

Final Supplementary Environmental and Social Impact Assessment Report

Limestone Quarry and Cement Production in the Thiès Region by CIMAF

30 September 2021

Project No.: 0589781

The business of sustainability

ERM

Document details	
Document title	Final Supplementary Environmental and Social Impact Assessment Report
Document subtitle	Limestone Quarry and Cement Production in the Thiès Region by CIMAF
Project No.	0589781
Date	30 September 2021
Version	1.5 / 07
Author	Caitlin Sicari, Michelle Herbert, Marianne Strohbach
Client Name	Ciments de l 'Afrique Sénégal

Document history

				ERM approval to issue		
Version	Revision	Author	Reviewed by	Name	Date	Comments
0.1	01	C Sicari	M Herbert	C Johnstone	10.06.2021	Internal Review
	02				16.06.2021	Updated maps
	03	M Herbert, M Strohbach	M Herbert	C Johnstone	10.08.2021	Internal Review
	04		CIMAF, IFC			Client Review
	05	Various	M Herbert	C Johnstone	16.09.2021	Internal Update and Review
1.0	06		M Herbert	C Johnstone	20.09.2021	Final Submission to Client
1.5	0.7	M Herbert		C Johnstone	30.09.2021	CIMAF Comments Update - Final

Signature Page

30 September 2021

Final Supplementary Environmental and Social Impact Assessment Report

Limestone Quarry and Cement Production in the Thiès Region by CIMAF

Chris Johnstone
Partner

Michelle Herbert
Principal Consultant

Environmental Resources Management Senegal (SARL)
12 Boulevard Djily Mbaye
Immeuble Azur
Dakar
Senegal

© Copyright 2021 by ERM Worldwide Group Ltd and/or its affiliates ("ERM").
All rights reserved. No part of this work may be reproduced or transmitted in any form,
or by any means, without the prior written permission of ERM.

CONTENTS

NON-TECHNICAL SUMMARY 4

INTRODUCTION AND PROJECT BACKGROUND 4

Location of the Project 4
Project Activities 6
Project Schedule 8

DESCRIPTION OF THE PROJECT AREA 8

Biophysical 8
Land Use and Economic Activities 8
Population 8
Services and Infrastructure 9
Cultural Heritage 9

THE ESIA PROCESS 9

STAKEHOLDER ENGAGEMENT 11

KEY FINDINGS OF THE ESIA 12

Limitations 12
Summary of the Findings 13
The Key Positive Impacts 13
The Key Negative Impacts 14

LIVELIHOOD RESTORATION PLANNING 21

CONCLUSION 22

1. INTRODUCTION 23

1.1 Background to the CIMAF Project 23
1.2 Purpose of this Report 23
1.3 Structure of this Report 23

2. PROJECT DESCRIPTION 25

2.1 Background to CIMAF 25
2.2 Project Need and Desirability 27
2.3 Project Location 28
2.4 Project Activities 29
2.4.1 Limestone Quarry 31
2.5 Project Schedule 43
2.6 Environmental Protection 43
2.7 Health and Safety 44
2.7.1 Internal Safety Audits 44
2.8 Control and Regulation 45
2.9 Labour and Procurement 45
2.10 CSR Policy 46

3. ALTERNATIVES 47

3.1 Site Alternatives 47
3.1.1 Quarry 47
3.1.2 Plant 47
3.2 Technology Alternatives 48
3.2.1 The Quarry Exploitation Techniques Assessed 48
3.2.2 Mining Activities 48
3.2.3 The Clinkerization Process 49

3.2.4 The Source of Water Supply 49
3.2.5 The Source of Energy Supply 50
3.2.6 Rehabilitation of the Quarry 50
3.3 Access Road Alternatives 51
3.4 No-Go Option 52

4. REGULATORY REVIEW 53

4.1 Senegalese Policy and Legal Framework 53
4.1.1 Policy Framework 53
4.1.2 National Legal Framework 56
4.1.3 Land Tenure 57
4.1.4 Environmental Code of Senegal 58
4.1.5 Forestry Code 63
4.1.6 The Labour Code 63
4.1.7 Emissions Standards 67
4.1.8 Relevant International Conventions and Treaties 70
4.2 International Standards 71
4.2.1 IFC Performance Standards 71
4.2.2 WBG General EHS Guidelines 73
4.2.3 WBG EHS Guidelines for Construction Materials Extraction 74
4.2.4 WBG EHS Guidelines for Cement and Lime Manufacturing 75

5. THE ESIA PROCESS 77

5.1 Introduction 77
5.2 Gap Assessment 77
5.3 Scoping 77
5.4 Baseline Data Collection 77
5.5 Stakeholder Engagement 78
5.6 Impact Types and Definitions 78
5.6.1 Assessing Significance 78
5.6.2 Determining Impact Magnitude 78
5.6.3 Determining Sensitivity/Vulnerability/Importance of Resource/Receptor 80
5.6.4 Determining Impact Significance 81
5.7 Identification of Mitigation and Enhancement Measures 82
5.8 Residual Impact Evaluation 82

6. STAKEHOLDER ENGAGEMENT 83

6.1 Introduction 83
6.2 Approach 83
6.3 Stakeholder Analysis 84
6.4 Stakeholder Feedback 86

7. PHYSICAL ENVIRONMENT BASELINE 96

7.1 Climate 96
7.2 Topography 97
7.3 Geology 99
7.4 Geological Hazards 99
7.4.1 Landslides 99
7.4.2 Rockfalls 99
7.4.3 Karst 100
7.5 Soils 100
7.6 Hydrology 100
7.6.1 Methodology 100
7.6.2 Surface Water 101
7.6.3 Groundwater 102
7.7 Land Cover 109

7.7.1 Methodology 110
7.7.2 Baseline Findings 111
7.8 Landscape and Visual 114
7.8.1 Methodology 114
7.8.2 Baseline Findings 119
7.9 Air Quality 119
7.9.1 Assessment Framework 119
7.9.2 Baseline findings 124
7.9.3 Methodology 127
7.9.4 Point Emission Sources 129
7.9.5 Fuels 129
7.9.6 Limitations and Assumptions 129
7.9.7 Model Methodology 130
7.9.8 Embedded Mitigation 135
7.10 Noise 136
7.10.1 Introduction 136
7.10.2 Scope of Analysis 136
7.10.3 Relevant Documents, Standards and Guidelines 136
7.10.4 Noise Criteria 137
7.10.5 Blasting Criteria 137
7.10.6 Noise Sensitive Receptors 139
7.10.7 Impact Significance 139
7.10.8 Determining Significance 139
7.10.9 Impact Terminology 140
7.10.10 Modelling Scenarios 141
7.11 Greenhouse Gas Emissions 144
7.11.1 Introduction 144
7.11.2 Methodology 144
7.11.3 Findings 145
7.12 Climate Change 146
7.12.1 Introduction 146
7.12.2 Methodology 146
7.12.3 Baseline Findings 146
7.12.4 Summary of Climate Change Material Risks 149
8. BIOLOGICAL BASELINE 151
8.2 Ecosystem Services 166
8.2.1 Provisioning Services 166
8.2.2 Regulatory Services 167
8.2.3 Socio-cultural Services 167
8.2.4 Supporting Services 167
9. SOCIAL BASELINE 168
9.1 Socio-economic 168
9.1.1 Introduction 168
9.1.2 Methodology 168
9.1.3 Baseline Findings 169
9.2 Traffic 180
9.2.1 Description of Major Roads 180
9.2.2 Existing Traffic Data 181
9.3 Cultural Heritage 182
9.3.1 Introduction 182
9.3.2 Methodology 182
9.3.3 Baseline Methodology and Approach 183

9.3.4 Data Sources ... 183
9.3.5 Geographic/ Topographic Context ... 183
9.3.6 Archaeological and Historical Background ... 183
9.3.7 Oral Traditions in Senegal ... 185
9.3.8 Designated Cultural Heritage Sites ... 188
9.3.9 Non-Designated Cultural Heritage Sites ... 188

10. PHYSICAL ENVIRONMENT IMPACT ASSESSMENT ... 198

10.1 Soils ... 198
10.1.1 Proposed Project Activities ... 198
10.1.2 Sensitive Receptors ... 199
10.1.3 Significance of Impact (Pre-Mitigation) ... 199
10.1.4 Mitigation/Management Measures ... 200
10.1.5 Residual Impact (Post-mitigation) ... 200
10.2 Hydrology ... 201
10.2.1 Proposed Project Activities ... 201
10.2.2 Significance of Impact (Pre-Mitigation) ... 202
10.2.3 Mitigation Measures ... 203
10.2.4 Residual Impacts (Post Mitigation) ... 204
10.3 Landscape and Visual ... 205
10.3.1 Sensitive Receptors ... 205
10.3.2 Significance of Impact (Pre-mitigation) ... 224
10.3.3 Assessment of Impacts: Construction ... 225
10.3.4 Assessment of Impacts: Operation ... 225
10.3.5 Mitigation/Management Measures ... 226
10.3.6 Residual Impact (Post-mitigation) ... 227
10.4 Air Quality ... 227
10.4.1 Construction Phase Assessment ... 227
10.4.2 Determination of significance of impacts ... 228
10.4.3 Dust Assessment ... 231
10.4.4 Modelling Results ... 233
10.4.5 Dust Deposition ... 240
10.4.6 Mitigation and Monitoring ... 241
10.4.7 Conclusion ... 245
10.5 Noise ... 245
10.5.1 Noise Assessment ... 245
10.5.2 Conclusion ... 250
10.6 Climate Change ... 251

11. BIOLOGICAL ENVIRONMENT IMPACT ASSESSMENT ... 253

11.1 Biodiversity ... 253
11.1.1 Vegetation ... 253
11.1.2 Fauna ... 262
11.2 Ecosystem Services ... 268
11.2.1 Proposed Project Activities ... 268
11.2.2 Sensitive Receptors ... 269
11.2.3 Significance of Impact (Pre-mitigation) ... 270
11.2.4 Mitigation/Management Measures ... 271
11.2.5 Residual Impact (Post-mitigation) ... 272

12. SOCIAL ENVIRONMENT IMPACT ASSESSMENT ... 274

12.1 Socio-economic ... 274
12.1.1 Traditional Livelihood Activities ... 274
12.1.2 Significance of Impact (Pre-mitigation) ... 275

12.1.3 Ecosystem Services ... 277
12.1.4 Community Health and Safety ... 278
12.1.5 Cultural Heritage ... 281
12.1.6 Significance of Impact (Pre-mitigation) ... 283
12.1.7 Access to Water ... 287
12.2 Economic Development ... 290
12.2.1 Proposed Project Activities ... 290
12.2.2 Sensitive Receptors ... 291
12.2.3 Significance of Impact (Pre-management measures) ... 291
12.2.4 Mitigation/Management Measures ... 292
12.3 Traffic ... 293
12.3.1 Proposed Project Activities ... 293
12.3.2 Sensitive Receptors ... 294
12.3.3 Significance of Impact (Pre-mitigation) ... 295
12.3.4 Traffic Increases ... 295
12.3.5 Infrastructure damage ... 297
12.3.6 Accidents and risks associated with traffic ... 298

13. CUMULATIVE IMPACT ASSESSMENT ... 301

13.1 Introduction ... 301
13.2 Objectives of the CIA ... 301
13.3 Scope of the Cumulative Assessment ... 302
13.4 Methodology ... 302
13.4.1 Selection and Description of VECs ... 303
13.4.2 Limitations ... 303
13.5 The Development Context ... 303
13.6 Identified Cumulative Impacts ... 306
13.6.1 Cumulative Impacts to Air Quality ... 306
13.6.2 Cumulative Impacts to Soils ... 306
13.6.3 Cumulative Impacts to Biodiversity ... 307
13.6.4 Cumulative Impacts to Ecosystem Services ... 307
13.6.5 Cumulative Impacts to Traditional Livelihood Activities ... 308
13.6.6 Cumulative Impacts of the Lowering of Water Table as a Result of Industrialization 309
13.6.7 Cumulative Impacts to Traffic ... 309
13.6.8 Cumulative Impacts to Cultural Heritage ... 309

14. STAKEHOLDER ENGAGEMENT PLAN ... 311

15. ENVIRONMENTAL AND SOCIAL MANAGEMENT SYSTEM STRUCTURE ... 312

15.1 Key Components for the Implementation of the ESMS ... 315
15.1.1 Training ... 315
15.1.2 Emergency Responses and Incident Reporting ... 316
15.1.3 Audit and Inspection ... 316
15.1.4 Reporting ... 316
15.1.5 Management of Change ... 317

16. ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN (ESMMP) FOR CONSTRUCTION AND OPERATION ... 318

16.1 Physical Environmental Management Plans ... 320
16.1.1 Air Quality Management ... 320
16.1.2 Soil Management ... 331
16.1.3 Water Management ... 337
16.2 Biodiversity Management ... 340
16.2.1 Objectives ... 340
16.2.2 Responsibility ... 340

16.2.3 Performance Criteria 340
16.3 Social Management 348
16.3.1 Management of Socio-Economic Impacts 348
16.3.2 Traffic and Transportation 359
16.4 General Management 366
16.4.1 Waste Management Plan 366
16.4.2 Blasting Management 373
16.5 Environmental and Social Monitoring 375
16.5.1 Introduction 375
16.5.2 Construction Phase Monitoring 375
16.5.3 Operational Phase Monitoring 377

17. CONCLUSION 388

18. REFERENCES 391

ANNEXURE A SOCIO-ECONOMIC FIELDWORK PHOTOGRAPHS (MARCH 2021) 393

ANNEXURE B PARTICIPANT LISTS (MARCH 2021) 398

ANNEXURE C HOUSEHOLD SURVEY FORM 412

ANNEXURE D BIODIVERSITY BASELINE REPORT 418

ANNEXURE E VULTURE SPECIALIST ASSESSMENT 419

ANNEXURE F AIR QUALITY METHODOLOGY 420

ANNEXURE G HYDROCENSUS REPORT 437

ANNEXURE H STAKEHOLDER ENGAGEMENT PLAN 438

ANNEXURE I TRAFFIC MANAGEMENT PLAN 439

ANNEXURE J INFLUX MANANGEMENT PLAN 440

ANNEXURE K FRAMEWORK LOCAL CONTENT PLAN 441

ANNEXURE L FRAMEWORK SOCIAL INVESTMENT PLAN 442

List of Tables

Table 2-1 CIMAF's Cement Operations in West and Central Africa 25
Table 2-2 Summarised Project Activities 29
Table 2-3 Cement Quantities for Dispatch 34
Table 2-4 Air Emissions from the Kiln Stack 42
Table 2-5 Breakdown of the Workforce 45
Table 4-1 Environmental Code of Senegal 58
Table 4-2 Labour Code of Senegal 63
Table 4-3 Air Emissions Standards for Senegal 67
Table 4-4 Concentration of Emissions of Air Polluting Substances 68
Table 4-5 Limit Values for Dust Emissions from Gaseous Emissions from Cement Kilns & Hydraulic Lime Kilns 68
Table 4-6 Limit Values for Other Gaseous Emissions from Cement Kilns & Hydraulic Lime Kilns 68
Table 4-7 Emission Limit Values in Boilers 68
Table 4-8 Limit Values for the Discharge of Wastewater into the Natural Environment 69
Table 4-9 Wastewater Quality Limit Values before Connection to a Collective WWTW Plant 70
Table 4-10 IFC Performance Standards 71
Table 4-11 WBG EHS General Guidelines 73
Table 4-12 WBG EHS Guidelines Construction Materials Extraction 74
Table 4-13 WBG EHS Guidelines for Cement and Lime Manufacturing 75
Table 5-1 Impact Nature and Type 78
Table 5-2 Impact Characteristics Terminology 79
Table 5-3 Definition for Likelihood Designations 80
Table 5-4 Illustrative Example of Sensitivity/Vulnerability/Importance of the Resource/Receptor 80
Table 5-5 Impact Significance 81
Table 5-6 Significance Definitions 81
Table 6-1 Project-Affected Communities 84
Table 6-2 Stakeholder Analysis 86
Table 6-3 Stakeholder Feedback 86
Table 6-4 Stakeholder Validation 91
Table 7-1 List of Hydraulic Structures in the Site Area 104
Table 7-2 Characteristics of Hydraulic Structures in Pout & Pout-Kirène Areas 105
Table 7-3 List of Hydraulic Structures for Industrial & Commercial Use 106
Table 7-5 Different Land Cover Classes & Area within 6.5-Km Radius of the Project Site 111
Table 7-6 Area Breakdown of Barren & Shrub/Scrub Classes under the Project Footprint 111
Table 7-7 Vertical Field of View 117
Table 7-8 IFC / WHO Air Quality Standards 121
Table 7-9 Senegalese Air Quality Standards 122
Table 7-10 UK / US EPA AQS 123
Table 7-11 Dust Deposition Guidelines 124
Table 7-12 Baseline Ambient Concentration 126
Table 7-13 Quarry Production Capacities 128
Table 7-14 Point Source Emission Limits (mg/Nm^3) 129
Table 7-15 Model Parameters 131
Table 7-16 Summary of Noise Criteria and Period Definitions 137
Table 7-17 Airblast - During Blasting Operations 138
Table 7-18 Vibration - During Blasting Operations 138
Table 7-19 Noise Impact Assessment Criteria 140
Table 7-20 Criteria for Evaluation of Impacts from Blasting 140
Table 7-21 Equipment Sound Power Levels - Construction 141
Table 7-22 Equipment Sound Power Levels – ICP & Primary Crusher 142
Table 7-23 Equipment Sound Power Levels - Quarry 143
Table 7-24 Total GHG Emission for Project (Operational Phase) 145

Table 7-25 Scenarios Selected for Inclusion 147
Table 7-26 Summary of Climate Change Material Risks 149
Table 8-1 IFC Critical Habitat Criteria (GN6, 27 June 2019) 153
Table 8-2 Threatened Flora Species Potentially Present in the Project Area 159
Table 8-3 Protected and Internationally Recognised Biodiversity Areas 159
Table 8-4 Threatened Avifauna Species Potentially Present in the Project Area 164
Table 8-5 Critical Habitat potentially present in the Project Area 165
Table 9-1 Infrastructure in the Social AoI 175
Table 9-2 Traffic Data, March 2021 181
Table 9-3 Gazetteer of Identified Cultural Heritage Features 189
Table 10-1 Proposed Project Activities that Potentially Impact Soils 198
Table 10-2 Rating of Impacts Related to Soil (Pre-Mitigation) 199
Table 10-3 Rating of Residual Impacts Related to Soil (Post-Mitigation) 200
Table 10-4 Potential Ground & Surface Water Impact Summary per Project Phase 201
Table 10-5 Rating of Impacts Related to Surface and Groundwater (Pre-Mitigation) 202
Table 10-6 Rating of Residual Impacts Related to Surface and Groundwater (Post-Mitigation) 204
Table 10-7 Sensitivity of Visual Receptors 205
Table 10-8 Magnitude of Visual Effect 206
Table 10-9 Viewpoints 207
Table 10-10 Significance of Visual Effect 224
Table 10-11 Rating of Impacts Related to Visual (Pre-Mitigation): Construction 225
Table 10-12 Rating of Impacts Related to Visual (Pre-Mitigation): Operation 226
Table 10-13 Rating of Residual Impacts Related to Visual (Post Mitigation) 227
Table 10-14 Determination of Magnitude 228
Table 10-15 Determination of Significance 229
Table 10-16 Predicted Environmental Concentration Maximum (PEC) < 25% AQS 234
Table 10-17 TOC and Arsenic Pollutant Contributions 235
Table 10-18 Predicted Environmental Concentration for NO_2, PM_{10} and SO_2 235
Table 10-19 Dust Management and Mitigation Measures 242
Table 10-20 Predicted Noise Levels – Construction 246
Table 10-21 Predicted Noise Levels – Operation 247
Table 10-22 Airblast Calculation 249
Table 10-23 Ground Vibration Calculation 250
Table 10-24 Climate Change Potential Hazards, Potential Impacts and Recommendations 251
Table 11-1 Construction and Operation Phase Impacts on Vegetation 253
Table 11-2 Vegetation Sensitivity Receptors and their Importance 255
Table 11-3 Impacts Rating Related to Impacts on Vegetation Habitats (Pre-Mitigation) 256
Table 11-4 Impacts Rating Related to Impacts on Large Trees (Pre-Mitigation) 257
Table 11-5 Impacts Rating Related to Impacts on Vegetation (Post-Mitigation) 262
Table 11-6 Construction and Operation Phase Impacts on Fauna and Faunal Habitats 263
Table 11-7 Fauna Receptors and Sensitivity/Vulnerability/Importance of Receptor 264
Table 11-8 Impacts Rating Related to Impacts on Fauna (Pre-Mitigation) 265
Table 11-9 Impacts Rating Related to Impacts on Fauna (Post-Mitigation) 267
Table 11-10 Proposed Project Activities that Potentially Impact Ecosystem Services 268
Table 11-11 Sensitive Receptors Related to Ecosystem Services 269
Table 11-12 Impacts Rating Related to Ecosystem Services (Pre-Mitigation) 270
Table 11-13 Residual Impacts Rating Related to Ecosystem Services (Post-Mitigation) 272
Table 12-1 Impacts Rating Related to Traditional Livelihood Activities (Pre-Mitigation) 275
Table 12-2 Impacts Rating Related to Traditional Livelihood Activities (Post-Mitigation) 277
Table 12-3 Impacts Rating Related to Community Health and Safety (Pre-Mitigation) 279
Table 12-4 Residual Impacts Rating Related to Community Health and Safety (Post-Mitigation) 281
Table 12-5 Activities per Project Phase Potentially Impacting Cultural Heritage 282

