އީ.އައި.އޭ ޑްރާފްޓްގެ ފޯމެޓް ޗެކްކުރުމަށް ރިޕޯޓް ހުށަހަޅާ ފޯމު

އާންމު މައުލޫމާތު

ޕްރޮޖެކްޓުގެ ނަން: Proposed Pilot Road Development Project in Thilafushi,Kaafu Atoll, Maldives

ރިޕޯޓް ތައްޔާރުކުރި ކޮންސަލްޓަންޓުންގެ ނަން: Hassaan Abdul Muhsin — މޯބައިލް ނަންބަރު: 7901665

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ރިޕޯޓުގައި ހިމަނާ މައުލޫމާތު

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3	ޓާރމްސް އޮފް ރެފަރެންސް މަންޒޫރު ކުރި ތާރީޚް	10/01/2024	
4	ސާރާ ޚުލާސާ ހިމަނާފައިވާ ސަފްހާ ނަންބަރު	vi	
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އިދާރީ ބޭނުމަށް

ރިޕޯޓް ރިސީވްކުރި ނަންބަރު ---------- ތާރީޚް ----------

ރިޕޯޓް ފުރިހަމައަށް މުރާޖާކުރުމަށް ގަބޫލުކުރެވޭ ބާވަތުގައި [ ]

ނަން ---------- ސޮއި ----------

ރިޕޯޓް ފުރިހަމައަށް މުރާޖާކުރުމަށް ބޭނުންވާ އިތުރު މައުލޫމާތު މުރާޖާކުރުމަށް ގަބޫލުކުރެވޭ ބާވަތްތަށް އަނބުރާ އެޕްލިކަންޓަށް ފޮނުވާނެ [ ]

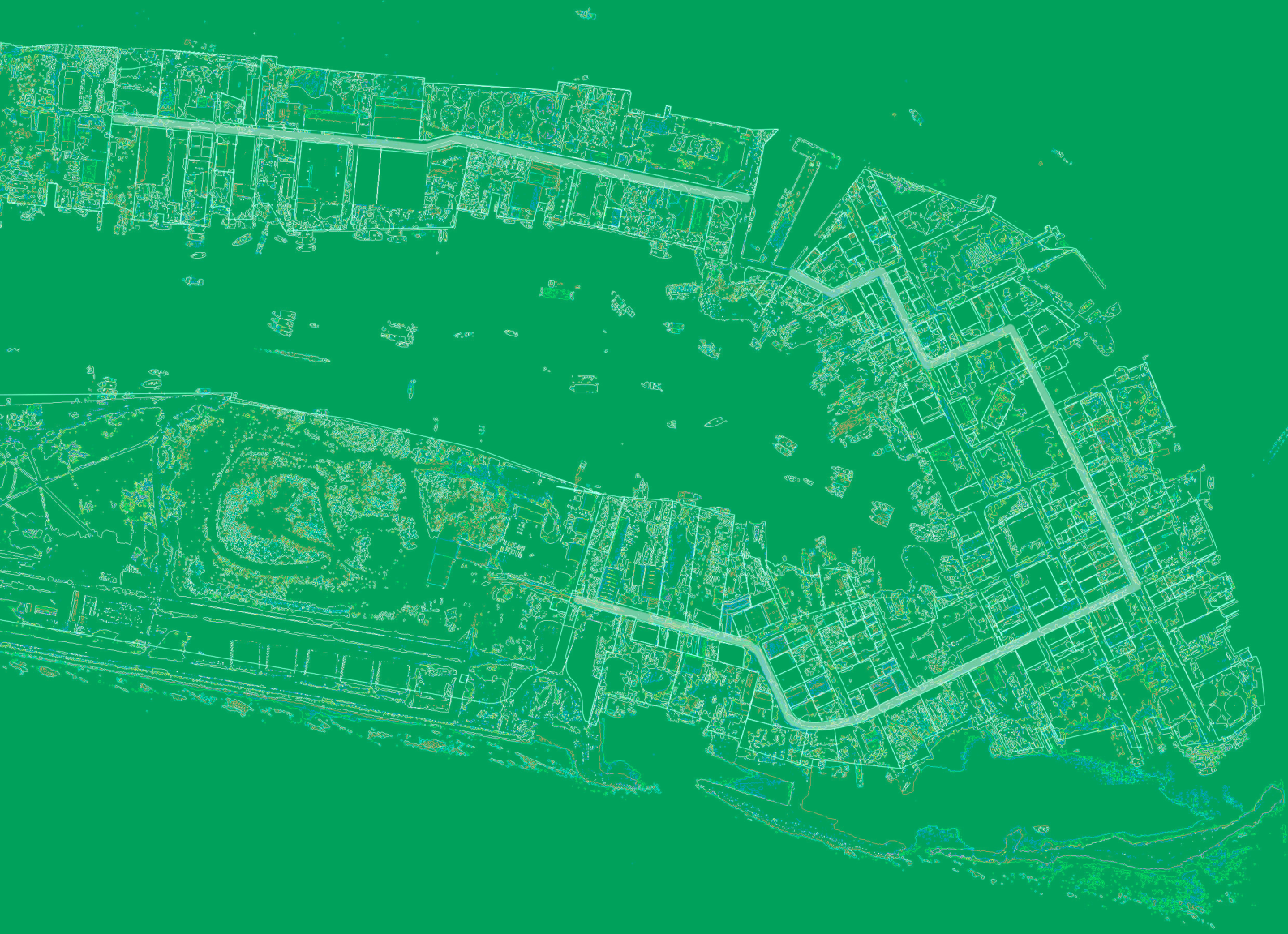
ނަން ---------- ސޮއި ----------

ހުއްދަދެއްވި ފަރާތް

ނަން ---------- ސޮއި ----------

ENVIRONMENT IMPACT ASSESMENT

FOR THE PROPOSED PILOT ROAD DEVELOPMENT PROJECT IN THILAFUSHI KAAFU ATOLL



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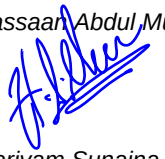
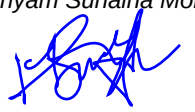
IV. Declaration of the consultants

We certify that the statements made in this EIA are true, complete, and are correct to the best of our knowledge and abilities.

Hassaan Abdul Muhsin (EIA P02/2020)



Mariyam Sunaina Mohamed (EIA-T(B)01/2023)



Hashma Hameed (EIA-T(B)04/2023)

V. Declaration of the Proponent

بسم الله الرحمن الرحيم

ހައުސިންގ ޑިވެލޮޕްމަންޓް ކޯޕަރޭޝަން ލިމިޓެޑް
ހުޅުމާލެ، ދިވެހިރާއްޖެ
Housing Development Corporation Limited
HDC Building, Hulhumalé, Republic of Maldives

urbanco

Letter no: HDC(161)-UBP/203/2024/1 January 08, 2023

Mr. Ibrahim Naeem,
General Director,
Environmental Protection Agency,
Ministry of Climate Change,
Environment and Energy,
Green Building,
Male,
Republic of Maldives.

Dear Sir,

SUBJECT: DECLERATION AND COMITMENT TO IMPLEMENT THE PROPOSED MITIGATION, MANAGEMENT ACTIONS, AND MONITORING AS PER THE PROPOSED ENVIRONMENT IMPACT ASSESSMENT (EIA)

The management of Housing Development Corporation Ltd hereby endorses the Environmental Impact Assessment (EIA) and assures its accuracy and completeness to the best of our abilities.

Furthermore, we affirm our commitment to implementing all specified mitigation measures and monitoring protocols during both the developmental and operational phases, as outlined in the impact assessment.

Yours Sincerely,

Ahmed Zinaf
Chief Planning Officer

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C-793/2008

IAS ACCREDITED Management Systems Certification Body MSCB-119
ISO 9001:2015

VI. ސާދާ ޚުލާސާ

މި ރިޕޯޓަކީ ކ.ތިލަފުށީގައި ފުޅިރަން އެއްކޮށްދެން އަސްއެކްޓަރު ގުޅުވައިދޭ މައިމަގުތަކުގައިވާ 'ޕައިލެޓް ރޯޑް' ހެދުމަށް ހުށަހަޅާފައިވާ މި މަސައްކަތުގެ ސަރަހައްދުން ތިމާވެއްޓަށް އަސަރުކުރާ މިންވަރު ބަޔާންކުރާ ބަޔާން ތަފްސީލުކޮށްދީފައިވާ ރިޕޯޓެކެވެ. މި ރިޕޯޓުގައި، ހުށަހަޅާފައިވާ ތަރައްގީގެ މަޝްރޫއު ކުރިއަށް ގެންދިއުމުން ތިމާވެއްޓަށް ކުރާނެ އަސަރުތައް ދެނެގަނެ، މިކަމުގެ ސަރަހައްދުން ތިމާވެއްޓަށް ކުރާ ނޭދެވޭ އަސަރުތައް ކުޑަކުރެވޭނެ، މަޝްރޫއުގެ ސަރަހައްދުގެ މަންޒަރު އެނގޭ ފުރިހަމަ ތަފްސީލުތަކުގައި ހުށަހަޅާ ގޮތްތަކާއި ލަފާތައް ހިމަނާފައިވެއެވެ.

މިރިޕޯޓް އެކުލަވާލެވިފައިވަނީ، ދިވެހިރާއްޖޭގެ ތިމާވެށި ރައްކާތެރިކުރުމާއި ދެމެހެއްޓުމުގެ ޤާނޫނު؛ ޤާނޫނު ނަންބަރު (93/4) ގެ ދަށުން އެކުލަވާލާފައިވާ ތިމާވެއްޓަށް އަސަރު ކުރާ މިންވަރު ބެލުމުގެ ރިޕޯޓް ހެދުމާބެހޭ ގަވާއިދު (R-27/2012) ގައި ބަޔާންކޮށްފައިވާ ކަންކަމާއި، މި މަޝްރޫއު ކުރިއަށް ގެންދިއުމަށް ބޭނުންވާ ތިމާވެއްޓަށް އަސަރު ކުރާ މިންވަރު ބެލުމުގެ ރިޕޯޓް ތައްޔާރުކުރުމަށް އެންވަޔަރަންމަންޓަލް ޕްރޮޓެކްޝަން އޭޖެންސީ (އީ.ޕީ.އޭ) އިން ދޫކުރެއްވި ޓާމްސް އޮފް ރެފަރެންސް (ނަންބަރު ECA/161/2023/5-203) އާއި އެއްގޮތަށެވެ. މި ރިޕޯޓަކީ މަޝްރޫއަށް އެންމެ ބަދަލުތަކާއިއެކު ބަދަލުކުރެވިދާނެ އިއާދަ ވަމުން އަންނަން ރިޕޯޓެކެވެ. އަދި ބަދަލުކަމަށް މިމަޝްރޫއާއި ގުޅޭ ސަރުކާރުގެ ކަމާބެހޭ ފަރާތްތަކަށް ހުށަހަޅާ، ފާސްކޮށް، އެއްބަސްވުމަށްފަހު ޖަހާނެއެވެ.

މި މަޝްރޫއުގެ އިސްނެގުމަކީ ހައުސިންގ ޑިވެލޮޕްމަންޓް ކޯޕަރޭޝަން URBANCO (HDC) އެވެ. މިރިޕޯޓުގައި ބަޔާންކޮށްފައިވާ މަޝްރޫއުގެ ސަރަހައްދަކީ މަޝްރޫއުގެ ކުރިން ހުށަހަޅާފައިވާ މަގުގެ ސަރަހައްދުގެއިތުރުން، މަޝްރޫއުގެ ކޮންޓްރެކްޓަރުގެ މުއައްޒަފުން ބޭއްވުމަށާއި، މަސައްކަތާގުޅުންހުރި އާލާތްތައް ގާއިމުކުރުމަށް އަދި މަސާލަ ކުރާނެ ވަގުތީ ޕްލާންޓެއް ގާއިމުކުރުމަށް ސައިޓް ކޭމްޕެއް ބޭނުންވާ ސަރަހައްދެވެ. އަދި މިސަރަހައްދުތައް މަޝްރޫއުގެ ސަރަހައްދުގެ ތެރޭގައި ހިމެނިގެން ވާނެއެވެ.

ހުށަހަޅާފައިވާ މަޝްރޫއުގައި ތަރައްގީ ކުރާ މަގުގެ ދިގުމިނުގައި 5.5 ކިލޯމީޓަރު އަދި ފުޅާމިނުގައި 12 މީޓަރު ހުރެއެވެ. މި މަޝްރޫއުގެ ސަރަހައްދުން ތިލަފުށީގެ އުތުރުގެ ދެކުނުކޮޅުގެ އިތުރުން ތިލަފުށީގެ ބޭރުން ދަތުރުކުރާ މަގުތަކާއި ގުޅުވައިދޭ ދެކުނު ތިލަފުށީގެ ފަސްގަނޑުގެން ދެއެވެ. މި މަގުގައި ފެން ހިއްކުމުގެ ނިޒާމު، ބޮއްތި، އަދި ކަރަންޓުގެ ފަދަ މުހިއްމު އިންފްރާސްޓްރަކްޗަރތައް ހިމެނެއެވެ.

މި މަޝްރޫއާއި ގުޅިގެން، ކަމާބެހޭ ފަރާތްތަކާއި ކުރި ބައްދަލުވުންތަކުގައި ސަރުކާރު، ސަރުކާރުގެ ހިއްސާވާ ވެރިފަރާތާއި އަދި އަމިއްލަ ކުންފުނިތަކާއި، ވިޔަފާރިތަކާއި ވަކިވަކި ފަރާތްތަކުން މަޝްވަރާކުރުމުން ހިޔާލުފާޅުކޮށްފައެވެ. މިފަރާތްތަކުން އެއްއަޑަކުން ދެއްކީ ތިލަފުށީގެ ތެރޭގައި ކުއްލި އަދި އުޅަނދުފަހަރު ގެންގުޅުމުގައި ދަތުރުފަތުރުކުރުމަށް ހުރި ދަތިތަކެވެ، މި މަޝްރޫއުގެ ސަބަބުން އެފަދަ މައްސަލަތައް ހައްލުވެގެން ދާނެކަމަށް ފަރާތްތަކުން ބާރުއަޅުއްވާފައެވެ. ކުރީގެ ފަރާތްތަކުގެ ހިއްސާ ލިބިފައިވާ ފަރާތްތަކުގެ ތެރޭގައި، ތިލަފުށި ކައުންސިލް ވަނީ ވިޔަފާރިތަކާއި ކުންފުނިތަކަށް ހިތާމަ ފަރާތްތަކުން ބާރުއަޅާ ކަންކަމަށް ތަފްސީލުކޮށް މަގު ބޭނުންކުރާ ގޮތް ކަމަށް ފާހަގަކުރިއެވެ، މަޝްރޫއުގެ މަސައްކަތުގެ ފުރުޞަތު މަޝްރޫއުގެ ކުންފުނިތަކުގެ މަޝްރޫއަށް ނުވާ އަސަރު ކުޑަކުރުމުގެ މަގު މަޝްރޫއުގެ ހިންގާ މަސައްކަތްތަކާއި ގުޅިގެން ހިއްސާކުރި ކޮންޓްރެކްޓަރ، މިކުންފުނިތަކާއި އަދި މި ފަރާތްތަކާއި މުއާމަލާތްކުރަން ވާނެއެވެ.

މިމަޝްރޫއުގެ އެކި މަރުހަލާތަކުގައި ތިމާވެއްޓާގުޅޭ ތިމާވެއްޓާއި، ބިންވެއްޓާއި، އިޖްތިމާއީ ފައިދާތަކާއި އަސަރުތަކުގެ ދިރާސާއިން ދެއްކާ ގޮތުގައި މަޝްރޫއުގެ ހިނގާފައިވާ އިތުރު މަޝްރޫއުގެ ނިމި މަގު ބޭނުންކުރާއިރު ކުރާއަސަރުތަކެއް ވެއެވެ. މިގޮތުގައި އޮޑިޓުކުރުމުގެ ސަރަހައްދުގެ ތަރައްގީއަށް މިންނަން ކުރާއަސަރުތަކާއި، މަގުބޭނުންކުރުމުގެ ސަރަހައްދުން އިޖްތިމާއީ އަދި އިގްތިސާދީ މަޝްރޫއުތަކަށް ކުރާ އަސަރުތަކަކީ ފާހަގަކުރެވޭ ކަންކަމެވެ.

Urban planning department,
GIS and Survey,
Environment Unit

Housing Development Corporation
HDC Building, Ground Floor
Hulhumalé, Republic of Maldives

މިގޮތުން މަސައްކަތްކުރާ ވަގުތާއި މަސައްކަތް ނިމުމުން މަގުގެ އުސްމިނަށް އަސަރު ބޯރުފެތުން މަސައްކަތްކުރާ ސަރަހައްދާއި ވަށައިގެންވާ ސަރަހައްދުގެ ތަކެތިން ދައުރުކުރާ ގޮތް ބަދަލުވެ، ބައެއް ސަރަހައްދުތަކުގައި ފެން ބޭއްވުމުގެ ހާލަތުތައް ކުރިމަތިވުމަކީ އެކަށީގެންވާ ކަމެކެވެ. ހަމައެހެންމެ، ފެނުގެ ފަރާތަށް މިކަމުގެ ސަބަބުން އަސަރުކުރާކަމުގައި ވެސް އެކަށީގެންވާކަމެކެވެ.
ހަމައެހެންމެ، މަގުހެދުމަށްބޭނުންކުރާ ހިރަފުސް މިގޮތަށް ގޯސްކޮށްފައިވާ ބައެއްޗެހި އޮޅުވާލެވިފައިވާ ގޮތުން ގޮސް، ގޮސް ކަނޑުގެ މަކުރާ މަސައްކަތުގައި ކަރަންޓާއި ފެނާއި ބޭނުންކުރަ ވާގިވެސް ކަނޑުގެ ތަކެތިން ދުރުކުރެވޭނެ ގޮތަކަށް ބެހެއްޓުމަކީ މުހިއްމު ކަމެކެވެ.

މި މަޝްރޫއުގެ އިމާރާތާއި އަދި އިމާރާތާއި އަސަރު މަސައްކަތުގެ ސަރަހައްދުގެ އިތުރުން އެހެން ސަރަހައްދުތަކަށްވެސް ކުރާނެ ކުރެވިދާނެ ގޮތްތަކެވެ. މަސައްކަތުގެ ސަބަބުން ކުރިމަތިވާ އިމާރާތާ މަސައްކަތުން ހަރުލާނީ، ތަރުގެ ދިރިއުޅޭ ފެހިތަކެތި ބައިތުރުކުރެވޭ، މައިގޮތުން ތަކެތި، އަދި ރަށްއިރުދޮށުގެ ކަނޑުގެ ތަކުރާރު ފެހިތަކެތި ހަމައަށް ހިފާނުކުރުމަށް މަސައްކަތުން ކުރާ ނިކަތް އަސަރު ކުރާނެ ގޮތްތަކެވެ. ހަމައެހެންމެ މަސައްކަތުން ފެހިތަކެތީގެ މުއައްސަސާ ދޫކުރާ ގޮތް ސާފުމިނުގެ ގަރުދާސް ދަމާ ކުރާ ސަރަހައްދުގައި ދިރިއުޅޭ ސާފުރިބުގެ ފެތުރެންވީ ތަފާތު ތަކެތި އިސްކަންދިނުމުން މުހިންމެވެ. ހަމަ މިފަދައިން މަސައްކަތުގެ ސަބަބުން ވައި ތަޣައްޔަރުވާނެ ބައިތަކެއް ވެސް އޮވެއެވެ.

ތިލަފުށީގައި މިމަސައްކަތް ހިންގުމުން ފެންބޮޑުވުމުގެ ފެނުސަތަހަ ބޮޑުވެ. އެހެންކަމުން ފެންބޮޑުވުމުގެ ނުރައްކާތަށް ރައްކާތެރިވުމަށް ބަލައި، ނުރައްކާތެރި ތަފްސީލު ތަރައްގީގައި އެކި އިންސާނުން ނިޔާމުތަކާއި ގުޅިގެން އިންފްރާސްޓްރަކްޗަރ ވަރަށް ބޮޑަށް ބޭނުންވާނެއެވެ.

މިމަސައްކަތުގައި ޖެނެރޭޓަރެއް ބޭނުންކުރުމަށް ކުރި މުނިޝަނާކުރުމަށް ވަރަށް މުހިންމު ކަމެކެވެ. އެގޮތުން ނުރައްކާތެރި ކުރި ރައްކާތެރިކަމުގެ ސަމާލުކަމާއި، ކުރި މަޑުކުރުމުގެ ސޮލިޑް ވޭސްޓް މެނޭޖްމަންޓާއި، ރިސައިކަލް ކުރުމުގެ ޕްރޮގްރާމްތަކާއި، ކުރި ވަކިކުރުމުގެ ހަރުދަނާ އުސޫލުތައް ހަރުދަނާ ގޮތެއްގައި އެކުލަވާލައިފައިވާ ޕްލޭނެއް ކަނޑައެޅުން ޖަރޫރީއެވެ.
މި މަޝްރޫއުގައި މަސައްކަތުގެ ވަގުތުތަކާއި އޮޕަރޭޝަން ގެ ތަރައްގީގައި ތިމާވެށީގެ ކަރަންޓުގެ ފުރަތަމަވެހިވާ ބޭނުމި އަސަރުތަކުން އެއްވެސް އަސަރުތަކަށް ގެނައުމަކީ ޕްރަވެންޝަނާ އެއްގޮތަށް ވަނީ ހުށަހަޅާފައެވެ. މިގޮތުން ބެލުމަށް ބައެއް ޕްރޮފެޝަނަލް ތިޔާގީގައި ބެލުމުގެ މިވަނީއެވެ.

- ބިމުގެ ފެންފަރާތުގައިގެ ކުލަހިއަށް ކުރާ ނުރައްކާ އަސަރުތައް ކުޑަކުރުމަށްޓަކައި ގަވާއިދާ އެއްގޮތްވާ ގޮތުގެ މަތިން ނުރައްކާތެރި ތަކެތި ރައްކާކުރުމާއި، ފެނުގެ ކުލަހި ގަވާއިދުން ބެލެހެއްޓުމަށް އިންތިޒާމުކުރުން.
- ރަށުގެ ބިންވެއްޓާއި އާއި ރަށުގައި ފެންކާރު ހިފުމަށް މަސައްކަތް ކުރާ ނުރައްކާ އަސަރުތައް ކުޑަކުރުމުގެ ގޮތުން، ކެމިކަލް ސްޕިލް ރޭޓްތައް ހުއްޓުވުމާއި، ހިފުމުގެ ކެމިކަލްގެ މެނޭޖް ކުރުމަށް ތަރުތީބު.
- މަގުހެދުމުގެ މަސައްކަތުގެ ވެރިޔާގައި ތަކެތި ފެންބޮޑުވުމުގެ ހުރުމަތްތެރިކަމުގެ ފެނުބޮޑުވުމުގެ ކުޑަކުރުމުގެ ޕްރޮޓޮކޯލް ހިމަނާ، ފެންހިންދުމުގެ ނިޒާމް މެނޭޖް ކުރުމަށް އިންތިޒާމް ކުރުން.
- މަގު ހަދައި ބޭނުންކުރުމާއި ގުޅިގެން، އިންފްރާސްޓްރަކްޗަރ އާއި ސަރވިސް އިމްޕްލިމެންޓް ކުޑަކުރުމަށް ކެމިކަލް ޕްރޮޓޮކޯލް ހިފުމަށް، އެމް ޕީގައި މަސައްކަތް ކުރެވޭ ފެނުގެ ގޮތުން ރިސައިކަލް ކުރުމާ ގުޅުން ހަރުދަނާކުރުން ހަރުދަނާކުރެވޭނެއެވެ.
- މަގުހެދުމުގެ މަސައްކަތުގެ ވެރިޔާގައި ފެންގެ ވަސީލަތްތައް ކުޑަ ނުރައްކާ އަސަރުތައް ކުޑަކުރުމަށްޓަކައި، ފެންގެ ހަރުކަށި އެއްގޮތަށް ބަލަހައްޓާފައި ބެލެހެއްޓުމާއި ގުޅޭ ބޭނުންކުރާ އިމާރާތުގެ ކުރިން ޖެނެރޭޓަރު ކުރާ ކަމުގެ ފަހުން އުސޫލުތަކަށް ތަބާ ކުރުން.
- އިމާރާތްކުރުމުގެ މަރުހަލާގައި ރަށުގެތަކެތި، ވައިބްރޭޝަން އާއި އުނދަގޫތަކުން ސަލާމަތްވުމުގެ ކޮންޓްރޯލްތަކާއި، އެކަށީގެންވާ ޕީ.ޕީ.އީ ފޯރުކޮށްދިނުމުގެ އިތުރުން، މަސައްކަތްކުރާ ގެޔަކަށް އުސޫލުތަކާއި ތަކެތި ރައްކާތެރި އުނދަގޫނާ ގެނައުމަކަށް ހެދުން.

ތިލަފުށީގައި ޕްރޮޖެކްޓް މާލީ ސަރަހައްދު ގުޅުވާލެވޭ ބާރު މި މަގުހެދުމުގެ މަޝްރޫޢު ވަރަށް މުހިއްމު މަޝްރޫޢެކެވެ.

VII. Non-Technical summary

Executive Summary: Proposed Development Project at Thilafushi Island

The proposed development project at Thilafushi Island, Maldives, represents a significant endeavor with the potential to bring about both substantial benefits and environmental challenges. This comprehensive assessment, based on an Environmental Impact Assessment (EIA) and extensive data inputs, aims to provide a holistic understanding of the project's potential impacts and recommendations for its sustainable execution.

This report is compiled in adherence to the environment protection act (93/4) and remains true to environment impact assessment formulation regulation (R-27/2012). In addition, as a guideline for the assessment, the consulting team was issued the Term of Reference (TOR); reference number 203-ECA/161/2023/5. The amendments and the attachments to this EIA will be in parallel to the changes to the proposed project and will be submitted, approved and to the relevant authorities and attached with this document.

The proponent of this project is Housing Development Corporation (HDC) URBANCO. The work area defined in the scope of the work includes the temporary work camp and the general footprint of the area.

The proposed development involves the construction of a vital road network connecting Thilafushi Island to the Greater Malé Area. This strategic road, measuring 5.5 kilometers in length and 12 meters in width, will facilitate enhanced transportation links between Thilafushi Island and the main grater Male' area. The road will include essential infrastructure such as drainage systems, pavements, and green spaces. A temporary work camp has been allocated

The comprehensive discussion surrounding the project involved engaging with various stakeholders, encompassing both governmental entities and private enterprises situated on Thilafushi Island. The focal points of these deliberations highlighted major stakeholders, with emphasis placed on larger corporations possessing significant land holdings directly aligned with the pilot road. Prominent entities identified in this context include Gulf Craft Maldives, Nalahiya Trading, and RDC.

Within the meetings it was noted that the pilot road path serves as the exclusive route for certain businesses and companies, thereby underscoring the critical nature of effective communication and coordination. In response to this, all stakeholders have unanimously expressed the need for proactive communication before the commencement of construction activities. This precautionary measure is deemed essential to ensure that the day-to-day operations of these entities face minimal disruption.

Identification of impacts:

This assessment has identified and evaluated the impacts during the Mobilization, Construction, and Operational phases of the project. Noise, vibration, and disturbance will be experienced during the mobilization and construction stages. Mobilization is expected to cause disturbances to residents, cultural facilities, and day-to-day activities on the island. Additionally, the economic activities will be significantly affected, particularly for companies relying on this road as their sole access point to facilities.

Throughout the construction phase, alterations in elevation and natural slopes on existing roads may occur, potentially changing drainage patterns that could, in turn, affect groundwater and soil. This road's development necessitates the complete removal of existing flora and fauna, impacting the island's overall greenery and climate.

Social and Economic Impact:

The project's social and economic implications are far-reaching. To mitigate social unrest and promote well-being, engagement with local communities, transparent grievance mechanisms, and community development initiatives are essential. Ensuring the well-being of project personnel, including safe accommodation and robust health and safety protocols, is crucial. Monitoring and controlling dust emissions to maintain air quality are imperative.

Flood Mitigation:

Thilafushi Island's vulnerability to flooding is a significant concern. A comprehensive flood risk assessment is necessary, along with early warning systems and physical infrastructure for flood mitigation to safeguard against potential inundation.

Waste Management:
Responsible waste management is paramount. A well-structured plan must encompass safe disposal of hazardous waste, waste reduction strategies, recycling programs, and effective waste segregation practices.

Mitigation measures have been proposed for the identified major impacts.

- To address groundwater table and quality impacts, it is recommended to store hazardous materials in accordance with regulations and regularly monitor water quality.
- To mitigate impacts on local infrastructure and services, the recommendation is to create contingency plans and monitor service continuity.
- For preventing flooding during road construction and road operation, implementing flood mitigation measures and monitoring drainage systems for flood risks is advised.
- During the road operational phase, mitigating infrastructure and service impacts can be achieved by developing contingency plans, including measures such as excavation notifications.
- To mitigate water resource impacts during construction, proper waste management practices should be implemented, alongside continuous monitoring of water quality.
- To ensure noise vibration and disturbances during the construction phase is avoided, ensure proper PPE is provided as well as time the construction work during working hours and have an adequate cut off time.

This road project is paramount to connect the island of Thilafushi to the grater Male area.

This road project is paramount to connect the island of Thilafushi to the grater Male area.

1 Introduction to the ESIA

1.1 Background and context

This Environmental Impact Assessment (EIA) addresses the proposed pilot road project at K. Thilafushi', Maldives. The document is prepared in accordance to the relevant laws and regulations in Maldives. The scope of the EIA is limited to road development at K.Thilafushi.

In this EIA, the baseline structure of the document is similar to that of leopold et al. (1971) Therefore, this EIA initiates with the statement of the objective, followed by the technologic possibilities for achieving the objective, proposed actions and alternatives, existing environment, alternative engineering plans, impact analysis, and recommendations, respectively (Figure 1-1).

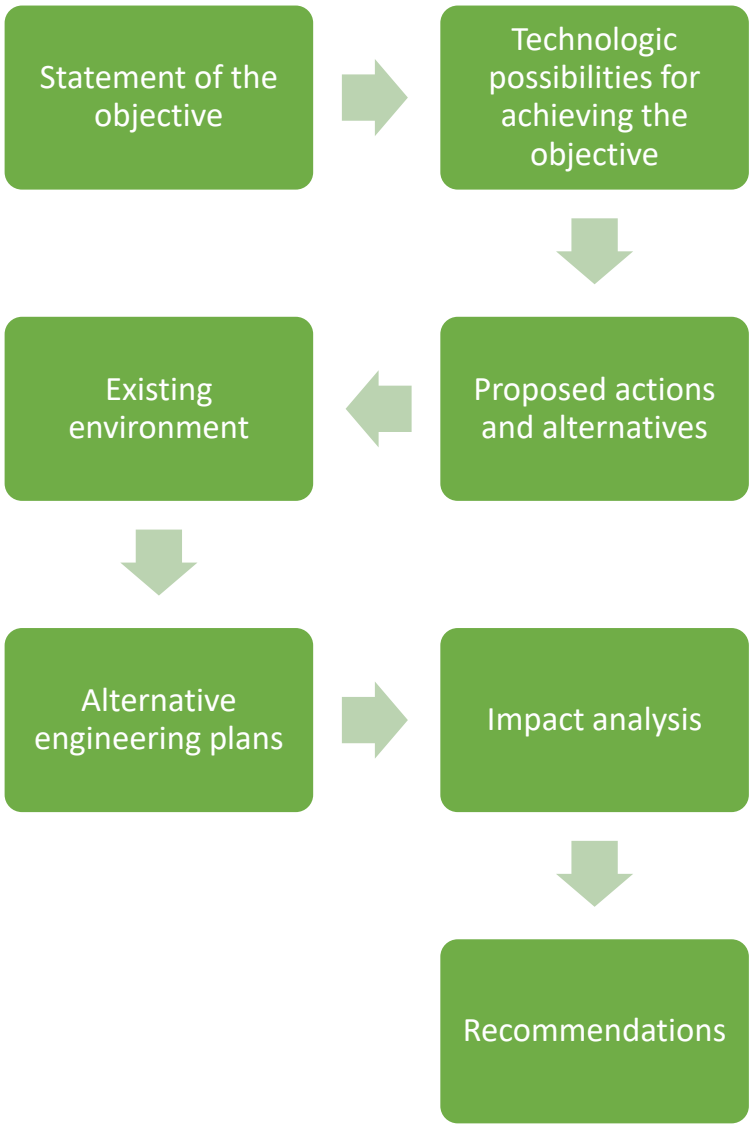

Figure 1-1: Base Structure of EIA

Urban planning department,
GIS and Survey,
Environment Unit

Housing Development Corporation
HDC Building, Ground Floor
Hulhumalé, Republic of Maldives

1.2 Pattern of the EIA

With the grater structure of the EIA in mind, this EIA follows the following pattern (Figure 1-2).

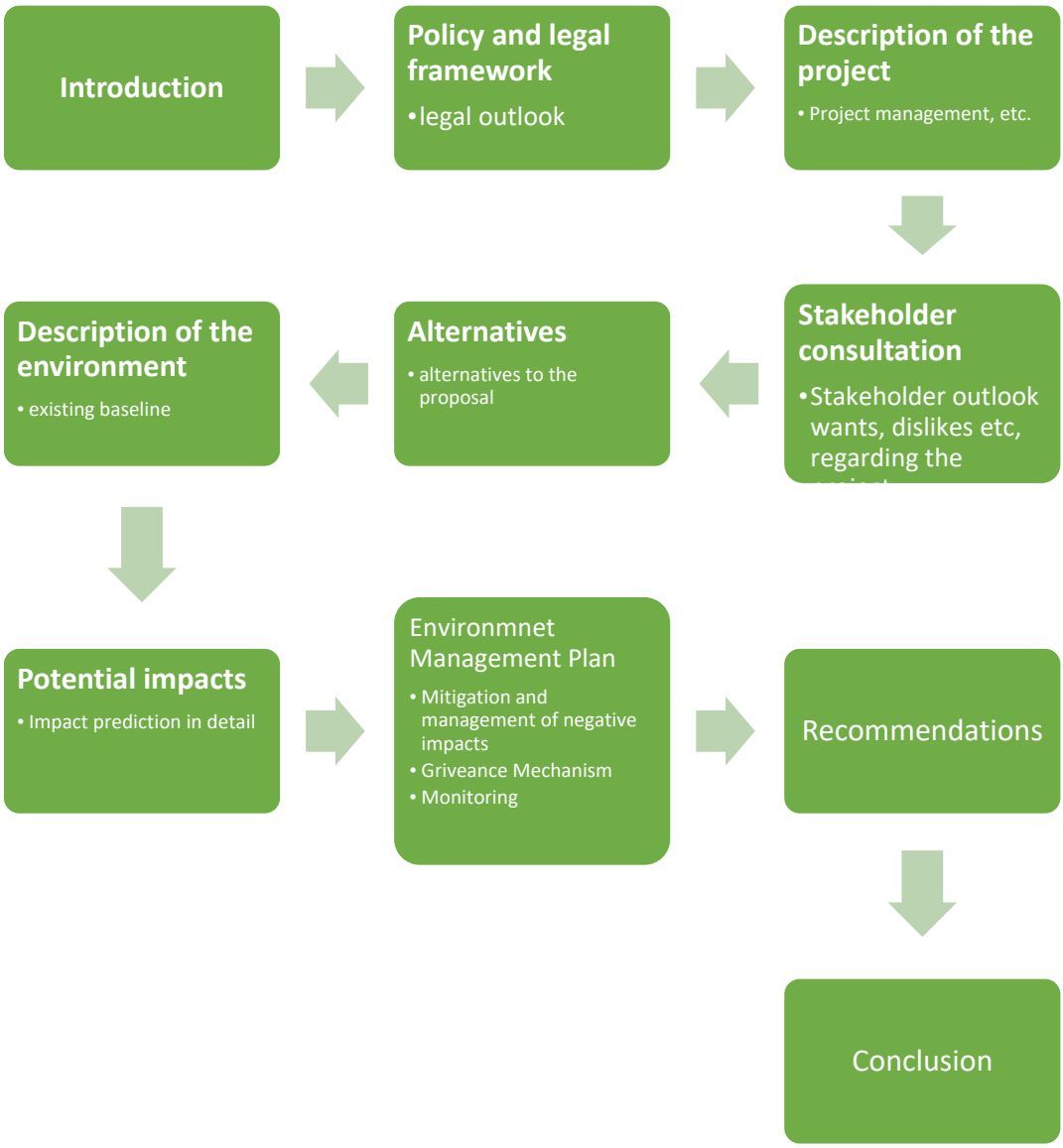

Figure 1-2: Pattern of EIA

Urban planning department,
GIS and Survey,
Environment Unit

Housing Development Corporation
HDC Building, Ground Floor
Hulhumalé, Republic of Maldives

1.3 Purpose of the EIA

The objectives of the EIA are;

- To provide an assessment of the potential environmental effects of the proposed development, determine the activities that are likely to have a significant effect on the environment, to propose relevant and economically feasible means of avoiding, mitigating or compensating for the predicted negative effects of the project,
- To provide the necessary information about the site of development and other factors surrounding the development to EPA,
- To assess the proposal and how it has been developed to achieve a satisfactory level of environmental performance in line with the EIA regulation.

1.4 Project proposal

The scope of the EIA study is limited to the following actions.

1. Road development
    a. To develop a safe and well-suited road surface for the vehicles operating in Thilafushi.
    b. To incorporate a well incorporated drainage system for the island.
    c. To provide a safe and convenient pedestrian walkway for the residents of Thilafushi.

The scoping meeting was held on 9th Jan 2023, after the screening decision statement (DS) ref number 203-ECA/161/2023/5. The scope in the form of Terms of reference, (TOR) (12.1) was set during this meeting using with the screening document with the relevant stakeholders in attendance. The baseline data, impact predicted, and recommendations are in accordance to the above stated TOR.

2 Policy and legal framework

2.1 Introduction

The upcoming section will discuss the legal, administrative, and policy framework related to environmental management, as well as the applicable regulatory guidelines and standards for the proposed project. All activities throughout the development and operation stages of the project will adhere to Maldives' existing plans, policies, guidelines, laws, and regulations, as well as relevant international conventions that Maldives has ratified.

2.2 Relevant, Environment Legislation

2.2.1 Environment Protection and Preservation Act (Act no. 4/93)

This Act set the basic principles and rules for the protection of the environment in the Maldives and whereby the Environmental guidance shall be provided by the authorized government bodies. Under this Act Environmental Impact Assessments (EIA) is mandated to be undertaken for all development projects that may have an undesirable impact on the environment. This addresses the disposal of oil, waste, and toxic gas or any substance that may have harmful effects on the environment within the Maldivian territory. it also deals with the penalty for breaching the law, and damaging the environment. The following articles are relevant during the undertakings of this project:

1. Article 2 states that the instructions for environmental protection will be given from the competent authority and everyone must respectfully follow these instructions
2. Article 3 states that all matters relating to environmental protection and preservation must be handled by the Ministry of Planning, Human Resource and Environment (MPHRE);
3. Article 4 states that the Ministry of Planning, Human Resources and Environment shall be responsible for identifying protected areas and natural reserves and for drawing up the necessary rules and regulations for their protections and preservation.
4. Article 5 states that any projects which pose significant impacts to the environment, an EIA report has to be made and submitted to the MPHRE. The projects which require an EIA and the regulation must be made by MPHRE;
5. Article 6 states that if any project is found to cause significant adverse impacts, MPHRE have the right to stop the project;
6. Article 7 states that any waste, oil or hazardous gas must not be dumped into any part of the Maldives, however, if strictly needed to be disposed it should be disposed of in an area designated by the Government. If such hazardous gas, waste or oil is to be disposed by combustion, it should be done in a way it does not impact human health and environment;
7. Article 9 states that any party who violates this law or any regulation under this law is punishable to no more than MVR 100 million according to the offence. The fine will be applied by the MPHRE.
8. Article 10 states that any offence to this law or any regulation under this law or any action resulting in environmental damage, the compensation for such damages can be taken through judicial processes.

2.2.1.1 1st addendum to Environmental Protection and Preservation Act (4/93) law no 12/2014

Article 3 and 11 of the Environmental Protection and Preservation Act (4/93) of Maldives is amended as follows: -
Under article 3, all matters relating to environmental protection and preservation must be handled by the Ministry charged with implementation of environmental policy.
Relevance to the project: the project is carried out in Maldives, hence must abide by all the regulatory requirements set forth.

2.3 Relevant Regulations and Guidelines

2.3.1 Environmental Impact Assessment Regulations 2012

The decision to go forward with an EIA will be decided upon the screening process. which dictates a category and the scope of the EIA. The proponent and the proponent's consultant (who is a registered consultant) will meet the EPA and stakeholders in a scoping meeting which will approve the TOR which will set the limits for the EIA. The EIA will start with the baseline studies, impact prediction and finally reporting the findings with impact mitigation and monitoring program. The EIA report will be reviewed by EPA, where a decision note will be given accordingly. After approval the project proponents will be required to follow the monitoring and implement the mitigation measures prescribed in the EIA.

2.3.1.1 Environmental Impact Assessment 2012 and Amendments

The EIA Regulation, which came into force in 2007, has been revised and this revised EIA Regulation is currently in force since May 2012. The Regulation sets out the criteria to determine whether a development proposal is likely to significantly affect the environment and is therefore subject to an EIA. Schedule D of the EIA Regulation defines the type of projects that would be subject to EIA. The main purpose of this Regulation is to provide step-by-step guidance for proponents, consultants, government agencies and the general public on how to obtain approval in the form of an Environmental DS.

2.3.1.2 2nd addendum to the Environmental impact Assessment Regulation 2012

With the 2nd addendum to the environmental impact assessment regulation 2012, there were some procedural changes made to the EIA process. The most important was the shifting of tourism related development projects EIAs to the Ministry of Tourism. Other than that, slight changes were made to the process such as the finalization of the TOR during the scoping meeting (article 11(b)) and changes in the fees for the review processes under three different categories (article 7(c)).

2.3.1.3 3rd addendum to the Environmental Impact Regulation 2012

One of the main modifications to the EIA regulation is that the EIA consultants are classified into 2 categories. To be eligible for a category A consultant, the applicant should hold a minimum of level 7 qualification in an environment related field recognized by the Maldives National Qualification Framework. Likewise, to be eligible for a category B consultant, the applicant should hold a minimum of level 7 qualification in specific fields relevant for the nature of the project recognized by the Maldives National Qualification Framework. As such, this report is prepared by registered category A EIA consultants.

2.3.1.4 4th addendum to the Environmental Impact Regulation 2012

One of the main modifications to the EIA regulation is that the exclusive list for EIAs were changed such that EIAs are not required for reclaimed lands until three years from the reclaimed date unless the project involves dangerous chemicals, oil storage, incinerators, release of toxic chemicals to atmosphere, and fiberglass works.

Relevance to the project: The current project, upon screening was categorized by EPA as a project that requires an ESIA.

1.1 Regulation handling, use and storage of hydrocarbons (2015/R-160)

The regulation was made to address law number 1/2008, clause 7, and 46. The purpose of the regulation is through mitigation and management, reduce loss of life and property of locals due to petroleum-based fires. Raise local awareness on management practices such as, handling, and storage of hydrocarbons. In addition to the above, the regulation ensures uniformity of the standard of the existing and proposed establishments that store, sell and manage hydrocarbons.

2.4 Regulation on management of hazardous chemicals (2019/R-1057)

The regulation was made to address law number 4/75,5 A, 3. The purpose of the regulation is to define what are hazardous chemicals, inform the necessary parties of the practices of importing and exporting such chemicals, inform the necessary parties of the pathway for importing the said chemicals, and the steps that must be put in place for the process, and inform the importers of the general best practice for the processes

2.5 Regulation on protected species (2021/R-25)

The regulation is designed to record, manage, maintain and promote the conservation of selected species, its diversity and their gene pool in the existing environment of the Maldives.

The purpose of this regulation is to:

a) Ensure preservation and conservation of the existing biota, its habitat, the integrated ecosystem's integrity and natural resources;
b) Ensure establishment of robust, inclusive, transparent regulations in nominating and managing the protected species;
c) To recognize key environmental species and their ecosystems;
d) Protect globally endangered species, cooperate with the global effort for conservation of the said species and contribute at a national level to achieve the conservation of the said species;
e) Establish protection and preservation of selected species and ban carrying out any activity that can potentially harm the protected species in nature;
f) Establish and manage a database of protected species;
g) Establish and manage a database that can reflect the status of endangered and endemic species;
h) Promote participation and awareness of the general public in determination and establishment of protected species:
i) Develop and make firm the policies that analyses and studies protected species.

Relevance to the project: This is a road side project which deals with either complete removal of existing tree species hence this regulation needs to be addressed. This project may consist of existing protected species of trees

2.6 Regulation for Protection and Preservation of Island Vegetation and Flora in the Maldives (2022/R-92)

This regulation defines the procedures for uprooting and replanting of vegetation in Maldives protecting, preserving and conserving the flora and fauna of Maldives.

The purpose of the regulation is:

1. Encourage proper propagation of vegetation, in order to enhance and conserve the vegetation of Maldives.
2. Protect, conserve and manage significant and old vegetation identified in the islands of Maldives.
3. To decentralize the management of felling, uprooting, excavating, and translocation of vegetation.
4. To determine and define, the procedures necessary for the management of felling, uprooting, excavating, and translocating of vegetation to mitigate the possible negative impacts on the total green percentage of the island, the natural beauty of the island, and the overall environment.
5. To ensure that vegetation felling, uprooting, excavation and translocation is only opted in cases that proves to be the only and final option and ensure that the processes are managed, monitored and reported.

Relevance to the project: The project has a terrestrial movement component to make way for the existing design

2.7 The Environmental Liability regulation (Regulation 2011/R-9)

This regulation is also pursuant to Environment Protection and Preservation Act of Maldives (4/93). The regulation is aimed at maintaining equal standards for reprimanding and enforcing environmental liabilities, fines for those who violate the rules and regulations and give guidance to those who are involved in the implementation process of the regulations pursuant to Preservation Act of Maldives (4/93). Provide the basis for levying fines on environmentally damaging violations to avoid environmental deterioration, extinction of biological resources, environmental degradation and wastage of natural resources. One of the key objectives of the environmental liability regulation is also to practice polluter-pay- principles in the Maldives.

Relevance to the project: Apply with respect to the environmentally relevant aspects of the construction and operation phase, the proponent shall take all practical measures to ensure that the mitigation proposed in this EIA is followed.

2.8 Construction Site Health and Safety Regulation (2019/R-156)

The regulation was published by Ministry of National Planning and Infrastructure on 30th January 2019 as supporting document to National Construction Act (4/2017). The purposes of the regulation are

To define the minimum Health and Safety precautions that needs to be practiced to ensure the Health and Safety of workers and the public.

To define the fines and actions that will be taken against the parties that do not follow the regulation.

Ministry of National Planning and Infrastructure will be the implementing authority of the regulation. The regulation defines the responsibilities of the contractor and fines for breaching the regulation. As per the regulation it is mandatory for the contractor to carry out the following:

A. To provide Personal Protection Equipment (PPE) to all workers.
B. To conduct Health and Safety Inductions sessions for all workers.
C. All workers must complete the Health and Safety Training when they start work at a company.
D. All contractors must have a Health and Safety Plan and Emergency Plan and workers must be trained to follow the both plans.
E. Contractor must ensure all the works are carried out as per Health Safety Plan.
F. Contractor must install Health and Safety Boards at the Works site. Warning signs and speed limits should be installed accordingly at the site.
G. Contractor must ensure the safety of adjacent properties next the work site and take all necessary precautionary measures to prevent damages to nearby properties.
H. Contractor must provide safe passage for the public when the works are carried out on public places and roads.
I. All work sites must have a Health and Safety Supervisor to assess the health and safety of site and compile reports. He must record all accidents on site and inform the head office.

Relevance to the Project: The project must follow regulation to ensure a safe working environment for the workers, volunteers, and staff. The project will follow all the requirements of the regulation at all mediums; land and sea, to ensure the Health and Safety of workers and the Public.

2.9 Public health emergency regulation (2020/R40)

The guideline defines the procedures to follow in case of a public health emergency.

Relevance to the project: The proponent is responsible for the general health of the staff involved. Hence must follow the procedures accordingly.

2.10 Regulation on treatment of the diseased in case of a contagious disease (2020/R34).

The guideline dictates the best practice for management and treatment of the diseased in case of suspected or confirmed contagious pathogen.

Relevance to the project: The project is carried out on an inhibited island. Given the current climate of reoccurring COVID 19 cases, other health emergencies, etc. The contractor must be informed and prepared for the proper procedure for such an unfortunate event.

2.10.1 Regulation on isolation and quarantine facility standards (2020/R35), amendment 1 (2020/R-76)

The regulation and the amendment define the requirements, and standards of the mandatory quarantine facilities for isolation of incoming, potential cases, and outgoing staff.
Relevance to the project: The contractor is required to follow the guideline to prepare proper quarantine facilities.

2.11 Regulation on waste management (58-R/2013), amendment 1 (10-R/2014), amendment 2 (29-R/2014), amendment 3 (90-R/2017), amendment 4 (63-R/2018), and amendment 5 (109-R/2021),

The waste management policy ensures that the Maldivians are well aware of the waste management techniques and maintains cleanliness as well as the natural aesthetics and clean air quality of the country is well maintained. Under this policy, all the inhabited islands need to implement a waste management plan and manage all the wastes generated from that island in accordance with that policy.
The policy was framed keeping in mind a healthy environment which is solid waste free. Ensuring safe disposal of Solid waste, chemicals and hazardous industrial waste. Encouraging recycling, and reducing of waste generated. It also allows development of guidelines on waste management and disposal and advocate enforcing such guidelines.
Relevance to the project: This project will comply with this guideline such that any waste generated during the construction and operation phases of this project will be dealt with in accordance with the waste management plans of HDC and the government

2.12 Regulation on migratory birds in Maldives

The aim of this regulation is to ensure protecting and conservation on Migratory birds in the Maldives, according to this regulation birds except Dhivehi Kambili, Huvadhooo, Raanbondhi, Dhivehi Raanbondhi, Medu Raajethera Raanbondhi, Dhivehi Koveli and Kaalhu are considered Migratory birds under this regulation.
Relevance to the project: The project consists of uprooting and relocation of existing tree species where these migratory birds can potentially take shelter in.
Relevant permits

2.13 EIA decision Statement

The DS is to be issued by EPA to allow commencement of the project giving clearance and go ahead by the government.
Relevance to the project: This project is one that requires an EIA, hence requires a DS to either allow the project to go ahead or to stop the project.

3 Introduction to the project

3.1 Project Setting

The proposed project involves the construction of pilot road in the island of K. Thilafushi. The need for the project, scope, and site conditions are detailed in this section. This ESIA was initially completed and approved. However, due to delays of extension of the decision statement (DS), the ESIA is repeated.

3.2 Objectives of the project

The general objectives of the project are;

1. potentially provide a better road to the island,
2. potentially provide a solution for the drainage system of the island, and
3. potentially provide a safe and convenient pedestrian walkway for the residents of Thilafushi.

3.3 Need and justification

The need for the project is well established based on the existing poor condition of the roads in Thilafushi. Despite being the industrial hub of the country, there has not been a proper modern road built in the most used and congested areas in Thilafushi up to this day. Numerous industries are established in Thilafushi and the island would be the one with the most number of heavy machinery in operation.

There are numerous issues with regards to the existing roads including:

- Require regular costly maintenance works to maintain the road levels
- Not friendly to pedestrians
- Does not have any dedicated drainage
- Not able to cater for the existing demand
- Health and safety concerns due to the usual poor condition of existing roads

Thilafushi pilot road project was thus formulated by Greater Male' Industrial Zone Limited (GMIZL) to improve the accessibility of the island within the eastern established side of the island. With the merger of GMIZL and HDC, it had been proposed to re-formulate the project to propose a road which covers the full span of Thilafushi Phase I. This is to connect with the already laid road in the southern half of the island which connects the eastern and western wings of the island. Furthermore, this additional road length would ensure the provisional connection for Male'-Thilafushi Bridge. This road will therefore be a key success factor to spear head the future development of Thilafushi.

In addition to attending to the issues previously mentioned, the goal of this project is to improve accessibility within Thilafushi, in order to provide safe transportation for the residents and visitors of the island. The aim is to design a safe and sustainable road system for Thilafushi.

The stated objectives of the Thilafushi pilot road project are:

- To develop a safe and well-suited road surface for the vehicles operating in Thilafushi.
- To incorporate a well incorporated drainage system for the island.
- To provide a safe and convenient pedestrian walkway for the residents of Thilafushi.

3.4 Project Proponent

The proponent for this project is Housing Development Corporation (HDC). Established in 2001, the proponent is a 100% state-owned enterprise, is the master developer, and regulator for the development of Hulhumalé investing in the infrastructure necessary for quality living and business prosperity.
The proponent undertakes projects ranging from residential, commercial, industrial, institutional, cultural, and hospitality.
Maldives merged greater Malé' industrial zone ltd ("GMIZL") into HDC in September 2019, adding the development and management of the nearby islands of Gulhifalhu and Thilafushi into the proponent's overall mandate. The proponent's vision is a leader in redefining quality living. The proponent's mission is to be a pioneer in establishing higher standards of living through intelligent, innovative, and sustainable developments in the Maldives.

3.5 Terms of reference (TOR)

This EIA is prepared in accordance with the Terms of Reference (TOR) approved by the Environmental Protection Agency (EPA) on 11th January 2023. It is a legal requirement that projects that have the potential for environmental impacts obtain environmental clearance or approval prior to construction and operation of such projects.

3.6 Scope of the EIA and approach

The principal environmental institution that implements EIA process in the country is Environmental Protection Agency (EPA). Additionally, the Ministry of Environment provides policy guidance and directions while Atoll Councils and Island Councils also provide approvals before projects are implemented. The role of the councils will not be applicable to this project.

The main scope of this EIA report is to assess, identify, predict and document potential environmental impacts from the proposed road development works.

The study will document the whole project proposal in detail, in order to identify the main environmental impacts that are associated with the proposed development, and what component of the development will have the most impact. The study will also cover the legal requirements that need to be taken into consideration while designing and implementing this project.

The environmental impacts can only be understood once the receptor of the impacts is identified and studied. As such, this document also addresses the existing environmental condition of the island and foresees the ways in which potential environmental impacts will be mitigated and/or nullified.

The study further assesses potential alternatives to components of the project and the total project as a whole. These alternatives are studied in terms of how environmentally favorable with respect to the proposed project.

In general, the EIA report has been based upon the following sources of information:

- Project documentation from proponent
- Preliminary design
- Discussions with stakeholders
- Site visits
- Baseline environmental assessments
- Legal literature- Environmental Impact Assessment Regulation 2012 and other relevant regulations
- Other similar EIAs, and environmental studies undertaken for the site
- The consultant's previous experience in similar projects

3.7 Project tasks completed

The site has been fully surveyed to obtain data for design works. Subsequently, preliminary design works have been completed and is now currently in the process of doing detailed design simultaneously with EIA works.

Geotechnical studies have also recently been completed to assess the soil profile along the proposed development area.

3.8 Project location and study area

The project is proposed in Thilafushi. General information on the island is given below.

ISLAND	**THILAFUSHI**
Location	04° 11' 00" N and 73° 26' 44" E
Area	120 Ha
Length	2.7 km
Width	350m average)

Table 3-1: Project Location

3.9 Relevant studies

Recent EIAs for road development projects and research done for Thilafushi have been referred to understand the project and gain insight to the existing environment of the island. These include:

- EIA for proposed Road Development Project at Sh. Milandhoo
- EIA for proposed Road Development Project at GDh. Milandhoo
- EIA for the proposed Design and build of major roads-phase II at Gdh.Thinadhoo
- EIA for the proposed greater Male' connectivity - K.Male' to K.Thilafushi Link Project, K.Male' Urban Region
- EIA for the Thilafushi Dempsite Rehabilitation – MLD: Grater Male' Waster to Energy project by Water Solutions

Specifically, issues discussed in the **EIA for the Proposed Road Development Project at GDh. Gahdhoo by Sandcays** in 2020 have been reviewed. Furthermore, recent studies done for Thilafushi island had been researched as well. Among these, the most reviewed document is the **EIA for the Thilafushi Dumpsite Rehabilitation – MLD: Greater Male' Waste to Energy project by Water Solutions** in 2020. The former report gave a good understanding of the impacts and mitigation and management aspects considered for road development projects while the latter provided valuable insights to the existing environment of Thilafushi island.

3.10 Work duration

The proposed work is to commence after the approval of the EIA. The duration of the work is set for 520 days form the approval of the EIA.

3.11 Study Methodology

The field studies have been undertaken using methods employed in EIA studies. The core samples and studies are from the geo technical report.

3.11.1 Existing conditions

The existing conditions were described initially by reviewing relevant available data, next the material was cross-checked on-site images. This was followed by setting up a plan for consultation of the stakeholders. The stakeholder consultation was executed on site and in official settings. During the visit interested locals were invited for a survey field visit to further aid in identifying the problems and sharing the local hindrances; in this methodology the interested parties will point out on site, the significant points of interest for them. On site, all hindrances relevant to the project was recorded and photographed and if relevant used in the report.

3.11.2 Methodology used in description of the environment

The physical environment and the climate conditions were described using onsite data, and available data in literature. The climatic conditions were described by using data from the weather stations. The natural and biological environment was surveyed, data collected, analysed, and reported. The socioeconomic data was collected and analysed with the help of the locals and reported. The following are the details of the methodology used.

3.11.3 Ecology

3.11.3.1 Overall conditions

The overall site conditions were analysed using an ATS image post survey and post stakeholder consultation. This was done using a WINGTRA drone and a complimentary application to grid out and stich the images.

3.11.3.2 Visual analysis

The objective of the study was to get a general idea of the benthic condition of a general area of interest. Two surveyors swam side by side timing the phase, parallel to each other recording the findings. In this visual survey the observers looked for natural, and anthropological factors and noted down the general benthic substrate condition. The visual survey is also required to determine if further analysis is necessary. If the area lacks hard coral structures and sea grass. The data from the visual analysis is used which reports general depth, horizontal and vertical visibility, top layer identification, and substratum analysis.

3.11.3.3 Water testing

Ground water testing was carried out on site using a YSI probe, and water samples were collected at around a depth of 3 m using a 500ml bottles. The sample sites were geo referenced.

3.11.4 Terrestrial Environment

The scope of the terrestrial survey was limited to the tree survey and spotted mega fauna.

3.11.4.1 Tree Survey

Tree survey was conducted 1 m inwards from the point of construction The survey conducted noted significant tree species along a footpath on the site of interest. Among the recorded parameters are; genus, species, girth, height, gps location, and health of the tree.

3.11.4.2 Maga and micro fauna count.

Maga fauna count was carried out with the GPS locations, the general genus of the fauna, and number.

3.11.5 Stakeholder's consultation

All stakeholder consultation was conducted after an official request for the meeting. Some meetings were granted online while others were physical. Further, onsite stakeholder consultations were carried out using online forms.

3.11.6 Impact prediction

Environmental impacts are predicted by using checklists and its significances are evaluated using matrices. Expert judgment and professional opinion as well as review of relevant EIA studies have also been widely used throughout the impact assessment and evaluation process. These methods are described in detail at the relevant section of this EIA Report.

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Environment Unit

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3.12 Project description and methodology

The proposed infrastructure development consists of the following components.

3.12.1 The project design details

The following are the design details (Table 3-2). The measurements are given in millimeters. The cross sections are appended under 125.

Design type	Footpath / mm	Infiltration zone / mm	Cobble stone block / mm	Road footprint / mm	Slope percentage in degrees	Road footprint / mm	Cobble stone blocks / mm	Slope percentage in degrees	Infiltration zone / mm	Footpath / mm
A-A	2000	1000		4000	3	4000		3	1000	2400
B-B	2000	1000		4000	3	4000		3	1500	2000
C-C	1000	800	1000	3000		3000	1000		1000	1200
E-E	2000	1000		4000	3	3000	1000	3	1000	1000
F-F	2000	1000		4000	3	4000		3	1500	2100
H-H	1300	1000		4000	3	4000		3	1500	2500
I-I	1100	1000	1000	3000	3	3000	1000	3	1000	1000
J-J	2300	1500		4000	3	4000		3	1000	1400
K-K	900	800	1000	2650		2650	1000		1000	1000
L-L	2000	1000		1000	3	3000	1000	3	1000	1300
M-M	1000		1000	3000	3	3000	1000	3	1000	1000
N-N	1000		1000	3000	3	4000			1500	2500
O-O	1500	1000		4000	3	4000		3	1000	1500

Table 3-2: Dimension of the sections of the road reflecting the design type

The developer has preferred to implement a green drainage system where water will be percolated into the groundwater aquifer. Water will not be discharged out to the sea and there are no storm water outfalls proposed. The drainage area ranges from 800mm to 1500mm in depth depending on the design type. The width of the footpath in the section varies from 900mm to 2000mm. The road with depends on the type as well, the range is from 1000mm to 4000mm where in some sections, a cobb stone structure exists on either side of the road or on one side of the road.

3.12.2 Mobilization and site setup

Construction materials and machinery will be brought to island on supply vessels. All the required materials can be brought to the island via the existing harbour. No new channel is to be dredged as part of the project.
Material will be temporarily stockpiled near the harbour area but later transferred to the project area and temporary site. Most of the machinery will be transferred to the temporary site. The process will in general include the following:

- Mobilization of required labour, materials, equipment, and tools for the project
- Training and orientation of contractor staff regarding the work to be performed, safety, social and security requirements prior to any site work being performed. The primary supporting/staging area will be utilized to stage temporary field offices, security office, and various equipment/tool storage
- Construction of a temporary fill stockpile area, a material staging area, and a clean backfill stockpile area.

Site preparation will commence as per approved site layout. Together with site preparations necessary preparations to construct transfer, staging and processing area will be undertaken. These include:

- Establishment of proposed excavation limits
- Establish site work zones
- Installation of dewatering facilities if required
- Installation of necessary traffic controls.
- Site accommodation, survey work, fencing and utility

3.12.2.1 Work camp

Work camp is proposed at location 4°10'53.92"N, 73°26'0.39"E, (Figure). The work camp must have enough accommodation space, utility space, parking space, vehicle repair space, waste management, oil management, and security space. The work space proposed is just a concept. However, must contain the necessary details identified in this section.

Site survey will then be undertaken by approved surveyors to establish permanent benchmarks, alignment of roads, elevations of all layers of roads, utility structures such as manholes, gully, medians, light poles and walkways.

3.12.3 Land clearance

Clearing and grubbing works will be undertaken once site setup works are completed. The works will be carried out based on site requirements and will typically involve the removal of non-protected tress as well as other vegetation. Trees or landscape elements of significance will not be tempered. These will be marked before commencing clearing works. Reasonable efforts will be made during clearing to ensure the survival of these trees. During the clearing process, subsurface root material and small vegetation patches will be separated and handled appropriately. It is expected that all roadside vegetation along the full length of the proposed road will be removed.

3.12.4 Excavation and removing waste

It is expected that large amounts of top layer would need to be removed along the full length of the road. Excavators would be engaged throughout to remove the top layer which is expected to be about 1.5 m from existing ground level. The waste will be collected onto dump trucks to be transported to Thilafushi waste landfill area.

Access to properties will be maintained for residents during construction activities. Temporary wooden or concrete walkways will be provided to all building sites. The contractor will coordinate the excavation works with the developers site office and keep them informed of the properties or areas where work will be performed. The developer can then inform all the property owners in a given area so that they can take the necessary steps to ensure continuation of their business operations. The developer will coordinate with the contractor and property owners and supervise the works closely.
Work will be undertaken by considering the emission of dust during the excavation process as properties are close by the main road. The target will be to generate no or minimal dust during the process. Water spraying will be carried out periodically as the primary method of dust control.

Excavation notification will be given to locate existing underground utilities. With the help of the utility services in the island, care will be taken to minimize damage to existing cables and pipes. Excavation would ideally be undertaken after getting the network drawings for the area to ensure minimal impact. However, it is expected that the actual pipes and cables may not

be representative of the network drawings or in the absence of the network drawings, the excavation would be pre informed to the utilities and will be done in the presence of staff from the utility services.
Excavation next to existing structures will proceed with caution. Regular monitoring will be done to observe any case of undermining or settlement at structure. The excavated areas will be shored and demarcated from the adjacent structures.
During non-working hours, temporary stockpiles will be covered with poly sheeting and secured with sandbags to prevent precipitation from entering the stockpile and minimize dust emission.

3.12.5 Utility and junction drainage

The replacement of relocation of utilities will be undertaken during backfilling operations. Coordination with developer, contractor and utilities will take place to establish specified protocols, materials, installation procedures, field testing, and inspections required for each utility. The process will be done in the design stage and again physically at site.
As seen from the section drawings, the roads predominantly consist of planting & drainage areas, otherwise known as a green drainage where water to be guided towards and use for plant growth. The excess water is to be absorbed into the ground water aquifer. This is a relatively maintenance free drainage type compared to concrete gutters, which require consistent clean up to maintain sufficient space for drainage.
Planting works will commence once the road construction works are completed. Within the scope of works, provisions will be made along the road for areas that require planting.

3.12.6 Transporting sand and backfilling

All the sand required for the backfilling works is proposed to be sourced from Hulhumale' Phase 3, which is under the jurisdiction of HDC. HDC had informed that there is sand stockpiled well in excess if the required quantities for backfilling works. Sand will be collected at Hulhumale' Phase 3 using excavators and dump trucks, which will load the required volume to barges to be transported to Thilafushi by sea. It is expected that over 30,000 cbm of sand will be required for the backfilling works for the approximately 1500m length, 15m wide, and 1.5m deep area. For the remaining area, any need to backfill can be attended by the sand that had been excavated from this area.
Sand transport will take place after the initial mobilization is completed. Once the sand barge reaches Thilafushi, excavators and dump trucks will again be engaged to transfer the sand from the barge to stockpile in Thilafushi. Stockpile will be made near BH6, where sufficient land is available. Sand will later be transported from the stockpile to the required area on a needs basis.
Backfill material will be taken from the sand stockpile, placed and graded, utilizing track dozers and loads in loose fits less than 200 mm. Compaction will be done using Steel Drum Roller, Plate Tempers, tracking with track dozers as required. Compaction will be to the required percentage of maximum dry density in accordance with standard specifications.
Static rollers will be used at a safe distance from any structure and underground utilities. Manual or hand compaction equipment may be used in narrow areas with limited access or adjacent to foundations or near underground utilities
Care will be taken adjacent to structures placing backfill material in 200 mm loose layers and backfilling against structure by carrying the material uniformly around the structure at the same elevation in each lift until final grade elevation is achieved.
Foundations with structural integrity issues will be backfilled with select fill and if necessary, the thickness of backfill layers will be reduced to 150 mm or less with compacting undertaken by manual or hand operations. Any requirement of additional backfill material/sand will be obtained from the stockpile.
Backfilling will be done only upon approval of the project engineer and completion of the topographic survey of the excavation limits.

3.12.7 Construction of asphalt road

- The carriageway surface will be established using excavator and grader. Sand required for this work will be obtained from the initial stockpile made in Thilafushi.
- The surface layer will be compacted to the optimum strength using vibratory roller.
- The surface will be kept moist throughout the whole process by spraying water. Existing sub base surface depressions and pot holes will be filled, and all corrugations will be removed by reshaping the surface to the required grade as necessary during this stage. The compacted subgrade shall be finished to levels, grades and cross sections shown in the drawings and as directed by the Engineer.
- A geotextile approved by the engineer shall be placed over the compacted sub-grade to separate sub-grade and infill material.
- Once the sub-grade compaction work is done and the optimal strength is achieved, a 150 mm thick Gravel Base is added and compacted. The compacted layer will be tested to check whether the required strength is met.
- Geocells with a thickness of 200 mm will be placed within the gravel base layer. The geocells will then be stretched and adjusted with steel bars before being filled with gravel and crushed with a vibrating plate compactor.
- A 150 mm thick Dense Aggregated Base Course (ABC) layer is then added and compacted.
- Hot Mix Asphalt production will then commence in the asphalt plant. The plant proportions, blends, and heat aggregate and asphalt to produce Hot Mix Asphalt that is up to standards. The produce will then be transported to the area that requires paving on the day.

- A tack coat will be applied to all existing surface prior to laying asphalt so as to provide a proper bond between ABC and Asphalt layer. Asphalt layer placing is completed with a paving machine. Regular tests will be undertaken throughout to ensure the quality of Asphalt. When placing the asphalt, it will be ensured that the appropriate slope is maintained to allow for proper drainage of water collected on the surface.
- The newly laid asphalt layer will be reoriented into a closely spaced arrangements using smooth wheel roller and pneumatic rollers to ensure the asphalt layer is fully compacted.
- Finally, a prime coat of bitumen emulsion is applied on the top surface. Afterwards, the surface will be left to cool down to surrounding temperatures before allowing for traffic.

3.12.8 Road markings, finishing and placing street lights

Road markings will be placed in accordance with the land transport regulation and complying with the requirements by the Traffic Police. Speed breakers, zebra crosses, LED street lights and clearing for final opening of the road will all be established during this last process.
Light pole foundations, power cables for the street lighting will be installed for the roads as per approved design and contract specifications.

3.12.9 Work force and machinery

This is one of the key components that need appropriate management on site during the construction phase. In the proposed project, an estimated number of 15 staff including laborers, engineers and supervisors will be stationed on the island.
The following list of equipment and machinery will mobilize to site.

1. Excavator
2. Pneumatic Roller
3. Asphalt compactor
4. Water Bowser
5. Bitumen Sprayer
6. Paver
7. Hot mix asphalt plant
8. Truck /pickup

3.12.10 Waste management

The following order of waste management hierarchy will be established as part of the project waste management;

- Avoid
- Reduce
- Reuse
- Recycle.

During the construction phase, the main waste stream including household wastes from accommodation blocks, hazardous waste (e.g. batteries, and spent oil) and unusable or spent materials (e.g. plastic pipes, packaging, cement bags, chemicals). Green waste collected during site clearance will be mulched and used as fertilizer for landscaping. In addition to these daily wastes, spillages during unloading of material would be of concern. Therefore, unloading processes will be properly supervised.
Furthermore, hazardous wastes such as grease, waste oil from generator and machinery, empty paint and varnish cans, batteries, water proofing and other finishing chemicals and chemicals required for the RO plant operational will be generated during the operational phase. They will be collected in separate areas within the facility and send for appropriate disposal at Thilafushi or other regional designated landfill in separate and appropriate packaging.

Figure 3-1: Hazardous Waste Signage to be Used on Site

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Environment Unit

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The following signboards will be used at areas where the aforementioned hazardous waste is to be stored within the site.

Other waste will be segregated, and the following signboards will be used to place where each type of waste are to be placed.

3.12.11 Health and safety

Health and safety is also an important aspect that needs careful consideration during the implementation phase. Protection of employees from likely adverse effects will be one of the core duties of the proponent or contractor. All machineries and equipment must be operated by trained and experienced personnel wearing necessary safety gears. The care shall be paid for the work underneath electric lines.
Person-in-charge of each group shall be responsible for following every safety measures. Supervisor shall conduct Safety Toolbox Meetings and explain the safety procedure to the employees. Warning signboards will be placed outside the temporary site.

Figure 3-2: Waste Segregation Signage to be Used on Site

Examples of signboards to be used include the following.
Special attention shall be paid for the pipe laying along the road. Traffic arrangement shall be discussed with the relevant authority prior to the commencement of work.
Road Safety shall be among the considerations of the safety precautions. In case of accidents and spills, an emergency response plan will be implemented. More health and safety issues are recommended under the Mitigation plan provided in the report.

Figure 3-3: Site Safety Signage to be Used on Site

3.12.12 Quality control plan

Quality Manual shall be maintained for Quality Assurance for the project.

- The specific QA/QC program will be established so as to ensure that the project requirements will be met for all elements of design, material/service procurement, fabrication, assembly, shipping and installation.
- Document Control
  - Document control covering the requirement for the preparation, review, approval and distribution will be established to ensure that those documents and changes thereto are controlled and distributed as required to locations where applicable work is being performed.
- Materials and Equipment Control
  - Controls will be established to assure that only correct and accepted items are used and installed
- Inspection/Testing
  - The objective of inspection and test is to ascertain that equipment and materials are manufactured and erected strictly in accordance with QA/QC program as well as client document.
- Quality Assurance Records
  - Records that furnish documentary evidence of quality, if required by the Client, will be specified, prepared and maintained
- Audits
  - Planned and scheduled audits will be performed to verify compliance with all aspects of the QA/QC program to evaluate its effectiveness.

3.13 Project schedule

The project physical works are proposed to commence during the 3rd quarter post EIA. It is anticipated 2 months will be taken for the tendering process. Duration of the construction works is expected to take approximately 510 days.
The works will be carried out the following sequence.

- Detail design works
- Procurement and import of supplies and machinery
- Mobilization
- Material casting including cable junctions, streel light foundation, curb stones, etc
- Excavation of sidewalks
- Installation of cable junctions and pipeline
- Placing aggregates and compacting and setting up drainage area
- Replanting trees

- Placing street lights foundation
- Laying of curbstones
- Paving sidewalks
- Excavation of carriageway
- Lowering and rising existing utility junctions
- Backfilling carriageway
- Supply, laying and compaction of aggregate base course
- Application of prime coat/tack coat
- Supply and laying of hot mix asphalt
- Road marking and signage
- Installation of speed breakwater
- Installation of street lights

Detailed work schedule is attached in the Annex (12.13) of this report.

3.14 Project inputs and outputs

The project has inputs in terms of human resources and natural resources such as water and

fuel. The main output of the project is effluent. These inputs and outputs are summarized in the following tables

INPUT RESOURCE(S)	HOW TO OBTAIN RESOURCES
Construction workers	Labourers mainly from contractors' team
Engineers and site managers/supervisors	Contractor's permanent staff.
Sand for backfilling (40,000 – 50,000 cbm)	Transported from Hulhumale' Phase II on barge
Construction materials: - road blocks, asphalt, aggregate, PVC pipes, sand, cement, road paint, etc.	Imported (mainly from India/Sri Lanka/Malaysia) and purchased where locally available at competitive prices. Contractor to approve materials and procure initially required items before mobilisation
Water	From MWSC
Electricity	From local utility company, STELCO
Machinery and Equipment (list given in section 2.8)	Contractors own and leased equipment
Protective clothing and gear	Contractors equipment procured for project
Firefighting equipment	Contractors equipment imported from abroad
Operational staff	Trained and hired from local community

Table 3-3: Major Project Inputs

Products and waste materials	ANTICIPATED QUANTITIES	METHOD OF DISPOSAL
Noise	50 – 80 dbA. Localized	Controlled using effective scheduling and barriers (site fence)
Waste oils from machinery	Moderate quantities	Collected and store in barrels to be transported to Thilafushi waste area
Uprooted Trees	10 trees	Trees to be replanted in the proposed green areas in the new road
Cleared green waste	Minor	Natural decompose at site
Buried waste (Rock, cardboard, gunny bags and scrap metals)	Moderate	Collected and transported to Thilafushi landfill
Excavated sand	Moderate	To be reused to backfill trenched areas. If waste content high (especially in BH2 – BH5 area, sand to be loaded to dump truck and transferred to Thilafushi landfill
Used oil (waste oil), grease	Small quantities	Reused as lubricants. Those that cannot collected on site to be transported to Thilafushi waste area when project ends.
Solid waste (kitchen waste, waste from workers)	1.5 m^3/day	Transported to landfill in Thilafushi.

