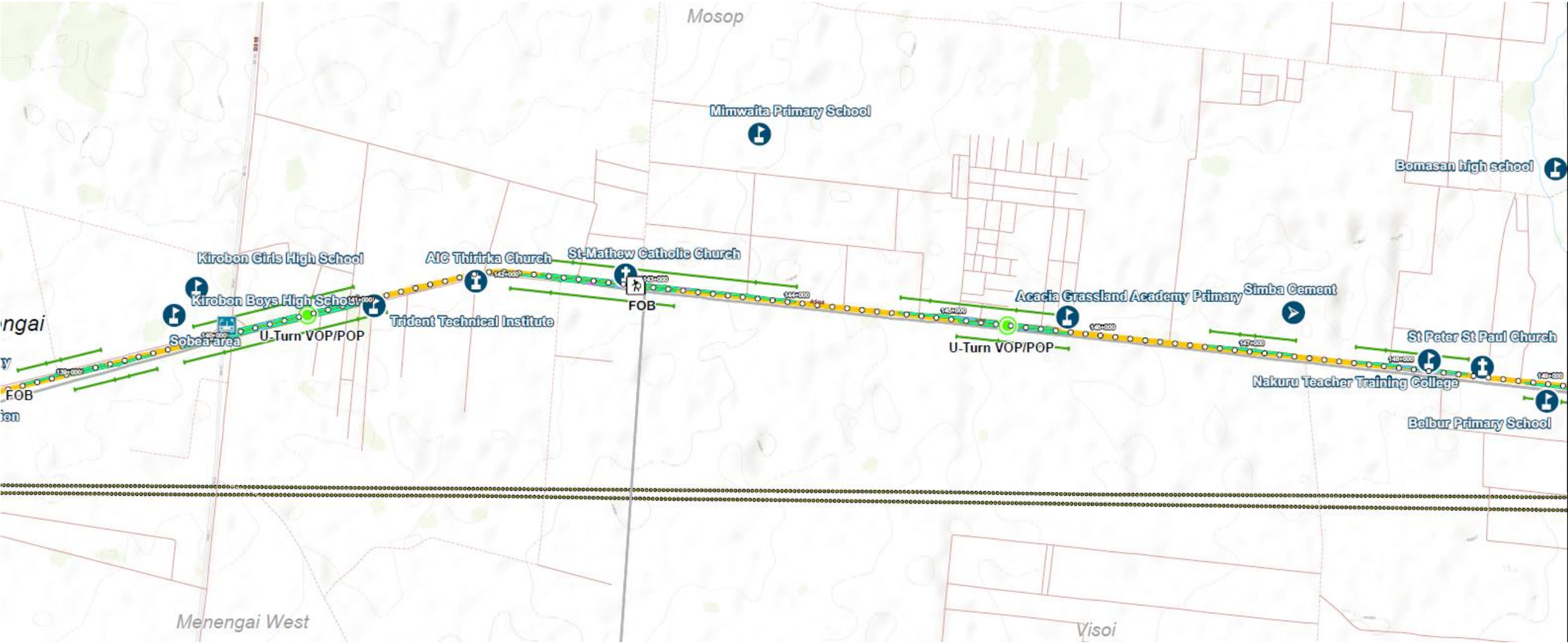
Design review – RONGAI

Design modifications for A8 :

- Bus bay shelter (existing bus stop)
- Pedestrian facility on interchange (Njoro)
- Noise intervention near Ngata Bridge and Ngata road
- Service lane extended at Ngata Gate



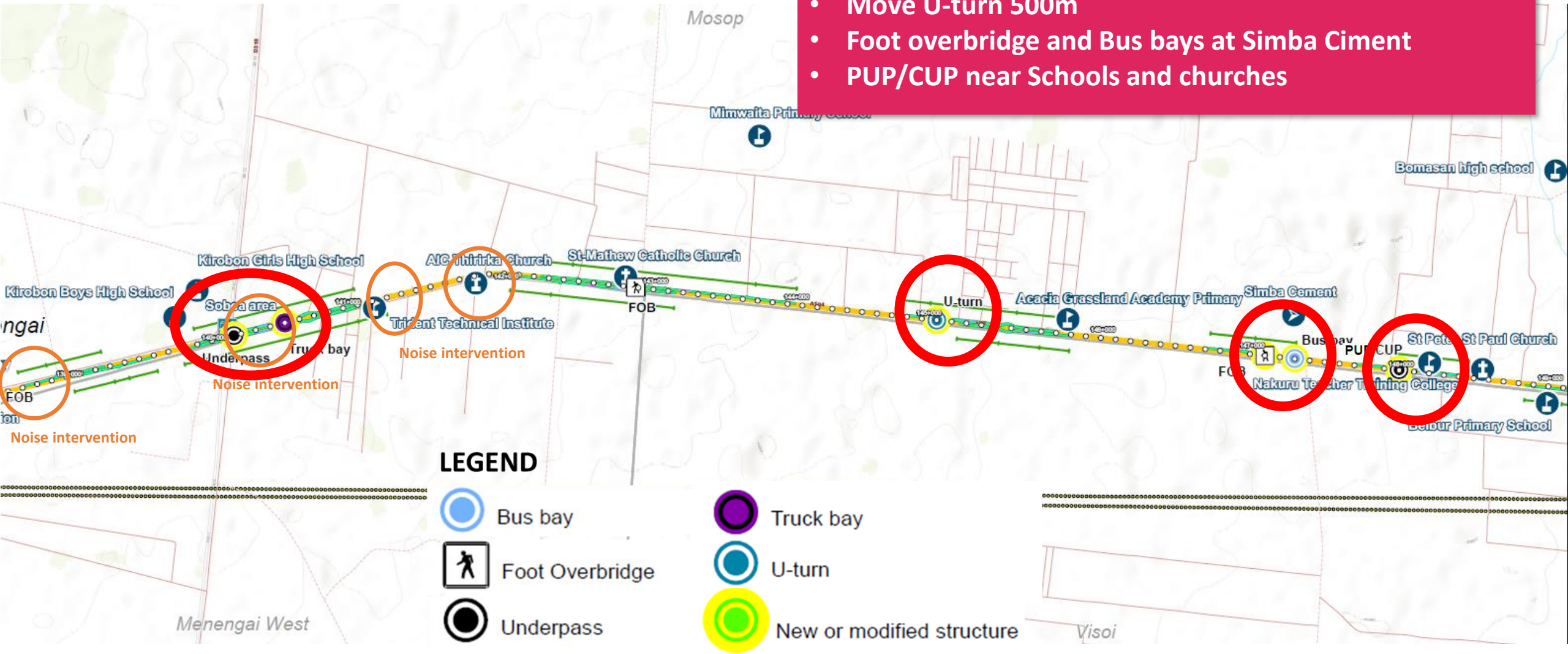
Design review – RONGAI



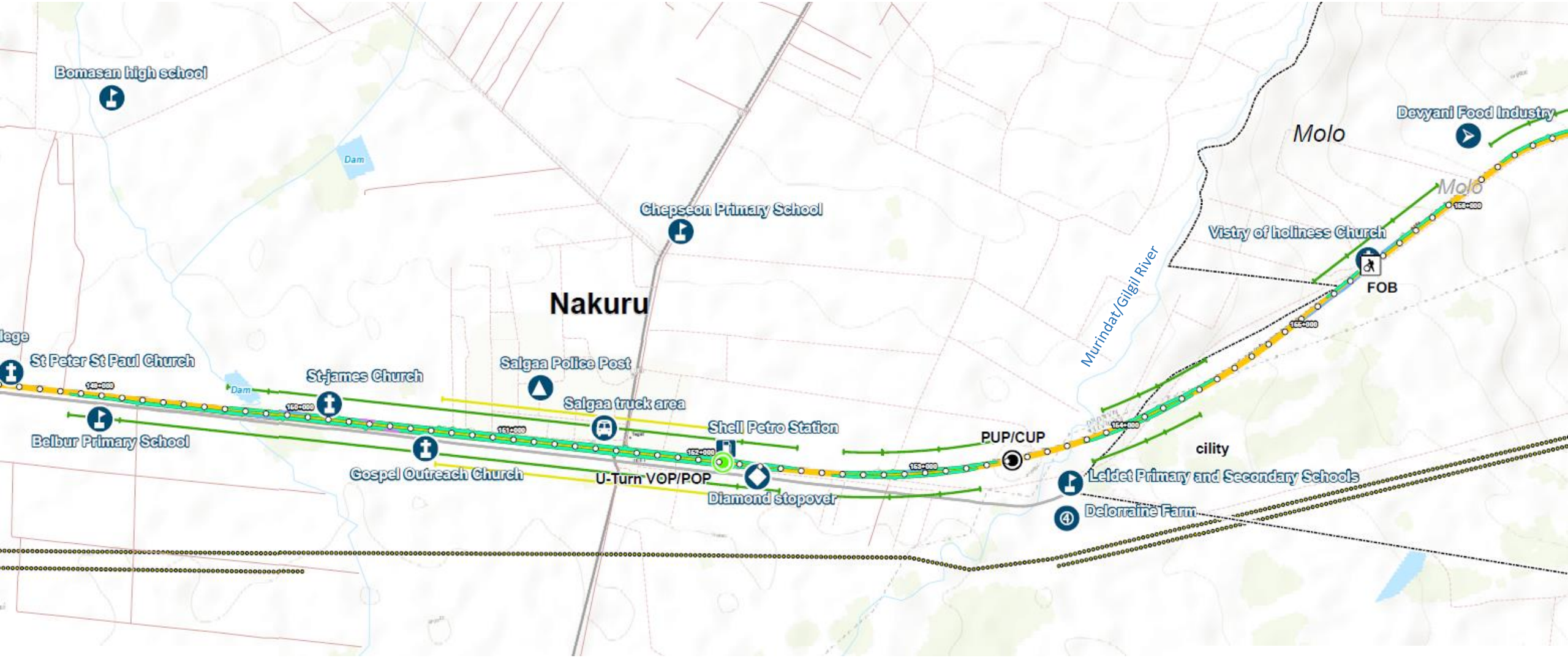
Design review – RONGAI

Design modifications for A8 :

- Noise intervention near Lake oil Petrol Station, Sobea area, Trident Technical Institute, etc.
- Change the interchange for an underpass in Sobea area
- Truck bays in Sobea area
- Move U-turn 500m
- Foot overbridge and Bus bays at Simba Ciment
- PUP/CUP near Schools and churches



Design review – RONGAI



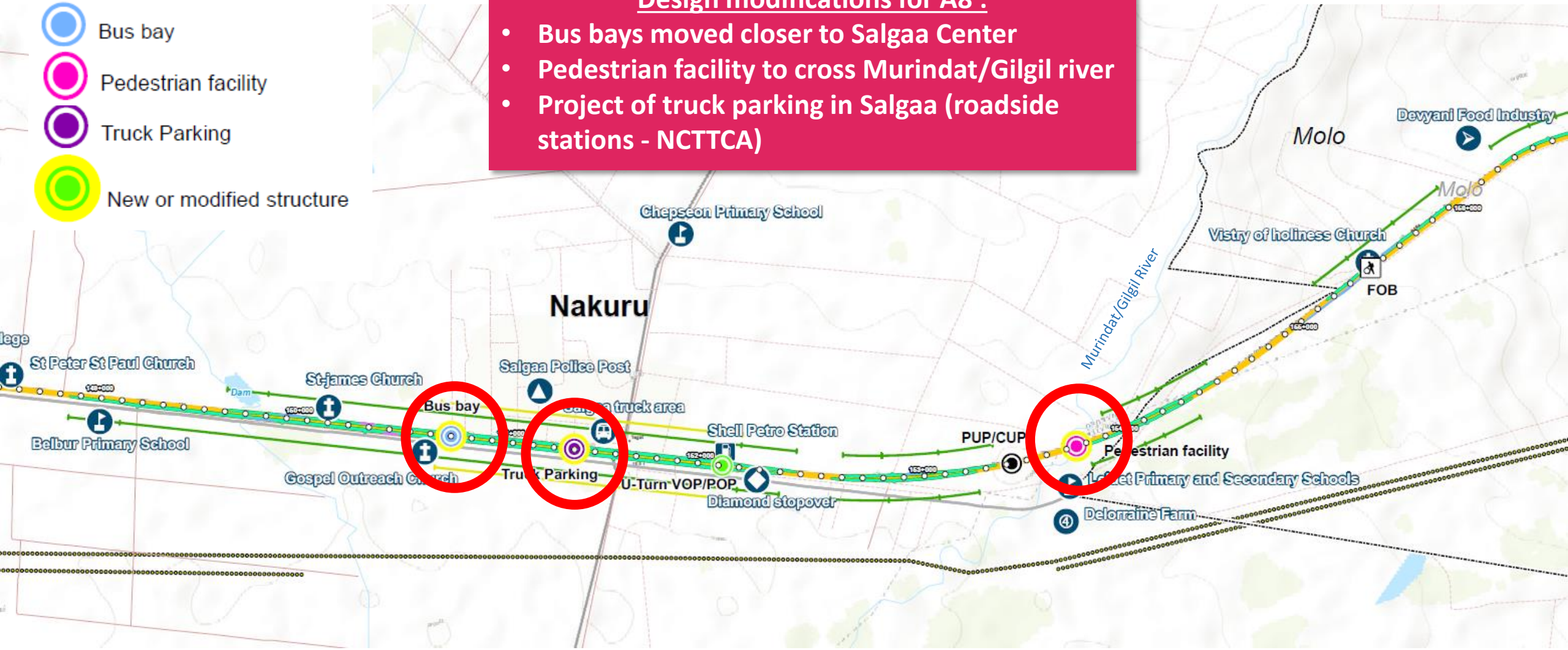
Design review – RONGAI

LEGEND

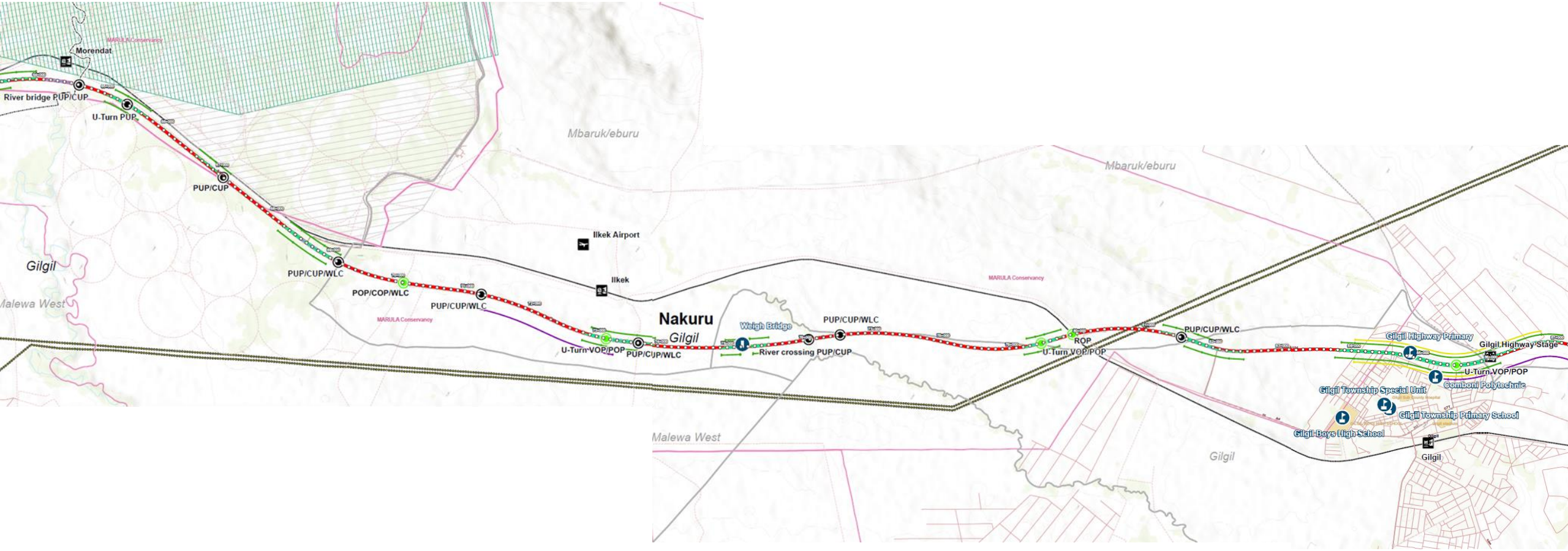
- Bus bay
- Pedestrian facility
- Truck Parking
- New or modified structure

Design modifications for A8 :

- Bus bays moved closer to Salgaa Center
- Pedestrian facility to cross Murindat/Gilgil river
- Project of truck parking in Salgaa (roadside stations - NCTTCA)



Design review – GILGIL

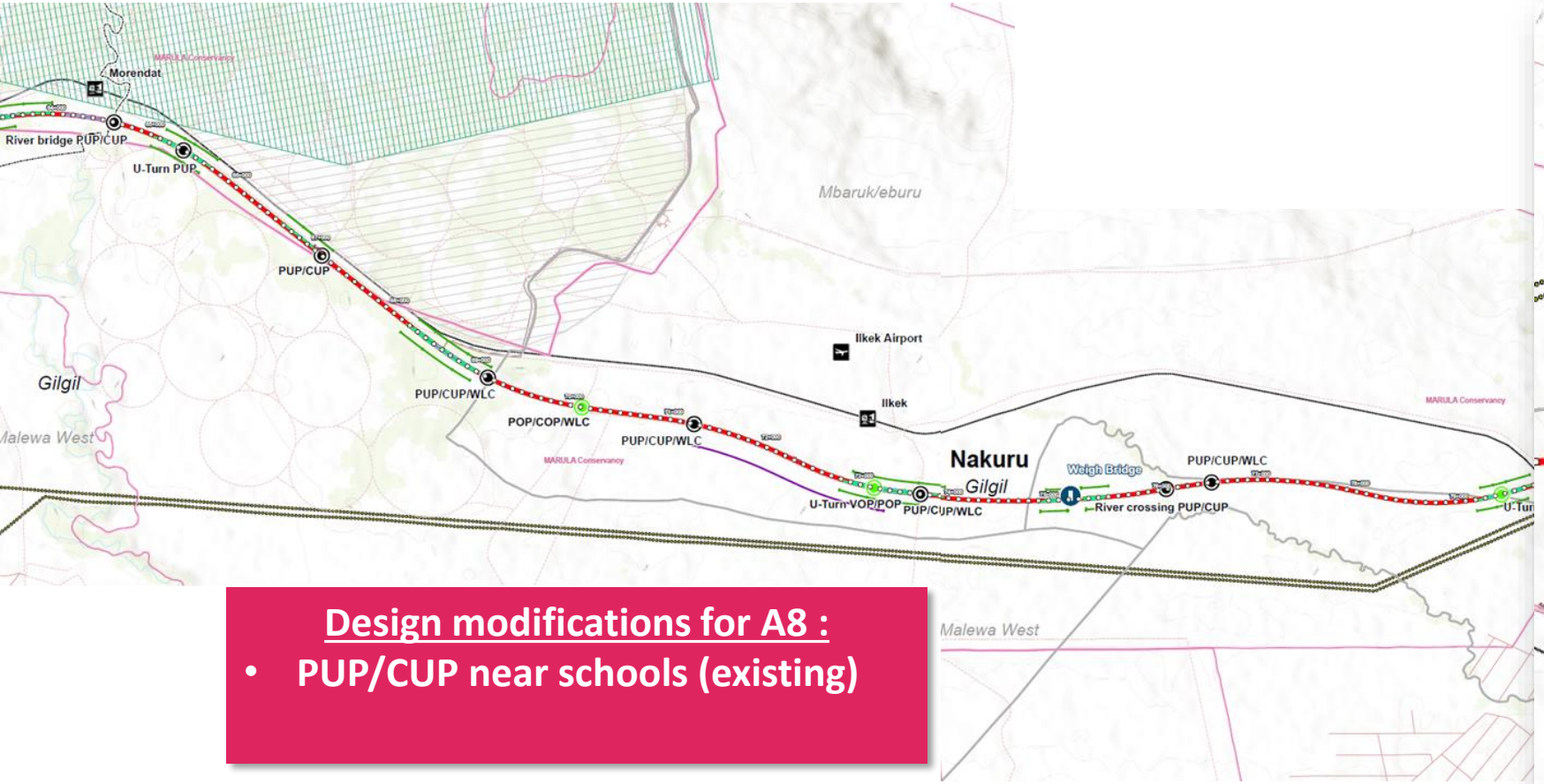


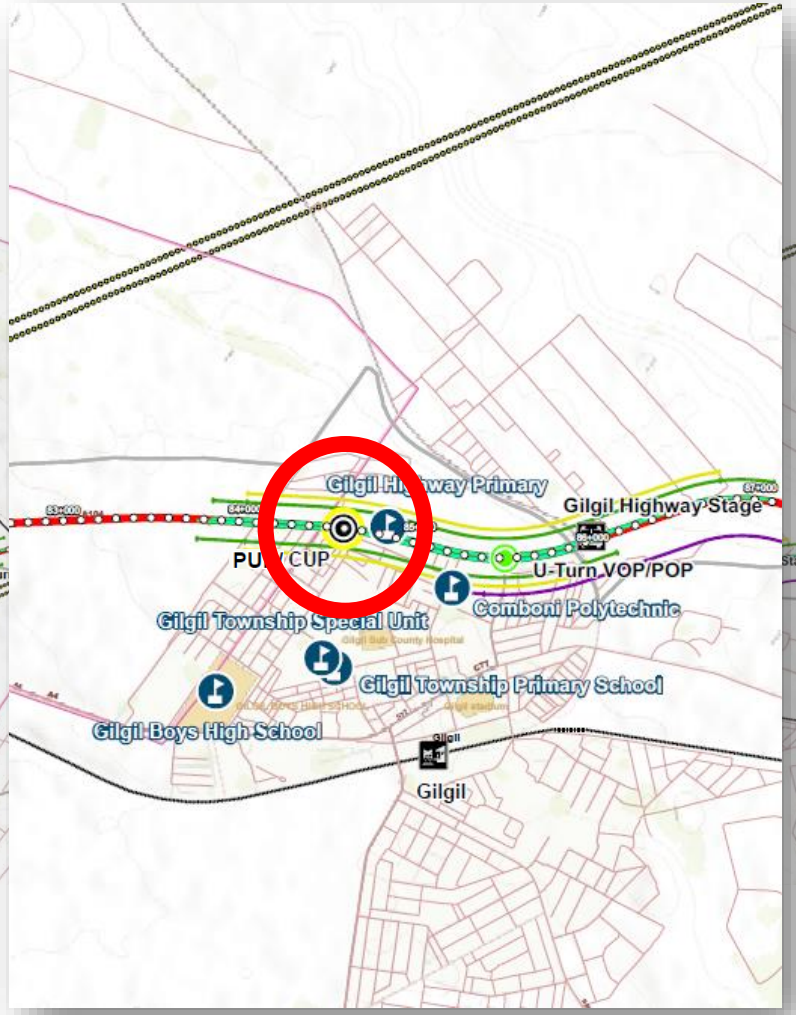
Design review – GILGIL

LEGEND

Underpass

New or modified structure

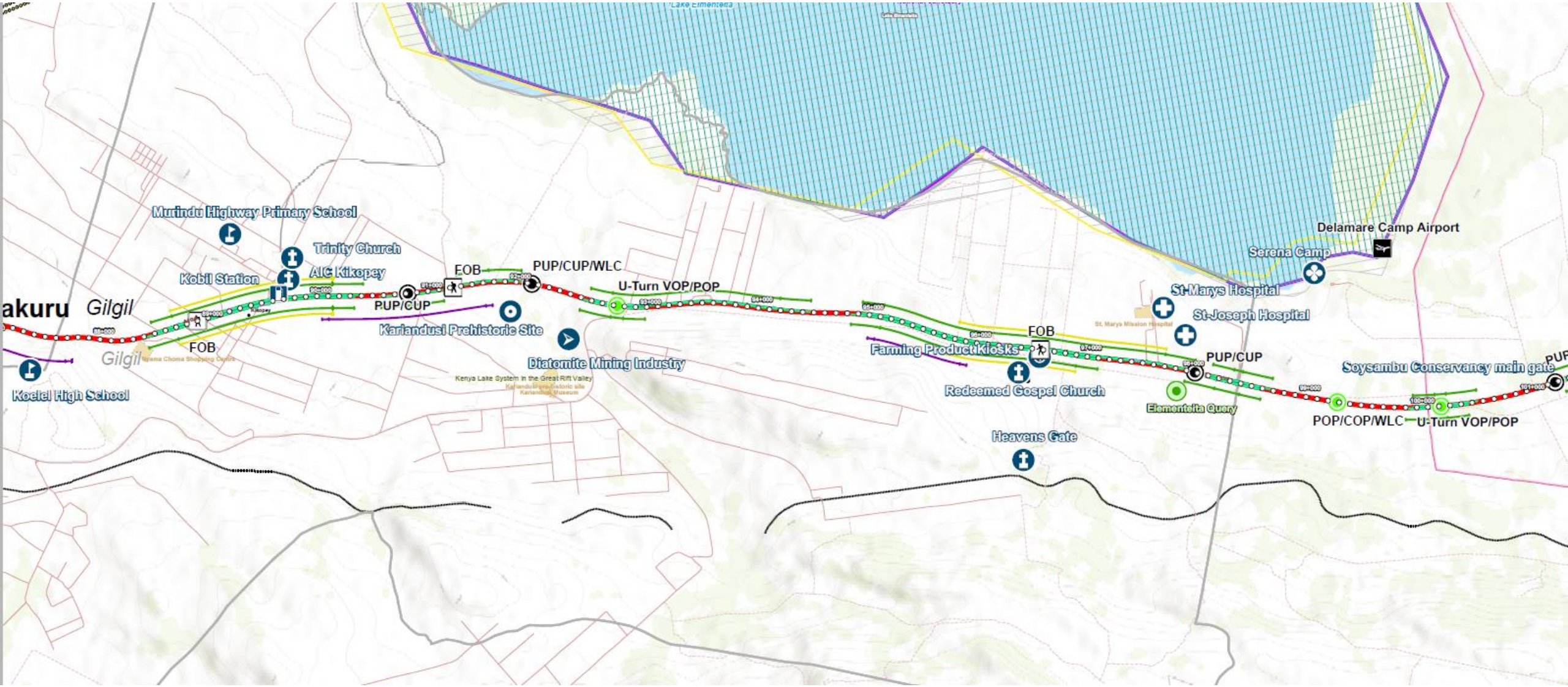




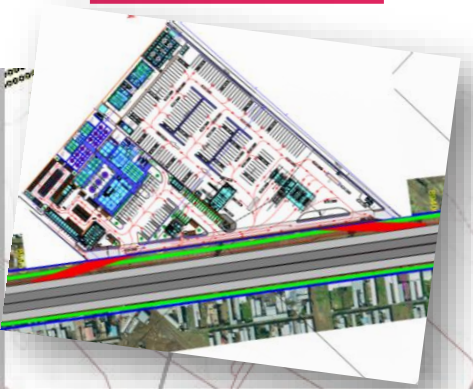
Design modifications for A8 :

- **PUP/CUP near schools (existing)**

Design review – GILGIL



Design review – GILGIL



Project of truck park in Kikopey

LEGEND

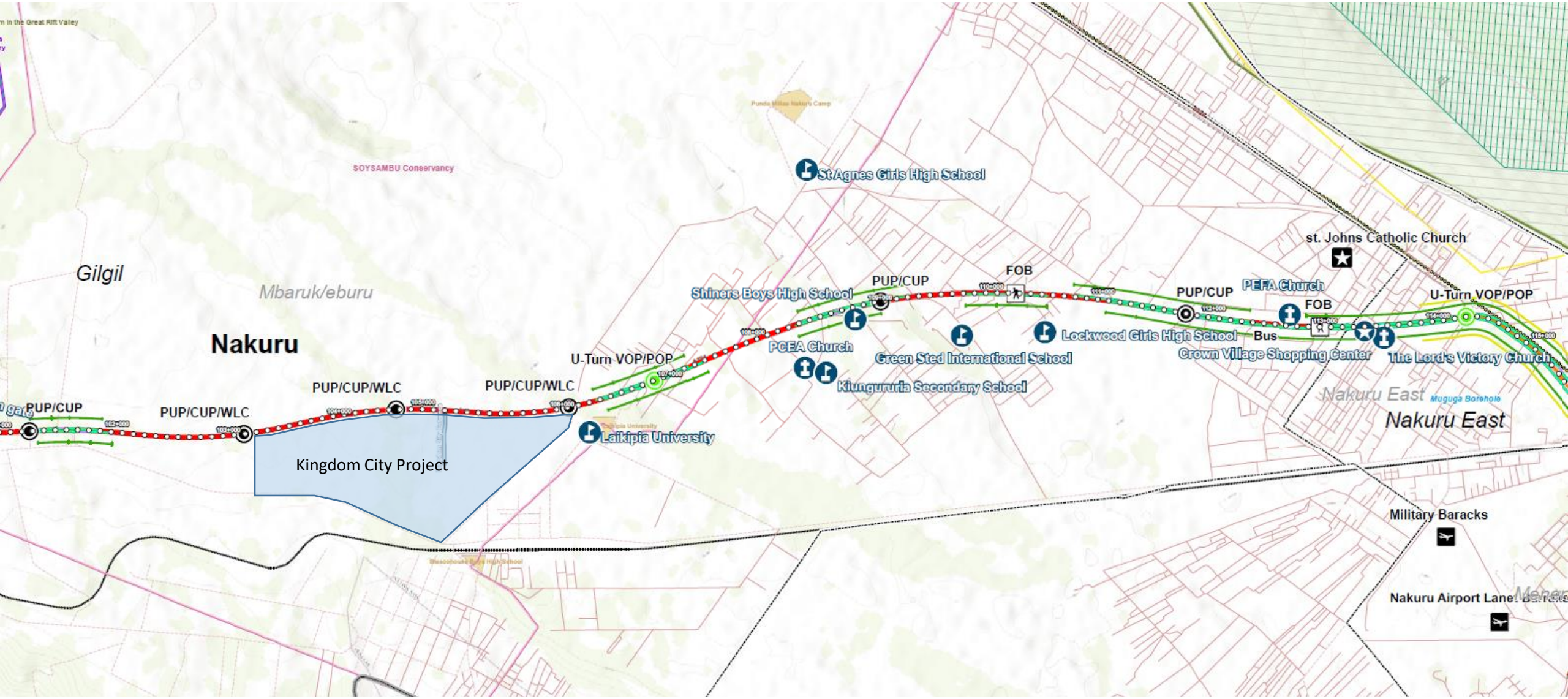
- Bus bay
- Foot Overbridge
- Truck Parking
- New or modified structure

Murindu Highway Primary School
Trinity Church
AIC Kikopey
Kobil Station
FOB
PUP/CUP
Kariandusi Prehistoric Site
Bus bay
FOB
Gilgil
Gilgil
Koelel High School
Diatomite Mining Industry
U-Turn VOP/POP
Farming Product Kiosks
FOB
Redeemed Gospel Church
Heavens Gate
Delamare Camp Airport
Serena Camp
St-Marys Hospital
St-Joseph Hospital
PUP/CUP
Elementeita Query
Soysambu Conservancy main gate
POP/COP/WLC
U-Turn VOP/POP

Design modifications for A8 :

- Bus bays in Kikopey
- Foot overbridge moved closer to Kikopey Center
- Bus bays near interchange and Diatomite industry
- Access to a truck parking (project of NCTTCA roadside stations)

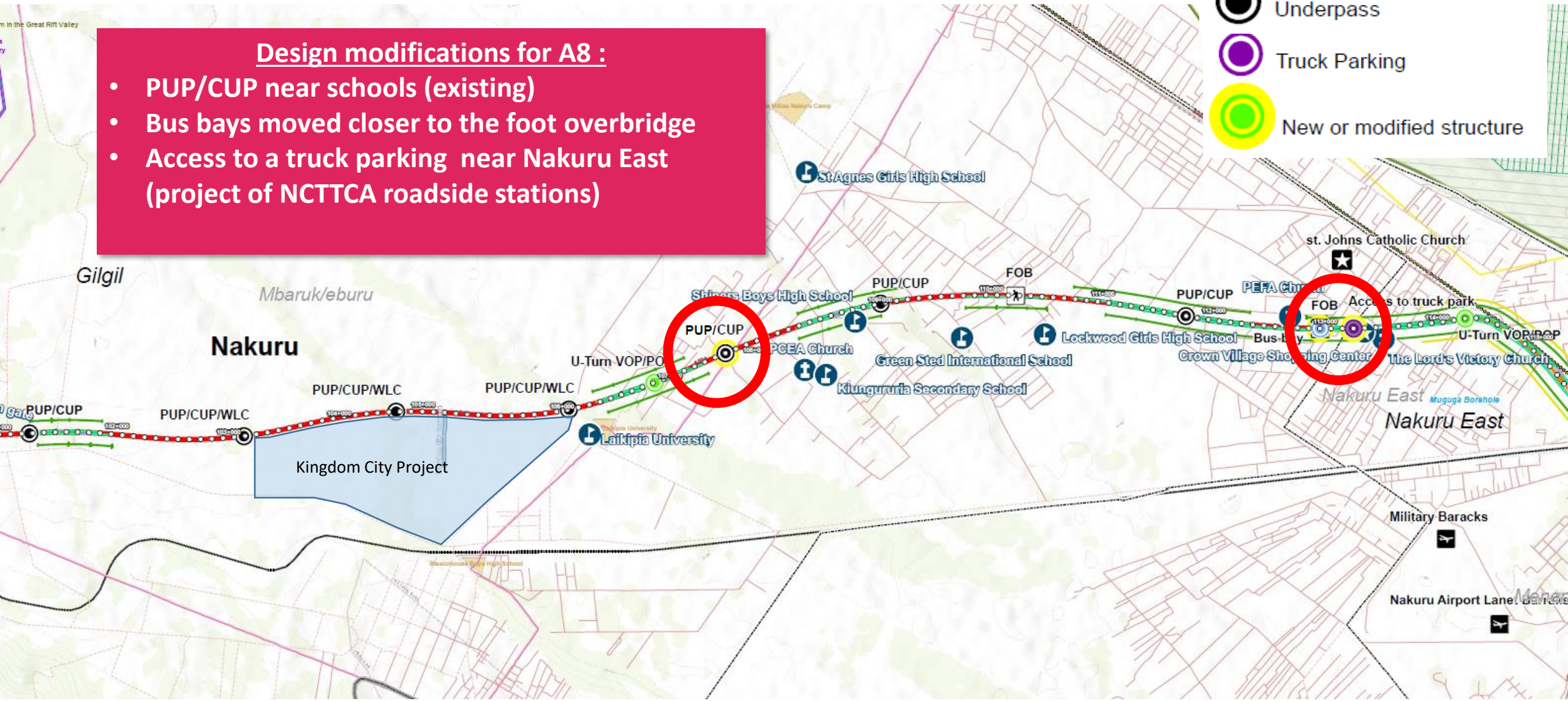
Design review – GILGIL



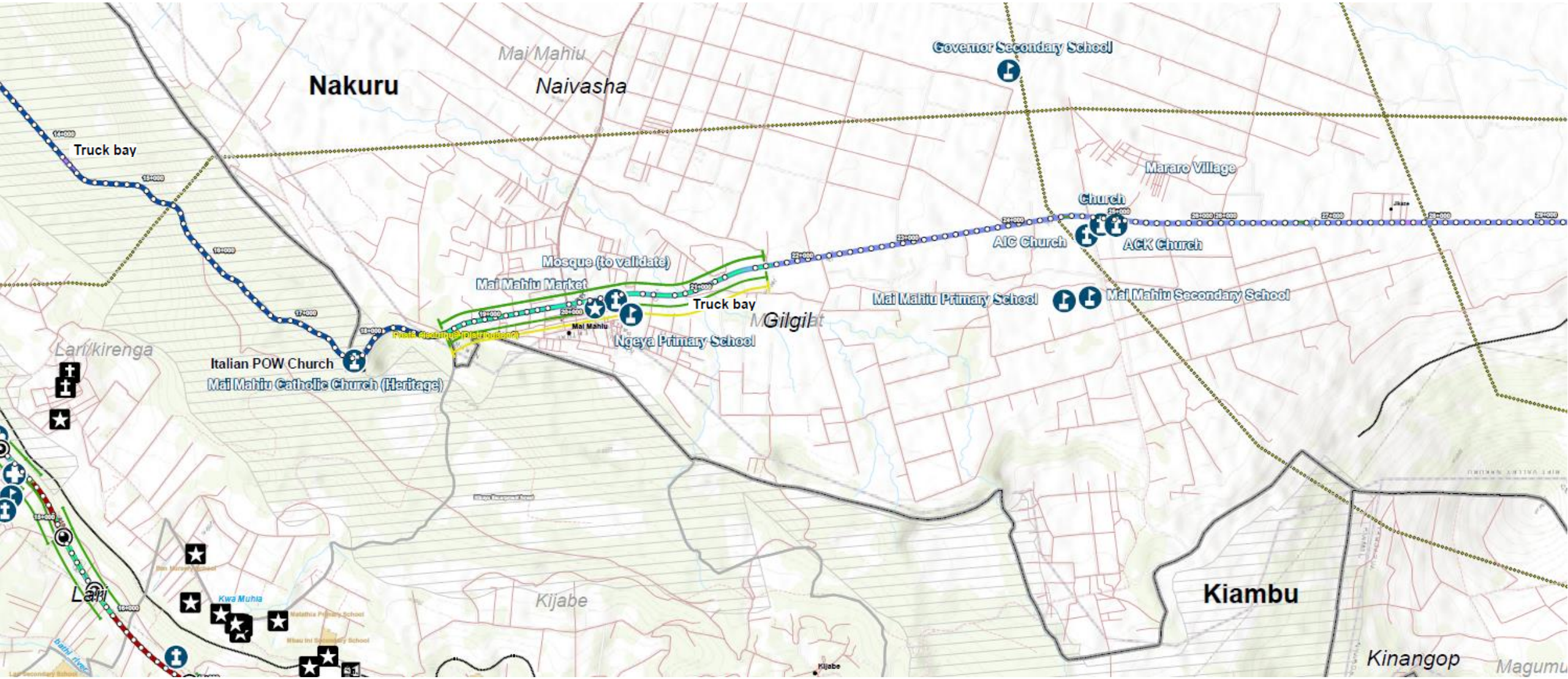
Design review – GILGIL

Design modifications for A8 :

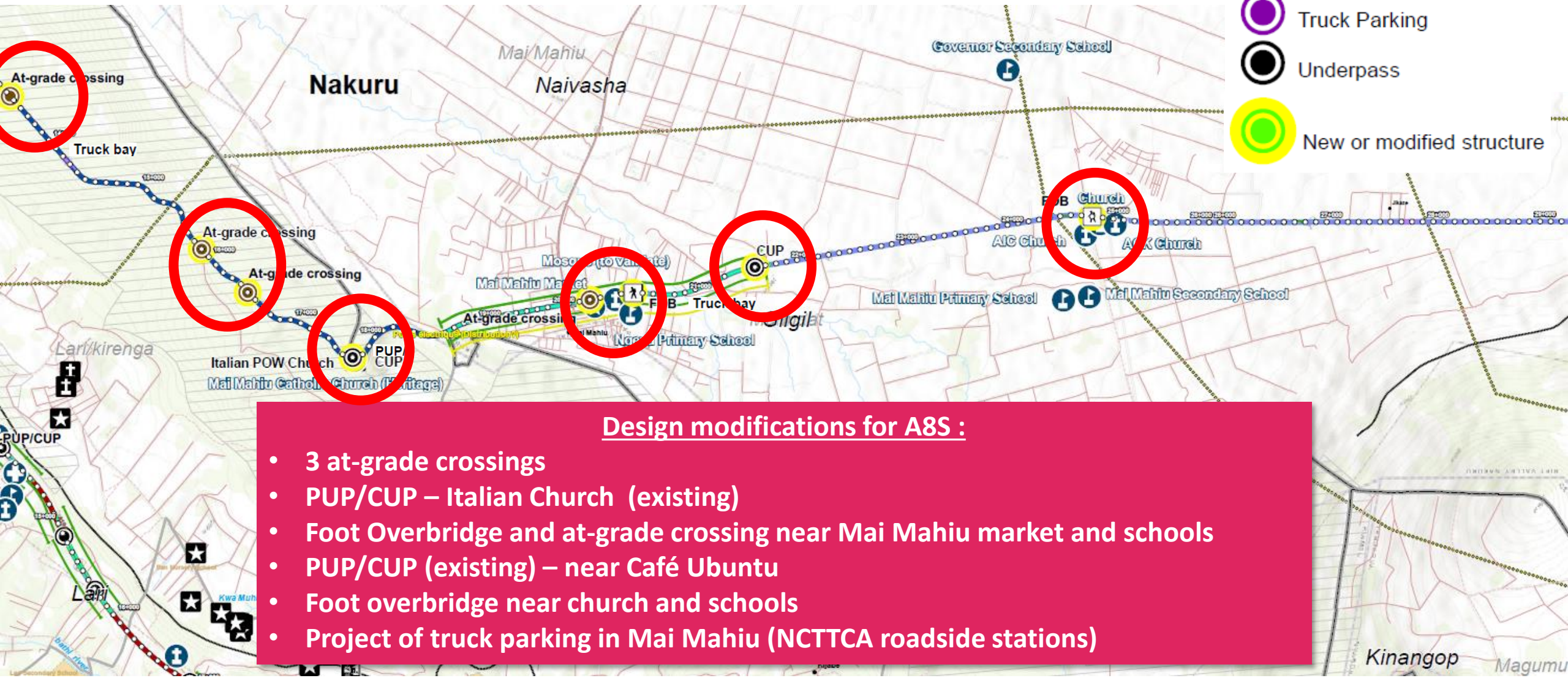
- PUP/CUP near schools (existing)
- Bus bays moved closer to the foot overbridge
- Access to a truck parking near Nakuru East (project of NCTTCA roadside stations)



Design review – NAIVASHA



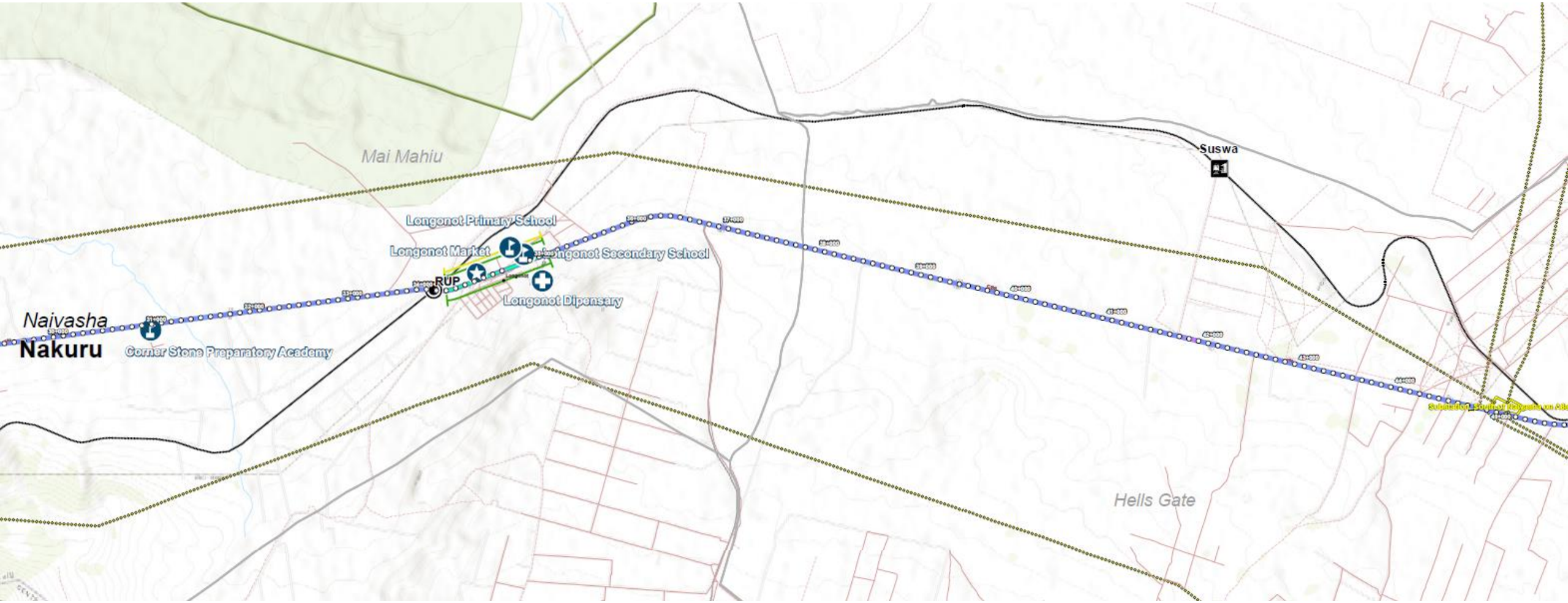
Design review – NAIVASHA



Design modifications for A8S :

- 3 at-grade crossings
- PUP/CUP – Italian Church (existing)
- Foot Overbridge and at-grade crossing near Mai Mahiu market and schools
- PUP/CUP (existing) – near Café Ubuntu
- Foot overbridge near church and schools
- Project of truck parking in Mai Mahiu (NCTTCA roadside stations)

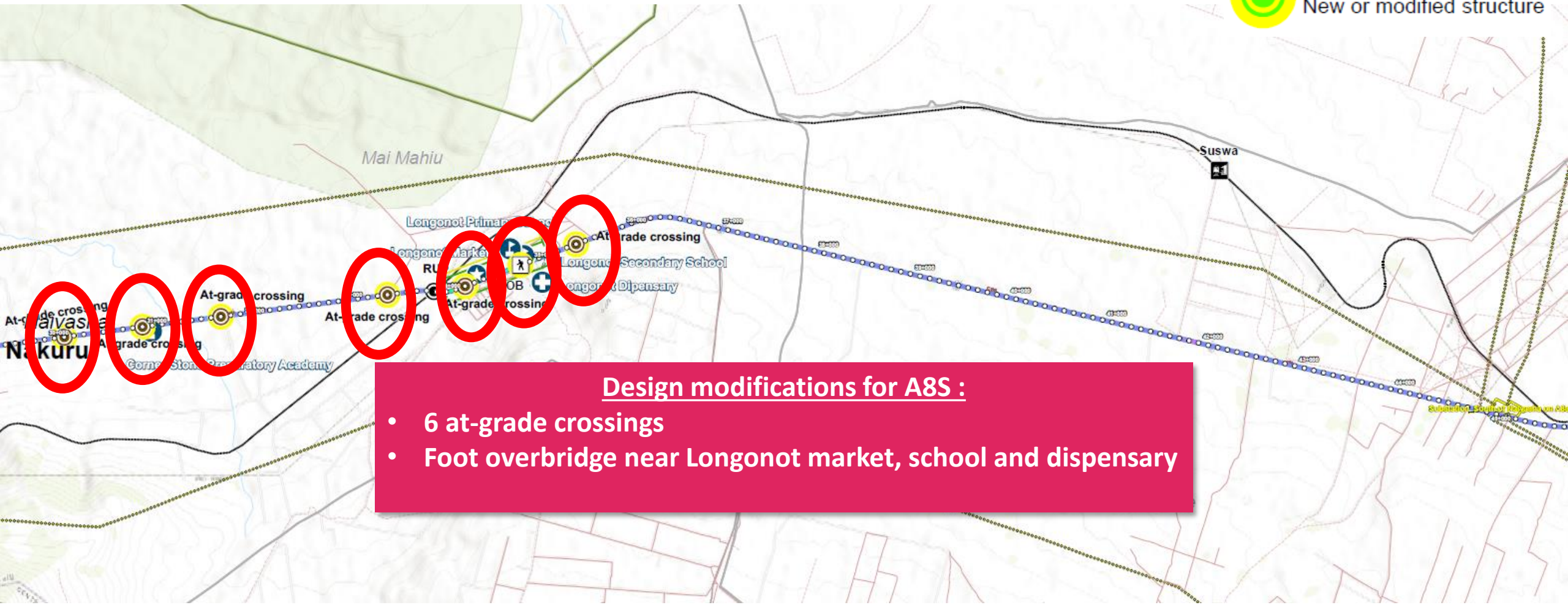
Design review – NAIVASHA



Design review – NAIVASHA

LEGEND

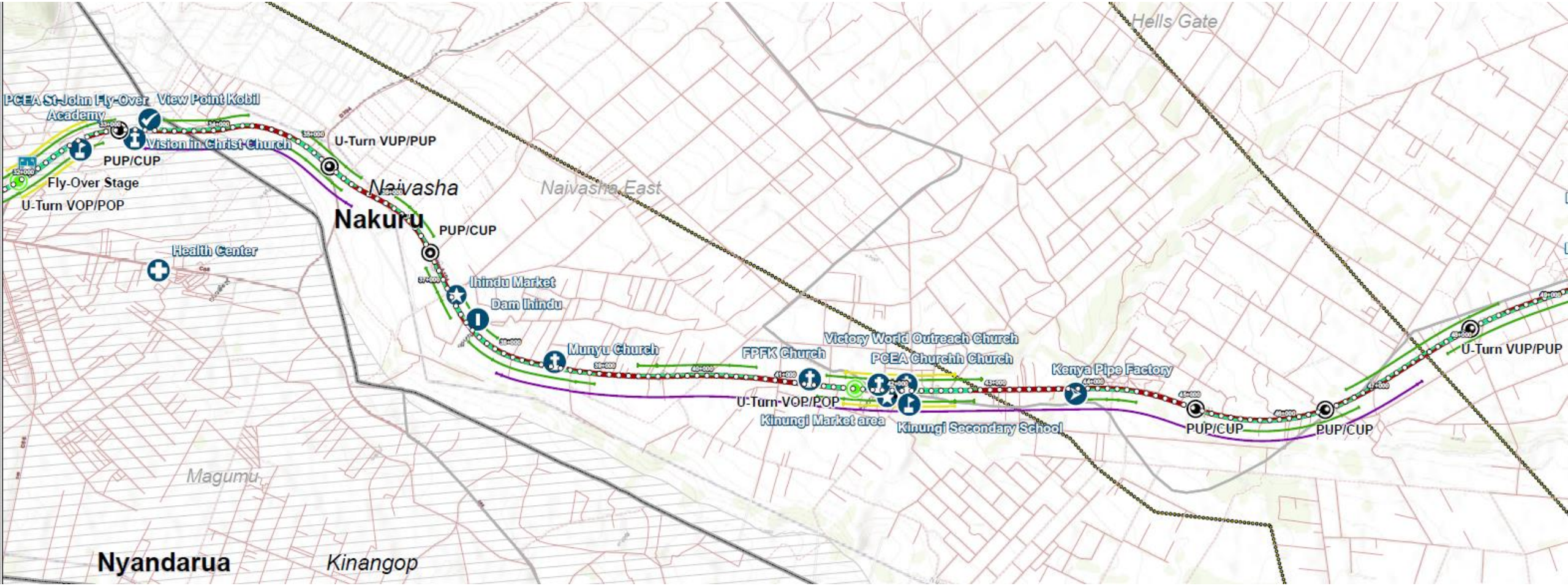
- At-grade crossing
- Foot Overbridge
- New or modified structure



Design modifications for A8S :

- 6 at-grade crossings
- Foot overbridge near Longonot market, school and dispensary

