# MOMBASA CEMENT LTD

**P.O BOX 83594-80100**
**MOMBASA**
**Email:csl@nyumba.com**

**PROPOSED MINING OF LIMESTONE AT ROKA AND MATSANGONI LOCATIONS, KILIFI NORTH SUB-COUNTY, KILIFI COUNTY**

# ENVIRONMENTAL IMPACT ASSESSMENT STUDY

**Geographical coordinates 3° 26' 0" South, 39° 54' 0" East**


Compiled by:-
**SIGTUNA CONSULTANCY LIMITED**
Registered and Licensed EIA/EA Firm of Experts Reg. No.9582
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**2021**

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**Signed by:**

_____

**Philip Manyi Omenge**
EIA/EA Lead Expert Reg. No. 1559
**Team Leader**
**Sigtuna Consultancy Limited EIA/EA Firm of Experts**

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**Geographical coordinates 3° 26' 0" South, 39° 54' 0" East**

# ENVIRONMENTAL IMPACT ASSESSMENT STUDY

**Submitted by:-**
MOMBASA CEMENT LIMITED
**Proponent**

_____

**MR. HASMUKH PATEL**
DIRECTOR
**MOMBASA CEMENT LIMITED**

## EXECUTIVE SUMMARY

This report presents findings of an Environmental Impact Assessment Study for proposed mining of coral limestone to be carried out by Mombasa Cement Limited. The proposed project will be carried out on 116 pieces of land located in Roka and Matsangoni Locations of Kilifi County GPS location 3° 26' 0" South, 39° 54' 0" East. The Environmental Impact Assessment Study and report was prepared as provided for in Legal Notice No. 31 and 32 of 2019, section 58 (2) of the Environmental Management and Coordination 1999 (Amended) Cap 387 and the Environmental (Impact Assessment and Audit Regulations), 2003.

### Objective of proposed project

The objective of the proposed project is to mine coral limestone and transport the mined limestone from the mine to Mombasa Cement Limited Factory at Vipingo.

### Scope of the proposed project

The proposed project will cover fencing and securing the proposed project site, construction of quarry camp and associated infrastructure, installation of weighbridge, mobilization of quarry equipment and machinery to site, actual open cast quarrying activities to recover coral limestone, haulage of the recovered coral limestone from site to Vipingo, continuous rehabilitation of disused quarry pits, demobilization of quarrying equipment, decommissioning of all quarry activities and site rehabilitation.

### Environmental condition

There is considerable biodiversity within the proposed project site such as trees, shrubs, herbs, grasses and sedge and fauna such as reptiles and amphibians, invertebrate, and avifauna. Within the immediate neighbourhood of the proposed project site there are both on going and abandoned hand-cut and machine cut coral lime quarry pits. Also in some plots of the proposed project site and in the immediate neighborhood there are hand dug wells. Some of the plots of the proposed project site are adjacent to local schools while some access roads to some of the proposed project site plots are pass at the periphery of some of the school compounds.

**Potential impacts of the proposed project**

A summary of potential positive social impacts likely be realized from the proposed project include:-

- ✓ Employment opportunities
- ✓ Support of existing local businesses
- ✓ Businesses spinoffs
- ✓ Support and development of local institutions
- ✓ Skill enhancement and technological transfer
- ✓ Elaborate corporate social responsibility projects

**Proposed enhancement measures of potential positive social impacts**

| **Potential positive social impacts** | **Proposed enhancement measures** |
|---|---|
| Employment opportunities | - Local people from the project area to be given first priority to benefit in direct employment opportunities.<br>- There should be no sourcing of unskilled or semi-skilled labour force from outside the project area<br>- Local youths, both male and female and local women who form the bulk of local labour force to be given utmost priority when sourcing quarry labour force<br>- Both male and female to be considered in allocating employment slots for each gender when sourcing labour force.<br>- Maintain records of employees with gender and locality of employees working at the quarry site to ensure the ratios are maintained. |
| Support of existing local businesses | - Local business community to position themselves strategically to be able to provide required services to the project by making required investment prior and during the project period. |
| Businesses spinoffs | - Local youths of both gender and women who will benefit from direct and indirect employment opportunities to invest part of their earnings in starting small businesses locally or inject more capital to their already existing businesses to scale up them up |
| Support and development of local institutions | - Local leadership to priorities and communicate to the proponent local institutions that will require developmental support.<br>- Local primary and secondary schools which can be identified as most |

| Potential positive social impacts | Proposed enhancement measures |
|---|---|
| | disadvantaged in terms of infrastructure development to be among those to be prioritized for support and development |
| Skill enhancement and technological transfer | - The proponent to provide opportunities for internship to enhance skill development<br>- The proponent to provide for student attachment opportunities from learners of local tertiary institutions |
| Elaborate corporate social responsibility projects | - The local community leadership to liaise with the proponent to tap into the proponent's corporate social responsibility programme for the locality for maximum possible benefit. |

Summary of potential negative social impacts from the proposed project may include:-

- ✓ Diminishing/ reduced local ground water resources
- ✓ Labour influx
- ✓ Traffic and Public Safety from trucks along access road
- ✓ Ponding risks resulting spread of malaria from increased breeding of mosquitoes
- ✓ Injuries and accidents
- ✓ HIV and AIDS and other communicable diseases
- ✓ Injuries and accidents
- ✓ Alteration of local aesthetics

**Proposed mitigation measures of potential negative socio impacts**

| Potential negative impact | Proposed mitigation measures |
|---|---|
| Reduced availability of local ground water in the area for community use | - To increase local aquifer recharge maintain pockets of vegetation at the project area and support tree planting activities in public utility areas outside the project site but within the project catchment<br>- Depth of limestone mining to be far above the local aquifer and a way from any existing hand dug well and or borehole<br>- Existing hand dug well and or boreholes to be maintained and rehabilitated to ensure improved water yield |

| **Potential negative impact** | **Proposed mitigation measures** |
|---|---|
| Labour influx | - The proponent to source required labour locally unless expatriates who are not available locally<br>- The labour to be sourced locally to include women and youth of both gender<br>- Numbers of women employed in the quarry site to be monitored to ensure they remain proportionate to those of their male counterparts. |
| Traffic and Public Safety | - The proponents to ensure all trucks collecting mined coral limestone from the quarry or delivering materials and equipment to the quarry are mechanically sound, serviceable and meet all the traffic act requirements.<br>- Drivers driving the trucks to observe the highway code, be experienced and licensed to drive such trucks<br>- Proponent to liaise with the County Government of Kilifi and the National Government to request for expansion, upgrading and or maintenance of key access roads that will be used to meet required needs.<br>- Appropriate safety signs including speed pumps to be erected along the said access roads.<br>- Local community to be sensitised on the increased traffic use of the access road and the need for the community to be vigilant and exercise of safety precaution when using the said access roads |
| Ponding risks resulting spread of malaria | - All quarry pits to be adequately drained to ensure no water stagnates when it rains<br>- Proponent to check all active and disused quarry pits to ensure no water stagnates.<br>- All disused quarry pits to be backfilled and rehabilitated as soon as recovery of limestone is complete |
| Injuries and accidents | - The quarry to be safely secured and fenced with a clear entry and exit gates that are manned.<br>- All active quarry pits to be clearly feasibly marked and manned.<br>- There should be no unauthorized access to the quarry pits including that of straying livestock from the community or children playing, or fetching water. |

| Potential negative impact | Proposed mitigation measures |
|---|---|
| | - Appropriate information notices and warning signs to be displayed at periphery of quarry to inform and educate local community of on-going quarrying activity and required safety measures to be observed. |
| HIV and AIDS | - Sensitization programs on issues HIV/AIDS for the quarry staff and local community to be developed and carried out at the quarry site and local community by peer educators.<br>- A condom dispenser always stocked with condoms to be availed at the quarry site<br>- Proponent to arrange for convenient and free voluntary and counseling services for quarry workers to be accessed at the quarry site and any community members willing to benefit from the service. |

**Summary of potential negative environmental impacts may include:-**

- ✓ Loss of site biodiversity
- ✓ Diminishing of local carbon
- ✓ Fugitive dust
- ✓ Vibration
- ✓ Solid waste generation
- ✓ oil and lubricant spills
- ✓ Soil erosion
- ✓ Change in local geological, hydrological and geotechnical conditions

**Proposed mitigation measures of potential negative impacts**

| Potential negative impacts | Proposed mitigation measures |
|---|---|
| Loss of flora | - Limit vegetation removal to actual areas within the proposed project site with limestone to be mined only<br>- MCL to support planting of trees in public areas such as schools, Chief camps, local dispensaries within the project catchment to offset overall vegetation loss in the area |

| **Potential negative impacts** | **Proposed mitigation measures** |
|---|---|
| | - Back fill and plant trees in all pits where mining is completed |
| Loss and displacement of site fauna | - MCL to maintain pockets of vegetation within the proposed project site where there are no limestone to be mined<br>- MCL to maintain pockets of vegetation around the quarry camp that can support local fauna habitat need<br>- MCL to maintain hedge of vegetation along quarry access roads that can support local fauna habitat needs.<br>- MCL to support planting of trees in public areas such as schools, Chief camps, local dispensaries within the project catchment to support local fauna habitat needs |
| Loss of local coconuts trees cover | - Coconut trees growing in parcels of land procured by MCL that do not have limestone deposits that can be mined to be preserved<br>- MCL to support local communities to grow coconut trees in their private farms to offset overall reduction of coconut trees in the area. |
| Generation of fugitive dust | - Regularly sprinkle water on dusty grounds including quarry access roads and active mining areas<br>- Maintain a vegetation buffer around the schools, local homesteads and other social amenities that border limestone pits.<br>- Maintain a hedge of trees along all quarry access roads to act as wind break, noise attenuator and trap fugitive dust |
| Noise disturbance | - Ensure quarry equipment and machinery are well serviced and maintained as per manufacturer's instructions.<br>- Use noise attenuators such as a hedge of vegetation around active quarry pits and along quarry access roads.<br>- Regularly measure and monitor noise levels to ensure they are maintained within the prescribed limits as provided for in the Environmental Management and Coordination (noise and excessive vibration pollution) (Control) Regulations 2009.<br>- MCL to develop and document a comprehensive environmental noise management and conservation programme that will cover |

| **Potential negative impacts** | **Proposed mitigation measures** |
|---|---|
| | all quarry activities. |
| Soil erosion | - Maintain pockets of vegetation including trees to act as wind breaks in areas where limestone will not be mined.<br>- Maintain a vegetation buffer around the schools, local homesteads and other social amenities that border limestone pits.<br>- Plant trees and other vegetation in open areas to minimise exposure of open ground to agents of erosion.<br>- Maintain a hedge of trees along all quarry access roads to act as wind break |
| Spills of oils and lubricants | - Provide an equipment service and maintenance garage complete with a service sump and oil/water separator for servicing quarry equipment.<br>- Provide for oil absorbents to aid in cleaning out any spilled oil and lubricants |
| Ponding of water in quarry pits | - Ensure all quarry pits are adequately and effectively drained to ensure no collection, stagnation and or ponding of rainwater in the pits when it rains. |
| Generation of solid waste | - Ensure all waste generated is managed and disposed as provided for in the Environmental Management and Coordination (Waste Management) Regulations, 2006.<br>- Where possible and applicable practice the four Rs i.e. refuse to generate waste, reduce waste generation, reuse generated waste or recycle generated waste.<br>- Provide for receptacles for dropping and collection of waste<br>- Segregate waste at source appropriately.<br>- Contract the services of a waste collector, ensure the vehicle used to collect waste are licensed by NEMA<br>- Maintain dually filled and completed waste tracking documents for all waste collected and disposed from the quarry |
| Injuries and accidents | - Fence off all active quarry pits and disused quarry pits to ensure no unauthorized person or livestock access the quarry pits. |

| **Potential negative impacts** | **Proposed mitigation measures** |
|---|---|
| | - Promptly backfill all quarry pits where mining of limestone is complete.<br>- Ensure all quarry pits are adequately and effectively drained to ensure no collection, stagnation and or ponding of rainwater in the pits when it rains.<br>- Ensure quarry equipment and machinery are well serviced and maintained as per manufacturer's instructions<br>- Ensure only well trained and experience plant and equipment operators are hired to operate quarry equipment and machinery |
| Increase in trucks on local roads | - Use alternative routes/feeder roads to reduce number of trucks on one local feeder road.<br>- Monitor number of trucks on local feeder roads from and to quarry<br>- Use fewer trucks of higher carrying capacity as opposed many trucks of lower carrying capacity |
| Alteration of local hydrological condition | - Maintain pockets of vegetation within the quarry area to minimize surface runoff and increase rainwater percolation to improve recharge of local aquifer.<br>- Quickly vegetate all areas where mining is completed to reduce soil moisture loss when dry and improve ground water aquifer recharge when it rains.<br>- No mining of limestone close to any existing well or borehole |
| Dilapidation of local roads | - All trucks in and out of the quarry to strictly adhere to required axial load limits on all roads used.<br>- Install weighbridge in the quarry to monitor weight of loaded trucks before they leave the quarry.<br>- Upgrade local roads to meet heavy load transportation demand from the quarry<br>- Regularly rehabilitate and maintain all local roads being used |

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# 1. BACKGROUND

## 1.1 Introduction

This report is an Environmental Impact Assessment Study for proposed mining of coral limestone to be carried out by Mombasa Cement Limited. The Environmental Impact Assessment Study was carried out and report compiled as provided for in Legal Notice No 31 and 32 of 2019, section 58 (2) of the Environmental Management and Coordination Act, 1999 (Amended) 2015 and Regulation 11 (1) of the Environmental (Impact Assessment and Audit Regulations), 2003.

## 1.2 Project definition

The proposed project will entail mining of coral limestone at the proposed project site using the open cast mining method. The mined limestone will then be transported out of the mine by a fleet of dump trucks to Mombasa Cement factory located at Vipingo area of Kilifi County for cement production.

## 1.3 Project Proponent

Mombasa Cement Limited, a private company incorporated with limited liabilities in the Republic of Kenya is the project proponent. The company holds a certificate of incorporation number C. 106734 date eleventh November two thousand and three and personal identification number certificate P051159492Z dated second June 2004. Appendix 1 is copy of the certificate of incorporation and copy of personal identification number certificate.

## 1.4 Location

The proposed mining of coral limestone is to be done in Kilifi County, Kilifi North Sub-County, Roka location and Matsangoni Location (Geographical location 3° 26' 0" South, 39° 54' 0" East) in 116 plots all owned by Mombasa Cement Limited. Within Roka Location the mining will be done in two sub-locations namely Roka Sub-Location and Chumani Sub-Location. Within Matsangoni Location, limestone mining will be carried out in two sub-locations namely Uyombo Sub-Location, and Matsangoni Sub-location (figure 1). The limestone mining will cover 116 plots this being 28 more plots from what was reported in the terms of reference report. Each plot has an individual title deed which is in the name of the proponent. Appendix 2 is a copy of the 116 title deeds as shown in table 1 and 2..

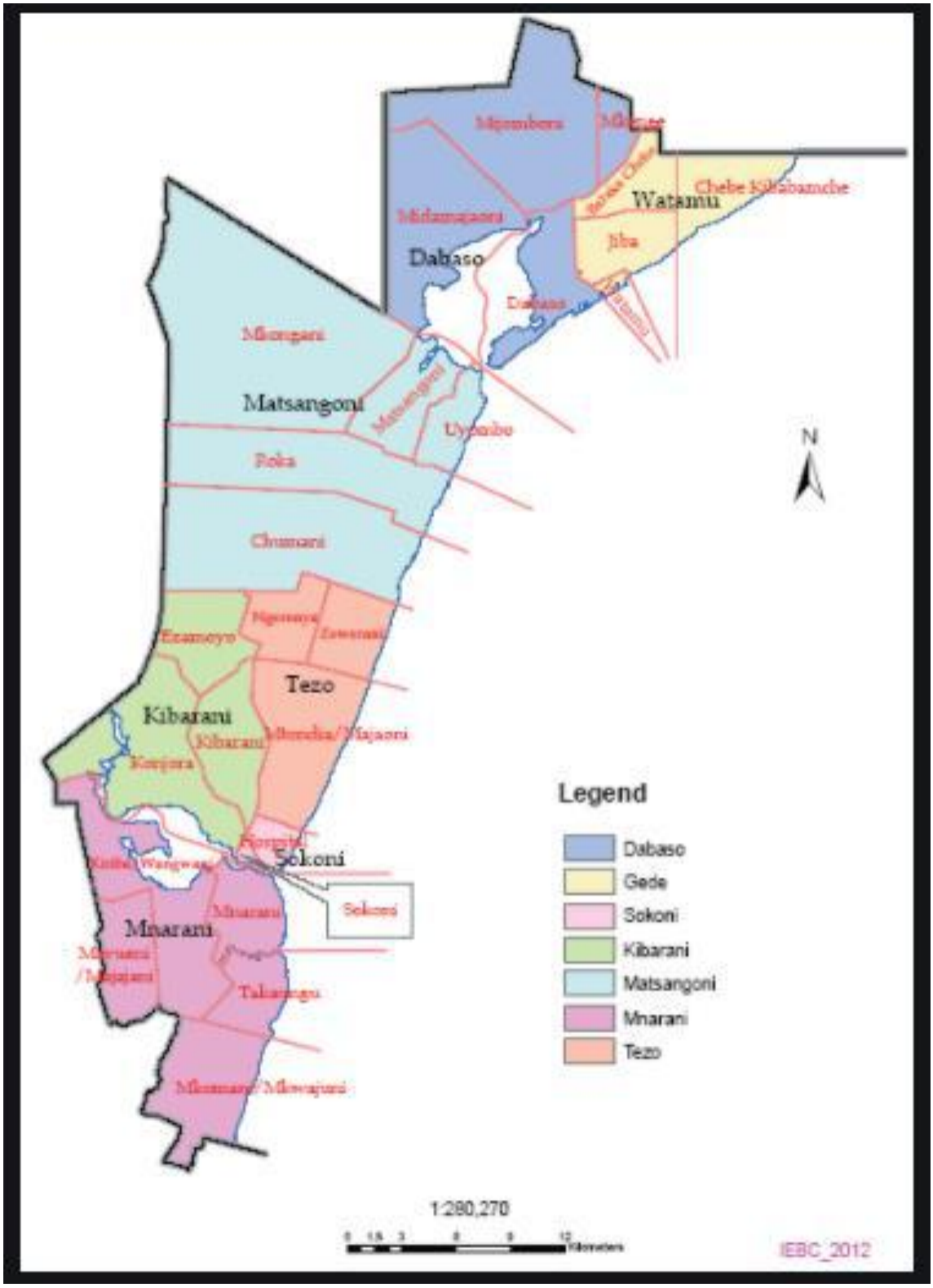


**Figure 1: Map of Kilifi North Sub- County showing Roka and Matsangoni locations**

### 1.5 Change of user

A change of user from agricultural to industrial (stone cutting and mining) has been obtained for the 66 plots (table 10 while 55 of the plots the change of user was yet to be obtained (table

2). The change of user was processed in the names of the previous owners of the plots before being transferred to Mombasa Cement Limited. Appendix 3 is a copy of the change of user

**Table 1: Proposed project land parcels with change of user**

| NO | LAND TITLE DEED | NO | LAND TITLE DEED |
|---|---|---|---|
| 1. | Roka/Uyombo/381 | 34. | Roka/Uyombo/190 |
| 2. | Roka/Uyombo/564 | 35. | Roka/Uyombo/298 |
| 3. | Roka/Uyombo/416 | 36. | Roka/Uyombo/229 |
| 4. | Roka/Uyombo/234 | 37. | Roka/Uyombo/609 |
| 5. | Kilifi/Roka/1008 | 38. | Roka/Uyombo/123 |
| 6. | Roka/Uyombo/231 | 39. | Roka/Uyombo/223 |
| 7. | Roka/Uyombo/481 | 40. | Roka/Uyombo/336 |
| 8. | Roka/Uyombo/459 | 41. | Roka/Uyombo/257 |
| 9. | Roka/Uyombo/227 | 42. | Roka/Uyombo/467 |
| 10. | Roka/Uyombo/612 | 43. | Roka/Uyombo/124 |
| 11. | Roka/Uyombo/469 | 44. | Roka/Uyombo/141 |
| 12. | Roka/Uyombo/439 | 45. | Roka/Uyombo/181 |
| 13. | Roka/Uyombo/485 | 46. | Roka/Uyombo/194 |
| 14. | Roka/Uyombo/212 | 47. | Roka/Uyombo/197 |
| 15. | Roka/Uyombo/370 | 48. | Roka/Uyombo/224 |
| 16. | Roka/Uyombo/318 | 49. | Roka/Uyombo/226 |
| 17. | Roka/Uyombo/607 | 50. | Roka/Uyombo/233 |
| 18. | Roka/Uyombo/452 | 51. | Roka/Uyombo/383 |
| 19. | Kilifi/TezoRoka/1009 | 52. | Roka/Uyombo/388 |
| 20. | Roka/Uyombo/588 | 53. | Roka/Uyombo/410 |
| 21. | Roka/Uyombo/583 | 54. | Roka/Uyombo/460 |
| 22. | Roka/Uyombo/397 | 55. | Roka/Uyombo/479 |
| 23. | Roka/Uyombo/601 | 56. | Roka/Uyombo/488 |
| 24. | Roka/Uyombo/77 | 57. | Roka/Uyombo/175 |
| 25. | Roka/Uyombo/176 | 58. | Roka/Uyombo/444 |
| 26. | Roka/Uyombo/154 | 59. | Roka/Uyombo/230 |
| 27. | Roka/Uyombo/96 | 60. | Roka/Uyombo/242 |
| 28. | Roka/Uyombo/246 | 61. | Roka/Uyombo/475 |
| 29. | Roka/Uyombo/445 | 62. | Roka/Uyombo/64 |

| | | | |
|---|---|---|---|
| 30. | Roka/Uyombo/249 | 63. | Roka/Uyombo/308 |
| 31. | Roka/Uyombo/147 | 64. | Roka/Uyombo/441 |
| 32. | Roka/Uyombo/413 | 65. | Roka/Uyombo/220 |
| 33. | Roka/Uyombo/400 | 66. | Roka/Uyombo/252 |

## 1.6 Project Objective and Scope

### 1.6.1 Proposed project objective

The objective of the proposed project is to mine coral limestone and transport the mined limestone from the mine to Mombasa Cement Limited Factory at Vipingo for production of cement.

**Table 2: Proposed project land parcels without change of user**

| NO | LAND TITLE DEED |
|---|---|
| 1. | Kilifi/Roka/Uyombo/399 |
| 2. | Kilifi/Roka/Uyombo/461 |
| 3. | Kilifi/Roka/Uyombo/131 |
| 4. | Kilifi/Roka/Uyombo/65 |
| 5. | Kilifi/Roka/Uyombo/331 |
| 6. | Kilifi/Roka/Uyombo/384 |
| 7. | Kilifi/Roka/Uyombo/463 |
| 8. | Kilifi/Roka/Uyombo/395 |
| 9. | Kilifi/Roka/Uyombo/157 |
| 10. | Kilifi/Roka/Uyombo/105 |
| 11. | Kilifi/Roka/Uyombo/315 |
| 12. | Kilifi/Roka/Uyombo/239 |
| 13. | Kilifi/Roka/Uyombo/570 |
| 14. | Kilifi/Roka/Uyombo/453 |
| 15. | Kilifi/Roka/Uyombo/255 |
| 16. | Kilifi/Roka/Uyombo/411 |
| 17. | Kilifi/Roka/Uyombo/391 |
| 18. | Kilifi/Roka/Uyombo/196 |
| 19. | Kilifi/Roka/Uyombo/482 |
| 20. | Kilifi/Roka/Uyombo/454 |

| | |
|---|---|
| 21. | Kilifi/Roka/Uyombo/372 |
| 22. | Kilifi/Roka/Uyombo/323 |
| 23. | Kilifi/Roka/Uyombo/376 |
| 24. | Kilifi/Roka/Uyombo/75 |

### 1.6.2 Project scope

The scope of the proposed project is as follows; fencing and securing the proposed project site, construction of quarry camp and associated infrastructure, installation of weighbridge, mobilization of quarry equipment and machinery to site, actual open cast quarrying activities to recover coral limestone, haulage of the recovered coral limestone from site to Vipingo, continuous rehabilitation of disused quarry pits, demobilization of quarrying equipment, decommissioning of all quarry activities and site rehabilitation.

## 1.7 Terms of Reference

Terms of reference (ToR) reference number NEMA/TOR/5/2/177 for the EIA study was prepared and submitted to the National Environment Management Authority (NEMA) for approval. The ToR was approved by NEMA on 19th October 2020 paving way to carry out the environmental impact assessment study and compilation of this environmental impact assessment study report. Appendix 4 is copy of the ToR approval letter from NEMA.

## 1.8 Economic activities in the area

Within the proposed project area, the immediate neighbourhood and the wider project catchment area, there are various economic activities. Notable one include:-

- ✓ Machine cut of coral limestone to recover building blocks. There are a number of quarries in the area which are involved in machine cutting of coral limestone to recover building blocks. Some of these quarries are adjacent to the plots of MCL; others are adjacent to local schools such as that adjacent to Uyombo Girls Secondary School while others are adjacent to homesteads.
- ✓ Cultivation of coconut trees, parts of the land in the neighbourhood including some of the parcels bought by MCL have coconut trees growing. Coconut farming is one of the important economic activities in the area. Other crops grown within the neighbourhood include cassava, watermelon, cowpeas, maize among others
- ✓ Livestock keeping is also carried out within the project catchment area, livestock such as goats and cows have been sported grassing within the project catchment area.


**Plate 1: Active machine cut coral limestone quarries adjacent to proposed project site areas**

**Plate 2: Some of the coconut trees within plots of the proposed project site and in the neighborhood**

**Plate 3: Livestock grazing in sections of the proposed project site**

### 1.9 Potentially affected environment

The proposed coral limestone mining activities will potentially affect the following environments:-

- ✓ Local homesteads adjacent to the proposed project site are likely to be affected from potential dust and noise from proposed quarrying activities.
- ✓ Local schools adjacent to the proposed project site are likely to be affected by potential noise and dust from proposed quarrying activities. This will potentially affect the learning environment for the learners. Further trucks driving in and out of the proposed project site will not only be a destruction to the learners but also a public safety risk.
- ✓ Local roads likely to be used by trucks to and from the proposed project site will be affected from potential increase in traffic in and out of the proposed project site. These roads are likely to be damaged more easily from loaded trucks

- ✓ Local ground water resources within the proposed project site is likely to be affected, the mining will potentially reduce local areas aquifer recharge and hence reduced water yield in the wells besides potential pollution from quarrying activities
- ✓ Local coconut farms within the proposed project site will be negatively affected as coconut trees within parcels of land for the proposed project site will be cut to pave way for proposed mining activities. Also coconut trees on plots adjacent to the proposed project site could potentially be affected by potential dust from the proposed project activities.
- ✓ Machine cut coral limestone building blocks quarries in the area will be affected as they will be competing for local limestone areas with MCL.
- ✓ Local social environment will potentially be affected from proposed project by potential labor influx into the area seeking gainful employment. Further those who will be selling their parcels of land and moving out to settle elsewhere will affect the existing local social fabric. Pressure on local social amenities including health facilities, schools and faith based institutions is likely to be felt from migrants' workers and their followers. This will affect the overall local social environment.

# 2. APPROACH AND METHODOLOGY

## 2.1 Study team

The Environmental Impact Assessment Study was carried out by Sigtuna Consultancy Limited firm of experts and Polucon Services Limited an accredited as follows:

- ✓ Philip Manyi Omenge, Team Leader, EIA/EA Lead Expert, Natural Resources Management/Ecology, Rural Development, Conflict Management and Gender Mainstreaming Specialist.
- ✓ James Morumbasi Mong'oni a registered EIA/EA Lead Expert, a Mechanical Engineer, a Safety Practitioner, Safety Trainer, and Inspector of pressure vessels and lifting equipment.
- ✓ Hezekiah Adala, EIA/EA Lead Expert, Mechanical Engineer, Safety Advisor;
- ✓ Jonathana Katana Yeri, EIA/EA Associate Expert, Soil, Water and Environmental Engineer
- ✓ Polucon Services (Kenya Limited)- Accredited laboratory air quality, noise and vibration and water quality.

Registration certificate and practicing license of the firm of experts is attached in appendix 5 while that of the individual experts is in appendix 6.

The study team was aided by the following members from Mombasa Cement Limited and the local community:-

- ✓ Thomas Orina Basweti- MCL Environmental Safety and Health Officer
- ✓ Yonnah Bosire- MCL in- Charge of Proposed project site
- ✓ Joshua Karisa- Surveyor involved in surveying of the proposed project site
- ✓ Dickson Nyamawi Mwaidza-Roka Maweni Village Elder

## 2.2 Approach

At the beginning of the assignment inception meetings were held between the Proponent and the Consulting Team Leader both in the office and at the proposed project site. The meetings served as formal introduction for clarification of terms of reference for the study team, introduce them to the contact persons and physically show the team the proposed project site. The consulting thereafter embarked on scoping exercise that culminated in the development of terms of reference for the study. Baseline studies and detailed field investigations were later carried out followed by stakeholder consultations. Findings from desk review, baseline

studies and field investigations were compiled into an environmental impact assessment study report.

### 2.3 Methodology

The following methodology was used in undertaking the Environmental Impact Assessment:

i) Scoping and development of Terms of Reference
ii) Desk review of relevant project documents including relevant policy and legislative documents.
iii) Baseline studies and field visits for detailed documentation of site conditions and actual site assessment.
iv) Public participation
v) Reporting.

### 2.3.1Scoping

Scoping identified the important issues in readiness for preparation of terms of reference; it was a critical, early step in the preparation of an EIA study report. The scoping process identified the issues that are likely to be of most importance during the EIA and eliminated those that were of little concern.

### 2.3.2 Desk review

Desk top review included review of the following:

- **Policy documents**: National Environment Policy, 2013, Kenya National Youth Policy, Kenya Gender Policy, and KNBS Economic Survey Report 2017, National Climate Change Framework Policy Sessional Paper No. 5 of 2016 among others.
- **National legislations:** The Constitution of Kenya, 2010; the Mining Act of 2016; The Environmental Management and Coordination Act (EMCA),1999; The Environmental (Impact Assessment and Audit) Regulations, 2003; The Environmental Management and Coordination (Water Quality) Regulations, 2006; The Environmental Management and Coordination (Waste Management) Regulations, 2006; Environmental Management and Coordination (Air Quality) Regulations, 2014; The Public Health Act Cap 242; The Occupational Safety and Health Act 2007; The Physical Planning Act 1996, Cap. 286, The Water Act 2016; Climate Change Act, 2016 among others.
- **Development Plans:** Kilifi County Integrated Development Plan 2013-2017
- International agreements, Conventions, and WB Policies:

### 2.3.3 Baseline studies and field assessment

Baseline studies carried out included local ground water quality analysis, local air quality analysis, noise and vibration levels measurements. Field assessments included local terrestrial flora and fauna survey. The vegetation survey employed the plot-less method to capture plant diversity at the proposed project site. The survey method involved random walks through the proposed project site and recording of the various vegetation species observed. Herpetofauna (reptiles and amphibians) and invertebrates and other terrestrial fauna were observed and recorded. Local account was used to supplement information on existence of species or taxa. Photographic recordings of some of the observed species were done.

### 2.3.4 Public participation

Due to the challenges brought about COVID-19, stakeholder consultations were innovative. To adhere to the government restrictions on large public gatherings, no public baraza was held, and instead identified key stakeholders were consulted in small groups while observing the Ministry of Health guidelines on social distancing. All stakeholder consultation and participation strictly adhered to the Ministry of Health Public Health guidelines and protocols. The proponent provided face masks, hand sanitizers, water and soap for washing hands and ensure that 1.5 m social distance was observed during the consultation process. Public participation involved office consultations with local leaders, focused group discussions, key informant interviews and questionnaire survey

### 2.3.5 Reporting

All the information and data collected from scoping exercise, the desk top document review, field assessments and stakeholder consultation and participation was compiled into two reports namely:-

- ✓ Terms of Reference Report; and
- ✓ Environmental Impact assessment (EIA) Study Report.

Terms of Reference Report was submitted to NEMA as specified in Regulation 11 (1) and 11(2) of the Environmental (Impact Assessment and Audit) Regulations, 2003. The Environmental Impact assessment (EIA) Study Report was prepared as specified in Regulation 18 of the Environmental (Impact Assessment and Audit) Regulations, 2003 and submitted to NEMA as specified in Regulation 19 of the Environmental (Impact Assessment and Audit) Regulations, 2003.