Table 12-6 Impacts Rating Related to Foret de Thiès Tangible Cultural Heritage (Pre-Mitigation) 283
Table 12-7 Impacts Rating Related to Foret de Thiès Intangible Cultural Heritage (Pre-Mitigation) 284
Table 12-8 Impacts Rating Related to Foret de Thiès Intangible Cultural Heritage (Pre-Mitigation) 285
Table 12-9 Residual Impacts Rating Related to Foret de Thiès Tangible Cultural Heritage (Post-Mitigation) 286
Table 12-10 Impacts Rating Related to Foret de Thiès Intangible Cultural Heritage (Post-Mitigation) 287
Table 12-11 Impacts Rating Related to Access to Water (Pre-Mitigation) 288
Table 12-12 Residual Impacts Rating Related to Access to Water (Post-Mitigation) 289
Table 12-13 Impacts Rating Related to Economic Development (Pre-Mitigation) 291
Table 12-14 Impacts Rating Related to Economic Development (Post-Mitigation) 293
Table 12-15 Receptor Sensitivity to Transportation Impacts 295
Table 12-16 Impacts Rating Related to Traffic Operations (Pre-Mitigation) 296
Table 12-17 Impacts Rating Related to Transportation Infrastructure (Pre-Mitigation) 297
Table 12-18 Impacts Rating Related to Transportation Safety (Pre-Mitigation) 298
Table 12-19 Residual Impacts Rating Related to Transportation Safety (Post-Mitigation) 299
Table 16-1 Applicable Project Air Quality Standards 321
Table 16-2 Air Quality Management – Construction Phase 323
Table 16-3 Air Quality Management – Operational Phase 327
Table 16-4 Soil and Stockpile Management 332
Table 16-5 Water Management Plan 338
Table 16-6 Initial Biodiversity Management 341
Table 16-7 Social Management Measures 354
Table 16-8 Traffic Management 360
Table 16-9 Waste Types Potentially Generated during Construction of the Project 366
Table 16-10 Waste Management 368
Table 16-11 Blasting Management 374
Table 16-12 Pre-construction & Construction Monitoring Measures (Engineer/ Contractor Responsibility) 378
Table 16-13 Operational Monitoring Measures 383

List of Figures

Figure 0-1 Project Site Location in the Commune of Keur Moussa & AoI 6
Figure 0-2 Project Layout Plan 7
Figure 2-1 Location of CIMAF Projects in West and Central Africa 26
Figure 2-2 Location of the Project Site in the Commune of Keur Moussa 29
Figure 2-3 Project Layout Plan 31
Figure 2-4 Schematic layout of the Cement Plant 33
Figure 2-5 Access Road Options 43
Figure 3-1 Layout and Associated Infrastructure Options 47
Figure 3-2 Access Road Options 51
Figure 7-1 Topography 98
Figure 7-2 Map of Watershed 102
Figure 7-3 Hydrogeological map of project area (DGPRE, 2018) 103
Figure 7-4 Geographical distribution of hydraulic structures 105
Figure 7-5 Distribution of Hydraulic Structures for Industrial & Agricultural Use 108
Figure 7-6 Geographical distribution of hydraulic structures 109
Figure 7-7 Land Cover Map 110
Figure 7-8 Land Cover Model Developed within 6.5-Km Radius of the Proposed Project Area 112

Figure 7-9 Structures nearby the Project Site 112
Figure 7-10 Landscape close to the Project Site 113
Figure 7-11 Residential/Commercial Area 113
Figure 7-12 Industrial Area 114
Figure 7-13 Field of View 117
Figure 7-14 Viewpoints locations 118
Figure 7-15 Wind Rose Annual Average 125
Figure 7-16 Location of AQ Monitoring Stations 126
Figure 7-17 Layout of Buildings 133
Figure 7-18 Location of Receptors 135
Figure 7-19 Noise Sensitive Receptors 139
Figure 8-1 Habitats within the Ecologically Appropriate Area of Analysis 156
Figure 8-2 Potential extent of Riparian Habitats across the quarry and haul-route areas 158
Figure 8-3 Location of Baobab Trees Relative to the Project Site 161
Figure 9-1 Project Social Area of Influence 170
Figure 9-2 Population of Senegal 171
Figure 9-3 Structures in Nangane 178
Figure 9-4 Existing Projects 179
Figure 9-5 Regional Land Use Plan 180
Figure 9-6 Traffic Count Location 182
Figure 9-7 Historic map of the Kingdoms, illustrating Senegambia and St Louis, 1758 184
Figure 9-8 Historic Topographic Map of Foret De Thiès, 1905 185
Figure 9-9 Historic map illustrating distribution of territories, 1853 185
Figure 9-10 Cultural Heritage Features Identified within the Study Area 187
Figure 9-11 Baobab Tree Associated With Path to Sacred Baobab Tree 188
Figure 10-1 Air Quality Assessment Infographic for Road Traffic 230
Figure 10-2 Air Quality Assessment for Dust - Infographic 232
Figure 10-3 NO_2 1-hr (IFC/WHO/SG AQS) 236
Figure 10-4 NO_2 Annual (IFC/WHO/SG AQS) 236
Figure 10-5 PM_{10} 24hr (SG AQS) 237
Figure 10-6 PM_{10} Third Highest 24hr (IFC /WHO AQS) 238
Figure 10-7 Annual PM_{10} (SG AQS) 238
Figure 10-8 SO_2 10min (IFC / WHO / SG) 239
Figure 10-9 SO_2 24hr (SG) 239
Figure 10-10 SO_2 Annual (IFC / WHO) 240
Figure 10-11 Dust Deposition 24hr (SG AQS) 241
Figure 10-12 Predicted Construction Noise Levels – Day 246
Figure 10-13 Predicted Operation Noise Levels – Day 248
Figure 10-14 Predicted Operation Noise Levels – Night 248
Figure 13-1 Rapid Cumulative Impact Assessment Methodology 302
Figure 13-2 Project Location Relative to Other Developments in the Broader Study Area 305
Figure 15-1 Main Elements of an ESMS 313
Figure 15-2 ESMS Structure Framework 313

Acronyms and Abbreviations

Name	Description
AIBD	Blaise Diagne International Airport
ANZECC	Australian and New Zealand Environment and Conservation Council
AoI	Area of Influence
AQIA	Air Quality Impact Assessment
AQS	Air Quality Standard
As	Arsenic
BMP	Biodiversity Management Plan
CBD	Convention on Biological Diversity
CCC	Control Command System
CIA	Cumulative Impact Assessment
CIMAF	Ciments de L'Afrique
CIMAT	Ciments de l'Atlas
CITES	Convention on International Trade in Endangered Species
CMIP	Coupled Model Intercomparison Project
Co	Cobalt
CO_2	Carbon dioxide
COP	Conference of the Parties
CR	Critically Endangered
Cu	Copper
DEFCCS	Department of Water, Forests, Hunting and Soil Conservation
EAAA	Ecologically Appropriate Area of Assessment
EHS	Environmental, Health and Safety
EITI	The Extractive Industries Transparency Initiative
ESIA	Environmental and Social Impact Assessment
GBIF	Global Biodiversity Information Facility
GIIP	Good International Industry Practice
GIS	Geographic Information System
ha	Hectares
HCl	Hydrogen Chloride
HF	Hydrogen Fluoride
HoH	Head of Household
HSE	Health, Safety and Environment
HV	High Voltage

Name	Description
IBA	Important Birding Area
IBAT	Integrated Biodiversity Assessment Tool
ICP	Integrated Cement Plant
IFC	International Finance Corporation
ILO	International Labour Organization
IMS	Integrated Management System
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for the Council of Nature
Kg	Kilogram
km	Kilometres
KV	Kilovolt
LCP	Local Content Plan
LP	Sound Pressure Levels
LRP	Livelihood Restoration Plan
LRTAP	Long-Range Transboundary Air Pollution
LW	Sound Power Level
m	Metres
MIC	Maximum Instantaneous Charges
Mn	Manganese
MoU	Memorandum of Understanding
NAPCB	National Action Plan for the Conservation of Biodiversity
NDVI	Normalised Difference Vegetation Index
Ni	Nickel
NO_2	Nitrogen dioxide
NO_x	Nitrogen Oxide
NPi	Australian National Pollutant inventory
NSED	National Strategy for Economic and Social Development
NSR	Noise Sensitive Receptor
OHS	Occupational Health and Safety
ONMP	Operational Noise Management Plan
Pa	Pascal
Pb	Lead
PC	Process Contribution
PEC	Predicted Environmental Concentration

Name	Description
PES	Plan for an Emerging Senegal
PM_x	Particulate Matter with an aerodynamic diameter less than x
PNL	Project Noise Levels
PS	Performance Standards
QSE	Quality-Safety-Environment
RCP	Representative Concentration Pathways
RN2	Route Nationale 2
Sb	Antimony
SDE	Senegalese Des Eaux
SENELEC	National Electricity Company of Senegal
SEP	Stakeholder Engagement Plan
SIP	Social Investment Plan
SNDES	National Strategy for Economic and Social Development
SO_2	Sulphur dioxide
SPNAB	National Strategy and a National Action Plan for the Conservation of Biodiversity
SRTM	Shuttle Radar Topography Mission
SSPT	Sociètè Senegalese des Phosphates da Thiès
TCFD	Climate-Related Financial Disclosures
TOC	Total Organic Compounds
ToR	Terms of Reference
TSP	Total Suspended Particulates
UEMOA	West African Economic and Monetary Union
UNCAC	United Nations Framework Convention on Climate Change
USEPA	United States Environmental Protection Agency
V	Vanadium
VEC	Valued Environmental and Social Components
VP's	View Points
VSR	Visual Sensitive Receptors
W	Watts
WBG	World Bank Group
WHO	World Health Organisation
ZTV	Zone of Theoretical Visibility

NON-TECHNICAL SUMMARY

INTRODUCTION AND PROJECT BACKGROUND

Ciments De L'Afrique (CIMAF) was established in 2011 to expand the cement sector in Africa. CIMAF has a wide presence in in the continent and their cement works have been developed according to the most up to date technologies and processes, energy saving and environmental protection. CIMAF plans to develop a Limestone Quarry and an Integrated Cement Plant (ICP) in Senegal, West Africa (the Project). In summary, the Project is aimed to achieve the following key development outcomes:

- Bring long-term economic benefits to Senegal, and the immediate community of Pout, in a sustainable way.
- Economy-wide benefits and employee skills development.
- Support domestic value addition to Senegal's abundantly available limestone deposits.
- Create approximately 280 full time direct jobs in Senegal.
- Support skills development of employees and adoption of manufacturing production know-how that are not readily available in Senegal.
- Support the continuous development of technical skills and training.
- Promote market competitiveness in Senegal via innovation and improved efficiency through usage of best available techniques.

An Environmental and Social Impact Assessment (ESIA) was undertaken for the Project by a local consultancy, Harmony Group, in 2019 in line with Senegalese legislation. In order to secure financing from the International Finance Corporation (IFC), the ESIA required an upgrade in order to comply with the IFC Performance Standards (PS); Environmental Resources Management Southern Africa (Pty) Ltd. (ERM) completed the updated ESIA in 2021.

This document presents the Non-Technical Summary (NTS) for the Supplementary ESIA Report completed by ERM. Important documents included in the ESIA Report include –

- The **Environmental and Social Management Plans (ESMP),** which define the commitments that CIMAF will adopt to prevent, minimise and manage adverse impacts and enhance positive impacts caused by the Project and associated infrastructure (transmission line and access roads).
- The **Stakeholder Engagement Plan (SEP)**, which describes how/where CIMAF will engage with the public, and how interested persons can pose questions or comments/complaints to CIMAF about the Project.
- The **Livelihood Restoration Plan (LRP)**, which describes how livelihood impacts will be managed, as a result of economic displacement.
- The **Influx Management Plan (IMP)**, which described how project-induced migration will be identified and impacts managed.
- The intention of CIMAF is to make it easy for the public to inform themselves about the Project, and to provide their views and comments (whether positive or negative) about the Project.

Location of the Project

The Project site is located in Senegal, in the commune of Keur Moussa in the department of Thiès, about 50 kilometres (km) east of Dakar, on the national road Route Nationale 2 (RN2, about 1,6 km north of the Project). The closest larger towns are Pout, 4,5 km to the north-west, and Thiès Ouest, 6 km in north-east of the Project site. An additional quarry is within 1 km of the Project site, and commercial as well as subsistence agricultural fields within 1,5 km west and south of the Project site.

Various small villages and hamlets lie within the 5 km radius of the Project site (i.e. the Project Area of Influence):

- Palal – 2 km from the clinker and 3 km from the quarry;
- Gap – 2.6 km from the clinker and 3.8 km from the quarry;
- Lene – 4 km from the clinker and 4.3 km from the quarry;
- Soune (Serere) – 4.5 km from the clinker and 4.9 km from the quarry;
- Soune Wolof – 4.2 km from the clinker and 3.6 km from the quarry;
- Nangane – a Peulh hamlet located approximately 1 km northeast of the clinker and 2 km north of the quarry;
- Thiambokh Peulh – a Peulh hamlet of the village of Soune Wolof, located approximately 3 km southwest of the clinker and 2.2 km southwest of the quarry;
- Palal Peulh – a Peulh hamlet of the village of Palal, located approximately 1.8 km northwest of the clinker and 3.3 km northwest of the quarry; and
- Thiambokh – incorrectly considered a hamlet of Soune Wolof in the 2019 ESIA, but in fact an independent village located approximately 4.4 km southwest of the clinker and 3.5 km southwest of the quarry.

Keur Moussa in particular has seen increased development due to the initiation of a number of new government projects, importantly including Dakar's new Blaise Diagne International Airport (AIBD, 6 km south-east of the Project) and the extension of the toll motorway between Diamniadio and Mbour (0,6 km south of the Project site).

The location of the Project (including Area of Influence) is illustrated in Figure 0-1 below.

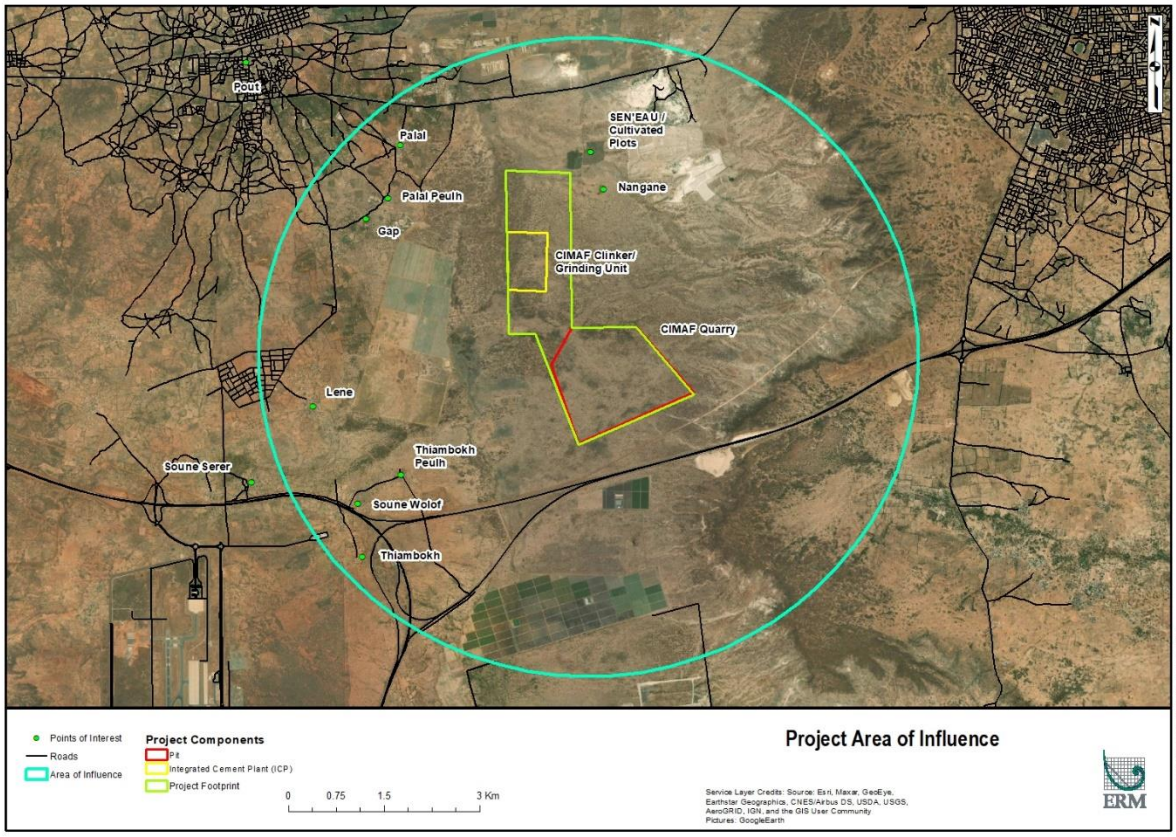


Figure 0-1 Project Site Location in the Commune of Keur Moussa & AoI

Project Activities

The Project will have two components:

- **Quarry:** Occupying an area of approximately 50 ha, the limestone quarry will be developed through stripping to expose the limestone rock and mining to fragment the limestone into rubble (including one blasting event per week).
- **Cement Plant:** The Project will include installation a new clinker line and a new cement grinding and dispatch line. Plant facilities will include production workshops, storage halls, and an electrical supply network. The plant will be connected to the national energy grid. Cement will be packed onsite, loaded manually and transported off site by truck. The plant will occupy and any area of approximately 80 ha.
- Additional supporting facilities and infrastructure occupying an area of approximately 20 ha include administrative building with a main control room and laboratory; cafeteria; infirmary; dressing / locker room; mosque; security post; perimeter fence; concrete walkways around workshops; internal roads and parking lots; and paved access road to the site from the N2. Refer to Figure 0-2, below, for the proposed layout.