Design review – NAIVASHA



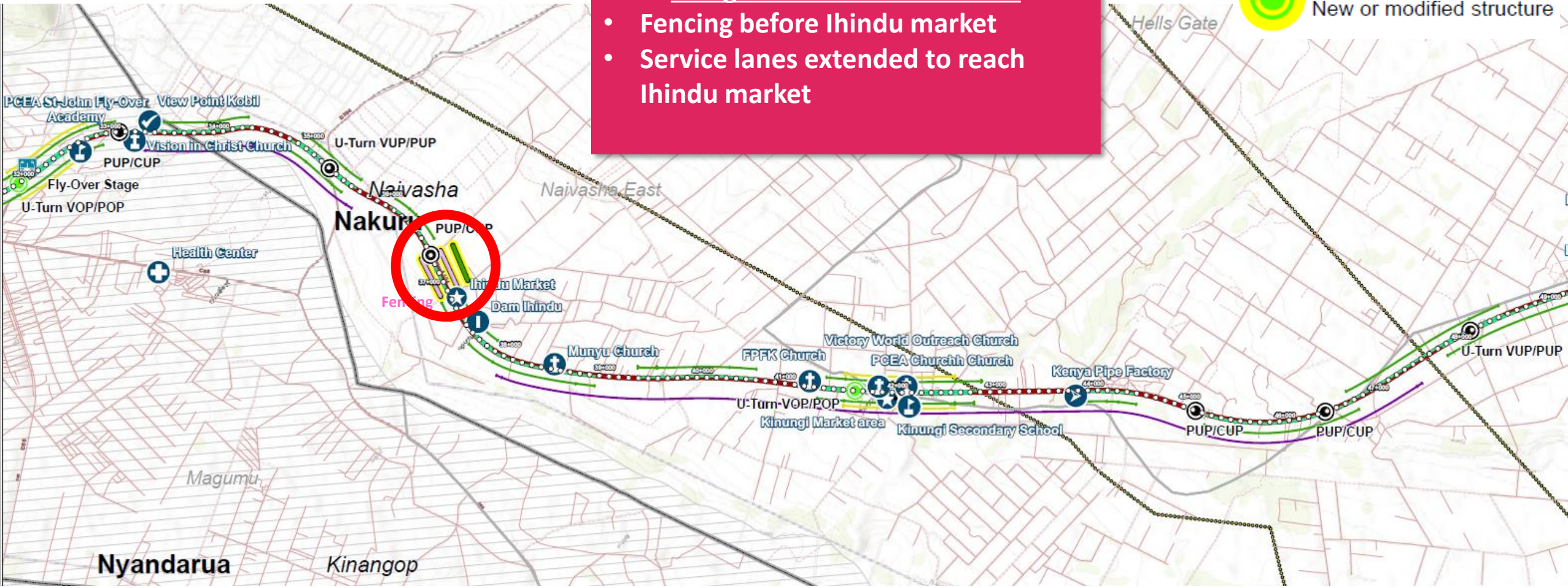
Design review – NAIVASHA

LEGEND

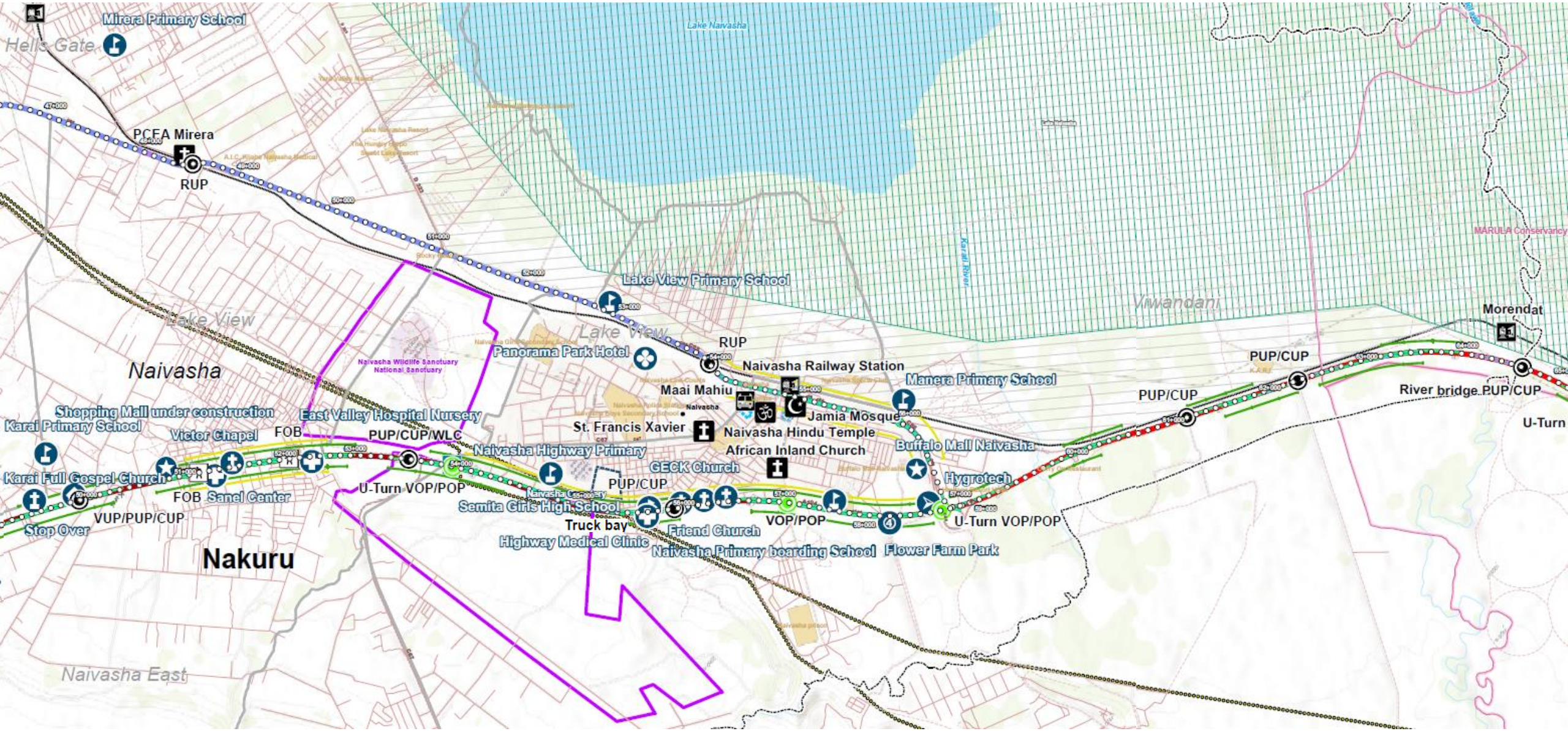
- Fencing
- Service Lane
- New or modified structure

Design modifications for A8 :

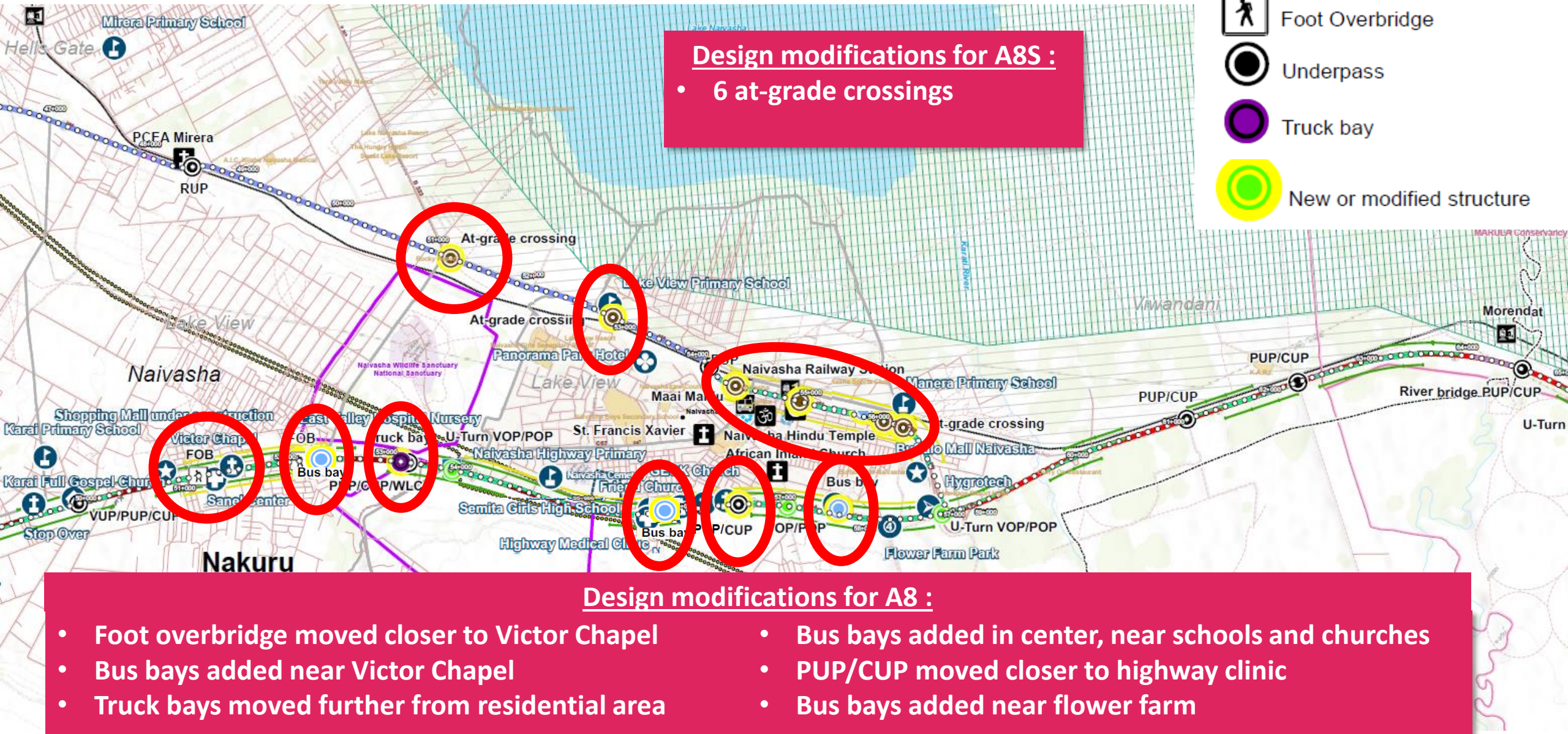
- Fencing before Ihindu market
- Service lanes extended to reach Ihindu market



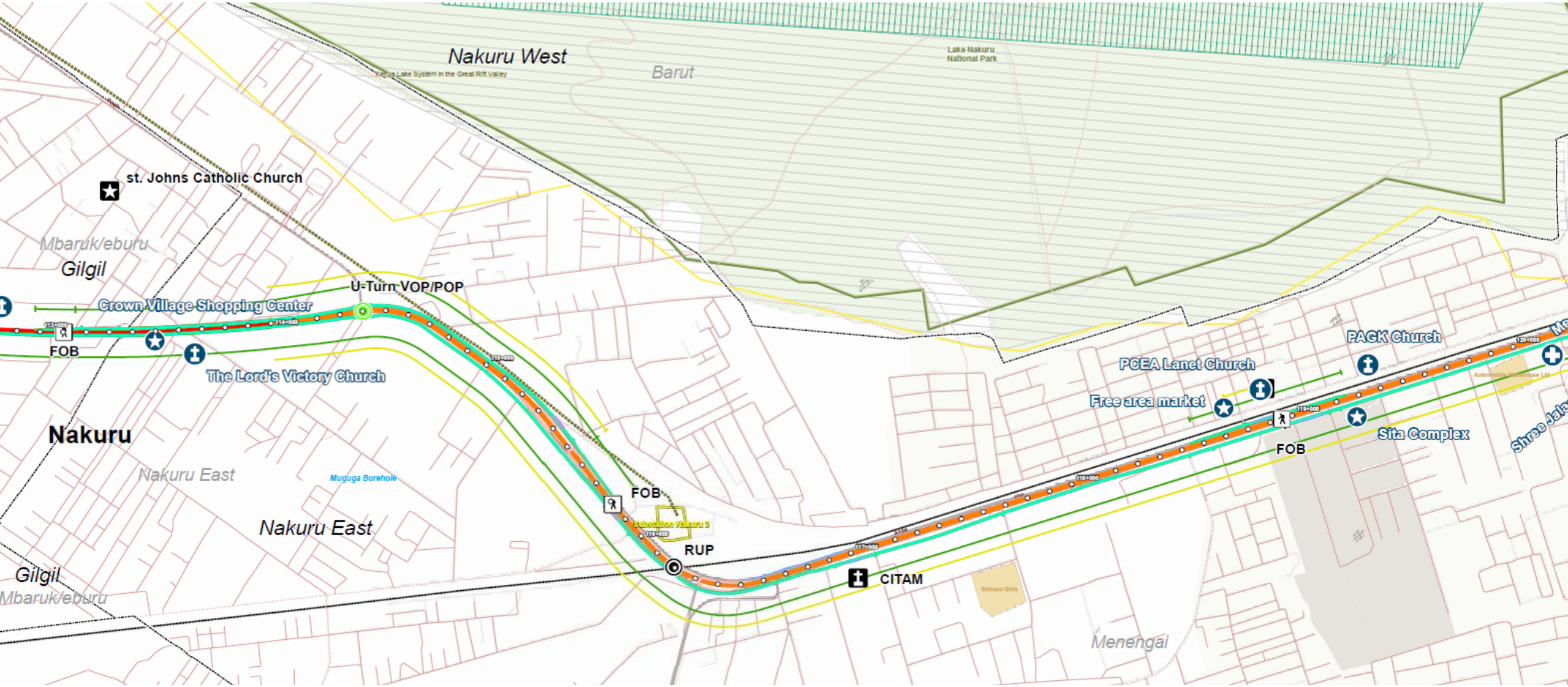
Design review – NAIVASHA



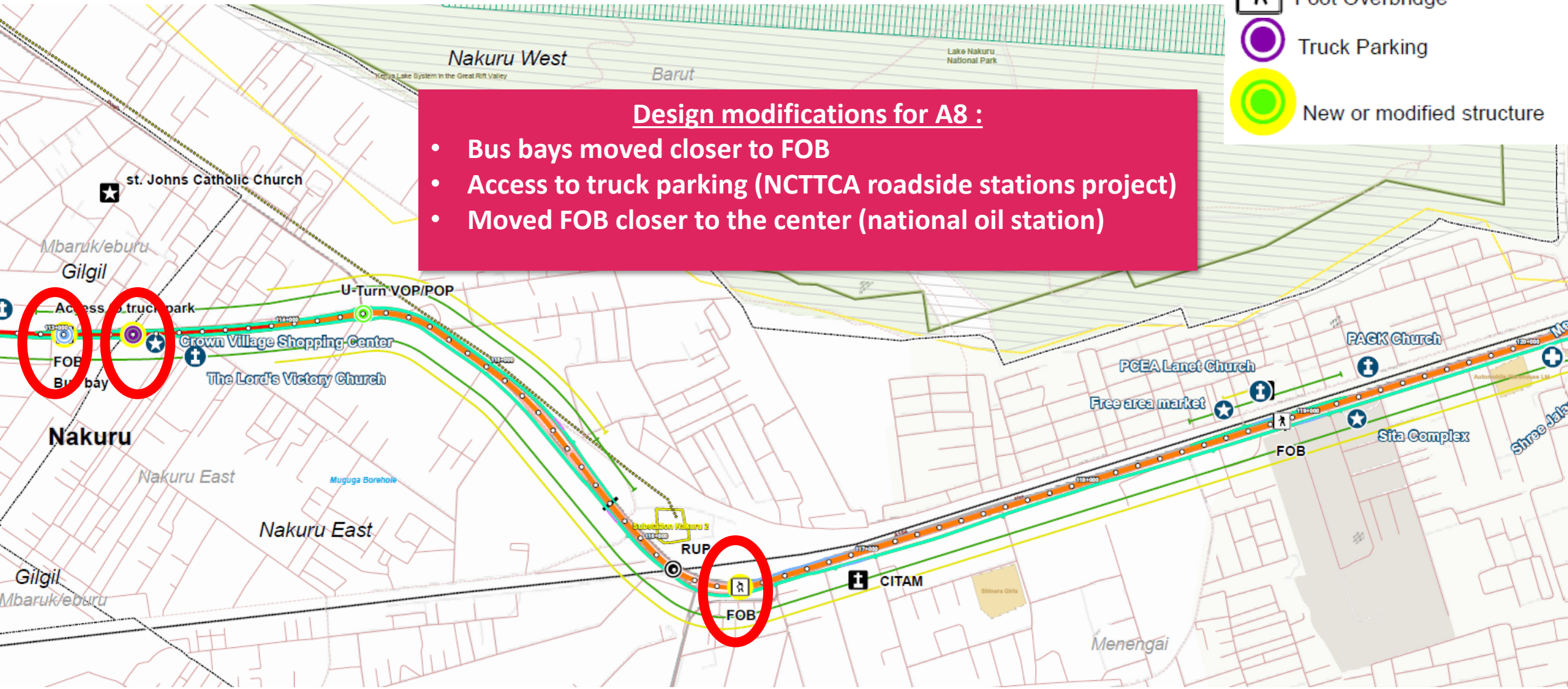
Design review – NAIVASHA



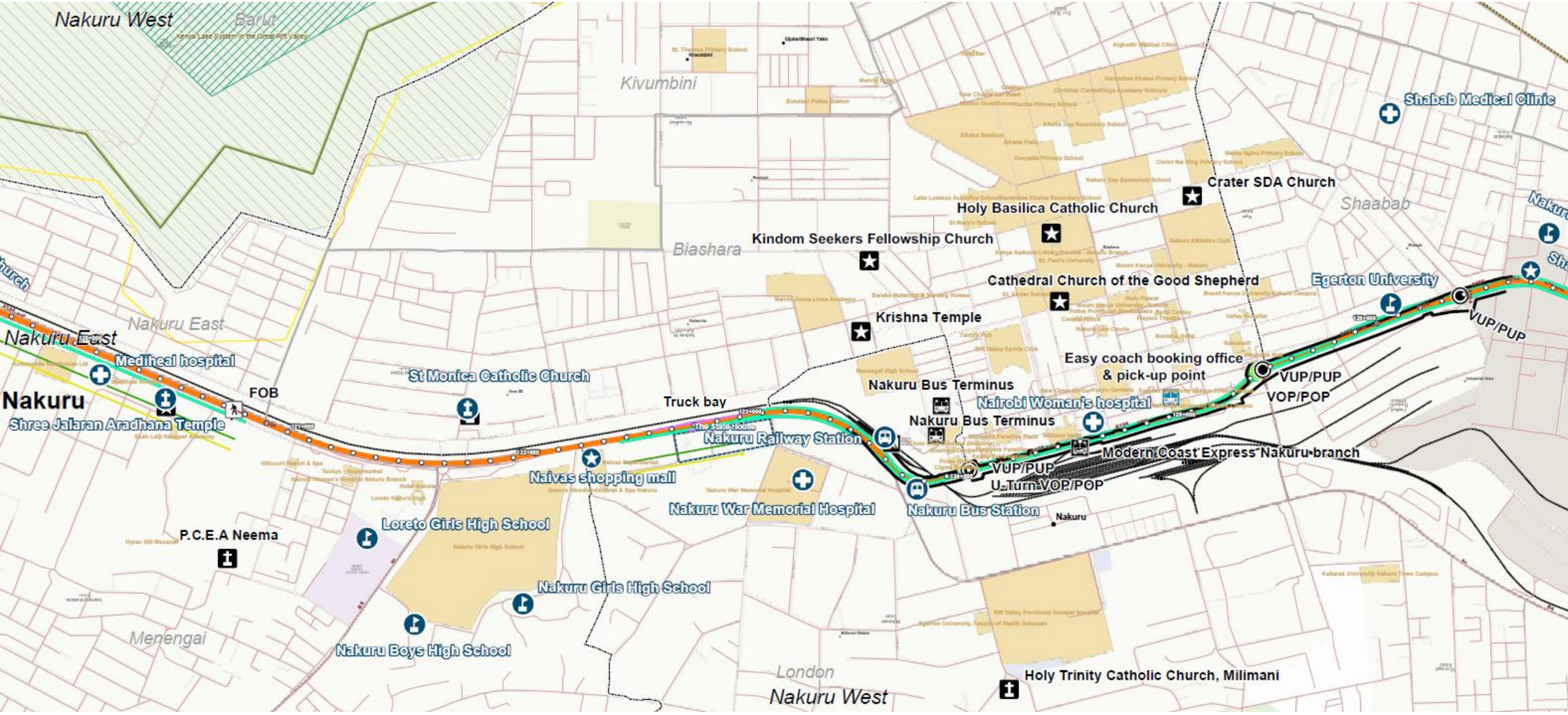
Design review – NAKURU



Design review – NAKURU



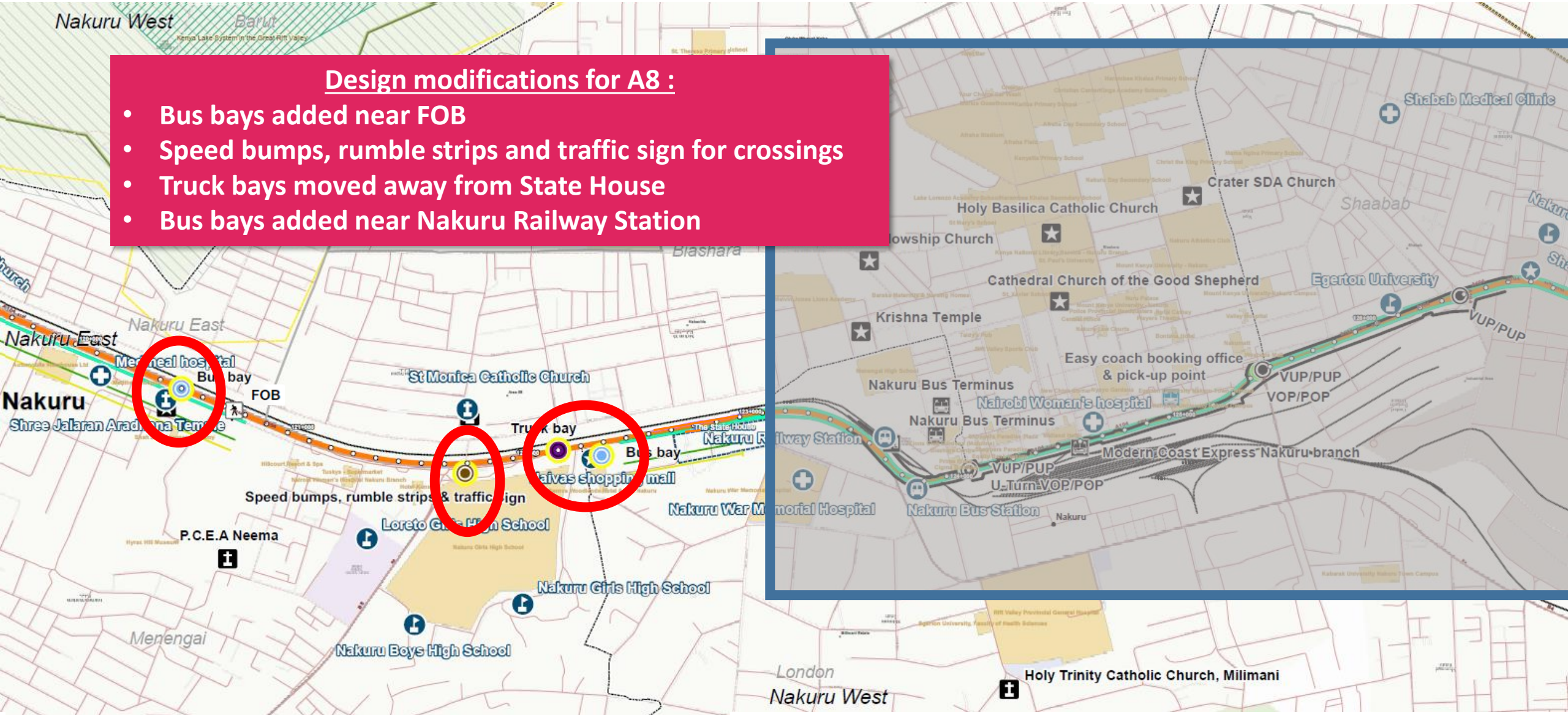
Design review – NAKURU



Design review – NAKURU

LEGEND

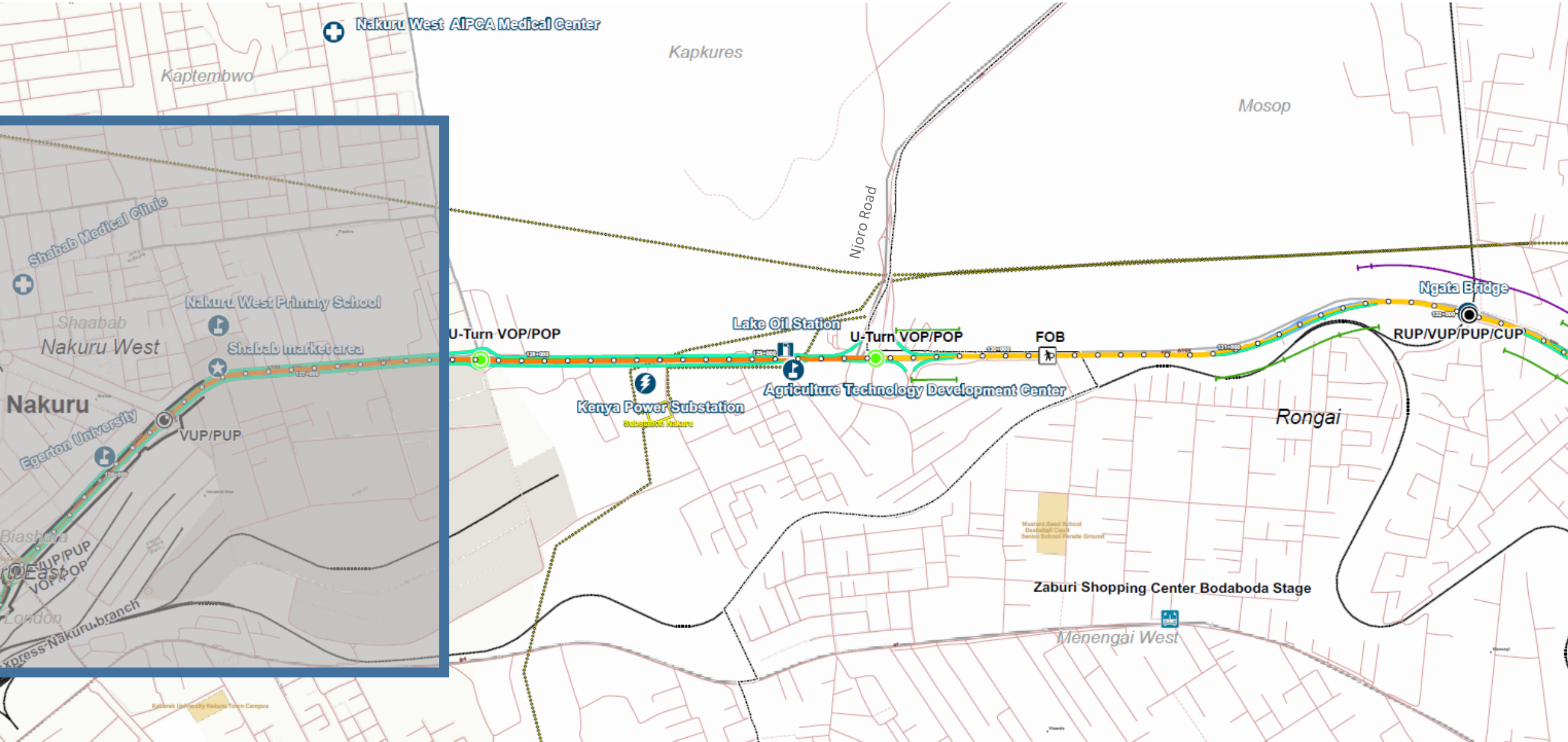
- Bus bay
- Truck bay
- Speed bumps, rumble strips and traffic sign
- New or modified structure



Design modifications for A8 :

- Bus bays added near FOB
- Speed bumps, rumble strips and traffic sign for crossings
- Truck bays moved away from State House
- Bus bays added near Nakuru Railway Station

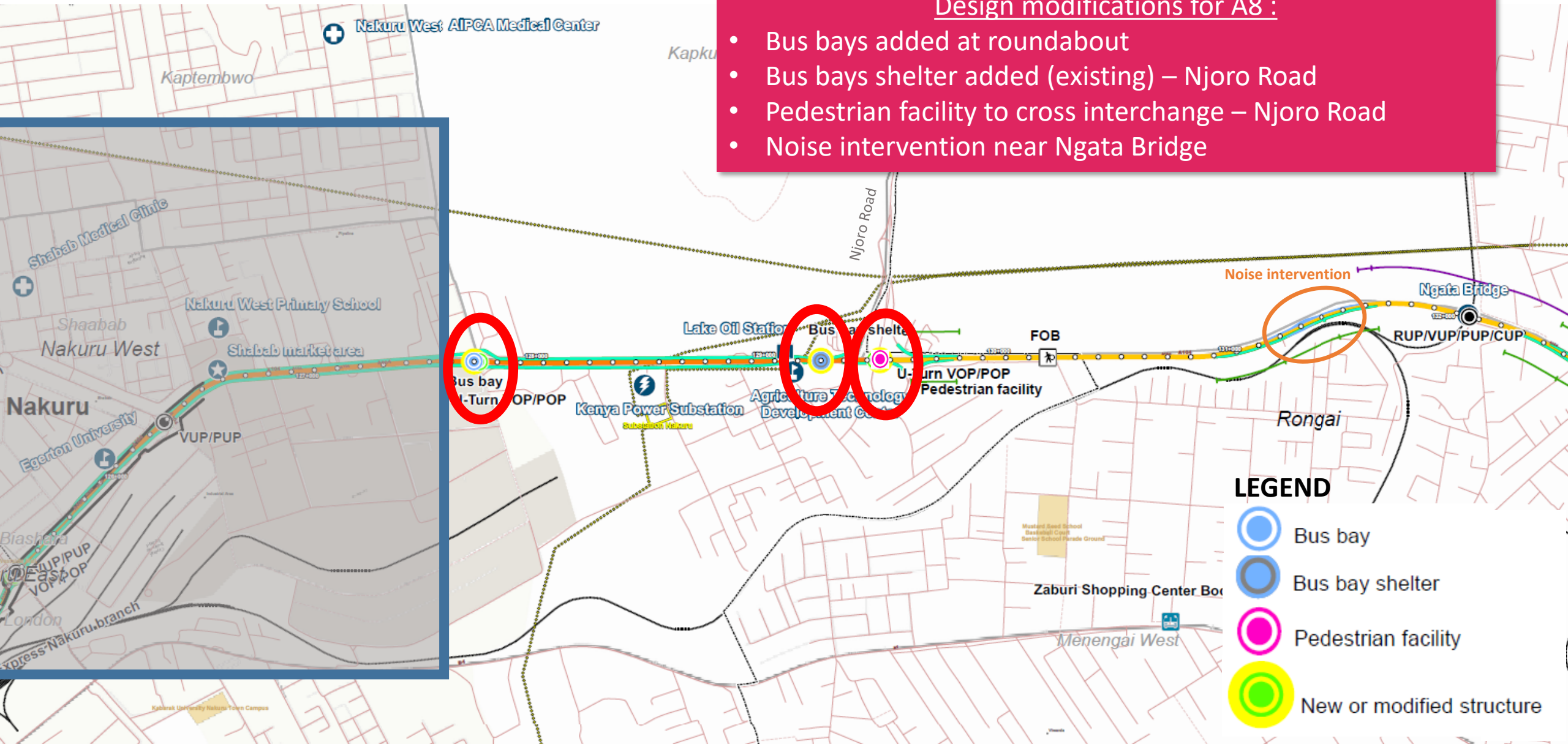
Design review – NAKURU



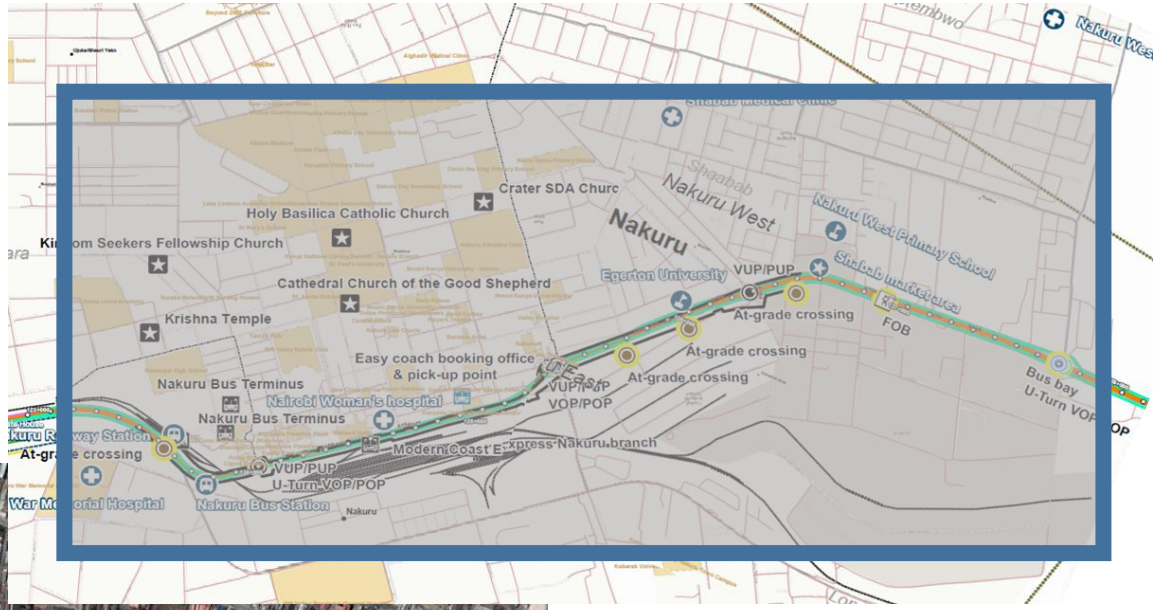
Design review – NAKURU

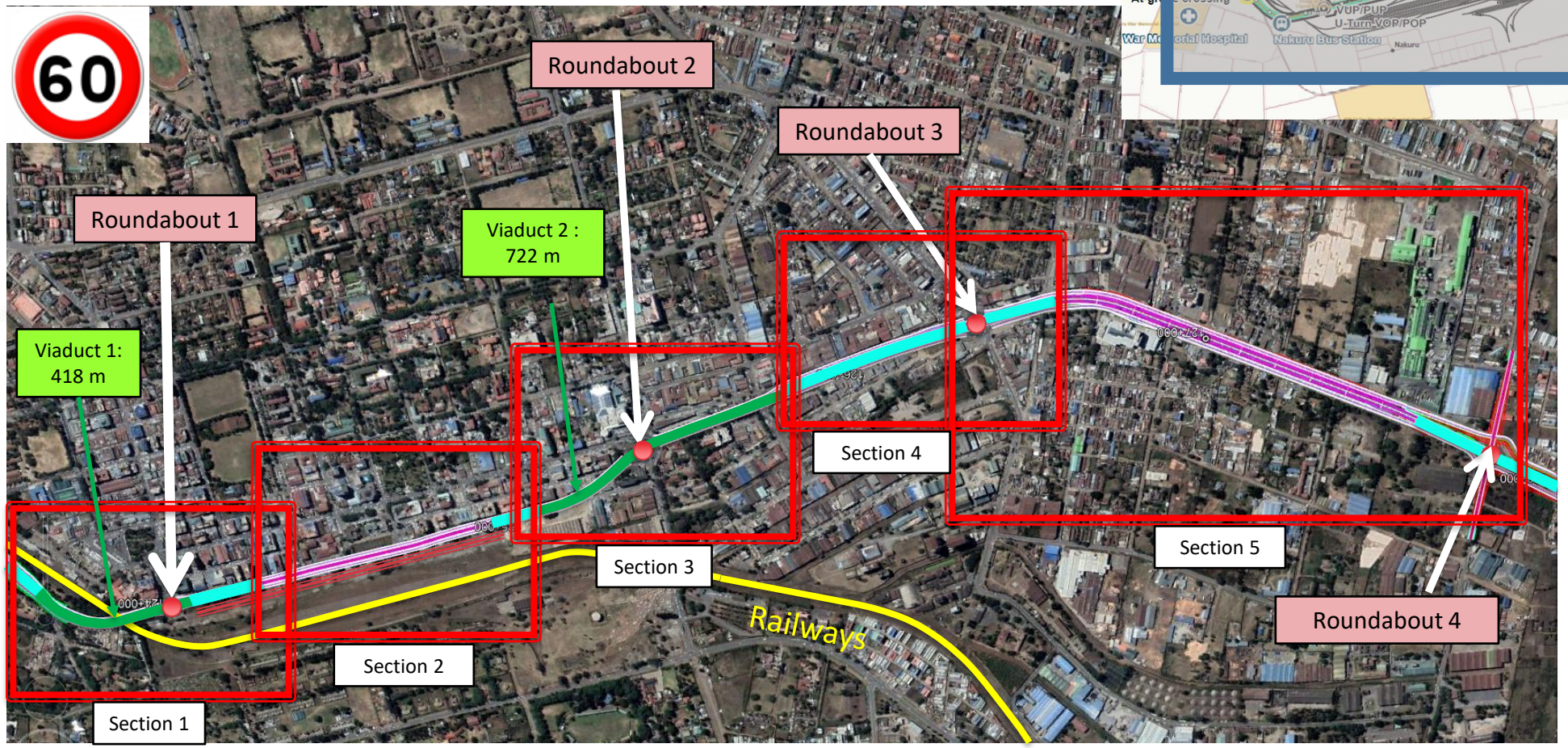
Design modifications for A8 :

- Bus bays added at roundabout
- Bus bays shelter added (existing) – Njoro Road
- Pedestrian facility to cross interchange – Njoro Road
- Noise intervention near Ngata Bridge



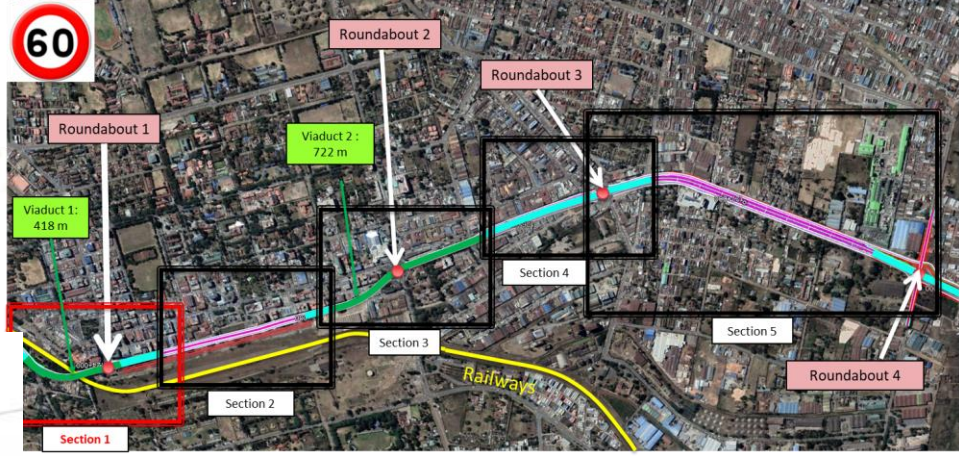
Design review – NAKURU

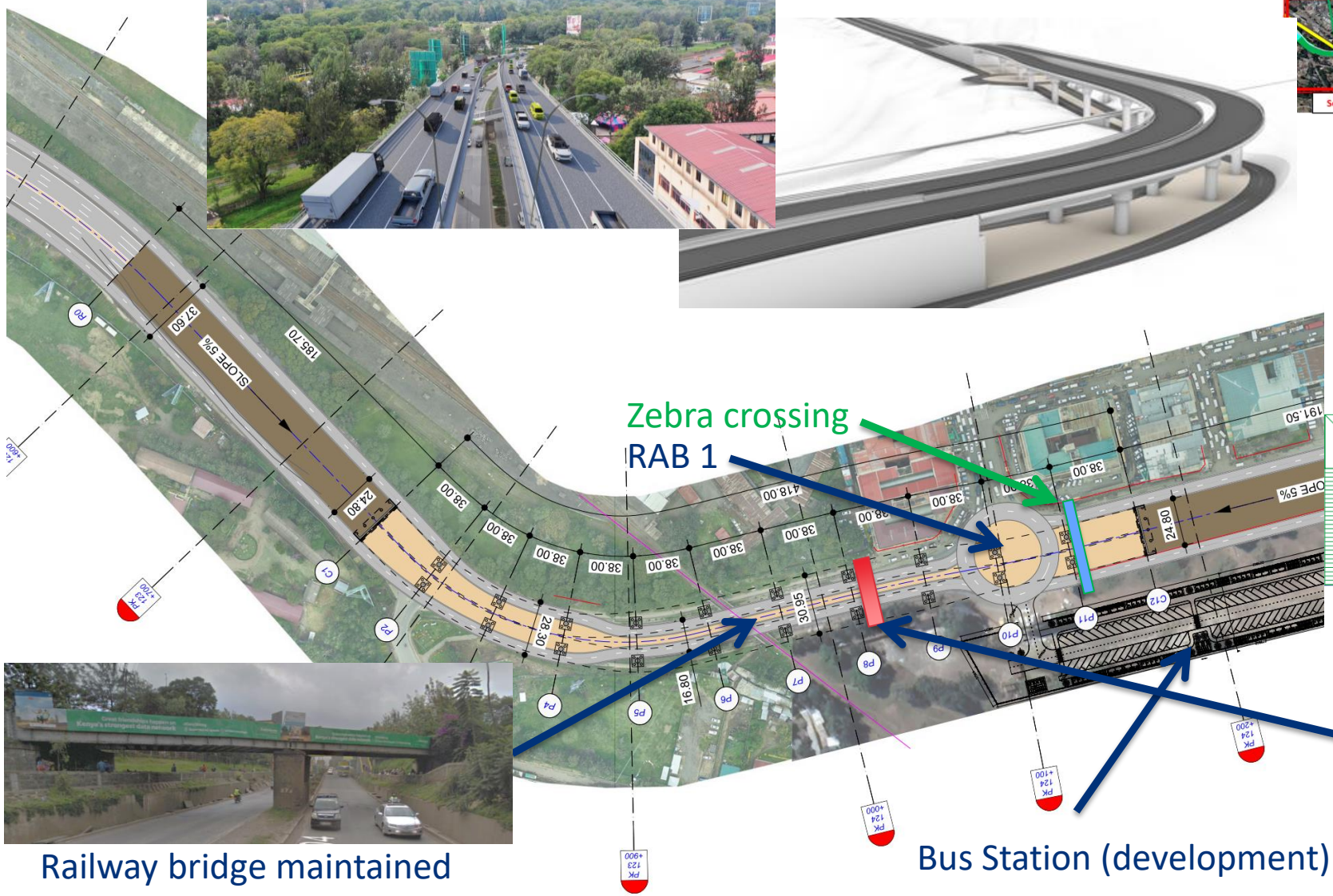


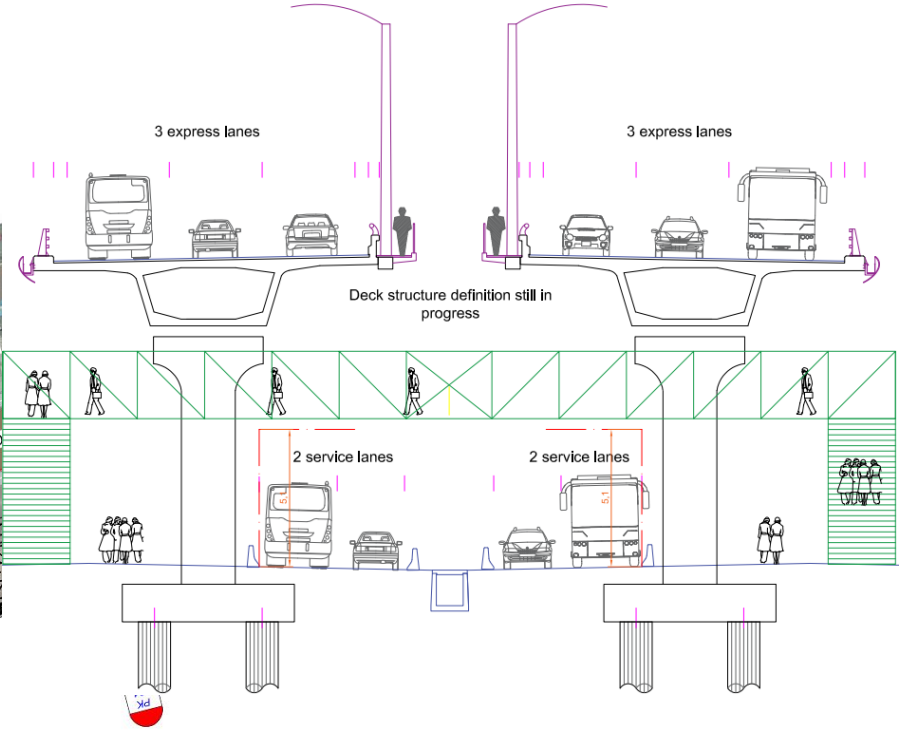


Section 1 – Viaduct 1 / RAB 1

Viaduct 1 : above railways and roundabout 1 : 418 m





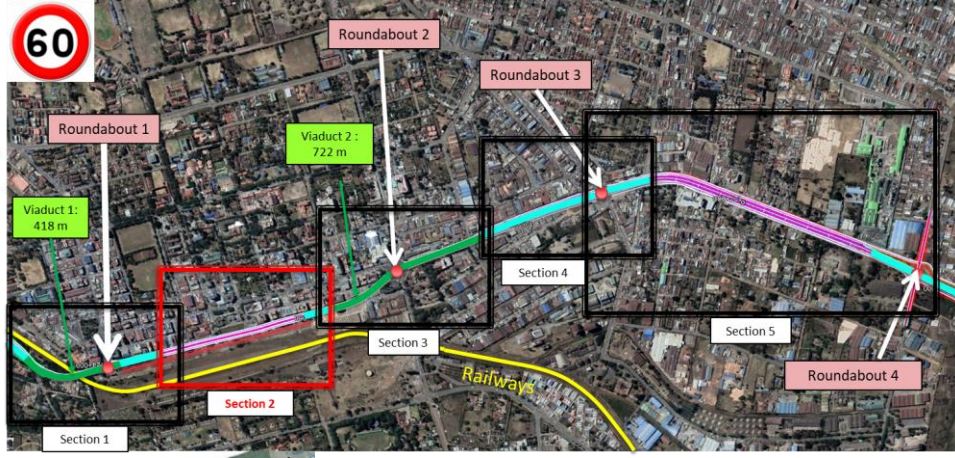


Railway bridge maintained

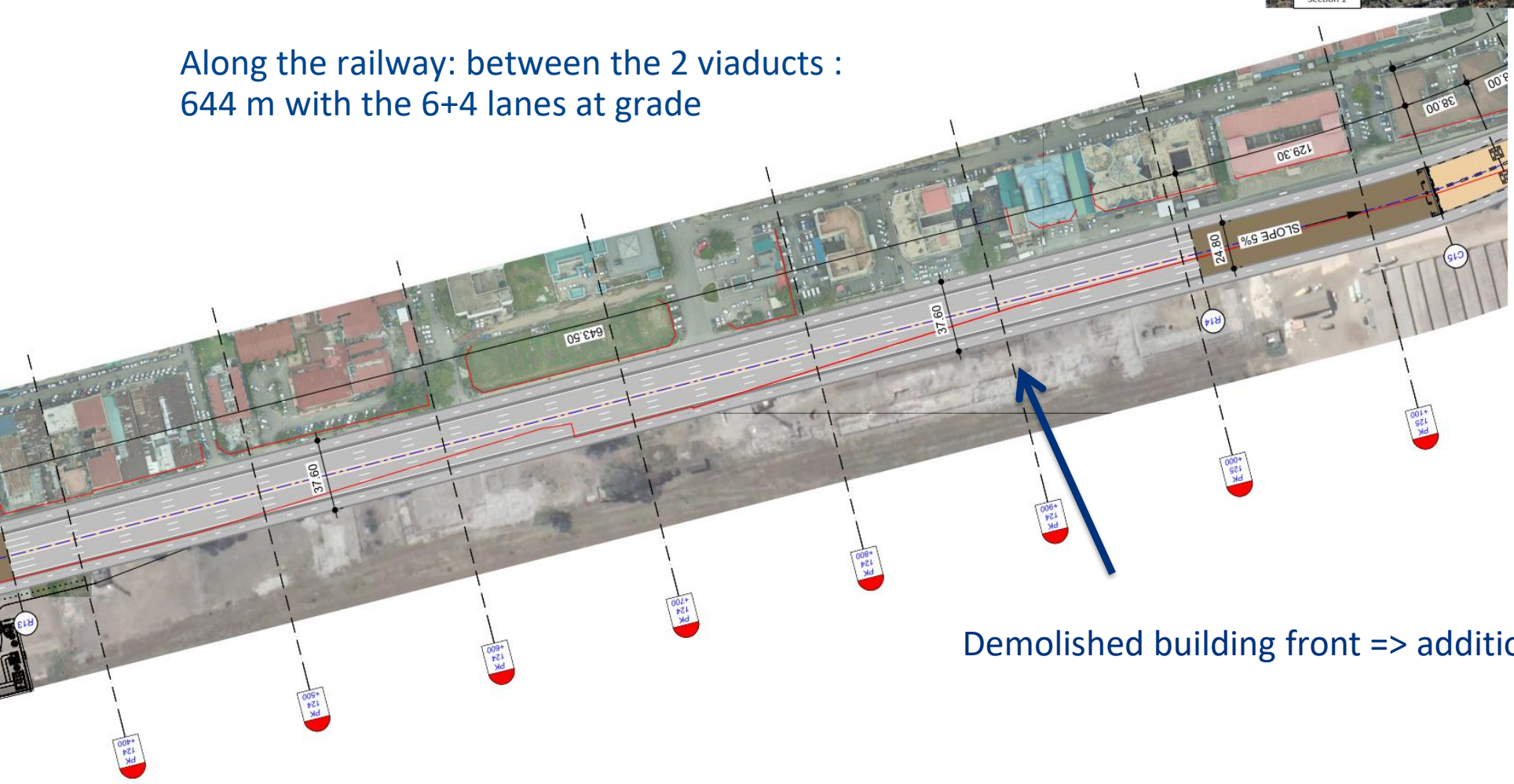
Existing footbridge maintained

Bus Station (development)

Section 2 – between RAB 1 and 2

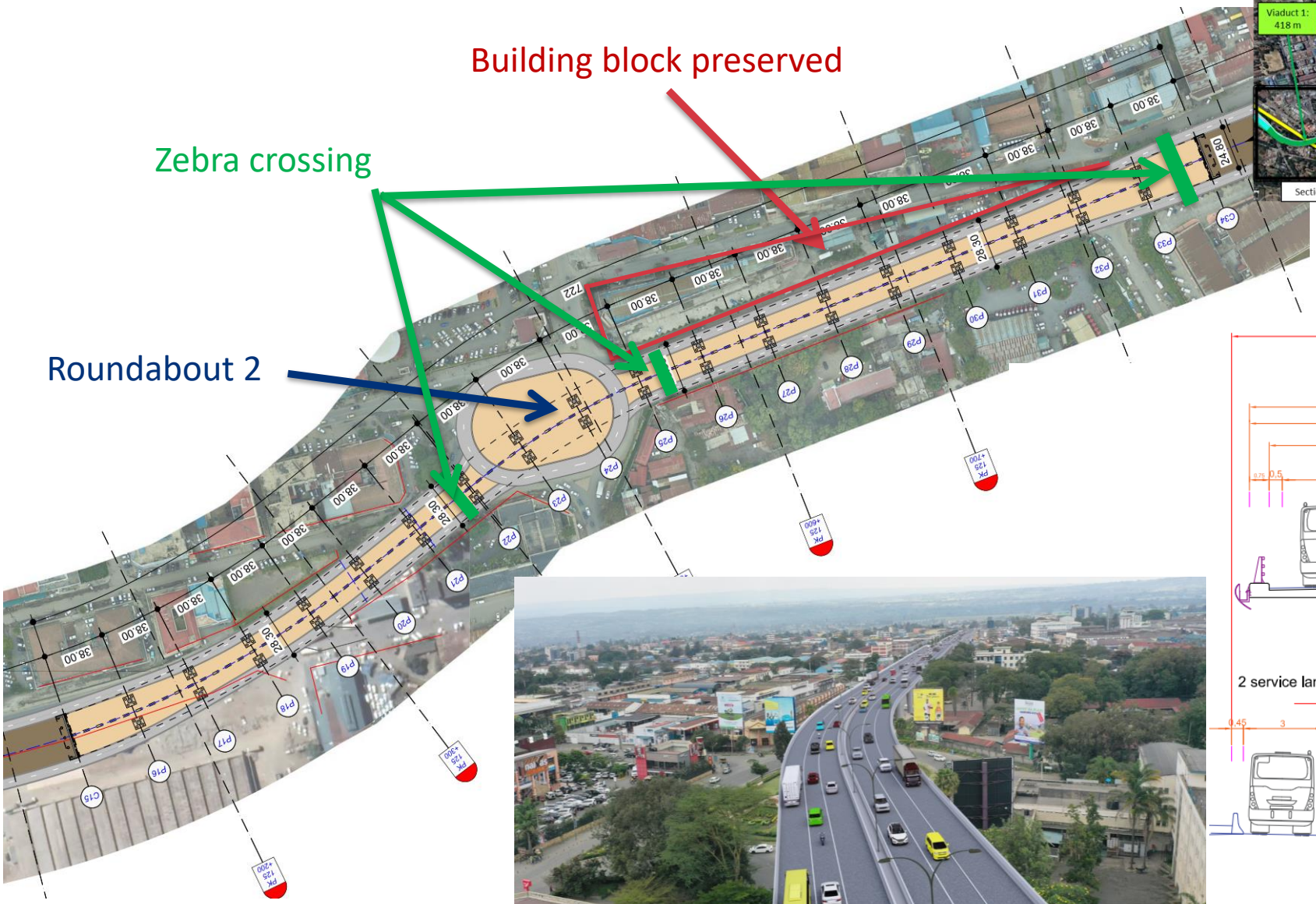


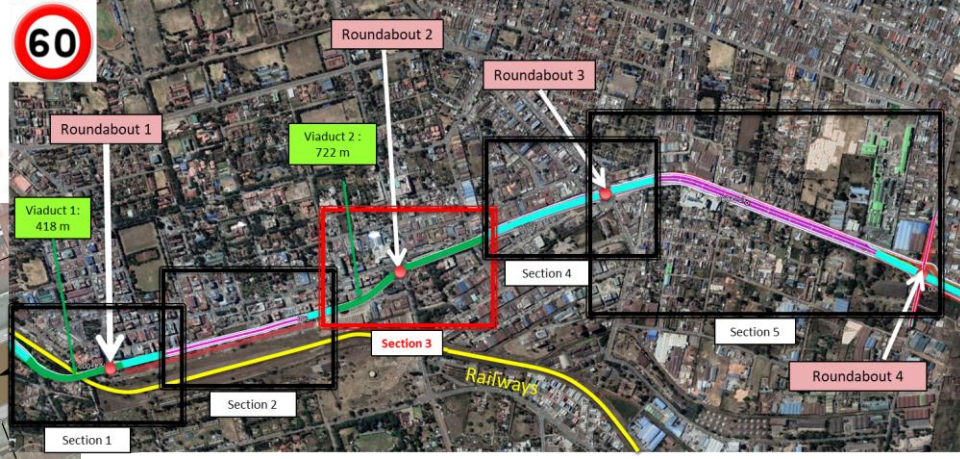
Along the railway: between the 2 viaducts :
644 m with the 6+4 lanes at grade