Table 3-4: Major Project Outputs

Figure 3-4: Proposed Road Development Layout

Urban planning department,
GIS and Survey,
Environment Unit

Housing Development Corporation
HDC Building, Ground Floor
Hulhumalé, Republic of Maldives

1. Mobilization and survey work
    a. Mobilisation
    b. Surveying and setting out
    c. Mobilisation for accommodation
    d. Machinery mobilization
2. Site accommodation, survey work, fencing and utility
    a. Temporary fencing
    b. Utility services arrangement
    c. Construction of temporary accommodation
    d. Security and sign board arrangement
    e. Surveying work
    f. Setup site office, site lab, and warehouse
3. Correction work, excavation, cleaning work
    a. Demolition and rectification
    b. Disposal of debris
    c. Removal of existing street lights, cable network
    d. Relocation of existing electrical/ telecom distribution boxes, junction boxes
    e. Removing and relocating trees
    f. Clearing the site area from rubbish and vegetable matter, stumps, and roots
    g. Cut and fill of subgrade
    h. Disposal of unsuitable soil
    i. Filling of suitable soil form Hulhumale stock pile
4. Utility junction installation
    a. Excavation for EJB/ TJB
    b. Excavation for manholes
    c. Installation of EJB
    d. Utility box installation
5. Utility work, EJB,TJB, manhole, pipe installation
    a. 200 mm PVC pipe laying
    b. Installation of TJB
    c. 100 mm PVC pipe laying
    d. Ducts for GPON network
    e. Construction of street light foundation
    f. Excavation for planting
6. Laying of PCC
7. Laying of kerb stone
8. Footpath bed preparation and laying of paver block
9. Carriage way work
    a. Subgrade preparation
    b. Catch pits
    c. Laying of geocell
    d. Adding Base course (ABC)
    e. Asphalt wearing course
    f. Geotextile, prime coat, tack coat

4 Stakeholder consultations

4.1 Introduction

The effective execution of the proposed project heavily relies on the engagement of stakeholders. Consultation with all the pertinent parties, including public consultation, relevant government authorities, and community members, has been an essential component of this EIA. The objectives of this chapter is to provide an overview of the stakeholder consultations that were carried out.

4.2 Methodology

For the Pilot Road of Thilafushi the following stakeholders have been identified and analyzed per project component. These stakeholders include affected parties (as defined in section 4.2.1), other interested parties (as defined in section 4.2.2) and disadvantaged/vulnerable individuals or groups (as defined in section 4.2.3).

4.2.1 Affected parties

Affected parties include local communities, community members and other parties that may be subject to direct impacts from the Project. Specifically, the following individuals and groups fall within this category:

MTCC
STO
MCCEE
MHLUD
RDC
Villa Hakatha
Gulf Craft Maldives
Apollo Holdings
Nalahiya holdings
Ibrahim Haleel
Abdul Samad
Hussain Manik
Mohamed
Abdullah Ihusan
Ali Hussein
Ibrahim Ismail

4.2.2 Other interested parties

The projects' stakeholders also include parties other than the directly affected communities, including:

NDMA

4.2.3 Vulnerable/disadvantaged individuals or groups

Vulnerable/disadvantaged individuals or groups are persons who may be disproportionately impacted or further disadvantaged by the project as compared with any other groups due to their vulnerable status, and that may require special engagement efforts to ensure their equal representation in the consultation and decision-making associated with the project. The main vulnerable groups identified are women, elderly, people with disabilities, migrants, and unemployed. These groups either are not provided access to decision-making positions, or they are unable to participate in decision-making forums. Within the Project, the vulnerable or disadvantaged groups may include but are not limited to the following:

Aseyla
A Kumar
Abdul Islam

Sanuad
Muneer khan
Nilamegu
Zaky
Mijaadh
Ridul Islam
Karan
Babul
Kamarudheen
Sobais
MD Jalal
Rowell
Humayun
MD Muzamil
Shumon
Mohsen
Surezkanal
Bizeygiri

4.3 Stakeholder Identification and Analysis

4.3.1 Stakeholder Mapping

Stakeholders were mapped based on the level of interest and their level of influence/power. A mapping exercise was conducted in order to identify the primary stakeholders of the project, utilizing the information that was accessible during the project formulation phase. An endeavor was undertaken to delineate stakeholders according to their degree of interest and influence by classifying them as high, medium, or low. In accordance with the results of the preliminary stakeholder identification process, the stakeholders' level of interest, influence and potential impact level is outlined in the table below.

Stakeholder	Level of Interest	Level of Influence	Potential Impact level
MTCC	High	High	High
NDMA	Low	Low	Low
STO	High	High	High
MCCEE	Low	High	Moderate
MHLUD	High	High	High
RDC	High	High	High
Villa Hakatha	High	High	High
Gulf Craft Maldives	High	High	High
Apollo Holdings	High	High	High
Nalahiya holdings	High	High	High
Aseyla	High	Low	Moderate
A kumar	High	Low	Moderate
Abdul islam	High	Low	Moderate
Ibrahim haleel	High	Low	Moderate
Abdul samad	High	Low	Moderate

Sanuad	High	Low	Moderate
Muneer khan	High	Low	Moderate
Hussain manik	High	Low	Moderate
Mohamed	High	Low	Moderate
Nilamegu	High	Low	Moderate
Zaky	High	Low	Moderate
Mijaadh	High	Low	Moderate
Ridul Islam	High	Low	Moderate
Karan	High	Low	Moderate
Abdullah ihusan	High	Low	Moderate
Babul	High	Low	Moderate
Kamarudheen	High	Low	Moderate
Sobais	High	Low	Moderate
Ali hussein	High	Low	Moderate
MD jalal	High	Low	Moderate
Rowell	High	Low	Moderate
Humayun	High	Low	Moderate
MD muzamil	High	Low	Moderate
Shumon	High	Low	Moderate
Mohsen	High	Low	Moderate
Ibrahim ismail	High	Low	Moderate
Surezkanal	High	Low	Moderate
Bizeygiri	High	Low	Moderate

4.3.2 Disadvantaged/vulnerable individuals or groups

Vulnerable individuals or groups are those who, by virtue of their vulnerable status, may be disproportionately affected or further disadvantaged by the project in comparison to other groups. In order to ensure their equitable representation in the project's consultation and decision-making processes, special engagement efforts may be necessary.

Women, the elderly, individuals with disabilities, migrants, and the unemployed have been identified as the primary vulnerable categories. Participation in decision-making forums is either not possible for these groups or they are denied access to decision-making positions.

4.4 Details of Stakeholder Engagement

Stakeholder	Impact Category	Name	Contact	Stakeholder Meeting
Government				
MTCC	High			-
NDMA	Moderate			Completed
STO	High			-
MOECCT	High			--
MNPHI	High			
RDC	High	Fathimath Rifa		Completed
Companies				

Villa Hakatha	High			--
Gulf Craft Maldives	High	Costas Eliopoulos		Completed
Apollo Holdings	High			
Nalahiya holdings	High	Ahmed Waheed		Completed
Indivudual		**Age**		
Aseyla	Moderate	30		Completed
A kumar	Moderate	24		Completed
Abdul islam	Moderate	42		Completed
Ibrahim haleel	Moderate	26		Completed
Abdul samad	Moderate	50	7420046	Completed
Sanuad	Moderate	52		Completed
Muneer khan	Moderate	40		Completed
Hussain manik	Moderate	60		Completed
Mohamed	Moderate	35		Completed
Nilamegu	Moderate	41		Completed
Zaky	Moderate	58	7854484	Completed
Mijaadh	Moderate			Completed
Ridul Islam	Moderate	43		Completed
Karan	Moderate	42		Completed
Abdullah ihusan	Moderate	25		Completed
Babul	Moderate	30		Completed
Kamarudheen	Moderate	35	9452041	Completed
Sobais	Moderate	32		Completed
Ali hussein	Moderate	25	7238397	Completed
MD jalal	Moderate	32		Completed
Rowell	Moderate	30		Completed
Humayun	Moderate	35		Completed
MD muzamil	Moderate	36		Completed
Shumon	Moderate	34		Completed
Mohsen	Moderate	31		Completed
Ibrahim ismail	Moderate	58		Completed
Surezkanal	Moderate	23		Completed
Bizeygiri	Moderate	28	9242072	Completed

Table 4-1: Stakeholder Consultation Summary

4.4.1 Road Development Corporation

On 17th April 2023 HDC met with Road Development Corporation to discuss about the methodology and implications of the project.

Date of consultation	17th April 2023
Venue	Microsoft Teams
Name of Stakeholders	Road development corporation (Fathimath Rifa)
Introduction	Consultation meeting on project and to get input and Feedback from stakeholder

Summary of discussion	Project Overview • A brief introduction and project presentation • RDC contains two plots and one of them lie directly in the footprint of the road. Urbanco Stated that RDC will lose jetty access from the plot and requested RDC to communicate with the private plots and discuss with Urbanco to shift RDC's transport to the other side. • Urbanco inquired details of the works usually done in the plot and the foreseeable implications during the construction of the road. • RDC informed that RDC's casting yard is located in the highlighted plot and as per the current schedule, materials are transported to the plot from male' every Monday and Thursday. RDC requested Urbanco to share the timeline for the road closings so that RDC may adjust material transportation schedule accordingly. • RDC informed that MTCC's ferry is utilized for the material transportation and the materials are loaded/unloaded from the MTCC jetty. • RDC informed that an alternative area to load/unload the materials is required for emergency transportations. • Urbanco stated that RDC's request will be planned and instructed during the EIA (6.3.5.1)

Table 4-2: Stakeholder Consultation Summary - RDC

4.4.2 Gulf Craft Maldives

On 18th April 2023 HDC met with Gulf Craft Maldives to discuss about the methodology and implications of the project.

Date of consultation	18th April 2023
Venue	Microsoft Teams
Name of Stakeholders	Gulf Craft Maldives (Costas Eliopoulos – General Manager)
Introduction	Consultation meeting on project and to get input and Feedback from stakeholder
Summary of discussion	Project Overview • A brief introduction and project presentation was given • Urbanco had identified Gulf Craft Maldives as a main stakeholder who will face issues with the development and progress of the project. • Highlighted points include the excavation in front of the Gulf Craft Services Center plot. Hence this would halt the day-to-day operations of the services center when work is carried out in section A and C of the project. • Gulf Craft Maldives informed that the route is utilized to move the garbage four times a week and bring food supply once a week. It was further noted that the workers use this route daily during morning and evening. • Gulf Craft Maldives shared that there was a similar case in UAE during a development of a road in one of the facilities. The contractor excavated the entrance area within a day and installed metal plates providing access to the facility. The road was developed in two phases (south and north separately) and joined the two phases at a later stage. With regard to this experience, Gulf Craft Maldives suggested this proposal to Urbanco in order to solve the issue. The details of the case will be shared through paperwork and photographs. • Urbanco stated their interest in the proposal suggested and plans to suggest the methodology to the potential contractors (5.2). • Gulf Craft Maldives noted that development of this road and the next phase of Thilafushi is significant with the upcoming development of the bridge. • Gulf Craft Maldives further stated that there is a Villa Group facility and the entrance is opposite from the Gulf Craft Service entrance which is used by several vehicles.

Table 4-3: Stakeholder Consultation Summary - Gulf Craft Maldives

4.4.3 Nalahiya Trading

On 29th May 2023 HDC met with Road Development Corporation to discuss about the methodology and implications of the project.

Date of consultation	29th May 2023
Venue	Microsoft Teams
Name of Stakeholders	Nalahiya trading (Ahmed Waheed – Manager, Thilafushi Operations)
Introduction	Consultation meeting on project and to get input and Feedback from stakeholder
Summary of discussion	Project Overview • A brief introduction and project presentation was given. • Urbanco informed that as there are 3 Nalahiya plots located within the grounds alone, Nalahiya will be one of the most effected companies on the grounds in terms of functioning while the project is taking place. • Nalahiya stated that a warehouse is located near hawks' area, as well as 2 more plots near the MTCC plots along the Main Road. Urbanco confirmed that this is a 5675 m2 plot which consists of a warehouse and a labor accommodation. • Nalahiya also clarified that there is a warehouse located in front of this plot, which is used as a loading jetty and warehousing. • Nalahiya mentioned that their aluminum and glass workshop was planned to renovate and reopen soon however the pilot road project would hinder this. Hence, they decided not to renovate in the near future, therefore no further difficulties would be faced. • Urbanco proposed a new idea formulated after site visits, stating the site can be divided from the middle, hence working on one side of the road at a time. However, as around 5m of waste has been found in borehole samples, Urbanco informed that the contractor may not be willing to work with a retaining wall for the site. • Nalahiya highlighted that once the project commences, moving supplies will be challenging, and an adjustment is required. • Nalahiya informed that the access door for the engineering site is located towards the Main Road, hence if the road is closed off for the project, there is no possible way to access the supplies. • Nalahiya enquired on a rough estimate of how long it will take to finish one road section, to which Urbanco stated that the contractor is yet to confirm this duration. • Nalahiya expressed that since the Main Road is not very wide, accessibility will be extremely difficult as vehicles would have to treat a narrow pathway as a two-way. It was stated that it would be very difficult to cross from the storage unit. Another option proposed is to bring in supplies through the jetty area, however the storage unit would need an accessible door in that particular direction. • Nalahiya enquired on the duration of work to finish the particular sections in which Nalahiya's plots are located. It was stated that considering it is a major project, if 3-4 months are taken, the company would be faced with major losses due to hindering operations on site. Urbanco clarified that a maximum duration of 1 (one) month is ideal in order to function without a big loss

Table 4-4: Stakeholder Consultation Summary - Nalahiya Trading

4.4.4 NDMA

On 29th May 2023 HDC met with National Disaster Management Authority to discuss about the methodology and implications of the project.

Date of consultation	29th May 2023
Venue	Microsoft Teams
Name of Stakeholders	MDMA (Mariyam Shiznaa, Programs Director)
Introduction	Consultation meeting on project and to get input and Feedback from stakeholder
Summary of discussion	Project Overview • The Pilot Road is shown to begin from the MTCC plots, and end at the Ministry's plots, joining with the bridge and acting as a key structure to internal road pathways. Urbanco also highlighted that all the road sections are modified differently depending on the neighborhoods, and that the neighborhoods will be closed off due to the ongoing project. • Urbanco informed that the current road floods very easily during rainy season, due to water collecting in the uneven road surface. Urbanco stated that current condition of the roads can be seen using the profiles (6.3.11.1), which was taken for the EIA, and that the improved structure will have better drainage systems, similar to those of Hulhumale. • Urbanco clarified that despite minor improvements, such as prevention of micro pit holes formed due to the impact of heavy vehicles, there are no straightforward guarantees to providing solutions to puddle formations dur to the new development. Urbanco highlighted that the chance of plots flooding is a major concern (6.3.11.1.2). • Urbanco stated that some stakeholders have already been informed on the impacts of the project, noting that they have shared a few concerns as well. • Urbanco highlighted that if the project is brought to a pause, it could result in a big economic hit as companies with a large economic drive (such as Villa Hakatha, etc.) are involved. • NDMA stated that this current plan does not seem feasible, as the natural drainage system would not solve the current issues, and no other problems can be solved apart from the cost reductions. • Urbanco informed that as an alternative to the project water drainage options and water management options will be added to the EIA and suggested to the proponent (5.2). Discussion on NDMA's main concerns: • NDMA enquired on who else Urbanco has consulted with, to which Urbanco confirmed that meetings have been held with the companies currently residing in Thilafushi. NDMA enquired on these residents' concerns on the matter. Urbanco stated that the residents are not particularly distressed, and are willing to collaborate with the project. Urbanco highlighted that the stakeholders' stance on the matter is that they understand that Thilafushi is an industrial island, and have no specific concerns on the impacts of the project. • NDMA highlighted that these residents may not fully understand these impacts due to conflict of their respective fields. Urbanco also added that it is difficult to discuss these impacts with them properly due to difficulties in contacting and response and their willingness to engage with Urbanco. • Per NDMA's enquiry, Urbanco confirmed that there are no emergency plans put in place by these residents, to which NDMA stated that there is no preparation for emergency situations, making it unsafe to go forward with the project. • NDMA suggested that Urbanco's team can consider giving the community a risk plan to improve the above matter. Urbanco stated that this will be weighed in on with the impact assessment and management plan, specifically in the mitigation plan.

Table 4-5: Stakeholder Consultation Summary - NDMA

4.4.5 WAMCO

On 16th May 2023 HDC met with Waste Management Corporation limited (WAMCO) to discuss about the methodology and implications of the project.

Date of consultation	16th May 2023
Venue	Microsoft Teams
Name of Stakeholders	WAMCO (Hussain Shajeeu, Facility Manager)
Introduction	Consultation meeting on project and to get input and Feedback from stakeholder
Summary of discussion	Project Overview • The purpose of the main road was promptly discussed, stating that it joins the bridge, increasing accessibility within the island • The attendees discussed that a majority of the core samples dug on site contained waste. The type of the waste collected is currently not classified and the toxicity level is unknown, but is estimated to include battery acid and non-biodegradable waste, as well as plastic. • Facility manager of WAMCO confirmed that small quantities of waste collected are usually handled by WAMCO directly, but toxic waste management is handled by the MNDF. The senior management will be notified for further details, which will be informed accordingly, post EIA. • Urbanco stated that the management options will be suggested for the contractor to coordinate with WAMCO for the waste management options (9, 10, and 11). • Facility manager of WAMCO confirmed that the Lagoon Site is being managed with the permission of HDC. The site is located behind the T-jetty, and is being used to dispose of clear CND, as well as a small quantity of waste. • A summary of the Borehole log samples was shown and the quantity of waste collected per sample was compared. • Facility manager of WAMCO clarified that an accommodation plot is located near BH4 area, near the coastline. Including the two garages on site, WAMCO has a total of 3 plots along the main road. • Facility manager of WAMCO was enquired if any difficulties will be faced by the workers on site due to the ongoing project, to which clarification was given that there are no specific difficulties to be highlighted, as alternative routes will be looked into and suggested (12.11, 12.12).

Table 4-6: Stakeholder Consultation Summary - WAMCO

4.4.6 General Public

On 3rd April 2023 HDC visited Thilafushi and interviewed 30 individuals from the island to discuss about the methodology and implications of the project.

Date of consultation	3rd April 2023
Venue	Thilafushi
Introduction	Consultation meeting on project and to get input and Feedback from the general public
Summary of discussion	Project Overview Our team surveyed individuals in Thilafushi. The survey extends to both foreigners and locals working and living on the island. 30 individuals were interviewed separately. Their views and comments are summarized below. • The existing road is used mainly for walking and by using motorcycles by these individuals • The existing road was rated at an average of 4.43 and most of them have not heard of this upcoming project.

	• Some of the main challenged highlighted are the roads being dusty, formation of puddles after light rain, hence no drainage systems as well as having poor lighting at night. • When asked what were the most important things to be present in the developed road, most individuals highlighted proper street lighting and drainage systems. • All the individuals have expressed that this project will have a positive impact on Thilafushi island both economically and individually.

Table 4-7: Stakeholder Consultation Summary - General Public

The following are the Outputs from the Survey with the General Public

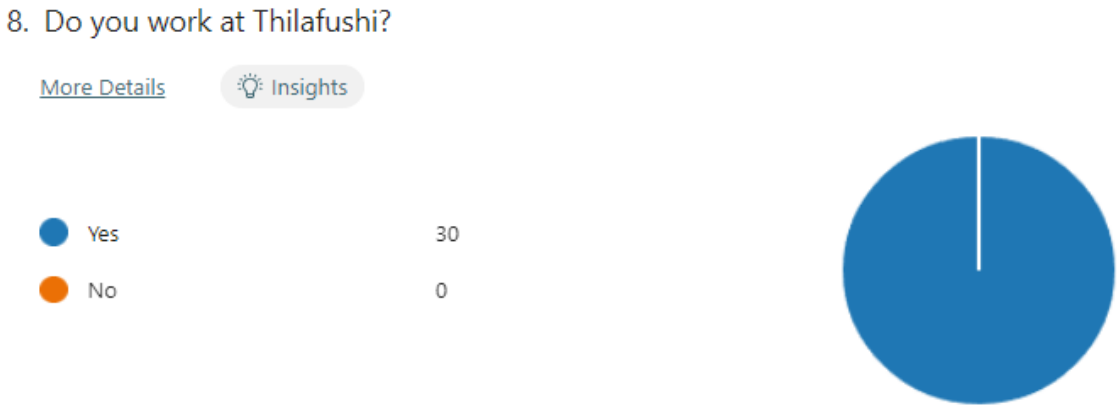


Figure 4-1: General Public Survey Question

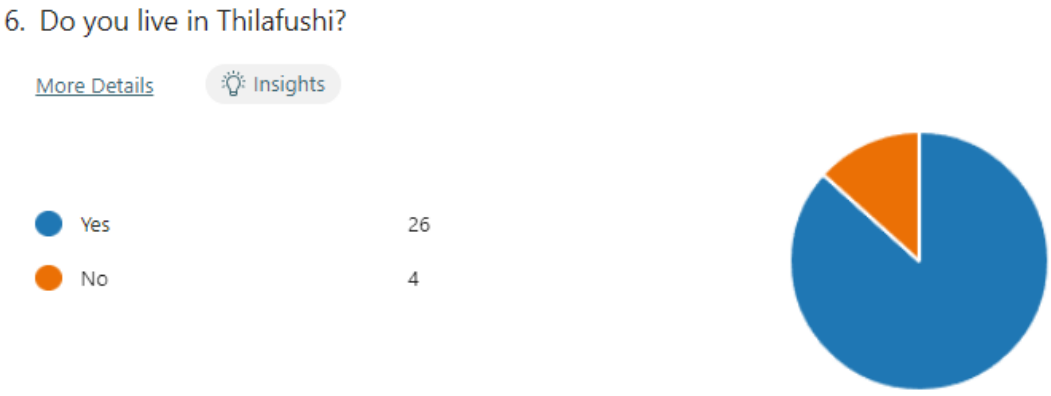


Figure 4-2: General Public Survey Question

Urban planning department,
GIS and Survey,
Environment Unit

Housing Development Corporation
HDC Building, Ground Floor
Hulhumalé, Republic of Maldives

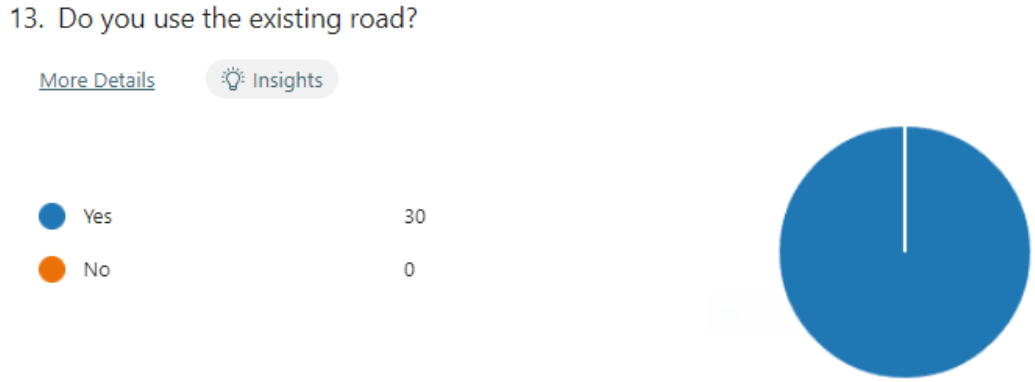


Figure 4-3: General Public Survey Question

Figure 4-4: General Public Survey Question

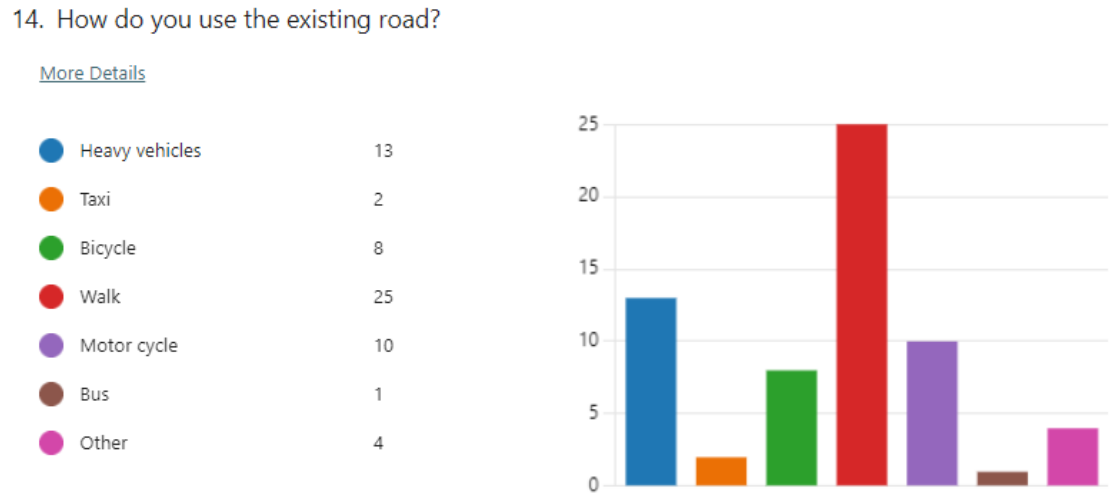


Figure 4-5: General Public Survey Question

16. What are the challenges of the existing road?

More Details

Bumpy	0
No lights	16
Dusty	22
Muddy	15
No drainage	18
Floods	20
Makes puddles	14
Has potholes	10
Weed on the street.	0
Grabage on the road	3
Other	9

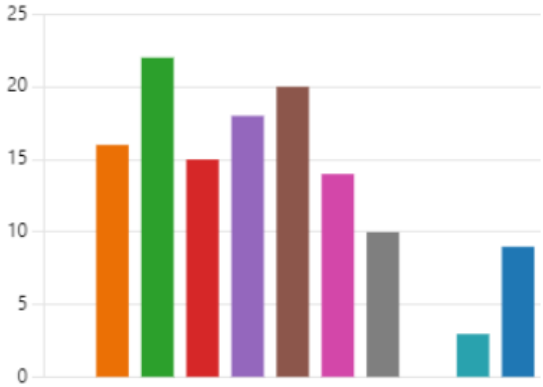


Figure 4-6: General Public Survey Question

18. How would you rate the proposed road?

More Details Insights

10.00
Average Rating

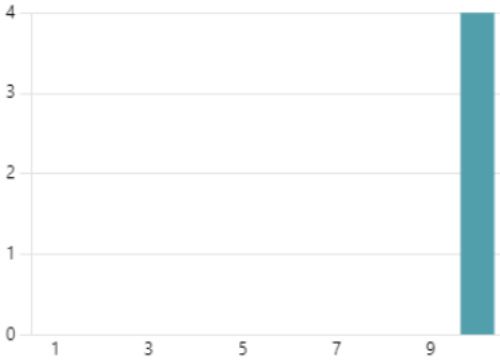


Figure 4-7: General Public Survey Question

Urban planning department,
GIS and Survey,
Environment Unit

Housing Development Corporation
HDC Building, Ground Floor
Hulhumalé, Republic of Maldives

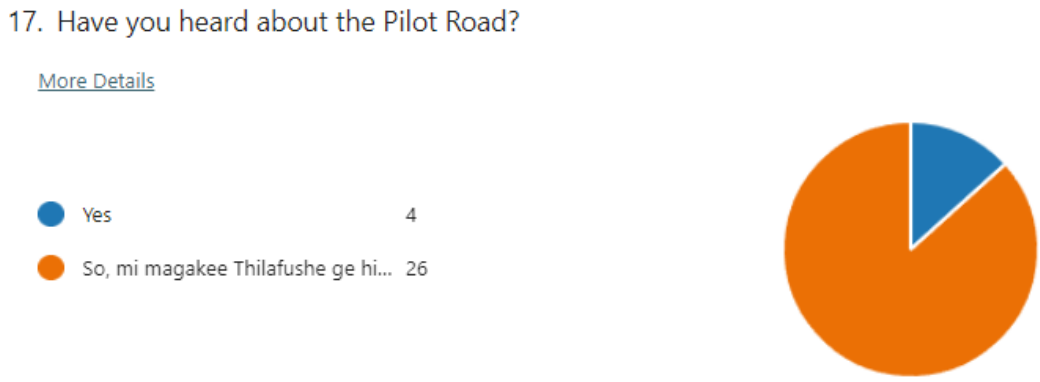


Figure 4-8: General Public Survey Question

4.5 Outcomes of the consultation

Outcomes of consultation	Comments from the Proponent
All the companies who responded to consultation, that have their plots within the pilot road have mentioned that they use the road on the daily and that it would be difficult to carry out the day-to-day works of some companies	Proponent agrees to provide alternative paths and ensure that the contractor follows the best phase wise implementation of the alternative paths.
Daily uses include, garbage collection, food supply delivery and entrance and exit to their plot for the workers.	The proponent agrees that the alternatives proposed will be discussed, with work methodology used with the contractor regarding the alternatives.
The pilot road has some of the only access to some labor accommodations as well as warehouses of some companies with no other alternatives.	Proponent agrees to consult them if need be and provide alternatives in collaboration with the contractor.
In order to be prepared for the hindrances that the pilot road will cause to these businesses, the stakeholders encouraged the proponent to release a detailed schedule and time frame for the road sections to be finished hence they would be able to plan their work load around the given timeline.	The proponent agrees that this will be done.
It was mentioned that a road section taking longer than 2-3 months might greatly impact the business of some companies.	The proponent ensures that the proponent will push the contractor to meet the timeline.
	Although a consultation could not be held with women, a woman who was at the island was identified who can be identified as a vulnerable individual.
	Apart from this elderly community, migrant workers and unemployed community was also identified to be on the island.
However, all the stakeholders have given positive feedback for the commencement of the pilot road development as they believe that it has been a long-anticipated project for development of Thilafushi island	

5 Alternatives

After consulting the input from the stakeholders, the following alternatives are proposed. The alternatives are feasible alternatives to components proposed in the EIA. Hence, if an alternative is to be implemented, the concerned party, must inform the relevant parties and make the changes accordingly.

5.1 No project options

The no development option takes into account,

- No mobilization,
- No road excavations, and
- No road blocks,

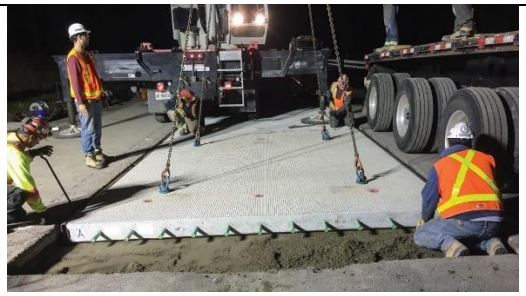
Action	Advantages	Disadvantages
No development options		
• No mobilisation	• No harm to the existing footprint	• Movement of the existing vehicles back to route.
• No excavation	• No disruption of the traffic in the island	• Public dissatisfaction • Inadequate road system • Nothing will be done to the existing scattered vehicles.

Table 5-1: No Project Option

5.2 Alternative options and Analysis

Analysis was carried out giving a grade to each alternative on the basis of the technical, economic, and environmental. All scores were considered giving importance to the existing environment and stakeholder consultation.
The following table further discusses the alternatives.

ID	Component	Alternative to	Details
A1	Alternative, split road construction	The road construction methodology.	The proposal is to split the development longitudinally on the road plane and allow for the traffic to move across half of the development segment. *Figure 5-1: Split Road Development*
A2	Alternative, road build; concrete construction.	The road designs.	The proposal is to use concrete instead of the proposed road structure.

ID	Component	Alternative to	Details
			 *Figure 5-2: Concrete Slab Alternative*
A3	Alternative, addition of a typical storm water drainage system, with a flow out and a collection system.	The road drainage system	The proposal is to use stormwater instead of the proposed drainage system. *Figure 5-3: Storm Water Drainage System*
A4	Alternative, varying elevation as per the neighbourhoods	Alternative to the design level.	This proposes the development to vary the elevation as per the local elevation of the neighbourhood. *Figure 5-4: Slopes on the Road*
A5	Alternative, addition of drainage system to the road	The road drainage system	This proposes the addition of additional drainage, to the side, as per the existing natural elevation of the road. This is ideally to flow the water that would collect in the depressions of the road into the drainage area.

ID	Component	Alternative to	Details

Figure 5-5: Local Drainage System

Table 5-2: Alternative Options

Alternative proposed	Technical feasibility	Economic feasibility	Environmental outlook
A1 Alternative, split road construction	Technically possible, the development requires the coordination and cooperation of the residents.	This will prolong the duration of the development	This will reduce the impact footprint, enabling a more manageable area for mitigation
A2 Alternative, road build; concrete construction.	Technically feasible. This can lead to a slower wear and tear and will enable the residents to use heavy machinery on the road.	Will be slightly cheaper than the current proposal	Will require less modification for the existing environment.
A3 Alternative, addition of a typical storm water drainage system, with a flow out and a collection system.	Technically possible. Slight modification of the details is required.	Will add to the cost of the current development	Will allow for less water to infiltrate into the water layer.
A4 Alternative, varying elevation as per the neighbourhoods	The process is tonically possible, but will require precision elevation management by the contractor. This will have to be in combination with the drainage system proposed in A5	Excavating to the same level throughout may add on to the cost of the development. Hence, the development can reduce the cost.	This will allow for the natural flow of water to the desired location
A5 Alternative, addition of drainage system to the road	This is feasible, but will have to be placed at strategic location	Will add to the cost of the current development	The water infiltration that is allowed will benefit the water lens.

Table 5-3: Alternative Options Feasibility

5.3 Recommendation

After analysis of the stakeholder consultations and engineer recommendations, that all alternatives that are proposed to different components of the project are recommended, except for the no project option. All the components, including A1 to A5 will be added to the impact (7.3.1.5.2) analysis.

6 Existing environment

6.1 Introduction

This section assembles, evaluates and presents the environmental baseline relevant to the project. It provides comprehensive details on the methodologies employed in the study and the corresponding findings. In order to depict the current state of the environment, the report categorizes it into three distinct aspects: physical, biological, and social. The physical environment encompasses geology, geomorphology, hydrography/hydrodynamics, and ecology, while the socio-economic environment and hazard vulnerability are also thoroughly described.

6.2 Physical Environment

6.2.1 Climate

6.2.1.1 General Climate

Maldives enjoys a typical tropical monsoon climate throughout the year. The south-west monsoon prevails from mid-May to November, while the north-east monsoon occurs between January and March. It is worth noting that the North-East monsoon tends to be drier compared to the South-West Monsoon. The transition period for the southwest monsoon takes place from March to April, whereas for the northeast monsoon, it spans from October to November Table 6.1. In terms of temperature, daily ranges fluctuate between 27°C and 31°C. The maximum mean dry temperature recorded is 30.4°C, while the minimum mean dry temperature stands at 25.7°C (Meteorology, 2006). Rainfall patterns in the Maldives are influenced by the Indian Ocean Monsoons, with an average annual rainfall of 2,124 mm. It is notable that the southern regions receive more rainfall compared to the northern areas.

Season	Dhivehi name	Month
NE-Monsoon	Iruvai	December
NE-Monsoon	Iruvai	January
NE-Monsoon	Iruvai	February
Transition period 1	Hulhangu Halha	March
Transition period 1	Hulhangu Halha	April
SW-Monsoon	Hulhangu	May
SW-Monsoon	Hulhangu	June
SW-Monsoon	Hulhangu	July
SW-Monsoon	Hulhangu	August
SW-Monsoon	Hulhangu	September
Transition period 2	Iruvai Halha	October
Transition period 2	Iruvai Halha	November

Table 6-1: Months and the Seasons associated with them

The project area, K.Thilafushi is in the general climate as the rest of the Maldives with minute differences which will be discussed in this section.

6.2.1.2 Temperature

The Maldives boasts a warm and humid climate that persists throughout the year, thanks to its location surrounded by vast seas and oceans. The presence of water bodies helps moderate the temperature on the small islands. The average temperature typically ranges from 25°C to 32°C. The influence of monsoons brings about seasonal variations in temperature throughout the year. The warmest period occurs from March to April, extending until the onset of the southwest monsoon in mid-May. Notably, the highest temperature ever recorded in the Maldives was 36.0°C on September 12, 1991, at the Kadhdhoo Meteorological Office. Conversely, the lowest temperature ever recorded was 18.2°C at the Hanimaadhoo Meteorological Office on December 23, 2002.

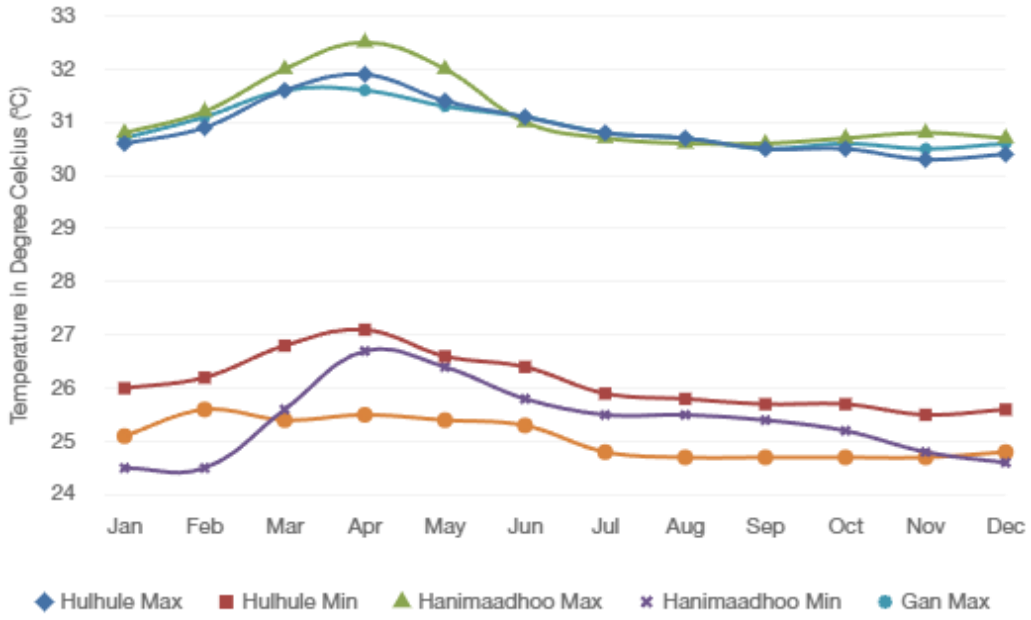


Figure 6-1: Temperature Data (Maldives Meteorological Service)

6.2.1.3 Rainfall

The rainfall patterns in the Maldives display fluctuations during the two monsoon seasons, wherein the southwest monsoon experiences a higher amount of precipitation. This distinction between seasons is clearly illustrated by the graph, which showcases the average monthly rainfall recorded across the north, central, and southern atolls. When considering the entirety of the Maldives, the amount of annual rainfall increases from north to south. On average, the southern atolls receive approximately 2,218 mm of rainfall per year, while the central and northern atolls receive annual rainfalls of 1,966 mm and 1,779 mm, respectively. The highest recorded rainfall within a 24-hour period was 228 mm at the Addu City meteorological

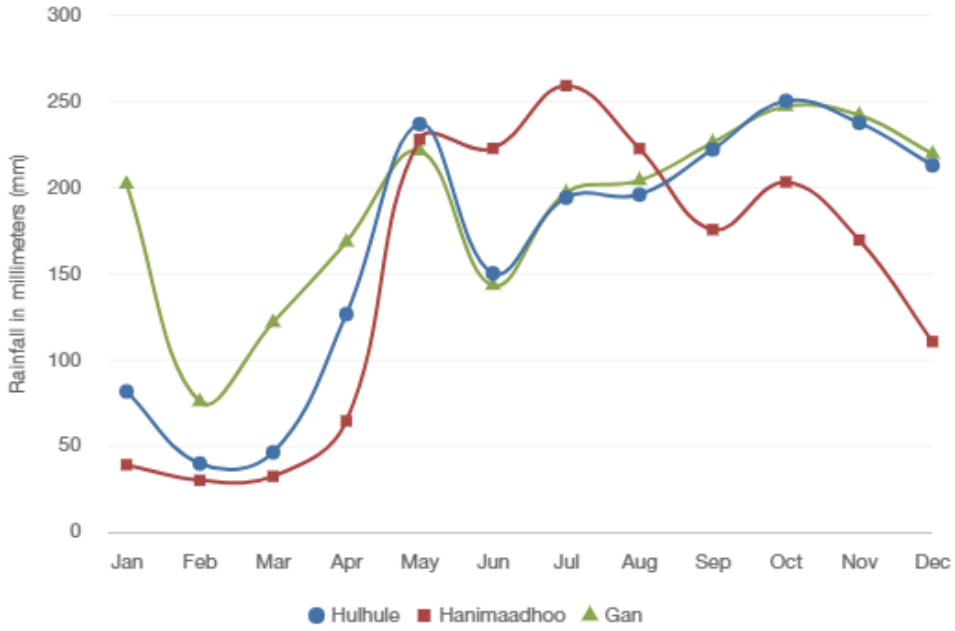


Figure 6-2: Rainfall Data (Maldives Meteorological Service)

office on November 24, 2015. Typically, rainfall in the Maldives occurs in the form of showers that do not persist for extended periods, allowing for intermittent sunny intervals.

6.2.1.4 Wind

Maldives generally has a mild monsoon. However, there are it varies and increases due to line and squalls. It is important to note that this is generally a cyclone free area. In the Northern Hemisphere summer, the Tibetan Plateau warms rapidly relative to the Indian Ocean. The resulting low pressure over Asia and higher pressure over the ocean gives rise to the strong low-level atmospheric pressure gradient that in turn generates the SW monsoon. (Jonathan Overpeck, 1995). Maldivian monsoon patterns show consistency for the past two decades according to observations by NASEER, 2003. This analysis shows that the wind speed is usually greater from May till October in central Maldives while the monsoon is significantly stronger in the central and the northern region in comparison to the south.
The figure below shows the wind rose for Hulhule based on hourly wind data of the month April 2022. This rose depicts that the winds at Hulhule during the period blow from the west majority of the time. The spokes in the directions west-south-west comprise about 23% of all hourly wind directions. This also shows that the wind rarely blows from different directions.

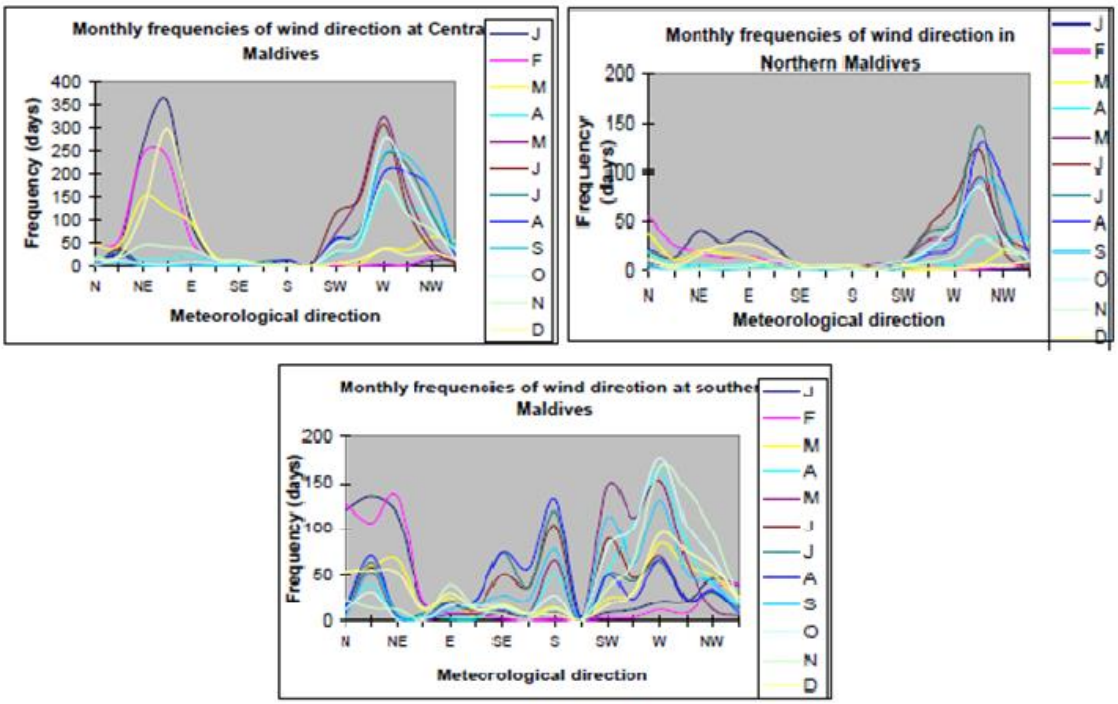


Figure 6-3: Wind Frequency Chart of Hulhule' for April 2022 (Maldives Meteorological Service)

6.2.1.5 Waves

Ocean wave conditions are the main control upon wave energy and approach the outer margins of the atolls (Pernetta & Sestini, 1989). Annual patterns of wave height reveal the effects of the two monsoon periods, which are marked by strong seasonal reversals in wind direction confined to a narrow range of wind angles (Kench & Brander, 2006). Towards the middle of each year, there is an increase in wave heights with the highest waves occurring from June to August, due to the effects of the Indian monsoon in the northern part of the Indian ocean. During the summer or 'northeast monsoon' (December to march), waves are generally smaller than the middle of the year, despite locally stronger winds. There are some large wave events and floods in the central and northern Maldives at the onset of the northeast monsoon- for example, the swells which recently impacted the northeast Maldives was considered 'normal' for that time of year (late December 2015) (Maldives independent 2015c). These floods were also associated with high tide levels.

For much of the year, swell is a principal factor in determining the wave climate of the Northern Indian Ocean (Langodan, 2012), and the wave period time series appears more chaotic than wave height. This is partly because swell waves reach Maldives throughout the year, generated from low-pressure systems persistently passing through the 'roaring forties' (between latitudes 40° south and 50° south. Late April-early May marks the onset of the 'southwest monsoon 'seasons where despite locally calm and dry weather, stronger winds are generated thousands of kilometres south and southwest of the

Maldives, which can generate large and long-period waves. This consistent high-period swell wave activity from the southern Indian ocean occurs between March and November, and during this period, the Maldives often experiences larger waves (and minor flooding) from further afield, known locally as 'udha' (DIRAM team and UNDP Maldives 2007). Maldives has been subjected to earthquake generated tsunamis reaching heights of 4 meters on land (UNEP,2005)

6.2.1.6 Evaporation rates

The Maldives has a humid tropical climate which ensures a high rate of evapotranspiration throughout the year (Foundation for Environment, A review of Water Resources of Maldives, 2017). The average annual evaporation rate is estimated to be around 1,800 millimetres per year. This high evaporation rate contributes to the arid nature of the island, resulting in limited water resources and a potential challenge for sustaining vegetation and supporting certain types of development projects that require water-intensive operations.

6.2.1.7 Risk of Hurricanes

Unlike many other tropical small islands in the Pacific or Atlantic regions, the cyclone (hurricane or typhoon) hazard for the Maldives is classified as Low. Cyclone hazard risk is highest in the north and very low in the south due to the proximity of northern latitudes to the cyclone belt. However, despite this overall low classification, there have been a few cyclones impacting on the Maldives in the recent past, including Very Severe Cyclonic Strom Vayu in June 2019, and Very Severe Cyclonic Storm Ockhi in November 2017. While impacts were not extensive, the storm caused damage to households and properly in 62 islands across the Maldives. Including flooding on 36 islands, torn roofs and fallen trees on 22 islands and coastal swells on 4 islands. (World Bank, 2020)

6.2.1.8 Storm surges

Storm surges are sudden rises in sea level caused by atmospheric pressure changes and strong winds associated with storms and cyclones. They can result in coastal flooding and erosion, posing risks to both the natural and built environment. The 2007 UNDP risk assessment highlights that there is a higher likelihood of storm surges in the northern area due to its higher possibility of cyclones. This is confirmed in mapping by ADB shown in figure 6.4.
The southern and western islands of Maldives may experience more swells waves due to the proximity to the South Indian Ocean and due to the predominant south westerly approach of the swell waves, but eastern rim islands may still experience impacts due to the propagation of swell waves through reef passes within the atoll lagoon. Eastern rim islands are predicted to experience more frequent tsunami waves, while western rim lagoon islands are offered protection by the atoll formations.

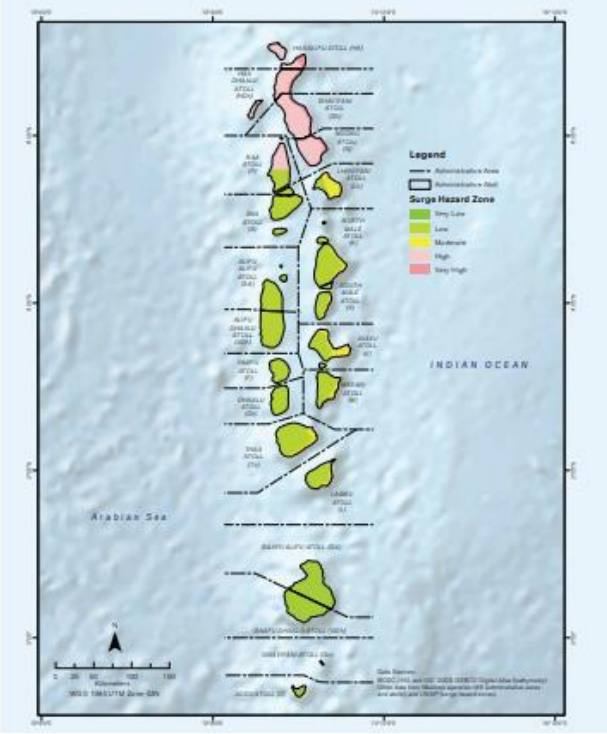


Figure 6-4: Maldives Surge Hazard Zones

Swell and tidal waves cause flooding in the Maldives islands, causing extensive damages to critical infrastructure. Properties, household goods, saltwater intrusion to groundwater aquifer, coastal erosion and livelihood.

6.2.2 Ecology

The island supports various species of fauna and flora, including migratory birds, marine life, and vegetation. The ecological balance of Thilafushi is essential for maintaining the island's natural resilience and supporting sustainable development. Therefore, any project in the area should consider the preservation of these ecosystems and the potential impacts on biodiversity.

6.2.2.1 Terrestrial Fauna and flora

A vegetation survey was carried out throughout the length of the road. Even though the number of vegetation is found to be moderate, there are a significant number of mature trees on the path which needs to be removed as a part of the project. The results of the survey are given in the table below.

Local Name	English Name	Scientific name	Count
Ipil ipil	Subaul	Leucaena leucocephala (lam.) de Wit	1
Fai Kudhi Nika	Benjamin tree	Ficus comosa Roxb	1
Fithuroan	Beefwood tree	casuarina africana	1
Hirundhu	Portia tree	Thespesia populnea	3
Madhu gas	Indian Almond Tree	Terminalia badamia DC	7
Nika gas	Banyan Tree	Ficus benghalensis L	6
Ofi elay	Burmese rosewood	Pterocarpus indicus Willd	1
Reethigas	Rain tree	Mimosa saman Jacq	1
Ruh	Coconut Palm	Cocos Nucifera	2

Table 6-2: Vegetation Survey

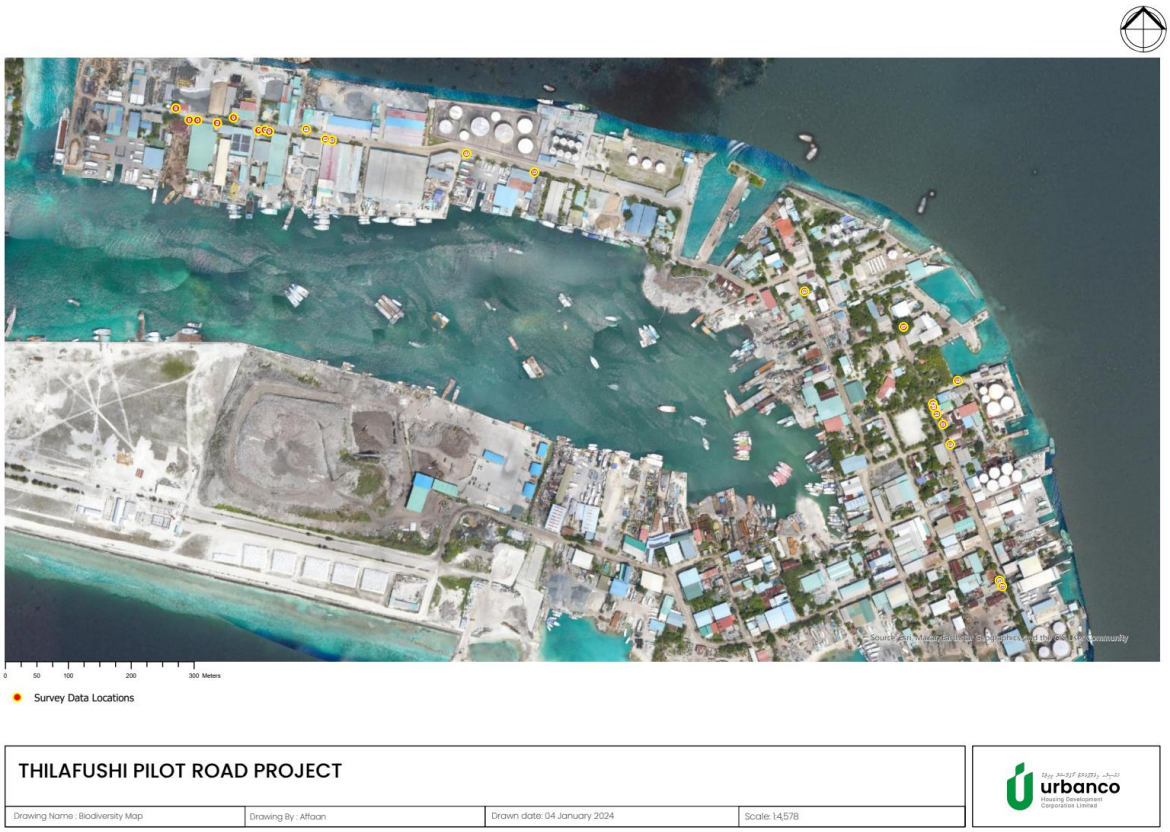


Figure 6-5 Trees surveyed and marked on the map

The following are the locations and details of the plants studied. A high-resolution map of Figure 6-5 is attached to the section 12.6. Table 6-3 Tree survey data, with GPS coordinates, are attached below.

Table 6-3 Tree survey data, with GPS coordinates

Object *	Local name	Height / m	Girth / m	Girth2	Canopy size / m	Tree Health	Bark Type	Lichens	Maga fauna, and other features	GPS POINT_X	GPS POINT_Y
2	Ruh	1.5	1.5	150	3	Good	Tight	No		73.439202	4.186717
3	Nika gas	**	0.15	15	3	Poor	Tight	No		73.439395	4.18655
4	Nika gas	7	2	200	10	Good	Tight	No		73.439513	4.186546
5	Ofi elay	5	3	300	0.5	Good	Breaking	No		73.439794	4.186507
6	Madhu gas	10	3	300	5	Good	Breaking	No	Kaalhu haali, Hathaa	73.440027	4.186585
7	Madhu gas	7	0.84	84	3	Good	Tight	Yes		73.440388	4.186404
8	Nika gas	4	2.45	245	5	Good	Tight	No		73.440479	4.18641
9	Madhu gas	5	0.95	95	4	Good	Tight	**		73.440542	4.186387
10	Madhu gas	5	0.64	64	5	Good	Tight	No		73.441441	4.186261
11	Nika gas	9	3.56	356	5	Good	Tight	No		73.44107	4.186421
12	Reethigas	4	0.93	93	3	Good	Breaking	No		73.441346	4.186279
13	Hirundhu	4	0.66	66	2	Good	Breaking	No		73.443367	4.186075
14	Madhu gas	3	0.38	38	3	Good	Tight	No		73.444341	4.185807
15	Hirundhu	6	1.3	130	10	Good	Breaking	**		73.448213	4.184102
16	Hirundhu	4	**	**	6	General	Tight	**		73.450412	4.182823
17	Nika gas	**	**	**	**	Good	**	**	Iruvaahudhu, fruit eating bat	73.449634	4.183594
18	Ipil ipil	7	2.42	242	3	Good	Tight	**		73.450056	4.182491
19	Ruh	4	1.01	101	2	Good	**	**		73.450068	4.182442
20	Madhu gas	4	0.9	90	1	Good	Tight	Yes		73.450112	4.182341
21	Fithuroan	8	1.44	144	2	Poor	**	**	Bees, spider	73.4502	4.182192
22	Madhu gas	7	1.01	101	2	Good	Tight	**		73.450306	4.181904
23	Nika gas	8	7.5	750	4.5	Good	Tight	**		73.451015	4.179951
24	Fai Kudhi Nika	7	1.38	138	3	Good	Tight	**		73.451053	4.179865

6.2.2.2 Detail tree counts.

Further tree counts were conducted using the GIS platform, and the 360-map data. The link for the data is attached herewith (https://experience.arcgis.com/experience/8d2b0a8b05534dfe8115fdf2acbaaf77/?data_id=dataSource_1-1889528c89a-layer-1%3A68). The map extract for the map is provided in the Figure 6-6 Tree map 1 using GIS tool till Figure 6-12 Tree map 7 using GIS tool. The maps show the count of plants that are impacted by the proposed work, and the plants that are safe from the general development. The tree maps below are in high resolution in the section 12.7

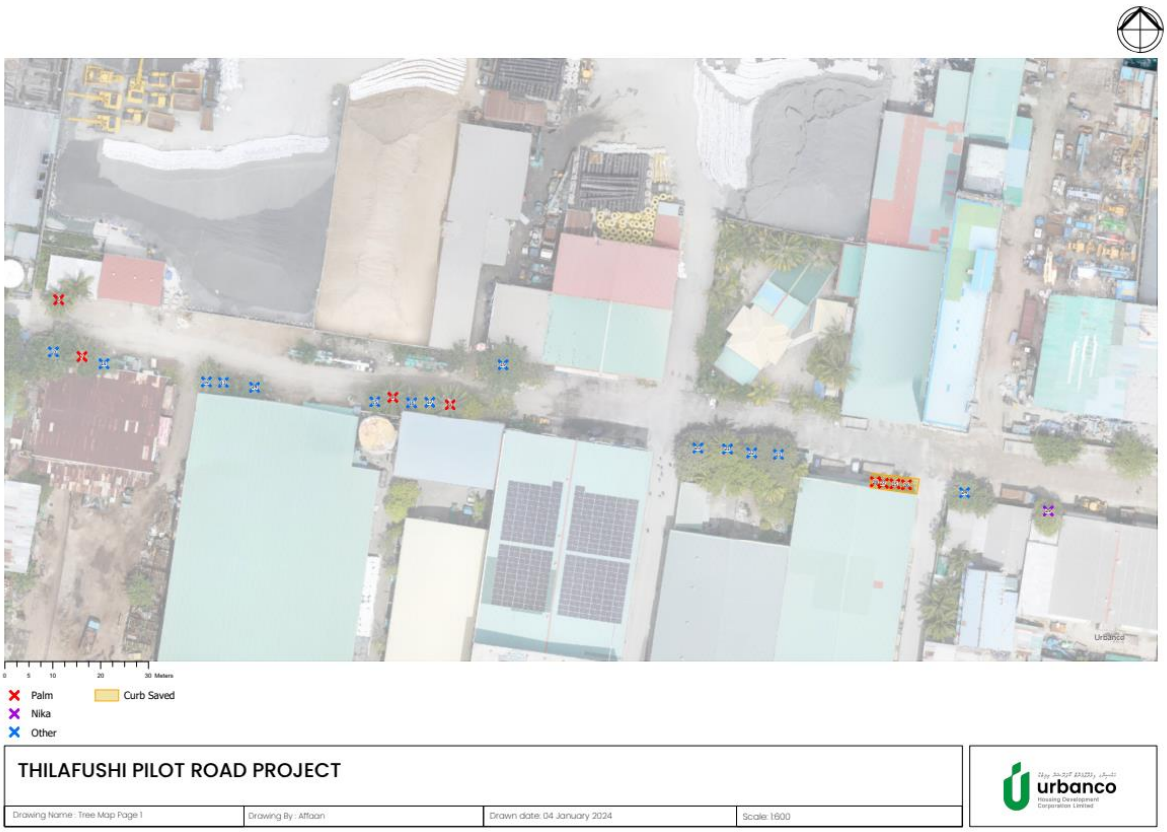


Figure 6-6 Tree map 1 using GIS tool

Urban planning department,
GIS and Survey,
Environment Unit

Housing Development Corporation
HDC Building, Ground Floor
Hulhumalé, Republic of Maldives

Figure 6-7 Tree map 2 using GIS tool

Figure 6-8 Tree map 3 using GIS tool

Urban planning department,
GIS and Survey,
Environment Unit

Housing Development Corporation
HDC Building, Ground Floor
Hulhumalé, Republic of Maldives

Figure 6-9 Tree map 4 using GIS tool

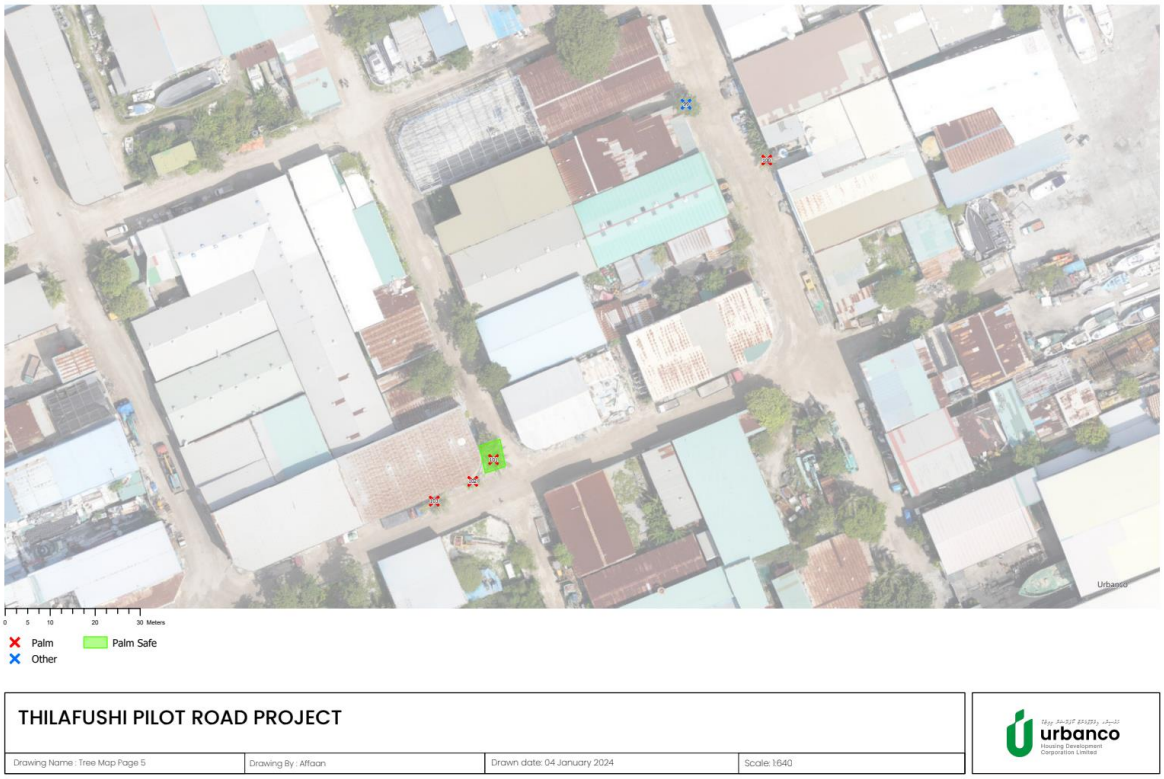


Figure 6-10 Tree map 5 using GIS tool

Figure 6-11 Tree map 6 using GIS tool

Figure 6-12 Tree map 7 using GIS tool

Table 6-4 Tree map with the GPS coordinates, which reflects the maps above

Count	OBJECTID *	Tree type	POINT_X	POINT_Y
1	6	Palm	326759.1336	462936.5319
2	7	Palm	326764.004	462924.6741
3	8	Palm	326828.965	462916.1658
4	9	Palm	326840.9474	462914.622
5	10	Other	326758.0398	462925.6488
6	11	Other	326768.5883	462923.1779
7	12	Other	326790.0037	462919.4003
8	13	Other	326793.5198	462919.2786
9	14	Other	326800.0537	462918.2699
10	15	Other	326825.1894	462915.241
11	16	Other	326832.8611	462915.0264
12	17	Other	326836.6837	462915.1366
13	19	Other	326851.9742	462922.9656
14	20	Other	326892.6998	462905.5801
15	21	Other	326898.8748	462905.3963
16	22	Other	326903.9471	462904.5877
17	23	Other	326909.534	462904.2569
18	24	Other	326948.4218	462896.2808
19	25	Palm	326933.8959	462898.1186
20	26	Palm	326936.2777	462897.9275
21	27	Palm	326931.4406	462898.2362
22	28	Palm	326929.782	462898.5643
23	29	Nika	326965.9119	462892.4536
24	30	Other	327017.9859	462885.728
25	31	Other	327010.5711	462886.8572
26	32	Other	327005.6782	462887.6476
27	33	Other	327041.3215	462882.9805
28	34	Other	327048.8491	462881.6631
29	35	Other	327055.097	462880.534
30	36	Other	327079.6747	462888.4003
31	37	Other	327222.9888	462866.0527
32	38	Other	327242.2195	462860.4658
33	39	Other	327281.0926	462850.7034
34	40	Other	327286.7972	462849.0127
35	41	Other	327301.5914	462846.1641
36	42	Other	327255.264	462856.7964
37	43	Other	327262.5627	462854.7007
38	44	Other	327268.3199	462853.1349
39	45	Palm	327258.4918	462855.881
40	46	Other	327342.3134	462834.5308

41	47	Other	327350.1938	462832.8253
42	48	Other	327419.7067	462813.8299
43	49	Other	327486.732	462792.8015
44	50	Other	327541.6954	462778.4437
45	52	Other	327578.9359	462786.2956
46	53	Palm	327555.5016	462749.0731
47	54	Palm	327553.4059	462754.4207
48	55	Palm	327554.3217	462737.2598
49	56	Palm	327552.7927	462732.6139
50	57	Palm	327550.3948	462721.516
51	58	Other	327549.4072	462715.253
52	59	Other	327559.1441	462693.2703
53	60	Other	327724.9634	462673.6379
54	61	Other	327728.3396	462675.6729
55	62	Palm	327732.1012	462677.2454
56	63	Other	327730.0942	462663.1499
57	64	Other	327734.4301	462664.836
58	65	Palm	327753.9213	462657.5729
59	66	Palm	327755.9208	462653.6327
60	67	Other	327757.9203	462648.7515
61	68	Other	327760.4491	462641.7532
62	69	Palm	327762.331	462636.872
63	70	Other	327767.5651	462628.227
64	71	Nika	327752.6863	462631.0498
65	72	Palm	327546.381	462703.4286
66	74	Palm	327808.4996	462547.3666
67	75	Palm	327814.5716	462550.4227
68	76	Palm	327821.2869	462552.9158
69	77	Other	327811.8774	462548.8142
70	78	Other	327818.3917	462551.5084
71	79	Other	327840.791	462559.7551
72	80	Other	327847.3686	462562.4058
73	81	Other	327855.8115	462565.2528
74	82	Other	327860.1312	462566.7254
75	83	Other	327859.5053	462576.9478
76	84	Other	327864.8742	462579.0953
77	85	Other	327873.4643	462581.2429
78	86	Palm	327885.8894	462576.3342
79	87	Palm	327890.6447	462578.1749
80	88	Nika	327915.1881	462589.2195
81	89	Other	327949.3092	462488.0738
82	90	Other	327962.2749	462477.6467
83	91	Other	327964.7253	462471.3636

84	92	Palm	327966.1704	462464.2637
85	93	Other	327969.3119	462459.1743
86	94	Other	327971.7623	462453.0169
87	95	Palm	327975.4065	462446.2311
88	96	Other	327980.3702	462436.618
89	97	Other	327982.6321	462431.7172
90	98	Other	327992.9364	462404.7626
91	99	Other	328023.3708	462301.6016
92	100	Palm	328041.2862	462289.166
93	101	Palm	327980.5587	462222.5525
94	102	Palm	327975.9092	462217.7145
95	103	Palm	327967.3642	462213.3163
96	104	Palm	327697.756	462101.3363
97	105	Palm	327692.7295	462101.3765
98	106	Palm	327688.1052	462098.2802
99	107	Other	327702.7825	462104.6739
100	108	Palm	327652.8318	462092.8692
101	109	Palm	327642.339	462091.9895
102	110	Palm	327633.5426	462090.0418
103	111	Palm	327628.3905	462089.7276
104	112	Palm	327623.6153	462090.1674
105	113	Palm	327621.1926	462090.9616
106	114	Palm	327618.2169	462090.8008
107	115	Palm	327613.3512	462091.806
108	116	Palm	327608.0433	462093.4145
109	117	Palm	327600.5639	462097.2347
110	118	Palm	327591.76	462107.6345
111	119	Other	327590.252	462112.4096
112	120	Palm	327569.8018	462106.1617
113	121	Palm	327570.8473	462113.6411
114	122	Palm	327539.1036	462194.5495
115	123	Palm	327548.1356	462211.239
116	124	Other	327410.0545	462248.6799
117	125	Other	327389.6528	462254.9692
118	126	Other	327381.983	462258.0371
119	127	Other	327409.9011	462236.8684
120	128	Other	327405.1458	462238.5558
121	129	Other	327390.7265	462242.6975
122	130	Palm	327291.4374	462275.999

The tree survey using the GIS platform shows that there are 49 palms, 3 Nika trees, and 70 other trees. Where in the total comes up to 122 trees. The vegetation plan accounts for the total number of trees in the pathway assuming complete mortality of the trees. The vegetation plan is presented on the section 12.2

6.2.2.3 Ground Water Quality

Figure 6-13 Ground water sampling points, map, high resolution map,12.8

6 Water samples were collected from the points as shown below. 2 Control point was taken at the marked location. Samples were collected in 1.5 litre plastic bottles as well as 1.5 litre glass bottles. Thiosulfate bags were used to collect the samples for micro-organic tests. All the water samples were collected on 4th July 2023 between 1100 to 1200 hours. Samples were then sent to Maldives Water and sewerage Company (MWSC) water quality assurance laboratory for testing.

Sampling Location	Sampling Location Coordinates	Parameters analysed
S1 (Control)	4°11'12.076" 73°26'21.1597"	Temperature, pH, Electrical Conductivity (EC), salinity, Total, Dissolved Solids (TDS), Total Petroleum Hydrocarbon (TPH), Total Coliform and Dissolved Oxygen (DO).
S2	4°11'7.217" 73°26'47.533"	
S3	4°11'3.881" 73°26'53.118"	
S4	4°10'49.417" 73°27'2.857"	
S5	4°10'47.913" 73°26'46.437"	
S6 (Control)	4°10'46.5019" 73°26'31.9492"	

Table 6-5: Ground Water Quality Sample Locations

It is expected that ground water at Thilafushi island is contaminated with the leached pollutants from areas reclaimed by dumping of wastes. Analysis of ground water samples from five wells located was thus considered to provide a representative data set for evaluation of ground water quality of the area. The control shown in Figure 16 lies away from the project site and lies nearer to the newly reclaimed sites in Thilafushi.

Figure 6-14: Site 1 (Control)

Figure 6-15: Site 2

Figure 6-16: Site 3

Figure 6-17: Site 4

Figure 6-18: Site 5

Figure 6-19: Site 6 (Control)

Test	Unit	S1(Control)	S2	S3	S4	S5	S6(Control)
Physical appearance	-	Cloudy with particles	Clear with particles	Cloudy with particles	Cloudy with particles	Clear with particles	Cloudy with particles
Conductivity	µS/cm	941	5770	1139	2310	3076	3060
pH	-	8.2	8.0	7.9	7.6	7.3	8.6
Salinity	‰	0.46	3.12	0.56	1.18	1.60	1.59
Temperature	°C	24.0	24.0	24.0	24.0	24.0	24
Total Dissolved Solids (TDS)	mg/L	470	2880	569	1154	1535	1531
Dissolved Oxygen	mg/L	7.59	7.60	6.27	5.32	2.74	6.77
Total Petroleum Hydrocarbon (TPH)	mg/L	<0.036 (LoQ 0.036 mg/L)	<0.036 (LoQ 0.036 mg/L)	<0.036 (LoQ 0.036 mg/L)	<0.036 (LoQ 0.036 mg/L)	0.041	<0.036 (LoQ 0.036 mg/L)

Total Coliform	MPN/100ml	>2420 (05/07/2023 03:00 PM)	>2420 (05/07/2023 03:00 PM)	>2420 (05/07/2023 03:00 PM)	>2420 (05/07/2023 03:00 PM)	>2420 (05/07/2023 03:00 PM)	-

Table 6-6: Ground Water Quality Sample Results reports extract on 12.9

The results of the ground water samples are represented in the table above, the pH levels range between 7.3 to 8.6. while salinity level was recorded lowest at S1 with 0.46‰. Highest salinity level was recorded at S2 with 3.12‰. This location lies significantly closer to the harbor area than the other samples sites, hence it was expected to have the higher salinity level. The same reasoning can be applied to the conductivity results of this sample as well as it has the highest conductivity level recorded as well. TDS level was highest at S2 with 288 mg/L. DO was recorded lowest at location S5 with 2.74 mg/L.

For the TPH the highest was recorded at 0.041 mg/L at S5 while all the other location had the TPH level below 0.036. High TPH can indicate leaching of waste oils into the ground. As this area is near to the waste disposal area of WAMCO, there are higher chances of oil spillage and leaching into the ground water in this area. For the Total coliform test the result was greater than 2420. This could potentially be due to rain after the sample wells were made. Rain can cause surface run off, carrying pollutants from roads into the well and thus causing contamination. The surface run off of rainwater can also be a reason for the higher pH range found as well. The acidity of rainwater has an effect on the composition of soil hard water minerals. Usually, rainwater tends to increase the pH of hard water minerals. Bicarbonate ion (HCO^-) in limestone deposits react with water to produce OH^- ions (Abdul A. J. Mohamed, 2014).

6.2.2.4 Noise Levels

The noise levels were measured at different points in relative to 3 different areas along the length of the road of the project site as well and surrounding connecting roads. The table below gives the measured values. Community noise levels are recommended to be below 70 dB in industrial, commercial and traffic areas (World Health Organization, 1999) . Table below shows the guideline values for community noise in specific environments.

Table 6-7 Guideline Values for Community Noise

			[hours]	[dB]
Outdoor living area	Serious annoyance, daytime and evening Moderate annoyance, daytime and evening	55 50	16 16	- -
Dwelling, indoors Inside bedrooms	Speech intelligibility & moderate annoyance, daytime & evening Sleep disturbance, night-time	35 30	16 8	 45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60
School class rooms & pre-schools, indoors	Speech intelligibility, disturbance of information extraction, message communication	35	during class	-
Pre-school bedrooms, indoor	Sleep disturbance	30	sleeping-time	45
School, playground outdoor	Annoyance (external source)	55	during play	-
Hospital, ward rooms, indoors	Sleep disturbance, night-time Sleep disturbance, daytime and evenings	30 30	8 16	40 -
Hospitals, treatment rooms, indoors	Interference with rest and recovery	#1		
Industrial, commercial shopping and traffic areas, indoors and outdoors	Hearing impairment	70	24	110
Ceremonies, festivals and entertainment events	Hearing impairment (patrons:<5 times/year)	100	4	110
Public addresses, indoors and outdoors	Hearing impairment	85	1	110
Music and other sounds through headphones/ earphones	Hearing impairment (free-field value)	85 #4	1	110
Impulse sounds from toys, fireworks and firearms	Hearing impairment (adults) Hearing impairment (children)	- -	- -	140 #2 120 #2
Outdoors in parkland and conservations areas	Disruption of tranquillity	#3		

#1: As low as possible.
#2: Peak sound pressure (not LAF, max) measured 100 mm from the ear.

The Figure 6-20 below gives a better idea of the representation of the areas mentioned above. Area 1 consists of major construction companies such as Apollo, Villa Hakatha Pvt Ltd, MTCC, Nalahiya Trading, STO Plc and Gulf Craft Services Centre Maldives Pvt Ltd. This area has only one major road with fewer surrounding roads. Hence the frequency of usage of this road is high. Area 2 consists of two of the main jetties used in Thilafushi as well as a lot of warehouses, and smaller garage/ workshops. The highlighted path is used by many pedestrians, medium and heavy vehicles. The Stelco Power house also lies

within this area. Area 3 consists of warehouses, garages and workshops as well. The highlighted path consists of the major road leading to the waste disposal area.