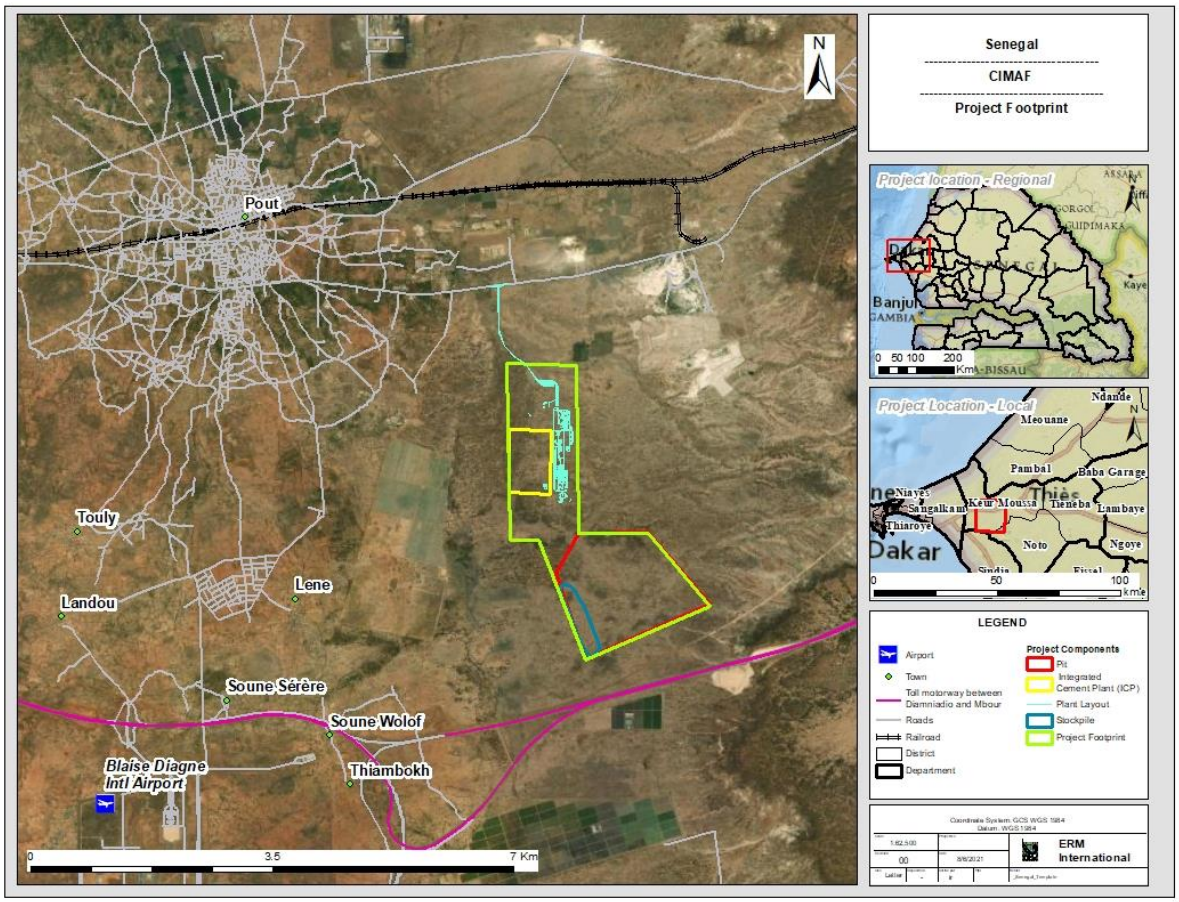


Figure 0-2 Project Layout Plan

The Project is expected to employ approximately 800 people during the construction phase, 10% of whom will be skilled workers (i.e. engineers and managers). During the operations phase, the Project will employ approximately 280 people, including 80 CIMAF employees and 200 contracted personnel. There will be no accommodation for workers built on site.

The Project's water supply will require construction of a compartmentalized basin with a water treatment system and set of pumps and devices required for operation of the plant and firefighting.

The quarry's water needs are estimated at 10 l/tonne of limestone produced, and those of the plant at 80 l/tonne of clinker. The Project intends to drill a borehole from which it will draw its water for the total consumption of 30m^3/day; it is estimated that the water table is at a depth of 200 m.

Protective measures will be put in place to minimize impacts on the environment and surrounding communities, including the use of bag filters for dust collection, construction of covered conveyors, installation of equipment to reduce noise levels, and continuous analysis of gases at the chimneys.

Consistent with its operations elsewhere in Africa, CIMAF will establish up an Integrated Management System (IMS) aimed at certifying the plant according to ISO 9000, ISO 14001 and ISO 18000 standards, and will deploy the same robust Health, Safety and Environment (HSE) policies and management systems in place at all its facilities.

The Project will be built in accordance with applicable legislative and regulatory requirements in Senegal pertaining to environmental, social and health and safety standards, as well as the requirements of the IFC Performance Standards and the World Bank Group's Environmental, Health and Safety (EHS) Guidelines for Construction Materials Extraction and for Cement and Lime Manufacturing.

Project Schedule

The pre-construction phase (permitting, authorisation acquisition etc.) of the Project is estimated to take eight (8) months to commence in January 2022. The construction phase (June 2022 – December 2023) is planned to be completed in 24 months. Operations are expected to continue for 100 years.

DESCRIPTION OF THE PROJECT AREA

Biophysical

The Project Area lies within the Sudano-Sahelian climatic domain. Two seasons can be distinguished: a rainy season from June to October and a dry season for the remaining months of the year.

The landscape has been classified into the following classes: barren, shrub/scrub, agriculture, mining area, residential area, and road. The agriculture class was further separated into large-scale industrial agriculture and small-scale agriculture. Forest shrub vegetation dominates the Project Area, however the most prominent trees are the Baobab. The Thiès Forest, a classified forest, is open to surrounding grazers who rely on this access for their livelihood and is an area where cultural beliefs are practiced. Within the forest, communities place importance on specific baobab tree for rituals, prayers and burials.

The direct impact of the Project activities on the biodiversity is not anticipated to extend much beyond the Project Footprint, but due to potential indirect impacts such as noise disturbance, dust and light pollution at night, as well as potential disturbances to surface runoff and migration patterns, the Ecologically Appropriate Area of Assessment (EAAA) was delineated as a 4.5 km radius from the midpoint of the combined Project Area

Limited presence of indigenous fauna and also low diversity of species were observed in the Project Area and AoI. This could, potentially, be as a result of the timing of the survey during the dry season, but most likely is more significantly impacted by the current high levels of human disturbance in the area.

Land Use and Economic Activities

The communities identified within the Project's Area of Influence (AoI) are predominantly Serer and Peulh, in terms of ethnic makeup. Traditionally, Peulh communities are largely nomadic, travelling with their livestock along established migration routes in accordance with the seasons. In recent years, Peulh communities have built semi-permanent structures in the villages of Nangane, Thiambokh Peulh, and Palal Peulh, and live a more sedentary lifestyle, grazing their livestock exclusively in the Classified Forest. Pastoralism was reported during the consultation by ERM and Harmony Group in March 2021 as the primary activity in all three Peulh communities.

The primary – and almost exclusive – livelihood activity of women in the Project's AoI is small-scale commerce. Among women in Peulh communities, this is specifically the sale of milk from livestock. Women in other communities' report collecting forest products or buying small goods such as vegetables and sugar and reselling them in surrounding villages or along the N2. Women's activities are directly linked to communities' access to ecosystem services in the Classified Forest, where they collect products including fruit, wood for burning, wood for construction and medicinal plants.

Population

Six (6) villages in the Project's AoI are predominantly Serer (Palal, Gap, Lene, Soun Serere, Soun Wolof, and Thiambokh); three of the villages have hamlets that are Peulh (Nangane, Thiambokh Peulh, and Palal Peulh). The Project's AoI also includes a privately owned land parcel (referred to as the SEN'EAU cultivated plots given location immediately adjacent to the SEN'EAU pumping station located northeast of the Project site) that is being cultivated by 13 workers who reside on site. The workers are all male between the ages of 19 and 39 who live alone on site (i.e., without their families).

Two specific groups within the communities of the AoI (i.e. woman and Peulh communities) have the potential to be differentially or disproportionately affected by the Project because of their marginalised status.

Services and Infrastructure

Major roads in the Project Area include the RN2, A1, and A2 motorways. The RN2 between Dakar and Thiès is the most travelled road in Senegal, and is the route used by buses, coaches, and other travellers from Dakar to all other destinations in Senegal.

The A1 is a 4-lane divided highway with a limited number of grade-separated interchanges. The A1 links Dakar to AIBD and the coastal city of Mbour. The A2 links the A1 near the airport to Touba. The A1 and A2 are also referred to as the Toll Roads (Autoroutes à péage).

Local road networks are more limited, with many rural roads in poor condition or unpaved. Unregulated transportation services provide services between smaller communities not linked by regulated buses and coaches.

Cultural Heritage

All identified potential tangible and intangible cultural heritage sites (assets), within the Project area were identified. No designated cultural heritage sites were identified in the Department of Thiès.

Non-designated cultural heritage features identified within the Project area include abandoned structures that may be associated with agro- pastoralism.

Results of a field visit in March 2021 by Harmony and ERM identified a Baobab tree approximately 2 km from the western edge of the quarry, which interviews with local communities confirmed as a burial ritual site for the community of Soune Serer. A second Baobab tree located at the start of the route followed to reach the sacred Boabab was also identified by locals.

THE ESIA PROCESS

The purpose of impact assessment is to identify and evaluate the significance of potential impacts on identified receptors (baseline) and resources according to defined assessment criteria, and to develop and describe mitigation measures / recommendations that will be taken to avoid or minimise any potential adverse effects and to enhance potential benefits. Impacts for both construction and operation were considered.

The potential impacts of the proposed Project were identified based on the findings of stakeholder consultation, the existing baseline conditions, the proposed Project activities and professional knowledge of the consultants. Impacts were distinguished as either positive or negative.

The ESIA for the Project was carried out using different scientific methodologies to comply with the local requirements and also the requirements of the IFC.

Main Step	Description
Gap Assessment	IFC and ERM undertook a review and gap analysis of the 2019 Project ESIA and outcomes to identify gaps in alignment with the requirements of the IFC PSs, and identify further action necessary to adhere to these requirements.
Scoping	Identify key sensitivities and those activities with the potential to contribute to, or cause, potentially significant impacts to environmental and socio-economic receptors and resources, and to evaluate siting, layout and alternatives for the proposed Project.

Data Collection and Observations	Physical, biophysical and social environmental data collection to identify receptors and resources potentially by the Project, through desktop reviews of available project documentation and relevant secondary data sources, field surveys and stakeholder engagement, i.e.: ▪ **Physical:** Desktop review and analysis of the climate topography, geology and soils, geological hazards. Completion of a viewshed analysis and visual baseline assessment, assessment of the receptions potentially affected by noise and dust generation, hydrocensus and baseline sampling undertaken for SO_2, CO, NO_2, PM_{10} and $PM_{2.5}$. ▪ **Biophysical:** Vegetation, terrestrial fauna and avifaunal, and specialist vulture surveys were undertaken, supported by local stakeholder engagement. A critical habitat determination were completed, followed by an ecosystem services assessment. ▪ **Socio-Economic:** Stakeholder engagement (key informant interviews, household survey with representative sample of affected household, and focus group discussions). Identify key conditions and sensitivities in the social area of influence, understand stakeholders concerns, perceptions and expectations.
Stakeholder Engagement	Engagement with local stakeholders was coordinated through the Mayor of Keur Moussa and then directly with the Village Chiefs of the communities in the Project's AoI. In each community, efforts were made to conduct focus group discussions or key informant interviews with the Village Chief and elders; farmers and herders; women; and youth. Included a household survey to establish a socio-economic baseline in four settlements that are likely to be significantly affected by the Project and the cultivated gardens located next to the pumping station of SEN'EAU. A Stakeholder Engagement Plan (SEP) has been prepared to coordinate stakeholder engagement and Project disclosure. The SEP is a *'living document'* and will be updated regularly as the Project progresses.
Impact Identification and Assessment	Impact assessment of proposed Project activities onto the baseline environmental and socio-economic conditions of the Project area. Impacts were described in terms of their 'significance', which is a function of the magnitude of the impact and the sensitivity/vulnerability/importance of the resources/receptor.
Identification of Mitigation Measures	Environmental and Social Management Plans (ESMPs) have been developed for varying Project activities for during the construction and operational phase of the Project. ESMPs detail environmental and social actions (mitigation and monitoring measures) to minimise potential impacts identified.
Residual Impact Evaluation	After first assigning significance in the absence of mitigation, each impact is re-evaluated assuming the appropriate mitigation measure(s) is/are effectively applied, and this results in a significance rating for the residual impact.

STAKEHOLDER ENGAGEMENT

The following table summarises the stakeholder engagement activities undertaken to date together with a summary of the key findings.

Stakeholder Engagement	Key Activities and Findings
Stakeholder consultation was carried out to inform development of the original Local Project ESIA in 2019	Consultation involved relevant stakeholders from government and communities but focused primarily on engagement with elected and traditional community leaders. The consultation format used was primarily focus groups, though some larger public meetings were held. Records of consultation carried out for the original ESIA are included in the ESIA Report (December 2019).
Supplementary ESIA related engagement (March 2021)	Update of the Social Area of Influence to include four additional communities within the 5 km radius of the Project Site (i.e. Nangane, Thiambokh Peulh, Palal Peuhl and Thiambokh) Of the topics raised by stakeholders during the March 2021 consultation the following were raised most frequently and have the highest potential to impact the Project's social license to operate: ▪ Land pressure and negative perceptions of the State's allocation of land in the Classified Forest for private sector projects; ▪ Employment for youth; ▪ Access to water for household use and livelihood activities; and ▪ Access to public services and requests for community development support.
Engagement activities for the livelihood restoration planning (June – July 2021);	Feedback of stakeholders in March and July 2021 was carried out through focus group discussions in each community in the Project's AoI. This approach allowed for the full participation of various stakeholder groups, including those identified as vulnerable – namely women and Peulh communities. Key informant interviews were conducted with specific individuals and groups who were identified on the basis of their experience with the types of activities being considered for the livelihood restoration programs. In July 2021, 259 people were consulted (114 women & 145 men). Engagement on livelihood restoration was well received by stakeholders, who acknowledged the importance of providing support for households whose livelihoods will be affected as a result of Project activities.
Disclosure of the Project ESIA and LRP September 2021	▪ Presentation of the ESIA and LRP to Institutional Actors in Keur Moussa ▪ Directorate of Environment and Classified Installations (DEEC) – Feedback on the Project – Compliance with national procedures – Monitoring ▪ Directorate of Water and Forests

	– Feedback on the Project – Compliance with national procedures – Monitoring ▪ Representatives of villages affected by the Project – Presentation of the ESIA and LRP – Open discussion with participants ▪ Technical Services of Thiès – Presentation of the ESIA and LRP – Solicitation of general impressions of the Project
Engagement during Project construction and operation	Pending – Subject to the implementation of the SEP.

KEY FINDINGS OF THE ESIA

Various alternatives were considered to optimise on operation, but also avoid or minimise the impact on the physical environment. CIMAF undertook various geological studies to understand the quantities, depths and feasible accessibility of the limestone in these areas. The preferred site location was selected as it was judged to be the most geologically attractive and feasible location.

Five options were investigated for the location of the processing plant. Proximity to the quarry, the topography and permit options were all considered. The current plant site was chosen as it was the closest to the quarry site, allowing greater efficiency, with suitable topography for construction of infrastructure. The selected site was also the only one that fell within the CIMAF mining permit.

In addition, the position of the plant allows a direct connection of the SENELEC network, located adjacent to the proposed plant. This will reduce potential avifaunal collision risks.

The close proximity of the crusher and plant to the pit enables the shortest haul road possible, thus significantly reducing associated negative impacts such as increased emissions and dust, further reach of noise disturbance as well as increased risk of collision with livestock, wildlife and/or humans that may have been created with a longer haul route should the plant be located outside the mining concession.

Limitations

The following limitation have been noted:

- Given the communal nature of the Project's displacement impacts, a comprehensive household survey was not undertaken, however baseline data was collected at the household level in the three Peulh communities in the AoI (where herding is practiced as the primary livelihood activity).
- ERM and Harmony Group did not provide detailed responses to questions raised or attempt to address stakeholder concerns, with the exception of explaining the objectives of the current consultation process, how data would be used to inform recommendations to CIMAF, and how national regulations and international lender standards would apply to the impact assessment process.
- No historic groundwater levels are available so trend analysis regarding potential groundwater sustainability in the area cannot be inferred, and current pumping regimes are unclear.
- Wet season fauna and flora field surveys were not completed.

Summary of the Findings

The table below lists all potential impacts (positive and negative) identified and assessed during the supplementary ESIA process, with summaries for the more major impacts provided.

Benefits and Negative Impacts of the Project

Environmental and Socio-Economic Benefits

- Long-term economic development for communities in the Area of Influence and the broader region
- Local employment opportunities
- Local Procurement of Goods and Services
- Opportunities for Community Development

Negative Environmental and Social Impacts

- Soil stripping - Accelerated erosion and loss of fertile soil with high nutrient value
- Contamination of surface and groundwater during construction and operation
- Visual impact mainly during construction and operational phases (i.e. dust and large construction vehicles associated with mining activities)
- Disturbance due to Dust, Noise and Vibration
- Loss of /degradation of natural habitat
- Loss of Baobabs and protected tree species
- Disruption of faunal movement corridors as well as displacement of fauna
- Loss of natural areas of the Forest of Thiès affecting ecosystem services
- Impact on traditional livelihood activities practiced within the Classified Forest
- Increase of alien vegetation
- Impact on community health and safety
- Impacts of earthmoving activities on tangible and intangible heritage resources
- Impact on the access to water
- Disruption to traffic
- Deterioration of road infrastructure
- Accidents and risks associated with traffic
- Increased risk of traffic accidents

The Key Positive Impacts

The proposed Project will have a number of potential positive impacts and benefits, especially to the local communities, the local and national economy. The mitigation measures in the ESIA and ESMP aim to enhance these benefits / positive impacts (estimated 800 jobs during construction and 280 during the operational phase. Further indirect employment and income can be achieved by promoting the use of local service providers such as drivers, cleaners, caterers etc. Influx of job seekers may generate positive impacts through rental accommodation and the purchase of goods and services.

In addition to direct jobs, the Project is expected to support about 5,100 jobs in Senegal through indirect and induced effects in the value chain. Many of the indirect jobs involve individuals who will be engaged in mining, transportation, and other business services.

Employment opportunities – direct, indirect and induced - will result in increased income and spending in the economy, and additional benefits associated with developing and enhancing work skills and experience on a major project according to international standards.

In addition to direct employment, each Project phase will be associated with the purchase of equipment and goods and services necessary to support construction and operations.

Growth in household income derived from direct and indirect employment is likely to improve the lives and living conditions of those who are able to benefit from these opportunities. This is especially likely where individuals are able to leverage these benefits into new or long-term income generating opportunities.

The Key Negative Impacts

Construction of the Project will result in the acquisition and clearing of 331.83 ha of land within the Classified Forest, in addition to conversion of an existing 2.9 km pathway to a paved access road (extending from the RN2 to the Project site) and construction of an additional 500 m of road between the access road and the cement plant.

The table below summarises main environmental and social impacts identified, as well as the proposed mitigation measures included in the ESMP.