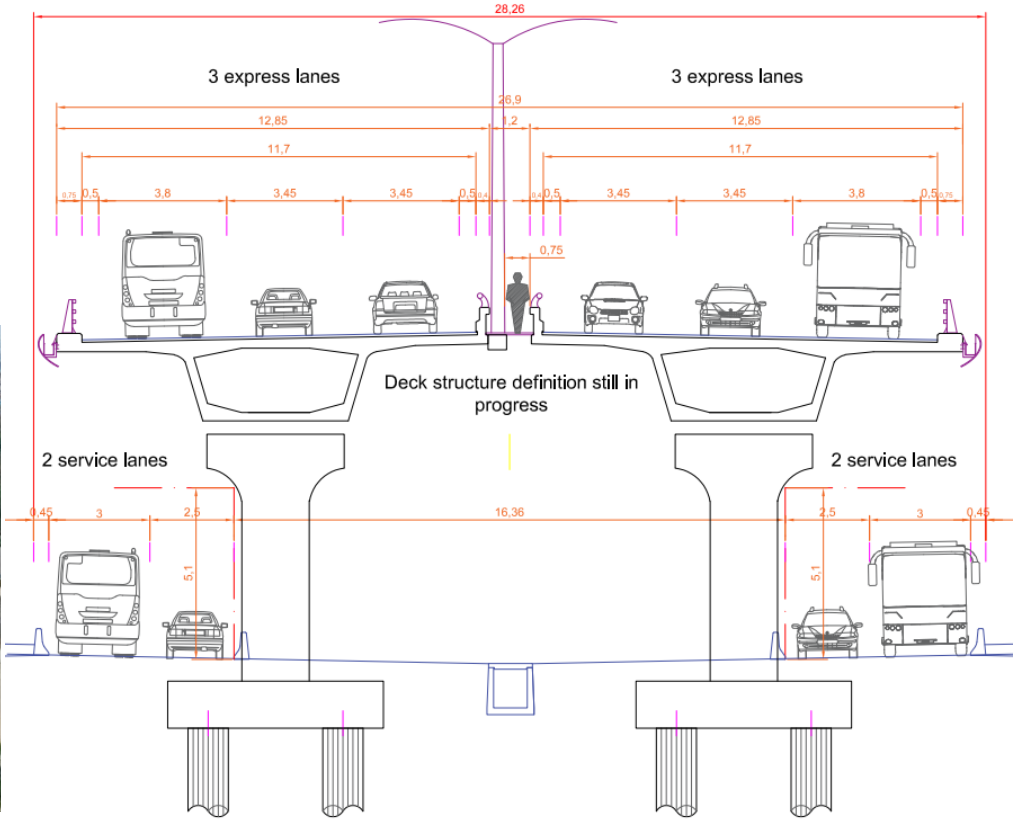
Demolished building front => additional land available

Section 3 – Viaduct 2 / RAB 2





Viaduct 2 at roundabout 2 : 722 m

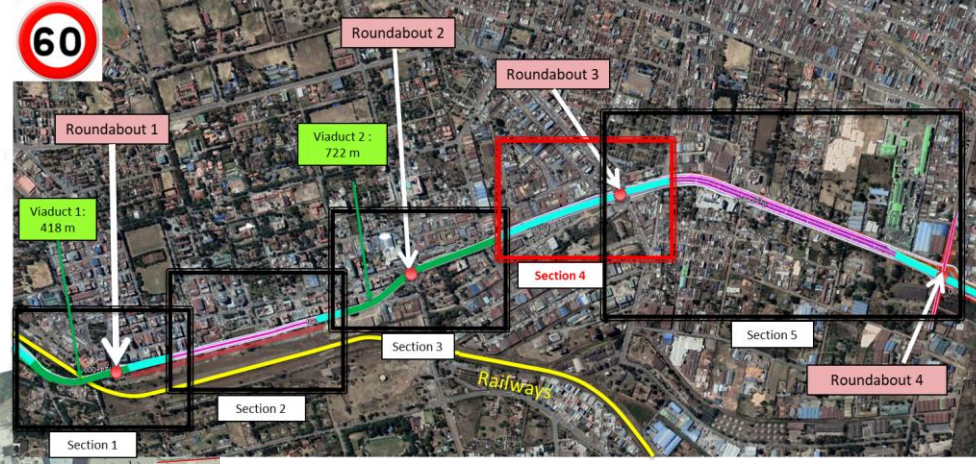


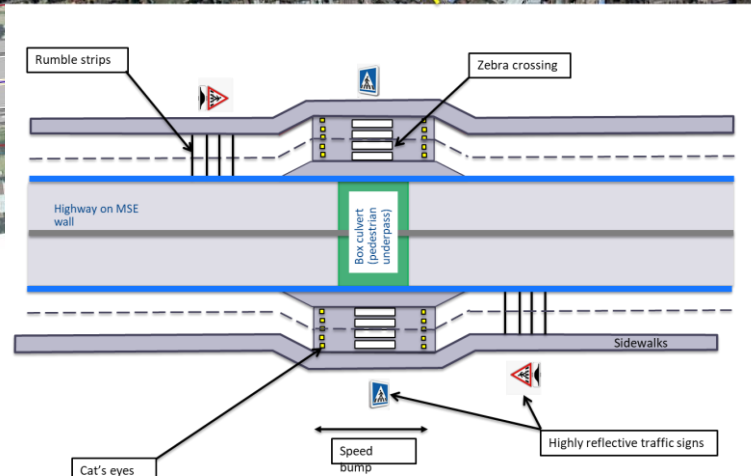
Section 4 – RAB 3

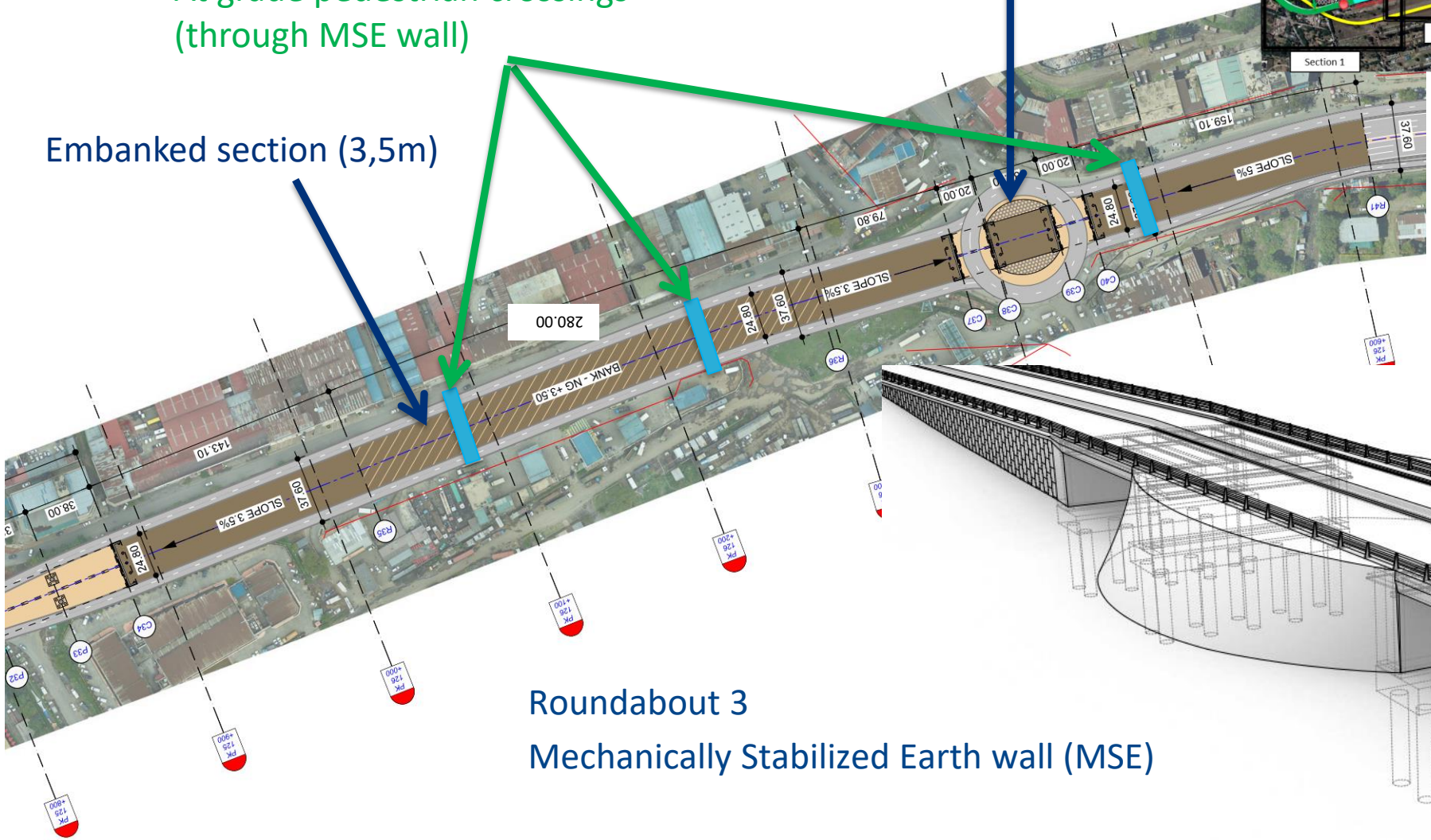
Roundabout 3

At grade pedestrian crossings
(through MSE wall)

Embanked section (3,5m)



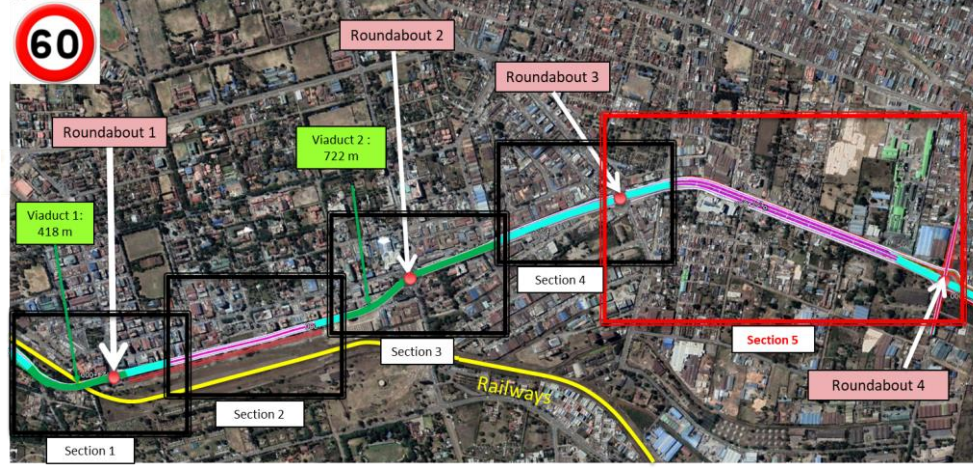




Roundabout 3

Mechanically Stabilized Earth wall (MSE)

Section 5: Between RAB 3 and 4

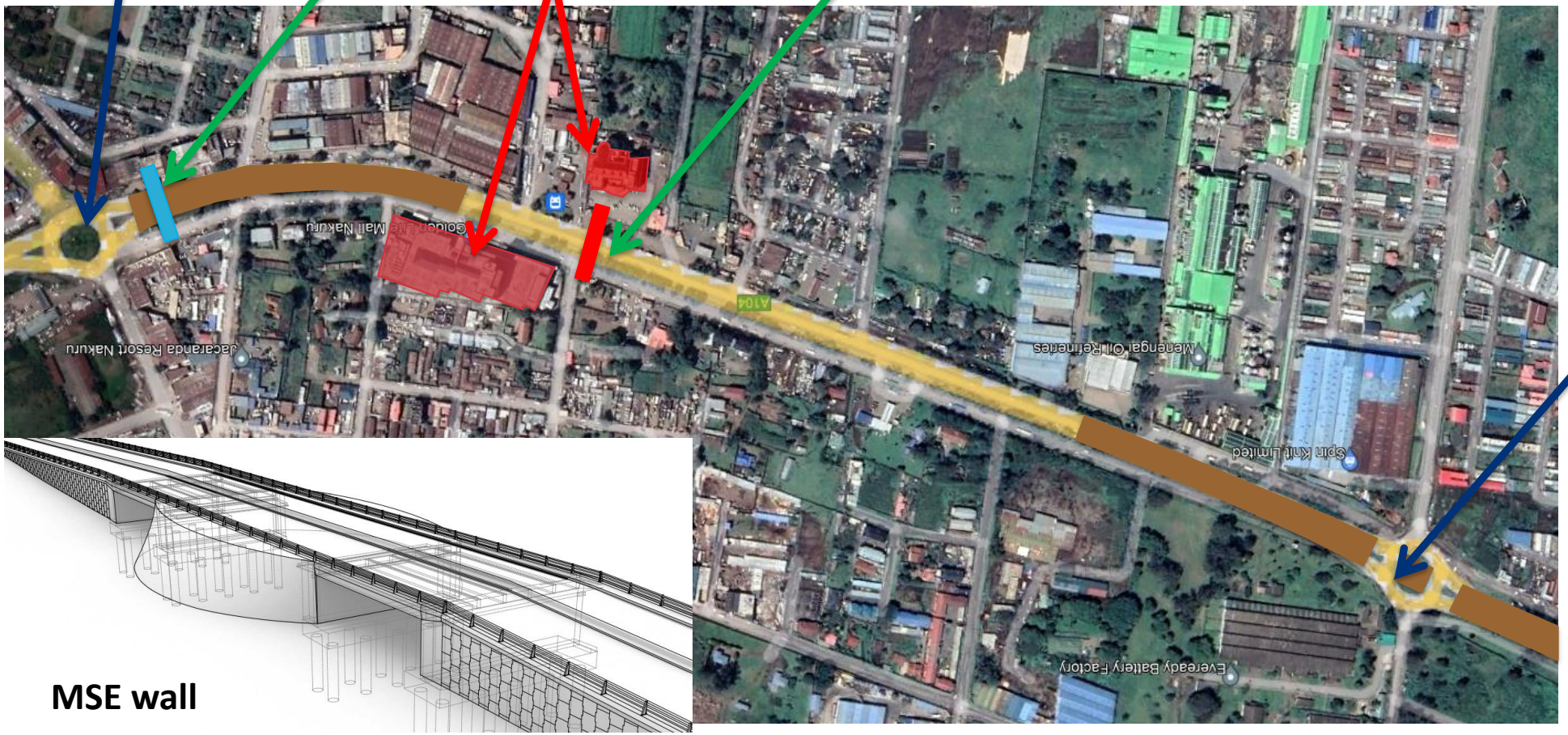


At grade pedestrian crossings (through MSE wall)

Roundabout 3

Malls

Footbridge



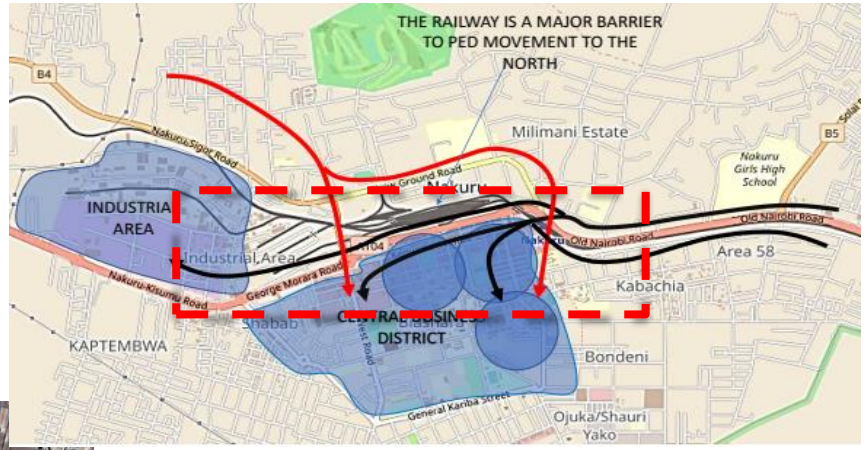
Roundabout 4

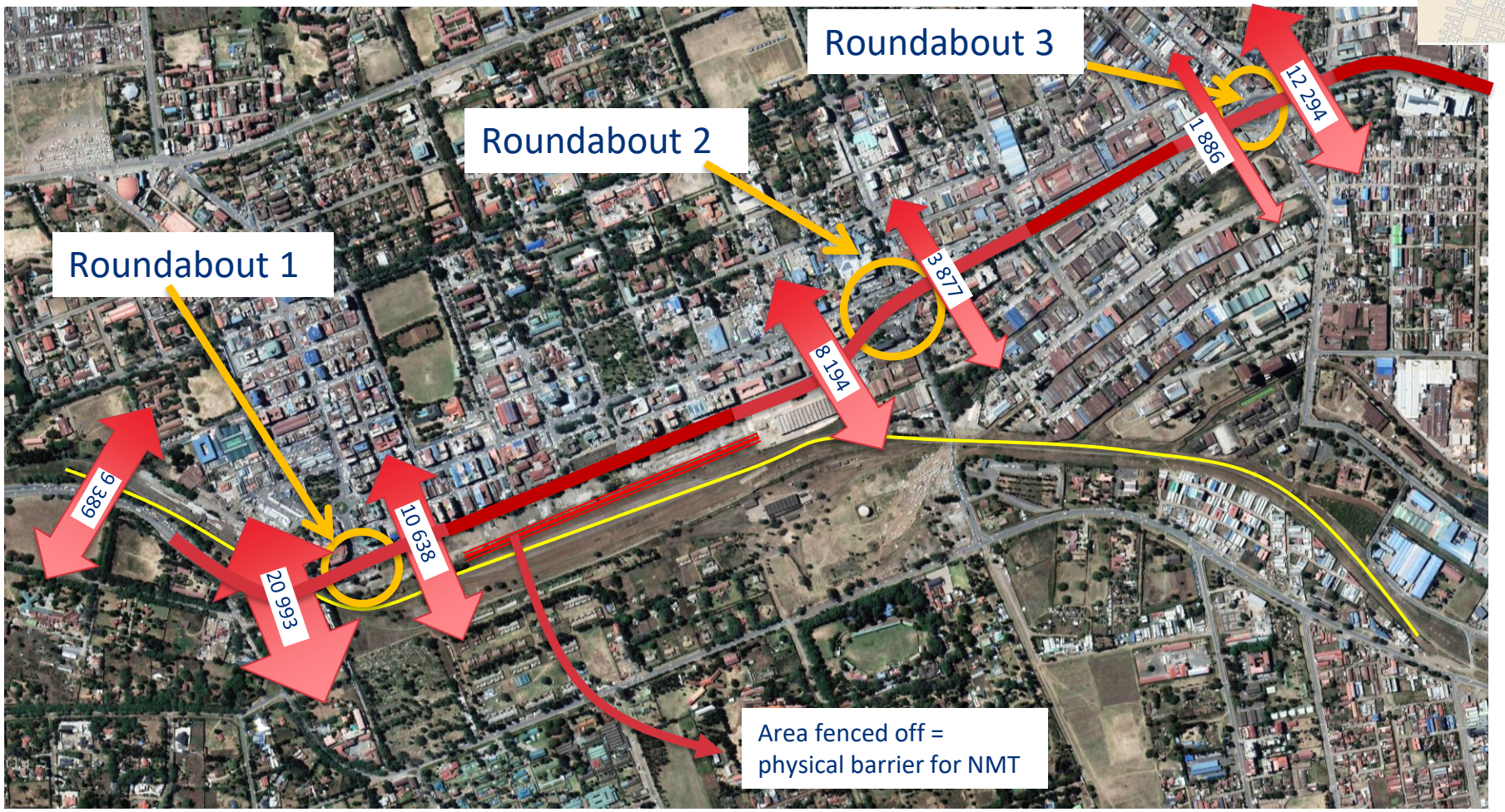
MSE wall

Pedestrian crossings

Numbers in the arrow represent the daily pedestrian crossing at this specific point

Overall view of pedestrian flows in Nakuru

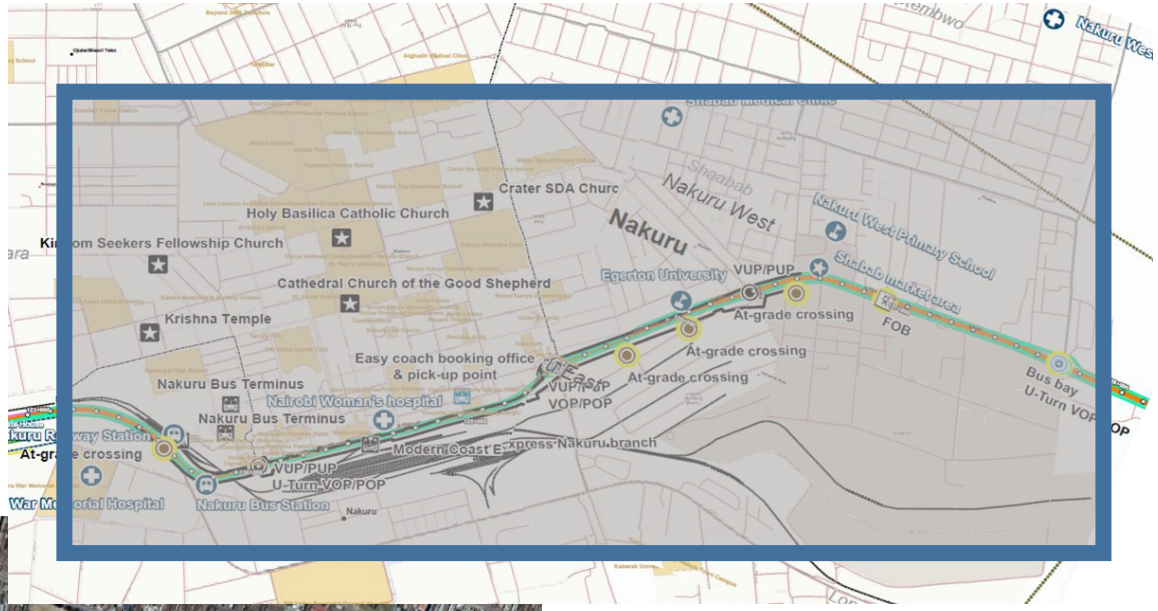


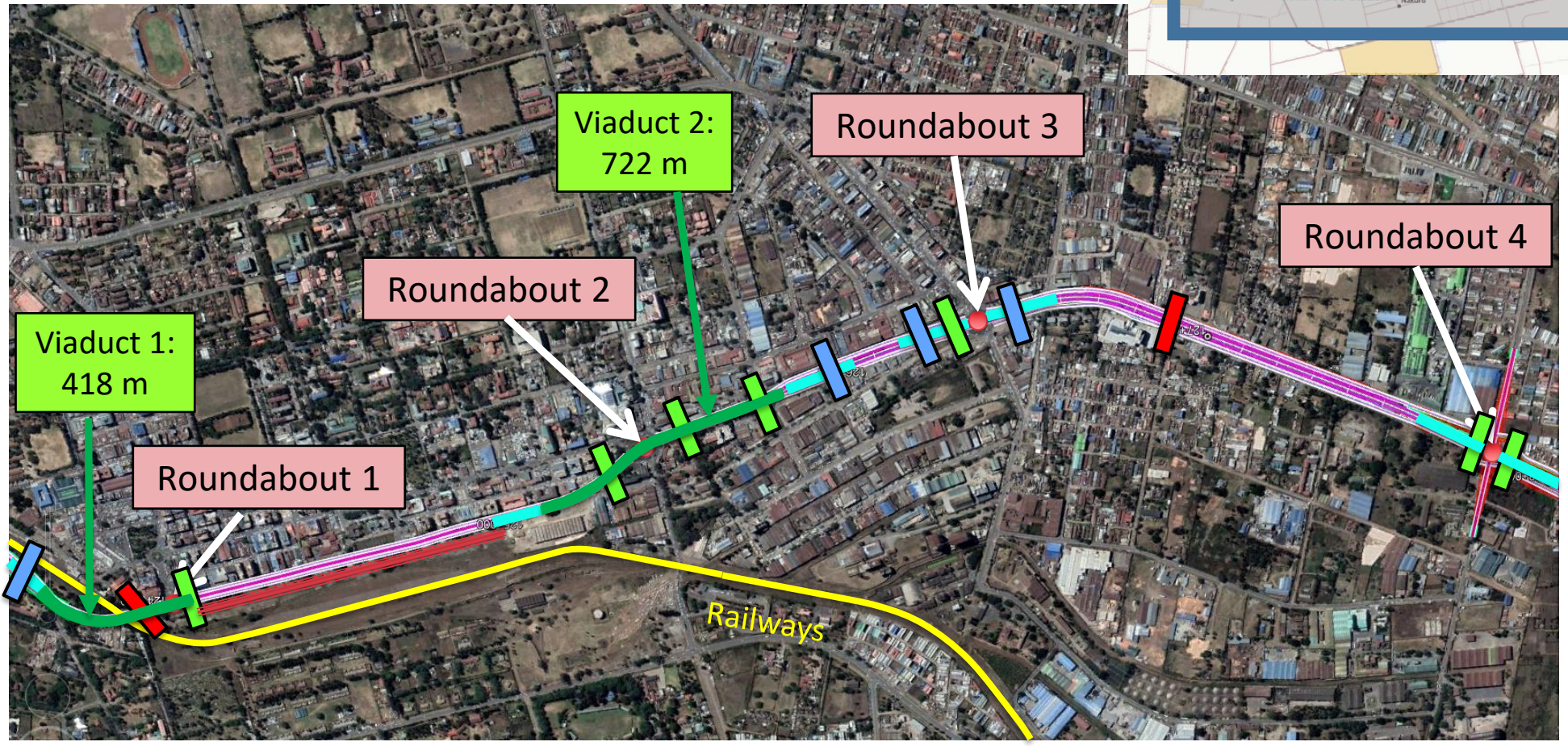


Pedestrian crossings

Design modifications for A8 :

- 4 MSE crossing
- 6 Zebra crossing
- 2 footbridges





Underpass in MSE wall

Zebra crossing

Footbridge

ENVIRONMENTAL AND SOCIAL IMPACTS AND PROPOSED MITIGATION MEASURES

KeNHA

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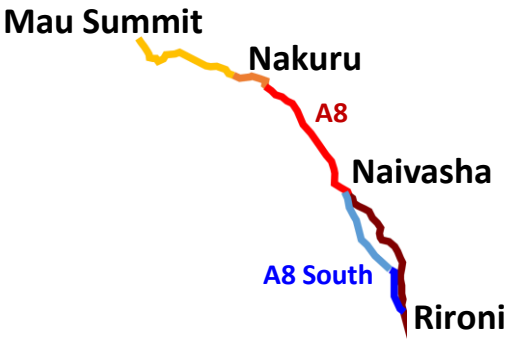
Environmental and Social Impact



Physical Environment

Potential Impacts	Proposed mitigation measures
Degradation of local air quality • due to dust emissions and air contaminants increases	➢ **Avoid** vehicle idling and **ensure** adequate maintenance of vehicles/machinery ➢ **Limit** speed at work sites ➢ **Use** water sprays as dust abatement and **favor** the use of tarpaulin when transporting fine granular material
Rise of local noise levels • due to vehicular movement increases, construction activities and increase speed and traffic (on A8 Highway only)	➢ **Ensure** adequate maintenance of vehicles/machinery ➢ **Limit** speed at work sites and use of motor brake ➢ **Monitor** noise levels during construction ➢ **Install** noise barriers where required ➢ **Implement** a grievance mechanism.

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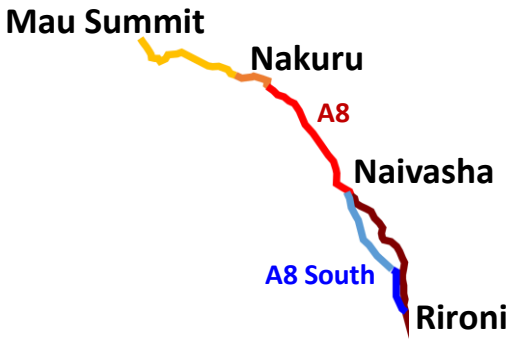
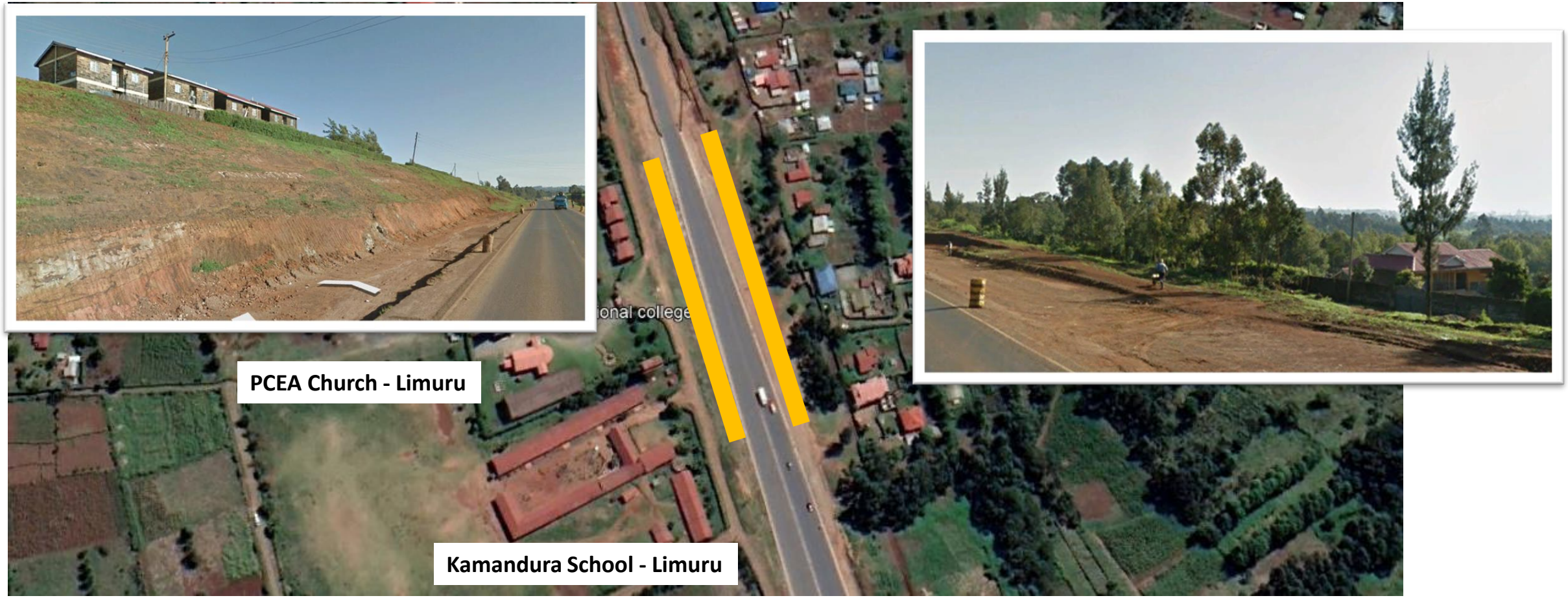
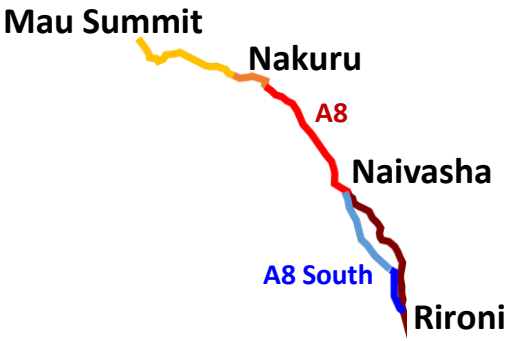
Environmental and Social Impact



Example of noise barrier



Environmental and Social Impact

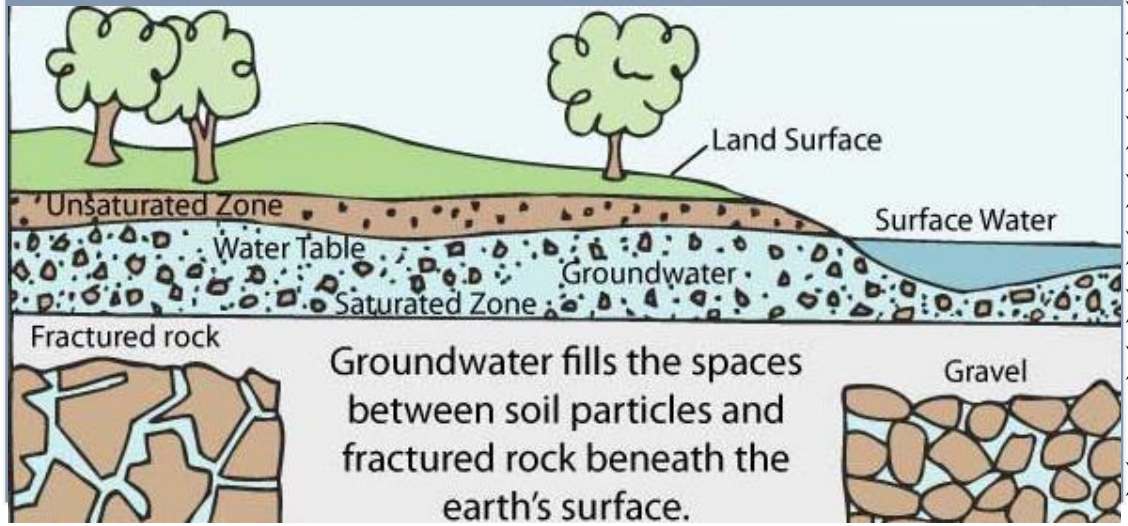


Physical Environment

Potential Impacts

Modification to surface water flow and quality
Modification to groundwater quality and quantity

- due to earthworks, accidental spills, water project use



Proposed mitigation measures

- **Maintain** minimal required waterflow at all time
- **Ensure** adequate maintenance of vehicles/machinery
- **Avoid** storage of granular material near watercourses
- **Upgrade** water crossing infrastructures to avoid flooding
- **Install** silt screens and **keep** spill kits available at work sites
- **Ensure** adequate storage of hazardous material and wastes
- **Control** efficiency of water treatment installations
- **Implement** a grievance mechanism
- **Limit** groundwater use to essential needs
- **Maintain** all infrastructure and equipment using water to eliminate leaks
- **Consider** using captured rainwater

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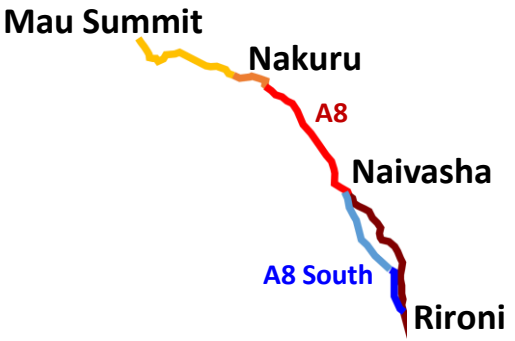
Environmental and Social Impact



Physical Environment

Potential Impacts	Proposed mitigation measures
Modification to soil and sediment quality • due to earthworks and accidental spills	➢ **Implement** applicable surface water quality measures ➢ **Ensure** management of contaminated soils and sediments through authorized companies and disposal sites.

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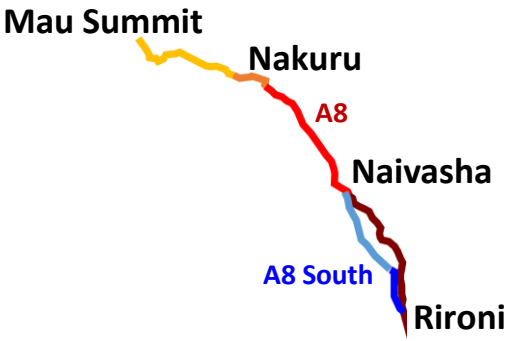
Environmental and Social Impact



Biological Environment

Potential Impacts	Proposed mitigation measures
Loss of habitat and flora • due to site clearing activities, heavy vehicle movements and accidental spreading of invasive species	➢ **Limit** vegetation clearing to area required for construction ➢ **Favour** revegetation once work is completed ➢ **Manage** adequately cleared invasive species ➢ **Compensate** vegetation losses through plantation with indigenous species
Loss and modification of habitat, limitation of movement and potential mortality of local/regional fauna • due to site clearing, vehicle movements and presence of highway	➢ **Implement** measures associated with noise levels, water quality and flora ➢ **Prohibit** hunting by workers and implement wildlife crossing points ➢ **Stop/limit** work in sensitive bird breading area ➢ **Develop/apply** a roadkill monitoring program

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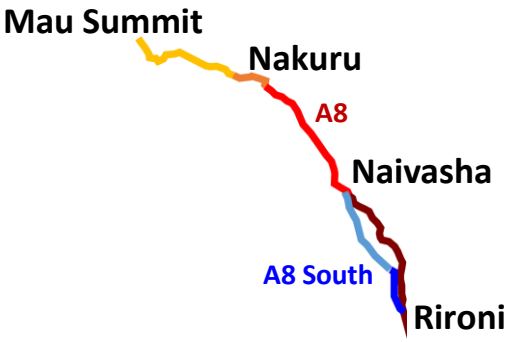
Environmental and Social Impact



Example of wildlife captured near the project area

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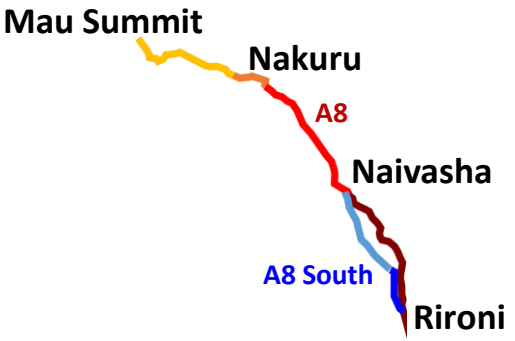
Environmental and Social Impact



Biological Environment

Potential Impacts	Proposed mitigation measures
Modification to freshwater ecology • due to earthworks and accidental spills	➢ **Implement** applicable surface water quality measures ➢ **Ensure** upstream/downstream connectivity for fish ➢ **Restore** shores and riverbeds following completion of construction activities ➢ **Prohibit** fishing by workers.
Loss of ecosystem services • mainly associated with use of flora as traditional medicine due to site clearing and other construction activities	➢ **Implement** measures associated with habitat and flora ➢ **Compensate** vegetation losses through plantation with indigenous species traditionally used by local communities.

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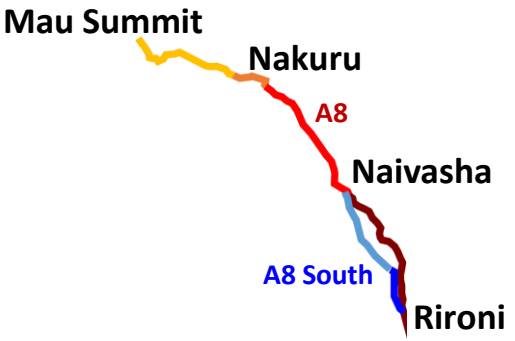
Environmental and Social Impact



Example of flora used for traditional medicine

Medicinal bark

Dawa

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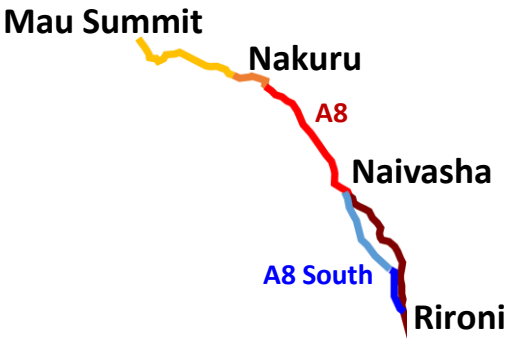
Environmental and Social Impact



Human Environment

Potential Impacts	Proposed mitigation measures
Loss of land • due to potential additional requirements outside current right-of-way	➢ **Develop/implement** a resettlement action plan for all additional land requirements.
Loss of community well-being and safety • due to construction activities, influx/presence of workers and increase traffic	➢ **Implement** air quality and noise mitigation measures ➢ **Ensure** all drivers are licenced and trained ➢ **Develop/implement** a traffic management plan, a stakeholder engagement plan and a worker's code of conduct ➢ **Organize** trainings on various health and safety topic

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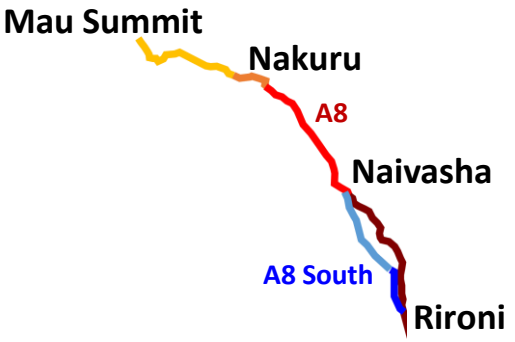
Environmental and Social Impact



Example of dangerous crossings

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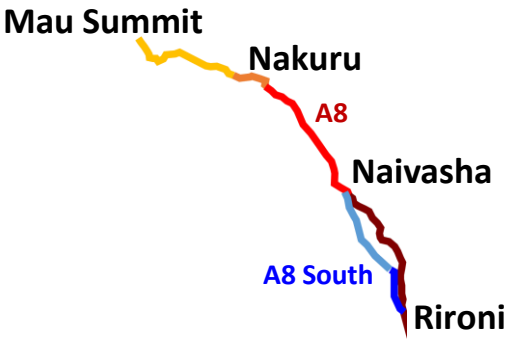
Environmental and Social Impact



Human Environment

Potential Impacts	Proposed mitigation measures
Modification to living condition, social amenities and community assets • due to property value fluctuations and access limitation to informal roads (temporary and permanent)	➢ **Implement** noise related mitigation measures ➢ **Develop/implement** a traffic management plan to protect informal roads ➢ **Maintain /Improve** highway crossing capacity (pedestrian and vehicular)
Modification to livelihood strategies and economic activities • due to temporary traffic disruption and limitation of access to and crossing of highway (potential effect on VMGs)	➢ **Implement** air and surface/groundwater quality, noise reduction, and freshwater ecology mitigation measures ➢ **Develop/implement** a traffic management plan ➢ **Relocate** street vendors and **maintain** access to commercial/industrial sites along highway ➢ **Maintain** capacity of crossing the work site for cattles

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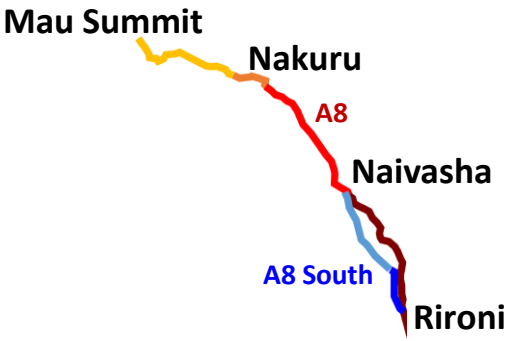
Environmental and Social Impact



Example of street vendors and kiosks

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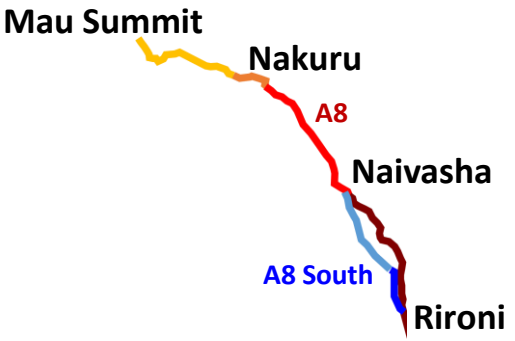
Environmental and Social Impact



Human Environment

Potential Impacts	Proposed mitigation measures
Modification of Labour conditions • due to inadequate application of labour regulation by RVH or subcontractors (potentially affecting VMGs and Gender aspects)	➢ **Develop/implement** clear hiring guidelines and **include** labour/HSE criteria in contractual documents ➢ **Monitor** contractors/subcontractors activities and develop/implement a grievance mechanism for worker ➢ **Maximise** hiring of local labour (social inclusive) ➢ **Ensure** equality of opportunity/treatment for employee ➢ **Develop/apply** a Gender and Social Inclusion Policy
Degradation of and perturbation of services associated with public infrastructure • due to overall construction activities.	➢ **Develop/implement** a traffic management plan ➢ **Establish/maintain** communication links with public infrastructures operators to avoid disruption of services ➢ **Ensure** adequate location of all underground services prior to initiating excavation work

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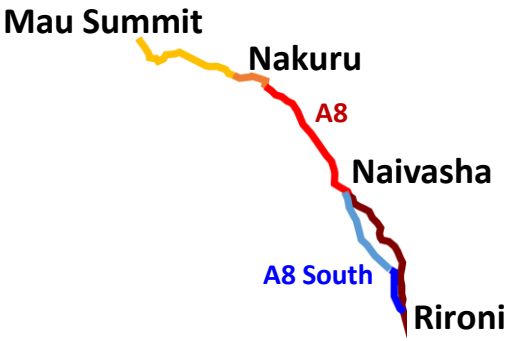
Environmental and Social Impact



Human Environment

Potential Impacts	Proposed mitigation measures
Damage or destruction of unregistered archaeological/cultural sites • due to excavation and other construction activities	➢ **Develop/apply** a chance finding procedure ➢ **Maintain** secure access to the Sashangwan memorial during construction
Modification to local visual environment • due to the presence construction activities and new road infrastructures	➢ **Consider** developing an architectural design well integrated in its visual environment ➢ **Include** vegetation to beautify

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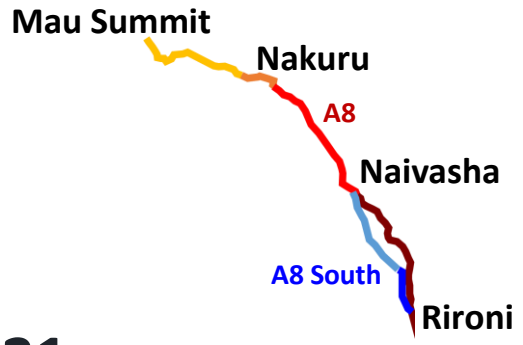
Next steps



- Submission of complete ESIA → December 2021
- Final Design Studies integrating ESIA requirements → 2022
- Project construction → 2022 / 2025

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QUESTIONS?

APPENDIX

7-9 OTHER STAKEHOLDERS COMMENTS RECEIVED

REPUBLIC OF KENYA
PARLIAMENT

Hon. Martha Wangari, MP.

Gilgil Constituency

Member - Defence & Foreign Relations Committee

Parliament Buildings
Tel: +254 20 2221291
P. O. Box 41842 - 00100 Nairobi, Kenya

K.I.C.C 18th Floor Rm. 1806
Mobile: +254 720 205 762
Email: hon.marthawangarimp@gmail.com

3rd JUNE, 2021

THE DIRECTOR GENERAL,
KENYA NATIONAL HIGHWAYS AUTHORITY
NAIROBI

Dear Eng.,

RE: SPECIAL CONSIDERATIONS ON THE GILGIL SECTION OF THE NAIROBI-NAKURU-MAU SUMMIT ROAD.

Gilgil section is among busiest sections of the A104 road that connects Kenya to other countries in the region. The section is a preferred stop over center by truckers using the route, and this is a factor that has accelerated growth in hitherto dormant centers such as Kikopey, Barnabas, Mbaruk, and Pipeline.

It is in view of the above that the People of Gilgil have identified the following key proposals for your consideration:

1. Elaborate exit from the Highway and C717 Eburru road.
2. Ample pedestrian bridges so as to safely link communities residing on either side of the road.
3. Consider rehabilitating the unutilized boreholes at Kekopey Catholic Church and Kasambara. And further sinking another borehole at Kambi Somali, preferably Gilgil Highway Secondary School. These boreholes can suffice as the main sources of water in the road construction in the area.
4. Consideration of the local community in casual and skilled job opportunities.
5. Ensure that sub-contracts for the supply of materials and services are locally sourced.
6. Consider constructing washrooms and canteens at Kasambara and Marula to serve trucks crews and bus passengers.
7. Keen consideration of the storm water management around Gilgil town and Kikopey trading center.

8. Construction of modern parking areas at Gilgil town, Kekopey and Barnabas areas.
9. Elaborate interchanges at both junctions that link Gilgil town and the Highway.
10. Specialized lanes for persons living with disability, non-motorized traffic and cylists

The above proposed interventions will go a long way in ensuring the economic and social vibrancy of the small town along the route on either side of the highway are maintained.

Yours Sincerely,

Hon. Martha Wangari, MP.
GILGIL CONSTITUENCY

NAIROBI/NAKURU HIGHWAY A8

PROPOSED UPGRADING TO DUAL CARRIAGEWAY

1. EXECUTIVE SUMMARY

CONSTRUCTION OF INTERCHANGE AND/ OR MEDIAN U-TURN POINTS

In line with the following detailed account of social economic developments by the Greater Lake Elementaita Conservation Area, hereinafter referred to as GLECA, and the joint annex by Lake Elementaita Land Owners, hereinafter referred to as LELO, it will be noted that the area has become a vital tourism destination. The proposed upgrading of Rironi – Mau Summit Section of A8 Highway to dual carriageway standard will affect the mode of access to the many hotels, lodges, campsites and other facilities in the area under consideration.

Most of the riparian land is reserved for biodiversity conservation, and is an important feeding and breeding area for wildlife and birds. Tourism and recreational facilities in the area are an important foreign exchange earner and employer. There are tourist class hotels, lodges, campsites, existing and proposed wildlife sanctuaries namely, the Sleeping Warrior, Mwa Mbili camp, Tented Camps in Soysambu; Jacaranda Lake Elementaita Lodge, Oasis Eco Camp, Pinklakeman Lodge, Kikopey Beach Camp, Cactus Eco Camp and Lodge, Pelican Lodge, Sirville Lodge, Epashikino Resort, View Point Hotel, Oldonyo Lodge, Sentrim Lodge, Season Country Elementaita Lodge, Eagle's Point Camp, New Serena tented camp, Sunbird Lodge, Bweha Camp, Lake Elementaita Mountain Lodge, Lemon Valley Camp and prehistoric site (Kariandusi) and one Observation View point (managed by Lake Elementaita Eco-Tourism Organization). There are many other existing and upcoming Tourist lodges and camps...

In order to avoid severing effective operation of in place and upcoming developments in the subject area, it is proposed the highway development incorporates interchanges or U-turn points in the highway median at the following critical points:-

I. Kikopey Pipeline Road – A8 Junction

II.(a) Between National Museum of Kenya Kariandusi Prehistoric Site Turn-off, Main Lake Elementaita Access Road and Lake Elementaita View Point.

