ENVIRONMENTAL IMPACT ASSESSMENT FOR ISLAND ACCESS AND JETTY CONSTRUCTION PROJECT IN RASGETHEEMU, RAA. ATOLL

Prepared For:

Ministry of Housing and Infrastructure

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Declaration of the Consultant:

I certify that the statements made in this Environmental Impact Assessment are true, complete and correct to the best of my knowledge and available information at the time of writing this report.

Dr. Mahmood Riyaz (EIA03/07)
10th July 2017

Declaration of the proponent

1 ސާދާ ޚުލާސާ

1. މިރިޕޯޓަކީ، ރ.ރަސްގެތީމުގައި ފަޅު ނިކުތުމަށްޓަކައި ބޭނުންކުރާނެ އިތުރު ނަރުދާއި ޖެޓީއެއް އަޅައި ތަރައްޤީކުރުމުގެ މަސައްކަތް މިނިސްޓްރީ އޮފް ހައުސިންގ އެންޑް އިންފްރާސްޓްރަކްޗަރ އިން އެކުލަވާލައި ފުރުމުގެ ކުރިން އެ މަސައްކަތުގެ ސަބަބުން ތިމާވެށްޓަށް ކޮށްފާނެ އަސަރު ދެނެގަތުމަށްޓަކައި ތައްޔާރު ކުރެވިފައިވާ އެންވަޔަރަންމަންޓަލް އިމްޕެކްޓް އެސެސްމަންޓް (އީ.އައި.އޭ) ރިޕޯޓެވެ. މަޝްރޫޢުގެ ޕްރޮޕޯނަންޓަކީ މިނިސްޓްރީ އޮފް ހައުސިންގ އެންޑް އިންފްރާސްޓްރަކްޗަރއެވެ. ރ.ރަސްގެތީމުގައި ފަޅު ނިކުތުމަށް އިތުރު ނަރުދާއި ޖެޓީއެއް އަޅައި ތަރައްޤީ ކުރުމުގެ އެކުލެވޭ ބޭނުމަކީ މަސައްކަތުގެ ކޮންޓްރެކްޓް އަސާސީ ޙަރަކާތް ތިމާވެއްޓަށް ކުރާ އަސަރުތައް ކަނޑައަޅައި ދެނެގަތުމަށް ހުށަހެޅުނު ތަޖުރިބާތަކުގެ ބިނާކުރަމުން (އީ.ޕީ. އައި. ސީ) ހިމެނެއެވެ.

2. ރިޕޯޓް ތައްޔާރުކުރި މިމަސައްކަތް ކޮންސަލްޓަންޓް ފަރާތެއް ހޮވުމަށް ހައުސިންގ މިނިސްޓްރީން ލިޔުނު ކުރި ޢިލާނާއި ގުޅިގެން ބިޑުހުށަހެޅި ފަރާތްތަކުގެ ތެރެއިން ޕްރޮފައިލް ބަލައި ކޮންސަލްޓަންސީ ހަވާލުކުރެވުނެވެ.

3. މިރިޕޯޓް ތައްޔާރުކޮށްފައިވަނީ މަޝްރޫޢުގެ ޕްރޮޕޯނަލް އެންވަޔަރަންމަންޓަލް ޕްރޮޓެކްޝަން އެޖެންސީއާ ދެމެދު އެއްބަސްވެފައިވާ ޓާރމްސް އޮފް ރެފަރެންސްގެ މަތީންނެވެ.

4. ރ.ރަސްގެތީމުގެ ހުޅަނގު ފަރާތުގައި 2007 ވަނަ އަހަރު ވަނީ ބަނދަރެއް ތަރައްޤީ ކުރެވިފައެވެ. މިއީ ގާތްގަޑަކަށް 60މ ދިގު 120މ ފުޅާ ބަނދަރެކެވެ. މިހާރު ޤާއިމުކުރެވިފައި ބަނދަރަށް ހުޅަނގު ދާދުވެސް ގަދަ ދޮރުވަސް ވަރު (ހުޅި، ދޫނި، ހަރި ދަތުރު މަސް) ވަދެ ނިކުމެ އުޅުމަށް ދަތިތަކެއް ނުބައްދާލުމަށް ހުރިޔާއަށް ކުރިމަތިވެ މުޅިންހާލު ދެތަރަފާއި، ތަކެއްޗަށް ގެއްލުމާވެސް ދަތިވާ ކަހަލަ ގޮތްތަކެއް ޤާއިމު ވެފައިވާ ކަމަށް އަރާއި ފަޅުބޭން އިތުރު ގޮތަށް ވާހަކަ ވެފައިވުން ދަތުރުކަމާ ރަށުގެ ރައްޔިތުންގެ އެދުމެވެ.

5. މިކަން ރަނގަޅުކުރުމަށް ރައްޔިތުންގެ ގޮތުން އެރަށުގެ ޖަހާ ފައިދާ ކަންކަން މާ ދަތިކުރާ ޤާނޫނީ އަތަކީ ނަރުދާ ކަނޑައި ފާލަމުގެ ކުރިމަތިން ކުރަ ތަނބުކޮށްފައި ކަން ފުންކުރުމުގެ ކަމަށް ސަރުކާރުން މިމަޝްރޫޢު ތަރައްޤީކުރުމާއި ތަރައްޤީކުރުމުގެ މަސައްކަތް ފަށައިގަތުމުގެ ކުރިން ނިންމާލާ މެނުއަލް ތަރައްޤީ ކުރަން ފަށަމުން އީ.ޕީ.އޭ.ގެ ހުއްދަ ހޯދާ ތަރައްޤީކުރެވޭ. މިމަޝްރޫޢު ގެ ބޭނުމަކީ އަރައްޓު ފެނަކާ ދަތުރުކުރެވޭ ފެށިގެން ރ. ރަސްގެތީމަށް އަރައި ފަރުބަދަ ބަނދަރުގެ ކުރިމަތިން ނުކުމެވޭ ގޮތް ހަދައިދޭ. އަދި ރެސިނގެ ދަތުރުކުރަށް ރައްޔިތުންނަށް ރަނގަޅުކޮށްދޭ ފަޅުވަޅު ދިމާ ކުރާއިރު މަސައްކަތަށް ހަރުފާއި ބޭނުންތަކުން ވަރަށް ފަސޭހައިން ހުރިކަނިކަމާ ބަދަލު ކުރެވިދާ ކުރިއަށް ޤާއިމު ޖެއްސުން ކަނޑަދިޔު ހިނގާނެ ގޮތް ނެތިއުޅޭ ކަރަދަނީކަންކަމުގެ ގޮތުން އެކަމަށް ބޭނުންވާ ވަސީލަތްތައް ޤާއިމު ކުރުމެވެ.

6. މިރިޕޯޓުގައި ރ. ރަސްގެތީމުގައި ފަޅު ނިކުތުމަށް އިތުރު ނަރުދާ ކޮށް ފުންކުރުމާއި ބަދަލު އަޅައި ހޯދައިދޭ ޤާނޫނީ އެޅުމާއި އަދި ކޮންގޮތެއް ނަގާފައި ގޮތްޖެހޭ ބޮޑެތިވަރެއް ސަބަބުން ދިމާވެދާނެ ތިމާވެށީގެ މަސްސަލަތަކަށް ބަލާލާފައިވާ ވާނެއެވެ. ހުޅަނގު މިނިސްޓްރީ އިން ހުށަހެޅުއްވާފައިވާ ރަށުގެ އިތުރު އުޅޭގޮތް ކަނޑައަޅާ މަގު ދިމާލުން 24މ ފުޅާ 28މ ދިގު ނަރުދާ ކަނޑައި ފުޅާކަން 31.15މ ދިގު، 4މ ފުޅާ ރީ-ކްލަމޭޝަން އަދި ރީ ކްލޭމް ކުރިމަތިން 40މ ދިގު 30މ ފުޅާ ބަނދަރުގެ ކޮށްފައެވެ. ކޮންމެ ބަނދަރާއި ނަރުދާ ފުންމިނުގައި ހަރަދަވަރަށް 3- މ ހުންނަ ގޮތަށެވެ. މިބަނދަރު ކޮންމެ ނަގާފައި ރީ-ކްލޭމް ބޯކުފާ އަށް ބޭނުންކުރެ އިތުރުވާބައި ރަށުގެ އިތުރު ފާރުތަކުގައި އޮންނަ ގޮސްޕަރަފިޓަން އެޅުމަށެވެ. ރ. ރަސްގެތީމުގައި ބަނދަރު ފުލުކުރުމަށް ހަމަޖެހިފައިވާ ނަގާއި، ފާރާއި، ކޮންމެހެން

ހުރަހަށްފައިވާ ތަންތަނުގެ މިންތަކަކީ އާއްމު ގޮތެއްގައި އަރައި ފޭބުމުގެ ދަތިކަން ދިމާވާ ރަށްތަކަށް އެކަން ރައްދު ކުރުމުގަނޑަކީ ހައުސިން މިނިސްޓްރީން ގެންގުޅޭ މިންގަޑު ތަކާއި ހުރިހާ ރަށްރަށުގައިވެސް ބޭނުންކުރާ އުސޫލު ތަކުގެ މައްޗަށް ބިނާކޮށް ކަނޑައަޅާފައިވާ މިންތަކެކެވެ.

7. ރ. ރަސްގެތީމުން އަރައި ފޭބުމުގެ ވަސީލަތްތައް ހޯއްދަ ކުރުމުގެ ގޮތުން ވަނީ ނިކުތުމަކަށް އިތުރު ބަނދަރާއި ރަށަށް އަރައި ފޭބުމަށް ފާލަމެއް އެޅުމަށް ހިންގާ މަޝްރޫއުގެ ސަރަހައްދުން ތިމާވެއްޓަށް ކުރިމަތިވެދާނެ މައްސަލަތައް ދެނެގަތުމަށްކަމުގައި ބޭނުންވާ ދިރާސާތައް ވެސް މި ރިޕޯޓް ތައްޔާރުކުރުމުގެ މަސައްކަތުގެ ތެރޭގައި ފުރިހަމަ ކޮށްފައެވެ. އެގޮތުން އެއްކަމާއި ދުރުގައި ގޮސްޖެހޭދުރުގެ ތަފާތުގެ ދިރާސާތައް ވެސް ފުރިހަމަ ކުރެވިފައެވެ. އޭގެ އިތުރުން އިންޖިނިއަރިންގެ ޑްރޯއިންގްތަކާއި ރަށުގެ މިހާރުގެ ބަނދަރުގެ މައުލޫމާތު އެއްކޮށް ސާރވޭއެއް ހިމަނާފައި ވާނެއެވެ. މިގޮތުން އެއްކުރެވުނު މައުލޫމާތުގެ ތެރޭގައި ހިމެނެނީ:

ހ. ރަށުގެ ގޮނޑުދޮށް، މަސައްކަތް ކުރުމަށް ހުށަހެޅިފައިވާ ސަރަހައްދާއި ތިމާވެށީގެ ގޮތުން ބޮޑެތި އަސަރު ފޯރާފާނެކަމަށް ލަފާކުރެވޭ ސަރަހައްދުގެ މޫދުގައިވާ ދިރުމާއި ތަފާތު ބާވަތްތަކުގެ މައުލޫމާތު އެއްކުރެވިފައެވެ.

ށ. ގޮނޑުދޮށުގައި ވެލި ދައްކުވާ ގޮތާއި ބީޗް ޕްރޮފައިލް އާއި މަސައްކަތް ކުރުމަށް ހުށަހެޅިފައިވާ ފާލަމުގެ ސަރަހައްދުގެ ފެންމިން އަދި އެސަރަހައްދުގެ އާރާއި ރަށުގެ ދިރާސާ ކުރެވިފައެވެ.

ނ. ކަރަންޓާ ބާރު މައުލޫމާތު އެއްކޮށް ބަލައިލުމުގެ ދިރާސާ ކުރެވިފައެވެ.

8. މިދިރާސާތަކުން ހޯދުނު މައިގަނޑު ކަންތައްތައް ތިރީގައި އެވަނީއެވެ.

ހ. މިހާރު ބޭނުންކުރަމުންދާ ބަނދަރަށް ވަނުމަކީ ހުޅަނގު މޫސުން ފެށިގެން އަންނަ ދުވަސްވަރު (މެއި، ޖޫން އަދި ޖުލައި މަސް) އާދަޔާ ހިލާފަށް ގަދަވެ އެއްރުން ވަދެނިކުތުމަކީ އުދަގޫ އަދި އާރާމު ނުރައްކާތެރިކަމެއް ކަން ފާހަގަ ކުރެވޭ ގޮތެއް ކުރެވިފައެވެ. މިގޮތުން ރަށުގެ ރައްޔިތުން އެދުނީ ރަސްގެތީމަށް ވަދެނިކުމުގެ އަމަލު ފަސޭހަ ރަށުގެ ދެކުނު ފަރާތުގައި ފާލަމެއް ކުރުމަށެވެ.

ށ. ރ.ރަސްގެތީމު ހުޅަނގު ފަރާތުން ކަނޑުގެ މަގާއި ދިމާލުން ޓީ-ޖެޓީއެއް އަޅައި ނުޖެހެއްޓަން ޖެޓީގެ ކުރިޔާލުން ފަސްކުރުމަށް އެކަށީގެން ބޭނުންކުރެވޭ ހުރަހަށްފައިވާ ކުރުމުގެ މިންތަކާ އެސަރަހައްދަށް ނުފޯރާ ކަން ފާހަގަ ކުރެވިފައެވެ.

ނ. ރަށުގެ ރައްޔިތުންގެ ކުރުވުން މަޝްވަރާތަކުންނާއި ހުރަހަށްފައިވާ މަސައްކަތް ކުރުމަށް އޮޅި ސަރަހައްދުގެ ޗާޓް ހުރި މިންވަރު ރިޕޯޓް ތަކުން ދެއްކި ގޮތުން އެސަރަހައްދުގައި ރާޅުބޯޅަ ކަންކަން ފާހަގަ ކުރެވުނެވެ. މިގޮތުން ފާލަމާއި ނުރު 150 މީޓަރު ދުރުން ޖެއްސާލުމަށް ރަށުގެ ރައްޔިތުން އެދުނެވެ. އަދި މިއީ ރަށުގެ މީހުން ބޭނުންވާގޮތް ކަމުގައިވެސް ހާމަ ކުރިއެވެ.

9. މިހެން ކަމުން މި އީއައިއޭ ރިޕޯޓް ތައްޔާރު ކުރުމުގައި މިވަނީ ރަށުގެ ވެށި ނިޔާމާ އަދި އަރައި ފާހަގަ ކުރެވޭ ބަދަލުތައް ބެލުމަށް ޑޭޓާ ނެގުން
ރ. ރަސްގެތީމުން ކޮންސަލްޓޭޝަން ބޭނުންވާކަމަށް ބަލައި އެގޮތަށް ބަލަފާނެއެވެ.

10. ހުޅުހެނދުނުގެ މަސްތާޅެއް މަސައްކަތްތަކުގެ ސަބަބުން ތިމާވެއްޓަށް އަސަރުކުރާ މިންވަރު ބޮޑުމަށް ޓެކްނިކަލް އިމްޕެކްޓް ފޮޓިޕްރިންޓް އެއްޗެއްސާއި ކުރެވުނެވެ. މިގޮތުން އިމްޕެކްޓް ފޮޓިޕްރިންޓް އަދި ޕްރޮޖެކްޓްގައި ތިމާވެއްޓަށް އަސަރުކުރާ މިންވަރުބަލާކަމަށް ބޭނުންކުރާ ޗެކްލިސްޓެއްކަމެވެ. މިފަދަ ޗެކްލިސްޓްގެ އެއްފަރާތްގައި (ރަނގަޅު) ޓެކްނިކް ފްރޭމްވާރކް ތަރައްޤީކުރެވުނު މަސައްކަތާއި އެކަން ބޭނުންކުރަން ފުރުޞަތު ކުރާ ކަންތައްތަކެވެ. އަނެއް ފަރާތްގައި (ދެވަނަ) ޓެކްނިކް މިފްރޭމްވާރކްގެ މަސައްކަތް ތަކެއް ސަބަބުން ތިމާވެށީގެ އެކިއެކި ސަރަހައްދުތަކާއި ތަނުތަނާއި ގުޅިގެން އަސަރުކުރާ މިންވަރެވެ.

11. ހުޅުހެނދުނުގެ މަސައްކަތްތަކުގެ ސަބަބުން ތިމާވެށްޓަށް އެކުލަ ބޮޑު ނޭދެވޭ އަސަރުތައް ކުރާނެ ކަމަށް ފާހަގަ ކުރެވޭ ބައިތައް ނޑުކޮށްލާއި ޑްރެޖިންގ ކޮންމެ ފަރާތެއް ފާހަގަކުރެވުނެވެ. ތިމާވެށީގެ ގޮތުން ބަލައިލުމުގައި ދިރުމުއްދަތުކަށް ދުރުގެންދާ މުޅި މިންވަރުގެ އަސަރުތައް ކުރާނެ ކަމެއްކަމެވެ. މިމަސައްކަތުގެ ސަބަބުން ދެން ތިމާވެއްޓަށް ނޭދެވޭ
އަސަރުތައް ކުރުމަށް ފަރާތުގެ ޑްރެޖިންގ ކޮށް ރީކްލެމޭޝަން ޕޯޓު ފުރާލުމާ ޑިޒައިންގައި ޖެހުމާއި، ކޮންމެހެން ސަރަ ފޮނި ޖެހޭ ބޭނުމަ
ގެއް ސަރަހައްދުތަކުގެ އެތެރެގެމަސައްކަތުގެ ސަބަބުން ދިރުމާ ތިމާވެށީގެ މައްސަލަތަކެވެ. މިއީ ކުރުމުއްދަތުގެ ދިރުމުގެ
ނިސްބަތުން ކުޑަ އަސަރެއް ކަމުގައި ފާހަގަ ކުރެވުނެވެ.

12. ހަރަކާތްތެރިވުން ކަންކަން ރައްޔިތުން ކުރުން ނުވަތަ ކުރާ ނޭދެވޭ އަސަރު ކުޑަ ކުރުމަށް ބޭނުންކުރެވޭ އެކިގޮތްގޮތް ފިޔަވަޅުތައް ވެސް
މިރިޕޯޓްގައި ހިމަނާފައި ވާނެއެވެ. ތިމާވެށީގެ ހާލަތު މޮނިޓަރިންގ ފޮލޯއަޕް ގޮތުގައި ޕްރޮޖެކްޓް ކުރިއަށްގެންދާ ގޮތެއް ވާނެ
އެންމެ ބޮޑަށް ބެލެހެއްޓޭ މޮނިޓަރިންގ ޕްރޮގްރާމް މިރިޕޯޓްގައި ހިމަނާފައިވާނެއެވެ. މިގޮތުން މޮނިޓަރިންގ ޕްރޮގްރާމްގެ ބޭނުމަކީ
ތިމާވެށީގެ ހާލަތަށް ކުރާ އަސަރުތައް ދެނެގަތުމަށް ޑޭޓާ ނެގުމާއި ވިޔަފާރިއާ އަދި ޖަމާކޮށް ފޮލޯކުރުމާއި ޕްރޮޖެކްޓް ސާފުކުރުމެވެ.
މިގޮތުން ޕްރޮޖެކްޓް ނިމުމުގައި ތަނަށް ބަލައި އެސްޓިމޭޓް ތިމާވެއްޓާއި ދުރުގެ ތިމާވެށީގެ ހާލަތު ދެނެގަނެ ބަލައިގެން ކުރެވޭ
އަސަރުތަކުގެ ތިމާވެށި ފޮލޯކޮށް ރިޕޯޓުކުރުމަށް އިސްލާހުކުރާ ބައިތައް ދިރާސާކޮށް ކުރެވެންވާ ކަންތައް ފަރާތްތަކަށް
ކުރެވޭނެއެވެ.

13. ހުޅުހެނދުނުގެ މަސައްކަތްތަކާއި ކުރުމުގައި ބަދަލުވުމަށް ރައްޔިތުން ބަލައިލާފައި ބަޔާންކުރާ މިރިޕޯޓްގައި
ބަލުކުރުން ދެކެން ކުރެވިފައިވާނެއެވެ. މިމަސައްކަތް ނިންމުމުގައި، މިހާރު މި މަސްތާޅެއް ހިންގުމަށް ހުޅުހެނދުނުގެ
ސަރަހައްދުގެ ބަދަލުތަކަށް ހުޅުހެނދުނުގެ ސަރަހައްދުގެ 150 މީޓަރު ދުރުގައި ފަޅަށް ބަދަލު ކުރުމާއި އަދި ފަޅަށް ބަދަލު
ކުރުވާ ސަރަހައްދުގައި ރަށް އެއް ފެށޭ ދުރުގައި ދިރޭސާކަށް މިން ވަރެއްކަށްވާނެއެވެ. މިގޮތުން މިދިރާސާއިން
ބެހެވިގެން ފަޅަށް 150 މީޓަރު ދުރުގައި ޖެހޭގޮތަށް އެސަރަހައްދުގައި ކަރަޔާއި ހަމަ އަށް (ފަރުގެ ބޮޑު ދުރާއި
ހަމައަށް) 65 މީޓަރުގެ ބޭ-ޖެހިފައި އެވާ ބީ ގެ ދިގުމިން 40މ ދިގުކުރުމަށެވެ. މިގޮތަށް މިމަސައްކަތް ކުރިއަށް
ނަމަ ކޮށްލާއި ފަރުކަނޑާ ނުވާ ހުރުމުގެ ސަބަބުން ތިމާވެއްޓަށް ކުރާ ނޭދެވޭ އަސަރު ކުޑަކުރެވި އެކަމުގެ ސަބަބުން
ރަށުގެ ގޮނޑުދޮށް އަސަރު ފޯރާނެތީވެ ކުޑަކުރެވޭނެއެވެ. އަދި ރަށަށް އަރައި ފޭބުމުގެ މަސައްކަތެއް ރައްޔިތުން
ފާސްއެވެ. އަދި އެސަރަހައްދުގައި އެކަން ކުރާއިރު ތިމާވެށީގެ ގޮތުން ކުރާ ނުރައްކާ އަސަރުތައް ކުޑަކުރުމަށް އެކިގޮތް
އިތުރު ފިޔަވަޅުތައް އެޅުން މިރިޕޯޓްގައި ހުށަހަޅާފައިވާނެއެވެ.

14. ރ. ރަސްގެތީމުގައި ވަރު ނިކުތުމަށް އިތުރު ނުރައްކާއި ރަށަށް އަރައި ފެބުމަށް ފާހަގަވެއް އެގުމަށްޓަކައި އެކުލަވާ
ލެވިފައިވާ މަޝްރޫޢުގެ މަސައްކަތްތަކުގެ ތެރެއިން ޖެނެރޭޓަރުތަކާއި ގުޅޭ ކަމަކު ދެވަނަ ފަރާތުގެ ކަނޑައަޅާ ތަރުކީބު ފާރަވެރިކަމަށް ޓަރަފް
އަށް ފެނުމަށް ދިރާސާކުރައި މަސައްކަތް ހިނގާނެ ގޮތުގެ ތަފްޞީލް ހުށަހެޅުމަށް ތިޔައި ސަރަހައްދު ލިބެ އަދި ރަށް ތަރައްޤީކުރުން
ކުރިއަށްދާނެ އިތުރު ފުރުސަތުތަކަށް ތަރައްގީވާނެއެވެ. މިކަމުގެ ސަރަޙައްދު އިމާރާތަށް ފުރުސަތުތަކަށް އިތުރަށް ހުޅުވި
ތަރައްގީ ވެގެންދާނެއެވެ. ގައުމީ ފެންވަރުގައި އިމާރާތް ތަރައްގީކުރުމަށް ރ. ރަސްގެތީމުގެ ހިމާޔާ ދިރުން އާދެ
ސަރަޙައްދު ތަރައްގީވެގެން ދާނެއެވެ. ވަރު ނިކުތުމަށް އިތުރު ށަރަކާއި ރަށަށް އަރައި ފެބުމަށް ފާހަގަވެއް އެގުމުގެ
ސަރަހައްދު ނުކުންނަ ތިމާވެށީގެ މައްސަލަތައް ހަމަޖެހޭ ކުރިމަތިވާނަމަ އަޅާނެ ޚަރަދުކުރާނެ ގޮތެއް ތަރައްގީކުރަނީ ސަރުކާރު
ގެވެށް އަޅުގަން ގެންދާނެއެވެ. ރިޕޯޓުގައި ފާހަގަކޮށްފައިވާ ބަދަލުތައް ގެނެސް ތަރަކީ އަދި ފެށުމުގެ މައްސަލަ
ހައްލުވާ ރިޕޯޓުގައި ބެލެވިފައިވާ މާލިޔަތު ފުޅާކޮށްގެން ތިމާވެށްޓަށް ގެއްލުން ކުޑަ ގޮތަކަށް މި މަޝްރޫޢު ކުރިއަށް
ގެންދެވިދާނެ ކަމަށް ފެނެއެވެ.

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2 NON TECHNICAL SUMMARY

1. The proponent of R. Rasgatheemu Island access and Jetty development project is the Ministry of Housing and Infrastructure (MHI). The Ministry is the government's responsible body for the development and regulate the housing and infrastructure of the country. Maldives Road Development Cooperation (MRDC) has been contracted to undertake the jetty and access channel construction work in R. Rasgatheemu.

2. Two freelance EIA consultants has been contracted through public bidding process to provide preparation services of an Environmental Impact Study (EIA) by (MHI) for the jetty and access channel construction work project in R. Rasgatheemu Island.

3. The assessment addresses specific key issues stated in the Terms of Reference (ToR) as agreed between EPA and the Proponent following the scoping meeting held on the matter.