# 3. BACKGROUND TO ENVIRONMENTAL IMPACT ASSESSMENT

## 3.1 Definition of Environmental Impact Assessment

Broadly environmental impact assessment (EIA) refers to the need 'to identify and predict the impact on the environment and on man's health and wellbeing of legislative proposals, policies, programmes, projects and operational procedures, and to interpret and communicate information about the impacts'(Munn 1979). UNECE (1991) defines EIA as 'an assessment of the impacts of planned activity on the environment', IAIA (2009) on the other hand defines EIA as 'the process of identifying, predicting, evaluating and mitigating the biophysical, social and other relevant effects of proposed development proposals prior to major decision being taken and commitments made'. Glasson *et.al* (2012) defines EIA as 'a systematic process that examines the environmental consequences of development actions in advance'. EIA is thus a vital tool that aid formulation of development actions, decision making, an instrument for sustainable development and vehicle for stakeholder consultation and participation (Glasson *et.al* 2012).

## 3.2 The purposes of EIA

### 3.2.1 An aid to decision making

EIA is an aid to decision-making. For the decision maker, for example, a local authority, it provides a systematic examination of the environmental implications of a proposed action, and sometimes alternatives, before a decision is taken. The EIA can be considered by the decision-maker along with other documentation related to the planned activity. EIA is normally wider in scope and less quantitative than other techniques, such as cost-benefit analysis (CBA).It is not a substitute for decision making, but it does help to clarify some of the trade-offs associated with a proposed development action, which should lead to more informed and structured decision-making. The EIA process has a potential, not always taken up, to be a basis for negotiation between the developer, public interest groups and the planning regulator. This can lead to outcome that balances well the interests of the development action and the environment.

### 3.2.2 An aid to the formulation of development actions

Developers may see the EIA process as another set of hurdles to jump before they can proceed with their various activities; the process can be seen as yet another costly and time-consuming activity in the development consent process. However, EIA can be of great benefit to them, since it can provide a framework for considering location and design issues

and environmental issues in parallel. It can be an aid to the formulation of development actions, indicating areas where a project can be modified to minimize or eliminate all together its adverse impacts on the environment. The consideration of environmental impacts early in the planning life of a development can lead to more environmentally sensitive development; to improved relations between the developer, the planning authority and the local communities; to a smoother development consent process, and sometimes to a worthwhile financial return on the extra expenditure incurred. O'Riordan (1990) links such concepts of negotiation and redesign to the important environmental themes of 'green consumerism' and 'green capitalism'. The growing demand by consumers to goods that do no environmental damage, plus a growing market for clean technologies, is generating a response from developers. EIA can be the signal to the developer of potential conflict; wise developers may use the process to negotiate 'environmental gain' solutions, which may eliminate or offset negative environmental impacts, reduce local opposition and avoid costly public inquiries. This can be seen in the wider and contemporary context of corporate social responsibility (CSR) being increasingly practiced by major businesses (Crane et al.2008)

### 3.2.3 A vehicle for stakeholder consultation and participation

Development actions may have wide-ranging impacts on the environment, affecting many different groups in society. There is increasing emphasis by government at many levels on the importance of consultation and participation by key stakeholders in the planning and development of projects. EIA can be a very useful vehicle for engaging with communities and stakeholders, helping those potentially affected by a proposed development to be much better informed and to be more fully involved in the planning and development process.

### 3.2.4 An instrument for sustainable

Existing environmentally harmful developments have to be managed as best as they can. In extreme cases, they may be closed down, but they can still leave residual environmental problems for decades to come. It would be much better to mitigate the harmful effects in advance, at the planning stage, or in some cases avoid the particular development together. This of course leads on to the fundamental role of EIA as an instrument for sustainable development-a role some writers have drawn attention to as one often more hidden than it should be when EIA effectiveness is being assessed (Jay et al.2007).

### 3.3 Origins and development of EIA

The first EIA legislation was formerly established in the United States of America in 1969 (NEPA 1970), in Europe the 1985 European Community directive on EIA (Directive 85/337) introduced broadly uniform requirements for EIA for all member states (CEC, 1985). In Australia, the Commonwealth EIA system was established in 1974 under the Environmental Protection (Impact of Proposal) Act (Wood 2003, Ellott and Thomas, 2009). The United Kingdom enacted a formal legislation on EIA in 1988 (Glasson *et.al* 2012). China formerly enacted its first EIA legislation in 1979 (Moorman and Ge 2007). In Africa and the Middle East, Israel and Algeria pioneered in enactment and implementation of EIA legislations in 1982, 2003 and 1983, 1990 respectively (Economic Commission for Africa, (2005) Almagi *et.al* (2007). In East Africa Uganda pioneered in enacting EIA legislation in 1998, Kenya EIA legislation was enacted in 2000, and implemented in 2003 (Morara *et.al* 2011).

### 3.4 Key elements in the EIA process

The environmental impact assessment process comprises of various interactive steps such as screening, scoping, consideration of alternatives, action design, preparation of the EIA report, reviewing or evaluating the report, decision making, and post decision activities such as monitoring and auditing (Glasson *et al.,* 1994; Wood, 1995). According to UNEP (2002) key elements in the EIA process are screening, scoping, impact analysis, mitigation, reporting, review, decision-making, follow up and public involvement. Figure 2 is the schematic presentation of general EIA process adopted from UNEP' environmental impact assessment training manual.

#### 3.4.1 Screening

Screening determines whether or not a proposal requires an EIA and, if so, what level of analysis is necessary. This process brings clarity and certainty to the implementation of EIA, ensuring that it neither entails excessive review nor overlooks proposals that warrant examination.

#### 3.4.2 Scoping

Scoping identifies the important issues in readiness for preparation of terms of reference; it is a critical, early step in the preparation of an EIA (UNEP. 2002). The scoping process identifies the issues that are likely to be of most importance during the EIA and eliminates those that are of little concern. In this way, EIA studies are focused on the significant effects and time and money are not wasted on unnecessary investigations (Glasson *et al.*, 2012).

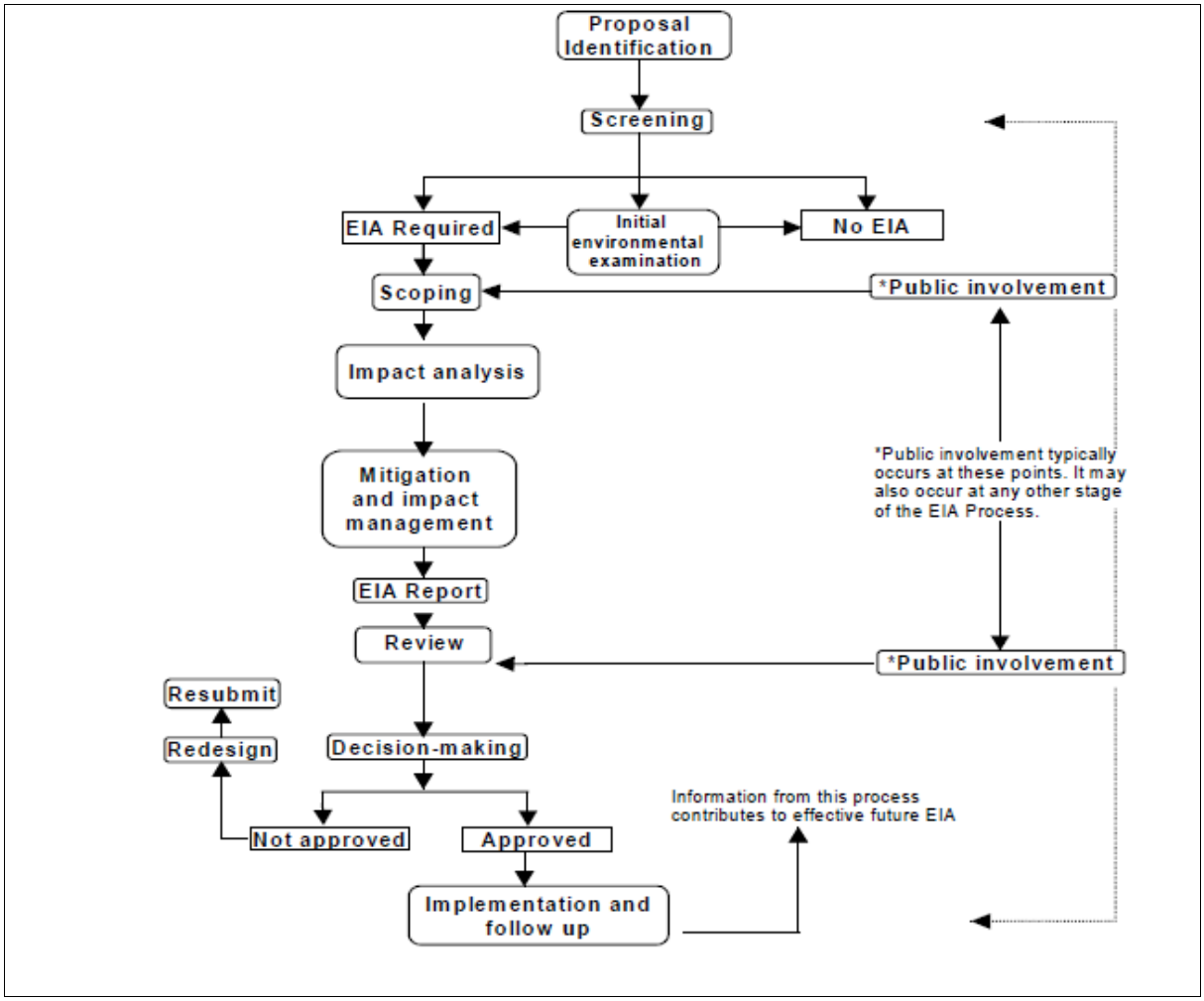


**Figure 2: Generalized EIA process flowchart. Adapted from UNEP 2002**

### 3.4.3 Impact analysis

Impact analysis is carried out in the detailed phase of the EIA; it involves identifying the impacts more specifically, predicting the characteristics of the main impacts and evaluating the significance of the residual impacts (UNEP, 2002).

### 3.4.4 Impact Mitigation

Mitigation is the stage of the EIA process when measures are identified to avoid, minimize or remedy impacts. These measures are implemented as part of the process of impact management, together with any necessary adjustments to respond to unforeseen impacts. Both elements are integral to ensuring that the EIA process leads to practical action to offset the adverse environmental impacts of proposed developments (UNEP, 2002). Mitigation recommends feasible and cost–effective measures to prevent or reduce significant negative impacts to acceptable levels.

### 3.4.5 Reporting

Reporting involves compiling all the information obtained into an EIA report which is a keystone document. It assembles the information that assists the proponent in managing the impacts of the proposal, the responsible authority in decision-making and condition setting; and the public in understanding the likely impacts of the proposal (UNEP, 2002).

### 3.4.6 Report review

The review stage of the EIA report is one of the main 'checks and balances' built into the EIA process to establish the quality of an EIA. It helps to ensure the information submitted is credible and sufficient for decision-making purposes (UNEP, 2002) by verifying the accuracy and comprehensiveness of the report (Glasson *et al.*, 2012). The decision-making element of the EIA process involves approving or rejecting the proposal and setting conditions. Decision making stage provides for incorporation of environmental considerations into proposed development (Glasson *et al.*, 2012). Once the proposed project is approved, implementation and follow up complete the EIA process (UNEP, 2002).

### 3.4.7 Monitoring and auditing

Monitoring, auditing and other tools are used to 'close the loop' of impact prediction and condition setting (Sadler, 1996). Monitoring and auditing is vital as it is used to identify the impacts that occur; to check that these are within the levels predicted and required by legislation; determine that mitigation measures are properly implemented and work effectively; ensure the environmental benefits expected are being achieved; and provide feedback to improve future applications of the EIA process (Arts, 1998)**.**

# 4. POLICY AND LEGAL FRAMEWORK

## 4.1 Relevant National Policies

### 4.1.1 National Environment Policy, 2013

The National Environment Policy document was prepared with the goal of bettering the quality of life for present and future generations through sustainable management and use of the environment and natural resources. The document underscores the importance and contribution of environment and natural resources to the local and national economy, people's livelihoods and the provision of environmental services such as watershed protection and carbon sequestration. It also reviews the status of environment in Kenya and highlights the key environmental issues and challenges. It identifies Kenya's critical ecosystems and natural resources and proposes measures to enhance conservation and management of ecosystems and sustainable use of natural resources. It addresses a wide range of issues relating to environmental quality and health. The areas covered include air quality, water and sanitation, waste management, radiation, toxic and hazardous substances, noise, HIV and AIDS and environmental diseases. It also outlines strategies and actions that will ensure effective implementation of the Policy and the Environmental Management and Coordination Act.

### 4.1.2 National Climate Change Framework Policy Sessional Paper No. 5 of 2016

This Policy was developed to facilitate a coordinated, coherent and effective response to the local, national and global challenges and opportunities presented by climate change. The policy adapts an overarching mainstreaming approach to ensure the integration of climate change considerations into development planning, budgeting and implementation in all sectors and at all levels of government. The Policy therefore aims to enhance adaptive capacity and build resilience to climate variability and change, while promoting a low carbon development pathway. The response to climate change in Kenya must adhere to the constitutional governance framework and commitment to sustainable development, while addressing the goal of attaining low carbon climate resilient development. To attain the latter, the policy focuses on appropriate mechanisms to enhance climate resilience and adaptive capacity, and the transition to low carbon growth.

## 4.2 National legislations

### 4.2.1 The Constitution of Kenya, 2010

The Constitution of Kenya 2010 is the overarching legal framework for matters on environment. It recognizes the environment as part of the country's heritage, and which must be safeguarded for future generations. It provides for the right to a clean and healthy

environment for every person in Article 42, obligating the state to enact legislation to protect that right as well as to establish systems of environmental impact assessment, environmental audit and monitoring of the environment in Article 69.

Article 69 imposes on the State, other obligations including, to:

- Ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits;
- Encourage public participation in the management, protection and conservation of the environment;
- Eliminate processes and activities that are likely to endanger the environment; and
- Utilize the environment and natural resources for the benefit of the people of Kenya.

Article 69 (2) similarly confers a conservation obligation on parties including the proponent of the proposed project. The proponent is thus obligated to cooperate with State organs and other persons to protect and conserve the environment.

### 4.2.2 The Environmental Management and Co-ordination Act, 1999 (Amended) 2015

EMCA, 1999 (Amended) 2015 provides a legal and institutional framework for the protection and conservation of the environment in line with Article 42 of the Constitution of Kenya, 2010. The ultimate objective is to provide a framework for integrating environmental considerations into the country's overall economic and social development. According to section 58 of the Act projects specified in the second schedule that are likely to have significant impact on the environment have to be subjected to an EIA study. Mining and other related activities are categorized as high risk projects in the second schedule and hence must be subjected to environmental impact assessment study prior to implementation.

### 4.2.3 The Occupational Safety and Health Act, 2007

This Act came into force in 2007 and replacing The Factories and Other Places of Work Act, Cap 514. It makes provisions for the health, safety and welfare to be observed by employers and persons employed in places of work. Part IV of the act covers health issues such as the state of cleanliness, refuse management, employee space requirement, ventilation and sanitary conveniences. Part V covers fire safety, operation and maintenance of machinery, fencing requirements, storage of dangerous substances, training and supervision of workers. Part VI deals with welfare issues; drinking water supply, washing facilities, sitting areas and first aid provision.

### 4.2.4 The Water Act 2016

This is an act provides for the regulation, management and development of water resources, water and sewerage services; and for other connected purposes. The Act aligns the water sector with the new Constitution's primary objective of devolution. The Act recognizes that water related functions are a shared responsibility between the national government and the County government. The Act provides that every person has the right to access water resources, whose administration is the function of the national government as stipulated in the Fourth Schedule to the Constitution. Section 63 thereof also provides that every person in Kenya has the right to clean and safe water in adequate quantities and to reasonable standards of sanitation as stipulated in Article 43 of the Constitution. The Water Resource Authority was established under this Act to protect, conserve, control and regulate use of water resources through the establishment of a national water resource strategy. The Water Act provides for the conservation and controlled use of water resources in Kenya. Under the Ministry of Water the Act prohibits pollution of water resources and controls the discharge of industrial and municipal effluents into the ocean and other water bodies.

### 4.2.5 Mining Act 2016

This is an act of Parliament to give effect to Articles 60, 62 (1)(f), 66 (2), 69 and 71 of the Constitution in so far as they apply to minerals; provide for prospecting, mining, processing, refining, treatment, transport and any dealings in minerals and for related purposes. The Mining Act, 2016 came into force on May, 2016 thereby repealing the previous Mining Act (Cap.306) which was enacted in 1940. Limestone is categorized as a mineral under this Act.

In this Act, a holder of a mining license shall:-

- Conduct mining operations in compliance with the approved programme for mining operations;
- Comply with the terms and conditions of the approved environmental impact assessment license, social heritage assessment and environmental management plan relating to the operations to be carried out under the mining license;
- Demarcate and keep demarcated the mining area in the prescribed manner;
- Comply with the conditions of the license, any applicable mineral agreement and any directions issued by the Cabinet Secretary or an authorized officer in accordance with this Act;
- Submit to the Cabinet Secretary up to date quarterly returns of mine development and mineral production;

- Stack or dump any mineral or waste products in the manner provided for in the license or as otherwise prescribed, having regard to good mining industry practice;
- Carry out prospecting and mining activities in accordance with international best practice and the prescribed guidelines; and
- Sign a community development agreement with the community where mining operations are to be carried out in such a manner as shall be prescribed in Regulations.

The holder of a mining license under this Act shall keep at the registered office, a complete and accurate record of the mining operations in the prescribed form. Records shall include:-

- Copies of all maps, geological reports, sample analysis, aerial photographs, cores, logs and tests and other data obtained and compiled by the license holder;
- Financial statements and such other books of account as the Cabinet Secretary may prescribe; and
- Such other reports and information as may be prescribed or otherwise determined by the Cabinet Secretary.

The holder of a mining license under this Act shall give the Cabinet Secretary a notice of any intention to cease or suspend mining operations, or curtail production carried on pursuant to the mining license. The holder shall give notice of at least -

- Six months, for cessation of mining operation;
- Three months, for suspension of mining operation; or
- One month, for curtailment in production.

A notice given under section shall include a statement that sets out the technical and economic basis for the proposed cessation, suspension or curtailment of production. Under the Act, the Cabinet Secretary shall not grant a prospecting license, a retention license or a mining license to an applicant; unless the applicant has submitted a site mitigation and rehabilitation or mine-closure plans for approval. The proposed coral limestone mining project will comply fully with the provisions and requirements of the Mining Act.

### 4.2.6 The Lands Act 2012

The Land Act 2012 is "an Act of Parliament to give effect to Article 68 of the Constitution, to revise, consolidate and rationalize land laws; to provide for the sustainable administration and management of land and land based resources, and for connected purposes". Part I of the act is preliminary provisions, part II of the act deals with management of public land, part III of the act deals with administration of public land (Leases, Licenses

and Agreements), part IV of the act deals with community land, part V of the act deals with administration and management of private land, part VI of the act deals with general provisions of leases, part VII of the act deals with general provisions of charges, part VIII of the act deals with compulsory acquisition of interests in land, part IX of the act deals with settlement programmes, part X of the act deals with easements and analogous rights, part XI of the act deals with miscellaneous, the schedule lists repealed laws i.e. The Wayleaves Act, Cap. 292 and The Land Acquisition Act, Cap. 295. The proposed mining of coral limestone will comply with the provisions and requirements of the Lands Act 2012.

### 4.2.8 Work Injuries Benefits Act 2007

Section 7 of the Act stipulates that every employer shall obtain and maintain an insurance policy with an insurance company approved by the Minister in respect of any liability that the employer may incur under this Act to any of his employees. An employee who is involved in an accident resulting in the employees' disability or death is subject to the provisions of this Act, and entitled to benefits provided for under the Act. Section 3 of the Act however states that no employee shall be entitled to compensation if an accident, not resulting to serious disability or death, is caused by the deliberate and willful misconduct of the employee. The proposed project will comply with the provisions and requirements of this Act.

## 4.3 Regulatory Framework

### 4.3.1 The Environment (Impact Assessment and Audit) Regulations, 2003

These regulations provide guidelines for conducting an EIA study as well as environmental auditing and monitoring. The Regulations state in Regulation 3 that "the Regulations should apply to all policies, plans, programmes, projects and activities specified in Part III and V of the Regulations" basically lists the guidelines of undertaking, submission and approval of the EIA/SEA Report.The Regulations requires proponents to conduct annual environmental audits to identify the environmental impacts of their undertakings and propose mitigation measures to improve their environmental performance. Section 17 of the same regulation stipulates that during the process of conducting the audit the proponent shall seek the views of persons who may be affected by their operations. This EIA study report is carried out by the project proponent of the proposed project in partial fulfillment to the provisions of this legislation.

### 4.3.2 Building Operations and Works of Engineering Construction Rules, 1984

The provisions of the Factories Act relevant to building operations and engineering construction works are contained in the Abstract of the Act for Building Operations and Works of Engineering Construction Rules. These rules specify the minimum safety and health measures to be taken during construction works which include that the proponent should:

- Give notice of particular operations or works;
- Such notice should be sent in writing to the Occupational Health and Safety Officer, not later than seven days after commencement of construction;
- Post printed copies or prescribed abstracts of the Occupational Safety and Health Act at the site of operations or works (Section 61 of the Act);
- Provide sufficient and suitable sanitary conveniences for persons employed. These must be kept clean and well lit.

The proposed project will adhere to the provisions of this rules..

### 4.3.3 Noise and Excessive Vibration (Pollution Control) Regulations, 2009

The regulations apply to persons wishing to operate or repair any equipment or machinery, engage in any commercial or industrial activity that is likely to emit noise or excessive vibrations. The regulations specify the limits or levels within which these shall be undertaken. The Regulations also stipulate in the second schedule that construction activities undertaken during the night should not emit excessive noise beyond the permissible levels. Mombasa cement will comply to the provisions of these regulations during implementation of the proposed coral limestone mining project.

### 4.2.7 The Public Health Act Cap 242

Key relevant provisions of this Act are:

- Section 10, 11, 12, and 13 for regulating the maintenance, repair and inspection of drains, latrines, cesspool or septic tanks
- Section 28, 29, and 30 which give requirements for the construction of drains in connection with buildings and
- Section 115 prohibiting nuisances that may cause injury or health hazards.

The proposed mining project will comply with the provisions of the Public Health Act.

### 4.3.4 Environmental Management and Coordination (Water Quality) Regulations, 2006

These regulations provide protection to ground water or surface water from pollution by providing the limits and parameters of pollutants in treated wastewater which can be discharged into the environment.

Relevant provisions of this regulation applicable to the proposed project include:-

- Every person shall refrain from any act which will directly or indirectly cause pollution and it shall be immaterial whether or not the water source was polluted before the enactment of these regulations;
- No person shall throw or cause to flow into or near a water source any liquid, solid or gaseous substance or deposit any such substance as to cause pollution;
- Discharge of effluent from sewer must be licensed according to the act;
- Water abstraction must only be done after approval of an Environmental Impact Assessment study.

### 4.3.5 Environmental Management and Coordination (Waste Management) Regulations, 2006

Part II of these regulations lists the responsibility of the waste generator and prescribes the proper mechanism of handling all waste through segregation and finally proposes environmental management programme through implementation of cleaner production mechanisms.

Relevant provisions of this regulation include:-

- Prohibition of any waste disposal on a public highway, street, road, recreational area or in any public place except in designated waste receptacle
- All waste generated to be collected, segregated and disposed in a manner provided for under these regulations
- All waste generators to minimize waste generated by adopting cleaner production methods
- All waste transporters to be licensed according to the Act
- Collection and transportation of the waste to be done in such a manner not to cause scattering of the waste
- The vehicle and equipment for waste transportation to be in such a manner not to cause scattering or escape of the waste

The proponent should ensure that the waste is managed in line with the provisions of these regulations.

### 4.3.6 Environmental Management and Coordination (Air Quality) Regulations, 2014

The objective of these Regulations is to provide for prevention, control and abatement of air pollution to ensure clean and healthy ambient air. The general prohibitions state that no person shall cause the emission of air pollutants listed under First Schedule (priority air pollutants) to exceed the ambient air quality levels as stipulated under the provisions of the Seventh Schedule (Emission limits for controlled and non-controlled facilities) and Second Schedule (Ambient air quality tolerance limits). The proponent will be guided by provisions of this act, during operation phase. Air quality monitoring will be guided by the standards stipulated thereof.

# 5. BASELINE INFORMATION

## 5.1 Biodiversity

The proposed project site is rich in biodiversity. Flora at the proposed project site includes trees, shrubs, herbs, grasses and sedge. Fauna at the proposed project site include herpetofauna mainly reptiles and amphibians, invertebrate and avifauna.

### 5.1.1 Flora diversity

Flora diversity at the proposed project site includes trees, shrubs, herbs, grasses and sedge. Trees at the proposed project site include *Azadirachta indica* (Neem tree), *Adansonia digitata* (Baobab), *Albizia gummifera* (Mchani mbao), *Manilicara sulcata, Tamarindus indica.* Table 3 is a list of flora at the proposed project site.


**Plate 4: A bush of neem at the proposed project site**

**Table 3: Species of trees observed**

| **Genus** | **Species** |
|---|---|
| *Acacia* | *nilotica* |
| *Tamarindus* | *indica* |
| ***Commiphora*** | ***edulis*** |

| | |
|---|---|
| *Adansonia* | *digitata* |
| *Manilkara* | *sansibarensis* |
| *Berchemia* | *discolour* |
| *Grewia* | *bicolour* |
| *Flacourtia* | *indica* |
| *Terminalia* | *brevipes* |
| *Ziziphus* | *mauritiana* |
| *Prosopis* | *juliflora* |

### 5.1.2 Fauna diversity

Fauna at the proposed project site include herpetofauna mainly reptiles and amphibians, invertebrate mainly insect pollinators; beetles, ants, and avifauna. Reptiles and amphibians include Black-lined plated lizard (*Gerrhosaurus nigrolineatus*), Puff Adder (*Bitis arietans),* Black mamba (*Latastia longicaudata*), Flap-necked chameleon, python and green mamba. Invertebrates observed at the proposed project site include pollinators of the bee family mainly *Apis melifera,* butterflies mainly *Papilio demodocus*, *Junonia oenone* and *Euphaedra neophron and* grasshopper (*Byblia ilithyia*). Avifauna at the site include Golden Pipit (*Tmetothylacus tenellus),* Malindi Pipit (*Anthus melindae),* Spotted Morning-thrush (*Cichladusa guttata),* Cattle Egret (*Bubulcus ibis),* Namaqua Dove (*Oena capensis).*

**Table 4: Species of butterflies observed in and in the neighborhood of the project site**

| **Genus** | **Species** | **Genus** | **Species** |
|---|---|---|---|
| *Azanus* | *jesous* | *Hypolycaena* | *philippus* |
| *Tirumala* | *petiverana* | *Colotis* | *danae* |
| *Physcaeneura* | *leda* | *Colitis* | *euippe* |
| *Belenois* | *thysa* | *Junonia* | *orithya* |
| *Belenois* | *aurota* | *Junonia* | *natalica* |
| *Phalanta* | *phalantha* | *Colitis* | *daira* |
| *Acraea* | *insignis* | *Eurema* | *regularis* |
| *Zizula* | *hylax* | *Deudorix* | *antalus* |
| *Papilio* | *demodocu* | *Byblia* | *ilithyia* |
| *Pardopsis* | *punctatissima* | *Catopsilia* | *florella* |

| | | | |
|---|---|---|---|
| *Salamis* | *parhassus* | *Colitis* | *vesta* |
| *Tuxentius* | *calice* | *Colotis* | *protomedia* |
| *Vanessa* | *cardui* | *Colotis* | *vesta* |
| *Ypthima* | *asterope* | *Cupidopsis* | *iobates* |
| *Zizina* | *antanossa* | *Danaus* | *chrysippus* |
| *Acraea* | *eponina* | *Eurema* | *floricola* |
| *Amauris* | *niavius* | *Eurytela* | *dryope* |
| *Amauris* | *ochlea* | *Freyeria* | *trochylus* |
| *Anthene* | *butleri* | *Graphium* | *angolanus* |
| *Axiocerses* | *harpax* | *Hypolimnas* | *misippus* |
| *Baliochila* | *hildegarda* | *Junonia* | *hierta* |
| *Belenois* | *creona* | *Junonia* | *oenone* |


**Plate 5: *Ricinus communis* growing at the edge of the access road**

**Table 5: Species of shrubs**

| **Genus** | **Species** |
|---|---|
| *Cassia* | *occidentalis* |
| *Aeschynomene* | *indica* |
| *Sansevieria* | *suffruticosa* |
| *Tephrosia* | *villosa* |
| *Calotropis* | *procera* |
| *Lawsonia* | *inermis* |
| *Melhania* | *ovata* |
| *Solanum* | *incanum* |
| ***Thilachium*** | ***africanum*** |
| *Triumfetta* | *rhomboidea* |
| *Waltheria* | *indica* |
| ***Strychnos*** | ***spinosa*** |
| ***Grewia*** | ***plagiophylla*** |
| *Grewia* | *plagiophylla* |
| *Grewia* | *forbesii* |
| ***Flueggea*** | ***virosa*** |
| *Agave* | *sisalana* |
| ***Ricinus*** | ***communis*** |
| *Hibiscus* | *vitifolius* |

**Table 6: Species of birds observed in and in the neighborhood of proposed project site**

| **Species** | **Common Name** |
|---|---|
| *Anthus melindae* | Malindi Pipit |
| *Ploceus cucullatus* | Village Weaver |
| *Anthus cinnamomeus* | Grassland Pipit |
| *Platalea alba* | African Spoonbill |
| *Glareola pratincola* | Collared Pratincole |
| *Turtur chalcospilos* | Emerald-spotted Wood-dove |
| *Ardea melanocephala* | Black-headed Heron |
| *Bubulcus ibis* | Cattle Egret |
| *Anastomus lamelligerus* | African Openbill |
| *Halcyon leucocephala* | Grey-headed Kingfisher |

## 5.2 Baseline air quality/particulate matter survey

Air quality remains a valued component in this assessment because of its fundamental significance to the well-being of humans, flora and fauna. This air quality baseline report forms part of a comprehensive baseline study of the proposed limestone mining and quarrying activities for the Mombasa Cement Limited. The purpose of this baseline environmental study was to determine conservative background ambient concentrations for contaminants of concern at the three proposed project areas of Roka, Chumani, and Matsangoni. Ambient air quality was done using the Aeroqual portable air quality device. Active method of monitoring was used during exercise. Ambient air quality was done for thirty monitoring locations and the following parameters were monitored:

- Particulate matter ($PM_{10}$)
- Particulate matter ($PM_{2.5}$)

### 5.2.1 Rationale for Monitoring Parameter Selection

A quarry is a place where rocks, sand, or minerals are extracted from the surface of the Earth. A quarry is a type of mine called an open pit mine because it is open to the Earth's surface. Another type of mine, a sub-surface mine, consists of underground tunnels or shafts. Quarrying is an activity where stones are dug for the purpose of being used in building, making roads through cutting, digging, or blasting. Quarrying is a huge supporter of local economic development: as the use of extracted material enhances trade, creating jobs for most people who depend on this for their livelihoods aside from other economic activities. Rock quarrying and stone crushing is a global phenomenon and has been the cause of concern everywhere in the world, including the advanced countries. Quarrying activity is a necessity that provides much of the materials used in traditional hard flooring, such as granite, limestone, marble, sandstone, slate and even just clay to make ceramic tiles. However, like many other man-made activities (anthropogenic factors), quarrying activities cause significant impact on the environment (Okafor, 2006). Dust from quarry sites is a major source of air pollution, although the severity will depend on factors like the local microclimate conditions, the concentration of dust particles in the ambient air, the size of the dust particles and their chemistry. Dust is one of the most visible, invasive, and potentially irritating impacts associated with quarrying, and its visibility often raises concerns that are not directly proportional to its impact on human health and the environment (Howard and Cameron, 1998). Dust may occur as fugitive dust from excavation, from haul roads, and from blasting, or can be from point sources, such as open cast mining, crushing, and screening

(Langer, 2001). Site conditions that affect the impact of dust generated during extraction of aggregate and dimension stone include rock properties, moisture, ambient air quality, air currents and prevailing winds, the size of the operation, proximity to population centers, and other nearby sources of dust. Dust concentrations, deposition rates, and potential impacts tend to decrease rapidly away from the source (Howard and Cameron, 1998). The air pollution is not only a nuisance (in terms of deposition on surfaces) and possible effects on health, in particular for those with respiratory problems but dust can also have physical effects on the surrounding plants, such as blocking and damaging their internal structures and abrasion of leaves and cuticles, as well as chemical effects which may affect long-term survival (Guach, 2001). The targeted parameters were monitored using proven sampling and analytical methods.

### 5.2.2 Monitoring Objectives

To measure the concentrations of fugitive particulates and gaseous parameters at selected locations (thirty) surrounding the project area and results compared to the Environmental Management and Coordination (Air Quality) Regulation 2014 for compliance purpose.