(b) Due to high number of vehicles accessing the Lake Riparian (beach) by members of public via the Main Lake Elementaita Access Road mentioned in II (a) above, KENHA is respectfully requested to tarmac this 1 km stretch.

III. Karura Shopping Centre

IV. St. Mary and St. Joseph Hospitals

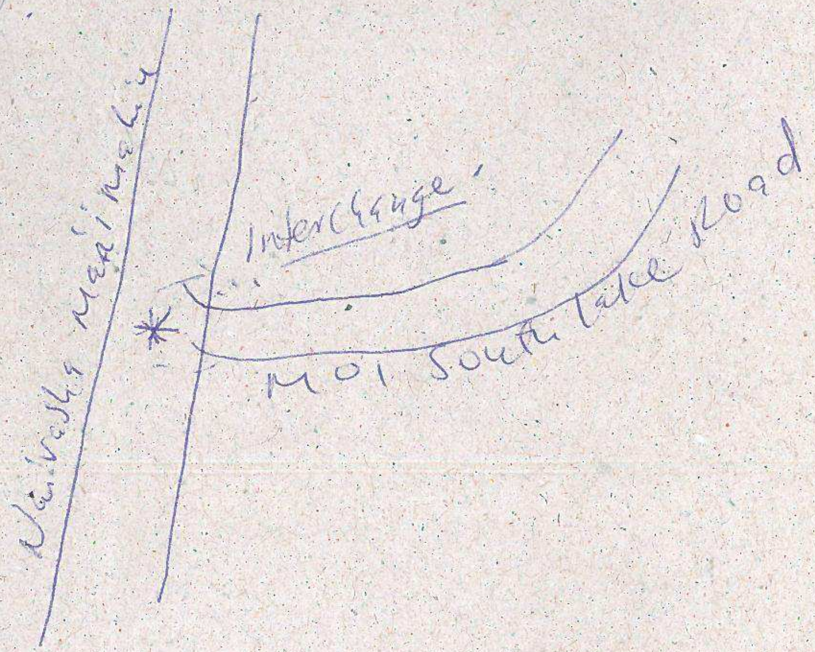
V. Soysambu Conservancy / Serena Camp / Lake Elementaita Mountain Lodge Turn-off point.

It will also be crucial to construct service roads and acceleration/deceleration lanes to facilitate safe and smooth access to strategic facilities along the highway in the area under consideration.

(2) Kuwait - Children crossing from mountain view village to minera primary school, minera secondary and minera youth polytechnic polytechnic
(overpass needed)

David Kavini 0720563560

(1) Naivasha – Maaimahiu Road Junction to Moi South lake Road.
A lot of accidents occuring their.
interchange from the main road to moi south lake road.



APPENDIX

7-10 STAKEHOLDER REQUEST INTEGRATION

A8 Additional requirements from the public

Type	Chainage From	Chainage To	Side	Dimensions	Comment(s)
Noise barrier	0+600	0+900	L		Add noise barrier
Noise Berm	0+600	0+900	R		Add noise berm
FOB	0+700	-	N		Add FOB - no ramp
CUP	1+350	-	N		Existing CUP to be maintained
CUP	1+950	-	N		Existing CUP to be maintained
Bus bay	3+200	-	L		Add
CUP	23+700	-	N		FOB at 23+900 to be changed to CUP and moved to 23+700
CUP	27+750	-	N		FOB to be changed to underpass
CUP	29+200	-	N		FOB at 29+350 to be changed to CUP and moved to 29+200
FOB	30+950	-	N		Add - No ramp
Bus bays	31+000	-	B		To shift bus bays at 30+500(LHS) and 30+700(RHS) closer to the market
Service Lane	30+800	31+050	R		To shift the service lane from [30+590;30+840] to [30+800; 31+050] for a better connection of the market
Fencing	36+800	37+200	B		Fencing
Service Lane	36+800	37+200	L		Add 400m service lane
FOB	52+300	-	N		Move FOB with ramp from 52+200 to 52+300
Bus bay	52+300	-	B		Add
Truck bay	53+300	-	R		Truck bay to be relocated from 55+800 to 53+300
Truck bay	53+600	-	L		Truck bay to be relocated from 55+000 to 53+600
Bus bay	55+600	-	B		Add
CUP	55+700	-	N		Existing CUP at 56+050 to be demolished and a new CUP added at 55+700
Bus bays	57+600	-	B		Add
CUP	84+700	-	N		Existing CUP to be maintained and extended
Bus bay	89+400	-	B		Add
FOB	89+500	-	N		Move FOB with ramps from 89+000 to 89+500
Bus bay	92+900	-	B		Add
CUP	107+700	-	N		Existing CUP to be extended
Bus bays	113+100	-	B		Bus bays at 112+000 to be moved to 113+100
Access to truck park	113+400	-	L		Access to truck park to be maintained
FOB	116+500	-	N		FOB with ramps at 115+800 to be moved to 116+500
Bus bay	120+400	-	R		Add
Speed bumps, rumble strips & traffic sign	121+700	-	B		Add speed bumps, rumble strips and traffic sign before and after the at-grade crossing
Truck bay	122+200	-	B		Move truck bays at 122+800 away from the state house to 122+200

N	Not applicable
L	Left
R	Right
B	Both

CUP	Cattle underpass
FOB	Foot Overbridge

Bus bay	122+300	-	R		Add bus bay to the RHS
At-grade crossing	123+650	-	N		Additional at grade crossing in MSE wall
At-grade crossing	125+700	-	N		Additional at grade crossing in MSE wall
At-grade crossing	126+000	-	N		Additional at grade crossing in MSE wall
At-grade crossing	126+500	-	N		Additional at grade crossing in MSE wall
FOB	126+900	-	N		Add FOB with ramps
Bus bays	127+700	-	B		Add
Bus bay shelter	129+300	-	B		Existing bus bay shelter to be provided
Pedestrian facility	129+550	-	N		Pedestrian facility to be arranged on the overpass
Noise barrier	131+200	131+400	R		Add noise barrier
Noise berm	131+400	131+600	R		Add noise berm
Noise barrier	133+100	133+400	R		Add noise barrier
Service Lane	136+925	137+950	R		Extended service lane
Noise berm	138+550	138+900	R		Add noise berm
Noise barrier	140+100	140+470	R		Add noise barrier
Underpass	140+250	-	N		Move the interchange at 140+750 to 140+250 and change it to an underpass
Truck bay	140+600	-	B		Truck bays at Ch. 142+700 (R) & 143+300 (L) to 140+600 (B)
Noise berm	141+200	141+300	R		Add noise berm
Noise berm	141+850	142+000	R		Add noise berm
U-turn	145+000	-	N		Move the U-turn at ch.145+500 to 145+000
FOB	147+200	-	N		FOB no ramp
Bus bay	147+300	-	B		Add
CUP	148+100	-	N		Add
Bus bays	150+800	-	B		Move the bus bays from 150+000 to 150+800
Truck parking	151+300	-	L		Access to truck parking to be arranged if necessary
Pedestrian facility	153+850	-	N		To arrange cantilever steel structure to enable pedestrian crossing
Bus bay	158+400	-	B		Add
Truck bay	158+900	-	B		Truck bays at Ch. 157+650 to be moved to 158+900
Service Lane	158+625	159+000	R		Extend the service lane to 159+000
CUP	160+400	-	N		Existing CUP to be extended and reinstated
Lighting	161+400	-	L		Memorial to be enlightened
CUP	161+900	-	N		FOB at 161+500 to be moved to 161+900 and changed into a CUP
Bus bay	162+000	-	B		Bus bay at 161+500 to be moved to 162+000
Bus bays	166+200	-	B		Add
FOB	171+200	-	N		Move the FOB no ramp from Ch. 169+900 to 171+200
Truck bays	171+400	-	B		Truck bays at Ch. 173+700 to be moved to 171+400
Bus bays	171+500	-	B		Add
FOB	173+500	-	N		FOB no ramp to be moved from 173+000 to 173+500

Bus bay shelter	174+200	-	B		To provide shelter at existing bus bays
Underpass	174+600	-	N		Existing underpass to be reinstated
Round about	174+800	-	L		Add roundabout (off Ch. 174 +800 along Kisumu Busia Road) at interchange to enable U-turn

A8 South					
Bus bays	1+400	-	B		Add
At grade crossing	1+500		N		Add
At grade crossing	13+450		N		Add for VMG
At grade crossing	15+900		N		Add
At grade crossing	16+550		N		Add for VMG
CUP	17+700		N		Maintain existing
At grade crossing	20+100		N		Improve existing
FOB	20+500		N		FOB with ramp
CUP	21+700		N		Maintain existing
FOB	24+900		N		Add one FOB no ramp
At grade crossing	30+200		N		Add for VMG
At grade crossing	31+000		N		Add
At grade crossing	31+800		N		Maintain existing
At grade crossing	33+500		N		Add
At grade crossing	34+300		N		Add
FOB	34+900		N		New FOB with ramp
At grade crossing	35+500		N		Improve existing
At grade crossing	51+300		N		Improve existing
At grade crossing	53+000		N		Improve existing
At grade crossing	54+400		N		Improve existing
At grade crossing	55+050		N		Improve existing
At grade crossing	55+900		N		Improve existing
At grade crossing	56+100		N		Add

APPENDIX

8-1 ATMOSPHERIC DISPERSION MODELING

RIFT VALLEY HIGHWAY

NAIROBI-NAKURU-MAU SUMMIT HIGHWAY

ASTMOSPHERIC DISPERSION MODELING

KENYA – RIRONI TO MAU SUMMIT

WSP REF.: 201-10312-00

DATE : 20 AUGUST 2021

CONFIDENTIAL

RIFT VALLEY HIGHWAY

NAIROBI-NAKURU-MAU SUMMIT **HIGHWAY**

ASTMOSPHERIC DISPERSION MODELING

KENYA – RIRONI TO MAU SUMMIT

CONFIDENTIAL

WSP REF.: 201-10312-00
DATE : 20 AUGUST 2021

REPORT (PRELIMINARY VERSION)

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QUALITY MANAGEMENT

VERSION	DATE	DESCRIPTION
VP	2021-08-20	Preliminary version

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Reference to mention:

WSP. 2021. *Nairobi-Nakuru-Mau Summit Highway, Astmospheric dispersion modeling, Kenya – Rironi to Mau Summit*. Report produced for Rift Valley Highway. WSP Ref.: 201-10312-00. Number of pages and tables, figures, maps and appendices.

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1 INTRODUCTION

1.1 BACKGROUND

The Kenya National Highways Authority ("KeNHA" or the "Contracting Authority") is engaged in the development, operation and maintenance of highways, and as part of this endeavor, has decided to undertake widening, improvement, and operation and maintenance of various sections of highways between Nairobi and Mau Summit through a Public Private Partnership (PPP) arrangement on a Design, Build, Finance, Operate, Maintain and Transfer (DBFOMT), as part of the Nairobi-Nakuru-Mau Summit Highway Project (the "Project").

The Project broadly comprise of:

The widening of approximately 175 km of the A8 Highway between Rironi and Mau Summit (4 (four) lane dual carriageway) and in due course its further development into a 6 (six) lane dual carriageway in sections depending upon traffic volumes;

Upgrading of approximately 57.8 km of the A8-South Highway between Rironi and Naivasha via Mai Mahiu (the "Project").

Figure 1 shows the location of these road segments.

In February 2019, a consortium made of VINCI Concessions, VINCI Highways and Meridiam Infrastructure Africa Fund, the Rift Valley Connect Consortium (the "Consortium") was selected as preferred bidder for the Project. Since then, the Consortium and the Contracting Authority have been negotiating the Project agreement and the finalization of this agreement is expected in the coming weeks. The Consortium is looking to initiate preparation of the environmental and social ("E&S") studies required for the Project and to select a qualified environmental and social advisor (the "Advisor") for this purpose.

The upgraded road will consist of four dual carriageways, with the possibility of six dual carriageways depending upon demand. No major deviations of the existing roadway are anticipated. Existing bridges, culverts and road crossings (i.e., cattle, pedestrian, and wildlife) will be repaired, upgraded or replaced, and new structures built where necessary. The Project also includes other ancillary works and facilities, including those related to utilities and drainage.

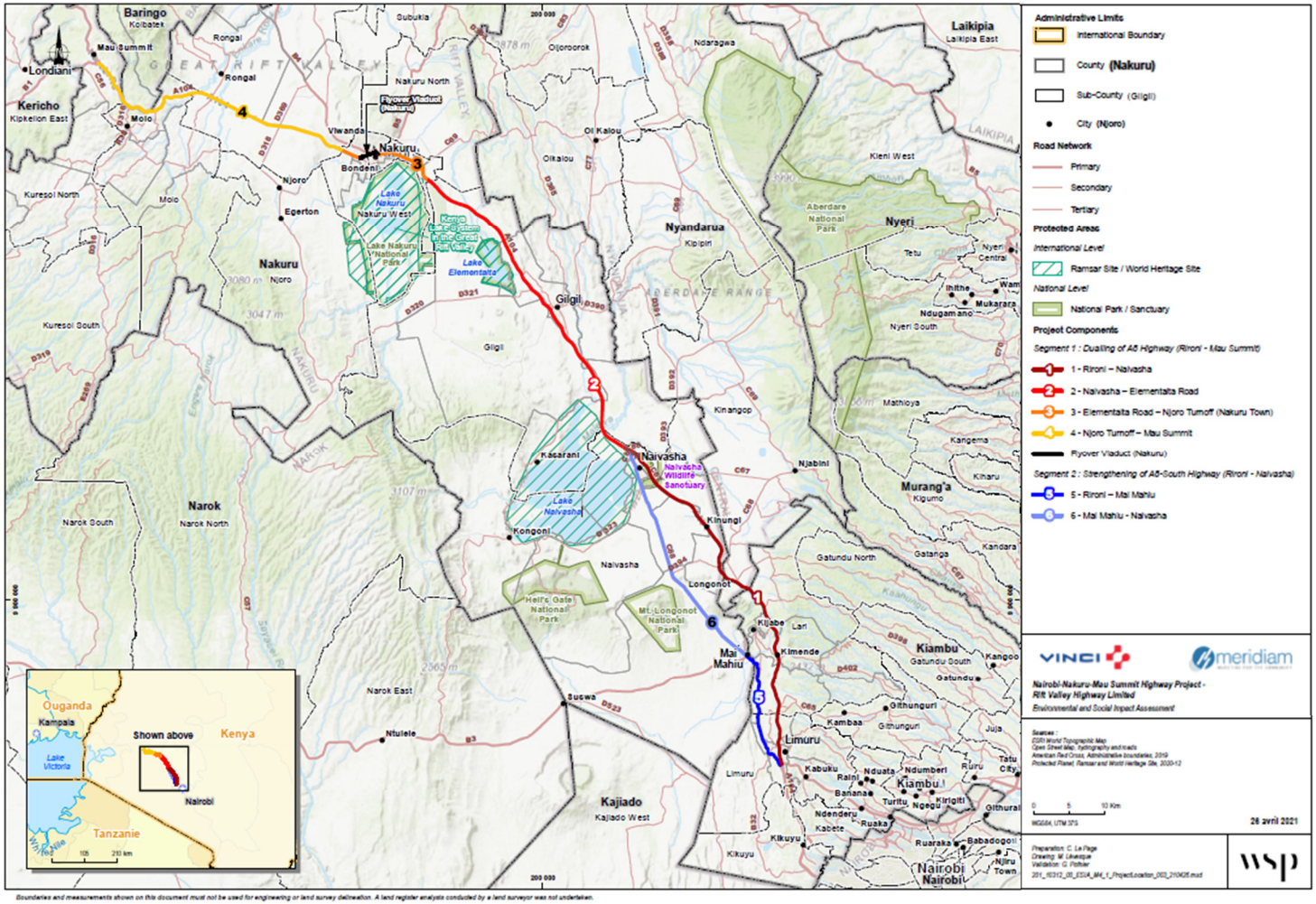

Figure 1 **Nairobi-Nakuru-Mau Summit Highway Project Location**

1.2 STUDY OBJECTIVES

An air dispersion assessment was carried out in order to evaluate the potential impact of the Project's emissions on the surrounding area. The expected contaminants from the Project include those emitted from vehicles travelling on the Nairobi-Nakuru-Mau Summit Highway. The contaminants considered in the assessment are total suspended particles (TSP), fine particles (PM_{10} and $PM_{2.5}$), nitrogen dioxide (NO_2) and sulfur dioxide (SO_2).

The following sections present the methodology followed to conduct the air dispersion modeling assessment. The existing conditions (ambient concentrations), and the standards and criteria for the quality of the atmosphere considered to assess the air quality impacts are also presented. Finally, the detailed results are presented and interpreted according to the assumptions made for the modeling.

2 MODELING PARAMETERS

In order to assess the Project's potential air quality impacts, it is important to define the basic parameters that will guide the elaboration of the modeling scenarios. The following briefly describes these parameters which includes reference guidelines, available existing air conditions baseline data, project scenarios considered, and project segmentation applied.

2.1 GUIDELINES

As a reference for the proposed modeling, the guidelines from the International Finance Corporation (IFC) and National Environment Management Authority (NEMA) will be used. The applicable air quality guidelines for the contaminants assessed are presented in the following table.

Table 1 Applicable air quality guidelines

Contaminants	Period	IFC Guideline (µg/m³)	NEMA Guideline (µg/m³)
TSP	24 h	-	200
PM_{10}	24 h	50	100
$PM_{2.5}$	24 h	25	75
NO_2	24 h	-	80
SO_2	24 h	20	125

The most stringent guideline was used in priority and these were generally those of the IFC. However, when there were no recommended IFC guidelines, the NEMA guidelines were used (i.e. for TSP and NO_2).

2.2 EXISTING CONDITION

The government of Kenya currently has no air quality data collection network in operation. Because of this, baseline existing conditions, also called initial concentrations for ambient air, were obtained from a study published in the Clean Air Journal of 2017 by deSouza et al[1]. In this study, air quality was monitored using low-cost monitoring system during 9 months from May 2016 to January 2017 on 6 specific sites in the Nairobi area, four school yards and the viscinity of a community center and a United Nations building. The sampling sites for this study were located within sensitive receptor sites including: Kibera Girls Soccer Academy; St-Scholastica School; All-Saints Cathedral School; Alliance Girls School; United Nations Environmental Program Headquarters and Viwandawi community center (near an industrial area, partial data only).

By conservatism, the station with the highest results (Kibera Girls Soccer Academy) was chosen as representative of the baseline air quality in the region of the project. The average pollutant concentration determined at that point are presented in

[1] deSouza etal, 2017. *A Nairobi experiment in using low cost air quality monitors.* Clean Air Journal, vol 27(2), 12-42.

table 2. These findings were selected to represent the air quality in the Project vicinity.

Table 2 Initial concentrations based on average results from the de Souza et al., (2017) study

Contaminants	Initial conc. (µg/m³)
TSP	59
PM_{10}	59
$PM_{2.5}$	23
NO_2	23
SO_2	105

As part of the assessment, the initial concentrations were added to the predicted modelled concentrations and compared to the guideline.

2.3 ASSESSMENT SCENARIOS

Four scenarios were considered to complete the modelling assessment:

- Year 2025 without the Project;
- Year 2025 with the Project;
- Year 2040 without the Project;
- Year 2040 with the Project.

The 2025 date corresponds to the year when the project should start its operation phase while 2040 is the date selected to represent a typical moment during the operation phase. Considering or not the project offers an opportunity to evaluate the effective contribution of the project to potential air quality modifications.

2.4 SEGMENTS

The project's construction activities will be broken down into sections to facilitate construction management. These sections were also used for the identification of typical road segments for the air quality modeling. Highway A8 was divided into four sections (S1 to S4) while the A8 South was divided into two sections (S5 and S6). For the modeling requirements a representative segment of 1 km length of each Project section was selected for the modelling of the air quality concentration along the Nairobi-Nakuru-Mau Summit Highway with and without the Project. figure 2 shows the location of the six segments.

Although specific, the 1 km segment used for the modelling is representative of the Project's section it represents with regards to conditions and configurations. The model then extrapolates for the entire road section.

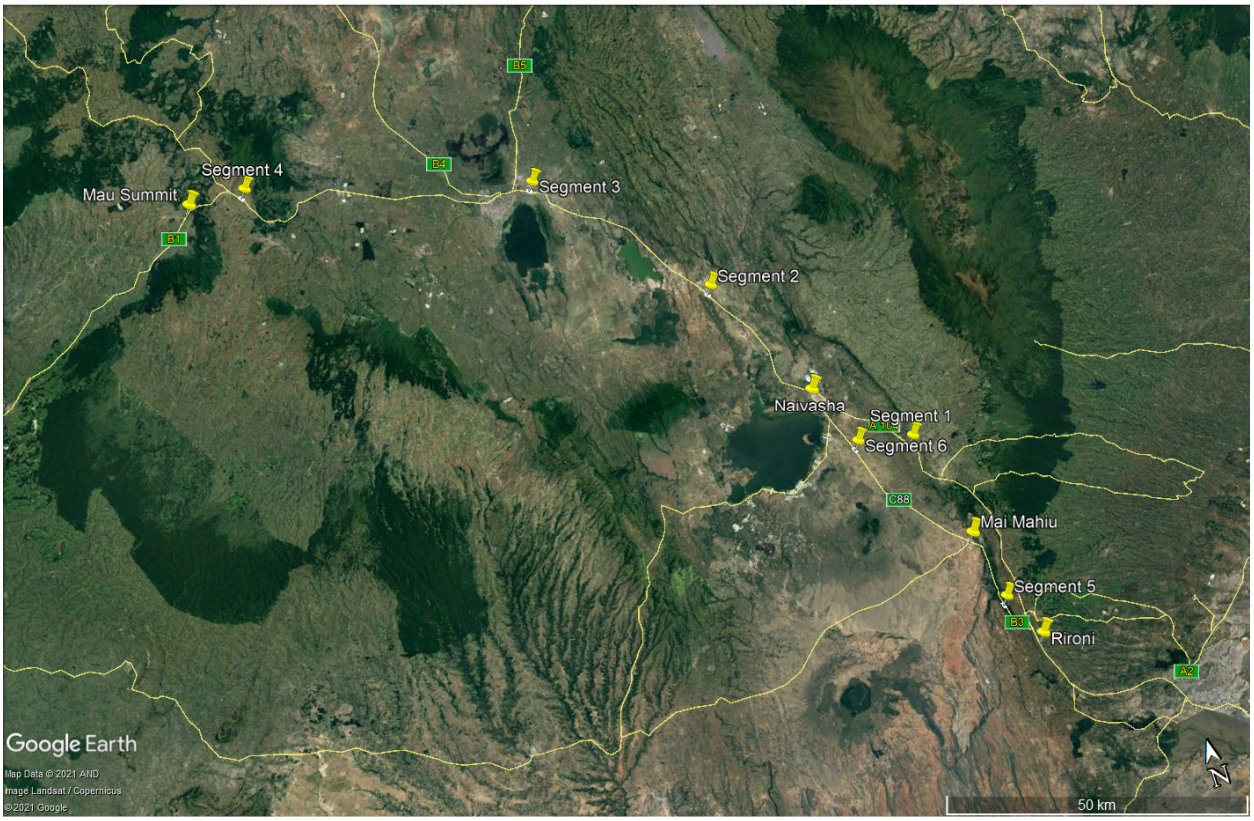

Figure 2 **Segments of the highway A8 and A8 South**

3 METHODOLOGY

The air dispersion modelling quantitatively and spatially assess the extent of air contaminants emitted by the traffic circulating on the existing and proposed Highway by means of a mathematical exercise (numerical model). Thus, this modeling evaluates the impact of the predicted modeled concentrations with regards to the applicable IFC and Kenya standards and guidelines.

This section presents the dispersion model used and the methodology followed to complete the modeling.

3.1 DESCRIPTION OF THE DISPERSION MODEL

The dispersion modelling was conducted in general accordance with best air dispersion modelling practices to support E&S assessment. The dispersion model used to complete the assessment is the AERMOD dispersion model (version 19191). The US EPA AERMOD modelling system is an approved and recognized dispersion model which includes the BPIP building downwash pre-processor with Plume Rise Model Enhancements (PRIME) algorithms for assessing the effects of buildings on air dispersion. AERMOD is applicable for assessing dispersion accommodating rural and urban areas, flat and complex terrain, surface and elevated releases as well as multiple source types (including point, area, and volume sources). The AERMOD modelling system consists of the AERMOD dispersion model, the AERMET meteorological pre-processor and the AERMAP terrain pre-processor.

The modelling was conducting using AERMOD View 9.9.0, developed by Lakes Environmental which is a graphical interface allowing easy configuration of the US EPA AERMOD modelling system (AERMOD version 19191).

3.2 MODEL PARAMETRISATION

3.2.1 MODELING AREA AND TOPOGRAPHY

The modeling domain determines the geographic limits of atmospheric dispersion modeling study area. As mentioned previously, six segments of 1 km were modeled to represent the different geographic and meteorological conditions in the Project Study Area. The modeling domain for each segment is located in UTM zone 37 of the southern hemisphere and extends on either side of the segment over a distance of 4 km by 4 km. The modeling domain of each segment covers a sufficient area where the maximum potential impacts to air quality will be predicted.

Topography and terrain elevations are relevant to the air dispersion modeling as the topography varies by more than 10 m in the modeled regions. Topographic data was therefore included and treated by the model and the model was executed using terrain elevations to account for its effects on the predicted modeled concentrations. The seleceted topographies are representative of the topography along the highway. The six segment and their respective topography are shown below.

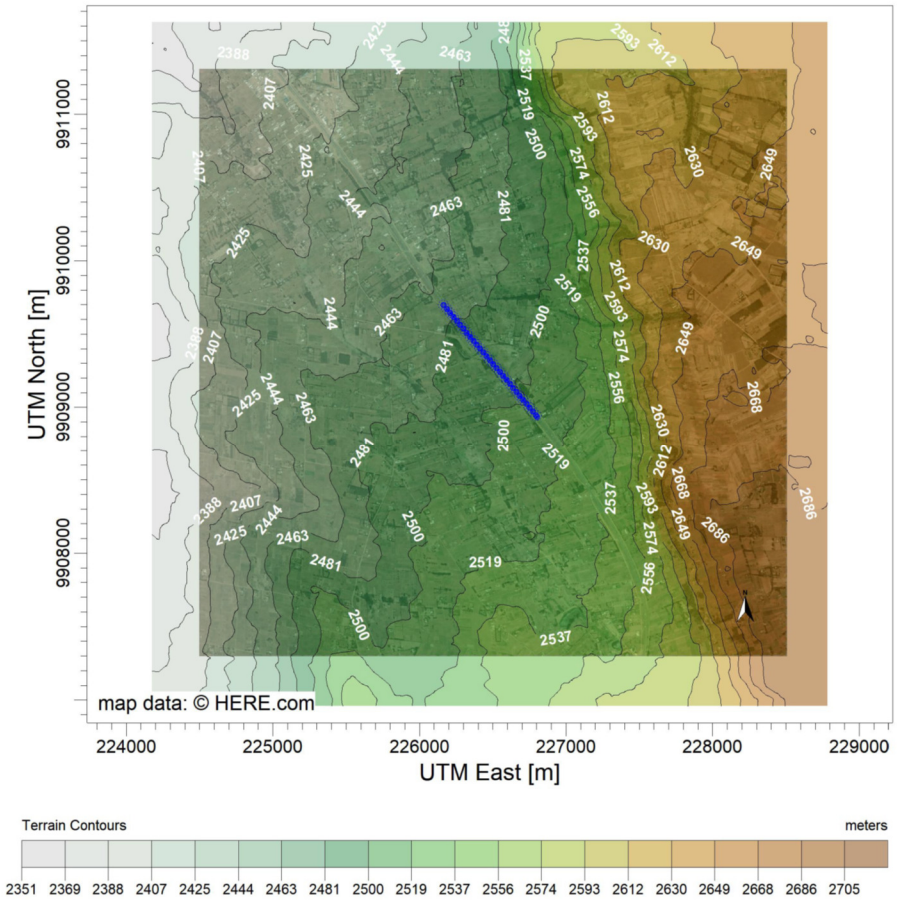

Figure 3 Topography of segment 1

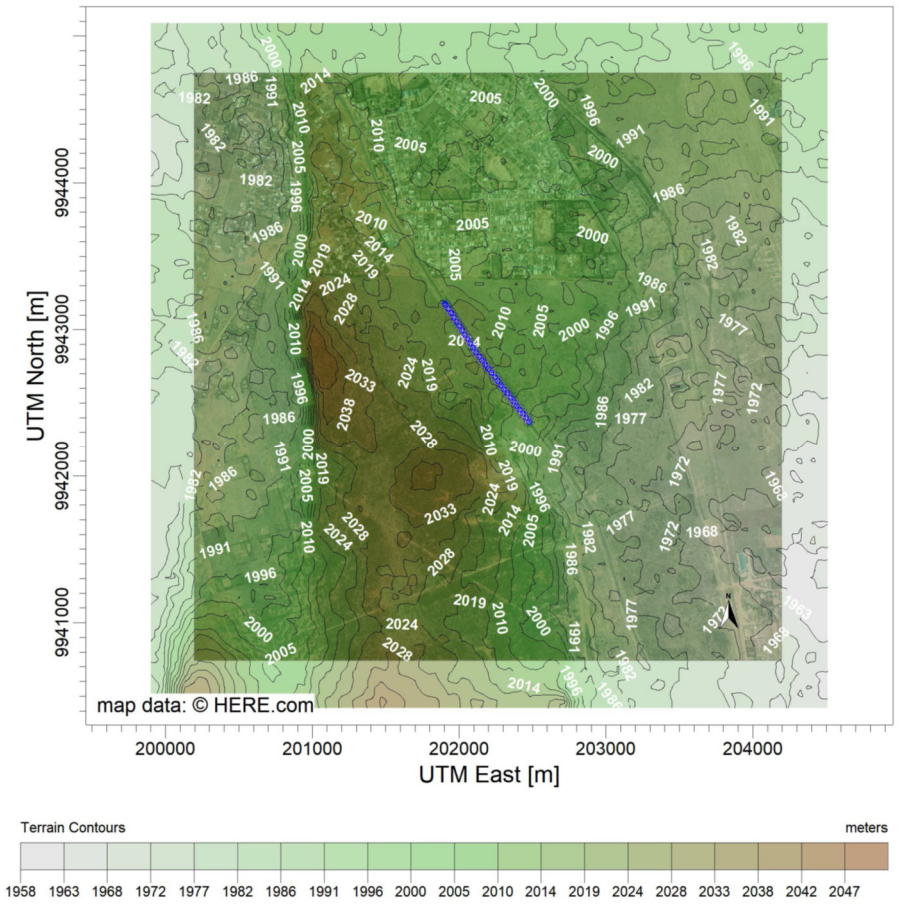

Figure 4 Topography of segment 2

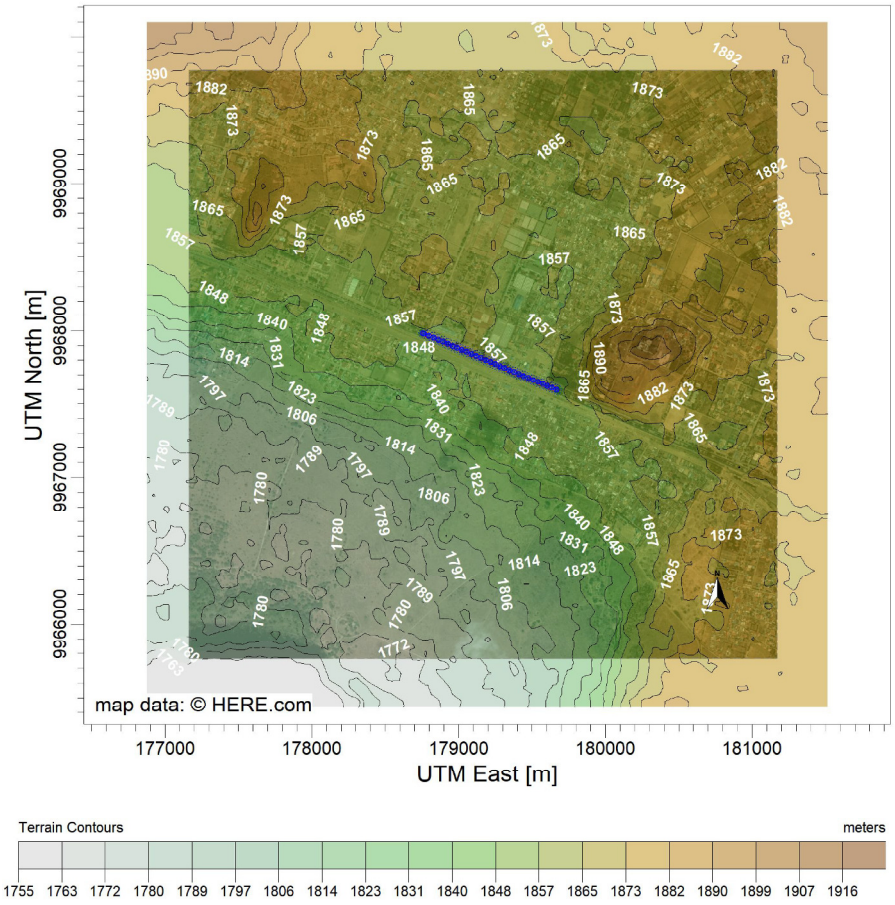

Figure 5 Topography of segment 3

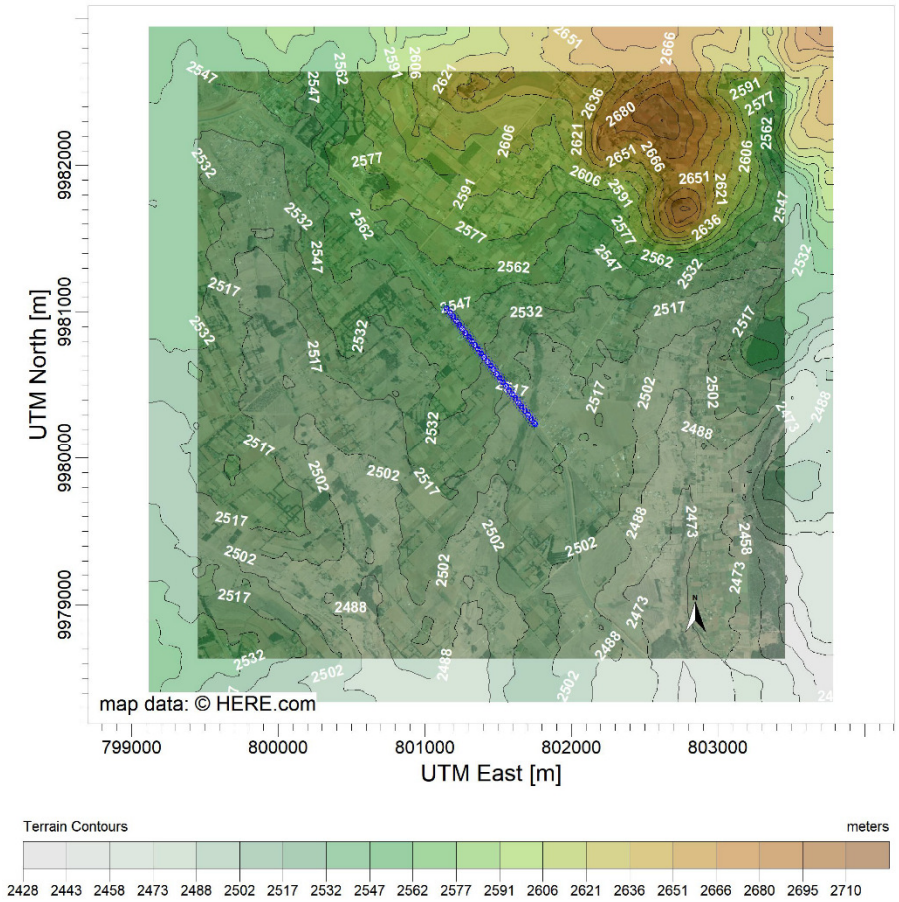

Figure 6 Topography of segment 4

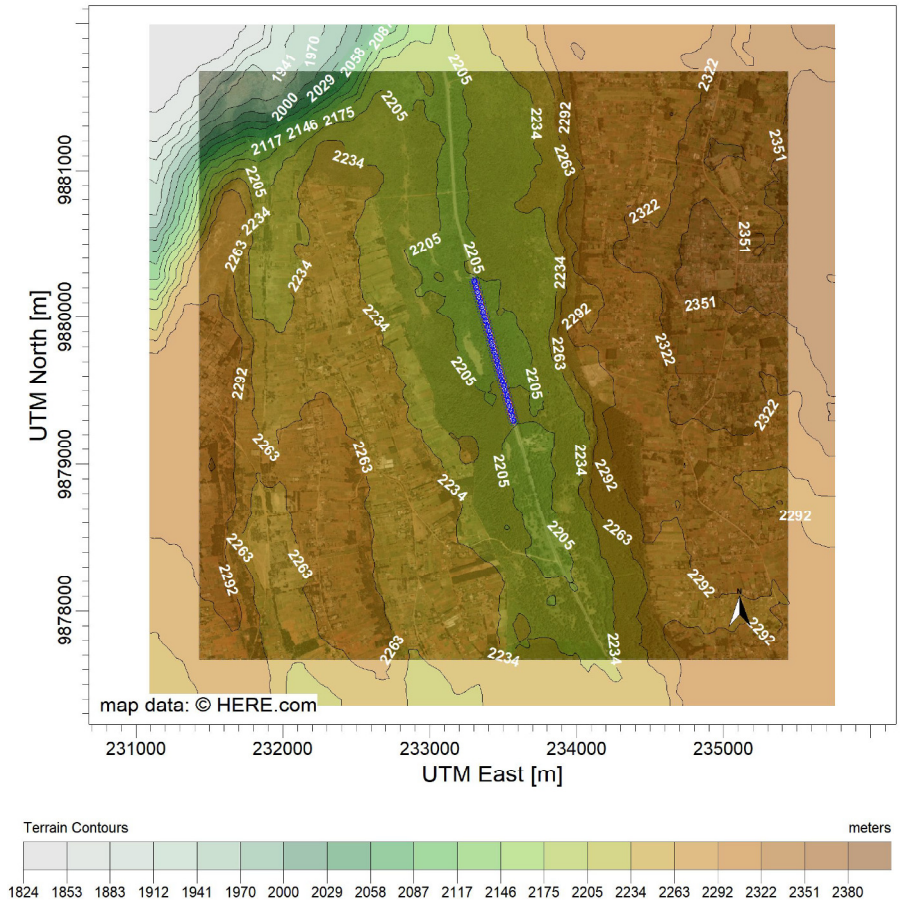

Figure 7 **Topography of segment 5**

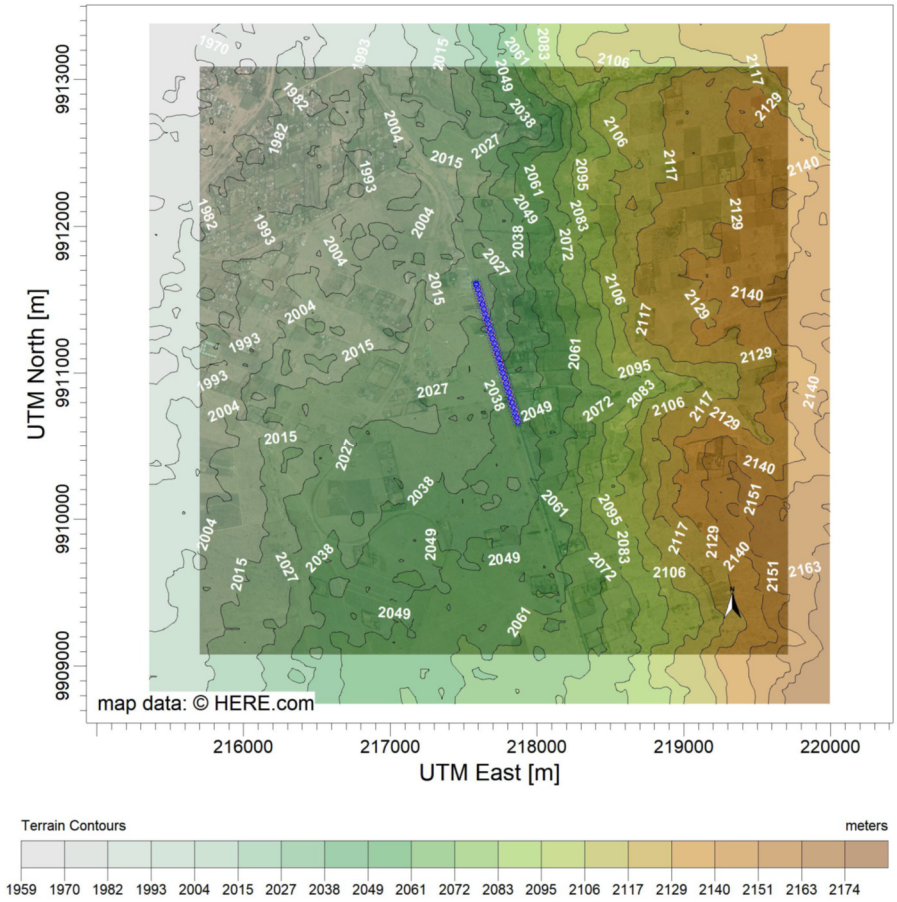

Figure 8 **Topography of segment 6**

3.2.2 RECEPTORS

3.2.2.1 RECEPTORS GRID

The AERMOD model perform its calculation for receptor points defined in the modeled region. For each of the segments, a receptor grid was positioned parallel to the road segment to allow the calculations of the resulting concentrations at various distances from the center of the segment, which also corresponds to the centerline of the road. The receptors at the extremity of the road segments were removed to avoid border effect which would not be present if the entire length of road was modeled.

Table 3 presents the number of receptors modelled for each segment.

Table 3 Numbers of receptor points per segment

Segments	Receptor point
1	2082
2	2175
3	2110
4	2171
5	2100
6	2238

The selected density of the receptor grid generates enough modeled values to obtain a good representativeness of the predicted concentrations (spatial distribution) in the ambient air. Examples of the fence line grid (white crosses) are shown for segment 3 and segment respectively 5 (Figures 9 and 10). The other segments have similar grid receptor points setup.

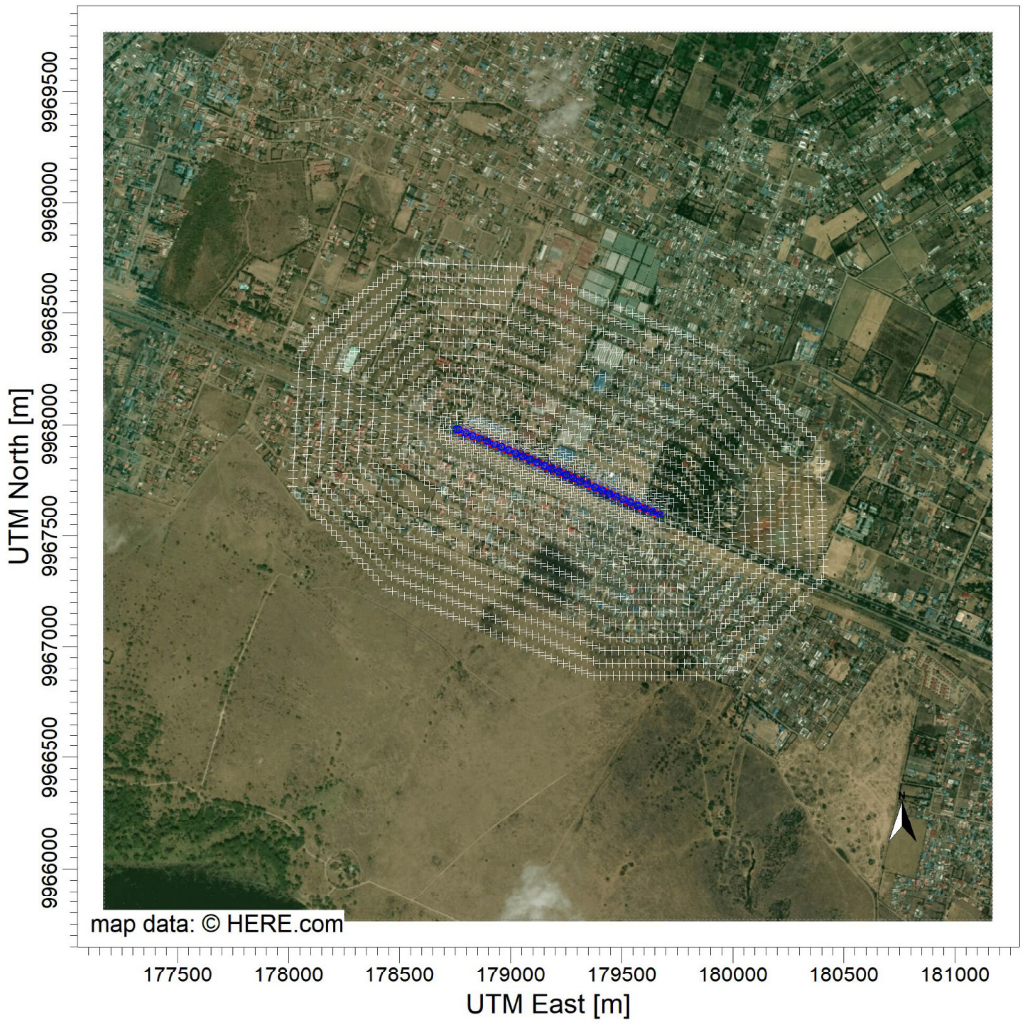

Figure 9 Fenceline grid for segment 3

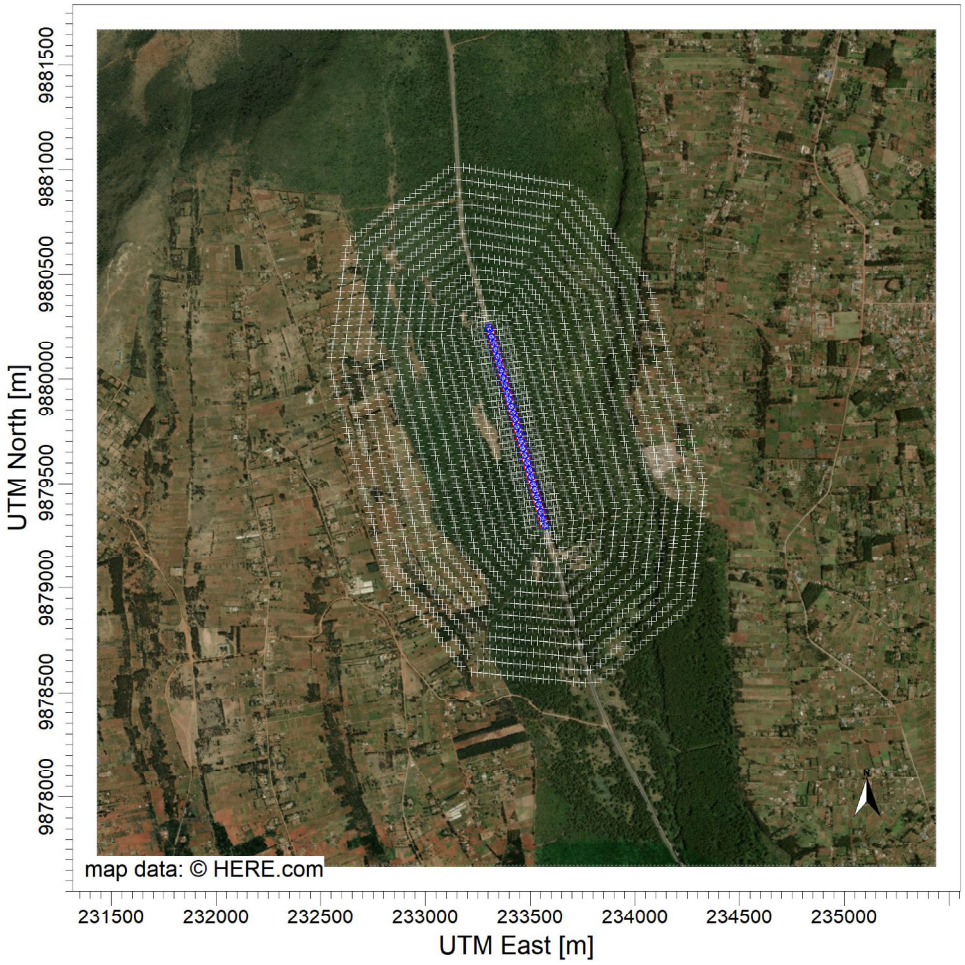

Figure 10 Fenceline grid for segment 5

3.2.3 METEOROLOGICAL DATA

The meteorological data for the assessment was obtained from Copernicus[2] ERA5 data for three virtual weather stations. The three stations are located on figure 11 and station information is provided in table 4.

[2] https://cds.climate.copernicus.eu/cdsapp#!/dataset/reanalysis-era5-single-levels?tab=overview

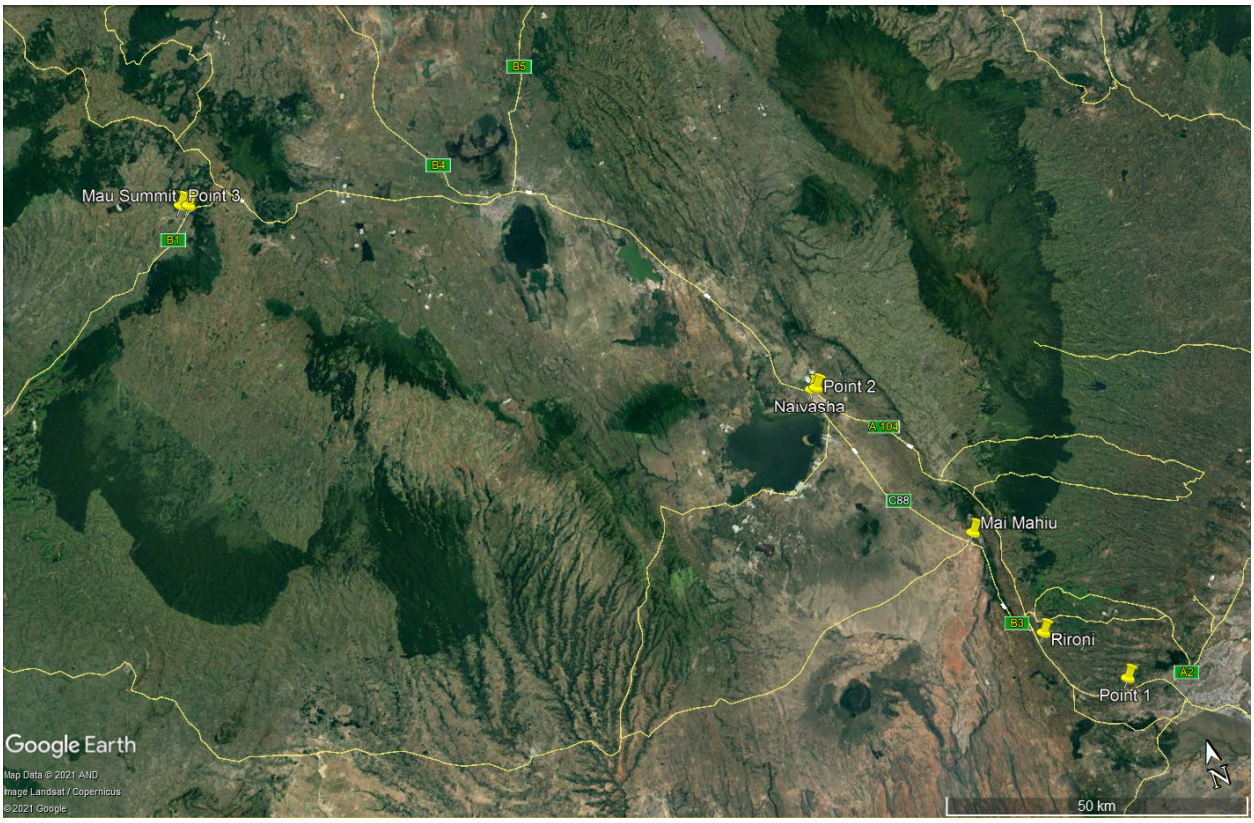

Figure 11 **Location of the Virtual Meteorological Stations**

Each segment was associated with the most representative meteorological station, segments 1 and 5 with Point 1, segments 2, 3 and 6 to Point 2 and segment 4 with Point 3.

Table 4 **Meteorological Station**

Meteorological Station	Coordinates		UTM Zone	Elevation
	X (mE)	Y (mS)		m
Point 1	248513	9860623	37M	1 853
Point 2	213681	9921450	37M	1 900
Point 3	790528	9981190	36M	2 313

The figures below show the wind roses for the three virtual weather stations. A wind rose is used to illustrate the frequency of wind direction and the strength of wind speed. The wind rose is made up of bars whose length indicates the frequency of winds blowing towards a given direction. The bars are also divided into sections, which define a range of speeds. A longer section indicates that winds are blowing more frequently at a given speed in that direction. Note that conventionally wind roses show the direction the wind is “blowing from”.