4. The Government has already developed a harbour in Rasgatheem in 2007. The existing harbour is 60m wide and 120m long and located on the western side of the island. The existing harbour is difficult to access during the SW Monsoon where the access channel on the western side is exposed to strong swells during the westerly monsoon period. Therefore the island is inaccessible during rough weather condition. To overcome the accessibility issues of people of the island has requested the Government to develop alternative island access facilities (jetty and an access channel) on the eastern side of the island. This project is implemented to develop island access and a jetty on the north eastern side of the island to enable an alternative island access to use during rough weather conditions.

5. The need for an alternative access for the island has been recognised by the government and decided to develop a jetty and cut an access channel on the eastern side to provide safe access for the vessels operating to and from R. Rasgatheemu Island.

6. The study investigates impacts associated with the channel dredging and jetty construction of R. Rasgatheemu and areas for disposal of dredged material. The proposed access channel will have a width of 24m and a length of 28m and the entrance channel which will be cut through the reef into the ocean ward will lead to a small rectangular shaped dredged area (mooring basin) 30m wide and 40m long, for vessel turning and temporary mooring purposes. The proposed mooring basin and the access channel will be dredged to maintain an average depth of -3m with respect to the MSL. A total of approximately 5616m^3 of dredged material is expected to be produced. This material will be used for jetty backfill and the excess will be used for the nourishment of the beach on the north eastern coast of the island which at present is undergoing severe erosion.

7. Main focus this reports is to document the general baseline condition surrounding island and particularly the proposed area for channel dredging and jetty construction. The following studies have been carried out as part of this assessment.

    a. Assessment of the marine and coastal species and habitats in surrounding impact areas.

    b. Coastal beach profiles to set baseline conditions of coastal processes.

    c. Wave and shoreline assessment study to evaluate the potential for the proposed channel dredging and jetty construction to impact adjacent shorelines.

d. Climatic and oceanographic conditions of the project site.

8. Findings from the environmental studies are summarized as follows;

    a. Access to the existing harbour is extremely difficult particularly at the onset of SW monsoon during the Months of May June and July. Therefore based on this assessment and experience the locals are opting to have an alternative access to the island on the NE side of the island.

    b. Field verification of the project site has revealed that the dimensions given in the MHI proposal does not fit into the location as the reef edge is closer and there is no need for channel dredging in the proposed location at end of Kanneli Magu, Rasgatheemu.

    c. Based on the discussion with the people of the island and in-situ wave measurements has suggested to shift the location of the jetty and the access channel further south for various reasons detail are evaluated in the alternatives section of this report which would be the preferred location to develop island access in R. Rasgatheemu.

9. This EIA has been carried out on the basis that it is necessary to carry out the jetty construction and island access project at the eastern side of R. Rasgatheemu to facilitate socio-economic development and easy access to the island.

10. During the preparation of the EIA report an impact matrix, which is a standard tool for identifying the possible impacts of project activities, has been created for proposed development project in R. Rasgetheemu Island. The activities carried out during the construction and post-construction or operational phases are arrayed against a selection of environmental factors that may be affected directly or indirectly as a result of project activities.

11. The environmental impact assessment study shows there are two main activities that would cause minor to moderate negative environmental impacts. Those, in order of minor to moderate impact, are:

    1. Channel and mooring basing dredging

    2. Jetty construction and backfilling

12. Of these a long term impact would be from dredging and beach backfilling of jetty area and nourishment of eroded beach on the NE side of the island. Potential erosion/accretion and adjustment of the existing beach to create a new equilibrium with the surrounding environmental conditions are likely to extend to medium to long term. These impacts would be cumulative occurring over long period of time and so can be managed through proper monitoring and addressing them in a timely manner. Based on the scale of dredging and beach nourishment work projects that is taking place in Maldives, impacts associated with the proposed dredging activity is insignificant. The positive socio economic impacts from the proposed development outweigh the temporary negative impacts of dredging.

13. The study has evaluated alternative locations for the project and recommended shifting the project 150m south of the proposed location. Also the study has evaluated two options to develop island access in the new location. Based on the alternative option evaluation, the preferred option is to construct a 65m long 4m wide T jetty with 40m long-T, standing on pad-column foundation. The recommended access jetty will eliminate the most of the impacts

envisaged with the proposed development. Even though there is no significant impact from this project particularly with the recommended T-jetty construction, the report has come-up with an extensive monitoring programme that will keep on monitoring coastal and marine environmental changes associated with the development to make necessary adjustment based on the findings of various measured environmental parameters suggested in the monitoring plan.

14. Therefore, on the basis of this environmental impact assessment study and the impact mitigation measures in the report will be duly implemented and recommendations are given due consideration, it is concluded that the benefits of alternative island access development project in the selected alternative location in this study at the eastern coasts of R. Rasgetheemu will substantially outweigh its imposition on the environment.

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3 INTRODUCTION

3.1 BACKGROUND AND CONTEXT

This Environmental Impact Assessment (EIA) addresses the proposed island access and jetty development project in R. Rasgatheemu. Two freelance EIA consultants prepared this document in accordance with the EIA Regulations (2012) and Regulation on Dredging and Reclamation (Regulation 2013/R-15) of the Environmental Protection Agency (EPA). This EIA provides a focused assessment of the proposed dredging and subsequent reclamation in terms of existing environmental conditions and potential environmental impacts to the surrounding near shore marine environment and shorelines as detailed in the Terms of Reference (TOR) for undertaking EIA for this project. TOR is given in Annex 1.

Studies conducted to evaluate the proposed island access and jetty construction project in Rasgatheemu include coastal mapping, assessment of the marine habitat, assessment of existing environment of the area proposed for development, assessment of island dynamics using satellite image aerial photography, wave and shoreline impact assessment studies of the area.

The Government developed a harbour on the western side of R. Rasgatheemu in early 2007. The harbour is protected with rock boulder breakwater and quaywall adjacent to the land. The harbour is properly functional to provide sheltering and safe mooring space for the vessels. Since the early days of commencement of harbour operation there has been difficulties to approach and enter the harbour through the dredged channel particularly during the onset of SW monsoon period (May, June and July) due to exposure of the area to strong surf waves that breaks on the western reef-flat of Rasgatheemu Island (***Figure 1***). Due to this the people of island are stranded either in or outside the island during the period. To overcome this issues the people of Rasgatheemu tried to develop and alternative access point in 2010 on the north eastern end of the island, where the jetty and access to the island is proposed in this project. The islanders dredged a small area on the north eastern end to provide sheltering for the vessels for loading unloading passengers and goods to and from the island. The islanders also cut the reef flat and cleared the rocks to provide access path to the dredged area. Since the north eastern end of the island is exposed to high oceanic swell during the NE monsoon, the dredged area was soon filled with sediment and the people of the island were not able to use the area to access the island. This is due to the strong wave action in the area and also due to the fact that the dredged area and the channel were not properly engineered and protected. The people of Rasgetheemu then requested for Government's assistance to develop an alternative access to the island particularly during the rough period where the harbour on the western side of the island is not accessible. As a response for this request the Government proposed this project to develop an alternative access for Rasgatheemu on the eastern side. The project involves development of a T-jetty, dredge an access path and a small mooring basin in front of the T-section of the jetty (***Figure 2*** and ***Figure 3***).

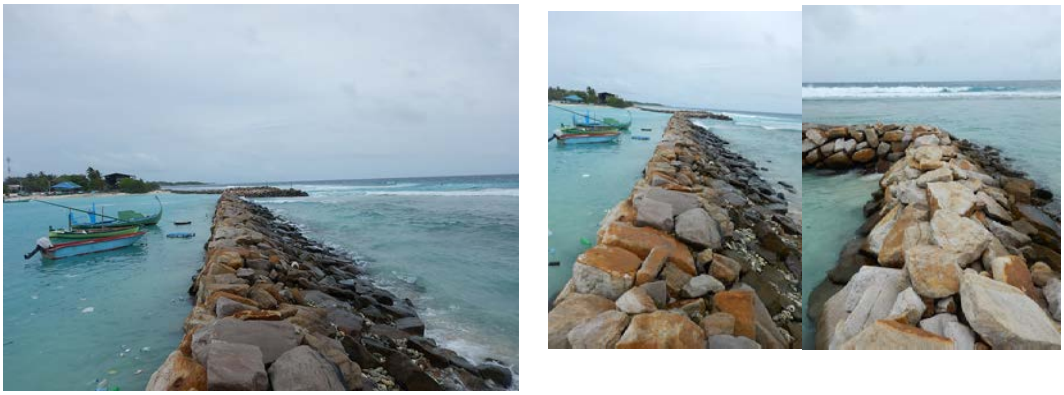

Figure 1: Existing R. Rasgatheemu harbour(top) and harbour protection

Figure 2: Wave condition at the channel entrance and approach, note the wave height

Safe access to the island is required throughout the year for the people of R. Rasgatheemu and to provide safe passage and shelter for the vessels operating to and from the island. The existing harbour and the entrance channel become unsuitable for during rough time. The shallowness and narrowness of the unprotected access channel and the strong high surf waves that breaks on the western reef flat has resulted in life threatening incident, grounding of vessels, damage to property and people in the last few years. Such accident covered in the local newspapers occurred in June 2014, where the council president's Dhoni was toppled and his left foot was lost in the incident (***Figure 4***). Many similar incidents have occurred in Rasgatheemu while trying to access the island from the existing channel on the western side of the island. Furthermore, a proper safe access to the island is a basic necessity that needs to be developed to in each island to provide freedom of movement as well as to facilitate socio-economic development of the island.

Figure 3: Alternative access channel and dredged area developed in 2011, soon became filled with sand and rubble.

Figure 4: Local newspaper cuttings on the incident in Rasgetheemu in 2014

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The government has proposed to develop an alternative access to the island through construction of a 31m long T-jetty with 4m wide walkway with 24m wide, 28m long access channel and 40m X 30m dredged deeper area at the end of the T-Jetty enough for vessel manoeuvring, turning and temporary mooring on the eastern side of the island (***Figure 5***). Both the access channel and the small mooring basin will be dredged to have a depth of -3m at low tide.

Figure 5: Proposed location for the new access channel and jetty development, a magnified map will be provided in Annex 2.

3.2 PURPOSE OF THE EIA

Given the potentially adverse environmental impacts associated with dredging and the other works in the marine environment at R. Rasgatheemu, the proponent has hired a freelance EIA consultant through public bidding process and assigned the preparation and submission of an Environmental Impact Assessment (EIA) report to EPA to comply with the Environmental Protection and Preservation Act (4/93) and EIA Regulations 2012.

The objective of the EIA study is:

a) To provide an assessment of the potential environmental effects of the proposal and to determine which of these, if any are likely to result in a significant effect on the environment and to propose ways and means of avoiding, mitigating and or compensating the perceived negatives effects of the project;

b) To provide necessary information to EPA applicable to the proposed development; and

c) To assess how the proposals have been developed to achieve a satisfactory level of environmental performance in line with the EIA Regulations

3.3 PROJECT SETTING

R. Rasgatheemu is located on the north eastern side of Raa Atoll. The proposed jetty and entrance channel dredging will take place on the north eastern side of the island at the ocean ward side.

Visual observations and studies conducted for similar environment suggested to be dredged, the substrate to be consisted mostly of medium hard consolidated calcareous reef limestone/conglomerate that forms the reef flat. Usually the hardness of coral rock on the reef flat on ocean ward side are greater than the lagoon wards side of the island due to continued exposure to ocean swells. Entrance channel dredging is planned to be undertaken by cutting through the hard reef flat on the eastern side. Some of the reef flat areas earmarked for dredging is expected to be hard and may require special tools and equipment to crush the hard reef flat to obtain the targeted minimum depth of -3m with respect to MSL.

3.4 SCOPE OF THE EIA

The scope of this EIA is based on the consultations held during the scoping meeting at the Environmental Protection Agency on 11th June 2017. Following the scoping meeting, the Consultant drafted a ToR which was finalized and endorsed by the EPA. The approved ToR highlighted 8 major tasks to be covered including;

1. Description of the proposed project;
2. Description of the existing environment;
3. Legislative and regulatory considerations;
4. Potential impacts of the proposed project;
5. Alternatives to the proposed project;
6. Mitigation and management of negative impacts;
7. Development of monitoring plan; and
8. Stakeholder consultation.

A copy of the ToR is attached in Appendix 1. The EIA for the island access and jetty development project in R. Rasgatheemu closely followed the approved ToR for the assessment.

The scoping meeting was attended by the representatives of the following organisations;

1. Ministry of Housing and Infrastructure;
2. Environment Protection Agency; and
3. R. Rasgatheemu Council members (attendance list is attached in Annexes)

3.5 PROJECT JUSTIFICATION

R. Rasgatheemu is an inhabited island with a registered population of 500 people, located on the north eastern rim of Ari Atoll in an isolated house reef. A harbour has been developed on the western side in R. Rasgatheemu in 2007 under the harbour development project. Like many island in the Maldives due to seasonal monsoonal shift in exposure to alternative sides of the islands, harbour was unable to access certain periods of the year. The existing harbour is accessible most of the time except during rough weather period May June and July, the existing harbour cannot be accessed. Therefore the people of the island have been opting for an alternative access to the island. Since this is an inhabited island the island should be accessible all the time throughout the year. Island access related developments such as harbours, access channel and jetties, in an inhabited island, are considered to be the most important infrastructure everyone craves for and viewed as a necessity for the development of the island to open up to the rest of the country. Therefore such development projects are socially-driven project to improve the livelihoods of people who have been waiting impatiently for a proper harbour. The primary objective of the project is to improve access to the island, and provide safe mooring facilities especially during rough weather. Access to the island is envisaged to bring economic growth and will improve living conditions of people of Rasgetheemu Island.

Location of the proposed alternative access jetty and access channel is on the eastern side on the northern part of the island. This is the ocean ward side where the area is exposed to ocean swell throughout the year and particularly strong swells during the NE monsoon.

In the past few years the locals of Rasgatheemu has learned that the island experiences extremely rough wave condition during the SW monsoon period. The existing harbour gets rough and unusable during the onset of SW monsoon as the location is not sheltered by an island or reef. Therefore based on this assessment and experience the locals are opting to have an alternative access to the island on

the NE side of the island. By proposing this location they believe that the island can be accessed either from the harbour on the western side or from the harbour or from the access channel and jetty on the eastern side throughout the year without any exception.

In terms of the design, the proposed design is a standard island access facility infrastructure with an access channel, jetty and a small dredged area for vessel manoeuvring at the end of T-Jetty. Consultation with the island council and elders have suggested relocate the proposed jetty access channel and the dredged area 150m further south of the proposed location. Also suggested to extend the T jetty, 40m more than the proposed jetty length, to the edge of the reef so the vessels can alongside the jetty.

Rasgatheemu Island is saturated meaning beach development reached to the maximum extent, to the reef flat from both southern and northern side. Therefore any shore perpendicular structure or dredged basin (channel and dredged area) will disrupt the natural longshore sediment transport regime. Also leaving the dredged area and the channel unprotected will result in sedimentation and infilling of dredged basin. The proposed design will therefore disrupt the sediment movement around the island and may cause sediment starvation in another part of the island which may consequently lead to severe erosion, which needs to be addressed at a later stage. Therefore coastal changes and dynamics should be closely monitored after the development to address erosion issues appropriately. Given the specific circumstances of R. Rasgatheemu a compromise need to be made between environment and peoples need.

3.6 PROJECT BOUNDARY

Major construction and R. Rasgatheemu island access infrastructure development activities will take place in the boundary shown in ***Figure 6***. Project impact boundary is shown in ***Figure 7***.

Figure 6: R. Rasgatheemu island access and Jetty construction project boundary

Figure 7: R. Rasgatheemu island access and Jetty project impact boundary

3.7 METHODOLOGY

Field studies have been undertaken using methods generally employed for EIA studies in the Maldives. This study was based mainly on data collected during a field investigation mission from 1-2nd June 2017, by the consultant. Field studies have been undertaken using methods generally employed for EIA studies in the Maldives. Environmental impacts are predicted by using descriptive checklists and its significances are evaluated by the use of 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.

3.8 REVIEW OF RELEVANT STUDIES

As part of relevant literature review and preparation of the report, the following EIA studies on dredging, reclamation and coastal protection related work in various parts of the Maldives have been reviewed and used as reference;

Environmental impact assessment for harbour development in R. Fainu island, Raa. Atoll by Riyaz M (2014).

Environmental Impact Assessment For Proposed Levelling And Earthworks Of Football Arena In Nadella, South Huvadhu Atoll by Riyaz M. (2016.

Environmental impact assessment for beach nourishment and maintenance dredging of access channels and harbour in Thulhaagiri island by Riyaz M. and M. Shiham (2014)

4 DESCRIPTION OF THE PROJECT

4.1 THE PROPONENT

The proponent of R. Rasgatheemu Island access and jetty development project is the Ministry of Housing and Infrastructure. The Ministry is the government responsible body for the development and regulate the housing and infrastructure of the country. Jetties and access channels being a public infrastructure the Ministry's mandate in relation to infrastructure development projects is at three levels.

- National Harbour and Reclamation Programme, which involves the construction of major harbours and reclamation projects in the country
- Access Improvement Programme, which was initiated in 2004 with a scope to provide a minimum access to all islands that had no means of a proper access
- Repair and Rehabilitation Programme, which was initiated following the catastrophic event of December 2004 tsunami that damaged a large number of harbours and jetties. This programme was initially implemented by National Disaster Management Centre (NDMC) and later handed over to the Ministry of Housing and Environment.

Harbour development project of all the inhabited islands fall under access improvement programme of which Rasgatheemu has been current government's campaign promise.

Maldives Road Development Cooperation (MRDC) has been contracted to undertake the jetty and access construction work in R. Rasgatheemu.

4.2 PROJECT LOCATION AND BOUNDARY

R. Rasgatheemu is located on the southern eastern side of Raa Atoll. The island is located at the north eastern rim of the atoll at Longitude 73.003198, Latitude 5.807783 (Figure 8). The Island is oval in shape oriented N-S and is found in a single reef that has similar island shape. The island is located on the central part of the oval shape reef. The island has approximately 900m in length and 520m in width and has an approximate land area of 36ha. Closest inhabited island located within the vicinity of Rasgatheemu Island include Angolhitheemu on the south and Vadhoo to the.

The proposed mooring basin and entrance channel dredging will take place on the north eastern side of the island in front of Kanneli Magu .

The project boundary is confined to R. Rasgatheemu Island and the reef and lagoon environment in which the island is found (***Figure 7***).

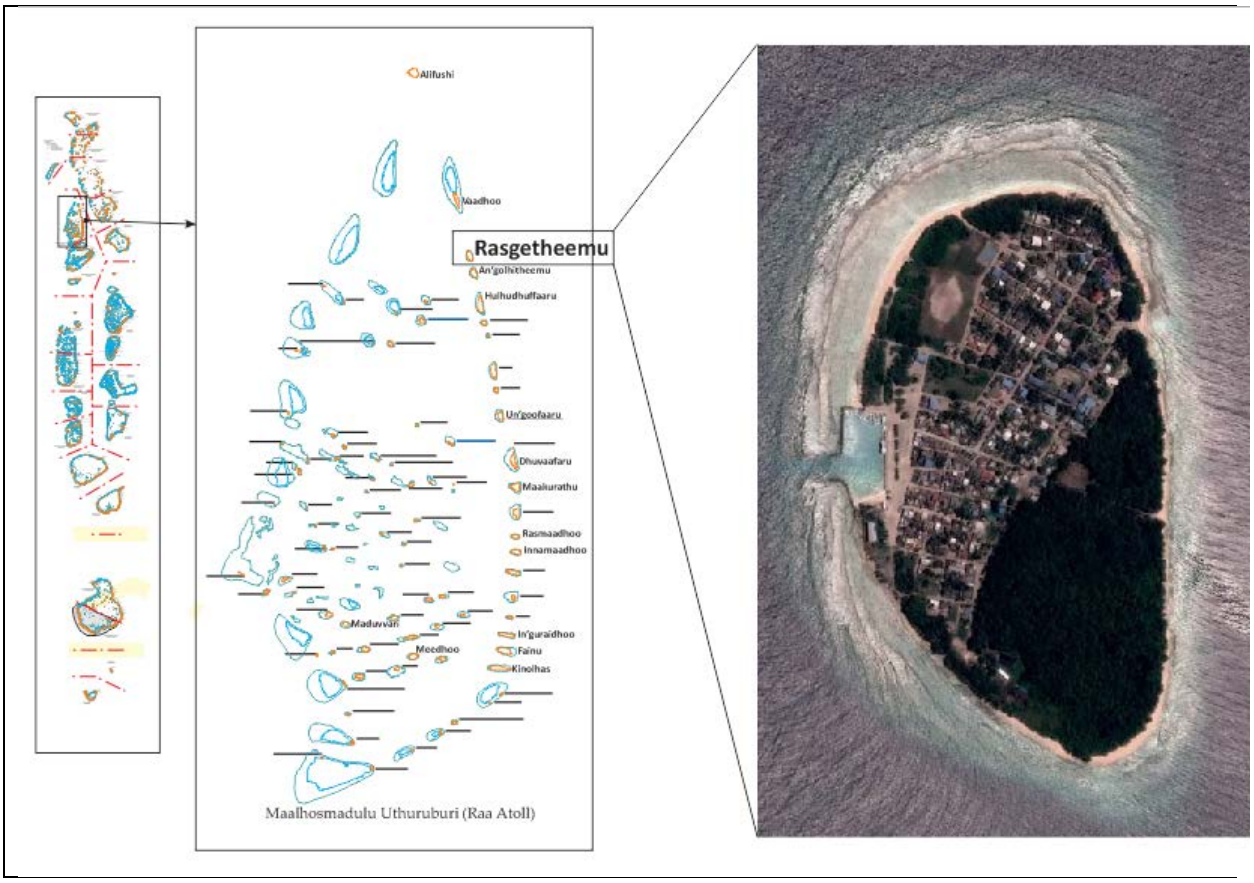


Figure 8: Location of R. Rasgatheemu Island in Raa Atoll

4.3 PROJECT OUTLINE AND SITE PLAN

The proposed design is a standard island access related infrastructure government develops in islands with the population size of Rasgatheemu. Island access related structures include an access channel, small mooring area and a jetty. Rasgatheemu access is designed to allow for safer access and turning of marine vessels and to accommodate slightly larger vessels (***Figure 9*** and ***Figure 10***). To do so the initial proposal of the Government includes the following components

- Construction of 31.15m long T-jetty with 4m width walkway
- Ground levelling the jetty area.
- Dredging near Jetty area 40m width & 30m length area
- Dredging new entrance channel 24m width & 28m length

Dredging would seek to achieve depths of up to -3m with respect to the MSL in the entrance channel and similar depth within the mooring basin.

Figure 9: Conceptual drawing and location of the proposed access channel and jetty

Figure 10: Details of the proposed access and jetty development in Rasgetheemu

Field verification of the project site has revealed that the dimensions given in the proposal does not fit into the location as the reef edge is closer and there is no need for channel dredging in the proposed location at end of Kanneli Magu, Rasgatheemu. Discussion with the people of the island has suggested to shift the location of the jetty and the access channel further south for various reasons that will be discussed in detail in the alternatives section of this report which would be the preferred location to develop island access in Rasgatheemu.

4.4 MAIN DEVELOPMENT FEATURES OF THE PROJECT

The following are main development features of Rasgatheemu access and jetty development project:

1. Dredging of a small turning basin (40m length X 30m wide) located at the tip of the T-jetty achieve -3m with respect to MSL
2. Dredging a 24m wide 28m long entrance channel through the reef flat into the atoll ocean to a depth of -3m
3. Construction of 31.15m long T-jetty with 4m width walkway
4. Use the dredged material for ground levelling of the jetty area

Above features are depicted in the (***Figure 10***). Since this is an extra access point for the island to be used during rough sea conditions the proposed size is considered to be adequate for the current traffic volumes as well as estimated future traffic to the island. The people of the island are hoping to increase the length of the jetty to the reef edge for their vessels to be anchored alongside the jetty. Therefore, they have suggested shifting the jetty 150m south of the proposed location.

4.5 MOORING AREA BASIN

An excavator on barge will be used to dredge proposed areas to obtain the desired depths. The excavator will transfer the dredged material on the dump truck which finally ends up on the stockpile location. A detailed bathymetry of the basin will be compiled by contractor before work commencement. Areas that need to be excavated will be identified and marked with floating buoys. It is planned to complete all activities within the scope of this project in 130 days.

4.5.1 The Entrance Channel

The proposed dredging project intends to excavate the entrance channel to achieve the required depth of -3m with respect to MSL at low tide. At present the average depth of the reef flat is 0.7- 1m during mid-tide and hence will not be suitable to provide access for vessels.

4.5.2 Jetty Works

Footing of the jetty will be made from concrete columns placed on pre-cast concrete footings. The footing will be made on land and placed using the barge. The columns will be transported to the jetty area on trucks or excavators. Existing roads of the island would be used for this purpose whenever possible. Once the concrete columns are in place, in-situ beams will be cast to receive timber deck. Details drawings of the jetty is provided in Annex 4.

4.5.3 Ground levelling of Jetty area

Dredged material will be used for ground levelling of the jetty excess material will be used to replenish the eroding beach on the northern end of the island.

4.6 VOLUMES AND TYPES OF SEDIMENT TO BE DREDGED

From existing depth information for the small mooring area entrance development has been estimated that a total of 5,616m^3 of dredged material will be generated by the proposed works (***Figure 11***) . With the proposed changes to the plan very minimum amount of dredging is required if the jetty is extended to the reef edge.