### 5.2.3 Methodology

It is important to accurately determine a baseline against which predicted effects can be gauged and assessed for any environmental effects' assessment. Detailed baseline data is also particularly desirable for air quality effect assessments involving modeling, as it enables modeled concentrations for the baseline situation to be correlated with monitored concentrations. This process enables greater confidence to be placed in model predictions. Baseline ambient air quality data were obtained from an ambient air quality monitoring program.

The ambient air monitoring stations for this study consist of thirty specific monitoring stations. Information for the Baseline Report is presented based on air monitoring completed for instantaneous weighted averages at each monitoring location.

#### 5.2.3.1 Active monitoring for gaseous and particulate parameters

It is important to accurately determine a baseline against which predicted effects can be gauged and assessed for any environmental effects' assessment. Active monitoring by use of real time equipment (Aeroqual) was deployed. The aeroqual gas meter series, a state-of-the-art gas analyser sensor is used for measurements The gas sensitive semiconductor (GSS)

sensor uses proprietary sensing material, built in automatic Correction (ABC) and interference rejection. This combination results in ppb resolution and a highly linear response. The gas sensitive electrochemical (GSE) sensors generate nano-amp currents proportional to the gas concentration. Aeroqual uses low noise electronics to capture these signals resulting in low detection levels. The laser particle counter (LPC) for Particulate Matter (PM) measurements uses optimized signal processing using low noise electronics added algorithms to correct for interferences. The non-dispersive infrared (NDIR) sensor uses infra-red light, a narrow band-pass filter and photodiode to measure the intensity of light at the gas absorption band. The light intensity is proportional to the gas concentration.

#### 5.2.3.2 Instrumentation

- Aeroqual portable air quality monitor
- Geographical positioning system (GPS)
- Digital camera

### 5.2.4 Monitoring Frequency

Air quality monitoring was conducted on 14$^{th}$ and 15$^{th}$ November 2020 for thirty monitoring locations within Roka, Chumani, and Matsangoni areas.

### 5.2.5 Monitoring Location

The air quality monitoring was conducted at the three target areas of the proposed project site namely, Roka, Chumani, and Matsangoni all located in Kilifi County. Thirty monitoring stations were selected. Point selection was based on the size of the site, maintaining a 10m minimum radius between each point. Detailed baseline monitoring report is in appendix 7.

**Table 7: A table of monitoring locations, parameters tested & GPS coordinates**

| Area Monitored | Parameters tested | GPS Coordinates | Weather and wind speed and direction |
|---|---|---|---|
| Point 1(Near Uyombo girls' Secondary school and close to an old quarry site) | $PM_{2.5}$ and $PM_{10}$ | S 03 25'212"<br>E 039.57'271" | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 2 (Close to Uyombo primary school and surrounded by bushes). | $PM_{2.5}$ and $PM_{10}$ | S 03 22'503"<br>E .039.55'323" | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 3 Control point far from MCL property | $PM_{2.5}$ and $PM_{10}$ | S 03 22'825"<br>E 039.55'581 | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 4 Control point Mkongani area | $PM_{2.5}$ and $PM_{10}$ | S 03 28'656"<br>E 039.55'890 | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 5Near residentials area | $PM_{2.5}$ and $PM_{10}$ | S 03 28'656"<br>E 039.54'976 | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 6 Near old blocks making quarry | $PM_{2.5}$ and $PM_{10}$ | S 03 28'656"<br>E 039.54'976 | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 7 Near residential area | $PM_{2.5}$ and $PM_{10}$ | S 03 28'130"<br>E 039.55'076 | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 8 Boundary wall between MCL land and Government land | $PM_{2.5}$ and $PM_{10}$ | S 03 28'191"<br>E 039.56'976 | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 9 Middle of the bush area (Roka) | $PM_{2.5}$ and $PM_{10}$ | S 03 28'656"<br>E 039.54'976 | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 10 Middle of the bush area (Roka) | $PM_{2.5}$ and $PM_{10}$ | S 03 27'792"<br>E 039.58'471 | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 11 (Near residents Chumani) | $PM_{2.5}$ and $PM_{10}$ | S 03 23'295"<br>E 039.55.827" | Weather was sunny. Wind speed was 12km/hr moving from North east to South |
| Point 12 (Near residents Chumani) | $PM_{2.5}$ and $PM_{10}$ | S 03 27'7499"<br>E 039.55'825 | Weather was sunny. Wind speed was 11km/hr moving from North east to South |
| Point 13 (At quarry site) Roka | $PM_{2.5}$ and $PM_{10}$ | S 03 27'7491"<br>E 039.56'085 | Weather was sunny. Wind speed was 12km/hr moving from North east to South |
| Point 14 (At bushy area near old quarry site -Roka) | $PM_{2.5}$ and $PM_{10}$ | S 03 277491"<br>E 039.56'085 | Weather was sunny. Wind speed was 12km/hr moving from North east to South |
| Point 15 (Middle of the bushy forest area). | $PM_{2.5}$ and $PM_{10}$ | S 03 27'7491"<br>E 039.56'085 | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 16 (At block making quarry) Roka | $PM_{2.5}$ and $PM_{10}$ | S 03 27'347"<br>E 039.56'463 | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 17 (Near residential area) | $PM_{2.5}$ and $PM_{10}$ | S 03 26'653"<br>E 039.56'721 | Weather was sunny. Wind speed was 13km/hr moving from North east to South |
| Point 18 (Near old quarry area) | $PM_{2.5}$ and $PM_{10}$ | S 03 26'277"<br>E 039.56'459 | Weather was sunny. Wind speed was 12km/hr moving from North east to South |

| | | | |
|---|---|---|---|
| Point 19 (Middle of the bushy forest) | $PM_{2.5}$ and $PM_{10}$ | S 03 25'472"<br>E 039.56'654 | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 20 (Middle of the bushy forest). | $PM_{2.5}$ and $PM_{10}$ | S 03 25'247"<br>E 039.56'825 | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 21(Control point 3) Matsangoni area | $PM_{2.5}$ and $PM_{10}$ | S 03 23'295"<br>E 039.55.827" | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 22 (Near old residential area) | $PM_{2.5}$ and $PM_{10}$ | S 03 27'7499"<br>E 039.55'825 | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 23 (Middle of the bushy forest area-Chumani) | $PM_{2.5}$ and $PM_{10}$ | S 03 27'7491"<br>E 039.56'085 | Weather was sunny. Wind speed was 12km/hr moving from North east to South |
| Point 24 (Middle of the bushy forest-Roka) | $PM_{2.5}$ and $PM_{10}$ | S 03 27'7491"<br>E 039.56'085 | Weather was sunny. Wind speed was 13km/hr moving from North east to South |
| Point 25 (Middle of the bushy forest Roka) | $PM_{2.5}$ and $PM_{10}$ | S 03 27'7491"<br>E 03936'085 | Weather was sunny. Wind speed was 13km/hr moving from North east to South |
| Point 26 (Middle of the bushy forest-Roka) | $PM_{2.5}$ and $PM_{10}$ | S 03 27'347"<br>E 039.56'463 | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 27 (Middle of the bushy forest-Roka) | $PM_{2.5}$ and $PM_{10}$ | S 03 26'653"<br>E 039.56'721 | Weather was sunny. Wind speed was 13km/hr moving from North east to South |
| Point 28 (Middle of the bushy forest-Roka) | $PM_{2.5}$ and $PM_{10}$ | S 03 26'277"<br>E 039.56'459 | Wind speed was 12km/hr moving from North east to South |
| Point 29 (Middle of the bushy forest-Roka) | $PM_{2.5}$ and $PM_{10}$ | S 03 25'472"<br>E 039.56'654 | Wind speed was 14km/hr moving from North east to South |
| Point 30 (Middle of the bushy forest-Roka) | $PM_{2.5}$ and $PM_{10}$ | S 03 25'247"<br>E 039.56'825 | Wind speed was 14km/hr moving from North east to South |

### 5.2.6 Results of the air quality monitoring

**Table 8: Sampling Locations and Measurement Results**

| Monitoring Locations | Particulate Matter $PM_{2.5}$ ($\mu g/m^3$) | EMC (Air Quality) Regulations 2014 | Comments | Particulate Matter $PM_{10}$ ($\mu g/m^3$) | EMC (Air Quality) Regulations 2014 | Comments |
|---|---|---|---|---|---|---|
| Point 1 | 10 | 75 | Complies | 22 | 150 | Complies |
| Point 2 | 8 | 75 | Complies | 18 | 150 | Complies |
| Point 3 | 12 | 75 | Complies | 25 | 150 | Complies |
| Point 4 | 15 | 75 | Complies | 31 | 150 | Complies |
| Point 5 | 11 | 75 | Complies | 24 | 150 | Complies |
| Point 6 | 17 | 75 | Complies | 43 | 150 | Complies |
| Point 7 | 7 | 75 | Complies | 19 | 150 | Complies |
| Point 8 | 8 | 75 | Complies | 28 | 150 | Complies |

| | | | | | | |
|---|---|---|---|---|---|---|
| Point 9 | 10 | 75 | Complies | 31 | 150 | Complies |
| Point 10 | 13 | 75 | Complies | 36 | 150 | Complies |
| Point 11 | 12 | 75 | Complies | 34 | 150 | Complies |
| Point 12 | 11 | 75 | Complies | 25 | 150 | Complies |
| Point 13 | 21 | 75 | Complies | 53 | 150 | Complies |
| Point 14 | 10 | 75 | Complies | 24 | 150 | Complies |
| Point 15 | 9 | 75 | Complies | 26 | 150 | Complies |
| Point 16 | 31 | 75 | Complies | 58 | 150 | Complies |
| Point 17 | 11 | 75 | Complies | 21 | 150 | Complies |
| Point 18 | 14 | 75 | Complies | 27 | 150 | Complies |
| Point 19 | 12 | 75 | Complies | 31 | 150 | Complies |
| Point 20 | 11 | 75 | Complies | 29 | 150 | Complies |
| Point 21 | 14 | 75 | Complies | 27 | 150 | Complies |
| Point 22 | 10 | 75 | Complies | 19 | 150 | Complies |
| Point 23 | 8 | 75 | Complies | 21 | 150 | Complies |
| Point 24 | 16 | 75 | Complies | 27 | 150 | Complies |
| Point 25 | 13 | 75 | Complies | 23 | 150 | Complies |
| Point 26 | 10 | 75 | Complies | 27 | 150 | Complies |
| Point 27 | 11 | 75 | Complies | 25 | 150 | Complies |
| Point 28 | 21 | 75 | Complies | 32 | 150 | Complies |
| Point 29 | 10 | 75 | Complies | 22 | 150 | Complies |
| Point 30 | 9 | 75 | Complies | 33 | 150 | Complies |

### *5.3 Baseline Noise Levels*

#### 5.3.1 Background

Noise, which is often referred to as unwanted sound, is typically characterized by the intensity, frequency, periodicity (continuous or intermittent) and the duration of sound. Sound is the result of pressure changes in the air caused by vibration (Thompson, 1994). Sound is measured as sound level in units of decibels, dB. The human ear responds differently to sounds at different frequencies. This is demonstrated by the fact that we hear higher pitched sounds more easily than lower ones of the same magnitude. To compensate for the different "loudness" as perceived by humans, a standard weighting curve is applied to measured sound levels. The weighting curve represents the frequency response of the human ear and is labeled as dBA ("A" weighted decibels).

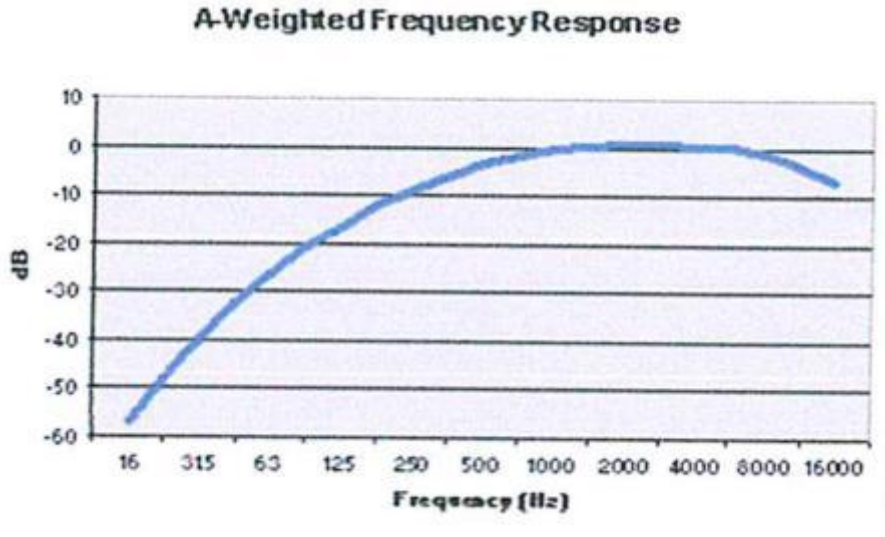


**Figure 3: The A-Weighted frequency reponse**

The response of the human ear varies with the sound level. At higher levels, 100dB and above, the ear's response is flatter, as shown in the C-Weighted Response to the right.

Although the A-Weighted response is used for most applications, C-Weighting is also available on many sound level meters. C Weighting is usually used for Peak measurements and in some entertainment noise measurement, where the transmission of bass noise can be a problem. C-weighted measurements are expressed as dBC or dB(C).

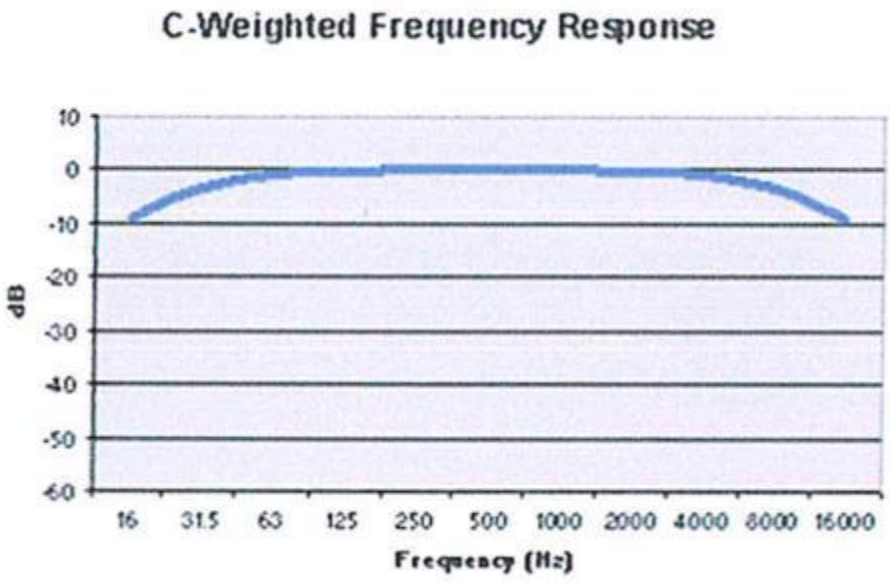


**Figure 4: The C-Weighted frequency response**

Excessive noise pollution, from various industrial/manufacturing activities, can have harmful effects on the humans, plants, animals, and trees constantly exposed to it. Human noise can have ripple effects on long-lived plants and trees that can last for decades even after the sources of noise subside. Many plants and trees rely on birds and other animals to deliver pollen from one flower or tree to the next, or to disperse their seeds, but many animals are adapting to the noise by changing their behavior or moving to quieter locales. Consequently, noise pollution is altering the landscape of plants and trees, which depend on noise-affected animals to pollinate them and spread their seeds. For these reasons environmental monitoring is paramount to objectively assess noise and to quantify and evaluate its potential impact to develop comprehensive conservation and control programs.

### 5.3.2 Monitoring Parameters

Noise is measured by use of equivalent noise levels.

**Leq** is the preferred method to describe sound levels that vary over time, resulting in a single decibel value, which takes into account the total sound energy over the period of time of interest. Leq-equivalent continuous noise level: Noise levels often fluctuate over a wide range with time. For example in the middle of the night the level might go down as low as 30 dB (A) with occasional passing vehicles of 70dB (A) or more. Later comes the dawn chorus followed by the general noises of the day before relative peace returns in the late evening. Alternatively, it may be an activity with different noise emissions throughout the day or week, with deliveries, intermittent compressors, and lots of varying noisy processes on top of

the routine production noise levels. This is where the Leq noise or equivalent continuous noise level meter comes in. This meter faithfully follows all the fluctuations, stores them in its memory and at the end of the measurement calculates an 'average energy' or Leq value. When we say average, this is not a simple arithmetic average because we are measuring in decibels which are logarithmic values. So our meter converts the dB values to sound pressure levels, adds them all up then divides by the number of samples and finally converts this equivalent level back to decibels-dBs.

**LAeq**-It is common practice to measure noise levels using the A-weighting setting built into all sound level meters. In which case the term is properly known as LAeq and the results should say so - for example LAeq = 73 dB or Leq = 73 dBA A good Leq sound level meter samples and 'captures' the noise levels 16 times a second which means over an hour it makes 16 x 60 x 60 = 57600 calculations, not difficult for a modern meter but quite an achievement a few years back.

**LCeq**-'C' weighting gives much more emphasis to low frequency sounds than the 'A' weighting response and is essentially flat or linear between 31,5Hz and 8kHz, the two-3dB or 'half power' points. In addition, Peak Sound Pressure measurements are made using the 'C' Frequency Weighting. Measurements made with this frequency weighting will be displayed as dB(C) or dBC. For example, as LCeq, LCPeak, LCE etc where the C shows the use of 'C' Weighting.

Leq noise levels are logarithmic (dB) values and cannot be added directly. A doubling of sound level results in a measured increase of 3 dB, four identical sources in a room would increase the noise level by 6 dB and so on. This works both ways, say 10 similar machines in a room produce 100 dBA then removing one machine completely will only reduce the overall noise level to 0.5 dBA, you would need to silence or remove 50% of the machines to achieve a 3 dB reduction. Leq is also used in the assessment of noise dose or sound exposure in the workplace and the 3 dB 'doubling rule' applies to time and/or level.

### 5.3.3 Other Parameters

- Lmax: Maximum Sound Level: level during a measurement period or a noise event and is not necespeak.
- Lmin: Minimum Sound Level: during a measurement period or a noise event.

- L10 is the level exceeded for 10% of the time. For 10% of the time, the sound or noise has a sound pressure level above L10. For the rest of the time, the sound or noise has a sound pressure level at or below L10. These higher sound pressure levels are probably due to sporadic or intermittent events. L10 is often used when assessing traffic noise and in planning applications: L10 is the level exceeded for 10% of the time and takes account of any annoying peaks in noise.
- L50 is the level exceeded for 50% of the time. It is statistically the mid-point of the noise readings. It represents the median of the fluctuating noise levels.
- L90 is the level exceeded for 90% of the time. For 90% of the time, the noise level is above this level. It is generally considered to be representing the background or ambient level of a noise environment. L90 is often used to quantify the background noise levels in assessments of noise pollution and nuisance noise from industrial sources.

### 5.3.4 Noise monitoring Objectives

- Baseline monitoring was done to measure and quantify the current ambient noise levels at the selected monitoring locations to represent the ambient noise levels within Roka, Chumani and Matsangoni before the commencement of the limestone mining project.
- To correlate the results of the findings against Environmental Management and Coordination (Noise and Excessive Vibration) Regulation 2009 for compliance purpose.

### 5.3.5 Monitoring Methodology

Ambient sound levels are the cumulative effects of innumerable sounds generated at various instances both far and near. High measurements may not necessarily mean that noise levels in the area are high. Similarly, a low sound level measurement will not necessarily mean that the area is always quiet, as sound levels will vary over seasons, time of the day, faunal characteristics, vegetation in the area and meteorological conditions (especially wind). This is excluding the potential effect of sounds from anthropogenic origin. It is assumed that the measurement location represents other residential dwellings in the area (similar environment). Some numerous factors that could impact on ambient sound levels at the time of monitoring including; the distance to closest trees, number and type of trees as well as the height of trees; available habitat and food for birds and other animals; distance to residential dwelling, locomotive sources (motorbikes, trucks & personal vehicles) and type of equipment used at the site (grinders) was considered. Determination of existing feeder roads traffic and other noise sources of significance was done, and notes taken. Vehicular noise is one of the

major components and could be a significant source of noise during busy periods. This reconnaissance showed that the vehicular activity at the site was mainly comprised of trucks loading blocks. Noise levels were determined using a Sound analyzer Meter with built-in octave band filters which does real time 1/1 and 1/3 octave analysis. The sound level meter was mounted on at 2.0m above ground level and 3.5m away from any sound reflecting surfaces at a boundary position and measurements are taken at timed intervals over 10 minutes and stored in SLM's memory. The SLM was oriented towards the facility of interest for each measurement taken. TES sound level meter was placed on the microphone to reduce any wind interference during measurements. The sound level meter, which was within its calibration period, was used at the time of monitoring.

In addition, the equivalent noise level (LAeq and LCeq), the maximum sound pressure level (LAFmax, LCFmax) and the minimum sound pressure level (LAFmin, LCFmin) during that measurement period were recorded. Factors to consider such as time, duration and predictability of the noise emission, amplitude and frequency of the noise emission, nature of the source, location of noise sensitive receptors, ambient and background noise level, nature and character of the locality, presence of special acoustic characteristics and the incongruity or familiarity of the noise during Noise Monitoring and site placement were put into consideration.

### 5.3.6 Parameters and score criteria

After finding various activities, aspects and impacts, identification of the significant aspects was done. It entirely depended on the management of the system or industry to give scaling factor. The table below shows six factors naming as A to F (top row) and column 1 to 6 shows rating scheme with minimum as 1 and maximum marks as 10 depending upon their severity.

#### 5.3.6.1 Procedure of significance evaluation

For evaluation processes, the various activities of the measurement sites are rated based on parameters and score criteria given in the table below and a benchmark of 75 units is taken as a deciding factor. If the total unit of any aspect for an activity comes out to be more than 75, then the aspect can be considered as significant otherwise insignificant.

**Table 9: Parameters and score criteria**

| A-Quantity 1-5 | B-Occurrence 1-6 | C-Impact 1-6 | D-Detection 1-5 | E-Controls 1-5 | F-Legislation 1 and 10 |
|---|---|---|---|---|---|
| 5-High | 6-Continuous | 6-Fatal to human life | 5-More than 24 hours | 5-Absence or no effective controls | 10-Not meeting legislation/control limits |
| 3-Moderate | 5-Several times a day | 5-Health effects | 4-Within 24 hours | 4-Mechanism in place but not reliable | 1-In compliance |
| 1-Low | 4-Once a day | 4-Affects flora and fauna | 3-Within 8 hours | 3-Control need human intervention | - |
| - | 3-Once a week | 3-Resource consumption | 2-Within 1 hour | 2-Has inbuilt secondary control | - |
| - | 2-Once a month or less frequent | 2-Discormfort, Acid rain, Nuisance | 1-Immediately | 1-Available and effective at source | - |
| - | 1-Very Rare | 1-Negligible visual impact | - | - | - |

### 5.3.7 Tools and Equipment

The following instruments were used during monitoring works:

- SLM TES 1358 C
- Geographic Positioning System (GPS)
- Digital camera

### 5.3.8 Monitoring Frequency

Baseline ambient levels monitoring was done on 14th and 15th November 2020 for thirty monitoring locations within Roka, Chumani, and Matsangoni areas.

### 5.3.9 Monitoring Location

The audiometric survey was conducted at the two target areas of the proposed project site namely: Roka and Matsangoni all located in Kilifi County. Thirty monitoring stations were selected. Point selection was based on the size of the site, maintaining a 10m minimum radius between each point. Detailed report of ambient noise monitoring is in appendix 8.

**Table 10: A table of monitoring locations, parameters tested & GPS coordinates**

| Area Monitored | Parameters tested | GPS Coordinates | Weather and wind speed and direction |
|---|---|---|---|
| Point 1(Near Uyombo girls' Secondary school and close to an old quarry site) | $PM_{2.5}$ and $PM_{10}$ | S 03 25'212"<br>E 039.57'271" | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 2 (Close to Uyombo primary school and surrounded by bushes). | $PM_{2.5}$ and $PM_{10}$ | S 03 22'503"<br>E .039.55'323" | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 3 Control point far from MCL property | $PM_{2.5}$ and $PM_{10}$ | S 03 22'825"<br>E 039.55'581 | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 4 Control point Mkongani area | $PM_{2.5}$ and $PM_{10}$ | S 03 28'656"<br>E 039.55'890 | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 5Near residential area | $PM_{2.5}$ and $PM_{10}$ | S 03 28'656"<br>E 039.54'976 | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 6 Near old blocks making quarry | $PM_{2.5}$ and $PM_{10}$ | S 03 28'656"<br>E 039.54'976 | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 7 Near residential area | $PM_{2.5}$ and $PM_{10}$ | S 03 28'130"<br>E 039.55'076 | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 8 Boundary wall between MCL land and Government land | $PM_{2.5}$ and $PM_{10}$ | S 03 28'191"<br>E 039.56'976 | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 9 Middle of the bush area (Roka) | $PM_{2.5}$ and $PM_{10}$ | S 03 28'656"<br>E 039.54'976 | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 10 Middle of the bush area (Roka) | $PM_{2.5}$ and $PM_{10}$ | S 03 27'792"<br>E 039.58'471 | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 11 (Near residents Chumani) | $PM_{2.5}$ and $PM_{10}$ | S 03 23'295"<br>E 039.55.827" | Weather was sunny. Wind speed was 12km/hr moving from North east to South |
| Point 12 (Near residents Chumani) | $PM_{2.5}$ and $PM_{10}$ | S 03 27'7499"<br>E 039.55'825 | Weather was sunny. Wind speed was 11km/hr moving from North east to South |
| Point 13 (At quarry site) Roka | $PM_{2.5}$ and $PM_{10}$ | S 03 27'7491"<br>E 039.56'085 | Weather was sunny. Wind speed was 12km/hr moving from North east to South |
| Point 14 (At bushy area near old quarry site -Roka) | $PM_{2.5}$ and $PM_{10}$ | S 03 277491"<br>E 039.56'085 | Weather was sunny. Wind speed was 12km/hr moving from North east to South |
| Point 15 (Middle of the bushy forest area). | $PM_{2.5}$ and $PM_{10}$ | S 03 27'7491"<br>E 039.56'085 | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 16 (At block making quarry) Roka | $PM_{2.5}$ and $PM_{10}$ | S 03 27'347"<br>E 039.56'463 | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 17 (Near residential area) | $PM_{2.5}$ and $PM_{10}$ | S 03 26'653"<br>E 039.56'721 | Weather was sunny. Wind speed was 13km/hr moving from North east to South |
| Point 18 (Near old quarry area) | $PM_{2.5}$ and $PM_{10}$ | S 03 26'277"<br>E 039.56'459 | Weather was sunny. Wind speed was 12km/hr moving from North east to South |

| | | | |
|---|---|---|---|
| Point 19 (Middle of the bushy forest) | $PM_{2.5}$ and $PM_{10}$ | S 03 25'472"<br>E 039.56'654 | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 20 (Middle of the bushy forest). | $PM_{2.5}$ and $PM_{10}$ | S 03 25'247"<br>E 039.56'825 | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 21(Control point 3) Matsangoni area | $PM_{2.5}$ and $PM_{10}$ | S 03 23'295"<br>E 039.55.827" | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 22 (Near old residential area) | $PM_{2.5}$ and $PM_{10}$ | S 03 27'7499"<br>E 039.55'825 | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 23 (Middle of the bushy forest area-Chumani) | $PM_{2.5}$ and $PM_{10}$ | S 03 27'7491"<br>E 039.56'085 | Weather was sunny. Wind speed was 12km/hr moving from North east to South |
| Point 24 (Middle of the bushy forest-Roka) | $PM_{2.5}$ and $PM_{10}$ | S 03 27'7491"<br>E 039.56'085 | Weather was sunny. Wind speed was 13km/hr moving from North east to South |
| Point 25 (Middle of the bushy forest Roka) | $PM_{2.5}$ and $PM_{10}$ | S 03 27'7491"<br>E 03936'085 | Weather was sunny. Wind speed was 13km/hr moving from North east to South |
| Point 26 (Middle of the bushy forest-Roka) | $PM_{2.5}$ and $PM_{10}$ | S 03 27'347"<br>E 039.56'463 | Weather was sunny. Wind speed was 14km/hr moving from North east to South |
| Point 27 (Middle of the bushy forest-Roka) | $PM_{2.5}$ and $PM_{10}$ | S 03 26'653"<br>E 039.56'721 | Weather was sunny. Wind speed was 13km/hr moving from North east to South |
| Point 28 (Middle of the bushy forest-Roka) | $PM_{2.5}$ and $PM_{10}$ | S 03 26'277"<br>E 039.56'459 | Wind speed was 12km/hr moving from North east to South |
| Point 29 (Middle of the bushy forest-Roka) | $PM_{2.5}$ and $PM_{10}$ | S 03 25'472"<br>E 039.56'654 | Wind speed was 14km/hr moving from North east to South |
| Point 30 (Middle of the bushy forest-Roka) | $PM_{2.5}$ and $PM_{10}$ | S 03 25'247"<br>E 039.56'825 | Wind speed was 14km/hr moving from North east to South |

### 5.3.10 Results of the Noise monitoring

**Table 11: Presentation of findings of noise monitoring including various regulatory limits guidelines and site remarks and notes**

| Measurement site | Measured sound pressure level (Noise dBA) | | | EMC Limits | World Bank Limits | WHO Limits | OSH Exposure Limits |
|---|---|---|---|---|---|---|---|
| | LAeq | Lmax | Lmin | LAeq | LAeq | LAeq | LAeq |
| Point 1(Near Uyombo girls' Secondary school and close to an old quarry site) | 48.4 | 58.8 | 30.9 | **55** | **70** | **85** | **90** |
| Point 2 (Close to Uyombo primary | 50.6 | 64.2 | 32.8 | **55** | **70** | **85** | **90** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| school and surrounded by bushes). | | | | | | | |
| Point 3 Control point far from MCL property | 48.3 | 58.6 | 39.1 | **55** | **70** | **85** | **90** |
| Point 4 Control point Mkongani area | 54.1 | 58.8 | 30.9 | **55** | **70** | **85** | **90** |
| Point 5Near residentials area | 50.2 | 64.2 | 32.8 | **55** | **70** | **85** | **90** |
| Point 6 Near old blocks making quarry | 50.4 | 58.6 | 39.1 | **55** | **70** | **85** | **90** |
| Point 7 Near residential area | 53.5 | 65.4 | 38.6 | **55** | **70** | **85** | **90** |
| Point 8 Boundary wall between MCL land and Government land | 48.7 | 62.0 | 32.1 | **55** | **70** | **85** | **90** |
| Point 9 Middle of the bush area (Roka) | 47.5 | 56.0 | 30.6 | **55** | **70** | **85** | **90** |
| Point 10 Middle of the bush area (Roka) | 41.3 | 52.1 | 31.6 | **55** | **70** | **85** | **90** |
| Point 11 (Near residents Chumani) | 42.6 | 50.3 | 32.8 | **55** | **70** | **85** | **90** |
| Point 12 (Near residents Chumani) | 50.5 | 62.6 | 32.3 | **55** | **70** | **85** | **90** |
| Point 13 (At quarry site) Roka | 65.7 | 77.8 | 56.8 | **55** | **70** | **85** | **90** |
| Point 14 (At bushy area near old quarry site -Roka) | 51.2 | 67.7 | 38.1 | **55** | **70** | **85** | **90** |
| Point 15 (Middle | 49.0 | 65.7 | 44.6 | **55** | **70** | **85** | **90** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| of the bushy forest area). | | | | | | | |
| Point 16 (At block making quarry) Roka | 77.8 | 98.8 | 65.4 | **55** | **70** | **85** | **90** |
| Point 17 (Near residential area) | 52.3 | 65.8 | 31.6 | **55** | **70** | **85** | **90** |
| Point 18 (Near old quarry area) | 45.4 | 57.6 | 32.8 | **55** | **70** | **85** | **90** |
| Point 19 (Middle of the bushy forest) | 50.2 | 61.2 | 32.3 | **55** | **70** | **85** | **90** |
| Point 20 (Middle of the bushy forest). | 46.5 | 58.2 | 38.1 | **55** | **70** | **85** | **90** |
| Point 21(Control point 3) Matsangoni area | 51.2 | 74.1 | 38.1 | **55** | **70** | **85** | **90** |
| Point 22 (Near old residential area) | 43.2 | 54.2 | 37.4 | **55** | **70** | **85** | **90** |
| Point 23 (Middle of the bushy forest area-Chumani) | 41.1 | 56.0 | 32.2 | **55** | **70** | **85** | **90** |
| Point 24 (Middle of the bushy forest-Roka) | 50.1 | 65.8 | 31.6 | **55** | **70** | **85** | **90** |
| Point 25 (Middle of the bushy forest Roka) | 45.4 | 57.6 | 32.8 | **55** | **70** | **85** | **90** |
| Point 26 (Middle of the bushy forest-Roka) | 50.2 | 61.2 | 32.3 | **55** | **70** | **85** | **90** |
| Point 27 (Middle of the bushy forest-Roka) | 46.5 | 58.2 | 38.1 | **55** | **70** | **85** | **90** |
| Point 28 (Middle of the bushy forest-Roka) | 51.2 | 74.1 | 38.1 | **55** | **70** | **85** | **90** |