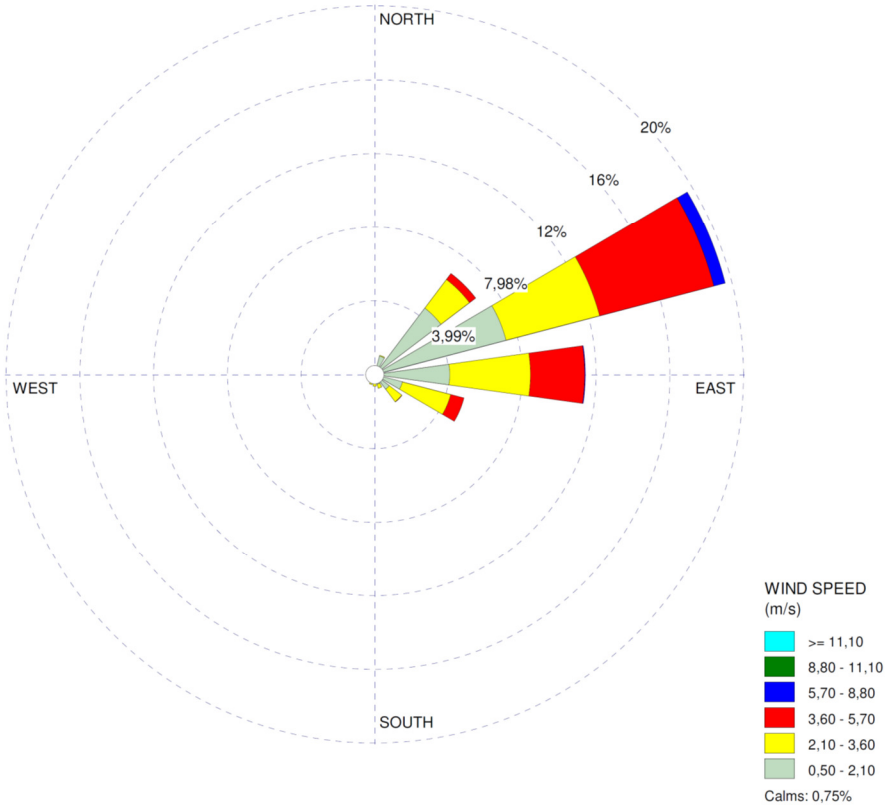

Figure 12 Windrose at Point 1

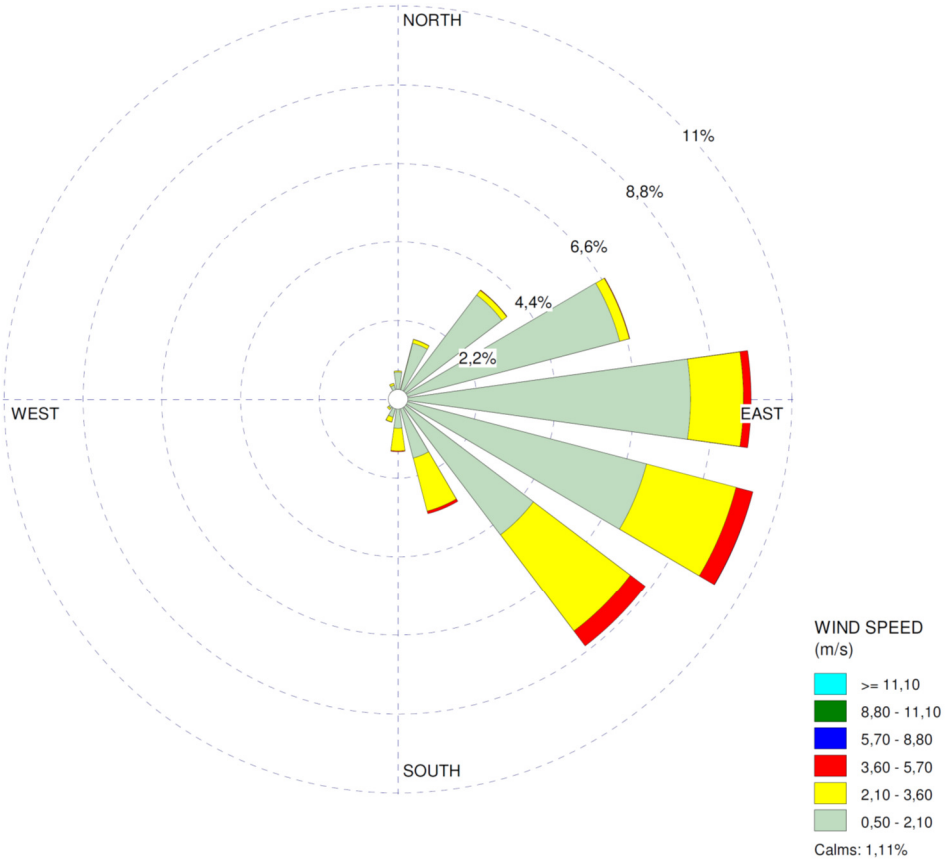

Figure 13 Windrose at Point 2

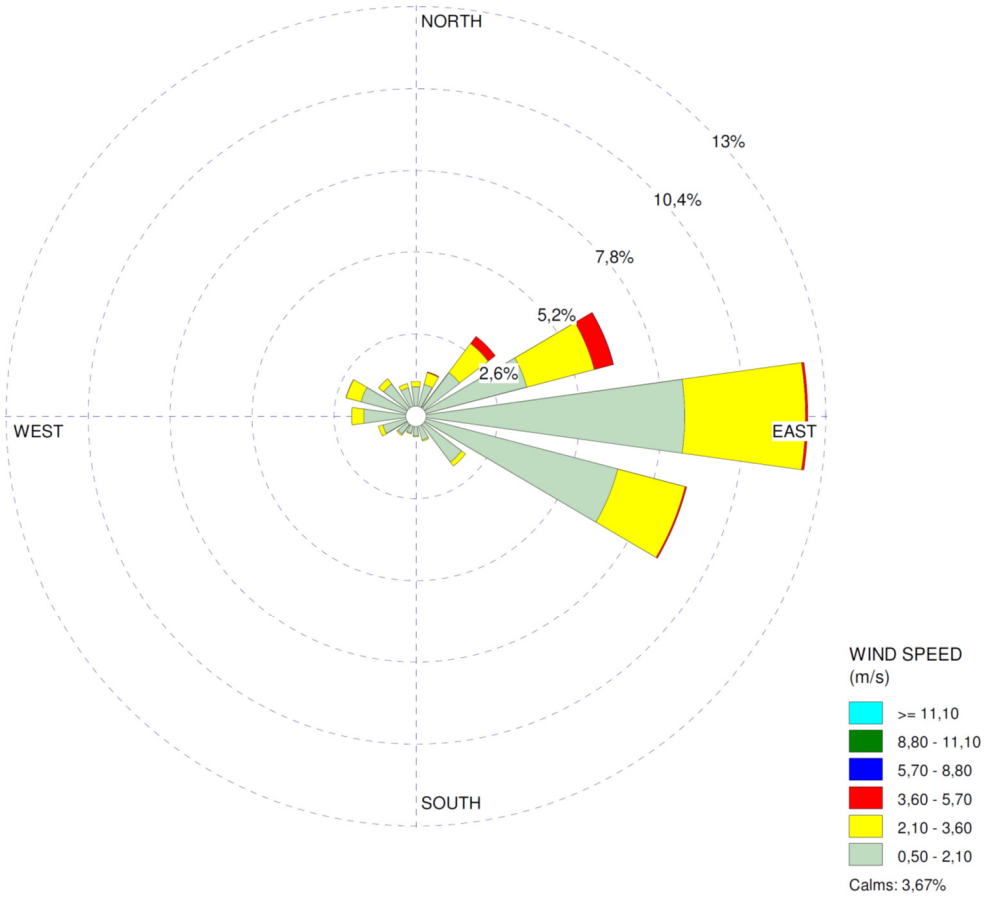

Figure 14 **Windrose at Point 3**

3.2.4 EMISSIONS RATES - MOVES

The daily traffic values with and without the Project for 2025 and 2040 were obtained for the Project area and processed in order to calculate the emission rates for the modeled scenarios. Emission rates from road vehicles were estimated using the United States Environmental Protection Agency's Motor Vehicle Emission Simulator (MOVES) model version 3. The MOVES model calculates exhaust, crankcase emissions, and brake and tire wear emissions. MOVES was configured at the project scale and the rate mode was used. Santa Cruz County in Arizona was selected as the default representative county in the model and data was entered into the County Data Manager for Kenya where possible. Both diesel and gasoline vehicles were considered with Class 3 as, passenger cars (gasoline), Class 4 as passenger trucks (diesel), Class 5 as single unit short-haul trucks (diesel), and Class 6 assumed to be a combination long-haul trucks (diesel)

Age distributions were estimated for each of the vehicle classes based on “Characteristics of the in-service vehicle fleet in Kenya” published in December 2018. The default weather data was replaced with location-specific meteorology for Kenya for the years 2015-2019. The speeds selected for the six segments were as follows:

Table 5 Speed limit for segments

Segment	Speed limit (km/h)
1	70
2	100
3	100
4	100
5	50
6	90

The rural unrestricted road type was selected for the assessment and no inspection and maintenance programs were specified. The emissions of $PM_{2.5}$ and PM_{10} were modelled in MOVES, and a ratio was used to calculate TSP emissions based on ratios developed by Brook et al. (1997)[3].

The annual average daily traffic was provided by VINCI Concessions and is a mix of light and heavy vehicles. The data for the six segments is summarized in the table below.

Table 6 Total number of vehicles per day

Segment	AADT (total number of vehicles)			
	2025 Without Project	2025 With Project	2040 Without Project	2040 With Project
1	21438	28800	40200	55213
2	20300	22200	37625	43150
3	54895	54658	111017	111792
4	14950	14275	27475	28175
5	15838	8475	29525	15425
6	9863	2150	17200	4000

3.2.5 RESUSPENSION EMISSIONS

Emissions from resuspension, produced when vehicles pass over the paved road network, were estimated using the emission factors proposed in Section 13.2.1 Paved Roads of the AP-42 compilation of air emissions factors (US EPA, 1995). In addition, silt loading was determined for each road segment based on the total AADTs (including all vehicle types) based on the recommended values for public roads in Table 13.2.1-2 of AP-42. The AADT ranges

[3] TSP = 2 x PM_{10}

and silt loads used for the calculations are presented in the following table.

Table 7 AADT ranges and silt loading

AADT	Silt Loading
<500	0.6
500-5 000	0.2
5 000-10 000	0.06
>10 000	0.03

3.2.6 EMISSION RATES

The emission rates for the four scenarios are presented in table 8.

Table 8 Emission rates for all scenarios (in µg/m³-km)

Contaminants	2025 Without Project	2025 With Project	2040 Without Project	2040 With Project
Segment 1				
TSP	4,86E-02	1,02E-01	8,86E-02	1,93E-01
PM_{10}	2,43E-02	5,08E-02	4,43E-02	9,65E-02
$PM_{2,5}$	6,19E-03	1,29E-02	1,08E-02	2,38E-02
NO_2	2,77E-03	6,62E-03	2,05E-03	8,12E-03
SO_2	1,17E-04	1,39E-04	1,66E-04	1,97E-04
Segment 2				
TSP	8,70E-02	8,86E-02	1,58E-01	1,69E-01
PM_{10}	4,35E-02	4,43E-02	7,90E-02	8,47E-02
$PM_{2,5}$	1,11E-02	1,13E-02	1,97E-02	2,11E-02
NO_2	5,63E-03	5,05E-03	6,02E-03	5,55E-03
SO_2	9,45E-05	1,08E-04	1,30E-04	1,54E-04
Segment 3				
TSP	1,50E-01	1,48E-01	2,92E-01	2,95E-01
PM_{10}	7,48E-02	7,39E-02	1,46E-01	1,47E-01
$PM_{2,5}$	1,87E-02	1,85E-02	3,62E-02	3,66E-02
NO_2	4,62E-03	4,54E-03	2,78E-03	2,84E-03
SO_2	4,37E-04	4,38E-04	6,63E-04	6,64E-04

Contaminants	2025 Without Project	2025 With Project	2040 Without Project	2040 With Project
Segment 4				
TSP	6,97E-02	6,59E-02	1,25E-01	1,28E-01
PM_{10}	3,49E-02	3,29E-02	6,27E-02	6,39E-02
$PM_{2,5}$	8,88E-03	8,38E-03	1,57E-02	1,60E-02
NO_2	5,25E-03	4,87E-03	5,75E-03	5,77E-03
SO_2	7,15E-05	6,95E-05	9,68E-05	9,99E-05
Segment 5				
TSP	9,78E-02	7,14E-02	1,82E-01	7,11E-02
PM_{10}	4,89E-02	3,57E-02	9,12E-02	3,56E-02
$PM_{2,5}$	1,23E-02	8,92E-03	2,23E-02	8,63E-03
NO_2	1,92E-02	5,65E-03	3,19E-02	7,89E-03
SO_2	1,07E-04	5,13E-05	1,52E-04	6,95E-05
Segment 6				
TSP	1,15E-01	3,22E-02	1,11E-01	6,07E-02
PM_{10}	5,73E-02	1,61E-02	5,57E-02	3,04E-02
$PM_{2,5}$	1,45E-02	4,06E-03	1,39E-02	7,56E-03
NO_2	7,77E-03	8,14E-04	1,01E-02	7,34E-04
SO_2	6,01E-05	1,42E-05	8,09E-05	1,69E-05

3.2.7 AERMOD CONFIGURATION

All the default options of the AERMOD model have been used. Consequently, the “RURAL” dispersion coefficient mode was selected for modeling as it is more conservative.

4 RESULTS AND ANALYSIS

Each of the 6 segments was modelled for the 4 scenarios as described in section 2. The resulting predicted concentration from the 24 model runs completed are presented only for the worst-case segment of highway A8 and A8 South with regards to overall concentrations. These segments are No. 3 for highway A8 (in Nakuru) and No 5 for highway 8 South (at the level of Ngarariga). The other segments were found to be similar in dispersion but having resulting pollutant air concentrations lesser than those found in segments No. 3 and No. 5. The modeled concentrations for these two segments are shown below. The important columns are:

- "Max Predicted Concentration" which presents the modelling result that is the concentration of emissions associated with vehicles using the highway;

- "Total Concentration" which is the sum of the "Max Predicted Concentration" column and of the ambient air concentration (Ambient value column);

- "Predicted Impact from the Scenario" is the difference between the "Total Concentration" and the existing "Ambient value" divided by the air quality standard. This represents the potential impact. For example, a 19% increase is forecasted for PST without the Project in 2025 and this increase would be of 18% with the Project.

The total concentration exceeds the standards as a result of elevated existing ambient concentration value for PM_{10}, $PM_{2,5}$ and SO_2. Indeed, the existing ambient air concentration used as baseline already respectively represents 118%, 92% and 525% of the standards for these parameters, thus any addition will inevitably generate a total concentration exceeding selected standards. As an example, for PM_{10} on segment 3 (2025 without Project), the total is 155% of the guideline but the predicted concentration from the modeled road segment only represents 37% of the guideline. Therefore, the predicted exceedance of the presented standard is mainly associated with the existing ambient air concentration.

It should also be noted that summing the predicted modeled concentrations with those of ambient air quality to generate "Total concentration" includes some double counting linked to contribution of the emissions of vehicular traffic which are already included in the ambient air quality data. Therefore, the results presented should be considered as conservative.

Another important aspect to take into account is the limitations of the model used. For example, when considering the total number of vehicles that would be circulating on segment 3, without or with the project, these numbers are almost the same which translate into similar predicted modelled air emission concentrations. In fact, what should be observed is that improvements to the highway should reduce air emissions by improving traffic circulation and minimizing emissions associated with congestion or poor road maintenance. However, the dispersion model used for the assessment does not have the ability to demonstrate this.

However, for segment 5, the predicted air emission concentration reductions can be more directly linked to the expected decrease in traffic as projected traffic with the Project should be reduced by more than 50%.

Table 9 Results for segment 3 – A8

Period	Contaminants	Description of the Guideline				Max Predicted Concentration	Total Concentration	Percentage of the Standard	Predicted Impact from the Scenario
		CAS number	Averaging Period	Ambiant value (µg/m³)	Standard (µg/m³)	(µg/m³)	(µg/m³)	(%)	(%)
2025 Without Project	PST	-	24 h	59	200	37,4	96,4	48	19
	PM_{10}	-	24 h	59	50	18,7	77,7	155	37
	$PM_{2,5}$	-	24 h	23	25	4,7	27,7	111	19
	NO_2	10102-44-0	24 h	23	80	1,2	24,2	30	1
	SO_2	7446-09-05	24 h	105	20	0,1	105,1	526	1
2025 With Project	PST	-	24 h	59	200	36,9	95,9	48	18
	PM_{10}	-	24 h	59	50	18,4	77,4	155	37
	$PM_{2,5}$	-	24 h	23	25	4,6	27,6	110	18
	NO_2	10102-44-0	24 h	23	80	1,1	24,1	30	1
	SO_2	7446-09-05	24 h	105	20	0,1	105,1	526	1
2040 Without Project	PST	-	24 h	59	200	72,9	131,9	66	36
	PM_{10}	-	24 h	59	50	36,4	95,4	191	73
	$PM_{2,5}$	-	24 h	23	25	9,0	32,0	128	36
	NO_2	10102-44-0	24 h	23	80	0,7	23,7	30	1
	SO_2	7446-09-05	24 h	105	20	0,2	105,2	526	1
2040 With Project	PST	-	24 h	59	200	73,6	132,6	66	37
	PM_{10}	-	24 h	59	50	36,7	95,7	191	73
	$PM_{2,5}$	-	24 h	23	25	9,1	32,1	129	37
	NO_2	10102-44-0	24 h	23	80	0,7	23,7	30	1
	SO_2	7446-09-05	24 h	105	20	0,2	105,2	526	1

Table 10 Results for segment 5 – A8 South

Period	Contaminants	Description of the Guideline				Max Predicted Concentration	Total Concentration	Percentage of the Standard	Predicted Impact from the Scenario
		CAS number	Averaging Period	Ambiant value (µg/m³)	Standard (µg/m³)	(µg/m³)	(µg/m³)	(%)	(%)
2025 Without Project	PST	-	24 h	59	200	23,0	82,0	41	12
	PM_{10}	-	24 h	59	50	11,5	70,5	141	23
	$PM_{2,5}$	-	24 h	23	25	2,9	25,9	104	12
	NO_2	10102-44-0	24 h	23	80	4,5	27,5	34	6
	SO_2	7446-09-05	24 h	105	20	0,0	105,0	525	0
2025 With Project	PST	-	24 h	59	200	16,8	75,8	38	8
	PM_{10}	-	24 h	59	50	8,4	67,4	135	17
	$PM_{2,5}$	-	24 h	23	25	2,1	25,1	100	8
	NO_2	10102-44-0	24 h	23	80	1,3	24,3	30	2
	SO_2	7446-09-05	24 h	105	20	0,0	105,0	525	0
2040 Without Project	PST	-	24 h	59	200	42,9	101,9	51	21
	PM_{10}	-	24 h	59	50	21,5	80,5	161	43
	$PM_{2,5}$	-	24 h	23	25	5,3	28,3	113	21
	NO_2	10102-44-0	24 h	23	80	7,5	30,5	38	9
	SO_2	7446-09-05	24 h	105	20	0,0	105,0	525	0
2040 With Project	PST	-	24 h	59	200	16,5	75,5	38	8
	PM_{10}	-	24 h	59	50	8,4	67,4	135	17
	$PM_{2,5}$	-	24 h	23	25	2,0	25,0	100	8
	NO_2	10102-44-0	24 h	23	80	1,9	24,9	31	2
	SO_2	7446-09-05	24 h	105	20	0,0	105,0	525	0

The following tables present the expected decrease in the predicted concentrations for a sensitive receptor located at a distance of 100 m from segments 3 and 5. Expected decrease for segment 3 is in the range of 60 to 70% while it is in the range of 40 to 50% for segment 5.

Table 11 Decrease in Concentration after 100 m – Segment 3 – A8

Scenario	Contaminants	Max Concentrations	Concentrations at 100 m	Decrease	# of vehicles
		µg/m³	µg/m³	%	
2025 Without Project	PST	37,4	11,2	70	54895
	PM_{10}	18,7	5,8	69	
	$PM_{2,5}$	4,7	1,4	70	
	NO_2	1,2	0,3	70	
	SO_2	0,1	0,0	70	
2025 With Project	PST	36,9	11,1	70	54658
	PM_{10}	18,4	6,0	67	
	$PM_{2,5}$	4,6	1,4	69	
	NO_2	1,1	0,3	70	
	SO_2	0,1	0,0	68	
2040 Without Project	PST	72,9	31,3	57	111017
	PM_{10}	36,4	11,3	69	
	$PM_{2,5}$	9,0	2,8	69	
	NO_2	0,7	0,2	67	
	SO_2	0,2	0,0	69	
2040 With Project	PST	73,6	23,1	69	111792
	PM_{10}	36,7	11,0	70	
	$PM_{2,5}$	9,1	2,8	69	
	NO_2	0,7	0,2	69	
	SO_2	0,2	0,0	69	

Table 12 Decrease of the Concentration after 100 m – segment 5 – A8 South

Scenario	Contaminants	Max Concentrations	Concentrations at 100 m	Decrease	# of vehicles
		µg/m³	µg/m³	%	
2025 Without Project	PST	23,0	12,2	47	15838
	PM_{10}	11,5	6,1	47	
	$PM_{2,5}$	2,9	1,5	49	
	NO_2	4,5	2,4	47	
	SO_2	2,52E-02	1,48E-02	41	
2025 With Project	PST	16,8	9,7	43	8475
	PM_{10}	8,4	5,1	39	
	$PM_{2,5}$	2,1	1,1	49	
	NO_2	1,3	0,7	49	
	SO_2	1,21E-02	7,10E-03	41	
2040 Without Project	PST	42,9	24,6	43	29525
	PM_{10}	21,5	12,8	41	
	$PM_{2,5}$	5,3	2,8	46	
	NO_2	7,5	4,0	47	
	SO_2	3,58E-02	1,82E-02	49	
2040 With Project	PST	16,5	8,7	47	15425
	PM_{10}	8,4	4,7	44	
	$PM_{2,5}$	2,0	1,1	47	
	NO_2	1,9	1,1	43	
	SO_2	1,64E-02	9,33E-03	43	

Table 13 compares the modelling results for segment 3 in 2025 Without the Project and the ambient air baseline measured in February for location A2. This location is included within segment 3.

Table 13 Comparison between the modelling and the baseline for A2

Contaminants	Model.	Baseline
	µg/m³	µg/m³
PST	96,4	252,2
PM_{10}	77,7	133,6
$PM_{2,5}$	27,7	64,8
NO_2	24,2	34
SO_2	105,1	1,9

Although the baseline data were collected over a limited time period (5 X 24 h for PST, PM_{10} and $PM_{2,5}$; 18 days for NO_2 and SO_2), the survey was completed during one of the dry-season periods to ensure worst-case conditions. It is thus interesting to note that the modelling results are below the 2021 baseline survey results. The only exception is for SO_2, and this is potentially due to conservative assessment of the sulfur content of the diesel used locally.

5 CONCLUSION

The air dispersion modelling study was completed to assess the potential impacts of traffic on air quality with and without the Project for both 2025 and 2040. Modelling scenarios were completed for 6 X 1 km segments representative of the different sections of highways A8 and A8 South. The predicted concentrations are presented for the worst-case segments of highway 8 (Segment 3) and highway 8 South (Segment 5).

The maximum predicted modeled concentrations are above the guideline, but existing ambient air concentration are the main contributor to the concentration and the results presented are conservative.

The concentrations for segment 3 without the Project are similar/identical to those with the project. As for segment 5 results with the Project is lower than without the project. This is in line with the fact that the results are closely tied to the vehicular traffic expected on the highway which are similar for segment 3 with and without the project while they are lower with the project for segment 5. None the less, for segment 3, the fluidity gained from the project through the reduction of congestion is expected to slightly improve the air quality in the vicinity of the Project.

As for air dispersion potential, the model shows that receptors located 100 m and more from the highway are not expected to see a significant increase in air emissions as the concentration attributed to the road is greatly reduced.

Finally, it is interesting to note that when comparing modeling results to on-site surveys of ambient air quality completed in 2021, all modeling results are lower than the measured results. The concentrations obtained through air dispersion modeling are determined through a conservative assessment process considering several “worst-case” hypotheses. The real concentrations monitored tend to prove that these hypothesis are indeed conservatives; their effects are less seen in real monitored air pollutant concentrations.

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APPENDIX

8-2 *WILDLIFE MITIGATION PLAN*

WSP CANADA

FEBRUARY 2022

WILDLIFE MITIGATION PLAN FOR THE RIRONI-NAKURU-MAU SUMMIT HIGHWAY UPGRADE, KENYA

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REV	DATE	DETAILS
A	13/08/2021	Draft for comment
B	23/09/2021	Draft- Revision after client review and additional data
C	09/12/2021	Draft- Revision after client review and consultation
D	15/12/2021	Draft- Revision after client review and consultation
E	24/01/2022	Draft- Revision after client review and consultation
F	01/02/2022	Draft- Revision after client review and consultation

	NAME	DATE	SIGNATURE
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Approved by:			

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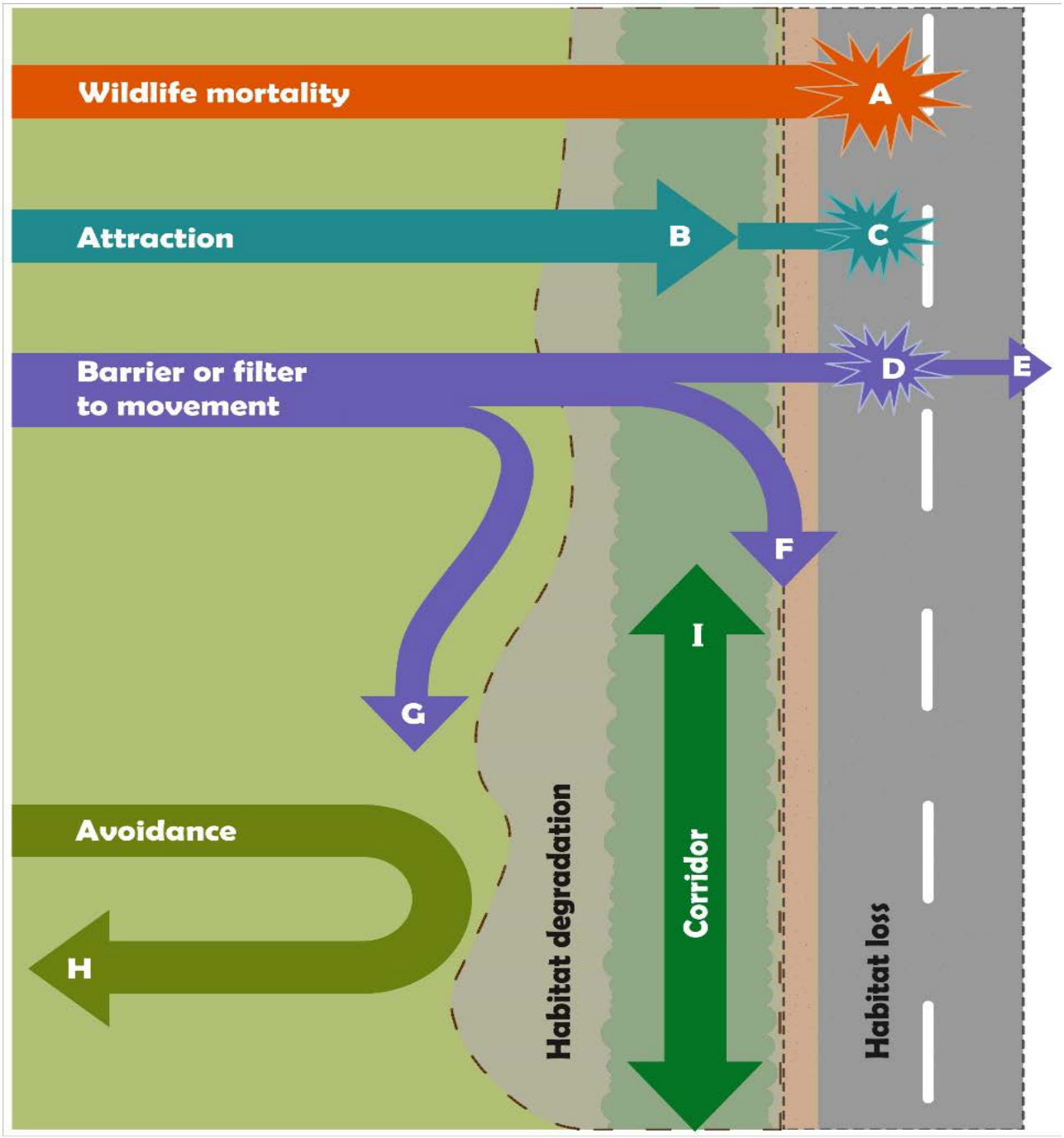
1 INTRODUCTION

Roads and other linear infrastructure are conspicuous and pervasive components of many landscapes around the world and exert a diverse suite of typically negative direct and indirect impacts on wildlife, vegetation and ecosystems (Figure 1.1). Individually and combined, these impacts reduce the diversity and abundance of wildlife in the area, thereby reducing the size of each discrete sub-population and the size of the overall population in the area. Ultimately, these impacts can result in the local and regional extinction of populations of wildlife.

The impacts of roads and traffic on wildlife include (van der Ree *et al.* 2015c); Figure 1.1):

- barrier or filter to the movement of wildlife, reducing accessibility of food and shelter on a daily basis, and preventing or limiting dispersal and annual migrations of wildlife over longer time-frames
- injury and mortality of wildlife due to wildlife-vehicle collision (WVC)
- loss of habitat due to clearing for road construction and maintenance, and subsequent loss of habitat clearing beyond the footprint of the road due to facilitated access
- habitat fragmentation as patches of habitat are divided into smaller patches
- degradation of habitat due to noise, light and chemical pollution, weed invasion, altered hydrological regimes, etc.

The severity of these impacts varies according to road conditions (i.e. traffic volume, road width, traffic speed) and landscape and environmental characteristics (i.e. habitat type, extent of clearing, etc.). The characteristics of the wildlife species that are resident or moving through the area is also an important factor, such as the frequency with which they encounter and attempt to cross roads, the speed with which they attempt to cross the road, and their response to oncoming traffic, such as to flee or freeze. These impacts, when considered singly or in combination, typically result in negative effects on wildlife, ultimately reducing population sizes and increasing the risk of local extinction, particularly for species that are rare or have small populations.



(Source: Zoe Metherell in van der Ree et al. 2015c)

Figure 1.1 Impacts of roads on individual wildlife, populations and ecosystems. Habitat is lost to build the road and habitat adjacent to the road is degraded. The most obvious impact of roads and traffic on wildlife is mortality due to wildlife vehicle collisions (WVC) (A). Some species are attracted to resources (e.g. carrion, spilled grain or heat for basking) on the road or roadside (B) which, depending on the animals ability to avoid traffic, may result in death due to WVC (C). The barrier or filter effect reduces the movement of animals across the road and a proportion of individuals attempt to cross are killed due to WVC (D) and some make it across (E), while others are deterred from crossing by the road (F) or degraded roadside habitat (G). Other species actively avoid the road or degraded habitat (H). In contrast, some species use the roadside vegetation as habitat and/or corridor for movement (I)

2 POTENTIAL IMPACTS OF THE RIRONI-NAKURU-MAU SUMMIT HIGHWAY UPGRADE ON WILDLIFE

Some of the potential impacts of the proposed upgrade of the Rironi-Nakuru-Mau Summit Highway (hereafter the 'project') on wildlife are likely to be significant and are summarised in Table 2.1 and described in more detail in Sections 2.1 to 2.6.

Table 2-1 Summary of the ecological effects and consequences of roads on wildlife

POTENTIAL EFFECT	EXAMPLE	CONSEQUENCE FOR WILDLIFE
Injury and mortality of wildlife due to collision with vehicles	Collision with moving vehicle	Injury and mortality results in smaller populations, and animal welfare implications Smaller populations are at an increased risk of extinction Less genetic variability can lead to inbreeding depression and loss of evolutionary potential Pain and suffering due to injury and potentially slow death
Direct and indirect loss and degradation of habitat	Reduced amount of habitat in area for wildlife to occupy Habitat may be degraded due to weeds, noise, light, chemical pollution etc, reducing the carrying capacity for wildlife	Lower rates of reproduction and survival due to increased rates and/or severity of disease and pathogens, increased stress Reduced ability to hear predators, prey or mates or find food due to noise pollution Reduced population size, contributing in longer-term to increased risk of local extinction
Reduced ecological connectivity	The road passes through habitat, dividing it into two, with reduced or no movement of wildlife between habitats The road passes through a wildlife corridor or other area that provides connectivity, reducing movement of wildlife between areas of habitat	Wildlife unable to access food, shelter, mates or avoid predators, resulting in reduced survival and reduced reproductive output Reduced gene flow among populations, resulting in inbreeding depression and less genetic variability to adapt to future environmental conditions Small or declining populations are unable to be bolstered by incoming individuals

2.1 WILDLIFE-VEHICLE COLLISIONS AND WILDLIFE MORTALITY

All roads with traffic have the potential to result in the mortality of native animals from wildlife-vehicle collisions (WVC). The risk of roadkill is higher where:

- Roads traverse through or between areas of wildlife habitat, including wildlife corridors
- Roads are located in close proximity to natural or artificial water bodies

- There are food sources (e.g. mown grass verges, nectar-producing shrubs or roadkill carcasses for scavenging species) which attract animals to the road or road edge
- Roads have moderate to high traffic volumes and high vehicle speeds
- There is no fencing or other barriers to prevent or limit movement of wildlife onto the road and road verge
- There is low visibility for both motorists and/or wildlife to detect and avoid each other (e.g. due to bends, crests or poor lighting).

Many species are vulnerable to injury and mortality (or roadkill) from roads, with the impacts on populations differing among species (Donaldson and Bennett 2004). The rate of WVC varies according to the speed with which wildlife attempt to cross the road, their response to oncoming vehicles (i.e. flight or freeze), their ability to move out of the way of oncoming vehicles and the frequency and duration of time the species encounters or is attracted to the road.

The severity of the population-level impact of wildlife mortality depends on the size of the population (smaller populations are at greater risk of local extinction), the natural rates of reproduction, mortality and longevity, and the degree of connectivity to other populations that may 'rescue' the declining population.

Numerous studies have quantified the rates of roadkill of different species across Africa, including in Mikumi National Park Tanzania (Drews 1995), Tsavo National Park Kenya (Lala *et al.* 2021), the Greater Mapungubwe Transfrontier Conservation Area (Collinson *et al.* 2019b) and the Tarangire—Manyara ecosystem of Tanzania (Kioko *et al.* 2015). These studies demonstrate that a large and diverse range of species are subject to roadkill, including on sealed and unsealed roads, on high and low traffic-volume roads and roads within and outside conservation areas. However, higher rates of collision are often observed where roads with high traffic volumes and high traffic speed pass through areas with high quality habitat and diverse and abundant populations of wildlife.

The impacts of roads and traffic varies among species according to their behaviour and life history traits (Fahrig and Rytwinski 2009). For example, raptor species and other scavengers are often attracted to the carrion left on roadsides, although if sufficiently mobile and able to avoid vehicles, these species may experience a net benefit from increased food availability. Amphibians and reptiles may be attracted to warm or wet roads and problems arise when they must cross the road in their annual migration to access different habitats on opposite sides of the road. This group show the greatest negative effect from roads due to their relative lack of mobility and low car avoidance behaviour. Small mammals generally show a positive or no effect, with impacts increasing with size in mammals and size of movement range, and depending on whether their predators have been affected.

The baseline studies completed for the ESIA demonstrate a diverse suite of mammals, birds, reptiles and amphibians in the study area with a large proportion of species being recorded in the various National Parks and private conservancies in the area. There was no existing comprehensive data on the rate of WVC along the highway, however the National Museum of Kenya (Appendix 1) has provided some anecdotal evidence and opinion on species at risk from WVC. This list of species is illustrative only, and the studies across Africa (e.g. (Collinson *et al.* 2015; Drews 1995; Kioko *et al.* 2015; Lala *et al.* 2021) demonstrate that the rate of WVC can be high on some roads.

Surveys of roadkill animals were undertaken during fieldwork for the two baseline surveys by scanning the roadsides while driving around the study area. The surveys were intense, with 11 staff across six vehicles from 16 to 26 February 2021 and 12 staff across seven vehicles from 13 to 25 April 2021. The entire project alignment was traversed, and many sections were traversed multiple times during each survey period, with all travel conducted between 07:00 hrs and 17:00 hrs. The total amount of time spent travelling during these two trips was 132 expert-days in February and 156 expert-days in April and included the A8, A8 South and other roads and areas in the study area. A total of four carcasses were detected during these two survey periods, namely an Egyptian Mongoose, a Baboon, an unidentified owl and a Zebra along the A8 adjacent to Marula Estate.

Repeated systematic surveys across multiple seasons were not conducted because anecdotal evidence and the results of the intense field survey confirmed that the rates of wildlife roadkill were very low. In addition, systematic surveys along the entire project were not feasible because: (i) the long length of the project; (ii) the safety risk posed to project staff to

inspect dead animals found on the road; (iii) the likely rapid removal of larger roadkill by local communities for their meat; and (iv) the fast rate with which smaller-bodied animals would be scavenged or be destroyed beyond recognition.

In addition, KWSTI, Soysambu and Marula Estate have installed wildlife fencing along much of the A8 which is installed and maintained to reduce the rate of WVC in those areas. Importantly, the occurrence of fencing in these areas means that roadkill animals only show where the animal was killed, and not necessarily where it entered the highway verge. Therefore, in these three areas of the project with the highest diversity and density of wildlife, roadkill data would not be spatially accurate enough to inform the specific placement of the wildlife crossing structures (WCS). Instead, the project has relied on habitat suitability modelling and wildlife surveys to determine the optimal placement of fencing and WCS.

Nevertheless, the duplication and safety improvements in the design of the highway will likely result in an increase in both the speed and the volume of vehicles and thus the rate of WVC is expected to increase after the project is finished, along with a concomitant increase in the likelihood of injury and fatality of motorists from WVC.

2.2 HABITAT LOSS

The loss, fragmentation and degradation of habitat are some of the most significant causes of the decline in biodiversity globally. The consequence of habitat loss for wildlife is a reduction in amount of habitat to support wildlife, which results in smaller populations and an elevated risk of population extinction.

The amount of habitat being cleared for this project is relatively small because the vast majority of the project can be accommodated within the existing road reserve. Some vegetation removal within the road reserve is required, however much of this is low-quality regrowth. Some additional clearing outside the road reserve is required for bridges, large interchanges and quarries for construction materials. Nevertheless, even roadside vegetation can provide habitat for some generalist species of wildlife, and the widening and duplication will have some impact on relatively common and widespread species that use or are able to persist in the roadside vegetation.

2.3 HABITAT FRAGMENTATION AND REDUCED CONNECTIVITY

The movement of animals, plants and ecosystem processes is critical to species survival and healthy ecosystems. Clearing and construction of roads commonly result in habitat fragmentation, thereby limiting or preventing animal movements, creating smaller populations that are more susceptible to decline. Roads and traffic can form a barrier or filter to movement for certain species, particularly those that are sensitive to the noise, light and disturbance caused by vehicles. The existing highway is likely to act as a barrier or filter to the movement of many species, and the severity is likely to increase significantly due to:

- An increase in the number and speed of vehicles, including trucks
- An increase in the width of the gap between habitat on opposite sides of the road
- An increase in the levels of noise, light and chemical pollution
- The inclusion of concrete Jersey barriers between the two carriageways, which prevents many small and medium-sized animals from traversing
- Proposed fencing in some sections of the project

This increase in the barrier effect of the highway will have significant impacts for many species, and is likely to increase the risk of extinction of some species.

2.4 HABITAT DEGRADATION FROM LIGHT, NOISE AND CHEMICAL POLLUTION

2.4.1 ARTIFICIAL LIGHT AT NIGHT

Artificial light that alters the natural patterns of light and dark in ecosystems is referred to as 'ecological light pollution' (Longcore and Rich 2004). Types of ecological light pollution include chronic or periodically increased illumination, unexpected changes in illumination, and direct glare (Longcore and Rich 2004). Light pollution from the project has the potential to impact fauna during construction through use of artificial lighting for early morning or night work (if required), as well as ongoing (during the operational phase of the road) from car headlights and street lighting. Street lighting will likely be kept to a minimum, with lights at some interchanges, in urban areas and not along the entire highway itself. With regard to construction lighting, night work is unlikely to be required and would be short-term only.

Artificial light affects species in different ways but the main responses are:

- Disorientation – Artificial light sources may disorient night flying species including birds and bats, as well as other species such as turtles (Gleeson and Gleeson 2012). Conversely, artificial lighting may increase orientation, providing a benefit to particular species.
- Attraction – Some predator species are attracted to the lights due to the increased insect activity (Patriarca 2010), as are some species of insectivorous bats. Wading birds have also shown increased foraging success under artificial lighting (Santos *et al.* 2010), however, this may lead to increased predation.
- Avoidance – Some species may avoid well-lit areas due to an increased risk of predation (Longcore and Rich 2004), however, it can be difficult to separate any avoidance behaviour shown by fauna as being the result of the lighting compared to noise or a physical barrier (Gleeson and Gleeson 2012).

The above responses may affect foraging, reproduction, communication, and other critical behaviours (Longcore and Rich 2004). One of the most notable implications of light pollution is alteration of interspecific interactions (e.g. predator-prey and competitive interactions) (Longcore and Rich 2004).

The impacts of the proposed highway upgrade from lighting are expected to be minimal because street lighting is not planned in areas where the highway passes through important wildlife habitat.

2.4.2 NOISE

A recent study has demonstrated that there is unequivocal evidence that noise is one of the factors responsible for the road-effect zone on birds (McClure *et al.* 2013b). The noise from road construction and operation can be stressful, eliciting a physiological stress response, with some animals temporarily or permanently moving away from the noise. Species that remain exposed to the noise have experienced a range of responses, including reduced breeding success (Halfwerk *et al.* 2011; Reijnen and Foppen 1994) and lower survival rates, potentially such that otherwise suitable habitat is no longer occupied (Slabbekoorn and Ripmeester 2008).

There is also an increasing body of evidence demonstrating a variety of responses to anthropogenic noise in frogs, birds and other species that rely on acoustic signals (Brumm 2004; Hoskin and Goosem 2010; Parris and Schneider 2008; Slabbekoorn and Ripmeester 2008). One of these impacts is masking, or where the noise interferes with the acoustic signals critical to many animal species (Halfwerk *et al.* 2011), including calling to attract mates, territory defence, and warning of predators. The negative effect of traffic noise on birds depends on the temporal and frequency (Hz) overlap with relevant acoustic sounds, such as their own song or calls of predators (Brumm and Slabbekoorn 2005). Most birds call to defend territory and attract mates, with much of this occurring around dawn. The impacts of traffic noise on birds can be particularly acute if this dawn 'chorus' of their calling coincides with morning peaks in traffic.

Similarly, some species of bats that rely on acoustic signals to locate their insect prey are disadvantaged close to noisy roads (Schaub *et al.* 2008; Siemers and Schaub 2011). A recent synthesis of the effects of traffic noise on birds suggested that masking typically occurs with noise levels between 50 and 60 dB (Dooling and Popper 2007).

There are two main components to noise which is relevant here: frequency, or pitch, which is measured in hertz (Hz); and, amplitude (also referred to as loudness), which is measured in pressure or intensity, and is expressed in decibels (dB). The decibel (dB) is a logarithmic scale that allows a wide range of values to be compressed into a more comprehensible range, typically 0 dB to 120 dB.

CONSTRUCTION VIBRATION AND NOISE

Vibration is predominantly expected to be short term during the construction phase which involves piling works and vibratory compaction of ground surfaces. Vibration is generally considered unlikely to impact fauna, as it will be short term and has only local impacts (i.e. near the site of the machinery). However, even short-term impacts during the breeding season for threatened fauna should be avoided, where possible.

A small number of studies have shown that exposure to high-intensity construction and traffic noise can result in temporary or permanent hearing loss in animals (Brattstrom and Bondello 1983; Dooling and Popper 2007). The sound pressure level of continuous noise that induces temporary hearing loss in birds is 93–110 dB(A) and higher levels are required to potentially cause permanent loss, while levels of pulses need to exceed 125 dB(A) to permanently damage hearing in birds (Dooling and Popper 2007).

OPERATIONAL NOISE

Substantial variation has been shown in scientific studies in the responses of wildlife to human-generated noise and vibration, ranging from serious to non-existent in different species and situations. The main impacts on wildlife associated with noise are behavioural. Vehicle noise has been shown, particularly in some species of birds and frogs, to interfere with communication essential for reproduction. An increase in traffic noise may impact birds' ability to maintain territories, attract mates and maintain pair bonds and possibly lead to a decrease in mating success (Parris and Schneider 2008). Noise may affect behaviour by causing animals to retreat from favourable habitat near noise sources, reducing time spent feeding and resulting in energy depletion and lower likelihood of survival and reproduction (Larkin 1996). These impacts will be most pronounced in species with low-frequency signals as they are likely to experience the most interference with traffic noise.

There is little information available regarding the significant species in the study area. In a study in Finland, highway construction at a wetland resulted in the abundance in wader birds breeding nearby (up to 200 m) dropping by 80%, with decline linked to road noise above 56 db (Hirvonen 2001b).

There have been several attempts to identify a threshold level in traffic noise above which negative impacts occur. Dooling & Popper (2007) suggested limits of 93–110 dB(A) for continuous traffic noise to prevent temporary hearing loss in birds, and pulses to not exceed 125 dB(A) to prevent permanent damage to hearing. Dooling and Popper (2007) also tentatively suggested that noise levels from roads should not exceed 50–60 dB(A) to prevent masking and other similar effects while a more recent study suggested the threshold was 49 dB(A) (Wiacek *et al.* 2015).

McClure et al (2013a) and Ware et al. (2015) both found a significant effect to propagated road noise at 55 dB(A)Leq within a road-free landscape with a background noise level of 41 dB(A), demonstrating a maximum threshold (i.e. 55 dB(A)) that should be avoided. Unfortunately, no studies have evaluated a range of noise levels to identify where thresholds might occur, and thus the 55 dBA Leq should be considered a maximum threshold. Much lower thresholds in acceptable noise levels for all species of breeding birds in woodland (42–52 dB(A)) and open grassland (47 dB(A)) in the Netherlands were suggested by Reijnen et al. (1997). Numerous studies that compared noisy environments with quieter ones had quiet environments around the 31 L10 18 h dB(A) SPL (Parris and Schneider 2009), and 42 dB(A) (Wiacek and Polak 2015) levels. A study of wetland birds in Finland found a negative effect where noise levels exceeded 56 dB, implying that this SPL may represent a threshold in that study (Hirvonen 2001a). An updated review by Dooling and Popper (Dooling 2016) found that masking can occur above ambient noise levels but that, given behavioural adaptation strategies, noise guidelines in the range of 50–60 dBA would be appropriate.

From this body of evidence, and relying largely on the comprehensive reviews by Dooling and Popper (2007 and 2016), where specific information is not available regarding the sensitivities of the species of interest, traffic noise should be kept below 60 dBA. This is likely to be especially important during the morning chorus and during breeding.

The noise impacts of the existing highway are likely high because of the frequent need for vehicles to slow down and rapidly accelerate to overtake slow vehicles, especially in the hilly areas to the north and south of the project. The need for repeated breaking and accelerating will be reduced after duplication. However, the increase in traffic volume and speed overall will likely result in an increase in vehicle noise.

2.4.3 VISUAL IMPACTS

Closely linked to the impacts of artificial light is the visual impact of the road, a large artificial structure with moving vehicles, raised in key points above the surrounding landscape and the impact this has on fauna behaviour.

The impacts of the presence of artificial structures and car movement (as separate from noise, light and mortality impacts) are poorly known, however, it is understood that certain species, including Giraffe, may be affected. This may lead to decreased use of habitat nearby to the highway.

The increased effect of the duplicated highway is unlikely to be significantly more than the existing highway because the upgraded road is in the alignment and with only minor modifications to the vertical height of the road to accommodate additional underpasses in select locations.

2.5 CONSTRUCTION IMPACTS

Mortality of wildlife during construction may occur during clearing, or during instances when wildlife strays into the construction zone (van der Ree *et al.* 2015d). The potential for injury and mortality of wildlife from the project is expected to be low because almost all clearing is expected to be within the already highly-disturbed existing road easement. Nevertheless, the injury and mortality of wildlife during construction is feasible and is summarised in Table 2.2

Table 2-2 Summary of potential for increased injury and mortality from construction phase

ACTIVITY WITH POTENTIAL TO CAUSE MORTALITY	WILDLIFE WITH POTENTIAL TO BE AFFECTED	NATURE AND MAGNITUDE OF THE IMPACT
Vegetation/habitat removal during construction: Removal of mature trees with hollows and dead standing trees	— Hollow-dependent bats — Hollow-nesting and canopy-nesting birds — Arboreal mammals — Arboreal reptiles — Arboreal frogs — Invertebrates	Some potentially hollow bearing large old trees are likely to be removed for the project. Conduct a pre-construction walkover tree survey within the road reserve to identify any active nests of hollow-nesting and canopy-nesting birds. If a threatened bird species is nesting, consult a local avifauna specialist for guidance on actions to be taken. The level of mortality and injury of both non-threatened and threatened species of birds, bats, arboreal mammals is likely to be lower with mitigation measures in place.
Removal of understorey, groundcover, topsoil and debris (wood, rocks, rubbish etc.)	— Small woodland birds — Ground-dwelling reptiles — Frogs — Invertebrates	Mortality of species of native (non-threatened) reptiles and frogs is likely to occur from vegetation clearing and soil excavation works

Machinery/plant and vehicle collisions with fauna during construction	— Terrestrial, semi-aquatic and arboreal reptiles, frogs and mammals — Birds	Occasional mortality of native animals may occur during vehicle movements within the study area. This is unlikely to be a substantial risk as construction speed limits would be low.
Other causes of mortality (trenches etc)	— Terrestrial, semi-aquatic and arboreal reptiles, frogs and mammals	Without sufficient controls, mortality may result from fauna falling into trenches or sheltering in construction materials. This risk can be substantially reduced by minimising the duration that trenches remain open, ensuring trenches have frequent sections with shallow slopes that animals can climb and escape, pre-construction inspections are conducted at dawn to rescue any trapped animals, and fencing to prevent wildlife from falling in.

2.6 INDIRECT IMPACTS

Whilst the direct impacts of roads and traffic on wildlife are typically quite obvious (i.e. Sections 2.1 to 2.5), there are other more subtle factors that should be considered. Indirect or secondary impacts occur indirectly from the direct effects of a development and can be the result of a complex sequence of interrelationships. For instance, indirect impacts may include the loss of habitat through degradation from weed invasion or pollution.

2.6.1 SECONDARY MORTALITY OF WILDLIFE

Carcasses from WVC are known to attract scavengers, especially mammals and birds. These opportunistic feeders are then at risk of being struck as they feed on the carcass. Secondary mortality shall largely be avoided by maintaining existing fences or constructing new fences in high quality habitat to prevent WVC and mortality of wildlife in the first place, thereby almost eliminating the risk of secondary mortality. In addition, the species most likely to bypass the fencing and be killed are more likely to be birds and smaller species, and they are likely to be quickly flattened by passing vehicles and thus not be an attraction to scavengers.

2.6.2 LOSS OF HABITAT THROUGH INVASIVE ALIEN SPECIES

Roads can facilitate and exacerbate the dispersal of invasive alien species by allowing movement through the landscape in ways that may have not been previously possible. The duplicated highway is unlikely to cause a significant increase in the spread of weeds because it is following the same alignment and is remaining largely within the same easement.

Increased spread of invasive alien species during construction is likely a more significant impact and will be managed through the development and implementation of an environmental management plan that is applied to the construction phase of the project.

2.6.3 LOSS OF HABITAT THROUGH INFLUX OF PEOPLE

New roads, railways and other linear infrastructure into wilderness areas increases accessibility of the area to people and subsequent colonization, illegal logging, clearing and agriculture and further infrastructure development (Selva *et al.* 2015; Southworth *et al.* 2011). This project is an upgrade of an existing sealed road and is not a new road in an otherwise unroaded landscape. Therefore, the impacts of additional loss of habitat through the influx of people to the area is expected to be negligible.