The disadvantages of dredging are potential short-term impacts to water quality. During dredging operations sediment becomes suspended into the water column. This sediment can then be carried by the current until it settles out of the water column. However, it is not possible to control sediments entirely because the work is done underwater and every dredge leaves some residual material on the bottom.

Figure 11: dredged material disposal sites

4.7 TIMINING

Timing of the dredging is proposed to be coincided during the period between August and November to allow the sediment plume to move south and northward influenced by the predominant wind direction and ocean currents to the plume to reach the deep ocean. The proposed dredging schedule is given below in ***Table 1***

4.8 ACCIDENTS AND HAZARDS

A major risk associated with the project is the impact on marine environment from the proposed island access and Jetty construction work. The construction works will be carried out using excavators placed on a barge, which will be floating during the entire operation. It is a possibility that the barge may run on to the reef flat during low tide, however, this can be avoided with work scheduling at high tide. There will be excavation involved so possibility of sedimentation of coral during construction is inevitable. Deployment of precast pad-column units will replace the natural seabed at direct construction footprint of the proposed structures, which cannot be avoided.

4.9 PROJECT SCHEDULE

The project is expected to take about 130 days to complete including the time needed for seeking necessary approvals. The main milestones include; obtaining approvals, mobilization, and onset of work, jetty works and entrance channel dredging works, and demobilization. ***Table 1*** shows the project schedule and project inputs and outputs are given in ***Table 2***.

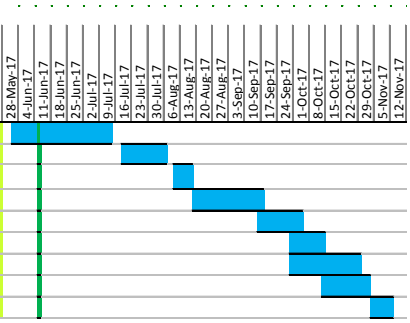
Table 1: Project Schedule – Indicative

Project - Rasgetheemu Island Access and Jetty Project

Today's Date: 06/13/17 0

Start Date: 05/30/17

Ser.	Tasks	Start	End	Duration days
1	EIA preperation and approval	05/30/17	07/14/17	45
2	Contract award preliminary survey	07/19/17	08/08/17	20
3	Mobilisation	08/10/17	08/20/17	10
4	Start dredging work	08/20/17	09/19/17	30
5	Concrete precasting	09/15/17	10/05/17	20
6	Transportation of precasts	10/01/17	10/16/17	15
7	Beach levelling work	10/01/17	10/31/17	30
8	Jetty Construction	10/15/17	11/04/17	20
15	Decomissioning	11/04/17	11/14/17	10



4.10 PROJECT INPUT AND OUTPUTS

Table 2: Matrix of project major inputs and outputs

Input resource(s)	Source/type	How to obtain resources
Workers	Skilled and semi-skilled labour, Manager (1) Supervisor (1) Excavator Operator (2), Loader operator (1), Welder (1), Driver (2), Carpenter (2), Bar bender (2), Mason (2) Labourer (11) Cook (1) Cook helper (1) total of 27 people, skilled and semi skilled 16 and unskilled labourers 11.	Trained and licensed staff of the contactor
Machinery (excavator, barge, operational tools)	02 excavators 02 dump trucks 01 loader 01 Concrete machine 01 Barge 01 Workshop container 01 Office Container 03 Diesel tank 5,000litres 01 Welding Genset	To be obtained and operated by the contractor. Contractor will be required to bring to the site machines in good working conditions to avoid loss of time due to breakdown of machines, vehicles and equipment.

	20KvA	
Output	**Anticipated quantities**	**Comments**
Mooring basin	Small mooring area basin 40m x 30m average depth of -3m will be achieved	Over time is it expected that substrate will be re-colonized by benthic / sessile organism, resuming an new ecological balance.
Entrance channel	28m long and 24m wide with an average depth of -3m, channel	Dredged material will be used for jetty area levelling and the excess to replenish the eroded beach on the northern side of the island
T-Jetty	Total length of the jetty sections 31.15m	Built using concrete, jetty columns will be pre-caste on land and transported to the site
Dredged material	Major quantity 5616m^3 approximately	Levelling the jetty base and excess material will be used to replenish the eroded beach on the northern side.
Wastes	Minor amount	No wastes during the excavation will be allowed to be dumped into the sea. Solid wastes and human wastes will be managed through the existing wastewater and solid waste management system on the island
Waste oil and lubricants	Minor amount	Gathered in a barrel and sent to Thilafushi through existing waste management system
Noise and light	Localized	Excavator and truck operation will generate some noise during the project execution. If work is carried out in the night lights will be necessary in the harbour area. Work will not be carried out late into the night to avoid disturbance to local population.
Plastics and packaging waste	Minor amount	Managed through existing waste management system of the island

5 ADMINISTRATIVE AND REGULATORY FRAMEWORK

This is section highlights relevant government stakeholders, their roles and reviews relevant legal framework applicable to the proposed project.

5.1 MINISTRY OF ENVIRONMENT, ENERGY

The Ministry of Environment and Energy (MEE) is key Ministry in the government mandated with the protection of the environment. Environmental responsibilities assigned to MEE includes formulating environmental policies, coordinating, preservation and management of the environment throughout the country, and enforcing Environmental Protection and Preservation Act (EPPA) (04/93). Under Article 5(a) of EPPA, Environmental Impact Assessment (EIA) is mandatory for projects that may cause potential harm to the environment. The EIA report has to be submitted to the EPA for approval before commencement of a project. As per this legislation, any project that has any undesirable impact on the environment can be terminated without compensation by MEE.

5.2 ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA is the key regulatory body on environment, which is an autonomous body formed under the umbrella of MEE. It is mandated with implementing the EIA process in the Maldives, implementing the Environment Act and subsequent regulations on behalf of MHE, regulating water and sanitation, biodiversity conservation, waste management and coastal zone management. Also, it is responsible for developing environmental standards and guidelines in the country.

5.3 MINISTRY OF HOUSING AND INFRASTRUCTURE

The Ministry of Housing and Infrastructure is mandated to undertake reclamation, harbour development and coastal protection infrastructures as per the government policies. The Ministry of Housing and Infrastructure has a harbour and jetties development programme where there are minimal requirements for harbours and jetties in local inhabited islands. The Access Improvement Programme, which was initiated in 2004, had a scope to provide minimum access to all islands that had no means of a proper access. The Ministry undertakes all coastal infrastructure projects except those specifically focused on shore protection. Depending on the environmental conditions of specific islands, breakwaters or side quay walls would be provided to make the harbour basin safe from adverse conditions.

Although there are no published local guidelines the Ministry uses British standards for coastal structures specifications. The environmental requirements considered are those provided by Ministry of Environment and Energy such as that of Dredging and Reclamation Regulation. The environmental criteria for each project are, however, defined according to the findings of the Environmental Impact Assessment, which is required to be undertaken for each and every harbour project.

5.4 LEGAL FRAMEWORK

Four regulations pertaining to the proposed project have been reviewed and the project's conformity to these has been assessed.

a) EIA Regulations 2012
b) Regulations on cutting down of Trees
c) Regulation on Dredging and Reclamation
d) Regulation and Waste Management

5.4.1 EIA Regulations 2012

The most important governing law as far as the environmental impact assessment is concerned is Environment Protection and Preservation Act (Law No. 4/93) (EPPA).

EPPA mandates all development projects in the Maldives to undertake an Environmental Impact Assessment prior to undertaking any such project.

Further the EPPA states an impact assessment study shall be submitted to the relevant Government authority before implementing any development project that may have a potential impact on the environment.

It goes on to say that the relevant Authority of Government shall formulate the guidelines for environmental impact assessment and shall determine the projects that need such assessment as mentioned in above.

The law also gives power to the relevant Government authority to terminate any project that has any undesirable impact on the environment. A project so terminated shall not receive any compensation.

According to the EPPA waste disposal, oil and poisonous substances any type of waste, oil, poisonous gases or any substance that may have a harmful effect on the environment shall not be disposed within the territory of the Maldives.

Government of Maldives reserves right to claim compensation for all the damages that area caused by the activities that are detrimental to the environment.

Environment Impact Regulations, 2012 & other relevant regulations

Under the provisions of EPPA the Government of Maldives has formulated and gazetted Environmental Impact Assessment Regulations (2012) detailing the EIA process and the EIA preparation.

In addition to EIA regulations, other relevant regulation will be followed in development and implementation of the proposed project. These regulations include ban on coral mining. Coral mining from house reef and atoll rim reef has been banned since 1990. Sand mining from any island has also been banned since March 2000.

The EPPA, EIA Regulations and other relevant regulations will be duly taken into consideration in preparing the EIA report and in the implementation of the project.

5.4.2 Regulation on Cutting down Trees

Cutting down and relocating of mature trees is regulated in Maldives under the by-law on cutting down, uprooting, digging out and export of trees and palms from one island to another. In the preamble of the law, made in pursuant to Law No. 4/93, it states the purpose of the law is to educate citizens and developers about the importance of trees including sound management to maintain trees and provide standards for the preservation of trees in the Maldives.

Under the law certain tree are prohibited to remove from island. They include:

- The coastal vegetation growing around the islands extending to about 15m into the island
- All trees and palms growing in mangroves and wetlands spreading to 15m of land area
- All trees in Government protected areas

- Trees that are being protected by the Government in order to protect species of animal / organisms that inhabit on such trees
- Trees / palms those are unusual in nature.

The law states that prior permission must be obtained for removal and/or relocation of 10 or more trees or palms. For indiscriminate removal and land clearances and EIA Decision Note is required. The size of the trees and palms that are allowed to be relocated should have more than 15feet from lowest point to the crown spread for palms and 8 feet from the lowest point to the trunk to tip of the highest branch for trees other than palms.

The law also states that cutting down and uprooting of the trees shall be made under supervision of the island / atoll offices (in the current context Atoll / Island Councils).

The project does not involve removal of any tree from the island hence the regulation will be fully complied to.

5.4.3 Regulation on Dredging and Reclamation

Regulation on Reclamation and Dredging of Islands Lagoons (Regulation 2013/R-15) came into effect in April 2013. The regulation requires having permission of EPA on projects requiring alternation of the island, either by reclamation of dredging. Specifically the regulation requires producing scaled-maps of the island before and after the proposed intervention. Special provisions have been made on protected and sensitive area restricting changes to the environment of the islands.

According to the new enforcement arrangement made since November application for Dredging and Reclamation Permit for the projects has to be submitted along with the EIA/Addendums to the Environmental Protection Agency. Therefore the application for Dredging and Reclamation Permit for this project is submitted together with the EIA report.

5.4.4 Regulation and Waste Management

Waste management Regulation (No. 2013/R-58) is more recent coming into effect on 6 February 2014. The regulation was gazetted on 05 August 2013. The regulation provides set of comprehensive guidelines on collecting, storing, transporting and managing waste. In the preamble its states the objective of the regulation is in line with the Article 22 of the Constitution which requires that development activities designed for achieving socioeconomic targets should ensure that environment and its constituent living component is not compromised and that resources are utilized effectively.

The regulation talks of the responsibilities of collection, transport, treating and storage of waste. It also talks of management centres and landfill sites and managing hazardous waste. Various sectors and entities (including tourist resorts) encouraged having their own waste management plans consistent with the Regulation.

EPA is the implementing agency of environmental law and the implementing agency of the EIA regulation.

Wastes produced from the project will be disposed in compliance to this regulation.

5.4.5 Summary

In summary, the proposed project will comply with all applicable environmental regulations requirements, relevant legislation, and legal and regulatory statutes. The EIA process ensured that this project has followed relevant laws and regulations and the scoping meeting and the stakeholder consultations enabled all related stakeholders participate in the process.

6 METHODOLOGIES

The study approach involved undertaking data collection through field surveys and literature review.

The project scoping was carried out to narrow down the project issues to those requiring detailed analysis. The process involved discussions with stakeholders on key project issues. The primary data was collected through the qualitative and quantitative methods of data collection. Qualitative data was collected through filed visits/site walks, public and stakeholder consultations and direct consultation with the people of the island. Stakeholder discussions were conducted to collect as much relevant information and views. Specific methodologies adopted to assess various aspects of the environment have been discussed in details in the respective sections of this report.

The secondary data was collected through literature reviews which included a study of the following:

Policies, Acts and Regulations;
Aerial photographs and satellite images; and
Previous project study documents

In undertaking baseline studies using available data and knowledge have been used. Key issues have been identified during scoping as given in the TOR. Based on the scoping need for further in-depth studies and additional data requirement were identified. Local knowledge was used as much as possible to ensure key questions are addressed in the assessment. Ideally minimum of two monsoon periods (NE and SW) of data is desirable for a study of this nature to understand seasonal variability and environmental change. However to avoid delay in decision making and to provide a conservative assessment of environmental impacts a short term data collection and use of existing data and expert judgments were adopted.

6.1 DREDGING REQUIREMENTS AND WORK METHODOLOGY

6.1.1 Dredging Method

Dredging works under this project involves the following three steps; excavation, transport and disposal.

6.1.2 Excavation

It involves dislodgement of and removal of sediments and/or rocks from sea bottom of the dredge areas. An excavator on a barge will be used to dredge the material by mechanical actions. The dredging will be performed utilizing a CAT 330 hydraulic excavator equipped with Young's 3.3-yd3 hydraulic bucket. The excavator will transfer the dredged material on the dump truck which finally ends up on the site of utilisation. A detailed bathymetry of the basin will be compiled by contractor before work commencement. Areas that need to be excavated will be identified and marked with floating buoys. Dredging will progress from entrance into the shallow areas.

6.1.3 Transport of Excavated Material

Transporting materials from the dredging area to the site of utilisation, will be achieved as follows. Sediments will be dumped into dump trucks to transfer into utilisation site; Excavator with appropriate bucket size has been recommended due to the relatively small size of the area requiring dredging and due to relative simplicity of the methodology for not having to do much pre-work preparation and to shorten the job schedule.

6.1.4 Disposal Site

Dredged material transported by dump trucks will be disposed off to the designated areas for levelling jetty base. The excess material will be used to replenish the eroded beach on northern end of the

island. Once the material is disposed off to the site proper ground levelling and spreading of the load is carried out by manually and using various equipment.

6.2 MARINE ENVIRONMENT

6.2.1 Reef and Surveys

Equipment and tools used

- Handheld Global Positioning System (GPS)
- Still photograph camera
- Underwater writing sheets
- Digital globe multispectral and Panchromatic satellite data

Status of coral reef was assessed from area proposed for the development. Due to time limitation photographic assessment was made. In order to give objectivity photo images were taken at every two fin strokes in swim along the reef. Photos were taken by holding the camera in horizontal plan. Care was taken that photos were taken at the same level throughout the swim. Assessment was on the western side on the reef flat about 2-4 m deep. These locations are given in Figure 13. For the analysis 10 images were selected at random from each transect. Substrate cover in each image was estimated by eyeballing method that has been proven by Adam and Naseer (2007) to be useful to provide reasonable average estimate of the substrate cover for the area.

The reef flat on the eastern side is extremely shallow hence not suitable for snorkelling or swimming due to the shallow depth of the area. Photographs are taken from the reef edge and which has an average depth of 0.7-1.5 meter.

6.2.2 Bathymetry

Bathymetric survey of the area proposed for island access and jetty construction in Rasgatheemu, reef were carried out by using echo sounder and a GPS. Differential GPS technique is used for correction of GPS locations points. Echo sounder measurements are corrected and related to the mean sea-level for the area. Bathymetry of the surveyed area is in shown ***Figure 12***

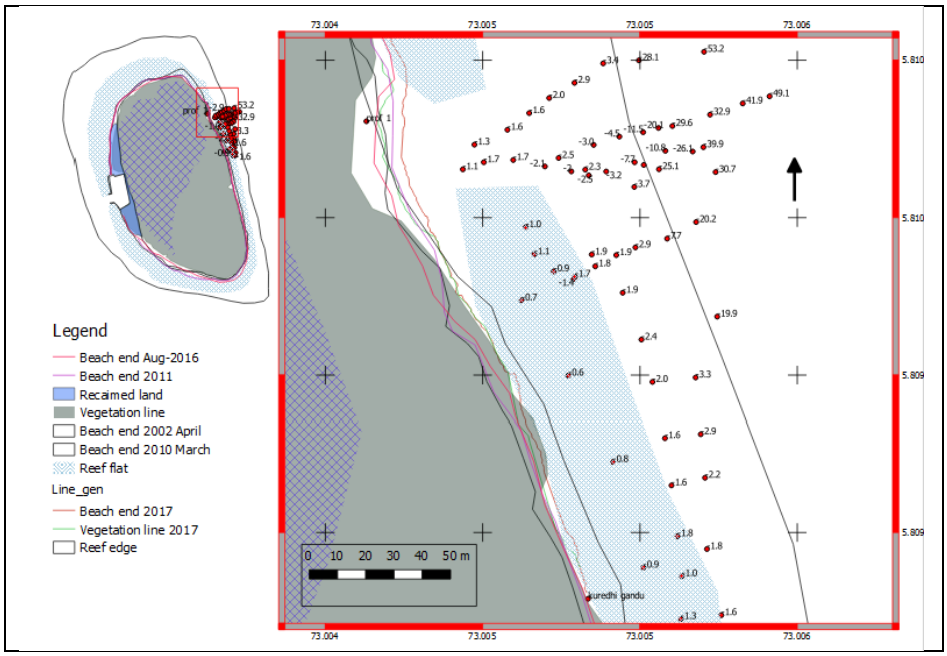


Figure 12 : Near-shore depth of the eastern coast of Ragetheemu Island magnified map of the area will be provided in the Annexes.

6.2.3 Waves and Currents

Generalised wave predictions and wave pattern predicted using hindcast for the Indian Ocean was obtained from weather information providing sites. Site specific near shore wave characteristics for R. Rasgatheemu was measured using a RBR wave Gauge location shown in ***Figure 12***.

6.2.4 Coastal Dynamics

Combination of remote sensing and GIS technology and field mapping and ground truthing were used to assess the long term coastal and morphological changes of the islands. Google earth historical image sequence was co-georeferenced with the survey data and comparatively evaluated using GIS technology to assess the long term geomorphological developments of the island. Changes in the shoreline from 2002-2014 was documented using Google earth images. Beach profiles are taken from the shoreline of the area proposed for development.

6.2.5 Geology, Sediment, Marine Benthic Assessment

Due to the homogenous nature of the geological characteristics of Maldivian Atolls, site specific investigation for reef and lagoon geomorphology was not conducted whereas coring studies conducted elsewhere in the Maldives was reviewed (Gischlera, et. al.,2008). Visual observations were also made during the field on the geomorphological aspects of the island lagoon and reef.

Coral communities and the coral reefs at the entrance channel and within the proposed access channel and jetty development area were assessed by combination of boat patrolling, and underwater visual observations. The proposed site for development of the jetty and the access channel is homogenous consists of medium hard consolidated calcareous rock/conglomerate reef platform that is usually found ocean ward side reef-flats.

6.3 TERRESTRIAL ENVIRONMENT

6.4 CLIMATE

Official meteorological observations services in Maldives are limited to airports. A total of 11 airports are in operation, however meteorological observation takes place only on 5 airports. They are Hanimaadhoo in the north, Ibrahim Nasir International Airport in the centre, Kahdhdhoo, in the south centre, Kaadehdhoo, in the south, and Gan Island in the extreme south. Observation routinely monitored and measured include, surface wind speed and direction, daily minimum and maximum air temperature at near-sea level, humidity, cloud cover. Monitoring of sea-level height takes place only in Hulhule (central), Hanimaadhoo (North) and in Gan Island (in south). Apart from the official meteorological observations, number of resort islands and individuals are installing portable mobile weather stations. Such weather stations are providing real time measurements to popular weather forecasting sites such as http://www.wunderground.com and htpp://www.windfinder.com. Data collected from these stations are now publicly available from those internet sites (accessed June 2017).

In the absence site specific weather data the normal procedure is to obtain whatever is available from the nearest weather station in an airport and apply it to the site assuming that average climate conditions do not show much variation between different islands. For the purposes of R. Rasgatheemu EIA meteorological observations from the Hanimaadhoo, which is located approximately 104km north of Rasgatheemu was used for description of the general weather conditions on the northern part of the Maldives. Data obtained from portable weather stations installed in N. Irufushi Islands,

approximately 35km south east of Rasgatheemu, was used for description of specific local climate condition of Rasgatheemu Island.

6.5 IMPACT ASSESSMENT METHODOLOGY

The environmental impacts that may be associated with the proposed island access and jetty construction project on R. Rasgatheemu Island are predicted by using a simple matrix. Island and access development is a very common and necessary infrastructure development that is needed in almost all the islands of the Maldives. People are very familiar with the environmental impacts associated with the development. Due to its necessity socio economic benefit of island access related development always overweight environmental concerns. Impacts from various activities of the proposed project both construction and operational phases have been identified through consultation with the project management team, field surveys, observations and assessment, as well as based on field experience and expert opinion on similar development projects in the country.

Other sources of information have been used wherever possible. Data collected during field surveys can be used to predict outcomes of various operational and construction activities on the various related environmental components. Data presented in this report can also be used as a baseline for environmental monitoring of the project activities.

6.6 DATA GAPS

In the Maldives it is common to expect a detailed environmental analysis for an EIA to be undertaken in a relatively short period of time. Therefore, limitation of the time spent on site has been the key limiting factor to get a more detailed assessment on all environmental aspects surrounding the island. Given the seasonal climatic variations in Maldives and the differences in island dynamics and climate settings in individual islands such a short time frame is too little to assess selected aspects of the environment. This problem is compounded by the absence or extreme difficulty in obtaining grey literature (held in technical reports in some government officers) and of long-term studies in other parts of Maldives. Hence, most EIA's end up being based on an environmental snapshot of specific point in time. However, experienced EIA specialists can deliver a close match to reality based on a number of similar assessments and expert judgments of the team. In this regard, the following gaps could be identified in information.

- Absence of long-term site specific or even regional data (at least1- 2 years). Most critical data include current, wave and coastal dynamics.
- Absence of historical and long-term records on reef and lagoon environment.

These gaps are seriously considered in the assessment and care has been taken to address the issue in designing mitigation measures and the monitoring programme. Nonetheless, most of the assessments, including sea water quality, island dynamics, reef health, bathymetry were done in accordance with the TOR and other relevant information are collected through literature review to reflect closest match to existing environment of the island at the time of these assessments.

Figure 13": Mapping and survey area and magnified view of sampling locations of Rasgatheemu (right)

7 EXITING ENVIRONMENTAL CONDITIONS

7.1 OBJECTIVES

The purpose of this was to assess the existing environmental conditions of the coastal environment of the area proposed for island access and jetty construction in Rasgatheemu Island. This is critical in assessing potential impacts and to determine the actual extent of damage should an unforeseen impact occur during the implementation phase. The current assessment is more focussed on locations planned for entrance channel dredging, jetty construction and associated activities.

7.2 METEOROLOGY AND CLIMATE

7.2.1 Temperature

The daily average temperatures rarely drop below 25°C and rarely go above 32°C. The warm period of the year is from March to May with an average daily high temperature above 31°C. The hottest day of the year is during April, with an average high of 32°C and low of 28°C.

The cool periods lasts from October/November to January with an average daily high temperature below 30ºC. The coldest day of the year is around mid-December, with an average low of 26°C and high of 30ºC. The sea surface temperature in the Indian Ocean in July 2014 is recorded to be around 29-30°C.

The annual average rainfall is approximately 1,950mm. As Maldives lies on the equator, Maldives receives plenty of sunshine throughout the year. Significant variation is observed in the climate between the northern and the southern atolls. The annual average rainfall in the southern atolls is higher than the northern atolls. In addition, greater extremes of temperature are also recorded in the southern atolls. On average southern atolls receive 2,704 hours of sunshine each year. Table 5 provides a summary of key meteorological findings for Maldives.

Table 3: Key meteorological features of the Maldives

Parameter	Data
Average Rainfall	9.1mm/day in May, November 1.1mm/day in February
Maximum Rainfall	184.5mm/day in October 1994
Average air temperature	30.0 C in November 1973 31.7 C in April
Average wind speed	3.7 m/s in March 5.7 m/s in January, June
Maximum wind speed	W 31.9 m/s in November 1978
Average air pressure	1012 mb in December 1010 mb in April

Seawater surface temperatures (SST) are usually 28-29ºC, but can reach 30 or more in shallow near shore areas. The Maldives are reported to experience a mixed layer of relatively saline water (36 ‰) from Arabian Sea which mixes with occasional intrusion of 34 ‰ waters from Bay of Bangal.

7.2.2 Monsoons

The climate of Maldives is characterised by the monsoons of Indian Ocean. Monsoon wind reversal significantly affects weather patterns. Two monsoon seasons are observed in Maldives: the Northeast (*Iruvai*) and the Southwest (*Hulhangu*) monsoon. The parameters that best distinguish the two monsoons are wind and rainfall patterns. The southwest monsoon is the rainy season while the northeast monsoon is the dry season. The southwest monsoon occurs from May to September and the

northeast monsoon is from December to February. The transition period of southwest monsoon occurs between March and April while that of northeast monsoon occurs from October to November.

7.2.3 Winds

The wind conditions for the islands are dominated by monsoons. These winds approach with great constancy, primarily from the northeast and southwest directions. Some seasonal changes occur within this pattern, as a result of the relative position of the sun and the earth's surface. In general, these seasonal changes in the annual wind regime may be described as follows:

Strong winds and gales are infrequent although storms and line squalls can occur, usually in the period May to October. During stormy conditions gusts of up to 60 knots have been recorded at Malé (data from Maldives Meteorological Services).