**Table 12: Determination of significance of singular diurnal results with reference to EMC regulatory limits**

| | Aspect | Condition | Impact | Quantity | Occurrence | Impacts | Detection | Control | Legislation | Total | Remarks (Sig/Insig) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Point 1(Near Uyombo girls' Secondary school and close to an old quarry site) | Noise | N | Hearing Impairment | **3** | **5** | **1** | **1** | **3** | **1** | **45** | Insignificant |
| Point 2 (Close to Uyombo primary school and surrounded by bushes). | Noise | N | Hearing Impairment | **3** | **5** | **1** | **1** | **3** | **1** | **45** | Insignificant |
| Point 3 Control point far from MCL property | Noise | N | Hearing Impairment | **3** | **5** | **1** | **1** | **3** | **1** | **45** | Insignificant |
| Point 4 Control point Mkongani area | Noise | N | Hearing Impairment | **3** | **5** | **1** | **1** | **3** | **1** | **45** | Insignificant |
| Point 5Near residentials area | Noise | N | Hearing Impairment | **3** | **5** | **1** | **1** | **3** | **1** | **45** | Insignificant |
| Point 6 Near old blocks making quarry | Noise | N | Hearing Impairment | **3** | **5** | **1** | **1** | **3** | **1** | **45** | Insignificant |
| Point 7 Near | Noise | N | Hearing | **3** | **5** | **1** | **1** | **3** | **1** | **45** | Insignificant |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| residential area | | | Impairment | | | | | | | | |
| Point 8 Boundary wall between MCL land and Government land | Noise | N | Hearing Impairment | **3** | **5** | **1** | **1** | **3** | **1** | **45** | Insignificant |
| Point 9 Middle of the bush area (Roka) | Noise | N | Hearing Impairment | **3** | **5** | **1** | **1** | **3** | **1** | **45** | Insignificant |
| Point 10 Middle of the bush area (Roka) | Noise | N | Hearing Impairment | **3** | **5** | **1** | **1** | **3** | **1** | **45** | Insignificant |
| Point 11 (Near residents Chumani) | Noise | N | Hearing Impairment | **3** | **5** | **1** | **1** | **3** | **1** | **45** | Insignificant |
| Point 12 (Near residents Chumani) | Noise | N | Hearing Impairment | **3** | **5** | **1** | **1** | **3** | **1** | **45** | Insignificant |
| Point 13 (At quarry site) Roka | Noise | N | Hearing Impairment | **3** | **5** | **1** | **1** | **3** | **10** | **450** | Significant |
| Point 14 (At bushy area near old quarry site - Roka) | Noise | N | Hearing Impairment | **3** | **5** | **1** | **1** | **3** | **1** | **45** | Insignificant |
| Point 15 (Middle of the bushy forest area). | Noise | N | Hearing Impairment | **3** | **5** | **1** | **1** | **3** | **1** | **45** | Insignificant |
| Point 16 (At | Noise | N | Hearing | **3** | **5** | **1** | **1** | **3** | **10** | **450** | Significant |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| block making quarry) Roka | | | Impairment | | | | | | | | |
| Point 17 (Near residential area) | Noise | N | Hearing Impairment | **3** | **5** | **1** | **1** | **3** | **1** | **45** | Insignificant |
| Point 18 (Near old quarry area) | Noise | N | Hearing Impairment | **3** | **5** | **1** | **1** | **3** | **1** | **45** | Insignificant |
| Point 19 (Middle of the bushy forest) | Noise | N | Hearing Impairment | **3** | **5** | **1** | **1** | **3** | **1** | **45** | Insignificant |
| Point 20 (Middle of the bushy forest). | Noise | N | Hearing Impairment | **3** | **5** | **1** | **1** | **3** | **1** | **45** | Insignificant |
| Point 21(Control point 3) Matsangoni area | Noise | N | Hearing Impairment | **3** | **5** | **1** | **1** | **3** | **1** | **45** | Insignificant |
| Point 22 (Near old residential area) | Noise | N | Hearing Impairment | **3** | **5** | **1** | **1** | **3** | **1** | **45** | Insignificant |
| Point 23 (Middle of the bushy forest area-Chumani) | Noise | N | Hearing Impairment | **3** | **5** | **1** | **1** | **3** | **1** | **45** | Insignificant |
| Point 24 (Middle of the bushy forest-Roka) | Noise | N | Hearing Impairment | **3** | **5** | **1** | **1** | **3** | **1** | **45** | Insignificant |
| Point 25 (Middle of the bushy | Noise | N | Hearing Impairment | **3** | **5** | **1** | **1** | **3** | **1** | **45** | Insignificant |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| forest Roka) | | | | | | | | | | | |
| Point 26 (Middle of the bushy forest-Roka) | Noise | N | Hearing Impairment | **3** | **5** | **1** | **1** | **3** | **1** | **45** | Insignificant |
| Point 27 (Middle of the bushy forest-Roka) | Noise | N | Hearing Impairment | **3** | **5** | **1** | **1** | **3** | **1** | **45** | Insignificant |
| Point 28 (Middle of the bushy forest-Roka) | Noise | N | Hearing Impairment | **3** | **5** | **1** | **1** | **3** | **1** | **45** | Insignificant |
| Point 29 (Middle of the bushy forest-Roka) | Noise | N | Hearing Impairment | **3** | **5** | **1** | **1** | **3** | **1** | **45** | Insignificant |

### 5.3.11 Discussion of Noise Monitoring Results

- Noise levels measurement was done within the selected monitoring locations within Roka, Chumani, and Matsangoni. From the results, point 16 had the highest noise levels. The noise levels recorded at this point could have been as a result of block cutting operations using the block cutting machine. Vehicular and motorcycle activities were also noted at the time of monitoring.
- Point 13 had the second highest noise levels. These noise levels were attributed by could have been as a result of block making operations using the block cutting machine at the time of monitoring. The lowest noise levels were recorded at point 11, which is located near residential settlements.
- After correlation with the Noise regulatory guidelines, point 13 and 16 had noise levels above the EMC (Noise and Excessive Vibration), Regulations, 2014 tolerance limits. All other locations had noise levels below the regulatory limits.
- Upon determination of significance; Point 13 and 16 were identifies as noise significant area. This is due to the total unit obtained for these two locations is above 75 units which is used as the benchmark.
- Upon comparison with the World Bank noise regulations, all the monitoring location had noise levels within the World Bank noise regulation except for point 16 which had noise levels above 70 decibels.
- All the monitoring stations had noise levels within the World Health Organization and the Occupational Health and Safety noise regulatory guidelines.

### 5.3.12 Conclusions from the Noise monitoring

- Upon comparisons of results to EMC (Excessive noise and vibration) regulations of 2009, all the monitoring had noise levels within the stipulated limits with the exception of point 13 and 16.
- Upon determination of significance test, all the monitoring locations were identified as Noise insignificant area with the exception of point 13 and 16.
- The resultant monitoring and study data will be used as the basis to predict effects from the proposed project.
- The same results documented in this report will be used in the subsequent noise level monitoring technical reports.

### 5.3.13 Recommendations

Exceedance of any sorts could potentially impact the nearby receptors negatively thus mitigation measures should be put in place and adhered to closely. The proponent is bound to make sure the noise levels are within the stipulated noise regulation limits during the operational life of the proposed project. In case of any exceedance of noise levels, the proponent should adopt noise mitigation measures and regular noise monitoring should be put in place to check the effectives of the noise mitigation measures put in place.

## 5.4 Local ground water resource

Supplies of ground water in the area are obtained within the unconfined aquifer in the area. Potable water is a scarce resource in the area. Water from the main pipeline by the Malindi Water and Sewerage Company (MAWASCO) are inadequate and are supplemented by groundwater. Despite the fact that groundwater aquifers in this area yield either saline or brackish water, the community relies on the wells to meet their water needs for domestic use. A survey of the area was conducted during this environmental impact assessment study process to document the wells and shallows wells used by the community. The table below gives a list of the wells and shallow wells identified.

**Table 13: Some of the wells surveyed**

| NAME OF WELL | Location (GPS Coordinates) |
|---|---|
| KIBI 42 Chumani | S03$^0$ 28.006' E039° 54.145 |
| Foleni well | S03$^0$ 27.662' E039° 55.605 |
| Timboni well | S03$^0$ 26.080' E039° 56.601 |
| Kadegeni well | S03$^0$ 25.310' E039° 56.071 |
| Uyombo Girls High School well | S03° 25.240' E039° 57.295 |
| Wireless A well | S03$^0$ 26.525' E039° 55.822 |
| Wireless B well | S03$^0$ 24.759' E039° 57.594 |
| Matsangoni Police Station borehole | S03$^0$ 23.761' E039° 55.591 |
| Gongoni Village Well | S03$^0$ 25.862' E039° 55.933 |
| Timboni 2 well | S03$^0$ 26.185' E039° 56.588 |

**Plate 6: Identification of boreholes**

### 5.4.1 Groundwater quality

The quality of the wells identified above was benchmarked for purposes of future reference. The bench-marking involved sampling and analyzing the quality of water in the identified wells within the local community. The sampling and analysis was carried out by Polucon Services (Kenya) Limited, an accredited laboratory. Water samples were drawn and analyzed for physical, chemical and microbiological properties. Appendix 9 is the detailed water quality laboratory analysis report for each of the water sample.

#### 5.4.1.1 Water sampling and analysis from KIBI 42 Chumani

Water samples were drawn from the KIBI 42 Chumani well by Polucon Services (Kenya) Limited an accredited laboratory and analyzed. Parameters analysed included pH @ $32.6^0$C, Conductivity, Total dissolved solids, Chlorides as Cl, Aluminium as Al, Iron as Fe, Sodium as Na, Magnesium as Mg, Calcium as Ca, Phosphates as $PO_4^{3-}$, Sulphates as $SO_4$, Nitrates as $NO^{3-}$ and Total coliform count. The results of the water sampled collected and analysed from KIBI 42 Chumani show that the water does not conform to the required specifications for natural potable water due to presence of high chlorides and presence of coliforms.

### 5.4.2.2 Water sampling and analysis for Foleni well

Water samples were drawn from the Foleni well by Polucon Services (Kenya) Limited an accredited laboratory and analyzed. Parameters analysed included pH @ 29.3$^0$C, Conductivity, Total dissolved solids, Chlorides as Cl, Aluminium as Al, Iron as Fe, Sodium as Na, Magnesium as Mg, Calcium as Ca, Phosphates as $PO_4^{3-}$, Sulphates as $SO_4$, Nitrates as $NO^{3-}$ and Total coliform count. The results of the water sampled collected and analysed from the Foleni show that the water does not conform to the required specifications for natural potable water due to high conductivity, total dissolved solids, chloride ions, sodium ions and presence of coliforms.

### 5.4.2.3 Water sampling and analysis for Timboni well

Water samples were collected from the Timboni well and analysed. Parameters analysed included pH@28.6$^0$C, Conductivity, Total dissolved solids, Chlorides as Cl, Aluminium as Al, Iron as Fe, Sodium as Na, Magnesium as Mg, Calcium as Ca, Phosphates as $PO_4^{3-}$, Sulphates as $SO_4$, Nitrates as $NO^{3-}$ and Total coliform count. The results of the water sampled collected and analysed from the Timboni Well show that the water does not conform to the required specifications for natural potable water due to high conductivity, total dissolved solids, chloride ions, sodium ions and presence of coliforms.

### 5.4.2.4 Water sampling and analysis for Kadegeni well

Water samples were collected from the Kadegeni Well and analysed. Parameters analysed included pH@30.7$^0$C, Conductivity, Total dissolved solids, Chlorides as Cl, Aluminium as Al, Iron as Fe, Sodium as Na, Magnesium as Mg, Calcium as Ca, Phosphates as $PO_4^{3-}$, Sulphates as $SO_4$, Nitrates as $NO^{3-}$ and Total coliform count. The results of the water sampled collected and analysed from the Kadegeni Well show that the water does not conform to the required specifications for natural potable water due to high conductivity, total dissolved solids, chloride ions, sodium ions and presence of coliforms.

### 5.4.2.5 Water sampling and analysis for Uyombo Girls High School well

Water samples were collected from the Uyombo Girls High School well and analysed. Parameters analysed included pH@28.9$^0$C, Conductivity, Total dissolved solids, Chlorides as Cl, Aluminium as Al, Iron as Fe, Sodium as Na, Magnesium as Mg, Calcium as Ca, Phosphates as $PO_4^{3-}$, Sulphates as $SO_4$, Nitrates as $NO^{3-}$ and Total coliform count. The results of the water sampled collected and analysed from the Uyombo Girls High School well show that the water does not conform to the required specifications for natural potable water due to

high conductivity, total dissolved solids, chloride ions, sodium ions, magnesium ions, calcium ions, sulphate and presence of coliforms.

#### 5.4.2.6 Water sampling and analysis for Wireless A well

Water samples were collected from the Wireless A well and analysed. Parameters analysed included pH@28.6$^0$C, Conductivity, Total dissolved solids, Chlorides as Cl, Aluminium as Al, Iron as Fe, Sodium as Na, Magnesium as Mg, Calcium as Ca, Phosphates as $PO_4^{3-}$, Sulphates as $SO_4$, Nitrates as $NO^{3-}$ and Total coliform count. The results of the water sampled collected and analysed from the Wireless A well show that the water does not conform to the required specifications for natural potable water due to high conductivity, total dissolved solids, sodium ions, magnesium ions and presence of coliforms.

#### 5.4.2.7 Water sampling and analysis for Wireless B well

Water samples were collected from the Wireless B well and analysed. Parameters analysed included pH@28.8$^0$C, Conductivity, Total dissolved solids, Chlorides as Cl, Aluminium as Al, Iron as Fe, Sodium as Na, Magnesium as Mg, Calcium as Ca, Phosphates as $PO_4^{3-}$, Sulphates as $SO_4$, Nitrates as $NO^{3-}$ and Total coliform count. The results of the water sampled collected and analysed from the Wireless B well show that the water does not conform to the required specifications for natural potable water due to high conductivity, total dissolved solids, chloride ions, sodium ions, and presence of coliforms.

#### 5.4.2.8 Water sampling and analysis for Matsangoni Police Station borehole

Water samples were collected from the Matsangoni Police Station borehole and analysed. Parameters analysed included pH@28.8$^0$C, Conductivity, Total dissolved solids, Chlorides as Cl, Aluminium as Al, Iron as Fe, Sodium as Na, Magnesium as Mg, Calcium as Ca, Phosphates as $PO_4^{3-}$, Sulphates as $SO_4$, Nitrates as $NO^{3-}$ and Total coliform count. The results of the water sampled collected and analysed from the Matsangoni Police Station borehole show that the water does not conform to the required specifications for natural potable water due to conductivity, total dissolved solids, chloride ions, sodium ions, magnesium ions, calcium ions and presence of coliforms.

#### 5.4.2.9 Water sampling and analysis for Gongoni Village Well

Water samples were collected from the Gongoni Village Well and analysed. Parameters analysed included pH@29.9$^0$C, Conductivity, Total dissolved solids, Chlorides as Cl, Aluminium as Al, Iron as Fe, Sodium as Na, Magnesium as Mg, Calcium as Ca, Phosphates as $PO_4^{3-}$, Sulphates as $SO_4$, Nitrates as $NO^{3-}$ and Total coliform count. The results of the water sampled collected and analysed from the Gongoni Village Well show that the water

does not conform to the required specifications for natural potable water due to conductivity, total dissolved ions, chloride ions, sodium ions, magnesium ions and presence of conforms.

#### 5.4.2.10 Water sampling and analysis for Timboni 2 Well

Water samples were collected from the Timboni 2 Well and analysed. Parameters analysed included pH@29.6$^0$C, Conductivity, Total dissolved solids, Chlorides as Cl, Aluminium as Al, Iron as Fe, Sodium as Na, Magnesium as Mg, Calcium as Ca, Phosphates as $PO_4^{3-}$, Sulphates as $SO_4$, Nitrates as $NO^{3-}$ and Total coliform count. The results of the water sampled collected and analysed from the Timboni 2 Well show that the water does not conform to the required specifications for natural potable water due to conductivity, total dissolved solids, chloride ions, sodium ions, magnesium ions and presence of conforms.

### 5.5 Climate

Climate is influenced by monsoon winds with the rainfall pattern being characterized into long rains (April-June with an average of 1040mm) and short rains (end of October to December with an average of 240mm). The average annual rainfall for the county is 640mm. The annual mean temperature in the county is 27.9$^0$C with a minimum of 22.7$^0$C and a maximum of 33.1$^0$C. The hottest month is February with a maximum average of 33.1$^0$C while the lowest temperature is in July with a minimum average of 22.7$^0$C. On average, the temperatures are always high in Roka area. Most rainfall (rainy season) is seen in April, May, October and November. On average, the warmest month is March and on average, the coolest month is September. May is the wettest month and February is the driest month.

#### 5.5.1 Temperature

On average, the temperatures in Roka area are always high. The warmest month is March and the coolest month is July. The average annual maximum temperature is: 87.8° Fahrenheit (31.0° Celsius) and the average annual minimum temperature is 69.8° Fahrenheit (21.0° Celsius).

:

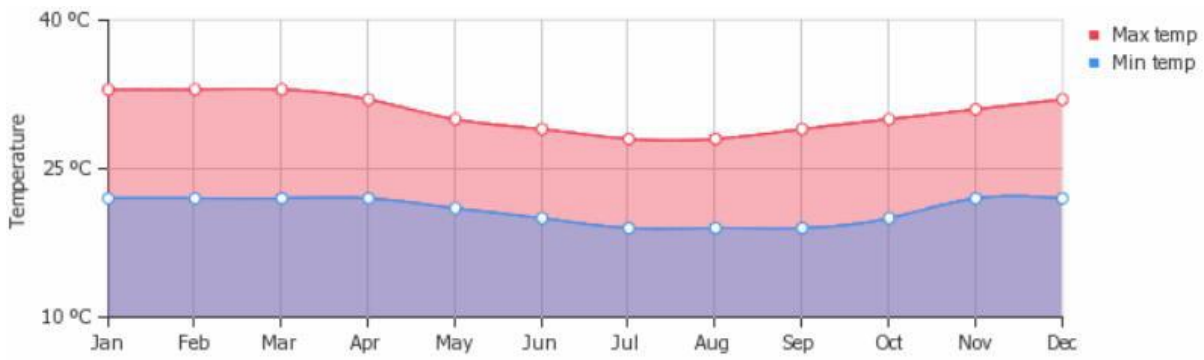

**Figure 5: Average minimum and maximum temperatures of Roka area over the year**

Source: www.weather-and-climate.com

### 5.5.2 Sunshine

On average, January, March and October are the sunniest months while May has the lowest amount of sunshine. Figure 2 below is the monthly total of sun hours over the year in Roka area.


**Figure 6: Monthly total of sunshine hours over the year in Roka area**
Source: www.weather-and-climate.com.

### 5.5.3 Water Temperature

On average, March has the hottest water temperature while September has the coldest water temperature. Figure 3 below is the mean water temperature in Roka area over the year.

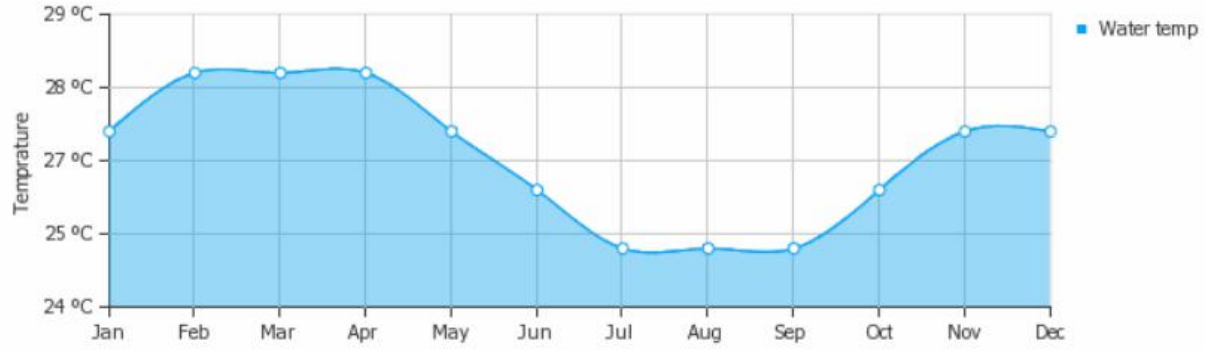


**Figure 7: Average mean water temperature in Roka area over the year**
Source: www.weather-and-climate.com.

### 5.5.4 Precipitation

A lot of rain (rainy season) in Roka area, falls in the months of April, May, October and November. On average, May is the wettest month while February is the driest month. The average amount of annual precipitation is: 39.37 in (999.9 mm) as shown in figure 4 below.

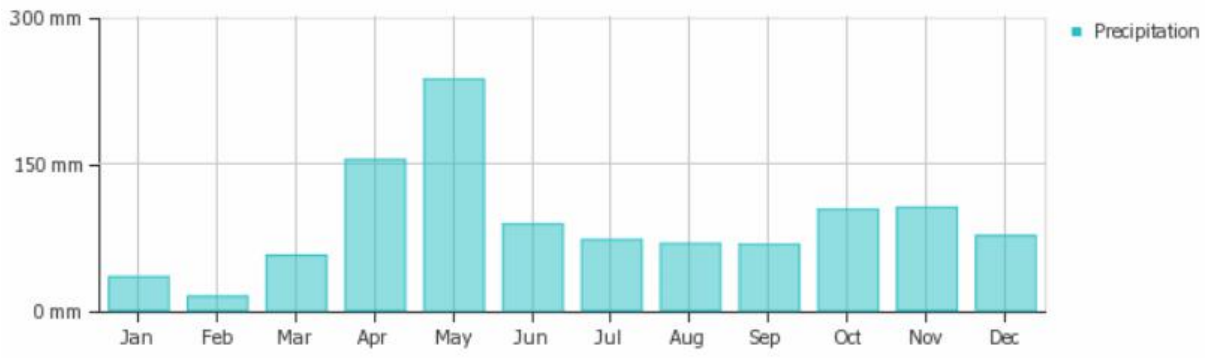


**Figure 8: Average precipitation in Roka area over the Year**
Source: www.weather-and-climate.com.

### 5.5.5 Monthly Rainy Days

Most rainy days are in the months of April, May, October and November with May having the highest number of rainy days. February has the least number of rainy days. Figure 5 below shows the average monthly rainy days in Roka area over the year.

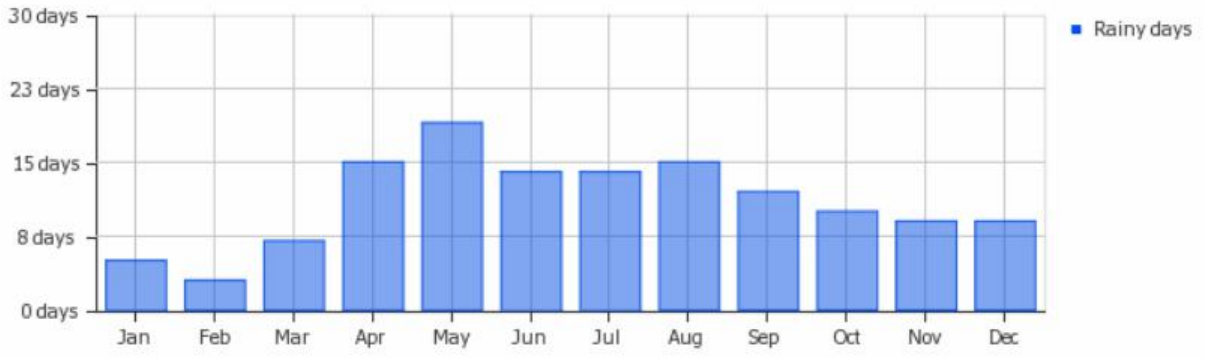


**Figure 9: Average Monthly Rainy Days in Roka area over the year**
Source: www.weather-and-climate.com.

### 5.5.6 Humidity

On average, May is the most humid month in Roka area while February is the least humid. Figure 6 is the mean monthly relative humidity over the year in Roka area.


**Figure 10: Mean monthly relative humidity over the year in Roka area**
Source: www.weather-and-climate.com.

### 5.5.7 Wind Speed

On average, the windiest months in Roka area are May and June while the least wind is seen in November. Figure 7 below is the mean monthly wind speed (meters per second).

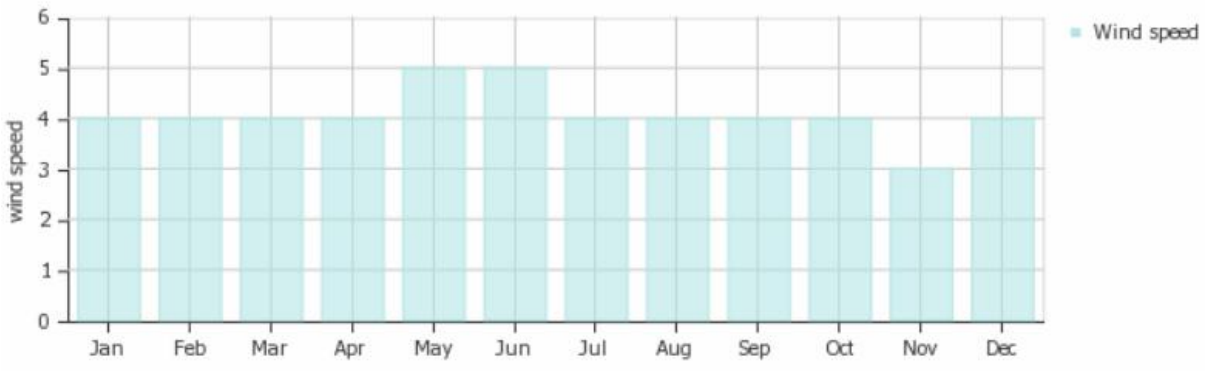


**Figure 11: Mean monthly wind speed over the year in Roka area in meters per second**
Source: www.weather-and-climate.com.

## 5.6 Geology

### 5.6.1 Introduction

The regional geological setting of Kilifi County is dominated by the rifting and break-up of the Palaeozoic Gondwana continent and the development of the Indian Ocean (Embleton and Valencio, 1977). Upper Proterozoic gneisses of the Mozambique belt form the basement of an intra-cratonic basin, filled with continental Permo-Triassic clastics (Pohl and Horkel, 1980). Rifting during the early to middle Jurassic, presumably preceded partly by up-doming along the incipient rift, transformed it into a marine marginal basin at the trailing edge of the African plate (Horkel et.al., 1984). Most of the area is underlain by the continental Permo-Triassic sediments assigned to the Duruma Group (Caswell, 1953), which is generally considered as the Kenyan equivalent of the Karroo system of southern Africa (Horkel et.al., 1984). The Duruma group includes the Taru Formation, Maji ya Chumvi formation, Mariakani Formation and Mazeras Formation (Onyancha and Nyamai, 2014). The Duruma sediments essentially comprise grits, arkosic sandstones, and additives accumulated under lacustrine, sub-aerial conditions (Onyancha and Nyamai, 2014). They also include minor marine ingressions in a broad, roughly NNE-SSW trending intra-cratonic trough, which formed towards the end of the Paleozoic within the Proterozoic gneisses of this part of the Gondwana (Embleton and Valencio, 1977). This fault trend controlled the deposition of all the other formations (Onyancha and Nyamai, 2014) including the Magarini formation and Mtomkuu (Kambe) formation.

After the termination of the Duruma sedimentation, major faulting and rifting led to the breakup of Gondwanaland; it caused a fundamental facies change from a continental cratonic trough to a marginal marine basin with sediments, located at the trailing edge of the continent (Horkel et.al., 1979). This transition is marked by a middle Jurassic marine ingression. The basal sediments of the Mtomkuu (Kambe) formation were deposited under near-shore neritic and estuarine conditions (Onyancha and Nyamai, 2014). Basal transgression conglomerates, largely composed of Duruma detritus, are overlain by impure micritic limestones, occasionally with small bioherms, and near-shore oolithic limestones, which were deposited in a shallow shelf environment with only moderate terrigeneous contamination (Braithwaite, 1984).

Erosion prevailed during the Tertiary until the Upper Pliocene, when tectonic reactivation resulted in increased erosion (Embleton and Valencio, 1977). Fluviatile pebble beds, gravels and sands of the Magarini formation were deposited on down-faulted and eroded Jurassic and Duruma sediments. After a regression during the Late Pleistocene, dunes which form the bulk of the Magarini formation were blown-up. This led to the formation of Pleistocene sands. At the same time, corals accumulated to form the Reef Complex along the Coast. The oldest rocks are the Gneisses of Neo Proterozoic Era while the youngest is the Reef Complex of Recent Age. The location of MCL Vipingo, Roka and Matsangoni sites consists of three geological units namely the Coral Reef Complex, Magarini Formation and Quaternary Sands. The units are readily identifiable and their field relationships clearly indicate the depositional history of the area.

### 5.6.2 Coral Reef Complex

Most of the MCL Vipingo, Roka and Matasangoni sites is founded on the Coral Reef Complex. In the wider context, the unit covers a long stretch of the Kenyan Coast from Vanga in the south to Lamu in the north. The Coral Reef Complex is considered to be Pleistocene age. Coral limestone, which is dead remains of sea corals, is the main rock type of the reef complex. However, depending on the conditions that prevailed at the time of deposition, within a locality, other sedimentary rocks may be found alongside the limestone. Often such rocks would include shale and marl. Over most of the unit, a thin layer of either wash down sand or brown soil covers the coral limestone. The brown soil (terra rosa), formed from weathering of part of the limestone, supports pockets of vegetation.

### 5.6.3 Magarini Formation

Part of the MCL Vipingo, Roka and Matsangoni sites especially the south-western and north-western sectors, consists of sandy reddish brown soils. The soils are part of the Magarini Formation that is Pliocene age. Magarini sands comprise of fluviatile pebble beds of gravels and sands deposited in fresh water environment. In the regional context, the Magarini Formation, known to consist of yellowish to brownish sandy soils with layers of clays, occupies a considerable part of the Coastal Belt inland of the Coral Reef Complex. The Magarini Formation resulted from back reef depositional environment.

### 5.6.4 Quaternary Sands

Thick alluvial sand deposits considered as Quaternary in age cover some parts of MCL Vipingo, Roka and Matsangoni sites. The sands are regarded to be derivatives of the Magarini Formation. Vegetative cover on the alluvial sands is mainly grass, indicating relatively low amount of soil and recent age of the unit. The alluvial sands are very difficult to drive through.

## 5.7Groundwater

The proposed project site of Roka and Matsangoni has groundwater resources; groundwater in the area occurs in confined and unconfined aquifers in sedimentary formations of fluvial and lacustrine origin. Groundwater flow direction is generally eastward with recharge rate decreasing westward. The geology of the area plays an important role in determining occurrence of the groundwater. Whereas coral limestone is permeable, the Magarini Formation and Quaternary alluvial sands have layers of clay that help trap water. Therefore over the entire Coastal Belt, occurrence of groundwater is characteristic of the dune sands lying behind the coral limestone. Given that Roka and Matsangoni sites are within the Reef Complex which was formed from accumulation of corals along the coast, limestone cavens allow sea-water intrusion inland where there are no faults causing little drawdown in boreholes even with continuous large-scale abstraction.

# 6. MINING

Mining is the extraction of economically valuable minerals or other geological materials from the earth surface.

## *6.1* Mining Methods

### 6.1.1 Surface Mining

Surface Mining is one of the oldest methods of mining. Surface mining is the predominant exploitation procedure worldwide. Most of these are mined by open pit or open cast methods. Ores closer to the surface are accessed by creating an open pit and then excavating the ore below for further processing. In most cases, a significant amount of overburden, which is a layer of rock or soil that covers the deposit, must be removed.

The open pit mining is a mechanical extraction method. Open pit is also called as open cast mining. It is usually employed to exploit a near-surface deposit or ore that has a low stripping ratio. This method often requires a large capital investment but generally results in high productivity, low operating cost and good safety conditions.

### 6.1.2 Underground Mining

Ores in buried bedrock deposits are usually accessed through the construction of access shafts and tunnels.

This method provides for less waste rock removal and offers less environmental impact than open-pit mining.