2.6.4 INCREASED MORTALITY OF WILDLIFE DUE TO POACHING AND BUSHMEAT HUNTING

In addition to increasing the accessibility of landscapes for human settlements and other development, new roads and other linear infrastructure also provide better access to natural areas and facilitates poaching and bushmeat hunting (Laurance *et al.* 2008; Laurance *et al.* 2006). The access that the existing highway provides for poaching and hunting is already substantial, and the increased risk of additional hunting pressure is expected to be low. Nevertheless, various strategies will be employed to minimise the risk of poaching and hunting where the roads pass through areas supporting wildlife populations.

3 AVOIDING, MINIMISING AND MITIGATING THE IMPACTS OF THE HIGHWAY ON WILDLIFE

3.1 PROJECT GOALS

The following goals have informed the strategy to reduce the impacts of the project on wildlife:

- The project will strive to avoid, minimise and mitigate deleterious impacts to wildlife, ecosystems and ecosystem processes.
- The project will, where possible, allow the movement of wildlife for all types of movement, including foraging and other day to day activities, dispersal and annual migration.
- The project will aim to reduce rates of WVC along the length of the project and prevent WVC in areas of high-quality habitat for wildlife.

3.2 PLANNING AND DESIGNING FOR THE FUTURE

An important consideration in the planning and design of this highway has been the incorporation of the needs of wildlife that are either currently absent or in very low numbers but for whom there is a reasonable likelihood of occurrence or increased abundance into the future. For example, the study area is recognised as an important landscape for a wide diversity of species and efforts are underway to improve linkages and corridors at a regional scale, including habitat protection and restoration and the removal of unnecessary fences and other barriers. Therefore, while species occurrence has been a primary determinant of mitigation, this project is being future-proofed to provide some capacity for the introduction or natural colonization of additional species and increases in the abundance and distribution of existing species.

3.3 THE MITIGATION HIERARCHY AND CONTROLS FOR THIS PROJECT

Mitigation is the third step in the mitigation hierarchy and is considered after avoidance and minimisation, and before offsets and compensation. The mitigation hierarchy has been applied in the following order to achieve no net loss, or ideally, a net gain in biodiversity values:

- Avoidance – can the sensitive area be avoided completely resulting in no impact?
- Minimisation – If the sensitive area cannot be avoided, can the potential impact be reduced through design, such as a reduced clearing footprint or moving the section of highway to another location?
- Mitigation – For impacts that are unable to be avoided or minimised, can structural features be added to the highway to further reduce the impact? These can include under- or over-passes for wildlife, fencing to prevent wildlife accessing the highway, jump-outs to allow trapped wildlife to leave the fenced highway reservation, reduced vehicle speeds or wildlife detection and deterrent systems.
- Rehabilitation or restoration – Can the severity or extent of any remaining impacts be lessened through restoration or rehabilitation at the site of impact?

- Offsetting and/or compensation – Any residual impacts that remain after working through the previous steps can be offset - where habitat elsewhere is bought and/or managed to achieve conservation gains – or compensated where funds are provided to support activities that can indirectly benefit the impacted entities, such as for research.

Avoidance should always be considered prior to developing minimisation and mitigation strategies, and can occur across a range of scales, including re-routing the entire alignment to avoid significant areas of biodiversity values or micro-siting to avoid smaller but still significant values, such as large old trees or small wetlands.

Minimisation and mitigation aim to reduce the severity of three main impacts of roads and traffic, namely (1) mortality due to WVC, (2) barrier effects, and (3) noise, light and pollution effects. Minimisation focuses on modifications to the design to lessen the overall impact, such as reductions in the width of clearing, while mitigation measures are typically structural features that address specific impacts.

This project is avoiding and minimising impacts to wildlife by restricting most of the construction works to the reservation of the existing highway. The mitigation measures proposed in this strategy will improve connectivity for wildlife and reduce the rate of injury and mortality of both motorists and wildlife from WVC.

3.4 METHODOLOGY TO IDENTIFY THE NUMBER, TYPE AND LOCATION OF WILDLIFE CROSSING STRUCTURES AND FENCING

The planning and design of the crossing structures for this project is based on expert advice from the Kenyan Wildlife Service (KWS) from 2017 and 2019, expert advice from other ecologists, extensive consultation with local stakeholders, the results of targeted wildlife surveys and wildlife connectivity modelling, and a review of the road design and international best practice in road ecology. The details of each are described in Sections 3.4.1 to 3.4.7

3.4.1 PRELIMINARY CONCEPT DESIGNS BY KENYA WILDLIFE SERVICE AND REVIEW BY THE BIODIVERSITY CONSULTANCY

During the preliminary planning for the project the Kenyan Wildlife Service (KWS) and the Kenyan Highways Authority provided an indicative assessment of the number and type of WCS and fencing required for this project (KWS 2017). These included 11 underpasses, two overpasses and fencing. The design of the crossings was further specified in the Schedule 2 (Design Construction Standards) that were adopted for the project. The Biodiversity Consultancy reviewed the 2017 assessment and confirmed that the 11 wildlife crossing structures were necessary and appropriately sized (Bennun *et al.* 2018). The same report also recommended that the number, location and design of the crossing structures be reviewed after conducting the baseline surveys, as well as the installation of fencing to prevent wildlife from accessing the road and to funnel them towards the crossing structures. In 2019, KWS, KeNHA and RVH reviewed the information and conducted a site visit and revised their recommendations to include an additional two underpasses, bringing the total to two land bridges and 13 underpasses. The location of these 15 structures is shown in Figure 3.1 and described in Table 3.1.

Table 3-1. Details of the 13 underpass and two overpasses proposed by the Kenya Wildlife Service for the preliminary design of this highway. These preliminary recommendations were reviewed during the ESIA and the final list is provided in Table 4.1.

ID	CHAINAGE (KM)	TYPE OF WILDLIFE CROSSING	SIZE (NUMBER, WIDTH X HEIGHT M)	LOCATION	DESCRIPTION
WLC1	22+825	Underpass	1 of, 5.0 x 3.5	Kijabe	Maintain Existing Underpass
WLC2	25+325	Underpass	1 of, 5.0 x 3.5	Kijabe	Demolition & reconstruction
WLC3	53+375	Underpass	2 of, 7.0 x 3.5	Naivasha East	New Multipurpose Underpass for KWSTI
WLC4	69+235	Underpass	1 of, 5.0 x 3.5	Marula	Demolition and reconstruction Underpass for Wildlife and livestock
WLC 5	70+220	Overpass	1 x 30.0	Marula	New Overpass, 30 m width
WLC6	71+340	Underpass	1 of, 5.0 x 3.5	Marula	New Underpass
WLC7	73+705	Underpass	3 of 5.0 x 3.5	Kigio	Demolition & reconstruction Underpass
WLC8	76+640	Underpass	1 of 7.0 x 3.5	Gilgil River	New Underpass
WLC9	81+620	Underpass	1 of 7.0 x 3.5	Marula- Near Gilgil Junction	New Underpass
WLC10	92+040	Underpass	1 of, 5.0 x 3.5	Elmenteita-Kariandusi	Maintain Multi-use culvert for wildlife and livestock
WLC11	99+380	Overpass	1 x 30.0	Soysambu	New Overpass
WLC12	103+285	Underpass	1 of, 5.0 x 3.5	Maendeleo-Soysambu	Demolition & reconstruction of a new underpass
WLC13	104+665	Underpass	1 of, 5.0 x 3.5	Soysambu	Demolition and reconstruction of a new underpass
WLC14	106+215	Underpass	1 of, 5.0 x 3.5	Soysambu	Maintain existing underpass
WLC15	164+370	Underpass	1 of 7.0 x 4.5	Koibatek Forest - Near Itare Dam	New Underpass for wildlife and livestock

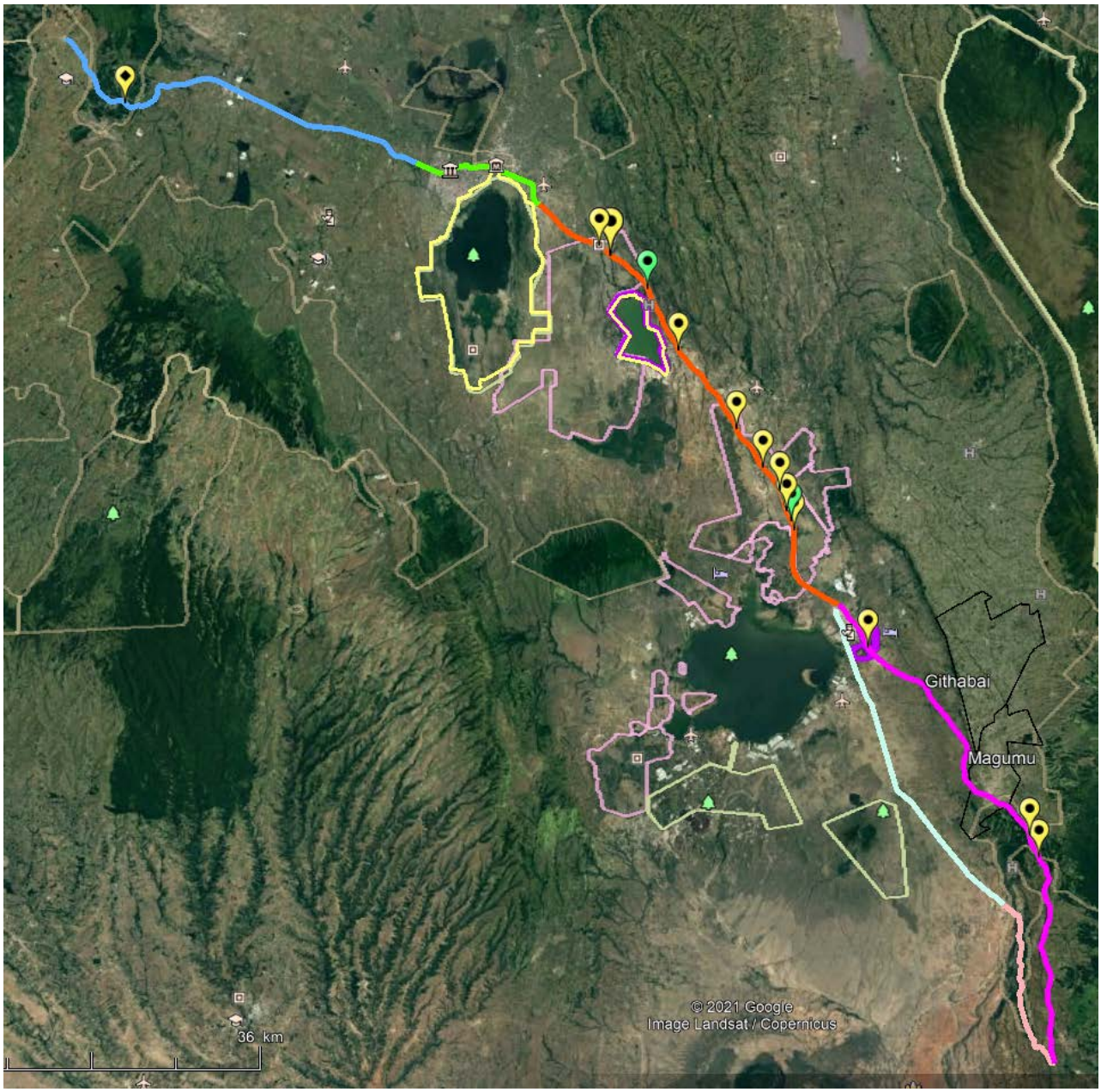


Figure 3.1. Map showing the location of the 15 wildlife crossing structures proposed by KWS, KenHA and RVC in 2019.

3.4.2 TARGET SPECIES

The Project passes through a diversity of ecosystems and numerous important habitat areas for wildlife, including Soysambu Conservancy, Marula Estate, the Kenya Wildlife Service Training Institute and the adjacent sanctuary, Lake Naivasha, Lake Nakuru and Mau Forest Escarpment. Two important areas with excellent data on species occurrence are Soysambu Conservancy and Marula Estate. Data provided by the managers of these two areas demonstrates the high species richness and in many cases abundance of wildlife that these conservation areas support (Table 3.2). It is also critical to note that these lists are not exhaustive because many smaller and cryptic species will not be detected during aerial surveys they used to survey their wildlife populations.

Table 3-2 Species list and number of individuals seen from aerial censuses undertaken at Marula Estate (2018) and Soysambu Conservancy (2020). Data courtesy of the managers of both areas.

SPECIES	SOYSAMBU CONSERVANCY (2020)	MARULA ESTATES (2018)
Aardvark	0	3
African Hare	10	0
Black-backed Jackal	0	100
Baboon	573	846
Bat-eared Fox	18	35
Buffalo	919	398
Bush Pig	3	8
Bushbaby	0	30
Bushbuck	0	9
C.Reedbuck	0	77
Caracal	0	1
Cheetah	0	1
Clawless Otter	0	1
Colobus Monkey	5	39
Hare	0	90
Crested Crane	0	67
Crocodiles	0	2
DikDik	36	99
Duiker	0	7
Egyptian Mongoose	0	5
Eland	252	458
Francolin	0	41
Genet Cat	0	14
Gerenuk	0	0
Giraffe	141	0
Gol Jackal	0	3
Grants Gazelle	256	97
Ground Hornbill	4	5
Guinea Fowl Flocks	95	49
Heartbeest (K.H) + (J.H)	0	7
Hippopotamus	0	108
Honey Badger	0	2
Hyena	22	0
Hyrax	19	105

SPECIES	SOYSAMBU CONSERVANCY (2020)	MARULA ESTATES (2018)
Impala	2528	3390
Jackal	29	0
Klipspringer	0	2
Leopard	1	5
Lesser Kudu	0	0
Lion	0	0
Mountain Reedbuck	0	3
Maasai Giraffe	0	41
Mongoose	4	0
Oribi	0	5
Oryx	0	8
Ostrich	0	12
Porcupine	0	7
Python	0	3
Reedbuck	0	0
S. Mongoose	0	4
Secretary Bird	8	5
Serval	1	2
Sid-St Jackal	0	2
Spotted Hyena	0	34
Springhare	0	76
Steinbuck	0	13
Stripped Hyena	0	1
Sykes	38	78
Thomsons Gazelle	716	1267
Topi	0	82
Tortoise	1	8
Vervet Monkey	123	112
White-tailed Mongoose	0	17
Warthog	57	291
Waterbuck	157	114
Wild Dog	0	0
Wildbeest	0	84
Zebra	4358	1801
Zorilla	0	3

3.4.3 TARGETED AND BASELINE WILDLIFE SURVEYS AND HABITAT CONNECTIVITY MODELLING

As part of the comprehensive studies for the ESIA, WSP commissioned targeted and baseline surveys of wildlife within the study area. This included the purchase and deployment of 50 cameras in Marula Estate and Soysambu Conservancy to quantify the distribution of wildlife in both conservation areas and to identify the optimal locations for crossing structures. These two conservancies were selected for the targeted surveys because:

- The A8 passed through both conservancies for relatively long distances
- They were identified as containing some of the largest areas of natural habitat and wildlife populations immediately adjacent to the project
- There were some anecdotal reports of WVC along the A8 in the vicinity of these conservancies
- They were relatively secure areas that would limit theft of camera equipment
- They had been identified as potential locations for WCS by KWS and others (Section 3.4.1).

WSP commissioned the University of Nottingham Malaysia (UoN) to analyse the results of the targeted camera trap surveys and the results are summarised in the ESIA and in the camera-trap report (Lechner *et al.* 2021a). The UoN was also commissioned to undertake a comprehensive wildlife connectivity modelling study to identify important habitat patches and linkages for wildlife in the area (Lechner *et al.* 2021b). The results of these analyses are presented in Appendix 6-19 and 6-20 of the ESIA, respectively.

The camera trap analysis focused on four key species because of their conservation status, proneness to collision with vehicles, risk of injury to motorists, knowledge of their ecology to inform the model and availability of occurrence data points. The four species were:

- African buffalo (*Syncerus caffer*) referred to as Buffalo
- Giraffe (*Giraffa spp.*). It is important to note that Soysambu Wildlife Conservancy has Nubian giraffe only (*Giraffa c. camelopardalis*), whereas Marula Estate has Masai giraffe (*Giraffa tippelskirchi*). However, the analysis conducted for this study uses the term Giraffe to refer to both species.
- Plains zebra (*Equus quagga*) referred to as Zebra
- Spotted hyena (*Crocuta crocuta*) referred to as Hyena

Nubian giraffes and Masai giraffes are critically endangered and endangered, respectively, and will require tailored crossing structures to be able to safely cross the A8. While considered near threatened and more common than Giraffe, Zebra and Buffalo can both move in herds and thus a group of individuals must be able to use a crossing structure at the same time. In addition, as large-bodied species, they also represent some of the greatest risks for motorist injury and fatalities as a result of WVC. Hyenas are predators and will thus have different requirements to the three species of herbivore. Finally, they also have the potential to act as ‘umbrella’ species and mitigation measures developed for these species will also be effective for many other species. However, a formal analysis of the degree to which these four species represent the needs of all other species has not been conducted and thus a conservative approach to the design and placement of wildlife crossing structures must be taken.

3.4.4 LITERATURE REVIEW AND BEST PRACTISE - WILDLIFE CROSSING STRUCTURES IN AFRICA

There is very limited published data on the use and effectiveness of wildlife crossing structures by African wildlife, with just three published studies identified in a recent comprehensive review (Collinson *et al.* 2019a), and an additional three studies published since then. The findings of each study and the implications for the design of WCS on this project are summarised in Table 3.3

Table 3-3 Summary of studies on the use of underpasses by wildlife in Africa

LOCATION AND TYPE OF STRUCTURES	FINDINGS	LESSONS FOR A8 AND A8 SOUTH	REFERENCE
Kenya – 1 x culvert 4.5m high, 6 m wide, 12 m long under the 2-lane A2 highway near Mt Kenya National Park. Fencing of corridor led elephants to the underpass.	Elephants used the underpass on the first night it was open, and >300 crossings recorded in the first year.	This study confirms African elephants will use underpasses when built at a known movement path, is fully fenced and when crossing a 2-lane road.	(Weeks 2015)
Kenya – Standard Gauge Railway (SGR) through Tsavo National Park, with 6 wildlife underpasses (70 m wide, 6 m high) and 9 large multi-use bridges that range in length from 20 m – 1980 m and 4 m – 12 m high. The SGR is fully fenced in Tsavo Conservation area to prevent wildlife-train collision, and the old railway and highway, plus powerlines and pipelines are parallel to SGR	Tracked movements of 10 elephants with GPS collars between March 2016 and March 2019. Eight elephants used the WCS and/or multi-use bridges under the SGR and the remaining two elephants remained on the same side of the infrastructure and did not cross the old highway nor the SGR. 78% of crossings were made at night, and elephant speed much higher while crossing, implying a behavioural response in risky landscape and under stress. Limited detail of rates of use or preferences for different structure types given – but elephants did use dedicated wildlife underpasses and some multi-use bridges.	This study focussed just on the movement of elephants, so mostly relevant to northern sections of the A8 project, but some trends applicable more broadly. Need to ensure that parallel linear infrastructure are also mitigated. Transient human settlements near underpasses likely restricted rate of crossing. Large underpasses appeared to be used by Elephants more than smaller underpasses, but difficult to interpret the data given.	(Okita-Ouma *et al.* 2021; Okita-Ouma *et al.* 2016)
Kenya – Standard Gauge Railway (SGR) project between Mombasa on the coast and Suswa in the Rift Valley. SGR included bridges, underpasses, culverts and flyovers in National Parks for wildlife movement and noise barrier in Nairobi NP.	Used qualitative data from interviews with 54 people from diverse organisations to identify impacts of SGR. Ecosystem fragmentation was the 2nd most dominant theme during interviews. Participants noted the 'likely ineffectiveness of mitigation measures' due to many underpasses along the SGR became occupied by people, and wildlife avoided them.	The subsequent management of underpasses and exclusion of people was not managed well, and wildlife (note elephants were the primary species discussed) avoided the WCS and increased human-wildlife conflict elsewhere. Unable to draw conclusions about the suitability of the design and spacing of WCS on SGR from this study.	(Nyumba *et al.* 2021)
Kenya – Standard Gauge Railway (SGR) project has 150 underpasses, of which 6 wildlife underpasses, 8 bridges and 27 culverts were open for use by wildlife and use was monitored between July 2017 and January 2021.	Preliminary analysis of use of underpasses based on visual inspections, looking for footprints, dung and physical sightings of wildlife. A total of 25 species were detected using underpasses, with livestock, Baboon, Elephant, Mongoose and Zebra most frequently detected, accounting for 70% of crossings. Other	A range of different species of wildlife will use dedicated and multi-use underpasses to cross under SGR. Average rate of detection in underpasses was highest for open span bridges over waterways, followed by	(Save the Elephants 2021)

LOCATION AND TYPE OF STRUCTURES	FINDINGS	LESSONS FOR A8 AND A8 SOUTH	REFERENCE
	species included Antelope, Buffalo, Camel, Dik Dik, Civet, Hyena, Impala. Wildlife used underpasses of varying width and height, but wider underpasses and taller underpasses appeared to be preferred by large species, and species that move in groups. Some of the variation in rate of use of different structures is likely related to location and proximity to suitable habitat, use by livestock, proximity to human settlement and distance from the nearby Mombasa-Nairobi Highway.	dedicated wildlife underpasses and lowest for culverts. Larger animals and those that travel in groups appear to prefer larger structures. Highest rates of use were generally observed in taller and wider underpasses. All underpass types contributed to connectivity and all should be designed / adapted for use by wildlife. Use of the underpasses by livestock and people, and proximity to human settlement. is likely to reduce rates of crossing by wildlife.	
Diani Beach on the south coast of Kenya. 28 rope-ladder canopy bridges installed over approx. 10 km of the 10m-wide Diani Beach Road. Two days were spent in 2013 observing animals use each bridge.	The vast majority of the 28 bridges were used – most frequently by Sykes', followed by Colobus and Vervet monkeys. Baboons were not observed using the bridges. Rate of use influenced by location – optimal location in good habitat or original movement pathways	The canopy bridges reduced WVC and monkey mortality. Accurate identification of monkey movement pathways and optimal monkey habitat on A8 and A8 South is essential	(Donaldson and Cunneyworth 2015)
Experimental trials at Lajuma Research Centre in Northern South Africa. Roadkill data collected on provincial paved road varying between 2 and 3 lanes wide (6 and 9m). Experimental testing of two canopy bridge designs – being a rope ladder and a rigid bamboo pole - at 25 sites using a paired choice design.	Used direct observations of Samango Monkeys crossing roads at the canopy bridge locations and assessed if they used the tree canopy, canopy bridge (and type of canopy bridge) or by ground. Canopy bridges reduced the likelihood of crossing at ground; canopy bridges were preferred to trees and ground when the canopy was open; and pole bridges were preferred over rope ladders. A range of other species also used canopy bridges, including rodents, Thick-tailed and Lesser Bushbaby, and low rates of use by Chacma Baboon	Primates are impacted by linear infrastructure through mortality from WVC and gaps in canopy can reduce connectivity. Canopy bridges are preferred by Samango Monkeys to crossing at ground. Further research and testing of bridge designs for very wide roads required	(Linden *et al.* 2020)

LOCATION AND TYPE OF STRUCTURES	FINDINGS	LESSONS FOR A8 AND A8 SOUTH	REFERENCE
Trials of shade-cloth fences to prevent mortality of Western Leopard Toad during their annual migration in Noordhoek, Cape Town, South Africa.	The shadecloth fence resulted in a significant reduction (to zero in 2013) in the rate of mortality from WVC of the Leopard Toads, The WVC hotspots were very spatially restricted to certain locations and are typically not dispersed over large areas.	Fences can effectively reduce frog mortality and must be paired with WCS to enable movement between overwintering habitats and breeding habitats. Need excellent data on location of WVC hotspots and movement paths to identify where mitigation is required. Good data on design of amphibian tunnels available globally.	(Le Brun 2013)
Ongoing study of use of drainage underpasses (culverts and bridge underpasses ranging in size up to 15 m wide and 6 m high) under a railway in South Africa	Preliminary results show use by a wide range of species, including Warthog, Leopard, Lion and a range of ungulate species. While there are occasional records of wildlife using small culverts (e.g. 1 m x 1 m), the vast majority of species and the highest number of individuals are using larger underpasses (e.g. 15 m wide x 6 m high)	Data collection is still ongoing, but strong evidence that while wildlife will occasionally use quite small structures, the highest rates of use are through the largest underpasses.	Wendy Collinson, unpub. data
Underpasses under the existing A8	Limited anecdotal data on the use of the existing underpasses under the A8	Lack of any data on the use of the existing structures under the A8 strongly implies they are not being overwhelmingly used by wildlife. It is unclear if this apparent lack of use is due to fencing or other obstructions, co-use of the structures by stock and machinery, or sub-optimal size and/or location.	Unpublished anecdotal observations from locals

The evidence from the limited experimental trials and evaluation of implemented WCS in Africa, which is supported from research globally is that WCS and fencing allow the safe movement of wildlife across the infrastructure and reduce or eliminate rates of WVC and the mortality of wildlife (van der Ree *et al.* 2015a). However, there is also an increasing body of evidence that while crossing structures do facilitate the movement of wildlife, the crossing structures are often too small, too infrequent, or not placed optimally in the landscape to fully remove the barrier effect of the road or railway (Rytwinski *et al.* 2016). Therefore, in general, most roads and railways require more and larger crossing structures, positioned in the best locations in the landscape and managed better to ensure ongoing success.

Fortunately, many of the lessons learnt from road ecology internationally can be applied to this project. The underlying principles for the design of wildlife crossing structures for this project are as follows:

1. Due to the lack of local data on the use of wildlife crossing structures across 4-lane dual carriageway roads, a conservative approach to the minimum size of structures for this project has been adopted.
2. Fencing appropriate to the target species is required to prevent wildlife from accessing the road and funnelling them to structures, and these must be effectively designed and managed.
3. Different types and sizes of crossing structures are included to provide a diversity of crossing opportunities in the likely scenario that different species have different preferences.
4. Consider installing noise walls and light screens at crossing structures where sensitive wildlife occur, subject to feasibility assessment during detailed design, to minimise disturbance from passing traffic and enable sensitive wildlife to approach and utilise the crossing structures.
5. Where possible, large and dedicated crossing structures are located in conservation areas with (a) the greatest diversity and density of species to benefit from the investment; (b) long-term security of land for conservation and (iii) active management of land to achieve conservation outcomes.
6. Crossing structures will be installed in a range of habitat types and topographical positions (e.g. some along waterways, higher points in the landscape, etc).

3.4.5 EXPERT AND STAKEHOLDER INPUT

A range of experts and stakeholders were engaged intentionally and opportunistically over the course of the ESIA to obtain input into the planning and design of the mitigation measures. The expert and stakeholder engagement included:

- Two wildlife workshops to discuss the wildlife connectivity modelling, including with KWS and managers of Marula Estate and Soysambu (April 2021 and July 2021). Both these workshops were supported by a Web-based expert mapping and survey tool called Maptionnaire.
- Review of the camera-trap analysis and connectivity modelling by ecologists from the Endangered Wildlife Trust, Giraffe Conservation Foundation and Ewaso Lions and Grevy's Zebra Trust
- A workshop with researchers in Africa and South America to discuss the design and feasibility of canopy bridge crossing structures for arboreal animals.
- A third final wildlife workshop to present the results of the camera-trap study, wildlife connectivity modelling and the outcomes of the study in terms of Wildlife Crossing Structures (January 2021). The workshop aimed to get input and comments from stakeholders on the final selection and design of Wildlife Crossing Structures.

An overview of consideration of comments and recommendation received during the wildlife workshops is provided in the table below. Further details of the engagement process are provided in the wildlife connectivity modelling report (Lechner *et al.* 2021b and Appendix 6-20 of the ESIA) and also in the Stakeholder Engagement Chapter of the ESIA (Section 7.5.1). The minutes of the different workshops are available in Appendix 7-2 of the ESIA.

Table 3-4 Consideration of comments and recommendations received during wildlife workshops

WORK-SHOP	QUESTIONS, COMMENTS AND RECOMMENDATIONS	RESPONSE PROVIDED / CONSIDERATION IN THE ESIA / IDENTIFICATION OF MITIGATION MEASURES
1	How are domestic animals being considered for crossings ?	Cattle crossing location were discussed in detail during the consultations with local communities. The wildlife movement study aims to identify key crossing points for wildlife and proposes dedicated wildlife crossings as well as multi use structures. Dedicated wildlife crossings are more effective than multi-use underpasses because the use of crossing structures by people and livestock can disturb wildlife.
1 and 3	The consideration of primate species, especially in Soysambu and Marula especially at WLC 11	Primates are not specifically considered in the wildlife movement study, but they were covered by the biodiversity surveys. The crossing structures in Marula Estate, Soysambu and in the Forest Reserves will also accommodate smaller animals such as primates, and they are located in the best habitat and thus be most useful for primates. WLC 11 has not been selected as wildlife crossing structures in Soysambu have been limited to existing structures, as Soysambu management confirmed they would not like endangered wildlife they are protecting within their land on the western side of the road to cross over to the eastern side. Although part of Soysambu property, the eastern side of the road is characterized by a more important number of human settlements which represents a greater risk of poaching for the giraffes. Furthermore, they have sold part of their land on the eastern side for future development and are considering selling additional land in the same area.
1 and 3	The consideration of endemic small mammals, including the Naivasha African mole-rat (*Tachyoryctes naivashae*)	Small mammals are not specifically taken into account in the wildlife movement study, but they were covered by the biodiversity surveys. The crossing structures in Marula Estate, Soysambu and in the Forest Reserves will also accommodate small mammals and they are located in the best habitat and thus be most useful for small mammals. The only endemic small mammal which distribution overlapped with the RAA, is the Aberdare mole shrew (*Suridisorex norae*). This species is endemic to the east side of the Aberdare Mountain Range. The distribution of this species probably follows the top of this mountain range hence it is unlikely to be found in the LAA, close to the road and no impacts are foreseen. With regards to the African mole-rat, IUCN does not consider T. naivashae as an endemic species, and rather follows Happold (in press) by including *ankoliae, annectens, audax, daemon, ibeanus, naivashae, rex, ruandae, ruddi, spalacinus* and *storeyi* within *Tachyoryctes splendens*. This species is widely distributed in East Africa and eastern parts of Central Africa and is not considered endemic and/or restricted range. Thus this species is not considered endemic or restricted-range.
1	Consideration of wildlife movement between KWTI Campus game sanctuary and its annex sanctuary next to lake Naivasha, as well as the Game farm Sanctuary. Consideration of an overpass	Special considerations was given to the three sections of the KWSTI, i.e. main campus, game farm and annex. A 40 m wide landbridge is planned over A8South between the campus and the annex (WCS29), and a 20m x 7m underpass is planned under A8 between the campus and the game farm (WCS3), to accommodate large mammals, including giraffe.

	which would be more adequate for giraffe, at least 30 m wide.	
1	Connection between either side of the highway in the KWSTI should also be provided to visitors, that should be able to drive through either side. s	Connection will be ensured by the two WCS mentioned above WCS29 and WCS3). However, it is recommended these be wildlife dedicated to increase their use by wildlife, especially considering their potential use by sensitive species such as giraffe.
1	Crossings as large as possible so that fauna can easily find escape routes and avoid death traps, not only from predators but also poachers.	Previous experiences do tend to show that larger animals and those that travel in groups appear to prefer larger structures and that highest rates of use are generally observed in taller and wider underpasses. 5m is considered a reasonable width considering technical and economic considerations and should avoid death traps.
1	Proper lighting for underpass to be considered and proper drainage	Lighting of underpass not considered at it would discourage use by numerous wildlife species. Proper drainage will be integrated in the detailed design.
1	Consideration of the section of the road from Maai Mahiu, which involves many roadkill and high wildlife crossings.	No WCS are planned along A8South, except at the KWSTI. It is considered the road strengthening (no dualling) of A8South will not increase barrier effect nor roadkill and will increase security.
1	Consideration of possible elephant movement that come from the Aberdares into the Kereita Forest (WLC1 and 2)	The potential presence of elephant in this area was noted and considered. While the new crossing structures (5m x 3.5m) were designed to accommodate species that are known to regularly occur in this area (Kikuyu Escarpment Forest/Kinale Forest), including small ungulates and large carnivores, the existing structure (10 m x 5 m) will be maintained (WCS1) and will possibly accommodate elephant movement.
2	WLC2 seems too close to settlement to be effective.	The existing WLC at WLC2 will be maintained for multiple use by wildlife, people and livestock. A new dedicated underpass will be planned at a minimum of 250 m from the multi-use underpass away from settlement. Exact location to be determined in detailed design.
2 and 3	Concern about a 5 meter width under 4 lane traffic not offering enough openness	Previous experiences do tend to show that larger animals and those that travel in groups appear to prefer larger structures and that highest rates of use are generally observed in taller and wider underpasses. 5m is considered a reasonable width considering technical and economic consideration.
2	Need for jump out structures if any ungulates get stuck between the road and fence line	This recommendation was noted and integrated into the design. Jump outs and other escape opportunities will be provided within Marula and Soysambu to enable wildlife to escape from the highway wayleave and re-enter the two conservation areas, as fencing in these areas are planned in continuous length.
2	Need for noise pollution mitigation especially for giraffe.	This recommendation was noted and integrated into the design. Subject to feasibility to be determined during detailed design, the impacts of traffic noise will be mitigated primarily through the use of noise walls and/or soil berms at the dedicated wildlife crossings, and to a lesser extent through the use of vegetation plantings and light walls in lower priority areas. For the landbridge, it was recommended to install noise and light screening and vegetation on edge of bridge and on approaches to the bridge are required to stop noise and light from oncoming vehicles. Soil berms on the bridge are not recommended due to the additional weight and the extra space they occupy, compared to screens.

		For bridge underpasses, it was recommended to install noise and light screens on the edge the planned bridge to reduce disturbance to wildlife passing underneath. Noise and light screens should also be considered for 100 m either side of each underpass to reduce disturbance to approaching animals.
2	Plantation of tree species for giraffe on the overpass.	This recommendation was noted and integrated into the design. It was recommended for the landbridge to be vegetated with native shrubs and trees and include optimal habitat for giraffe in the middle of the overpass
2	WLC 7 – connects to an existing dirt road. Wildlife would not likely use this	WLC7 is an existing underpass, currently used by livestock, pedestrians and farming (also entrance to Kigio Estate). It is considered low feasibility for a dedicated WCS due to private land on both sides of road. The existing underpass is to be extended under new carriageway and a new multi-use underpass 7 m wide x 3.5 m tall is to be installed for wildlife, livestock, pedestrians and farm machinery.
2	Consideration of waterways as important corridors for wildlife including primates, amphibians, small mammals and predators. Including retrofitting provisions for wildlife at the Gilgil river bridge, the river to the north of marula conservancy, the Kinungi riparian zone and the Melewa River, considering year round water levels).	Existing river crossings were considered and provisions for wildlife were integrated into the design where feasible, including Melawa River Crossing (WCS19), Gilgil River Crossing (WCS8), River North of Marula Estate (WLC10), as well as at Kinungi River (WCS17) In general, it was included to add fencing, landscaping and revegetation to enhance use by wildlife.
2	The gap between WCL9 and WCL8 seems too long given there are a lot of ungulates along that stretch of road.	No additional WLC structures were identified in Marula Estate between WCS9 and WCS8 because important considerations in determining the location and design of crossing structures was given to the land tenure and management considerations. These considerations focus on the long-term security of land tenure for conservation and the ability to audit the use of such land for conservation purposes. Despite being important from a wildlife conservation perspective, Marula Estate are not protected in perpetuity, and the number and size of WCS in these areas reflects this significant constraint. All underpasses under the new carriageway at Marula Estate and Soysambu Conservancy will match or be slightly larger than what currently exists under the existing highway to act as multi-use underpasses.
2	Consideration of the conservancies' management plan to be assessed, so wildlife crossing are not use for moving cattle.	Important consideration in determining the location and design of crossing structures was given to the land tenure and management considerations. These considerations focus on the long-term security of land tenure for conservation and the ability to audit the use of such land for conservation purposes. Despite being important from a wildlife conservation perspective, Marula Estate are not protected in perpetuity, and the number and size of WCS in these areas reflects this significant constraint. All underpasses under the new carriageway at Marula Estate and Soysambu Conservancy will match or be slightly larger than what currently exists under the existing highway to act as multi-use underpasses.

2	WLC 12 – connects to a dirt road and would not be optimum for wildlife use. Idem WCS13 and WCS 14	WLC 12 was finally not selected because Soysambu sold the area east of the road for a residential development. Also, because of land tenure issues (Despite being important from a wildlife conservation perspective, Soysambu is not protected in perpetuity and long-term security of land tenure for conservation and the ability to audit the use of such land for conservation purposes cannot be assured) no new crossing structures were proposed in the area. It was recommended to maintain WCS13 and WCS14.
2	Manguo swamp is an important area for cattle crossing, which could also be used by small mammals.	No specific WCS is planned at Manguo swamp but there is an existing underpass that will be maintained as cattle crossing near Manguo Swamp, which could in fact be used my small mammals and other small wildlife.
2	Implementation of sound barrier along stretch near the Lake Elmentaita WHS	The implementation of a noise barrier near Lake Elmentaita was not considered feasible. However, it was included to ensure that the directives of the noise permit to be obtained from NEMA will also be applied in areas of high-quality habitat for wildlife, such as near Lake Elmentaita. Furthermore, noise modelling has not demonstrated significant increases of noise levels along the Project section located close to lake Elmenteita.
2	Consideration of putting a number of crossing structures along between the Longonot and Maai Mahiu area.	No WCS are planned along A8South, except at the KWSTI. It is considered the road strengthening (no dualling) of A8South will not increase barrier effect nor roadkill and will increase security. Vehicular traffic volumes on the A8South are also expected to decrease following the doubling of the A8, which should lower vehicle wildlife collision risks.
3	How has the location of quarries/borrow pits considered the presence of wildlife habitat ?	The location of source material and temporary construction sites are not determined yet. The information gathered in the ESIA will help guide decisions on the locations. A dedicated ESIA will be completed for each quarry site and will be submitted to NEMA to get approval
3	The consideration of smaller animals in the design of fencing.	The fencing design will be adapted to the target species. If in an area with important small mammals, or amphibians and reptiles populations, the bottom of the fence will be a smaller mesh, compared to the top of the fence.

3.4.6 REVIEW AND SYNTHESIS OF INPUTS

The final recommended mitigation measures in this ESIA were derived after reviewing the KWS recommendations, the results of field surveys and outputs of the connectivity modelling, and conducting a desktop assessment of the likely effectiveness and adequacy of the proposed recommendations against international best practice. This was combined with input and comments from the ecological experts and stakeholders.

3.4.7 PRIORITISATION OF CROSSING STRUCTURES AND LOCATIONS

Each location for a potential wildlife crossing structure was prioritised and categorized according to the following:

Ecological priority was determined by considering the diversity and abundance of wildlife in the area and the quality and tenure of habitat in the area

Expected use of a structure was classified as a priority for wildlife (i.e. high priority) or incidental (low priority)

Structure type describes the type and size of the structure – e.g. vegetated land bridge, bridge underpass, box culvert or canopy bridge

Structure focus describes whether the structure is being designed and constructed specifically for wildlife (i.e. dedicated wildlife crossing) or whether it is intended to function for other purposes in addition to the movement of wildlife, such as drainage or the movement of people and livestock.

Land tenure and management describes the current land-use and tenure of land adjacent to the proposed crossing structure, based on the following four criteria:

1. Adjacent landowners must commit to managing the land immediately surrounding each WCS and more broadly leading up to each WCS for the conservation of wildlife
2. All highway fencing at the WCS will be opened up to allow the free movement of wildlife through the WCS. Similarly, any gates at the WCS shall remain open at all times. Wildlife must learn that a location is an open crossing, and if it is periodically closed, they will not learn that it is an effective crossing
3. The primary use of dedicated WCS should be wildlife and the landowner must agree to this condition. Occasional use by vehicles, farm machinery and livestock can occur, but excessive use which results in the trampling of vegetation and ongoing disturbance to wildlife will reduce effectiveness for wildlife.
4. Adjacent landowners must agree to a long-term commitment with specific conditions that can be audited and compliance assessed by the relevant authority.

4 PROPOSED MITIGATION MEASURES

4.1 BACKGROUND

A wide range of novel and innovative strategies are being developed and employed locally and globally to minimise and mitigate the negative ecological impacts of roads and traffic. Many new roads are being planned and designed to reduce impacts on wildlife, following the mitigation hierarchy, focusing on avoidance as the first priority, followed by minimisation, mitigation and offsetting. The minimisation and mitigation strategies for road planning and design are numerous and include:

- wildlife crossing structures (WCS) (e.g. culvert and bridge underpasses, land bridges, canopy rope bridges and glider poles) to facilitate the safe movement of wildlife under or over roads
- fencing to prevent wildlife from accessing the road and funnelling them towards crossing structures
- noise and light walls to reduce the egress of visual and acoustic stimuli from the road into adjacent habitat
- temporary and permanent road closures, speed reductions and other traffic calming measures through sensitive habitats or at times of high-collision risk with wildlife.

The rates of use of wildlife crossing structures and the effectiveness of different approaches varies significantly depending on the type of treatment and the quality of the installation. For example, wildlife crossing structures and continuous fencing installed together and continuous fencing alone can reduce the rates of WVC by up to 90%. In contrast, there is still much uncertainty about the effectiveness of flight diverters (walls or other structures intended to encourage birds to fly up and over traffic) and ongoing trials and debate over the use of acoustic, chemical or light stimuli to deter animals from entering the roadway.

The mitigation measures for this project are:

- Wildlife crossing structures - underpasses and overpasses
- Fencing to prevent wildlife from accessing the highway and funnelling them towards crossing structures
- Noise and light screening in sensitive areas
- Fauna-sensitive lighting
- Management, maintenance, monitoring and evaluation

4.2 WILDLIFE CROSSING STRUCTURES

4.2.1 BACKGROUND

Wildlife crossing structures, including over- and under-passes enable the movement of wildlife over or under the highway and remove, or significantly reduce, the risk of collision with vehicles. Crossing structures have been installed around the world for a wide diversity of species, including terrestrial and arboreal mammals, reptiles, amphibians, birds and bats.

Wildlife crossing structures can be planned, designed, built and managed with the sole purpose of facilitating the movement of wildlife (i.e. hereafter termed ‘dedicated’ wildlife crossing structures) or they can be crossing structures that facilitate the movement of wildlife as well as other functions, such as drainage or the movement of stock, people and machinery (hereafter ‘multi-use’ crossing structure).

4.2.2 PROPOSED WILDLIFE CROSSING STRUCTURES – OVERVIEW

The highway upgrade project passes through a complex and varied environment that includes:

- areas that provide important habitat for wildlife, such as Soysambu Conservancy, Marula Estate, KWSTI, Lake Naivasha, and other conservation areas
- numerous urban areas and towns
- agricultural areas that are used for a diversity of uses at different intensities, including irrigated and non-irrigated cropping, vegetable growing, stock grazing and livestock herding
- forestry and timber production, particularly to the north and south of the project.

Dedicated wildlife crossing structures will primarily be built where the highway passes through conservation areas with secure land tenure and long-term conservation of wildlife is assured (refer to Section 3.4.7).

The multi-use crossing structures will primarily be built within the conservation areas as supplemental/incidental crossing opportunities as well as in areas outside conservation areas where wildlife may occur in typically lower quality habitat

Further details of the location and design of each crossing structure is provided in Section 7 of this report.

4.3 LAND BRIDGE (VEGETATED OVERPASS)

4.3.1 BACKGROUND

One of the most effective techniques to facilitating the movement of wildlife across linear infrastructure is with land bridges, which allows animals to pass above the infrastructure via a vegetated overpass (see Figure 4.1 and Figure 4.2). This is achieved by building a bridge or arch over the road, placing soil on it and allowing vegetation to grow and to connect to vegetation on both sides of the road. Land bridges are more expensive than underpasses, but when well-designed and maintained they allow for seamless landscape integration and movement of wildlife, plants and ecosystem processes across the road. Land bridges are most cost-effectively employed at locations where the infrastructure is within or partially within a cutting, however they can also be built where the road is at-grade.

Figure 4.1. Vegetated landbridge for wildlife built using arches (left) and as a bridge (right).

Figure 4.2. View on the top of land bridges that are 50 – 70 m wide in The Netherlands and France, showing rows and piles of tree stumps and shrubs within grassy areas which provide habitat and 'furniture' for a range of different species and enable views across the bridge.

4.3.2 DESIGN OF LANDBRIDGES

The vegetated land bridge on this project is proposed for areas supporting Giraffe or areas that Giraffe use as dispersal or migration corridors, as both KWS (2019) and species experts have suggested that landbridges are the best approach for this species, followed by tall underpasses. Landbridges are also the most effective approach to facilitating the movement of almost all other species, including sensitive birds and bats that avoid crossing above the road itself, or may be prone to WVC due to their habitat of low-flying.

There are no examples of landbridges in Africa to guide the design of landbridges on this project, however the following is relevant:

- The Kenya Wildlife Service originally proposed in 2017 that the landbridges should be 100 m wide (KWS 2017), which The Biodiversity Consultancy supported in their 2018 report (Bennun *et al.* 2018)
- The recommended minimum width of landbridges in Europe is 40 – 50 m (IENE 2003), and the minimum width of a landscape bridge is > 80m.
- The (US DOT FHA 2011) recommend a minimum width of 40 – 50 m, and a recommended width of 50 – 70 m
- The Indian guidelines recommend that land bridges are up to 70 m in width.
- The German guidelines recommend wildlife overpasses be 50 m wide.
- All guidelines and prescriptions from around the world, and indeed almost all reviews of the rates of use of crossing structures by wildlife have shown that wider landbridges typically have higher rates of use by more species.
- The species experts have advised that Giraffe are sensitive species and likely to be disturbed by traffic noise, lights and the visual disturbance and this may hinder their use of crossing structures.
- Given the height of their heads at 4.5 – 5.5 m, wider overpass structures with opaque fencing are required to provide a central core area that is quiet and free from disturbance
- Soysambu is considered critical habitat for the Nubian Giraffe, which is Critically Endangered according to the IUCN Red-list and Marula Estate is home to the Endangered Masai Giraffe. However, both conservancies are privately owned and there is no binding long-term commitment to the conservation of wildlife, and thus expensive landbridges are not justified at these locations (refer to Section 3.4.7 for more details). In addition, the managers of Soysambu have advised they do not want a landbridge because they do not want to encourage the free movement of wildlife to the east of the highway because the area of habitat is relatively small, in close proximity to humans, has been sold in part for development and thus has an elevated risk of poaching.

There is one landbridge proposed for this project across the A8South with the following design parameters:

- 40 m wide (measured as usable width at its narrowest point)
- Noise and light screens on the edge of the landbridge above the road and for 100 – 200 m on all approaches, with feasibility to be confirmed during detailed design
- Vegetated with native shrubs and trees and include optimal habitat for giraffe in the middle of the overpass
- Be free of any human or livestock activity that may disturb and discourage use by Giraffe

Further details for the design of land bridges are provided in Table 4.1.

The number and location of landbridges for this project are given in Table 7.1

Table 4-1. Detailed design elements for land bridges

DESIGN ELEMENT	CONSIDERATIONS
Efficacy	— Proven in Europe, North America and Asia for numerous large species. Likely effective in Africa.
Target species	— Many species of terrestrial wildlife, including mammals, reptiles, amphibians and invertebrates, as well as birds and bats
Design, dimensions and construction materials	— At least 40 metres of usable space wide so Giraffe are able to use without disturbance from traffic. — Soil depth to be a minimum of approximately 2 m, as required to support the same type of vegetation growing adjacent to the highway and suitable for grass, shrubs and scattered trees — Gently graded vegetated ramps / approaches, ideally 5:1 (horizontal to vertical). — Approach ramps to be hourglass-shaped, to encourage wildlife to access and enter the bridge — No artificial lighting within 500 m of land bridge — Construction method depends on topography (i.e. in a cutting or at grade), the length of the span and can include pre-cast concrete arches, cut and cover tunnels, or concrete bridges
Landscape position, fencing and landscaping	— Ideal when the road is in a cutting, but also feasible where the road is at grade — Install a minimum of 2 km of wildlife fencing in each direction wherever there is a risk that the target species may access the highway. Longer fencing may be required for wide-ranging species. — Avoid potential barriers across or near to landbridge, such as farm fences, roads — Vegetation on the bridge should match the adjacent vegetation or be specific for the target species, as well as include different bands of habitat (e.g. one side forested, the other more open grassland) depending on the target species — Allow vegetation adjacent to the road to grow to the landbridge, providing seamless transition from adjacent habitat to structure. — Noise and light screening and vegetation on edge of bridge and on approaches to the bridge are required to stop noise and light from oncoming vehicles. Soil berms on the bridge are not recommended due to the additional weight and the extra space they occupy, compared to screens
Furniture to encourage use and reduce the risk of predation	— Place logs, strategically placed piles of rocks or other habitat features that suit the target species on the landbridge to provide natural cover/shelter from predators and improve habitat suitability — Wetlands at the base of the approach ramps are recommended to deal with stormwater run-off and provide resources to attract wildlife to the bridge — Place structures at the entrances to the bridges that prevent unauthorised vehicle access but does not restrict wildlife movement
Maintenance	— Inspections should be undertaken in accordance with an approved Operational Environmental Managemental Plan (OEMP) and Standard Operating Procedures (SOP) that protects vegetation and habitat according to the ecological aims of the structure — Inspections to assess the structural integrity of bridge should be conducted at the same frequency as for normal bridge structures

	— Inspections to assess the ecological condition of the land bridge should be conducted annually for the first three years, and once every three years thereafter

4.4 WILDLIFE UNDERPASSES

Underpasses for wildlife come in a variety of shapes and sizes, ranging from very large viaducts to open span bridges, box and pipe culverts. Underpasses can be specifically for wildlife (i.e. dedicated underpass) or multi-use (i.e. human use such as drainage, livestock etc and wildlife). In almost all situations, dedicated wildlife underpasses are more effective than multi-use underpasses.

The original 2017 recommendations made by KWS specified that the underpasses must be 30 m wide and 7 m high (KWS 2017). The Schedule 2 (design Construction Standards) Execution Version lists 11 underpasses that were to be at least 20 m wide and 7 m high, with the height to allow use by Giraffe. The 2019 recommendations were significantly smaller, at between 5 and 7 m wide and 3.5 m high (Table 3.1). The underpasses proposed in this ESIA are built according to the target species of wildlife and whether they are dedicated or multi-use.

Two types of underpasses are proposed, namely open span bridges and culverts. The primary difference in the two options are size and construction technique, with bridges being wider and more open than culverts. Open span bridges are described in detail in Section 4.5 and culverts described in Section 4.6.

4.5 OPEN SPAN BRIDGES

4.5.1 BACKGROUND

Bridge underpasses can include single span bridges, as well as longer multi-span bridges or viaducts. Bridges and viaducts are typically employed where roads cross important habitats and wildlife populations, major waterways, steep valleys or areas prone to flooding. Bridges and viaducts are the most effective underpass option for wildlife because they are large and open, have a natural substrate and typically support more shrubs, logs and other cover than culverts. Wherever possible, bridge underpasses should be used instead of multi-cell culverts where wildlife movement is a high priority. As for other types of underpasses, larger and more open is always better because larger underpasses are typically used at higher rates by a greater diversity of species than smaller underpasses. Standard bridge designs can be easily modified to accommodate the movement of wildlife (e.g. Figure 4.3,Table 4.2).

Careful consideration is required in the design of bridge underpasses to ensure that scour protection (e.g. concrete, large rocks) does not interfere with the movement of wildlife. Where possible, there should be sufficient and separated space for water movement, wildlife movement and scour protection. The length of bridges may need to be increased slightly to allow space for wildlife movement on both sides of the waterway if the area required for scour protection is unable to be reduced.

The bridge underpasses installed as part of the SGR project range in width from 20 m to almost 2 km, and from just under 6 m to 12 m in height.

Figure 4.3. The Slaty Creek Bridge on the Calder Freeway in south-east Australia was designed to be higher and longer than required simply for drainage, to encourage wildlife movement. In this example, the vegetation has been planted underneath the structures, and tall trees retained between the two carriageways. This is an example of a very large bridge – most do not need to be this large. Photos Rodney van der Ree, WSP.

Figure 4.4. (Left) Example of a well-designed bridge underpass that is open, with a natural substrate and continuous vegetation compared to a poorly designed bridge underpass (right) with minimal space on both sides of the waterway and over-use of large rocks for erosion control that hinders the movement of many species. Photos Rodney van der Ree, WSP.