Wind speed is usually higher in central region of Maldives during both monsoons, with a maximum wind speed recorded at 18 ms-1 for the period 1975 to 2001. Mean wind speed is highest during the months May and October in the central region. Wind analysis indicates that the monsoon is considerably stronger in central and northern region of Maldives compared to the south (Naseer, 2003). Annual averages shows that wind directions are mostly in W (32%) and E (11%) and NW (10%).

Wind data obtained from Hdh. Hanimaadhoo has been compared with the local conditions recorded in Irufushi Island 35 km south east of Rasgatheemu to see the wind direction and speed variation that can take place over a considerable distance (***Figure 14***).

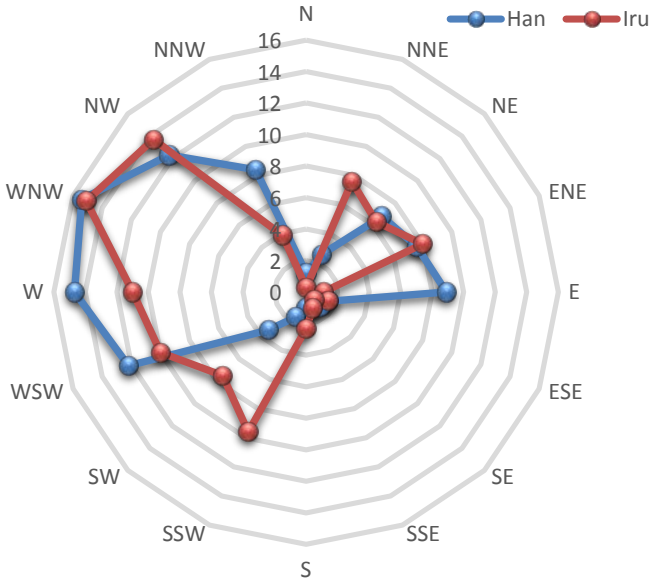


Figure 14: Wind data analysis for N.Irufushi Island and HDh Hanimaadhoo Island; closest islands to R. Rasgatheemu for which weather data is available(1975 to 2001)

The comparison showed significant variation between the wind records from Hanimaadhoo and Irufushi Island in dominant wind direction and speed.

Wind data comparison shows that 73% of the wind is blowing between SSW and NW directions in Irufushi while 69% of the wind direction is concentrated between SWS- NNW directions in Hanimaadhoo Island. Also 15% of the westerly wind has WNW direction in Irufushi while 15-12% of the dominating wind direction in Hanimaadhoo is W and WNW direction. Wind speed recoded from Irusfushi shows that the average wind speed is lower than Hanimaadhoo throughout the year

except in June and July, where wind speed is similar or very close between the two islands during this period.

Figure 15 shows monthly local variations in wind characteristics between Hdh. Hanimaadhoo and N. Irufushi which is 35 km south east of R.Rasgatheemu. Considering the distances between R. Rasgatheemu and Hanimadhoo and Irufushi weather conditions is R. Irufushi is more likely to prevail in R. Rasgatheemu.

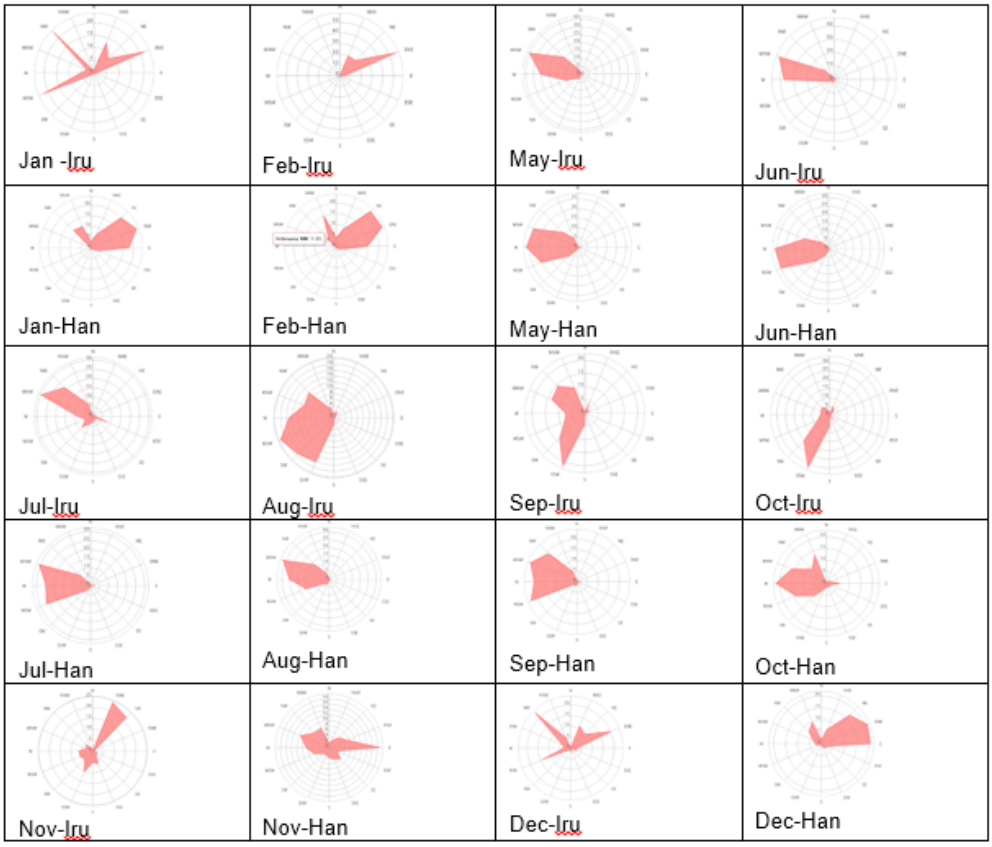


Figure 15: Monthly local variations in wind characteristics between Hdh. Hanimaadhoo and N. Irufushi (Han=Hanimaadhoo, Iru=Irufushi).

Considering the predominant wind directions for both islands studied, the following can be generalised for the expected wind directions prevailing in R. Rasgatheemu.

a) January to July: Winds are primarily from the NW to ENE.
b) August to October: Winds are mainly from the North West to SSW.
c) November to December: Winds are primarily from the NNE to ENE.

Accordingly it is proposed to carry out the excavation activities during the period between the month of August and October considering the existing location of the harbour.

7.2.4 Rainfall

Rainfall data for N. Rasgatheemu was obtained from the nearest meteorological station which is at Hanimadhoo Island. Analysis of the rainfall data for the past 20 years (1992-2012) shows high variability from year to year with an average yearly mean of 1778mm as shown in the ***Figure 16***.

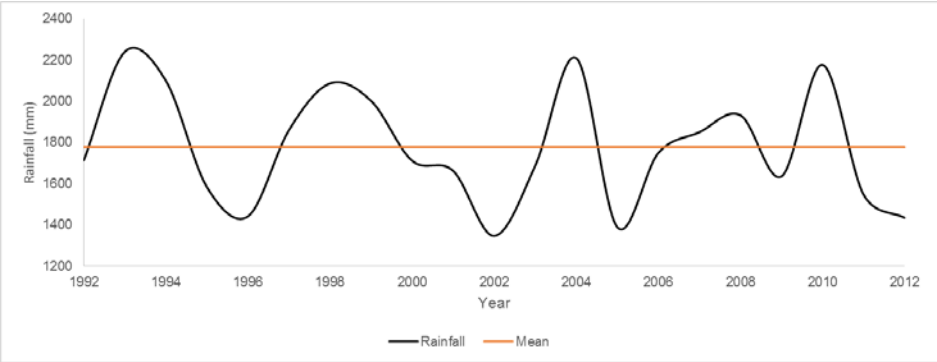


Figure 16: Yearly rainfall for Hanimaadhoo for the period between 2011 and 2012

Month by month analysis of rainfall data for the period 2011 – 2012 shows lowest chances of precipitation for the first quarter of the year. Chances of precipitation being greatest for the period between May – October (***Figure 17***).

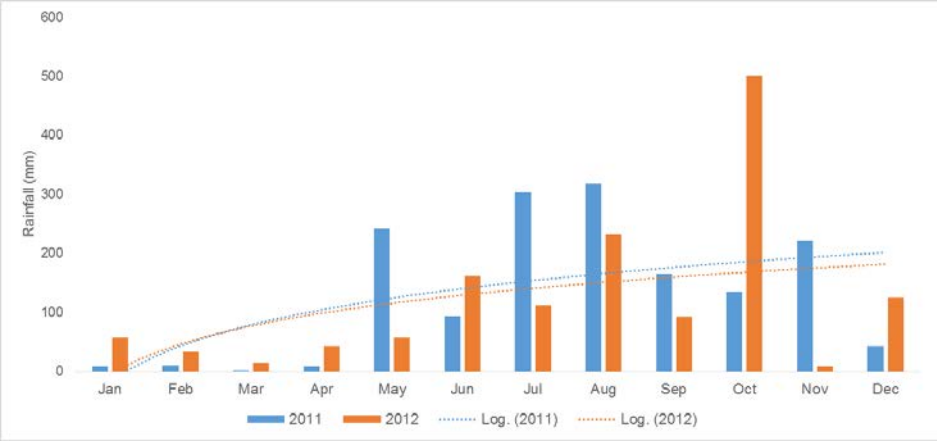


Figure 17: Rainfall for Hanimaadhoo by month 2011 – 2012

Wind and rain fall pattern expected for R. Rasgatheemu show that the higher wind speed during southwest monsoon is co-incided with higher precipitation. Since the dredging has been proposed to be undertaken during the period between January – July, planning for dredging should expect rough weather conditions that may occur during the period.

7.3 TIDES, CURRENTS AND WAVES

7.3.1 Tides

Tides experienced in Maldives are mixed and semi-diurnal/diurnal. Typical spring and neap tidal ranges are approximately 1.0m and 0.3m, respectively. Maximum spring tidal range in the central atolls is approximately 1.1m. There is also a 0.2m seasonal fluctuation in regional mean sea level, with an increase of about 0.1m during February to April and a decrease of 0.1m during September to November. Like in most other atolls, semidiurnal tides are experienced in Raa Atoll - that is two high tides and two low tides a day. The tide varies from place to place, depending on the location and on the shape and depth of the basin, channels and reefs and also time of the year. Tidal variations in Maldives are presented in ***Table 4***.

Table 4: Tidal variation observed at Ibrahim Nasir International Airport (Mean levels reported by the Maldives Meteorological Services).

Tide Level	Referred to MSL
Highest Astronomical Tide (HAT)	+0.64
Mean Higher High Water (MHHW)	+0.34
Mean Lower High Water (MLHW)	+0.14
Mean Sea Level (MSL)	0.00
Mean Higher Low Water (MHLW)	-0.16
Mean Lower Low Water (MHLW)	-0.36
Lowest Astronomical Tide (LAT)	-0.56

Astronomical tides are related to the motion of the earth-moon-sun system, and have a range of periodicities. The highest astronomical tide was recorded in the Maldives has been 0.64 m above the mean sea level and the lowest astronomical tide was recorded has been 0.56 m below the mean sea level. Tidal variation of 1.2m from lowest to the highest tide levels were recorded in the country. Tidal fluctuations (rise and fall of tides) cause changes in current flow pattern around the island and bring subsequent changes in physical aspects of the shoreline. At low tide water movement is very slow, therefore low tide period is considered to be a good time to conduct dredging and reclamation work.

7.3.2 Currents

Currents which affect the sea area around the Maldives are caused by one or more of the following systems:

a) Oceanic currents
b) Tidal currents
c) Wind-induced currents
d) Wave-induced currents

The oceanic currents flowing across the Maldives are notorious for their strength. The exposure of the Maldives to the vast Indian Ocean ensures that an immense body of water is constantly flowing across the plateau on which the atolls are built. In the Arabian Sea, as one gets closer to the equator, the prevailing winds become more and more indicative of the oceanic surface current. Thus, wind (especially during monsoons) can be a major factor affecting current velocity and direction, and currents can be of great strength (wind-induced currents). For example: currents in the channels near Malé have been recorded at 4 knots or more. Inside an atoll, current speeds are more settled. Oceanographic currents are driven by two monsoonal winds, namely the westerly and easterly wind. The westerly flowing current tend to dominate from January to March while the easterly currents dominate from May to November. The changes in current flow patterns occur in April and December. The current velocities are about 0.5 m/s, only in May values may increase to 0.8 m/s.

The vertical water movements associated with the rise and fall of the tide are accompanied by horizontal water motion termed tidal currents. These tidal currents have the same periodicities as the vertical oscillations, but tend to follow an elliptical path and do not normally involve simple to- and-from motion. Generally the tidal currents are eastward in flood and westward in ebb. Tidal currents, which flow according to the height of the tide, are generally not strong. There is a strong diurnal influence, which governs the tides in the Maldives, but in general the tidal range is less than 1m.

On a more local scale, especially on the reef flats, wave-induced currents (cross-shore and/or long-shore) also form an important factor affecting the current regime.

7.3.3 Waves

The swell and wind waves experienced on the Maldives are governed mainly by the two monsoon periods. Swell caused by cyclonic storms in the area west of Australia may also reach the southern atolls of the Maldives on occasion.

The swells and wind waves experienced by the Maldives are conditioned by the prevailing biannual monsoon wind directions, and are typically strongest during April – July in the south-west monsoon period. During this season, swells generated north of the equator with heights of 2-3m with periods of 18-20 seconds have been reported in the region.

The Maldives also experiences swells originating from cyclones and storm events occurring well south of the equator. It is reported that the swell waves from southeast to south-south-east occur due to strong storms in the southern hemisphere in the area west of Australia with direction towards the Maldives.

Local wave periods are generally in the range 2-4 seconds and are easily distinguished from the swell waves. Due to the shallow depths on the reef flat, significant wave breaking (energy dissipation) will take place at the reef's edge, reducing the wave height of waves, which pass over the reef flat. A general swell forecast and swell periods are available from various weather related websites. These forecasts are very general and it does not reflect local variations in wave period and wave height (***Figure 18***).

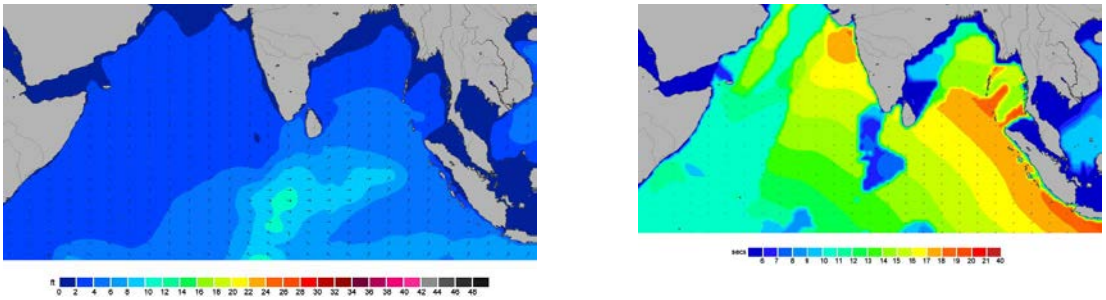


Figure 18: Generalised wave height (left) and wave period (right) prediction for the Indian Ocean on 23rd November 2014 (http://magicseaweed.com/, accessed 4th December 2014)

As per the wind record observations Rasgatheemu Island is subjected to average wind speed of 4-10 knots. Wind speed of 4-6 knots can generate small wavelets with glassy appearing crest without breaking. Wind speed of 7-10 knots can generate large white-capped fetch waves. Irufushi Island shows that wind speed around Rasgatheemu and Irufushi area could reach 20-40 knots at gale, rain and thunderstorms periods. This means that Rasgatheemu region has potential to generate medium-high waves with long wave lengths. The proposed site for development of island access and jetty is exposed to wind generated waves during NE monsoon and during transition periods. It is also expected to experience residual swell waves throughout the year. The western side experiences wind-induced regenerated waves originating from atoll lagoon during SW monsoon and residual waves approaching the reef from the western side.

Site specific wave measurement was conducted for 24 hours (2-3 June 2017) in the near-shore area on the north eastern side, by installing a RBR Solo wave gauge in the area proposed for island access and jetty construction. A total of 512 samples with a burst rate of 2Hz at 0.05 minutes interval were taken. General specification and wave statistics on the north eastern side of Rasgatheemu is shown in ***Table 5***. Wave height (***Figure 20***), average, maximum and significant wave height shown in ***Figure 19***. Measured periods of average wave period is 6.6s, maximum wave period is 11.0s, significant wave

period is 10.3s and the 1/10 wave period is 11.1s. The design of coastal structures should consider the wave conditions at the site.

Table 5: Measured near-shore wave statistics, eastern side R Rasgatheemu refer to Figure x for location of wave gauge

Channel	Value	Average	Std	unit
Pressure	11.23586	11.29234	0.140182	dbar
Sea pressure	1.10336	1.159835	0.140182	dbar
Depth	1.09658	1.152708	0.139321	m
Tidal slope	-0.2021	-0.00737	0.066724	m/hour
Significant wave height	0.229672	0.325644	0.065142	m
Maximum wave height	0.298698	0.464056	0.109066	m
Average wave height	0.139095	0.197723	0.040715	m
1/10 wave height	0.278095	0.416271	0.092887	m
Wave energy	42.30635	74.02711	25.64192	J/m²

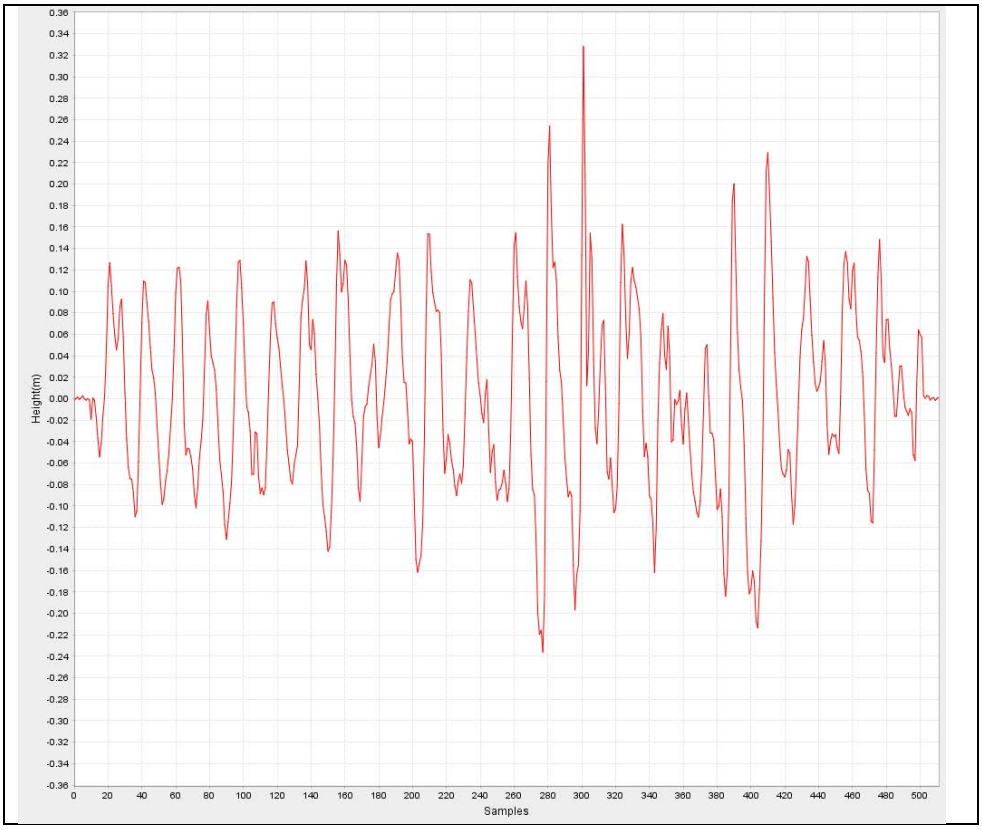


Figure 19: Near-shore wave heights eastern side of Rasgatheemu

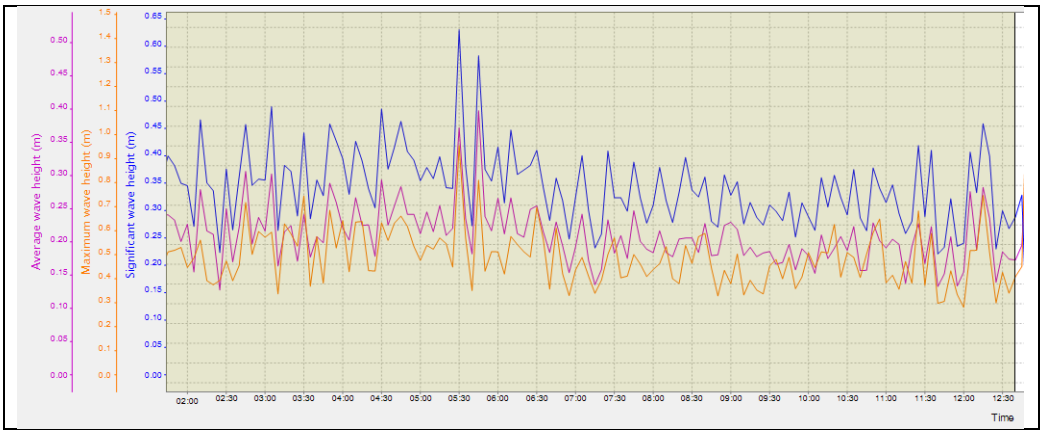


Figure 20: Average, maximum and significant wave height at Rasgetheemu NE side.

7.4 ISLAND MORPHOLOGY AND COASTAL ENVIRONMENT

Historic Digital Globe, Google Earth images (2002-2016) and island surveys are comparatively evaluated using GIS technology to assess the beach dynamics of the island. Co-georeferencing technique of historical digital globe images taken in various months of the year was used to map the beach end of the island and overlaid to quantify long term changes in island area. Both seasonal and monthly changes in beach erosion, accretion and sediment dynamics were quantified using this technique.

Figure 20 shows beach end change and dynamics over time in the island and a magnified view of the designated beach area for the proposed development. A comprehensive sequence of digital globe images are available from 2002-2016. The result shows that the overall area of the island in 2002 and 2016 remained very close (37.2ha in 2002 and 38. 5 ha in 2016) despite the fact that 1.78 hectares of land was added to the island through reclamation during the harbour development in 2005. Sequence of images of also shows that a near-shore area at the end of Kanneli Magu was dredged in 2010 in order to provide access for the island but soon that area was filled up with sediment and could not be used as an access for the island. This indicates that the area proposed for the development of jetty and access path in Rasgatheemu is a highly dynamic major seasonal accretion area. This area is slightly south of the northern tip of the island where fairly wide sand spit develops seasonally. According to the islander as consequence of the and as a consequence of dredging near-shore area the adjacent beach on the northern part has undergone severe erosion (***Figure 22*** and ***Figure 23***).

Comparison of beach dynamic and the prevailing wind condition in R. Rasgatheemu it could be presumed with great degree of certainty that at the end of NE monsoon beach gets wider on the western end with slightly elongated sand bank on the western tip of the island. Starting from February at the onset of transition period and SW monsoon, beach formed on the western end of the island becomes narrower with net shift in sediment eastward of the island. Beach width is more evenly distributed around the island during SW monsoon period.

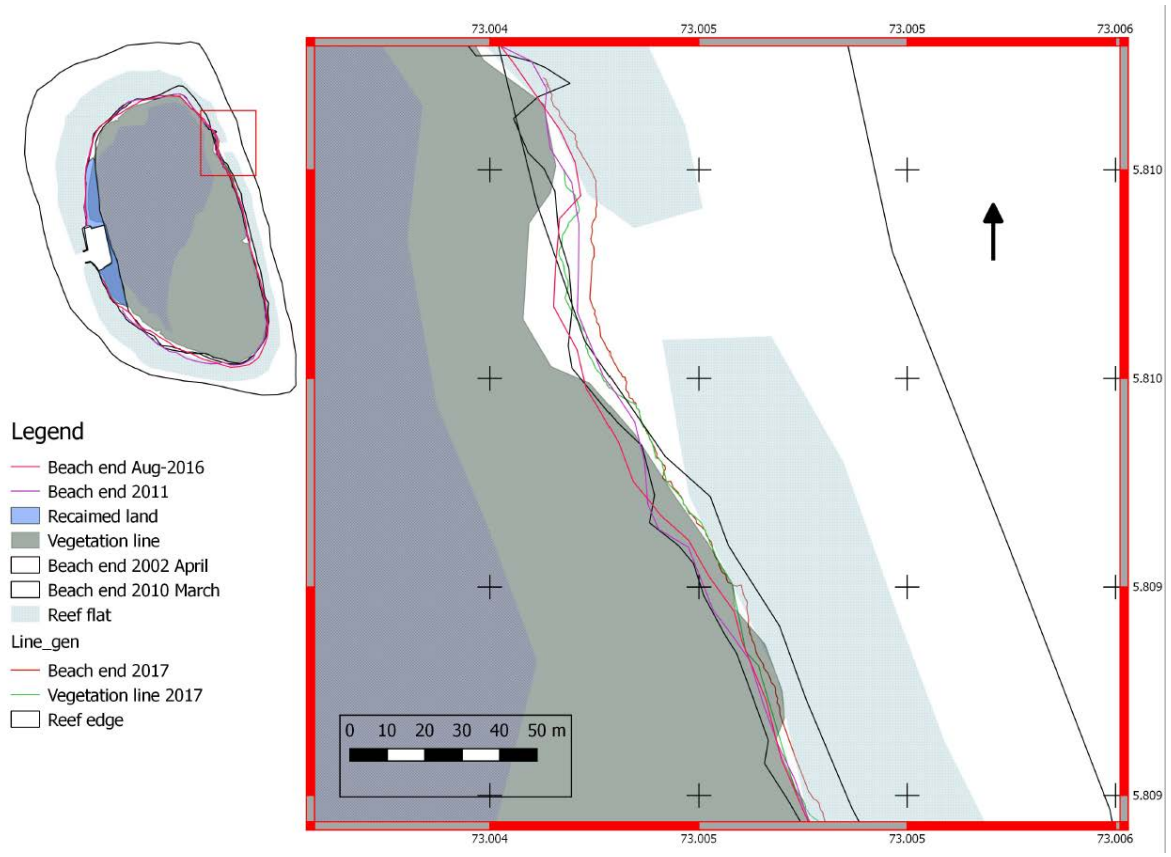


Figure 21: R. Rasgatheemu beach dynamics (2002-2017) showing beach change, magnified view of the proposed project site.