Figure 6-20: Area Distribution

The A-weighting scale lets the sound level meter hear "soft sounds approximately the way an average normal human ear does, by making the meter less sensitive to most low-frequency, and some high-frequency, energy. The C-weighting scale is used to measure loud sounds with approximately equal sensitivity at all frequencies.
The figures below depict the noise levels recorded at A-weighted scale and C-weighted scale with the control line at 70dB. The red line indicates the standard community industrial noise level at 70 dB as per WHO recommendations.

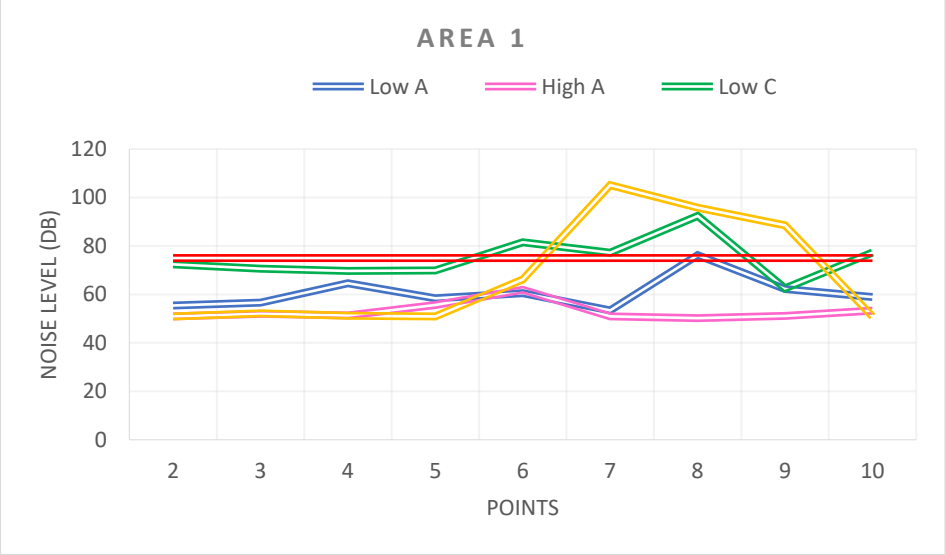


Figure 6-21: Noise level for Area 1

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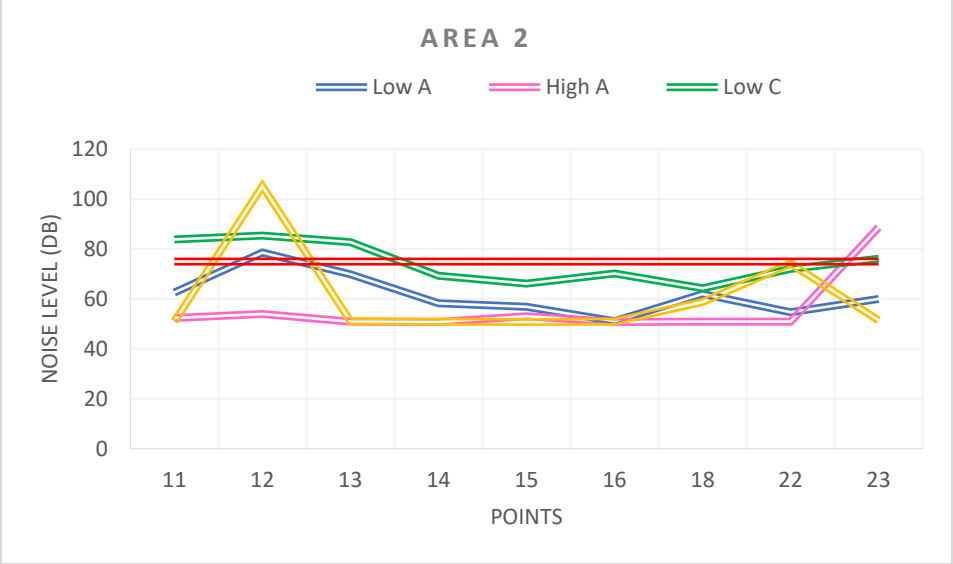

Figure 6-22: Noise level for Area 2

An anomaly can be seen at area 2 with a maximum recorded measurement at 105.2 dB. This could be due to an equipment start up at one of the construction sites nearby.

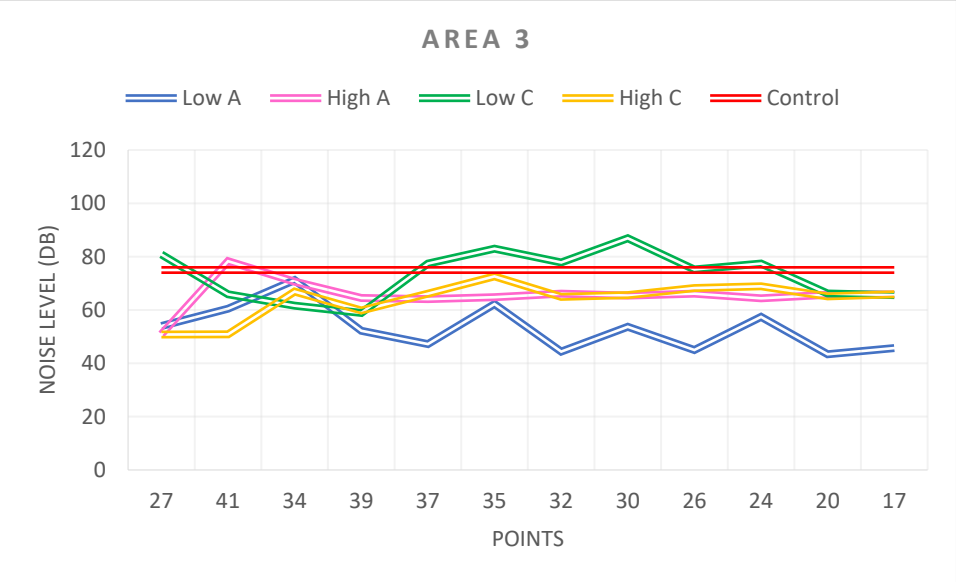

Figure 6-23: Noise Level for Area 3

6.2.2.5 Traffic

The traffic was counted in the island at the intersections of each road section where it branches out to other roads. For this data collection, the proposed road location was distributed to 4 different sections. Among these 4 sections, 2 sections consist of only one accessible road that was present in the area: meaning there are no other roads branching out to smaller roads. This was important to be highlighted as this is only existing road the users in that general area can access to travel and no alternative route of traffic flow can be suggested. These roads need to be taken into account during the construction process and it would affect the economic activities of the business that highly depend on these roads for transportation.

Figure 6-24: Traffic flow in Proposed Roads

The above figure shows the traffic flow in the proposed roads up for development. As seen in figure 6.19. All the roads that are included in the project are two-way roads.
The figure below shows the percentage of vehicles found in the proposed site. The highest percentage were found to be motorcycles and pickup trucks of various sizes. The percentage of heavy vehicles were found to be 23% of the count as displayed in the pie chart below.

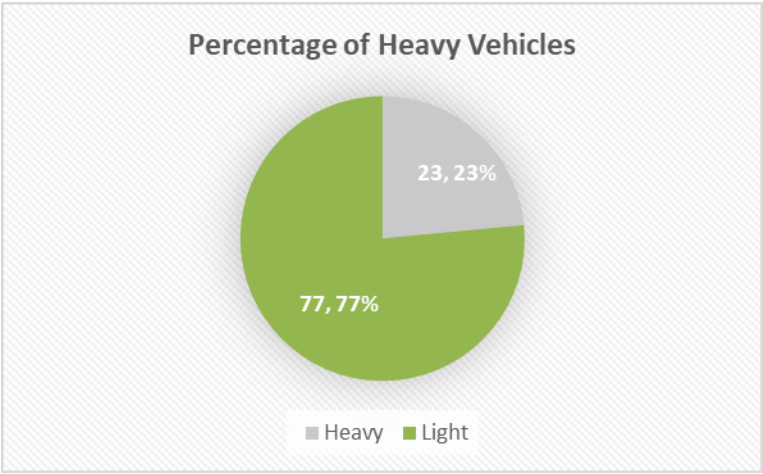

Figure 6-25: Percentage of Heavy Vehicles

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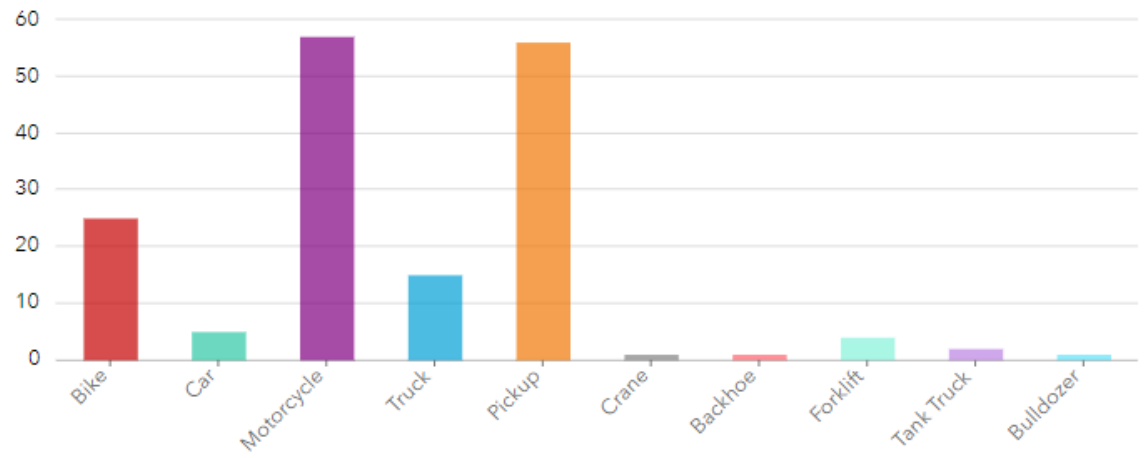

Figure 6-26 The categories of vehicles found in Thilafushi island

The above figure shows the different type of vehicles found in traffic during the traffic count. Even though there is a 23% of heavy vehicle, the types of vehicles found usually in traffic can be concluded to be pickups and motorcycles.

6.2.2.6 Air quality

Thilafushi island has been used to manage huge volumes of wastes from neighbouring major islands such as Male Villingili and Hulhumale as well as nearby resort islands. To deal with the huge volume of waste, open burning of mixed waste is being practiced. The smoke generated from burning results in increase in air pollution and effects the air quality of the islands nearby. Currently the government has made it a landfill site with future waste to energy plans to be built. With this development of waste to energy, the method of open burning for waste management in Thilafushi was brought to an end in September 2021 and the island is no longer enveloped in harmful gases (raajje.mv).

Air quality Monitoring could not be done in such a short period. Hence the summary of a comprehensive air quality monitoring done by CDE consulting services is referred for the initial conditions of Thilafushi when open burning was carried out regularly. The parameters were analysed in g/m3 (SO2, NOx, PM 2.5 and PM 10) and ppm (CO, HC) units. The collected data was compared with the WHO Ambient Air Quality Guidelines.

The 24 hourly PM10 values recorded for the stations generally varied in the range of 7.0 - 124.0 µg/m3 with the highest mean value recorded downwind of Thilafushi WMC (42.4 µg/m3) thereby complying with WHO standards specified for such pollutant i.e., 50 µg/m3. The 24 hourly PM2.5 values recorded for the stations generally varied in the range of 3.0 -111.0 µg/m3 with the highest mean value recorded downwind of Thilafushi WMC (31.5 µg/m3) thereby exceeding the WHO standards specified for such pollutant i.e., 25 µg/m3. The 24 hourly SO2 values recorded for the stations exhibited conformance with WHO standards (20.0 µg/m3) with mean values for such pollutant ranging within 2.0 - 3.5 µg/m3. The highest 24 hourly SO2 value (5.0 µg/m3) was observed both at downwind of existing Thilafushi WMC and at Villingili Island.

Due to absence of 24-hourly standard values for NO2 the results have been compared with WHO one-year standard value i.e., 40 µg/m3 to check for any possible non-conformances. The NO2 results so obtained were however found to be conformance with the aforesaid standard with mean values generally varying within 3.4 – 4.7 µg/m3. The highest 24-hourly value for NO2 was observed downwind of existing Thilafushi WMC (8.4 µg/m3). Carbon monoxide was not recorded in any of the air samples collected at the monitoring stations during the study period.

6.2.2.7 Overall condition of surrounding roads

The surrounding roads of the Thilafushi pilot road project site is similar to that of the pilot road itself. There is currently a road section between Rainbow Enterprise and Apollo holdings which is paved. However, all other roads are unpaved, slightly uneven and dusty. To succumb the dust, the Thilafushi operations regularly water the main roads a few times a day, however the same treatment is not given to the surrounding roads as the water tank truck cannot access due to its smaller size and due to the fact that these roads are not used as frequently as the main roads. Majority of the surrounding roads does not have adequate lighting installed. Most surrounding roads are smaller in size comparative to the proposed pilot road. There is more vegetation seen in surrounding roads than the main road.

Figure 6-27: Paved Section Near Apollo Holdings Pvt Ltd

Figure 6-28: Example of a Surrounding Road

6.2.2.1 Landscape integrity

The following table consist of road sections along the pilot road site with their descriptions of land integrity.

Image	Description
	Moving from the initial point of the proposed construction, the area is a compacted zone, extending from the initial point of the proposed construction, east.
	This area consists of a small section of paved road and continues with a compacted sand path towards the T jetty area.

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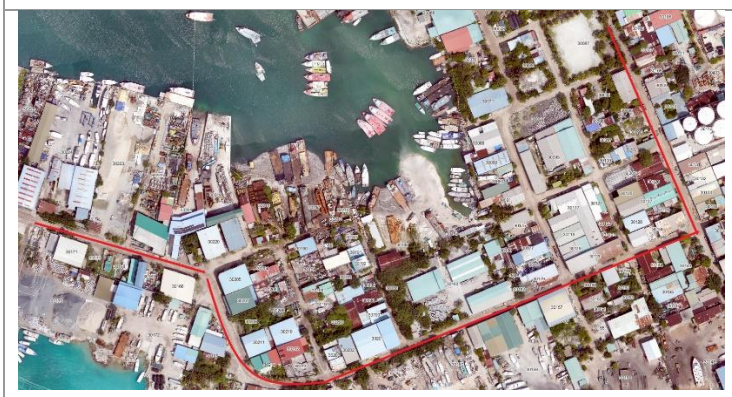
	The sand path continues in this section as well. It Is noteworthy to mention that his section contains the highest number of trees.
	The compacted sand path continues towards south and then west towards the Wamco waste site.
	This path continues towards the end point of the pilot road near the current waste management facility towards south and onto the newly built road.

6.3 Socio-economic environment

6.3.1 Demography

According to the 2014 census, there were 2,052 persons in Thilafushi island. The total number of males and females are 2,048 and 4 respectively. Out of the 2,052 persons on the island, 333 persons were Maldivian. The dominant age group is 20-24 years that's accounts for about a quarter of the population. Currently there are at least 60 different companies established on the island.

6.3.2 Economic activities

Thilafushi plays a vital role in the Maldivian economy as a center for industrial and waste management activities. The island is primarily known for its landfill and waste treatment facilities, which serve as an important hub for waste disposal in the Maldives. The waste management industry has created numerous employment opportunities for local residents, contributing to the island's economic development. In addition to waste management, Thilafushi is also involved in other economic activities such as importing and stockpiling of construction materials and warehousing facilities, wholesale and retail trade, workshops and other industrial and commercial activities. There are more than 60 different companies established in Thilafushi.

There are over 200 tenants established in Thilafushi who all have industrial / commercial properties in the island. Industrial activities in the island include: Fiber boat building and boatyards for repair and maintenance of vessels, light, medium heavy warehousing, furniture, carpentry and woodwork, cement plants, fuel storage, machine shops, vehicle maintenance and repair, aluminium works, private loading and unloading docks and metal fabrication.

This pattern reflects the current land use pattern on the island. As noted above, most of these workers especially international migrant workers are unskilled or semi-skilled who are trained on the job upon arrival. The locals working on the site are usually semi-skilled or skilled workers who lead or manage the activities on each plot.

6.3.3 Seasonal changes in activities

Thilafushi experiences some seasonal changes in economic activities, although they are relatively minimal compared to other regions since there are no economic activities directly related such as tourism. Due to the nature of waste management and industrial activities, the demand for services and employment opportunities remains relatively stable throughout the year.

6.3.4 Land use plan

Thilafushi follows a comprehensive land use plan to guide the development and allocation of land for various purposes. The primary focus of the land use plan is to accommodate the industrial and waste management activities while also considering the needs of the local community. The island that has been reclaimed by dumping wastes on the submerged "Thilafushi" lagoon area since 1992. The island was initially developed as a sand bank using dredged material from the Thilafushi Reef. Since then, land has been reclaimed by placing solid waste in dredged holes on the reef flat and later topping it up with fresh lagoon sand.

The land use plan of Thilafushi was developed in an ad hoc manner without a master plan. Hence, the present land use patterns show a mixed approach to development with a variety of industrial, manufacturing and warehousing activities being undertaken on the island.

The plan allocates specific areas for landfill and waste treatment facilities, industrial zones, residential areas, and recreational spaces. It also takes into account the need to preserve environmentally sensitive areas and protect the island's natural resources. The land use plan aims to strike a balance between economic development and environmental sustainability, ensuring that the island's resources are utilized efficiently and responsibly. The following figure gives an overview of the Thilafushi land use plan.

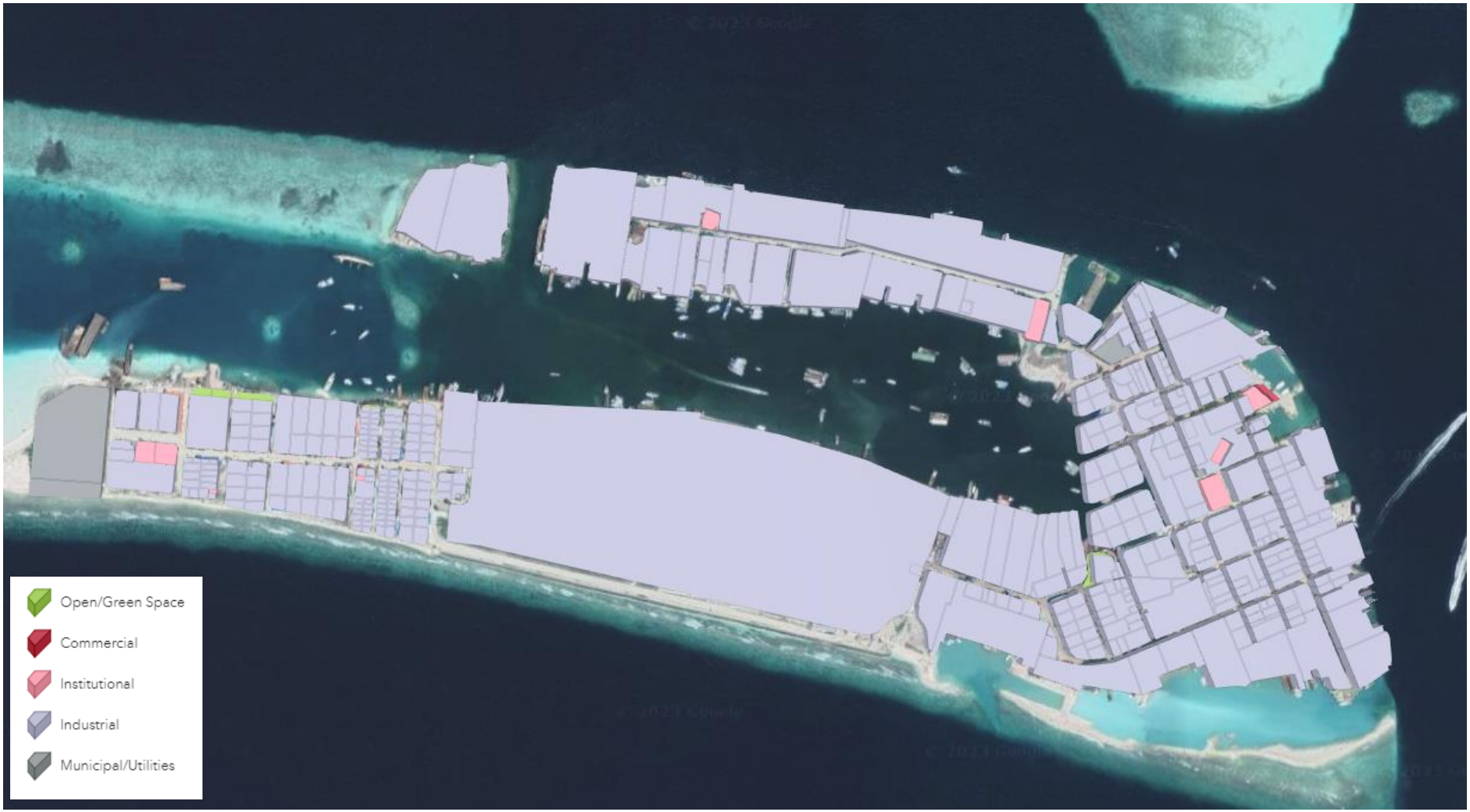


Figure 6-29: Land Use Plan of Thilafushi Phase I

6.3.5 Accessibility and public transport

The island is connected to the capital city of Malé and other nearby islands through regular ferry services and speedboat transfers. These modes of transport provide convenient options for residents and workers commuting to Thilafushi on a daily basis. The island itself does not have any public transport services however, transportation can be organized through Urbanco, WAMCO or other private parties.
There are over 36 private marine access points which are used by various companies for loading and unloading of cargo and passengers. The main harbour is located on the North-Eastern side which is the main access point for Thilafushi island. The main commercial point is "T-Jetty", it is managed by HDC since the merger of GMIZL and HDC.

6.3.5.1 Details of Road Openings

The Table 6-8 below shows the details of road openings of the tenants in Thilafushi. The presence of the opening with regards to the specific project segments are given, whether it falls on that specific segment or not. The direction of the opening with regards to the pilot road orientation is given. The number of openings in each direction is given separately in order to identify the impact with regards to the direction. The GPS coordinate indicates the opening locations.

Segment ID	Design type	Plot Name	Existing tenant	Presence of plot opening	Details of Road openings									
					Direction and No. of openings								GPS coordinate mark 1	GPS coordinate mark 2
					N	No.	E	No.	S	No.	W	No.		
1	A-A	Lot 30003	MTCC	✓							✓	1	4°11'12.188" 73°26'20.883"	4°11'11.716" 73°26'20.82"
		Lot 30004	V.A Private Limited	✓	✓	1							4°11'12.062" 73°26'21.77"	4°11'11.928" 73°26'22.78"
		Lot 30005	Apollo Holdings Private Limited	✓	✓	1							4°11'11.545" 73°26'25.365"	4°11'11.545" 73°26'25.365"
		Lot 30006	Mosque	✓	✓	1							4°11'11.4556" 73°26'25.899"	4°11'11.4379" 73°26'26.0177"
		Lot 30008	Nalahiya Trading Pvt Ltd	✓	✓	1							4°11'11.2501" 73°26'27.2358"	4°11'11.2182" 73°26'27.4511"
		Lot 30401	State Trading Organization Plc	✓	✓	1							4°11'10.623" 73°26'31.552"	4°11'10.595" 73°26'31.798"
		Lot 30010	Apollo Holdings Pvt Ltd	✓					✓	1			4°11'11.55" 73°26'21.884"	4°11'11.531" 73°26'22.01"
		Lot 30011	BMC Transport & Maldives Marine Contracting company	✓					✓	1			4°11'11.43" 73°26'22.723"	4°11'11.378" 73°26'23.052"
		Lot 30012	Apollo Holdings Pvt Ltd	✓					✓	1			4°11'11.202" 73°26'24.439"	4°11'11.178" 73°26'24.624"
		Lot 30013	Abbas Abdulla(warehousing)	✓					✓	1				

Segment ID	Design type	Plot Name	Existing tenant	Presence of plot opening	Details of Road openings								GPS coordinate mark 1	GPS coordinate mark 2
					Direction and No. of openings									
					N	No.	E	No.	S	No.	W	No.		
		Lot 30015	Apollo Holdings Pvt Ltd	✓					✓	1			4°11'10.946" 73°26'26.11"	4°11'10.871" 73°26'26.618"
		Lot 30016	Rainbow Enterprises/Aluminum	✓			✓	2	✓	3				
		Lot 30017	Nalahiya Trading Private Limited	✓					✓	1			4°11'10.415" 73°26'29.549"	4°11'10.348" 73°26'30.15"
		Lot 30018	Villa Hakatha Pvt Ltd	✓					✓	6				
2	B-B	Lot 30018	Villa Hakatha Pvt Ltd	✓					✓	1				
		Lot 30009	Villa Hakatha Pvt Ltd	✓	✓	3							4°11'9.304" 73°26'39.9112" 4°11'8.8087" 73°26'41.8104" 4°11'7.6335" 73°26'46.2498"	4°11'9.2679" 73°26'40.0451" 4°11'8.7479" 73°26'42.0391" 4°11'7.5961" 73°26'46.3983"
		Lot 30019	Gulf Craft Services Centre Maldives Pvt Ltd	✓					✓	1			4°11'9.5762" 73°26'36.8987"	4°11'9.5284" 73°26'37.0798"
		Lot 30020	Maldives Structural Products Pvt Ltd	✓					✓	1				
		Lot 30022	State Trading Organization Plc Ltd	✓					✓	1			4°11'7.658" 73°26'44.0537"	4°11'7.6231" 73°26'44.2493"
		Lot 30023	? (Office)	✓					✓	1			4°11'7.139" 73°26'46.23"	4°11'7.035" 73°26'46.641"
3	C-C	Lot 30028	Ahmed Sameeru (Warehouse)	✗										
		Lot 30030	State Electric Company Ltd	✗										
		Lot 30027	Vermillion International Pvt Ltd	✓					✓	1			4°11'3.4081" 73°26'49.4749"	4°11'3.387" 73°26'49.5238"
4	E-E	Lot 30038	Agas Maldives Pvt Ltd	✓	✓	1							4°11'2.626" 73°26'51.165"	4°11'2.689" 73°26'51.31"
		Lot 30030	State Electric Company Ltd	✓	✓	1							4°11'3.3541" 73°26'51.673"	4°11'3.4044" 73°26'51.8078"

Segment ID	Design type	Plot Name	Existing tenant	Presence of plot opening	Details of Road openings								GPS coordinate mark 1	GPS coordinate mark 2
					Direction and No. of openings									
					N	No.	E	No.	S	No.	W	No.		
		Lot 30032	Mario Maldives Pvt Ltd	✓	✓	2							4.1843316 73.4478673	
		Lot 30040	Hussain Khalid (warehouse/accommodation)	✓					✓	1			4.184171, 73.447767	4.184171, 73.447767
		Lot 30041	Mohamed Haleel	✓					✓	1			4.184213952128507 , 73.44785345189013	4.184213952128507 , 73.44785345189013
5	F-F	Lot 30032	Mario Maldives Pvt Ltd	✓	✓	2							4.1843316 73.4478673	4.1843316 73.4478673
		Lot 30043	Marine Export & Trading Company Pvt Ltd	✓							✓	3	4.1841791 73.4480443	4.1841791 73.4480443
		Lot 30044	Marine Export & Trading Company Pvt Ltd	✓			✓	3					4.1840387 73.4482257	4.1840387 73.4482257
		Lot 30054	Ahmed Shiyam (Docking and vessel repair)	✓							✓	3		
		Lot 30056	Mohamed Naasih (Warehousing)	✓							✓	1	4°11'0.806" 73°26'53.8562"	4°11'0.7109" 73°26'53.8991"
		Lot 30055	Heavy Force Pvt Ltd	✓							✓	1	4°11'0.326" 73°26'54.0526"	4°11'0.1906" 73°26'54.1063"
		Lot 30057	Hello Maldives Pvt Ltd	✓							✓	2	4.183289 73.448407	
		Lot 30058	Marine Coral Maldives Pvt Ltd	✓			✓	2					4.183599 73.448412	
		Lot 30060	Marine Coral Maldives Pvt Ltd	✓			✓	1					4.183326 73.448527	
6	K-K	Lot 30060	Marine Coral Maldives Pvt Ltd	✓			✓	1					4.183326 73.448527	
		Lot 30061	Marine Coral Maldives Pvt Ltd	✓	✓	1							4.1833928 73.4489071	4.1833851 73.4488894
		Lot 30072	Null	✓					✓	1			4°10'59.65" 73°26'55.611"	4°10'59.704" 73°26'55.757"
7	H-H	Lot 30063	Marine Export & Trading Company Pvt Ltd	✓	✓	2							4.183499 73.4491479	4.1835137 73.4491828
		Lot 30074	Waste Management Corporation Limited	✗										

Segment ID	Design type	Plot Name	Existing tenant	Presence of plot opening	Details of Road openings								GPS coordinate mark 1	GPS coordinate mark 2
					Direction and No. of openings									
					N	No.	E	No.	S	No.	W	No.		
		Lot 30064	Coastline Investments Pvt Ltd	✓	✓									
8	K-K	Lot 30074	Waste Management Corporation Limited	✓					✓	2	✓	3	4.1833807 73.4495453	4.183176 73.4496278
		Lot 30079	Waste Management Corporation Limited	✓			✓	1					4.1834323 73.449665	4.1834042 73.4496768
		Lot 30072	Null	✓			✓	1					4°10'59.3137" 73°26'58.8903"	4°10'59.3137" 73°26'58.8903"
		Lot 30077	Dhivehi Raajjeyge Gulhun Plc	Uncertain										
		Lot 30082	Maldives Islamic Bank ATM	✓			✓	1					4.1831571 73.4498016	4.1831374 73.4497934
		Lot 30083	Null	Uncertain										
		Lot 30085	Null	✓			✓	1					4.1828302 73.4499221	4.1828125 73.4499293
		Lot 30103	Nazaki Aluminium Pvt Ltd	✓			✓	2					4.1824085 73.4501084	4.182367 73.4501271
9	I-I	Lot 30105	Damas Company Pvt Ltd	✓			✓	1					4°10'56.157" 73°27'0.629"	4°10'56.062" 73°27'0.665"
		Lot 30107	Dhivehi Meysthiri Pvt Ltd	✓			✓	1					4°10'55.755" 73°27'0.8025"	4°10'55.6852" 73°27'0.8322"
		Lot 30108	Haajaraa Workshop	✓			✓	1					4°10'54.686" 73°27'1.2727"	4°10'54.6251" 73°27'1.2945"
		Lot 30109	Agas Maldives Pvt Ltd	✓			✓	1					4.1817316 73.4504007	4.1816894 73.4504135
		Lot 30110	Ahmed Luthfee	✓			✓	1					4°10'53.7185" 73°27'1.6636"	4°10'53.6604" 73°27'1.6879"
		Lot 30113	The Hawks Pvt Ltd	✓			✓	1					4.1812609 73.4505937	4.181194 73.4506205
		Lot 30087	Null	✗										
		Lot 30094	Amin Construction Pvt Ltd	✓							✓	1	4.1818182 73.450248	4.1817801 73.4502667

Segment ID	Design type	Plot Name	Existing tenant	Presence of plot opening	Details of Road openings								GPS coordinate mark 1	GPS coordinate mark 2
					Direction and No. of openings									
					N	No.	E	No.	S	No.	W	No.		
		Lot 30096	Mohamed Moosa	✓							✓	1	4.1816131 73.4503265	4.1815983 73.4503318
		Lot 30098	Aaru Pvt Ltd	✓							✓	1	4.1812492 73.4504769	4.1812125 73.4504608
10	J-J	Lot 30124	Ibrahim Abdul Latheef	✓							✓	1	4.181076 73.45054	4.181033 73.450557
		Lot 30126	Dynamic Construction and Trading Pvt Ltd	✓			✓	1					4°10'51.6369" 73°27'2.0062"	4°10'51.5424" 73°27'2.0418"
		Lot 30127	Nalahiya Trading Pvt Ltd	✓			✓	1					4.1808812 73.4506198	4.1808557 73.4506302
		Lot 30129	Fuel Supplies Maldives Pvt Ltd	✓			✓	1					4°10'50.4824" 73°27'2.4896"	4°10'50.3574" 73°27'2.543"
		Lot 30130	Aima Construction Pvt Ltd	✓			✓	1					4.1805602 73.4507479	4.1805405 73.4507556
		Lot 30116	The Hawks Pvt Ltd	✓	✓	1							4°10'52.5489" 73°27'2.1465"	4°10'52.3032" 73°27'2.2428"
		Lot 30131	Monaza Contracting Company Pvt Ltd	✓			✓	1					4.1810032 73.4507005	4.1809731 73.4507113
		Lot 30132	Aima Construction Pvt Ltd	✓			✓	1					4°10'51.108" 73°27'2.7365"	4°10'51.0566" 73°27'2.7576"
		Lot 30133	Aima Construction Pvt Ltd	✓			✓	1					4.1807551 73.4507971	4.180738 73.4508121
		Lot 30134	LuckyHiya Maldives Pvt Ltd	✗										
11	K-K	Lot 30130	Aima Construction Pvt Ltd	✓					✓	2			4.180292 73.4503275 4.1804499 73.4506875	4.1803108 73.450357 4.1804345 73.4506473
		Lot 30130	Heavy Load Maldives Pvt Ltd	✓	✓	1							4°10'49.318" 73°27'2.966"	4°10'49.408" 73°27'2.792"
		Lot 30144	FW Construction Company Pvt Ltd	✓					✓	2			4.1803007 73.4505408 4.1802372 73.4503866	4.1802874 73.4505019 4.1802158 73.4503323

Segment ID	Design type	Plot Name	Existing tenant	Presence of plot opening	Details of Road openings								GPS coordinate mark 1	GPS coordinate mark 2
					Direction and No. of openings									
					N	No.	E	No.	S	No.	W	No.		
12	P-P	Lot 30120	Damas Company Pvt Ltd	✓			✓	2					4.1801755 73.4500458 4.1801107 73.4498714	4.1801622 73.4500156 4.1801107 73.4498714
		Lot 30148	Asir Nizar	✓			✓	1					4.1801338 73.4502298	4.1801518 73.4501959
		Lot 30149	The Wiz Company Pvt Ltd	✓			✓	1					4.180091 73.4500354	4.1800747 73.4500169
		Lot 30150	Afcons Infrastructure Limited	✓					✓	1			4°10'48.198" 73°26'59.873"	4°10'48.155" 73°26'59.77"
		Lot 30179	Onus Pvt Ltd	Uncertain										
		Lot 30157	Nakachafushi Island Resort	✗										
13	K-K	Lot 30159	Universal Enterprises Pvt Ltd	✓					✓	1			4°10'47.015" 73°26'57.07"	4°10'46.989" 73°26'57.008"
		Lot 30183	Road Development Corporation	✓	✓	1							4°10'46.783" 73°26'55.614"	4°10'46.746" 73°26'55.495"
		Lot 30159	Universal Enterprises Pvt Ltd	✓					✓	2			4.1798 73.449357 4.179726 73.449186	4.179784 73.449327 4.179698 73.449119
		Lot 30160	Heavy Dockyard Maldives Pvt Ltd	✓					✓	1			4°10'46.314" 73°26'55.4"	4°10'46.275" 73°26'55.276"
		Lot 30161	Alia Investments Pvt Ltd	✓					✓	1			4°10'44.957" 73°26'52.07"	4°10'45.004" 73°26'52.202"
		Lot 30201	Sunfront Pvt Ltd	✓	✓	3							4.179395 73.448105 4.179332 73.447993 4.179286 73.447869	4.17938 73.4481 4.179308 73.447935 4.179262 73.447815
		Lot 30202	Alia Investments Pvt Ltd	✓	✓	1							4.179246 73.447711	4.179229 73.447665

Segment ID	Design type	Plot Name	Existing tenant	Presence of plot opening	Details of Road openings								GPS coordinate mark 1	GPS coordinate mark 2
					Direction and No. of openings									
					N	No.	E	No.	S	No.	W	No.		
		Lot 30203	Ahmed Sameeru	✕										
		Lot 30162	Heavy Load Maldives Pvt Ltd	✓					✓	1			4°10'44.504" 73°26'50.849"	4°10'44.545" 73°26'51.022"
		Lot 30163	Heavy Load Maldives Pvt Ltd	✕										
		Lot 30213	Ali Naashid	✓	✓	1							4.1790883 73.447191	4.179086 73.4471679
14	L-L	Lot 30214	Aasandha Company Limited	✓	✓	1							4.179121 73.4468054	4.1791123 73.4468267
		Lot 30163	Heavy Load Maldives Pvt Ltd	✕										
		Lot 30164	Heavy Load Maldives Pvt Ltd	✓					✓	1			4°10'44.512" 73°26'47.884"	4°10'44.462" 73°26'48.071"
		Lot 30165	Aimo Enterprises Pvt Ltd	✓							✓	1	4°10'45.745" 73°26'47.379"	4°10'45.577" 73°26'47.389"
		Lot 30172	Fuel Express Maldives Pvt Ltd	✓					✓	1			4°10'47.108" 73°26'46.295"	4°10'47.052" 73°26'46.467"
		Lot 30211	Timber House Pvt Ltd	✓							✓	1	4.179308 73.446679	4.179422 73.446632
		Lot 30209	Prime Fertilizers Maldives Pvt Ltd	✓							✓	1	4.179643 73.44655	4.179468 73.446627
		Lot 30207	Alia Investments Pvt Ltd	✓							✓	1	4.179804 73.446485	4.179712 73.446527
		Lot 30205	Sunfront Pvt Ltd	✕										
15	M-M	Lot 30166	Moosa Kaleem	✓					✓	2			4.1800283 73.4461272 4.1800537 73.446044	4.1800136 73.4461788 4.1800656 73.4459954
		Lot 30167	Mafhaa Private Limited	✓					✓	1			4°10'48.509" 73°26'44.734"	4°10'48.464" 73°26'44.871"
		Lot 30168	Timber Stores Private Limited	✓					✓	1			4°10'48.817" 73°26'43.7591"	4°10'48.7652" 73°26'43.9179"

Segment ID	Design type	Plot Name	Existing tenant	Presence of plot opening	Details of Road openings								GPS coordinate mark 1	GPS coordinate mark 2
					Direction and No. of openings									
					N	No.	E	No.	S	No.	W	No.		
		Lot 30170	-	✓				✓	1				4.1802903 73.4453604	4.1803344 73.4452303
		Lot 30171	Adam Ibrahim	✓				✓	1				4.180358 73.4451031	4.1803684 73.4450722
		Lot 30173	Fuel Express Maldives Pvt Ltd	✓					✓	1			4°10'49.64" 73°26'41.24"	4°10'49.592" 73°26'41.416"
		Lot 30220	A.H.Brothers Pvt Ltd	✕										
		Lot 30221	Leo Trading Pvt Ltd	✓	✓	1							4°10'48.749" 73°26'45.283"	4°10'48.67" 73°26'45.52"
		Lot 30222	Uniforce Investments Pvt Ltd	✓	✓	1							4°10'49.18" 73°26'43.999"	4°10'49.128" 73°26'44.166"
		Lot 30223	Agas Maldives Pvt Ltd	✓	✓	1							4°10'49.468" 73°26'43.148"	4°10'49.411" 73°26'43.318"
		Lot 30224	Silver Sands Pvt Ltd	✕										
16	N-N	Lot 30224	Silver Sands Pvt Ltd	✓	✓	1							4°10'50.231" 73°26'41.059"	4°10'50.248" 73°26'40.918"
		Lot 30174	Null	✕										
17	O-O	Lot 30174	Null	✓	✓	1							4°10'49.392" 73°26'40.549"	4°10'49.313" 73°26'40.791"
		Lot 30229	Environment Ministry	✓				✓	1				4.1808311 73.4437565	4.1808632 73.4436761

Table 6-8: Details of Road Openings

6.3.5.1 Traffic diversion

The traffic movement maps are attached to the section 12.12. The survey shows that when the work starts, some plots can be accessed through the attached ports. This is true for the plots at the periphery of the island, with big plots extending the entire stretch till the proposed road. Some plots do not have the port access and face the road and will be blocked by the work but will have access through the road, and some will not have any access when the work starts. The details of the plots are provided in the section 6.3.5.1, and 12.11. As the work is proposed in sections, traffic diversion is proposed. However, as we are unable to define the traffic diversion, currently, the survey focused on the possible points of port for accessibility, and the alternative road paths for possible road movement. The pathways and points of access can be used by the contractor to manage and propose potential traffic diversion possibilities. The maps are attached under the sections 12.11, and 12.12.Details of Road Openings

6.3.6 Services quality and accessibility

Thilafushi offers a range of essential services to cater to the needs of its residents, workers, and visitors. Power is provided by State Electric Company (STELCO) and from private generators. 80% of the plots use STELCO electricity. Desalinated water is provided by MWSC to all the plots who operate a 150m/day desalination plant on the island.
There are accommodation blocks where private companies accommodate their expatriate workers and is managed by the private companies themselves. After a social survey conducted on the island, most expatriate workers accommodate 5-10 people in one room
Retail outlets are limited on the island. There about 6 small shops in operation distributed mainly around the Thilafushi-1 area. Three food outlets are in operation in the Island. This number varies occasionally with new businesses starting and others ceasing.

6.3.7 Community needs

There are no educational facilities on Thilafushi. Such facilities are available on nearby islands such as Male and Villingili. There are no established hospitals

6.3.8 Sites with historical or cultural interests

Thilafushi, being primarily an industrial and waste management hub, does not have significant historical or cultural sites of its own. The island consists of two mosques.

6.3.9 Types of vehicles and peak traffic hours

The following Figure 6-30: Percentage of Vehicle Types Found in Site depicts the percentage of vehicles found in the project site road. The highest percentage was found to be motorcycles followed by Pickup trucks of various sizes.

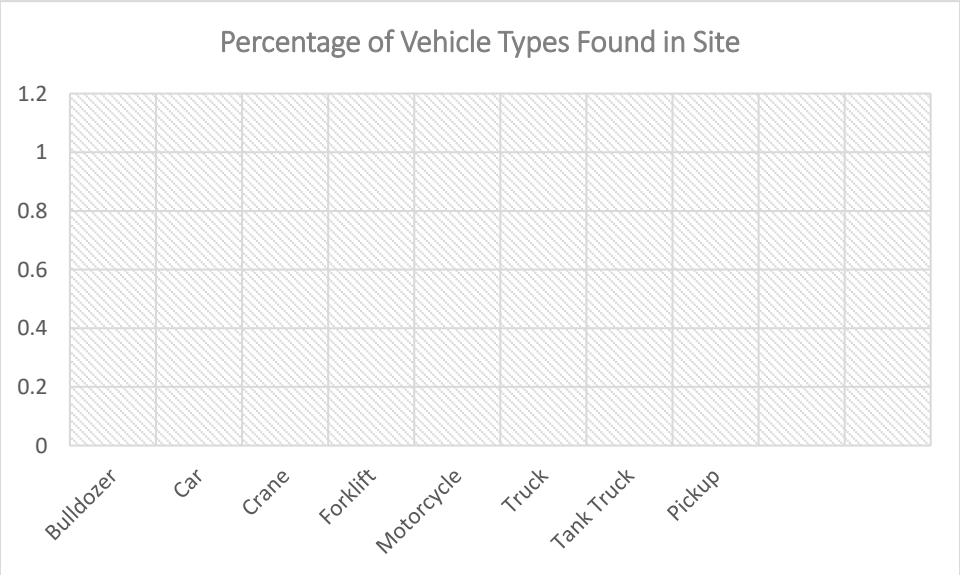


Figure 6-30: Percentage of Vehicle Types Found in Site

6.3.10 Waste management practices

Thilafushi is the largest dump site in Maldives that caters to Male and the surrounding islands. Thilafushi also receives waste from resorts and construction and demolition sites. On a daily basis the Thilafushi island receives around 700-750 TPD of waste which includes around 106 TPD of industrial waste; 195 TPD of domestic waste from Malé; 33 TPD from Villingili Island; 6 TPD from Hulhumalé Island; 42 TPD from Airport Island and around 350 TPD from resorts and islands in the immediate vicinity of Malé.

Domestic waste consists of around 70% organic material and balance 30% recyclable/ inert consisting mainly of LDP plastic, HDP plastic, metal waste product, aluminium, wood, glass and packaging material. Due to the recent waste segregation standards introduced by the government, the waste brought to the island for waste disposal services are relatively segregated. If they are not segregated, they are manually sorted by the workforce of WAMCO.

Open burning of waste has been practiced in Thilafushi till end of September 2021, post consistent efforts made by the government to ban the practice, burning is no longer practiced to favour alternative waste management practices.
The current management of waste is done by the Waste Management Corporation through regular collection of segregated waste by their dump trucks.

There are future plans of establishing a waste to energy plant to combat the waste issue in the greater male region.
The WtE facility can process 500 tons/day of municipal solid waste, with up to 12 MW power generation (Asian Development Bank, 2020). This is expected to reduce GHG emissions by 40,417 tCO2-eq./year. The components of this project include establishment of the 500-ton per day Waste-to-Energy (WTE) plant with flue gas treatment, emissions monitoring, bottom ash processing plant, and ash disposal landfill with leachate treatment pond. This project also includes institutional capacity building in sustainable waste management, environmental monitoring and public awareness.

6.3.11 Hazard vulnerability

The United Nations Development Program (UNDP) has compiled a very thorough study to develop a risk profile for the Maldives in order to determine the probability of hazards across different regions of Maldives based on geological evidence, historical data and projections derived from theoretical analysis (UNDP, 2006). Likelihood of storm hazards for the island

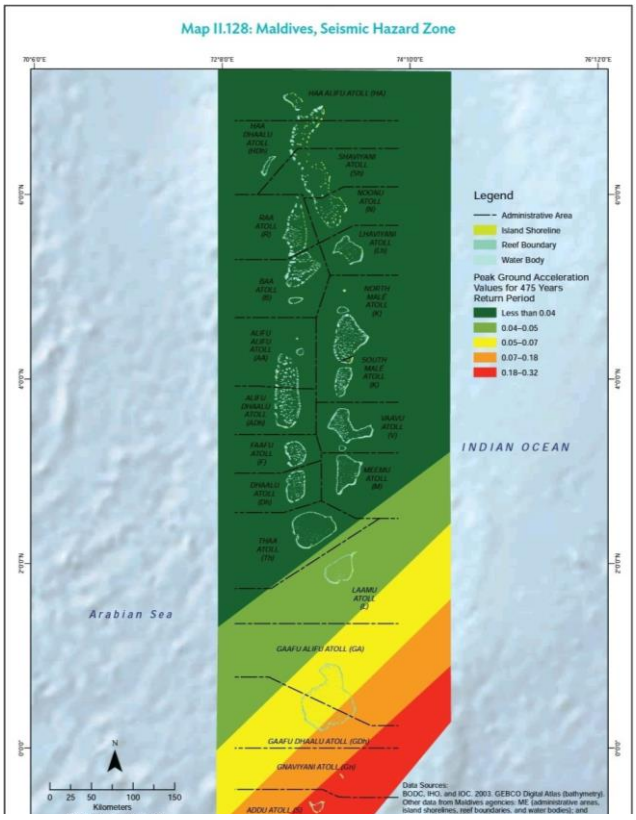


Figure 6-31: Probability of Hazards across Maldives

under concern are analysed using this disaster risk management study done by the UNDP and likelihood of flooding is analysed using rainfall data from the nearest meteorological centre to each island.

6.3.11.1 Flooding

Standard deviation of rainfall can be used to find out the areas which has been affected by floods. If in a particular year, the percent departure of rainfall from its long-term mean is greater than one standard deviation, it may be considered as a year of excess rainfall or flood. Conversely, if the difference is less than one standard deviation, it may be considered as a deficient or drought year.
From the rainfall data of Maldives, the standard deviation of rainfall has been found to be about 16 percent. The number of excess, normal and deficient years for the above stations for the data period can be found in the figure below ().

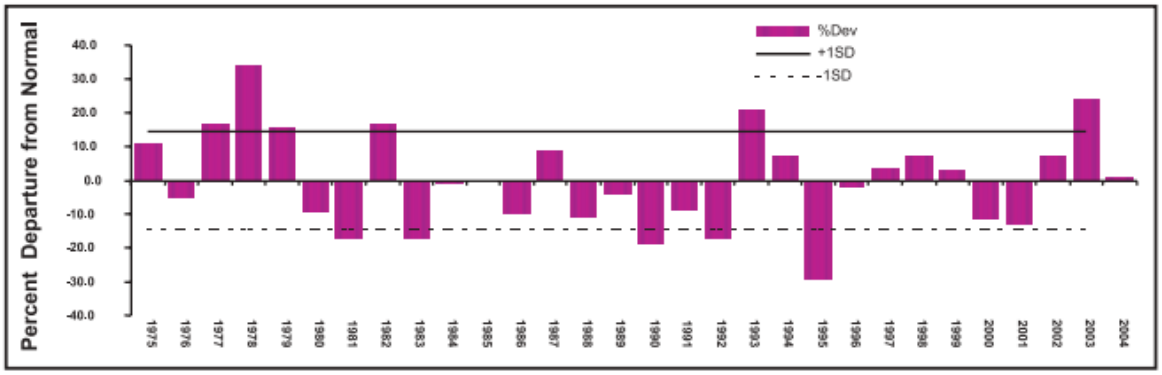


Figure 25: Excess, Normal and Deficient Rainfall Years of Hulhule

Figure 6-32: Excess, Normal and Deficient Rainfall Years of Hulhule'

Table 16: Frequency of Excess and Deficient Rainfall Years (per cent departure in brackets)

Station Name	Number of drought years	Extreme drought years	Number of flood years	Extreme flood years
Hanimaadhoo (1992 to 2004)	2	2002 (-26.0)	2	1993 (23.2)
Hulhule (1975 to 2004)	5	1995 (-29.4)	6	1978 (34.1)
Gan (1978 to 2004)	3	1999 (-32.6)	4	1978 (38.5)

Table 6-9: Frequency of Excess and Deficient Rainfall Years

The results in the table above indicate that the southern parts of Maldives are less prone to drought and floods compared to northern part, through frequency of floods/drought years is small (about 15 to 16 per cent of the years).

6.3.11.1.1 Flooding areas due to rain

One of the parameters for finding out years in which area has been affected by floods and Earlier studies have pointed at wind-waves as the primary mechanism causing flooding events in the Maldives, similarly to other Indian and Pacific islands (Hoeke et al., 2013) Similarly, in 2007, the Fares island, located in the southernmost atoll of the Maldives was flooded due to a series of remotely-generated swell events reaching the island (Wadey et al., 2017; Beetham and Kench, 2018) which also affected other areas of the eastern Indian Ocean (e.g., Lecacheux et al., 2012 in La Réunion Island) (https://www.frontiersin.org/articles/10.3389/fmars.2021.665672/full)

Flooding due to rain are one of the most frequent natural events that occur in the Maldives. However, data on flood events are lacking in the Maldives as well as a proper mechanism for collecting or recording such data need to be established. Only the most extreme rainfall occurrences generally lead to the danger of significant floods. Individual daily rainfall is often linked to flash-floods of limited special extent. However, multi-day rainfall generally has a broader spatial footprint and thus more extensive flooding can be a cause. Studies done by () have estimated flood and drought years based on rainfall data. The figure below shows the flood years together with drought years for the central region of Maldives.

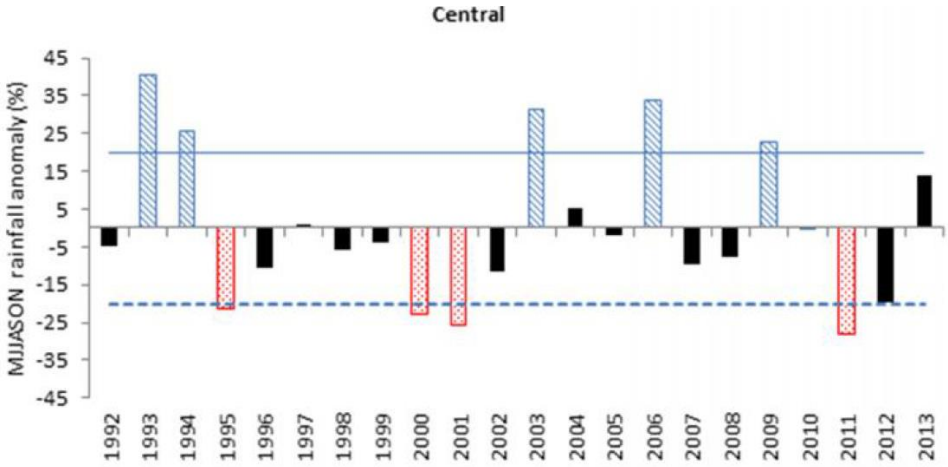


Figure 6-33: Flood and Drought Years for the Central Region of Maldives

Below are the flooding profiles for Thilafushi taken from RTK Surveys along the entire length of the Pilot Road site starting from MTCC to Wamco waste disposal site. According to these profiles the most flooding possible would be likely to occur in the area below with the lowest mean height from MSL.

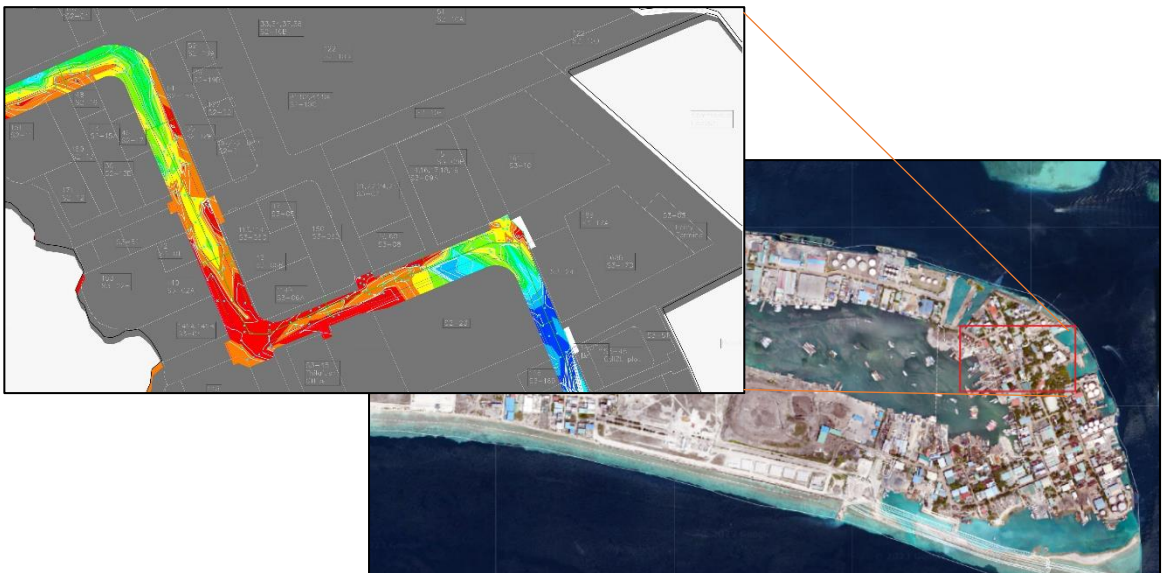


Figure 6-34: Profile of Thilafushi

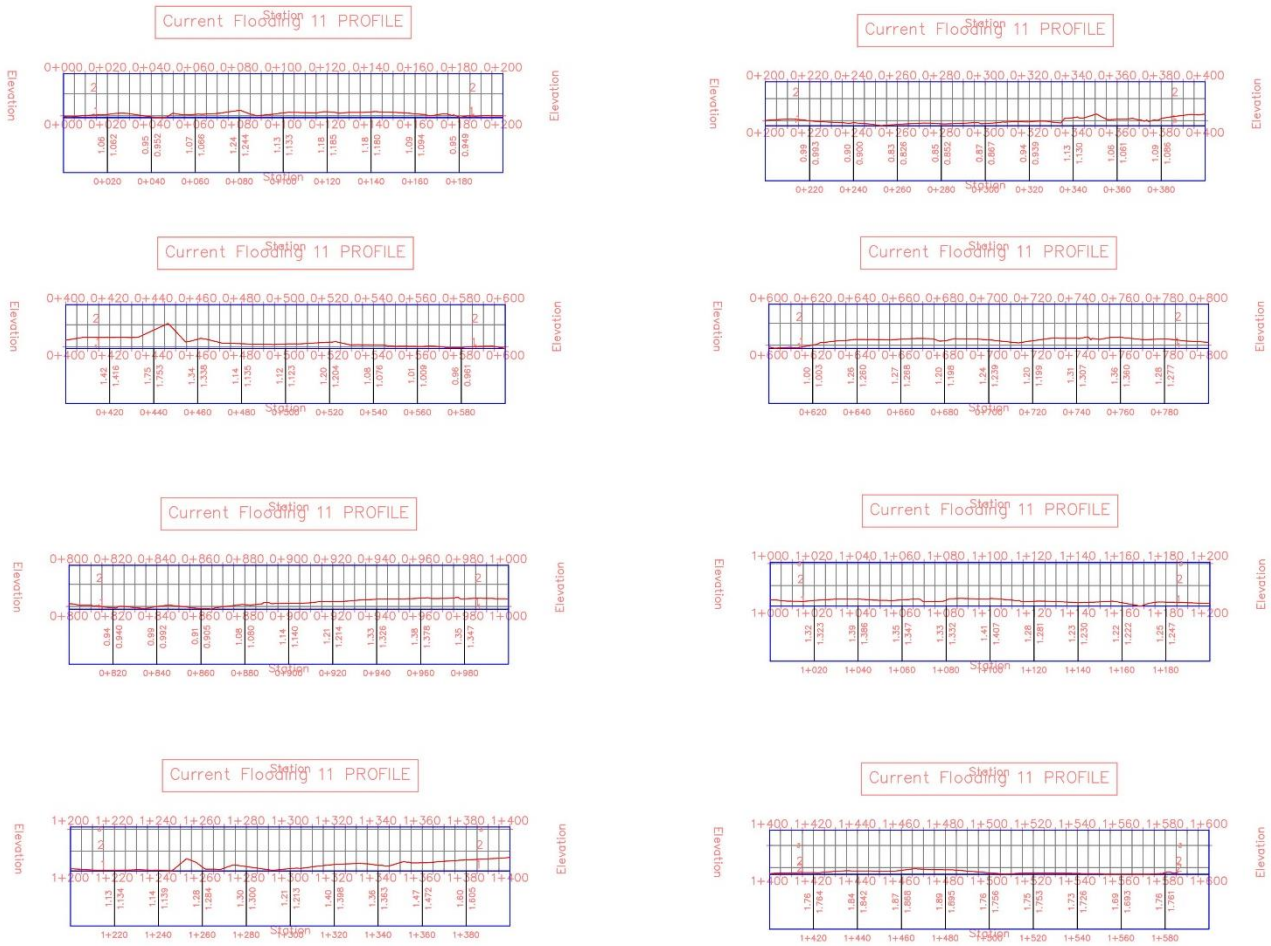


Figure 6-36: Profile of Thilafushi

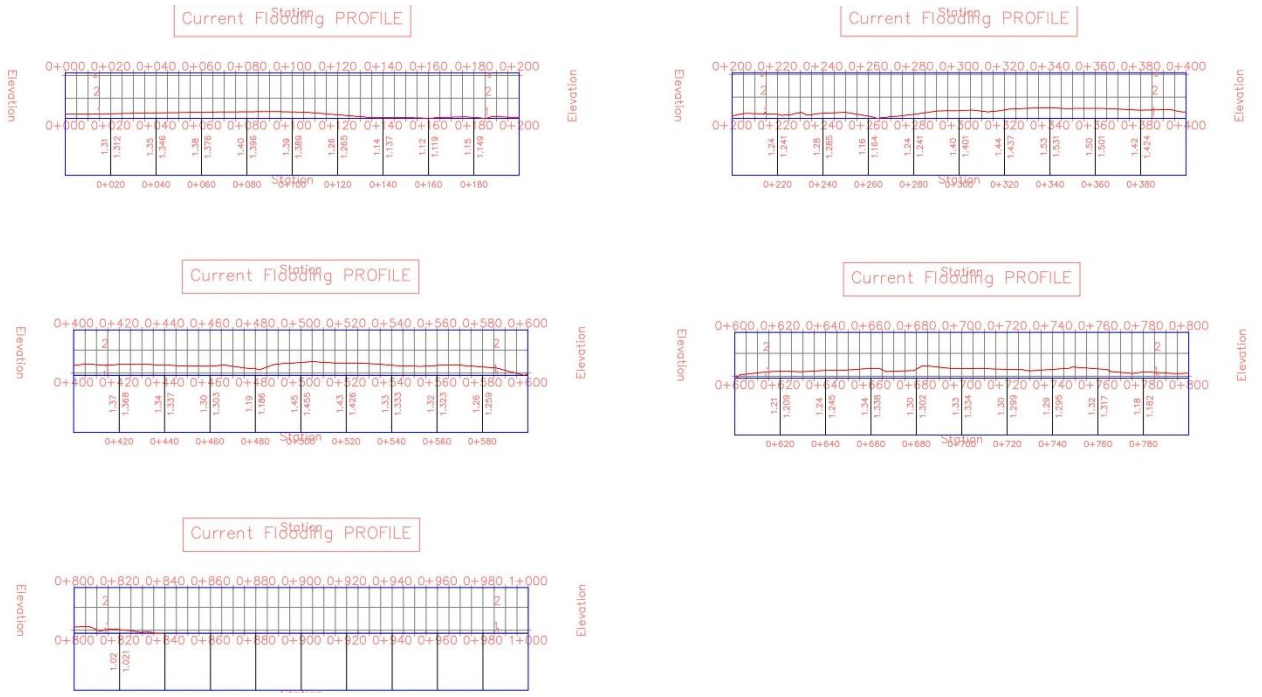


Figure 6-35: Profile of Thilafushi

Urban planning department,
GIS and Survey,
Environment Unit

Housing Development Corporation
HDC Building, Ground Floor
Hulhumalé, Republic of Maldives

6.3.11.1.2 Flooding areas

The lower elevations and depressions seen on the island are likely to collect water and cause material and otherwise loss. The definition of these collections in the context of Maldives is very different form island to island. In the Maldivian context, we refer to these as floods. The main validity of this classification lies in the impact these have on economy and material. The following are the flood prone areas within the proposed project site (Figure 6-37). A high-resolution map is attached to the section 12.6.

The areas A and D are relatively elevated in comparison to the other flood prone areas, all other areas are likely to, and does flood with the slightest shower. There is potential for the relative surrounding ground level to be further lower than the road elevation and it can further collect the water in the areas.

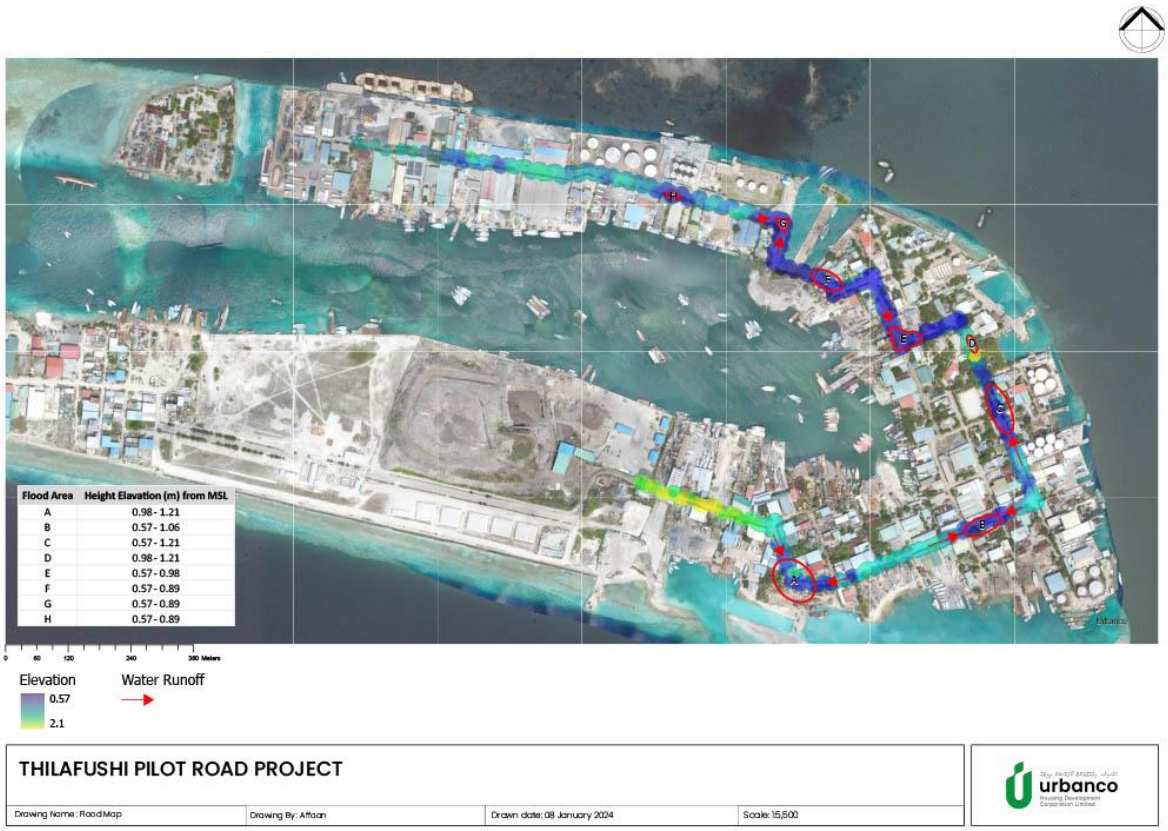


Figure 6-37 flooding area maps

6.3.11.1.3 Storm surges

According to the bathymetric surveys of the entire Maldives, the ocean slope towards the eastern side is steeper than the west coast which indicates that the eastern islands of the Maldives are more vulnerable to higher surge hazard compared to the western islands. Accordingly, the country has been divided into 5 b road storm surge hazard zones from 1-5, with 5 being the highest risk category. According to this zoning, (UNDP, 2006)

7 Potential Impacts

7.1 Introduction

In this section the objective is to investigate the potential impacts of the proposed project on the existing environment. The identification of an impact does not ensure the occurrence of the impact and it does not mean that it cannot be mitigated. However, it informs the authorities that the proponent is made aware of the impacts and the contractor is informed of the expected mitigation measures for the proposed project prior to awarding of the work.

7.2 Impact predication

Various methods of impact assessment are available. The assessor must understand and consider the proposed method, the baseline natural environment and the socioeconomic environment of the project while assessing the impacts.
The principle of Leopold matrix (Leopold, Clarke, Hanshaw, & Baisiey, 1971) has been used to classify the magnitude and importance of the possible impacts which may arise during the various stages of the proposed project. The dimensions of the matrix refer to the possible / foreseeable / probable impacts of the proposed work/project/activity) on the existing environmental conditions at the proposed work area. Leopold matrix lists numerous actions which cause impacts and environmental conditions. The current matrix is modified for the specific project.
The actions are evaluated in terms of magnitude of impact on the environment, significance of impact on the environment and the probability of impact as described in the paper by Josimović & Petric, 2014.

Evaluated criteria	Indicator to humans	Designation	Scale
Impact probability		M	impact is possible (probability of less than 50%);
		V	impact is probable (probability of over 50%);
		I	impact is certain (100% probability).
Impact magnitude	Promote life	+5	Highly significant positive change
	Long term healing and benefits	+4	Major positive change
	Short term healing and benefits	+3	Significant positive change
	Promotes pleasantness	+2	Moderate positive change
	Promotes peace	+1	Slightly positive change
	Indifferent	0	No change
	Disturbance	-1	Slightly negative change
	Irritation	-2	Moderate negative change
	Short term Health issues	-3	Significant negative change
	Long term Health issues	-4	Major negative change
	Death	-5	Highly negative change
		+/-	Simultaneous positive and negative change
Impact significance		L	Limited impact on location
		O	impact of importance for municipality;
		R	impact of regional character;
		N	impact of national character;
		M	Impact of cross-border character.
Impact duration		P	Occasional/Temporary
		D	Long term/ Permanent

Table 7-1: Evaluation Criteria, Grading Scale

7.3 Limitations of impact prediction

Due to time constrains and scheduling, long term data necessary for impact prediction is unavailable. Thus, acting as a major limitation. Long term data is necessary to understand the complex systems of the project area. A limited understanding of these unique features and how these features change over time and the impact the locals have on these features due to their activities and a lack of documented historical data is another limitation.
The possible bias in the available historical data, stakeholder's consultation and the proponent's information is also considered. The limited site-specific data on the species, types and forms of corals is another limitation to consider. Impact prediction is carried out using the available data during site visit. Hence, is another major limitation.

1.1 Impact prediction

7.3.1 Impacts on the natural environment

7.3.1.1 Impacts of noise, vibration and disturbance

A study carried out by Atmaca, parker and Altin, (2005) carried out at concrete traverse, cement, iron and steel and textile factories where in the noise can be compared to that of the unmitigated conditions of Maldives, shows that the noise levels; detected during construction are above 80dBA. That is; textile maximum 99dBA, minimum 75dBA, iron and steel maximum 100dBA, minimum 77dBA, cement maximum 106dBA, minimum 70dBA, concrete traverse 107dBA, and 80dBa. From the samples, they observed that, 73.83% of the workers in these industries are disturbed from the noise in their workplaces, 60.96% of them have psychological complaints, 30.96% of these workers are suffering from hearing problems.

Further, The baseline noise average at 56.6675 db for Low A for 60.065 db for High A db for 72.685 db for Low C and 63.925 db for High C throughout the road at peak working hours. This is relatively silent and calm in comparison to most of the roads in the greater Male' area. However, as the baseline shows, there is considerable outliers in the frequencies which indicate the noise levels of construction and heavy vehicles.

As per the Government du Québec (2023), the Prolonged exposure to loud noises (75 dBA over eight hours a day for years) can lead to hearing loss. At location during construction the consultant expects a noise level of 130 dBA during construction; that is jackhammers, and pneumatic tools.

1.1.1.1.1 Impacts of noise, vibration and disturbance due to mobilisation.

The location at which mobilization is carried out is already a loud area. The location for mobilization is a semi residential area, where in only the south side is not a construction site. Work being carried out will add to an area that is already loud due to permanent construction work.

Here literature can be used to draw parallels while grading the impact magnitude. As the majority of the workers in the literature were reportedly disturbed, followed by other more significant disturbances and just a handful reporting health issues, and this particular aspect being short lived considering the small scale of the project, the consultant grades the impact using the indicator to humans, under class Irritation.

Hence, if unmitigated, the impact of sound, vibration and disturbance due to mobilization for accommodation, utility service arrangement is certain, moderate negative, limited on location, and temporary. The possible receptors of the impact include, but are not limited to local residents, and fauna.

7.3.1.1.1 Impacts of noise, vibration and disturbance due to construction

Impact of noise and vibration is going to be a major inevitable component of the construction process. It is unlikely that during the process, of construction this specific disturbance will be a main source of complaint.

Given the anticipated level of noise of 130 dbA, it is likely that the level of noise will be an irritation. Hence, when it comes to the impact of construction as proposed, the impact of noise and vibration, the impact is certain, the impact will bring about moderate negative change, the impact is limited to location, and the impact duration is temporary
The possible receptors of the impact include, but are not limited to; locals and local fauna

In addition, the impact of the construction alternative method prolongs the impact duration, from the proposed method. Given the anticipated level of noise of 130 dbA, and the prolonged nature of the method, it is likely that the level of noise will be a short-term heath issue. Hence, when it comes to the impact of construction as per the alternative proposed, the impact is certain, the impact will bring about significant negative change, the impact is limited to location, and the impact duration is temporary. The possible receptors of the impact include, but are not limited to; locals and local fauna.

Impact of noise due to the alternative road build is the same as the proposed. Given the anticipated level of noise of 130 dbA, and the potential use of concrete machines at location in the method, it is likely that the level of noise will be a short-term heath issue. Hence, when it comes to the impact of construction as per the alternative proposed, road build proposed, the impact is certain, the impact will bring about significant negative change, the impact is limited to location, and the impact duration is temporary. The possible receptors of the impact include, but are not limited to; locals and local fauna

Given the anticipated level of noise of 70 dbA, and the potential magnification of the noise, it is likely that the level of noise will be a disturbance.
Hence, when it comes to the impact of operation and management as the proposal, the Impact is certain, the impact will bring about slightly negative change, the impact is limited to location, and the impact duration is temporary. The possible receptors of the impact include, but are not limited to; locals and local fauna.

7.3.1.1.2 Operation

Operation wise, if the road is built to the standard proposed, the impact of noise will be far less in comparison to the baseline. The impact of the sound of vibration and landing / and going through, of vehicles in potholes will be drastically reduced once the road is complete. However, this removes just the abovementioned component of the noise and retains the vehicle noise which comes up to 70 dbA. Hence, does not reduce the noise level as a whole.

7.3.1.2 Impacts on ground water table and quality (leaching of salts in the deposited sediments and change in ground water quantity);

A similar range as the baseline was sampled and analyzed by the study for the environmental Impact assessment for Thilafushi MLD: Greater Malé Waste-to-Energy Project. Waste to Energy Plant, (2020) their analysis shows that in general, coliform, total dissolved solids, iron, and manganese did not comply with the National Drinking Water Quality Standards (NDWQS) and hence was not safe for consumption without treatment.

7.3.1.2.1 Construction and Operation

The island was reclaimed using mixed trash and ash as backfilling material. The core samples show multiple layers deep below MSL. Therefore, in general it is safe to conclude that the shallow water from the island is not safe to use for drinking without treatment. Further, the fact that the island does not have a centralized sewage collection system, or a treatment plant further magnifies the input of relative sewage waste in the ground water system.

Excavation and agitation of the shallow waterline, may result in further kick up of the minerals in the ground water. This is true regardless of the construction method, and as a result can further spread minerals to other parts of the island, which may impact the smell of the shallow ground water.

However, regardless of the mode of development, the overall impact is the same. Removal of the layers of trash as per the proposal, be advantageous, as cleaning of the top layer of the potential waste can help flush the water from the road pavement point. However, this alternative will lead to a prolonged development time. Hence, prolonging the magnitude of impact

Given the anticipated level of kickup of dissolved solids in the process and considering the baseline, and the compact nature of the existing road, the completion and operation of this development will have a minor negative impact on the quality of water. Given the proposed removal of a considerable amount of the mixed trash from the footprint, and the impact, post removal can be slightly positive for the overall quality of water in the general vicinity. Given that the proposed development / regardless of the method, has features built in to the design that caters for water infiltration, the general area of infiltration will experience a flush.

Hence, considering the cumulative effect of all the components discussed, the impact of construction as per the proposed method is anticipated to have a negative impact on the ground water table and quality of the water.

The impact is possible, the magnitude moderately negative, the significance limited to the locality, and the duration temporary. The possible receptors of the impact include, but are not limited to; local flora, and local fauna.
And for the alternative, the impact is possible, the magnitude significant negative, the significance limited to the locality, and the duration temporary.

Addition of a storm water drainage to the design can flush the water that is meant to be absorbed by the design into the fresh water lens and system. However, the addition of the drainage will ensure proper removal of the potential flood waters from the recipient neighborhoods. However, the same drainage can cause numerous negative impacts on the environment.

Addition of stormwater can act on an area in the following 3 ways. From the source area, it can reduce the quantity of infiltration and increase the salinity of the water, thus increasing the concentration of the dissolved minerals of the area and effectively reducing the quality of the water. This effect can be negative in comparison to the primary proposal which retains a lot of the water.

On the flow out area, this can introduce minerals, pesticides, and other material to the existing environment, promoting eutrophication and changes to the biota.

In addition, this can result in flow of urban waste and trash that bypasses the main drainage, into the flow out area. As a result, this can lead to negative impacts on the unique or threatened habitats or species.

A working drainage system will have a positive impact on the neighbourhoods. It will reduce the possibility of financial damages and potentially the cost of management and impact the project positively.

Hence, the impact is probable, the magnitude significant negative, the significance limited to the locality, and the duration permanent. The possible receptors of the impact include, but are not limited to; local flora, and local fauna.

Operation is likely to introduce hydrocarbon-based substances with metal and plastic properties to the road. However, this is something that one expects to see in the baseline. Hence, it is unlikely that this will have an additional impact on the baseline.