### 6.1.3 In-Situ Leach (ISL) Mining

Some ore bodies, due to ore concentration or the surrounding material, can only be accessed by dissolving the ore body using water soluble acids or alkalis and then pumping out the solution. The ore body is then recovered as a precipitate. This method is common when extracting minerals near aquifers. It is also used if ores are not locally concentrated but spread over a wide area.

### 6.1.4 Solution and Placer mining

**Solution mining** includes both borehole mining, such as the methods used to extract sodium chloride or sulphur, and leaching, either through drill holes or in dumps or heaps on the surface.

**Placer mining** is used to exploit loosely consolidated deposits like common sand and gravel or gravels containing gold, tin, diamonds, platinum, titanium, or coal.

Placer and solution mining are among the most economical of all mining methods but can only be applied to limited categories of mineral deposits.

The aqueous extraction methods depend on water or another liquid (e.g., dilute sulphuric acid, weak cyanide solution, or ammonium carbonate) to extract the mineral.

## *6.2* Mining of Stones/Quarrying

### 6.2.2 Introduction

Stones occur in the form of natural rock masses or layers on the surface. The process of mining/extraction of suitable stones from their natural rock beds or layers is commonly called Quarrying of Stones.

It differs from the mining of ores of metals in that whereas quarrying is an operation carried out entirely on the surface, mining involves digging below the ground, sometimes at considerable depth.

Mining of stone is basically by surface mining method.

### 6.2.3 Excavation Methods in Quarrying

Excavations can be made with any means. Economics and time determine what method is most viable.

Excavation can be either:-

- Without blasting, or
- By blasting

The table below summarizes the excavation methods

**Table 14: Excavation methods in quarrying**

| **Excavation Method** | | | **Technology/Tools Required** |
|---|---|---|---|
| Excavation without blasting | Small-scale hand excavation | | ▪ Hammer and chisel<br>▪ Fire setting |
| | Mechanical | Digging and ripping | ▪ Man-made shovel/excavator<br>▪ Ripper |
| | | Cutting and grinding | ▪ Road Header<br>▪ Trench Cutter |
| | | Hammering | ▪ Jack Hammer<br>▪ Hydraulic/Pneumatic Hammer |
| Excavation by Blasting | | | Drill and Blast |

#### *6.2.3.1 Quarrying of Stones without Blasting*

In these methods, blocks of rocks are broken loose from their natural outcrops by men using hand tools or special purpose mechanical machines.

No explosive material is used at any stage in this method of quarrying of stones. Soft rocks and also those rocks which have layered structure are easily quarried by these methods.

#### *6.2.3.2 Quarrying of Stones by Blasting*

This method consists of using explosives for breaking stones from very hard rocks. The basic principle of this method is to explode a small quantity of an explosive material at a calculated depth within the rocks. The force generated due to this explosion is sufficient only to create cracks and loosen blocks of good size Quarrying by blasting, therefore, requires very experienced persons thoroughly acquainted with blasting explosives on the one hand and strength qualities of rocks on the other hand. Quarrying by blasting involves a series of systematic operations such as drilling of blast-holes, charging of blast-holes and firing the shots.

#### *6.2.3.3 Quarrying without blasting verses quarrying by blasting*

The main environmental impacts associated with quarrying are dust, noise and vibrations. These impacts are usually aggravated with blasting. Blasting operations cause several adverse environmental effects, including ground vibrations, air-blast, fly-rock and generation of dust to a much higher extent. Stone quarries are long-term projects with a life of their own in which deposits are usually mined over several decades. These quarries are part of the landscape, and during operations residential developments often expand up to the edges of the quarry site. The use of explosives to mine the rock then becomes a source of annoyance to residents, and a safety issue. Overtime, changes in the law, environmental requirements and/or safety considerations have made the use of explosives difficult. Quarry owners should always review the breaking method when they want to avoid possible operation restrictions, simplify the renewal of mining permits, maintain profitability or increase the demand on product quality.

# 7. PROJECT DESIGN AND DESCRIPTION

## 7.1 Background to limestone

Limestone is composed essentially of calcium carbonate, varying percentages of magnesium carbonate and mechanically admixed impurities of sand and clay. Depending on the type and source of limestone, a range of accessory minerals may be present, including iron and magnesium oxides, sulfides of common metals, authigenic feldspars, gypsum, quartz, clay minerals, mica and bituminous matter. However, quality of the limestone can be ascertained from its chemical composition, which is commonly analysed as percentages of calcium oxide (CaO), magnesium oxide (MgO), iron oxide ($Fe_2O_3$), Alumina ($Al_2O_3$), silica ($SiO_2$) and LOI (Loss on Ignition). Some chemical analyses include percentage of potash ($P_2O_5$), TC (Total Carbonate) and magnesium carbonate ($MgCO_3$). Limestone at the proposed project site is to mined and later transported out of the site to Vipingo cement factory.

## 7.2 Proposed project components

The components of the proposed quarry will include:

- ✓ Quarry access roads
- ✓ Site camp
- ✓ Sanitary facilities
- ✓ Weighbridge
- ✓ Overburden stockpile
- ✓ Holding area of recovered coral limestone
- ✓ Operational quarry pits
- ✓ Disused quarry pits

### 7.2.1 Quarry access roads

All quarry access roads will be graded and graveled from time to time to ensure they are able to sustain heavy weights of loaded trucks evacuating mined coral limestone from the quarry. The quarry access roads will connect from the nearest existing graveled road to where the quarry pits will be opened up.

### 7.2.2 Site camp

The site camp will consist of essential facilities necessary for day-to-day smooth operation of the quarry. These will include a site office, temporary garage for minor repairs of quarry equipment, oil/water separator, site workshop, water tanks for sanitation and dust suppression, waste handling facilities and security guard station.

### 7.2.3 Sanitary facilities

Sanitary facilities will be those that will be used at the quarry pit areas where actual limestone mining is being done and those within in the quarry camp. Sanitary facilities will include toilets, urinals, showers and hand washing stations. The sanitary facilities will have reliable and adequate water connection to ensure requires hygiene standards are achieved and maintained.

### 7.2.4 Weighbridge

A weighbridge will be appropriately sighted close to the quarry camp along the access road within a parcel of land owned by the proponent. The weighbridge will be used to monitor the quantity of mined limestone ferried out of the quarry.

### 7.2.5 Overburden stockpile

An area will be set aside where all the stripped overburden material will be stockpiled and held through the mining period. It will be important to stockpile all the overburden material recovered because it contains important plant and animal genetic material that will be necessary for successful site rehabilitation. The stored overburden will therefore be used later during site rehabilitations.

### 7.2.6 Holding area of recovered coral limestone

Recovered limestone will be held temporary at a designated holding area before haulage out of the quarry. The holding will enable quarry, recovery of limestone and stockpiling to be a head of the pace of haulage of the quarried limestone out of the quarry. This will reduce and or eliminate dump truck idling time waiting material to be recovered for transportation.

### 7.2.7 Operational quarry pits

Quarry pits will be open systematically to match the rate of recovered limestone haulage from the quarry pit to either the holding area or direct to Vipingo. Continuous excavation of the limestone will overtime create a quarry pit. The changing boundary of the quarry pits will be clearly marked with red flags to warn all persons of existing of the quarry pit in the area ns to keep off. Further as mining progresses measures will be put in place to avoid ponding/ pooling of water in the pit when it rains. This will include drain out any water collected in the quarry pit. All active quarry pits will in addition be physically manned to ensure no unauthorized access to the site by local community members including livestock. This will be critical to ensure no accidents occur.

### 7.2.8 Disused quarry pits

Quarry pits where mining and recovery of limestone is complete will be adequately secured and manned to ensure no persons or livestock access them. This is vital to ensure to cases of incidences of dropping in the quarry or accidents occur as such open pits are a safety hazard. Rehabilitation of all disused quarry pits will begin once it has been ascertained that no further limestone recovery will be done from such pits in the future. The rehabilitation will be done in such a way that the resulting rehabilitated land will be economically usable.

## 7.3 Mining method

Winning of the limestone will be by quarrying also referred to as open cast mining. No explosives will be used at any time. Any identified hard bedrock; a dozer will first be used to break the bed rock.

## 7.4 Opening of quarry pits

Opening of a quarry pit will entail identification of the most suitable site for setting up of new quarry pit within the MCL limestone deposits; clearing, cleaning and stripping of overburden on the identified site to adequately expose coral limestone in readiness for mining. Overburden material will be scrapped and moved to other locations using a bulldozer, and sometimes using a shovel and/or dump truck if necessary.

## 7.5 Extraction of limestone and additives

The operations at the quarry pits will include stripping of the overburden to expose the required limestone to be mined. The mining of the limestone will involve stripping of the limestone using a bucket excavator. Where the limestone bedrock is hard that it cannot be mined using the bucket excavator, then a dozer will be used to break the hard limestone first before employing the bucket excavator. The entire mining will require committing adequate mining equipment including excavators, dozers, wheel loaders and shovel. Once the limestone has been mined, the materials are transported out of the quarry to MCL cement plant at Vipingo using a fleet of dump trucks.

# 8. ANALYSIS OF PROJECT ALTERNATIVES

A Project Alternative (project option) is another combination of the project's costs, schedules, resources, and risks that allow achieving the same results as compared to the project base-line. It is one or more ways to produce the project and address its need while using the same resource base yet operating in a new way and facing new working conditions. Project alternative considered for the proposed coral limestone mining project include the yes project alternative, the no project alternative, alternative use of proposed project site, alternative project site and alternative mining methods. An analysis of each of the project alternatives to the project costs, schedules, resources, and risks is tabulate in table 13. Evaluation of each of the project options is as follows.

## 8.1 The No Project Alternative

The no project alternative means that the project as currently proposed i.e. mining of coral limestone using the open cast mining method at the proposed project site to be totally rejected. This means that the proposed project site to remain as currently is. The no project alternative implies that the developer MCL having procured the proposed project site transferred the title to company name and processed change of user to new user to allow for the proposed project will not be able to achieve the proposed plans to develop the company land and recover limestone from the proposed project site.

## 8.2 The Yes Project Alternative

The yes project alternative means that, the proposed project of mining coral limestone from the proposed project site to be implemented as currently proposed. The yes project alternative will enable the project proponent achieve the proposal of mining and recovering limestone from the proposed project site.

## 8.3 Alternative use of proposed project site

The proposed project site consists of a number of plots that were procured from local people. The previous owners of these plots used the plots in extraction of coral limestone building blocks, grazing of livestock and in arable crop farming including coconut farming among other crops such as cassava. Alternative use of the proposed project site could be farming, machine cutting of building blocks, livestock grazing among others.

**Table 15: Tabulation of an of each of the project alternatives to the project costs, schedules, resources, and risks**

| Project alternative / Project aspect | Yes project alternative | No project alternative | Alternative project site | Alternative design/ mining method |
|---|---|---|---|---|
| **Cost** | No change on current projected project cost | Loss of the project as it will not be implemented | Will change the project cost as an alternative site has to be procured | Redesigning the project and or changing the mining method will be an added cost |
| **Schedules** | No change on current project schedule | Proposed project schedule will not be used as the project will not be implemented | Will change the schedule to take care of time lost in obtaining alternative site | New schedules will have to be developed to take care of the requirements of the new design and mining method |
| **Resources** | No change on current planned project resources | Available project resources will not be used as the project will not be implemented | More resources ( time, expertise, finances) will be required | Resources needed will change depending on the new design and or mining method |
| **Risks** | Risk of not implementing the project is minimal | All risks associated with implementation of the project will not be realized as the project will not be implemented | Risk of not implementing the project on schedule or failing to implement it all together is feasible | Risk of not getting a design that can be implemented within the project budget and location |

### 8.4 Alternative project site

The proposed project aims to mine and recover limestone from the proposed project site. An alternative project site should have adequate coral limestone deposits of required quality. Within the South Coast there are other places with parcels of land which limestone that can be mined. Likewise in the South Coast area of Likoni area stretching all the way to Lunga Lunga there are limestone deposits that can be mined. So both at the South and North Coast there areas that can be alternative project sites for mining of coral limestone.

### 8.5 Alternative mining methods

The proposed project will by surface mining which employs the open cast mining method without blasting to recover coral limestone from the site. The open cast mining method is used to exploit a near-surface deposit that has a low stripping ratio. Limestone in the area being on the surface, open cast mining method will be the best mining methods that can be used for the proposed project site. Other available mining methods such as underground mining, in-situ leach mining and solution mining are not relevant to exploitation of minerals occurring at the surface or near-surface. Therefore there is no alternative mining method to the proposed one.

# 9. OCCUPATIONAL SAFETY AND HEALTH

## 9.1 Introduction

Occupational Health and Safety (OHS) is of importance at project sites. It is important for mechanisms to be put in place to predict potential risks, incidents and hazards in the said working environment. This is because the occupational environment directly affects employees involved in a project, the neighborhood, visitors, contractors, sub-contractors and the general public. Therefore before commissioning of the project, a number of safety measures have to be in place to ensure the safety of employees, neighbors and the general public. Employees and visitors to the project site may be exposed to a variety of personal health and safety risks. The type and level of exposure is generally related to factors controlled by the employer/ developer. Such factors include design, equipment, tools, work procedures, project, and employee training. Occupational health and safety risks that should be considered by the employer arise from normal functions and operations and during unusual circumstances such as accidents and incidents. The project proponent is responsible for:

- Implementation of appropriate national and internal recognised OHS standards, practices and guidelines.
- Inclusion of meaningful participation of employees in implementation and maintenance of procedures and processes.
- Implementation of a programme to change employee culture and altitudes regarding health and safety.
- Planning, implementing and monitoring programs and s required to ensure OHS at the workplace.
- Provide and maintain workplaces, equipment, tools and machinery and organise work so as to eliminate or control hazardous ambient work factors.
- Provide appropriate occupational health and safety training for all employees.
- Provide adequate personal protective equipment to all employees at no cost to employees.
- Record and report occupational injuries and illness.
- Ensure contract specifications include demands for service providers, contractors, and sub-contractors to have or establish enabling them to meet the OHS requirements of the employer.

### 9.2. Occupational Health and Safety Management

An Occupational Health and Safety Management system (OHSMS) will be established, managed and operated for the proposed project. The system will contain the following features:

1. Occupational Health and Safety Policy for the company
2. Organizational framework of the OHSMS
    - ✓ Staffing of OHSMS
    - ✓ Competence requirements
    - ✓ Operating procedures
    - ✓ Training programs
    - ✓ Documentation
    - ✓ Communication
3. OHSMS objective (documentation)
4. Hazard prevention
    - ✓ Risk assessment
    - ✓ Prevention and control measures
    - ✓ Management of changes
    - ✓ Emergency preparedness and response
    - ✓ Procurement (tools, equipment, services, contractors)
5. Performance monitoring and measurements
    - ✓ Hazard prevention measures
    - ✓ Ambient working environment
    - ✓ Work related injuries, ill health, disease and injuries
6. Evaluation
    - ✓ Feedback
    - ✓ Corrective measures
    - ✓ Action plan

### 9.3. Employee safety

In addressing requirements and needs to ensure employee safety, the following will be in place: -

- ➢ Pre- employment medical examination
- ➢ Annual medical examination against baseline pre-employment medical examination records

- Provision of adequate personal protective equipment.
- Enforcement and proper use of personal protective equipment by all employees.
- Provision of first aid and emergency services on site.
- In case of injury of employee during work; management must have a clear policy on treatment of the injured employee.
- In case of permanent disability arising from injury at work place, adequate compensation should be available within the law.
- Appropriate tools and equipment in sound working condition must be provided to employees to enable them work safely.
- All practical measures must be in place to ensure that the work place is free of dust and excessive noise.

### 9.4. Safety of neighbours and general public

Project sites are associated with incidents and accidents that endanger workers, neighbors and general public. The proponent must ensure the safety of all neighbours and the general public is taken care of by putting the following measures in place: -

- ✓ All neighbours to be informed of the date of commencement of project.
- ✓ Heavy vehicles and trucks that will be ferrying in project equipment to the project site to observe required minimum speed limit when approaching the site to avoid accidents.
- ✓ There should be notices and warning prominently displayed at entry of project site and strategically around the project boundaries informing general public of on-going activity and safety requirements.

### 9.5 Machine use and Electrical Safety

During the implementation of the proposed project, it is expected that different machines, tools and equipment will be used. Most of this machine will be powered internally by use of diesel. In regard to electrical safety, the following will have to be undertaken: -

- Installation and fitting of proper electrical appliances to enable supply of electrical energy to utility point.
- All electrical installations and fittings are done according to electrical safety rules.
- All electrical wires must be safely insulated.
- Sockets and other electrical outlets must be securely fitted.
- When not in use all machines should be shut down.

- Qualified and well-experienced electrician should be hired to carry out all electrical work.
- Safety slogans should be strategically posted as a reminder to employees.
- Operating manuals of equipment should be available for use whenever needed.

### 9.6. Internal Safety

During the entire project implementation and operation cycle, safety of the employees on the site should be taken care of. Some of the things that need to be in place include:-

- ✓ Emergency preparedness
- ✓ First aid
- ✓ Welfare facilities
- ✓ Personal protective equipment

### 9.7. First-Aid

i. Proponent to ensure qualified First Aiders are available to administer first aid to affected employees at all times.
ii. An appropriately equipped First-Aid station to be easily accessible at the project site.
iii. The First Aid station to be adequately equipped to meet first aid needs at the project site.
iv. A written Emergency Procedure to be in place.

### 9.8. Welfare facilities

i. Changing rooms for workers to be provided.
ii. Shower rooms and washing facilities to be provided.
iii. Proponent to avail potable drinking water to all employees at site.
iv. Appropriate and adequate Personal Protective Equipment to be provided
v. The enforcement on the consistence of the correct use of PPE provided
vi. The PPE provided are to maintain clean and replaced when damaged or worn out.

### 9.9. Ambient factors in the project site

#### 9.9.1 Noise

Management will put in place a comprehensive noise conservation programme which will include the following:-

i) Training of workers in noise prevention, control and management.
ii) Provision of appropriate noise protective devices to workers.

iii) Training of the workers on the importance of making appropriate use of the protective devices provided.

iv) Monitoring of noise levels through periodic noise survey.

v) Use of appropriate noise attenuators.

vi) Audiometric test of workers

### 9.9.2 Dust

- ✓ Exposure to dust to be controlled by ensuring dust accumulation at project site is mitigated.
- ✓ Equipment to be selected, especially that with in-built dust extraction.
- ✓ Employee exposed to dust to be provide with disposable dust masks.
- ✓ Regular sprinkling of water on dusty roads and other dusty working areas.

## 10. STAKEHOLDER CONSULTATION AND PUBLIC PARTICIPATION

Consultation with stakeholders that are likely to be affected and those that are likely to have an interest in the proposed limestone quarry project was conducted as provided for in Regulation 17 of the Environmental (Impact Assessment and Audit) Regulations, 2003. The consultation was vital and served to:-

- Inform local community especially those drawn from the proposed project site of the proposed development within their locality.
- Explain to the local community the nature of the proposed project, its objectives and scope.
- Give local community especially those drawn from the proposed project site an opportunity to present their views, concerns and issues regarding the proposed.
- Obtain feedback and suggestions from the local community and other stakeholders on the proposed limestone quarry project on possible ways potential negative impacts can be effectively mitigated and how the stakeholders can be involved in the project cycle to ensure their interests are addressed.

### *10.1*Steps taken to consult with stakeholders

Due to the prevailing Covid-19 challenges and restrictions on gatherings, stakeholder consultation and public participation activities involved the following;

- Key Informants Interviews
- Focused Group Discussions
- Questionnaire survey

### *10.2* Key Informants Interviews

Key informants interviews were undertaken with various Government Officers and representatives of government institutions and/or Lead Agencies.

**County Commissioner Kilifi County:-** On the 8th October 2020, the Environmental Impact Assessment Study team held a meeting with the County Commissioner Kilifi County and briefed the County Commissioner on the proposed project and the requirement for stakeholder consultation and participation. On his part, the County Commissioner Mr. Kutswa Olaka urged the experts involved in the Environmental Impact Assessment Study to ensure that they undertake an assessment that is above board. He reiterated that any consultation with members of the public should be in strict conformity with the Ministry of Health guidelines on Covid-19 regarding restrictions in gatherings.

**Plate 7: The EIA Team meeting the County Commissioner Kilifi County**

**Deputy County Commissioner Kilifi County:-** On the 8th October 2020, the Environmental Impact Assessment Study team held a meeting with the Deputy County Commissioner Kilifi County and briefed the Deputy County Commissioner on the proposed project and the requirement for stakeholder consultation and participation. On his part, the Deputy County Commissioner Mr. Josphat S. Mutisya urged the experts involved in the Environmental Impact Assessment Study to ensure they do good work. He said that findings of the assessment should be made available to all stakeholders including his office.

**Plate 8: The EIA Team meeting the Deputy County Commissioner Kilifi County**

**Member of County Assembly-Matsangoni Ward and Chairperson Water, Environment and Natural Resources Committee:-** On the 8th October 2020, the Environmental Impact Assessment Study team held a meeting with the Member of County Assembly-Matsangoni Ward and Chairperson Water, Environment and Natural Resources Committee and briefed him on the proposed project and the requirement for stakeholder consultation and participation. On his part, the MCA Matsangoni Ward Hon. Hassan Mohamed urged the

experts involved in the Environmental Impact Assessment Study to ensure that all stakeholders are involved in the environmental impact assessment process.

**County Director of Environment -Kilifi County:-** On the 8th October 2020, the Environmental Impact Assessment Study team held a meeting with the County Director of Environment Kilifi County and briefed him on the proposed project. On his part, the County Director Mr. George Oyoo urged the experts involved in the Environmental Impact Assessment Study to ensure they do good work as per the EMCA 1999 (Amended) 2015.


**Plate 9: The EIA Team meeting the County Director of Environment Kilifi County**

**Senior Chief-Roka Location:-** On the 6th October 2020, the Environmental Impact Assessment Study team held a meeting with the Senior Chief Roka Location and briefed him on the proposed project and the requirement for stakeholder consultation and participation. On his part, the Senor Chief Mr. Julius Pole Ziro urged the experts involved in the Environmental Impact Assessment Study to ensure all stakeholders are consulted and their views taken on board. He said his office was ready and willing to help in organizing stakeholder consultations through the offices of the two Assistant Chiefs within the Location and through the Village Elders and *Wazee wa Nyumba Kumi*.



**Plate 10: The EIA Team meeting the Senior Chief Roka Location**

**Senior Chief-Matsangoni Location:-** On the 7th October 2020, the Environmental Impact Assessment Study team held a meeting with the Senior Chief Matsangoni Location and briefed him on the proposed project and the requirement for stakeholder consultation and participation. On his part, the Senor Chief Mr. Festus Yaa urged the experts involved in the Environmental Impact Assessment Study to ensure all stakeholders are consulted and their views taken on board. He said his office was ready and willing to help in organizing stakeholder consultations through the offices of the three Assistant Chiefs within the Location and through the Village Elders and *Wazee wa Nyumba Kumi*.


**Plate 11: The EIA Team meeting the Senior Chief Matsangoni Location**

### *10.3* Focused Group Discussions

Focused group discussions were held with various organized groups within the proposed project catchment area. Focused group discussions were organized as follows:-

- Focused Group Discussions with Learning Institutions' Boards of Management
- Focused Group Discussions with Religious Leaders
- Focused Group Discussions with Village Elders
- Focused Group Discussions with *Wazee wa Nyumba Kumi*

#### 10.3.1 Focused Group Discussions with Learning Institutions

Focused group discussions were held with the following learning instructions' Boards of Management within Roka and Matsangoni Locations:-

- Chumani Secondary School Board of Management
- Roka Secondary School Board of Management
- Katana Ngala Secondary School Board of Management
- Uyombo Girls Secondary School Board of Management

- Roka Primary School Board of Mnagement
- Kararacha Primary School Board of Management

#### 10.3.1.1 Focused Group Discussion with Chumani Secondary School Board of Management

Chumani Secondary School Board of Management raised the following issues and/or suggestions.

- The need to have haulage roads to be used by the heavy trucks ferrying the quarried limestone maintained
- The need to have excavated land rehabilitated after mining
- That the local community members should be given first priority on any employment opportunities that may arise as a result of the proposed project.
- That the proponent should have proper checks and balances to ensure that no minors and/or school going children are employed at the proposed project.
- That to handle the social impacts of the project such as STIs, the proponent should help equip the local dispensaries.
- Impacts on dust and noise to be adequately handled.


**Plate 12: Focused group discussions with the Chumani Secondary School BOM**

Appendix 10 is Minutes of the Focused Group Discussion with the Chumani Secondary School Board of Management.

#### *10.3.1.2 Focused Group Discussion with Roka Secondary School Board of Management*

Roka Secondary School Board of Management raised the following issues and/or suggestions.

- Dust impacts be adequately mitigated

- That noise from the project activities may affect the tranquility of the neighbourhood including the learning environment for students.
- That quarry pits should be rehabilitated after excavation.
- Heavy trucks that would be ferrying the limestone would lead to road deterioration.
- What are the checks and balances to ensure that the proponent would adhere to the Environmental and Social Management Plan?
- That the proposed project could potentially impact on the marine environment especially if it involves blasting.
- The proponent to escalate their CSR activities within the area.
- The proposed project could potentially impact on the acquifer especially knowing that most of the people in the area depend on ground water.
- That the occupational health and safety of employees should be a top priority.

**Plate 13: Focused group discussions with the Roka Secondary School BOM**

Appendix 11 is Minutes of the Focused Group Discussion with the Roka Secondary School Board of Management.

#### *10.3.1.3 Focused Group Discussion with Katana Ngala Secondary School Board of Management*

Katana Ngala Secondary School Board of Management raised the following issues and/or suggestions.

- Dust impacts should be adequately mitigated
- Noise impacts should be adequately mitigated
- Very deep excavations should be avoided
- Quarry pits to be rehabilitated after excavation
- That the occupational health and safety of employees should be a top priority

- That haulage roads should be adequately maintained
- Cleared vegetation should be compensated for
- The proponent to escalate their CSR activities within the area.

**Plate 14: Focused group discussion with the Katana Ngala Secondary School BOM**

Appendix 12 is Minutes of the Focused Group Discussion with the Katana Ngala Secondary School Board of Management.

#### *10.3.1.4 Focused Group Discussion with Uyombo Girls Secondary School Board of Management*

Uyombo Girls Secondary School Board of Management raised the following issues and/or suggestions.

- How will dust impacts be handled? The BOM emphasized that dust impacts be mitigated properly so that any health complications especially to the students are avoided.
- Quarry pits should be rehabilitated after excavation
- Loss of vegetation should be mitigated
- That impacts on dust, noise and vibrations should be mitigated well.
- That the proponent should put in measures to protect the school from the glare and general disturbance of the activities that would be going on at the quarries.
- That a wide-enough buffer zone of trees should be established between the school and the quarry area.


**Plate 15: Focused group discussion with Uyombo Girls Secondary School BOM**

Appendix 13 is Minutes of the Focused Group Discussion with the Uyombo Girls Secondary School Board of Management.

***10.3.1.5 Focused Group Discussion with Roka Primary School Board of Management***

Roka Primary School Board of Management raised the following issues and/or suggestions.

- The proposed project is welcome to the area, only that appropriate mitigation measures put in place.
- Priority should be given to the local community in terms of employment
- Dust impacts to the neighbourhood to be adequately handled.
- Quarry pits should be rehabilitated.
- Health and safety of workers be taken care of.

**Plate 16: Focused group discussion with Roka Primary School BOM**

Appendix 14 is Minutes of the Focused Group Discussion with the Roka Primary School Board of Management

#### *10.3.1.6 Focused Group Discussion with Kararacha Primary School Board of Management*

Kararacha Primary School Board of Management raised the following issues and/or suggestions.

- The project should go on with appropriate mitigation measures put in place
- Heavy trucks that would be ferrying the limestone may lead to road deterioration.
- Members of the community should be given priority for employment opportunities.
- What are the checks and balances to ensure that the proponent would adhere to the Environmental and Social Management Plan?
- The proponent to escalate their CSR activities within the area.

**Plate 17: Focused group discussion with the Kararacha Primary School BOM**

Appendix 15 is Minutes of the Focused Group Discussion with the Kararacha Primary School Board of Management

### 10.3.2 Focused Group Discussions with Religious Institutions

On the 9th October 2020, the Environmental Impact Assessment Study team held a discussion with a group of religious leaders drawn from the Roka and Matsangoni Locations and briefed them on the proposed project and the requirement for stakeholder consultation and participation. On their part, the religious leaders raised the following issues.

- The need to have excavated land rehabilitated after mining
- That the local community members should be given first priority on any employment opportunities that may arise as a result of the proposed project.
- Impacts on dust and noise to be adequately handled.
- Dust impacts be adequately mitigated

- The proponent to escalate their CSR activities within the area.
- Cleared vegetation should be compensated for
- Health and safety of workers and the general public should be taken care of.


**Plate 18: Focused group discussion with religious leaders**

Appendix 16 is Attendance List of the Focused Group Discussion with the Religious Leaders

### 10.3.3 Focused Group Discussions with Village Elders

Focused group discussions were held with a section of village elders drawn from Roka and Matsangoni Locations.

#### *10.3.3.1 Focused Group Discussion with Roka and Chumani Sub-Locations' Village Elders*

The Village Elders drawn from the Roka and Chumani Sub-Locations raised the following issues and/or suggestions.

- The village elders said potential impacts on fugitive dust should be handled well so as not to adversely affect people living in the area.
- The said that the local community should be given first priority when it comes to job opportunities at the proposed project
- The village elders expressed concern that the haulage of limestone by heavy trucks would render the local roads unusable.
- They said that the there is no doubt that the proposed project will be beneficial to the local community, however they said that, dust impacts should be handled prudently.
- They said that vegetation cleared should be compensated for.


**Plate 19: Focused group discussion with the Roka and Matsangoni Sub-Locations Village Elders**

Appendix 17 is Minutes of the Focused Group Discussion with the Roka and Chumani Sub-Locations Village Elders

#### *10.3.3.2 Focused Group Discussion with Matsangoni and Uyombo Sub-Locations' Village Elders*

The Village Elders drawn from the Matsangoni and Uyomboi Sub-Locations raised the following issues and/or suggestions.

- The village elders expressed concern that the haulage of limestone by heavy trucks would render the local roads unusable.
- They said quarry pits should be rehabilitated after excavation.
- They wanted to know the expertise required for the work at the proposed project so the local community can prepare adequately.
- They expressed concern that crop farms bordering the quarries would be rendered less productive.
- They also said that the locals should be given priority for employment opportunities.


**Plate 20: Focused group discussion with the Matsangoni and Uyombo Sub-Locations' Village Elders**

Appendix 18 is Minutes of the Focused Group Discussion with the Matsangoni and Uyombo Sub-Locations Village Elders

#### 10.3.3.3 Focused Group Discussion with Mkongani Sub-Locations Village Elders

The Village Elders drawn from Mkongani Sub-Location raised the following issues and/or suggestions.

- The village elders wanted to know how dust impacts will be handled.
- They said that the locals should be given priority for employment opportunities.
- They said quarry pits should be rehabilitated after excavation.

**Plate 21: Focused group discussion with Mkongani Sub-Locationa Village Elders**

Appendix 19 is Minutes of the Focused Group Discussion with the Mkongani Sub-Location Village Elders

### 10.3.4 Focused Group Discussions with *Wazee wa Nyumba Kumi*

Focused group discussions were held with a section of the *Wazee wa Nyumba Kumi* and they raised the following issues and/or suggestions.

- That dust impacts should be adequately mitigated
- That quarry pits should be rehabilitated after excavation
- They expressed concern that heavy truck to be involved in the proposed project would damage local roads.

**Plate 22: Focused group discussion with *Wazee wa Nyumba Kumi***

Appendix 20 is Minutes of the Focused Group Discussion with a section of the *Wazee wa Nyumba Kumi*.

### *10.4*Questionnaire survey

A questionnaire survey was carried out targeting as many stakeholders of the proposed project as possible. These included the local administrative leaders, the political leaders, learning institutions in the area, religious leaders in the area, business community and the community members. The following are the respondents to the questionnaire and the key issues/concerns raised.

### 10.4.1 Questionnaire Survey Responses from Local Administration

The following leaders in the Local administration responded to the questionnaire.

- Julius Pole Ziro-Snr Chief Roka Location
- John Amuma Munga-Snr. Asst. Chief Matsangoni Sub. Location
- William Karabu Kombe-Asst. Chief Uyombo Sub. Location
- Albert Kazungu Menza-Asst. Chief Mkongani Sub. Location
- Kombe Vincent J. Katana-Mtsangoni Town Village Elder
- Lawrence Garama Mwamure-Uyombo Centre (B) Village Elder
- James Charo Konde-Kadaina Island Village Elder

The following is a summary of the responses by the local administration leaders:-

- The proposed project will create job opportunities for the residents that will thus enhance their socio-economic lives and the general development of the area.
- The company being an investor will help in driving the development agenda of the area.
- The proposed project will lead to increased population in the hood and thus enhancement of business activities in the area.