Figure 22: Beach condition around the island

Figure 23: The eastern coast of Rasgatheemu is exposed to energy as a result beach deposits comprise of large to medium sized coral rock an cobble-size coral fragments.

From the observed sediment movement pattern, island geomorphology, and beach dynamics it is very likely that if a channel is dredged on the proposed area will get filled with sand and become shallower in both SW and NE monsoon periods during the sediment transportation process. As seen from the observations sediment starvation and coastal erosion is likely to take place on the eastern side as the sediment that goes into the dredged area does not return back seasonally as has been the situation in the past. Therefore the natural process that has been taking place in Rasgetheemu beach will be disrupted with the change in near shore hydrodynamics of the island. Therefore in order to sustain a long term access to the island, it seems the best option in Rasgetheemu would be to extend the proposed jetty to the reef edge and to avoid cutting the reef-flat and dredging a channel through the reef-flat. This in turn will reduce the impacts associated with dredging cutting reef flat.

Composition of beach material on the eastern coast of R. Rasgatheemu is fairly uniform consists of coral rubble and boulders indication of high energy environment deposits. In some areas of the eastern coast medium o fine grained coral sand is deposited at the back coral boulders ***Figure 22***. Beach rock, which is considered to be an indicator of erosion, is exposed on the eastern side of the island. The eastern and northern side is exposed to strong surf wave action throughout the year.

The beach profile #1 shows relatively high elevated island ridge followed by a gently sloping beach and the lagoon approximately 15m wide beaches slope consist of coral sand in between the beach toe and the island ridge and coral rouble boulder at the toe. Beach profile #2 is taken from the location where the islanders have shown preference to locate the proposed jetty on the eastern end of the island. The profile shows a very high elevated ridge with steep sloping 5m wide steep sloping beach and erosional scarp (***Figure 24***. Beach material consists of coral pebble and boulders, no sand on this part of the shoreline, typical high energy deposits. Geographic coordinates of the beach profiles are given ***Table 6*** and the location is shown in ***Figure 13***.

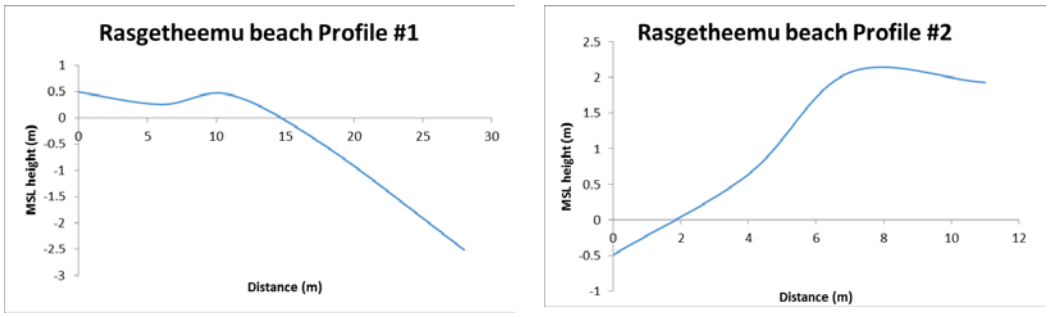


Figure 24: Beach profiles of R. Rasgatheemu Island eastern side

Table 6: Geographic coordinates and bearing direction of beach profiles.

Profile No	Latitude	Longitude
Profile #1	5° 48' 37.100"N	73°00'14.864"E
Profile #2	5° 48' 31.650"N	73°00'17.403"E

Bathymetry of the area proposed for island access channel and jetty construction work in Rasgatheemu was measured by using handheld echo sounder and a GPS. Differential GPS technique is used for correction of GPS locations points.

Echo sounder measurements are corrected and related to the mean sea-level for the area. Depth of the reef-flat, reef edge and the drop-off on the eastern side of Rasgatheemu is varied ranged within -10.5to -30m. The depth of the area proposed for access channel and jetty development in Rasgatheemu is within the range of -0.6 to -1.5m ***Figure 25***. The reef flat proposed for access channel and jetty development totally exposed at low tide and the lagoon area has a depth of -0.5to -0.9m at mid tide. There is a sharp drop-off between the reef edge and ocean where the water depth falls from 2-3m to 30- 50m within less than 5m distance from the reef edge. This can be considered as a vertical or near vertical drop-off.

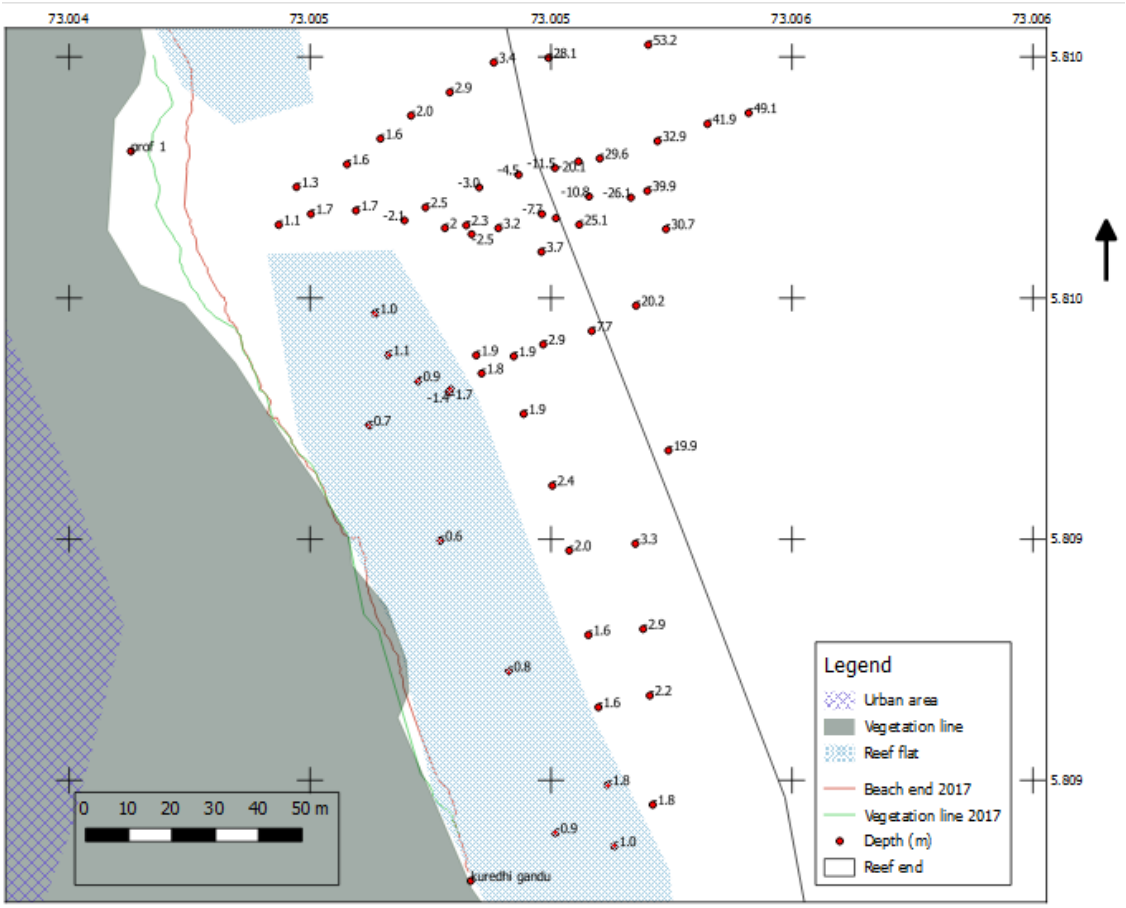


Figure 25: Bathymetry of the area proposed for access channel and jetty construction work in R. Rasgetheemu.

7.5 MARINE ENVIRONMENT

As stated in the introduction and the description of the Project the proposed development area is in a north eastern section of the island. Being the ocean-ward side, the reef edge is only about 70 meter from the mean shoreline. The section is being used as an access point to the island during times the vessel have difficulty in accessing channel on the western side. These periods, limited to three months, invariably coincide with the onset of south west monsoon seas when the wind direction creates dangerously rough conditions on the western side.

At the proposed project site a wide footpath (clearing) leads into the island. Wind drive surface waves from north and north easterly direction is visible from the series of the Google Earth Images (2001, 2002, 2010, 2011, 2014 and 2016) against background long wave southern swells. Although oceanward side of the island, the area does not experience large waves with strong surges due the area being sheltered during the SW monsoon.

The series of photographs shows, over time, clearance and development of a channel created for ease of entry. The clearance is visible in the section closer to the shore. In short a sandy bottom with sparse coral heads is present in the section close to the shore whereas in the deeper waters up to the reef edge boulder / rock and rubble dominant substrate is present. These attributes are described in slightly more detail in section below.

7.6 METHODS AND APPROACHES

Standards approaches were used to obtain qualitative and quantitative information on the existing marine environment. Timed swims were conducted along the channel area starting from the shallow to the reef edge. Fish in the visual field were noted. Since there is relatively poor visibility it is assumed that field width of the sampling belt would be 8 m wide. Swims were done for 10 mins. Two such swims were performed and the data were pooled to give an aggregated count to provide general feel of the faunal composition of the area.

A separate set of swims were done in the area to obtain series of photographs. Swims were done in an attempt obtain representative set of the images of the area. Images were captured at third stroke of the swim maintaining the camera in a horizontal plan as much as possible. Using the images, a coarse relative cover of 5 categories (live coral, dead coral, soft coral, sand, rock/rubble) were estimated.

7.6.1 Substrate Cover

Photo image analysis of the substrate cover data is given in ***Figure 25***. Summaries are given sepertely for the northern and southern section (either side of the opening). The reported values are averages of 10 randomly selected images from transects. Live coral cover is around 10% and consist of mainly boulder (Porites) and few Acropora (short-finger) colonies. Dead coral cover was around 25-30% and sand occurred around 15-20% of the cover. The most dominant cover is rock/rubble which are essentially compacted over time breaking into loose fragments due to wave and current action. The category also includes coralline algae (in this case Halimeda like algae) which was dominated in at least 2 of the images selected in the southern section.

The northern section has slightly more live coral boulders. Some of the boulder rock have fresh scars of the parrot fish which is common in these types of environments. There were indication that site was

(or have been) used for anchoring some remnants of the ropes and metal were found on the substrate ***Figure 27***.

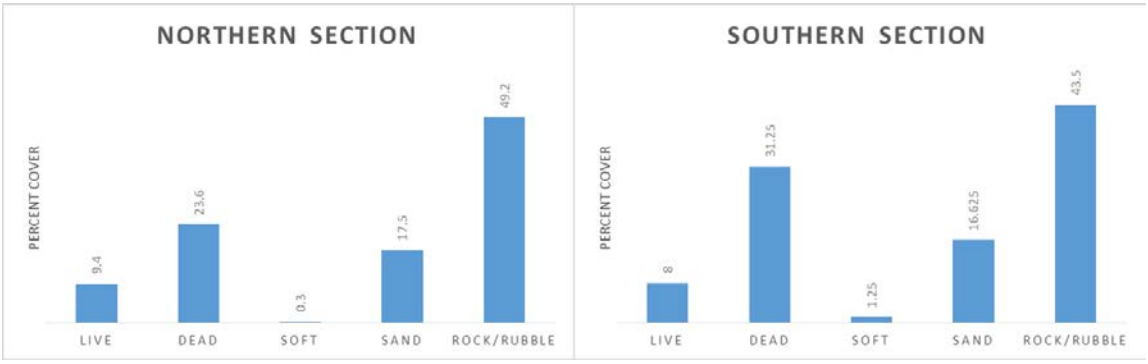


Figure 26: Average coral substrate cover estimated from 10 images on northern and southern section of the existing opening

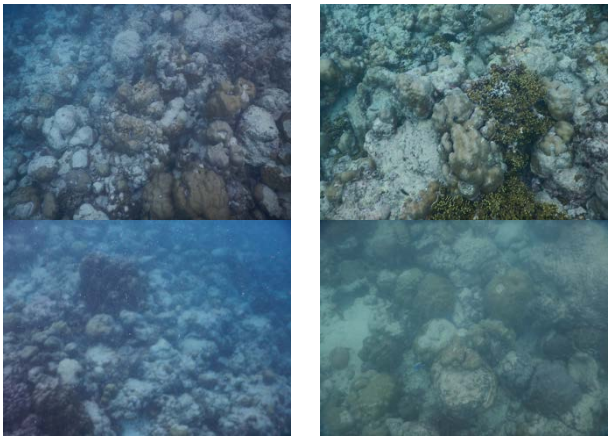


Figure 27: Representative images from the northern and southern sections of the proposed development site

7.6.2 Faunal Composition

Not so much fish were visible during the swim. The water was murky with sediment suspension there was less-than sufficient visibility. Most of fish censored belonged to Acanthurids – herbivores (algal feeders) which is common on current swept high energy sites. The most of common of these is powder blue surgeon fish (*Acanthurus leucosternon*) and bristle tooth tang - *Ctenochaetus truncates*. Although there was heavy presence scraping marks on the Porites very few scarid (parrot fish) were observed during the census ***Table 7***.

It should be noted that visual census of fish surveys are notoriously variable can be quite subjective depending on the person and time of the day. Small cryptic species are often difficult to see and would be very much under-represented. The qualitative results presented here would therefore biased toward against smaller varieties. Nevertheless for the purposes of describing the marine environment it may be considered sufficient.

Table 7: Aggregated summary of the visual census of the fish on the three 10-minute swims covering the northern and southern section of the survey area.

Family	Species	Abundance
Acanthuridae	*Acanthurus leucosternon*	VC
Acanthuridae	*Acanthurus lineatus*	C
Acanthuridae	*Acanthurus lineatus*	C
Acanthuridae	*Ctenochaetus truncatus*	VC
Acanthuridae	*Ctenotchaetus binotatus*	C
Balistidae	*Balistapus undulatus*	R
Chaetodontidae	*Chaetodon lunula*	R
Chaetodontidae	*Hemitauricthythis zoster*	C
Haemulidae	*Plectorhinchus vittatus*	R
Labridae	*Bodianus axillaris*	R
Labridae	*Chelinus fasciatus*	R
Labridae	*Thalassoma hardwicke*	C
Lethrinidae	*Monotaxis grandoculis*	C
Pomacentridae	*Chromis opercularis*	C
Pomacentridae	*Dascyllus aruanus*	C
Pomacentridae	*Pomacentrus chrysurus*	R
Pomacentridae	*Stegastis nigricans*	R
Scaridae	*Scarus prasionnathus*	R
Scaridae	*Scarus psittacus*	R
Scaridae	*Scarus niger*	C
Serranidae	*Cephalapholis argus*	R
Zanclidae	*Zanclus cornutus*	C

7.6.3 Wave and Surface Flow

Unlike in large reef flats it is unlikely to have large wave set ups in the area; the space between the reef-edge and the shallow beach is quite narrow (70 m) and there is not obvious reef-ridge on the crest. Wave crash quite close (when the depth becomes of 1/3 of the wave height) to the beach. The dominant surface flow appears to be from northeasterly and owning to site on the western section of the double atoll chain eastern side is protected from wind induced swells during the north east monsoon season.

A surface flow about 0.1-0.3 m/sec was observed; measured from the distance travelled by low floating object in the water.

7.7 MARINE WATER QUALITY

Water quality was assessed at the Male Water and Sewerage Company's Water Quality Assurance Laboratory using standard methodologies. Marine water samples are collected and water quality has been assessed to establish the baseline condition for Rasgatheemu Island during field visit. The results would be useful for future monitoring and comparison Table 8.

Table 8: Seawater quality test results

Location	73.004747°, 5.810461°
pH	8.21
Temperature	20.9
Salinity (mg/l)	34.43
Total Dissolved Solids	26200
Turbidity (NTU)	0.763

8 SOCIO-ECONOMIC ENVIRONMENT

8.1 INTRODUCTION

Located in the north central parts of Maldives, Raa atoll lies 5° 58' N and 5° 20' N and runs 35 in length from N to S, and 15 miles across at its broadest part. The total area of Raa Atoll is estimated to be 5km2. It consists of around 88 islands out of which 15 are inhabited. There are four tourist resort in operation, which are Meedhupparu, Loamaa, Furaaveri and Kudafushi. The capital of the atoll is Ungoofaaru. The largest islands in Raa Atoll are Fainu, Dhuvaafaru and Alifushi having 50ha, 49ha and 46ha respectively.

8.2 POPULATION AND HOUSING

The total population of Raa Atoll based on Population and Housing Census undertaken in 2005 was 14,756 people divided into 15 inhabited islands. The largest population in the atoll is found in Dhuvaafaru having 2,717 and the smallest population is found in Fainu having only 249 persons and the population growth rate was 0.3% (DNP, 2011). Based on this growth rate, it is believed that the total population of the atoll will be in the range of 15,000.

The total number of households found in the atoll is 2,538, hence, the average household size is 6 persons. Majority of the households (47%) have a land plot area greater than 1,000ft2 having 3 or more rooms (Greentech, Riyan and CDE, 2010).

The total registered population of Rasgetheemu is 507 according the census 2014. Only 300-350 people actually live in the island. The rest of the registered population of Rasgatheemu is living out either for employement or migrated to other islands.

8.3 HEALTH AND EDUCATION

There is a regional hospital located in Ungoofaaru, the atoll capital. All other islands are served with either a health center or a health post. Health centers are available in almost all islands except for Angolhitheemu, Fainu and Kinolhas, where health related services in these islands are provided by a health post. In general there is 1 regional hospital, 10 health centers and 3 health posts in Raa Atoll (Isles website). Overall access to health is available for approximately 93.4% of the population, however, 71% reported that the access to health services in the atoll is difficult (Greentech, Riyan and CDE, 2010).

There are over 20 schools in Raa Atoll and most of the schools are up to GCE O' Level. Currently only 2 schools in the atoll located in Hulhudhufaaru and Meedhoo are up to GCE A' Level (Isles website). The majority of the school goers are studying in the secondary level having 32.2% from Grades 6 – 12 followed by primary school goers are studying in the primary level having 29.2% from Grades 1 – 5 (Greentech, Riyan and CDE, 2010).

8.4 WATER, SANITATION AND ENERGY

One hundred per cent of the population of Raa Atoll have access to safe drinking water of which the majority of water that is used daily come rainwater having 97.2%. Rainwater is mostly collected from the house and public building roofs and stored locally. About 2.5% of the population use well water as a drinking water source, while only 0.1% of the population use bottledwater or mineral water as a drinking water source.

Although 98% of the population in Raa Atoll have access to sanitation services, the majority of the population use septic tanks having 96%. About 2% use pit toilets and 2% do not have access to sanitation.

The majority of the households use LPG as the main source of energy for cooking having 87%, while 13% use fuel wood as their main source of energy for cooking (Greentech, Riyan and CDE, 2010).

8.5 ELECTRICITY

In 1997, about two thirds of the islands electricity is available for only 6 hours a day, however, now all islands have access to 24 hours electricity. Yet, there is still difficulty for people of Angolhitheemu for access to 24 hours electricity (Greentech, Riyan and CDE, 2010).

8.6 WASTE MANAGEMENT

Due to the rapid population and changing life styles in the islands, waste generation is getting increased annually. Due to the absence of proper collection and disposal facilities segregation of waste is very low. There is very little waste segregation undertaken even at household level in Raa Atoll. Most of the waste generated in the atoll are managed by open burning having 96.4%, while 3.6% dispose waste to landfill sites. Only 6 islands in Raa Atoll have Island Waste Management Centers (IWMCs) for waste collection purposes (Greentech, Riyan and CDE, 2010).

8.7 PUBLIC INFRASTRUCTURE

Currently only 8 islands in Raa Atoll have proper harbours, while 5 islands only have jetties for accessing the islands. Two islands do not have either harbour or jetties and accessing the island have been reported very difficult (Greentech, Riyan and CDE, 2010). About 97% of the population have access to mobile phones.

8.8 LOCAL ECONOMY

The main economic activities in the islands of Raa Atoll are fishing and almost all islands are involved in fishing activities. Alifushi, Innamaadhoo and Inguradhoo are quite famous for boat building, which is also a major economic activity in the atoll. Agriculture is also practised in many islands, however, mostly done at a household level. Activities of trading is also an integral part of the local economy where goods brought from Male' are traded in the islands.

In summary the main components of the local economy can be summarized as follows; there are 286 shops in the atoll for trading general goods, about 30 cafes and restaurants, about 538 vehicles including motorcycles, cars, pickups and lorries, about 86 sailing fishing boats, about 178 motorized fishing boats, 2 safari yachts, 11 ferries, 18 cargo boats that carries goods to and from the atoll and about 34 speedboats. All these components greatly contribute to the local economy of Raa Atoll (Greentech, Riyan and CDE, 2010).

Tourism is an emerging economic activity in Raa Atoll. Currently there are four tourist resort in operation which currently have about 680 bed capacity in the Atoll. However, there are currently on-going tourist resort development projects in the Atoll including resort development in Maamigili and Vakkaru island. A number of islands have already been allocated for toursit resort development in the atoll Lundhufushi, Aarah, Dhigali, Maamunagau, Ufulandhoo, Muravandhoo, Faarufushi, Kottafaru are some of the islands. Once currently ongoing resort development projects are completed, the atoll will have over 1,500 bed capacity and tourism will make an integral economic activity in the atoll.

Although there is generally a good economic outlook for Raa Atoll, unemployment is generally very high having 46% for the ages between 15 years and above of the labour force. Most of the employed labour force is engaged in salaried jobs covering 25% while self-employed percentages reach 18% and fisheries related employments are over 10% (Greentech, Riyan and CDE, 2010). Over 29% of the households in the atoll receive an income between 100,000 –m 200,000 annually.

8.9 SOCIO-ECONOMIC BENEFITS

Island access related developments such as harbours, access channel and jetties, in an inhabited island, are considered to be the most important infrastructure everyone craves for and viewed as a necessity for the development of the island to open up to the rest of the country. The primary objective of the project is to improve access to the island, and provide safe mooring facilities especially during rough weather. Access to the island is envisaged to bring economic growth and will improve living conditions of people of Rasgatheemu Island. Therefore the proposed development project in R. Rasgetheemu is an important infrastructure development project that will open-up the island and improve travel and trade to and from the island in all weather conditions.

9 STAKEHOLDER CONSULTATION

The scoping meeting to determine the scope of the EIA report was held on 11th June 2017 at EPA. During the meeting the stakeholders were identified and the scope of the EIA report was determined. Methods used for stakeholder consultation include direct communication and interviews with locals in R. Rasgetheemu, formal meeting such as the scoping meeting, island council and the people of R. Rasgetheemu.

9.1 KEY STAKEHOLDERS

As per the TOR the key stakeholders identified are

1- Rasgatheemu islands council
2- People of Rasgatheemu and boat owners island
3- Ministry of Housing and Infrastructure
4- Environmental Protection Agency

9.2 EIA SCOPING MEETING

EIA scoping meeting was held on the 11th June 2017. Most of the stakeholders were present in the meeting (meeting attendance is in Annex 7). The meeting was chaired by Ms. Fathimath Reema, Director EPA. The consultant gave a briefing on the proposed development of access channel and a jetty on the north eastern end of R. Rasgatheemu and explained the difficulty the people of island is going through during the rough monsoon season particularly May June and July.

The consultant visited the island prior to the scoping meeting on 1st of June and shared his firsthand experience he had while trying to access the island through the existing channel on the western side of the island. He also stressed about the importance of visiting the islands during the difficult time particularly during rough weather conditions to see and experience the difficulties people area facing in islands. He said that usually government authorities and agencies visit islands at nice and calm weather period, so they have difficulties to assess and comprehend the real situation in the islands, no matter how hard people explain to them. He also pointed out some of the issues in the drawings submitted by the MHI and also shared the views of the island council and people with regard to relocation of the jetty. He pointed out the consultation with the people of the island has indicated that the proposed location is not very suitable and particularly rough during the NE monsoon. Therefore; they have suggested relocating jetty 150m south of the present location. He also shared a briefing about the discussion and consultation had with the people of the island.

The newly elected President of R. Rasgatheem Council present at the meeting reiterated the view the of the consultant and mentioned that the location of the proposed jetty was decided without consultation with the people of island. He also mentioned that during the discussion with MHI official visited the island a month back, they have indicated that they want the jetty to be located between the Kanneli Magu and Seedhaakuri Magu and they have clearly mentioned their preference to be midway between those two roads.

MHI noted the concerns of the island council and mentioned that they have no objection to shifting the location of the jetty and bring changes to the proposed plan as long as the changes does not increase the project budget, or within the limitation of the budget. They also requested further discussions with the council straight after the scoping meeting.

In the light of the discussions held in the scoping meeting, EPA requested to provide options for alternative location for the access and jetty and recommend the preferred locations in the EIA report.