Key Impact Description and Proposed Mitigation Measures Summary

Key Environmental Impacts	Impact Description	Proposed Mitigation Measures
Soil stripping	Accelerated erosion and loss of fertile soil with high nutrient value. This impact could be increased if effective soil stock piling is not undertaken sequentially. Incorrect sequencing of soil stocks and lack of management of stockpiles would result in an almost total loss in fertility of soil as well as sedimentation of surrounding water bodies due to erosion and runoff. Without a healthy topsoil layer vegetation cannot be established.	▪ Develop a Soil Stockpile Management Plan in order to ensure soils are effectively managed and conserved. ▪ Soil stripping will be done in a successional manner for project development to allow present species more time to provide the essential ecosystem functions; and all topsoil stockpiles should have a vegetation cover to ensure fertility. Uncovered /unvegetated stockpiles will be surrounded by silt traps to prevent runoff and erosion, causing sedimentation of surrounding water bodies.
Loss of / Degradation of Natural Habitat	All natural vegetation within the EAAA will be at risk of incurring negative impacts as a result of the proposed activities. Many modified habitats and natural habitats are situated outside the proposed project footprint, and that it will unlikely be impacted. The four habitat types that would be affected by direct and indirect impacts are: Thicket Vegetation, Potential Ephemeral Vegetation, Wetlands; and Drainage Lines with Riparian Vegetation. Related Project activities include clearing of vegetation and topsoil during the construction phase; disturbance of areas not within the allocated footprint (i.e. construction materials storage and temporary access roads); stockpiling of soil; potential spills and contamination; movement of large machinery generating dust, noise lighting, other activities related to the quarry excavation (i.e. dust deposition on vegetation and blasting); and movement of heavy vehicles, potential spills leading to soil and water contamination. The key sensitive receptors are the Classified Forest, thicket and potential ephemeral vegetation, wetlands, drainage lines and riparian vegetation, large indigenous trees (e.g. *Adansonia digitata*), potential individuals of threatened and/or protected plant species, dense stands of undesirable invasive indigenous	▪ A Biodiversity Management Plan (BMP) will be implemented from the start of site establishment and construction; a Biodiversity Action Plan will expand on this BMP and be prepared within a year of the start of operations ▪ Implement mitigation to conserve important habitats and trees, ensure ongoing ecological functioning to retain benefits from ecosystem services, and implement rehabilitation measures. ▪ Avoid the introduction and spread of alien invasive plants, and eradicate these plants from the mining concession area. ▪ Compliance with the DEFCCS Memorandum of Understanding (MoU) Requirements to reforest and protect against all forms of degradation the Mining Lease Area.

	woody shrubs and/or alien invasive trees, and protected Internationally Recognised Biodiversity Areas.	
Key Social Impacts	**Impact Description**	**Proposed Mitigation Measures**
Economic Impact and Disruption to Land-Based Livelihoods	Project construction and operational activities will result in loss of access to land in the Classified Forest. The loss of access to land will impact herders and women who are dependent on access to natural resources within the Classified Forest as part of their household livelihood activities. The Project's acquisition of land will result in the loss of some grazing land for herders (grazing will be permitted within some of the fenced areas of the Project site where human and livestock safety can be assured), resulting in impacts on access to fodder year-round for livestock, as well as restrictions on herders' ability to access the watering point northeast of the SEN'EAU pumping station. The Project's land acquisition also will result in a loss of area from which women collect fruit, wood, and plants for household consumption or sale and in restrictions on access to remaining resources on either side of the Project site. The Project's acquisition of land within the Classified Forest is also likely to increase the strain on remaining natural resources, as residents will be concentrating their activities within a smaller area. This has the potential to lead to increased environmental degradation of the Classified Forest over time. Sensitive receptors include both Peulh communities and women.	▪ Project has developed a Livelihood Restoration Plan (LRP) in accordance with national regulations on land acquisition and IFC PS5 requirements. ▪ The LRP aims to strengthen traditional livelihood activities before introducing new activities. ▪ Two programs are proposed to address the identified impacts of the project on livelihoods: - **Livestock Development Program** ▪ Construction of an agricultural store for sale of products to improve the health of livestock ▪ Construction of six water points for livestock spread out across the AoI to ensure equitable access by herders from all affected communities ▪ Rehabilitation of two existing vaccination parks in the AoI and facilitation of vaccination and information campaigns - **Women's Economic Development Program** ▪ Training and support for women's groups from communities in the AoI to enable the diversification and improvement of small-scale economic activities
Economic Impact and Loss of Natural Areas of the Forest of Thiès Affecting Ecosystem Services	Sensitive receptors include natural vegetation providing provisioning services, regulatory services, socio-cultural services, and supporting services. The Classified Forest provides access to natural resources for surrounding residents who collect wood for fuel, fruit for household consumption, and medicinal plants	▪ Prior to construction, the Project will consult with local stakeholders on feasible measures to mitigate impacts on access to ecosystem services within the Classified Forest. Consultation with stakeholders as per the Project SEP.

	for their own use. These activities are undertaken year-round in accordance with availability of the products.	▪ Prior to construction, the exact locality of sacred Baobab trees within the Project area, and the routes people take to them should be established and ways determined, with communities, on ensuring such trees are preserved, either through avoidance or relocation. ▪ Conserve Baobab Trees (*Adansonia digitata*) where possible. Protect and maintain the trees that do not fall in the Project footprint through adequate fencing around tree trunk, descriptive signage and training of workers and subcontractors. ▪ If possible, avoid or maintain a 500 m buffer around edges of any potential ephemeral water bodies that do not fall within the Project area, ensure no direct, untreated runoff from project areas into any remaining potential ephemeral water bodies. ▪ Soil stockpiles should be located away from potential ephemeral water bodies and surrounded by silt traps. ▪ If possible, the disturbance of the natural topography and catchment characteristics should be minimised to avoid altering the natural surface drainage flow of the landscape. ▪ No hiring of workforce at the Project gate - reduce number of people traveling between the N2 and the Project site. ▪ No workers or contractors will harvest natural vegetation/ resources for personal use within the Project Area.
Social Impact and Community Health and Safety	Land pressure due to increasing industrialization and limits on access to the Classified Forest. In some cases, residents report not being able to access land to build or expand their households, while others say agricultural land is being subdivided and sold as residential plots due to decreasing revenue from seasonal agriculture. Influx of job seekers: The low levels of economic resiliency in these communities including limited infrastructure, healthcare, public services and land, suggests that communities in the Project's AoI do not have the absorptive capacity to	On the basis of consultation with community stakeholders and collaboration with its own specialists and contractors, the Project have developed the following to be implemented: ▪ Project-specific Traffic Management Plan. ▪ Project Influx Management Plan. ▪ Framework Local Content Plan (LCP). ▪ Framework Social Investment Plan.

	benefit from in-migration over the long term. Other impacts include communicable diseases, conflict potential, etc. Depending on preferred access route, the owners and residential workers of the cultivated plots surrounding the SEN'EAU pumping station may also experience impacts associated with increased traffic on the road that runs between the two fields.	
Impacts of Earthmoving Activities on Tangible and Intangible Heritage Resources	Disturbance due to earthworks during construction have the potential to impact tangible cultural heritage resources and include, but are not limited to the following: ▪ Ground disturbing activities will most likely have a direct physical impact to undiscovered archaeological sites, if present; ▪ Built heritage and living heritage resources are also susceptible to direct physical impacts if buildings, shrines, or other resources will be removed or damaged during road construction. Impacts could occur if resources are removed during construction or due to ancillary impacts from increased vibration and pollutants caused by increased vehicle traffic. ▪ Built and living heritage resources are also susceptible to indirect impacts through the introduction of intrusive visual or auditory elements to their physical environment or "setting". These impacts could include increased noise and/or exhaust and dust during construction and functioning of the Project ▪ The creation of construction restriction zones, as well as restricted public access associated with the Project could also restrict user access to existing cultural heritage sites during construction and operational phases.	Develop and implement a project-specific Cultural Heritage Management Plan (CHMP) to ensure cultural heritage issues are addressed and managed adequately. The CHMP will cover regulator engagement, further location verification, access management, Community Grievance Mechanism, Grave Relocation Plan, Chance Finds Procedure, mitigation control and management of Intangible heritage through community engagement.
Impacts Related to Access to and Quality of Water	Access to water is a common challenge across rural and peri-urban communities in Senegal. While the national water agency, SEN'EAU, continues to expand its piped water network, water is not provided for free (even at public taps) and the cost can be prohibitive for poor households.	▪ Design stormwater runoff structures and drainages under roads. As far as possible, incorporate water saving- and recycling measures into the daily construction and operational activities.

	Increasingly unpredictable rainfall levels have contributed to reduced yields from seasonal agriculture, a traditional livelihood activity in the Project's AoI, and reduction in water points for livestock. Herders report paying for water from public taps for their livestock when natural water points cannot be accessed or dry up. Access to water adds an additional layer of vulnerability to traditional livelihood activities in the Project Area. ▪ The potential release of soluble contaminants used in construction and/ or production (e.g. oil, chemicals, solvents and effluent) from surface activities in the aquifer can impact existing boreholes and abstraction well in the Project area. The main pathways are infiltration of surface soluble contaminants and percolation to the groundwater surface; and migration of soluble contaminants (e.g. oil, chemicals, solvents) entering the groundwater	▪ Ensure water effluent from Project separator plants and sewage treatment plants is adequately contained and treated. No discharge of contaminated water to the environment allowed. ▪ Although potential impacts on groundwater levels are regarded as negligible, a baseline study is to be completed against which potential impacts of the Project can be monitored and quantified. ▪ Obtain a base reading of level and water quality of existing boreholes in close proximity of the Project Site and establish and implement a groundwater monitoring plan. ▪ To avoid any leachate that might impact groundwater, wastes generated from the project activities should be managed in accordance with the site Waste Management Plan. ▪ All wastes should be removed and disposed of at dedicated waste treatment facilities in accordance with the Waste Management Plan.
Increased Risk of Traffic Accidents	Project construction and operation would result in three types of traffic-related impacts during construction and operations; ▪ Marginal increases in traffic congestion and delay due to Project-related vehicle trips, primarily along the RN2; ▪ Marginal increases in deterioration of public roads, due to Project-related vehicle trips, especially heavy vehicle trips. Most likely to occur on the access road and the RN2; and ▪ Increased transportation safety risks due to crashes involving Project vehicles on public roads. Settlements near the RN2 and access road will be more vulnerable to these impacts.	A Traffic Management Plan has been developed for implementation, i.e. speed limits, vehicle safety, driver and passenger behaviour, use of drugs and alcohol, hours of operation, rest periods and accident reporting and investigations etc.

Other Potential / Residual Impacts

Noise and Blasting	Anticipated noise impacts will by generated by construction activities such as construction vehicles and equipment, and by operational activities such as 24-	Although no noise mitigation measures have been recommended for the construction and operation of this Project. During operation, noise monitoring

	hour operation, project's equipment noise from the primary crusher and conveyors; quarry and primary crusher (operating 8hrs/day, 6 days/week; daily delivery trucks (raw materials) and trucks exporting the product from the ICP. The construction and operational scenarios of the Project were modelled and are predicted to comply with noise and blasting limits.	will be conducted on a regular basis to check compliance. Where exceedances are detected, implement corrective actions to minimise noise impacts, particularly during night time. Regular noise compliance monitoring will allow CIMAF to effectively manage noise and blasting emissions from the operation.
Air Quality: Construction and Operational phases	Construction phase: The main air quality impact from construction activities are related to dust generation. No modelling was undertaken for the construction phase however a semi qualitative method was used to assess the magnitude of dust generation and was determined to be of a large magnitude. Operational phase: The operational phase impacts were modelled. The main source of dust is from the quarry area and haul road. Emissions in the quarry area will move dynamically as the quarry operations move within the site. The dust and PM_{10} baseline concentrations are considered to already be exceeding the ambient concentration standards. The modelling predicts the site contribution will be about 50% of the ambient concentration standard at the plant boundary. The baseline concentration and the process contributions will further the increase concentrations therefore the overall impact is considered to be large.	An air quality management plan will be developed which will include a section on construction phase dust management to ensure commitments are upheld. Develop and implement a Dust Management Plan (DMP) including monitoring of dust deposition, dust flux, real-time PM_{10} continuous monitoring (if possible or deemed essential) or periodic and visual inspections. The DMP should also include 'action levels' for triggering further dust mitigation when exceeded. Site boundary monitoring will be undertaken during the construction phase to allow dust emissions to be actively quantified and controlled.

LIVELIHOOD RESTORATION PLANNING

In accordance with the requirements of IFC Performance Standard 5 (PS5), a Livelihood Restoration Plan (LRP) has been prepared for the Project to manage displacement impacts. Preparation of the LRP was informed by the consultation carried out with government and community stakeholders in March 2021 to prepare the updated ESIA for the Project. This consultation enabled the identification of economic displacement impacts, as well as the development of high-level concepts for potential livelihood restoration measures. While the Project will not result in any physical displacement or any impacts on lands or assets owned (through formal or customary rights) by any individuals or households, the Project is expected to result in restrictions on access to communal resources used by residents of the Project's AoI as part of their traditional livelihood activities. This includes land and fodder for grazing livestock and forest products (fruit, plants, wood, etc.) collected by women for household use and sale.

In June and July, Harmony Group carried out an additional round of consultation with government, community and civil society stakeholders focused on livelihood restoration specifically. The objectives of these consultations were to confirm the scope of displacement, build stakeholders' understanding of the concept of livelihood restoration (and the Project's associated responsibilities) and solicit input on the conceptual measures. This consultation process involved more than 250 participants, including members of the groups expected to be most affected by displacement impacts (herders and women) as well as government agencies and local NGOs that could potentially partner with the Project on implementation of livelihood restoration measures.

The Project has agreed to allow grazing within some of the fenced areas of the 300 ha Project site where human and livestock safety can be assured; this will help to reduce the scope of economic displacement. The following livelihood restoration measures are proposed, aimed to mitigate the remaining impacts of the loss of access to communal resources and improve traditional livelihood activities:

Proposed Measure	Timeline (Phases)	
	Construction	Operations
Livestock Development Program		
Construction of an agricultural store for sale of products to improve the health of livestock.	Planning / Launch	Implementation / Monitoring
Construction of six water points for livestock spread out across the AoI to ensure equitable access by herders from all affected communities;	Planning / Implementation	Monitoring
Rehabilitation of two existing vaccination parks in the AoI and facilitation of vaccination and information campaigns	Planning / Implementation	Monitoring
Additional Support (to be determined)	TBD	TBD
Women's Economic Development Program		
Training and support for women's groups from communities in the AoI to enable the diversification and improvement of small-scale economic activities	Planning / Launch	Implementation / Monitoring

The proposed livelihood restoration measures were validated with external stakeholders in September 2021. Additional consultation will be undertaken as part of the development of detailed implementation plans for each of the measures.

Livelihood restoration measures will be implemented by the Project with the support of an experienced consultant, relevant government agencies, and civil society partners. Implementation will be actively monitored by the Project and reported on to internal and external stakeholders, including a multi-stakeholder Monitoring Committee that will be set up as part of the Project's ongoing stakeholder engagement program. As needed, additional support measures will be put in place for vulnerable households to ensure they are not disproportionately impacted by displacement and can participate fully in livelihood restoration measures.

CONCLUSION

The proposed Project is a financially feasible opportunity. Moreover, the Project has the potential to provide social benefits at national, regional and local levels through employment opportunities and procurement of local goods and services. The proposed Project also comes at a potential cost, with impacts to both the regional and local economic, social and biophysical environments, as elaborated in the Draft ESIA Report and this NTS.

The importance of the Project to the economic development in Senegal and the project region is recognized; however, the significant challenges with balancing the needs of environmental protection with the economic and developmental needs of both countries are also recognized.

This Project is not immune to these challenges. The ESIA has therefore attempted to describe both the benefits of the Project as well as the environmental and social sensitivities associated with it. Where impacts are identified, detailed mitigation measures to reduce the significance of these impacts are described; also, where impacts may not be mitigated, this too has been described. In the case of positive impacts, measures to enhance such positive impacts are provided.

1. INTRODUCTION

1.1 Background to the CIMAF Project

Ciments De L'Afrique (CIMAF) was established in 2011 to expand the cement sector in Africa. CIMAF has a wide presence in in the continent and their cement works have been developed according to the latest technologies, as well as taking into consideration processes, energy saving and environmental protection. CIMAF plans to develop a Limestone Quarry and an Integrated Cement Plant (ICP) in Senegal, West Africa (the Project).

An Environmental and Social Impact Assessment (ESIA) was undertaken for the Project by a local consultancy, Harmony Group, in 2019 in line with Senegalese legislation. In order to secure financing from the International Finance Corporation (IFC), the ESIA required an upgrade in order to comply with the IFC Performance Standards (PS).

1.2 Purpose of this Report

The purpose of the ESIA Report is to describe the existing baseline regarding the physical, biological and social environment, and identify potential opportunities and impacts associated with the proposed Project. The key objectives of ESIA are to:

- Present a description of the Project and the relevant alternatives considered;
- Present relevant Senegalese legislation and international best practice requirements to be adhered to / considered during the eventual ESIA process;
- Present the ESIA process (including impact assessment methodology);
- Present the stakeholder engagement;
- Present a physical, biological and social baseline of the Project Area and Area of Influence (AoI);
- Identify and present the potential impacts (positive and negative) to the physical, biological and social environment that need to be assessed further as part of the eventual ESIA, together with upfront recommendations to address these; and
- Identify and present the cumulative impacts of the Project.

1.3 Structure of this Report

This report is structured as follows:

Chapter	Contents
Chapter 1 – Introduction	Presents a brief background to the Project, the ESIA process and the purpose and structure of the ESIA Report (this report)
Chapter 2 – Project Description	Describes the Project and associated activities during the construction and operations phases. This chapter also discusses Project alternatives
Chapter 3 – Alternatives	Describes the various alternatives for the Project
Chapter 4 – National Legislative and International Good Practice Requirements	Identifies and briefly describes the National Senegalese environmental and social legislative requirements, as well as international best practice applicable to the Project
Chapter 5 – The ESIA Process	Describes the ESIA process and associated impact assessment methodology to be followed for the Project
Chapter 6 – Stakeholder Engagement	Summarises the stakeholder engagement plan for the Project and outcomes associated with engagement

Chapter	Contents
Chapter 7 – Physical Baseline	Receiving Physical Environment
Chapter 8 – Biological Baseline	Receiving Biological Environment
Chapter 9 – Social Baseline	Receiving Social Environment
Chapter 10 – Physical Impact Assessment	Describes the potential impacts to the physical environment that have been identified
Chapter 11 – Biological Impact Assessment	Describes the potential impacts to the biological environment that have been identified
Chapter 12 – Social Impact Assessment	Describes the potential impacts to the social environment that have been identified
Chapter 13 – Cumulative Impact Assessment	Describes the potential cumulative environmental and social impacts that have been identified
Chapter 14 – SEP	Brief description of Framework Stakeholder Engagement Plan
Chapter 15 – ESMS	Environmental and Social Management System
Chapter 16 – ESMMP	Environmental and Social Management and Mitigation Plan
Chapter 17 – Conclusion	Summarises the key findings of the ESIA process
Annexure A – Socio-economic Fieldwork Photos	Presents the engagement photos taken during the ESIA process
Annexure B – Participants Lists	Presents the stakeholder database that was developed during the ESIA process
Annexure C – Household Survey Form	Original Household Survey Forms
Annexure D – Biodiversity Baseline Report	Presents the baseline findings of the Biodiversity Study for the AoI
Annexure E – Vulture Specialist Report	Presents the findings of the Specialist Vulture Assessment
Annexure F – Air Quality Methodology	Described the baseline air quality data collection
Annexure G – Hydrocensus Report	Summary of the hydorcensus survey completed
Annexure H – Stakeholder Engagement Plan	Defines a strategy for stakeholder engagement with affected stakeholders throughout the Project
Annexure I – Traffic Management Plan	Plan to identify and manage impacts related to traffic and transportation associated with the construction and operation of the Project
Annexure J – Influx Management Plan	Plan to identify and manage impacts of project-induced in-migration
Annexure K – Framework Local Content Plan	Plan to maximise local participation in the direct and indirect employment opportunities provided by the Project
Annexure L – Framework Social Investment Plan	Sets the priorities, objectives, and criteria that will determine the level and type of contribution the Project will make to supporting community development

2. PROJECT DESCRIPTION

This chapter provides a description of the Project, including related activities and ancillary infrastructure.

2.1 Background to CIMAF

CIMAF's business activities in Africa include the research and exploration for, and exploitation of quarries and construction aggregates; the operation of cement, grinding and bagging plants; and the production, transport, marketing of cement and derivative products and related materials.

The company's mission is to produce, market and develop innovative materials and services for the construction sector while respecting the most demanding national and international standards both in terms of process and environmental protection.

In addition to its facilities in Morocco, CIMAF currently operates cement production facilities in 12 countries in West and Central Africa, as listed in Table 2-1 and Figure 2-1 below.