7.3.1.3 Impacts on unique or threatened habitats or species;

7.3.1.3.1 Mobilisation

Baseline shows mobilisation is carried out on a relatively empty field that is weedy. In addition, the area does not have significant vegetation that can be regarded as unique or threatened. In addition, the area does not hold or contain any endangered species. Hence the process of mobilisation is not likely to have a significant impact on unique and tented species.

7.3.1.3.2 Construction and Operation

The impact of the flow out of the stormwater during operation is significant as the salinity increase and decreases the to the existing environment. Hence it is discussed in detail above. (See Impacts on ground water table and quality)

1.1.1.1 Changes in elevation and natural slopes on existing roads due to proposed road works that may result in changes in drainage patterns, which may impact groundwater and soil;

From the islands like Male' city in Maldives and islands like Addu city, we understand that the development elevation if unmatched; ie higher than the elevation of the island can cause water to naturally flow into the island; lower ground.

Experience, and literature show that pavement performances are significantly influenced by the magnitude and frequency of traffic loads (Chen , Lambert, Tsai, & Zhang, 2012) and directly influences the overall performance of the road. Thilafushi is an island that will require movement of light to super heavy load vehicles on the island. As a result, resistance induced damages are expected. There are potentially 5 types of damages that we can expect from this proposal for Thilafushi once in operation regardless the build type (proposed build or the alternative). Which are as per the (Texas Department of Transportation, 2012);

1. Shearing of the pavement surface during turning movements. The **Error! Reference source not found.** emphasizes the need to consider road geometry in the super heavy load route evaluation. This damage can be prevented by using trailers with steerable axles. If the mover does not have this equipment, the mover must take effective measures to protect the surface at the turn.

Figure 7-1: Shearing of Pavement Surface During Turning Movement

Figure 7.1: Rutting or cracking due to overload of the pavement structure. Recent rainfall or poor drainage conditions resulting in weak or wet subgrade or base materials are often associated with structural damage of this type. The Figure 11 also shows the need to consider road geometry. The road is narrow, and the outside tires are tracking on the unsurfaced shoulder. Moving of super heavy loads should be avoided on such roads. If there is no other route available, the carrier must effectively protect the shoulders where the trailer is going to track.

Figure 7-2: Rutting or Cracking Due to Overload of the Pavement Surface

Peeling of fresh seal coats or asphalt concrete pavement overlays. Moves should avoid on fresh seal coats. If there is no other alternative, the mover can take effective measures to protect the pavement (Figure 7-3,Figure 7-4)

Figure 7-3: Peeling of Fresh Seal Coats

Figure 7-4: Peeling of Fresh Seal Coats

1. Bleeding of seal coats or asphalt concrete surfaces (Figure 7-5).

Figure 7-5: Bleeding of Seal Coats

2. Lateral shear failure at the pavement edge (Figure 7-6,Figure 7-7).

Figure 7-6: Lateral Shear Failure of Pavement Edge

Figure 7-7: Lateral Shear Failure of Pavement Edge

Given that the footprint of the work, has depressions on the road and can retain water, the excavation and standardization of the road will be an advantage to the overall island. However, as the road is higher than the rest of the island, water will flow into some of the lower plots, despite the drainage and will cause overall unrest and potentially damage to plots at lower elevations. In addition, upon completion, there is the possibility of clogging the drainage, if unmanaged and as a result will make the pots redundant.

Given that there is the potential for damages due to utility, to the slopes and the general existing structure, the built infrastructure has to be used with all the mitigation measures in mind.

However, mitigation has to be ideally practiced, but in an island being used by numerous contractors, it is unrealistic to assume that the mitigation can be carried out as per the recommendation. Hence, due to changes in elevation and natural slopes on existing roads due to proposed road works, if unmitigated, the impact is certain, the magnitude highly negative, the significance extended to the region, and the duration permanent.
The possible receptors of the impact include but not limited to, locals, local flora, and local fauna

Further upon operation, if unmitigated, the impact is certain, the magnitude highly negative, the significance extended to the region, and the duration permanent.
The possible receptors of the impact include but not limited to, locals, local flora, and local fauna; including humans.

7.3.1.4 Potential flooding due to road works;

Potential flooding due to roadworks is inevitable. Excavation, retention and trenching of the footprint opens up 2 major avenues of flooding; flooding because of the retention wall, and flooding in the trench.
This flooding due to trenching can cause harm to the resident facilities at place, and eventually cause significant financial harm.
Similarly, this can also cause a reduction of the speed of the progress of work and can cause major harm to the financiers.
Hence, the impact of flooding, due to construction, if unmitigated, is certain, the magnitude is highly negative, the significance extended to the region, and the duration permanent.

The possible receptors of the impact include but not limited to, locals, local flora, and local fauna.

7.3.1.5 Impacts on terrestrial flora and fauna from preparation works, if any;

Studies show that habitat destruction effectively does destroy numerous species related to the said habitat. For instance, Poephila cincta (black-throated finch) (southern), saw a decline throughout the southern part of its range. As it is fairly

sedentary, local threatening processes had a big impact on populations. The decline of this species in the southern part of its range began in the early twentieth century with the extensive clearing for sheep grazing (Nelder, et al., 2017).

Further, there is sufficient evidence to show that shipping networks may introduce invasive species to previously pristine environments such as the Antarctic (McCarthy, Peck, & Aldridge, 2022). To add to that, as per Pemphis;48, Invasive alien species. (2015), the Giant African snail, Achatina fulica, was introduced in the 1960s. As per the report Upon the introduction, its population is known to increase dramatically. It is considered as a garden pest but with it can reproduce to such numbers to cause public nuisance. The Giant African snail can alter the habitat properties by feeding on the native plants. Furthermore, it is known to out-compete the native snail population as well. It can also act as a vector of human pathogens and parasites.

7.3.1.5.1 Mobilisation, Construction, and Operation

In every proposed development methodology, the terrestrial flora and fauna on the area will be affected. Typically, the footprint will be cleared and plants replanted after completion. This will result in the loss of a set of trees on the footprint that attract fauna. A list of the affected trees on the footprint with a GIS link is presented for clarity (https://experience.arcgis.com/experience/8d2b0a8b05534dfe8115fdf2acbaaf77/?data_id=dataSource_1-1889528c89a-layer-1%3A68) .

Apart from the flora on site, only 2 major types of fauna were observed on site; birds form the genus Corvus, and birds form the genus Eudynamys. Insects of the order Hymenoptera, Hemiptera, Coleoptera, blattodea, Isoptera and diptera were observed, and will be affected by the development. The impact will be on the flora will be on the fauna associated with the organisms.

However, it is very likely that the disturbance will cause the organisms to move away and take refuge elsewhere as a mode of adaptation, which will have an impact on the anthropological environment, due to a preference to not share an environment with arthropods.

7.3.1.5.2 Alternatives

Among the alternatives, the proposed A1 is likely to allow un interrupted operation opearation of the island. this will provide minimum vehicle access to the plots that are blocked by the construction process. A2 is an alternative to the road build, that ensures longevity of the road. As the roads will likely be used by heavy machinery that will potentially damage the road build and the functioning of the road, this will minimize the road damage and extend the road's operation period.

A3 is in connection to the drainage system, the drainage system proposed is an infiltration system, that might not be as effective in case of high input of rain and flood waters. Hence, the proposal is to manage the flood waters to drain the input.

A4 and A5 deal with the water movement due to the elevation changes and the management of the moving waters for the areas. If the elevation is not altered accordingly, there is a chance that the water will impact the operation of the locals. Hence, the water must be moved accordingly.

7.3.1.6 Impacts on air quality; Impact on GHG emissions

Site specific literature of construction work carried out on location shows the following concerns;

- An EIA carried out for land reclamation, at Thilafushi noted that the construction phase for the project is expected to have a minor negative impact, as the construction period is quick, and the relative area of work is open and would easily carry out the generated gases and particles to the atmosphere (Saleem A. , 2016).
- An EIA carried out for sheet piling, on the outer cost at Thilafushi, stated that due to the release of GHG, and other gases into the atmosphere during the construction phase is very low and since construction site is close to the coast, it is expected that any released gases will not remain stagnant to a particular area to cause a nuisance. Further, the consultant stated that the risk of the impact on air quality is medium, limited to project site, and last only for the duration of the construction phase of the project hence is not expected to cause any significant adverse impacts on the environment and people working on Thilafushi within the vicinity of the project site (Abdull Wahhab & Ibrahim Jaleel, 2017).
- Another EIA, on a larger scale, as per the consultant, the proposed project was considered to provide minimum damage as the project was carried out on a large scale and in open grounds (Jameel & Faiz, EIA Reclamation of 15 hectares of land at Thilafushi for development of the Regional Waste Management Facility for Zone 3, 2017).

On another EIA on the same island, the consultant had stated that during the construction period short-term degradation of ambient air quality may occur due to release emissions such as CO, NOx, and diesel exhaust particulate matter of dust/particulate matter generated through various construction activities. They also stated that during construction period GHGs will be emitted through the operation of vessels and vehicles which uses fossil fuels to operate (Faizan, 2023).

7.3.1.6.1 Mobilisation

Mobilization will introduce a work camp with accommodation to the location. Hence, it is highly likely that the introduction of the work camp with waste management and human activities will introduce a kick up to the location.

Given the specific nature of the island and the proximity of the area to the main waste management plot, this particular aspect introduction is not likely to have a major impact on the air quality.

Hence, if unmitigated, the impact on air quality; is possible, the magnitude is no change, Impact significance is limited to location, and the duration is Temporary. The possible receptors of the impact include, but are not limited to local residents, flora, and fauna.

7.3.1.6.2 During construction

During construction and post completion the project will produce GHGs, decomposition fumes, and particulate matter through two different components of the project; vehicle emission and construction aberration. This will impact the air quality of the island.

Conversely, this will also reduce the amount of kick up from the main road once completion. However, this is highly dependent on the level of use management. The generated dust at each phase will result in a cumulation to the existing baseline.

The proposed construction and operation will have impacts on the air quality of the island.
The impact will likely be more intensely felt than the referenced projects carried out else ware on the island due to the area not being as open as the previous locations. However, it is likely that the development will improve the baseline; if un mitigated properly.

Hence, the impact on air quality; Impact on GHG emissions, if unmitigated, is certain, the impact magnitude on location is slightly negative, the significance of the impact is of a national character and the duration permanent. The possible receptors of the impact include but not limited to, residents, local flora, and local fauna.

7.3.1.7 Impacts on landscape integrity/scenery.

7.3.1.7.1 Mobilisation

Mobilization requires clearing of the location of shrubs, trees and other plant matter on the location. This will have an impact on the landscape. Given the fact that the area is a relatively clear patch of land, and that the area is a construction ground kept clear, the impact of this maintenance will be minimum. Hence, if unmitigated, the impact on landscape integrity and scenery, ; is possible, the magnitude is no change, Impact significance is limited to location, and the duration is Temporary. The possible receptors of the impact include, but are not limited to natural scenery, local's resident on the island.

7.3.1.7.2 During construction

Post completion, the road and the planned nature of the treeline on the infiltration zone, is likely to improve the quality of air, and volume of stagnant water on the road, while providing a straight path for the vehicles. Hence, completion if mitigated, is likely to impact the drive time positively.

7.3.2 Impacts on the socio-economic environment

7.3.2.1 Impacts on employment and income, potential for local people to have (temporary) job opportunities (and what kind) in the execution of the works;

Upon consultation with local vendors who procure services of locals in the geographical vicinity in various projects, states that procurement of locals is a gamble. The efficiency, skillset, punctuality, and delivery of the available locals vary over, a range of factors such as, the political climate, weather, monsoon rains, etc. They also informed that the locals available are mostly un-enthusiastic unless the pay is unreasonably high and often in cases of unreasonably high pay, the local vendors delay deliverables, due to a range of factors including but not limited to; availability of material, and availability of labour. At the same time, they also emphasised that some procured locals are extremely efficient, and can be easy to communicate and deliver the outputs and bring variations to maximise the utility of the work. However, they report that this is a rare case (Hameez, 2023).

7.3.2.1.1 Mobilisation, construction and operation

The project is not likely to procure services form the local vendors of the immediate island as the island is an industrial hub and does not contain idle vendors for hire. However, this fact does not limit the possibility of internal cross procurement services and will provide numerous avenues of economic exchange for the parties involved, which can be considered as opportunities of employment and income; temporary or permanent.
Upon the proponent's approval, the likely kind of works that the locals can be procured for are, but not limited to; Construction work, administrative work, vendors for niche services, camp management work, and product procurement.

The two major types of services that the contractor can procure throughout the lifetime of the project are the temporary services and the permanent services.
The temporary services range from, minor non-technical to major technical services such as, procurement of material to setting out.

Permanent services also range from, minor non-technical to major technical services such as daily cleaning to structural and environment monitoring. The same applies in the operation phase.

The overall experience from the developments carried out in Maldives show that, when a proponent or a contractor allows procurement from locals or the free market of the island, the more technical employment procured, has the most positive impact and the more non-technical employment procured suffers the most negative impact. This is true both during construction and operation.

The impact depends on the level of financial, administrative, and legal backing offered during, and provided at the time of termination of services and the economic scale of the service provided. In cases of technical work, the cost of service is higher, and causes less damage to the employed party during termination with simultaneous avenues of income.

In cases of non-technical work however, the procured, if procured under un-official means, is not protected by a cooperate umbrella which safeguards the interests of the procured and finds un employed once the need of the service is overcome, with minimum to no prior warning. As a result, this often impacts locals and dependents attached who can be at the most vulnerable state.

Hence, the impact on employment and income, potential for local people, if unmitigated and un managed, is likely, the impact magnitude on location is slightly positive, the significance of the impact is of a national character and the duration temporary. The possible receptors of the impact include but not limited to, residents and local companies.

7.3.2.2 Level of protection against hazards like sea level rise, storm surges, etc.;

There is a potential for health risk regardless of the work being carried out at the location as the area is a waste management site. This is highlighted by (Mohamed H. , 2020) in the EIA carried out for the proposed development of the damaged STO jetty at Thilafushi. Here, the consultant highlighted that the divers working in the quay wall construction will have significant health risk since K. Thilafushi is an unmanaged dumping site for municipal solid waste and hazardous waste.

7.3.2.2.1 Mobilisation

The work camp is the most exposed component in this project on the island. It faces the southern channel and is exposed in this regard to the storm surges. The exposure to the elements can lead to a lot of impacts including that of camp infrastructure damage, health issues, etc.

The lack of physical barriers in between the work camp and the southern edge of the island will make living in the accommodation difficult, especially when the location does not offer a wind break. This can lead to numerous problems ranging from damage to personal belongings to psychological difficulties. Hence, looking into the indicator criteria, the range of impact can be within the range of disturbance: -1, Irritation: -2, or short-term Health issues: -3; depending on the level of mitigation. Since the latter is the most pessimistic, we carry this score to prevent underestimation of the possibilities.

Hence, if unmitigated, the impact on the society living in the work camp due to mobilization on location is possible, the magnitude is significant negative change, Impact significance is limited to location, and the duration is Temporary.

The possible receptors of the impact include, but are not limited to local resident on the island.

7.3.2.2.2 Construction and operation.

Levels of protection is a major hurdle in case of development. The residents, and locals will be exposed to the construction hazards during excavation and operation hazards during operation and management.
During construction, this exposure is, but not limited to, the following potential possibilities; storm surges, floods, sea level rise, contamination, and disease. During operation, the exposure is, but not limited to; floods, contamination, and disease.

The hazard that is most prominent that is likely to reach the locals during construction from the scope are the possibilities of contamination of the built environment, and disease. Other possibilities of risk due to exposure, are being mitigated by the built in structures and design of the proposed development.

Hence, the impact of local people due to the hazards of the proposed development, if unmitigated and un managed, is likely, the impact magnitude on location is slightly negative, the significance of the impact is of a national character and the duration permanent.

7.3.2.3 Social destabilization on of the island community;

7.3.2.3.1 Construction and operation.

There is not enough evidence to show that social destabilization can occur due to the proposed development at this location. Thilafushi being an island put together by companies and community of employed individuals, the dynamic of the development is relatively different from other local islands. Hence, this has been addressed above (see Construction related hazards and risks: Impacts on social and economic values, norms and belief due to project outputs)

7.3.2.4 Monitoring of socioeconomic and demographic development.

The boom and correlation to population growth and GDP is studied and identified by Peterson and Wesley (2017) In their study, they have explored in detail, the average annual growth of population, real per capita GDP, and real GDP of selected countries from 1945 to 1975. In the study, among the many examples, France with a population growth of 1.02%, showed real per capita GDP growth of 5.39% and real GDP growth of 6.41%. Similarly, India, with a population growth of 0.40%, showed real per capita GDP growth of 0.25% and real GDP growth of 0.65%.
This shows a general population growth and a GDP percentage increase.

7.3.2.4.1 Mobilisation

Although undocumented in Maldives, mobilization to a location can lead to numerous socio economic and demographic changes. In an island like, Thilafushi, where shops and facilities are few, the addition of the new population can lead to a slight temporary boom in the local economy.

This universally applicable relationship proven by the above stated study can be expected at Thilafushi upon mobilization. With limited number of shops and a semi limited population, the addition of the new population can lead to a boom in

businesses that can lead to negative impacts to the economic climate of the island once the temporary boom declines. This can lead to irritation for the business owners.

Hence, if unmitigated, the impact of mobilization can lead to a temporary boost in the local economy which once upon demobilization can lead to moderate negative change. The impact is possible, limited to municipality, and the impact temporary. The possible receptors of the impact include, but are not limited to local's resident on the island.

7.3.2.5 Impact on health and safety

7.3.2.5.1 Mobilisation

Mobilization can cause numerous health and safety challenges. The challenges are due to lack of facilities available in the accommodation, congestion of space and lack of proper storage space.
Below is a breakdown of the major mobilization, work camp and accommodation health and safety challenges as per Mubarik (2019):

Challenges to access the desired location:
Often in the past, accessing the island was a major issue. If a port is not set, then the main boat will have to be placed at a specified location, often exposed to the elements, changing currents and storms. The party will have to access the island through small vessels and the heavier machines will have to be brought in using artisanal rafts to not damage the existing wildlife and reefs.

A lot of the time, to reach a specified location to set up the work accommodation, the initial party will have to cut through and clear the vegetation of the area. This in turn is a major challenge and is one of the slowest processes of accommodation establishment.

The possibilities of accidents are countless during the procedure.

Challenges to establish disease free habitat:
After building the accommodation blocks, the forest sand of the block will have to be smothered, using white, coralline, saline, sand. This controls arthropods which are considered as pests; Myriapoda, Hexapod, Arachnida, Blattodea, Iseptora, etc.
Even so, the presence of light, heat, human as a food source, and human waste will attract arthropods to the location and can potentially result in significant diseases. This can case major outbreaks in the camp site form pest infestations to diseases related to these pests.

The health hazards are countless due to pests.

In addition, disease due to close proximity and unhygienic practices during deployment is a major hurdle to overcome. Almost immediately, personal hygiene related challenges and hazards become a major challenge while managing mobilization related health and safety.

The health hazards are countless due to personal hygiene.

Drug abuse during deployment
Identification of practices such as drug use and vetting for drug abuse during mobilization is impossible. Almost all staff use tobacco and often a shortage impacts the progress of the project. In addition, evidence of narcotics, less addictive illegal drugs and pharmaceutical drugs can be observed around the work camp, which is again a major health hazard.

Ragging and violence within the camp ground
Physical violence due to ragging, boredom, bigotry / gang affiliation, racism, and work-related activities is common in the work camp. Often companies turn a blind eye to the gangs which have infiltrated to the work camps and the illegal human trafficking into and out of the country that often led to the abovementioned violence, due to the cheap labor they often offer.

Hence, this uneasy environment can lead to count less hazards due to violence.

The same health hazards from Maldives, can be applicable to all the islands of the Maldives. When the work camp is established, post mobilization, at Thilafushi, this can lead to numerous health hazards. Therefore, this can lead to long term health issues and even death.

Hence, if left unmitigated, the impact of mobilization on health hazards can be possible, can have a permanent effect, can lead to highly negative change, in which the impact effect is extend to the region, and the impact can be of permanent effect. The possible receptors of the impact include, but are not limited to locals resident on the island.

7.3.2.5.2 Operation

Health and safety are a major concern during and post development. The chances are that there will be numerous challenges during development that needs to be dealt with to ensure safety of the locals.

The construction and operation health safety components differ drastically.
The construction health and safety deals with exposure hazards, fall hazards, and social exposure and has been explored in detail above (see: Impacts on the socio-economic environment: Impact on health and safety)

The operation health and safety deals with speeding and other related factors, that can harm or expose the locals to risk.

Overtime it is likely that there will be accidents as the road is built and connected to the grater male area link bridge. However, this can be mitigated.
Hence, on occurrence the impact of this on the local ls during operation is possible, impact magnitude moderate negative, impact significance range to the municipality and the impact long term.

7.3.2.6 Disturbances to residents and cultural facilities/activities; Impacts on transportation/traffic; and Impact on the nearby uses.

7.3.2.6.1 Mobilisation

Due to mobilization, it is unlikely that the residents and the general culture of the island be affected in any form. However, this may add to the traffic up and down the island adding to the activities of the island.

The same health hazards from Maldives, can be applicable to all the islands of the Maldives. When the work camp is established, post mobilization, at Thilafushi, this can lead to numerous health hazards. Therefore, this can lead to long term health issues and even death.

Hence, if left unmitigated, the impact of mobilization on Disturbances to residents and cultural facilities/activities, can be probable, can have a permanent effect, can lead to major negative change, in which the impact effect is extend to the region, and the impact can be of permanent effect. The possible receptors of the impact include, but are not limited to locals resident on the island.

7.3.2.6.2 Operation

The likelihood of residential change due to the construction and operation of the road and the impact it has on the socio-economic environment of the footprint is unlikely to create a major impact on the overall day to day operations of the island.

However, as mentioned above (For Mobiisation, Impacts on the socio-economic environment: Disturbances to residents and cultural facilities/activities; Impacts on transportation/traffic; and
Impact on the nearby uses, and

7.3.3 Construction related hazards and risks

7.3.3.1 Pollution of the natural environment (e.g. oil spills, discharge of untreated waste water and solid waste, including construction waste);

Sewage pollution is a major aspect that will have an impact on the natural environment if the work accommodation is placed in this location and if the sewage is allowed to drift along the reef edge, on to a PA (South side lagoon), The lion's head, or allowed to flow into the inner lagoon (Northern side), that a lot of the main stakeholders interact with on a daily basis. There could be a lot of negative impacts based on the amount of flush the area experiences. Reed, Kay & Russo (1977) observed at Waianae, Oahu, Hawaii, that a chronic exposure to low volumes of effluents, evidence of chemical stress, nutrient enrichment, solids deposition, and bacterial contamination of coral reefs from small hotels in Jamaica.

The most common response observed in the above stated study was an increase in benthic alae, filter feeders, sponges, tunicates, and a reduction of the hermatypic corals.

7.3.3.1.1 Mobilization

Pollution, due to mobilization is inevitable. Anthropological waste at the habitat is likely to cause an impact on the environment. The temp camp location has a ridge on the south side that is excavated sand and accumulated trash; in which the residents add to, and oceanic drift accumulates.

Release of effluents can cause changes to the ecosystem, and result in disturbances to the recreational divers that visit the PA. Conversely, release of effluent to the inner lagoon can lead to effluent buildup and can result in addition to the disturbance in the area.

Hence, if left unmitigated, the impact of mobilization on Pollution of the natural environment, can be probable, can have a slightly negative change, in which the impact effect is extend to the region, and the impact can be of permanent effect.

The possible receptors of the impact include, but are not limited to locals resident on the island.

7.3.3.2 Risk of accidents and pollution on workers and local population.

Construction accidents and fatality is a major concern in Maldives, numerous recorded cases are reported overtime. The case of eight-year-old Rawshan Jian who died on December 17 after succumbing to her injuries while battling for her life in intensive care at the state run Indira Gandhi Memorial Hospital (IGMH), after a cement bag fell from a construction site (2019) is one. This was followed by the case of the expatriate worker who passed away during the treatment after falling from the 14th story building at Hulumale' (Mohamed S. , 2020).

We have seen and observed the implications of living in trash and the impact it has on the residents of a population. Chronic exposure to various elements can lead to multifaceted complications within the society. These include but are not limited to: health, and environmental impacts.

Etea, Girma, & Mamo (2021), in their study of risk perceptions and experiences of residents living nearby municipal solid waste open dumpsite in Ginchi town, Ethiopia observed that there was a good perception that opens dumpsite was a risk to the environment and health. Risk perceptions were much influenced by lived experiences and observations of physical features. In return, risk perceptions and lived experiences had affected the level of emotional reactions from living nearby to the open dumpsite.

The residents were mainly victims of respiratory-related health problems associated with the open dump site in question. Sinus, cold, chest pain, coughing, sneezing, and irritation of the nose, throat and eyes were affecting majority of the residents. They are also exposed to emotional stresses. Offensive odors during winter; smoke and bad smell from burning of MSW in summer were believed to cause health problems by the participants.

7.3.3.2.1 Mobilization

Active living in a construction site has numerous risks associated to it including but not limited to, mental, and biological health. Mobilization on the proposed location can potentially lead to numerous health hazards and can bring out emotional distress in populations.

Chronic and acute exposure to numerous fumes and trash can lead to numerous health complications which includes but not limited to, sinus, cold, chest pain, coughing, sneezing, and irritation of the nose, throat and eyes which can be indicative of a barrage of different long-term diseases, indicating long term health issues.
Hence, if left unmitigated, the impact of mobilization on chronic and acute exposure to numerous fumes and trash can, can be probable, can have a major negative change, in which the impact effect is extend to the nation, and the impact can be of permanent.

The possible receptors of the impact include, but are not limited to local's resident on the island.

7.3.3.3 Impact due to any traffic diversions

Traffic diversion of the island will be a major factor that will impact the functioning of the island. It is likely that the stakeholders will have to find ways to manage the daily movement in order to function within the construction stage. Some of the contractors will have to give up the use of few vehicles in order to function and find ways to carry the load of the temporarily grounded vehicles on site. This will be a major inconvenience for the locals and will likely lead to public dissatisfaction.

7.3.3.4 Impacts on social and economic values, norms and belief due to project outputs.

The island is an industrial hub for numerous local companies who at plots owned or otherwise hold housing units that accommodate their staff.
On random interviewing, on our survey we understood that a number of the locals who use the accommodation were from other islands and had no other means of accommodation in Male', Hulumale' or Viligilli and were forced to stay in the accommodation provided regardless of the conditions.
Further, all participants specifically, the expatriates on questioning on the living conditions described crammed conditions in the accommodation and inhumane practices. Also, a lot of the expatriates were either unsure of the visa \ passport status or did not have the visa or passport.

The Edition (2020), in a report that reported the police releasing 126 of 133 expats arrested from a Thilafushi dispute, reported that the main cause of the dispute was inhumane living \ working conditions which on reporting, was ignored by the companies that lead to unrest.

Suhail (2015) in his study Health hazards and the effects of these hazards to the health of the workers of Thilafushi, Maldives, further stated that the main causes of reported illness for smoke, toxic wastes and mosquitoes. They also found out that 91.4% people are exposed to sunlight, 91.4% people dispose toxic wastes and 70% people visited doctor due to common cold and respiratory diseases.

Further, upon asking about sexual violence and sex services within the communities of the island, the residents, local and expatriate alike stated that there were no such incidents on the island. Further on interview with officials, they stated that they are not aware of incidents of sex work, and sexual violence on the island (Saleem V. A., 2023).

However, it will be naïve on the side of the consultant to consider that Thilafushi is an island with an economically booming and rapidly moving population without incidents of sex work, and sexual violence on the island.

Construction accidents and fatality is a major concern in Maldives, numerous recorded cases are reported overtime. The case of eight-year-old Rawshan Jian who died on December 17 after succumbing to her injuries while battling for her life in intensive care at the state-run Indira Gandhi Memorial Hospital (IGMH), after a cement bag fell from a construction site (2019) is one. This was followed by the case of the expatriate worker who passed away during the treatment after falling from the 14th story building at Hulumale' (Mohamed S. , 2020).

7.3.3.4.1 Mobilization

The island has a micro society that has normalized a lot that can be considered conditions un fit for modern living. This includes living with and on areas with hazardous chemical. In addition, the island has seen numerous officially reported and officially unreported cases of human rights where the workers living at the location protested and resorted to violence due to a lack of accountability on part of the parent companies.

Further, we cannot assume that in an island without stimulus and entertainment, alternative means to seek these stimuli will not be a constant or periodic routine. Hence, in pursue of these stimuli, numerous avenues may be explored and opted for by the residents which may be detrimental to the social and economic values, norms and belief of the greater recipient society.

The non ideal, baseline; social and economic values, norms and belief, that exist on the island, is not assumed to further magnify with the addition of the 30 staff. This impact will be indifferent, however, the project management and in turn the project proponent needs to mitigate and manage these impacts.

Hence, if left unmitigated, the impact of mobilization on social and economic values, norms and belief is not likely to have an impact on the island.

However, it is likely that if unmitigated the aforementioned pursue of stimuli may persist, magnify the impact and cause further negative impact on the impact of mobilization on social and economic values, norms and belief of the grater society. The possible receptors of the impact include, but are not limited to local's resident on the island.

7.4 Impact evaluation

Mobilization				
		mobilization for accommodation	Utility services arrangement	Human interactions form temp site
Impacts on the natural environment	Impacts of noise, vibration and disturbance	I,-2,L, P	I,-2,L, P	
	Impacts on ground water table and quality (leaching of salts in the deposited sediments and change in ground water quantity);			
	Impacts on unique or threatened habitats or species;			
	Changes in elevation and natural slopes on existing roads due to proposed road works that may result in changes in drainage patterns, which may impact groundwater and soil			
	Potential flooding due to road works;			
	Impacts on terrestrial flora and fauna from preparation works, if any;			
	Impacts on air quality;	M, 0, L, P		M, 0, L, P
	Impact on GHG emissions and			
	Impacts on landscape integrity/scenery.			M, 0, L, P
Impacts on the socio-economic environment	Impacts on employment and income, potential for local people to have (temporary) job opportunities (and what kind) in the execution of the works;			
	Level of protection against hazards like sea level rise, storm surges, etc.;			M,-3,L,P
	Social destabilization on of the island community;			
	Monitoring of socioeconomic and demographic development.			M,-2,L,P
	Impact on health and safety			M,-5,R,D
	Disturbances to residents and cultural facilities/activities; Impacts on transportation/traffic; and			V,-4,R,D
	Impact on the nearby uses.			
Construction related hazards and risks	Pollution of the natural environment (e.g., oil spills, discharge of untreated waste water and solid waste, including construction waste);		V,-1,R,D	
	Risk of accidents and pollution on workers and local population.			V,-4,N,D
	Impact due to any traffic diversions			
	Impacts of noise, and work-related safety issues.			
	Impacts on social and economic values, norms and belief due to project outputs.			V,0,N,D

Table 7-2: Impact evaluation during mobilization

		Land modification	Other components						
		Construction as proposed	Alternative, construction as per the alternatives (Split road alternative)	Alternative, construction as per the alternatives (alternative road build; concrete.	Alternative, addition of a typical storm water drainage system, with a flow out and a collection system.	Alternative, addition of drainage system to the road	Alternative, varying elevation as per the neighborhoods.	Operation	Management
Impacts on the natural environment	Impacts of noise, vibration and disturbance	I,-2,L,P							
			I,-3,L,P						
				I,-3,L,P					
								I,-1,L,P	I,-1,L,P
	Impacts on ground water table and quality (leaching of salts in the deposited sediments and change in ground water quantity);	M,-2,L,P		M,-2,L,P					
			M,-3,L,P						
					V,-3,L,D				
	Impacts on unique or threatened habitats or species;								
	Changes in elevation and natural slopes on existing roads due to proposed road works that may result in changes in drainage patterns, which may impact groundwater and soil	I,-5, R, D						I,-5, R, D	
	Potential flooding due to road works;	I,-5, R, D							
	Impacts on terrestrial flora and fauna from preparation works, if any;	I,-1, L, P	I,-1, L, P	I,-1, L, P	I,-1, L, P			I,-3, L, P	
						I,-1, L, P			
	Impacts on air quality; Impact on GHG emissions	I,-1, N, D						I,0, N, D	
	Impacts on landscape integrity/scenery.								
Impacts on the socio-economic environment	Impacts on employment and income, potential for local people to have (temporary) job opportunities (and what kind) in the execution of the works;	M,+1, N, P						M,+1, N, P	
	Level of protection against hazards like sea level rise, storm surges, etc.;	M,-1, N, P						M,-1, N, P	
	Social destabilization on of the island community;								
	Monitoring of socioeconomic and demographic development.								
	Impact on health and safety							M, -2, O, D	
	Disturbances to residents and cultural facilities/activities; Impacts on transportation/traffic; and Impact on the nearby uses.	I,-2,L, P							
Construction related hazards and risks	Pollution of the natural environment (e.g. oil spills, discharge of untreated waste water and solid waste, including construction waste);	V,-1,R,P							
	Risk of accidents and pollution on workers and local population.	V,-1,R,P						V,-1,R,P	
	Impact due to any traffic diversions	M,-5,L,M							
	Impacts of noise, and work-related safety issues.								
	Impacts on social and economic values, norms and belief due to project outputs.	V,-1,R,P							

Table 7-3: Impact Evaluation

7.5 Cumulative impacts

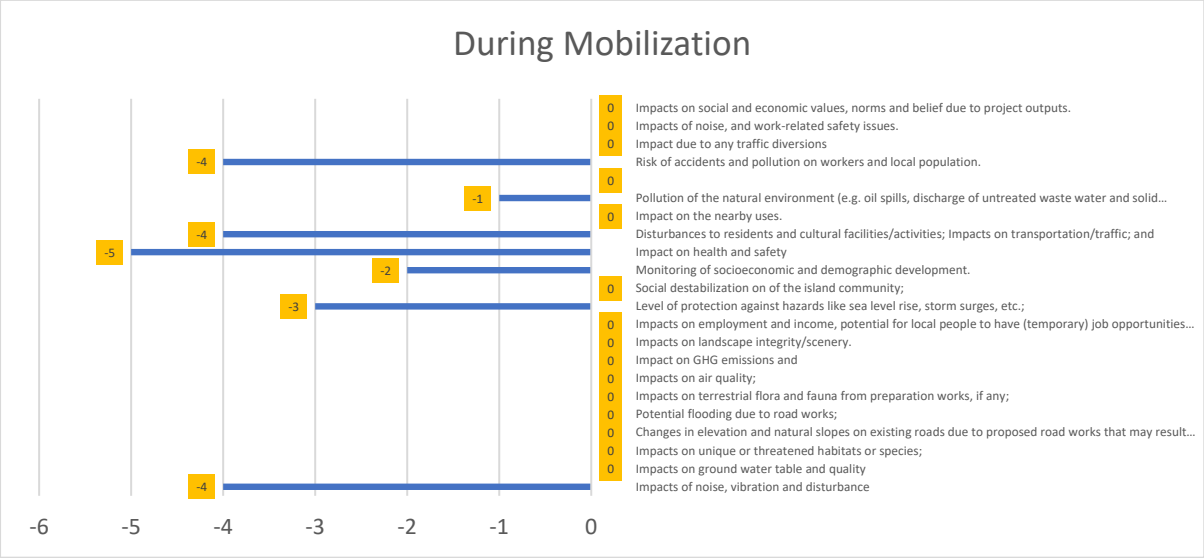


Figure 7-8: Cumulative Impact Analysis

An analysis of the cumulative impact of the development shows that the highest impact during mobilisation on the mobilisation site will be due to human interactions with the environment. The level of modification that will have to be brough to the area and the proximity of the area to the PA is a major concern and must be mitigated to reduce the magnitude of the proposed impact. If left un mitigated, the harm done to the natural environment can be irreversible and lead to a regional impact footprint. This is followed by the impact of the utility services where a failure or a leak can lead to harm for the natural and built environment.

Figure 7-9: Cumulative Impact Analysis

Mobilization					
		mobilization for accommodation	Utility services arrangement	Human interactions form temp site	Cumulative
Impacts on the natural environment	Impacts of noise, vibration and disturbance	-2	-2		-4
	Impacts on ground water table and quality (leaching of salts in the deposited sediments and change in ground water quantity);				0
	Impacts on unique or threatened habitats or species;				0
	Changes in elevation and natural slopes on existing roads due to proposed road works that may result in changes in drainage patterns, which may impact groundwater and soil				0
	Potential flooding due to road works;				0
	Impacts on terrestrial flora and fauna from preparation works, if any;				0
	Impacts on air quality;	0		0	0
	Impact on GHG emissions and				0
	Impacts on landscape integrity/scenery.			0	0
Impacts on the socio-economic environment	Impacts on employment and income, potential for local people to have (temporary) job opportunities (and what kind) in the execution of the works;				0
	Level of protection against hazards like sea level rise, storm surges, etc.;			-3	-3
	Social destabilization on of the island community;				0
	Monitoring of socioeconomic and demographic development.			-2	-2
	Impact on health and safety			-5	-5
	Disturbances to residents and cultural facilities/activities; Impacts on transportation/traffic; and			-4	-4
	Impact on the nearby uses.				0
Construction related hazards and risks	Pollution of the natural environment (e.g. oil spills, discharge of untreated waste water and solid waste, including construction waste);		-1		-1
					0
	Risk of accidents and pollution on workers and local population.			-4	-4
	Impact due to any traffic diversions				0
	Impacts of noise, and work-related safety issues.				0
	Impacts on social and economic values, norms and belief due to project outputs.			0	0
		-2	-3	-18	

Table 7-4: Cumulative Impact Analysis

Analysing the factors that can have an impact during mobilisation, impact on health and safety has the highest negative impact. Followed by the negative impact of disturbance to the residents, impact of noise, and the potential risks of accidents, which must be mitigated separately.

		Land modification	Other components							
		Construction as proposed	Alternative, construction as per the alternatives (split road alternative)	Alternative, construction as per the alternatives (alternative road build, concrete.	Alternative, addition of a typical storm water drainage system, with a flow out and a collection system.	Alternative, addition of drainage system to the road	Alternative, varying elevation as per the neighborhoods.	Operation	Management	**Cumulative**
Impacts on the natural environment	Impacts of noise, vibration and disturbance	-2								-2
										0
			-3							-3
										0
				-3						-3
										0
								-1	-1	-2
	Impacts on ground water table and quality (leaching of salts in the deposited sediments and change in ground water quantity);	-2		-2						-4
			-3							-3
					-3					-3
	Impacts on unique or threatened habitats or species;									0
	Changes in elevation and natural slopes on existing roads due to proposed road works that may result in changes in drainage patterns, which may impact groundwater and soil	-5						-5		-10
	Potential flooding due to road works;	-5								-5
	Impacts on terrestrial flora and fauna from preparation works, if any;	-1	-1	-1	-1			-3		-7
						-1				-1
	Impacts on air quality; Impact on GHG emissions	-1						0		-1

		Land modification	Other components							
		Construction as proposed	Alternative, construction as per the alternatives (split road alternative)	Alternative, construction as per the alternatives (alternative road build; concrete.	Alternative, addition of a typical storm water drainage system, with a flow out and a collection system.	Alternative, addition of drainage system to the road	Alternative, varying elevation as per the neighborhoods.	Operation	Management	**Cumulative**
	Impacts on landscape integrity/scenery.									0
Impacts on the socio-economic environment	Impacts on employment and income, potential for local people to have (temporary) job opportunities (and what kind) in the execution of the works;	1						1		2
	Level of protection against hazards like sea level rise, storm surges, etc.;	-1						-1		-2
	Social destabilization on of the island community;									0
	Monitoring of socioeconomic and demographic development.									0
	Impact on health and safety							-2		-2
	Disturbances to residents and cultural facilities/activities; Impacts on transportation/traffic; and Impact on the nearby uses.	-2								-2
Construction related hazards and risks	Pollution of the natural environment (e.g. oil spills, discharge of untreated waste water and solid waste, including construction waste);	-1								-1
	Risk of accidents and pollution on workers and local population.	-1						-1		-2
	Impact due to any traffic diversions	-5								-5
	Impacts of noise, and work-related safety issues.									0
	Impacts on social and economic values, norms and belief due to project outputs.	-1								-1
	Cumulative	-26	-7	-6	-4	-1	0	-12	-1	

Table 7-5: Cumulative Impact Analysis

During construction, the factor that will have the highest cumulative negative impact is that of the impact the construction process will have on the elevation and slopes, which can lead to material and economic loss due to flooding, which is analysed separately. Followed by, the impact of the work on the terrestrial flora and fauna. Further, the cumulative negative impact is also high due to traffic diversions during work. Hence, all negative impacts must be mitigated accordingly. There is a possibility of a positive impact due to due to job opportunities this can create.

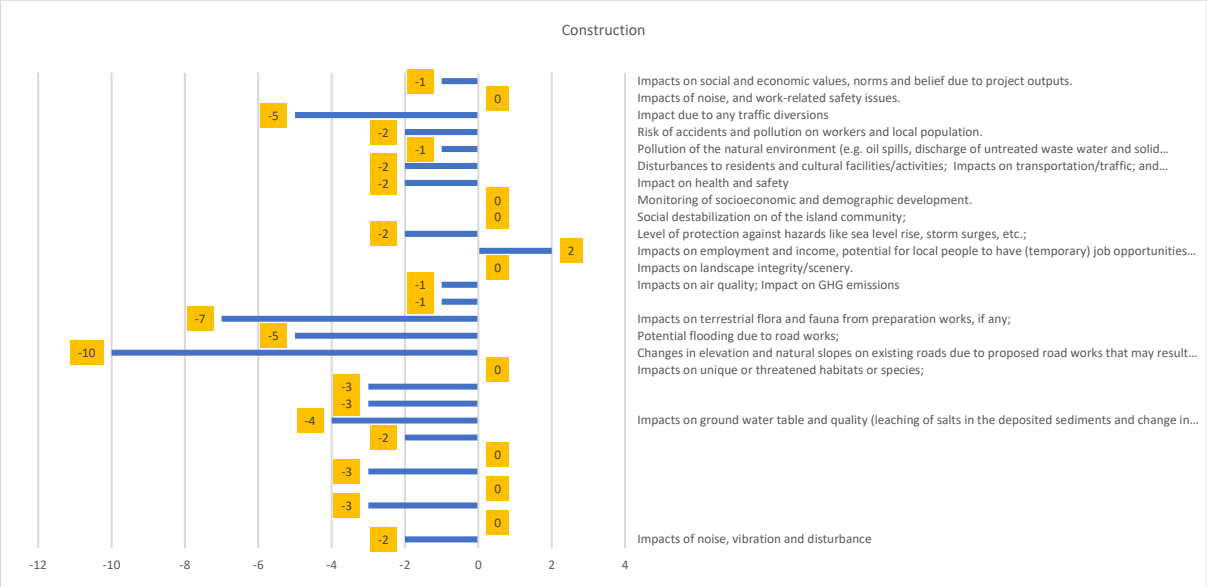


Figure 7-10: Cumulative Impact Analysis

An analysis of the cumulative impact of the development shows that the highest impact during is the highest when it comes to the development as proposed.

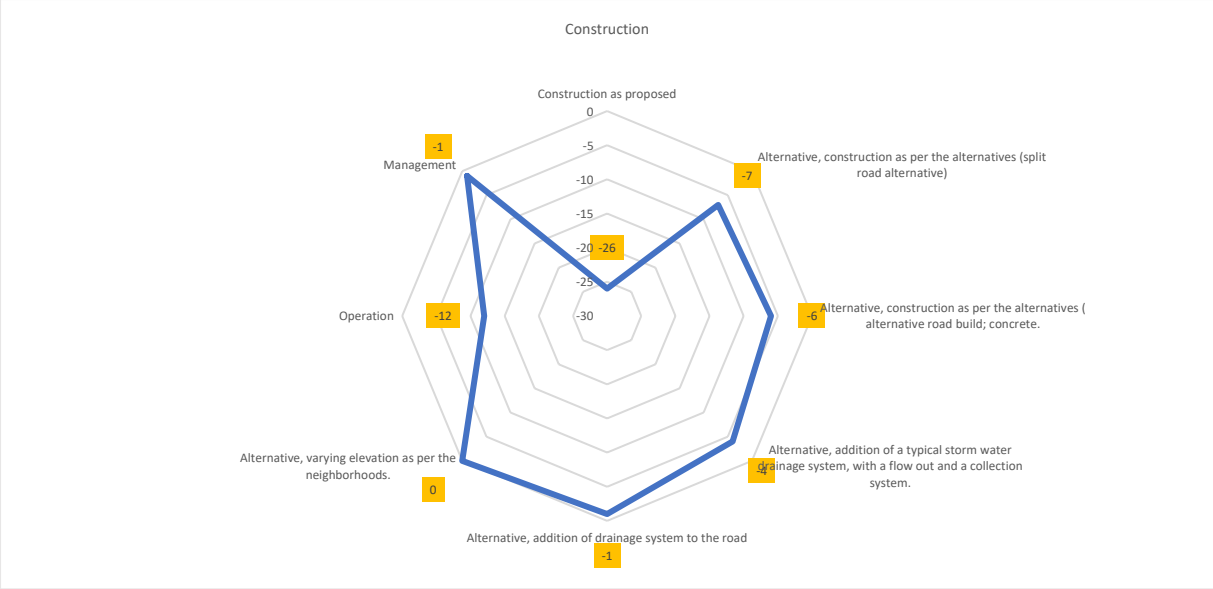


Figure 7-11: Cumulative Impact Analysis

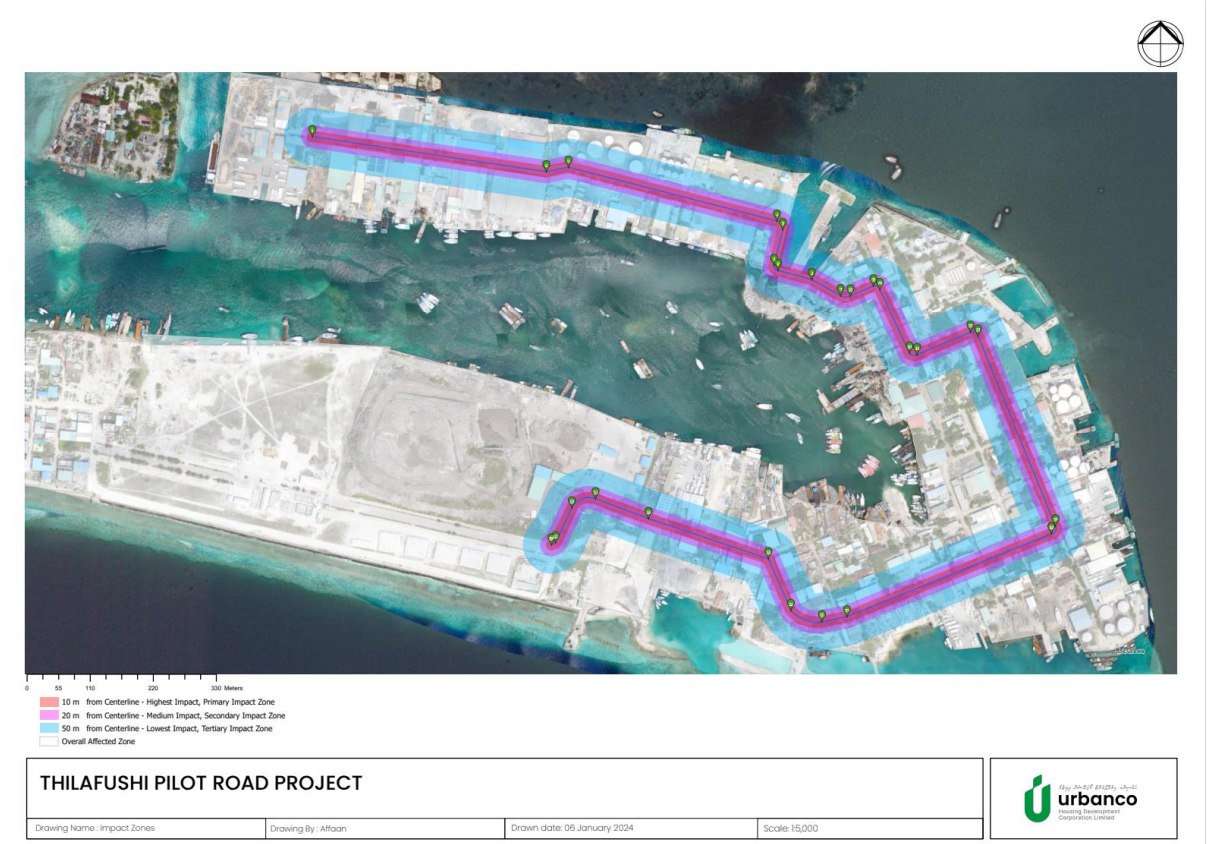


Figure 7-12 Impact map low resolution (12.5)

Urban planning department,
GIS and Survey,
Environment Unit

Housing Development Corporation
HDC Building, Ground Floor
Hulhumalé, Republic of Maldives

8 Environment management plan

The Environmental Management Plan (EMP) aims to create a framework for monitoring and mitigation of environmental and social impacts, reporting, and implementation of corrective actions, and to provide evidence of compliance to relevant laws, regulations, policies, guidelines, and requirements
Management structure the parties involved in the EMP.

Party	Role	Responsibilities
HDC (Urbanco)	Proponent	• Concept design and design details • Project activities • Monitoring and recording project activities, progress, issues, and incidents • Reporting to EPA on additional environmental issues if needed
Contractor	Project Contractor	• Execution of project activities • Implementation of mitigation measures • Reporting to proponent and environmental consultant • Carryout works according to EIA and laws, policies, and regulations
Registered EIA Consultant	Registered EIA Consultant	• Preparation of the EIA and addendums. • Monitoring performance • Audit, amend and update EIA and addendums. • Preparation of environmental monitoring reports as required
EPA	Environment regulator	• Review and approval of EIA and addendums. • Review of environmental monitoring reports • Site inspection and intervention as needed

Table 8-1: Management Structure of EMP

The actions of management require the responsible party to coordinate with the stakeholders and carry out social management actions in order to fully mitigate the impact. There are 2 major types of management actions defined under the scope of the ESIA. The management actions taken to mitigate or enhance the immediate impact of the work carried out or the management action carried out to clarify certain actions for the main stakeholders and manage negative impact a certain action will have on the residents. Ideally the responsible parties are to coordinate and provide the social mitigation measures in sessions and terms clear for the residents to understand and provide sufficient time for the residents to discuss the management actions and report grievances.

8.1 Mitigation and management plan

The following is the mitigation and management plan

8.1.1 Construction phase

Impact ID	Impact Description	Potential Impact	Mitigation Measures	Justification for mitigation	Responsible Party (Proponent and Contractor)	Phase of Mitigation	Estimated Cost of Mitigation (MRF)
Impacts of noise, vibration and disturbance	Noise and vibration pollution	Can impact the workers and residents	1. Provide PPE 2. Time the construction work during working hours. 3. Have a cut off time	Exposure of the staff to the construction process, without proper PPE may lead to potential hazards. Constant exposure to construction noise, can lead to permanent damages.	Contractor	During Construction	40,000
Impacts on Natural Coastal Protection due to temporary work camp	Coastal Erosion	Changes in elevation and vegetation impact coastal protection.	4. Implement coastal protection measures. 5. Monitor changes in coastal conditions.	Changes in coastal conditions may affect natural protection of the camp.	Contractor	During Construction	90,000
Impact on Terrestrial Biodiversity and Impacts on unique or threatened habitats or species. Impacts on terrestrial flora and fauna from preparation works, if any;	Biodiversity Impact	Habitat alteration and introduction of invasive species.	6. Implement measures to prevent introduction of invasive species. 7. Monitor habitat changes. 8. For each tree and palm cut (6.2.2.2), ensure introduction of 2 in the re vegetation component (12.1).	Construction and operation may alter terrestrial biodiversity. Further loss of trees can be managed through compensation matters ensuring maintenance and exceeding the green percentage.	Contractor	During Construction	50,000
Waste management practices	Impact of mismanagement	Exposure to the legacy waste	9. Implement one of the waste management techniques such as,	To Ensure that the excavation process does not add to the waste	Contractor	During Construction	90,000

Impact ID	Impact Description	Potential Impact	Mitigation Measures	Justification for mitigation	Responsible Party (Proponent and Contractor)	Phase of Mitigation	Estimated Cost of Mitigation (MRF)
	of excavated waste		waste to material, or waste to energy, etc.	management burden on the island.			
	Impact of mismanagement of construction waste.	Potential seepage of the excavated waste to the surrounding.	10. Ensure, a practicable excavation waste management plan is agreed upon with the waste management parties before initiation. 11. Ensure use of trucks to remove the waste to the waste management areas.	To ensure that the waste management parties involved, and the waste producers in this specific project are in agreement of what is to be done and how much work is to be done for waste management.	Proponent	During Construction	50,000
Water Resource Impacts	Water Resource Impact	Potential water depletion and contamination due to mobilization.	12. Implement proper waste management practices. 13. Monitor water quality.	Mobilization may lead to water depletion and contamination.	Proponent	During Mobilization	40,000
Impacts on ground water table and quality (leaching of salts in the deposited sediments and change in ground water quantity);	Water Quality	Impact on water quality from construction materials.	14. Implement proper waste management. 15. Construct stormwater infiltration or drainage systems. 16. Monitor water quality.	Construction materials and activities may impact water quality.	Contractor	During Construction	80,000
Impact on Infrastructure and Services	Infrastructure Impact	Potential impact on infrastructure and services due to mobilization.	17. Develop contingency plans for infrastructure and services. 18. Monitor local infrastructure capacity.	Mobilization may strain local infrastructure and services.	Proponent	During Mobilization	60,000
	Service Disruption	Construction may disrupt services to the community.	19. Develop contingency plans for service disruptions.	Construction may lead to temporary service disruptions.	Contractor	During Construction	40,000

Impact ID	Impact Description	Potential Impact	Mitigation Measures	Justification for mitigation	Responsible Party (Proponent and Contractor)	Phase of Mitigation	Estimated Cost of Mitigation (MRF)
			20. Monitor service continuity.				
Impact on Aesthetic and Visual Resources	Aesthetic Impact	Changes in the landscape due to construction and operation.	21. Potential for altered aesthetic values.	Construction and operation may alter aesthetic values.	Contractor	During Construction	40,000
Impact on Land Use and Planning and everyday operations	Operation impact	Changes in land use and operations due to construction and operation.	22. Potential for altered land use and the proposed use of alternative roads to move around the path (12.10) during construction	Construction and operation may alter land use patterns.	Contractor with the aid of the Proponent	During Construction	150,000
Impact on Social Structure and Community Services	Social Structure Impact	Potential impact on social structure and community services.	23. Potential for altered day to day operations.	Construction and operation may temporarily impact social structure.	Contractor	During Construction	60,000
Potential flooding due to road works	Flooding Impact	Flooding during construction may cause structural damage and safety hazards.	24. Implement flood mitigation measures. 25. Monitor and manage flood risk and drainage systems.	Flooding poses risks to structures and safety during construction and operation.	Contractor	During Construction and Operation	100,000
Tsunami during Construction	Tsunami Impact	Tsunami during construction may pose risks to structures and safety.	26. Implement tsunami preparedness measures. 27. Monitor tsunami risk and response systems.	Tsunamis pose risks to structures and safety during construction and operation.	Contractor	During Construction and Operation	120,000
Fire during Construction	Fire Impact	Fire during construction may cause damage and safety hazards.	28. Implement fire prevention and response measures. 29. Monitor fire risk and response systems.	Fires pose risks to structures and safety during construction and operation.	Contractor	During Construction and Operation	80,000

Impact ID	Impact Description	Potential Impact	Mitigation Measures	Justification for mitigation	Responsible Party (Proponent and Contractor)	Phase of Mitigation	Estimated Cost of Mitigation (MRF)
Civil Unrest during Construction	Civil Unrest Impact	Civil unrest during construction may lead to safety and security issues.	30. Implement security measures. 31. Monitor civil unrest risk and security systems.	Civil unrest poses safety and security risks during construction and operation.	Contractor	During Construction and Operation	150,000
Unforeseen Global Occurrence during Construction	Global Occurrence Impact	Unforeseen global occurrences during construction may disrupt construction.	32. Develop contingency plans for global occurrences. 33. Monitor global occurrence risks and response systems.	Unforeseen global occurrences may disrupt operations during construction and operation.	Contractor	During Construction and Operation	100,000
Financial Crisis during Construction	Financial Crisis Impact	Financial crisis during construction may lead to budgetary constraints.	34. Develop financial contingency plans. 35. Monitor financial stability.	Financial crises may lead to budgetary constraints during construction.	Contractor	During Construction	50,000
Hurricane during Construction	Hurricane Impact	Hurricanes during construction may pose risks to structures and safety.	36. Implement hurricane preparedness measures. 37. Monitor hurricane risk and response systems.	Hurricanes pose risks to structures and safety during construction and operation.	Contractor	During Construction and Operation	140,000

Table 8-2: Mitigation and Management Plan - Construction Phase.

8.1.2 Operational Phase

Impact ID	Impact Description	Potential Impact	Mitigation Measures	Justification for Impacts	Responsible Party (Proponent and Contractor)	Phase of Mitigation	Estimated Cost of Mitigation (MRF)
Water Resource Impacts	Water Resource Impact	Potential impact on water resources from operational activities.	1. Formulation of road use guidelines 2. Implementation of road use tax.	Operational activities may impact water resources, a form of taxation must be extracted from the users	Proponent	During Operation	40,000
	Water Quality				Proponent	During Operation	80,000

Impact ID	Impact Description	Potential Impact	Mitigation Measures	Justification for Impacts	Responsible Party (Proponent and Contractor)	Phase of Mitigation	Estimated Cost of Mitigation (MRF)
			3. Proper management of the road. 4. Implement proper water infiltration system management practices. 5. Monitor water quality.	to potentially manage the road.			
Impact on Infrastructure and Services	Infrastructure Impact	Potential impact on infrastructure and services from operational activities.	6. Develop contingency plans for infrastructure and services. Including measures such as excavation notifications. 7. Monitor local infrastructure capacity.	Operational activities may strain local infrastructure and services.	Proponent	During Operation	60,000
	Service Disruption	Potential service disruptions due to operational activities.	8. Develop contingency plans for service disruptions. 9. Monitor service continuity.	Operational activities may lead to temporary service disruptions.	Contractor	During Operation	40,000
Tsunami during Operation	Tsunami Impact	Tsunami during operation may pose risks to structures and safety.	10. Implement tsunami preparedness measures. 11. Monitor tsunami risk and response systems.	Tsunamis pose risks to structures and safety during construction and operation.	Proponent	During Construction and Operation	120,000
Fire during Operation	Fire Impact	Fire during construction and operation may cause damage and safety hazards.	12. Implement fire prevention and response measures. 13. Monitor fire risk and response systems.	Fires pose risks to structures and safety during construction and operation.	Proponent	During Construction and Operation	80,000

Impact ID	Impact Description	Potential Impact	Mitigation Measures	Justification for Impacts	Responsible Party (Proponent and Contractor)	Phase of Mitigation	Estimated Cost of Mitigation (MRF)
Civil Unrest during Operation	Civil Unrest Impact	Civil unrest during operation may lead to safety and security issues.	14. Implement security measures. 15. Monitor civil unrest risk and security systems.	Civil unrest poses safety and security risks during construction and operation.	Proponent	During Construction and Operation	150,000
Unforeseen Global Occurrence during Operation	Global Occurrence Impact	Unforeseen global occurrences during operation may disrupt operations.	16. Develop contingency plans for global occurrences. 17. Monitor global occurrence risks and response systems.	Unforeseen global occurrences may disrupt operations during construction and operation.	Proponent	During Construction and Operation	100,000
Hurricane during Operation	Hurricane Impact	Hurricanes during operation may pose risks to structures and safety.	18. Implement hurricane preparedness measures. 19. Monitor hurricane risk and response systems.	Hurricanes pose risks to structures and safety during construction and operation.	Proponent	During Construction and Operation	140,000
Impact on Land Use and Planning	Land Use and Planning Impact	Potential changes in land use and planning and greenery due to operational activities.	20. Monitor changes in land use and planning regulations. 21. Ensure that for each tree and palm cut (6.2.2.2), 2 plants are introduced in the re vegetation component (12.1).	Operational activities may lead to changes in land use and planning.	Proponent	During Operation	60,000
Impact on Socioeconomic Factors	Socioeconomic Impact	Potential socioeconomic impacts due to operational activities.	22. Implement community engagement programs. 23. Monitor socioeconomic indicators.	Operational activities may have socioeconomic impacts.	Contractor	During Operation	50,000

Impact ID	Impact Description	Potential Impact	Mitigation Measures	Justification for Impacts	Responsible Party (Proponent and Contractor)	Phase of Mitigation	Estimated Cost of Mitigation (MRF)
			24. Offer recreational and stress-relief facilities to promote a positive work environment and mental health among project workers.				
Monitoring Financial Stability during Operation	Financial Stability Monitoring	Monitoring financial stability during operation for budgetary management.	25. Develop and maintain financial stability monitoring systems. 26. Monitor financial stability indicators.	Monitoring financial stability during operation is essential for budgetary management.	Proponent	During Operation	60,000

Table 8-3: Mitigation and Management Plan - Operational Phase

8.2 Grievance Redress Mechanism

8.2.1 Outline

A grievance redress mechanism for the project is given below:

- Establish a joint committee with the proponents management staffs and representatives from the stakeholder community to monitor the works. Focal point from island management staff to supervise the work and report any damages that needs to be resolved.
- This committee shall have monthly meetings with management staff and discuss any issues in the project.
- The committee will send those issues in writing to Proponent. The Proponent will inform the Contractor to address the issues.
- Contractor to provide 2 weekly schedules to the proponent detailing the type of work during the period and if stakeholders need to be informed regarding any road blockage or heavy noise. The focal point from the proponent is to inform the local community and relevant authorities.
- Formal complaints can be lodged at the stakeholders focal point, who must inform the relevant focal point from Contractor side and Proponent side as necessary. If the issue can be resolved locally, it must be done so. If not, it must be reported to relevant authorities and the decision must be communicated to all parties.

All recorded complaints must be responded to within 15 working days. However, any time sensitive complaints during construction period must have an immediate response mechanism within Contractor's side.

8.2.2 Contacts for Grievance Redress Mechanism

Proponents management staffs:

Message address to:

- Amjad Waheed, Director, Thilafushi & Gulhifalhu Operations, amjad.waheed@urbanco.mv, 7999080
- Noor Farooq, Assistant Site Engineer, Project Management & Development, noor.farooq@urbanco.mv, 9700418
- Tholaal Naseer, Assistant Site Engineer, Project Management & Development, tholaal.naseer@urbanco.mv, 7875456

Message copy to:

- Projects Team A, projects-team.a@urbanco.mv
- Urban Planning, urbanplanning@urbanco.mv
- Environment Unit, Environment@urbanco.mv

8.3 Monitoring

The monitoring program is proposed to ensure that the mitigation carried out is effective and to change the monitoring as needed to move towards the desired impact mitigation outcome. There are 2 major monitoring protocols set for the monitoring program. The construction monitoring, in this case that will be carried out by the contractor. The operation phase monitoring will be carried out by the proponent.

8.3.1 Construction phase

Impact ID	Impact Description	Potential Impact	Mitigation Measures	Key Monitoring Parameters	Components and methodology	EIA reference	Frequency	Responsible Party for Monitoring	Estimated Cost of Monitoring (MRF)
Impact on Terrestrial Biodiversity	Biodiversity Impact	Habitat alteration and introduction of invasive species.	Implement measures to prevent introduction of invasive species. Monitor habitat changes.	Biodiversity assessment and habitat monitoring	Photo analysis of trees	Baseline data 3.11.4.1	Every 3 months during construction	Contractor	10,000
Water Resource Impacts	Water Resource Impact	Potential water depletion and contamination due to mobilization.	Implement proper waste management practices. Monitor water quality.	Water quality monitoring	Visual analysis, photo evidence	Look into the waste management, oil management, vehicle management and the sewage treatment of the work camp	Every 3 months during construction	Proponent	8,000
	Water Quality	Impact on water quality from construction materials.	Implement proper waste management. Construct stormwater drainage systems. Monitor water quality.	Water quality monitoring	Temperature, pH, Electrical Conductivity (EC), salinity, Total, Dissolved Solids (TDS), Total Petroleum Hydrocarbon	Baseline data 6.2.2.2Water testing	Every 3 months during construction	Contractor	16,000

Impact ID	Impact Description	Potential Impact	Mitigation Measures	Key Monitoring Parameters	Components and methodology	EIA reference	Frequency	Responsible Party for Monitoring	Estimated Cost of Monitoring (MRF)
					(TPH), Total Coliform and Dissolved Oxygen (DO).				
Impact on Aesthetic and Visual Resources	Aesthetic Impact	Changes in the landscape due to construction and operation.	Potential for altered aesthetic values.	Visual impact assessment and monitoring	Visual analysis, photo evidence	Baseline data 6.2.2.26.3.11.1.1 and Survey map provided by proponent in the EIA (12.10). Water testing	Every 3 months during construction	Contractor	8,000
Impact on Land Use and Planning and everyday operations	Operation impact	Changes in land use and operations due to construction and operation.	Potential for altered land use due to traffic diversions	Land use and operation assessment and monitoring	Land and operation use analysis. Traffic diversion analysis.		Every 3 months during construction	Proponent	10,000
Impact on Social Structure and Community Services	Social Structure Impact	Potential impact on social structure and community services.	Potential for altered social structure.	Social structure assessment and monitoring	Interviews of the staff	Baseline data 4	Every 3 months during construction	Contractor	12,000
Flooding during Construction	Flooding Impact	Flooding during construction may cause structural damage and safety hazards.	Implement flood mitigation measures. Monitor flood risk and drainage systems.	Flood risk monitoring and drainage assessment	Puddle and flood monitoring	Check for flood prone areas during construction and development	Every 3 months during construction	Proponent and Contractor	20,000
Waste management practices	Impact of mismanagement of excavated waste	Exposure to the legacy waste	Implement one of the waste management techniques such as, waste to material, or waste to energy, etc.	Work logs of the project management team	Daily logs of the project management team	P 102, Point 9, Implement one of the waste management techniques such as, waste to material, or	Every 3 months during construction	Contractor	20,000
	Impact of mismanagement	Potential seepage of the excavated	Ensure, a practicable excavation waste management plan is	Monitoring of the waste					

Impact ID	Impact Description	Potential Impact	Mitigation Measures	Key Monitoring Parameters	Components and methodology	EIA reference	Frequency	Responsible Party for Monitoring	Estimated Cost of Monitoring (MRF)
	of construction waste.	waste to the surrounding.	agreed upon with the waste management parties before initiation. Ensure use of sealed trucks to remove the waste to the waste management areas.	management plan		waste to energy, etc.			

Table 1-1: Monitoring Program - Construction Phase

8.3.2 Operational Phase

Impact ID	Impact Description	Potential Impact	Mitigation Measures	Key Monitoring Parameters	Components and methodology	EIA reference	Frequency	Responsible Party for Monitoring	Estimated Cost of Monitoring (MRF)
Impact on Terrestrial Biodiversity	Biodiversity Impact	Habitat alteration and introduction of invasive species.	Implement measures to prevent introduction of invasive species. Monitor habitat changes.	Biodiversity assessment and habitat monitoring	Photo analysis of trees	Baseline data 3.11.4.1	Every 6 month	Proponent	10,000
Water Resource Impacts	Water Resource Impact	Potential water depletion and contamination due to use of the road.	Implement proper waste management practices. Monitor water quality.	Water quality monitoring	Visual analysis, photo evidence	Look into the waste management, oil management, vehicle management and the sewage treatment of the work camp	Every 6 month	Proponent	8,000
	Water Quality	Impact on water quality from heavy use of vehicles and other external unforeseen factors.	Implement proper waste management. Construct stormwater drainage systems. Monitor water quality.	Water quality monitoring	Temperature, pH, Electrical Conductivity (EC), salinity, Total, Dissolved Solids (TDS), Total Petroleum Hydrocarbon (TPH), Total	Baseline data 6.2.2.2Water testing	Every 6 month	Proponent	16,000

Impact ID	Impact Description	Potential Impact	Mitigation Measures	Key Monitoring Parameters	Components and methodology	EIA reference	Frequency	Responsible Party for Monitoring	Estimated Cost of Monitoring (MRF)
					Coliform and Dissolved Oxygen (DO).				
Impact on Infrastructure and Services	Infrastructure Impact	Potential impact on infrastructure and services from operational activities.	Develop contingency plans for infrastructure and services. Monitor local infrastructure capacity.	Infrastructure capacity, condition, and collected budget monitoring.	Hand over documents, including as-built from the contractor to the proponent. Toll system monitoring.	**no baseline as work is not complete	Every 6 month	Proponent	$12,000
	Service Disruption	Potential service disruptions due to operational activities.	Develop contingency plans for service disruptions. Monitor service continuity.	Service continuity monitoring		**no baseline as work is not complete	Every 6 month	Proponent	$8,000
Impact on Aesthetic and Visual Resources	Aesthetic Impact	Changes in the landscape due to operational activities.	Potential for altered aesthetic values.	Visual impact assessment and monitoring	Photo analysis. Check for general completeness of the roads.	**no baseline as work is not complete	Every 6 month	Proponent	$8,000

Table 1-2: Monitoring Program - Operational Phase

8.3.3 Reporting mechanism and report format

Monitoring is a component lacking in many projects in the Maldives. This may be due to the lack of emphasis for the components. Usually, the consultant is required to provide with a reporting format only. However, a structure is not provided. Therefore, in this project we have provided a structure with the reporting format.

A monitoring report mechanism is essential for tracking and reporting on the various impacts and mitigation measures identified in the environmental assessment. This mechanism helps ensure that the project proponent and relevant stakeholders are informed about the status of the project's environmental impact and the effectiveness of mitigation measures.

By implementing this monitoring report mechanism, the project proponent can maintain transparency, track environmental performance, and demonstrate a commitment to mitigating the project's environmental impacts. This mechanism also ensures that regulatory authorities and the public are informed about the project's environmental status throughout its construction and operational phases. The following is a general framework for a monitoring report mechanism:

Environmental Monitoring Report Mechanism

1. Frequency of Reporting:
   - Monthly reports during the construction phase.
   - Quarterly reports during the operational phase.
   - Immediate reports for critical incidents (e.g., tsunamis, fires).
2. Report format:
   - Executive Summary: A concise overview of the project's environmental performance, highlighting key findings, incidents, and mitigation measures' effectiveness.
   - Status of Impacts: A detailed assessment of each identified impact, including its current status, severity, and any changes observed.
   - Mitigation Measures: An evaluation of the implementation and effectiveness of mitigation measures, including any modifications made.
   - Cost Tracking: Documentation of expenditures related to mitigation and monitoring efforts for each impact.
   - Key Monitoring Parameters: Reporting on the monitoring of specific parameters for each impact, including data and trends.
   - Incident Reports: Detailed reports for critical incidents such as tsunamis, fires, or civil unrest, including emergency response actions taken.
   - Financial Stability: Updates on the financial stability of the project during the construction and operational phases.
3. Responsible Parties:
   - The project proponent and contractor are responsible for compiling and submitting monitoring reports.
4. Submission Channels:
   - Reports should be submitted electronically to the relevant regulatory authorities, stakeholders, and posted on a designated project website or portal for public access.
5. Review and Verification:
   - Regulatory authorities, independent environmental experts, and stakeholders can review and verify the reports.
6. Corrective Actions:
   - If significant issues or non-compliance with mitigation measures are identified, corrective actions should be proposed, implemented, and reported in subsequent reports.
7. Public Disclosure:
   - Reports should be made available to the public to promote transparency and engage stakeholders.
8. Record Keeping:
   - Maintain a record of all monitoring reports and supporting documentation for future reference.
9. Emergency Response Plan:
   - Include a section in the report mechanism detailing the emergency response plan for critical incidents, including contact information, procedures, and responsibilities.
10. Continuous Improvement:
    - Regularly assess and update the monitoring report mechanism to reflect changing project conditions and environmental priorities.
11. Compliance and Enforcement:
    - Regulatory authorities should have the authority to enforce compliance with the monitoring and reporting requirements and take necessary actions in case of non-compliance.

12. Budget Allocation:
    Ensure that adequate budgetary provisions are made for monitoring, reporting, and emergency response activities.
13. Stakeholder Engagement:
    Encourage feedback and engagement from relevant stakeholders to improve the effectiveness of the monitoring report mechanism.
14. Public Meetings:
    Hold periodic public meetings or consultations to discuss the findings of the monitoring reports and address concerns from the community.

9 Recommendations

The recommendation for the proponent and contractor are provided below. The recommendations defined below act as greater umbrellas for the main mitigation recommendations specified in the mitigation recommendations chapter.

9.1 Recommendations for the Contractor:

1. Flood Mitigation:
    - Collaborate closely with the proponent to implement flood protection measures in accordance with the approved flood map (12.5).
    - Train project personnel on emergency response procedures in the event of flooding to ensure their safety and the safety of residents.
2. Waste Management:
    - Adhere to the waste management agreement (6.3.11.1.29, P102) rigorously, ensuring proper waste segregation, disposal, and recycling practices at construction sites.
    - Conduct regular training sessions for construction workers on waste management best practices and the importance of environmental responsibility.
3. Social Unrest and Well-Being:
    - Maintain open lines of communication with local communities to address their concerns promptly and transparently (Chapter 8.2).
    - Support community development initiatives, such as vocational training and job opportunities, to enhance social well-being and minimize potential conflicts.
    - Divert traffic in the most effective way that minimizes negative impact on the operation of the island (12.10).
4. Staff Well-Being:
    - Implement and enforce health and safety regulations to protect the well-being of all project workers (1).
    - Provide necessary accommodations, recreational facilities, and mental health support to ensure a positive working environment.
5. Air Quality:
    - Monitor and control dust emissions from construction activities, complying with air quality regulations.
    - Regularly service and maintain construction equipment to reduce emissions and minimize air pollution.
    - By following these recommendations, both the proponent and the contractor can contribute to flood mitigation, effective waste management, social harmony, staff well-being, and improved air quality throughout the project's lifecycle.

9.2 Recommendations for the Proponent.

1. Flood Mitigation:
    - Conduct a comprehensive flood risk assessment to identify vulnerable areas and potential flood hazards (12.5).
    - Design and implement flood protection measures, such as levees, embankments, or flood barriers, in coordination with local authorities and experts.
    - Develop an early warning system to alert residents and project personnel of impending flood events.
2. Water Resource Impacts
    - Formulation of road use guidelines
    - Implementation of road use tax.
    - Proper management of the road.
    - Implement proper water infiltration system management practices.
3. Waste Management:
    - Establish a robust waste management plan that includes proper disposal, recycling, and waste reduction measures.
    - Implement waste segregation practices at construction sites to minimize environmental impact and ensure the safe disposal of hazardous waste.
    - Collaborate with local waste management services to streamline waste collection and disposal processes.
4. Impact on Infrastructure and Services
    - Develop contingency plans for infrastructure and services. Including measures such as excavation notifications.
    - Monitor local infrastructure capacity.
5. Social Unrest and Well-Being:

- Engage with local communities to understand their concerns and expectations regarding the project's impact on their livelihoods and well-being.
- Develop community engagement programs, including job opportunities and skill development, to mitigate potential social unrest.
- Establish grievance mechanisms to address concerns and conflicts promptly and transparently (8.2).
- Aid in diverting traffic in the most effective way that minimizes negative impact on the operation of the island (12.10).
- Aid in the contractor's effort to divert traffic in the most effective way that minimizes negative impact on the operation of the island (12.10).

6. Staff Well-Being:
    - Prioritize the well-being of project operation personnel by providing comfortable and safe accommodation.
    - Implement health and safety protocols, including regular health check-ups and access to medical facilities, to ensure staff well-being.
7. Air Quality:
    - Monitor air quality throughout the project's lifecycle, especially during construction activities.
    - Implement dust control measures, such as dust suppressants and construction site enclosures, to minimize air pollution.
    - Ensure that heavy machinery and vehicles comply with emission standards to reduce air pollutant levels.

10 Conclusion

This EIA is conducted for the proposed development of the pilot road on the footprint of the existing dirt road. The main objective behind the development is to establish a built road that offers a vehicle drive path, built pedestrian path, and rain water flood management system that can be easily managed.