9.3 CONSULTATION WITH MHI

Formal consultation with MHI, the proponent of the project, was held on the 11th June prior to the EIA scoping meeting to give a briefing about the main findings from the field visit to R. Rasgatheemu and the consultations held with the people and island council. The consultant conveyed concerns of the people and council and their need to relocate the jetty 150m further south as the proposed location is exposed to ocean swells particularly during the NE monsoon. Also the consultant conveyed other adjustment to the jetty that has been requested by the people, such as the length, width and extent etc. As a matter of principle MHI expressed their willingness to accommodate people's need and had no objection to fulfill the people's request as long as the adjustment proposed is within the budgetary limitations. They also expressed that they will discuss the matter further with council to ensure that people's needs fulfilled.

9.4 CONSULTATION WITH RASGETHEEMU COUNCIL AND THE PUBLIC

Stakeholder consultation with Rasgetheemu Island Council was held on the 2nd of June 2017 night 10:00 pm at the Council Office during the field visit (***Figure 28***). The meeting was held after the field visit and survey of the proposed location for island access and jetty construction in R. Rasgetheemu and also exploration of the potential alternative locations. Representatives of the general public, a selected group of youth, senior citizens, former boat owners, present council members, women's committee etc., are invited for the meeting (***Figure 28***). A list of attendees to the meeting is given in Annex 7. Council president gave a brief introduction about the meeting. He said that he was utterly surprised to see the location of the Jetty and the people of the island never had in the past request the government to put the jetty in the proposed location. He also said that the planned location of the jetty is not suitable in many ways and particularly the area is exposed to oceanic swell. Then the consultant gave a briefing about the project and the proposed dimensions of the channel, small mooring area and the jetty. He also briefed about the EIA process and the role of stakeholder consultation in environment related decision making. The consultant explained the process and shared some of the observations from the field assessment. Then the floor was open for discussions. Main points of discussions are given below:

1- The location of jetty is decided without discussions with the people of the island
2- The dimensions of channel and small mooring area given in the drawing does not fit to the location, it seems that the planning and concept has been made without proper field investigation as the drawings does not fit into the location.
3- The people of R.Rasgetheem always wanted to have the alternative access in a location, midway between Kanneli Magu and Seedhaakuri Magu. That would be the Kuredhi tree located approximately 150m south of the proposed location. This has been conveyed to MHI officials, state minister and others, visited the island a month back.
4- The length of the proposed jetty is too short
5- Potential option would be to relocate the jetty 150m south of the proposed plan. Extend the jetty to reef edge, up to the reef drop off or to have a short jetty and dredge an access channel.
6- The reef flat on the eastern side has fairly hard rock on its reef flat might have difficulty to excavate and crush and might require reef blasting to crush the strong rock formation.

Figure 28: Stakeholder consultation R. Rasgetheemu Council members and representation of general public

9.5 MAIN CONCLUSIONS FROM THE STAKEHOLDER DISCUSSIONS

Following are the conclusions of the consultations

1. Everyone agrees that there is a need to have an alternative access to the island that can be used to access the island during the rough weather condition particularly May, June and July period.

2. Concerns were raised due to selection of jetty location without consultation with the people of the island

3. Most of the concerns were on Jetty location length and width and the suggested changes are presented as alternative options for access and jetty construction in Rasgetheemu island.

4. MHI has no objection for the proposed changes to project and expressed willingness to accommodate people's need and fulfill the people's request as long as the adjustment proposed is within the budgetary limitations.

Table 9: list of stakeholder consultation

Name	Designation	Contact No
Ahmed Hassan	Nafaa, R. Rasgatheemu	7523867
Ahmed Fuad	Kenereege, R. Rasgatheemu	7828858
Mohamed Maniku	Tiulip, R. Rasgatheemu	7786879
Mohamed Naseeru	AAvilu, R. Rasgatheemu	7741520
Ibrahim Nasir	Saaniyaa, R. Rasgatheemu	
Abdula Ghanee Ibrahim	Orchid Villa, R. Rasgatheemu	
Abdulla Saleem	Feyrumaage, R. Rasgatheemu	
Abdulla Ali	Mala, R. Rasgatheemu	7903115
Ibrahim Mousa	Kashimaage, R. Rasgatheemu	9754075

Ibrahim Ahmed	Manfa, R. Rasgatheemu	
Abdul Latheef Mousa	Kudehige, R. Rasgatheemu	794994
Mohamed Ali	Kudhiruhmaage, R. Rasgatheemu	9999643
Ibrahim Ali	Kudhiruhmaage, R. Rasgatheemu	7477003
Ali NIyaazu	Huvadhumaage, R. Rasgatheemu	7442254
Ahmed Muaz	Nishaan, R. Rasgatheemu	7955530
Dr. Mahmood Riyaz	Consultant	7890307
Ms. Nafha Aujaz	Environment Analyst (MHI)	7721554
Aroosha Hashim	Assit. Project Office (MHI)	
Mariyam Shidha	Snr Research Officer (EPA)	
Aiminath Mohamed	Asst. Project Officer (EPA)	
Moosa Naseem	FFehendhoo Council (president)	
Ali Azhar	Asst. Director (Fulhadhoo Council)	
Ahmed Asif	Fulhadhoo Council (member)	7787992
Hussain Rashad	Rasgetheem Council (President)	
Fathimath Reema	Director (EPA)	
Hashim Nabeel	Project officer (EPA)	

10 POTENTIAL IMPACTS AND MITIGATION MEASURES

This section of the report identifies the potential environmental impacts and possible issues that could arise from implementation of the dredging works using an excavator. Their identification of potential impacts does not mean that they would necessarily occur or that they could not be successfully mitigated. The proposed other works include island access path, small mooring basin and, construction of a jetty on the eastern side of the island.

Possible impacts arising from the construction and operation works are categorized into reversible and irreversible impacts. Reversible and irreversible impacts are further categorized by intensity of impacts (negligible, minor, moderate and major) for identifying best possible remedial (mitigation measures) action to be taken. Below are the impact categories

- **Negligible:** the impact is too small to be of any significance (Reversible)
- **Minor:** the impact is undesirable but accepted (Reversible)
- **Moderate:** the impact give rise to some concern but is likely to be tolerable in short-term, or will require value judgment as to its acceptability (May or may not be Reversible)
- **Major:** the impact is large scale giving rise to great concern; it should be considered unacceptable and requires significant change or halting of the project (Irreversible)

Severity of impact is assessed by reviewing the engineering design, detailed site plan as well as comparison of development with the existing environment and construction methodologies employed. Mitigation measures are derived based on the site specific assessment as well as similar project elsewhere in the Maldives. Impact identification matrix is provided in ***Table 10***. Potential impacts and their mitigation measures and detail discussion is the following sections. Table 11 gives a summary of impacts their reversibility significance and cost.

10.1 IMPACT IDENTIFICATION

The following section describes in detail and discusses the main potential environmental impacts that have been identified and predicted for the proposed island access and jetty construction project in R. Rasgetheemu. Identified potential impacts are divided into construction phase and operation phase environmental impacts.

10.2 LIMITATION/UNCERTAINTY OF IMPACT PREDICTION

The methods used to predict and evaluate the environmental impacts that may be associated with the cutting the access channel, dredging and jetty construction work on R. Rasgetheemu Island may not be the most comprehensive. The main shortcoming of these methods is that impacts are predicted by reviewing the survey data collected during the field visits and information revealed by the designers and engineers, therefore the assumptions have been made to predict the impacts which may or may not be accurate. Also, the data collected during the field visit is limited, which subsequently limits the overall understanding of even the short term environmental conditions (wave condition, currents, and littoral movement). Nonetheless, within the time limitation of EIA field data collection and report preparation the methods used are concise and provide a general overview as well as the range of impacts that can affect the environment.

Table 10: Impact Identification matrix

		Construction phase Activities						Operational phase Activities
Impact	Site setup and mobilization	Work force	Dredging / excavation	Jetty construction	Jetty base leveling	Equipment and vehicle maintenance	Demobilization	Operation of access Channels and jetty
Noise	-	-	-	-	-	X	-	-
Dusting -Air Quality	-	X	-	-	-	-	-	-
Coastal process	X	X	-	-	-	X	-	X
Terrestrial flora	X	X	X	X	X	X	X	X
Ground water	X	X	X	X	X	-	X	X
Soil	X	X	X	X	X	-	X	X
Marine water	-	X	-	-	-	-	-	-
Hydro dynamics	-	X	-	-	-	X	X	-
Marine habitat and Fauna	-	X	-	-	-	X	-	-
Natural hazard risk and safety	X	X	X	+	X	X	X	+
Employment	+	+	+	+	+	+	-	+

(-) Negetive impact (+) Positive impact (X) no impact

10.3 IMPACTS AND MITIGATION MEASURES

Construction phase can be considered as the period in any developmental project that causes major direct and indirect long and short-term impacts on the environment. Anticipated potential direct and indirect environmental impacts from the proposed entrance channel and harbour dredging project in R. Rasgatheemu is includes the following

- Direct impacts from mobilization of equipment and labour
- Access channel dredging, and subsequent sedimentation
- Short term changes hydrodynamic regime and potential long term changes
- Impacts to marine habitat and coastal environment
- Direct impacts from noise, vibrations and air pollution
- Greenhouse Gas Emissions from the equipment
- Potential discharges of oil and broken parts during equipment & vehicle maintenance

The following paragraphs will provide detailed impacts and mitigation measures during the construction phase of the project.

10.3.1 Impacts from Mobilization of Equipment and Labour

Mobilization of dredging set excavator and other heavy equipment and machinery needed for the project in R. Rasgatheemu will have minor impact on the marine and coastal environment. The major impact of the mobilization would be aesthetic unattractiveness of the vehicles and equipment camp site. Disposal of minor amounts of hazardous waste and sewage may be a concern but use of the existing systems in the island, e.g., sewerage system, water and waste disposal mechanism will make the impact negligible

10.3.2 Dredging, beach nourishment and subsequent sedimentation

Cutting and dredging of entrance channel and the small mooring area 40x30m on the eastern side of R. Rasgatheemu Island and jetty levelling work on the eastern side of the island will have a direct irreversible negative impact to the ecological habitat in the area. Direct impact of this activity is limited to R. Rasgatheemu reef only.

Given below are relevant impacts that should be considered:

1. Physical damage on live coral and loss of live coral: The effect of this would be in the immediate to medium term with the loss of substrate and its fauna.
2. Disturbance to the area during dredging activity: Release of sediments and potential loss of the faunal composition underneath sediment material will undoubtedly occur.
3. Dredging and jetty construction will change in the flow patterns. Tidal flows can be quite significant on the shallow reef flats and deeper areas will dampen the flow. The unexpected outcome may be erosion or accretion of the island or coastal areas.

In order to minimize the impact from sediment, dredging should be completed in shortest time possible. Dredging ought to take place during low tides or slack tides to minimize the release of sediment to the area.

10.4 IMPACTS TO CORAL REEF

Cutting an access channel through the reef flat and dredging a mooring area will result in the short-term irreversible loss of the existing coral communities on the affected area. It should be borne in mind that around 10% of the corals on the reef-flat are presently comprised of live corals (cf. Section 7.5). The potentially negative impacts on the associated fish species are thought to be less severe given that that there are adequate reef ecosystems on the island house reef to which they may retreat. Over time, recruits of the same coral species are likely to recolonize the fresh rock face of the now deepened plateau and a similar ecosystem would become established. Thus, the immediate negative impact of the proposed activities would be reversed over the long-term period.

Without turbidity barriers the currents and the wave action mostly generated by wind particularly during the North East monsoon in and around are would promote rapid sediment transport of turbid waters away from the immediate area and into the ocean. This will tend to reduce the time period over which undisturbed coral species would have to endure deteriorated water clarity.

The construction of jetty columns on the reef flat will have an impact on corals. The construction would kill some of the coral that fall on the foot print of the structure however the installation of columns will create new hard substrate suitable for new coral growth.

Use of dredged material for jetty level and on the eroded coast will not result in having to lose any live corals as a direct result since the area consist only of dead corals and debris. Noticeable numbers of crabs have been observed to live the coral crevices. Since they are highly mobile creatures they will

move away from the disturbed area and retreat into elsewhere on the coast. However, sedentary organisms falling in the area of beach replenishment will be negatively impacted.

10.4.1 Hydrodynamic regime

The proposed development on the eastern part of the island can influence the shoaling characters and wave energy in and around the eastern coast of the island through refraction and redirection of the incident waves. Cutting channel through the reef flat and dredging a mooring area will increase the depth within the area and is likely to change the overall hydrodynamic regime within R. Rasgatheemu eastern coast due to increase in water depth. Further, the dredged areas are likely to act as sediment sinks and therefore lagoon conditions may take a number of years to stabilize against the prevailing conditions.

Proposed activities on the eastern coast of Rasgetheemu will in general increase wave heights and reduces currents in and near the dredged areas. The following identifies these changes more specifically to their areas;

Dredging of the entrance channel will have a limited impact on the wave conditions. The mooring area basin may slightly increase the amount that wave energy is expended on the eastern shore, resulting in a slight increase in the amount of wave energy reaching the beach. This increase may bring more filling material into the deep areas result frequent maintenance dredging of the channel and the mooring area basin. However, it is proposed to have in place a beach monitoring program against the baseline set up for this study should an unforeseen changes occur to the beach especially during unusual weather.

The proposed construction jetty on pad-and-column structures will not obstruct the long shore currents transporting sediment around the island.

10.5 IMPACTS TO COASTAL MORPHOLOGY AND AESTHETIC VALUE

The wave direction, wave height and current changes are expected to change the beach slightly under normal conditions but not significant. Rasgatheemu eastern beach is highly dynamic and will respond to changes in the hydrodynamic conditions. The changes that are expected to occur due to the dredging will likely remain within the area.

The turbidity associated with the excavation will probably be restricted largely to the bottom, and the immediate vicinity of the dredging area. A plume will still be visible around the dredging operation. It is possible that the visual impact will be moderately severe and localised. The overall perceived significance of this impact will vary from person to person, but on a precautionary basis is regarded as being moderate. Whilst there is a lack of residential island near the dredging site and people will be not be able to see the equipment and the dredging area and associated plume could be not become visible to the people.

10.6 DREDGED SAND DISPOSAL

The dredged material is proposed to be used for backfilling the jetty base and the excess will be used to replenish the eroded areas on the northern end of the island (***Figure 11***). With supply of sand to the eroded coast beach will be created. Trucks will carry dredged materials on the existing road network on the island. The material to the site will be supplied by trucks. One of the main concerns with regards to the dredged material disposal is the impacts on water quality, which include those associated with increased turbidity, decreased dissolved oxygen levels, and visual impacts. Dredged material disposal typically has a short term (several hours to days) impact on the water column

following discharges of solids and solutes during the transportation process and excavations. The greatest proportion of dredged material consists of negatively buoyant solids that sink as a turbid suspension through the water column to the sea floor. Dissolved constituents of dredged material are entrained in the turbulent water associated with the convective descent.

10.7 NOISE, VIBRATIONS AND AIR POLLUTION

During the mobilisation of equipment and operation of heavy machinery for dredging and beach nourishment work, it is anticipated that significant noise will be generated. Minor ground vibration is anticipated during movement of excavators and heavy vehicles. Furthermore, noise vibrations may alter species behaviour. In addition, dust and emissions from vehicle and machinery exhausts will degrade the air quality. However, these impacts will be short term and can be mitigated to avoid nuisance to the locals in the island. With proper mitigation measures, it is unlikely that noise, vibration and air pollution impacts will cause long term effects such as human health risks leading to increased public and private health costs.

10.7.1 Equipment & vehicle maintenance

All sorts of motorized equipment, requiring fuel, lubrication and maintenance will be used on the site. Many will be fitted with lead batteries. Therefore the potential accidental spillage and contamination of the soil and the sea by hydrocarbons as well as the careless disposal of batteries exists during the construction period.

10.8 POTENTIAL POSTIVE IMPACTS

Potential positive impact of the project would be on creation of employment during construction period particularly for locals. The project will have a noticeable impact economically to R. Rasgatheemu Island as it will resolve the difficulties faced by the islanders to access the island and safe mooring areas for vessels and reduce the transportation cost through smooth access and operations of boats and launches and minimize damage by accidental grounding to the boat caused by shallow water depth of the area. This in turn will contribute to overall economic growth of R. Rasgatheemu and islands in the region.

1. Better income to the region
2. Better employment opportunities in the region
3. Improved navigational safety and transport at local level
4. Improved regional economy as a result of the improved facility

10.9 NEGATIVE IMPACTS

1- Loss of coral head and benthic biota at its entrance channels and mooring area basin in the reef flat.
2- Short-term sedimentation and turbidity over coral along harbour due to suspension and dispersal of fine sediments.
3- Possible impacts on pelagic environment due to suspended sediments.
4- Impaired visual/seascape impacts from the presence of the dredging equipment.
5- Increased noise levels in the harbour due to dredging operations.

10.10 IMPACT MITIGATION MEASURES

Table 9 below lists the potential impacts identified above describes the corresponding mitigation measures that should be put in place during implementation of the proposed dredging works at R. Rasgatheemu. In summary the impact mitigation measures proposed should entail:

1) Good dredging practice to minimise sediment suspension and dispersal at the dredging sites.
2) Coinciding the dredging activity for the period August and September is important to avoid the rough weather condition of the NE Monsoon and to force the plume to move away from the house into the ocean.
3) Deployment of a turbidity barrier across the beaches and the work site as appropriate depending on location and currents.
4) Environmental monitoring of the project to ensure use of turbidity barriers, disposal of dredged material only at approved sites, and turbidity level do not exceed the recommended levels.
5) The contractor shall be mandated that appropriate turbidity barriers be deployed at all times during dredging, disposal and construction to ring each and all of the dredging, construction and water disposal activities. The type of barriers selected should take into consideration the shallowness of the area and the prevailing wave and current conditions. The extent of each area ringed should also be carefully determined in order to maximise the effectiveness of the barrier, especially during the proposed dredging activities.
6) Blasting shall be avoided.
7) Sand-bag bund shall be constructed associated with the use of the dredged material for the replenishment of eroded beach area on the east coast.
8) During the project activities and operational phases, all efforts should be made to prevent the intentional or accidental spill of oil, waste oil and hazardous materials release into the environment which could lead to further damage to the marine environment.
9) Contractor should take steps to ensure that there is no dumping of oily waste from vehicles or land-based activities related to the project. Careful consideration should be given to the requirements for storage and appropriate disposal of waste oil.

10.11 MITIGATION COST

The mitigation measures associated with significant costs, beyond those of dredge equipment rental and deployment, and good dredging practice, is identified below in Table 11 along with the major cost elements. Costs are based on the estimation of the magnitude activity

Table 11: Significant impacts, mitigation measures and associated costs

ACTIVITY	IMPACTS	IMPACT PREDICTION			MITIGATION MESURES	Mitigation cost (MVR)
		Magnitude	Revers ibility	Duration		
1. Cutting entrance channel Excavation of channel and mooring areas	Loss of benthic biota	L	R	M	Deploy turbidity barriers to prevent sedimentation on seagrass and coral colonies Dredging should be completed in shortest time possible. Dredging during low tides or slack tides	
	Modification of current and wave pattern	L	R	S		
	Sedimentation from dredging	M	R	S		10,000 cost of barrier

	Attenuation of light in water column	L	R	S	Apply above measures to control sediment dispersion	
	Increased ambient noise level	L	R	S	All construction work that produces significant noise should be undertaken during day time to minimize noise pollution. Provide ear muffs for construction workers to wear when using machinery that produce significant noise.	1,000 cost of earmuffs
2. Dredged material disposal	Increased ground water salinity	L	R	S	Leave the material in rain prior to disposal	
	Leakage of sediments during transport to disposal site	L	R	S	Containing the sediment in the truck to minimize leakage	2,000 cost of leak proof rubber sheet
3. Social impact: the people	Improvements in island accessibility	H	R	M	Major positive impact of the project	
	Employment	M	R	S	Short term employment	

Key

Magnitude	Reversibility	Duration
H=High	I=Reversible	L= Long Term (Over 10 years)
M=Medium	R=Reversible	M=Medium term (Over 5 years)
L=Low		S=Short term (Below 5 years)

11 ALTERNATIVES

11.1 NO DEVELOPMENT OPTION

Not implementing the proposed island access channel and small mooring area and the jetty implies that the local population of Rasgatheemu will have limited access the island during the periods, in particular, May June and July of the year. The locals will be locked in the island during the period and face considerable challenges as to basic need of accessing the island. There is no alternative to achieving socio-economic development without proper safe access to the island and developing an access channel mooring are and jetty to access the island during the rough weather periods of SW monsoon.

It is believed that a number of environmental impacts will have to be born as a results of the proposed development access channel, small mooring area and jetty in Rasgetheemu. Although no impacts on the environment will be associated if the proposed development does not go ahead, but should the development goes ahead, it will improve and ensure accessibility to the island throughout the year in all weather conditions. The project is likely to facilitate economic opportunities and contribute directly and indirectly to health and wellbeing of the community.

Given the range of benefits that the proposed development will bring the project has been considered important and "No-Development" Option has been considered not favorable for the proposed development and decided to go ahead with the proposed development.

Development can take place only within the limits of the environment and the community with which the development is taking place. Hence, the aim is to ensure that all project activities are undertaken without serious adverse long term irreversible environmental damages that that proves to be difficult to mitigate. Preferred alternatives discussed below has been selected based on the above broad development concept.

11.2 DEVELOPMENT OPTIONS

11.2.1 Relocation of proposed island access

As mentioned in the report the initial request for the development of alternative access to the island was proposed without discussions with the community. The dimensions of channel and small mooring area provided in the drawing does not measure to the location. The community of R. Rasgetheem always wanted to have the alternative access, midway between Kanneli Magu and Seedhaakuri Magu. The exact point would be the Kuredhi tree located approximately 150m south of the proposed location ***Figure 29***.

The main reason for relocating the island access is that the proposed location is exposed to very strong wave in both monsoons particularly during the NE monsoon period. An attempt to create an alternative access in the proposed location in the past has resulted in extensive sedimentation and further erosion of the northern end of the island. The main advantage of the proposed new location is that from experience the islanders have learned that the location is the calm area (location) where waves from NE and SW dissipate and loose much of the wave energy while shoaling through the reef flat. The area has been used, and still is being used, by the community to anchor their vessels during rough sea period. Therefore, the community strongly believe that proposed new location would be the best location to create an alternative access to the island.

MHI in principal have agreed to relocate the proposed island access to the new location during the scoping meeting.

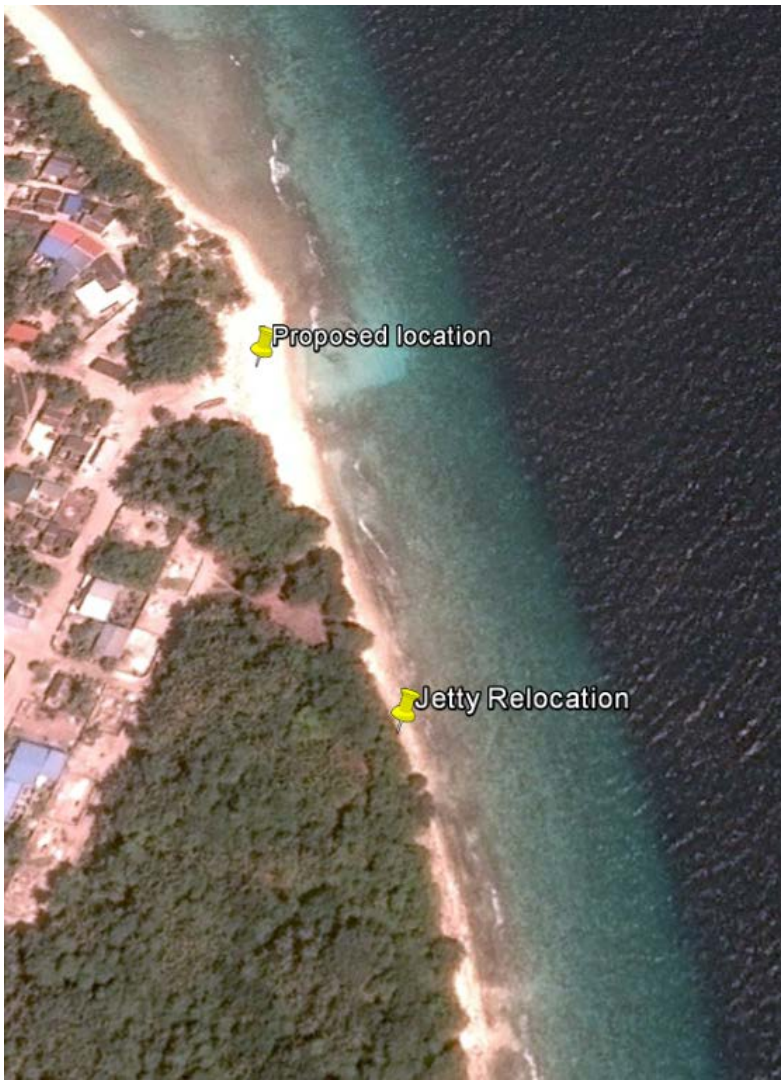


Figure 29: Showing the proposed location and the alternative relocation area at the eastern coast of R. Rasgetheemu.

11.2.2 Existing environment of the proposed new location for island access

The proposed new location for island access is on the eastern side almost at the center of the eastern coastline of Rasgetheemu. The area is extremely shallow 0.5-1.0m reef flat. No live corals only hard reef substrate until the reef drop-off. The distance between the reef-end the beach is approximately 70m. There is a very sharp drop-off between the reef flat and the reef slope. Ideal access this area would be to construct a T-jetty that is standing on pad-columns, to the reef edge. This will allow alongside bathing vessels on the T section of the jetty.