- Mass production of dust and smoke from machines are likely to pollute the environment which may cause health complications among residents and low plant production.
- The mining processes may have adverse impacts on the road network of the area.
- Dust mitigation mechanisms should be inculcated in the project.
- Construction, repair and or maintenance of the roads in the area and if possible tarmac the access road to the limestone mining sites.
- Abandoned quarries should be turned into fish ponds.
- Rehabilitate (abandoned) quarries once the mining processes are completed to restore/improve the aesthetic value of the area.
- Develop tree planting and or soil reclamation programs that will also incorporate the organized community groups.
- Undertake Corporate-social-responsibility like the construction of health facilities around the project sites and support of existing institutions as a way of ploughing back to the host community.
- The purchasing power of the residents shall be improved due to the economic empowerment of the community.
- Residents of the area should be given priority in terms of employment and any other arising opportunities from the company.
- Residents to be accorded assistance in terms of education, health and incase of calamities.
- Institutions within the area should be included in the company's welfare fund.

Detailed responses from each of the respondents in this category are in appendix 21.

### 10.4.2 Questionnaire survey responses from Political Leaders

The following political leaders responded to the questionnaire.

- Mr. Hassan Mohamed; Member of County Assembly-Matsangoni Ward and Chairperson Water, Environment and Natural Resources Committee.

The following is a summary of the responses:-

- The proposed project will create job opportunities for the residents that will thus enhance their socio-economic lives and the general development of the area.
- Infrastructural development as a result of the project will lead to the growth of the area.
- The proposed project will lead to increased population in the hood and thus enhancement of business activities in the area.
- Increased debris and wastes in the hood.
- Water, noise and air pollution due to the mining processes will affect the locals and the living organisms.

- Proper waste management at the site to avoid any form of pollution in our environment.
- Minimize on the usage of heavy machinery at the site to reduce on the impact of earth tremours.
- The proposed mining project will open up the area in terms of development and for many youths who could not manage to complete school may get a form of employment to earn income and improve their living standards unlike the current devastating state.

Detailed responses from each of the MCA are in appendix 22.

### 10.4.3 Questionnaire survey responses from local learning institutions

The following learning institutions responded to the questionnaire

- Roka Secondary School
- Chumani Secondary School
- Katana Ngala Secondary School
- Uyombo Girls Secondary School
- Roka Primary School
- Uyombo Maweni Primary School
- Roka Maweni Primary School
- Chumani Primary School
- Ufuoni Primary School
- Kararacha Primary School

The following is a summary of the responses from the local learning institutions:-

- The proposed project will create job opportunities for the residents that will thus enhance their socio-economic lives and the general development of the area.
- The community will be able to source building materials locally from the mines.
- Land value is likely to rise in the area due to demand and thus better income for the land sellers though it may also increase landlessness due to thirst for ease money.
- Noise from machinery and dust will have a damaging impact on the learners of the area.
- Limestone mining will lead to depletion of top soils causing land degradation as well as creation of open pits that may be breeding grounds of vectors like mosquitoes.
- Exposure of the land due to the mining processes will actuate soil erosion in the area.
- Clearance of vegetation to pave way for the proposed project will affect the quality of air and the hydrological cycle that may trigger climate change.
- The mining processes will have adverse impacts on the road network of the area.
- The project will destroy the bio-diversity of the area.

- Increased school dropout which may emanate from early pregnancies, created employment opportunities, early marriages and land displacement/migration of families may be witnessed.
- The mining processes will lead to destruction of water catchment areas that are a heritage to the community besides diminishing the water quantity and quality of the area.
- Loss of communal grazing lands will lead to low animal production.
- The current serene and tranquil state shall cease once mining processes begin due to noise pollution.
- Quarrying activities should not be undertaken near schools and other institutions where the company has acquired land.
- Buffer the community/institutions from the company's activities likely to cause negative impacts in the area.
- Construction, repair and or maintenance of the roads in the area and if possible tarmac the access road to the limestone mining sites.
- Rehabilitate (abandoned) quarries once the mining processes is completed to restore/improve the aesthetic value of the area.
- Develop tree planting and or soil reclamation programs that will also incorporate the organized community groups.
- Create awareness/train staff and the community at large on the need to protect and or conserve the environment.
- Conduct open clinics to address/create awareness and or to treat ailments emanating from the project's activities.
- Provide alternative water sources to the community/institutions to be affected by mining activities.
- Develop employment guidelines at the company in respect to the labour laws.
- Undertake Corporate-social-responsibility like the construction of health facilities around the project sites and support of existing institutions as a way of ploughing back to the host community.
- Quarrying processes pose risks to learners especially young girls who elope with employees while students drop early out of school to seek employment at the mines.
- The purchasing power of the residents shall be improved due to the economic empowerment of the community.
- Residents to be accorded assistance in terms of education, health and incase of calamities.
- Disintegration of families due economic empowerment esp. the women.

- Guiding and counseling programs to be developed to aid students who may intent to drop out of school to join the mines to complete school first being doing so.

Detailed responses from each of the respondents in this category are in appendix 23.

### 10.4.4 Questionnaire survey responses from Health institutions

The following health institutions responded to the questionnaire

- Roka Maweni Dispensary

The following is a summary of the responses from the health institutions:-

- Effect to ground water considering that the people in the area rely on well water
- Air pollution as a result of mining activities may lead to respiratory problems.
- Provide an alternative to the well water for the community
- Ensure proper management of waste
- Boost the health facilities in the areas with medicine and equipment so that they are able to effectively deal with any conditions that may arise.
- The company should give first priority to employ people from the locality before employing people from other places.

Detailed responses from each of the health institutions are in appendix 24.

### 10.4.5 Questionnaire survey responses from Religious Institutions

The following religious institutions responded to the questionnaire

- Roka Maweni Agape Church-Pst. Dickson Nyamawi Mwaidza
- The Sanctuary of Praise Ministry-Paul C. Mbaru
- Upendo Gospel Planter Ministries Church-Deacon Harrison Ngao Vaya
- Baptist Church-Mishi Stori Chege
- Kajiweni Gospel Planters Church-Bishop. Ambrose Senje Mwayaona

The following is a summary of the responses from the religious institutions:-

- The proposed project will create job opportunities for the residents that will thus enhance their socio-economic lives and the general development of the area.
- Noise from machinery and dust will have a damaging impact on the learners of the area.
- Loss of communal grazing lands will lead to low animal production.
- Dust mitigation mechanisms should be inculcated in the project.
- Construction, repair and or maintenance of the roads in the area and if possible tarmac the access road to the limestone mining sites.
- Develop tree planting and or soil reclamation programs that will also incorporate the organized community groups.

- Provide alternative water sources to the community/institutions to be affected by mining activities.
- Undertake Corporate-social-responsibility like the construction of health facilities around the project sites and support of existing institutions as a way of ploughing back to the host community.
- Residents to be accorded assistance in terms of education, health and incase of calamities.

Detailed responses from each of the religious institutions are in appendix 25.

### 10.4.6 Questionnaire survey responses from Community Members

The following community members responded to the questionnaire

- Henry Said Wanje
- Gilbert Baya Kadzamba
- Kenga Gona Charo
- Rose Mbala Kitengele
- David Baraka Masha
- Kombe Yeri Cleophas
- Stanley Kitsao Lewa
- Samuel Gunga Ndurya

The following is a summary of the responses from the community members:-

- The proposed project will lead to increased population in the hood and thus enhancement of business activities in the area.
- Water, noise and air pollution due to the mining processes will affect the locals and the living organisms.
- Noise from machinery and dust will have a damaging impact on the learners of the area.
- Limestone mining will lead to depletion of top soils causing land degradation as well as creation of open pits that may be breeding grounds of vectors like mosquitoes.
- Clearance of vegetation to pave way for the proposed project will affect the quality of air and the hydrological cycle that may trigger climate change.
- The mining processes will have adverse impacts on the road network of the area.
- Loss of communal grazing lands will lead to low animal production.
- The mining project may lead to cracking and falling of structures e.g. buildings.
- Insecurity problems may emanate if the company doesn't put proper measures to man or clear bushes in the large tracks of land that they have acquired as thugs may use it as a hiding den.

- The proposed project will affect the economy of the local stone cutters and their consumers at the area who depend on the sites acquired by the company.

Detailed responses from each of the community members who responded to the questionnaire are in appendix 26.

### 10.4.7 Consolidated Views, Issues and/or Concerns as captured in the questionnaires

- The proposed project will create job opportunities for the residents that will thus enhance their socio-economic lives and the general development of the area.
- Infrastructural development as a result of the project will lead to the growth of the area.
- The company being an investor will help in driving the development agenda of the area.
- The community will be able to source building materials locally from the mines.
- The proposed project will lead to increased population in the hood and thus enhancement of business activities in the area.
- Land value is likely to rise in the area due to demand and thus better income for the land sellers though it may also increase landlessness due to thirst for ease money.
- Increased debris and wastes in the hood.
- Water, noise and air pollution due to the mining processes will affect the locals and the living organisms.
- Noise from machinery and dust will have a damaging impact on the learners of the area.
- Mass production of dust and smoke from machines are likely to pollute the environment which may cause health complications among residents and low plant production.
- Limestone mining will lead to depletion of top soils causing land degradation as well as creation of open pits that may be breeding grounds of vectors like mosquitoes.
- Exposure of the land due to the mining processes will actuate soil erosion in the area.
- Clearance of vegetation to pave way for the proposed project will affect the quality of air and the hydrological cycle that may trigger climate change.
- The mining processes will have adverse impacts on the road network of the area.
- The project will destroy the bio-diversity of the area.
- Increased school dropout which may emanate from early pregnancies, created employment opportunities, early marriages and land displacement/migration of families may be witnessed.
- The mining processes will lead to destruction of water catchment areas that are a heritage to the community besides diminishing the water quantity and quality of the area.
- Loss of communal grazing lands will lead to low animal production.

- Displacement of persons to pave way for the proposed mining project will lead to disintegration of families.
- The mining project will lead to cracking and falling of structures e.g. buildings.
- The current serene and tranquil state shall cease once mining processes begin due to noise pollution.
- Insecurity problems may emanate if the company doesn't put proper measures to man or clear bushes in the large tracks of land that they have acquired as thugs may use it as a hiding den.
- The proposed project will affect the economy of the local stone cutters and their consumers at the area who depend on the sites acquired by the company.
- The proposed project will affect us if the company doesn't observe the NEMA guidelines and regulations on the environment.

### 10.4.8 Measures proposed to be put in place to protect and or conserve the environment as captured in the questionnaire

- Proper waste management at the site to avoid any form of pollution in our environment.
- Minimize on the usage of heavy machinery at the site to reduce on the impact of earth tremors.
- Quarrying activities should not be undertaken near schools and other institutions where the company has acquired land.
- Dust mitigation mechanisms should be inculcated in the project.
- Buffer the community/institutions from the company's activities likely to cause negative impacts in the area.
- Construction, repair and or maintenance of the roads in the area and if possible tarmac the access road to the limestone mining sites.
- Construction of a perimeter wall around the proposed quarry sites.
- Abandoned quarries should be turned into fish ponds.
- Rehabilitate (abandoned) quarries once the mining processes is completed to restore/improve the aesthetic value of the area.
- Develop tree planting and or soil reclamation programs that will also incorporate the organized community groups.
- Create awareness/train staff and the community at large on the need to protect and or conserve the environment.
- Conduct open clinics to address/create awareness and or to treat ailments emanating from the project's activities.

- Provide alternative water sources to the community/institutions to be affected by mining activities.
- Develop employment guidelines at the company in respect to the labour laws.
- Undertake Corporate-social-responsibility like the construction of health facilities around the project sites and support of existing institutions as a way of ploughing back to the host community.
- Respect the rights and demands of the host community.
- NEMA and the Ministry of Health to ensure that the Mombasa Cement Company is doing their work in the area positively in the interest of residents.

### 10.4.9 The General Concerns, Issues and or observations as captured in the questionnaires

- The proposed project is a great idea likely to benefit the community once the negative impacts are mitigated.
- The proposed mining project will open up the area in terms of development and for many youths who could not manage to complete school may get a form of employment to earn income and improve their living standards unlike the current devastating state.
- Pollution is the greatest concern from the mining processes.
- Quarrying processes pose risks to learners especially young girls who elope with employees while students drop early out of school to seek employment at the mines.
- Roads should be enhanced to ease transportation and minimize road accidents.
- Purchase of land at fair price and returning of land to original owners after rehabilitation.
- The proposed project should create job opportunities for the community especially the youths.
- Security in the area will be enhanced especially when the idle people involved in thug life shall have an alternative source of income.
- The proposed project being a business of the company should also benefit the community.
- The purchasing power of the residents shall be improved due to the economic empowerment of the community.
- Residents of the area should be given priority in terms of employment and any other arising opportunities from the company.
- Residents to be accorded assistance in terms of education, health and incase of calamities.
- Institutions within the area be included in the company's welfare fund.
- Harmonious working relationship between the company and the residents will lead to reaping of dividends to both parties.

- Disintegration of families due economic empowerment esp. the women.
- Guiding and counseling programs to be developed to aid students who may intent to drop out of school to join the mines to complete school first being doing so.
- Transparent agreement between the company and the community on issues/projects towards corporate responsibility to avoid hyped up expectations.
- The Mombasa Cement company has undertaken projects in the area that have already benefited the community which we appreciate and we look towards a positive engagement in all our future dealings.
- It is our hope and desire that MCL will regard our opinions as well as abiding by the NEMA & Ministry of Health's instructions when implementing the proposed project.

## 11. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The Environmental (Impact Assessment and Audit) Regulations, 2003 define environmental management plan to mean "all details of project activities, impacts, mitigation measures, time schedule, costs, responsibilities and commitments proposed to minimise environmental impacts of activities, including monitoring and environmental audits during implementation and decommissioning phases of a project". This environmental and social management plan (ESMP) identifies potential impacts from implementation of the proposed coral limestone mining process, outlines measures to be put in place during the implementation, operation and decommissioning phases of the coral limestone mining project to enhance positive impacts and mitigate negative impacts, identifies compliance requirements, training and capability building needs, safeguards implementation, grievance redress mechanism, quarry rehabilitation and decommissioning. More specifically, the ESMP address the following;

- ✓ Company management policies
- ✓ Potential positive social impacts
- ✓ Potential negative social impacts
- ✓ Potential negative environmental impacts
- ✓ Maximization of identified potential positive impacts.
- ✓ Mitigation of identified potential negative environmental and social impacts
- ✓ Environmental management action plans
- ✓ Monitoring for compliance with the provisions of relevant national legislations.
- ✓ Training, capacity development, implementation schedule and related costs**.**
- ✓ Institutional arrangements for safeguard implementation and reporting.
- ✓ Grievances redress mechanism.
- ✓ Quarry pits rehabilitation and decommission plan

### 11.1 Management policies

MCL will need to update and document policies to reflect unique requirements of the proposed project that will guide implementation of the proposed coral limestone mining project at Roka and Matsangoni Locations. The policies once updated will be vital in the following ways among others:

The policies once updated will be vital in the following ways among others:

- ✓ The policies will identify the unique stakeholder mix within the project catchment hence enable management to develop and maintain sound relations with all stakeholders.

- ✓ The policies will enable management identify and fact in unique and project specific measures and structures that will care for the safety, health and welfare of all workers and the neighbouring community to the project site.
- ✓ The policies will provide a broad framework for management to plan for, and put in place, monitoring programmes that will ensure conservation and protection of the environment.
- ✓ The policies will provide an enhanced framework for management to expand its corporate responsibility to the proposed project area and wider project catchment to foster environmental conservation, sustainable utilization of natural and the well-being of the local community.

MCL being an on-going concern already has developed and documented most if not all of these policies. We therefore propose that MCL to update the existing policies by incorporating requirements and needs of the proposed project. The updated policies should therefore capture unique requirements of the proposed project site and its diverse stakeholder mix. The following policies should be updated:-

a) Environmental Management Policy
b) Occupational Health and Safety Policy
c) Local Community Policy
d) Employment Policy

### 11.1.1 Environmental Management Policy

The environmental policy to be updated should be one that enables MCL to carry out company activities with the highest regard to the natural environment and sustainable utilisation of environmental resources therein. The policy update should therefore cover the following, among other issues:-

- ✓ All legal requirements that will need to be complied during implementation of the coral limestone mining project.
- ✓ Measures to be put in place to ensure continuous environmental improvement and performance through monitoring of limestone mining activities.
- ✓ Ways to ensure that utilisation of natural resources is optimal with measures in place to ensure resource availability for future generation.

- ✓ Awareness creation to the surrounding community regarding sustainable utilisation of natural resources, protection of sensitive ecosystems and bio-diversity maintenance for communal livelihood.
- ✓ Balancing between natural resource use, environmental conservation and economic development.

### 11.1.2 Occupational Health and Safety Policy

The Occupational Health and Safety Policy to be updated should enable MCL put in place appropriate measures that will ensure that the health, safety and welfare of all employees of the mining project is cared for; together with the health requirements of the local community The policy should highlight the following, among others:-

- ✓ Handling of heavy mining equipment
- ✓ Quarry mine safety
- ✓ Safety measures required for evacuation of recovered coral limestone.
- ✓ Appropriate safety and rescue equipment to be availed at the mine
- ✓ Emergency procedures and actions at the mine
- ✓ Risk minimization of accidental damage to employees, community and environment
- ✓ Mining equipment maintenance and machine operator proficiency
- ✓ Training in mining safety.

### 11.1.3 Local Community Policy

The proponent will update local community policy to bring on-board Matsangoni and Roka communities. The updated policy will serve to ensure that the company develops and maintains sound relations with quarry employees and the local community on mutual respect and active partnership. The policy should highlight on ways the proponent should:-

- ✓ Work with the local community to achieve sustainable community development.
- ✓ Promote public awareness in regard to monitoring of developments site; potential environmental consequences to the area and the role of the local community.
- ✓ Propose ways of enhancing information flow from management to the community and employees, and vice visa.
- ✓ Community capacity building.
- ✓ Active engagement of the local community in the project.

### 11.1.4 Employment Policy

The Employment Policy to be updated by MCL should take into consideration the varying employment needs of the community in the new proposed project site. The policy update should endeavour to protect the local community from unfair competition when it comes to recruitment of workers to work in the mine. The policy update should cover the following, among other issues:-

- ✓ Local community considerations in employment.
- ✓ Training needs for employees.
- ✓ Employment of people with specialized skills.
- ✓ Casual Workers.
- ✓ Compensation, allowances and benefits.
- ✓ Terms of payment and scales.

## 11.2 Potential social impacts

Implementation of the proposed coral limestone mining activities will potentially result in impacts that will affect the social environment. Social environment refers to the aggregate of social and cultural institutions, forms, patterns, and processes that influence the life of an individual or community. It includes the immediate physical and social setting in which people live or in which something happens or develops. Social environment also includes the culture that the individual lives in, and the people and institutions with whom they interact. The interaction may be in person or through communication media.

### 11.2.1 Potential positive social impacts

Implementation of the proposed coral limestone mining activity will potentially result in the following positive social impacts:-

- ✓ Employment opportunities
- ✓ Support of existing local businesses
- ✓ Businesses spinoffs
- ✓ Support and development of local institutions
- ✓ Skill enhancement and technological transfer
- ✓ Elaborate corporate social responsibility projects

#### 11.2.1.1 Employment opportunities

Implementation of the proposed coral limestone mining activity has the potential to provide both direct and indirect employment opportunities. Likely direct employment will include

security personnel, machine and plant operators, truck drivers, quarry camp staff, site mechanics, bush clearing and ground maintenance personnel among others. To ensure maximum employment returns to the local community, MCL will ensure that sourcing of required personnel is first from the local community. The project also will provide indirect employment opportunities; this will include food outlets who will benefit from clientele drawn from workers at the quarry site, hotels and lodges offering catering and accommodation services, other service providers such as local garages, financial institutions, shop outlets, entertainment joints such as bars and clubs that will draw clients from quarry workers.

#### 11.2.1.2 Support of existing local businesses

Local businesses are likely to benefit from improved purchasing power of people in the area as a result of their remuneration. There is likelihood that there will be more money in the pockets of people who are directly or indirectly employed in the quarry and that part of the money will be spent in the local economy hence benefits local businesses.

#### 11.2.1.2 Businesses spinoffs

The multiplier effect of implementation of the proposed coral limestone mining project is likely to star business spinoffs in the area. Small business such as outside catering, track transport businesses, accommodation businesses and entertainment business are some of the likely incidental businesses to be realized.

#### 11.2.1.3 Support and development of local institutions

Implementation of the proposed project will further open up the area and hence increase the need of supporting and developing local institutions to meet growing demand of services. Increased activities in the area will require that institutions such as local administration, local health institution, and local basic and tertiary learning institutions be further developed and expanded to meet growing demand for services.

#### 11.2.1.4 Skill enhancement and technological transfer

Implementation of the proposed coral limestone mining project will involve the use of heavy mining equipment. The operation, use, servicing and maintenance of the equipment will be by well trained and experienced personnel. The availability of the equipment in the locality will expose local people to their use, servicing and maintenance, through this new skills and knowledge will be imparted. Further skill enhance and knowledge transfer will be realised through attachment and internship program where students and interns can be attached to an

experienced equipment operator for a given period of time to learn how the equipment is operated, serviced and maintained.

#### 11.2.1.5 Elaborate corporate social responsibility projects

Whereas MCL has not started implementing the proposed project on site, the company has started extending its corporate social responsibility (CSR) programme to the area. A number of local primary schools are already benefiting from the project, the company is carrying out extensive rehabilitation of school building and structures and in some cases constructing new buildings and structures to improve infrastructure of local schools. Equally local administration offices have started to receive major facelift. MCL intends to roll out an elaborate CSR programme in the local community that will significantly transform social institutions within the catchment of the proposed project once the proposed project commences.

### 11.2.2 Potential negative social impacts

Potential negative social impacts likely from implementation of the proposed coral limestone mining activities may include the following:-

- ✓ Diminishing/ reduced local ground water resources
- ✓ Labour influx
- ✓ Traffic and Public Safety from trucks along access road
- ✓ Ponding risks resulting spread of malaria from increased breeding of mosquitoes
- ✓ Injuries and accidents
- ✓ HIV and AIDS and other communicable diseases

#### 11.2.2.1 Diminishing/ reduced local ground water resources

Most local households depend on local hand dug wells for their water supply needs. Whereas the water in most of the wells is saline, it is relied on for domestic uses. Implementation of the proposed project may affect recharge of local aquifer due to reduced vegetation in that area that will reduce rainwater percolation and hence aquifer recharge. Reduced aquifer recharge will gradually reduce the yield of water in the local hand dug wells and hence available water in the well.

#### 11.2.2.2 Labour influx

Implementation of the proposed coral limestone mining project will require both skilled and unskilled labour force. In the event that the required skilled workforce cannot be obtained locally either because of lack of technical skills or capacity, in such a scenario, the required labour force may be sourced outside the project area. In such a scenario, there is a potential

for potential workers together with other people who will be supplying goods and services to the proposed project in the short term to migrate from outside and settle at the project area resulting in a labour influx into the project area. Social risks associated with such labour influx will include the following:-

- ✓ Increased pressure on local accommodation facilities and rent hiking: Sourcing of quarry labour outside the project area will necessitate that they seek for convenient accommodation close to the project site. This will increase pressure on available accommodation facilities. Further due to increased demand for accommodation there may be increase of accommodation prices and crowding out of local residents.
- ✓ Local inflation of commodity prices: Labour influx may result in a significant increase in demand of goods and services at proposed project site and its environs; this may result in local price hikes and/or crowding out of community consumers.
- ✓ Gender-based violence: Mine workers in most mining sites are younger males although more recently young females are now joining the workforce. Based on this it is likely that quarry staff to the proposed project site may be male dominated. Young males who are away from home on the quarrying job will be separated from their family and act outside their normal sphere of social control. This can lead to inappropriate behavior, such as sexual harassment of women and girls, exploitative sexual relations, and illicit sexual relations with minors from the host community.
- ✓ Incidence of child labour and school dropout**:** The proposed project will potentially increase opportunities for the host community to sell goods and services to the incoming workers. Depending on the nature of the social fabric and individual local family dynamics, such an opportunity can be a temptation to parents who can allow their children to produce and deliver these goods and services at the expense of attending school. This will lead to enhanced school dropout.

#### 11.2.2.3 Traffic and Public Safety from trucks along access road

The public safety of users of the access roads that are off the Kilifi-Malindi Highway to the project site may be affected by the potential increase of traffic to and from the project site during the coral limestone mining period. Considering that the said access roads are all earth roads narrow and with pot holes and that it were meant for light traffic, it is likely that trucks ferrying limestone out of the mining sites will potentially affect public safety of the users of the access roads.

#### 11.2.2.4. Ponding risks resulting spread of malaria from increased breeding of mosquitoes

Poorly drained quarry pits will potentially collect rainwater which becomes potential mosquito breeding grounds. This may result in contributing to breeding of mosquitos that can in turn potentially contribute to the spread of malaria in the area.

#### 11.2.2.5 Injuries and accidents

Open quarry pits pose a risk for injuries and accidents to local community, local livestock and workers. People and livestock can easily fall in unmarked and unsecured quarry pits and injury themselves. The injuries and accidents can be more severe if the open quarry pits are deep and contain stagnant water. In such a scenario, people and livestock that accidently fall in can draw.

#### 11.2.2.6 HIV and AIDS and other communicable diseases

Considering the possibility that quarry workers in most quarry sites are young males who sometimes are sourced outside the project area, sexual interactions between local workforce and services providers with those from outside the project area may contribute to spread of communicable diseases in the project area and or among quarry workers, including sexually transmitted diseases such as HIV and AIDS.

### 11.3 Proposed enhancement measures of potential positive social impacts

**Table 16: Proposed measures to enhance positive impacts**

| Potential positive social impacts | Proposed enhancement measures |
|---|---|
| Employment opportunities | - Local people from the project area to be given first priority to benefit in direct employment opportunities.<br>- There should be no sourcing of unskilled or semi-skilled labour force from outside the project area<br>- Local youths, both male and female and local women who form the bulk of local labour force to be given utmost priority when sourcing quarry labour force<br>- Both male and female to be considered in allocating employment slots for each gender when sourcing labour force.<br>- Maintain records of employees with gender and locality of employees working at the quarry site to ensure the ratios are maintained. |
| Support of | - Local business community to position themselves strategically to be |

| Potential positive social impacts | Proposed enhancement measures |
|---|---|
| existing local businesses | able to provide required services to the project by making required investment prior and during the project period. |
| Businesses spinoffs | - Local youths of both gender and women who will benefit from direct and indirect employment opportunities to invest part of their earnings in starting small businesses locally or inject more capital to their already existing businesses to scale up them up |
| Support and development of local institutions | - Local leadership to priorities and communicate to the proponent local institutions that will require developmental support.<br>- Local primary and secondary schools which can be identified as most disadvantaged in terms of infrastructure development to be among those to be prioritized for support and development |
| Skill enhancement and technological transfer | - The proponent to provide opportunities for internship to enhance skill development<br>- The proponent to provide for student attachment opportunities from learners of local tertiary institutions |
| Elaborate corporate social responsibility projects | - The local community leadership to liaise with the proponent to tap into the proponent's corporate social responsibility programme for the locality for maximum possible benefit. |

### 11.4 Mitigation measures for potential negative social impacts

**Table 17: Proposed mitigation measures for potential negative social impacts**

| Potential negative impact | Proposed mitigation measures |
|---|---|
| Reduced availability of local ground water in the area for community use | - To increase local aquifer recharge maintain pockets of vegetation at the project area and support tree planting activities in public utility areas outside the project site but within the project catchment<br>- Depth of limestone mining to be far above the local aquifer and a way from any existing hand dug well and or borehole<br>- Existing hand dug well and or boreholes to be maintained and rehabilitated to ensure improved water yield |
| Labour influx | - The proponent to source required labour locally unless expatriates |

| Potential negative impact | Proposed mitigation measures |
|---|---|
| | who are not available locally<br>- The labour to be sourced locally to include women and youth of both gender<br>- Numbers of women employed in the quarry site to be monitored to ensure they remain proportionate to those of their male counterparts. |
| Traffic and Public Safety | - The proponents to ensure all trucks collecting mined coral limestone from the quarry or delivering materials and equipment to the quarry are mechanically sound, serviceable and meet all the traffic act requirements.<br>- Drivers driving the trucks to observe the highway code, be experienced and licensed to drive such trucks<br>- Proponent to liaise with the County Government of Kilifi and the National Government to request for expansion, upgrading and or maintenance of key access roads that will be used to meet required needs.<br>- Appropriate safety signs including speed pumps to be erected along the said access roads.<br>- Local community to be sensitized on the increased traffic use of the access road and the need for the community to be vigilant and exercise of safety precaution when using the said access roads |
| Ponding risks resulting spread of malaria | - All quarry pits to be adequately drained to ensure no water stagnates when it rains<br>- Proponent to check all active and disused quarry pits to ensure no water stagnates.<br>- All disused quarry pits to be backfilled and rehabilitated as soon as recovery of limestone is complete |
| Injuries and accidents | - The quarry to be safely secured and fenced with a clear entry and exit gates that are manned.<br>- All active quarry pits to be clearly feasibly marked and manned.<br>- There should be no unauthorized access to the quarry pits including that of straying livestock from the community or children playing, or fetching water.<br>- Appropriate information notices and warning signs to be displayed |

| Potential negative impact | Proposed mitigation measures |
|---|---|
| | at periphery of quarry to inform and educate local community of on-going quarrying activity and required safety measures to be observed. |
| HIV and AIDS | - Sensitization programs on issues HIV/AIDS for the quarry staff and local community to be developed and carried out at the quarry site and local community by peer educators.<br>- A condom dispenser always stocked with condoms to be availed at the quarry site<br>- Proponent to arrange for convenient and free voluntary and counseling services for quarry workers to be accessed at the quarry site and any community members willing to benefit from the service. |

## 11.5 Potential negative environmental impacts

### 11.5.1 Impact identification and predication

The type, scale and location of the proposed project guided the scope of the impact identification. The direct and indirect project-related impacts on the environment and local community and residual impacts were considered during the assessment of impacts. The extent of impact covers the project site, specific project activity at particular period and potentially affected areas beyond the project site. Duration in which the impact takes place is also considered in the evaluation of the impact. The period can be specific to the period of certain activities or could be related to the occupancy period of the project development. Thus, in terms of duration an impact can be viewed as a short, medium, long term impact or permanent. Impact can affect biodiversity partially or completely. For instance only small part of habitat, ecological processes or small population of species can be destroyed by the impact. Thus, magnitude of an impact was evaluated as proportion of the environmental entity affected. The probability of the impact to happen was derived from the frequency of the activity and frequency of impacts. The four characteristics described above were used to synthesise significance of the impact as shown in impact significance assessment criteria (figure 12) that is used to generate the risk assessment matrix (figure 13).

**EXTENT**

| | |
|---|---|
| Localized (At localized scale and a few hectares in extent) | 1 |
| Study area (The proposed site and its immediate environs) | 2 |
| Regional (County and Regional level) | 3 |
| National (Country) | 4 |
| International (Beyond Kenya) | 5 |

**MAGNITUDE**

| | |
|---|---|
| Small and will have no effect on the environment | 0 |
| Minor and will not result in an impact on the processes | 2 |
| Low and will cause a slight impact on the processes | 4 |
| Moderate and will result in process continuing but in a modified way | 6 |
| High (processes are altered to the extent that they temporarily cease) | 8 |
| Very high and results in complete destruction of patterns and permanent cessation of the processes | 10 |

**DURATION**

| | |
|---|---|
| Very short (0 – 1 Years) | 1 |
| Short (1 – 5 Years) | 2 |
| Medium term (5 – 15 years) | 3 |
| Long term (>15 years) | 4 |
| Permanent | 5 |

**PROBABILITY**

| | |
|---|---|
| Highly improbable (<20% chance of occurring) | 1 |
| Improbable (20 – 40% chance of occurring) | 2 |
| Probable (40% - 70% chance of occurring) | 3 |
| Highly probable (>70% - 90% chance of occurring) | 4 |
| Definite (>90% chance of occurring) | 5 |

**Figure 12: Impact significance assessment criteria**

### 11.5.2 Methodology used to determine environmental and social risks of the impacts

Determination of environmental and social risks of the impacts involved the identification of potential negative impacts, analysis and evaluation of the negative impacts associated with the proposed project. Potential negative impacts were identified using checklists and matrices as defined by Petra (2009). An impact assessment was carried out to identify where the interactions were likely to occur between the proposed project activity and the receiving environment. Checklists of project activities were used and impact scores were assigned

through consultative approaches, brainstorming sessions, scenario analyses, interviews and prior experience. Expert judgement was used to elicit, distributions, preferences, rankings, comparisons, qualitative information, point values and probabilities as explained by O'Hagan et. al.(2006). Leopold Matrix developed by Leopold et. al (1971) was used to estimate the magnitudes and importance of the potential impacts. The Leopold, Lohani and Thanh methods (Petra, 2009) were used to identify major activities and define areas were attention was mostly required. The resulting information together with available information from baseline data, professional judgement of the assessment team constituted the basis for the environmental and social risks of the identified potential negative impacts.