The some of the main project recommendations during construction are, the contractor should manage the flood prone areas in accordance to the survey data (6.2.1.10) and establish mitigation accordingly, the contractor should establish waste management procedures as specified in the mitigation recommendations (6.3.11.1.29), maintain open lines of communication with local communities to address their concerns promptly and transparently (Chapter 8.2), implement and enforce health and safety regulations to protect the well-being of all project workers (1), and divert traffic in the most effective way that minimizes negative impact on the operation of the island (12.10).

The some of the main recommendations during operations are, conduct a comprehensive flood risk assessment to identify vulnerable areas and potential flood hazards (12.5). Formulation of road use guidelines, Implementation of road use tax, Proper management of the road, Implement proper water infiltration system management practices. Establish grievance mechanisms to address concerns and conflicts promptly and transparently (8.2), Aid in diverting traffic in the most effective way that minimizes negative impact on the operation of the island (12.10), Aid in the contractor's effort to divert traffic in the most effective way that minimizes negative impact on the operation of the island (12.10).

Further, mitigations, recommendations, and monitoring specifications are specified in the relevant sections. In conclusion, the proposed development project at Thilafushi Island offers opportunities for growth and progress but also carries significant environmental and social responsibilities. By adhering to the mitigation and recommendations outlined in this assessment, the project can minimize its adverse impacts, contribute positively to local communities, and ensure the sustainable development of Thilafushi Island.

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12 Appendix

12.1 TOR

بسم الله الرحمن الرحيم

Environmental Protection Agency EPA

No: 203-ECA/161/2023/5

Terms of Reference for Environmental Impact Assessment Report for the Proposed Road development project in Thilafushi, Kaafu Atoll

The following is the Terms of Reference (ToR) following the scoping meeting held on **9th January 2023** for undertaking the **EIA for the proposed Road development project in Thilafushi, Kaafu Atoll, Maldives.** The proponent of this project is **Housing Development Corporation.** The consultant is **Mr. Hassaan Abdul Muhsin (EIA P02/2020).**

While every attempt has been made to ensure that this TOR addresses all of the major issues associated with development proposal, they are not necessarily exhaustive. They should not be interpreted as excluding from consideration matters deemed to be significant but not incorporated in them, or matters currently unforeseen, that emerge as important or significant from environmental studies, or otherwise, during the course of preparation of the EIA report.

1. **Introduction and rationale** – Describe the purpose of the project with the rationale and, if applicable, the background information of the project/activity and the tasks already completed. Objectives of the development activities should be specific and if possible quantified. Define the arrangements required for the environmental assessment including how work carried out under this contract is linked to other activities that are carried out or that is being carried out within the defined project boundary. Identify the donors and the institutional arrangements relevant to this project.

2. **Study area** – – Submit a minimum A3 size scaled plan with indications of all the proposed infrastructures. Specify the agreed boundaries of the study area for the environmental impact assessment highlighting the proposed development location and size. The study area should include adjacent or remote areas, such as relevant developments and nearby environmentally sensitive sites (e.g. coral reef, sea grass, mangroves, marine protected areas, special birds site, sensitive species nursery and feeding grounds) if deemed significant for the study. Relevant developments in the areas must also be addressed including residential areas, all economic ventures and cultural sites.

3. **Scope of work** – The report should be categorized into the following components:

Task 1. Description of the proposed project - Provide a full description and justification of the relevant parts of the road and drainage design, using maps at appropriate scales where necessary. The following should be provided (all inputs and outputs related to the proposed activities shall be justified):

- Drawings of the road works and related components on an A3 scaled map;
- Design and construction of road and drainage system;
- Provision for existing utility networks;
- Excavation methods, if required for construction purposes including machinery, man power, expertise and scheduling;
- Excavated earth disposal method and location;
- Transporting sand and backfilling excavated areas;
- Emergency plan during spillages;

- Environmental monitoring during construction activities;
- Measures to protect environmental values during construction and operation phase i.e. surface sedimentation run-off control;
- Details of vegetation clearance (if any)- identify locations at which two palms/trees will be replanted for every palm/tree removed/translocated;
- Backfilling of holes created from uprooting (if any);
- Clearly mention who will be responsible and compensate if there is damage to existing networks during road construction;
- Grievance redress mechanisms;
- Flood prone zones of the island identified on a map;
- Details of the design calculations used for designing the roads, especially considerations made for rainfall and flooding;
- Waste management plan, special demobilization and managing leftover tar and other chemicals; and
- Project management (include scheduling and duration of the project (Component wise scheduling) and life span of facilities: communication of construction details, progress, target dates, labour requirement, local labour availability, housing of temporary labour, construction/operation/closure of labor camps, emergency plan in case of spills (diesel, grease, oil) access to site, safety, equipment and material storage, fuel management and emergency plan in case of spills).

Temporary facilities if any

- Construction methods, scheduling and operation of temporary facilities including power generation, oil storage, water supply, wastewater treatment, accommodation facilities, waste management and decommissioning;
- Labour requirements;
- Material storage;
- Housing of temporary labour; and
- Waste management at the temporary facility.

Drainage system

- Flood prone zones of the island identified on a map;
- Details of drainage system (piping, settlement tanks, PS, catchpits) under project description. Justification for the road construction works;
- Details of the design calculations used for designing the roads, especially considerations made for rainfall and flooding; and
- Clearly mention who will be responsible and compensate if there is damage to existing networks during road construction.

Landscaping plan

- Number and type of trees required;
- Source of trees; and
- Measures that will be taken to confirm the legality of the trees attained.

Task 2. Description of the environment – Assemble, evaluate, and present the environmental baseline study/data regarding the study area and timing of the project (e.g. monsoon season). Identify baseline data gaps and identify studies and the level of detail to be carried out by consultant. Consideration of likely monitoring requirements should be borne in mind during survey planning so that data collected is suitable for use as a baseline. As such all baseline data must be presented in such a way that they will be usefully applied to future monitoring. The report should outline detailed methodology of data collection utilized.

The baseline data will be collected before construction and from at least two benchmarks. All survey locations shall be referenced with Geographic Positioning System (GPS) including water sampling points and vegetation transects sites for posterior data comparison. Information should be divided into the categories shown below:

Climate

- Temperature, rainfall, wind, waves, evaporation rates (including extreme conditions);
- Risk of hurricanes and storm surges; and
- Current flooding areas on the road (through consultation or existing topographic data).

Ecology

- Terrestrial fauna and flora;
- Landscape integrity;
- Assessment of groundwater from project and temporary site locations covering the road proposed. This shall include Temperature, pH, Electrical Conductivity (EC), salinity, Total Dissolved Solids (TDS), Total Petroleum Hydrocarbon (TPH), Total Coliform and Dissolved Oxygen (DO). In addition, groundwater should be tested for the same parameters from a control site;
- Noise levels at different locations;
- Traffic flow (size and direction) around the project site;
- Air quality at the project site and a control site (Carbon monoxide (CO), Nitrogen oxide (NO) and Sulphur dioxide (SO2));
- Vegetation survey including type of vegetation and numbers and extent of vegetation to be cleared, if vegetation clearance is required as part of the project;
- Baseline noise level should be taken from project and temporary site locations within the proposed project site and from a control site; and
- Condition of the surrounding roads.

Socio-economic environment

- Demography: total population, sex ratio, density, growth, and pressure on land and marine resources;
- Economic activities of both men and women (e.g. fisheries, home gardening, fish processing, employment in industry, government);
- Seasonal changes in activities;
- Land use planning, natural resource use and zoning of activities at sea;
- Accessibility and (public) transport to another island;
- Services quality and accessibility (water supply, waste/water disposal, energy supply, social services like health and education);
- Community needs;
- Sites with historical or cultural interest or sacred places (mosques, graveyard);
- Identify types of vehicles and peak traffic hours (if any); and
- Waste Management practices of the island.

Hazard vulnerability:

- Vulnerability of area to flooding and storm surge.

Absence of facilities in the country to carry out the water quality tests will not exempt the proponent from the obligation to provide the necessary data. The report should outline the detailed methodology of data collection utilized to describe the existing environment.

Task 3. Legislative and regulatory considerations – Identify the pertinent legislation, regulations and standards, and environmental policies that are relevant and applicable to the proposed project, and identify the appropriate authority jurisdictions that will specifically apply to the project. Include permits and approvals in the EIA document.

Task 4. Potential impacts (environmental and socio-cultural) of proposed project, incl. all stages – The EIA report should identify all the impacts, direct and indirect, during and after construction, and evaluate the magnitude and significance of each. Particular attention shall be given to impacts associated with the following:

Impacts on the natural environment

- Impacts of noise, vibration and disturbance during construction;
- Impacts on ground water table and quality (leaching of salts in the deposited sediments and change in ground water quantity);
- Impacts on unique or threatened habitats or species;
- Changes in elevation and natural slopes on existing roads due to proposed road works that may result in changes in drainage patterns, which may impact groundwater and soil;
- Potential flooding due to road works;
- Impacts on terrestrial flora and fauna from preparation works, if any;
- Impacts on air quality;
- Impact on GHG emissions and
- Impacts on landscape integrity/scenery.

Impacts on the socio-economic environment

- Impacts on employment and income, potential for local people to have (temporary) job opportunities (and what kind) in the execution of the works;
- Level of protection against hazards like sea level rise, storm surges, etc.;
- Social destabilization on of the island community;
- Monitoring of socioeconomic and demographic development.
- Impact on health and safety
- Disturbances to residents and cultural facilities/activities;
- Impacts on transportation/traffic; and
- Impact on the nearby uses.

Construction related hazards and risks

- Pollution of the natural environment (e.g. oil spills, discharge of untreated waste water and solid waste, including construction waste);
- Risk of accidents and pollution on workers and local population.
- Impact due to any traffic diversions

- Impacts of noise, and work-related safety issues.
- Impacts on social and economic values, norms and belief due to project outputs.

The methods used to identify the significance of the impacts shall be outlined. One or more of the following methods must be utilized in determining impacts; checklists, matrices, overlays, networks, expert systems and professional judgment. Justification must be provided to the selected methodologies. The report should outline the uncertainties in impact prediction and also outline all positive and negative/short and long-term impacts. Identify impacts that are cumulative and unavoidable.

Task 5. Alternatives to proposed project – Describe alternatives including the "*no action option*" should be presented. Determine the best practical environmental options. Alternatives examined for the proposed project that would achieve the same objective including the "*no action alternative*". This should include alternative coastal protection measures, alternative designs, alternative materials; alternative locations and alternative borrow sites. The report should highlight how the best location was determined. All alternatives must be compared according to international standards and commonly accepted standards as much as possible. The comparison should yield the preferred alternative for implementation. Mitigation options should be specified for each component of the proposed project.

Task 6. Mitigation and management of negative impacts – Identify possible measures to prevent or reduce significant negative impacts to acceptable levels. These will include both environmental and socio-economic mitigation measures with particular attention paid to sedimentation control and future changes in coastal processes. Mitigation measures to avoid or compensate habitat destruction caused by dredging will have to be considered, e.g. temporal sediment control structures. Measures for both construction and operation phase shall be identified. Cost the mitigation measures, equipment and resources required to implement those measures. The confirmation of commitment of the developer to implement the proposed mitigation measures shall also be included. An Environmental management plan for the proposed project, identifying responsible persons, their duties and commitments shall also be given. In cases where impacts are unavoidable arrangements to compensate for the environmental effect shall be given.

Task 7. Development of monitoring plan– Identify the critical issues requiring monitoring to ensure compliance to mitigation measures and present impact management and monitoring plan for ground water and sea water quality. Ecological monitoring will be submitted to the EPA to evaluate the damages during construction, after project completion and every three months thereafter, up to one year and then on a yearly basis for five years after. The baseline study described in task 2 of section 2 of this document is required for data comparison. Detail of the monitoring program including the physical and biological parameters for monitoring, cost commitment from responsible person to conduct monitoring in the form of a commitment letter, detailed reporting scheduling, costs and methods of undertaking the monitoring program must be provided.

- Condition of the sensitive ecosystems; and
- Environmentally sound site clearance.

Task 8. Stakeholder consultation, Inter-Agency coordination and public participation) – Identify appropriate mechanisms for providing information on the development proposal and its progress to all stakeholders, government authorities, government agencies, engineers/designers and development managers. The EIA report should include a list of people/groups consulted and summary of the major outcomes. Major stakeholder consultation shall include relevant government agencies including following;

- Relevant local Councils;
- General public;

- National Disaster Management Authority;
- Waste Management Corporation Limited (To discuss how to manage the waste generated from the project)
- Ministry of Environment, Climate Change and Technology (Waste Section) (To discuss about Policies and access to waste management centre)
- Ministry of National Planning, Housing and Infrastructure

➢ ***Summarize the issues identified during the consultation process, include responses by the Proponent to the issues raised and discuss the stakeholder input that has been incorporated or addressed in the EIA. Concerns that were raised by the stakeholders but not considered in the EIA must be justified by the Proponent.***

Presentation- The environmental impact assessment report, to be presented in digital format, will be concise and focus on significant environmental issues. It will contain the findings, conclusions and recommended actions supported by summaries of the data collected and citations or any references used in interpreting those data. The environmental assessment report will be organized according to, but not necessarily limited by, the outline given in the Environmental Impact Assessment Regulations 2012

Timeframe for submitting the EIA report – The developer must submit the completed EIA report within 12 months from the date of this Term of Reference.

……………………………………………

10th January 2023

ENVIRONMENTAL PROTECTION AGENCY
Male', Rep of Maldives

12.2 Vegetation plan

The following is a vegetation plan for the newly dredged area in Thilafushi, incorporating the provided list of plant species. This area is primarily going to be used for industrial purposes and other supporting facilities for the said industrial component. Since this is an unplanned naturalized landmass with the vegetation being removed for the process of road development the entire vegetation process is going to be offsite, with the possibility of establishing a localized nursery in the future.
The baseline referred in the project is in section Tree Survey map, were we take the GIS survey map data (Table 6-4) to formulate the vegetation plan.

Objectives:
The main purpose of this vegetation effort is to ensure establishment of a system that has the capacity to become a self-sustaining biome which requires minimal management and rich biodiversity.

Site Background:

- The site once dredged will be fully owned and operated by the Housing Development Corporation.
- The planned size of the site is 20 hectares
- Soil type on the site initially will be coarse coral sand. There are no topographic modifications planned for the initial stage other than the site being mostly flat.

Reference site:
Reference site used for this project as a baseline is Hulhumale Phase 1 and Phase 2. For the initial vegetation stage Housing Development Corporation's internal floristic data will be used and all the regulations set up by Environment protection agency regarding transplanting and or moving trees from one site to others will be adhered to throughout the project.

Site Preparation:
The area should be cleared of debris and any unwanted foreign objects such as plastic, dead coral etc. Water sources and irrigation systems should be established to accommodate the scale and scope of planting. Advice and consultation of an environmental specialist should be obtained to minimize maintenance and ensure progress towards the completion targets.

Plant Selection:
The following plants were selected based on their adaptability to the coastal environment and their ability to thrive in nutrient-poor soils:

	Family	Scientific name	Common Name	Dhivehi Name
Pioneer species				
1	Cyperaceae	Fimbristylis polytrichoides	Rusty sedge	Vinahui
2	Aizoaceae	Sesuvium portulacastrum	Sea purslane	Lonumagoo
3	Convolvulaceae	Ipomoea pes-caprae	Beach Morning glory	Bodu veliveyo
4	Elaeocarpaceae	Muntinga calabura	Japanese Cherry	Jeymu
5	Poaceae	Zoysia matrella	Manila grass	Ban hui
6	Cyperaceae	Cyperus dubius	Kulhandhuru	Hui
7	Cyperaceae	Cyperus javanicus	Java sedge	Hai
8	Cyperaceae	Cyperus malaccensis	Chinese mat grass	Bahui
9	Poaceae	Dactyloctenium aegyptium	Egyptian crabgrass	Maahui
10	Boraginaceae	Cordia subcordata	Sea Trumpet	Kaani
11	Apocybaceaee	Ochrosia oppositifolia	Cork wood tree	Dhunburi
12	Goodeniaceae	Scaevola taccada	Beach plum	Magoo
13	Malvaceae	Taliparitiliaceum	Sea hibiscus	Dhiggaa
14	Convolvulaceae	Ipomoea aquatica	Water spinich	Kankoon
15	Combretaceae	Terminalia catappa	Indian almond	Midhili gas
16	Arecaceae	Cocos nucifera	Coconut	Dhivehi ruh
17	Lythraceae	Pemphis acidula	Pemphis	Kuredhi

18	Clusiaceae	Calophyllum inophyllum	Alexandrian laurel	Funa
19	Casuarinaceae	Casuarina equisetifolia	Beefwood tree	Fithuroanu
20	Rubiaceae	Morinda citrifolia	Indian mulberry	Ahi
21	Pandanaceae	Pandanus tectorius	Thatch screwpine	Boa kashikeyo
22	Surianaceae	Suriana maritima	Bay cedar	Halaveli
23	Malvaceae	Thespesia populnea	Indian tulip	Hirundhu
24	Boraginaceae	Tournefortia argentea	Tree heliotrope	Boshi

Table 12-1: Vegetation Plan - Plant Selection

Planting:
The selected plant species should be planted in the prepared site in suitable locations, considering their growth requirements and spacing. The planting can be done manually or using machinery.
To stabilize the soil and prevent erosion the plants from grass-like families should be planted first. These include Cyperaceae and Poaceae. They should ideally be planted in such a way as to create grassy ground cover.
The remaining larger tress should ideally be planted once grassy plants are established. The planting beds or pits should be prepared with nutrient rich soil a mixture of organic mulch, topsoil and cow manure or coco peat is recommended. These should be watered at least once a day and timber stilts should be provided for support wherever needed.
Plants should be sourced from a local nursery and it is recommended to plant young or juvenile tress in good to excellent condition with a height not more than 3-5 meters tall. Organic mulch should be added to all trees, 100mm thick layer of organic mulch within the drip line is recommended. The mulch should not touch the tree trunk therefore, leave a 100mm gap between mulch layer and the trunk. This is to avoid potential damage from diseases and insects.

Planting Timeline:
Month 1-2: Plant Cyperaceae and Poaceae in cohesive and orderly manner to establish a grassy ground cover. Provide protective shade nets and fencing around planted areas if necessary. Horticulturist should determine whether such a measure is required up on site inspection.
Month 3-4: Begin planting Aizoaceae, Convolvulaceae, Elaeocarpaceae, Goodeniaceae, Lythraceae, Clusiaceae, Casuarinaceae, Rubiaceae, Pandanaceae, Surianaceae, Malvaceae, and Boraginaceae in well-designed beds.
Month 5-6: Continue planting remaining species and ensure all plants are well-maintained, including regular watering, fertilization, and pruning as needed.

Maintenance:
After planting, the site should be regularly maintained to ensure the success of the vegetation project. Maintenance activities include watering, fertilizing, pruning, and weed control. The plants should be monitored for any signs of disease or pests.
Housing Development corporations' Greening and landscaping team will prepare the required maintenance schedules and plans once the site is handed over for planting.

Monitoring:
The progress of the vegetation project should be monitored regularly to determine the success of the project. The monitoring should include the growth of the plants, soil conditions, and any changes in the environment.
Photographic data and other related data (trunk size, leaf coloring, inflorescence, etc) should be collected every 3 months to monitor the progress and growth of plant material.

Conclusion
In summary, the vegetation plan for the Thilafushi dredged area incorporates a variety of plant species that are adaptable to the coastal environment and nutrient-poor soils. The success of the project relies on proper site preparation, plant selection, planting, maintenance, and monitoring.

THILAFUSHI PILOT ROAD

RE-VEGETATION PLAN

LANDSCAPE DESIGN
DATE: 07 JANUARY 2024

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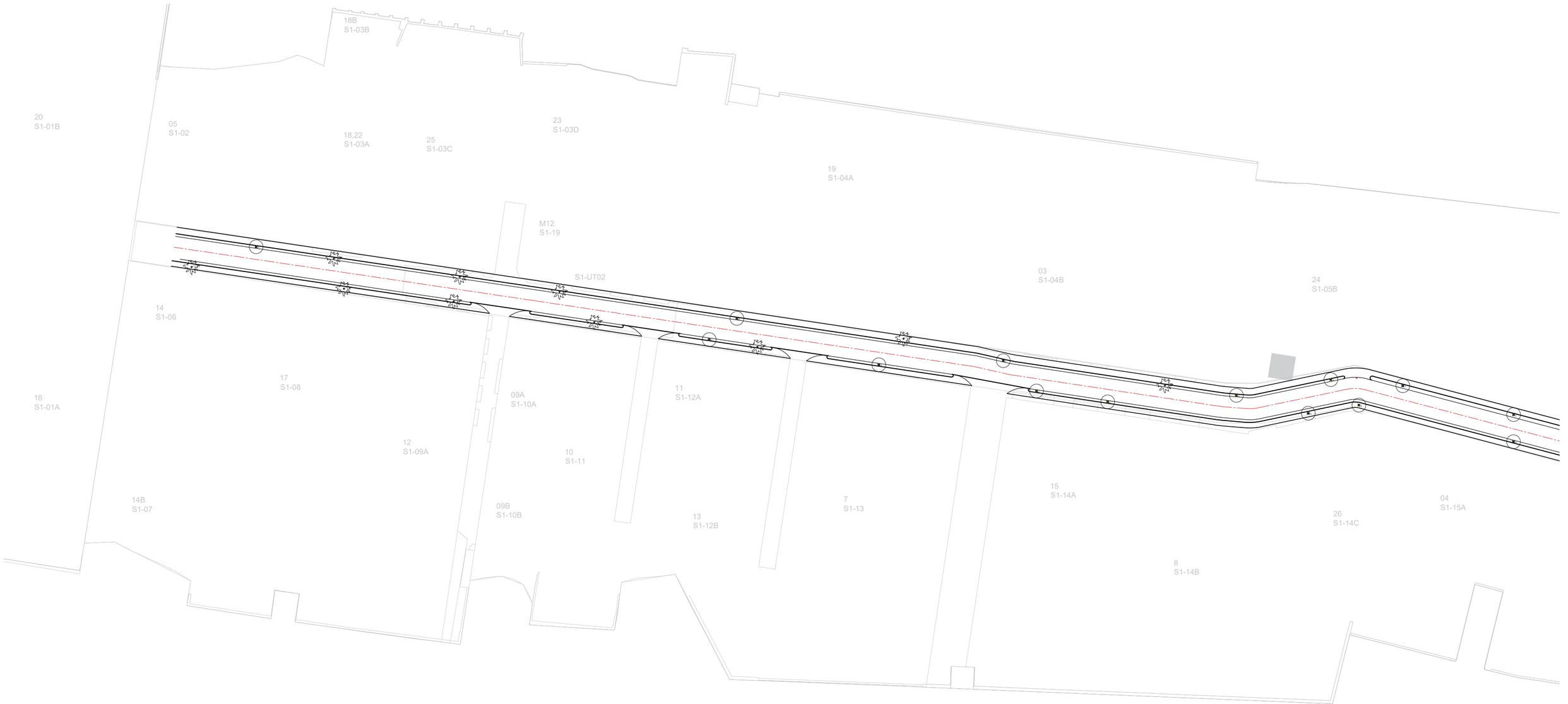
Housing Development
Corporation Limited



CURB LEGEND

- A- Curb:
- B- Curb:
- C- Curb:
- Center Line:
- Paved Area:
- Catch Pit:

TREE LEGEND

- COCS NUCIFERA
- Thespesia populnea
- Hibiscus hiliaceus
- Ficus benghalwnsis l.

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PILOT ROADS
THILAFUSHI

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DOCUMENT NAME	**.....**	REVISION	**1**
AUTHOR	**SAMAAN**	CREATED DATE	**07/01/2024**
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REVIEWED BY	**USHVA**	REVIEWED DATE	**08/01/2024**
APPROVED BY	**USHVA**	APPROVED DATE	**08/01/2024**
INFORMATION CLASSIFICATION SCHEME	**(Public, Open, Confidential, Confidential & Sensitive and Secret)**		

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X	**DD/MM/YYYY**	**Z**	**(FEEDBACK FORMS INCLUDED)**
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LANDSCAPE ARCHITECT	**SAMAAN**
STRUCTURAL ENG.	**.....**
MECHANICAL ENG.	**NAME**
ELECTRICAL ENG.	**NAME**
SCALE	**AS MENTIONED**

SHEET CONTENT
PLANTING PLAN

SHEET NO.
01

CURB LEGEND

- A- Curb:
- B- Curb:
- C- Curb:
- Center Line:
- Paved Area:
- Catch Pit:

TREE LEGEND

- COCS NUCIFERA
- Thespesia populnea
- Hibiscus hliaceus
- Ficus benghalwnsis l.

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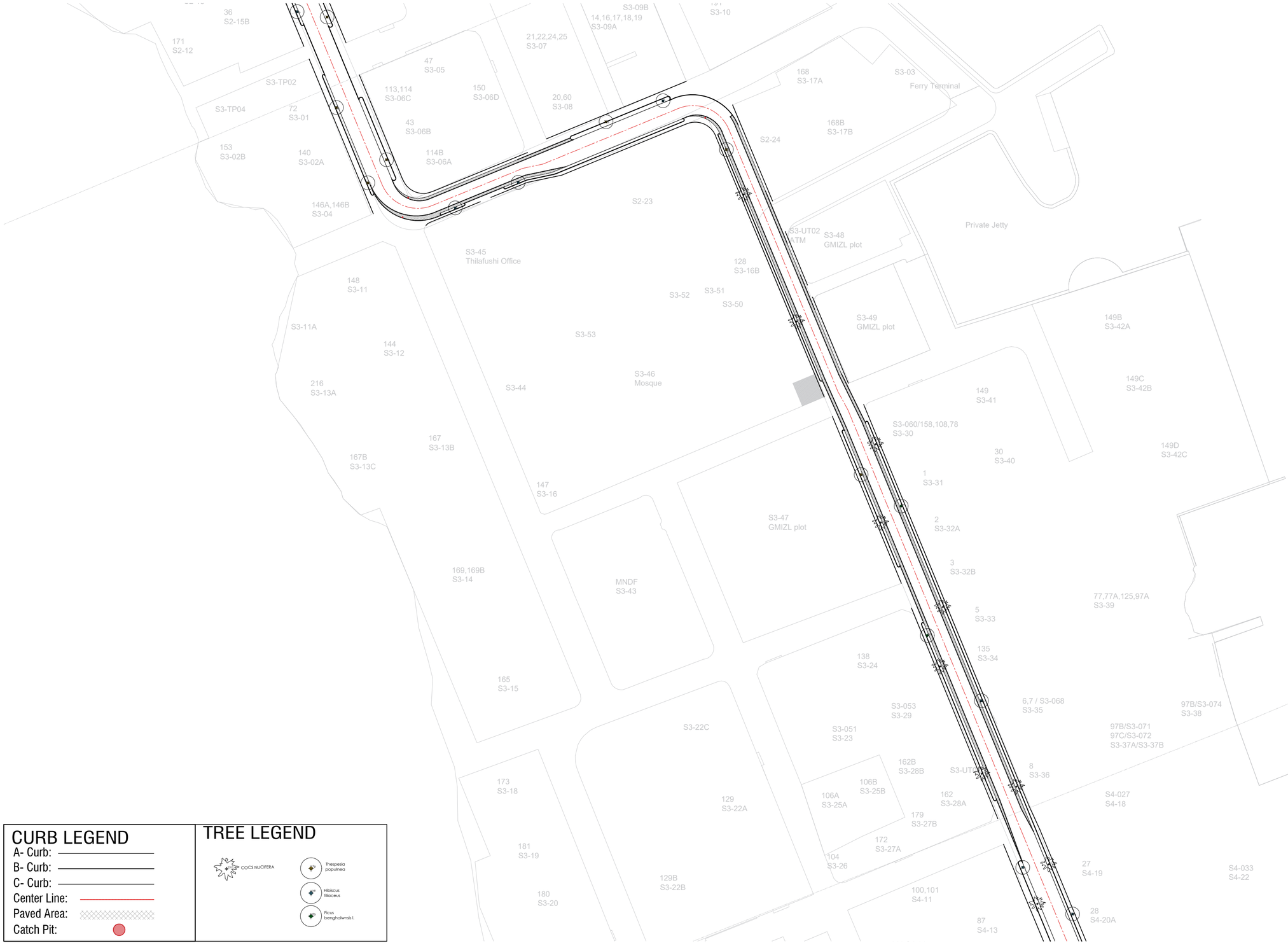
SHEET CONTENT

PLANTING PLAN

SHEET NO.

02



CURB LEGEND

- A- Curb:
- B- Curb:
- C- Curb:
- Center Line:
- Paved Area:
- Catch Pit:

TREE LEGEND

- COCS NUCIFERA
- Thespesia populnea
- Hibiscus tiliaceus
- Ficus benghalwnsis l.

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SCALE	AS MENTIONED

SHEET CONTENT: **PLANTING PLAN**

SHEET NO.: 03

CURB LEGEND

- A- Curb:
- B- Curb:
- C- Curb:
- Center Line:
- Paved Area:
- Catch Pit:

TREE LEGEND

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PLANTING PLAN

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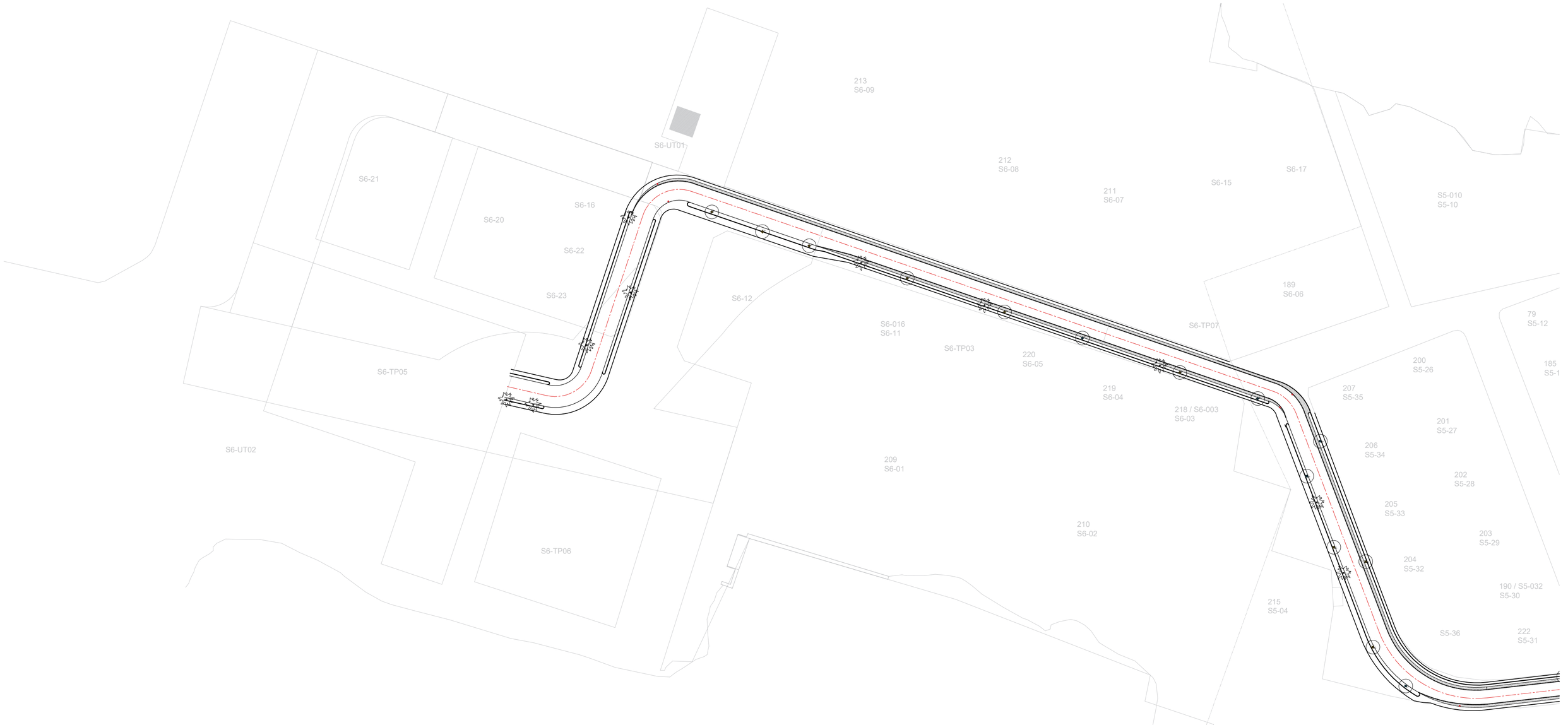
04



CURB LEGEND

- A- Curb:
- B- Curb:
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- Catch Pit:

TREE LEGEND

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PILOT ROADS
THILAFUSHI

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MECHANICAL ENG.	**NAME**
ELECTRICAL ENG.	**NAME**

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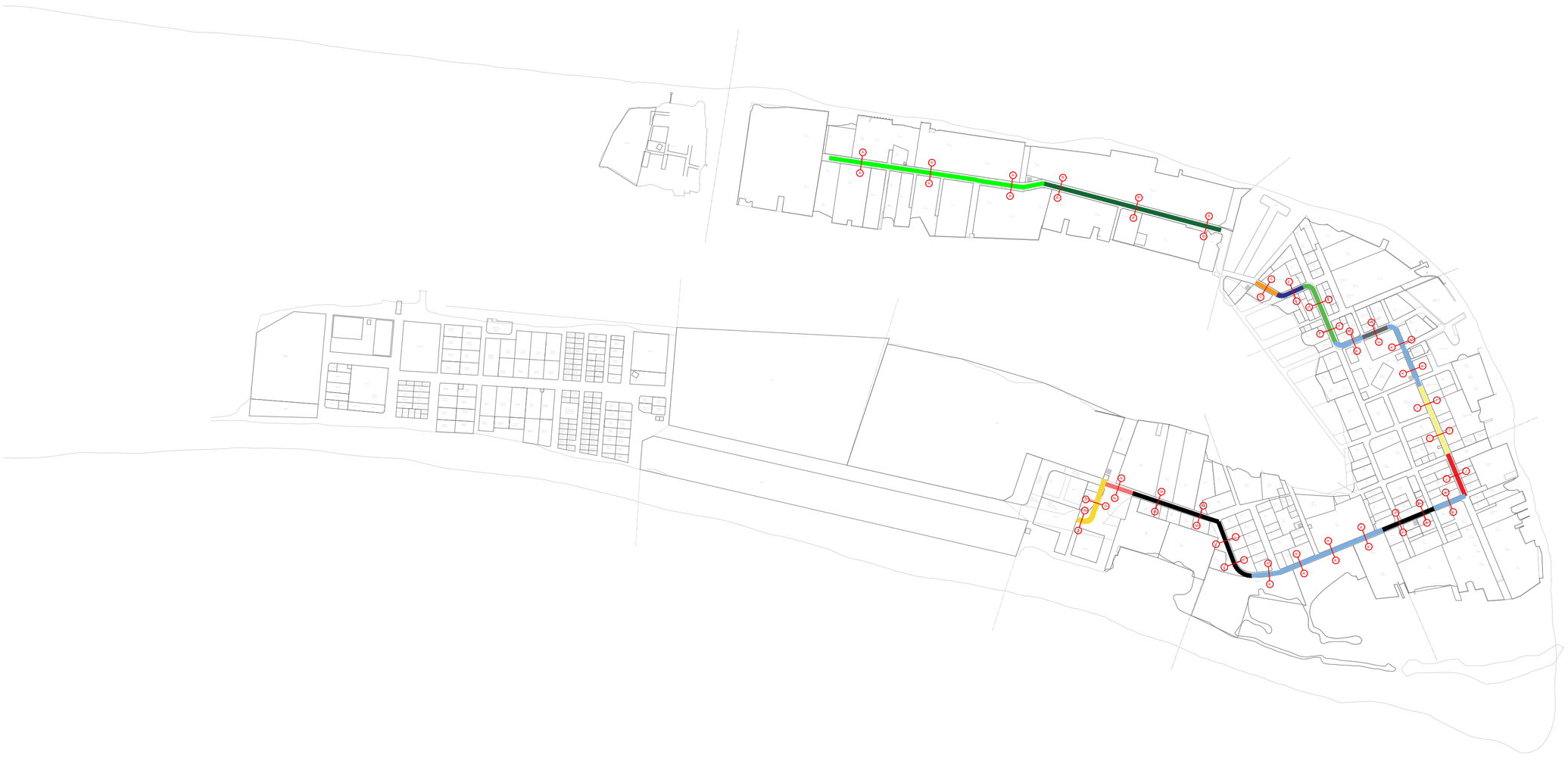
SHEET CONTENT

PLANTING PLAN

SHEET NO.

05

12.3 Concept drawings and technical drawings



HOUSING DEVELOPMENT CORPORATION

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PILOT ROADS PROJECT
THILAFUSHI

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DESIGNER:

AMEEN/DHIL/SAMAHA — Architectural

HUSSAIN SALIQ — Structural

DRAWN BY:

AMEEN/DHIL/SAMAHA/AYSHA

MAY 2021

REVISION

-	-

SCALE: 1:1000

SHEET NO:

CHECKED BY:

Architectural

HUSSAIN SALIQ — Structural

MOHAMED YAMEEN — Services

Communication

APPROVED BY:

SAEED ADAM

DECEMBER 2022

SHEET CONTENT:

LOCATION PLAN

PAGE NO.

00

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HUSSAIN SALIQ Structural

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AMEEN/DHIL/SAMAHA/AYSHA
MAY 2021

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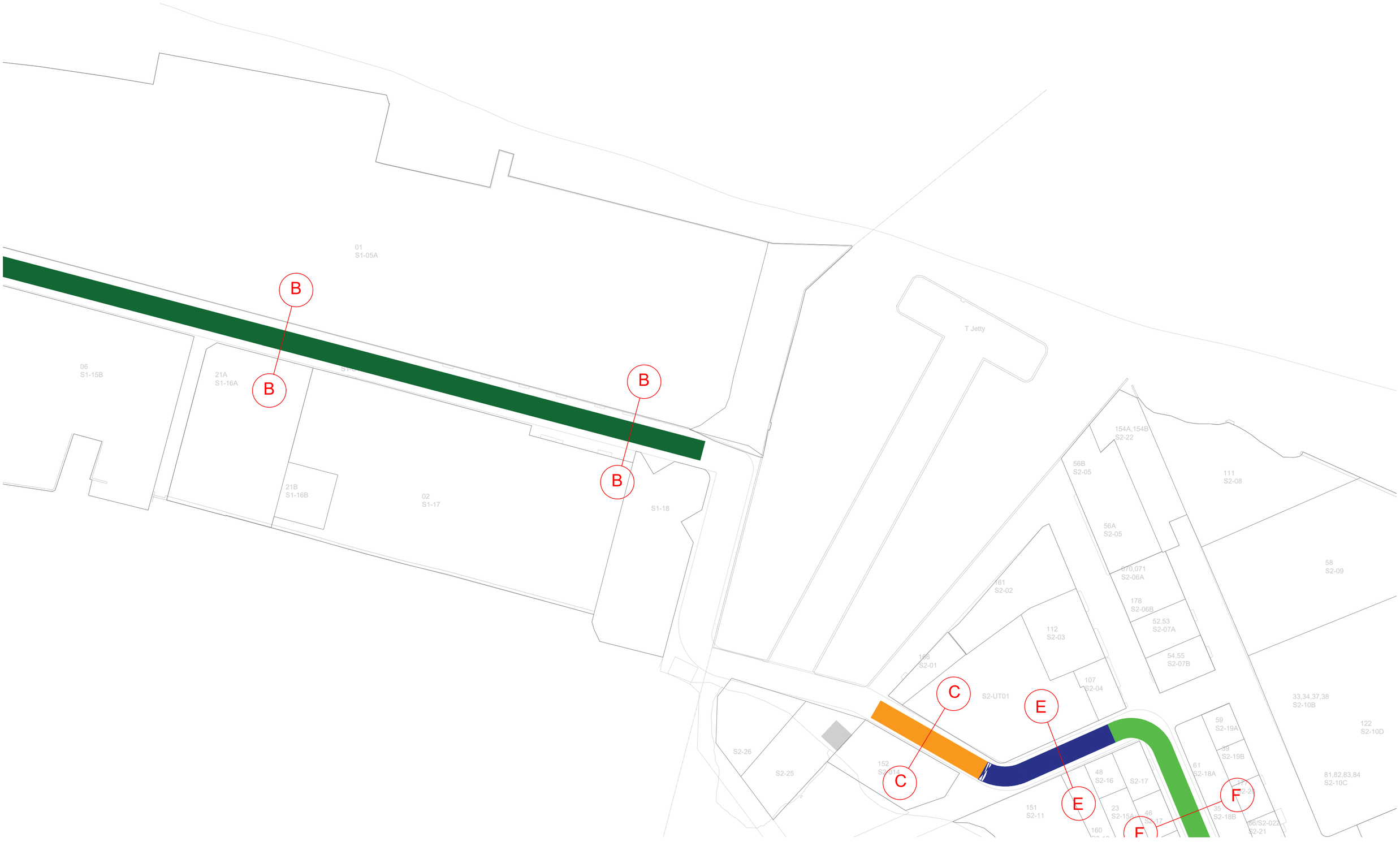
MOHAMED YAMEEN Services
Communication

APPROVED BY:
SAEED ADAM
DECEMBER 2022

SHEET CONTENT:
LOCATION PLAN PT 1

PAGE NO.
01



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02

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LOCATION PLAN PT 3

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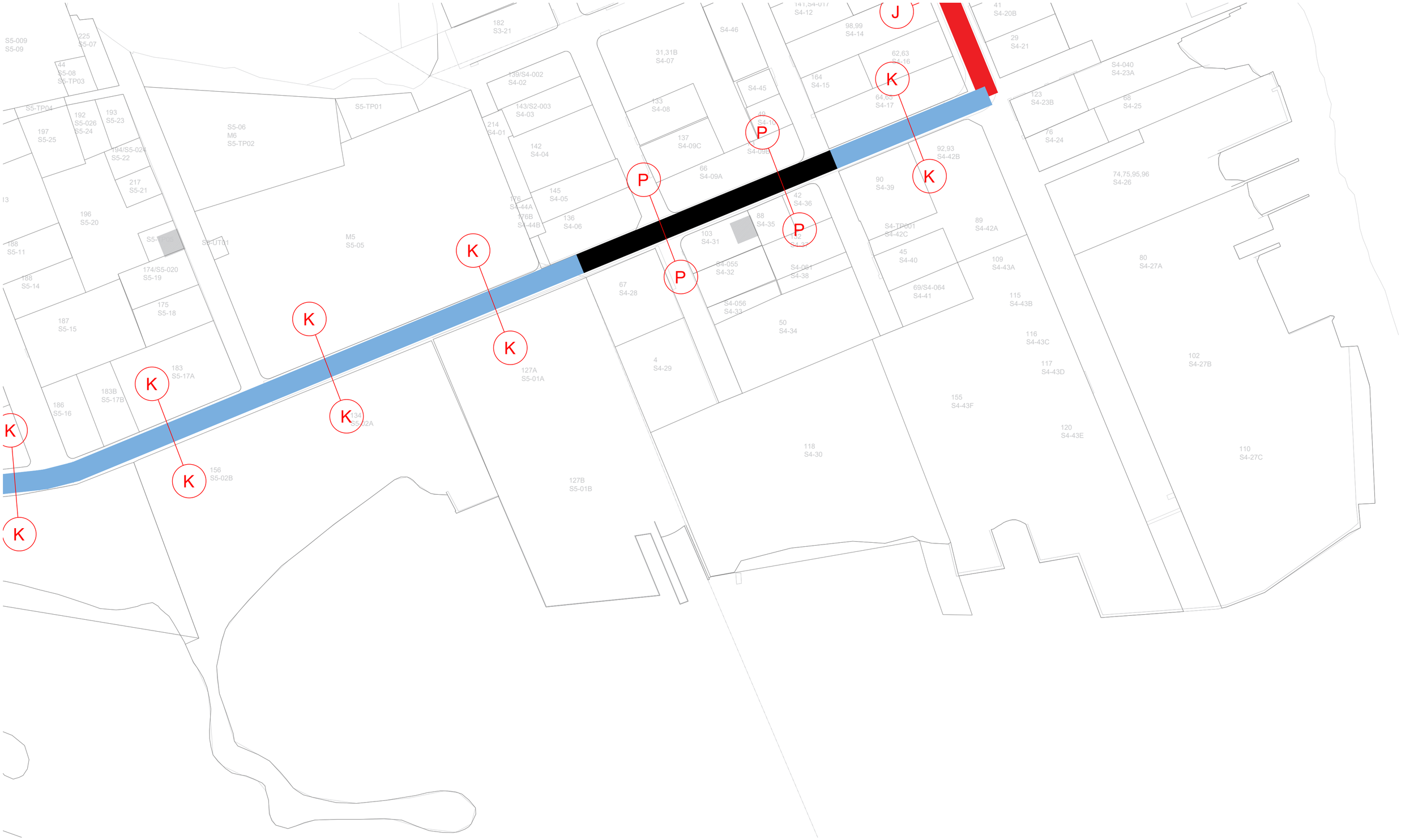
03



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LOCATION PLAN PT 4

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04

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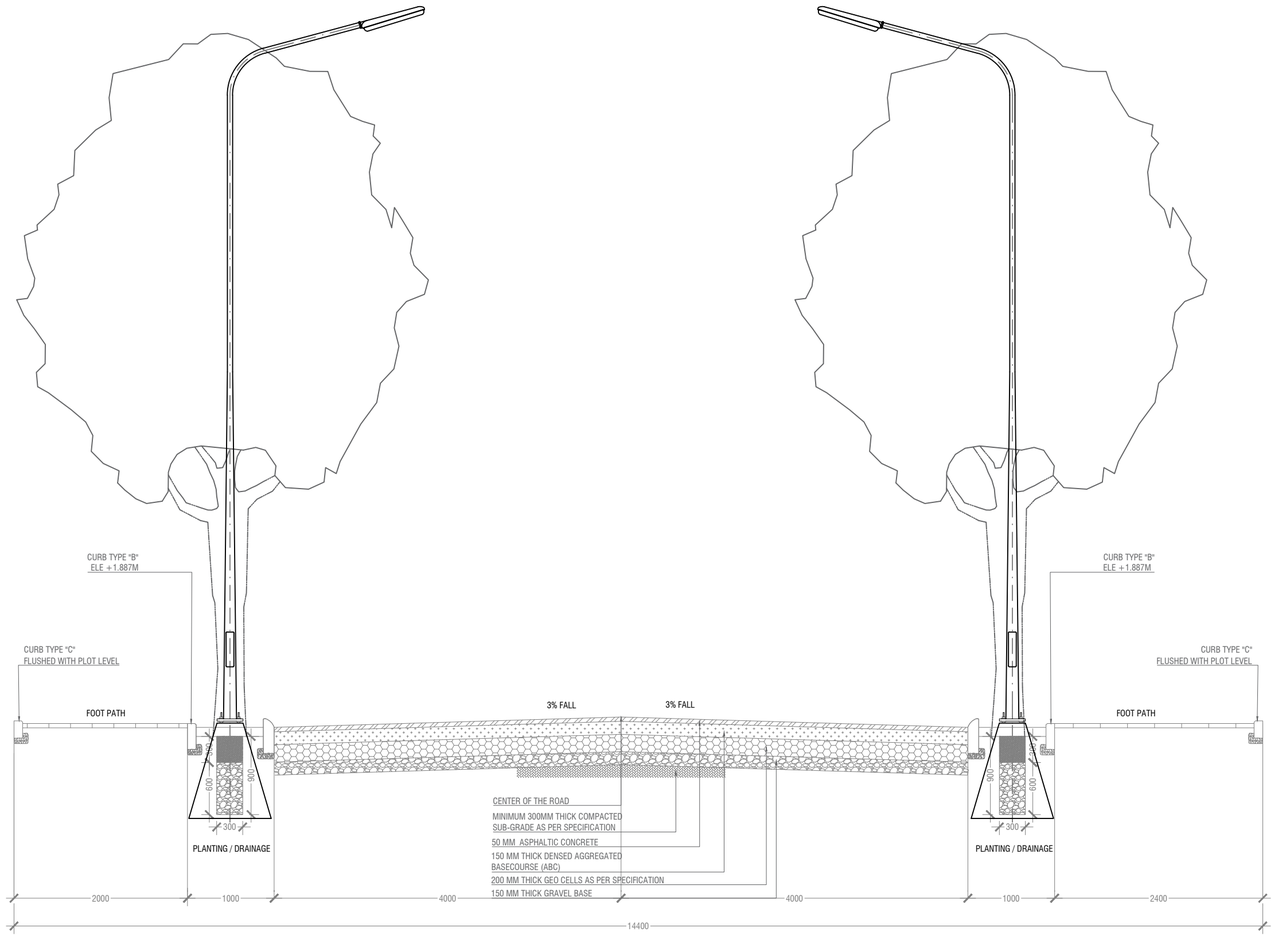
LOCATION PLAN PT 5

PAGE NO.
05

12.4 Cross sections of the road



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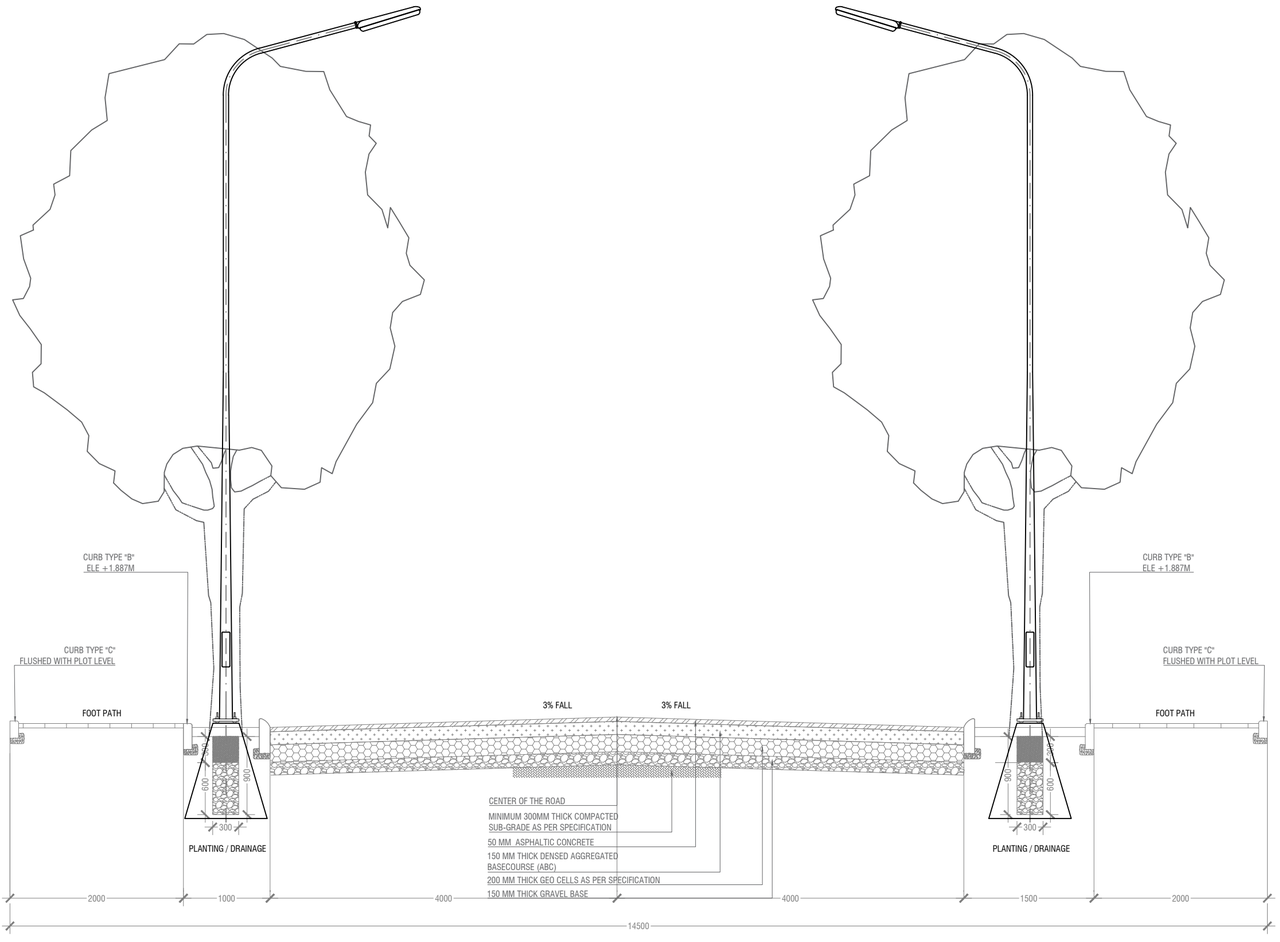

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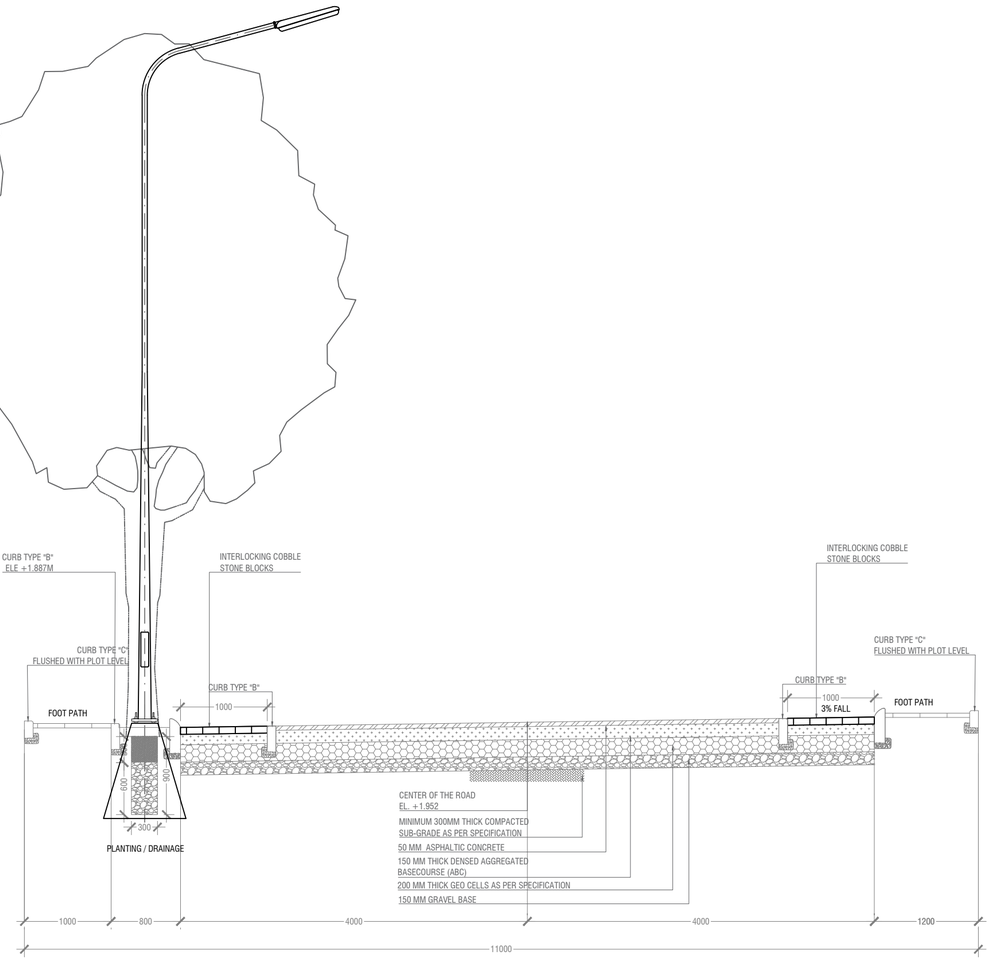

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SECTION B AND C

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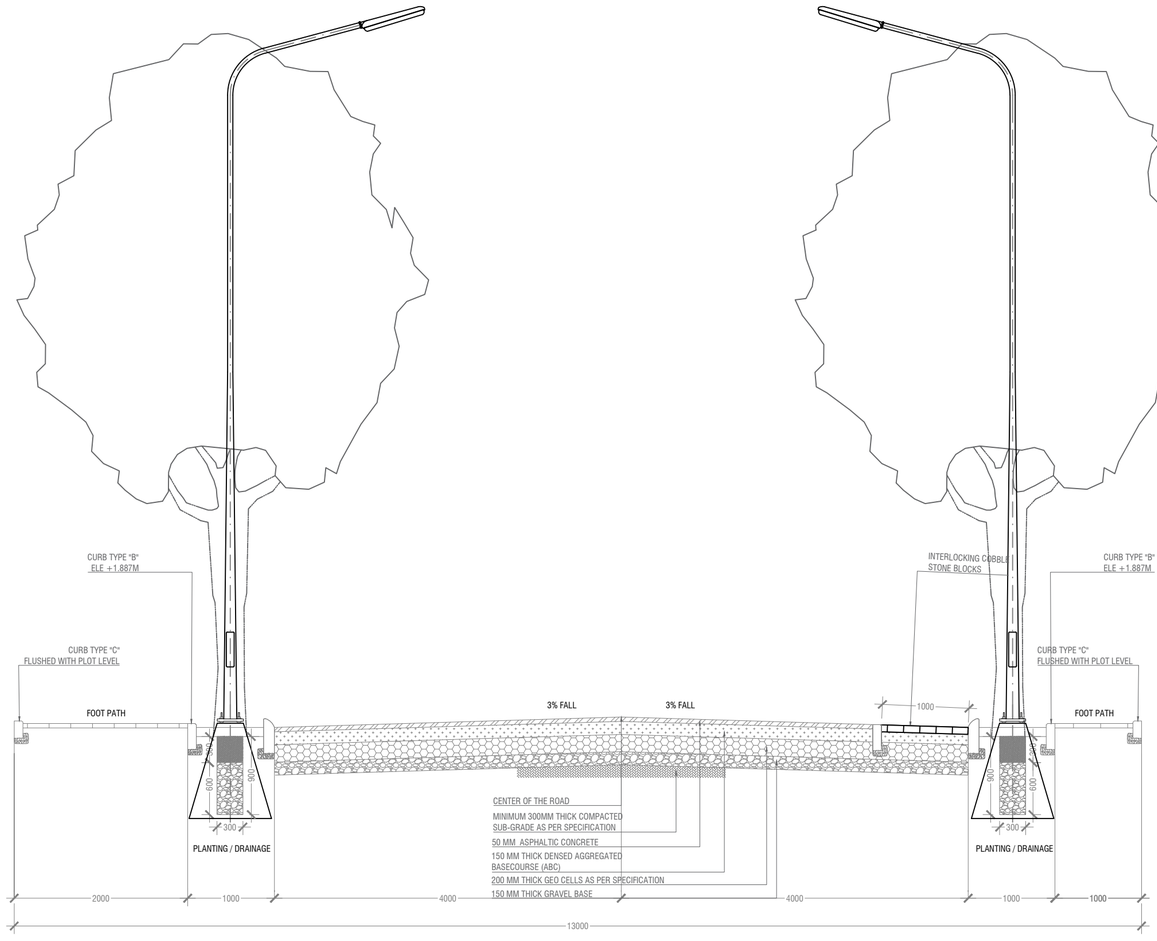

E-E

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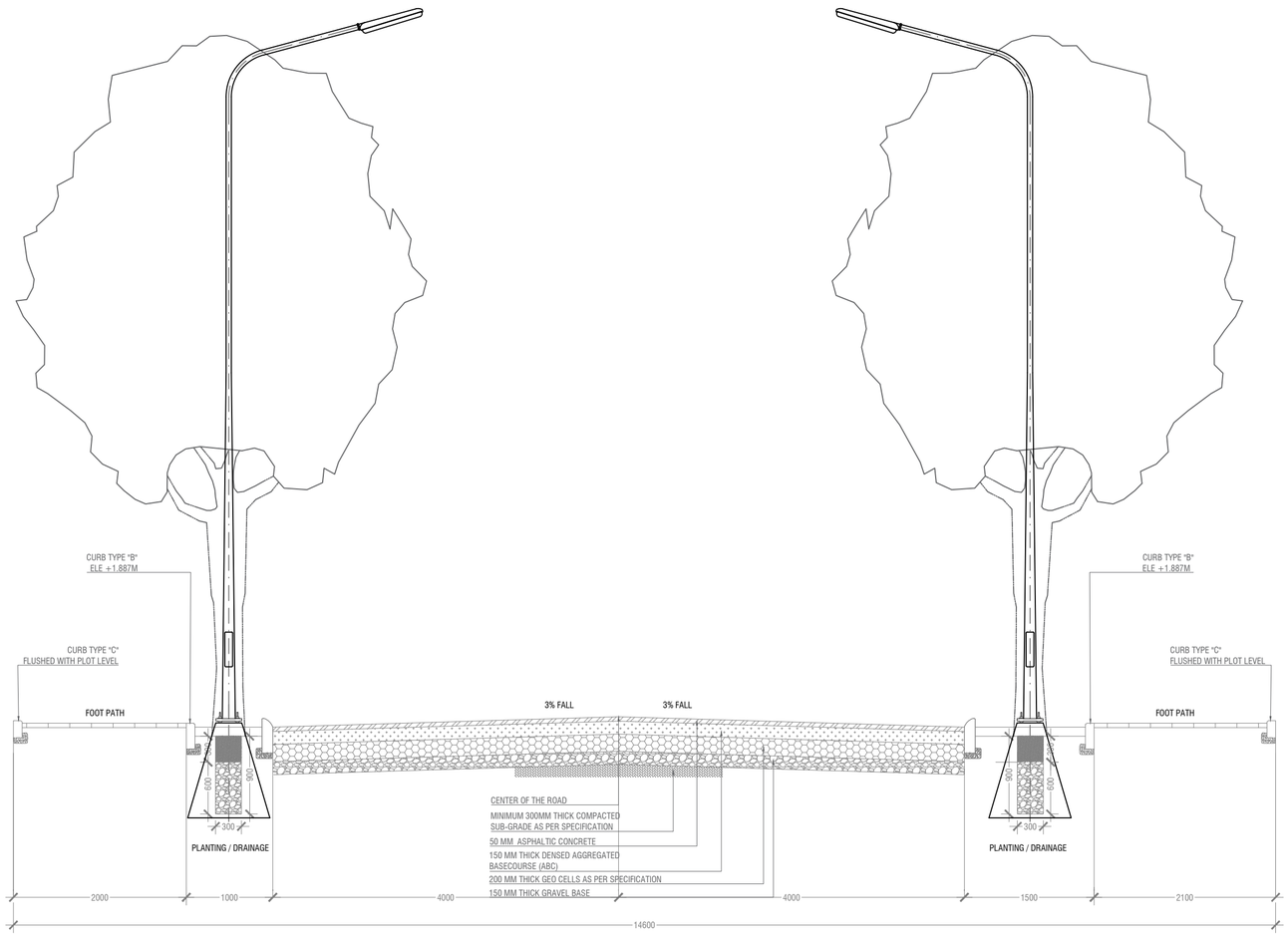

F-F

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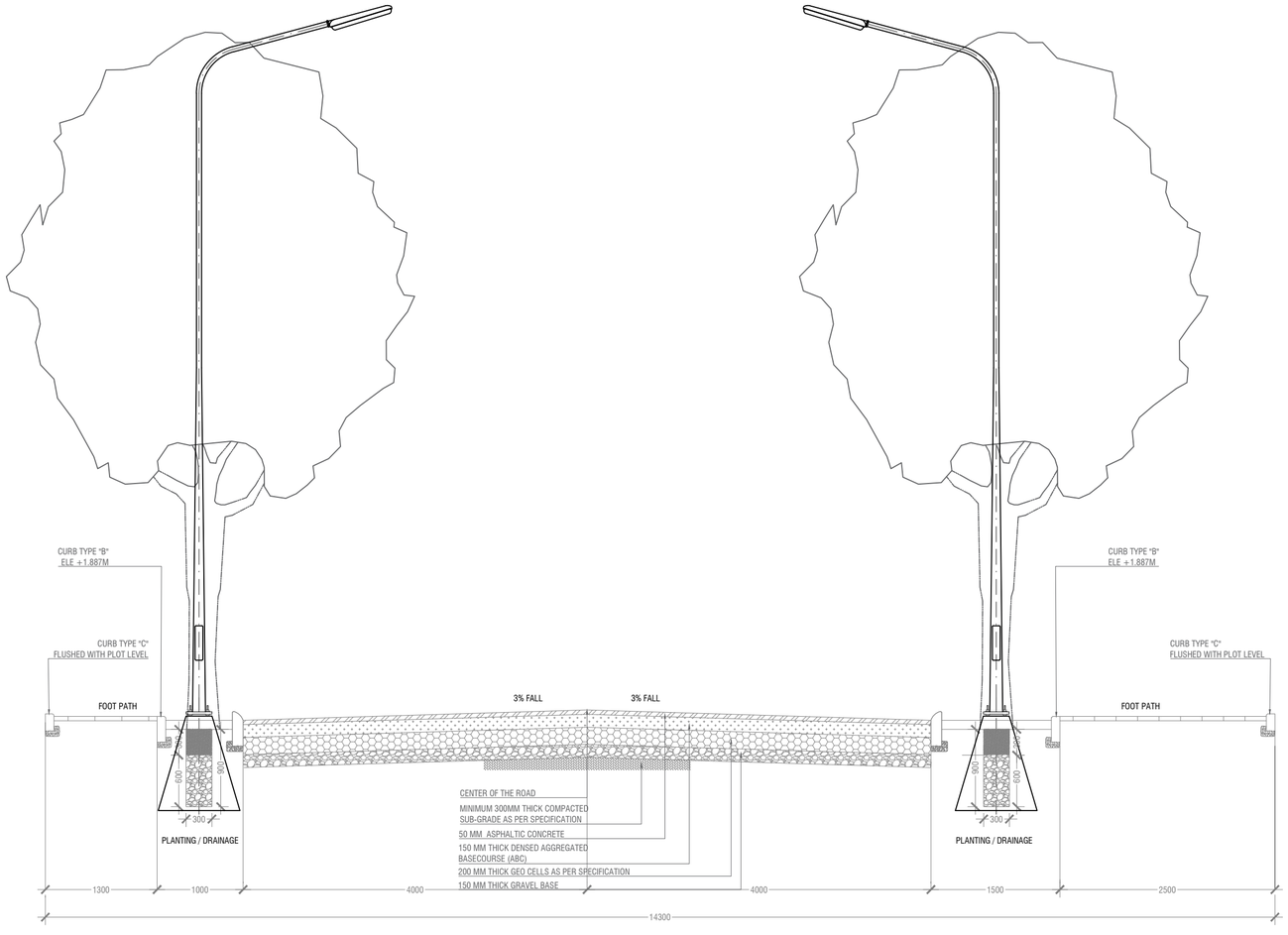

H-H

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SECTION H

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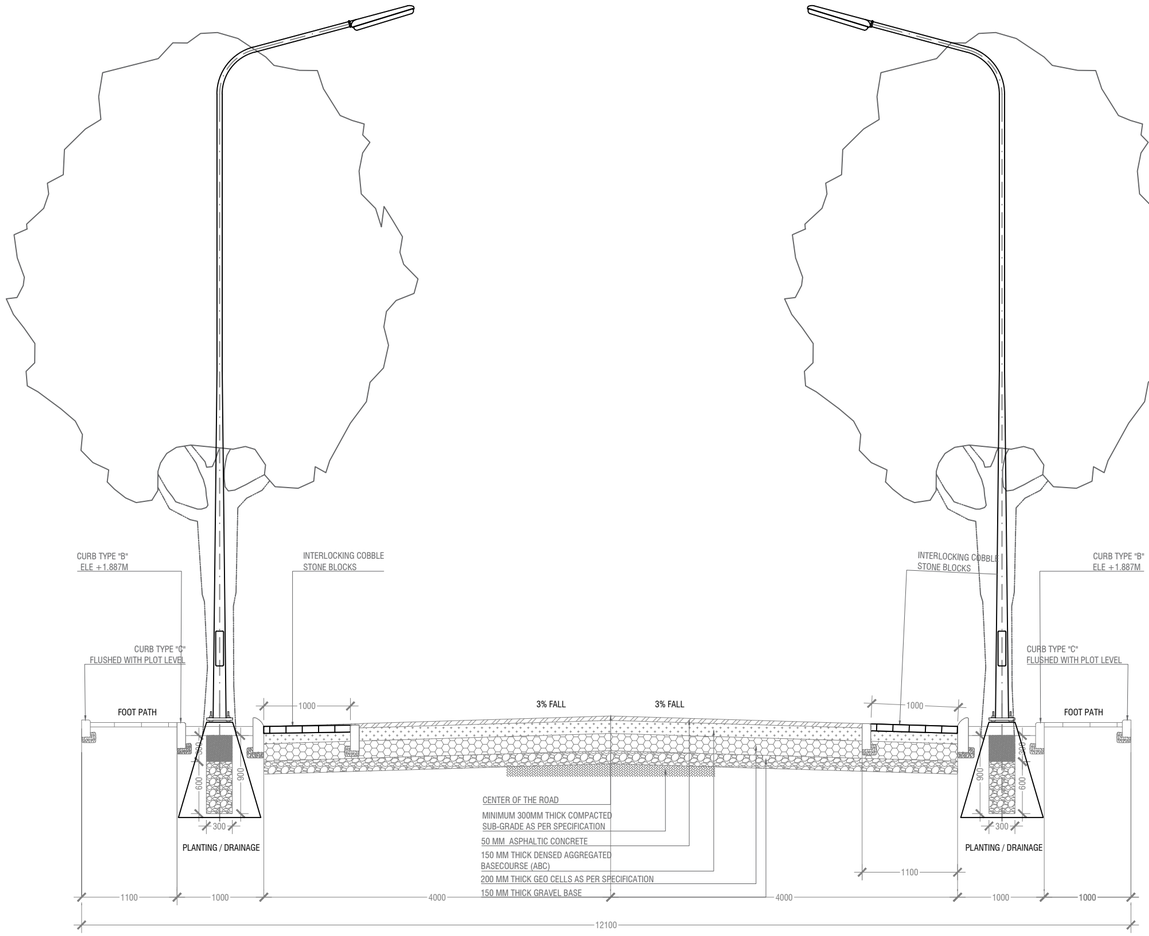

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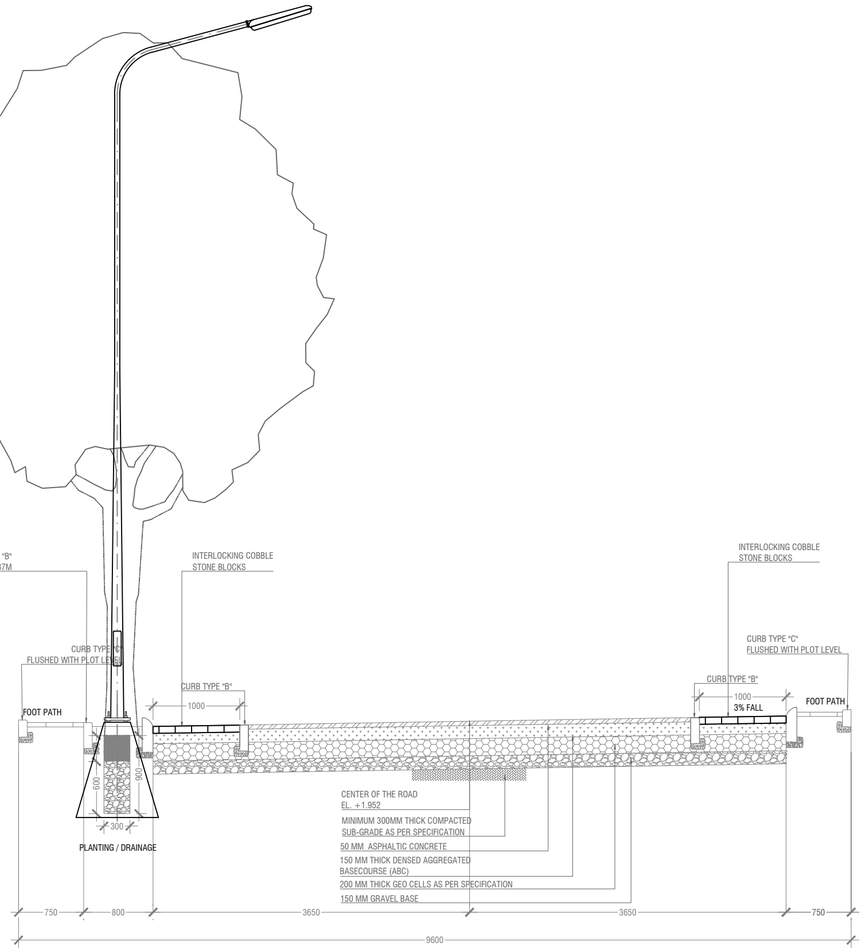

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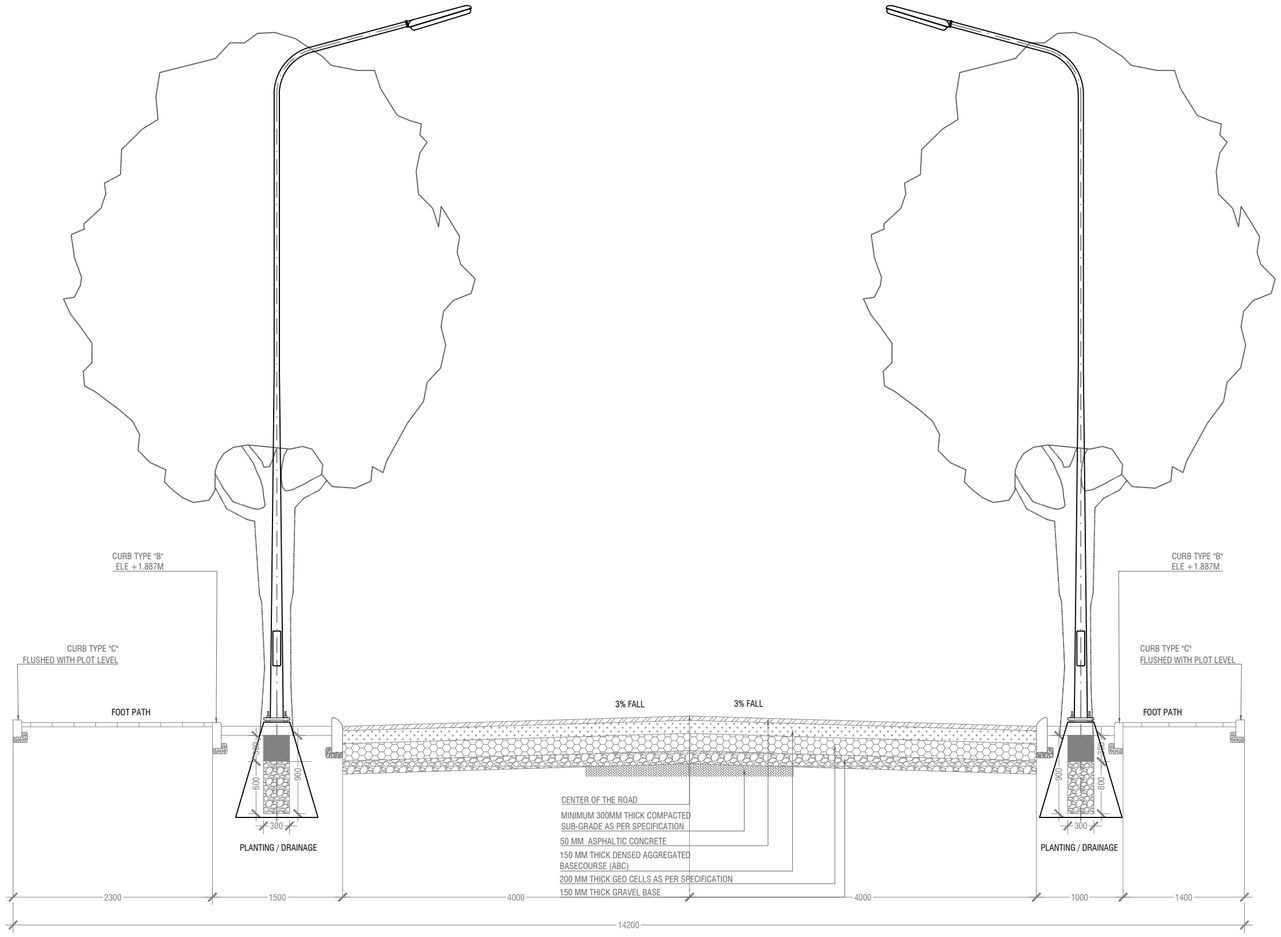
SECTION I AND P

PAGE NO.