11.2.3 Alternative access design

Two potential designs (***Figure 30***) for the development of island access in the proposed new location are evaluated as an alternative analysis for the project based on environmental and socioeconomic criteria including:

- Accessibility to the facility
- Economic viability
- Environmental justifiability
- Social acceptability
- Sustainability

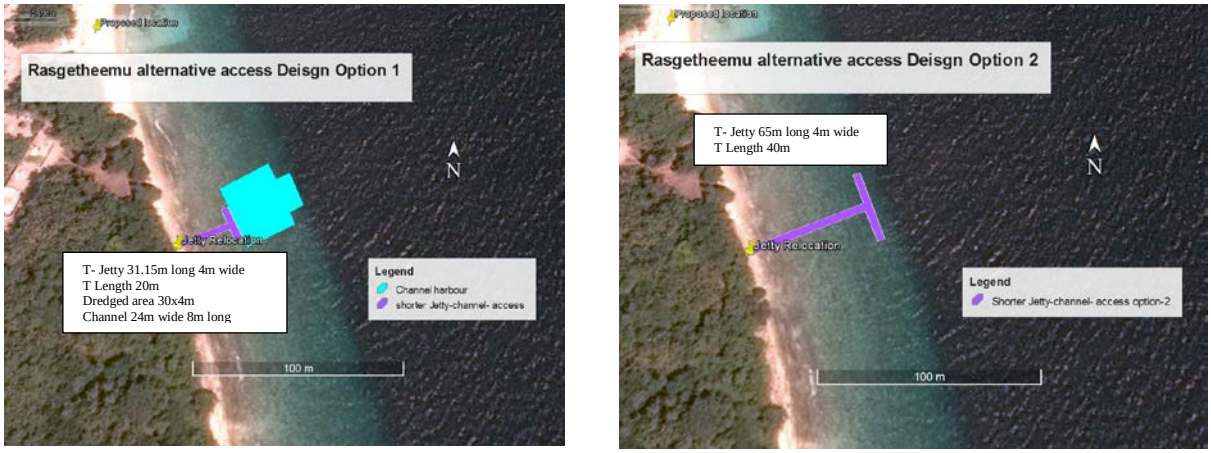


Figure 30: Relocation and alternative access design options Rasgetheemu

Based on the above five criteria, alternative design of island for the island access was weighed with scores given for each design from 1 to 5. The purpose of developing a scoring system is weight the options to obtain a favourable alternatives designs based on the criteria proposed by considering alternatives in terms of accessibility, economic viability (cost of construction), environmental justifiability and social acceptability Table 12. The main components of the design are: T- Jetty, access channel, small mooring area. Based on these three components the design presented is;

1- With access channel and small mooring area (requires dredging) 31.15m long 4m wide T-jetty with 40x30m mooring basin and 24m wide channel
2- Longer T- jetty up to the reef edge (no dredging required)

The total for all factors gives an overall weight of the location Table 13. The highest total score provides the most desirable and preferred alternatives and vice versa.

Table 12: Alternative access design

Criteria	Longer T- Jetty	shorter T-Jetty channel and mooring are
Accessibility	Easy access Rough at times Boats can anchor along side No depth limit very deep (20-30m)	Need maneuvering to access through the channel Anchoring limited with the size of mooring area Depth limitation approximately 3 at low tide May become filled with sediment (maintenance time to time) Not rough once inside the mooring area
Economic viability	Jetty longer, longer columns at	Jetty cost lower

	deep water Jetty cost higher No dredging required no dredging cost No extra protection required	Shorter columns Dredging required Dredging cost May need protection to prevent filling maintenance dredging may required
Environmental feasibility	No dredging very minimal destruction to reef flat Minor hydrodynamic changes to the coast Unlikely to trigger erosion Mitigation cost lower	Channel and mooring basin dredging Change in the hydro dynamic of the coastline May trigger erosion Frequent filling of the dredged area Sedimentation and associated problems to the reef Mitigation cost higher
Social acceptability	The area is used by the local to anchor their vessels during rough weather. Can anchor at a distance from the jetty	The area is used by the local to anchor their vessels during rough weather. Extra safety once inside the mooring area Limited mooring area
Sustainability	Considering the long term development of the island the jetty will have less environmental damage, overall cost will be less Unlikely to cause major erosion problem Aesthetically more acceptable	Environmental damage associated with dredging May cause long term erosion problem Overall development cost and the maintenance cost will likely be higher

1.1.1 Assessment of the weights for options on alternative design

The following Table 13 shows the weighted scores of the alternative access design analysis exercised for the proposed for the island access and jetty construction project in R. Rasgetheemu .

Table 13: Weighted scores of alternative location analysis

Criteria	Longer T- Jetty	shorter T-Jetty channel and mooring are
Accessibility	3	1
Economic viability	2	2
Environmental justifiability	5	1
Sustainability	4	2
Social acceptability	1	2
Total	**15**	**8**

Based on the option analysis longer T-jetty design option is the highest. The alternative longer T-jetty design was preferred because it is more favorable in terms of accessibility environmental friendliness and sustainability of the proposed option.

1.1.2 Preferred Alternative

The preferred alternative design for island access in Rasgetheemu is therefore the option with a long T jetty from the beach to reef edge.

1.1.3 Mitigation measures for the preferred alternative

The mitigation measure for this option would be less than the mitigation measure analysed for the project in the relevant section. As the only envisaged impact from the preferred long –T jetty construction would be minor impacts associated with trampling of reef flat during the placement of Pad-columns of the Jetty. Two design options are shown in Figure 25.

12 ENVIRONMENTAL MONITORING PLAN

Environmental monitoring is essential to ensure that post-construction and operational impacts are known and eliminated in a timely manner. Dealing with impacts earlier would save money and also help planning and operationalize the process.

The parameters that are most relevant for monitoring the impacts that may arise from the proposed project are included in the monitoring plan. These include sea water (turbidity, sulphate, phosphates, nitrates, and BOD), sediment deposition. Monitoring the shoreline changes that may occur due to the medium to long-term impacts from the changes in coastal processes.

The purpose of environmental monitoring plan (EMP) is to monitor or control the environmental effects of the proposed project. It should be based on compliance, verification, feedback, and know-how. It is therefore suggested that the Contractor carries out the EMP. The EMP should be able to provide responses to the following three questions:

a) Why is monitoring being conducted?
b) What specifically is being carried out?
c) How are the data and information to be used in planning and decision-making?

Table 14, ***Table 15*** and ***Table 16*** shows the details of the proposed monitoring aspects including the monitoring parameters, indicators, baseline, proposed methods, frequency and estimated costs

Table 14: Monitoring of the shoreline, beach profiles and coastal environment

Parameter	Indicators	Baseline / Reference Values	Method / Technique	Frequency	Estimated cost in USD
Shorelines (high / low tides)	Beach morphology	Baseline to be re-established immediately after construction is complete	Differential GPS	Bi-annually in the first two years after completing the dredging activities.	100/ trip
Beach profiles	coastal changes	Requires to re-establish the baseline following the construction	Beach profile surveys	Bi-annually in the first two years after completing the dredging activities.	100 / trip
Currents	Nearshore currents	Baseline to be collected immediately constructions are over, especially on western side	Drogue survey	Bi-annually in the first two years after completing the dredging activities.	100/trip

Table 15: Monitoring of the reef environment

Parameter / Method	Frequency of Monitoring	Purpose	Estimated cost (USD)
Benthic cover by major life forms (live, dead, rock rubble and sand)	Once six months after dredging	Indicative of the changes in the live coral cover	200/trip
Fish population / visual census	Once six months after dredging	To assess broad scale change in the ecological status of the coral reefs (increase / decrease of herbivores, etc.)	

Table 16: Monitoring of the sea water quality

Type	Parameters	Locations	Frequency	Estimated cost (USD)
In situ monitoring / sampling and testing from a laboratory	Dissolved oxygen Turbidity (NTU) Nitrates Sulphates TDS	All locations marked	Bi-annual	200/ set of tests

12.1 MONITORING COSTS

It is understood that costs of monitoring be borne by the proponent. It is also understood the mitigation measures would be accommodated in the contract costs. A commitment letter confirming compliance on mitigation measures is given in Annex 6.

12.2 MONITORING REPORT

Based on the data collected, a detailed monitoring report will be compiled annually and submitted to the relevant government authorities for compliance. The report will include methodologies and protocols followed for data collection and analysis, quality control measures and indicate the uncertainties.

Table 17: A tentative schedule for submission of EIA monitoring report to EPA

	2017	2018				2019				2020			
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Monitoring report, Operational Phase													

13 CONCLUSIONS

This EIA has been carried out on the basis that it is necessary to carry out the reef entrance cutting, channel and mooring basin dredging and T- jetty construction work in R. Rasgatheemu and to maintain the required depth to provide safe navigation, access accommodate vessels travelling to the island. The environmental impact assessment study shows there are two main activities that would cause minor to moderate negative environmental impacts. Those, in order of minor to moderate impact, are:

1. Channel and mooring basing dredging
2. Jetty construction and backfilling

Of these a long term impact would be from dredging and beach backfilling of jetty area and nourishment of eroded beach on the NE side of the island. Potential erosion/accretion and adjustment of the existing beach to create a new equilibrium with the surrounding environmental conditions are likely to extend to medium to long term. These impacts would be cumulative occurring over long period of time and so can be managed through proper monitoring and addressing them in a timely manner. Based on the scale of dredging and beach nourishment work projects that is taking place in Maldives, impacts associated with the proposed dredging activity is insignificant. The positive socio economic impacts from the proposed development outweigh the temporary negative impacts of dredging.

The study has evaluated alternative locations for the project and recommended shifting the project 150m south of the proposed location. Also the study has evaluated two option to develop island acess in the new location. Based on the alternative option evaluation the preferred option would be to construct a 65m long 4m wide T jetty with 20m long-T standing on pad-column foundation. The recommended access jetty will eliminate the most of the impacts envisaged with the proposed development. Even though there is no very significant impact from this project particularly with the recommended T jetty construction, the report has come-up with an extensive monitoring programme that will keep on monitoring coastal and marine environmental changes associated with the development to make necessary adjustment based on the findings of various measured environmental parameters suggested in the monitoring plan.

Therefore, on the basis of this environmental impact assessment study and the impact mitigation measures in the report will be duly implemented and recommendations are given due consideration, it is concluded that the benefits of alternative island access development project in the selected location in this study in R. Rasgetheemu eastern coast will substantially outweigh its imposition on the environment.

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15 ANNEXURES

Annex 1: Approved Terms of Reference (ToR) for the Project
Annex 2: Approved site plan
Annex 3: Jetty construction detail plans
Annex 4: List of participants in council meeting and scoping meeting
Annex 5: Seawater quality test
Annex 6: Commitment letter from the proponent
Annex 7: Letter from R. Rasgatheemu Atoll Council
Annex 8: Details of consultant's contributions to the report
Annex 9: Bathymetry

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Environmental Protection Agency EPA

No: 203-EIARES/138/2017/85

Draft Terms of Reference for Environmental Impact Assessment for Jetty construction and island access project, R. Rasgatheemu North Maalhosmadulu Atoll

The following is the Terms of Reference (ToR) following the scoping meeting held on 11/06/2017 for undertaking the EIA of the proposed Jetty development a Project at R. _Rasgatheemu North Maalhosmadulu Atoll._ The proponent if the project is _Ministry of Housing and Infrastructure._

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 to the project** -Describe the purposed artificial beach development project and, if applicable, the background of the project and the tasks already completed. Clearly identify the rationale and objectives to enable the formulation of alternatives. Define the arrangements required for the environmental assessment and how coordination between other consultants, project engineers, contractors and government institutions will be carried out.

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

3- **Scope of work-** Identify and number tasks of the project including site preparation, construction and decommissioning phases. The following tasks shall be completed:

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

The main activities of the proposed development are:

- Construction of 31.15m long T-jetty with 4m width walkway.
- Ground levelling the jetty area.
- Dredging near Jetty area 40m width & 30m length area.
- Dredging new entrance channel 24m width & 28m length
- Measures to protect environmental values during construction and operation phase;

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- Project management (include scheduling and duration of the project and life span of facilities; communication of construction details, progress, target dates, construction/operation/closure of labour camps, access to site, safety, equipment and material storage, fuel management and emergency plan in case of spills)

jetties, and lagoon area:

- Justification for the selection of these locations;
- Labour requirements and (local) labour availability;
- Housing of temporary labour, and
- Emergency plan in case of spills (diesel, grease, oil)

The EIA report should investigate possibilities for alternatives:

- Operation and positioning options;
- Alternative locations: have these been considered and if so, give arguments why these alternatives have not been selected, and

Power water, and sewerage:

- Sources of power and water during the construction phase ;
- Detail solid waste disposal mechanisms, equipment used and periodicity (how often?).

Waste management:

- Materials to be collected and management, waste reduction and recycling;
- Transportation mechanisms and costs;

Ground levelling and beach nourishment activities:

- Access channel and mooring area size, location, including oceanographic justification and map;
- Quantity of dredged material;
- Beach nourishment details including locations and width
- Ground levelling work

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, reef transects 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;

Geology and geomorphology

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- Shoreline of the project impact area
- Vegetation line of the project impact area
- Offshore/coastal geology and geomorphology (use maps);
- Bathymetry (bottom morphology) (use maps);
- (Seasonal) patterns of coastal erosion and accretion (see appendix for monitoring details), and
- Characteristics of seabed sediments to assess direct habitat destruction and turbidity impacts during construction;

Hydrography/hydrodynamics (use maps)

- Tidal ranges and tidal currents;
- Wave climate and wave induced currents;
- Wind induced (seasonal) currents;
- Sea water quality measuring these parameters: temperature, pH, salinity and turbidity.

Ecology

- Identify marine protected areas (MPAs) and sensitive sites such as breeding or nursery grounds for protected or endangered species (e.g. coral reefs, spawning fish sites, nurseries for crustaceans or specific sites for marine mammals, sharks and turtles). Include description of commercial species, species with potential to become nuisances or vector.
- Benthic and fish community monitoring around the impact area ;

Socio-economic environment

- Demography: total population, sex ratio, density, growth and pressure on land and marine resources;
- Income situation and distribution
- 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 other 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).

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 on marine habitats including damages to coral reefs and seagrass communities, fish stocks, protected areas and protected species;

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- Changes in erosion/sedimentation patterns, which may impact shore zone configuration/coastal morphology;
- Temporary sediment dispersal in water column (turbidity at the dredging site, beach noursihment areas and jetty construction areas), possibly resulting in changes in visibility, smothering of coral reefs and benthic communities and affecting fish and shellfish etc.;
- Impacts on landscape integrity/scenery.

Impacts on the socio-economic environment

- Impacts on employment and income, potential for local people to have (temporary or long term) job opportunities (and what kind) in the execution of the works;
- Disturbance to local natural resource users such as fishing areas, other tourism ventures;
- Impacts to nearby industrial establishments;
- Impact equity (economic activities, employment, income);

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.

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". The report should highlight how the 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. Mitigation measures to avoid or compensate habitat destruction, e.g. temporal sediment control structures, coastal protection structures to reduce erosion. 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. 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 coastal modification, beach morphology, sediment movement around the island. 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.

- Water quality, especially turbidity;
- Erosion and accretion changes;
- Temporal sedimentation rates on nearby coral reefs, benthic system and seagrass beds;
- Condition of the sensitive ecosystems and marine resources;
- Environmentally sound removal of dredging and other equipment including construction materials, and
- Employment of available local labour force.

Task 8. Stakeholder consultation, Inter-Agency coordination and public/NGO participation) – Identify appropriate mechanisms for providing information on the development proposal and its progress to all stakeholders, government authorities such as Ministry Environment and Energy, Ministry of Housing and Infrastructure, Island and Atoll Council, local community, government agencies, engineers/designers, development managers and members of the general public. The EIA report should include a list of people/groups consulted, their contact details and summary of the major outcomes.

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 f 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 6 months from the date of this Term of Reference.

13 June 2017

Annex-2.

ADH. MANDHOO JETTY

DRAWN BY:

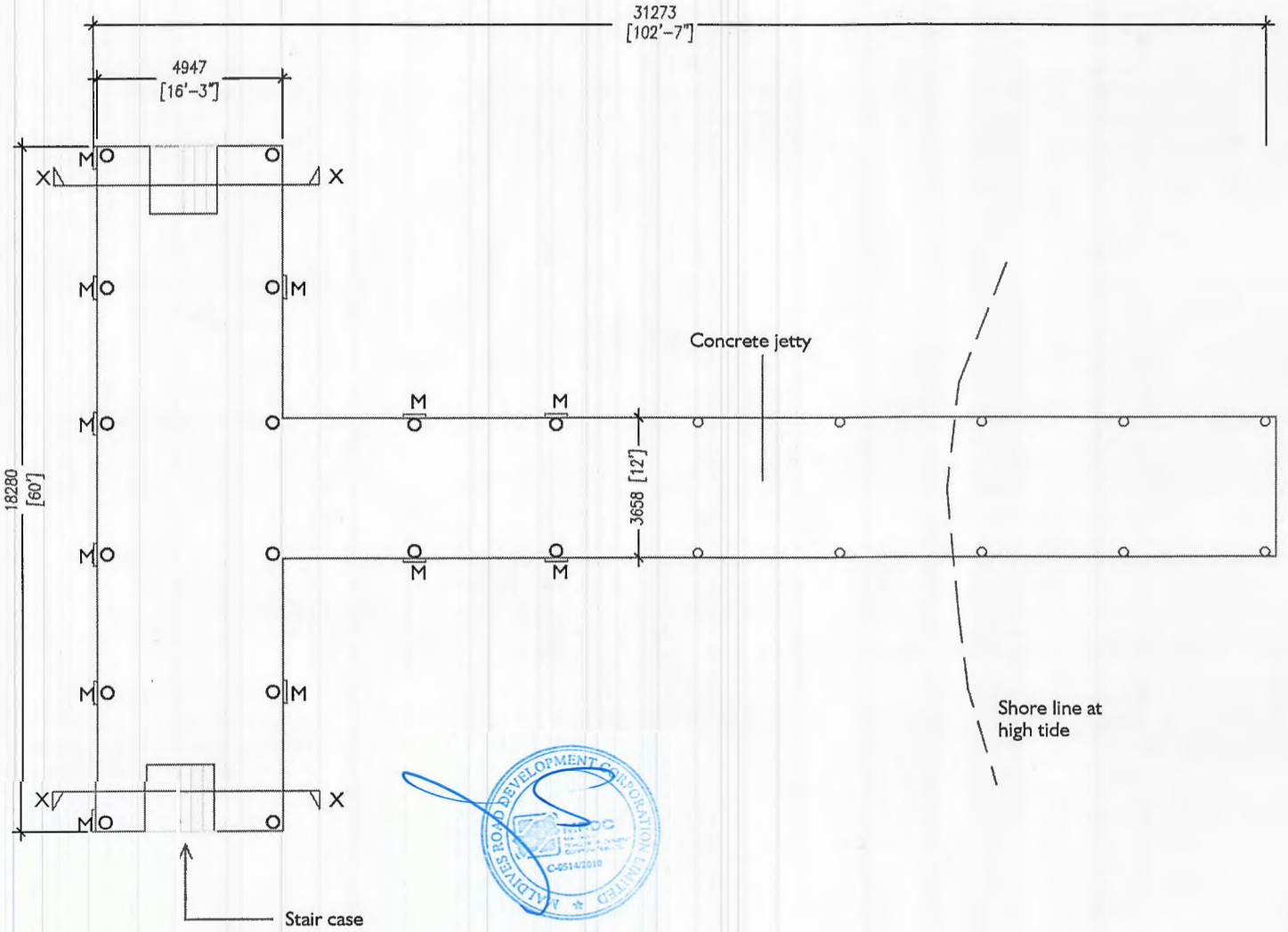
AHMED EVAN WASEEM

DATE:

23 - 07 - 2015

INFRASTRUCTURE DEPARTMENT
MINISTRY OF HOUSING AND INFRASTRUCTU
IZZUDHDHEEN MAGU MALE' 20-01
REPUBLIC OF MALDIVES
TEL:323234, 323474, FAX:328300

Annex 3.

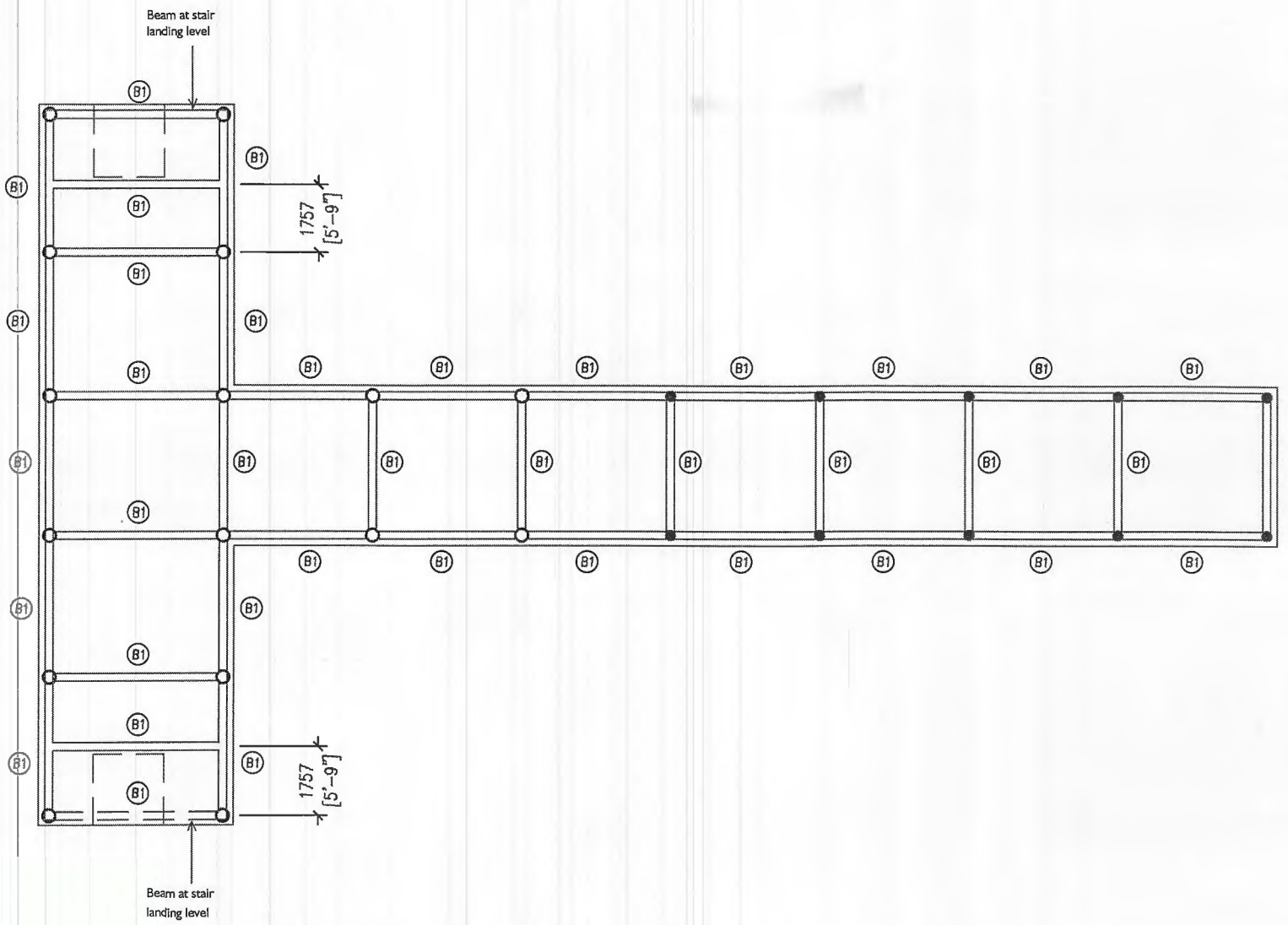


JETTY PLAN

SCALE 1:250

Note;
M-Mooring Hook

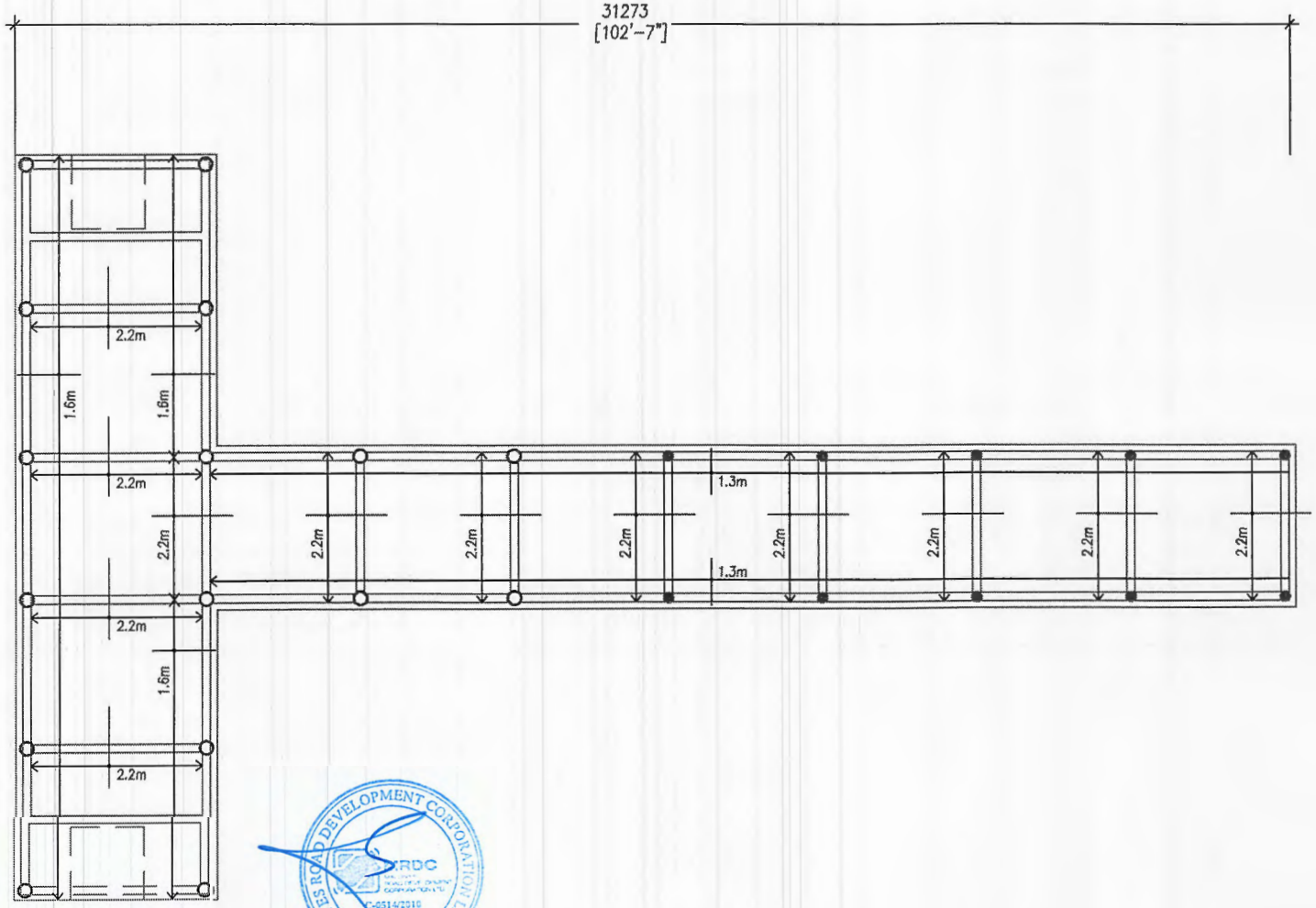
INFRASTRUCTURE DEPT.