Table 2-1 CIMAF's Cement Operations in West and Central Africa

Location	Capacity (T/yr)	Start Date
Cote d'Ivoire	500,000 T	09-2013
Guinea	500,000 T	11-2013
Cameroun	500,000 T	02-2014
Burkina Faso	500,000 T	09-2014
Gabon	500,000 T	07-2015
Republic of Congo	500,000 T	07-2015
Mali	500,000 T	10-2015
Mauritania	500,000 T	11-2015
Ghana	1,000,000 T	12-2015
Chad	500,000 T	01-2016
Democratic Republic of Congo	1,000,000 T	03-2016
Guinea Bissau	500,000 T	06-2016

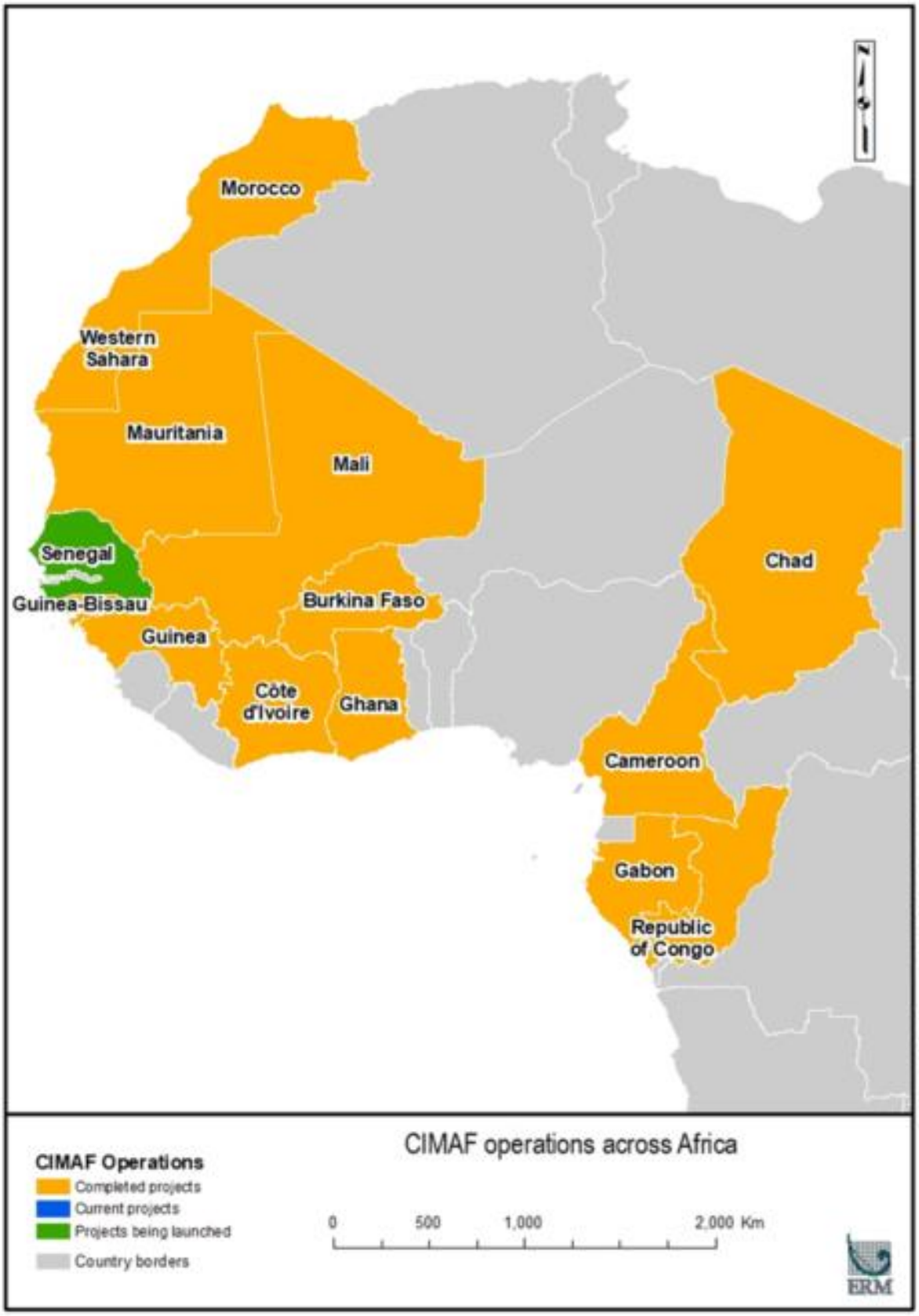


Figure 2-1 Location of CIMAF Projects in West and Central Africa

CIMAF strives to be a recognised operator in Africa, and a key contributor to the strengthening of the continent's manufacturing sector.

In line with systems at existing operations in Morocco, CIMAF will establish an Integrated Management System (IMS) aimed at certifying the plant according to ISO 9000, ISO 14001 and ISO 18000 standards, and will deploy the same robust Health, Safety and Environment (HSE) policies and management systems in place at all company operations.

2.2 Project Need and Desirability

The most significant, expected project-level outcomes are economy-wide benefits and employee skills development. Beyond the Project, it is expected that the investment will promote market competitiveness in Senegal via innovation and improved efficiency through usage of best available techniques (BAT) in cement production. The Project will also increase regional integration through sales of clinker between Senegal and Mali, as well as potentially to a few of the neighbouring countries.

Senegal is a lower-middle income country. The creation and preservation of high quality and well-paying jobs is particularly important, as its economy is characterized by a high degree of informality, and with an important share of workers in vulnerable employment. The unemployment rate is 7 percent in Senegal, and the number of workers in informal employment accounts for 90 percent of total non-agriculture employment.

The Project will support domestic value addition to Senegal's abundantly available limestone deposits. The Project is expected to directly contribute to the economy of Senegal through indirect and induced effects. In addition to value addition, the investment is also expected to create approximately 280 full time direct jobs in Senegal.

The Project will also reflect the burgeoning regional economic integration in the WAEMU and West Africa at large. As the "Gateway to the Sahel", Senegal is already a driving force of integration, particularly within the WAEMU area, and thanks to this Project, it will emerge as a major supplier of clinker to meet the growing demand in neighbouring countries. Given its abundant high-quality limestone, Senegal is a natural candidate as a clinker base for the subregion, and this is one reason why CIMAF Senegal's cement plant has been designed and sized to produce more than what the company needs in Senegal.

The Project is, moreover, expected to support skills development of employees and adoption of manufacturing production know-how that are not readily available in Senegal. Skills development is critical for fostering economic transformation and social progress, as it can reduce unemployment, raise productivity and incomes, and improve standards of living. Yet, Senegal continues to lag peers when it comes to human capital development and availability of skilled workers for the manufacturing sector. According to the Global Human Capital Report, based on factors such as labour force capacity, knowhow, development and deployment, Senegal ranks in the bottom quartile (126th and 128th, respectively, out of 130 countries ranked). Due to the technical nature of the Group's manufacturing operations, the Project will support the continuous development of technical skills, as well as the development of industry-relevant experience, and adoption of enhanced production techniques, which will lead to an improvement of the human capital in these countries.

The Project will also support the continuous development of technical skills and training. During the construction and the operational periods, the CIMAF Technical Centre (CTS) based in Casablanca will provide necessary support, including technical assistance, consolidation and capitalization of technical knowledge, and monitoring of production process, maintenance of equipment, and employees' safety. In addition to technical support, CTS will also help develop local skills and technical expertise by organizing customized training.

The Project will contribute to market creation through increased competitiveness, especially in Senegal: being one of few players in the country rolling out energy-efficient solutions in the cement production industry may create a demonstration effect across the market, based on the more favourable cost profile

of its technology. The project presents a relatively strong business case in West Africa, and particularly in Senegal, for the adoption of modern kiln designs, and going forward, the use of renewable energy and alternative fuels in cement production.

Unlike other countries in the region, Senegal has an excess cement production capacity. The cement market in Senegal is still dominated by older kilns. No single player controls the market, as the market shares of each competitor are very close to their respective cement production capacities. Senegal is the regional hub for clinker, and the country is exporting, or will export, its surplus to deficit countries in the region, including Gambia, Guinea, Guinea Bissau, Mali and Mauritania.

The entry of a new player using best E&S practices and sustainable technologies, which have been tested in Morocco and have resulted in proven fuel and electricity savings, is anticipated to accelerate innovations and improved efficiencies in the Senegalese cement market. The CIMAF Senegal plant will employ a vertical roller mill with a five-stage preheater, allowing to achieve thermal consumption rates of under 3,100 MJ/t clinker, which is 10 percent less than the current regional average. The Group is planning to use low clinker factors of between 0.6-0.7, resulting in both lower costs per ton of cement in addition to a lower carbon footprint (less than 650 kg CO_2/t cement).

A strong enabling environment exists for alternative fuels exists in Senegal, which CIMAF will explore as the plant stabilizes. Such an environment would require setting up the waste management-supporting infrastructure and making sure the related cost structure is, or can rapidly become, efficient and thus likely to reach other players in Senegal.

Overall, the Project is expected to bring long-term economic benefits to Senegal, and the immediate community of Pout, in a sustainable way.

2.3 Project Location

The Project site is located in Senegal, in the commune of Keur Moussa in the department of Thiès, about 50 kilometres (km) east of Dakar, on the national road Route Nationale 2 (RN2, about 1,6 km north of the Project). The closest larger towns are Pout, 4,5 km to the north-west, and Thiès Ouest, 6 km in north-east of the Project site. An additional quarry is within 1 km of the Project site, and commercial as well as subsistence agricultural fields within 1,5 km west and south of the Project site.

Keur Moussa has seen increased development due to the initiation of a number of new government projects, importantly including Dakar's new Blaise Diagne International Airport (AIBD, 6 km south-east of the Project) and the extension of the toll motorway between Diamniadio and Mbour (0,6 km south of the Project site).

The Project location is at 14°44'31.4"N 17°01'06.6"W (14.74231918, -17.01849159) (WGS 84) and is illustrated in Figure 2-2 below.

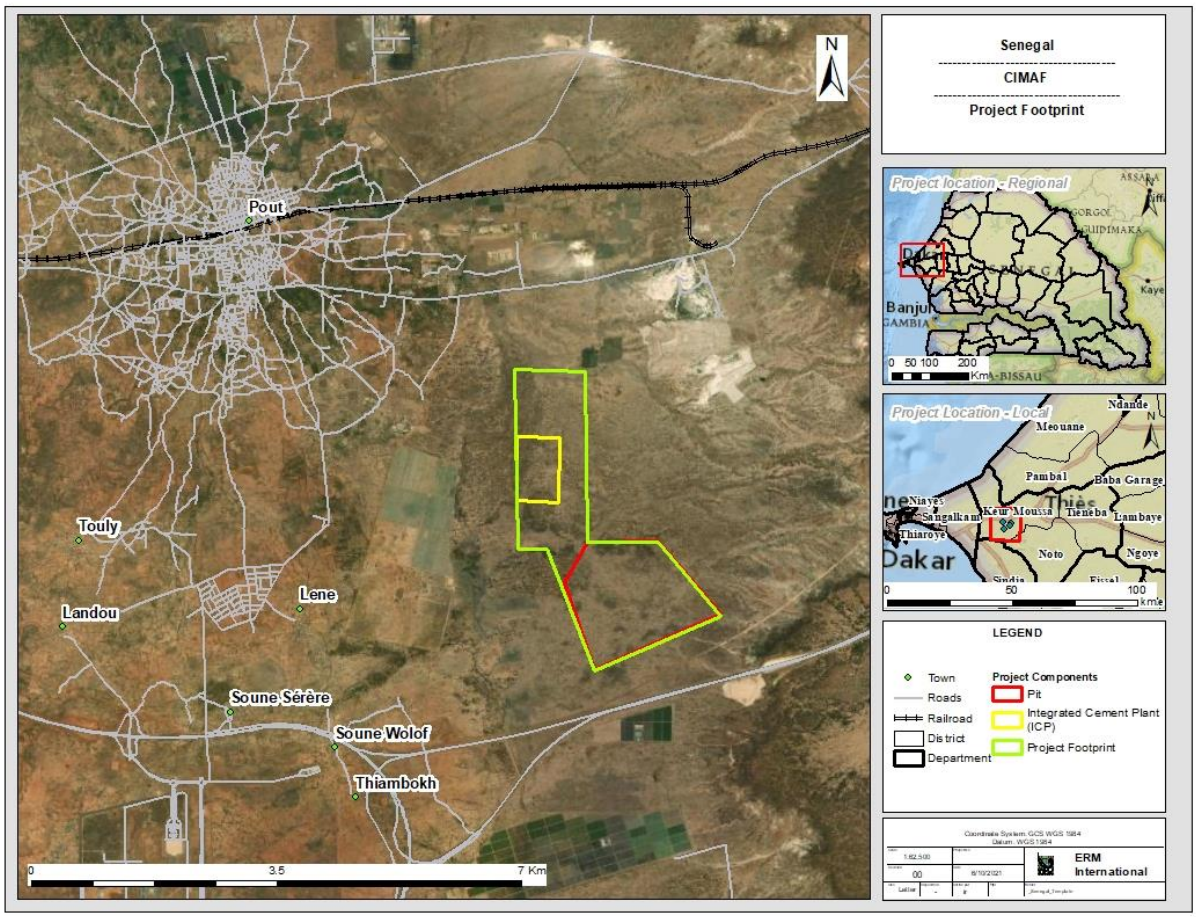


Figure 2-2 Location of the Project Site in the Commune of Keur Moussa

2.4 Project Activities

This section provides a detailed description of the various project activities associated with the proposed project, as summarised in Table 2-2 below and described in detail in Section 2.4.1.

Table 2-2 Summarised Project Activities

Main Activities	Supporting Activities / Elements	Details
Limestone Quarry	Quarry Operations	
Cement Plant	Manufacturing Output	
	Raw Materials	▪ Sources ▪ Raw materials ▪ Production capacities
	Productions Workshops	▪ Crushing and raw material storage ▪ Quarry crusher ▪ Materials storage ▪ Meal storage and feeding ▪ Kiln feed ▪ Kiln line

		▪ Coal mill ▪ Clinker storage ▪ Cement grinding
	Dispatch	▪ Clinker dispatch ▪ Cement bulk dispatch ▪ Packing ▪ Truck bag load ▪ Palletising
	Ancillary and Auxiliary Building	▪ Infrastructure ▪ Equipment and ancillary buildings
Power Supply	Electrical Power Supply and Distribution	▪ SENELEC power station ▪ Transmission line ▪ Electrical rooms ▪ Electrical networks and various networks ▪ External lighting
Water	Water Supply	▪ Industrial water ▪ Wastewater ▪ Rainwater
Other	▪ Fuel ▪ Quality control ▪ Protective measures ▪ Atmospheric emissions ▪ Production and distribution of compressed air ▪ Gas analysis and control	
Site access		

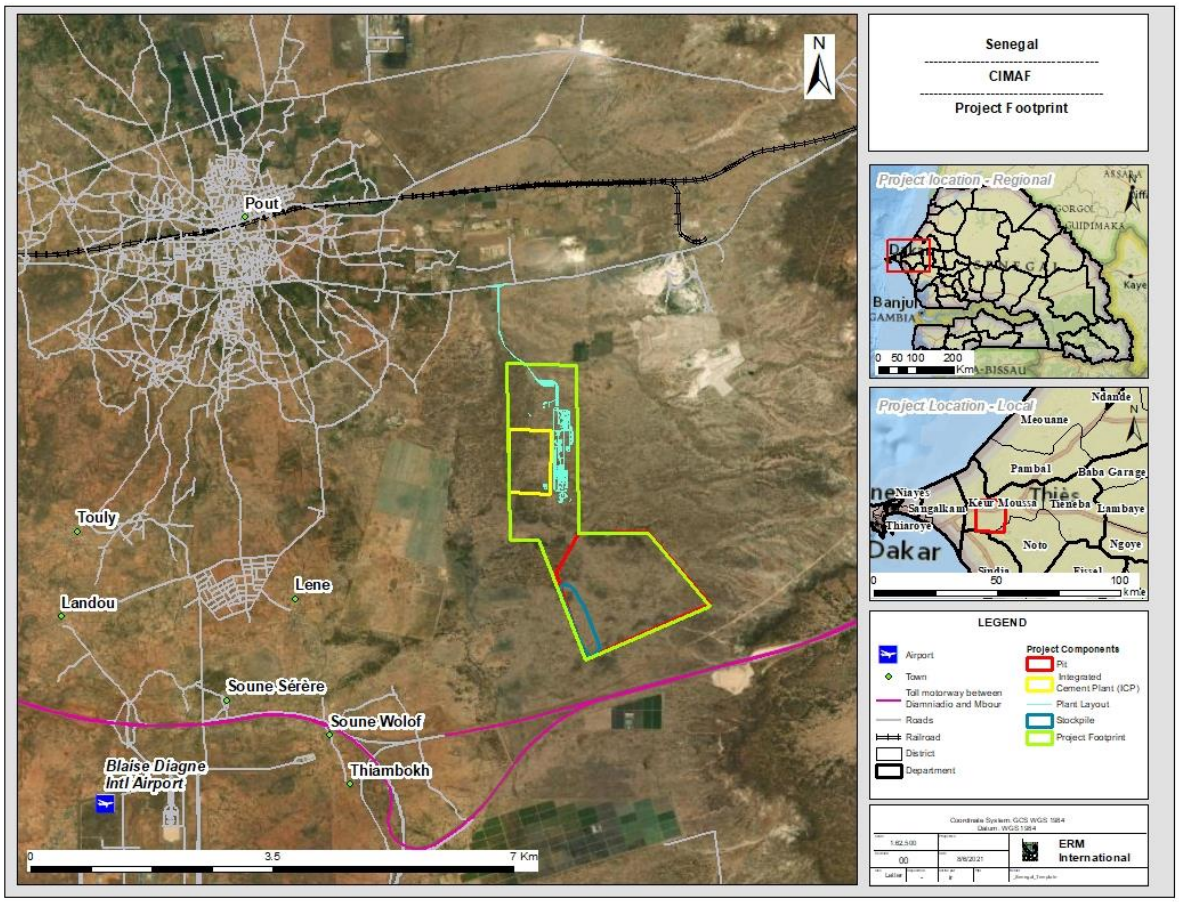


Figure 2-3 Project Layout Plan

2.4.1 Limestone Quarry

The limestone quarry occupies an area of 250 ha within the 520 ha exploration permit held by CIMAF.

The main stages in the exploitation of the limestone quarry will be:

- Clearing vegetation and topsoil to expose the limestone rock. This step consists of removing the non-usable materials above the levels to be exploited (topsoil, weathered rocks, etc.). The topsoil will be stored and composted to enrich the soil where the site rehabilitation plantings will be carried out as part of a progressive rehabilitation plan.
- Blasting to break up the limestone into transportable fragments. The footprint of the initial pit is 5 ha (500 m x 100 m), sufficient to extract 250,000 m^3 of limestone from the two initial levels of exploitation (2 front heights of 7.5 m, or 15 m in total). The mining wall will be oriented East-West and will progress on two levels towards the South. It is planned to carry out blasting of 15,000 tons per week according to the following cycle:

- Drilling will produce 50 - 60 blast holes, approximately 115 mm in diameter, at a 7.5 m depth placed in a grid of 4x4m in 4-5 rows of 10 to 15 holes. This will result in about 400 m to be drilled per week.

- One (1) blasting event per week, using 1.5 to 2.0 tons of nitrate fuel type will be conducted. Loading of blasting holes and firing of explosives will be subcontracted. There will be no storage of detonators or explosives at the site.

The bench depths will be 10 m initially and then increase to a maximum of 50m. Overburden and waste rock will be stored temporarily, as indicated in Figure 2-3 above.

2.4.1.1 Quarry Exploitation

The quarry exploitation and limestone transportation will be subcontracted.

The crusher will be located within the Project site as shown in Figure 2-3 and crushing will done by CIMAF SENEGAL. The distance between the quarry and crusher will be approximately 100 m and it is projected that dump trucks will complete 76 trips per day. Cement Plant

The Project includes installation of a new clinker line capable of producing 3,600 tons per day (1,100,000 tons of clinker per year) and a new cement grinding and dispatch line capable of producing 140 tons per hour (1,100,000 tons of cement per year). The Project will use a completely dry process.