11



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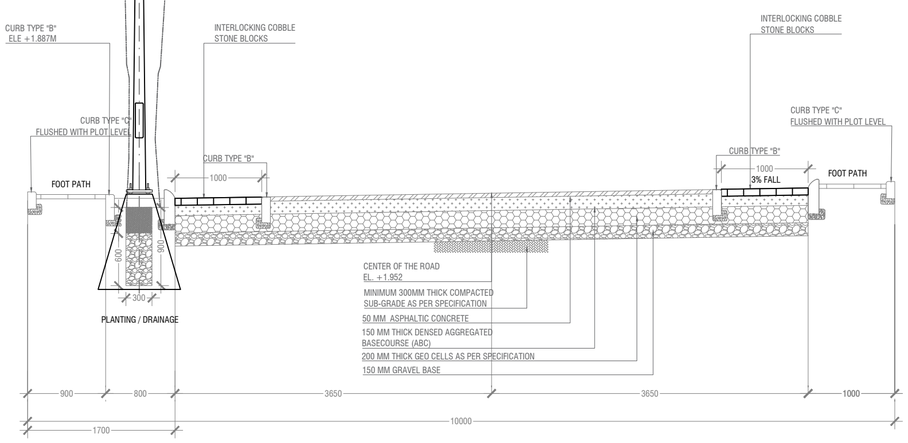

K-K

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SECTION J AND K

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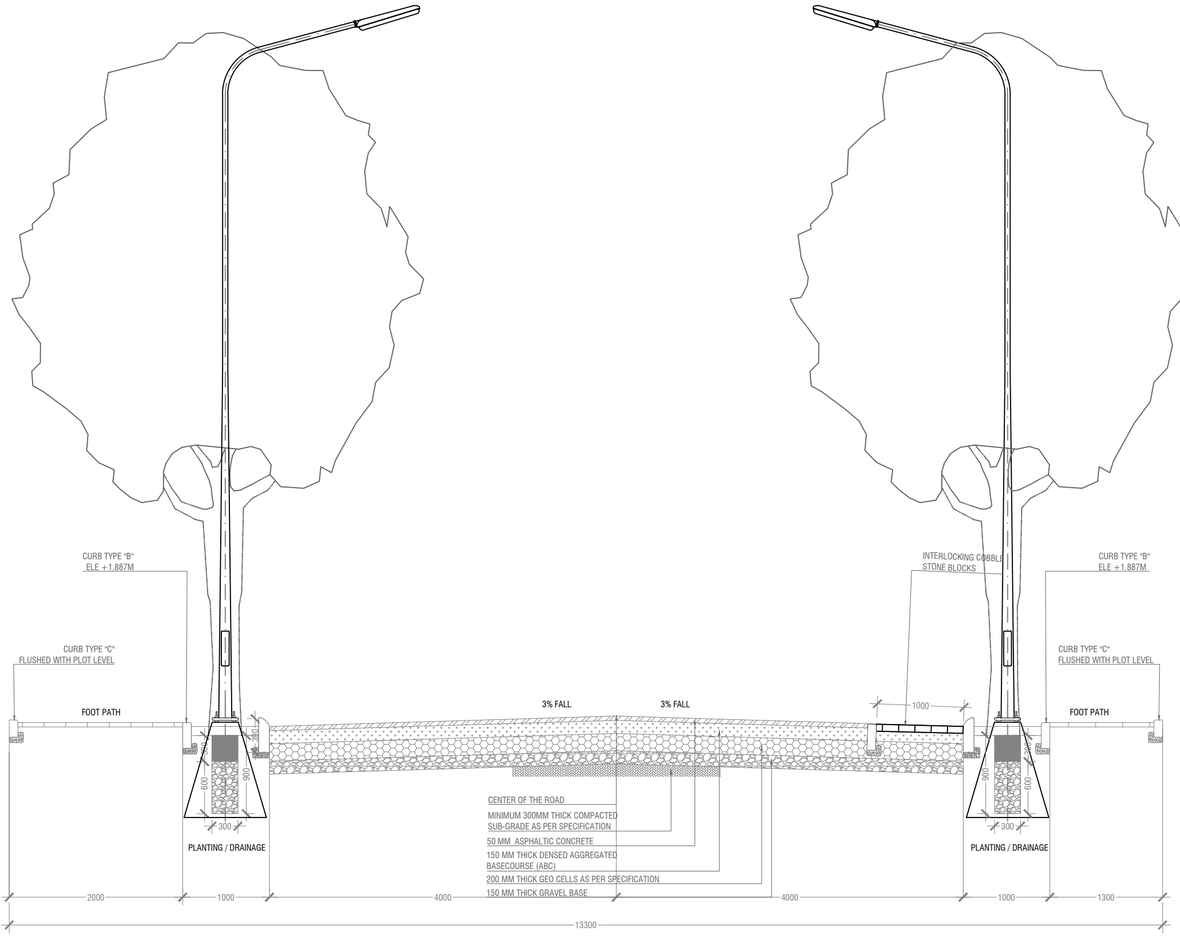

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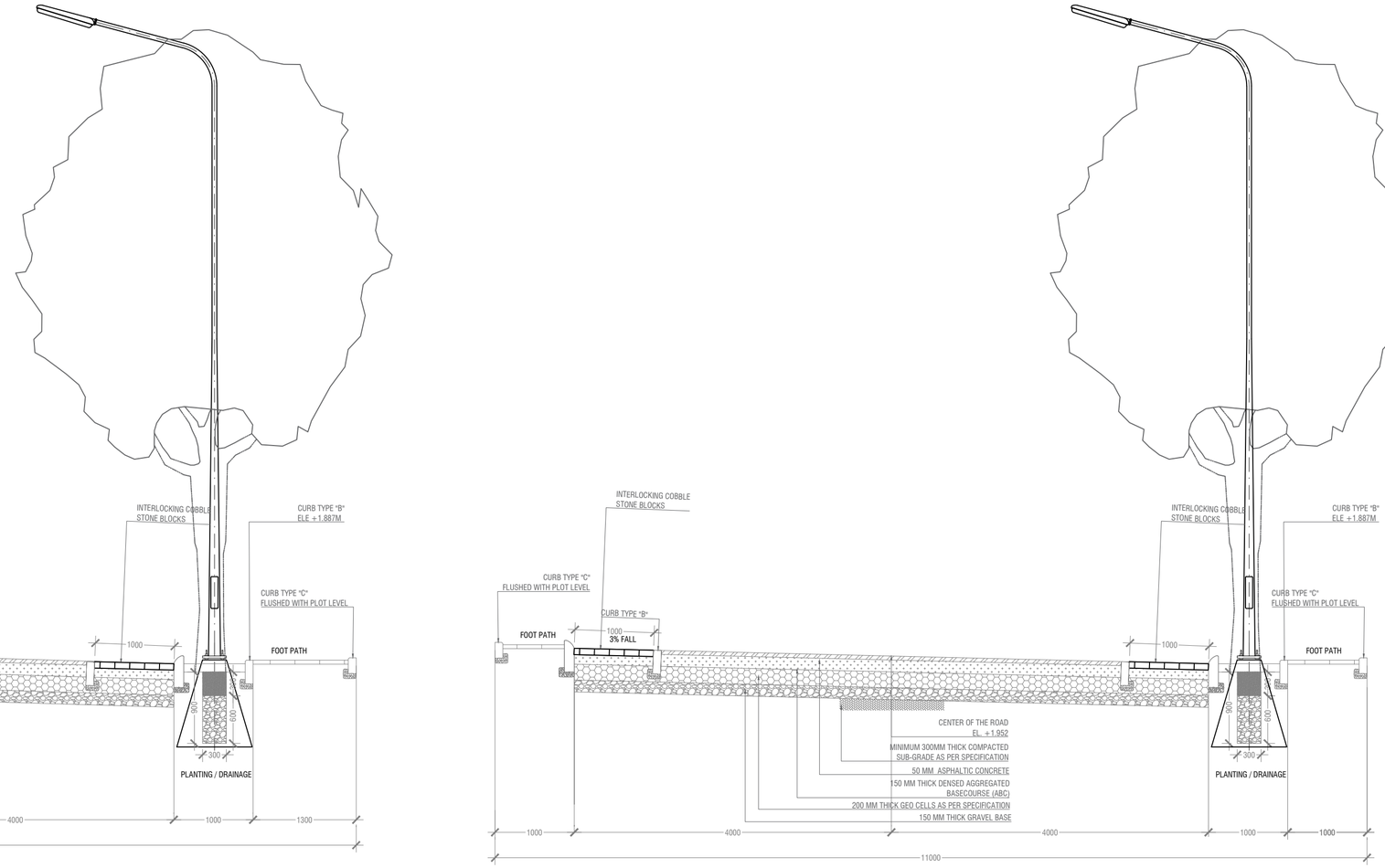

M-M

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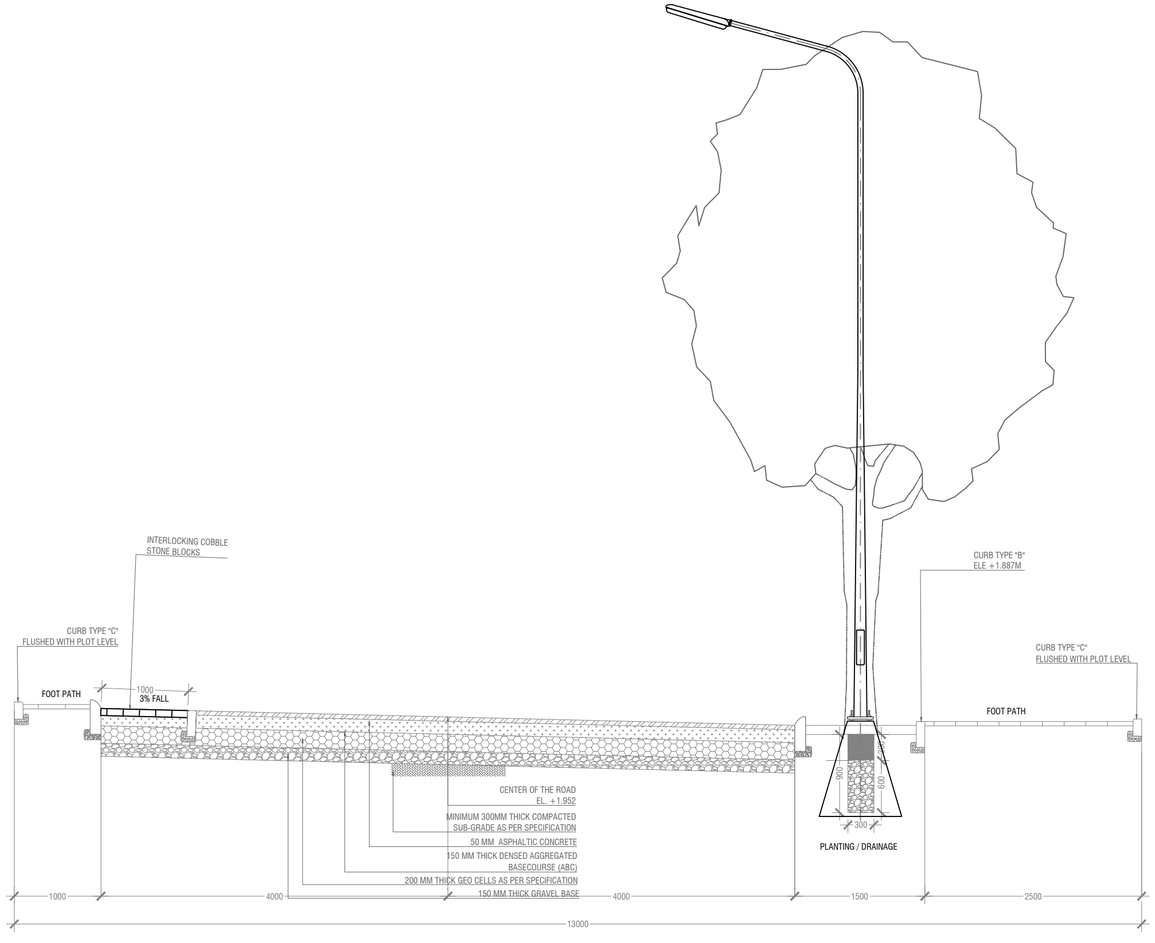

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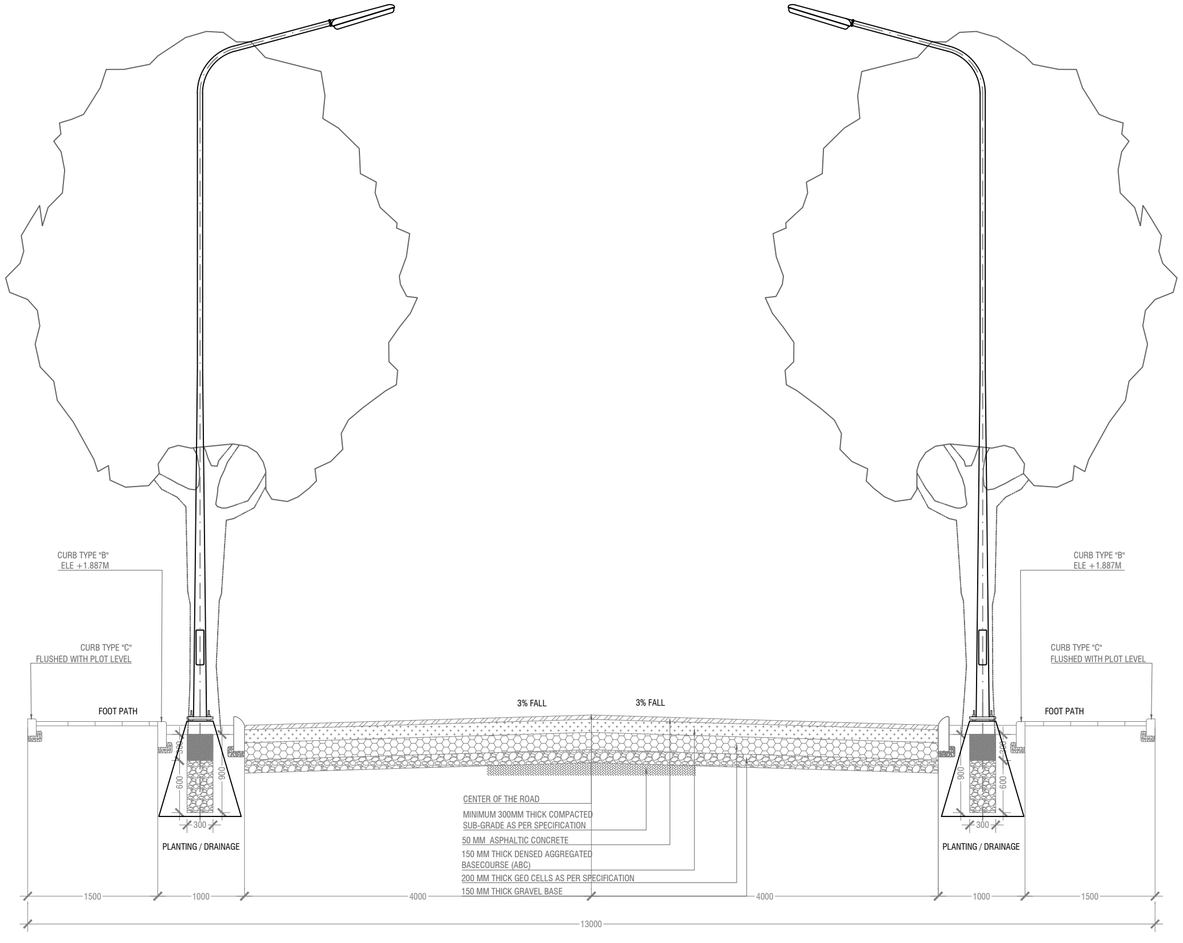

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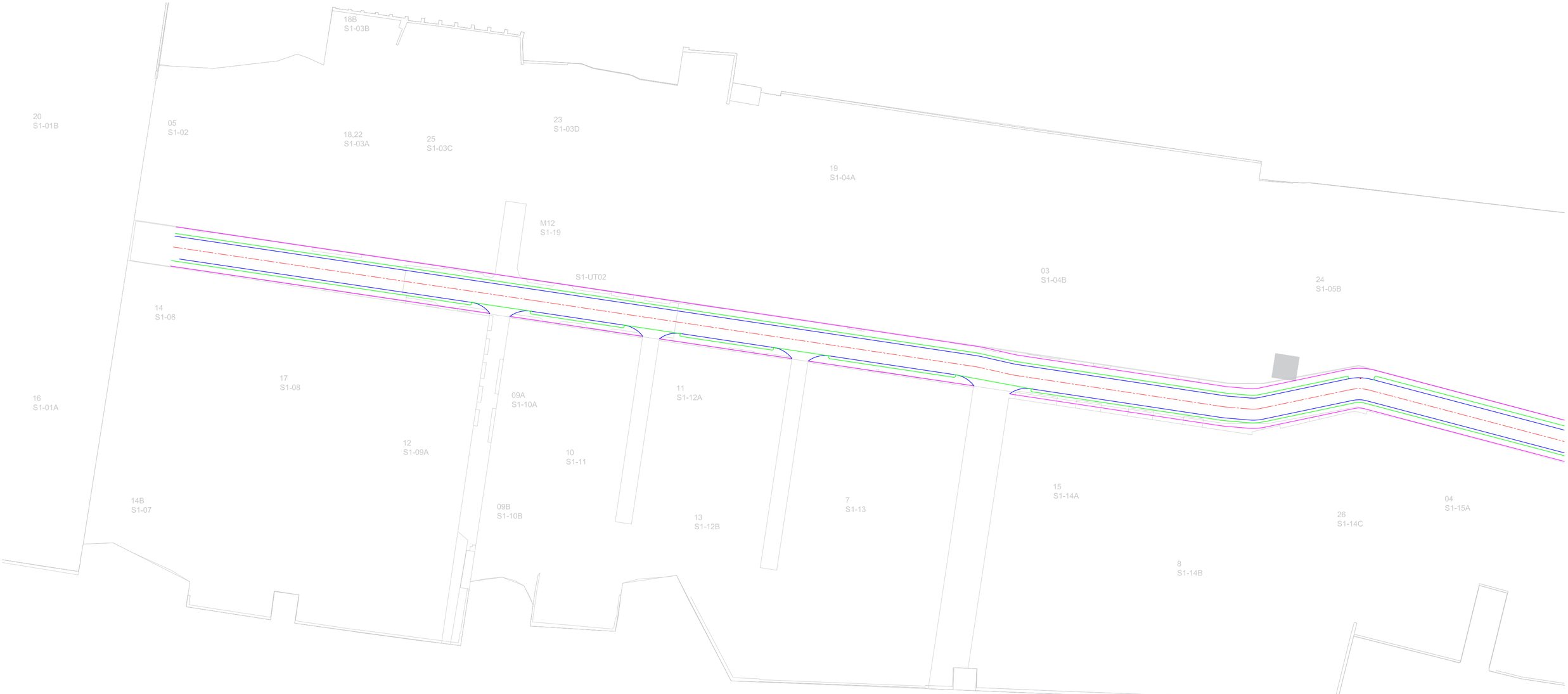

CURB LEGEND

- A- Curb:
- B- Curb:
- C- Curb:
- Center Line:
- Paved Area:
- Catch Pit:

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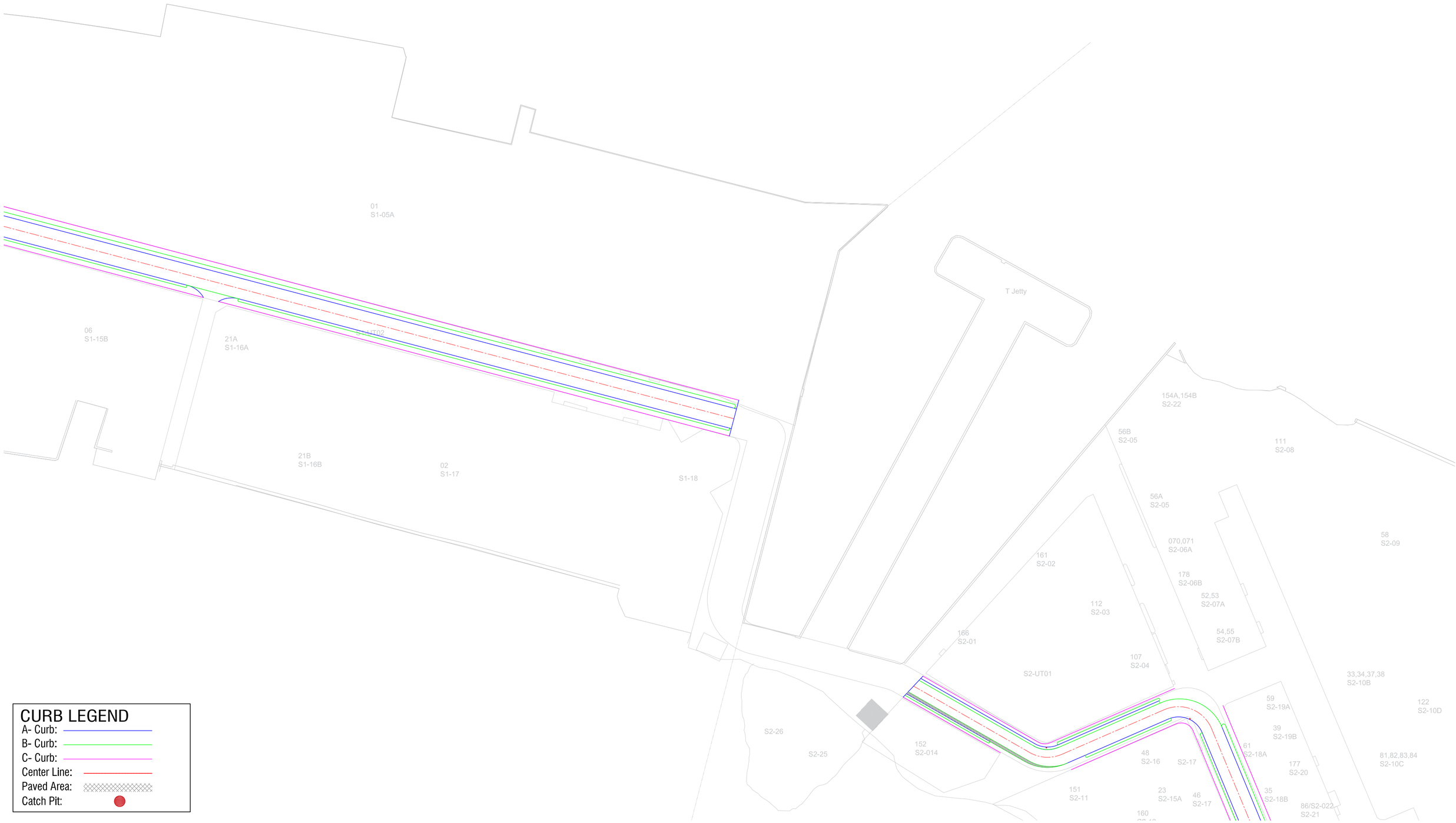

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HUSSAIN SALIQ — Structural

DRAWN BY:

AMEEN/DHIL/SAMAHA/AYSHA

7/09/2021

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CHECKED BY:

Architectural

HUSSAIN SALIQ — Structural

MOHAMED YAMEEN — Services

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APPROVED BY:

SAEED ADAM

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SHEET CONTENT:

CURBS LAYOUT PT 4

PAGE NO.

18

CURB LEGEND

- A- Curb:
- B- Curb:
- C- Curb:
- Center Line:
- Paved Area:
- Catch Pit:

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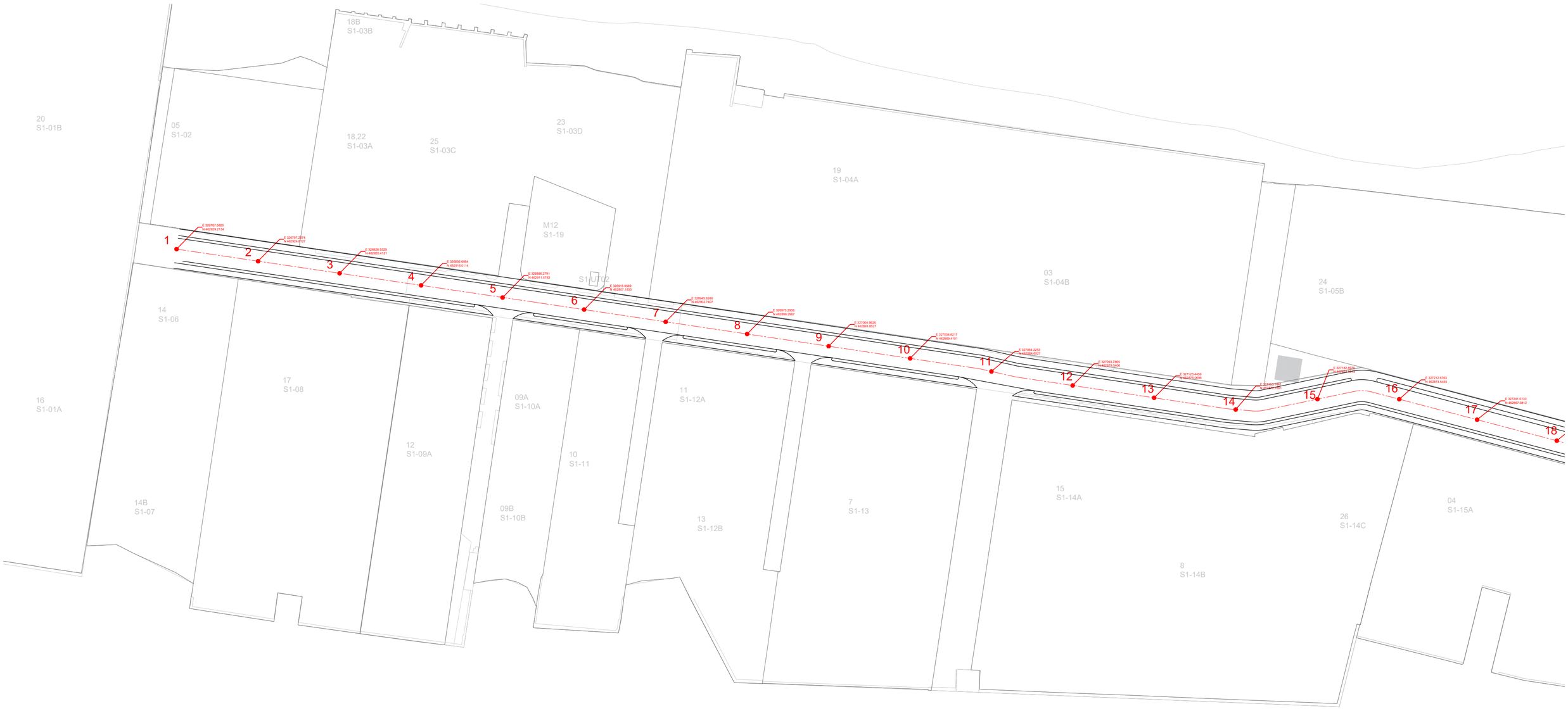
CURBS LAYOUT PT 5

PAGE NO.
19



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LAYOUT PT1

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20

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COORDINATES
LAYOUT PT5

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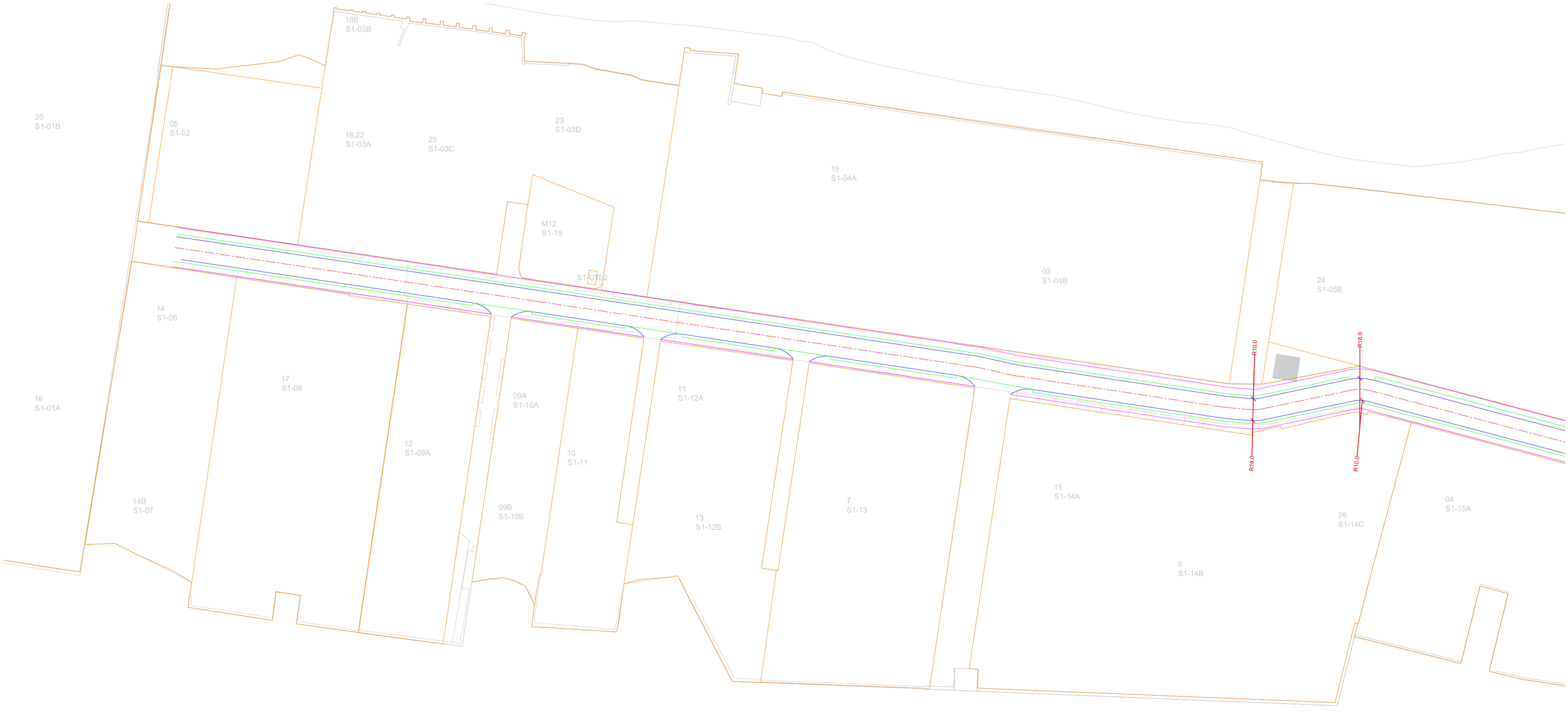
24



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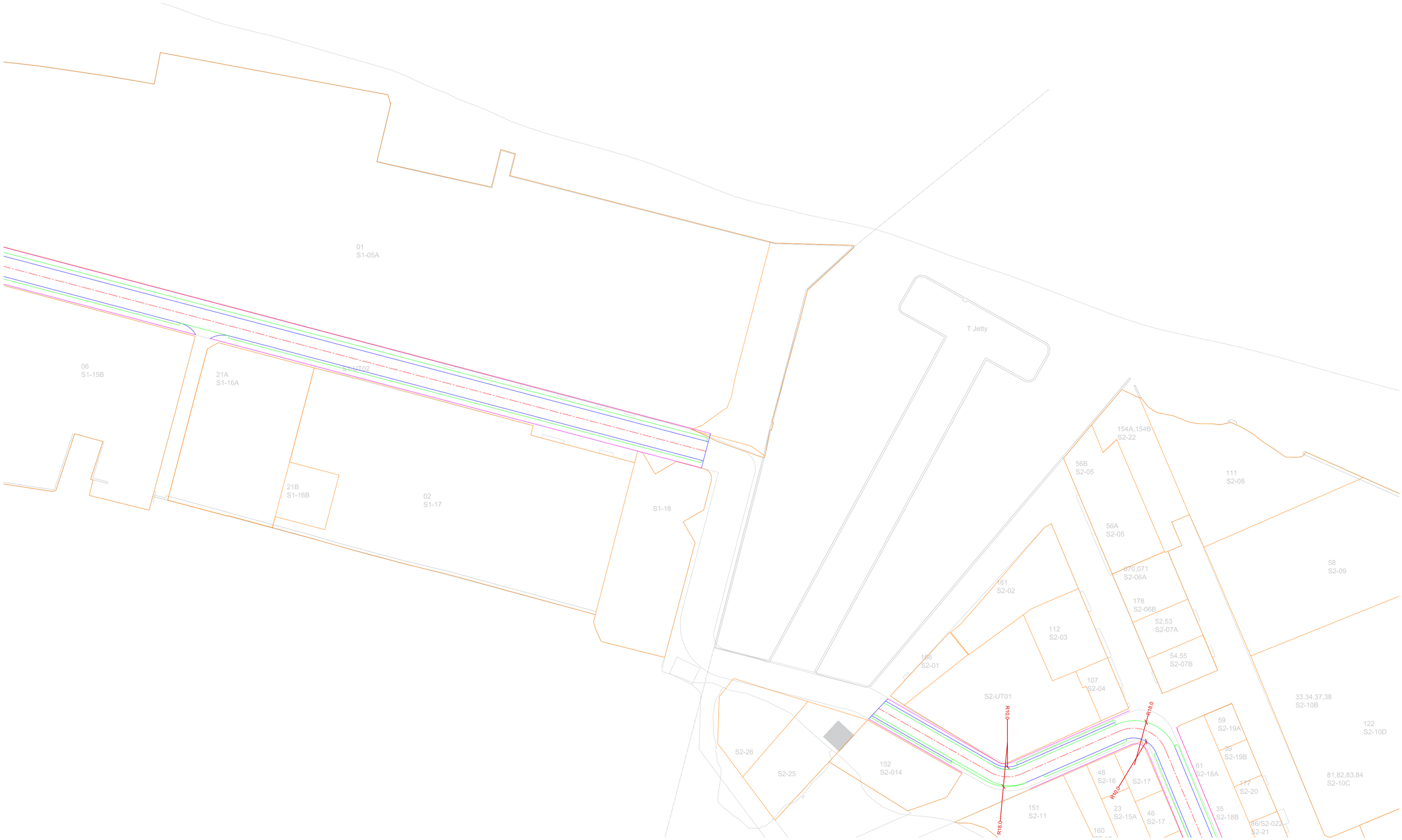
RADIUS LAYOUT PT1

PAGE NO.
25



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RADIUS LAYOUT PT2

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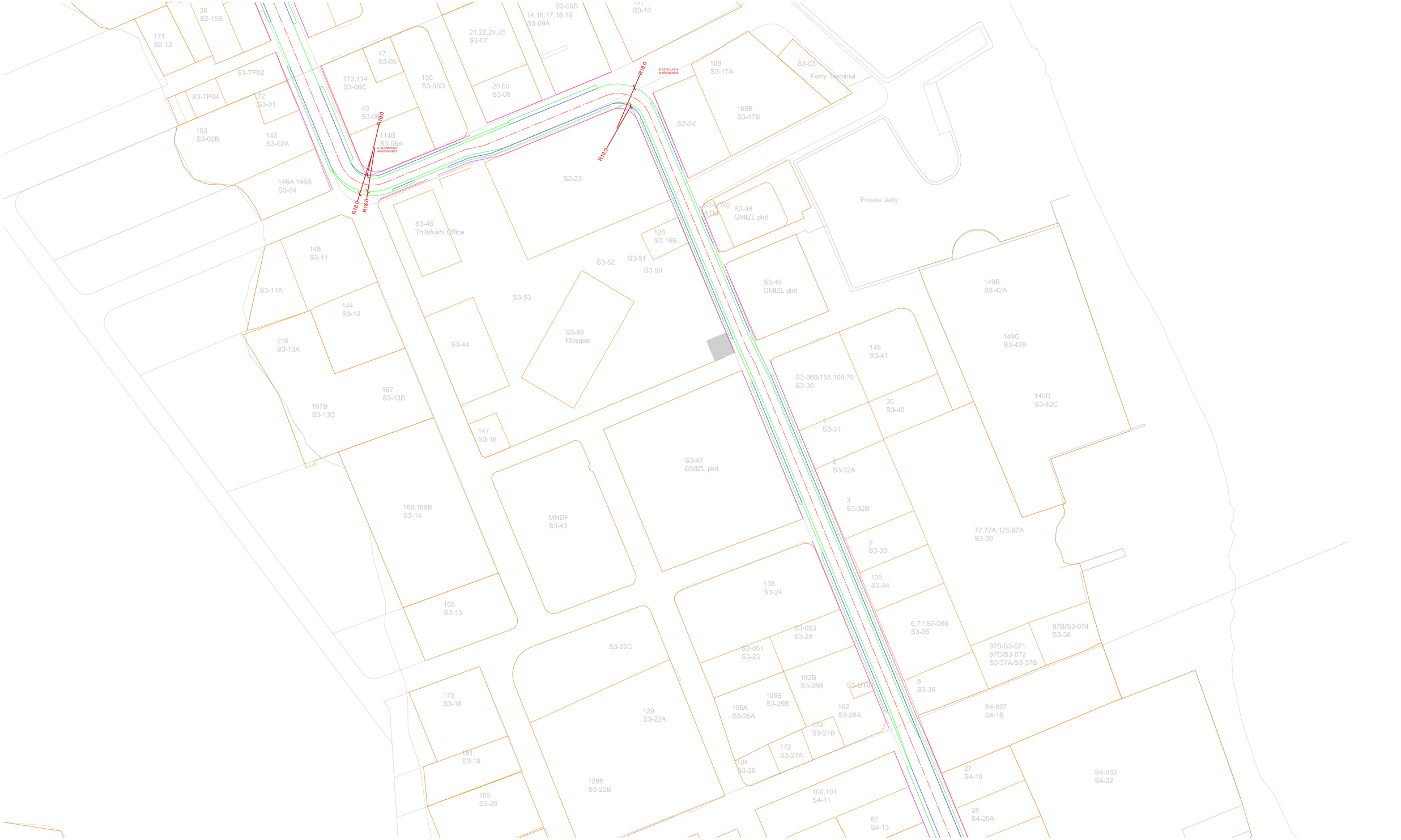
26



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		AMEEN/DHIL/SAMAHA/AYSHA		**HUSSAIN SALIQ**		RADIUS LAYOUT PT3	27
		7/09/2021	Architectural	Structural			
		REVISION					
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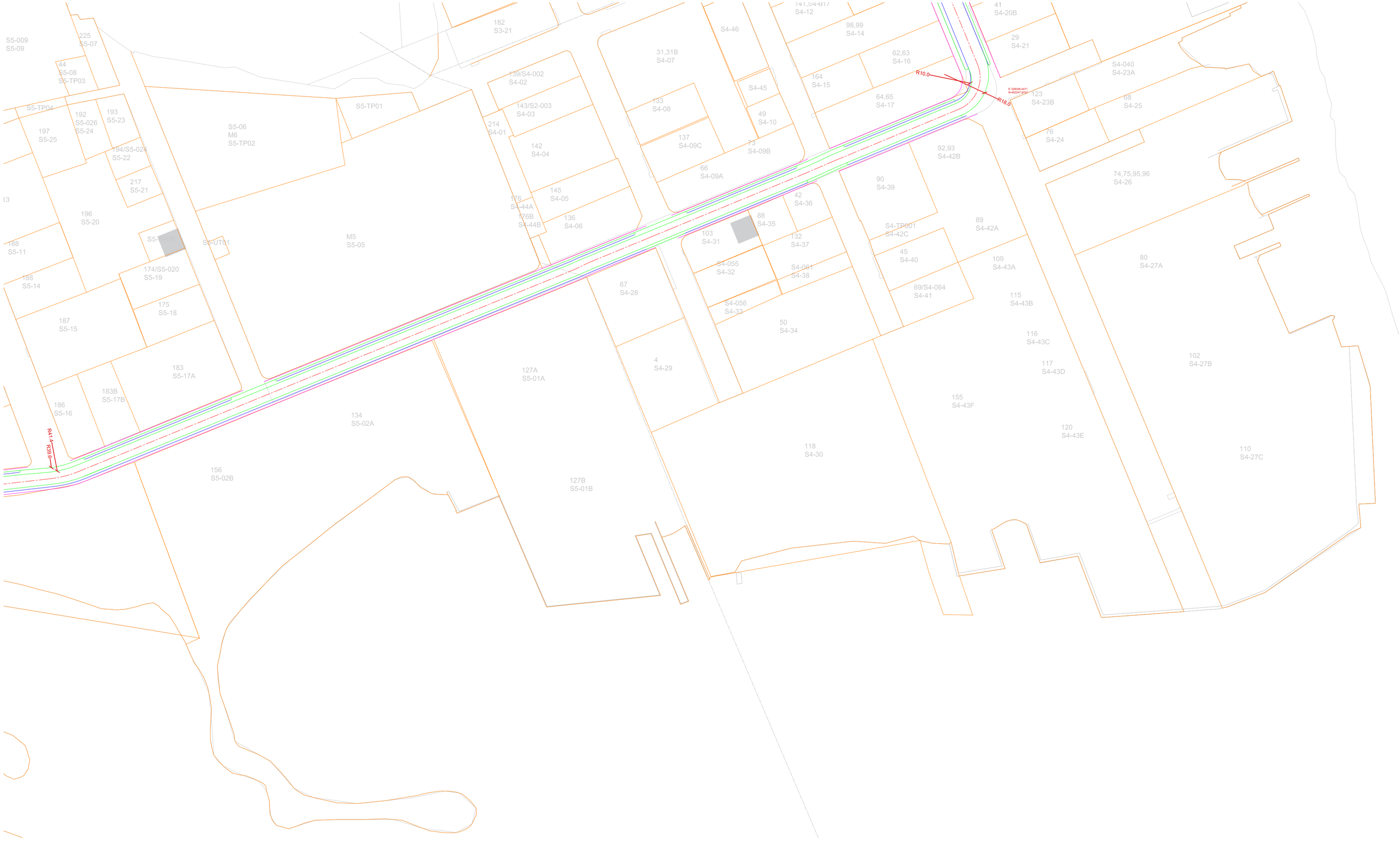
Architectural	Structural	SHEET NO:	Services	Communication	**DECEMBER 2022**		



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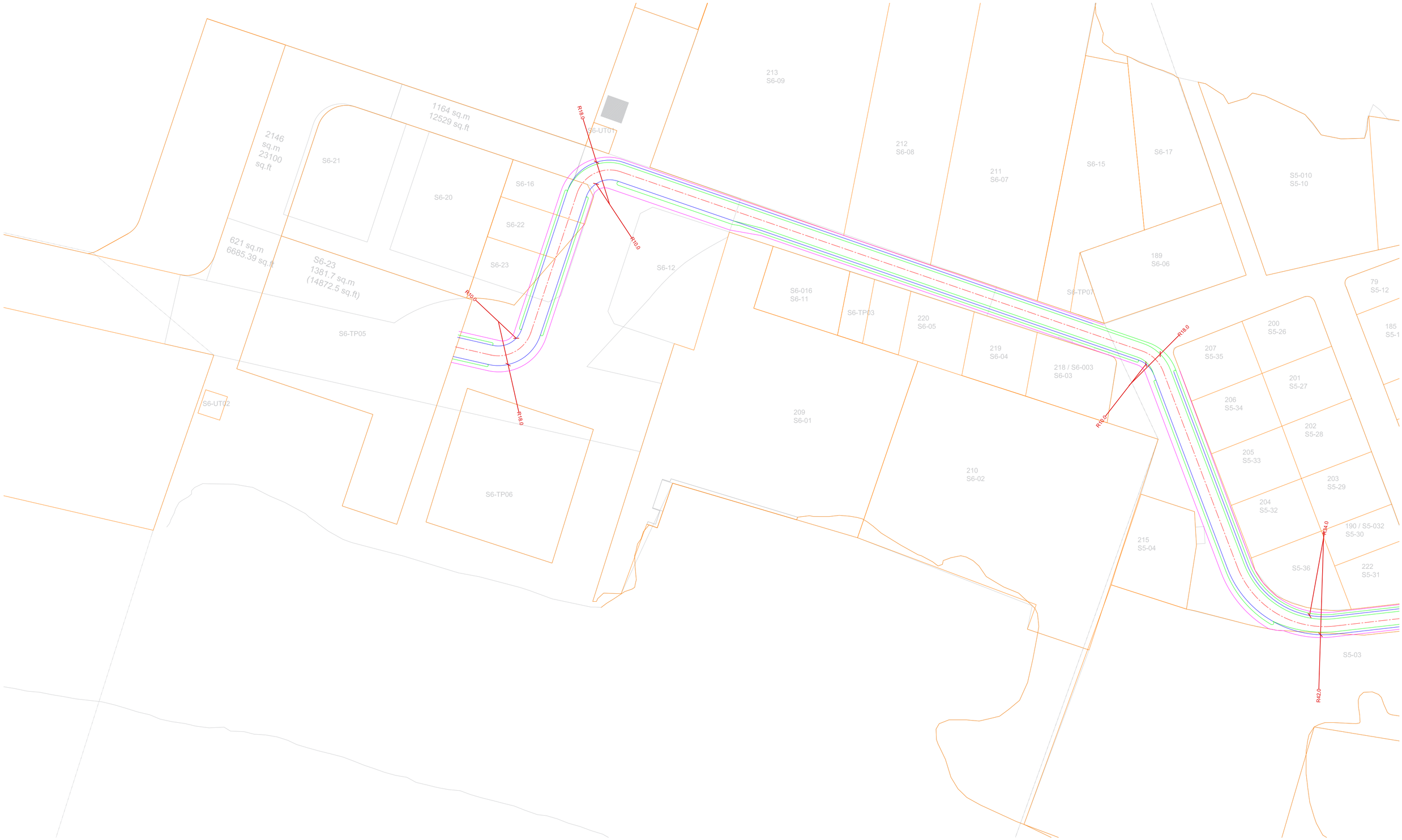
RADIUS LAYOUT PT4

PAGE NO.
28



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RADIUS LAYOUT PT5

PAGE NO.
29

SERVICES LEGEND

EJB [0.8 x 1.4m]

TJB [1.2 x 0.6 x 0.8m]

GPON MANHOLE [1.7 x 0.8 x 1m]

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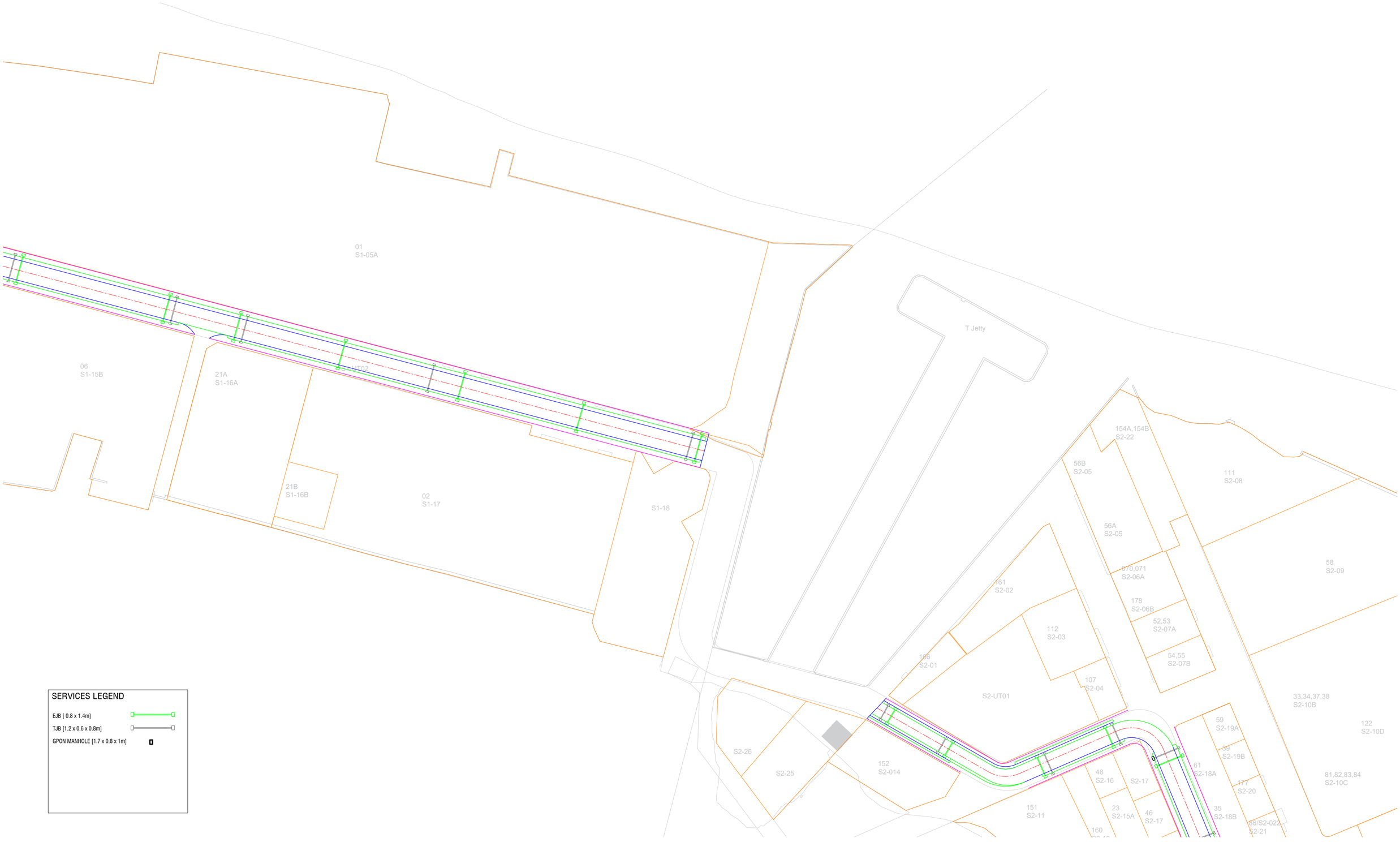
SHEET CONTENT:

EJB TJB PT1

PAGE NO.

30



SERVICES LEGEND

EJB [0.8 x 1.4m]

TJB [1.2 x 0.6 x 0.8m]

GPON MANHOLE [1.7 x 0.8 x 1m]

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SHEET CONTENT:

EJB TJB PT2

PAGE NO.

31

SERVICES LEGEND

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TJB [1.2 x 0.6 x 0.8m]

GPON MANHOLE [1.7 x 0.8 x 1m]

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EJB TJB PT3

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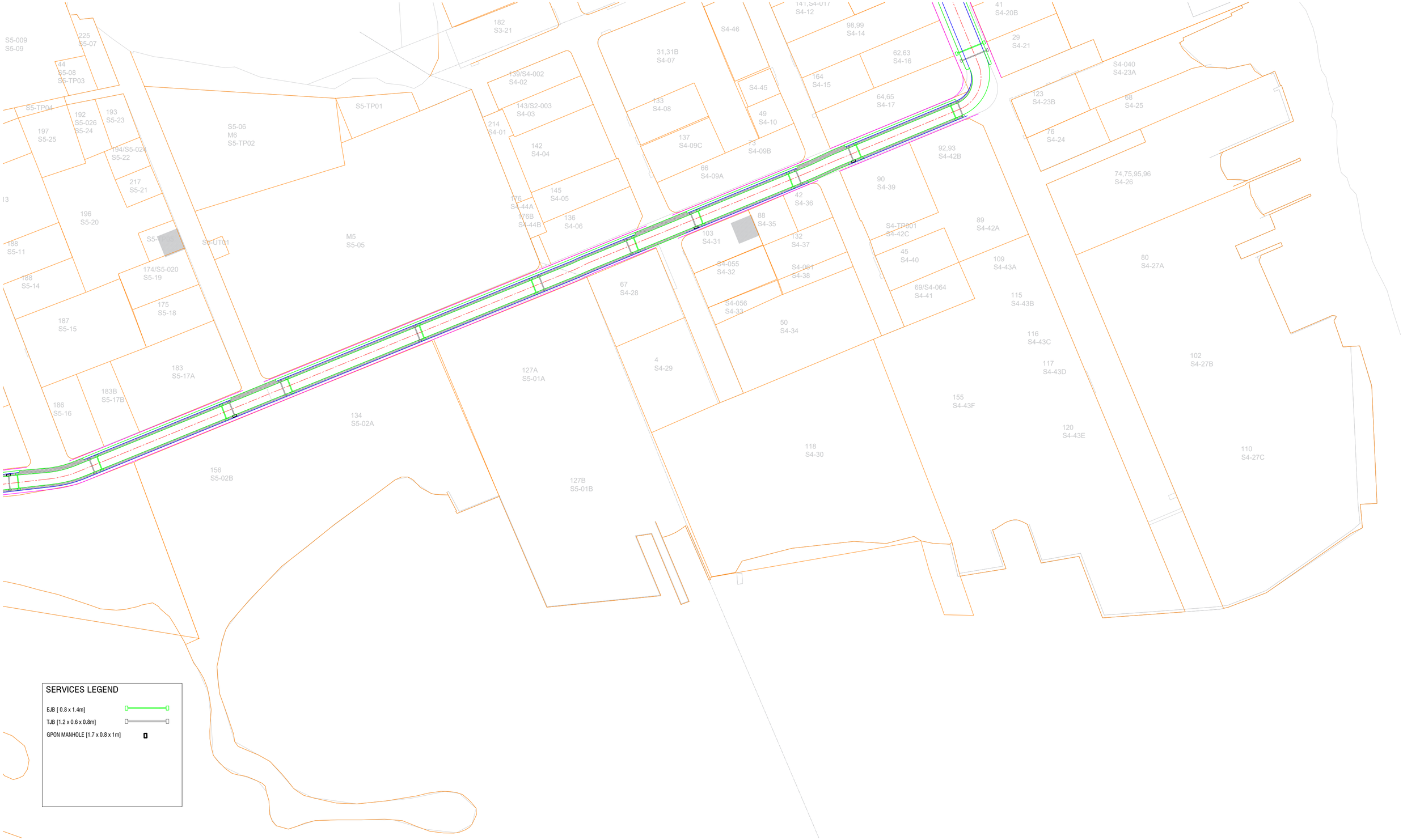
32



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EJB TJB PT4

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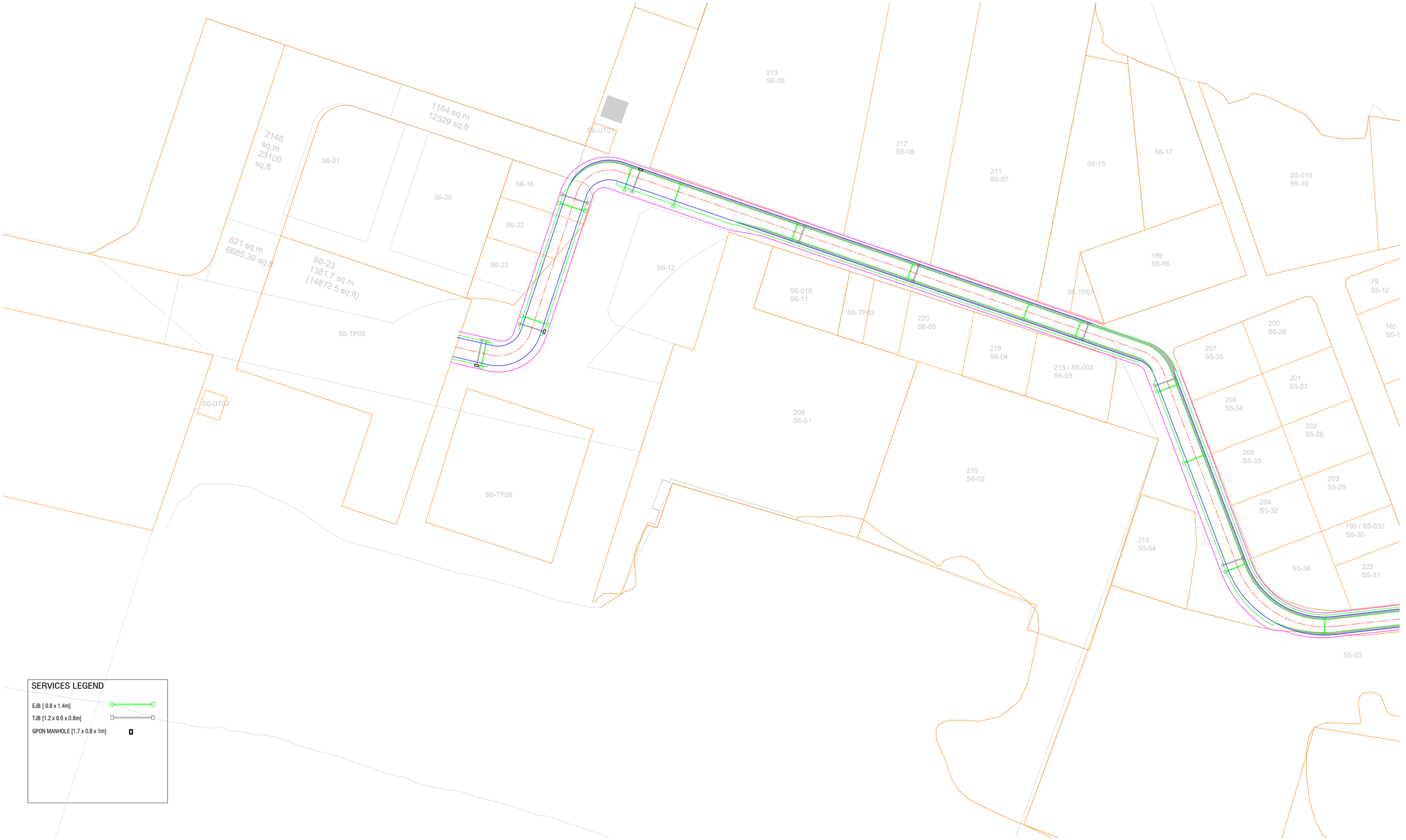
33



SERVICES LEGEND

- EJB [0.8 x 1.4m]
- TJB [1.2 x 0.6 x 0.8m]
- GPON MANHOLE [1.7 x 0.8 x 1m]

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EJB TJB PT5

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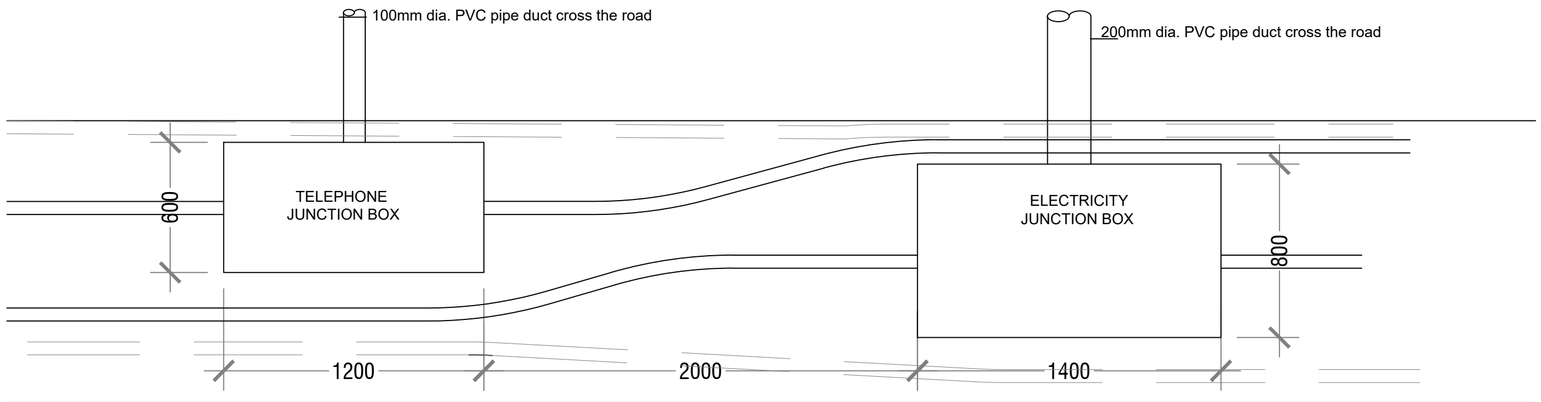

NOTE:

DEPTH FOR DUCT IS 750MM FROM FOOT PATH TO DUCT BOTTOM

DUCTS TO GO UNDER JUNCTION BOX IF NOT AMPLE SPACE WITHIN THE CORRIDOR

JUNCTION BOXES ARRANGEMENT AT ROAD CROSSINGS FOR DUCTS

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SHEET CONTENT:
EJB TJB JUNCTION BOXES ARRANGEMENT AT ROAD CROSSINGS FOR DUCTS

PAGE NO.
35

SERVICES LEGEND

50W STREET LIGHT	⊠
100W STREET LIGHT	⊠

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SHEET CONTENT:
LIGHTING LAYOUT
PTT

PAGE NO.
36

SERVICES LEGEND

50W STREET LIGHT	⊠
100W STREET LIGHT	⊠

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DECEMBER 2022

SHEET CONTENT:

LIGHTING LAYOUT
PTZ

PAGE NO.

37

SERVICES LEGEND

50W STREET LIGHT	⊠
100W STREET LIGHT	⊠

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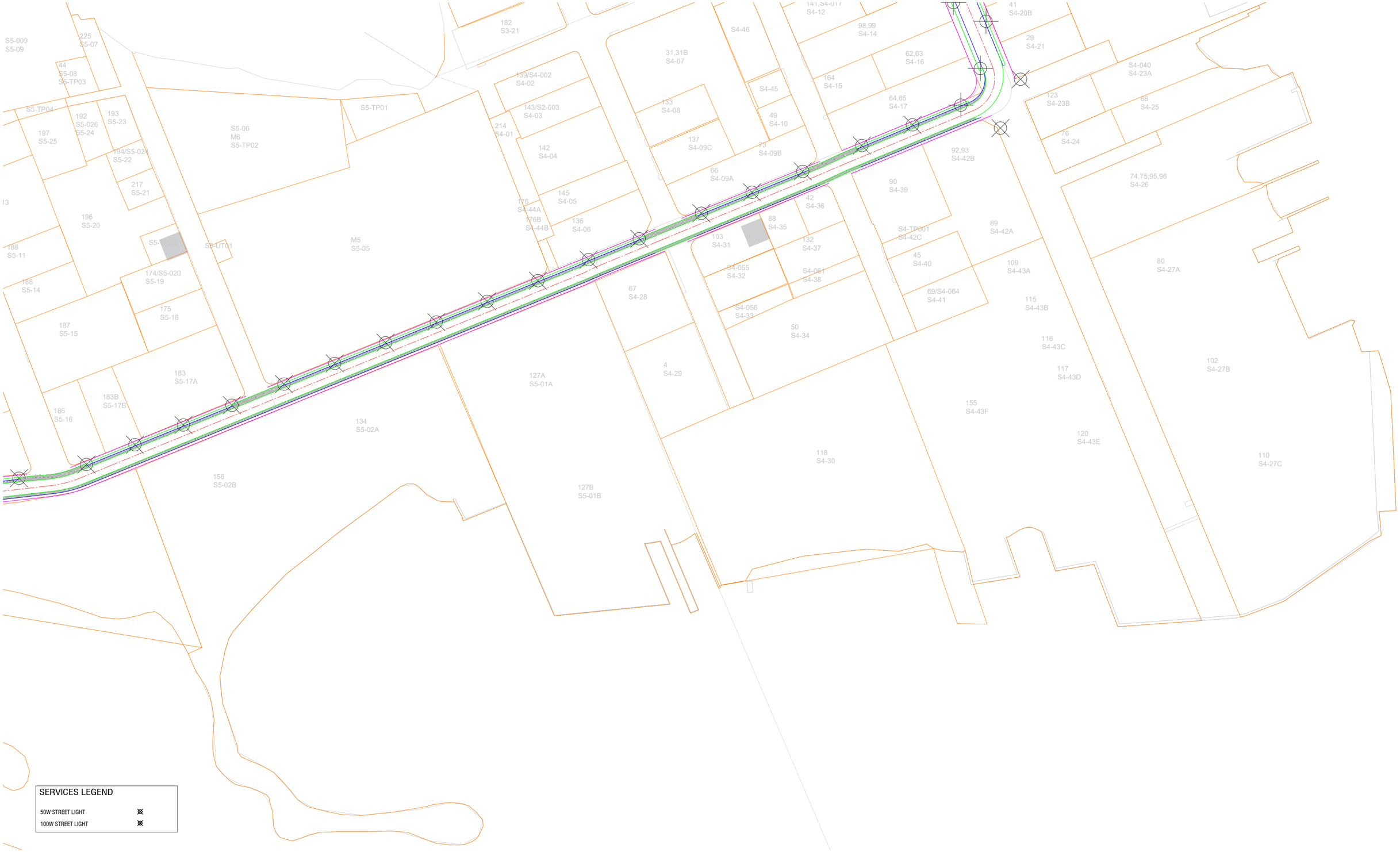
Architectural	Structural	7/09/2021	Architectural	Structural			
		REVISION - -	MOHAMED YAMEEN		SAEED ADAM		
		SCALE: SHEET NO:	Services	Communication	DECEMBER 2022		



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AMEEN/DHIL/SAMAHA Architectural
HUSSAIN SALIQ Structural

DRAWN BY:
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Architectural
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MOHAMED YAMEEN Services
Communication

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DECEMBER 2022

SHEET CONTENT:
LIGHTING LAYOUT
P14

PAGE NO.
39

SERVICES LEGEND

50W STREET LIGHT	⊠
100W STREET LIGHT	⊠

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HUSSAIN SALIQ Structural

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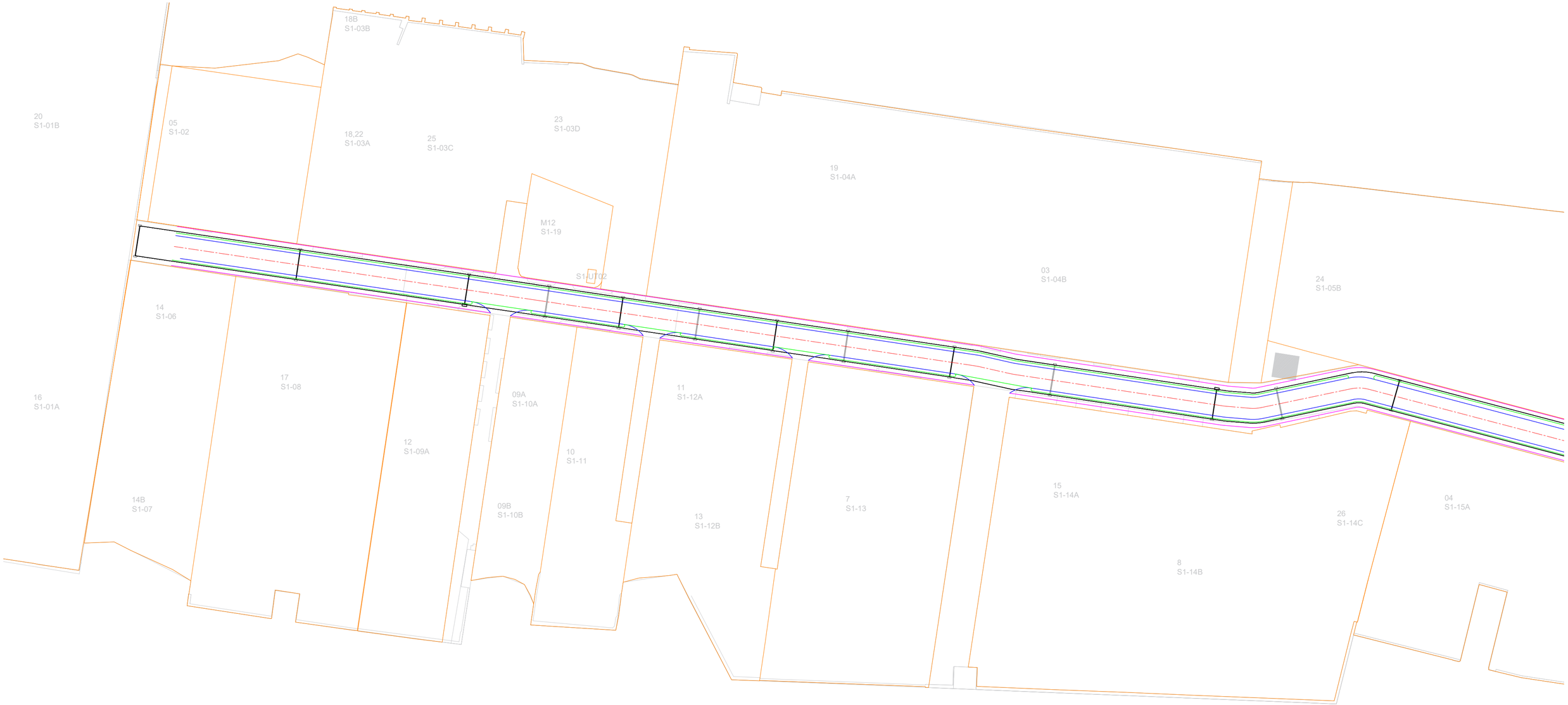
SHEET CONTENT:
LIGHTING LAYOUT
PT5

PAGE NO.
40



SERVICES LEGEND

GPON DUCT ROUTE
[1PIPE 100mm with 7-way 25mm]

TJB [1.2 x 0.6 x 0.8m]

GPON MANHOLE [1.7 x 0.8 x 1m]

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SHEET CONTENT:

GPON LAYOUT PT1

PAGE NO.

41

SERVICES LEGEND

GPON DUCT ROUTE
[1PIPE 100mm with 7-way 25mm]

TJB [1.2 x 0.6 x 0.8m]

GPON MANHOLE [1.7 x 0.8 x 1m]

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SHEET CONTENT:

GPON LAYOUT PT2

PAGE NO.

42

SERVICES LEGEND

GPON DUCT ROUTE
[1PIPE 100mm with 7-way 25mm]

TJB [1.2 x 0.6 x 0.8m]

GPON MANHOLE [1.7 x 0.8 x 1m]

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GPON LAYOUT PT3

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43

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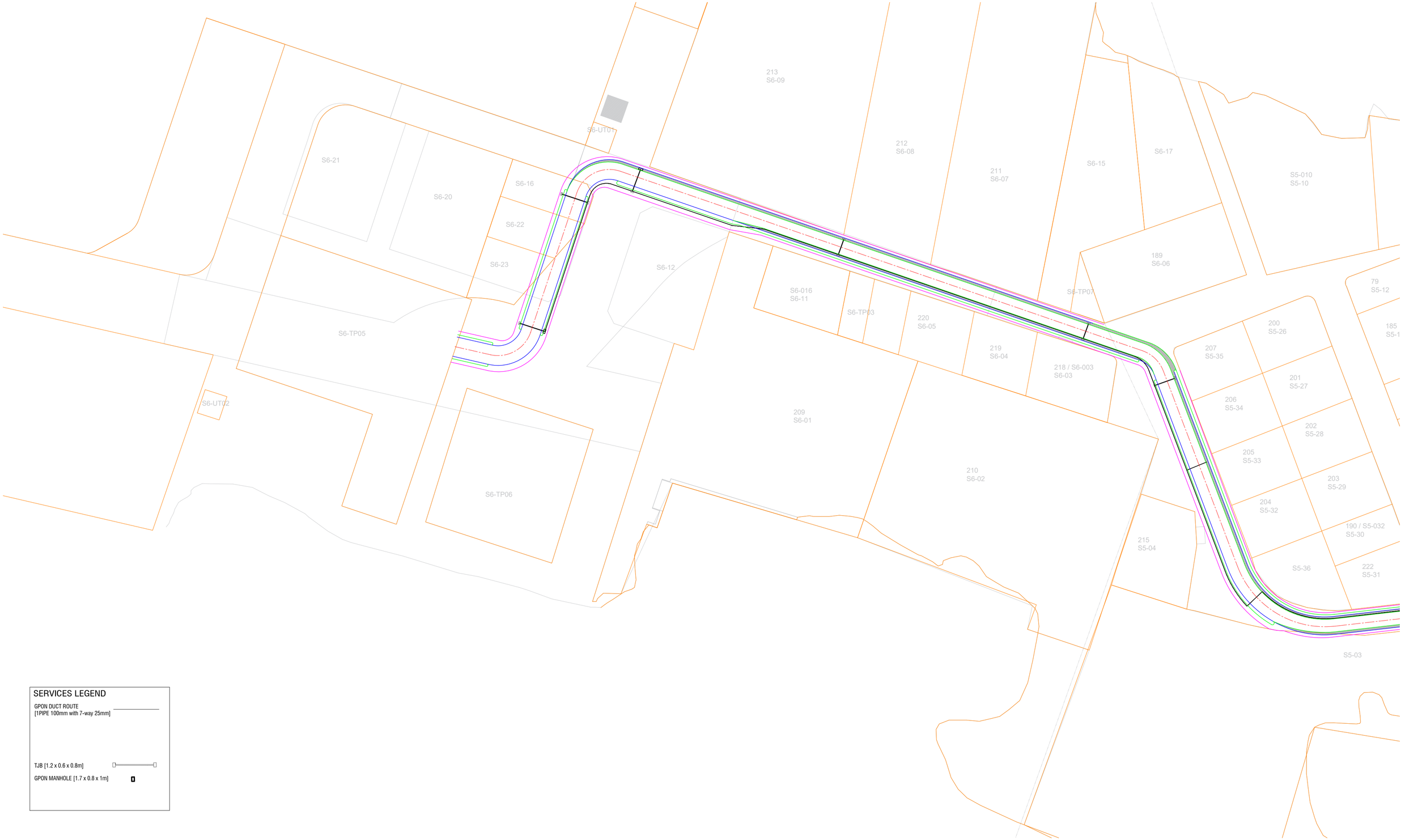
SHEET CONTENT:
GPON LAYOUT PT4

PAGE NO.
44



SERVICES LEGEND

GPON DUCT ROUTE
[1PIPE 100mm with 7-way 25mm]

TJB [1.2 x 0.6 x 0.8m]

GPON MANHOLE [1.7 x 0.8 x 1m]

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SHEET CONTENT:
GPON LAYOUT PT5

PAGE NO.
45

LEGEND:

Pedestrian Cross

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HUSSAIN SALIQ Structural
AHMED FATHHEE Services
Communication

APPROVED BY:
HUSSAIN ZIYATH
JUNE 2021

SHEET CONTENT:
ZEBRA CROSSING & SIGN BOARD PT1

PAGE NO.
46

LEGEND:

Pedestrian Cross

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AHMED FATHHEE	
Services	Communication

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SHEET CONTENT:

ZEBRA CROSSING & SIGN BOARD PT2

PAGE NO.

47

LEGEND:

Pedestrian Cross

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SHEET CONTENT:

ZEBRA CROSSING & SIGN BOARD PT3

PAGE NO.

48

LEGEND:

Pedestrian Cross

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SHEET CONTENT:

ZEBRA CROSSING & SIGN BOARD PT4

PAGE NO.

49

LEGEND:

Pedestrian Cross

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HUSSAIN ZIYATH

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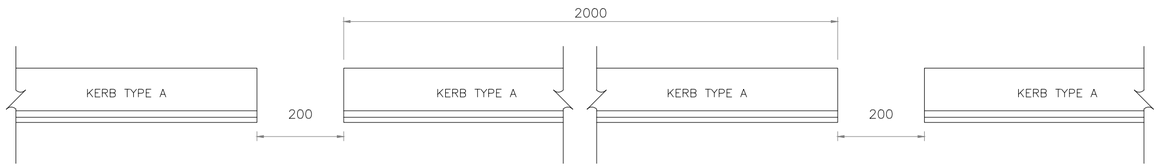
SHEET CONTENT:

ZEBRA CROSSING & SIGN BOARD PT5

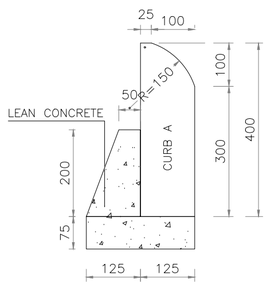
PAGE NO.