### 11.5.2.1 Determination the environmental and social risk of the impacts

The environmental and social risk of each of the identified impact was calculated by multiplying impact consequence by impact probability. Impact consequence is the summation of the extent of the impact, its duration and magnitude as shown in the risk assessment matrix below.

| | | CONSEQUENCE (Extent+Duration+Magnitude) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| PROBABILITY | 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| | 2 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 32 | 34 | 36 | 38 | 40 |
| | 3 | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 | 39 | 42 | 45 | 48 | 51 | 54 | 57 | 60 |
| | 4 | 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 | 40 | 44 | 48 | 52 | 56 | 60 | 64 | 68 | 72 | 76 | 80 |
| | 5 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 |

**Figure 13: Risk assessment matrix**

**NOTE 1**: Risk = Consequence x Probability

**NOTE 2:** Consequence = Extent + Duration + Magnitude

**NOTE 3**: Confidence assessment (low, medium and high) based on combination of available information and expert judgment

**Low impact (<30)** this impact would not have a direct influence on the decision to implement the proposed project

**Medium impact (30-60)** the impact could influence the decision to implement the proposed project unless the impact is effectively mitigated

**High impact (>60)** the impact will have a direct influence on the decision to implement the proposed project

### 11.5.3 Identified Potential negative Environmental Impacts

Mining is widely regarded as having adverse effects on environment of both magnitude and diversity. Some of these effects include erosion, formation of sinkhole, biodiversity loss and contamination of groundwater by chemical from the mining process in general and open-pit

mining in particular (Monjezi, et.al. .2009). Open-cast mining changes geological, hydrological and geotechnical conditions; it influences the existing ecological system and landscape (Drebenstedt, et.al. 2015). The actual environmental impact of mining will depend of the type of mineral, the mining process utilized, the vulnerability of the area affected and the timescale over which impacts occur (Parliamentary Commissioner for the Environment (2010). The implementation of the proposed limestone mining project will potentially result in environmental impacts that will affect the biophysical environment. The **biophysical environment** includes living things (bio), such as plants and animals, and non-living things (physical), such as rocks, soils and water. The biophysical environment is made up of four parts: the atmosphere, hydrosphere, lithosphere and biosphere. Interactions occur between the four spheres. The **atmosphere** refers to the whole mass of air surrounding the earth. At a local level it refers to the air of a locality. The **hydrosphere** is the portion of the earth that is composed of water in all forms i.e. running water, ice and water vapor. The lithosphere refers to the rocks and soils on the crust of the earth. The **biosphere** is the zone of the earth and adjoining parts of the atmosphere in which plants and animals exist.

#### 11.5.3.1 Potential negative environmental impacts during quarry preparation phase of the proposed limestone mining project

Site preparation activities for proposed limestone mining will include the following:

- ✓ Development of access roads to the areas to be mined
- ✓ Clearing of vegetation on site
- ✓ Construction of quarry camp and other support facilities
- ✓ Assembly of heavy mining equipment

#### 11.5.3.1.1. Development of quarry access roads to the areas to be mined

Accesses roads will be required to access various plots were proposed limestone mining is to be done. This may necessitate connecting the proposed mining site to the nearest access road. Also improvement of some of the existing access roads may be necessary to be able to accommodate increase of vehicular traffic on the roads. Development and improvement of the access roads will require vegetation removal, excavation, removal of overburden, placement of gravel, leveling and compaction. These activities will potential result in negative impacts. Potential negative impacts likely from the development of access roads to the areas to be mined could include:

- ✓ Loss of site vegetation where the access roads will be developed. Loss of vegetation will translate to reduced local greenery, overall reduction in local carbon sink.

- ✓ Generation of fugitive dust from soil excavation activities, removal of overburden and leveling activities. Generated fugitive dust will potentially negatively affect people using the access road as it could contribute to reduction of local feasibility, vegetation along the access road and adjacent areas as when the dust settles on surfaces of the vegetation it result in smothering of vegetation foliage.
- ✓ Generation of noise and vibration from equipment activity, exaction and compaction works on site. This will potentially contribute to interferences conversation and communication, course annoyance, interfere with local recreation, and negate work performance, thought and concentration.

An assessment of the environmental risk associated with development of access roads at the proposed project site to make developed quarries accessible to move out quarried limestone was informed by the identified potential negative impacts associated with access roads development. The assessment was done using the risk assessment matrix. The confidence of assessment of impacts resulting from quarry access roads development when unmitigated and the resulting environmental risk based on the risk assessment matrix is as tabulated table 18 below.

**Table 18: Assessment of environmental risk resulting from quarry access roads development**

| | |
|---|---|
| Extent of impact | 1 |
| Magnitude of impact | 2 |
| Duration of impact | 1 |
| Probability of impact | 4 |
| Risk = (Extent + Magnitude + Duration) x Probability | 16 |
| Environmental risk of site vegetation clearing | Low impact |

The outcome of the assessment of the environmental risk associated with development of quarry access roads at the proposed project site is low. This implies that impacts associated with development of quarry access roads at the proposed project site should not have a direct influence on the decision to implement or not implement the proposed project.

### *11.5.3.1.2 Clearing of vegetation on site*

Clearing of site vegetation will be a pre-requisite to pave way for opening the ground for limestone mining. Vegetation at the proposed project site includes trees, shrubs, herbs, climbers, grasses and sedge. Some of the plots vegetation include food trees such as coconuts. Clearing of the vegetation at the proposed project site will result in loss of environmental and ecological services derived from the vegetation. Also cutting down of

food trees such as coconuts will result in loss of the various economic and social benefits delivered from coconut crop trees. The environmental services that will be lost include reduction in local carbon sink, loss of local shade and loss of local wind break. Ecological services likely to be lost include loss of soil conservation as tree roots bind soil aggregates thus minimizing soil erosion, nitrogen fixing, and windbreak. Potential negative environmental impacts likely to result from vegetation clearing from the proposed project site will include:-

- ✓ Direct loss of local vegetation abundance and biodiversity due to the clearing of vegetation within the proposed project area
- ✓ Direct and indirect loss of fauna abundance and biodiversity through habitat loss resulting from vegetation clearance.
- ✓ Diminishing of local carbon sink resulting in reduced area capacity of carbon sequestration.
- ✓ Overall reduction of flora in the area and overall loss and/or reduction of ecological and economic services derived from the lost floral species.
- ✓ Loss and or reduced foliage for local fauna species that will negatively impact on the growth, reproduction and development of the affected faunal species.
- ✓ Loss of various economic services derived from coconut tree such as source of food (coconut), source of palm wine (mnazi) source of madavu, source of building and thatching materials among many others.

An assessment of the environmental risk associated with vegetation loss from the project site as a result of implementation of the proposed project was informed by the identified potential negative impacts. The assessment was done using the risk assessment matrix. The confidence of assessment of negative impacts to vegetation when unmitigated and the resulting environmental risk based on the risk assessment matrix is as tabulated in table 19 below.

**Table 19: Assessment of environmental risk of vegetation loss from project site**

| | |
|---|---|
| Extent of impact | 2 |
| Magnitude of impact | 8 |
| Duration of impact | 4 |
| Probability of impact | 5 |
| Risk = (Extent + Magnitude + Duration) x Probability | 70 |
| Environmental risk of site vegetation clearing | High impact |

The outcome of the assessment of the environmental risk associated with site vegetation clearing and resulting potential negative impacts of vegetation loss from the proposed project site is high. This implies impacts associated with vegetation clearing from the proposed project site could have a direct influence on the decision to implement/ not implement the proposed project.

*11.5.3.1.3 Construction of quarry camp and other support facilities*

A quarry camp will be constructed as part of the pre-requisite infrastructure before commencement of mining of the limestone. It is anticipated that the quarry camp will be secured by perimeter fencing and that it will include among others office spaces, sanitary facilities, truck parking area, temporally area for minor repairs of trucks, staff canteen, water storage facilities among others. Potential negative impacts likely to result from the construction of the quarry camp could include:

- ✓ Loss of vegetation that will be cleared to crate room to construct the camp
- ✓ Generation of fugitive dust from opening up the ground where the camp will be constructed
- ✓ Noise and vibration during the actual construction of the various camp structures and infrastructure. The noise and vibration could be from use of equipment and the actual construction activities.
- ✓ Generation of solid waste from construction activities. Waste likely to be generated includes excavated earth material offcuts of timber, steel and plastic among others.
- ✓ Injuries and accidents from construction activities and use of tools and equipment. Injuries and accidents could include falling from height, fractures, cuts, bruises among others.

An assessment of the environmental risk associated with quarry camp construction at the proposed project site was informed by the identified potential negative impacts associated with construction of the quarry camp. The assessment was done using the risk assessment matrix. The confidence of assessment of impacts resulting from construction of the quarry camp when unmitigated and the resulting environmental risk based on the risk assessment matrix is as tabulated table 20 below.

**Table 20: Assessment of environmental risk resulting from quarry camp construction**

| | |
|---|---|
| Extent of impact | 1 |
| Magnitude of impact | 2 |
| Duration of impact | 1 |

| | |
|---|---|
| Probability of impact | 3 |
| Risk = (Extent + Magnitude + Duration) x Probability | 12 |
| Environmental risk of site vegetation clearing | Low impact |

The outcome of the assessment of the environmental risk associated with quarry camp construction at the proposed project site is low. This implies that impacts associated with quarry camp construction at the proposed project site should not have a direct influence on the decision to implement or not implement the proposed project.

*11.5.3.1.4 Mobilization of heavy mining equipment at the mining site*

Mining of limestone at the proposed project site will require use of heavy mining equipment. Such equipment will include bucket excavators, backhoes, bulldozers, often referred to as "dozers," front-end loaders, or simply "loaders," stationary and portable electrical generators, haul trucks, or "haulers," among others. As part of preparation for mining these equipment will be assembled on site. Potential negative impacts of site assembly of the equipment include:

- ✓ Noise disturbance to local neighborhood when the equipment are being mobilized to site.
- ✓ Inconvenience to local access road users due to presence of heavy quarry equipment on local access road during equipment mobilization.
- ✓ Leakage of oil and lubricant from equipment will potentially contaminate local information.

An assessment of the environmental risk associated with quarry equipment mobilization to proposed project site was informed by the identified potential negative impacts associated with their mobilization. The assessment was done using the risk assessment matrix. The confidence of assessment of impacts resulting from equipment mobilization when unmitigated and the resulting environmental risk based on the risk assessment matrix is as tabulated table 21 below.

**Table 21: Assessment of environmental risk resulting from quarry equipment mobilization**

| | |
|---|---|
| Extent of impact | 1 |
| Magnitude of impact | 2 |
| Duration of impact | 1 |
| Probability of impact | 2 |
| Risk = (Extent + Magnitude + Duration) x Probability | 8 |
| Environmental risk of site vegetation clearing | Low impact |

The outcome of the assessment of the environmental risk associated with quarry equipment mobilization to the proposed project site is low. This implies that impacts associated with quarry equipment mobilization to the proposed project site should not have a direct influence on the decision to implement or not implement the proposed project.

#### 11.5.3.2 Potential negative environmental impacts during quarry implementation phase of the proposed limestone mining project

Activities that are likely during mining phase of the limestone will include the following:

- ✓ Site excavation and removal of overburden
- ✓ Breaking and loosening of limestone bedrock
- ✓ Loading of mined limestone into trucks
- ✓ Haulage of mined limestone out of the Quarry
- ✓ Impacts from repair and maintenance of quarry equipment

##### *11.5.3.2.1 Site excavation and removal of overburden*

Limestone recovery from the site will be by the open cast method; this will involve first site excavation and removal of overburden. Potential negative impacts likely to result will include:-

- ✓ ***Loss of biodiversity***: Excavation and removal of overburden will contribute to loss of site biodiversity. All flora on site will be cleared and removed, also site fauna that depend on site flora for feeding, roosting, and as a habitat and those in affected local soil and limestone rocks will be lost. Potential loss of site biodiversity will disrupt local food chains and food webs.
- ✓ ***Generation of fugitive dust***: Excavation and removal of overburden will potentially result in fugitive dust generation. Such fugitive dust will potentially negatively affect potential receptors such as site mine workers, adjacent homesteads and other neighboring facilities. The fugitive dust can potentially result in throat irritation for site workers and occupants of adjacent homestead, reduce local feasibility, skin irritation, coughing and sneezing.
- ✓ ***Noise and vibration***: Heavy mining equipment which will be used in excavation and stripping the overburden will potentially cause noise and vibration. Also actual equipment activity on site will potentially result in noise and vibration. Mine workers and adjacent neighbors are potential receptors of the noise and vibration. Potential negative effects of the noise and vibration will include loss of comfort and repose

- ✓ ***Alteration of local aesthetics***: Excavation and removal of overburden will potentially alter local aesthetics the area will be glaringly open, local beauty will be lost.
- ✓ ***Opening ground to erosion agents***: Vegetal removal and stripping of overburden will open the ground to wind and water erosion. The open ground will be susceptible to wind erosion when windy and water erosion during rainy session. Adjacent homesteads and likely to be affected from suspended soil particles as a result of wind erosion.

An assessment of the environmental risk associated with excavation and removal of overburden at the proposed project site was informed by the identified potential negative impacts associated with the activity. The assessment was done using the risk assessment matrix. The confidence of assessment of impacts resulting from excavation and removal of overburden when unmitigated and the resulting environmental risk based on the risk assessment matrix is as tabulated table 22 below.

**Table 22: Assessment of environmental risk resulting from excavation and removal of overburden**

| | |
|---|---|
| Extent of impact | 2 |
| Magnitude of impact | 6 |
| Duration of impact | 4 |
| Probability of impact | 3 |
| Risk = (Extent + Magnitude + Duration) x Probability | 36 |
| Environmental risk of site vegetation clearing | Low impact |

The outcome of the assessment of the environmental risk associated with excavation and removal of overburden is medium. This implies that the impact could influence the decision to implement the proposed project unless the impact is effectively mitigated.

*11.5.3.2.2 Breaking and loosening of limestone bedrock*

Actual quarrying will involve breaking and loosening of the massive limestone bedrock to recover limestone aggregates. The breaking and loosening of the limestone bedrock will be by use of equipment. Potential negative impacts likely to result will include:-

- ✓ ***Noise and vibration***: Breaking and loosening of limestone bedrock will by means of heavy mining equipment. Noise and vibration will be generated from equipment use and the exercise of breaking of the limestone.
- ✓ ***Generation of fugitive dust***: Mining activity, coupled with equipment activity on site will be a source of fugitive dust. Wind action on mined loosened limestone material

in an open area devoid of any vegetation to act as wind break is more likely to be blown and hence more fugitive dust in the area.

- ✓ ***Change in local geological, hydrological and geotechnical conditions***. Likely environmental geological problem from the open pit mining will be stability of the resulting open pit slopes. Open cast mining result in artificially shaped slope which keep expanding with the increase of mining deep, with a potential to damage the natural balance to the stress and lead to artificial slope deformation, damage and slippage. Also the open cast mining has the potential to alter local hydrological conditions as a result of clearance of site vegetation and removal of overburden this lead to water retention capacity decreased in the area.
- ✓ ***Change in local landscape***: The surface mining method that will be used will be the open-cast mining method. This method results in change of local landscapes as borrow pits are generated once the limestone is extracted. The removal of vegetation and excavation of overburden alter the local natural landscape of the affected area.

An assessment of the environmental risk associated with breaking and loosening of the massive limestone bedrock was informed by the identified potential negative impacts associated. The assessment was done using the risk assessment matrix. The confidence of assessment of impacts resulting from breaking and loosening of the massive limestone bedrock when unmitigated and the resulting environmental risk based on the risk assessment matrix is as tabulated table 23 below.

**Table 23: Assessment of environmental risk resulting from breaking and loosening of the massive limestone bedrock**

| | |
|---|---|
| Extent of impact | 2 |
| Magnitude of impact | 4 |
| Duration of impact | 5 |
| Probability of impact | 3 |
| Risk = (Extent + Magnitude + Duration) x Probability | 33 |
| Environmental risk of site vegetation clearing | Low impact |

The outcome of the assessment of the environmental risk associated with breaking and loosening of the massive limestone bedrock is medium. This implies that the impact could influence the decision to implement the proposed project unless the impact is effectively mitigated.

*11.5.3.2.3 Loading of mined limestone into trucks*

The mined limestone will be loaded into trucks by means of front wheel loaders. During loading it is likely that the exercise may result in negative impacts. Some of the potential negative impacts could include:-

- ✓ ***Generation of fugitive dust***::Fine particles scoped with the limestone pebbles are likely to be airborne when the pebbles are being emptied from the front wheel loaders into the trucks hence generating fugitive dust. Potential receptors of this fugitive dust will be workers within the quarry and adjacent neighbors to the quarry.
- ✓ ***Noise disturbance***: Equipment activity on site necessary for loading work will potentially result in noise disturbance. Potential receptors of the likely noise to be emitted will include workers in the quarry site and adjacent neighbors.
- ✓ ***Occupational injuries***: Occupational injuries such as slip and falls, skidding, sliding, cuts could potentially occur due to equipment activity on site coupled with the actual quarrying activities.

An assessment of the environmental risk associated with loading of the mined limestone into trucks was informed by the identified potential negative impacts associated with limestone loading activity. The assessment was done using the risk assessment matrix. The confidence of assessment of impacts resulting from limestone loading activity when unmitigated and the resulting environmental risk based on the risk assessment matrix is as tabulated table 24 below.

**Table 24: Assessment of environmental risk resulting from loading into trucks of the mined limestone**

| | |
|---|---|
| Extent of impact | 1 |
| Magnitude of impact | 2 |
| Duration of impact | 1 |
| Probability of impact | 2 |
| Risk = (Extent + Magnitude + Duration) x Probability | 8 |
| Environmental risk of site vegetation clearing | Low impact |

The outcome of the assessment of the environmental risk associated with loading of mined limestone into trucks is low. This implies that impacts associated with loading of mined limestone into trucks should not have a direct influence on the decision to implement or not implement the proposed project.

*11.5.3.2.4 Haulage of mined limestone out of the Quarry*

The mined limestone once loaded into tracks will be hauled from the quarry site via quarry access roads into local feeder loads to the Malindi highway then to Mombasa Cement factory at Vipingo. Limestone haulage will be done by a fleet of dump trucks driving in and out of the limestone quarry pits. The haulage activity is likely to result in negative impacts to the environment. Some of the potential negative impacts will include:

- ✓ ***Fugitive dust*** along the quarry access roads, and local feeder roads being used. Increased heavy commercial trucks on local roads will potentially result in generation of fugitive dust along the said roads. Potential receptors of this fugitive dust will include other users of the same roads, occupants of homesteads along the said roads, learners and teachers of schools along the said roads, shops and other social facilities located along the said roads.
- ✓ ***Noise disturbance*** from trucks playing along the said roads is likely to increase with an increase in vehicular activity on the said roads. The noise is likely to be a nuisance to leaners and teachers of schools along the said roads, medical facilities, churches and other places of worship, homesteads and other amenities along the said roads.
- ✓ ***Accidents and incidents*** on the said roads due to increased vehicular activity on the roads may be witnessed. Increased road use by heavy commercial vehicles playing in and out of the quarry pits will potential contribute to incidents of local accidents on the said roads.
- ✓ ***Increase in wear, tear and dilapidation*** of local road infrastructure due to increased use of the roads by loaded heavy commercial trucks. This will translate to increased costs of maintenance of affected roads. In absence of timely maintenance of affected roads, then motorists using affected roads will have to spend more time on the said roads besides spending more on maintaining their vehicles.

An assessment of the environmental risk associated with haulage of mined limestone out of the quarry was informed by the identified potential negative impacts associated with the activity. The assessment was done using the risk assessment matrix. The confidence of assessment of impacts resulting from haulage of mined limestone out of the quarry when unmitigated and the resulting environmental risk based on the risk assessment matrix is as tabulated table 25 below.

**Table 25: Assessment of environmental risk resulting from quarry equipment mobilization**

| | |
|---|---|
| Extent of impact | 2 |
| Magnitude of impact | 4 |
| Duration of impact | 4 |
| Probability of impact | 3 |
| Risk = (Extent + Magnitude + Duration) x Probability | 30 |
| Environmental risk of site vegetation clearing | Medium impact |

The outcome of the assessment of the environmental risk associated with haulage of mined limestone out of the quarry is medium. This implies that impacts associated with associated haulage of mined limestone out of the quarry could influence the decision to implement the proposed project unless the impact is effectively mitigated

### 11.5.3.3 Potential negative environmental impacts during decommissioning phase of the limestone mining project

Activities that are likely during decommissioning phase of the Quarry include the following:

- ✓ Dismantling of quarry camp and removal of support infrastructure
- ✓ Demobilization of all quarrying equipment and machinery
- ✓ Backfilling of open quarry pits
- ✓ Rehabilitation of the quarries

#### *11.5.3.3.1 Dismantling of quarry camp and removal of support infrastructure*

Dismantling of quarry camp and all support infrastructures will be carried out at the end of the useful life of the limestone mining activities at the proposed project site. Structures housing site office, sanitary facilities and other structural developments on site will be dismantled and cleared from site. It is likely that the dismantling and removal of these structures will potentially result in negative impacts to the environment. Some of the potential negative impacts will include:-

- ✓ ***Generation of noise*** which will be a nuisance to neighbors, passersby and workers involved in the decommissioning exercise. Noise will likely be generated from actual demolitions activities and from use of equipment on site during demolition.
- ✓ ***Fugitive dust*** generation which will be a nuisance to neighbors, passersby and workers involved in the decommissioning exercise. Potential fugitive dust on site will be from demolition activities.

- ✓ ***Generation of waste*** including scrap metal, wooden waste, wastepaper, concrete rubbles. If the waste is not appropriately handled, managed and disposed, it can be scattered all over the place thus polluting the local environment.

An assessment of the environmental risk associated with dismantling of the quarry camp and removal of support infrastructure was informed by the identified potential negative impacts associated with the activity. The assessment was done using the risk assessment matrix. The confidence of assessment of impacts resulting from the activity when unmitigated and the resulting environmental risk based on the risk assessment matrix is as tabulated table 26 below.

**Table 26: Assessment of environmental risk resulting from dismantling of quarry camp and removal of support infrastructure**

| | |
|---|---|
| Extent of impact | 1 |
| Magnitude of impact | 2 |
| Duration of impact | 1 |
| Probability of impact | 3 |
| Risk = (Extent + Magnitude + Duration) x Probability | 12 |
| Environmental risk of site vegetation clearing | Low impact |

The outcome of the assessment of the environmental risk associated with dismantling of quarry camp and removal of support infrastructure is low. This implies that impacts associated with the activity should not have a direct influence on the decision to implement or not implement the proposed project.

*11.5.3.3.2 Demobilization of all quarrying equipment and machinery*

At the end of quarrying activities at the proposed project site, all quarry equipment that had been mobilized to the proposed project site will be demobilized out of the site. It is anticipated that equipment demobilization may result in negative impacts to the environment. Some of the potential negative impacts may include:-

- ✓ ***Spill of oil and lubricants***, most of the equipment will likely be old, not maintained to date, with defects and leakages here and there which could contribute to leakage of oils and lubricants in the equipment.
- ✓ ***Noise disturbance.*** Equipment demobilization may also result to noise disturbance to neighbors especially if the equipment will be old and poorly maintained.

An assessment of the environmental risk associated with equipment demobilization out of the proposed project site was informed by the identified potential negative impacts associated with the activity. The assessment was done using the risk assessment matrix. The confidence

of assessment of impacts resulting from the activity when unmitigated and the resulting environmental risk based on the risk assessment matrix is as tabulated table 27 below.

**Table 27: Assessment of environmental risk associated with equipment demobilization from site**

| | |
|---|---|
| Extent of impact | 1 |
| Magnitude of impact | 2 |
| Duration of impact | 1 |
| Probability of impact | 2 |
| Risk = (Extent + Magnitude + Duration) x Probability | 8 |
| Environmental risk of site vegetation clearing | Low impact |

The outcome of the assessment of the environmental risk associated with the activity is low. This implies that impacts associated with equipment demobilization out of the proposed project site should not have a direct influence on the decision to implement or not implement the proposed project.

#### 11.5.3.3.3 Rehabilitation of the quarries

All open quarry pits will be backfilled with remnants of the quarried material first then at the top by the overburden that was kept aside. Backfilling will thus involve use of quarry equipment among other techniques. Thereafter appropriate species of tree seedlings will be planted among other vegetation. The use of equipment in backfilling open pits will potentially result in negative impacts such as noise disturbance and generation of fugitive dust. Potential receptors of noise and fugitive dust will be equipment operators and adjacent neighbors. An assessment of the environmental risk associated with backfilling of quarry pits was informed by the identified potential negative impacts associated with the activity. The assessment was done using the risk assessment matrix. The confidence of assessment of impacts resulting from the activity when unmitigated and the resulting environmental risk based on the risk assessment matrix is as tabulated table 28 below.

**Table 28 Assessment of environmental risk resulting from backfilling of open quarry pits**

| | |
|---|---|
| Extent of impact | 1 |
| Magnitude of impact | 2 |
| Duration of impact | 1 |
| Probability of impact | 2 |
| Risk = (Extent + Magnitude + Duration) x Probability | 8 |
| Environmental risk of site vegetation clearing | Low impact |

The outcome of the assessment of the environmental risk associated backfilling of open quarry pits is low. This implies that impacts associated with the activity should not have a direct influence on the decision to implement or not implement the proposed project.

### 11.6 Proposed mitigation measures for potential negative environmental impacts

**Table 29: Proposed mitigation measures for potential negative environmental impacts**

| Potential negative impacts | Proposed mitigation measures |
|---|---|
| Loss of flora | - Limit vegetation removal to actual areas within the proposed project site with limestone to be mined only<br>- MCL to support planting of trees in public areas such as schools, Chief camps, local dispensaries within the project catchment to offset overall vegetation loss in the area<br>- Back fill and plant trees in all pits where mining is completed |
| Loss and displacement of site fauna | - MCL to maintain pockets of vegetation within the proposed project site where there are no limestone to be mined<br>- MCL to maintain pockets of vegetation around the quarry camp that can support local fauna habitat need<br>- MCL to maintain hedge of vegetation along quarry access roads that can support local fauna habitat needs.<br>- MCL to support planting of trees in public areas such as schools, Chief camps, local dispensaries within the project catchment to support local fauna habitat needs |
| Loss of local coconuts trees cover | - Coconut trees growing in parcels of land procured by MCL that do not have limestone deposits that can be mined to be preserved<br>- MCL to support local communities to grow coconut trees in their private farms to offset overall reduction of coconut trees in the area. |
| Generation of fugitive dust | - Regularly sprinkle water on dusty grounds including quarry access roads and active mining areas<br>- Maintain a vegetation buffer around the schools, local homesteads and other social amenities that border limestone pits. |

| **Potential negative impacts** | **Proposed mitigation measures** |
|---|---|
| | - Maintain a hedge of trees along all quarry access roads to act as wind break, noise attenuator and trap fugitive dust |
| Noise disturbance | - Ensure quarry equipment and machinery are well serviced and maintained as per manufacturer's instructions.<br>- Use noise attenuators such as a hedge of vegetation around active quarry pits and along quarry access roads.<br>- Regularly measure and monitor noise levels to ensure they are maintained within the prescribed limits as provided for in the Environmental Management and Coordination (noise and excessive vibration pollution) (Control) Regulations 2009.<br>- MCL to develop and document a comprehensive environmental noise management and conservation programme that will cover all quarry activities. |
| Soil erosion | - Maintain pockets of vegetation including trees to act as wind breaks in areas where limestone will not be mined.<br>- Maintain a vegetation buffer around the schools, local homesteads and other social amenities that border limestone pits.<br>- Plant trees and other vegetation in open areas to minimise exposure of open ground to agents of erosion.<br>- Maintain a hedge of trees along all quarry access roads to act as wind break |
| Spills of oils and lubricants | - Provide an equipment service and maintenance garage complete with a service sump and oil/water separator for servicing quarry equipment.<br>- Provide for oil absorbents to aid in cleaning out any spilled oil and lubricants |
| Ponding of water in quarry pits | - Ensure all quarry pits are adequately and effectively drained to ensure no collection, stagnation and or ponding of rainwater in the pits when it rains. |
| Generation of solid waste | - Ensure all waste generated is managed and disposed as provided for in the Environmental Management and Coordination (Waste |

| Potential negative impacts | Proposed mitigation measures |
|---|---|
| | Management) Regulations, 2006.<br>- Where possible and applicable practice the four Rs i.e. refuse to generate waste, reduce waste generation, reuse generated waste or recycle generated waste.<br>- Provide for receptacles for dropping and collection of waste<br>- Segregate waste at source appropriately.<br>- Contract the services of a waste collector, ensure the vehicle used to collect waste are licensed by NEMA<br>- Maintain dually filled and completed waste tracking documents for all waste collected and disposed from the quarry |
| Injuries and accidents | - Fence off all active quarry pits and disused quarry pits to ensure no unauthorized person or livestock access the quarry pits.<br>- Promptly backfill all quarry pits where mining of limestone is complete.<br>- Ensure all quarry pits are adequately and effectively drained to ensure no collection, stagnation and or ponding of rainwater in the pits when it rains.<br>- Ensure quarry equipment and machinery are well serviced and maintained as per manufacturer's instructions<br>- Ensure only well trained and experience plant and equipment operators are hired to operate quarry equipment and machinery |
| Increase in trucks on local roads | - Use alternative routes/feeder roads to reduce number of trucks on one local feeder road.<br>- Monitor number of trucks on local feeder roads from and to quarry<br>- Use fewer trucks of higher carrying capacity as opposed many trucks of lower carrying capacity |
| Alteration of local hydrological condition | - Maintain pockets of vegetation within the quarry area to minimise surface runoff and increase rainwater percolation to improve recharge of local aquifer.<br>- Quickly vegetate all areas where mining is completed to reduce |

| **Potential negative impacts** | **Proposed mitigation measures** |
|---|---|
| | soil moisture loss when dry and improve ground water aquifer recharge when it rains.<br>- No mining of limestone close to any existing well or borehole |
| Dilapidation of local roads | - All trucks in and out of the quarry to strictly adhere to required axial load limits on all roads used.<br>- Install weighbridge in the quarry to monitor weight of loaded trucks before they leave the quarry.<br>- Upgrade local roads to meet heavy load transportation demand from the quarry<br>- Regularly rehabilitate and maintain all local roads being used |

## 117. Environmental Management action plans

**Table 30: Biodiversity conservation action plan**

| Issue/concern | Potential impact | Proposed mitigation measure | Monitoring | Responsibility | Timeframe | Budget estimate |
|---|---|---|---|---|---|---|
| Vegetation removal | ✓ Loss of local vegetation abundance<br>✓ Loss of fauna abundance<br>✓ Diminishing of local carbon sink<br>✓ Reduced foliage for local fauna<br>✓ Loss of local fauna habitats | - Limit vegetation removal to areas to be mined<br>- MCL to support planting of trees in public areas within project catchment<br>- Back fill and plant trees in all pits where mining is completed | - Actual number of trees to offset vegetation loss<br>- Check for maintained vegetation pockets within project area<br>- Feedback from local community and other stakeholders | - Top management of MCL<br>- Local MCL site project Manager<br>- Project contractor<br>- MCL Environmental and Safety officer<br>- Assigned MCL employees | From commencement of proposed project and be sustained throughout the life of the proposed project | 5, 000, 000 |
| Excavation of overburden | ✓ Loss of biodiversity<br>✓ Fugitive dust<br>✓ Decrease in water retention capacity in the area<br>✓ Alteration of local | - Keep aside excavated overburden that is rich in biodiversity for later use in rehabilitation work<br>- Limit | - Physical checks and observation of adherence to mitigation measures<br>- Feedback from local community | - Top management of MCL<br>- Local MCL site project Manager<br>- Project contractor<br>- MCL | From commencement of proposed project and be sustained throughout the life of the proposed project | 1, 000, 000 |

| Issue/concern | Potential impact | Proposed mitigation measure | Monitoring | Responsibility | Timeframe | Budget estimate |
|---|---|---|---|---|---|---|
| | aesthetics<br>✓ Soil erosion | excavation to areas to be mined only<br>- Sprinkle water regularly to arrest fugitive dust<br>- Maintain pockets of vegetation to camouflage the pits and act as wind breaks to minimise soil erosion | and other stakeholders | Environmental and Safety officer<br>- Assigned MCL employees | | |