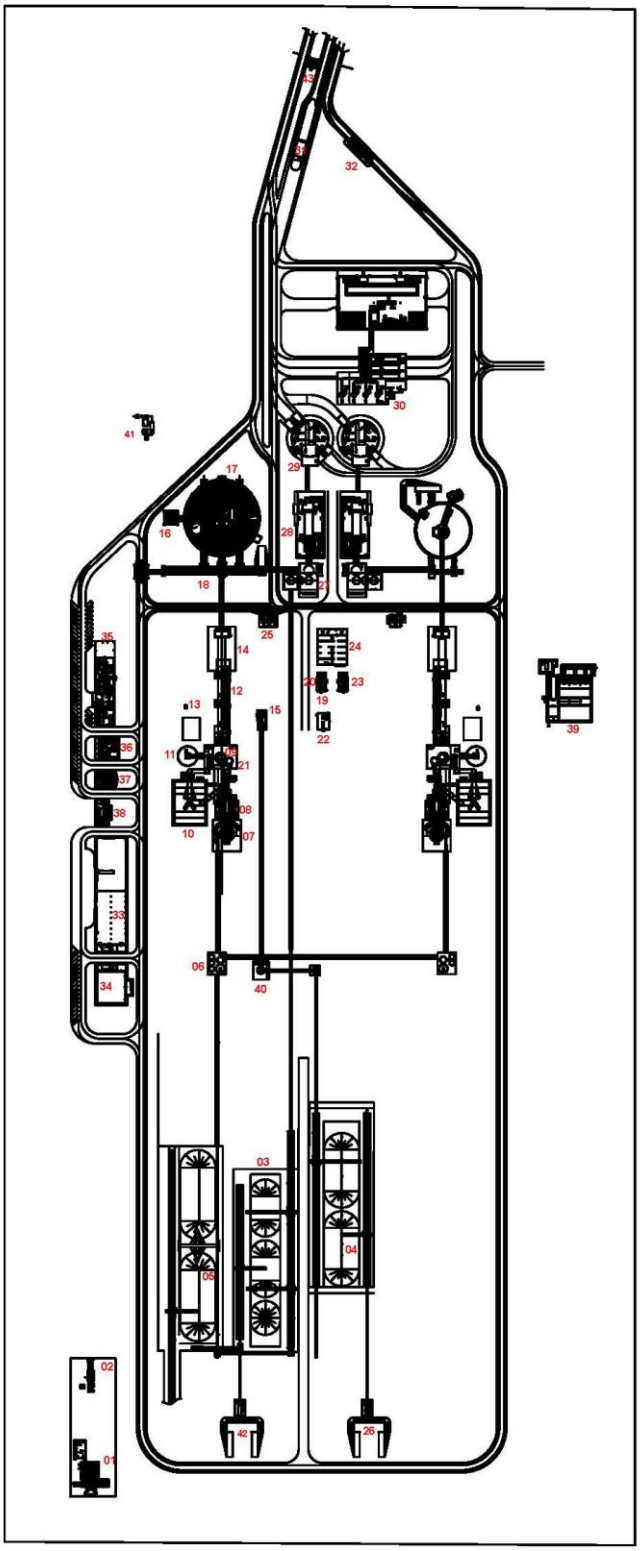
The new plant will be designed and constructed using the best available technology in terms of energy consumption, technical reliability, and environmental protection.

As shown in Figure 2-4, the plant will contain the flowing production workshops:

- Raw material crushing workshop at the quarry;
- Raw material homogenization and storage hall;
- Correctives and additives storage hall;
- Raw meal feed and dosing workshop;
- Raw meal grinding with a vertical mill;
- A storage and homogenization silo for raw meal with a capacity of 11,000 tons;
- Petcoke storage hall;
- Petcoke grinding workshop;
- Clinker line with 5-stage preheating tower and precalciner, a rotary kiln and a grate cooler. The excess of cooler gazes will be dedusted in the raw mill filter (common filter);
- Clinker transport, storage, and dispatch; and
- Grinding Plant, consisting of:
  - Cement grinding and cement storage silo; and
  - Cement packing and dispatch.

The storage halls will be covered and equipped with automatic storage and reclamation equipment.

In order to guarantee staff safety and facilitate maintenance operations, overhead cranes for the main equipment and an elevator for the preheater tower will be installed.



Number	Description
1	CRUSHER BUILDING
2	ANALYZER
3	LONG ADDITIVE PARK
4	LONG COAL PARK
5	PRE-HOMO PARK
6	RAW HOPPER BUILDING
7	RAW CRUSHER BUILDING
8	CYCLONE SUPPORT BUILDING
9	PREHEATING TOWER
10	COMMON FILTER BUILDING
11	SILO HOMO
12	OVEN
13	SCANNER
14	COOLER
15	CHARCOAL CRUSHER BUILDING
16	SILO UNFIRED
17	SILO CLINKER
18	CLINKER EMERGENCY HOPPERS
19	PIT A
20	OVEN COOLING TOWER
21	COMPRESSOR ROOM COOKING
22	PUMP ROOM
23	COOLING TOWER
24	WATER RESERVOIR
25	DIESEL RESERVOIR
26	COKE RECEPTION HOPPER
27	HOPPER BUILDING
28	SHREDDER BUILDING
29	SILO
30	BAGGED BUILDING
31	COMMERCIAL BUILDING
32	RAW MATERIALS WEIGHBRIDGE
33	SHOP
34	STUDIO
35	ADMINISTRATIVE AND TECHNICAL BUILDING
36	RESTAURANT
37	MOSQUE - INFIRMARY
38	CLOAKROOMS
39	POST 0
40	COKE HOPPER TOWER
41	STEP
42	GUARD POST

Figure 2-4 Schematic layout of the Cement Plant

2.4.1.2 Manufacturing outputs

Two (2) types of cement will be produced at the plant:

- CEM II 42.5; and
- CEM II 32.5.

The cement quantities and dispatch are described in Table 2-3 below:

Table 2-3 Cement Quantities for Dispatch

Cement type	Proportion %	Conditioning			
		Bag		Bulk	
		%	Quantity t/an	%	Quantity t/an
CEM II 32.5	70%	100%	350,000	0%	0
CEM II 42.5	30%	67%	100,000	33%	50,000

2.4.1.3 Raw Materials

Sources

The source of bauxite will be imported from Guinea (8,000 tonnes /year). Petcoke will also be imported. Gypsum will be sourced from a proximate quarry in Senegal. All other raw materials will be sourced on site.

Raw Material Qualities

The meal that will be used in the new plant is a Quaternary meal composed of Limestone, Laterites, Attapulgite Marls and Bauxite.

The various constituents and their proportions, given as an indication, are as follows:

- Limestone 75 %;
- Laterites 14 %;
- Attapulgite Marls 10 %; and
- Bauxite 13 %.

The final meal composition will be determined through technological tests that will be carried out on material samples.

Production Capacities

The new plant will be designed to take into account an annual utilization rate of 85% for the kiln and 90% for the raw mill and cement mill.

2.4.1.4 Production Workshops

Crushing and Raw Materials Storage

The plant will include a single quarry crushing workshop for the main materials (limestone and laterites), and for the raw meal corrections and the cement grinding additives.

Quarry Crusher

This workshop will be equipped with a 1,200 t/h crusher, two hoppers of 75 m^3 each and two metallic apron feeders. The composition of the mixture will be controlled by an on-line analyser that acts on the flow rates of the different materials. The workshop will include power supply, and efficient dust collection by bag filters. The crushing workshop will be covered to protect the installations from inclement weather, and to protect staff and residents from noise nuisance.

Materials Storage

The storage of raw materials will be in covered sheds equipped with stackers and reclaimers. Storage halls will be fed directly from the crusher by the belt conveyor, and by hoppers for feed arriving by truck. The storage will have a 28,000 tons' capacity; the additives and correctives storage hall will have a 14,000 ton capacity. The petcoke storage will have 2 x 7,000 tons' capacity, and will be fed from a reception and unloading hopper with cladding and de-dusting bag filters.

Meal Grinding

Grinding and drying of the raw material will be done using a vertical roller mill with a sufficient output (320 t /h) to ensure a production of 3,600 t of clinker per day with 19 hours / day mill operation. The raw materials are taken from storage sheds and arrives firstly at feed hoppers building.

The hoppers and dosing building will have four weighed hoppers, including; a mix hopper, a bauxite hopper, a limestone hopper and a Marl hopper. These hoppers will have sufficient capacities to ensure an uninterrupted feed of the material. The hoppers will be equipped with anti-clogging coatings to ensure the good flow of the material.

Material extraction, dosing and feeding of the raw mill will be ensured by extractors and weight feeders, with a safety coefficient of 1.2, with respect to the mill flow.

Weight feeders will be calibrated in two (2) ways:

- On-line calibration using variations in hopper weights; and
- Calibration with material directly from the belt conveyor feeders and through a truck-loading device, which will be weighed on the plant weighbridge.

Meal Storage and Feeding

The meal will be recovered by high efficiency cyclones and a bag filter. It will be stored in a silo of 10,120 tons, which will provide two days of kiln production.

During raw mill shutdowns, kiln dust will be stored in a hopper with a capacity corresponding to 6 hours of kiln operation. This dust may be diluted during the combined operation (mill / kiln), or evacuated and used in the cement mill.

Kiln Feed

The meal feed capacity will be at least 300 t/h. This feed will be controlled by a belt or rotary weighting feeder installed under a weighed feed hopper. All meal transport will be provided by belt bucket elevators and airslides.

Kiln Line

The capacity of the burning workshop will be at least 3,600 t/day of clinker.

The firing line will be designed to guarantee a calorific consumption of less than 3'050 kJ / kg of clinker. This firing line will include:

- A five-stage cyclone preheater and Low Nitrogen Oxide (No_x) Precalciner;

- A rotary kiln with three (3) support stations and girth gear;
- A last generation high-efficiency cooler, with air-air heat exchanger for cooling the air excess. Dedusting of the cooler gases can be done in the same dedusting filter of the raw mill;
- A high-performance pyrotechnic system for the kiln and the pre calciner. The kiln burner will be multi-channel to allow the use (future) of alternative fuels in the oven; and
- All required instrumentation for kiln control and operation (temperature, pressure, level, gas analyser).

The main fuel used will be petcoke, or coal if petcoke is not available. The installation will be designed for both fuel sources.

Various temperature measurements and controls will be provided. This will include pyrometer and kiln, a precalciner thermal camera, a high-resolution kiln scanner and kiln shell-cooling fans.

Gas analysers for the kiln operation as well as a gas emissions control analyser at the chimney and a dust opacimeter are also to be provided.

Coal Mill

The grinding of the fuel (petcoke or coal) will be carried out by a horizontal ball mill designed and equipped with the safety devices required for a fuel with a non-negligible volatile content (CO analyser, CO_2 inertisation equipment and fire-fighting equipment).

The power and size of the mill will be determined to ensure a sufficient flow rate to meet the following specifications:

- Clinker production - 3,600 t/day;
- Mill operation - 19 hrs/day;
- Petcoke/Coal hardness up to 35 hardgrove; and
- Finished product with 1.28% residue on a 90-micron sieve.

The dried and ground fuel will be stored in two weighed hoppers with dosing units next to the mill, the maximum distance between dosing units, and the kiln and precalciner nozzles should not exceed 80 m in order to ensure correct operation of the installation.

The hot gases for drying the fuel come from the preheating tower (gases with low or no oxygen to limit the risk of explosion or fire) and will be dedusted by a cyclone.

Clinker Storage

The clinker produced by the new line will be stored in storage with a capacity of 50,000 tons. The silo emptying rate will be at least 96%. A small silo of 400 tons adjoining the new silo will be used for the storage of out-of-specification clinker. It will be equipped with a 200 t/h bulk loading telescopic chute and efficient dust removal. This silo will also be used for the shipment of clinker by truck. Clinker will be transported to Mali and to the Port of Bargny (located 25 km from the plant).

The extraction of the clinker will be done by motorised valves and conveyor belts. The clinker will feed the cement grinding mill.

Particular attention will be given to the waterproofing of the silo roof and to the dusting of chutes and transfer points.

Cement Grinding

The grinding capacity, determined by a 24-hour per day operation, is designed for 140 t/h for the CEM II 32.5. The cement will be ground in a closed-circuit ball mill.

The mill will be fed from hoppers for clinker, limestone, gypsum and the potential use of other additives (e.g. pozzolan). These hoppers will have sufficient capacity to ensure uninterrupted feeding of the material.

Anti-clogging lining will be provided in gypsum hopper and limestone hopper to ensure the smooth flow of materials.

A Fly-Ash silo for reception, storage and inclusion in the cement will also be constructed.

The calibration of weight feeders will be done in two ways:

- On-line calibration using variations in hopper weights.
- Calibration with material directly from the belt conveyor under weigh feeders and through a truck loading device, which will be weighed on the plant weighbridge.

The cement will be transported to the silo storage by air slides and a bucket elevator.

The cement will be stored in a five-chamber cellular silo with a total capacity of 20,000 tons. The fluidizing blowers will be equipped with air dryers to limit the humidity in the fluidizing air.

Dispatch Clinker Dispatch

Two (2) bulk-loading devices will be equipped with a chute. Dedusting will be installed next to the clinker storage.

Cement Bulk Dispatch

A bulk-loading device, equipped with a weighbridge for weighing the trucks being loaded, will be installed under the cement silo. The bulk-loading device will be mobile (6 m) to avoid the manoeuvring of tank trucks during loading.

The bulk loading station will have a 250 t/h capacity and will be equipped with a vibrating screen to remove any lumps or foreign bodies from the product.

The bulk loading station will be fed from three chambers of the compartmentalised cement silo.

Packing

Cement packing will be in a workshop of two (2) 12-spout rotary packing machines with a unit capacity of 180 t/h. The location of a third bagging machine will be provided in the workshop engineering.

The bagging machines will be equipped with automatic bag applicators.

Truck Bag Loading

The truck loading will be carried out by four (4) manual loading lines.

Palletizing

Four weighbridges will be installed, including two for bag dispatch at the plant entrance, one for raw materials at the plant entrance and one for bulk shipments beneath the cement silo.

2.4.1.5 Ancillary and Auxiliary Buildings

The plant will include an administrative building, with a main control room and laboratory, as well as a restaurant, infirmary, dressing room and mosque.

Auxiliary buildings (such as stores, workshops, garages at the quarry) are planned to ensure the storage of spare parts and consumables, and to allow maintenance works.

Infrastructure

In addition to industrial facilities, planned additional infrastructure includes:

- The factory fence;
- The drainage system of the plant site with the rainwater network;
- Concrete paving around the production workshops;
- The layout and coating of internal roads and parking lots (proposed capacity of 40 trucks);
- The access road to the plant;
- Connection of the plant to the HV electricity network of SENELEC; and
- Pump station and pipelines for the abstraction of groundwater.

Equipment and Ancillary Buildings

In addition to the equipment for the production line itself, the plant will be equipped with the following equipment:

- Three (3) weighbridges will be developed at the same position located at the entrance and exit of the plant, i.e. empty trucks entering the plant and clinker, loaded trucks exiting the cement and clinker, and loaded and empty trucks for raw materials (i.e. petcoke, gympsum, etc.);
- Two (2) sets of industrial water storage and distribution from a pumping station, with water treatment, closed circuit and refrigeration basin;
- A firewater storage and distribution network;
- A compressed air distribution network provided by the compressor rooms; and
- A set of equipment for handling inside the factory.

The plant will also include the following ancillary buildings:

- A set of workshops, garages and stores;
- A central building with control room, laboratory and offices;
- Social buildings for staff and subcontractors (canteen, place of worship, changing rooms, infirmary, etc.); and
- Security post.

2.4.1.6 Electrical Power Supply and Distribution

The electricity needs for the Projects would be 2 kWh / ton of limestone for the quarry, 60 kWh / ton of clinker for the clinker production, 30 kWh / ton of cement for the cement grinding and 5 kWh / ton of cement for packing and dispatch.

The 20 MW electricity supply will be drawn from the electricity network of SENELEC (National Electricity Company of Senegal) by the construction of and High Voltage (HV) power line just east of the plant and connecting directly to the SENELEC power line south of the plant, and a main HV / MV transformation substation (P0).

A 1,000 kVA generator will be installed to back up critical equipment in the event of a power outage.

SENELEC Power Station

The plant will be supplied with power from the SENELEC electricity network by HV transmission lines and a main HV / MV transformation substation (P0). The medium voltage at P0 used to supply the plant, is 5.5 kV.

The main electrical substation (P0) has two HV/MV transformers (HV/MV) each with a power of 35 kVA, one in operation and one in standby.

The maximum power demanded by the factory is 20 MVA, leaving a power reserve of 15 MVA to continue operating with a single transformer.

Transmission Line

CIMAF has received confirmation regarding the viability of the requested power and different scenarios for its distribution to site are currently being explored.

The most convenient option would allow CIMAF a connection to the existing 225 kV line that crosses the Project site between the plant and the quarry. Connection would be through an additional 225 kV line to the main substation (called P0) within the plant area over a distance of less than 1 km.

The alternative option would be to connect to the existing 90 kV line that runs parallel to the N2 road. The connection would be through an additional 90 kV line to the main substation P0 over a distance of approximately 2 km (this length falls within the Project Area and there is no other human or commercial activity along this line).

For both these cases, there are no special activities on the additional routing of the connection.

The concept for power distribution is:

- Main station P0 receiving the high voltage line, and including transformers to Medium voltage (5 kV) and other needed equipment (breakers, voltage measurement);
- Substation P11 for the crusher area;
- Substation P12 for storage halls area;
- Substation P13 for the raw mill and preheater tower area;
- Substation P14 for kiln and clinker cooler area;
- Substation P15 for cement grinding and cement silo area; and
- Substation P17 for cement packing and dispatch area.

These substations will contain transformers to low voltage and other necessary equipment, the outputs of which during the final engineering phase.

Electrical Rooms

The supply of the various production workshops and ancillary installations will be made from secondary electrical rooms, these rooms will be supplied from the MV cells (5,5 kV) at the main substation. The ventilation and air conditioning of the electrical rooms, as well as the fire detection are part of the scope of supply.

Electrical Networks and Various Networks

Utility bridges will be used to host cable trays and support the fluid pipes (compressed air, drinking water, cooling water, firewater, diesel fuel, etc.). These bridges will link the various production workshops and their electrical rooms to the main electrical substation and the control room.

External Lighting

Where possible, roads will be lit via utility bridges, and where not by underground network connections.

2.4.1.7 Water Supply

The water supply of the plant is ensured by a compartmentalised basin (raw water, treated water, firefighting water) with a water treatment system and with a set of pumps, and any accessories or devices required for the proper operation of the plant.

Particular attention will be given to the firefighting network, which will include, in addition to the network supply pumps, an electric emergency pump (on stand-by) and a diesel motor pump with automatic start in case of total loss of power supply to the plant.

One (1) water basin with cooling towers will be installed close to the new kiln line for cooling the bearings of the kiln and compressors, and another similar water basin to be installed close to the cement grinding line.

The water needs for the Project are estimated at 30 m^3/d from the SDE boreholes.

Industrial Water

The water consumed in the plant will meet the needs of the process (equipment cooling).

The water supply to the plant will be provided by a compartmentalised basin (raw water, treated water, firewater) equipped with a water treatment system and a set of pumps and any accessory or device required for the proper functioning of the plant.

The fire network will include, in addition to the network supply pumps, an emergency electric pump (on stand-by) and a diesel motor pump with automatic start in the event of a total loss of electrical power to the plant.

At least one (1) water basin, with cooling tower, will be installed near the cooking line for cooling the bearings and compressors.

Wastewater

The generated sanitary wastewater will be channelled to a treatment plant, which will operate on the principle of activated sludge of the suspended biomass type. The technique consists of promoting, in the aeration tank, the development of an aerobic bacterial flora contained in the effluent and thus allowing the biochemical degradation of organic materials. The oxygen required for the treatment is distributed by means of aeration membranes placed at the bottom of the bioreactor and supplied by a booster. A gravity-type sludge recycling system sends the settled sludge from the clarifier to the aeration tank ensuring more stable operation, good denitrification and better sludge management. This system minimises the generation of sludge. Cleaning is carried out only once a year, allowing small amounts of sludge to be recovered and eliminated in the Clinker Kiln. The treated water will be systematically injected into the raw mill for internal elimination.

The station will be sized to treat an effluent corresponding to 200 Inhabitant Equivalent. The supplier guarantees the quality of the water after treatment in accordance with the regulations in force.

Rainwater

Rainwater with no risk of contamination will be channelled to the natural outlet. The rainwater collected in the Clinker, at road level, in car parks and around industrial buildings, will be channelled to a rainwater management system of open gutters equipped with grit removal (sand traps), settling to remove suspended matter and an oil separator to retain any oils and grease.