4.5.2 DESIGN OF BRIDGE UNDERPASS

Open span bridges are the optimal underpass for the movement of wildlife because:

- Bridge underpasses are larger than culverts and allow herds of animals to use them as a group
- Bridge underpasses are more ‘open’, thereby allowing sensitive species that don’t like enclosed spaces to use them and provides opportunities for prey species to avoid potential predators. Culverts can give a perception of being a tunnel, which some species avoid.

- With a large span, there is space in the underpass for different features, such as a line of logs, tree stumps or rocks to provide protection and shelter for smaller prey species from predators
- Bridge underpasses have a natural 'floor' (rather than a concrete base like culverts), which encourages more sensitive species to use them
- Bridge underpasses should be built as grade separated structures, allowing light and water to reach the ground and facilitate the growth of natural vegetation adjacent to and between each structure
- The light reaching the ground level between the structures increases light levels in the underpass, making it more inviting to more species

Further details for the design of open span bridge underpasses are provided in Table 4.2.

Table 4-2. Detailed design elements for bridge underpasses

DESIGN ELEMENT	CONSIDERATIONS
Efficacy	— Proven in Europe, North America and Asia. Evidence from SGR indicate also effective in Africa. If sufficiently tall, they may be suitable for Giraffe.
Target species	— Many species of terrestrial wildlife, including mammals, reptiles, amphibians and invertebrates, as well as birds and bats — If large enough and with appropriate furniture and vegetation, target species can include arboreal species, birds and bats
Design, dimensions and construction materials	— Bridge underpasses should be as tall and wide as possible to enable the movement of the widest diversity of species — Dedicated bridge underpasses for wildlife shall have a minimum clearance of 5 m and width of at least 20 m. Underpasses for Giraffe should be at least 7 m tall. — Where possible, use two separated bridge structures to allow light and water to penetrate and support vegetation growth. Install wildlife fencing between the bridge structures to prevent wildlife from accessing the road and people from accessing the underpasses. — Install noise and light screens on the edge of the bridge to reduce disturbance to wildlife passing underneath. Noise and light screens should also be considered for 100 m either side of each underpass to reduce disturbance to approaching animals — No artificial lighting within 500 m of dedicated wildlife bridge underpasses — Any use that could compromise the function of the underpass (e.g. movement of stock or machinery) should ideally be moved to another location, be restricted to a culvert installed next to the bridge underpass or strictly kept within a narrow portion of the bridge underpass. Grow screening vegetation between the farm access road and the wildlife movement to reduce disturbance for wildlife. — If the bridge crosses a waterway, wildlife movement areas should be on both banks of the waterway and ideally remain dry year-round except during 1:10 year flood events — Do not use large rocks for scour protection within the wildlife movement zone as this will discourage larger mammals from entering. If scour protection is required, use concrete or small rocks instead and increase the span of the bridge accordingly.

DESIGN ELEMENT	CONSIDERATIONS
Landscape position, fencing and landscaping	— Install a minimum of 2 km of wildlife fencing in each direction wherever there is a risk that the target species may access the road — Avoid potential barriers across or near to bridge underpasses, such as farm fences or roads
Furniture to encourage use and reduce the risk of predation	— Allow vegetation and habitat adjacent to the road to grow under the bridge structure, maximizing continuous protection and shelter across the road. Species selection for planting adjacent to and under bridges should take into account the needs of the target species, adjacent plant communities and risk of damage to the bridge structure. — Place logs, strategically placed piles of rocks or other habitat features that suit the target species underneath the bridge to provide natural cover/shelter from predators and improve habitat suitability — If the bridge underpass is combined with drainage, ensure fauna furniture is not washed away during floods
Maintenance	— Place structures at the entrances to the underpasses that prevent unauthorised vehicle access but does not restrict wildlife movement — Inspections to assess the structural integrity of bridges and viaducts should be conducted at the same frequency as for normal bridge structures — Inspections to assess the ecological condition of the bridge underpasses should be conducted annually for the first three years, and once every three years thereafter. Ecological inspections should also be conducted after every 1:20 year rainfall event — 6-monthly inspections are required to detect and exclude people from setting up camps under the bridges

4.6 DEDICATED WILDLIFE CULVERTS

4.6.1 BACKGROUND

Dedicated wildlife culverts are circular or box-shaped underpasses, typically made of concrete, that are primarily installed to facilitate the movement of wildlife under the linear infrastructure (Figure 4.5 and Figure 4.6). Dedicated wildlife culverts may occasionally allow the movement of water (e.g. during a 1:10 or 1:100 year flood event) but they are always optimised for wildlife and other uses are incidental. The use of dedicated wildlife culverts by people and livestock is discouraged due to the risk of disturbance to wildlife.

Box culverts are square, rectangular or arched-shaped culverts that are significantly more effective than pipes at facilitating the movement of wildlife. Therefore, box culverts should always be adopted in preference to pipes whenever possible. Box culverts and arches are more effective than pipes because they have flat bottoms and larger openings than pipes of the same height, and thus facilitate greater movement of wildlife.

Culverts are typically targeting terrestrial wildlife, including mammals, reptiles, amphibians and, if they are large enough or with appropriate features, they may permit some movement of certain species of birds and bats. The optimal size of a culvert is determined by the requirements of the target species of wildlife and are best suited where the road is already on fill. However, it is always better to install larger culverts than required because the majority of studies evaluating the effectiveness of underpasses from around the world indicate that larger (tall and wide) and shorter (length) underpasses are better than those that are smaller and longer.

Where possible, culverts should have a natural substrate and include furniture (e.g. logs and scattered rocks) to provide natural cover/shelter from predators and improve habitat suitability. Furniture features can be installed on the ground, attached to walls or built into the structure itself (i.e. bat roosts built into culverts).

The entrances to culverts should be kept as natural as possible, and the use of large rocks for erosion control should be avoided as this will restrict entry by some species. Wildlife culverts should be positioned in the landscape to be above drainage lines and flood levels as much as possible, as wet culverts are likely to deter terrestrial wildlife. Culverts for the movement of amphibians should remain as wet as possible to facilitate their movement.

Figure 4.5. Dedicated 3 m x 2 m (left) and 2 m x 2 m (right) culverts for wildlife. Culverts are smaller than open span bridges and present as a 'tunnel' to wildlife and are likely less effective than bridge underpasses for open-country species.

Figure 4.6. (Left) Interior of a recently constructed wildlife culvert, with a timber rail for scansorial and arboreal species. (Right) large arch culvert with logs and branches providing furniture for arboreal wildlife.

4.6.2 DESIGN OF DEDICATED CULVERTS

All dedicated culverts for wildlife are at least 3.5 m tall and 5 m wide, in accordance with the dedicated wildlife culverts proposed by KWS in 2019. These are proposed as intermediate or lower-priority crossings below the dedicated bridge underpasses in the important conservation areas. The effectiveness of box culverts at permitting the movement of larger species is less certain than for overpasses

and open span bridges, and thus are considered as crossing structures for smaller species that prefer enclosed spaces, such as fossorial species or those that live in underground dens. Culverts are also considered as facilitating incidental crossing by a wider groups of species that will use smaller structures such as culverts only occasionally.

The use of dedicated wildlife culverts by people and livestock is discouraged, and adjacent culverts that are specifically for people and livestock are typically provided as an alternative to use of the wildlife culvert.

Dedicated box culverts are proposed at various locations along the highway – see Table 7.1 for more details. Enhancements to existing drainage culverts are also proposed to increase permeability of the overall project.

Further details for the design of open span bridge underpasses are provided in Table 4.3

Table 4-3. Detailed design elements of dedicated wildlife culverts

DESIGN ELEMENT	CONSIDERATIONS
Efficacy	— Proven
Target species	— Target species depends on the size of the culvert and includes many species of terrestrial wildlife, including mammals, reptiles, amphibians — If large enough and with appropriate furniture, target species can include arboreal species, birds and microbats
Design, dimensions and construction materials	— Culverts should be straight, and as wide, tall and short as feasible to allow unobstructed views through the culvert — If a culvert is to extend under a dual carriageway with a separated median, use two culverts with a break in the middle to allow light and water to penetrate. Install fencing between the two carriageways to prevent wildlife from accessing the road and from people accessing the culverts — No artificial lighting within 500 m of culverts
Landscape position, fencing and landscaping	— Encourage habitat for the target species to grow to the entrance of the culvert — Install a minimum of 500 m of wildlife fencing in each direction wherever there is a risk that the target species may access the highway. Longer fencing may be required for wide-ranging species. — Place dedicated wildlife culverts at known or likely movement pathways and mortality hotspots for the target species — Avoid potential barriers across or near to culverts, such as farm fences, roads
Furniture to encourage use and reduce the risk of predation	— The base of dedicated wildlife culverts should be as natural as possible, such as soil or mulch. Where possible, use culverts without a concrete base. — Scatter some large rocks, logs or artificial shelters within the culvert and at entrances to provide shelter for small wildlife from predators and to encourage use — Do not use large rocks at culvert entrances for scour protection, as this will discourage larger mammals from entering. If scour protection is required, use concrete or small rocks instead. — Include horizontal logs suited for the target species to provide alternative pathways and avoid predators.
Maintenance	— Inspections to assess the structural integrity of culverts should be conducted at the same frequency as for drainage culverts — Inspections to assess the ecological condition of the culverts should be conducted annually for the first three years, and once every three years thereafter. Ecological inspections should also be conducted after every 1:20 year rainfall event

4.7 MULTI-USE CULVERTS

4.7.1 BACKGROUND

The optimal approach to crossing structures is to design and manage them specifically for wildlife, and to keep wildlife passage and drainage separate. When this is not feasible, culverts and arches that allow the movement of water and wildlife are possible. However,

these structures must be carefully planned and designed because wildlife movement is typically compromised when the focus of the design is primarily drainage. For example, it may not be feasible to keep furniture in multi-use culverts if they impede drainage or furniture and substrate may be washed away during flood events. However, drainage culverts that only infrequently have water for short periods of time provide important opportunities for incidental crossings and should be optimised. A significant problem in all types of multi-use culverts is standing water, which often occurs due to poor design and ponding (Figure 4.7).

Figure 4.7. Poor drainage and ponding can reduce the effectiveness of all types of culverts and they must be carefully designed, constructed and managed to effectively enable both uses. Photos (left) Rodney van der Ree WSP and (right) Scott Watson VicRoads.

For example, culverts that contain permanent water or water for many weeks of the year are less preferred by terrestrial wildlife than culverts which are dry or mostly dry for most of the year. Strategies to provide dry passage in drainage culverts include:

- Raising the height of the floor of the two (or more) outer cells so they remain dry except during major flood events (Figure 4.8)
- Lowering the height of the floor of the middle cell(s) to provide drainage during typical flow events
- Installing ledges and shelves above the height of the typical water level on the outer walls of the culvert(s) (Figure 4.9)

Figure 4.8. Example of multi-cell culverts on the Pacific Highway NSW where the middle cell is designed to take water flow year-round, with the outer cells remaining dry except during flood events. Photos Rodney van der Ree WSP.

Figure 4.9. Example of strategies that provide dry passage if the culvert contains standing or flowing water. Note that the concrete ledge and timbershelf in the left photo are still to be connected back to the adjacent habitat. Photos by Rodney van der Ree WSP.

4.7.2 DESIGN OF MULTI-USE CULVERTS

Multi-use culverts for people, livestock and wildlife have been designed with separate cells to keep wildlife separate from people and livestock. Two such structures are proposed for Kikuyu Escarpment Forest Reserve. Other multi-use culverts are for drainage and wildlife.

All drainage structures within the conservation and important biodiversity areas will be modified to act as multi-use culverts. In addition, all underpasses under the new carriageway at Marula Estate and Soysambu Conservancy will match or be slightly larger than what currently exists under the existing highway to act as multi-use underpasses.

Further details for the design of multi-use culverts are provided in Table 4.4

Table 4-4. Detailed design elements for multi-use wildlife culverts and arches. Note that this table should be read in conjunction with Table 4.3

DESIGN ELEMENT	CONSIDERATIONS
Efficacy	— Proven for some species, depending on the size, design and frequency of flooding
Target species	— Many species of wildlife, including smaller terrestrial mammals, reptiles, amphibians — Multi-use culverts are less effective for terrestrial mammals than dedicated culverts, unless the species are aquatic, semi-aquatic or don't mind wet feet.
Design, dimensions and construction materials	— If combined use includes people and livestock, accommodate them in a separate cell to avoid disturbance to wildlife. Use plantings or other screenings to limit disturbance upon approaches to the structure entrances. — If a single-cell culvert or arch, include a concrete ledge or shelf at a height above typical water levels that allows passage of the target species for most days of the year. Under typical flows, dry passage should be possible for ~80 - 90% of the time.

DESIGN ELEMENT	CONSIDERATIONS
	— If multi-cell culverts includes drainage, construct the two outer cells to be higher than the middle cell, which is the focus for water flow. The two outer cells should be high enough relative to normal flows to be dry approximately 90% of the time. — Shelves can also be used instead of concrete ledges or installed near the roof of the culvert, and flat/wide shelves are likely better than logs, depending on the target species. The attachment technique must be strong enough to withstand water velocity during high flows. — Do not use large rocks at culvert entrances for scour protection, as this will discourage larger mammals from entering. If scour protection is required, use concrete or small rocks instead.
Landscape position, fencing and landscaping	— The placement of multi-use culverts will be primarily influenced by hydrology requirements. Where possible, they should be adjusted to also coincide with known or likely movement pathways and mortality hotspots for the target species
Furniture to encourage use and reduce the risk of predation	— The base of multi-use culverts must be able to withstand high flow events, and thus concrete surfaces are suitable. — Due to its combined drainage purpose, any furniture that is not permanently attached will be washed away. Scattered large rocks in outer cells can be concreted into the floor of the culvert. Furniture should not present a blockage risk or significant impediment to water flow during flooding — Include horizontal logs suited for the target species to provide alternative pathways and avoid predators.
Maintenance	— Inspections to assess the structural integrity of culverts should be conducted at the same frequency as for drainage culverts — Inspections to assess the ecological condition of the culverts should be conducted annually for the first three years, and once every three years thereafter. Ecological inspections should also be conducted after every 1:20 year rainfall event.

4.7.3 DESIGN OF MULTI-USE PIPE CULVERTS

Multi-use pipe culverts are less effective for most species than multi-use box culverts and are not recommended for the movement of wildlife. At best, they may provide incidental connectivity for some wildlife. If multi-use pipe culverts are to be implemented, follow the same guidelines as for multi-use box culverts (Table 4.4).

4.8 CONNECTIVITY FOR ARBOREAL SPECIES

4.8.1 BACKGROUND

Arboreal species spend all or some of their time living in and moving between trees (Soanes and van der Ree 2015). The loss of trees across roads creates gaps in the connectivity of tree canopies, reducing or eliminating movement of arboreal species. This effect is the most severe for strictly arboreal species that rarely or never come to the ground and for those that are at high risk of predation when on the ground.

Arboreal species are often small in size, and historically were rarely considered in roadkill and connectivity mitigation. However, mitigation for these species has expanded rapidly in the last decade, and is becoming widespread across the world, including in Asia, Europe, North America, South America, Africa and Australia.

4.8.2 DESIGN OF ARBOREAL CROSSING STRUCTURES

Arboreal crossing structures include maintaining or restoring natural canopy connectivity and the installation of canopy bridges.

Canopy connectivity is where tree canopies are retained during construction or encouraged to grow after construction and provide a continuous or near continuous connection above the road. Achieving canopy connectivity is very difficult with 4-lane dual carriageway roads because the size of the gap usually exceeds the width of tree canopies and are thus not a viable option in this project.

Canopy bridges are a lightweight structure suspended above the road from poles or trees that connects woodland or forest habitat on either side of the barrier. Canopy bridges are typically used for arboreal mammals, but can also include arboreal reptiles. Canopy bridges vary in design, but include single strands of rope or rope-like materials, rope ladders, fabricated aluminium structures, timber poles and other similar materials. Key considerations when designing canopy bridges are that the target species is physically capable of climbing on the structure, that it is stable over the span of the road and requires minimal maintenance.

The target species for canopy bridges are arboreal mammals, such as Syke's, Vervet and Colobus Monkeys, and potentially arboreal reptiles, such as chameleons.

A design workshop for the canopy bridges for this project was held with primatologists and ecologists with expertise in roads and primates from South Africa, Kenya, Brazil and the USA. The workshop addressed design considerations, location, target species and other relevant factors. There was a consensus on the important need for canopy bridges, as well as uncertainty about the optimal design and thus the need for rigorous testing of whatever crossing structures are installed. The following design considerations are based on the results of trials of canopy bridges around the world and the topics discussed at the workshop.

Canopy bridges should be a minimum of 2 m above the height of the tallest trucks and are usually suspended from two treated timber poles or other support structures. They can also be attached to trees however assessing the structural integrity of trees at installation and over time is more difficult than for timber poles. Timber poles are probably better than steel or concrete poles because they are more similar to trees and probably easier to climb, however alternatives to timber should be considered in areas with high termite activity. Furthermore, access from the ground can also be facilitated with netting or other structures that come to the ground. Both timber bridges and rope ladders have been used successfully for primates in Kenya and South Africa (Donaldson and Cunneyworth 2015; Linden *et al.* 2020), although neither study spanned a 4-lane highway.

The width of the A8 duplication is problematic as the longest canopy bridges in Kenya and South Africa span relatively narrow two-lane roads and thus the behavioural willingness of primates to cross 4-lanes is unknown. From an engineering perspective, a 4-lane span is feasible, as single-span canopy bridges in Australia are up to 80 m in length. The inclusion of poles in the centre median was suggested during the canopy bridge workshop, however this may allow primates to climb down to the road, and unless this can be prevented, it is not recommended. Furthermore, the centre median will consist of concrete Jersey barriers, and is thus not suitable for wildlife to access.

Two important considerations in the design of the canopy bridges is that they must accommodate the weight of the primates and take into account the use of the bridges by multiple individuals. While baboons are not necessarily a target species for all bridges (as they will also use underpasses, as observed under the SGR in Tsavo National Park), designing the bridges to support multiple adult male baboons (up to 20 kg each) will ensure adequate capacity for all other species. An additional design criteria is that larger-bodied animals do not fall off as large trucks pass underneath at >100km hr^{-1}. A flattened 'U' shaped design currently being tested in South America looks very promising Figure 4.12 and is recommended for further testing on this project.

The canopy bridge should be as short as possible and be positioned within good-quality habitat for the target species. Both ends of each bridge should be tied back to at least two, and preferably three large trees to improve access and increase rate of use by wildlife.

Connecting the canopy bridges back to multiple trees builds in redundancy if some of the feeder trees collapse. Strategic revegetation around the poles and leading up to the poles is required to increase their medium-term connection to adjacent habitat. Further identification of habitat for primates and other arboreal animals is required to confidently identify optimal locations.

Poles should be accessible with an elevated work platform for inspections and maintenance and to install and maintain cameras or other monitoring equipment. A gravel hard stand beneath each pole will enable access during wetter months of the year.

A total of eight canopy bridges are proposed where the project passes through forested areas which support arboreal animals. The specific locations have not yet been identified, but will include the Kikuyu Escarpment Forest Reserve on the A8 and where the A8 South passes through the Kikuyu Escarpment Forest Reserve. Two designs of canopy bridge shall be installed as an experimental trial to test the efficacy of each design, most likely a flat ladder and a U-shaped netting. See Table 7.1 for more details.

Further details for the design of canopy bridges is provided in Table 4.5.

Figure 4.10. Canopy rope bridge across a highway (left) and on top of a land bridge (right), both in Australia

Figure 4.11. Example of the 'Squirrel Bridge' by Animex in the UK (left), an adapted overhead sign structure in Japan (middle) and simple pole structures that can be fitted to culverts and other structures. The optimal design for the diversity of arboreal animals on the A8 is yet to be determined.

Figure 4.12. Design of canopy bridge being tested for use by primates in South America and proposed for further testing on the A8 and A8South Project. This should be tested against other potential designs to evaluate use and effectiveness. Design by Fernanda Abra, ViaFauna, Brazil.

Table 4-5. Detailed design elements of canopy bridges

DESIGN ELEMENT	CONSIDERATIONS
Efficacy	— Proven in Australia, Asia, South America and for some species in Africa
Target species	— Arboreal and some semi-arboreal mammals, reptiles and amphibians
Design, dimensions and construction materials	— Consultation with local experts and field-testing is required to test different designs for relevant target species. A promising design is shown in Figure 4.12. — Rope ladders made of UV-stabilised marine-grade silver rope attached to steel cables are used in Australia for possums and gliders. — Timber structures such as bamboo poles may be suitable if supported to span the width of the road. — Bridges for monkeys in Malaysia have used sections of old fire-hose. — Rope ladders were successful for primates at Diani Beach Kenya and Brazil — The structure must be a minimum of 2 m above the height of the tallest trucks — The supports can be timber poles or trees, with poles recommended at locations where there are no suitable large trees or where the risk of damage to high-value understorey vegetation during installation or maintenance is low — Use rough-sawn timber poles where possible and avoid steel poles and smooth timber poles because they are more difficult or impossible for an animal to climb, unless a rope or netting ladder extends to the ground — In most situations, poles need to be treated to prevent rot and termite damage and extend lifespan of the pole. Non-treated poles can be used where risk of rot and termite damage is low. The cross-arm assemblies should be non-treated hardwood as this is where animals will spend most of their time.

DESIGN ELEMENT	CONSIDERATIONS
	— The ends of canopy bridges should be tied back to a minimum of two and preferably three or more large trees to increase access by wildlife — Identify important access trees adjacent to the road during detailed planning and design and ensure these are protected and retained during construction — Include hard stands at the base of poles to enable access for maintenance during wetter months — Shorter canopy bridges are better than longer ones — No artificial lighting within 500 m of canopy bridges
Landscape position, fencing and landscaping	— It is not possible to build effective fences for arboreal mammals and canopy bridges because many species are adept and excellent climbers. Therefore, install in high quality habitat, along existing corridors or movement paths and at natural pinch points — Additional poles, canopy bridge and/or tree planting may be required to connect the canopy bridge to adjacent vegetation
Furniture to encourage use and reduce the risk of predation	— Rope-ladders are more stable and provide more opportunity for wildlife to avoid aerial predators than single strands of rope. Single strands should never be used to span above the linear infrastructure — Depending on the target species, consider including shields and refuges to provide protection from aerial predators, ensuring it doesn't compromise function of the canopy bridge.
Maintenance	— Annual inspections of pole integrity, sagging or twisting of the rope ladder, connection to feeder trees and condition of predator protection is required

4.9 WILDLIFE FENCING

4.9.1 BACKGROUND

The most effective method to reduce rates of WVC and mortality of terrestrial wildlife is to install enough appropriate fencing that prevents them from accessing the highway. A recent review of the international scientific literature showed that roadside fencing that is correctly designed, installed and maintained can reduce rates of mortality by an average of approximately 50%, and up to almost 100% in some situations (Rytwinski *et al.* 2016). Fencing that is effective at reducing rates of collision with wildlife necessarily increases the barrier effect because they are designed to keep animals off the road. Therefore, wildlife fencing is typically recommended where crossing structures can also be installed.

Wildlife fencing is used to reduce the rate of WVC by preventing wildlife from entering the highway and to increase landscape connectivity by funnelling wildlife towards the crossing structures (van der Ree *et al.* 2015a). Wildlife fencing must be designed specifically for the target species to maximise its effectiveness, which in the case of this project includes small to large mammals, amphibians and reptiles. Primates in the study area are excellent climbers and are likely able to climb all designs of fencing currently available, and thus no fencing for primates is feasible or recommended. At best, the canopy bridges should be easier to climb than fences, and over time the primates will hopefully learn that they are a safer means to cross the road than by crossing the road at ground level.

The length of wildlife fencing at a crossing structure will depend on the extent of habitat in the area, the movement patterns of the target species and the occurrence of other roads accessing the highway. Where possible, wildlife fencing should be continuous through

important habitat in order to prevent wildlife from accessing the road at fence endpoints. Wildlife fencing that also acts as a property boundary fence should be connected to boundary fencing, thus providing a continuous single fence.

The ends of wildlife fencing need a specific treatment, and where possible, should be angled away from the highway to encourage wildlife to turn back, rather than simply have them move around the fence end and onto the highway. Where possible, wildlife fencing should continue past the habitat and into adjacent non-habitat before being angled back. Fencing can also terminate at natural barriers to movement, such as cliffs, rocky areas or other geographical features that limit movement of the target species.

Ensure wildlife fencing is strongly and tightly attached to the crossing structures so that animals are unable to squeeze between the fence and (for example) the abutment walls and access the highway.

Other important considerations include whether it is electrified, fence height, mesh size and whether the fence needs to be buried to prevent burrowing animals from digging underneath it. Floppy-top fencing is not recommended because it has higher maintenance requirements compared to straight fencing. Sheet metal or fine mesh may be required along the bottom to prevent smaller wildlife (e.g. frogs, reptiles, small mammals) from passing through and accessing the highway.

Wildlife fencing will usually need breaks in it to allow vehicles to access the highway, such as at intersecting roads or property access points. Where these occur, effort must be made to prevent animals from accessing the highway, such as through the use of gates, cattle grids across the intersecting road, or wildlife fencing that is run up the intersecting road for a few hundred metres. Poorly installed gates can provide a point of egress for fauna to access the highway reservation, so gaps underneath and between gates need to be minimised to prevent fauna going under them.

Where possible, wildlife fencing should be combined with property fencing to reduce the number of fences required and minimise installation and maintenance costs.

Wildlife inevitably breach fencing and so escape mechanisms are required to allow them to leave the fenced highway reservation. Further information about escape mechanisms is given in Section 4.10.

Figure 4.13. Electric fencing with wire mesh at the base and dug into the ground (left) is a standard and effective approach to controlling the movement of wildlife in East Africa, and will be installed in continuous lengths in Marula and Soysambu and in shorter

lengths at crossing structures. Photo on right shows cattle grids on low-volume roads which if wide enough can prevent wildlife movement. Modified cattle grids and/or electrified mats are proposed for use where wildlife movement across gates or access roads is required.

Figure 4.14. Care must be taken to avoid gaps under wildlife fencing, especially at gates and where fencing is attached to crossing structures. Photo Josie Stokes WSP.

Figure 4.15. Barbed wire presents a significant risk of entanglement and mortality to wildlife, such as this Squirrel Glider, and should never be used near crossing structures for at-risk species. Photo Rodney van der Ree WSP.

4.9.2 DESIGN OF FENCING

- Various types of fencing already exists along one or both sides of different sections of A8 and A8 South, including game fencing where A8 passes through Marula Estate and Soysambu Conservancy. Existing fencing that is effective will be retained where possible, and additional fencing to prevent wildlife from accessing the highway and to funnel them towards the crossing structures will be installed for the full length of where the highway passes through Soysambu Conservancy, Marula Estate and other important habitats, as well as in short lengths (up to 2 km) at all dedicated wildlife crossing structures which are not fully fenced.
- Fencing will be as suggested by KWS (2019) (i.e. 8-strand electrified, mesh to a height of 600 mm and buried to 500 mm to prevent digging animals). The height will be re-assessed prior to construction to ensure no species in the area can jump over.
- Jump outs and other escape opportunities will be provided within Marula and Soysambu to enable wildlife to escape from the highway reservation and re-enter the two conservation areas
- There will only be limited opportunities to directly access Marula and Soysambu from the highway because these locations are the weakest points in the fence and if damaged or poorly maintained they are the locations where wildlife may access the highway reservation. Such access points will be controlled through the use of cattle grids, electrified mats, automatic gates and be positioned as far from wildlife habitat as possible

Table 4-6. Detailed design considerations for wildlife fencing

DESIGN ELEMENT	CONSIDERATIONS
Efficacy	— Proven for many target species, when designed accordingly
Target species	— Designs exist for most terrestrial species including small to large terrestrial mammals, reptiles, and amphibians — Not effective for gliders as they can glide above the fence from adjacent trees and many arboreal species can climb over — Always consider unintended impacts to other species, such as entanglement and restriction of movement
Design, dimensions and construction materials	— Ensure wildlife fences are attached securely to crossing structure, such as abutment walls, ensuring wildlife are funnelled directly to crossing structure and are unable to squeeze between crossing structure and fence — Height, mesh size or impermeable material, depth buried or use of skirt is target-species specific — Mesh should not be plastic-coated as this will melt during fires — Consider placement and strength of fence in areas subject to flooding — Wildlife fencing should be integrated with property fencing to save costs, and avoid unnecessary parallel fencing — Where possible, wildlife fencing should be continuous in areas of habitat for the target species and extend past the suitable habitat into adjacent areas of non-habitat — Wildlife fences should be installed on both sides of the highway, however one side may be adequate if the source area for the target species of wildlife are only on one side — Wildlife fencing should typically include a ‘return’, an angled section of fence to encourage wildlife to turn backwards rather than move around the fence end and access the highway. Fence ends can be integrated with other infrastructure such as boundary fencing or topographical features such as cuttings — Gates must be installed as close to the ground as possible
Landscape position, fencing and landscaping	— Manage vegetation on the habitat side of the wildlife fence according to the target species and their climbing ability — A minimum clearance zone of 3 m between the wildlife fence and adjacent vegetation is required to allow movement of maintenance vehicles
Furniture to encourage use and reduce the risk of predation	— Ensure appropriate escape mechanisms (Section 4.10) where wildlife fencing is continuous for lengths that exceed half of the typical home range of the species — Escape mechanisms include one-way gates, escape ramps and drop-down poles. One-way gates require additional maintenance and are to be avoided
Maintenance	— Wildlife fencing should be inspected and repaired every 2nd year and after major flood events or wildfires

4.10 FENCE ESCAPE OPTIONS

4.10.1 BACKGROUND

Wildlife inevitably breach fencing and escape mechanisms are required to allow them to leave the highway reservation. Escape mechanisms are particularly important in areas with long-lengths of wildlife fencing; elsewhere wildlife can move to the ends of fencing to leave the highway reservation. The length of wildlife fencing where escape mechanisms are required is species-specific and dependent on their typical movement parameters. As a guide, escape mechanisms are likely required where the length of fencing exceeds their typical maximum home range length. These escape mechanisms include one-way gates or jump outs, where animals can jump down and out of the highway road reserve but not back into it (Figure 4.16). One way gates are not recommended because they have jammed open or closed in installations overseas and thus require additional maintenance to ensure they operate effectively.

4.10.2 DESIGN OF FENCE ESCAPE OPTIONS

The design of effective escape mechanisms for East African wildlife has not been investigated and can not be specified with any certainty without research. The project will undertake targeted research to identify the species most likely to require escape options and test some preliminary designs for inclusion in the final design. However, the following features are likely suitable design options for this project:

- The simplest approach is probably where wildlife can jump down and out of the highway reservation, such as where the road is built up on fill and has steep batters (i.e. a jumpout). These could be co-located with underpasses where the road must be built up to provide space for culverts of bridge underpasses.
- A retaining wall at least 2 m tall (e.g. Figure 4.16), potentially with a cross-bar structure to prevent animals from climbing up or jumping up may be effective
- Jumpouts should be placed in locations along the highway where wildlife may naturally be attracted, such as water bodies or suitable food. The attractant should be outside the road reservation to encourage wildlife to leave the reservation, and not enter it.
- Jumpouts will be required on both sides of the highway so wildlife can access the jumpout without being required to cross the road multiple times.
- The suitability and effectiveness of different jump-out designs should be tested prior to construction and/or constructed in such a way that modifications can be implemented relatively easily and cheaply.

Figure 4.16. Example of one-way gates (left) and jumpouts (middle) from the USA and Pacific Hwy NSW (right) to allow animals that breach wildlife fencing and find themselves trapped between the fence and the highway to escape. A limitation of one-way gates is that they can become stuck in the 'open' or 'closed' positions and become ineffective. Jump-outs must be designed and tested for the target and non-target species to ensure they are unable to climb up and into the highway reservation. Photos Rodney van der Ree WSP.

4.11 MITIGATING LIGHT, NOISE AND VISUAL DISTURBANCE

4.11.1 LIGHT

Design principles for road (and other) lighting are detailed in Table 4.7. These principles should be followed for the entire road alignment. The primary approach to mitigating the impacts of artificial light at night from street lights will be by not installing any street lights within areas of high quality wildlife habitat.

The table does not address vehicle lights. Screening will be required to shield light, particularly headlights, and noise from the vegetated land bridges and other important crossings.

Table 4-7 Lighting principles

	LIGHTING DESIGN PRINCIPLES	KEY REFERENCES
Siting of lights	— Utilise lighting only where necessary – consider white lining and 'cats' eyes' in other location. Use the minimum amount of light (lumens) required — Site lighting columns well away from sites of ecological value – we recommend a minimum of 500 m to landbridges and 250 m to other crossings. — Consider the height of lighting. Generally, a lower mounting height is preferred (although not always, this should be determined by a lighting designer with experience minimising impact on sensitive receptors).	— Interim Guidance: Artificial lighting and wildlife - Recommendations to help minimise the impact of artificial lighting (Bat Conservation Trust Undated). — Florida Fish and Wildlife Conservation Commission – Wildlife Lighting Criteria

	LIGHTING DESIGN PRINCIPLES	KEY REFERENCES
Fixtures	— Install fully shielded lights or fixtures to direct light down to where it is needed only, and to minimise light spill onto sites of ecological value. — Avoid using reflective surfaces under lights.	(Florida Fish and Wildlife Conservation Undated). — International Dark-sky Association website (International Dark-Sky Association Undated).
Wavelengths	— Use narrow-spectrum light sources to lower the range of species affected by lighting — Avoid white or blue wavelengths – where white light sources are required they should be of a warm colour temperature (definitely <4,200 kelvin, preferably <3,000 kelvin). — Minimise emission of ultra-violet light. — Utilise long wavelength light sources.	
Temporary fencing	— Should vegetation be utilised as a screening measure, install temporary fencing until vegetation is sufficiently mature.	

4.11.2 NOISE

The impacts of construction and operational noise on wildlife will be mitigated by:

1. Ensuring noise control protocols that are adopted in areas with sensitive receptors (e.g. schools, hospitals, residential areas) are also followed in areas of high-quality habitat for wildlife. There are currently:
   a. Day time (7h to 22 h): ambient noise before work + 3 dBA
   b. Night time (22h to 7h): IFC criteria (45 dBA) + 2 dBA
2. Where these noise control protocols are unable to be followed in high quality habitat, the construction noise should be ‘ramped up’ over a few days, allowing animals in areas immediately adjacent to the construction to move away temporarily, should they wish to do so.
3. Peaks in traffic noise are expected to decrease slightly due to a reduction in the acceleration and deceleration of traffic attempting to pass each other on the currently single-lane road. The slight increase in general operational traffic noise is not expected to be a major additional impact compared to current levels and no further mitigation is required, except at wildlife crossing structures.
4. Subject to feasibility to be determined during detailed design, the impacts of traffic noise will be mitigated primarily through the use of noise walls and/or soil berms at the dedicated wildlife crossings (see Section 4.11.3), and to a lesser extent through the use of vegetation plantings and light walls in lower priority areas.

4.11.3 VISUAL DISTURBANCES

The impacts of visual disturbance on wildlife shall be mitigated in areas of high-quality habitat for wildlife through:

1. The planting and maintenance of screening vegetation along the road edge / fenceline, limiting the distance that the road is visible from and the distance that vehicle headlights can penetrate into adjacent areas
2. Construction of noise and light screens at wildlife crossings and the approaches to the wildlife crossings. This is particularly important at the high priority crossings to enable more sensitive wildlife species to approach and use the crossing structures. Further details of the noise and light screens is given in Sections 4.3 to 4.7

4.11.4 OTHER DISTURBANCES

Other disturbances to wildlife occur through the use of WCS by people to cross the highway or the use of underpasses or areas close to WCS by people for shelter. Further disturbance or impacts occur through poaching and bushmeat hunting.

The impacts of people using WCS for crossing the road or shelter will be avoided and mitigated by:

1. Allowing people to use specific structures and discouraging them from using the dedicated WCS. Where use is combined, people and livestock will either be restricted to an adjacent culvert or restricted to a narrow pathway on one side of the crossing structure that is screened from the wildlife area. Large rocks or other structures will be strategically placed on the landbridges to prevent vehicle access.
2. Placing many of the WCS in areas of protected land that has wildlife conservation as a primary goal will help to ensure that the WCS and adjacent lands will be managed primarily for wildlife, and managers will be provided with specific instructions that detail allowable activities near to each WCS.

Poaching and bushmeat hunting is not expected to increase as a result of the highway upgrade because it is already a well-travelled road and traffic volume will increase after construction, further discouraging illegal activities. Nevertheless, poaching and bushmeat hunting will be discouraged by:

1. Constructing wildlife fencing in the conservation areas that limit easy access by poachers and securely attaching the fencing to the WCS
2. Regular and frequent monitoring of fencing by managers of adjacent conservation lands and the Kenya National Highways Authority (KeNHA)

4.12 SIGNAGE

Signage to alert motorists to the presence of wildlife and the risk of WVC has limited success at modifying driver behavior because motorists soon ignore the signs. This occurs for a variety of reasons, including that drivers rarely see wildlife near such signs and therefore do not equate a high risk with such signs, especially the standard warning signs (i.e. with black stencil of wildlife) (i.e. Figure 4.17). However, signs that are more interactive or informative, such as those that are triggered when wildlife are detected nearby, or signs that are regularly updated with the number of recent WVC appear to result in an albeit small reduction in vehicle speed for a longer period of time (Huijser *et al.* 2015).

Signage warning drivers of the risk of WVC will be installed along the highway however it will not be relied upon as a primary method to reduce the rate and severity of WVC. Fencing and crossing structures will be the primary method, and signage a secondary method.

Figure 4.17. Standard wildlife warning signs are largely ineffective at reducing the rate of wildlife-vehicle collision and are therefore an additional and secondary approach to reduce WVC on this project

5 MANAGEMENT AND MAINTENANCE OF MITIGATION MEASURES

The ongoing management of wildlife crossing structures is critical to the long-term success of the project and the ongoing survival of wildlife. The management of the crossing structures must:

1. Prevent people from using the structures for shelter, storage of equipment or any other use that may discourage wildlife from using them to cross the highway. Particular focus and effort must be given to prevent people from using the structures as locations to poach or hunt wildlife for meat. The design and position of wildlife fencing at crossing structures is a key determinant (see Section 4.8)
2. The crossing structures must be managed for their primary intended purpose, which is primarily wildlife passage for the dedicated crossing structures and a combination of uses, including wildlife movement, in the multi-use structures.
3. The maintenance activities must include an assessment of the structural integrity of the wildlife crossing structures and fencing, as well as the ecological condition and function. Inspection and maintenance of the ecological condition means:
   - Ensuring the vegetation on the approaches to the crossing structures and on the land bridges are suited to the target species
   - Avoid excessive clearing of soil and other debris within underpasses which may reduce the ecological suitability of the structure
   - Ensuring additional barriers, such as fencing, tracks and roads are not built in front of crossing structures, limiting access to the structure

6 MONITORING AND EVALUATION

The monitoring and evaluation of the use and effectiveness of the various mitigation measures deployed on this project is critical to adaptively managing the mitigation measures to achieve successful biodiversity outcomes and also improving the design of future road, rail and other linear infrastructure projects.

It is beyond the scope of this report to specify in detail the methods and study design that will be used to evaluate the use and effectiveness of the different mitigation measures. A detailed monitoring and evaluation plan will be prepared prior to the commencement of construction of this project. What follows is a brief outline of some of the questions, methods and study designs that should be considered. A key guiding principle in designing the monitoring and evaluation program is a focus on gathering robust and reliable evidence to confidently answer important questions about use and effectiveness. Further information to guide the monitoring and evaluation are provided in (Van der Grift *et al.* 2015; Van der Grift and van der Ree 2015; van der Ree *et al.* 2015b).

The proponent will establish a reference and implementation committee with representatives from KWS, KenHA, the adjacent conservation land managers, relevant wildlife conservation NGOs (e.g. Giraffe Conservation Foundation, Ewaso Lions and Grevy's Zebra Trust, Endangered Wildlife Trust) and ecologists with expertise in road ecology and linear infrastructure studies to develop and implement the monitoring and evaluation program. This committee should commence in the pre-construction period. Importantly, this highway project is an excellent opportunity to support post graduate research programs at a Masters and PhD level to do research on the impacts of highway upgrades and simultaneously meet any reporting requirements.

The proponent should commit to at least five years of detailed evaluation of both the rate of use of crossing structures and their effectiveness at achieving population outcomes for wildlife. The rate of use will be measured through the use of cameras deployed at both entrances to each WCS as well as facing the approaches to the crossing structures to determine the relative abundance of species to use the structures. This will enable an evaluation of the suitability for use of crossing structures by measuring the abundance of animals that are nearby and may use the structures, as well as those that approach and turn around.

These studies will continue for at least five years, and consideration will be given for longer durations if key species are yet to use the structures. Studies from Europe and North America have shown that a period of five to 10 years is required for some species to use WCS.

The monitoring will also quantify the rates of WVC in order to assess the effectiveness of fencing for all species of wildlife. Roadkill monitoring will not be used to evaluate the WCS, just to assess the effectiveness of fencing. Roadkill monitoring will be undertaken at two scales – for the first five years monitoring will be through standardised surveys by RVHL road maintenance crews following specified protocols (e.g. Collinson *et al.* 2014). After that, the RVHL road maintenance crews will record all roadkill that they clean up, plus any they incidentally observe during routine maintenance tasks. Data collected will be a combination of the results of the drive-by surveys as well as records of any collisions they attend. All data will be collected using an appropriate mobile phone application and regular training for the staff to identify species will be provided. Unfortunately, there is no baseline roadkill data against which future roadkill rates can be assessed – however the information collated to date indicate that rates of roadkill are currently low.

The population-level effect of the crossing structures is an important measure of success because it demonstrates how well the package of mitigation works is contributing to conservation benefits for the species. The scope and cost for this work is difficult to specify without further investigation of existing data sets and capacity of suitable partners to undertake this research. The project should set aside some money on an annual basis for the first ten years to contribute to research projects that investigate the population-level effects of the road and mitigation and use this commitment to leverage additional funds from a range of partners and donors to undertake this work. This approach is using funds for research as an additional compensatory tool to improve outcomes on this project and equally importantly to improve the planning, design and implementation of future road and rail projects in Kenya and Africa more generally. There are a range of questions and methods that could be employed to assess population-level success, including:

- Rates of movement and purposes of movement across the highway. This could be done for a select group of species that are of conservation concern or are expected to be representative of other species. A good example of one approach to this was the tracking of Elephants around the SGR in Tsavo National Park (Okita-Ouma *et al.* 2021).
- Rate of gene flow across the highway for certain species, such as Giraffe. This should be implemented for species for whom gene flow is a concern or where measurements of gene flow are expected to yield important data. These studies should be done in collaboration with relevant research centres or NGOs (e.g. Giraffe Conservation Foundation if Giraffe are studied)
- Changes in the size of the population on one or both sides of the highway. This can be cost-effectively implemented at Soysambu and Marula as these areas undertake regular aerial censuses of their wildlife populations anyway
- Changes in the rate of survival or longevity of key species, which require the marking and identification of individual animals and following them over time.

A key consideration in all monitoring and evaluation programs is to have a scientifically robust study design. This simply means collecting data in such a way as to maximise the ability to detect an effect of the highway or mitigation, should one exist. In practice, these means collecting data before and after mitigation, and to do this at sites being mitigated and at sites without mitigation. For example, measuring changes in gene flow is best done by measuring genetic diversity before the upgrade and after the upgrade, and doing this at the A8 and other nearby roads that are not being upgraded so any changes can be attributed to the work on the A8. Similarly, trying to quantify the effectiveness of fencing at reducing rates of WVC ideally requires the collection of roadkill data before and after the fences are installed at locations with fencing and locations without fencing.

As explained at the beginning of this section, monitoring and evaluation is an important part of the project and one that should be planned for, budgets set aside and implemented as early as possible in the process. If left until after the road is completed, any opportunity to collect ‘before’ data has passed, and the ability to accurately and reliably measure success has been severely curtailed.

7 LOCATION OF WILDLIFE CROSSING STRUCTURES AND FENCING

Wildlife crossing structures and fencing are proposed for areas along the alignment where the highway dissects or passes close to wildlife habitat. The specific locations are shown in Table 7.1 below and a description of each crossing in the following sections.

The following criteria were used to classify each location and are used in Table 7.1.

Importance for connectivity was derived from the Connectivity Modelling analysis conducted by UoN.

Ecological priority was determined by considering the diversity and abundance of wildlife in the area and the current and potential future extent, quality and tenure of habitat in the area

Expected use of a structure was classified as a priority for wildlife (i.e. high priority) or incidental (low priority).

Structure type describes the type and size of the structure – e.g. vegetated land bridge, bridge underpass, box culvert, canopy bridge, etc. The size of a structure is always given in metres, and describes the cross-section of the structure from the perspective of wildlife using it (H x W x L).

Structure focus describes whether the structure is being designed and constructed specifically for wildlife (i.e. dedicated wildlife crossing) or whether it is intended to function for other purposes in addition to the movement of wildlife, such as drainage or the movement of people and livestock (i.e. multi-use).

Incidental multi-use structures are essentially drainage structures or people/livestock underpasses that are slightly modified to also help some wildlife

Intentional multi-use structures are drainage structures and people/livestock underpasses that are specifically planned, designed and managed to also function effectively for wildlife. This typically means the inclusion of a culvert cell that is specifically for people and livestock to keep people and wildlife separate or building a large open span bridge and keeping people and livestock to one side.

Important considerations in determining the location and design of crossing structures were the land tenure and management considerations outlined in Section 3.4.7. These considerations focus on the long-term security of land tenure for conservation and the ability to audit the use of such land for conservation purposes. Despite being important from a wildlife conservation perspective, Marula Estate and Soysambu Conservancy are not protected in perpetuity to the same extent as the KWS land, and the number and size of WCS in these areas reflects this significant constraint. Indeed, the recent sale of land on the east side of the A8 by Soysambu, which occurred between the commencement of this project, highlights the rapid changes in land ownership and land-use in the study area.

Table 7-1. Details of wildlife crossing structures for the Project. Crossings 1 to 15 originally proposed by KWS (see Table 3.1 for preliminary suggested design) and other crossings were identified during the ESIA.

Road Section	WCS ID#	Chainage	Location	Relative importance for connectivity*	Ecological priority**	Expected use (intentional or incidental)	Structure focus (dedicated or multi-use)	Final recommendation (Width x height)
Section 1 - A8	**1**	22825	Kikuyu Escarpment Forest Reserve (Kijabe)	Medium (23.3)	High	Intentional	Dedicated	-Maintain the existing structure (10 m x5 m) for multiple use by wildlife, people, livestock -Install new 5 m x 3.5 m dedicated wildlife underpass -Add fencing, revegetation and landscaping to existing and new WCS
Section 1 - A8	**2**	~25325	Kikuyu Escarpment Forest Reserve (Kijabe)	Medium (21.6)	High	Intentional	Dedicated	-Maintain existing structure (4.5 m x 4 m) for multiple use by wildlife, people, livestock -Install new 5 m x 4.5 m dedicated wildlife underpass -Add fencing, revegetation and landscaping to existing and new WCS
Section 1 - A8	**16**	22700 to 29000	Kikuyu Escarpment Forest Reserve	NA (arboreals)	High	Intentional	Dedicated	-Install 4 canopy bridges (approx. 1 per 1.5 km of road) in this location -Precise location and design to be confirmed
Section 1 - A8	**17**	42900	Kinungi – existing waterway crossing	Very low (5.5)	Low	Incidental	Multi-use	-Maintain existing structure 2.5 m x 2.5 m -Add fencing, revegetation and landscaping to existing WCS
Section 1 - A8	**3**	53375	Naivasha East - KWSTI	Low (12.1)	High	Intentional	Dedicated	-Install new 20 m x 7 m underpass for Giraffe. -Underpass proposed to minimise noise and light effects from adjacent developments and nearby interchange. -Add fencing, revegetation and landscaping to new WCS
Section 2 - A8	**18**	59710	Existing Karati River crossing	Low (18.1)	Low	Incidental	Multi-use	-Maintain existing structure and build same structure under new carriageway with 5 m separation between two bridges -Add fencing, revegetation and landscaping to existing and new WCS
Section 2 - A8	**19**	64710	Existing Melawa River crossing	High (39.9)	Low	Incidental	Multi-use	-Maintain existing structure and build same structure under new carriageway with 5 m separation between two bridges -Add fencing, revegetation and landscaping to existing and new WCS
Section 2 - A8	**4**	69235	Marula Estate	High (38.1)	High	Incidental	Multi-use	-Maintain and extend existing 3 m x 2.5 m underpass under new carriageway. -Add/re-align fencing if required, revegetation and landscaping to existing and new WCS to enhance use by wildlife

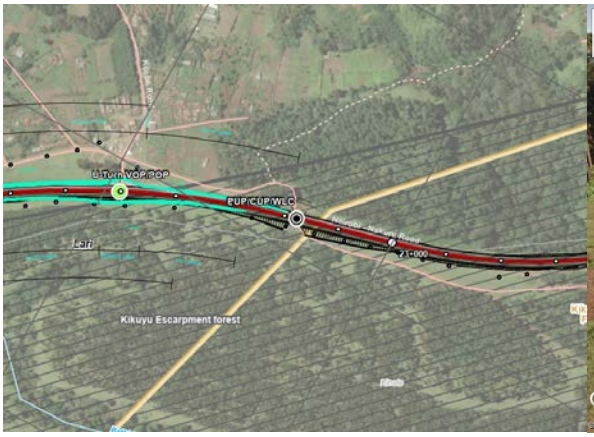
Section 2 - A8	**5a**	70220	Marula Estate	High (34.7)	High	Intentional	Multi-use	-Maintain and extend existing 5 m x 4 m underpass under new carriageway -Add/re-align fencing if required, revegetation and landscaping to existing and new WCS to enhance use by wildlife
Section 2 - A8	**7**	73705	Kigio (Marula Estate)	High (35.5)	High	Intentional	Multi-use	-Maintain and extend existing 5 m x 4 m underpass under new carriageway. -Install new multi-use 7 m x 3.5 m underpass under both carriageways -Add/re-align fencing if required, revegetation and landscaping to existing and new WCS to enhance use by wildlife
Section 2 - A8	**8**	76180	Gilgil River (Marula Estate)	Medium (26.3)	High	Intentional	Multi-use	-Maintain existing 3-cell culvert under existing carriageway -Install 8 m x 3.5 m underpass under new carriageway with 2 m gap between carriageways -Add/re-align fencing if required, revegetation and landscaping to existing and new WCS to enhance use by wildlife
Section 2 - A8	**10**	92040 and 92250	Elmenteita-Kariandusi	Medium (24.0)	High	Intentional	Multi-use	-Maintain and extend existing 5 m x 3 m culvert at CH92040 under new carriageway -Maintain and extend twin cell 2.5 m x 2.5 m culvert at CH 92250 under new carriageway -Add/re-align fencing if required, revegetation and landscaping to existing and new WCS to enhance use by wildlife
Section 2 - A8	**13**	104665	Soysambu Conservancy	Very high (82.2)	Moderate – adjacent land sold	Intentional	Multi-use	-Maintain and extend existing 5 m x 3.5 m underpass under new carriageway. -Add/re-align fencing if required, revegetation and landscaping to existing and new WCS to enhance use by wildlife
Section 2 - A8	**14**	106215	Soysambu Conservancy	Very high (68.1)	Moderate – adjacent land sold but waterway retained	Intentional	Multi-use	-Maintain and extend existing 5 m x 3.5 m multi-use underpass under new carriageway. -Maintain and extend existing twin cell drainage culvert (3 m x 2.5 m) under new carriageway -Add/re-align fencing if required, revegetation and landscaping to existing and new WCS to enhance use by wildlife
Section 4 - A8	**21**	153820	Existing waterway crossing	Very low (0)	Moderate – waterway through private land	Incidental	Multi-use	-Maintain and extend existing 15 m x 4 m bridge on waterway under new carriageway. -Assess hydrology requirements and if feasible, install ledge/shelf on one side of bridge for pedestrians and 2nd ledge or shelf on opposite side for wildlife -Add/re-align fencing if required, revegetation and landscaping to existing and new WCS to enhance use by wildlife

Section 4 - A8	**23**	166600 to 168200	Koibatek forest in Mount Londiani Forest Reserve.	Very low (0)	High	Intentional	Dedicated	-Install new 10 m x 5 m underpass for wildlife, specifically elephants -Add/re-align fencing if required, revegetation and landscaping to new WCS to enhance use by wildlife
Section 4 - A8	**24**	162600 - 168200	Koibatek forest in Mount Londiani Forest Reserve.	NA	High	Intentional	Dedicated	-Install 4 canopy bridges (approx. 1 per 1.5 km of road) in this location -Precise location and design to be confirmed
Section 5 - A8South	**29**	51500	Corridor between KWSTI and Lake Naivasha	Low (17.8)	Very high	Intentional	Dedicated	-Install 40 m wide vegetated landbridge -Install noise and light walls on edge of landbridge and on approaches to landbridge. -Add/re-align fencing if required, revegetation and landscaping to new WCS to enhance use by wildlife

* Sum of movement probability index using favorable scenario Zebra, Giraffe, Buffalo

** Based on land tenure, habitat, wildlife

7.1 WCS 1: CH22825



Context

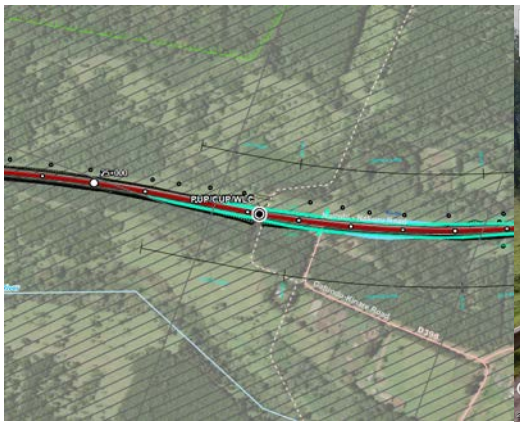
Existing structure is a 10 m wide x 5 m high underpass for livestock, pedestrians and farm/forestry machinery where road is raised on extensive fill. A8 passes through Kikuyu Escarpment forest which is a large area of forest to the east and west of the road with extensive wildlife populations.