50

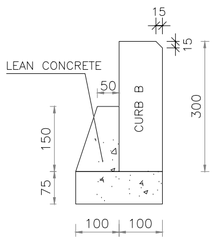


TYPICAL PLAN STROM WATER OUT LET

scale 1 : 10



CURB TYPE A



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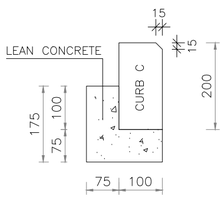
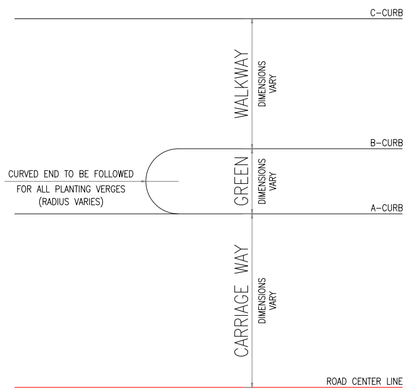


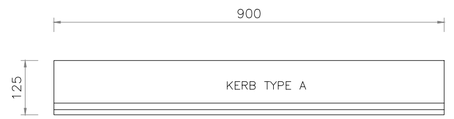
CURB TYPE C

REVISED CURB BACKING CONCRETE DETAIL



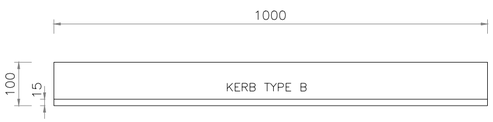
TYPICAL CURB LAYOUT

scale N.T.S.



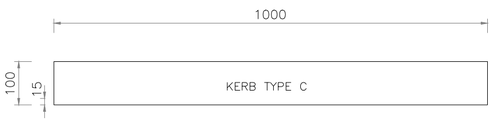
TYPICAL PLAN OF CURB TYPE "A"

scale 1 : 10



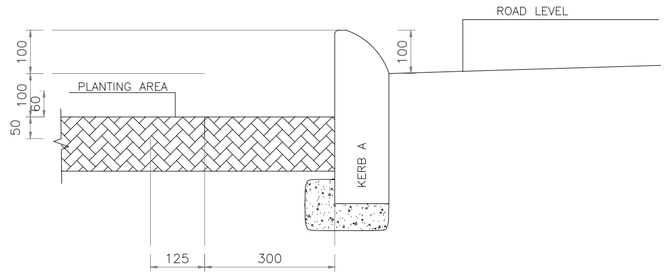
TYPICAL PLAN OF CURB TYPE "B"

scale 1 : 10



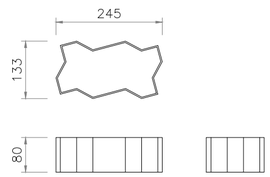
TYPICAL PLAN OF CURB TYPE "C"

scale 1 : 10



TYPICAL SECTION 1

scale 1 : 10



TYPICAL DETAIL PRECAST CONCRETE PAVING BLOCKS

scale 1 : 10

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NA	**NA**
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DRAWN BY:

AMEEN / DHILSHAN / AYSHA

7/09/2021

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AMEEN / DHILSHAN / AYSHA	**7-09-2021**

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-	**-**
Electrical & Mechanical	Communication

APPROVED BY:

NAME

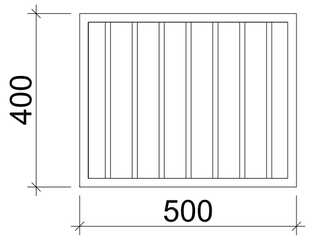
DATE

SHEET CONTENT:

CURB & BLOCK DETAILS

PAGE NO.

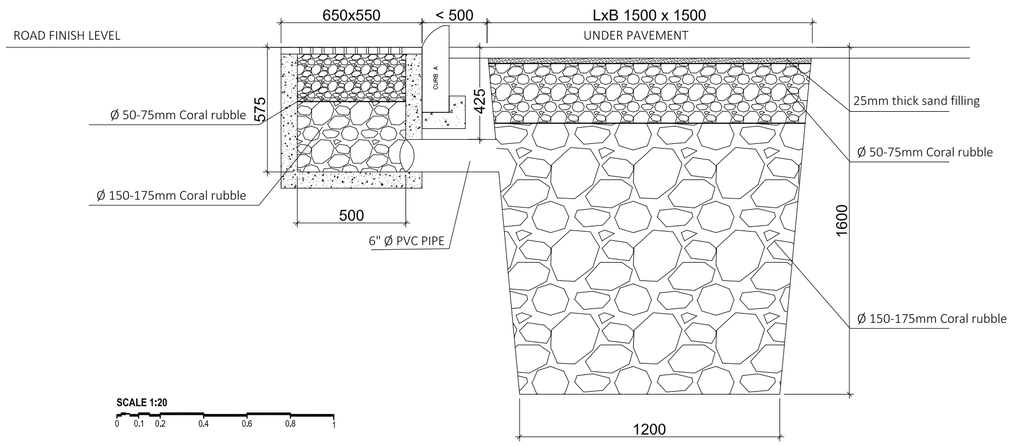
51



Hot DIPPED GI GRATING

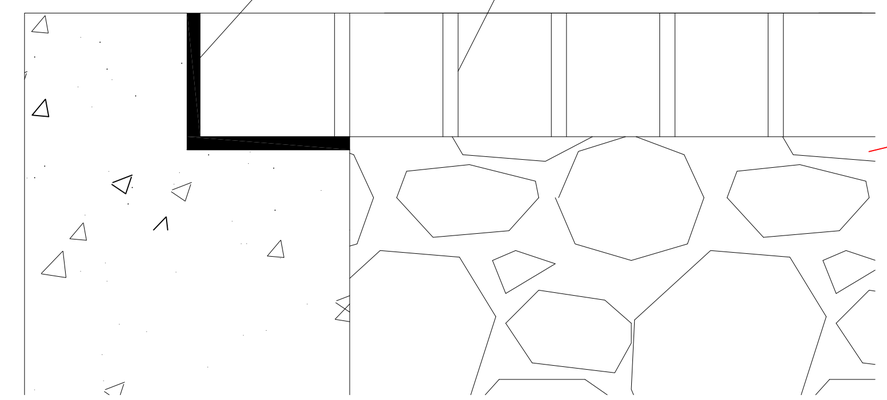
SCALE 1:10

0 0.1 0.2 0.4 0.6 0.8 1



EQUAL ANGLE IRON OF 40mm x 3.5mm THICK

FLAT IRON 34mm x 3.5 THICK C/C 25 mm



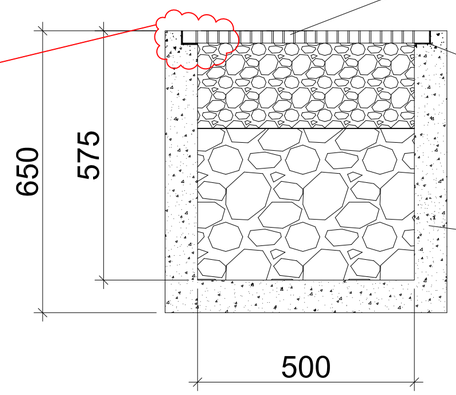
SCALE 1:10

0 0.1 0.2 0.4 0.6 0.8 1

Hot dipped GI Grating as Shown in Drawing

Equal Angle Iron as Shown in Drawing

G25 Concrete with R6mm Ø 100 C/C bar R/F



CATCH PIT SECTION

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Architectural	Structural

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7/09/2021

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AMEEN / DHILSHAN / AYSHA	**7-09-2021**

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-	**-**
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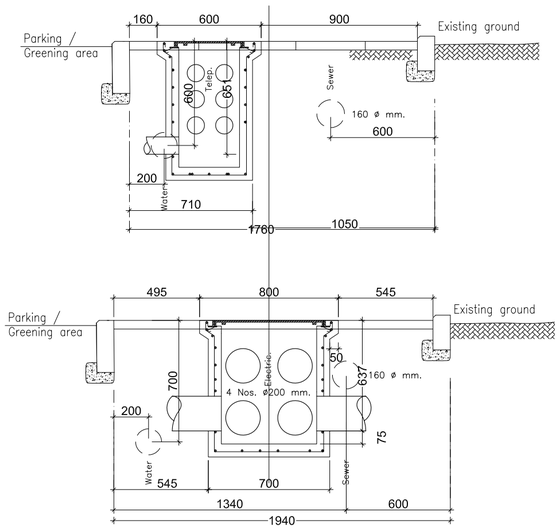
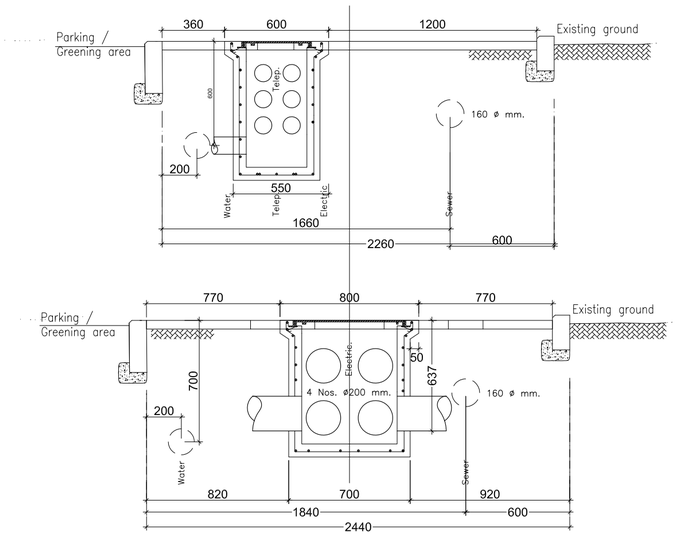
CATCH PIT DETAILS

PAGE NO.
52



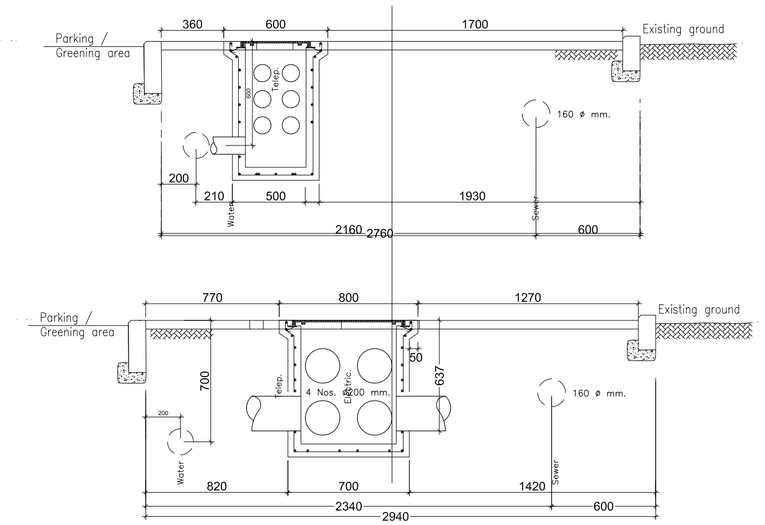
TYPICAL DETAILS AT 2.0 METER PAVEMENT

scale 1 : 25



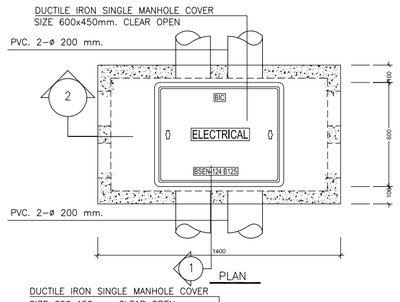
TYPICAL DETAILS AT 2.5 METER PAVEMENT

scale 1 : 25



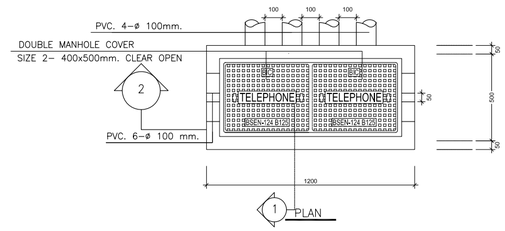
TYPICAL DETAILS AT 3.0 METER PAVEMENT

scale 1 : 25



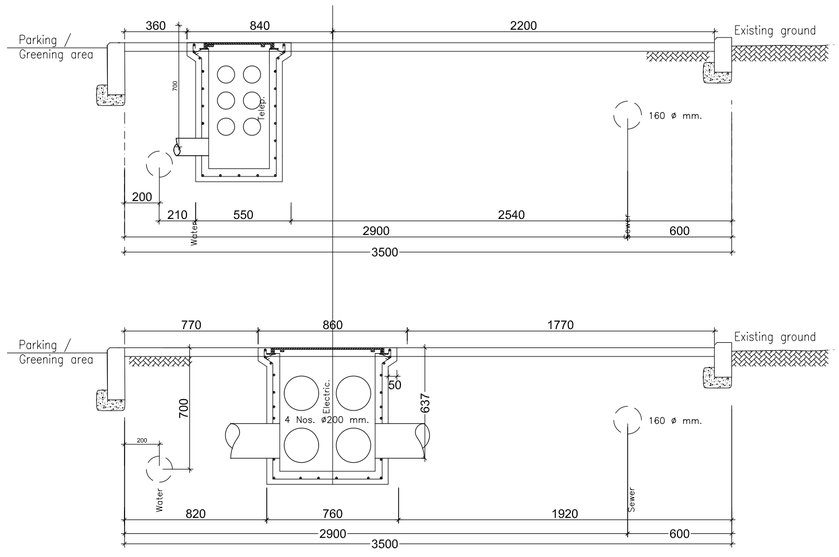
TYPICAL DETAIL ELECTRICAL JUNCTION BOXES

scale: 1 : 25



TYPICAL DETAIL TELEPHONE JUNCTION BOXES

scale: 1 : 25



TYPICAL DETAILS AT 3.5 METER PAVEMENT

scale 1 : 25

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DESIGNER:

NA	**NA**
Architectural	Structural

DRAWN BY:

AMEEN / DHILSHAN / AYSHA
10-10-2016

REVISION

AMEEN / DHILSHAN / AYSHA	**7-09-2021**

SCALE: **1:25**
SHEET NO:

CHECKED BY:

NAME	**-**
Geo-Spatial Analyst	Structural
-	**-**
Electrical & Mechanical	Communication

APPROVED BY:

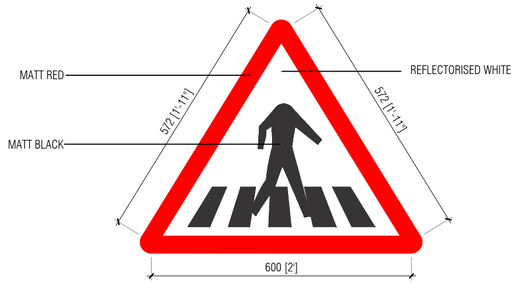
NAME
DATE

SHEET CONTENT:

JB DETAILS

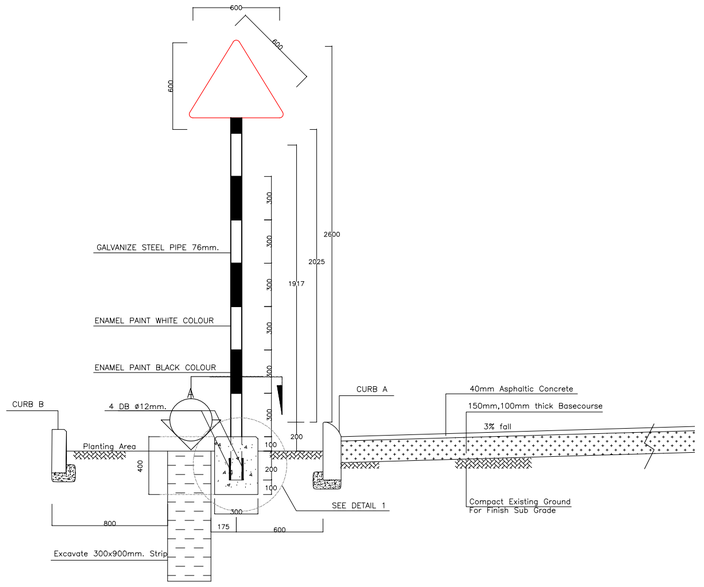
PAGE NO.

53



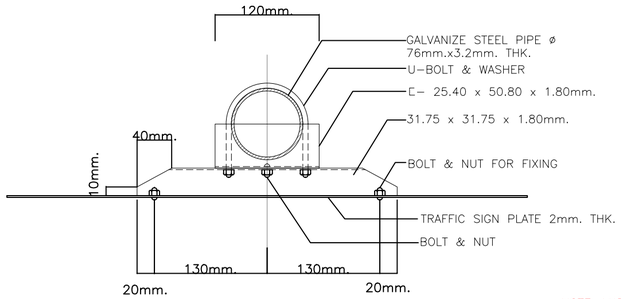
ZEBRA CROSSING
CROSSING AHEAD

scale 1 : 10



FRONT SIDE

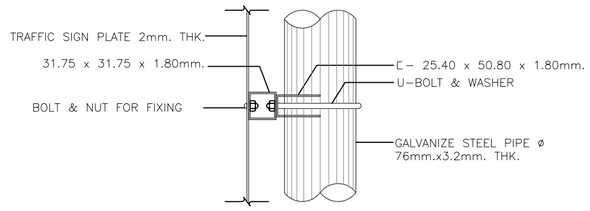
scale 1 : 30



TOP VIEW FIXING ACCESSORIES

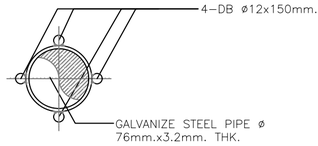
scale 1 : 5

NOTE: MATERIAL AND COLOR SHALL BE APPROVED PRIOR TO PRODUCTION



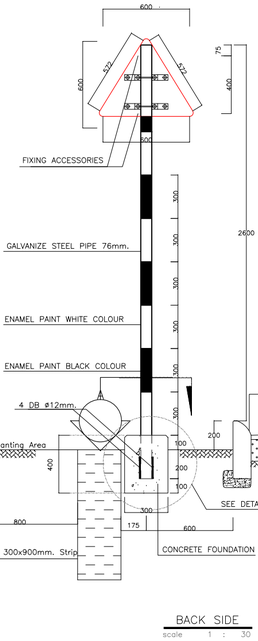
SIDE VIEW FIXING ACCESSORIES

scale 1 : 5



DETAIL 1 TOP VIEW

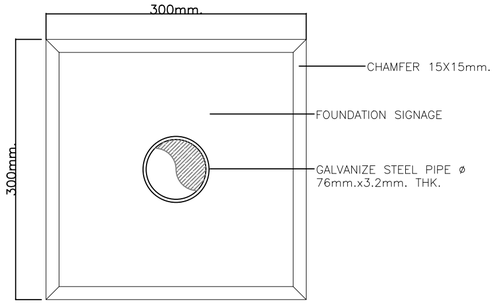
scale 1 : 5



BACK SIDE

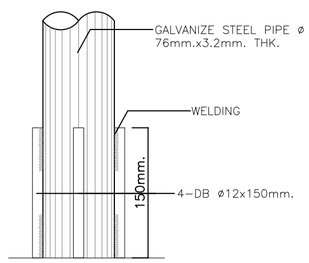
scale 1 : 30

DETAIL INSTALLATION OF TRAFFIC SIGN



SECTION A

scale 1 : 5



DETAIL 1 SIDE VIEW

scale 1 : 5

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THILAFUSHI

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DESIGNER:

NA	**NA**
Architectural	Structural

DRAWN BY:

AMEEN / DHILSHAN / AYSHA
10-10-2016

REVISION

AMEEN / DHILSHAN / AYSHA	**7-09-2021**

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-	**-**
Electrical & Mechanical	Communication

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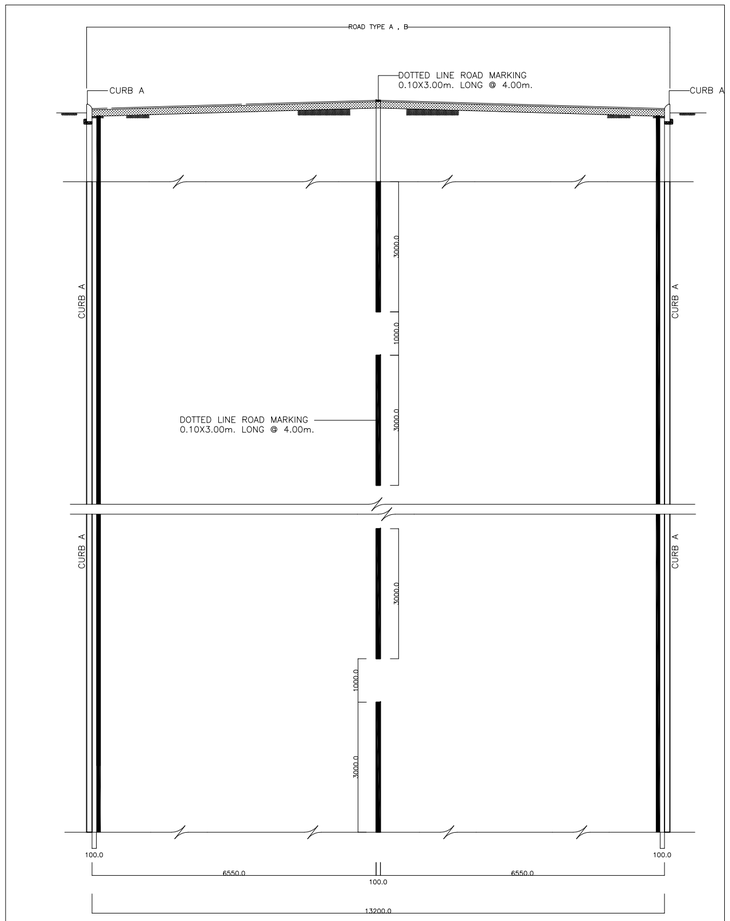
SHEET CONTENT:

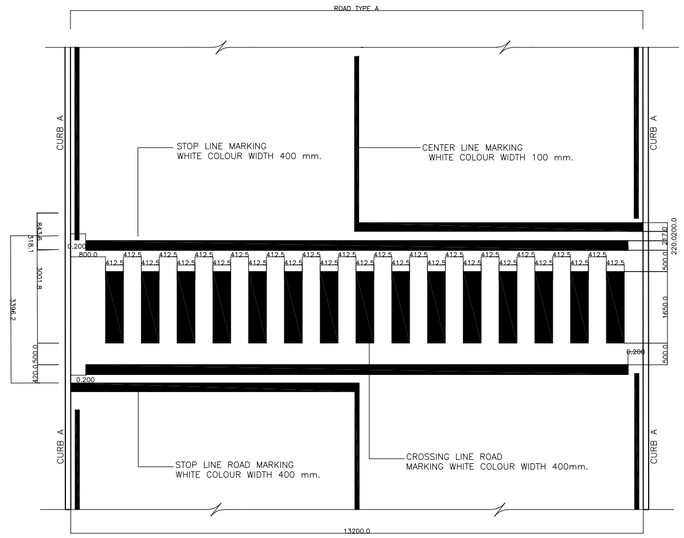
SIGN DETAILS

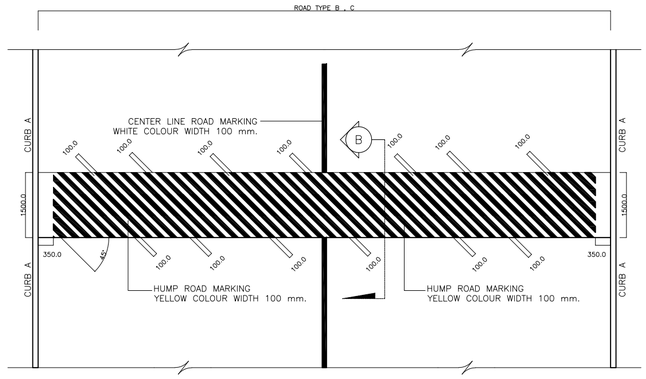
PAGE NO.

54

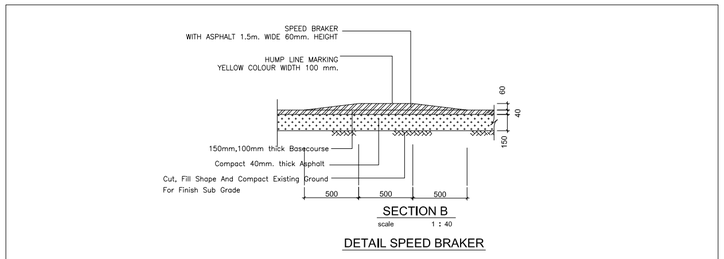


ROAD MARKING OF ROAD TYPE A , B
scale 1 : 100





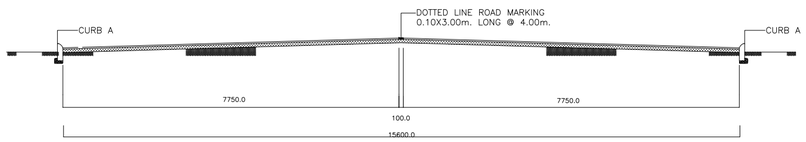
PLAN SPEED BRAKER
scale 1 : 100



SECTION B
scale 1 : 40

DETAIL SPEED BRAKER

ROAD CROSSING JUNCTION DETAILS



SECTION A
scale 1 : 100

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DESIGNER:
NA Architectural
NA Structural

DRAWN BY:
AMEEN / DHILSHAN / AYSHA
10-10-2016
REVISION
AMEEN / DHILSHAN / AYSHA **7-09-2021**
SCALE: **AS GIVEN** SHEET NO:

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- Structural
- Electrical & Mechanical
- Communication

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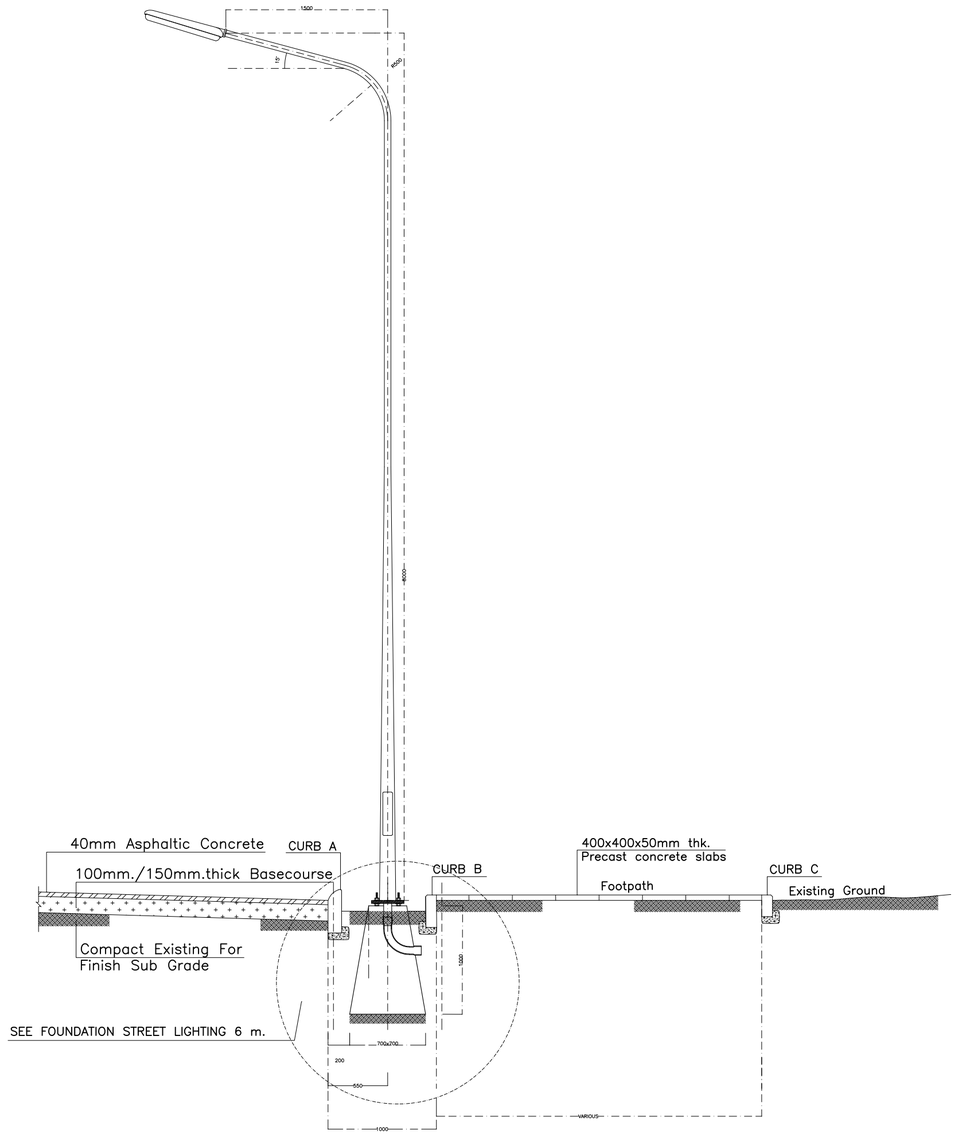
NAME
DATE

SHEET CONTENT:
SB & RC DETAILS

PAGE NO.
55



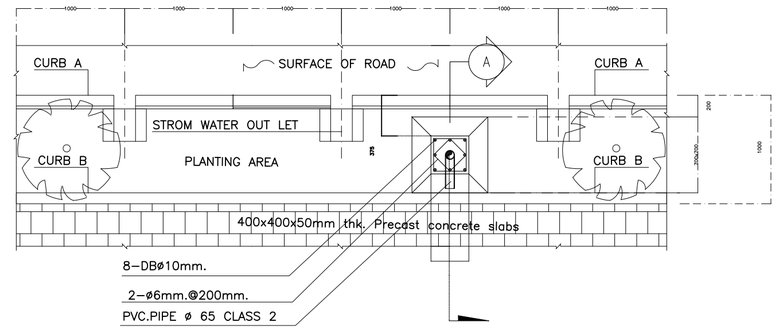
SECTION A DETAIL INSTALLATION OF LAMP POST

Scale 1:40

LIGHT POLE DETAILS

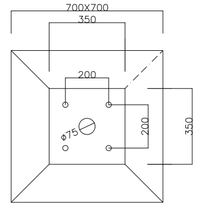
Main roads: 8m pole height
60watts
Internal roads: 6m pole height
40watts

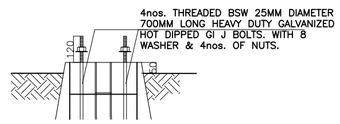
- Led lights more than 40,000hrs life span
- 1 year warrenty.
- Luminar output more that 100 lux
- ISO or CE certified.



PLAN FOUNDATION STREET LIGHTING 6.00m.

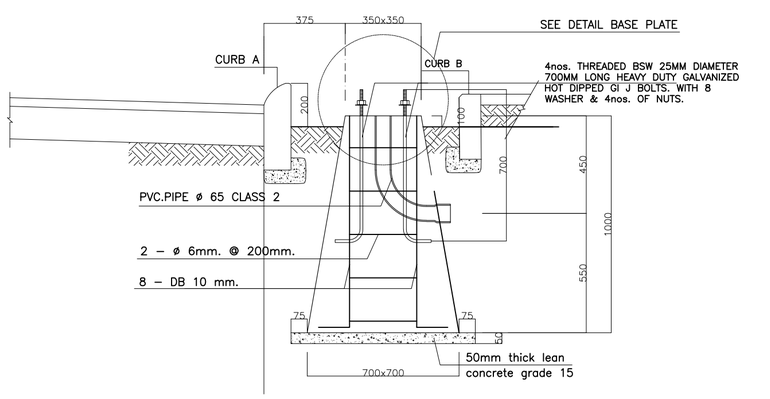
scale 1 : 40





PLAN FOUNDATION STREET LIGHTING
scale 1 : 20

BASE PLATE DETAILS
scale 1 : 20



DETAIL FOUNDATION STREET LIGHTING 6.00m.

scale 1 : 20

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DESIGNER:

NA	**NA**
Architectural	Structural

DRAWN BY:
AMEEN / DHILSHAN / AYSHA
10-10-2016

REVISION

AMEEN / DHILSHAN / AYSHA	**7-09-2021**

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Geo-Spatial Analyst	Structural
-	**-**
Electrical & Mechanical	Communication

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DATE

SHEET CONTENT:
LIGHT POLE DETAILS

PAGE NO.
56

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DESIGNER:
AMEEN/DHIL/SAMAHA — Architectural
SALIQ — Structural

DRAWN BY:
AMEEN/DHIL/SAMAHA
MAY 2021

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SCALE: **AS GIVEN**
SHEET NO: **AS GIVEN**

CHECKED BY:
Architectural
HUSSAIN SALIQ — Structural
MOHAMED YAMEEN — Services
Communication

APPROVED BY:
SAEED ADAM
DECEMBER 2022

SHEET CONTENT:
STREET LIGHTING LAYOUT PT1

PAGE NO.
57

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DESIGNER:
AMEEN/DHIL/SAMAHA — Architectural
SALIQ — Structural

DRAWN BY:
AMEEN/DHIL/SAMAHA
MAY 2021

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SCALE: **AS GIVEN**
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CHECKED BY:
Architectural
HUSSAIN SALIQ — Structural
MOHAMED YAMEEN — Services
Communication

APPROVED BY:
SAEED ADAM
DECEMBER 2022

SHEET CONTENT:
STREET LIGHTING LAYOUT PT2

PAGE NO.
58

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DESIGNER:	
AMEEN/DHIL/SAMAHA	**SALIQ**
Architectural	Structural

DRAWN BY: **AMEEN/DHIL/SAMAHA**
MAY 2021

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SCALE: **AS GIVEN**

SHEET NO: **AS GIVEN**

CHECKED BY:	
Architectural	**HUSSAIN SALIQ** Structural
MOHAMED YAMEEN Services	Communication

APPROVED BY: **SAEED ADAM**
DECEMBER 2022

SHEET CONTENT: **STREET LIGHTING LAYOUT PT3**

PAGE NO. 59

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DESIGNER:
AMEEN/DHIL/SAMAHA Architectural
SALIQ Structural

DRAWN BY:
AMEEN/DHIL/SAMAHA
MAY 2021

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SCALE: **AS GIVEN**
SHEET NO: **AS GIVEN**

CHECKED BY:
Architectural
HUSSAIN SALIQ Structural
MOHAMED YAMEEN Services
Communication

APPROVED BY:
SAEED ADAM
DECEMBER 2022

SHEET CONTENT:
STREET LIGHTING LAYOUT PT4

PAGE NO.
60

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DESIGNER:

AMEEN/DHIL/SAMAHA — Architectural

SALIQ — Structural

DRAWN BY:

AMEEN/DHIL/SAMAHA

MAY 2021

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SCALE: **AS GIVEN**

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HUSSAIN SALIQ — Structural

MOHAMED YAMEEN — Services

Communication

APPROVED BY:

SAEED ADAM

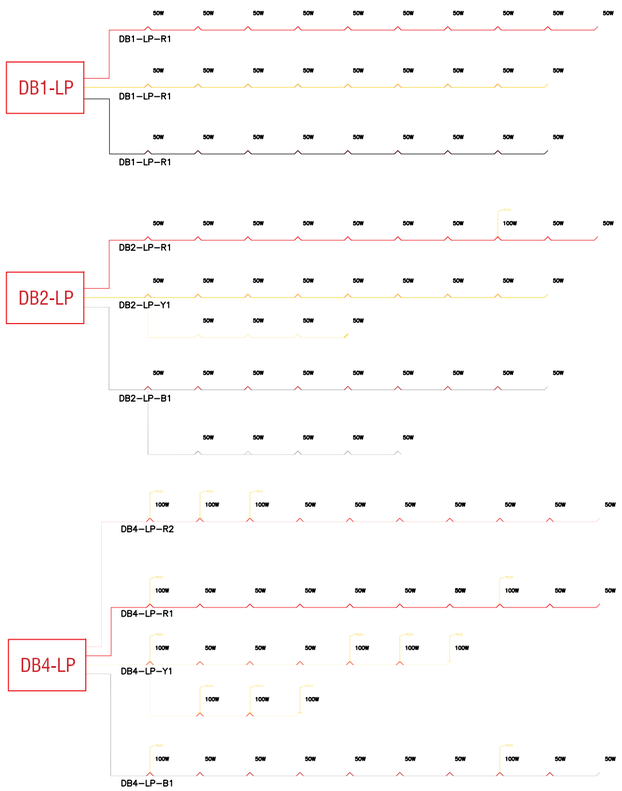
DECEMBER 2022

SHEET CONTENT:

STREET LIGHTING LAYOUT PT5

PAGE NO.

61



TOTAL WATTS	CABLE LENGTH	VOLTAGE DROP	CABLE SIZE	ALLOWABLE VOLTAGE DROP
500	235 M	6.5 V	3C*4	11.5 V

TOTAL WATTS	CABLE LENGTH	VOLTAGE DROP	CABLE SIZE	ALLOWABLE VOLTAGE DROP
450	232 M	5.7 V	3C*4	11.5 V

TOTAL WATTS	CABLE LENGTH	VOLTAGE DROP	CABLE SIZE	ALLOWABLE VOLTAGE DROP
450	258 M	6.4 V	3C*4	11.5 V

TOTAL WATTS	CABLE LENGTH	VOLTAGE DROP	CABLE SIZE	ALLOWABLE VOLTAGE DROP
550	455 M	9.3 V	3C*6	11.5 V

TOTAL WATTS	CABLE LENGTH	VOLTAGE DROP	CABLE SIZE	ALLOWABLE VOLTAGE DROP
450	200 M	4.9 V	3C*4	11.5 V

TOTAL WATTS	CABLE LENGTH	VOLTAGE DROP	CABLE SIZE	ALLOWABLE VOLTAGE DROP
200	102 M	1.12 V	3C*4	11.5 V

TOTAL WATTS	CABLE LENGTH	VOLTAGE DROP	CABLE SIZE	ALLOWABLE VOLTAGE DROP
450	251 M	6.2 V	3C*4	11.5 V

TOTAL WATTS	CABLE LENGTH	VOLTAGE DROP	CABLE SIZE	ALLOWABLE VOLTAGE DROP
250	177 M	2.4 V	3C*4	11.5 V

TOTAL WATTS	CABLE LENGTH	VOLTAGE DROP	CABLE SIZE	ALLOWABLE VOLTAGE DROP
650	385 M	9.3 V	3C*6	11.5 V

TOTAL WATTS	CABLE LENGTH	VOLTAGE DROP	CABLE SIZE	ALLOWABLE VOLTAGE DROP
600	341 M	7.6 V	3C*6	11.5 V

TOTAL WATTS	CABLE LENGTH	VOLTAGE DROP	CABLE SIZE	ALLOWABLE VOLTAGE DROP
550	150 M	4.5 V	3C*4	11.5 V

TOTAL WATTS	CABLE LENGTH	VOLTAGE DROP	CABLE SIZE	ALLOWABLE VOLTAGE DROP
300	77 M	1.3 V	3C*4	11.5 V

TOTAL WATTS	CABLE LENGTH	VOLTAGE DROP	CABLE SIZE	ALLOWABLE VOLTAGE DROP
600	327 M	7.3 V	3C*6	11.5 V

TOTAL WATTS	CABLE LENGTH	VOLTAGE DROP	CABLE SIZE	ALLOWABLE VOLTAGE DROP
650	386 M	9.3 V	3C*6	11.5 V

TOTAL WATTS	CABLE LENGTH	VOLTAGE DROP	CABLE SIZE	ALLOWABLE VOLTAGE DROP
650	148 M	5.3 V	3C*4	11.5 V

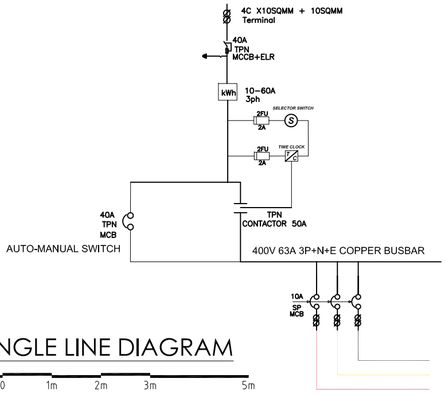
TOTAL WATTS	CABLE LENGTH	VOLTAGE DROP	CABLE SIZE	ALLOWABLE VOLTAGE DROP
300	88 M	1.5 V	3C*4	11.5 V

TOTAL WATTS	CABLE LENGTH	VOLTAGE DROP	CABLE SIZE	ALLOWABLE VOLTAGE DROP
900	266 M	8.9 V	3C*6	11.5 V

TOTAL WATTS	CABLE LENGTH	VOLTAGE DROP	CABLE SIZE	ALLOWABLE VOLTAGE DROP
550	266 M	8 V	3C*4	11.5 V

TOTAL WATTS	CABLE LENGTH	VOLTAGE DROP	CABLE SIZE	ALLOWABLE VOLTAGE DROP
850	263 M	8.3 V	3C*6	11.5 V

TOTAL WATTS	CABLE LENGTH	VOLTAGE DROP	CABLE SIZE	ALLOWABLE VOLTAGE DROP
850	297 M	9.4 V	3C*6	11.5 V



SINGLE LINE DIAGRAM

0 1m 2m 3m 5m

VOLTAGE DROP CALCULATION

0 1m 2m 3m 5m

HOUSING DEVELOPMENT CORPORATION
PLANNING AND DEVELOPMENT DEPARTMENT
THIRD FLOOR, HDC BUILDING HULHUMALE'
REPUBLIC OF MALDIVES
TEL. +(960)3353535, FAX +(960)3358892
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PILOT ROADS PROJECT
THILAFUSHI

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DESIGNER:
AMEEN/DHIL/SAMAHA Architectural
SALIQ Structural

DRAWN BY:
AMEEN/DHIL/SAMAHA
MAY 2021
REVISION
- | -

SCALE: **AS GIVEN**
SHEET NO: **AS GIVEN**

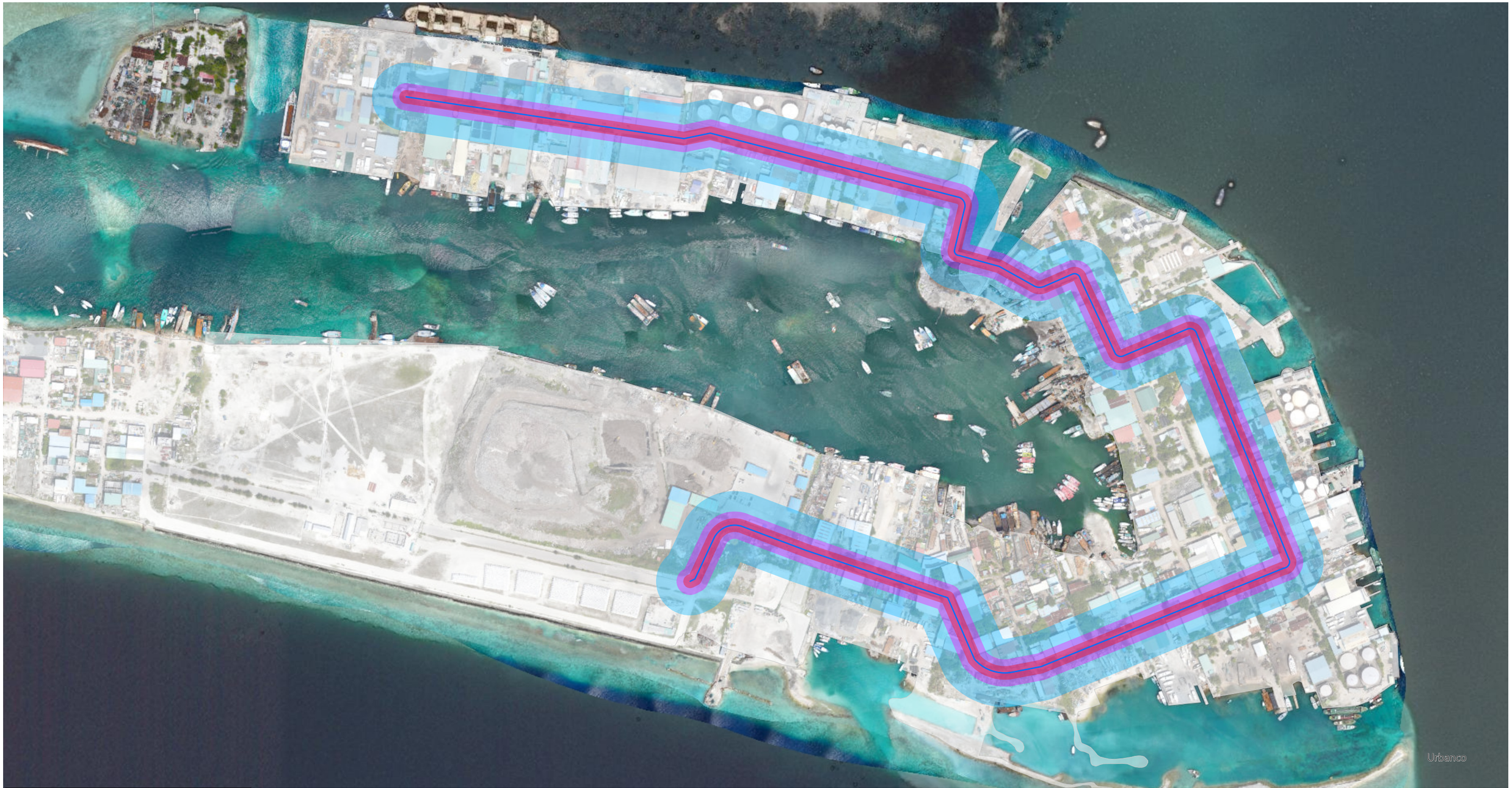
CHECKED BY:
Architectural
HUSSAIN SALIQ Structural
MOHAMED YAMEEN Services
Communication

APPROVED BY:
SAEED ADAM
DECEMBER 2022

SHEET CONTENT:
SINGLE LINE DIAGRAM & VOLTAGE CALCULATION

PAGE NO.
62

12.5 Impact Zones



0 60 120 240 360 Meters

- 10 m from Centerline - Highest Impact, Primary Impact Zone
- 20 m from Centerline - Medium Impact, Secondary Impact Zone
- 50 m from Centerline - Lowest Impact, Tertiary Impact Zone
- Overall Affected Zone

THILAFUSHI PILOT ROAD PROJECT

Drawing Name : Impact Zones	Drawing By : Affaan	Drawn date: 07 January 2024	Scale: 1:5,500

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12.6 Flood Map

Flood Area	Height Elavation (m) from MSL
A	0.98 - 1.21
B	0.57 - 1.06
C	0.57 - 1.21
D	0.98 - 1.21
E	0.57 - 0.98
F	0.57 - 0.89
G	0.57 - 0.89
H	0.57 - 0.89

0 60 120 240 360 Meters

Elevation

0.57

2.1

Water Runoff

THILAFUSHI PILOT ROAD PROJECT

Drawing Name : Flood Map	Drawing By : Affaan	Drawn date: 08 January 2024	Scale: 1:5,500

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12.7 Tree Survey map

0 5 10 20 30 Meters

Palm
Nika
Other
Curb Saved

THILAFUSHI PILOT ROAD PROJECT

Drawing Name : Tree Map Page 1	Drawing By : Affaan	Drawn date: 04 January 2024	Scale: 1:600

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0 10 20 40 60 Meters

Palm

Other

THILAFUSHI PILOT ROAD PROJECT

Drawing Name : Tree Map Page 2	Drawing By : Affaan	Drawn date: 04 January 2024	Scale: 1:1,100

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0 10 20 40 60 Meters

Palm
Nika
Other
Palm Safe

THILAFUSHI PILOT ROAD PROJECT

Drawing Name : Tree Map Page 3	Drawing By : Affaan	Drawn date: 04 January 2024	Scale: 1:900

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Housing Development Corporation Limited

- Palm
- Nika
- Other

THILAFUSHI PILOT ROAD PROJECT

Drawing Name : Tree Map Page 4	Drawing By : Affaan	Drawn date: 04 January 2024	Scale: 1:1,000

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0 5 10 20 30 Meters

Palm
Other
Palm Safe

THILAFUSHI PILOT ROAD PROJECT

Drawing Name : Tree Map Page 5	Drawing By : Affaan	Drawn date: 04 January 2024	Scale: 1:640

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THILAFUSHI PILOT ROAD PROJECT

Drawing Name : Tree Map Page 6	Drawing By : Affaan	Drawn date: 04 January 2024	Scale: 1:700

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Housing Development Corporation Limited

0 5 10 20 30 Meters

Palm

Other

THILAFUSHI PILOT ROAD PROJECT

Drawing Name : Tree Map Page 7	Drawing By : Affaan	Drawn date: 04 January 2024	Scale: 1:448

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12.8 Water Sample Points

Pilot Road

Water Sample Location

THILAFUSHI PILOT ROAD PROJECT

Drawing Name : Water Sample Map	Drawing By : Affaan	Drawn date: 06 January 2024	Scale: 1:4,500

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Housing Development Corporation Limited

12.9 Water Sample Test Report

Male' Water & Sewerage Company Pvt Ltd
Water Quality Assurance Laboratory
Quality Assurance Building, 1st Floor, Male' Hingun, Vilimale', Male' City, Maldives
Tel: +9603323209, Fax: +9603324306, Email: wqa@mwsc.com.mv

LB-TEST-090

WATER QUALITY TEST REPORT

Report No: 500196802

Customer Information:
Housing Development Corporation Ltd

HDC Building, 3rd Floor
Male 20120

Report date: **10/07/2023**
Test Requisition Form No: **900198043**
Sample(s) Recieved Date: **05/07/2023**
Date of Analysis: **05/07/2023 - 06/07/2023**

Sample Description ~	S1	S2	S3	**TEST METHOD**	**UNIT**
Sample Type ~	Ground Water	Ground Water	Ground Water		
Sample No	83240434	83240435	83240436		
Sampled Date ~	04/07/2023 12:15 PM	04/07/2023 12:15 PM	04/07/2023 12:15 PM		
PARAMETER	**ANALYSIS RESULT**				
Physical Appearance	Cloudy with particles	Clear with particles	Cloudy with particles		
Conductivity *	941	5770	1139	Method 2510 B. (adapted from Standard methods for the examination of water and waste water, 23rd edition)	µS/cm
pH *	8.2	8.0	7.9	Method 4500-H+ B. (adapted from Standard methods for the examination of water and waste water, 23rd edition)	-
Salinity	0.46	3.12	0.56	Method 2520 B. (adapted from Standard methods for the examination of water and waste water, 23rd edition)	‰
Temperature	24.0	24.0	24.0	Electrometry	°C
Total Dissolved Solids	470	2880	569	Electrometry	mg/L
Dissolved Oxygen (DO)	7.59	7.60	6.27	In-house Test method (Adapted from HACH BOD LDO® Probe (Model LBOD10101) manual)	mg/L
Total Petroleum Hydrocarbon (TPH)	<0.036 (LoQ 0.036 mg/L)	<0.036 (LoQ 0.036 mg/L)	<0.036 (LoQ 0.036 mg/L)	UV Fluorescence	mg/L
Total Coliforms	>2420 (05/07/2023 03:00 PM)	>2420 (05/07/2023 03:00 PM)	>2420 (05/07/2023 03:00 PM)	Colilert®-18/Quanti-Tray®2000	MPN/100ml

Keys: µS/cm : Micro Seimen per Centimeter, **‰** : Parts Per Thousand, **°C** : Degree Celcius, **mg/L** : Milligram Per Liter, **MPN/100ml** : Most Probable Number

Checked by

Aminath Sofa
Senior Laboratory Executive

Approved by

Nihaz A. Zahir
Assistant Quality Manager

Notes:
Sampling Authority: Sampling was not done by MWSC Laboratory.
This report shall not be reproduced except in full, without written approval of MWSC.
This test report is ONLY FOR THE SAMPLES TESTED.
~ Information provided by the customer. This information may affect the validity of the test results.
*Parameters accredited by EIAC under ISO/IEC 17025:2017

Male' Water & Sewerage Company Pvt Ltd
Water Quality Assurance Laboratory
Quality Assurance Building, 1st Floor, Male' Hingun, Vilimale', Male' City, Maldives
Tel: +9603323209, Fax: +9603324306, Email: wqa@mwsc.com.mv

LB-TEST-090

WATER QUALITY TEST REPORT

Report No: 500196802

Customer Information:
Housing Development Corporation Ltd

HDC Building, 3rd Floor
Male 20120

Report date: **10/07/2023**
Test Requisition Form No: **900198043**
Sample(s) Recieved Date: **05/07/2023**
Date of Analysis: **05/07/2023 - 06/07/2023**

Sample Description ~	S4	S5	**TEST METHOD**	**UNIT**
Sample Type ~	Ground Water	Ground Water		
Sample No	83240438	83240439		
Sampled Date ~	04/07/2023 12:15 PM	04/07/2023 12:15 PM		
PARAMETER	**ANALYSIS RESULT**			
Physical Appearance	Cloudy with particles	Clear with particles		
Conductivity *	2310	3076	Method 2510 B. (adapted from Standard methods for the examination of water and waste water, 23rd edition)	µS/cm
pH *	7.6	7.3	Method 4500-H+ B. (adapted from Standard methods for the examination of water and waste water, 23rd edition)	-
Salinity	1.18	1.60	Method 2520 B. (adapted from Standard methods for the examination of water and waste water, 23rd edition)	‰
Temperature	24.0	24.0	Electrometry	°C
Total Dissolved Solids	1154	1535	Electrometry	mg/L
Dissolved Oxygen (DO)	5.32	2.74	In-house Test method (Adapted from HACH BOD LDO® Probe (Model LBOD10101) manual)	mg/L
Total Petroleum Hydrocarbon (TPH)	<0.036 (LoQ 0.036 mg/L)	0.041	UV Fluorescence	mg/L
Total Coliforms	>2420 (05/07/2023 03:00 PM)	>2420 (05/07/2023 03:00 PM)	Colilert®-18/Quanti-Tray®2000	MPN/100ml

Keys: µS/cm : Micro Seimen per Centimeter, **‰** : Parts Per Thousand, **°C** : Degree Celcius, **mg/L** : Milligram Per Liter, **MPN/100ml** : Most Probable Number

Checked by

Aminath Sofa
Senior Laboratory Executive

Approved by

Nihaz A. Zahir
Assistant Quality Manager

Notes:
Sampling Authority: Sampling was not done by MWSC Laboratory.
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~ Information provided by the customer. This information may affect the validity of the test results.
*Parameters accredited by EIAC under ISO/IEC 17025:2017

********** END OF REPORT **********

Male' Water & Sewerage Company Pvt Ltd
Water Quality Assurance Laboratory
Quality Assurance Building, 1st Floor, Male' Hingun, Vilimale', Male' City, Maldives
Tel: +9603323209, Fax: +9603324306, Email: wqa@mwsc.com.mv

LB-TEST-090

WATER QUALITY TEST REPORT

Report No: 500196803

Customer Information:
Housing Development Corporation Ltd

HDC Building, 3rd Floor
Male 20120

Report date: **10/07/2023**
Test Requisition Form No: **900198043**
Sample(s) Recieved Date: **05/07/2023**
Date of Analysis: **05/07/2023 - 05/07/2023**

Sample Description ~	S6	**TEST METHOD**	**UNIT**
Sample Type ~	Ground Water		
Sample No	83240441		
Sampled Date ~	04/07/2023 12:15 PM		
PARAMETER	**ANALYSIS RESULT**		
Physical Appearance	Cloudy with particles		
Conductivity *	3060	Method 2510 B. (adapted from Standard methods for the examination of water and waste water, 23rd edition)	µS/cm
pH *	8.6	Method 4500-H+ B. (adapted from Standard methods for the examination of water and waste water, 23rd edition)	-
Salinity	1.59	Method 2520 B. (adapted from Standard methods for the examination of water and waste water, 23rd edition)	‰
Temperature	24.0	Electrometry	°C
Total Dissolved Solids	1531	Electrometry	mg/L
Dissolved Oxygen (DO)	6.77	In-house Test method (Adapted from HACH BOD LDO® Probe (Model LBOD10101) manual)	mg/L
Total Petroleum Hydrocarbon (TPH)	<0.036 (LoQ 0.036 mg/L)	UV Fluorescence	mg/L

Keys: µS/cm : Micro Seimen per Centimeter, **‰** : Parts Per Thousand, **°C** : Degree Celcius, **mg/L** : Milligram Per Liter

Checked by

Aminath Sofa
Senior Laboratory Executive

Approved by

Nihaz A. Zahir
Assistant Quality Manager

Notes:
Sampling Authority: Sampling was not done by MWSC Laboratory.
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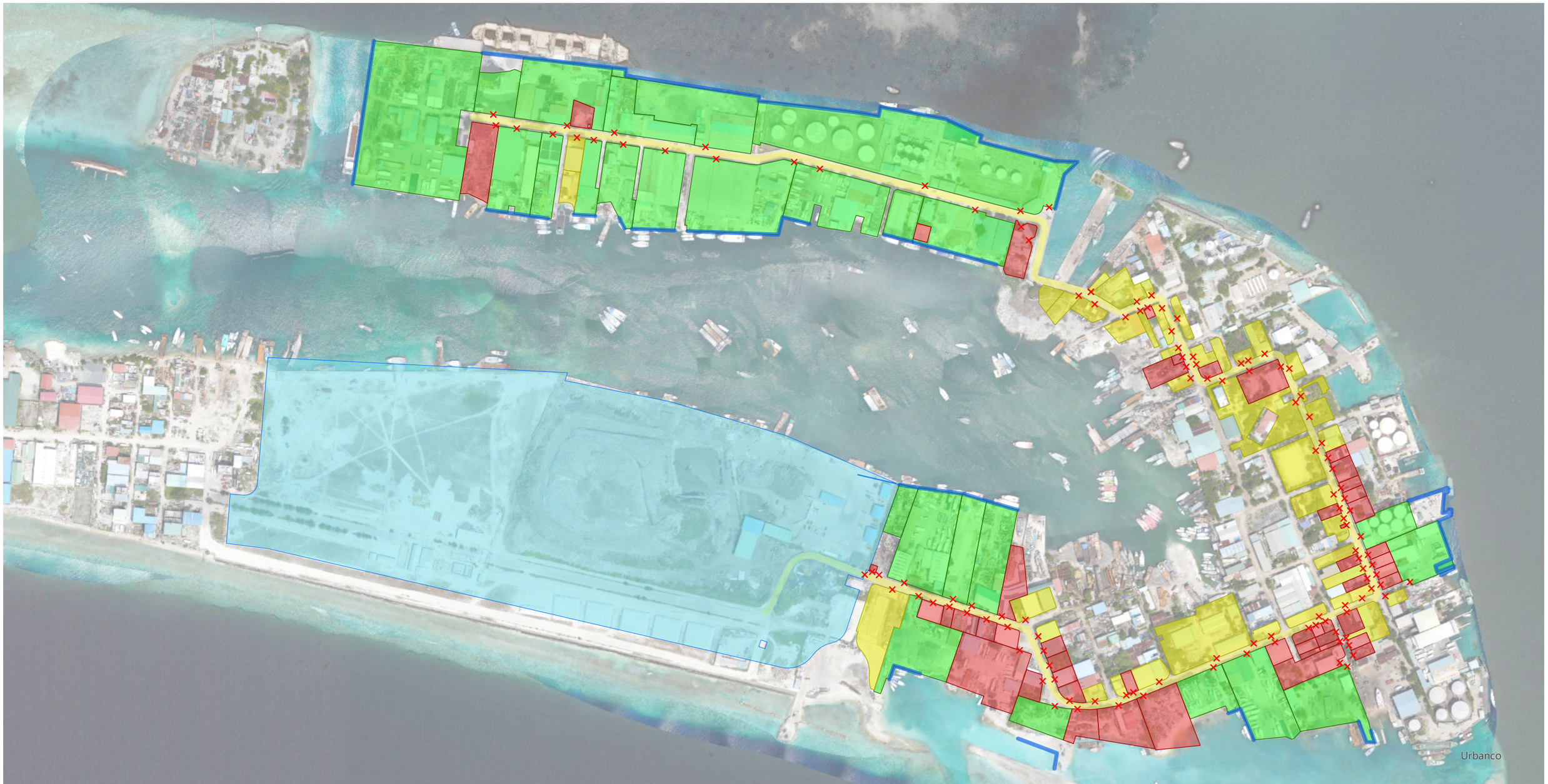
This test report is ONLY FOR THE SAMPLES TESTED.
~ Information provided by the customer. This information may affect the validity of the test results.
*Parameters accredited by EIAC under ISO/IEC 17025:2017

********** END OF REPORT **********

12.10 General map of Access and Access Completely Blocked



0 60 120 240 360 Meters

Potential Access Impact

- Port and Land Access
- Alternative Land Access Only
- Port Access Only
- No Access
- Access Blockage
- Potential Port
- Pilot Road

THILAFUSHI PILOT ROAD PROJECT

Drawing Name : General Map of Access	Drawing By : Affaan	Drawn date: 08 January 2024	Scale: 1:5,500

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Housing Development Corporation Limited

0 60 120 240 360 Meters

No Access

Pilot Road

THILAFUSHI PILOT ROAD PROJECT

Drawing Name : Access Completely Blocked Plot Map	Drawing By : Affaan	Drawn date: 08 January 2024	Scale: 1:5,500

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Housing Development Corporation Limited

12.11 Available port access map

0 60 120 240 360 Meters

Pilot Road
Port Area
Access Point
Proposed Traffic Diversion Route

THILAFUSHI PILOT ROAD PROJECT

Drawing Name : Available Port Access Map	Drawing By : Affaan	Drawn date: 06 January 2024	Scale: 1:5,500

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Housing Development Corporation Limited

12.12 Alternative road paths and traffic diversion study maps.

0 60 120 240 360 Meters

Pilot Road

Potential Access Port

Potential Alternative Access Route

THILAFUSHI PILOT ROAD PROJECT

Drawing Name : Potential Access Map of Cut off Areas	Drawing By : Affaan	Drawn date: 07 January 2024	Scale: 1:5,500

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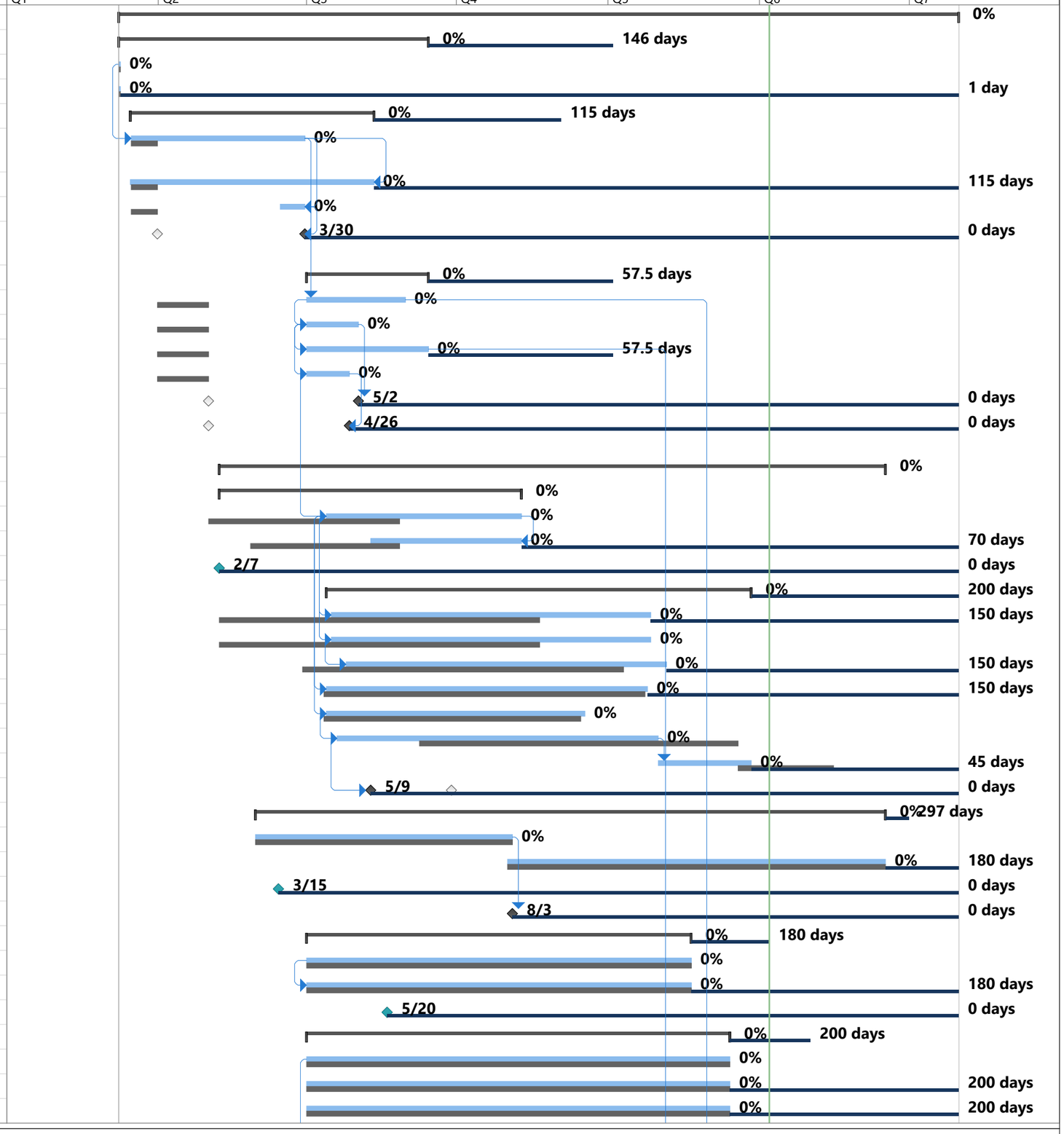
Housing Development Corporation Limited

12.13 Work Schedule

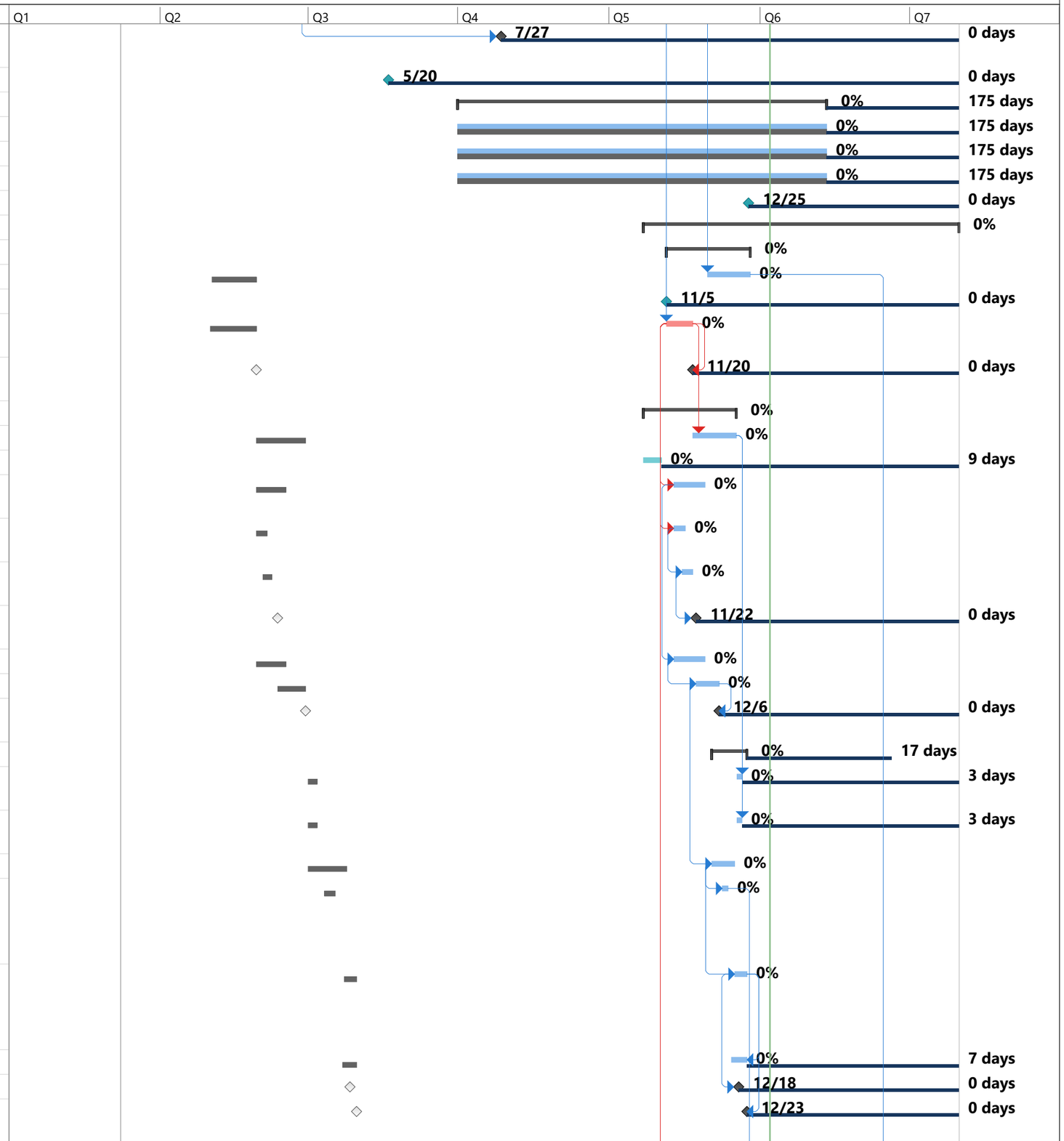
TPRP Work Schedule

ID	Task Name	Duration
1	**THILAFUSHI PILOT ROAD**	**510 days**
2	**Preliminaries - Contract Signing & Site Handover**	**146 days**
3	Contract Signing	1 day
4	Site Handover	1 day
5	**Milestone -1**	**115 days**
6	Review, discuss and finalization of detailed design - 50%/100%	82.5 days
7	Mobilization Stage-1	115 days
8	Accommodation Stage-1	12 days
9	Key Deliverable Date (Initial Discussion on Design, Part of Mobilization & Accommodation Work)	0 days
10	**Milestone -2**	**57.5 days**
11	Review, discuss and finalization of detailed design	46.5 days
12	Accommodation Stage -2	24 days
13	Topography & Survey Setout work @ Part B	57.5 days
14	Material Approval Stage-1	21 days
15	Inspection Request - for Site Accommodation	0 days
16	Key Deliverable Date (Accommodation, Survey, Material Approval)	0 days
17	**Procurement**	**314.5 days**
18	**Supply of General Materials**	**141.5 days**
19	Cement, Aggregates & Steel	90 days
20	Othe Construction Materials	70 days
21	Material Arrival to site	0 days
22	**Supply of precasted items**	**200 days**
23	Electrical Junction Box	150 days
24	Telephone Junction box	150 days
25	Manhole	150 days
26	Kerb - Type A	150 days
27	Kerb - Type B	120 days
28	Paver Block	150 days
29	Street light Foundation	45 days
30	Inspection Request - for Precasted Materials	0 days
31	**Pipes & Electrical Cable**	**297 days**
32	Supply of Pipes	120 days
33	Supply of Electrical Items	180 days
34	Material Arrival at Site	0 days
35	Inspection Request - for Pipe Material Arrival	0 days
36	**Supply of Stablization Materials**	**180 days**
37	Geo Web@Geo Cell	180 days
38	Geotextile	180 days
39	Material Arrival at Site	0 days
40	**Asphalt Materials**	**200 days**
41	Aggregate Base Course Materials	200 days
42	Aggregate/Filler Materials	200 days
43	Binder Materials	200 days



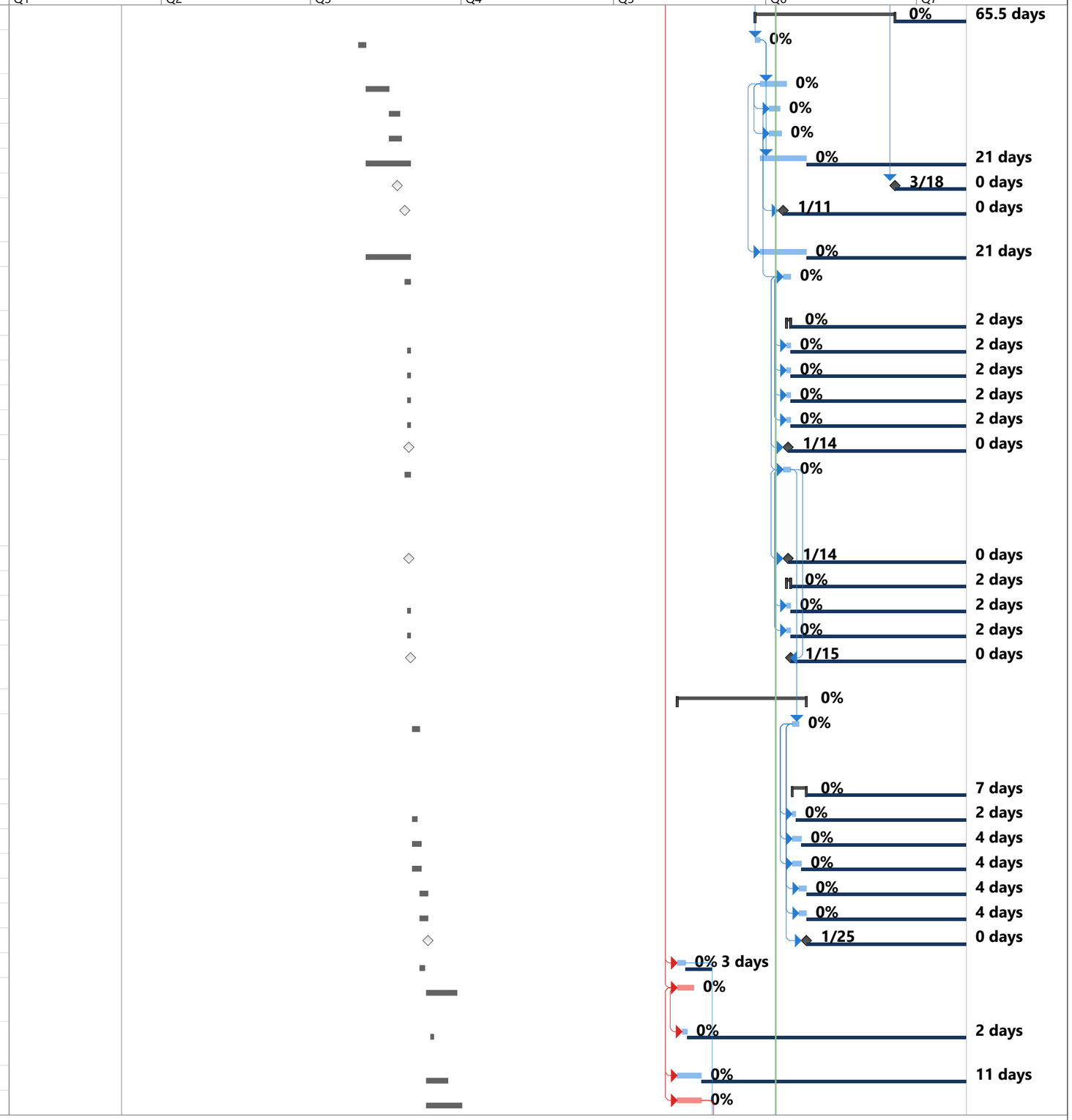
TPRP Work Schedule

ID	Task Name	Duration
44	Inspection Request - for ABC & Asphalt Aggregate & Bitumen Arrival	0 days
45	Material Arrival at Site	0 days
46	**Traffic Control Materials**	**175 days**
47	Road Marking Paints	175 days
48	Supply of Signboard	175 days
49	Speed Break	175 days
50	Material Arrival Date	0 days
51	**Commencement Date - Physical Work**	**150 days**
52	**Milestone -3**	**40.5 days**
53	Mobilization Stage -2	21 days
54	Commencement Date	0 days
55	Clear the site area from rubbish & vegetation matters @ Part B, 0-400M	12 days
56	Key Deliverable Date (Work Started @ Part B, 0 - 400 & Part of Mobilization)	0 days
57	**Milestone -4 @ Part B -0-400M (1-14)**	**45 days**
58	Material Approval Stage- 2	21 days
59	Trail for EJB, TJB & Kerb Casting	9 days
60	Excavation for Electrical and telephone junction box -30Cum	14 days
61	Excavation and installation of Manholes and connect to the GPON Network – 1No	5 days
62	Laying of UPVC pipes/ducts for GPON (Fiber) network-850 Rm - Longitudinal	5 days
63	Trail Inspection Request - for TJB & EJB installation & its Pipe Laying	0 days
64	Installation of grade-25 precast junction boxes – 40 Nos	14 days
65	Installation of Street light foundation – 33 Nos	11 days
66	Key Deliverable Date (TJB & EJB Installation @ Part B, CH 0 - 400)	0 days
67	**Milestone -5 @ Part B 0-400M (1-14)**	**17 days**
68	Supply and laying of 200mm UPVC pipes for Electrical Pipes – 400m	3 days
69	Supply and laying of 100mm UPVC pipes for telephone junction boxes – 565m	3 days
70	Installation of Street light foundation Installation – 33 Nos	11 days
71	Excavate, remove, dispose all the existing materials up to 300mm width and to a depth of 1.0m at the middle of the planting strip to accommodate new graded available material -230 Cu.m	3 days
72	Cut, fill grade to lines & levels and compact the subgrade -3300 Sq.m	6 days
73	CBR Test @ Every 1500 sq m - PART B CH 0 - 400	7 days
74	Inspection Request - for Subgrade Prepartion Work	0 days
75	Key Deliverable Date (TJB & EJB Pipe Laying & Sub Grade Work @ Part B, CH 0 - 400)	0 days