The treated water is proposed to meet the Senegalese standard NS 05-061 in particular for the concentrations of total suspended solids (50 mg/l) and total hydrocarbons (15 mg/l).

2.4.1.8 Fuel

The cement plant will be engineered to allow use different fuels interchangeably. Approximately 160,000 t of petcoke, imported from the international market, will be used per year. 120,000 l/annum of diesel will be used for heating the kiln.

Heating fuel will be stored in a 100 m^3 tank equipped with unloading pump and feed pumps for the burners of the kiln line.

All necessary equipment and networks for the new kiln line are included. This installation will be equipped with all safety and firefighting elements.

2.4.1.9 Quality Control

Mix control at the crusher outlet will be ensured by an on-line analyser (Californium source or gamma ray tube), which will act on the flow rates of limestone and laterites in order to maintain the desired chemical composition of the mixture.

Automatic samplers, including pneumatic transport, will be installed at the main collection points of semi-finished products (meal at silo feed, meal at kiln feed, clinker, and pulverised fuel at petcoke hoppers feed and produced cement).

The samples will be prepared in an automatic device (grinding and pelleting) and then analysed in an X-ray spectrometer. The results of the analyses will be transmitted to the control room to be integrated in the operation of the installations.

2.4.1.10 Protective Measures

The plant will only use bag filters. This will also be used for the process and dust collection at material transfer points in general, and for clinker and cement.

All external conveyors will be covered.

Particular attention will be paid to installations and equipment to reduce their noise level, such as casing, suction silencer for large fans, cladding of the kiln outlet platform, etc.

Gases at the chimneys will be analysed by continuous analyser (combustion gases) and/or opacimeter.

2.4.1.11 Atmospheric Emissions

There will be two types of air emissions:

1. The preheater exhaust gases discharged by the main chimney after filtration in a bag filter; and
2. The ventilation air of the mills, as well as the air used for the transfer or cooling of the products generally discharged in chimneys after filtration in bag filters.

The main channelled atmospheric emission discharge points are as follows:

- Main chimney, which channels the exhaust gases from the kiln line;
- Chimney of the cooler, which channels the excess air necessary for cooling the clinker at the outlet of the kiln, possibly in the case of two (2) different filters;
- Chimney of the coke mill, which channels the air out of this workshop; and
- Chimney of the cement mill workshop.

The cement plant will be fitted with bag filters at the level of all the discharge points, which are: the main gas chimney from the kiln line, excess air from the cooler and exhaust air from the petroleum coke workshop.

Table 2-4 summarises the compositions and the estimated flow rate of atmospheric emissions from the stack of the furnace of the cement plant. These values correspond to estimates established on the basis of material balances and operating conditions of the cement plant.

Table 2-4 Air Emissions from the Kiln Stack

Section	Chimney oven outlet
Dry Gas	
Flow Nm^3/h	416,000
Temperature °C	130
Polluting elements	
NO_x mg/Nm^3	570
SO_2 mg/Nm^3	30
Dust mg/Nm^3	0,48

2.4.1.12 Production and Distribution of Compressed Air

Compressed air production will be provided from compressor rooms, one for the new firing line and another for cement grinding and dispatch. The crushing plant near the quarry will be supplied with compressed air from a compressor with air dryer to ensure proper operation.

Particular attention will be paid to silo fluidization blowers that need to be installed under the cone to prevent deterioration by material (cleaning, leakage and overflow).

2.4.1.13 Gas Analysis and Control

The cooking line will be equipped with three smoke analysers, being:

- The first analyser will be installed at the entrance to the kiln. It will allow the analysis of the combustion gases and will be used mainly for the conduct of the process;
- The second analyser will be installed on the main chimney of the kiln line and ensures continuous monitoring of plant emissions, in particular NO_x, SO_x, CO_2, HCl, etc.; and
- The third analyser will be installed at the exit of the precalciner to control combustion.

2.4.1.14 Site Access

CIMAF will be responsible for the construction of the access road to the Project area. The access road to the Project Site will be accessed via the national road N°2. Two (2) potential access route options are being considered as shown in Figure 2-5 below.

- Upgrade and extend the existing SDE (Senegalese Des Eaux) road, which is currently tarmacked. This route is currently used for SDE activities (See Route A and Route A extension).
- To construct a new access road (independent of the SDE road) from the north of the Project Site to the N2 road, there is no specific activities ongoing along that route (See Route B).

If either road option is chosen, the entire access road will be of tarmac surfacing.

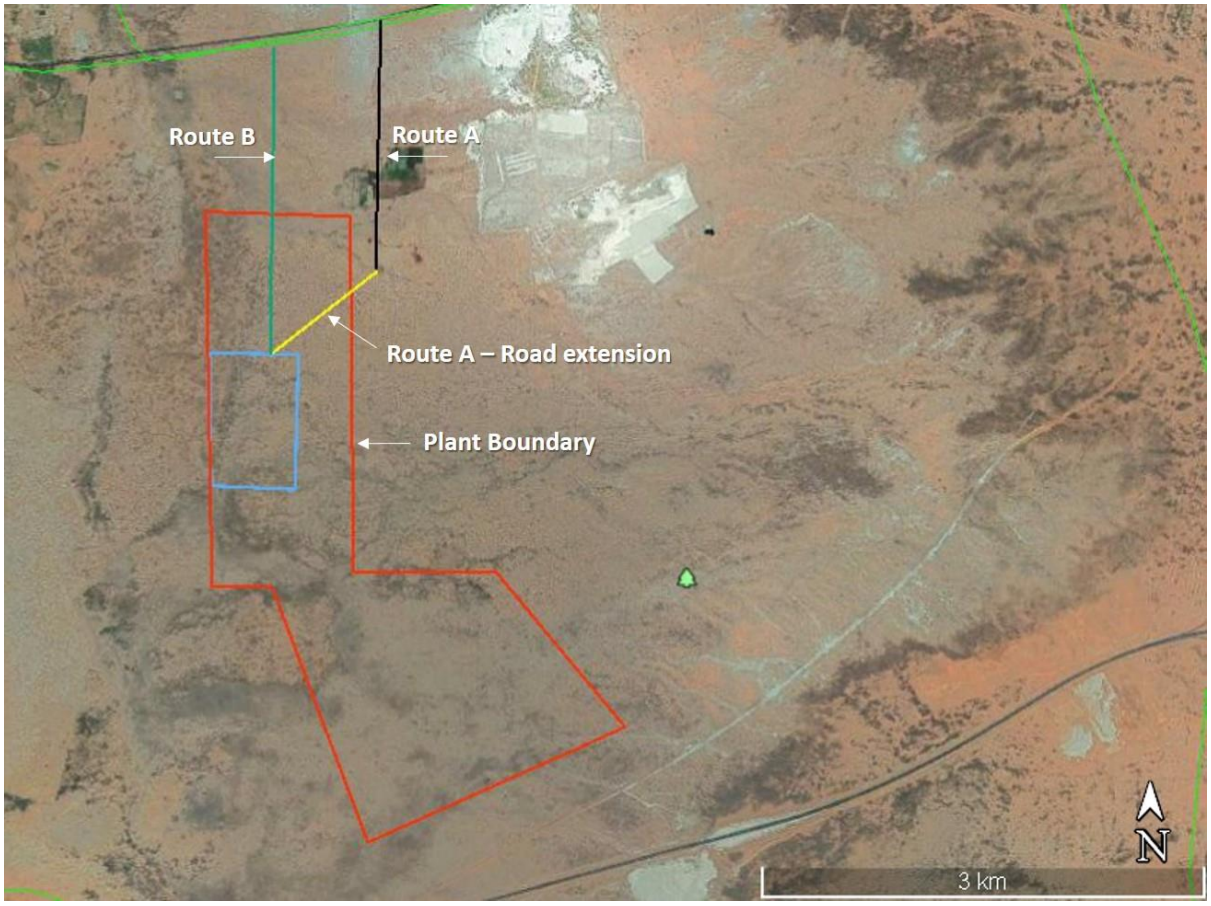


Figure 2-5 Access Road Options

2.5 Project Schedule

The pre-construction phase (permitting, authorisation acquisition etc.) of the Project is estimated to take eight (8) months to commence in January 2022. The construction phase (June 2022 – December 2023) is planned to be completed in 24 months. Operations are expected to continue for 100 years.

2.6 Environmental Protection

CIMAF SENEGAL is committed to an environmental policy based on "sustainable development". Notably, 15% of the amount of the overall investment intended for the construction of the Project will be devoted to measures and equipment for the protection of the environment, including:

- Coverage of storage halls;
- Coverage of production workshops;
- Coverage of carriers and conveyors;
- Gas and dust analysers;
- The wastewater treatment plant;
- The rainwater drainage network;
- Dedusting filters;
- The chimneys; and
- The roads (coatings).

Consistent with its operations elsewhere in Africa, CIMAF will establish up an Integrated Management System (IMS) aimed at certifying the plant according to ISO 9000, ISO 14001 and ISO 18000 standards, and will deploy the same robust Health, Safety and Environment (HSE) policies and management systems in place at all its facilities.

The plant will only use bag filters, both for the process and for the dedusting of material chutes in general, and for the clinker and cement in particular. External conveyors will all be covered.

Particular attention will be paid to installations and equipment in order to reduce their noise level (silent casing, suction by large fans, cladding of workshops, etc.).

The emissions from the chimneys will be monitored by continuous analysers to ensure timely intervention if needed.

2.7 Health and Safety

Occupational health and safety (OHS) is a major concern for CIMAF. Like the group's factories in Morocco, CIMAF will guarantee suitable and safe working conditions for all staff and its partners. The objective of the security policy will therefore be:

- Identification of the main risks that could generate an accident at work or an occupational disease;
- Improving working conditions; and
- Continuous improvement of health and safety performance. In addition, CIMAF will put in place a health and safety plan in accordance with the regulations in force in Senegal for the health and safety of workers. In addition, a health, safety and environment committee will be set up to educate staff and ensure compliance with instructions and procedures. The mission of this committee will be to maintain the well-being of workers within the quarry site and the factory through several action plans.

Significant resources will be made available to employees in order to ensure their safety (in particular by setting up an infirmary, a medical service, an ambulance, a firefighting network, etc.), as well as their hygiene (in particular through a collective restaurant respecting the necessary hygiene measures).

In addition, periodic internal monitoring of the working environment as well as the medical records of employees will be put in place. All CIMAF staff will be engaged in a process of continuous improvement in occupational health and safety through internal communication and effective dissemination of the necessary information, in particular through postings, reports, training sessions, awareness raising, trainings, meetings, etc.

In accordance with CIMAF's safety policy, an OHS management system will be set up by a safety management committee. The latter, made up of the plant manager, site managers, the Quality-Safety-Environment (QSE) manager, the safety coordinator and any person who can help with safety, will perform the following tasks on a monthly basis:

2.7.1 Internal Safety Audits

The following will be undertaken to ensure internal safety:

- Safety training programs;
- Safety meetings;
- Risk analysis and implementation of actions to reduce them;
- Definition of safety instructions and rules; and
- Approval of proposed action plans and definition of communication tools.

In addition, the safety management committee will carry out plant safety reporting, analyse accidents and incidents that have occurred and monitor the corrective and preventive measures put in place.

2.8 Control and Regulation

The manufacture of clinker and cement requires a complex network of regulation, control and protection to ensure the proper functioning of the facilities. A cement production plant has nearly 2,000 control and detection points including, temperature measurements, gas analyses, rotation and speed controls, etc.

Numerous temperature and pressure sensors continuously monitor thermal stability along the cooking line. Some temperature sensors are also used to ensure the safety of the installation.

Current control technology is based on microprocessors, computers and programmable logic controllers. This technology is now universally applied in all recent industrial installations. The concept applied nowadays is that of a centralised control room for the kiln and crushers, with the raw material crusher and shipments being ordered locally.

The production process is controlled by operators, by means of terminals with screens, where the process diagrams and the various values of the operating parameters such as temperatures, pressures and flow rates are displayed. The menus available on the various terminals allow operators and other members of the management to view flowsheets, trend curves, parameter values, alarms and messages, and to generate reports with statistics of production and consumption.

The cement plant will be equipped with a centralised Control Command System (CCS) to supervise and control the various workshops of the plant. The system is designed to allow independent control of the following units:

- Raw materials (crushing, handling, pre-homogenization sampling and transport to storage);
- Feeding of raw materials, grinding of the raw material and transport of the flour to storage;
- Kiln supply, clinker production, clinker cooling and transport of clinker to storage;
- Cement grinding, packing and dispatch; and
- External services and general installation services.

2.9 Labour and Procurement

The Project will employ approximately 800 people during the construction phase, 10% of whom will be engineers and managers. During the operational phase, the Project will employ around 280 people, including 80 of CIMAF's own staff and around 200 subcontractors. The supervision rate in the operating phase is estimated at 15%. The labour figures are illustrated in Table 2-5 below. Labour will be sourced from the surrounding villages (Pout, Thiès, etc.). There will be no accommodation within the Project area.

Table 2-5 Breakdown of the Workforce

Project Phase	Number or Workforce
Construction Phase	800
Operational Phase	280
Of which CIMAF own staff	*80*
Of which sub-contractors	*200*

In addition to direct employment, each Project phase will be associated with the purchase of equipment and goods and services necessary to support construction and operations.

Although not all specialised goods will be able to be sourced in country, the Project will endeavour to prioritise Senegalese companies to the fullest extent possible.

2.10 CSR Policy

CIMAF ensures that all its activities occur within the framework of sustainable and lasting development, taking into account the preservation of the environment but also harmonious integration into its socio-economic environment.

As soon activity commences, CIMAF will ensure that its activities are part of a good neighbourly environment with its residents. Priority will be given to local resources in terms of employment. Likewise, CIMAF will contribute to the establishment or renovation of local infrastructure (roads, schools, mosques, health structures, etc.), and to the improvement of access to water in the area with the setting up of wells/boreholes.

3. ALTERNATIVES

3.1 Site Alternatives

Various site alternatives were investigated as part of the conceptual development of the Project. From these alternatives CIMAF made decisions regarding preferences. Outcomes of the alternative analysis are presented below.

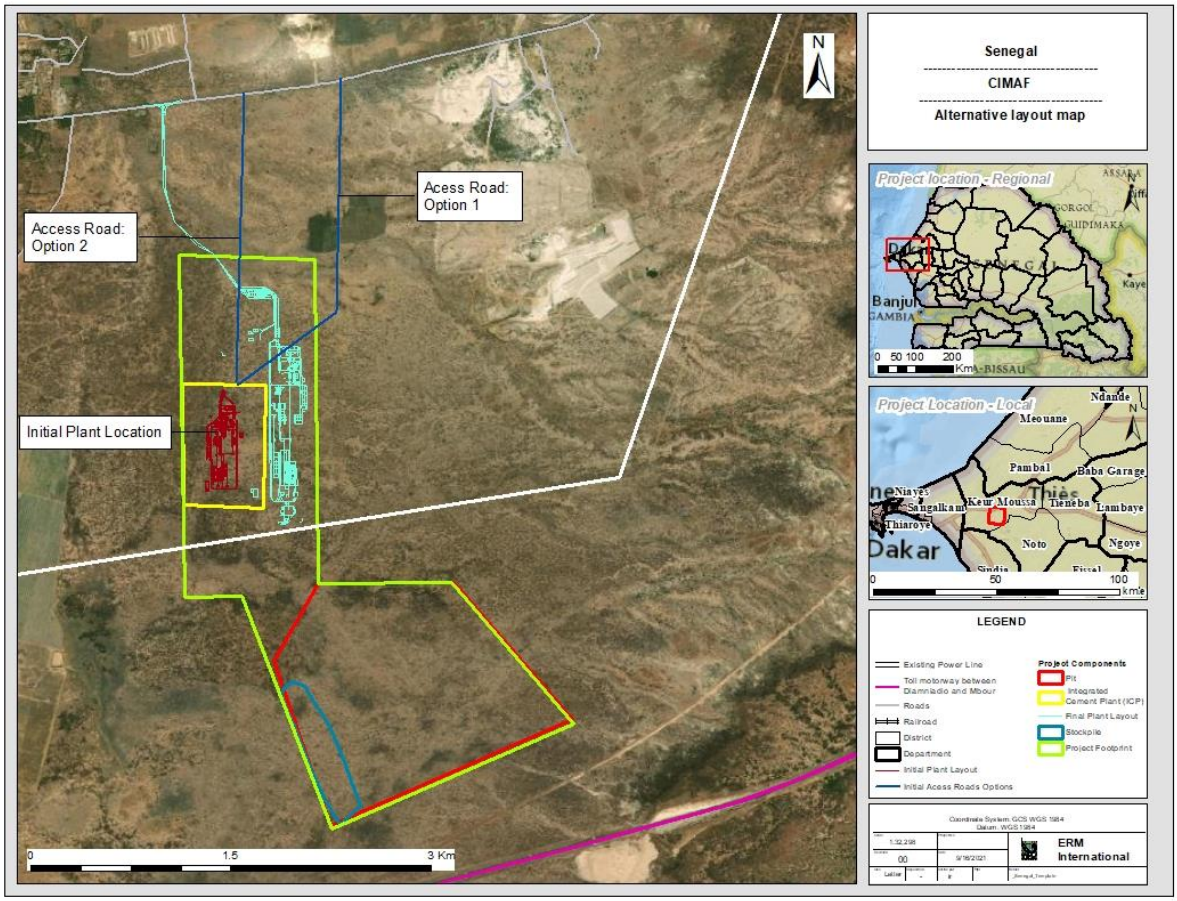


Figure 3-1 Layout and Associated Infrastructure Options

3.1.1 Quarry

Three areas were highlighted to CIMAF by the Senegalese Government as potential sources of limestone. The three options all lie within the limestone corridor that runs north and south of the Project site.

CIMAF undertook various geological studies to understand the quantities, depths and feasible accessibility of the limestone in these areas. The current site was chosen as it was judged to be the most geologically attractive and feasible location.

3.1.2 Plant

Five (5) options were investigated for the location of the processing plant. Proximity to the quarry, the topography and permit options were all considered. The current plant site was chosen as it was the closest to the quarry site, allowing greater efficiency, with suitable topography for construction of infrastructure. The selected site was also the only one that fell within the CIMAF mining permit.

In addition, the position of the plant allows a direct connection of the SENELEC network, located adjacent to the proposed plant. This will reduce potential avifaunal collision risks.

The close proximity of the crusher and plant to the pit enables the shortest haul road possible, significantly reducing associated negative impacts such as increased emissions and dust, further reach of noise disturbance, and increased risk of collision with livestock, wildlife and/or humans.

As shown in Figure 3-1 above, during development of this Supplementary ESIA the initial proposed plant location was moved from the western to eastern boundary of the Project site to avoid potential impacts on wetlands beyond the western Project boundary and to reduce the amount of baobab trees impacted.

3.2 Technology Alternatives

A number of technology alternatives for the Project were analysed to arrive at the preferred technology proposed for Project development and operations.

3.2.1 The Quarry Exploitation Techniques Assessed

The quarry exploitation techniques were considered, are described below:

- **Blasting:** Blasting is commonly used in quarries because of its low cost and can be used for any type of rock. This method allows large volumes of rock to be knocked down in a short period and thus offers increased productivity.
- **Mechanical mining:** Requires high investments in equipment and a good match between equipment and use to avoid the additional costs associated with the premature wear of the equipment used. This option also reduces the productivity of the quarry, as it only allows processing of small volumes of rock per time interval.

Mechanical mining is more suitable for small quarries with a low production capacity.

CIMAF will adopt blasting as the preferred mining technique for quarry exploitation.

3.2.2 Mining Activities

The implementation of mining operations requires the logistics and special skills necessary for proper execution in accordance with the health and safety standards in force in Senegal. Two options are available:

- **Internal mining:** Internal management of mining will require CIMAF to train or recruit qualified personnel dedicated to this task. It will also have to acquire and properly set up the infrastructure and security protocols related to the storage, transport and handling of explosives. This option presents higher accident risks due to the uncertain nature of the control that the trained or recruited staff will have on safety aspects. It will also require the promoter to use part of its resources to manage a related activity instead of focusing on its main activity (production of aggregates). Finally, this option is economically less profitable because it leads the promoter to internalise costs.
- **Outsourced mining:** For CIMAF, this would involve calling on a specialised company to carry out its mining operations. While reducing the risk of accidents, this option would also relieve CIMAF of structural costs and difficulties related to the establishment of infrastructure and the application of protocols for compliance with health and safety standards.