BEAM PLAN

SCALE 1:250

INFRASTRUCTURE DEPT.

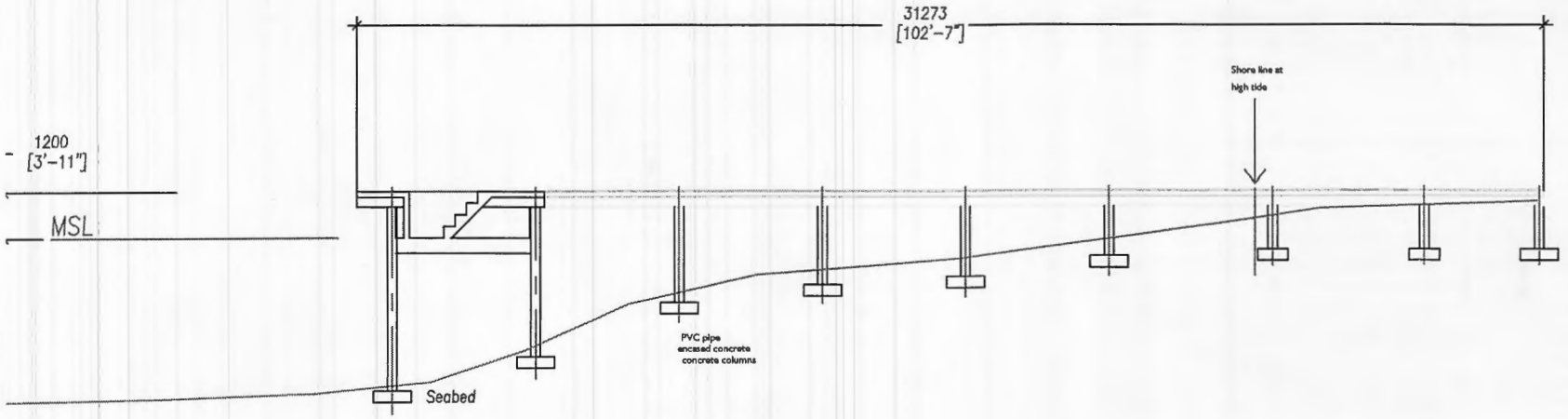


SLAB REINF. PLAN

SCALE 1:250

SLAB
150MM THICK
BOTTOM T12 @ 150 B/W
TOP T12 @ 200 B/W + T12 @ 200 AS SHOWN
COVER 35mm

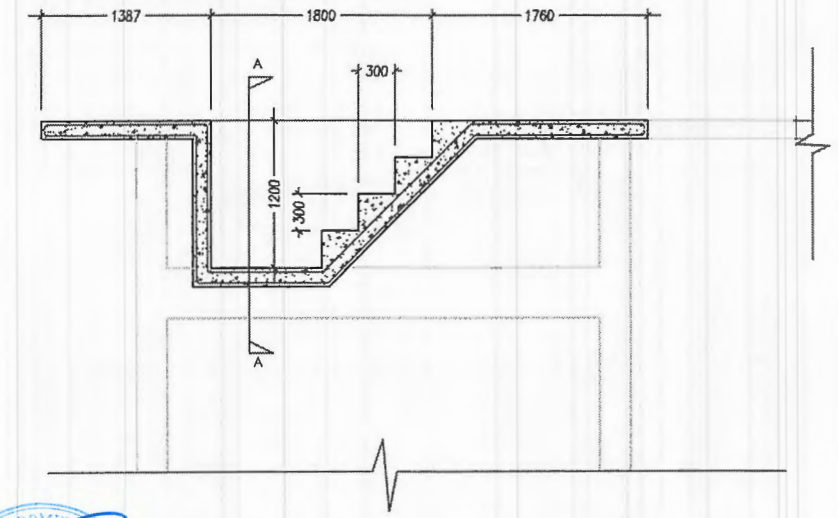
INFRASTRUCTURE DEPT.



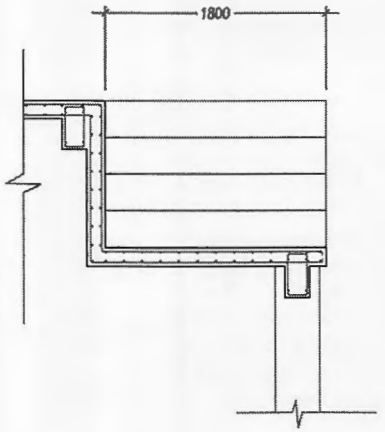
MINISTRY OF HOUSING AND INFRASTRUCTURE
REPUBLIC OF MALDIVES

MALDIVES ROAD DEVELOPMENT CORPORATION LIMITED
MRDC
C-051-4/2020

INFRASTRUCTURE DEPT.
MINISTRY OF HOUSING AND INFRASTRUCTURE



SECTION X-X

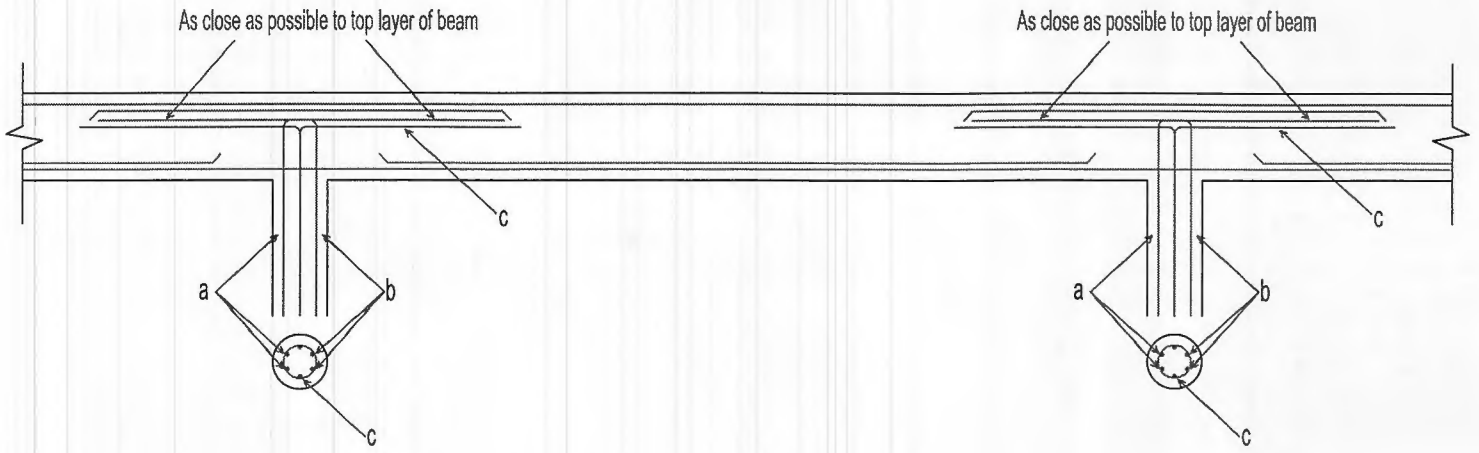


SECTION A-A

STAIR CASE DETAIL

SCALE 1:50

INFRASTRUCTURE DEPT.

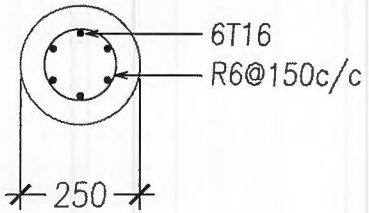


Note: Shear links not shown for clarity

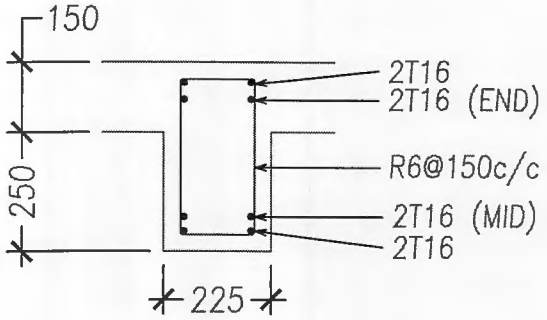
COLUMN - BEAM FIXED CONNECTION DETAIL

SCALE 1:25

INFRASTRUCTURE DEPT.



CIRCULAR COLUMNS
All encased in PVC pipes



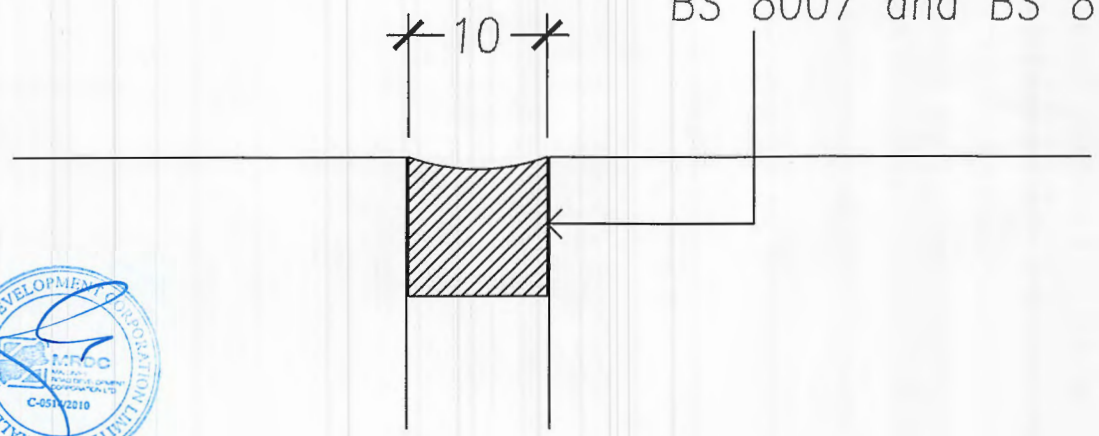
B1

NOTE:
COLUMN CONCRETE COVER = 50mm
BEAM CONCRETE COVER = 40mm
Foundation for circular columns are
1200 x 1200 x 300
T12@150 BW at bot

STRUCTURAL DETAIL

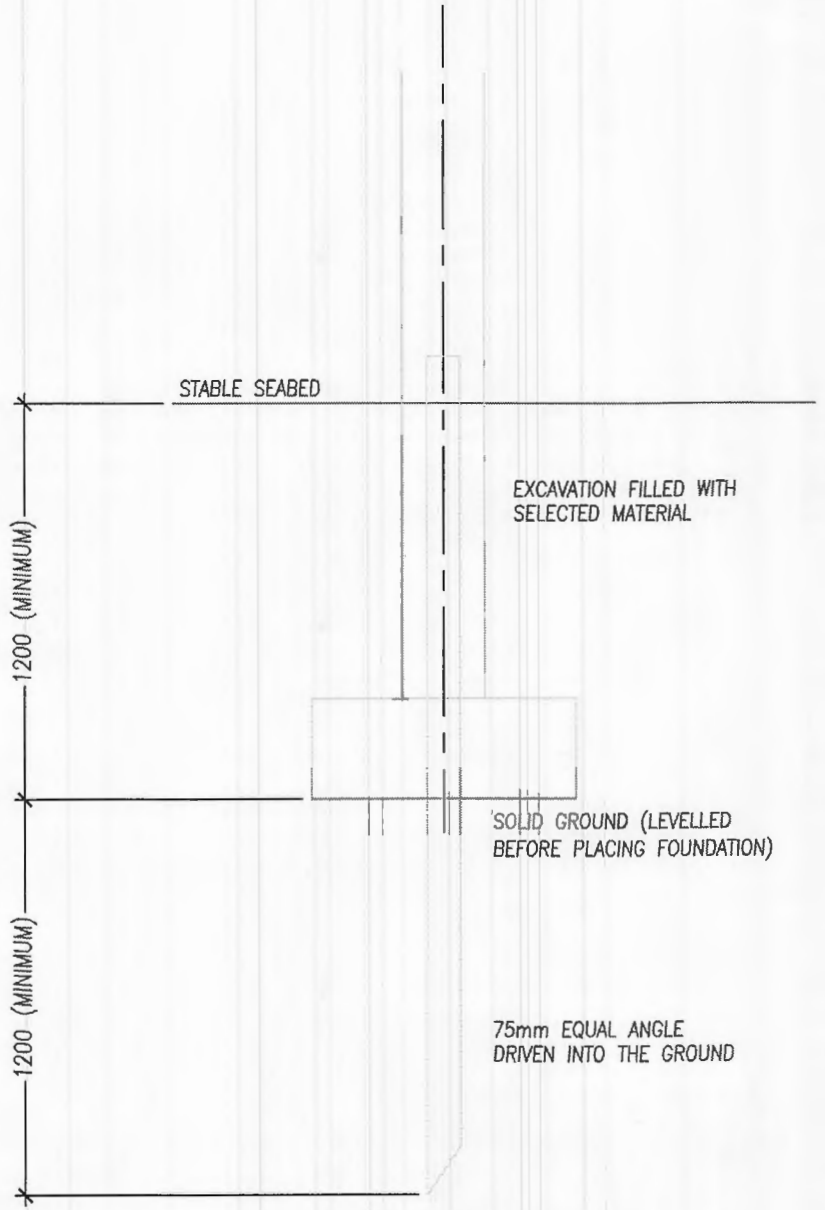
SCALE 1:20

INFRASTRUCTURE DEPT.



EXPANSION JOINT

INFRASTRUCTURE DEPT.



FOUNDATION PAD DETAIL

SCALE 1:20

INFRASTRUCTURE DEPT.

Annex 4.

Environmental Protection Agency
Male', Rep of Maldives

Meeting: Jetty construction in ADh. Mandhoo, 12. Rasgetheemu, B. Fehendhoo and B. Fulhadhoo
Date: 11/06/2017
Time: 13:00

MEETING ATTENDANCE

	Name	Designation	Office	Email	Phone No.	Signature
01	Mahmood Rijaz	Consultant		Mahmood Rijaz@gmail.com	7881039	
02	Nafha Anjaz	Environment Analyst	MHI	enu@housing.gov.mv	7721554	
03	Anoosha Hashim	A. Project officer	MHI	enu@housing.gov.mv		
04	Mariam Shidha	Snr Research Officer	EPA	mariyam.shidha@epa.gov		
05	Aminath Mohamed	Asst. Project officer	EPA	aiminath.mohamed@epa.gov		
06	MOOSA NASEEM	President	Fehendhoo Council			
07	ALI AZHAR	Asst Director	Fulhadhoo Council	baafulhadhoo@gmail.com	7775808	
08	AHMED ASIF	Council	fulhadhoo Council	"	7787992	
09	HUSSAIN RASHAD	council Rees	R. RASGETHEEMU	RASGETHEEMOFFICE@gmail.com	7777409	
10	Farhana Fahmy	Senior Research officer	EPA	farhana.fahmy@epa.gov.mv	9874988	
11	Fathimath Reenu					
12	Hashim Nabeel					

Male' Water & Sewerage Company Pvt Ltd
Water Quality Assurance Laboratory
FEN Building 5th Floor, Machangoalhi, Ameenee Magu, Male', Maldives
Tel: +9603323209, Fax: +9603324306, Email: wqa@mwsc.com.mv

Annex-5.

WATER QUALITY TEST REPORT

Report No: 500173891

Customer Information:
Mahmood Riyaz
H.Hithifaiy

Report date: **15/06/2017**
Test Requisition Form No: **900175736**
Sample(s) Recieved Date: **13/06/2017**
Date of Analysis: **13/06/2017 - 13/06/2017**

Sample Description	Rasgatheem	Fehendhoo	Fulhadhoo	**TEST METHOD**	**UNIT**
Sample Type	Sea Water	Sea Water	Sea Water		
Sample No	83187020	83187021	83187022		
Sampled Date	05/06/2017	05/06/2017	05/06/2017		
PARAMETER	**ANALYSIS RESULT**				
Physical Appearance	Clear with particles	Clear with particles	Clear with particles		
pH	8.21	8.06	8.22	Method 4500-H+ B. (adapted from Standard methods for the examintation of water and waste water, 21st edition)	-
Salinity	34.43	34.09	34.22	Method 2520 B. (adapted from Standard methods for the examintation of water and waste water, 21st edition)	‰
Temperature	20.9	20.6	20.8	Electrometry	°C
Total Dissolved Solids	26200	26000	26100	Electrometry	mg/L
Turbidity	0.763	0.258	0.353	HACH Nephelometric Method (adapted from HACH 2100N Turbidimeter User Manual)	NTU

Keys: ‰ : Parts Per Thousand, **°C** : Degree Celcius, **mg/L** : Milligram Per Liter, **NTU** : Nephelometric Turbidity Unit

Checked by

Afnan Farooq
Laboratory Executive Gr.1

Approved by

Mohamed Eyman
Assistant Manager, Quality

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

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

Annex-6.

Proponents Declaration

Re: EIA for Island access and Jetty project in R.Rasgetheemu

As the proponent of the proposed project we guarantee that we have read the report and to the best of our knowledge, all information relevant to this project in terms of project description, project construction works and operational aspects provided here are accurate and complete.

As the Proponent of the project; we assure you our commitment to undertake the proposed mitigation measures and monitoring programme given in the report.

Signature:

Name: Fathimath Shaana Farooq

Designation: Director General

On behalf of: Ministry of Housing and Infrastructure

Date: 09 July 2017

Annex-7.

بسم الله الرحمن الرحيم

ދަށްސުވަލުގެ ތެރޭގައި ހުންނަ ރަސްގެއްދޫ ކައުންސިލް ރަސްގެއްދޫ

SECRETARIAT OF THE RASGETHEEMU COUNCIL, NORTH MAALHOSMADULU

RASGETHEEMU – REP OF MALDIVES

ނަންބަރ:300-EC/2017/3

ވެރިކަމާއި ގުޅުން ހުރި ބައެއް

ތިމާވެށި ބިދޭސީ ފަރާތް ގެނައުން

ބަލަހައްޓާ ނަން:

Draft environmental impact assessment for island access and jetty construction project in Rasgetheemu, Raa·Atoll

ބަލަހައްޓާ ފަރާތުގެ ނަން: ބަހަރިން ކަންސަލްޓަންޓް

ދަތުރުދާ: ކައުންސިލްގެ ތެރެއިން

ތިމާވެށި ނަން: ދަށްސުވަލުގެ ތެރޭގައި ހުންނަ ރަސްގެއްދޫ ކައުންސިލް ތިމާވެށި

ތާރީޚް: 04 ފެބްރުވަރީ 2017 ގަޑި: 8:30

ސޮއި :

اِحتِرام قَبُوْل

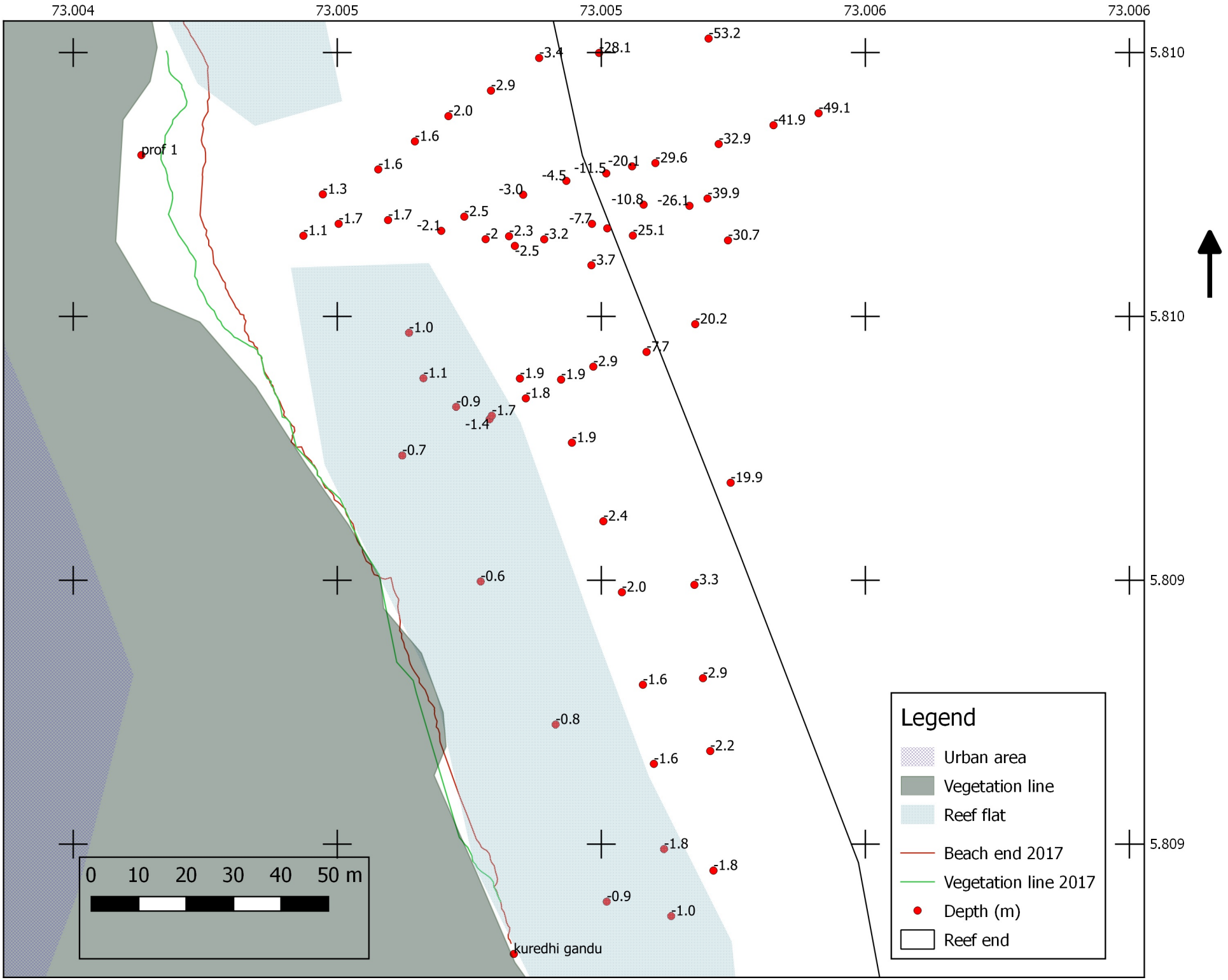
١٠ شَوَّال ١٤٣٨

04 فبراير 2017

Annex-8.

Chapter	Name of Consultant	Registration No.	Signature
Introduction	Dr. Mahmood Riyaz	(EIA 03/07)	
Project Description	Dr. Mahmood Riyaz	(EIA 03/07)	
Administrative and regulatory framework	Dr. Mahmood Riyaz Dr. Mohamed Shiham Adam	(EIA 03/07) (EIA 01/07)	
Methodology	Dr. Mahmood Riyaz Dr. Mohamed Shiham Adam	(EIA 03/07) (EIA 01/07)	
Existing Environment	Dr. Mahmood Riyaz Dr. Mohamed Shiham Adam	(EIA 03/07) (EIA 01/07)	
Stakeholder consultation	Dr. Mahmood Riyaz	(EIA 03/07)	
Potential impacts and mitigation measures	Dr. Mahmood Riyaz Dr. Mohamed Shiham Adam	EIA 03/07) (EIA 01/07)	
Alternatives	Dr. Mahmood Riyaz	(EIA 03/07)	
Environmental Monitoring plan	Dr. Mahmood Riyaz	(EIA 03/07)	
Conclusions	Dr. Mahmood Riyaz	(EIA 03/07)	

Annex-9.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-28.1
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-3.3
-1.6
-2.9
-0.8
-2.2
-1.6
-1.8
-1.8
-0.9
-1.0
kuredhi gandu
0 10 20 30 40 50 m
Legend
Urban area
Vegetation line
Reef flat
Beach end 2017
Vegetation line 2017
Depth (m)
Reef end