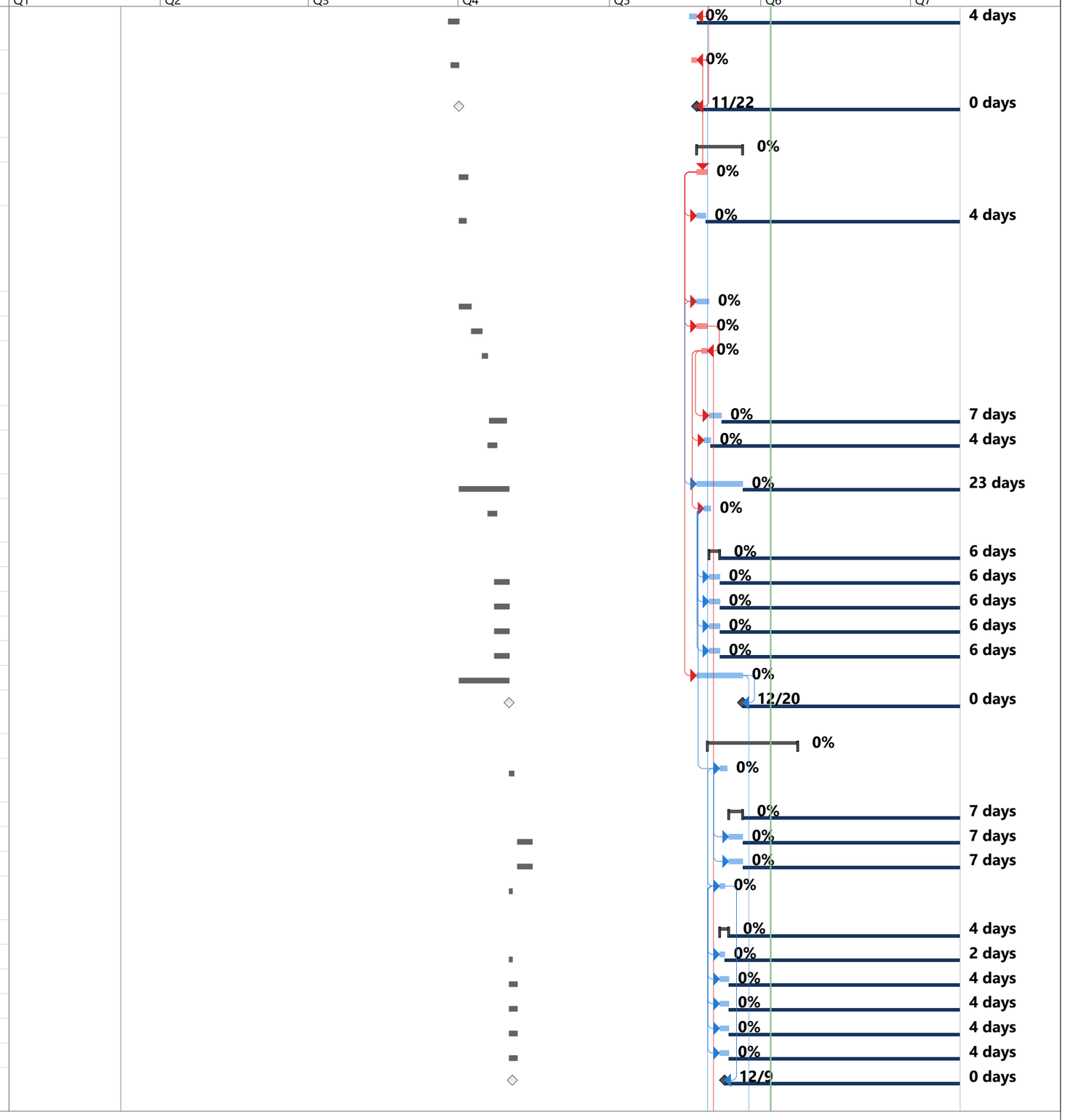
TPRP Work Schedule

ID	Task Name	Duration
76	**Milestone -6 Completion Part B 0-400M (1-14)**	**65.5 days**
77	Backfill, 300mm wide strip to a depth of 900mm at the middle of Planting area -200Cu.m	3 days
78	Installation Street light foundation Installation – 32 Nos	11 days
79	Supply & Lay "Type-B' Pre-cast Kerbs – 850 Rm	5 days
80	Supply & Lay "Type-A" Pre-cast Kerbs - 770 Rm	6 days
81	Plant Commisioning Work	21 days
82	Inspection Request - for Asphalt Plant Installation	0 days
83	Inspection Request - for Curb Laying, Streetlight Foundation Work	0 days
84	Paver Block Laying -1060 Sq.m	21 days
85	Supplying & laying of geocell over 150mm thick and it's Base layer – 3300 Sq.m	3 days
86	**Sub Base - PART B CH 0 -400**	**2 days**
87	CBR Test @ Every 1000 Sq m	2 days
88	Field Dry Density Test @ Every 1000 Sq m	2 days
89	Field Moiture Test @ Every 250 Sq m	2 days
90	Degree of Compaction Test @ Every 500 Sq m	2 days
91	Inspection Request - for Sub base course layig	0 days
92	150mm thick Aggregate Base Course (ABC material) layer -3300 Sq.m	3 days
93	Inspection Request for Base course laying	0 days
94	**Base Layer - PART B CH 0 -400**	**2 days**
95	CBR Test @ Every 600 Sq m	2 days
96	Degree of Compaction Test @ Every 600 Sq m	2 days
97	Key Deliverable Date (Curb Laying, Sub base & Base Course @ Part B, CH 0 - 400)	0 days
98	**Milestone 7 Part B 400-820M (14-28)**	**61 days**
99	Supply Hot mix Asphalt Lay & Compact to a 50mm thickness in all the roads -3300 Sq.m @ 0-400M	3 days
100	**Asphalt Layer - PART B CH 0 -400**	**7 days**
101	Prime Coat - Rate of Application Every 250 sq m	2 days
102	Marshall Stability and Flow - One Test for per 300 Tonne	4 days
103	Laboratory of Density Mix (Marshall) - One Test for per 300 Ton	4 days
104	Thickness of Layer Core @ Every 400 Sq m	4 days
105	Degree of Compaction @ Every 400 sq m	4 days
106	Inspection Request for Asphalt Laying Work	0 days
107	Clear the site area from rubbish & vegetation matters	3 days
108	Excavation for Electrical and telephone junction box -30Cum	7 days
109	Excavation and installation of Manholes and connect to the GPON Network – 1No	2 days
110	Installation of Street light foundation – 50 Nos	11 days
111	Installation of grade-25 precast junction boxes -40 Nos	11 days



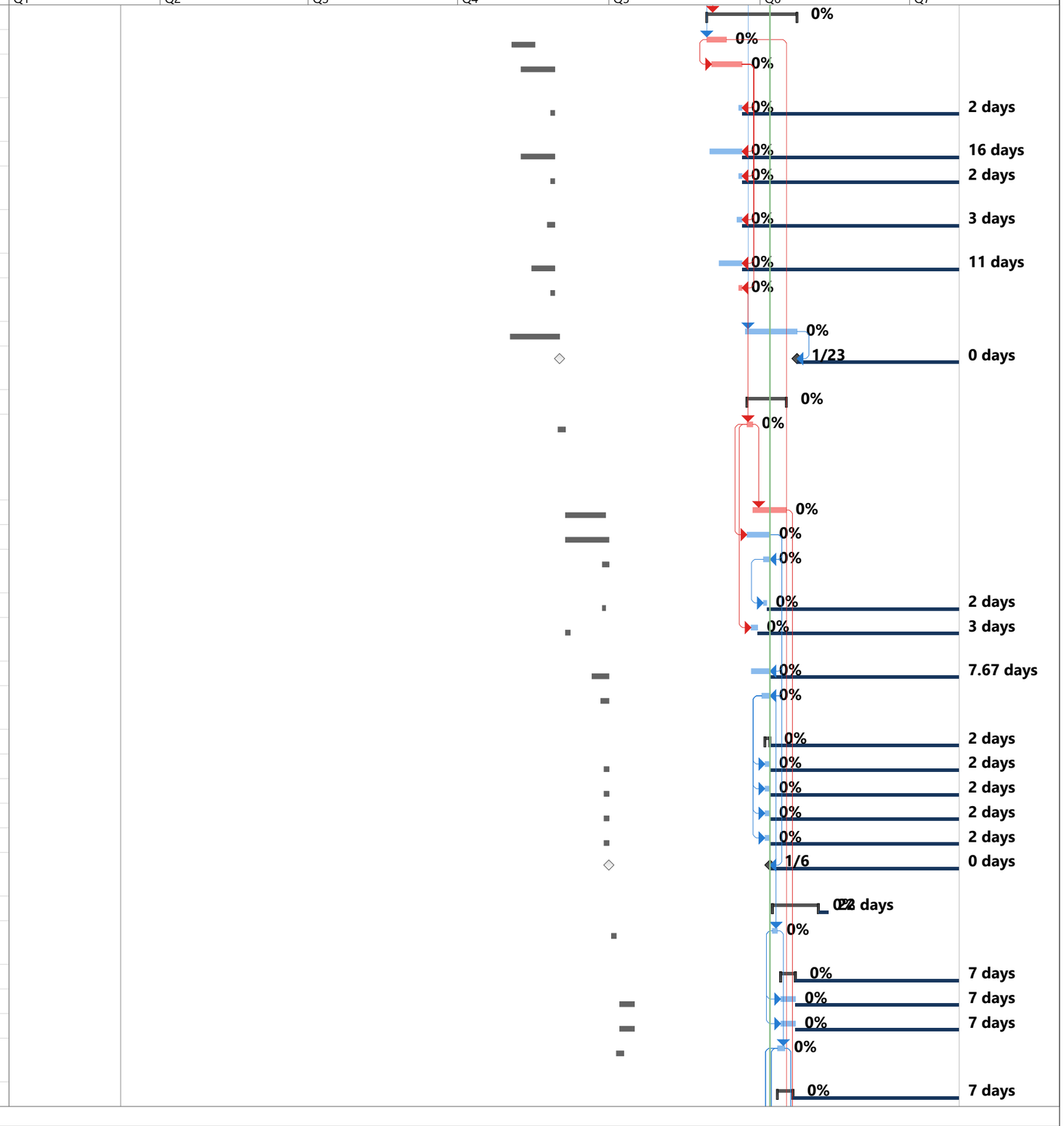
TPRP Work Schedule

ID	Task Name	Duration
112	Supply and laying of 200mm UPVC pipes for Electrical Pipes – 420m	4 days
113	Supply and laying of 100mm UPVC pipes for telephone junction boxes – 580m	3 days
114	Key Deliverable Date Hot Mix Asphalt @ Part B, CH 0 - 400 , EJB & TJB @ Part B CH400 - 820)	0 days
115	**Milestone 8 Part B 400-820M**	**23 days**
116	Supply and laying of UPVC pipes/ducts for GPON (Fiber) network-900 Rm	5 days
117	Excavate, remove, dispose all the existing materials up to 300mm width and to a depth of 1.0m at the middle of the planting strip to accommodate new graded available material -245 Cu.m	4 days
118	Supply & Lay "Type-B' Pre-cast Kerbs – 850 Rm	6 days
119	Supply & Lay "Type-A" Pre-cast Kerbs - 770 Rm	5 days
120	Cut, fill grade to lines & levels and compact the subgrade -3500 Sq.m	3 days
121	CBR Test @ Every 1500 sq m - PART B CH 400 - 820	7 days
122	Backfill, 300mm wide strip to a depth of 900mm at the middle of Planting area -225Cu.m	4 days
123	Paver Block Laying -1060 Sq.m	23 days
124	Supplying & laying of geocell over 150mm thick and it's base Layer – 3500 Sq.m	4 days
125	**Sub Base - PART B CH 400 - 820**	**6 days**
126	CBR Test @ Every 1000 Sq m	6 days
127	Field Dry Density Test @ Every 1000 Sq m	6 days
128	Field Moiture Test @ Every 250 Sq m	6 days
129	Degree of Compaction Test @ Every 500 Sq m	6 days
130	Survey - Coordinate Setout work @ Part A	23 days
131	Key Deliverable Date Curb Laying, Subgrade & Sub Base @ Part B CH400 - 820)	0 days
132	**Milestone 9 Part B 400-820M**	**43 days**
133	150mm thick Aggregate Base Course (ABC material) layer -3500 Sq.m	3 days
134	**Base Layer - PART B CH 400 - 820**	**7 days**
135	CBR Test @ Every 600 Sq m	7 days
136	Degree of Compaction Test @ Every 600 Sq m	7 days
137	Supply Hot mix Asphalt, Lay & Compact to a 50mm thickness in all the roads -2900 Sq.m	2 days
138	**Asphalt Layer - PART A CH 400 - 890**	**4 days**
139	Prime Coat - Rate of Application Every 250 sq m	2 days
140	Marshall Stability and Flow - One Test for per 300 Tonne	4 days
141	Laboratory of Density Mix (Marshall) - One Test for per 300 Ton	4 days
142	Thickness of Layer Core @ Every 400 Sq m	4 days
143	Degree of Compaction @ Every 400 sq m	4 days
144	Key Deliverable Date ABC Layer & Hotmix Asphalt @ Part B CH400 - 820)	0 days



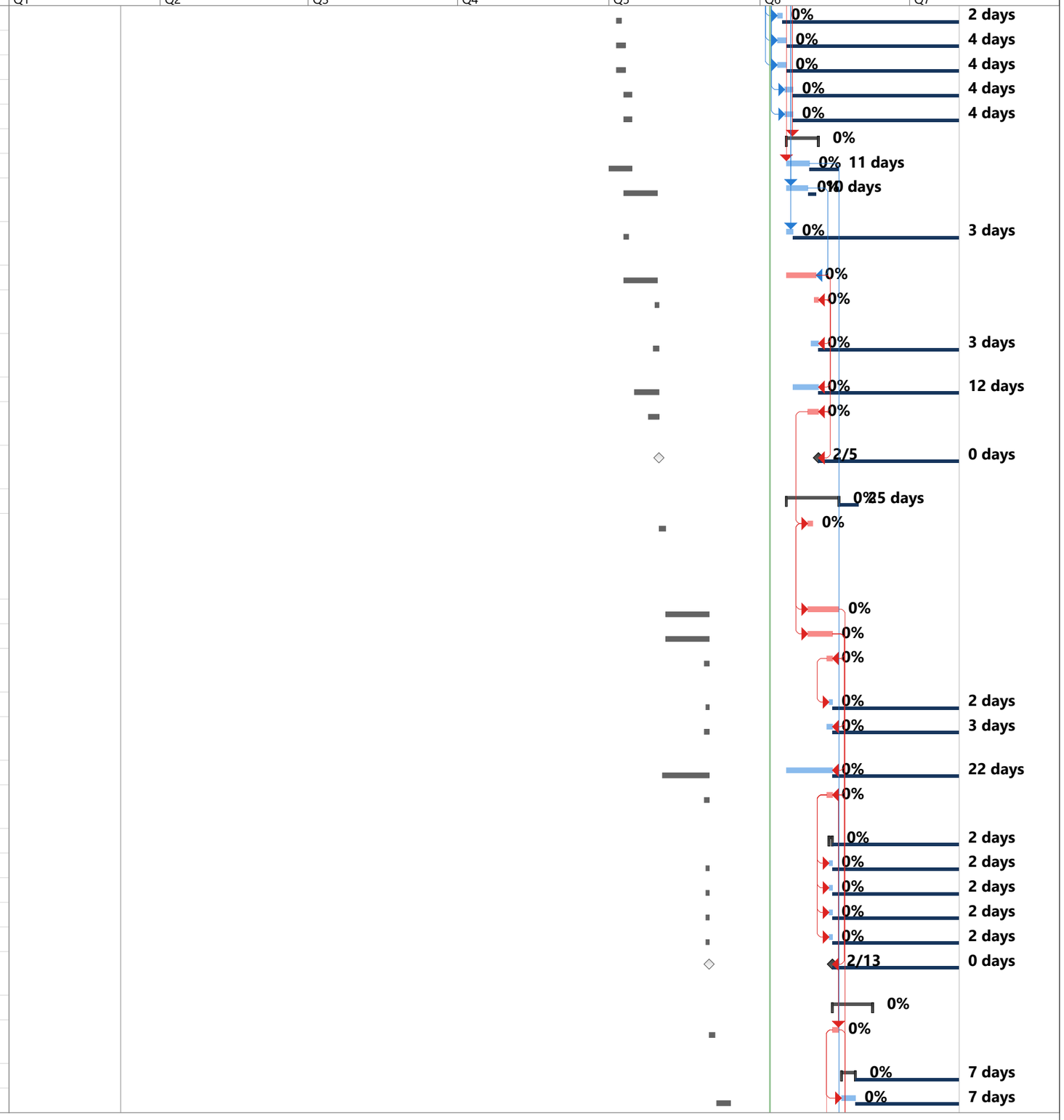
TPRP Work Schedule

ID	Task Name	Duration
145	**Part A 0-400M (79-96)**	**43 days**
146	Clear the site area from rubbish & vegetation matters	10 days
147	Excavation for Electrical and telephone junction box -30Cum	15 days
148	Excavation and installation of Manholes and connect to the GPON Network – 2No	2 days
149	Installation of grade-25 precast junction boxes - 39Nos	16 days
150	Supply and laying of 200mm UPVC pipes for Electrical Pipes –350m	2 days
151	Supply and laying of 100mm UPVC pipes for telephone junction boxes –450m	3 days
152	Installation of Street light foundation -25 Nos	11 days
153	Supply and laying of UPVC pipes/ducts for GPON (Fiber) network- 390Rm	2 days
154	Survey - Coordinate Setout work	24 days
155	Key Deliverable Date EJB & TJB Installation & Pipe Laying @ Part A CH 0 - 400)	0 days
156	**Milestone 10 Part A 0-400 (79-96)**	**18 days**
157	Excavate, remove, dispose all the existing materials up to 300mm width and to a depth of 1.0m at the middle of the planting strip to accommodate new graded available material - 135Cu.m	3 days
158	Supply & Lay "Type-B' Pre-cast Kerbs –1300Rm	15 days
159	Supply & Lay "Type-A" Pre-cast Kerbs - 650m	10 days
160	Cut, fill grade to lines & levels and compact the subgrade - 3400Sq.m	3 days
161	CBR Test @ Every 1500 sq m - PART A CH 0- 400	2 days
162	Backfill, 300mm wide strip to a depth of 900mm at the middle of Planting area -120Cu.m	3 days
163	Paver Block Laying -370 Sq.m	7.67 days
164	Supplying & laying of geocell over 150mm thick and it's Base Layer -3500 Sq.m	4 days
165	**Sub Base - PART A CH 0 - 400**	**2 days**
166	CBR Test @ Every 1000 Sq m	2 days
167	Field Dry Density Test @ Every 1000 Sq m	2 days
168	Field Moiture Test @ Every 250 Sq m	2 days
169	Degree of Compaction Test @ Every 500 Sq m	2 days
170	Key Deliverable Date Curb, Subgrade & Sub base @ Part A CH 0 - 400)	0 days
171	**Mile Stone 11 Part A 0-400 (79-96)**	**22 days**
172	150mm thick Aggregate Base Course (ABC material) layer - 3500Sq.m	3 days
173	**Base Layer - PART A CH 0 - 400**	**7 days**
174	CBR Test @ Every 600 Sq m	7 days
175	Degree of Compaction Test @ Every 600 Sq m	7 days
176	Supply Hot mix Asphalt, Lay & Compact to a 50mm thickness in all the roads -2900 Sq.m	3 days
177	**Asphalt Layer - PART A CH 0 -400**	**7 days**



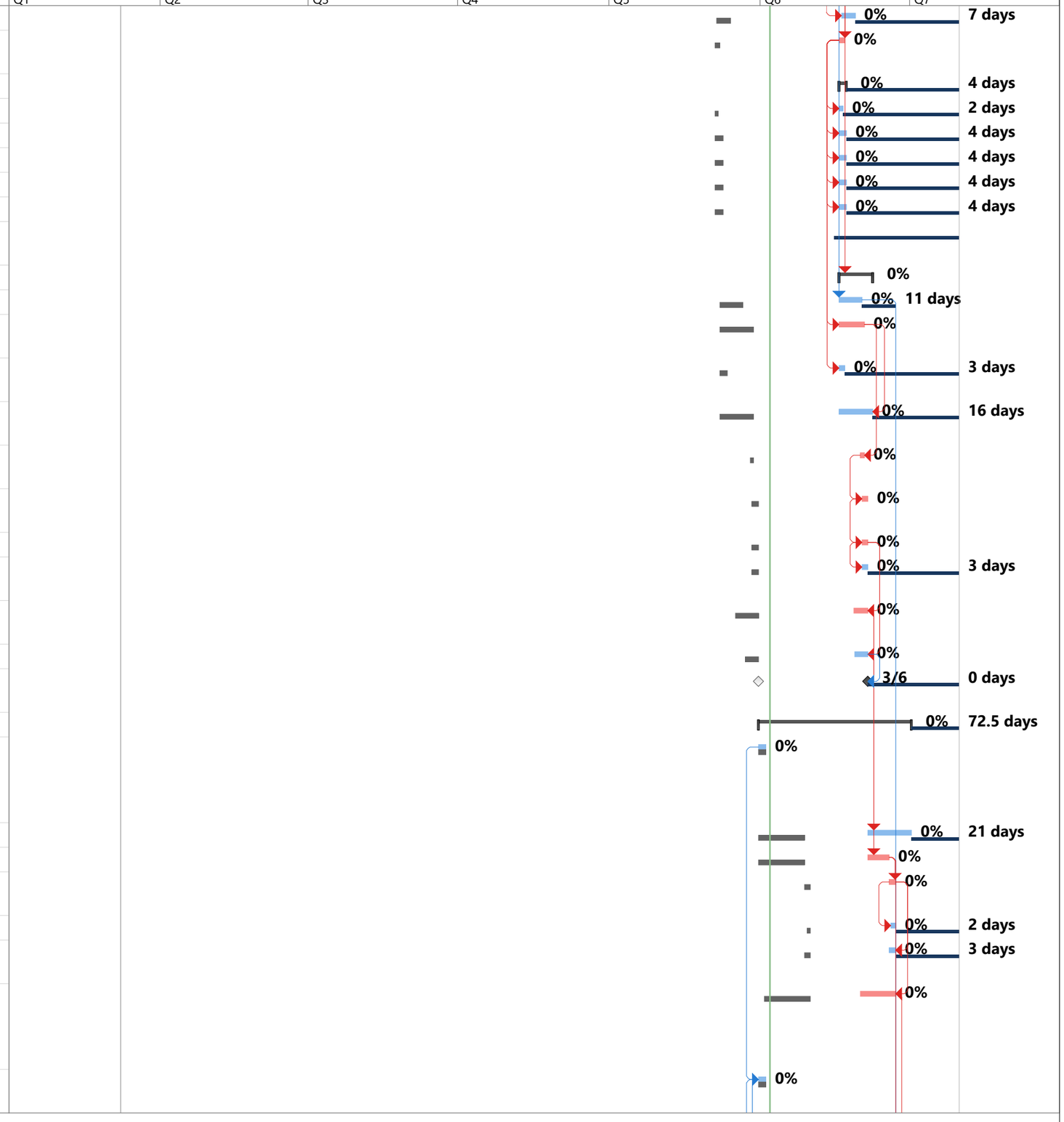
TPRP Work Schedule

ID	Task Name	Duration
178	Prime Coat - Rate of Application Every 250 sq m	2 days
179	Marshall Stability and Flow - One Test for per 300 Tonne	4 days
180	Laboratory of Density Mix (Marshall) - One Test for per 300 Ton	4 days
181	Thickness of Layer Core @ Every 400 Sq m	4 days
182	Degree of Compaction @ Every 400 sq m	4 days
183	**PART A 400-890M (64-79)**	**15 days**
184	Clear the site area from rubbish & vegetation matters	11 days
185	Excavation for Electrical and telephone junction box -45Cum	10 days
186	Excavation and installation of Manholes and connect to the GPON Network – 3No	3 days
187	Installation of grade-25 precast junction boxes - 50Nos	14 days
188	Supply and laying of 200mm UPVC pipes for Electrical Pipes –450m	2 days
189	Supply and laying of 100mm UPVC pipes for telephone junction boxes –550m	3 days
190	Installation of Street light foundation -30 Nos	12 days
191	Supply and laying of UPVC pipes/ducts for GPON (Fiber) network- 450m	5 days
192	Key Deliverable Date EJB & TJB & Its Pipe Laying @ Part A CH 400 - 890)	0 days
193	**Mile Stone 12 PART A 400-890M (64-79)**	**25 days**
194	Excavate, remove, dispose all the existing materials up to 300mm width and to a depth of 1.0m at the middle of the planting strip to accommodate new graded available material - 175Cu.m	3 days
195	Supply & Lay "Type-B' Pre-cast Kerbs –1400m	15 days
196	Supply & Lay "Type-A" Pre-cast Kerbs - 800m	12 days
197	Cut, fill grade to lines & levels and compact the subgrade – 3600 Sq.m	3 days
198	CBR Test @ Every 1500 sq m - PART A CH 400 - 890	2 days
199	Backfill, 300mm wide strip to a depth of 900mm at the middle of Planting area -140Cu.m	3 days
200	Paver Block Laying -400 Sq.m	22 days
201	Supplying & laying of geocell over 150mm thick and it's Base Layer -3700 Sq.m	3 days
202	**Sub Base - PART A CH 400 - 890**	**2 days**
203	CBR Test @ Every 1000 Sq m	2 days
204	Field Dry Density Test @ Every 1000 Sq m	2 days
205	Field Moiture Test @ Every 250 Sq m	2 days
206	Degree of Compaction Test @ Every 500 Sq m	2 days
207	Key Deliverable Date Curb Laying Sub Grade and Sub Base @ Part A CH 400 - 890)	0 days
208	**Mile Stone 13 Part PART A 400-890M (64-79)**	**19 days**
209	150mm thick Aggregate Base Course (ABC material) layer - 3700Sq.m	3 days
210	**Base Layer - PART A CH 400 - 890**	**7 days**
211	CBR Test @ Every 600 Sq m	7 days



TPRP Work Schedule

ID	Task Name	Duration
212	Degree of Compaction Test @ Every 600 Sq m	7 days
213	Supply Hot mix Asphalt, Lay & Compact to a 50mm thickness in all the roads -3100 Sq.m	3 days
214	**Asphalt Layer - PART B CH 400 -820**	**4 days**
215	Prime Coat - Rate of Application Every 250 sq m	2 days
216	Marshall Stability and Flow - One Test for per 300 Tonne	4 days
217	Laboratory of Density Mix (Marshall) - One Test for per 300 Ton	4 days
218	Thickness of Layer Core @ Every 400 Sq m	4 days
219	Degree of Compaction @ Every 400 sq m	4 days
220	Key Deliverable Date ABC & Asphalt Layer @ Part A CH 400 - 890)	
221	**PART A 890-1440M (50 -64)**	**16 days**
222	Clear the site area from rubbish & vegetation matters	11 days
223	Excavation for Electrical and telephone junction box -30Cum	12 days
224	Excavation and installation of Manholes and connect to the GPON Network – 3 No	3 days
225	installation of of grade-25 precast junction boxes – 36 Nos	16 days
226	Supply and laying of 200mm UPVC pipes for Electrical Pipes –380m	2 days
227	Supply and laying of 100mm UPVC pipes for telephone junction boxes –420m	3 days
228	Installation of Street light foundation -25 Nos	3 days
229	Supply and laying of UPVC pipes/ducts for GPON (Fiber) network -400m	3 days
230	Supply and fixing of 8M height poles for street lamps at locations @ Part B -25 Nos	7 days
231	Cable Laying @ Part B -700m	6.5 days
232	Key Deliverable Date EJB &TJB Inatllation and it's Pipe Laying @ Part A CH 890 - 1440)	0 days
233	**Milestone 14 PART A 890-1440M (50 -64)**	**72.5 days**
234	Excavate, remove, dispose all the existing materials up to 300mm width and to a depth of 1.0m at the middle of the planting strip to accommodate new graded available material - 140Cu.m	3 days
235	Supply & Lay "Type-B' Pre-cast Kerbs –1300m	21 days
236	Supply & Lay "Type-A" Pre-cast Kerbs - 650m	10 days
237	Cut, fill grade to lines & levels and compact the subgrade - 3400Sq.m	3 days
238	CBR Test @ Every 1500 sq m - PART A CH 890 - 1440	2 days
239	Backfill, 300mm wide strip to a depth of 900mm at the middle of Planting area -130Cu.m	3 days
240	Paver Block Laying -350 Sq.m	17 days
241	Supplying & laying of geocell over 150mm thick and it's Base Layer – 3300 Sq.m	3 days

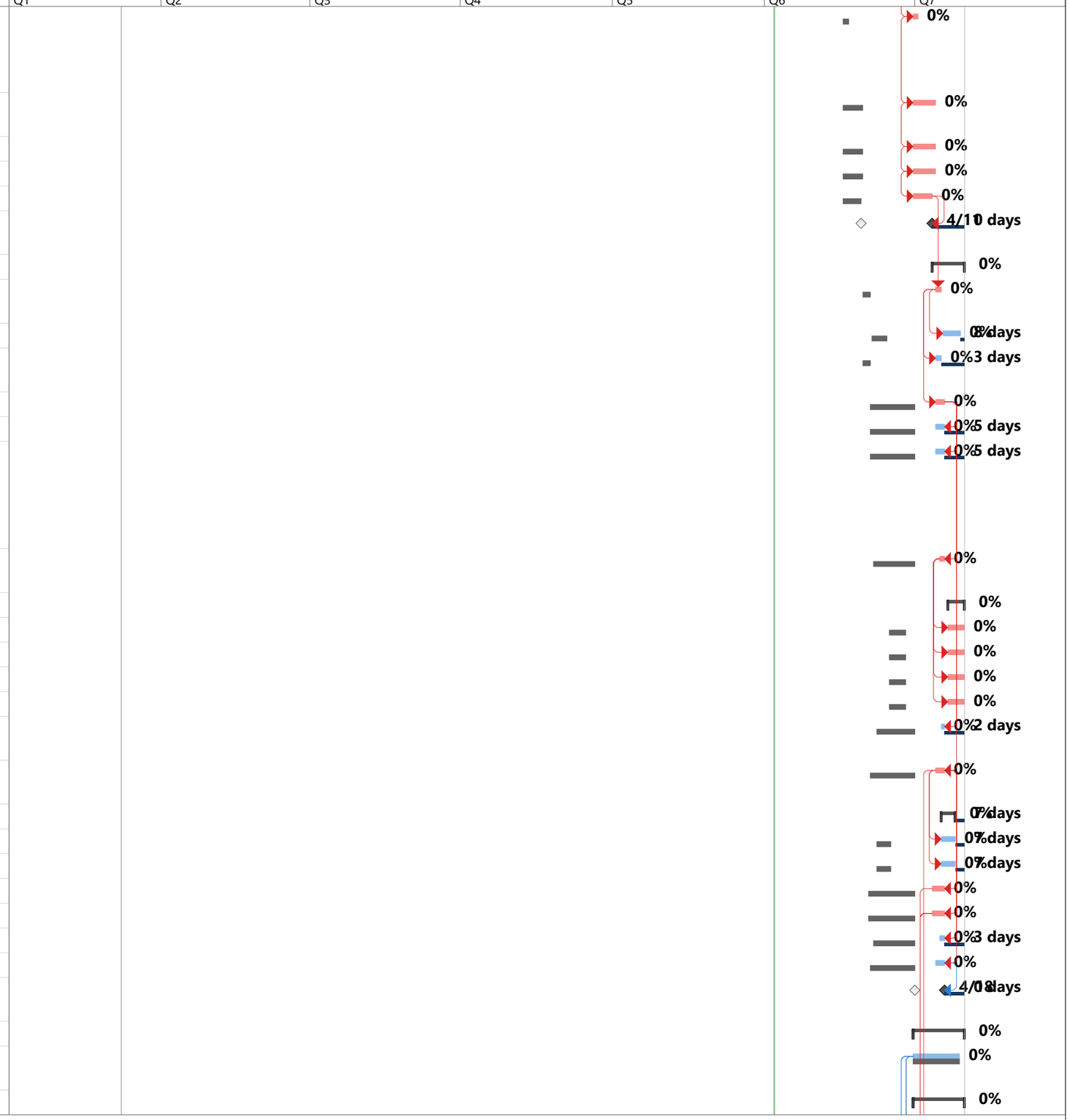


TPRP Work Schedule

ID	Task Name	Duration
242	**Sub Base - PART A CH 890 - 1440**	**8 days**
243	CBR Test @ Every 1000 Sq m	8 days
244	Field Dry Density Test @ Every 1000 Sq m	8 days
245	Field Moiture Test @ Every 250 Sq m	8 days
246	Degree of Compaction Test @ Every 500 Sq m	8 days
247	150mm thick Aggregate Base Course (ABC material) layer – 3300 Sq.m	3 days
248	**Base Layer - PART A CH 890 - 1440**	**7 days**
249	CBR Test @ Every 600 Sq m	7 days
250	Degree of Compaction Test @ Every 600 Sq m	7 days
251	Supply and fixing of 8M height poles for street lamps at locations @ Part B -40 Nos	11 days
252	Distribution Boxes and Meters @Part B -2 Nos	10 days
253	Cable Laying @ Part B -1300m	10 days
254	Road Marking @ Part B -1850m	9 days
255	Inspection Request - for Traffic control Activity, Marking & Signage Board	0 days
256	Key Deliverable Date Subgrade, Sub base, Curb Laying & ABC @ Part A CH 890 - 1440)	0 days
257	**Milestone 15 PART A 890-1440M (50 -64)**	**23 days**
258	Supply Hot mix Asphalt, Lay & Compact to a 50mm thickness in all the roads – 2800 Sq.m	23 days
259	**Asphalt Layer - PART A CH 890 - 1440**	**6 days**
260	Prime Coat - Rate of Application Every 250 sq m	2 days
261	Marshall Stability and Flow - One Test for per 300 Tonne	4 days
262	Laboratory of Density Mix (Marshall) - One Test for per 300 Tor	4 days
263	Thickness of Layer Core @ Every 400 Sq m	4 days
264	Degree of Compaction @ Every 400 sq m	4 days
265	Key Deliverable Date - Hot Mix Asphalt Laying @ Part A CH 890 - 1440)	0 days
266	**PART A 1440-1720 (35-50)**	**16 days**
267	Clear the site area from rubbish & vegetation matters	10 days
268	Excavation for Electrical and telephone junction box -25Cum	9 days
269	Excavation and installation of Manholes and connect to the GPON Network – 2No	3 days
270	installation of grade-25 precast junction boxes - 30Nos	3 days
271	Supply and laying of 200mm UPVC pipes for Electrical Pipes –270m	3 days
272	Supply and laying of 100mm UPVC pipes for telephone junction boxes –370m	4 days
273	Fabrication of Installation of Street light foundation -20 Nos	11 days
274	Supply and laying of UPVC pipes/ducts for GPON (Fiber) network- 300m	3 days

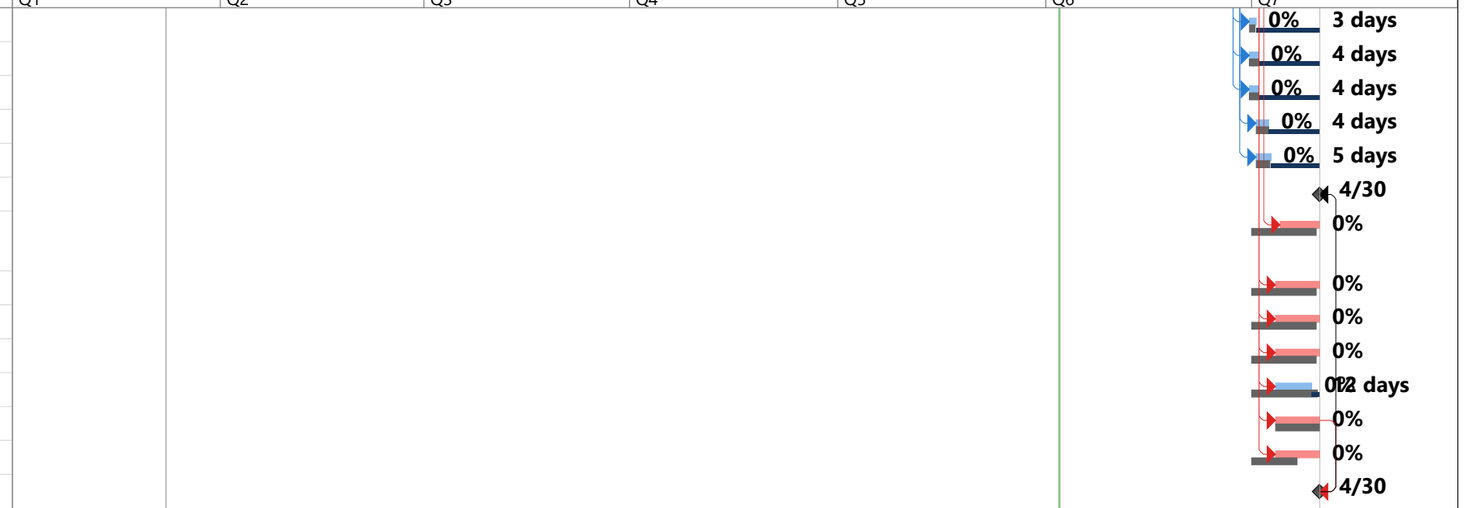
TPRP Work Schedule

ID	Task Name	Duration
275	Excavate, remove, dispose all the existing materials up to 300mm width and to a depth of 1.0m at the middle of the planting strip to accommodate new graded available material - 130Cu.m	3 days
276	Supply and fixing of 8M height poles for street lamps at locations @ Part A -50 Nos	10 days
277	Distribution Boxes and Meters @Part A – 1 No	10 days
278	Cable Laying @ Part A – 800m	10 days
279	Supply & Fixing of Signage Board @ Part B -10 Nos	9 days
280	Key Deliverable Date -EJB, TJB, Pipe Laying @ Part A CH 1440 - 1720)	0 days
281	**Milestone 16 PART A 1440-1720 (35-50)**	**15 days**
282	Cut, fill grade to lines & levels and compact the subgrade - 3200Sq.m	3 days
283	CBR Test @ Every 1500 sq m - PART A CH 1440 - 1720	8 days
284	Backfill, 300mm wide strip to a depth of 900mm at the middle of Planting area -110Cu.m	3 days
285	Supply & Lay "Type-B' Pre-cast Kerbs –1200m	5 days
286	Supply & Lay "Type-A" Pre-cast Kerbs - 600m	5 days
287	Paver Block Laying -300 Sq.m	5 days
288	Supplying & laying of geocell over 150mm thick and it's Base Layer -3150 Sq.m	3 days
289	**Sub Base - PART A CH 1440 - 1720**	**8 days**
290	CBR Test @ Every 1000 Sq m	8 days
291	Field Dry Density Test @ Every 1000 Sq m	8 days
292	Field Moiture Test @ Every 250 Sq m	8 days
293	Degree of Compaction Test @ Every 500 Sq m	8 days
294	150mm thick Aggregate Base Course (ABC material) layer – 3150 Sq.m	2 days
295	Supply and fixing of 8M height poles for street lamps at locations @ Part A -50 Nos	5 days
296	**Base Layer - PART A CH 1440 - 1720**	**7 days**
297	CBR Test @ Every 600 Sq m	7 days
298	Degree of Compaction Test @ Every 600 Sq m	7 days
299	Distribution Boxes and Meters @Part A – 1 No	6 days
300	Cable Laying @ Part A – 1100m	6 days
301	Main Connection @ Part B	3 days
302	Road Marking @ Part A – 1700m	5 days
303	Key Deliverable Date -EJB, TJB, Pipe Laying @ Part A CH 1440 - 1720)	0 days
304	**Milestone 17 PART A 1440-1720 (35-50)**	**24 days**
305	Supply Hot mix Asphalt, Lay & Compact to a 50mm thickness in all the roads – 2400 Sq.m	15 days
306	**Asphalt Layer - PART A CH 1440 - 1720**	**24 days**



TPRP Work Schedule

ID	Task Name	Duration
307	Prime Coat - Rate of Application Every 250 sq m	3 days
308	Marshall Stability and Flow - One Test for per 300 Tonne	4 days
309	Laboratory of Density Mix (Marshall) - One Test for per 300 Ton	4 days
310	Thickness of Layer Core @ Every 400 Sq m	4 days
311	Degree of Compaction @ Every 400 sq m	5 days
312	Project Completion Date	0 days
313	Supply and fixing of 8M height poles for street lamps at locations @ Part A	14 days
314	Distribution Boxes and Meters @Part A – 1 No	15 days
315	Cable Laying @ Part A -1250m	15 days
316	Main Connection @ Part A	15 days
317	Road Marking @ Part A – 2000m	12 days
318	Supply & Fixing of Signage Board @ Part A – 30 Nos	15 days
319	Demobilization & Site Cleaning	15 days
320	Key Deliverable Date -Hotmix Asphalt @ Part A CH 1440 - 1720)	0 days



12.14 Stakeholder Meeting requests

Fw: Thilafushi Pilot Road Project EIA - Stakeholder Consultation

Hashma Hameed <hashma.hameed@urbanco.mv>

Mon 5/15/2023 10:40 AM

To:info@mtcc.com.mv <info@mtcc.com.mv>;projects@mtcc.com.mv <projects@mtcc.com.mv>
Cc:Aishath Afshaan Waheed <aishath.afshaan@urbanco.mv>;Hassaan Abdul Muhsin <Hassaan.Abdul@urbanco.mv>

1 attachments (2 MB)
20221207_THILAFUSHI_PILOT_ROAD-1.pdf;

Dear Stakeholder,

Please find the email below for your reference. Let us know a date and time at your earliest convenience to have the mentioned online stakeholder meeting.

Regards,

HASHMA HAMEED
JUNIOR ENVIRONMENTAL PLANNER
URBAN PLANNING, ENVIRONMENTAL UNIT

HDC Building, 3rd Floor, Hulhumalé, Republic of Maldives
Tel: +(960) 3353535, **Fax:** +(960) 3358892
hello@urbanco.mv www.urbanco.mv

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From: Hashma Hameed <hashma.hameed@urbanco.mv>
Sent: Thursday, April 6, 2023 11:00 AM
To: info@mtcc.com.mv <info@mtcc.com.mv>
Cc: Environment Unit <Environment@urbanco.mv>; Shahid Ahmed Waheed <shahidahmed@urbanco.mv>; Hassan Akram <akram@urbanco.mv>; Hussain Saliq <saliq@urbanco.mv>; Dhimyan Ahmed Ismail <dhimyan@urbanco.mv>
Subject: Thilafushi Pilot Road Project EIA - Stakeholder Consultation

Dear Stakeholder,

The Thilafushi pilot road project was formulated by Greater Male' Industrial Zone Limited (GMIZL) to improve the accessibility of the island. With the merger of GMIZL and HDC, it had been proposed to re-formulate the project to propose a road which covers the full span of Thilafushi Phase I. This is to connect with the already laid road in the southern half of the island which connects the eastern and western wings of the island. Furthermore, this additional road length would ensure the provisional connection for Male'-Thilafushi Bridge.

The objectives of the project are as follows,

- Potentially provide a better road in the island
- Provide a solution for the drainage system in the island, and
- provide a safe and convenient pedestrian walkway for the residents of Thilafushi

This road will therefore be a key success factor to the future development of Thilafushi. However, during the development, this project will disrupt the day-to-day operations of your company. Hence, your company is a main stakeholder identified for this project for the EIA process, we would like to meet with you individually to share the plans for the approved drawings and hear your concerns. Therefore, please find the attached pilot road approved drawings for your information and please provide us with a contact number to set up an online discussion meeting.

Best Regards,

HASHMA HAMEED
JUNIOR ENVIRONMENTAL PLANNER
URBAN PLANNING, ENVIRONMENTAL UNIT

HDC Building, 3rd Floor, Hulhumalé, Republic of Maldives
Tel: +(960) 3353535, **Fax:** +(960) 3358892
hello@urbanco.mv www.urbanco.mv

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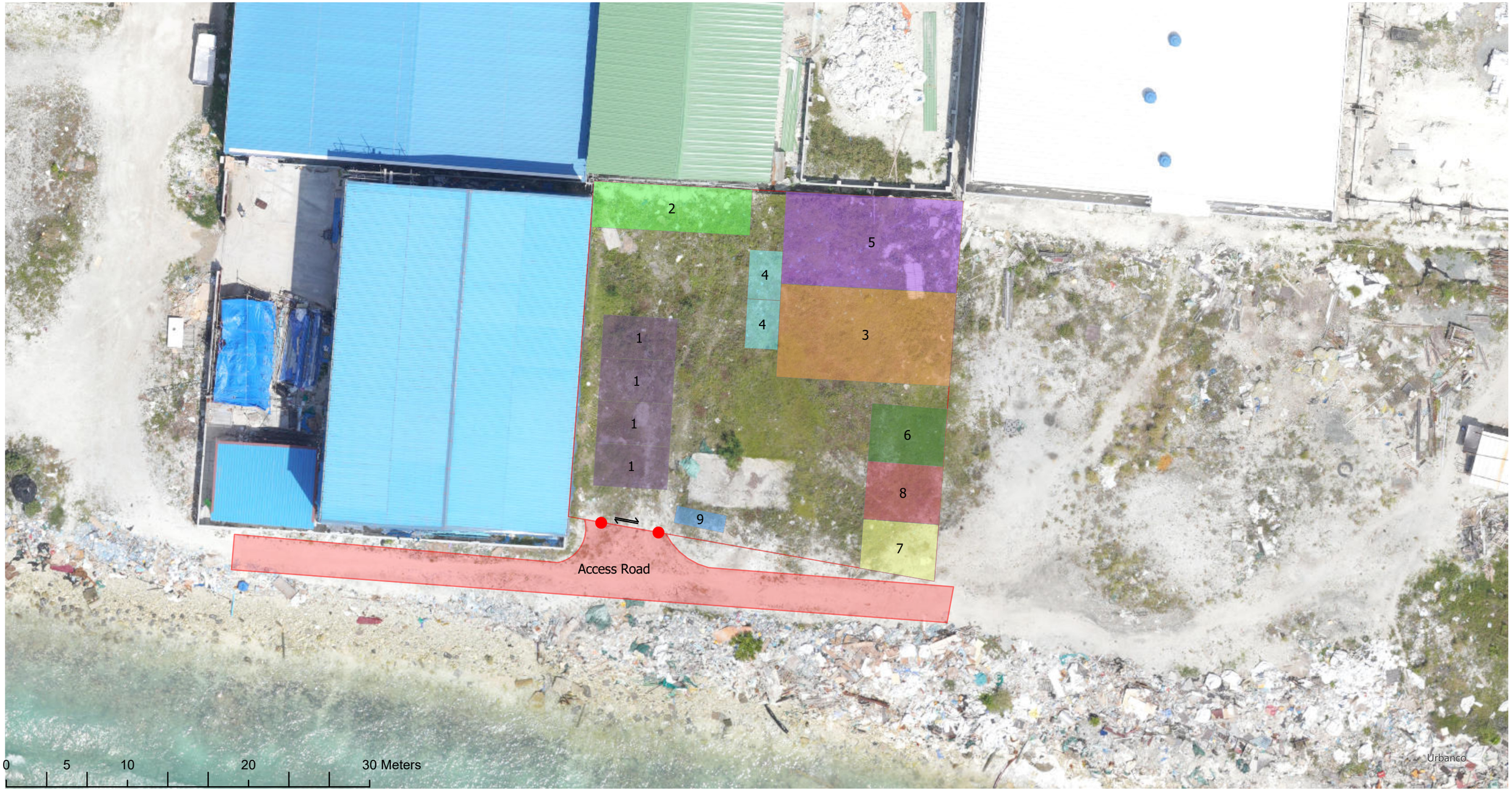
12.15 Temporary Work Camp



CAMP
Vehicle Parking
Accomodation
Hazardous Waste
Toilet
Waste Management
Rereation Space
Oil Management
First Aid
Security
Access Road

TEMP WORK CAMP

Drawing Name : EIA Map	Drawn date: 02 January 2024	Scale: 1:309

urbanco
Housing Development Corporation Limited

12.16 Team and Role

List of contributors	Component covered or role	Identification / licenses	Category	Contact	Signature
Hassaan Abdul Muhsin	Non-technical Summery Introduction to the ESIA Description of the proposed project Stakeholder's consultation Policy and legal framework Description of the environment Potential Impacts Mitigation of the negative impacts Environment Management Plan Alternatives Environmental Monitoring Recommendations	EIA P02/2020	A	7901665 hassaanabdulmuhsin@gmail.com	
Mariyam Sunaina Mohamed	Engineer Work methodology Impact Prediction Detailed Design Drawings Potential Impacts	EIA T(B)01/2023	B	9873819 17sunai@gmail.com	
Hashma Hameed	Non-technical Summery Existing Environment Mitigation of the negative impacts Stakeholder's consultation Potential Impacts Mitigation of the negative impacts Environment Management Plan	EIA T(B)04/2023	B	7632012 hashmahameed@gmail.com	
Mahaath Abdulla	Stakeholder Consultation Survey 360 Imagery Impact Map	-	-	7244444 Mahaath.abdulla@gmail.com	
Mohamed Sameeh	Stakeholder Consultation Survey	-	-	7501066 m.sameeh@urbanco.mv	
Mohamed Affaan	360 Imagery Flood Map Tree Survey Map General map of access	-	-	9969610 mode.affaan@gmail.com	
Aishath Afshan Waheed	Stakeholder's consultation	-	-	7899863 aishath.afshaan@urbanco.mv	
Hussain Saliq	Detailed Design Drawings	DPR2021097LE (Engineer license)	-	7550909 saliq@urbanco.mv	
Mohamed Samaan	Vegetation plan	-	-	9149706 samaan@outlook.com	

List of contributors	Component covered or role	Identification / licenses	Category	Contact	Signature
Uza. Aishath Ashiya Shathir	Stakeholder Identification and Analysis	PL-2023/13	-	9191949 aishathshathir@gmail.com	
Suhaa Mohamed	Stakeholder Identification and Analysis	-	-	9998383 Suhaa.mohamed333@gmail.com	
Aiman Shiyam Waheed	Formatting GIS Tree Map	-	-	7882266 aiman.shiyam@urbanco.mv	

12.17 CVs

Curriculum Vitae

1. Name: Hassaan Abdul Muhisn
2. **Date of Birth:** 22nd April 1989
3. Nationality: Maldivian
4. **Contact:** 7901665
5. Education:

2016 – 2018	M.Se In Environmental Science Chiang Mai University, Chiang Mai, Thailand.
2012 – 2012	University of Mysore B.Ed University of Mysore St.Joseph's College Of Education, Mysore, India
2008 - 2011	BSc (BTCZ) Programme in Bio-technology, Chemistry and Zoology University of Mysore St. Philomena's College, Mysore, India
2006 - 2008	Centre for Higher Secondary Education Male', Maldives Edexcel GCE A/L (Biology, Chemistry, Physics), HSC (Dhivehi, Islam)
2003 - 2005	Majeediyya School Male', Maldives Cambridge IGCSE (English, Maths), Cambridge GCE O/L (Physics, Biology, Chemistry, Computer Studies), SSC (Dhivehi, Islam)
1996 - 2002	Kalaafaanu School Male', Maldives Primary Schooling

6. Languages

Dhivehi
1. speaking, good 2. reading, good 3. writing, good

English
1. speaking, good 2. reading, good 3. writing, good

7. Experience/ Employment Record

Date of employment	*Employer*	*Details*
Since April 2022		***Position**: Environment Analyst HDC* ***Primary role:*** *Providing solution to HDC*
July 2020 to April 202	*Majeediyya School, Maldives*	***Position**: Teacher, Key stage 3* ***Primary role:*** *Teaching* *a) Key stage 3 (Grade 7)*
March 2018 to May 2020	*INSA.PVT.LTD*	***Positions held:** Environmental researcher, analyst., licenced consultant 2018*
Aug 2015 to Aug 2016	*MMPRC*	***Positions held:** Assistant Director* ***Primary role:*** *1. Connecting desk between MMPRC and MOT.*
Feb 2013 to Aug 2015	*Majeediyya School, Maldives*	***Positions held:** Teacher* ***Primary role:*** *1. Teaching* *a) Grade 9 and 10 (CIE)* *b) Grade 11 (IGCSE)* ***Sub tasks assigned:*** *2. Internal verifier* *a)B-tech sports* *b)B-tech arts* *3. Lead invigilator* *a) IGCSE exams*
Aug 2011, To Dec 2011	*Seamarc.pvt.ltd*	***Positions held:** Environment Analyst* ***Summary of Projects Undertaken:*** *1. Setting out, Landaa Giraivaru* *a) Sea wall near the main pool* ***Role:** Setting out survey* *2. Setting out , Cheval Blanc Randheli* *a) the water villas* *b) reclaimed islands* *c) arrival jetties* ***Role:** Setting out survey* *3. Cheval Blanc Randheli* *a) the coral propagation component* ***Role**: Setting out survey*
Dec 2005 - March 2006	*Sunset restaurant Paradise Island*	1.***Positions held:** Billing clerk*

Resort, Maldives	*Sunset Restaurant* *Paradise Island Resort,* Maldives

8. Qualifications, and trainings

17 September 2011	PADI Open water Sea explores dive school Bodufungandu magu *Male', Maldives*
6 March 2014	In service training Professional development Curriculum Application and Change
1 – 3 April 2014	Invigilator's Training Department of Public Examinations *Male', Maldives*
12 February 2015	In service training Professional development Specific learning difficulties and Mentoring *Male', Maldives*
31 March 2015	BTEC Internal Verification and Standardisations
23 April 2015	In service training Professional development Multiple Intelligence & Activity based learning. *Male', Maldives*
26 May 2015	PADI Speciality Diver Dive against Debris *Villa College Maldives* *Bodutakurufaanu magu* *Male', Maldives*
26 May 2015	PADI Reef Check Eco Diver Villa College Maldives Bodutakurufaanu magu Male', Maldives
27 March 2019	Environment consultant licence (permanent) EIA P02/2020, Category A Environmental Protection Agency

9. Publications

H.Abdul Mushin, I. Patawang, C. Phalaraksh, (2018) Chromosomal Aberrations Observed in two Fejervarya spp. living in Artisanal Mining Farms in Pichit Province, Thailand. Proceeding of ISER-107th International Conference on Environment and Natural Science (ICENS). February 10th 2018, Phuket, Thailand (Awaiting publication in JMES, Journal of Materials and Environmental Science (ISSN: 2028-2508))

11 Publications Worked

September 2018-december 2018	**Bio-diversity Survey** Conserving Kelaa's Kandoofa – a Biodiversity Mapping and Food Security Approach, for Ha Kelaa under the Global Environment Facility Small Grants Program OP6.
07th April 2022 - 30th May 2023	Green Climate Fund (GCF). Island Water Resource Conservation and Management Plan (IWRMP) done for the Ministry of Environment Climate Change and Technology. Maldives
Jan 2023 – May 2023	**Bio-diversity Survey** Biodiversity survey Kurin'bee wetland assessment, Done for The NGO Kurinbee Youth Movement

EIA		Supervisor	Proponent/ Contractor / main contact
25th Dec 2022 – 15th May 2023 (author) Completed	EIA for the Proposed Reef Scaping Project at Eastern Beach, Hulumale', Kaafu Atoll	**	**Proponent** Housing development Cooperation (HDC)
2nd Jan 2023 – 24th Jan 2023 (author) Completed	EMP for the Proposed Development of a Wreck Dive Site at Kudagiri Island, Kaafu Atoll	**	**Proponent** Housing development Cooperation (HDC)
1st Sept 2022 – 13 October 2022	EMP for the Proposed Development of a Wreck Dive Site at Kubuladi Thila; Fiyavi Dive Point Project	**	**Proponent** Housing development Cooperation (HDC)
9th September 2019 - Oct 2021 (author) Completed	Environment Impact Assessment (EIA) for water supply development project at R.Rasmaadhoo, Maldives	**	**Proponent** Ministry of National Planning, Housing and Infrastructure (MNPHI). Mohamed Moosa Didi 7778246 **Client** MICRON PVT LTD | C-0268/2005 Ali Najeeb 7774005
9th September 2019- 24th Oct 2021 (author) Completed	Environment Impact Assessment (EIA) for water supply development project at TH Burunee, Maldives	**	**Proponent** Ministry of National Planning, Housing and Infrastructure (MNPHI). Mohamed Moosa Didi 7778246 **Client**

			MICRON PVT LTD | C-0268/2005 Ali Najeeb 7774005
25th Aug – 25th Oct 2021 (author) Completed	Environment Impact Assessment (EIA) for water supply development project at F. Feeali, Maldives	**	**Proponent** Ministry of National Planning, Housing and Infrastructure (MNPHI). Mohamed Moosa Didi 7778246 **Client** MICRON PVT LTD | C-0268/2005 Ali Najeeb 7774005
May 2021 (author) *Completed*	Proposed development of 12 story building at M.Pisthaage, 20012ø, Male'	**	Infinity Builders (SP-0814/2016)
May 2021 (author) *Completed*	EIA for the proposed development of access platforms, outdoor rendezvous area and community replantation of mangroves in the wetland at Kelaa, Haa Alif Atoll, Maldives	**	Kelaa Youth Forum (KYF) Proponent for Component A Island Development and Environment Awareness Society (IDEAS) Proponent for Component B
October 2020 *(Co- authored) completed*	Environmental Impact Assessment: for the Proposed shore protection, shoreline restoration, channel dredging and development of floating pontoon platform cages in the lagoon at N Karinmaa Vattaru, Maldives.	Mahfooz Abdull Wahhab (EIA P22/2016) 9994467 mahfoozabdullwahhab@gmail.com	Blackgold Investments Pvt Limited.
April 2020 *(Co- authored) completed*	Environmental Impact Assessment for a tourist resort and factory island development at Gulf lagoon, (4°16'40.06"N, 73°2l '7.27"E), Kaaf Atoll, Maldives.	Mohamed Zuhair (EIA P01/2015) 7776800 moh.zuhair@gmail.com	Gulf Craft Maldives Pvt Ltd Aiminath Thauma (aiminath.thauma@gulfcraft.com) Conbizz.Pvt Ltd Ali Akram (alimarka@gmail.com)
March 2020 *Co- authored) completed*	Environmental Impact Assessment: Proposed Harbour re-development at Bilehfahi, Shaviyani Atoll	Mahfooz Abdull Wahhab (EIA P22/2016) 9994467 mahfoozabdullwahhab@gmail.com	Maldives Transport and contracting Agency (MTCC) Mamdhooh Ali 7853929 Ministry of Planning and Infrastructure (MNPI) Shimya Moosa (7784150)
March 2020 *Co- authored) completed*	Environmental Impact Assessment: for the Proposed Harbour expansion Projects at Hulhumeedhoo and Hulhudhoo, Seenu Atoll	Mahfooz Abdull Wahhab (EIA P22/2016) 9994467 mahfoozabdullwahhab@gmail.com	Maldives Transport and contracting Agency (MTCC) Mamdhooh Ali 7853929 Ministry of Planning and Infrastructure (MNPI) Shimya Moosa (7784150)
February 2020 *(Co- authored) completed*	EIA for the development of a senior football ground, and a picnic area at Mulah, M. Atoll, Maldives.	Mahfooz Abdull Wahhab (EIA P22/2016) 9994467 mahfoozabdullwahhab@gmail.com	SASe Pvt Ltd Saudulla Ahmed 7771682
November 2019 *(Co- authored) completed*	Environmental impact assessment for the proposed harbour re-development and swimming area development project at Maamendhoo, Gaaf Atoll, Maldives	Mahfooz Abdull Wahhab (EIA P22/2016) 9994467 mahfoozabdullwahhab@gmail.com	SASe Pvt Ltd Saudulla Ahmed 7771682
October 2019 *(Co- authored) completed*	The second addendum to Environmental Impact Assessment: Proposed Harbour Re-development Project at Kelaa, Haa Alif Atoll,	Mahfooz Abdull Wahhab (EIA P22/2016) 9994467 mahfoozabdullwahhab@gmail.com	Maldives Transport and contracting Agency (MTCC) Mamdhooh Ali 7853929 Ministry of Planning and Infrastructure (MNPI) Shimya Moosa (7784150)
August 2019, *(Co- authored) completed*	Environmental impact assessment for the proposed harbour re-development project at Noomara, Shaviyani Atoll, Maldives	Mahfooz Abdull Wahhab (EIA P22/2016) 9994467 mahfoozabdullwahhab@gmail.com	SASe Pvt Ltd Saudulla Ahmed 7771682 Ministry of Planning and Infrastructure (MNPI) Shimya Moosa (7784150)
July 2019, *(Co- authored) completed*	Environmental impact assessment for the Proposed Access Channel in the Agricultural Island of Fenfuraaveli. Meemu Atoll, Maldives	Mahfooz Abdull Wahhab (EIA P22/2016) 9994467 mahfoozabdullwahhab@gmail.com	Bion PVT LTD Mohamed Aslam 9997112

April 2018, *(assisted in) completed*	Environmental impact assessment for second addendum to: Hulhule-Hulhumale connecting link road development project,North Male', atoll, Maldives	Mahfooz Abdull Wahhab (EIA P22/2016) 9994467 mahfoozabdullwahhab@gmail.com	Housing Development Cooperation (HDC)

Monitoring		**Proponent**
April 2018	Environmental monitoring report - Emboodhoo lagoon Development, south male' atoll report 6	SASe Pvt Ltd Saudulla,Ahmed,7771682
June 2018	Environmental monitoring report - Emboodhoo lagoon Development, south male' atoll report 7	SASe Pvt Ltd Saudulla,Ahmed,7771682
July 2018	Environmental monitoring report - Emboodhoo lagoon Development, south male' atoll report 8	SASe Pvt Ltd Saudulla,Ahmed,7771682
August 2018	Environmental monitoring report - Emboodhoo lagoon Development, south male' atoll report 9	SASe Pvt Ltd Saudulla,Ahmed,7771682
September 2018	Environmental monitoring report - Emboodhoo lagoon Development, south male' atoll report 10	SASe Pvt Ltd Saudulla,Ahmed,7771682
Monitoring Period: 27st September 2018 to 20th October 2018	Environmental monitoring report Emboodhoo lagoon Development, south male' atoll, Report 1	SASe Pvt Ltd Saudulla,Ahmed,7771682
Monitoring Period: 20th October 2018 to 22nd November 2018	Environmental monitoring report Emboodhoo lagoon Development, south male' atoll, Report No: 02	SASe Pvt Ltd Saudulla,Ahmed,7771682
Monitoring Period: 22nd November 2018 to 10th December 2018	Environmental monitoring report Emboodhoo lagoon Development, south male' atoll, Report 3	SASe Pvt Ltd Saudulla,Ahmed,7771682
Monitoring Period: 15th December 2018 to 15th January 2019	Environmental monitoring report Emboodhoo lagoon Development, south male' atoll Report 4	SASe Pvt Ltd Saudulla,Ahmed,7771682
Monitoring Period: 15thJanuary 2019 – 02ndFebruary 2019	Environmental monitoring report Emboodhoo lagoon Development, south male' atoll Report 5	SASe Pvt Ltd Saudulla,Ahmed,7771682
Monitoring Period: 02ndFebruary 2019 – 12thFebruary 2019	Environmental monitoring report Emboodhoo lagoon Development, south male' atoll Report 6	SASe Pvt Ltd Saudulla,Ahmed,7771682
Monitoring Period: 12th February 2019 to 3rd March 2019	Environmental monitoring report Emboodhoo lagoon Development, south male' atoll Report 7	SASe Pvt Ltd Saudulla,Ahmed,7771682
Monitoring Period: 3rd March 2019 to 20th March 2019	Environmental monitoring report Emboodhoo lagoon Development, south male' atoll Report 8	SASe Pvt Ltd Saudulla,Ahmed,7771682
Monitoring Period: 20th March 2019 to 20th April 2019	Environmental monitoring report Emboodhoo lagoon Development, south male' atoll Report 9	SASe Pvt Ltd Saudulla,Ahmed,7771682
Monitoring Period: 20th March 2019 to 20th April 2019	Environmental monitoring report Emboodhoo lagoon Development, south male' atoll Report 10	SASe Pvt Ltd Saudulla,Ahmed,7771682
Monitoring Period: 20th May 2019 to 20th June 2019	Environmental monitoring report Emboodhoo lagoon Development, south male' atoll Report 11	SASe Pvt Ltd Saudulla,Ahmed,7771682
4th March 2019	Blue beach construction monitoring work report 1	SASe Pvt Ltd Saudulla,Ahmed,7771682
20th March 2019	Blue beach construction monitoring work report 2	SASe Pvt Ltd Saudulla,Ahmed,7771682
20th April 2019	Blue beach construction monitoring work report 3	SASe Pvt Ltd Saudulla,Ahmed,7771682
20th May 2019	Blue beach construction monitoring work report 4	SASe Pvt Ltd Saudulla,Ahmed,7771682
20th June 2019	Blue beach construction monitoring work report 5	SASe Pvt Ltd Saudulla,Ahmed,7771682
25th July 2019	Blue beach construction monitoring work report 6	SASe Pvt Ltd Saudulla,Ahmed,7771682
7 March 2020	Baglioni environment monitoring report 1	Ali Mubeen 779079
1 April 2020	Kahssan Faru Construction Monitoring report 1	SASe Pvt Ltd Saudulla,Ahmed,7771682 **Client** *INSA.PVT.LTD* *Dr Mohamed Shareef, mo.shareef@insa-consultancy.biz*
22 October 2020	Kahssan Faru Construction Monitoring report 2	SASe Pvt Ltd Saudulla,Ahmed,7771682 **Client** *INSA.PVT.LTD* *Dr Mohamed Shareef, mo.shareef@insa-consultancy.biz*
7 September 2021	Kahssan Faru Construction Monitoring report 3	SASe Pvt Ltd Saudulla,Ahmed,7771682 **Client** *INSA.PVT.LTD* *Dr Mohamed Shareef, mo.shareef@insa-consultancy.biz*

10. **Academic referees**

Referee	Contact	Address
Dr Chitchol Phalaraksh PhD Environmental Toxicology	0817160209	Chiang Mai University | CMU · Department of Biology Chiang Mai Thailand.
Prof. Marcel.C. Enos	08212511992	St Joseph College of Education Jayalakshmipuram Mysore Karnataka India
Dr. Ruth Shantha Kumari T. M.Sc, Ph.D, M.Sc in Counselling & Psychotheraphy	9449086598 821- 4240930 stphiloszoo@gmail.com	St Philomena's Degree College, Bannimantap, Mysuru 570 015 Phone 0821-4240900 / 4240912 / 4240918 Fax 0821-4240950

11. **Work references**

Referee	Post during interaction	Contact
Dr. Mohamed Shareef	Managing Director, INSA Pvt Ltd	7775640, mo.shareef@gmail.com
Haris Mohamed	Managing Director, MMPRC	7761516
Mohamed Hamzeel	Chief Operations Officer, MMPRC	7903010
Aminath Sheeza	Assistant Principal, Majeediyya School	7784658
Aiminath Shahadha	Assistant Principal, Majeediyya School	ashaha1@hotmail.com
Anthirious Georgemary	Biology HOD, Majeediyya School	9144842, anthrrious@hotmail.com
Thomas Le Berre	Managing Director, Seamarc Pvt Ltd	960 7787642, thomas@seamarc.com

MARIYAM SUNAINA MOHAMED

Civil Engineer

CAREER OBJECTIVE

An enthusiastic and highly motivated recent engineering graduate, dedicated with a keen interest in this field who has a clear understanding of the roles and responsibilities associated with an engineer. On the technical side, I am able to accurately prepare designs and drawings. Backed by successful internship experience and knowledge of engineering theories, principles, specifications, and standards. Seeking a challenging career with a progressive organization that provides an opportunity to capitalize my technical skills and abilities in the fields of Engineering and Project Management.

+960 9873819 | 17sunai@gmail.com | G.Agoohaa, Lonuziyaaraiy Magu | www.linkedin.com/in/MSMohamed

EDUCATIONAL QUALIFICATION

Bachelor of Civil Engineering (Honours)

Monash University Malaysia (MUM) | Subang Jaya, Malaysia | June 2018 – June 2022

- Graduated with Second Class Honours.

Pearson Edexcel International Advanced Level (IAL) & HSC

Centre for Higher Secondary Education (CHSE) | Male', Maldives | June 2015 – June 2017

- Physics (A), Statistics (A), Biology (B), Chemistry (B), Islam (A) & Dhivehi (A).

General Certificate of Education (GCE), International General Certificate of Secondary Education (IGCSE) & SSC

Aminiya School | Male', Maldives | January 2012 – October 2014

- Physics (A*), Chemistry (A*), Biology (A), Travel & Tourism (A), English as a Second Language (A*), Mathematics (A*), Dhivehi (B) & Islam (A).

ENGINEERING EXPERIENCE

- Excellent research skills, which enabled me to finish a high-quality final year project.
- Modelled a novel grouted sleeve connection using ABAQUS and ran simulations to determine its characteristics.
- Planned the expansion of a Health Care Centre from concept to execution using Microsoft Projects.
- Conducted experiments in the laboratory for material testing.

PROFESSIONAL EXPERIENCE

Civil Engineering Intern

Housing Development Corporation (HDC) | Male, Maldives | Dec 2020 – Mar 2021

- Visited projects sites regularly during construction for on-site inspections.
- Collaborated with team members to write reports after surveying and site investigations.
- Participated in the weekly team meetings.
- Gained experience in reading engineering drawings. Analysed AutoCAD drawings for structural and road projects.

SKILLS

Personal Skills

- Creativity
- Good Team Player
- Communication
- Ability to Work under Pressure
- Leadership skills
- Time Management

Professional Skills

- Autodesk AutoCAD
- SketchUp
- ArcGIS
- ABAQUS
- MATLAB
- Microsoft Projects

PROFESSIONAL ASSOCIATIONS

- Member of Institute of Civil Engineers Monash (ICE-Monash).

REFEREES

- Dr. Chua Yie Sue

  Lecturer, School of Engineering, Monash University Malaysia

  chua.yiesue@monash.edu

Hashma Hameed

Chemical Engineer

A quick learner and dynamic individual who is willing to adapt in order to complete a certain task.

hashmahameed@gmail.com

7632012

Raincrest, Hulhumale, Maldives

24 August 1997

linkedin.com/in/hashma-hameed-4a2a57152

EDUCATION

BACHELOR'S DEGREE
UNIVERSITY OF NOTTINGHAM MALAYSIA

09/2016 - 06/2020 *Malaysia*

Courses

- Masters in Engineering with Honors (MEng) in Chemical and Environmental engineering
- Students Election commission member
- Cultural societies Student representative at student council

A-LEVEL
CENTER FOR HIGHER SECONDARY EDUCATION

2014 - 2016 *Maldives*

Courses

- Edexcel IAL
- Subjects: Physics , Biology, Chemistry, Islam, Dhivehi
- Optional Subjects: Mathematics with Mechanics

WORK EXPERIENCE

Junior Environmnental Planner
Urbanco (Housing Development Corporation)

03/2023 - Present

Achievements/Tasks

- Assist to plan and conduct studies of the environment and of the population, distribution, structure and functional characteristics and behavior of plants and animals; aiding in the overall greening and urban planning
- Provide assistance to conduct ecological and environmental impact and monitoring studies, and prepare reports accordingly.
- Assist to review and evaluate proposals for land use and development plans and prepare recommendations.

Engineer
Ministry of Environment, Climate Change and Technology

04/2021 - 02/2023

Achievements/Tasks

- Implementation of energy efficiency standards and labelling program 'Hakathari program'.
- Run the public awareness campaign for Energy Efficiency.
- Provide technical assistance for the Energy department for renewable energy projects.

SKILLS

Autocad | Adobe Photoshop | Microsoft Word | Microsoft Excel | Microsoft Powerpoint | Event planning

INTERESTS

Photography | Painting | Travelling | Fishing | Sports

LANGUAGES

English ●●●●●

Dhivehi ●●●●○

ORGANIZATIONS

Zero Waste Maldives (NGO)
(01/2021 - Present)

Promote a Zero Waste Low Impact Lifestyle in the Maldives and to enable individuals, businesses, communities and government to send nothing to the oceans, landfills or incinerators.

WORK EXPERIENCE

Quality Assurance Intern
Male' Water and Sewerage Company

06/2019 - 09/2019

Achievements/Tasks

- Assisted with planning of quality assurance testing projects following functional specifications.
- Created and achieved product quality objectives and met product specifications.
- Researched new tools and technologies for potential use by quality assurance team.

Research Assistant
CDE Consulting PVT.LTD

07/2017 - 09/2017

Achievements/Tasks

- Helped in compiling EIA reports for companies
- Assisted in completing sedimentation sampling
- Attended site visits throughout Maldives for EIA projects

PROJECTS

Consultancy Services for Design of Regional Laboratory in Hdh.Hanimaadhoo for Epoch Associates (01/2021 - 09/2021)

- Conduct desk review of the local level regulatory water quality testing requirements set for water and sewerage services and international ISO certified laboratory testing requirements and related equipment's.

Consultancy Services for Design of Regional Laboratory in L.Fonadhoo for Epoch Associates (09/2021 - 12/2021)

- Conduct desk review of the local level regulatory water quality testing requirements set for water and sewerage services and international ISO certified laboratory testing requirements and related equipment's.

UNDP Small Grants program Plastic Innovation Project for Fuvahmulah City (08/2022 - Present)

- Improving the Effectiveness of Segregation of Waste in Fuvahmulah City of Maldives, towards a Zero Waste Future by Zero Waste Maldives

12.18 Submission to City council

EIA Report Submission for Thilafushi Pilot Road

Hashma Hameed <hashma.hameed@urbanco.mv>

Tue 1/9/2024 2:41 PM

To:secretariat@malecity.gov.mv <secretariat@malecity.gov.mv>
Cc:Hassaan Abdul Muhsin <Hassaan.Abdul@urbanco.mv>;Hassan Akram <akram@urbanco.mv>

Dear Staff,

As per the requirements of the regulation, PFA the EIA for your review.
Please send your comments via mail or to set a meeting with the consultant team, please contact 7901665.

Thilafushi Pilot Road EIA Final 1.pdf

Best Regards,

HASHMA HAMEED
JUNIOR ENVIRONMENTAL PLANNER
URBAN PLANNING, ENVIRONMENTAL UNIT

HDC Building, 3rd Floor, Hulhumalé, Republic of Maldives
Tel: +(960) 3353535, **Fax:** +(960) 3358892
hello@urbanco.mv www.urbanco.mv

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