Recommendation

Maintain existing underpass for people, livestock, machinery and incidental wildlife use. Install dedicated box culvert 5 m wide x 3.5 m tall for wildlife a minimum of 250 m from the multi-use underpass.

Install wildlife fencing from ~CH22400 to CH29000. Undertake landscaping and revegetation to enhance use by wildlife.

7.2 WCS 2: CH25325



Context

Existing structure is a single cell culvert (4.5 m wide x 4 m tall) for people, livestock and machinery where road is on extensive fill. A8 passes through Kikuyu Escarpment forest which is a large area of forest to the east and west of the road with extensive wildlife populations.

Recommendation

Maintain existing underpass for people, livestock, machinery and incidental wildlife use. Install dedicated box culvert 5 m wide x 4.5 m tall for wildlife a minimum of 250 m from the multi-use underpass.

Install wildlife fencing from ~CH22400 to CH29000. Undertake landscaping and revegetation to enhance use by wildlife.

7.3 WCS 16: CH ~22700 – 29000

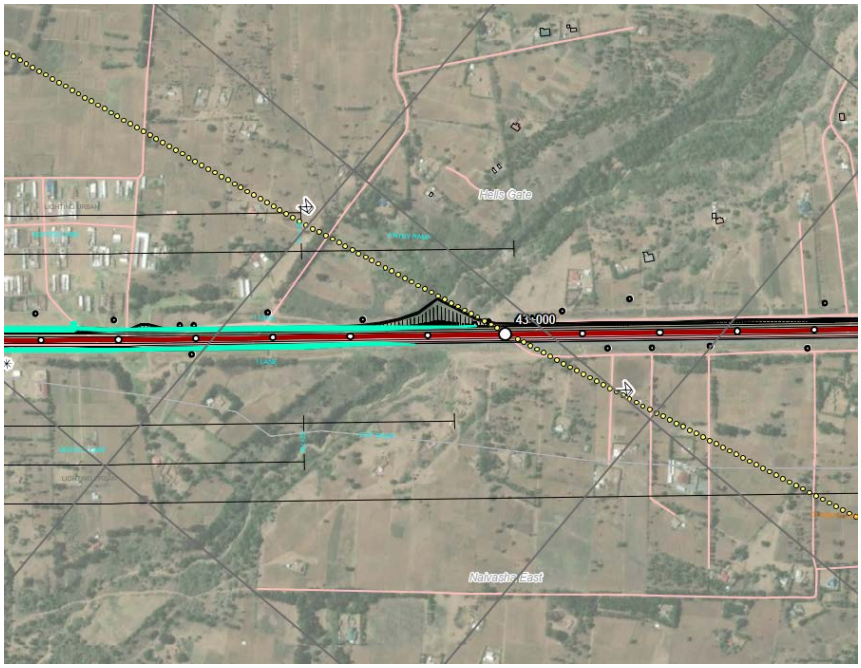
Context

A8 passes through Kikuyu Escarpment Forest Reserve with connections to extensive areas of forest to east and west of A8.

Recommendations

Install four canopy bridges (approximately one every 1.5 km of highway) for arboreal species of wildlife through the Kikuyu Escarpment Forest Reserve. The confirmation of the exact location and design is dependent upon confirmation of suitable target species of wildlife in the forest, sufficiently large trees close to the highway and the development and testing of approved designs. These four canopy bridges may be moved to elsewhere on A8 or A8South.

7.4 WCS 17: CH42900



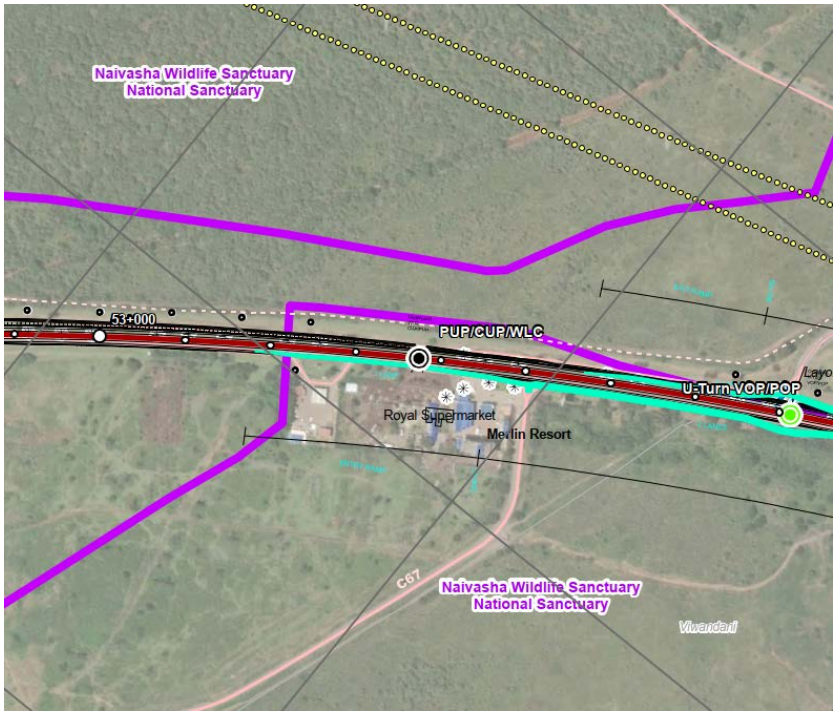
Context

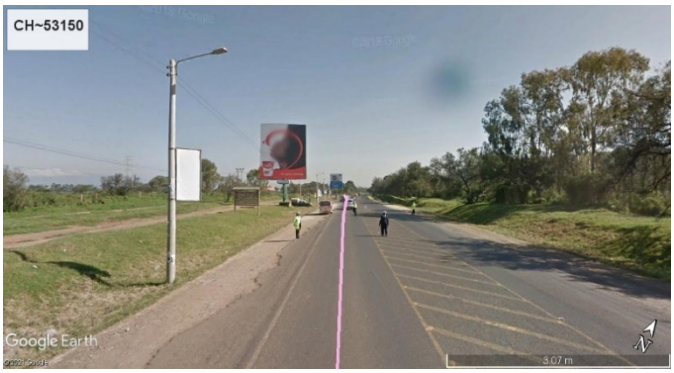
Waterway crossing through 2.5m x 2.5m culvert under A8 that supports wooded vegetation and provides landscape linkage through private agricultural and pastoral land.

Recommendation

Maintain existing and extend under new carriageway as incidental multi-use structure for occasional water flow and wildlife. Add fencing, landscaping and revegetation to enhance use by wildlife.

7.5 WCS3: CH53375





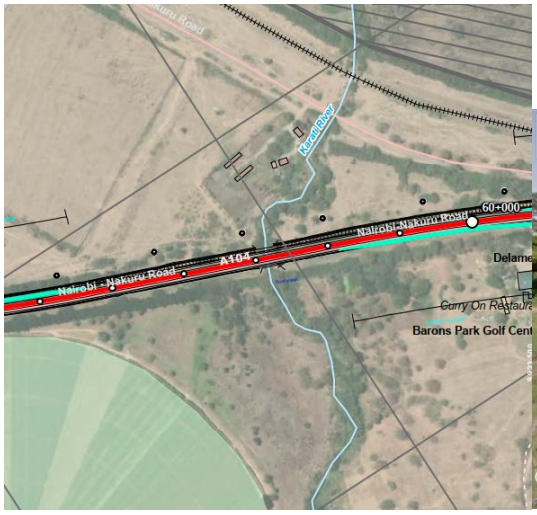
Context

Crossing across A8 to connect Naivasha Wildlife Sanctuary and the Kenya Wildlife Service Training Institute (KWSTI). Important linkage from Lake Naivasha across A8South and A8 to the east. Includes large areas of secure conservation land and extensive wildlife populations, including Giraffe. Existing powerlines, petrol station, hotel and streetlighting, and new interchange proposed for CH 53800.

Recommendations

Install large underpass 20 m wide x 7 m tall for Giraffe and other species. Maintain and enhance fencing if required, and use noise and light walls above underpass and on approaches to underpass to protect Giraffe from disturbance. Adjust position of street lighting if it interferes with underpass. Add fencing, landscaping and revegetation to enhance use by wildlife.

7.6 WCS 18: CH 59710



Context

Karati River crossing under A8 that supports wooded vegetation and provides landscape linkage through agricultural and pastoral land.

Recommendation

Replicate existing structure under new carriageway with 5 m separation between carriageways to allow sunlight and rain to penetrate and support natural vegetation growth. Separation also reduces tunnel effect for wildlife. Add fencing, landscaping and revegetation to enhance use by wildlife.

7.7 WCS 19: CH64710

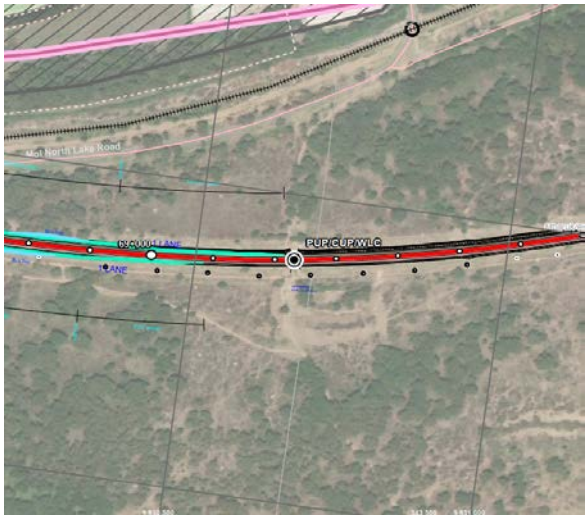
Context

Melawa River crossing under A8 via a bridge that supports wooded vegetation and provides landscape linkage through agricultural and pastoral land.

Recommendation

Replicate existing structure under new carriageway with 5 m separation between carriageways to allow sunlight and rain to penetrate and support natural vegetation growth. Separation also reduces tunnel effect for wildlife. Add fencing, landscaping and revegetation to enhance use by wildlife.

7.8 WCS 4: CH69235



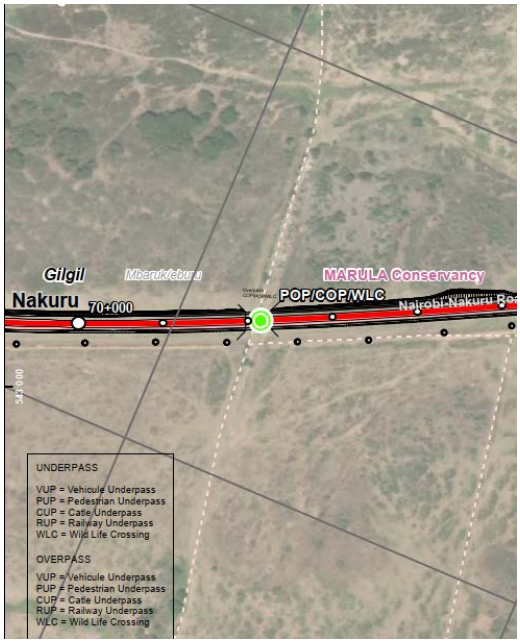
Context

In Marula Estate, A8 is on fill and this location has an existing underpass 3 m wide x 2.5 m tall. Existing fence and locked gate. Currently used by livestock, pedestrians and farming.

Recommendation

Low feasibility location due to private land on both sides of road. Extend existing underpass with same dimensions under new carriageway. Add/re-align fencing if required, revegetation and landscaping to existing and new WCS to enhance incidental use by wildlife.

7.9 WCS 5A: CH70220



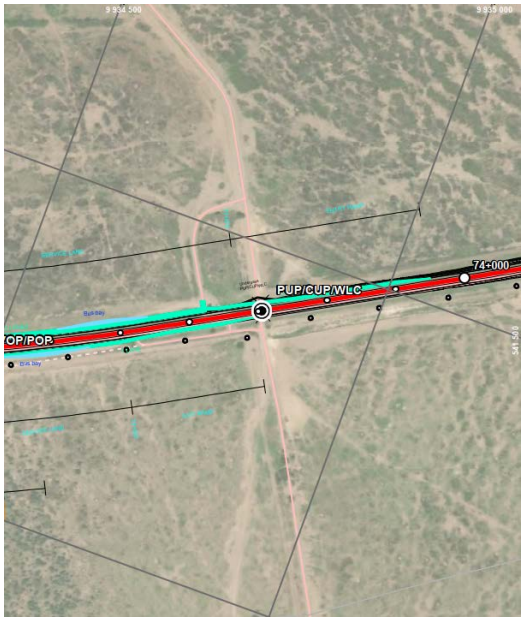
Context

In Marula Estate, A8 is on fill and this location has an existing underpass 5 m wide x 4 m tall, currently used for livestock, pedestrians and farming. Existing fencing and gate on west side of road.

Recommendation

Low feasibility location due to private land on both sides of road. Extend existing underpass with same dimensions under new carriageway. Add/re-align fencing if required, revegetation and landscaping to existing and new WCS to enhance use by wildlife.

7.10 WCS7: CH73705



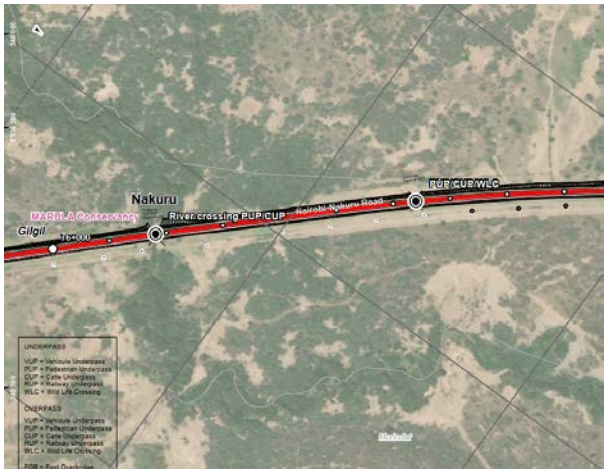
Context

In Marula Estate, A8 is on fill and this location has an existing underpass 5 m wide x 4 m tall, currently used for livestock, pedestrians and farming. Existing fencing and gate being built on west side of road.

Recommendation

Low feasibility for dedicated WCS due to private land on both sides of road. Existing underpass to be extended under new carriageway and new multi-use underpass 7 m wide x 3.5 m tall to be installed for wildlife, livestock, pedestrians and farm machinery. Add/re-align fencing if required, revegetation and landscaping to existing and new WCS to enhance use by wildlife.

7.11 WCS8: CH76180



Context

In Marula Estate, A8 is on fill and this location has an existing 3-cell culvert for Gil Gil river crossing. Outer cells 3 m x 3 m and middle cell 3 m wide x 5 m tall. Currently used for livestock, pedestrians and farming. Existing on west side of road.

Recommendation

Low feasibility location due to private land on both sides of road. Maintain existing underpass and build 8 m x 3.5 m underpass under new carriageway that is more open for wildlife with 2 m separation between two carriageways. Add/re-align fencing if required, revegetation and landscaping to existing and new WCS to enhance use by wildlife.

7.12 WCS 10: CH 92040 AND CH 92250

Context

A8 is on fill in this area and there is an existing single cell multi-use culvert (at CH 92040) that is 5 m wide x 3 m high and a twin cell culvert (at CH 92250) for drainage that is 2.5 m x 2.5m.

Recommendation

Extend existing underpass at CH 92040 and CH 92250 with same dimensions under new carriageway. Add/re-align fencing if required, revegetation and landscaping to existing and new WCS to enhance use by wildlife.

7.13 WCS13: CH104665

Context

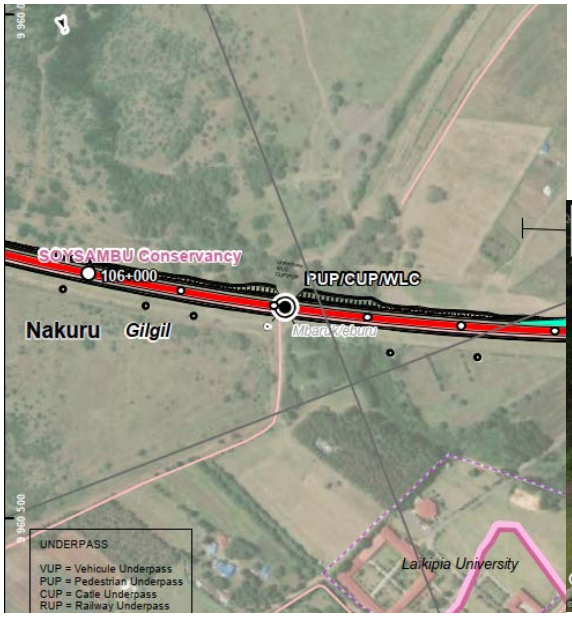
A8 is on fill in this location with existing 5 m wide x 3.5 m tall culvert for livestock, pedestrians and farm use by Soysambu conservancy.

Recommendation

Low feasibility location due to private land on both sides of road and sale of land on east side of road for intensive private development.

Extend existing underpass with same dimensions under new carriageway. Add/re-align fencing if required, revegetation and landscaping to existing and new WCS to enhance use by wildlife.

7.14 WCS14: CH106215



Context

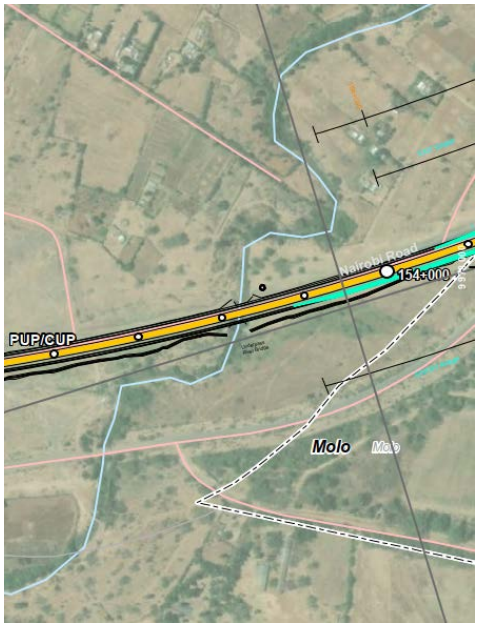
A8 on extensive fill and large culvert (5 m wide x 3.5 m tall) for livestock, vehicles and pedestrians, plus twin cell culvert (3 m wide x 2.5 m tall) at waterway. Both sides of road fenced. Land on east side of A8 at this location has been sold and will be developed. This waterway has been retained a spart of Soysambu conservancy.

Recommendation

Low feasibility location due to private land on both sides of road and sale of land on east side of road for intensive private development.

Extend existing underpasses with same dimensions under new carriageway. Add/re-align fencing if required, revegetation and landscaping to existing and new WCS to enhance use by wildlife.

7.15 WCS 21: CH153820



Context

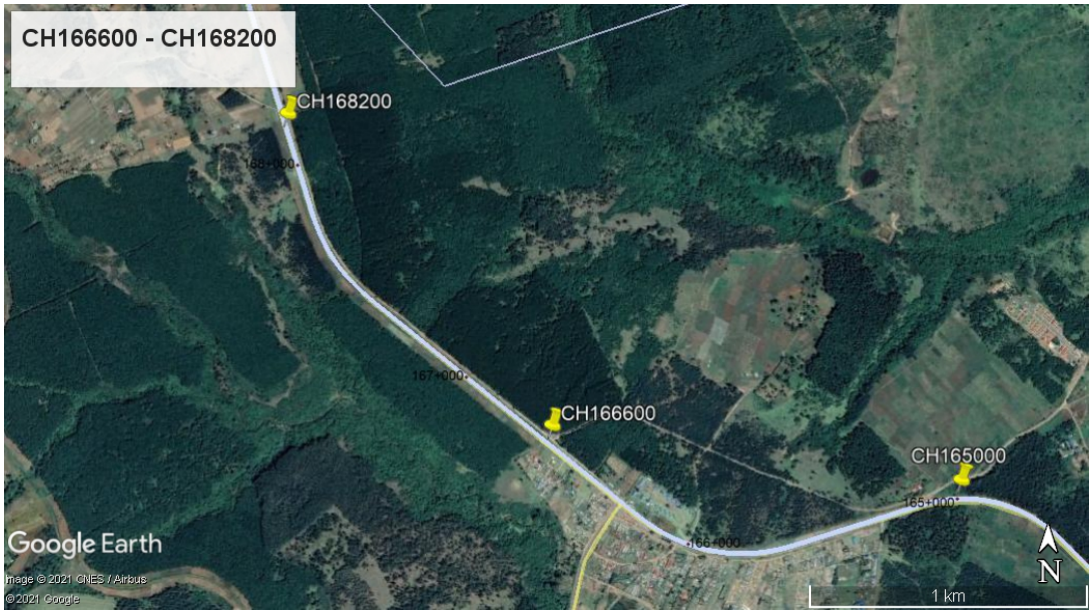
A8 is on extensive fill and existing crossing (15 m wide x 4 m tall bridge) of waterway passing through agricultural land. School nearby and request for pedestrian crossing at this structure for school children.

Recommendation

Maintain and extend existing crossing under new carriageway. Undertake hydrological study and if feasible, install ledge or shelf for pedestrian use and second ledge or shelf on opposite side for wildlife use.

Add/re-align fencing if required, revegetation and landscaping to existing and new WCS to enhance use by wildlife.

7.16 WCS23: CH166600 TO CH168200



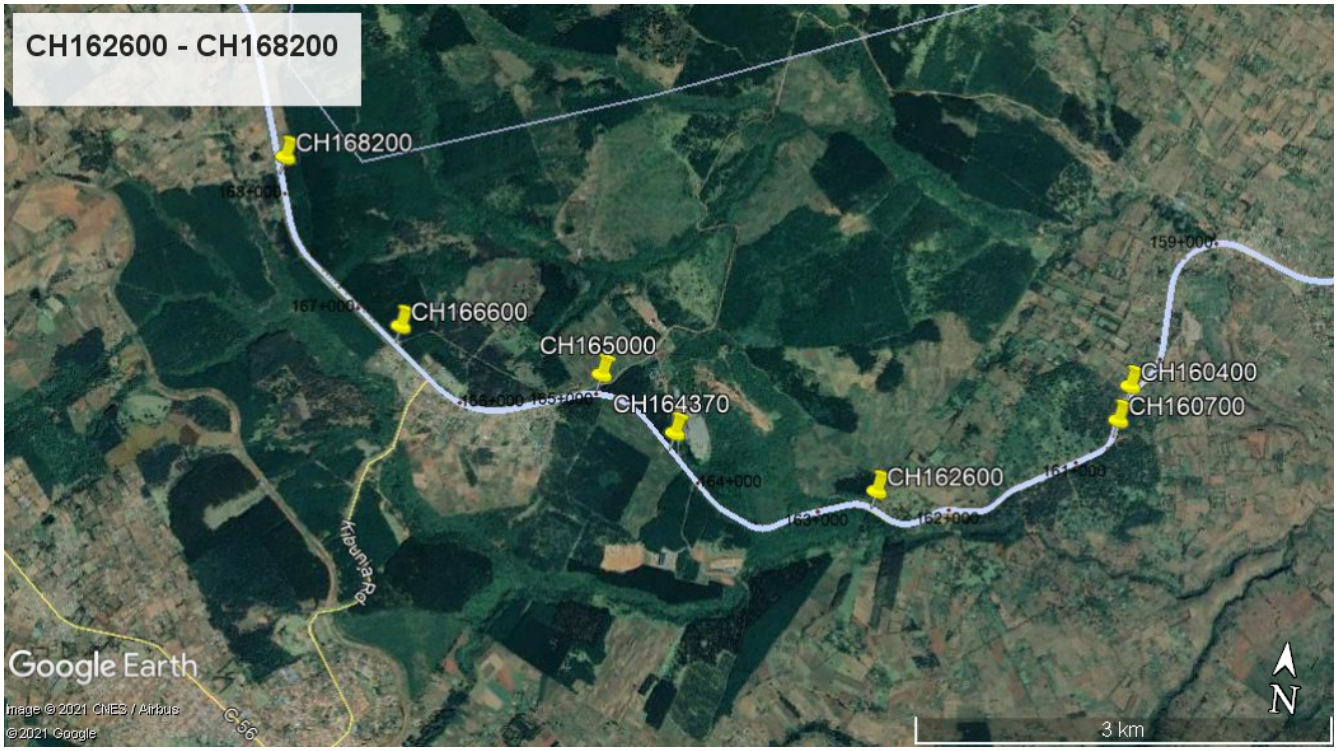
Context

A8 passes through Koibatek Forest in Mount Londiani Forest Reserve, an extensive area of potential habitat which has recently had elephant sightings. The forest includes a mix of tree species and some commercial harvesting. The A8 is either at grade or in cuttings or on the side of a hill through much of this area.

Recommendation

Install a 10 m wide x 5 m high underpass for wildlife, specifically elephants. Install fencing on both sides of the road to funnel elephants and other wildlife to the underpass. Undertake revegetation and landscaping to WCS to enhance use by wildlife.

7.17 WCS24: CH162600 – CH168200



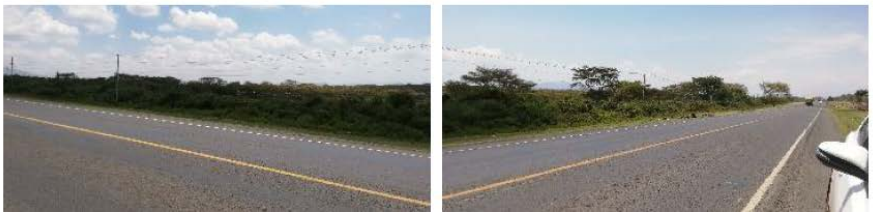
Context

A8 passes through Koibatek Forest in Mount Londiani Forest Reserve, an extensive area of potential habitat. The forest includes a mix of tree species and commercial harvesting. The A8 is either at grade or in cuttings or on the side of a hill through much of this area.

Recommendations

Install four canopy bridges (approximately one every 1.5 km of highway) for arboreal species of wildlife through Mount Londiani Forest Reserve. The confirmation of the exact location and design is dependent upon confirmation of suitable target species of wildlife in the forest, sufficiently large trees close to the highway and the development and testing of approved designs. These four canopy bridges may be moved to elsewhere on A8 or A8South.

7.18 WCS29: CH51500 (A8 SOUTH)



Context

A8 South passes through an active wildlife dispersal corridor from Lake Naivasha to the KWSTI with numerous roadkills. A8 is mostly at grade through this location.

Recommendation

Install a 40 m wide vegetated landbridge to accommodate all species in the area, including Giraffe, Buffalo, Eland, Zebra etc. This landbridge on A8South is critical to the function of the underpass (WCS3) on A8. Install noise and light walls on edge of landbridge and on approaches to land bridge. Add/re-align fencing if required, revegetation and landscaping to existing and new WCS to enhance use by wildlife.

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8 APPENDIX 1. ANECDOTAL RECORDS OF WILDLIFE-VEHICLE COLLISSIONS FROM NATIONAL MUSEUM OF KENYA

PROJECT AREA	SPECIES IMPACTED (COMMON NAME)		COMMENTS
Limuru/Upland/Rironi area	Monkeys (vervet and/or Sykes')	*Cercopithecus spp*	Commonly crashed by vehicles
	Northern Greater Galago	*Otolemur garnettii*	Rare
	Maned Rat	*Lophiomys imhausi*	Commonly killed
	Horseshoe Bat	*Rhinolophus spp*	Rare
	Large-eared free-tailed bat	*Otomops martiensseni*	Very rare
	Four-toed hedgehog	*Atelerix albiventris*	Very commonly killed
Karai-Naivasha	Mole Rats	*Tachyoryctes spp*	Commonly killed
	Scrub Hare	*Lepus saxitilis*	Commonly killed
	Short-snouted elephant shrew	*Elephantalus brachyrynchus*	Rare
Gilgil/Elmentaita	Olive Baboon	*Papio anubis*	Very commonly killed
	Common warthog	*Pharcocherus africanus*	Rare
	Plains Zebra	*Equus quagga*	Common
	Common eland	*Taurotragus oryx*	Very rare
	Aardvark	*Orycteropus afer*	Commonly killed
	Vervet monkey	*Chlorocebus pygerythrus*	Common
	East African springhare	*Pedestes surdaster*	Rare but easily isolated by road
	Silverbacked jackal	*Canis mesomelas*	Commonly killed
	African striped weasel	*Poecilogale albinucha*	Commonly killed as they scavenge
	Leopard and Lion	*Panthera spp*	Leopard commoner than Lion

	Cheetah	*Acinonyx jubatus*	Rare
	Serval	*Leptailurus serval*	Fairly common
	African civet	*Civettictis civetta*	Common as they scavenge
	Spotted hyena	*Crocuta crocuta*	Very commonly killed as they scavenge on road kills
	White-tailed mongoose	*Ichneumia albicauda*	Commonly killed
Salgaa-Sachangwan-mau summit	East African mole-rat	*Tachyoryctes naivashae (splendens)*	Endemic; commonly killed when dispersing on land
	Kerbis Peterhans's wood mouse	*Hylomyscus kerbispeterhansi*	Endemic: rare
	Small-footed forest mouse	*Hylomyscus endorobae*	Rare

APPENDIX

9-1 *DETAILED CONSEQUENCE SCORING*

Factor	People					Environment	Financial		
Degree	**Health and safety**	**Social**	**Reputation**	**Quality of service**	**Governance**	**Physical**	**Cost of Restoration**	**Legal/ litigation**	**Economy**
1- Very low	First aid	No tangible impact on society	Localised temporary impact on public opinion	No tangible impact to services	No changes to management required	No adverse effects on natural environment. Localised to point source. No recovery required	Little financial loss or increase in operating expenses	No litigation and/or legal action	No effect on the broader economy
2- Low	Minor injury, medical treatment with/or restricted work.	Localised, temporary social impacts.	Localised, short-term impact on public opinion.	Localized or temporary disruption to services.	General concern raised by regulators requiring response action.	Minimal effects on the natural environment. Localised within site boundaries. Recovery measurable within 1 month of impact.	Additional operational costs. Financial loss small, <10% of turnover.	Minimal individual legal action.	Minor effect on the broader economy due to disruption of service provided by the asset.
3 - Moderate	Serious injury or lost work.	Localised, long-term social impacts.	Local, long-term impact on public opinion with adverse local media coverage.	Localized long-term disruption to services.	Investigation by regulators Changes to management actions required.	Some damage to the environment including local ecosystems. Some remedial action may be required. Recovery in 1 year.	Moderate financial loss, 10-50% of turnover.	Multiple claims and/or litigations.	High impact on the local economy with some effects on the wider economy.
4- High	Major or multiple injuries, permanent injury or disability.	Failure to protect poor or vulnerable groups. National, long-term social impacts.	National, short-term impact on public opinion; negative national media coverage.	Failure to provide services with long-term region-wide impacts.	Notices issued by regulators for corrective actions. Changes required in management. Senior management responsibility questionable.	Significant effect on the environment and local ecosystems. Remedial action likely to be required. Recovery longer than 1 year. Failure to comply with environmental regulations / consents.	Major financial loss, 50-90% of turnover.	Major litigation and/or legal action by multiple claimants.	Serious effect on the local economy spreading to the wider economy.
5- Very high	Single or multiple fatalities.	Loss of social license to operate. Community protests.	National, long-term impact with potential to affect stability of Government.	Permanent disruption and/or termination of services.	Major policy shifts. Change to legislative requirements. Full change of management control.	Very significant loss to the environment. May include localised loss of species, habitats or ecosystems. Extensive remedial action essential to prevent further degradation. Restoration likely to be required. Recovery longer than 1 year. Limited prospect of full recovery.	Extreme financial loss >90% of turnover.	Class action legal action.	Major effect on the local, regional and state economies.

Source: designed by WSP

APPENDIX

9-2 *RISK REGISTER*

Climate Change Risk Assessment

			Exposure			Vulnerability					Risk							Adaptation
						Sensitivity		Adaptive Capacity				Severity of Impact						
	ID	Potential Impact	Climate Hazard	Maximum Likelihood of Climate Hazard Rating	Ranking of regions (south, center, north)	Rating	Rationale	Rating	Rationale	Vulnerability Rating	Likelihood of Impact	Economic	Health and Safety	Environmental	Severity Rating	Severity Rationale	Risk Rating	Suggestions for control measures
Construction phase and facilities	1	Loss of labour productivity during construction	Heat waves	High	1 - south 2 - center 3 - north	High	Construction of the infrastructure may be delayed, and has no plan for weather contengencies. Even a small decrease in productivity will have a large impact.	Moderate	Working schedules can be arranged to better fit cooler hours of the day. Health guidlines for working in heat can be applied. Alternate personnel can be available, but only in limited quantity.	**Moderate**	**High**	Moderate	Low	Very Low	**Moderate**	Heat waves have the potential to impact construction schedule resulting in a moderate economic impact. There is a health and safety risk to workers if they are working in extreme heat.	**High**	Implementation of a sustainable reserve of alternate personnel in case of emergency and high rates of absenteeism. Development of practices for working in extreme heat including break times and ensuring drinking water availability for workers. Ensuring workers understand the risks of working in extreme heat and have first aid on site for any heat related illness.
	2	Increase in the number of health and safety incidents in the workplace	Heat waves Extreme precipitation and pluvial flooding High winds and storm activities Landslides	High	1 - north 2 - center 3 - south	Moderate	More incidents can jeopardize the construction schedule and on-time delivery of the infrastructure.	Low	Alternate staff to replace those unable to work remains scarce. The health and safety system for construction needs to be revised and significantly improved.	**Moderate**	**High**	Low	High	Very Low	**High**	Depending on the severity of incidents, the impact on workers can be severe and evacuation of injured people may be difficult. Financial losses can be expected if there are not enough replacement staff or if the necessary work interruptions are long or repetitive.	**High**	Development of practices for working in extreme weather conditions including break times and work interruption when conditions are too dangerous. Ensuring workers understand the risks of working in extreme conditions and have first aid on site for any related injuries.
	3	Decrease of potable water supply	Heat waves Droughts	High	1 - south 2 - north 3 - center	Moderate	Access to potable water for workers is essential during construction. Supply could be reduced as there is less precipitation during the dry season. Some municipal systems can provide for personal use.	Moderate	Potable water can be stored and brought to the construction site. But water availability in general can trigger some supply problems in case of very dry conditions.	**Low**	**Moderate**	Low	Moderate	Very Low	**Moderate**	Decreasing water supply will have a high impact to human health and safety, and hence have a minor economic impact on construction.	**Moderate**	Development of water management plans for dry conditions, and keep stored water on hand in the case of low supply. Implementation of rainwater storage if possible. Investigation of opportunities for greywater reuse if municipal water infrastructure is in good shape.
	4	Delays in material deliveries and lack of access to construction site	Droughts Extreme precipitation and pluvial flooding Landslides	High	1 - north 2 - center 3 - south	Moderate	In case of extreme events blocking access paths, delivery of materials can be delayed or even cancelled and workers staying in neighboring communities will not be able to access the construction site. This would lead to potential major delays in construction.	Moderate	Deliveries can be scheduled in advance to assure availability of essential materials.	**Low**	**Moderate**	Moderate	Very Low	Very Low	**Moderate**	The impact could be severe in an economic side only. Delays would occur, and quality of infrastructure could decline as well if emergency measures are implemented to minimize delays.	**Moderate**	Implementation of a contingency plan to ensure sufficient materials are already on site to continue construction for at least two weeks.
Pavement structures	5	Melting of pavement due to high temperatures	Heat waves	Very High	1 - south 2 - center 3 - north	Moderate	Concrete and bitumen are sensitive to high temperatures and sun exposure. In the long term, the warmest day of the year will reach 33C in the south. Even if the infrastructure is built following codes and standards, it might not be enough to avoid damages.	Moderate	Following design standards is good, but not sufficent. A security factor can be implemented, but would require a significant change in design and material use.	**Low**	**Moderate**	Moderate	Low	Very Low	**Moderate**	Damages to pavement due to heat will mainly lead to higher O&M costs, and they can occur more often. Health and safety of users is also slightly impacted, depending on the extent of damages. This will happen especially in the south portion of the infrastructure.	**Moderate**	Implementation of more intense monitoring to prevent significant damages. Consideration of exceeding codes and standards to define higher thresholds for pavement resistance to heat.
	6	Tree fall or rock crumbling causing damages on pavement	Extreme precipitation and pluvial flooding High winds and storm activities Landslides	Very High	1 - south 2 - center 3 - north	Moderate	Although removal of tree hazards are part of the site work, trees on site will remain sensitive to this risk over time. Crumbling will remain a significant issue on secondary roads, directly constructed on rock. And damages can cause temporary loss of serviceability if substantially major.	High	Trees and unstable rock can be actively monitored and managed to prevent issues.	**Low**	**Moderate**	Moderate	Moderate	Very Low	**Moderate**	Damages to pavement due rock or tree fall will mainly lead to higher O&M costs, and they can occur more often. Health and safety of users is also impacted, depending on the extent of damages. This will happen especially in the secondary road.	**Moderate**	Implementation of more intense monitoring to prevent significant damages.

Engineering structures	7	Higher maintenance needs on pavement due to cracks and destruction	Extreme precipitation and pluvial flooding Landslides	Very High	1 - north 2 - center 3 - south	High	If a major landslide or flood do occur due to high precipitation, serious damages could occur and maintenance work may be urgent to ensure road safety.	Low	When such a hazard occurs, damages are not avoidable, even if the infrastructure is strong. The only measure to be taken is to ensure a sufficent contingency fund to repair damaged road as soon as possible.	**High**	**Very High**	Moderate	Low	Very Low	**Moderate**	Damages to pavement due to intense runoff will mainly lead to higher O&M costs, and they can occur more often. Health and safety of users is also slightly impacted, depending on the extent of damages. This will happen especially in the north portion (A-8) and south portion (on A-8-S) of the infrastructure, where landslides are more likely.	**High**	Implementation of a contingency fund to ensure damages can be repaired on short notice. Collaboration with scientific institutions to better monitor the occurrence of potentially destructive hazards.
	8	Increase in vegetation spread on pavement	Heat waves	Very High	1 - south 2 - center 3 - north	Low	Higher temperatures will lead to rapid growth of unwanted vegetation on the infrastructure.	High	Vegetation can be actively monitored and managed to prevent issues.	**Very Low**	**Low**	Low	Very Low	Low	**Low**		**Low**	
	9	Higher maintenance needs on bridge joints	Heat waves	Very High	1 - south 2 - center 3 - north	Moderate	Increased thermal expansion can cause joint displacement and accelerated deterioration of materials. The design criteria give a maximum temperature corresponding to historical average only , and does not consider future climate conditions.	Moderate	The design criteria comply with the recommendations of design standards, but may not be sufficient in the relatively near future. A security factor can be implemented, but would require a significant change in design and material use.	**Low**	**Moderate**	Moderate	Very Low	Very Low	**Moderate**	Major renovations may be required, but the damage would be gradual over a long period of time and therefore predictable to a certain extent.	**Moderate**	Implementation of more intense monitoring to prevent significant damages. Consideration of exceeding codes and standards to define higher thresholds for joint resistance to heat.
	10	Excessive lateral wind loading on bridge and viaduct structures	High winds and storm activity	Moderate	1 - south 2 - center 3 - north	Low	Although high winds due to storm activity are projected to increase, it is anticipated that winds will still be within design thresholds.	Low	Although it is expected that the infrastructure will be designed with these potential risks in mind already (design standards consistent with future climate conditions), retrofitting of the structure of bridges and viaducts remains very expensive.	**Low**	**Low**	High	Low	Very Low	**High**		**Moderate**	
	11	Thermal expansion of steel structures of bridges and viaducts	Heat waves	Very High	1 - south 2 - center 3 - north	Moderate	Increased thermal expansion can cause joint displacement and accelerated deterioration of materials which may lead to premature failing that can lead to water and/or air leakage (ex. sealant joints). In the long term, the warmest day of the year will reach 33C in the south. Even if the infrastructure is built following codes and standards, it might not be enough to avoid damages.	Low	Retrofitting of bridge and culvert components remains relatively feasible but would incur a significant additional cost that is not foreseen in any contingency plans.	**Moderate**	**High**	Moderate	Moderate	Very Low	**Moderate**	Major renovations may be required, but the damage would be gradual over a long period of time and therefore predictable. If renovations are not completed in due time, safety of users may be compromised, and injuries may happen.	**High**	Verification that inspection and maintenance schedules are developed to identify and repair any issues. Use of materials that are designed to work with high temperatures.
	12	Insufficient capacity of the drainage systems	Extreme precipitation and pluvial flooding	Very High	1 - north 2 - center 3 - south	High	The design criteria used for drainage and storm water management need to meet current and future extreme precipitation statistics. The high topography and the relatively insufficient storm water management system (in light of past experience and future statistics) may lead to major runoff and flooding of the asset. The hydrological model used (TRRL East African Flood Model) does not consider future climate projections. Unsufficient capacity may be more critical in northern regions.	Low	If flooding was to exceed the capacity of the system, it would overflow pathways and roads and even flood neighboring communities. Surface drainage flow could be retroactively improved which could be expensive and require site regrading. Retroactive grading changes, incorporating increase to storm pipes may be invasive and expensive.	**High**	**Very High**	High	Moderate	Low	**High**	Flooding could damage the road itself and the surronding environment. A flood could cause considerable material damage, a prolonged shutdown of serviceability and a significant maintenance cost. Runoff would have substantial consequences for surronding communitiies and safety of users.	**Very High**	Monitoring of the stormwater management capacity is sufficient given the values of future extreme precipitation statistics incorporating climate change effects. Improvement of grading/surface drainage where water accumulates associated with flooding problems. Optimal integration of the project with other major projects in the surronding areas and planning of the drainage system at a larger scale to avoid that stormwater affects neighboring communities. High and frequent maintenance of drainage systems to avoid clogging. Extension of some culverts identified during consultation further away from the main road.
	13	Blockage of crossing points due to water and debris accumulation	Extreme precipitation and pluvial flooding High winds and storm activity Landslides	Very High	1 - north 2 - center 3 - south	High	Crossing points are essential for wildlife and local communities. Flash floods can occur in these points when drainage capacity is insufficient.	Moderate	Clenaning operations are easy to implement, but stormwater management capacity is hard and expensive to improve.	**Moderate**	**High**	Low	High	Moderate	**High**	Water and debris accumulation may challenge the safety of wildlife and local communities. In some cases, casualties may happen if a flashflood does occur.	**High**	Monitoring of the stormwater management capacity is sufficient given the values of future extreme precipitation statistics incorporating climate change effects. High and frequent maintenance of drainage systems to avoid clogging.

	14	Corrosion of retaining walls	Extreme precipitation and pluvial flooding	Very High	1 - north 2 - center 3 - south	Moderate	Corrosion of retaining walls is a slow process and will not affect the serviceability of the infrastructure as much as, for example, thermal expansion of bridge materials. But, on the long term, high rates of corrosion can compromise the efficiency of the walls and increase damages of a potential landslide.	High	Non-corrosive material can be used in the final design of the retaining walls for a reasonable cost.	**Low**	**Moderate**	Low	Moderate	Low	**Moderate**	Although economic impacts directly linked to corrosion is relatively low, it may bring an additional safety problem for users in case of a potential landslide and high precipitation events.	**Moderate**	Use of non-corrosive materials for the construction of retaining walls. Frequent monitoring to properly foresee potential maintenance costs.
Additional road equipment	15	Power and communication system failure	Heat waves High winds and storm activity	Very High	1 - south 2 - center 3 - north	Moderate	In case of extreme heat or high winds, major power failures can occur. The infrastructure does not have a back-up power source, and street lightning and signals may become out of service. This triggers the serviceability of the infrastructure itself.	Moderate	An alternative source of power is difficult to implement in this situation and remains costly.	**Low**	**Moderate**	Low	Moderate	Very Low	**Moderate**	Power and communication failures can lead to safety issues for users of the infrastructure. Minor costs due to rehabilitation of power infrastructure is likely.	**Moderate**	Investigation to identify alternative sources of power in case of a major outage.
	16	Landscaping vulnerable to increased temperatures and reduced soil moisture	Heat waves Droughts	Very High	1 - south 2 - center 3 - north	Low	Well-established species may not be adapted to new climate conditions. But the serviceability of the infrastructure is not compromised. In case of major plant extinction, soil may be more subject to landslides in some specific areas.	High	Watering frequency can be modified (although water supply must be sufficient to do so), and more heat resistant plants can be introduced if not already part of landscaping plan.	**Very Low**	**Low**	Low	Very Low	Moderate	**Moderate**		**Low**	
	17	Destruction or deterioration of shelters and street lighting	Extreme precipitation and pluvial flooding High winds and storm activity Landslides	Very High	1 - north 2 - center 3 - south	Moderate	In case of a major extreme event, shelters and street lighting may be destroyed, especially by strong winds if horizontal loading standards are not sufficient to future conditions, and by landslides because of which some components of the infrastructure can be seriously damaged.	Moderate	It is expected that the infrastructure will be designed with these potential risks in mind already (design standards consistent with future climate conditions), retrofitting of shelters and signals remains relatively affordable compared to the renewal of other larger components, such as bridges or culverts.	**Low**	**Moderate**	Low	Low	Very Low	**Low**	Destruction of shelters and signals can cause retrofitting or renewal costs, but the latter remain relatively low compared to other costs due to extreme events. The safety of users is challenged as well but temporary shelters can be easily implemented.	**Low**	
s and environment	18	Dust dispersion in communities during construction	Droughts High winds and storm activitiy	High	1 - south 2 - center 3 - north	Low	Dispersion of dust is very likely during construction work and surrounding communities can be impacted by respiratory problems and reduced visiblity. However, this impact is temporary and does not affect the construction of the infrastructure.	Moderate	Monitoring of dust dispersion can not be done in an efficient way during construction. Warnings can be sent to surrounding communities to reduce the temporary impact on their activities. Water spreading is already a common practice in the environmental management plan.	**Low**	**Moderate**	Very Low	Moderate	Low	**Moderate**	Dust dispersion mainly leads to health issues for the surronding communities.	**Moderate**	Modification of the environmental management plan to increase the frequency of water spreading during very dry and windy conditions.
	19	Flooding of surrounding areas	Extreme precipitation and pluvial flooding	Very High	1 - north 2 - center 3 - south	Very High	In the recent years, an important number of communities and farms were flooded because of malfunctioning drainage systems directly linked to the infrastructure. Ecomonic activities are strongly impacted for local communities. The high topography and the relatively insufficient storm water management system (in light of past experience and future statistics) may lead to major runoff and flooding of surrounding areas. The hydrological model used (TRRL East African Flood Model) does not consider future climate projections. Unsufficient capacity may be more critical in northern regions.	Low	If flooding was to exceed the capacity of the system, it would overflow neighboring communities. Surface drainage flow could be retroactively improved which could be expensive and require site regrading. Retroactive grading changes, incorporating increase to storm pipes may be invasive and expensive.	**High**	**Very High**	Very High	Moderate	Very Low	**Very High**	The consequences are severe for economic activities of local communities in particular. This could cause major fees for the infrastructure owner if he/she has been identified as the entity accountable for the damages. Safety of communities will then be significantly compromised.	**Very High**	Monitoring of the stormwater management capacity is sufficient given the values of future extreme precipitation statistics incorporating climate change effects. Improvement of grading/surface drainage where water accumulates associated with flooding problems. Optimal integration of the project with other major projects in the surronding areas and planning of the drainage system at a larger scale to avoid that stormwater affects neighboring communities. High and frequent maintenance of drainage systems to avoid clogging. Extension of some culverts identified during consultation further away from the main road.
	20	Reduced visibility due to smoke during wildfires	Heat waves Droughts	Very High	1 - south 2 - center 3 - north	Moderate	Good visibility is a priority for users of the infrastructure. In case of a major wildfire nearby, visibility can be significantly reduced and traffic may have to be interrupted until the fire is under control.	Moderate	Monitoring of wildfire occurrence is relatively easy to prevent low visibility problems for users. However, in a case of a wildfire, the infrastructure owner has no capacity to adapt to such extreme conditions.	**Low**	**Moderate**	Low	Moderate	Low	**Moderate**	Presence of smoke mainly cause health and safety issues for users. The economic impact remains relatively low for the infrastructure owner.	**Moderate**	Collaboration of national weather services and the Kenya Forest Service to better forecast distrubances due to wildfires and to better plan any necessary road closures.

Nearby communities	21	Injuries or fatalities due to flash flooding of crossing points	Extreme precipitation and pluvial flooding Landslides	Very High	1 - north 2 - center 3 - south	High	Crossing points are essential for wildlife and local communities. Flash floods can occur in these points when drainage capacity is insufficient and when accumulation of debris is significant.	Moderate	Cleaning operations are easy to implement, but stormwater management capacity is hard and expensive to improve. Awareness campaign for local communities can be easily implemented to prevent any injuries in case of extreme weather conditions. However, controling wildlife traffic at crossing points remains challenging.	**Moderate**	**High**	Low	High	Moderate	**High**	Water and debris accumulation may challenge the safety of wildlife and local communities. In some cases, casualties may happen if a flashflood does occur.	**High**	Collaboration with local communities to implement awareness campaigns for the use of crossing points only when weather conditions allow it. Installation of barriers to temporarily close crossing points in case of a high likelihood of a major extreme event occurring within the next hours/days.
	22	Long-term loss of serviceability of the infrastructure	Droughts Extreme precipitation and pluvial flooding Landslides	Very High	1 - north 2 - center 3 - south	Moderate	When a portion of the road is seriously damaged by a climate hazard (flash flood, landslide, wildfire), road closures are unavoidable. However, this may rarely happen, and if it does, only a small part of the infrastructure will be affected. The spatial distribution of linear infrastructure is an opportunity here to reduce its sensitivity to this specific impact.	Low	The adaptive capacity of the owner remains low when a portion of the infrastructure becomes unusable. Actions to clean the infrastructure will be implemented as soon as possible, but a delay could occur. The adaptive capacity of local communities is low as well, since there is no alternative road to travel to a neighboring county.	**Moderate**	**High**	Moderate	Low	Low	**Moderate**	The interruption of traffic mainly has an economic impact for the infrastructure owner and on local communities.	**High**	Construction of an alternative route in areas most exposed to risk to traffic all along the infrastructure.
	23	Large-scale disturbance of economic activities	Droughts Extreme precipitation and pluvial flooding Landslides	Very High	1 - north 2 - center 3 - south	High	In a case of a major climate hazard, local businesses, regional transit and international trade can be impacted, which leads to less traffic on the infrastructure. Alternatively, if the infrastructure is closed due to weather damages, economic activities which rely on transportation of merchandise or people may be strongly affected.	Low	There is no alternative road to travel to a neighboring county and for transit of goods between Port of Mombasa and inland northeastern Africa (Uganda, Ethiopia, Congo Democratic Republic), and local businesses depend on road infrastructure to generate revenus (e.g. farmers).	**High**	**Very High**	High	Very Low	Very Low	**High**	Local, regional and international businesses are very sensitive to road accessibility and condition, and may experience serious economic issues if their activities need to be reduced.	**Very High**	Construction of an alternative route in areas most exposed to risk to traffic all along the infrastructure. Promotion of climate resilient strategies in local business model to decrease interdependancies between transportation infrastructure and profitability.