**Table 31: Local water resource conservation action plan**

| Issue/concern | Potential impact | Proposed mitigation measure | Monitoring | Responsibility | Timeframe | Budget estimate |
|---|---|---|---|---|---|---|
| Removal of vegetation | - Increased surface runoff<br>- Reduced rainwater percolation<br>- Decrease in water retention capacity in the area<br>- Increase local | - Vegetation removal to be limited to only areas to be mined<br>- Maintain pockets of vegetation in the area in all other areas not to be mined<br>- Promptly rehabilitate all disused quarry pits and plant trees in all | - Physical checking of availability of vegetation in areas not being mined<br>- Tracking of promptness of disused quarry pits | - Top management of MCL<br>- Local MCL site project Manager<br>- MCL Environmental and Safety officer<br>- Assigned MCL employees<br>- Local community | From commencement of proposed project and be sustained throughout the life of the proposed project | 1, 000, 000 |

| Issue/concern | Potential impact | Proposed mitigation measure | Monitoring | Responsibility | Timeframe | Budget estimate |
|---|---|---|---|---|---|---|
| | soil moisture loss through evaporation<br>- Reduced local aquifer recharge | rehabilitated areas | rehabilitation | and other stakeholders | | |
| Soil excavation and removal of overburden | - Reduced local water percolation due to loss of local soil barrowing fauna that are essential in barrowing local soil to increase soil porosity and by extension improve water percolation<br>- Increase local soil moisture loss through evaporation<br>- Reduced local aquifer recharge | - Limit excavation to quarry pit area only<br>- Avoid excavation in areas with existing hand dug wells and boreholes<br>- Rehabilitate all excavated and mined areas promptly once mining is complete | - Physical checking of existing hand dug wells and bores to ensure they are not damaged<br>- Tracking promptness of rehabilitation of mined areas | - Top management of MCL<br>- Local MCL site project Manager<br>- MCL Environmental and Safety officer<br>- Assigned MCL employees<br>- Local community and other stakeholders | From commencement of proposed project and be sustained throughout the life of the proposed project | 1.000.000 |
| Open cast mining | - Increased surface runoff | - Prompt rehabilitation of all open cast mined | - checking of existing hand | - Top management of MCL | From commencement | 1, 000,000 |

| Issue/concern | Potential impact | Proposed mitigation measure | Monitoring | Responsibility | Timeframe | Budget estimate |
|---|---|---|---|---|---|---|
| | - Reduce local aquifer recharge<br>- Damage to local water aquifer<br>- Reduce ground water resource availability in the area | areas of the proposed project site<br>- Areas within the proposed project site that have existing hand dug wells and boreholes to be preserved | dug wells and bores to ensure they are not damaged<br>- Tracking promptness of rehabilitation of mined areas | - Local MCL site project Manager<br>- MCL Environmental and Safety officer<br>- Assigned MCL employees<br>- Local community and other stakeholders | of proposed project and be sustained throughout the life of the proposed project | |

**Table 32: Dust management action plan**

| Issue/concern | Potential impact | Proposed mitigation measure | Monitoring | Responsibility | Timeframe | Budget estimate |
|---|---|---|---|---|---|---|
| Removal of vegetation | - Opening up ground which becomes susceptible to blowing of local wind that will increase amount of suspended soil particles in the air that will pollute local ambient air<br>- Local air pollution from | - Sprinkle water as often as possible in all open areas devoid of vegetation where there is equipment activity<br>- Restrict vegetation removal to only areas to be mined<br>- Maintain pockets of vegetation in all areas that will not be mined that are within the project site<br>- Promptly rehabilitate | - Measurement of suspended dust particles (local air quality) monitoring as per the requirements of Environmental Management and Coordination (Air Quality) Regulations 2014 | - Top management of MCL<br>- Local MCL site project Manager<br>- MCL Environmental and Safety officer<br>- Project contractor<br>- Assigned MCL employees<br>- Local community and other | - Air quality monitoring to be done every three months<br>- Quarry rehabilitation to be continuous throughout the project life | 5, 000,000 |

| Issue/concern | Potential impact | Proposed mitigation measure | Monitoring | Responsibility | Timeframe | Budget estimate |
|---|---|---|---|---|---|---|
| | fugitive dust generation from equipment activity | all mined areas | - Trucking of rehabilitation of mined areas<br>- Trucking of planting of trees and other vegetation in rehabilitated areas | stakeholders | | |
| Ground excavation | - Generation of fugitive dust<br>- Local dust pollution | - Maintain a hedge of trees ten miters wide at the boundary of all mining areas and adjacent homesteads, schools and other public facilities<br>- Regularly sprinkle water | - Air quality monitoring report as per the provisions of Environmental Management and Coordination (Air Quality) Regulations 2014<br>- Feedback from local community and other stakeholders | - Top management of MCL<br>- Local MCL site project Manager<br>- MCL Environmental and Safety officer<br>- Project contractor<br>- Assigned MCL employees<br>- Local community and other stakeholders | - Air quality monitoring to be done every three months (quarterly)<br>- Maintenance of hedge of trees to be continuous throughout the project life | 5,000,000 |
| Actual mining and recovery of limestone | - Emission of cloud of dust<br>- Pollution of local air | - Maintain a hedge of trees ten miters wide at the boundary of all mining areas and | - Air quality monitoring report as per the provisions | - Top management of MCL<br>- Local MCL site project Manager | - Air quality monitoring to be done every three | 5, 000, 000 |

| Issue/concern | Potential impact | Proposed mitigation measure | Monitoring | Responsibility | Timeframe | Budget estimate |
|---|---|---|---|---|---|---|
| | quality<br>- Reduced local visibility | adjacent homesteads, schools and other public facilities<br>- Regularly sprinkle water | of Environmental Management and Coordination (Air Quality) Regulations 2014<br>- Feedback from local community and other stakeholders | - MCL Environmental and Safety officer<br>- Project Contractor<br>- Assigned MCL employees<br>- Local community and other stakeholders | months (quarterly)<br>- Maintenance of hedge of trees to be continuous throughout the project life | |
| Loading of limestone to trucks | Generation of fugitive dust | - Sprinkle water on dusty limestone being loaded t | - - Air quality monitoring report as per the provisions of Environmental Management and Coordination (Air Quality) Regulations 2014<br>- Feedback from local community and other stakeholders | - Top management of MCL<br>- Local MCL site project Manager<br>- MCL Environmental and Safety officer<br>- Project contractor<br>- Assigned MCL employees<br>- Local community and other stakeholders | - Air quality monitoring to be done every three months (quarterly)-<br>- Feedback from local community to be continuous throughout project life | 5, 000, 000 |

| Issue/concern | Potential impact | Proposed mitigation measure | Monitoring | Responsibility | Timeframe | Budget estimate |
|---|---|---|---|---|---|---|
| Haulage of the limestone out of the quarry | Generation of fugitive dust along the haulage route | - Sprinkle water as often as possible on all haulage routes used<br>- Trucks to be driven in low speed along the haulage routes | - Air quality monitoring report as per the provisions of Environmental Management and Coordination (Air Quality) Regulations 2014<br>- Feedback from local community and other stakeholders | - Top management of MCL<br>- Local MCL site project Manager<br>- MCL Environmental and Safety officer<br>- Project contractor<br>- Assigned MCL employees<br>- Local community and other stakeholders | - Air quality monitoring to be done every three months (quarterly)-<br>- Feedback from local community to be continuous throughout project life | 5,000, 000 |

**Table 33: Noise and vibration management action plan**

| Issue/concern | Potential impact | Proposed mitigation measure | Monitoring | Responsibility | Timeframe | Budget estimate |
|---|---|---|---|---|---|---|
| - Mining equipment activity on site<br>- Loading of limestone into trucks<br>- Haulage of limestone in a | - Noise disturbance to workers at the mining site<br>- Noise disturbance to neighbouring households | - Develop and implement a comprehensive noise and vibration management plan for the entire quarry site.<br>- Periodic noise levels measurements as | - Periodic environmental noise measurements as per Environmental Management and | - Top management of MCL<br>- Local MCL site project Manager<br>- MCL Environmental and Safety officer | - Noise measurements to be carried out biannually<br>- All other mitigation measures to | 1,000, 000 |

| Issue/concern | Potential impact | Proposed mitigation measure | Monitoring | Responsibility | Timeframe | Budget estimate |
|---|---|---|---|---|---|---|
| fleet of trucks in and out of the quarry | - Noise disturbance to neighbouring schools<br>- Noise disturbance to neighbouring social amenities | provided for in the Environmental Management and Coordination (noise and excessive vibration) (pollution) Control Regulations 2009.<br>- Mining equipment to be serviced and maintained as per manufacturer's instruction<br>- Noise attenuators such as a hedge of trees of ten meters wide to be maintained between adjacent homesteads, schools and social amenities and active quarry pit.<br>- Quarry workers to be provided with ear plugs | Coordination (noise and excessive vibration) (pollution) Control Regulations 2009.<br>- Feedback from neighbours and other stakeholders | - Project contractor<br>- Assigned MCL employees<br>- Local community and other stakeholders | be put in place from commencement of the proposed project and be sustained throughout the operational life of the project | |

**Table 34: Traffic management action plan**

| Issue/concern | Potential impact | Proposed mitigation measure | Monitoring | Responsibility | Timeframe | Budget estimate |
|---|---|---|---|---|---|---|
| - Increased | - Reduction of | - Appropriate | - Physical | - Road Agency | The proposed | 1,000, 000 |

| Issue/concern | Potential impact | Proposed mitigation measure | Monitoring | Responsibility | Timeframe | Budget estimate |
|---|---|---|---|---|---|---|
| traffic on local access road<br>- Fleet of trucks on local roads | local road safety concerns for members from local community.<br>- Safety concerns for children crossing and using local roads<br>- Fugitive dust emission from increased vehicular use of local roads<br>- Increased noise disturbance for institutions such as schools along the local roads | road signs to be erected along affected local roads for safe use of the roads<br>- Sensitization of local community on increase of vehicular traffic on local roads and the need to exercise care and safety while using the roads<br>- Regular maintenance of the local roads to deter off-road driving due to poor road condition<br>- Elect speed pumps along road roads to | checking of the condition of carriage way of the local roads, placement of safety road signs along the road and erection of speed pumps.<br>- Records of training and sensitization of local community on local road safety.<br>- Records of cases of accidents, incidents and near misses on local roads.<br>- Records of water sprinkling along local roads | in-charge of the local roads<br>- County Government of Kilifi<br>- Project contractor<br>- Local community<br>- Individual truck drivers using local roads<br>- MCL top management | mitigation measures to be put in place from the beginning of the proposed project and be sustained throughout the life of the project | |

| Issue/concern | Potential impact | Proposed mitigation measure | Monitoring | Responsibility | Timeframe | Budget estimate |
|---|---|---|---|---|---|---|
| | | deter over speeding.<br>- Regular sprinkling of water to arrest fugitive dust along affected local roads. | including pictures and frequency charts.<br>- Ambient dust measurement records<br>- Ambient noise measurement records<br>- Feedback from local community and other stakeholders | | | |

**Table 35: Waste management action plan**

| Issue /concern | Potential negative impact | Proposed mitigation measure | Monitoring | Responsibility | Timeframe | Budget estimate |
|---|---|---|---|---|---|---|
| Waste generation from construction of quarry camp | - Littering and untidiness of the workplace<br>- Blockage and clogging of local storm water drainage system | - All generated waste to be handled, managed and disposed as provided for in the Environmental Management and Coordination (Waste Management) Regulations, 2006<br>- Management to provide waste bins at strategic | - Waste disposal trucking documents<br>- Physical checking of the workplace<br>- Feedback from local community | - Quarry Manager<br>- MCL Environmental Safety and Health Officer<br>- Project contractor<br>- Assigned | Prior to commencement of activities at the workplace requires waste management structures to be put in place and be sustained | 1, 000, 000 |

| Issue /concern | Potential negative impact | Proposed mitigation measure | Monitoring | Responsibility | Timeframe | Budget estimate |
|---|---|---|---|---|---|---|
| | | position for dropping of waste.<br>- Management to contract a licensed waste collector to collect and safely dispose all generated waste.<br>- Management to ensure any vehicle used to very waste from the facility to disposal site is NEMA licensed. | | employees | throughout the lifespan of the project | |
| Waste generation from day to-day use of quarry camp | | - Minimize waste generation, embrace reuse and recycling where possible<br>- Provide waste bins at every workstation for dropping of waste<br>- Consolidate waste from all waste bins into a transfer station for collection and disposal as per waste management regulations | - Waste disposal trucking documents<br>- Physical checking of the workplace | - Quarry Manager<br>- MCL Environmental Safety and Health Officer<br>- Project contractor<br>- Assigned employees | Throughout the operational life of the quarry | 200, 000 |
| Waste generation from servicing of quarry equipment | - Contamination of workplace with oils and greases<br>- Littering of workplace with oil and | - All oil and grease stained rugs to be collected and dropped in a designated waste bins for appropriate disposal.<br>- All used oil filters and air filters from equipment and | - Waste disposal trucking documents<br>- Physical checking of the workplace | - Quarry Manager<br>- MCL Environmental Safety and Health Officer | Throughout the operational life of the quarry | 200, 000 |

| Issue /concern | Potential negative impact | Proposed mitigation measure | Monitoring | Responsibility | Timeframe | Budget estimate |
|---|---|---|---|---|---|---|
| | grease stained rugs | other automobile servicing to be collected and dropped in designated receptacles for latter collection and appropriate disposed. | | - Project contractor<br>- Assigned employees | | |

**Table 36: Oil spills management action plan**

| Issue /concern | Potential negative impact | Proposed mitigation measure | monitoring | Responsibility | Timeframe | Budget estimate |
|---|---|---|---|---|---|---|
| - Servicing of quarry equipment<br>- Servicing of trucks<br>- Servicing of service vehicles | - Contamination of local soil from oil spills<br>- Contamination of local ground water resources from oil spills<br>- Burning and destruction of vegetation by spilled oil | - Servicing of all quarry equipment, trucks and service vehicles to be done in a properly constructed servicing garage with appropriate facilities for collection of oil and greases<br>- All collected used oil and greases to appropriately handled and kept in drums.<br>- Only NEMA licensed used oil handles to dispose the collected waste oil | - Physical examination of the workplace<br>- Sampling, testing and analysis of local water quality from local wells and boreholes<br>- Local soil sampling, testing and analysis<br>- Records of quantities of generated waste oil<br>- Records of quantities of disposed waste oil by NEMA licensed waste oil handler<br>- Feedback from neighbors | - MCL top Management<br>- Quarry Manager<br>- MCL Environmental, Safety and Health Officer<br>- Project Contractor<br>- Assigned employees | From commencement of project implementation activities and then throughout the project life | 500, 000. |

## 11.8 Environmental monitoring

### 11.8.1 Noise and excessive vibrations monitoring

The noise levels should be monitored as provided for in the Environmental Management and Coordination (noise and excessive vibration) (pollution) Control Regulations 2009 taking consideration zonation requirements and day and night as shown table 37 below.

**Table 37: Maximum permissible noise levels for constructions sites when measurement taken within the facility**

| Facility | | Maximum Noise Level Permitted (Leq) in dB(A) | |
|---|---|---|---|
| | | Day | Night |
| **i.** | Health facilities, educational institutions, homes for disabled etc. | 60 | 35 |
| **ii.** | Residential | 60 | 35 |
| **iii.** | Areas other than those prescribed in (i) and (ii) | 75 | 65 |

Timeframe: Day; 6:01am-6:00pm & Night; 6:01pm-6:00am

*Source: Second schedule of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.*

Further noise and excessive vibration shall be monitoring in line with provisions of Regulation 14(3) that states that any person carrying out construction, demolition, mining or quarrying work shall ensure that the vibration levels do not exceed 0.5 centimeters per second beyond any source property boundary or 30 meters from any moving source. The monitoring is to ensure the maximum permissible limits are not exceeded as shown in the table 38 below.

**Table 38: Maximum Permissible Noise Levels for Mines and Quarries**

| Facility | | Limit Value in dB (C) Max |
|---|---|---|
| 1 | For any building used as a health facilities, educational institutions, convalescent home, old age home or residential building | 109 dB (C) |
| 2 | For any building in an areas used for residential and one or more of the following purposes: commerce, small-scale production, entertainment, or any residential apartment in an area that is used for purposes of industry, commerce or | 114 dB (C) |

| | | |
|---|---|---|
| | small-scale production, or any building used for the purpose of industry, commerce or small-scale Production. | |

*Source: Third schedule of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.*

### 11.8.2 Air Quality Monitoring

Monitoring of particulate matter to ensure that the project activities adhere to the Ambient Air Quality requirements at Property Boundary for General Pollutants. Part (b) of the First Schedule of the Environmental Management and Coordination (Air Quality) Regulations, 2014 require that the particulate matter for at a property boundary should not exceed 70µg/$m^3$. Further air quality monitoring aim will be to ensure that stipulated air quality tolerance limits stipulated in the First Schedule of the Environmental Management and Coordination Act (Air Quality) Regulations, 2014 is not exceeded as shown in table 39 below.

**Table 39: Ambient Air Quality Tolerance Limits**

| **Pollutant** | **Time weighted average** | **Industrial area** | **Residential, Rural and Other area** | **Controlled areas** |
|---|---|---|---|---|
| Suspended particulate matter | Annual Average | 360µg/$m^3$ | 140g/$m^3$ | 70µg/$m^3$ |
| Respirable particulate matter | Annual average | 70µg/$m^3$ | 50g/$m^3$ | 50µg/$m^3$ |
| $P.M_{2.5}$ | Annual average | 35µg/$m^3$ | | |
| | 24 Hours | 70µg/$m^3$ | | |

*Sources: First Schedule of the EMC (Air Quality) Regulations, 2014, for pollutants within quarry sites*

The monitoring will ensure emission limits of air pollutants for controlled and non-controlled facilities including mining and quarry is observed as tabulated below.. The table 40 below is an excerpt from the third schedule of the regulations on emission limits for mining and quarry.

**Table 40: Emission Limits**

| Parameter | Emission Limit |
|---|---|
| Opacity | 20% |
| Particulate (Dust) $PM_{10}$ ($mg/Nm^3$) | 400 |

*Sources: Third schedule of EMC (Air Quality) Regulations, 2014*

### 11.8.3 Water quality monitoring

Monitoring of quality of local groundwater resources will be carried out as provided for in the second schedule of the Environmental Management and Coordination (Water Quality) Regulations.2006 Legal notice Number 120 as tabulated in the table 41 below.

**Table 41: Water quality monitoring parameters**

| Parameter | Results | |
|---|---|---|
| | Observed value | Guide value( maximum allowable) |
| pH | | 6.5-8.5 |
| Suspended solids | | 30 (mg/L) |
| Nitrates-$NO_3$ | | 10 (mg/L) |
| Ammonia-$NH_3$ | | 0.5 (mg/L) |
| Nitrite-$NO_2$ | | 3 (mg/L) |
| Total dissolved solids | | 1200 (mg/L) |
| E-coli | | Nil /100ml |
| Floride | | 1.5 (mg/L) |
| Phenols | | Nil (mg/L) |
| Arsenic | | 0.01 (mg/L) |
| Cadmium | | 0.01 (mg/L) |
| Lead | | 0.05 (mg/L) |
| Selenium | | 0.01 (mg/L) |
| Copper | | 0.05 (mg/L) |
| Zinc | | 1.5 (mg/L) |
| Alkyl benzl sulphonates | | 0.5 (mg/L) |
| Permanganate value | | 1.0 (mg/L) |

*Source: The Environmental Management and Coordination (Water Quality) Regulations.2006*

### 11.8.4 Solid waste disposal monitoring

Monitor the type of solid waste generated, quantity of solid waste generated, frequency of collection and disposal, where the waste is disposed and proof of waste tracking documents

in the format provided in FORM III schedule one of the Environmental Management and Co-Ordination (Waste Management) Regulations 2006. This monitoring is to be done monthly.

### 11.9 Training and capacity building

The following training and capacity building is proposed:-

- Sensitization of the proponent and contractor (s) on the importance of the ESMP, its contents, how it is applied and who is responsible for the implementation of each part of the ESMP.
- Training and capacity building for quarry employee on the importance and proper use of PPEs while at the workplace.
- Training and capacity building for management staff and all quarry employees on acceptable waste management practices.
- Training and capacity building of quarry site occupational safety and health committee on quarry site occupational safety and health requirements and individual safety obligations.
- Training and capacity building of site first aid.
- Training and capacity building on quarry site fire safety
- Sensitization on HIV and AIDS and other communicable diseases

### 11.10 Institutional arrangements for safeguard implementation and reporting

#### 11.10.1Institutional arrangement

The responsibility of implementation of the safeguards is vested on Mombasa Cement Limited who is the project proponent while the National Environment Management Authority (NEMA) ensures compliance through enforcement. NEMA will coordinate with relevant lead agencies to ensure compliance and enforcement of the ESMP. There will be periodic site visits by relevant lead agencies coordinated by NEMA to assess compliance. Inspection reports of the outcome of the site visits will be prepared by the lead agencies/NEMA and served to the proponent for implementation. The proponent will be required to prepare periodic monitoring reports and annual environmental audit reports and submit these reports to NEMA. Further the proponent will be required to promptly respond to NEMA improvement orders by compiling a report on the issues raised in the orders. The contractor who will be constructing structures on site and be involved in actual quarry of the coral limestone will be required to prepare monthly progress reports and submit the progress reports to the proponent on the contractor's contractual obligations on safeguards implementation responsibilities specified in the ESMP. The contractor will be supervised on

the ground directly by the proponent. The proponent will oversee the implementation of the ESMP.

### 11.10.2 Reporting obligations

The following reports will be prepared:

- ✓ Monthly progress reports by the contractor on the implementation status of every obligation of the contractor on safeguards implementation specified in the ESMP. These monthly reports will be submitted by the contractor to the Proponent.
- ✓ Periodic monitoring reports to be prepared by the proponent and submitted to NEMA. Specifically; quarterly air quality monitoring report, water quality monitoring reports and biannual noise and vibration monitoring reports.
- ✓ Initial Environmental and Social Audit report to be prepared by the proponent and submitted to NEMA in the first year of operation of the project to confirm the efficacy and adequacy of the ESMP.
- ✓ Self-environmental and social audit report to be prepared annually by the proponent and submitted to NEMA to report on the progress of implementation of the ESMP. The first self-environmental and social audit reports will be prepared one year after submission of the initial environmental and social audit report.
- ✓ Reports responding to NEMA improvement orders to be prepared by the proponent and submitted to NEMA as and when such improvement orders are issued.

### 11.10.3 Quarry rehabilitation monitoring

Monitoring of progress in quarry pits rehabilitation will be done on a continuous basis. Once an active quarry pit is exhausted and confirmed that mining of limestone is complete. It will be required that backfilling and rehabilitation of the disused quarry pits to begin immediately. All disused quarry pits will be monitored continuously to ensure timely rehabilitation.

## 11.11 Quarry rehabilitation plan

Quarry rehabilitation is returning the quarried land to a different and usually productive use; it is thus the return of the land to a useful condition as opposed to leaving it as a wasteland.

### 11.11.1 Rehabilitation procedure

Rehabilitation procedure will involve:-

- ✓ Re-spreading and contouring of topsoil materials and stored overburden materials.
- ✓ Stabilization of battered slopes and grassing in completed and restored extraction areas to create a free draining and stable landform.

- ✓ Monitoring of re-vegetation to ensure the success of the rehabilitation.

Key principles of rehabilitation include:

- ✓ Reinstallation of topsoil to ensure the soil can be used for agricultural or other uses. This may require the topsoil to be mixed with organic material or a soil conditioner.
- ✓ Appropriate vegetation cover undertaken using appropriate low-seeding grass species. Topsoil and re-grassing should be undertaken during rainy season to maximise on growth.
- ✓ Development of a free draining stable landform.
- ✓ The removal of all quarry operating machinery, equipment and buildings at the conclusion of all extraction activities.
- ✓ Maintaining the site through controlling weeds and grazing, as appropriate.
- ✓ Monitor and where necessary, maintain rehabilitated areas to ensure they are functioning appropriately post-rehabilitation for a period of 24 months.

Rehabilitation planning that is integrated with extraction sequences will ensure rehabilitation can commence, in areas where extraction activity has concluded. This will ensure that vegetation can be established, or a return to other land use (e.g. pasture), as soon as possible rather than leaving a disused quarry area on part of the Site. It also ensures that rehabilitation effort is not wasted on areas which will be disturbed again later.

### 11.11.2 Quarry rehabilitation works

Quarry rehabilitation works to be undertaken after the completion of the extraction of the coral limestone will include:

- ✓ Removal of all fixed and mobile plant.
- ✓ Removal of all temporary and permanent structures unless required for future use.
- ✓ Removal and appropriate disposal of all waste materials.
- ✓ Demolition of all concrete structures, including quarry office, sanitary facilities and weighbridge.
- ✓ Backfilling of all open pits
- ✓ Levelling of bunds and overburden stockpiles.
- ✓ Planting of appropriate vegetation including trees
- ✓ Caring, maintaining and monitoring of the planted trees and other vegetation to ensure growth and development to maturity and hence success of the rehabilitation.

Table 42 is the rehabilitation action plan

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**Table 42: Quarry pit rehabilitation action plan**

| Activity | Equipment and tools | Actors | Timeframe |
|---|---|---|---|
| Backfilling | - Excavators<br>- Caterpillars<br>- Dumpers<br>- Shovels<br>- Spades | - Quarry site manager<br>- Quarry supervisors<br>- Foremen<br>- Quarry workers | - Backfilling of quarry pits to begin immediately quarrying is completed in a particular quarry pit.<br>- Before a new quarry pit is opened, backfilling of the old one should be completed first |
| Compacting | - compactor<br>- compressor | - Quarry site manager<br>- Quarry supervisors<br>- Quarry workers | Compaction of backfilled material to be continuous as backfilling is being done |
| Leveling and landscaping | - Leveler<br>- Rakes<br>- Harrower<br>- Shovels<br>- Spades<br>- Wheelbarrows | - Quarry site manager<br>- Quarry supervisors<br>- Foremen<br>- Quarry workers | Leveling and landscaping to be done continuously once backfilling and compaction is complete. |

| Activity | Equipment and tools | Actors | Timeframe |
|---|---|---|---|
| Vegetation/tree planting | - Hoes<br>- Spades<br>- Forked jembes<br>- Rakes<br>- Watering cans<br>- Wheelbarrows | - Quarry site manager<br>- Quarry supervisors<br>- Foremen<br>- Quarry workers | - Tree planting to begin immediately once reveling and landscaping is complete.<br>-Selection of appropriate tree species to be done in consultation with the Forest Service Kilifi Office.<br>- Tree planting to be done continually in all backfilled, compacted, leveled and sites.<br>- Continues watering of planted tree seedlings to be done. |

## 11.12 Grievance redress mechanism

### 11.12.1 Definition and purpose

This Grievance redress Mechanism (GRM) is defined as organizational system and resources established as part of the EMP for the implementation of the proposed coral limestone quarrying project to receive and address concerns about the impact of the implementation of the proposed mining project on any stakeholder (persons, groups or communities). The stakeholder input handled through this GRM system and procedures are called "grievances," "complaints," or "feedback," This GRM is intended to be accessible, collaborative, expeditious, and effective in resolving concerns raised by any stakeholder on the implementation and operation of the proposed coral limestone mining project through dialogue, joint fact-finding, negotiation, and problem solving. This GRM will be the "first line" of response to stakeholder concerns that have not been addressed and or prevented by proactive stakeholder engagement.

### 11.12.2 Formation

There is a need for the formation and establishment of a GRM to address grievances that may arise during the implementation and operation of the proposed coral limestone mining project. This need has been necessitated by the fact that currently there is no GRM to address grievances that may arise during the project cycle. There is need therefore to establish this GRM as part of the EMP implementation process to ensure transparency and accountability where an individual, a group or a community is aggrieved by the implementation of aspects of the proposed project. Formation of the GRM will entail formation of a committee at the local level (project implementation level).

### 11.12.3 GRM Committee Members

It is proposed that there be one level of this grievance redress process; the level will have a committee established with defined membership. The level will be at the local (project implementation level). The GRM committee will comprise of experienced and competent persons able to command the respect of affected persons, groups and communities. Membership of the GRM Committee at the local level will be as follows:-

- ✓ Member of County Assembly, Matsangoni Ward (or appointed representative).
- ✓ Ward Administrator Matsangoni Ward (or appointed representative).
- ✓ Liaison Officer MP's Office Kilifi North Constituency representing Matsangoni Ward

- ✓ Chiefs of Roka and Matsangoni Locations
- ✓ Assistant Chiefs of Roka Sub-Location, Chumani Sub-Location, Uyombo Sub-Location, and Matsangoni Sub-location
- ✓ Four members (two male and one female) to represent Nyumba Kumi from each sub-location
- ✓ Four Members (two male and two female) to represent Wazee Wa Mtaa from each sub-location
- ✓ Four youth representatives (two male and female female) from each sub-location
- ✓ Two representative of people with disability
- ✓ Two representative of civil society ( from a civil society active in the project area)
- ✓ Three members from the project proponent

The members will select the Chair Person and the Secretary for the Committee.

### 11.12.4 Mode of Communication

The grievances will be submitted to the Grievance Redress Committee at the local level in any of the following ways:-through SMS, written letter, email or raise the grievance in a local meeting where the grievance will be captured in the form of minutes to be forwarded to the local Grievance Redress Committee.

### 11.12.5 Process

When there is a grievance at the project area, it is proposed that the affected individual(s), affected group(s), or affected community will be required to forward complaints to the local GRC. The local GRC will be required to record the grievances and call a meeting of the committee to resolve the grievances. The next step in the process will be for the GRC to meet and resolve each grievance forwarded to them at the project community level 7-10 working days of receiving the grievance.

### 11.12.6 Information Awareness

To ensure appropriate dissemination of information, transparency and accountability, it is proposed that this grievance redress mechanism procedure be printed in both English and Swahili and posted on a notice board at the project site, Chiefs and Assistant Chiefs Offices and MCA's Office.

### 11.12.7 Record keeping

All submitted complaints will be captured in a register or a project file at the local project level by the GRC. This file should always be in the custody of the GRC. The status of the grievances submitted and the grievance redress at the site will be reported on a regular basis to the affected persons as soon as it is practically possible as well as other stakeholders.

## 11.13 Decommissioning plan

Decommissioning of the project will involve terminating project operations, dismantling of all project equipment and allied infrastructure and rehabilitating the site to the original status. Before decommissioning will be done, the Project Management will communicate in writing to the National Environment Management Authority stating their intension to decommission and provide a detailed decommissioning plan for approval.

# 13. CONCLUSIONS AND RECOMMENDATIONS

## 13.1 Conclusions

The following are some of the conclusions drawn from the assessment findings of the proposed coral limestone mining project by Mombasa Cement Limited at the proposed project site.

- ✓ Mombasa Cement Limited the proponent of the proposed project site has procured all the plots of the proposed project site. The titles of all the plots of the proposed project site are in the name of the proponent.
- ✓ The proponent has obtained change of user from agricultural to industrial (stone cutting and mining) of some of the plots of the proposed while others the change of user is yet to be processed.
- ✓ Within Roka Maweni area, the neighborhood of the proposed project site and the wider catchment of the proposed project, there are many active quarries extracting coral limestone building blocks using machine cutting technology.
- ✓ Fugitive dust is evident from the activities of existing coral limestone building blocks a clear indication that dust pollution will be of concern from the proposed project.
- ✓ There are hand dug wells in some of the plots of the proposed project site and in the neighboring plots. Water in these wells is for domestic use by local community. The quality of the water in the wells is mainly saline.
- ✓ Some of the plots of MCL for the proposed project site are adjacent to schools such as that next to Uyombo Girls Secondary School.
- ✓ Local roads serving the proposed project site such as Roka Maweni Beach Road are maintained by the County Government of Kilfi.
- ✓ Coral limestone outcrops are evidently visible on the surface of some of the plots of the proposed project site within no or minimum overburden.
- ✓ A larger proportion of the plots of the proposed project site have vegetation cover that range from grasses, to shrubs to trees.
- ✓ The proposed project is likely to have negative impacts to the biophysical and social environment. There is appropriate technology and other measures that can be used to appropriately mitigate the potential negative impacts to acceptable national standards.
- ✓ Monitoring of environmental parameters will be important throughout the project cycle.

- ✓ Continuous stakeholder engagement will be necessary to ensure emerging stakeholder issues and concerns are timely addressed throughout the project cycle.

### 13.2 Recommendations

The following recommendations are suggested:

- ✓ The project proponent, Mombasa Cement Limited to be patient and wait until the EIA Process is concluded and should only begin implementation of the proposed project when the National Environment Management Authority issues an Environmental Impact Assessment License to the project proponent for the implementation of the proposed project.
- ✓ Mitigation measures proposed to be fully implemented and monitored to ensure environmental protection and sustainability once the proposed project is licensed for implementation.

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