CIMAF has selected outsourced mining as the preferred mining activity.

3.2.3 The Clinkerization Process

As described below, different types of processes can be used for the production of Clinker, i.e. wet, semi-dry, semi-wet and dry processes.

- **Wet process:** In this system, the clinkerization takes place inside long furnaces. The dough enters one end of the oven as raw (raw flour) with water (about 35-40%). The dough is homogenised in large basins and introduced upstream of long rotary ovens in which the cooking takes place. In the first part of the oven, the dough is dried and continuing its progression in the oven, it reaches the clinkerization temperature. Thus, the clinker is obtained on leaving the furnace. The cooling of the clinker takes place in the grate cooler. The major drawback for this type of process is its high thermal energy consumption, which is approximately double the consumption of the dry process.
- **Semi-dry process (LEPOL):** For this process, which dates from the 1930s, the mix is prepared with the addition of 13 to 15% water. Granules are formed on a rotating plate, which enter the oven through a mobile grid. They are then dried out by the hot gases coming from the oven. This system can be disturbed by a number of phenomena, including, for example, the bursting of granules, a consequence of thermal shock, production of dust, which can fill the space necessary for the passage of gases, etc. In addition, the maintenance of the grid is more expensive than that of the preheating with heat exchanger towers used in the dry process. The thermal energy consumption is about 50% higher than in the dry system.
- **Semi-wet process:** This system is only used today in the case of conversion of existing factories using the wet process. It presents a more economical alternative than the dismantling of a completely wet process plant for the reconstruction of a dry process plant. Indeed, this alternative maintains the use of raw grinding by wet process. The pulp, leaving the wet mill, contains between 35 to 40% water.
- The dough is dried before being introduced into the oven thanks to the hot air coming from the oven. The drying takes place in a pre-heater with paddles that allow the exchange of heat between the air and the dough.
- The furnace is referred to as a “short furnace”, with a diameter / length ratio of 14 to 16. It is fitted with an exchange tower in only two stages, and the outlet temperature of the gases from the exchanger is about 800°C. This temperature is sufficient for drying the paste. The thermal energy consumption of the system is in the order of 1,000 to 1,200 kcal / kg of clinker, which is 30% higher energy consumption than the dry process
- Completely **dry process:** Currently, this is the most widespread process in the world. The mastery of techniques of homogenization, dosage and preparation of the raw material allowed the development of dry cooking during the 1950s. The thermal energy consumption is of the order of 800 kcal / kg of Clinker.
- The completely dry process has been selected for the Project.

3.2.4 The Source of Water Supply

Three options of water supply are available at this level. This involves the drilling of a borehole, the connection to the SDE network from the existing boreholes in the area and the supply by tanker from the SDE boreholes.

- **Drilling:** This will involve drilling a borehole to have water permanently. The main drawback of this option lies in the additional pressure that will be exerted on the resource, the costs of carrying out such a structure and the hydraulic fee to be paid. However, it will make it possible to cover all the water needs of the Project and will have less impact on the quality of the SDE service. In addition, it will ensure a certain autonomy for the Project.

- **Water intake from SDE boreholes:** Six (6) SDE boreholes exist in the Project area, which can be used to cover the water needs of the Project. These boreholes have an average production of 21,000 m^3/d. The water needs for the Project are estimated at 30 m^3/d or 3.2% of the daily production of SDE boreholes. This option has the advantage of being less expensive, but its main disadvantages are the need to have an SDE agreement and dependence on it.
- **Supply by tanker truck:** CIMAF could also install a water tank on site and supply it with tanker trucks. The main drawback would be the continual movements of the supply truck, which can also increase the transport related risks. In addition, this option will not be able to meet the water needs of the Project.

CIMAF has selected borehole drilling to source water.

3.2.5 The Source of Energy Supply

For energy supply, three options will be considered:

- Connection to the SENELEC network;
- The use of solar panels; and
- The use of generators.

For this Project, connection to the SENELEC network is possible due to the presence of a high voltage line and a medium line near the site. However, the major disadvantage results from the dependence on SENELEC.

The advantage of solar energy lies in the fact that it is clean and therefore non-polluting energy, thus preserving the environment. It also ensures independence from SENELEC. However, one of its main drawbacks is its investment and maintenance cost, and also the limited power output it can provide in relation to the surfaces available for the installation of solar panels.

The use of generators is essential for the smooth running of Project activities. While this option has advantages, it also has drawbacks, such as modifying the sound environment and the emission of greenhouse gases.

Connection to the SENELEC network has been selected for the Project.

3.2.6 Rehabilitation of the Quarry

Three options for rehabilitation of the quarry are available:

- **Complete rehabilitation at the end of the Project:** This comprehensive rehabilitation will involve tackling the full exploitation of the limestone resource and then carrying out the rehabilitation at the end of the Project. This option has the advantage of offering the possibility of developing and carrying out a rehabilitation plan, which will affect, in a coherent way, the different parts of the site which will be adapted to the needs of use identified with. However, it has the disadvantage of subjecting large areas of land and for long periods (throughout the life of the Project) to the risk of erosion (especially water) and the risk of accidents for livestock and populations that frequent the area.
- **Progressive rehabilitation:** This will consist of rehabilitating the site as the exploitation works progress. These are small areas that will be subject to erosion and the risk of accidents for short periods of time.
- **Mixed rehabilitation:** This option will consist of reforesting the site as the exploitation works progress and in developing it globally at the end of the Project. These are therefore small areas that will be subject to erosion and the risk of accidents for short periods of time. This option has the advantage of preventing erosion while taking into account the site's rehabilitation needs.

CIMAF have chosen the mixed rehabilitation approach for the Project.

3.3 Access Road Alternatives

Layout alternatives are currently being explored for the access road to the Project Site, and are shown in Figure 3-2 below.

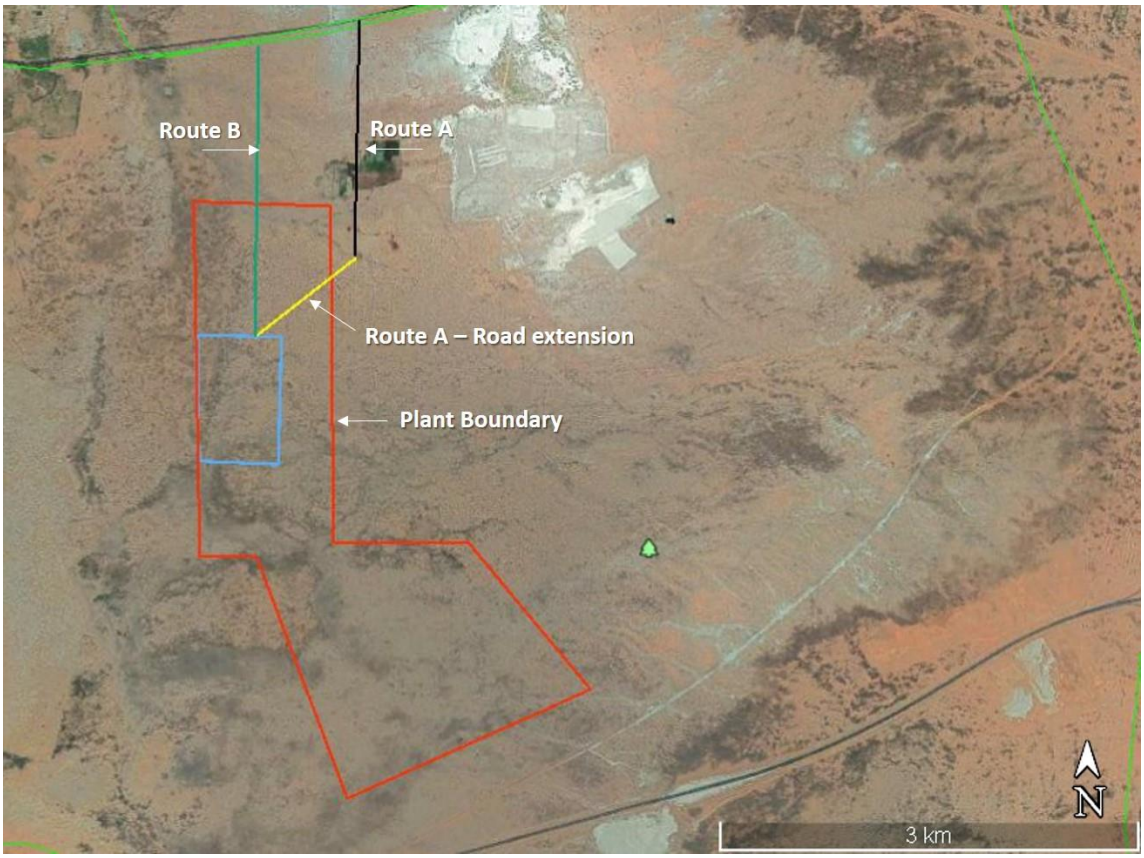


Figure 3-2 Access Road Options

The road that provides access to the quarry is the one that connects RN2 (Pout-Thiès section) to the SDE catchment areas. This access track extends over a total length of 2.9 km. It is paved for 605 m from the RN2. Here, the options to consider are:

- **Maintaining the existing route as the main access:** Maintaining this option involves the rehabilitation of this road and the establishment of a particularly strict monitoring and prevention system to manage the cohabitation between Project activities (movements of trucks and machinery), very dense traffic on the RN2 and the activities of the SDE in Zone. During the rehabilitation of the access road to the boreholes, CIMAF will ensure the widening and protection of manholes near the road by reinforced concrete ducts. CIMAF must also consider bypassing the PS4 drilling site (SDE Groundwater borehole) and set up a consultation committee with SDE. This option will both rehabilitate the degraded road to a usable state and will also benefit the users from SDE. It will also have less impact on the surrounding environment as the footprint of the road already exits.
- **Creation of a new access route:** CIMAF will build a new access road that will allow Project vehicles and trucks to access the quarry without crossing the SDE drilling road. This option will lead to deforestation to free up rights-of-way and damage to forest resources.

A decision by CIMAF on the route options is pending.

3.4 No-Go Option

The No-Go Option presents a scenario, where the forecasted 800 potential jobs created during the construction phase and the 200/250 jobs during the operation phase will not be offered to the local population (inhabitants of surrounding villages, Thiès and Pout). This scenario will also not allow for the domestic value addition to Senegal's abundantly available limestone resources, which is expected to directly and indirectly contribute to the economy of Senegal. This investment is to provide at least 280 full time job opportunities, as well as other opportunities throughout the value chain.

As the "Gateway to the Sahel", Senegal is already a driving force of integration, particularly within the WAEMU area, and in the absence of this Project, the need to meet the major supplier of clinker to the growing demand in neighbouring countries, will not be met.

Furthermore, CIMAF will incur financial losses after their investment in the development of this Project (permits, impact studies etc.).

The No-Go Option presents a scenario where the forecasted 800 potential jobs created during the construction phase and the 200/280 jobs during the operation phase will not be offered to the local population (inhabitants of surrounding villages, Thiès and Pout).

The No-Go Option also presents a scenario where the project-level development outcomes, including promotion of market competitiveness in Senegal via innovation and improved efficiency through usage of best available techniques (BAT) in cement production, increase regional integration through sales of clinker between Senegal and Mali and other, do not materialize.

4. REGULATORY REVIEW

This section describes the policy, legal, and administrative framework that includes:

- A description of the Senegalese policy and legislative framework;
- Relevant International Conventions and Treaties;
- IFC Performance Standards;
- World Bank Group (WBG) General Environmental, Health and Safety (EHS) Guidelines;
- WBG EHS Guidelines for Construction Materials Extraction; and
- WBG EHS Guidelines for Cement and Lime Manufacturing.
- As has been noted, CIMAF will set up an Integrated Management System (IMS) aimed at certifying the plant according to ISO 9000, ISO 14001 and ISO 18000 standards; and will deploy the same robust Health, Safety and Environment (HSE) policies and management systems in place at its other operations.

4.1 Senegalese Policy and Legal Framework

4.1.1 Policy Framework

This section describes the applicable Senegalese Policy and Legislative Framework that is relevant to the Project.

4.1.1.1 The Emerging Senegal Plan

Senegal adopted a new model to accelerate economic and social development in 2014. The Plan for an Emerging Senegal (PES) frames the country's mid and long-term social policy and includes actions designed to sustainably drive growth, creativity and private initiative under the broad vision of "An emerging Senegal in 2035, with a cohesive society under the rule of law". The PES is underpinned by three priorities aimed at:

- Structural transformation of the economy by strengthening current drivers of growth and developing new sectors that can create wealth, jobs, and social inclusion with a strong power of attraction for export and investments;
- Promoting human capital through a significant improvement of people's living conditions and a more sustained fight against social inequalities; and
- Enabling good governance: to strengthen security and stability, protect rights and liberties, consolidate the rule of law and create a setting more conducive to social peace.
- In line with the PES, Senegal intends to exploit its mining potential and ensure the emergence of industries structured around these resources.

4.1.1.2 The Environmental Sector Policy Letter

The Development Policy Letter for the environment and sanitation sector aims to put in place the conditions for sustainable economic and social development. In line with the Millennium Development Goals, and the Johannesburg Action Plan (2002), Senegal intends to fully contribute to reversing the trend of environmental degradation as well as improving the living environment.

The objectives pursued by this policy are:

- Improve the knowledge base of natural resources and the environment in order to better measure their carrying capacities;

- Reverse the current trend of resource degradation by 2007 by putting in place an effective institutional and regulatory framework based on international conventions;
- Improve the capacities, planning and coordination of actions to preserve the environment in a context of greater empowerment of various actors;
- Promote income-generating activities and collective infrastructure combining the fight against poverty and the preservation of the environment;
- Increase the supply of the populations with autonomous collective sanitation facilities;
- Correctly deal with the wastewater discharges currently produced and following the implementation of the drinking water production component;
- Promote sustainable production and consumption patterns;
- Protect the urban environment by treating waste water and drain materials and, in the long term, by purification before discharge to the sea;
- Promote citizen attitudes and behaviors in favor of good management of the environment and natural resources through the development of environmental education, awareness, information and training;
- Ensure rational management / use of chemicals;
- Involve peripheral populations in the concerted management of protected areas;
- Regulate the management of urban solid waste;
- Develop regional master plans for waste management;
- Strengthen collection and cleaning equipment; and
- Set up adequate waste treatment infrastructure.

4.1.1.3 The Mining Sector Development Policy

The Mining Sector Policy Letter was drawn up in 2016 with the aim of supporting development of "a structured and competitive Senegalese mining sector making a full contribution to the inclusive and sustainable development of the country for an emerging Senegal by 2035".

Four strategic axes are identified:

- Axis 1: Updating the legal and institutional framework;
- Axis 2: Development of mineral potential;
- Axis 3: Supervision and promotion of artisanal mines; and
- Axis 4: Strengthening the governance of the mining sector.

The objectives pursued by the Mining Sector Policy Letter are:

- Strengthening the legal and regulatory framework for better management of the economic, social and environmental impacts of mining activity;
- Improving the geological knowledge of the subsoil to ensure attractiveness and strengthen the promotion of the national mining potential;
- Strengthening the means of control, surveillance and monitoring of mining operations by recruiting and building the capacity of human resources and strengthening the adequate institutional mechanism for large-scale mines, small mines and artisanal operations;
- Improving the collection and management of mining taxes and royalties; and

- Improving the redistribution of income from mining operations at local and national levels by using income for sustainable projects supporting and integrating large mining projects into the local and regional economy.

4.1.1.4 Strategy for the Implementation of the United Nations Framework Convention on Climate Change

The implementation strategy of the United Nations framework convention on climate change is a tool to support Senegal in meeting its priority economic and social development objectives in accordance its climate change commitments.

Key measures include:

- Policy changes to promote more efficient and sustainable practices;
- The development of new and renewable energies;
- The valuation of plant biomass; and
- The introduction of economic incentives through the adoption of technologies that emit less greenhouse gases.

4.1.1.5 National Strategy and Action Plan for the Conservation of Biodiversity

The national strategy aims to preserve the achievements of biodiversity conservation in Senegal while associating the populations and the various stakeholders in sustainable management by integrating it into their production activities (agriculture, livestock, fishing, etc.).

Conscious of the role and importance of biological diversity at all levels and of the many threats to its constituent elements, Senegal signed and then ratified the Convention on Biological Diversity (CBD) in 1994. Through these acts, the country solemnly pledged to contribute to the achievement of the objectives set by the Convention. To do this, Senegal adopted in 1998 a National Strategy and a National Action Plan for the Conservation of Biodiversity (SPNAB), articulated around four (4) major strategic objectives:

- Conservation of Biodiversity in High Density Sites;
- The Integration of Biodiversity Conservation Into Production Programs and Activities;
- The Equitable Sharing of Roles, Responsibilities And Benefits In The Management Of Biodiversity; and
- Information and awareness of all stakeholders on the importance of biodiversity and the need for its conservation.

The regular assessment of the implementation of this strategy and its action plan through five national reports has so far made it possible to assess the many results obtained in terms of conservation of biological resources but also the various limits to which conservation actors are confronted. However, after more than a decade of implementation of these strategic orientations, it is important, in the light of the noted limitations, of the evolution of the socio-economic and ecological context of the country, of the recommendations of the tenth Conference of the Parties (COP), take into account the following emerging issues:

- The strategic plan for biodiversity (2011-2020) and its associated goals, objectives, and indicators;
- Integration of biodiversity in poverty eradication and development, national (statistical) accounting, economic sectors, land use planning process, etc.;
- Human rights and indigenous peoples taking into account the United Nations Declaration on Indigenous Peoples; and

- Gender issues.

In addition to these emerging themes, there is the necessary integration of adaptation to climate change into major planning processes, in particular in the field of biodiversity conservation and the imperative to align with the vision of the Senegal Plan Emergent (PSE), repository of all the country's public policies.

4.1.1.6 National Land Use Plan

The objective of the National Land Use Plan is to implement a coherent regional planning policy, by allowing, on the one hand, better knowledge and development of the country's resources and potential and, on the other hand, to serve as a reference framework and spatial coherence of the various sectoral policies.

This plan is supplemented at the local level by Regional Land Use Planning Schemes (SRAT) and Regional Integrated Development Plans (PRDI).

4.1.1.7 The Internal Governance Sector Policy Letter

The Internal Governance Sector Policy Letter was adopted in June 2010 and constitutes a preliminary step for the implementation of development projects and programs and specifies the Government's orientations, particularly in terms of the security of persons and property and civil protection. The Sector Policy Letter intervenes in an international context marked by the development of various documents, including the Hyogo Framework for Action (CAH) for 2005 - 2015: for resilient nations and communities in the face of disasters. The main purpose of this instrument is to build the resilience of nations and communities and, as such, provides guidelines, practical means and certain priorities. At the national level, the civil protection policy aims to prevent risks of all kinds, to inform and alert populations as well as to protect people, property and the environment against accidents, disasters and disasters through the preparation and implementation of appropriate measures and resources under the responsibility of the State, local authorities and other public or private persons.

4.1.2 National Legal Framework

4.1.2.1 Constitution of the Republic of Senegal (2001)

The Constitution of the Republic of Senegal was adopted in 2001. The Constitution defines the political and administrative organization of the State and assigns the roles and responsibilities of the executive, legislative and judicial branches. Constitutional rights and norms relevant to this document include the right to private property (Article 8), expropriation in the case of public necessity legally ascertained and subject to fair and prior compensation (Article 15), and equal rights to property for men and women (Article 15).

4.1.2.2 Mining Code (2003)

The Mining Code establishes a system for managing mineral resources and actors in the mining sector. It defines the conditions, rights and obligations attached to several types of mining permits, including those required for prospecting, exploration and exploitation.

Title IX, Chapter III of the Mining Code includes several articles of importance concerning the occupation of lands for a mining project. Article 73 confers on the holder of a mining title a right of occupation of lands both inside and outside the perimeter attributed. This applies to land required for a variety of purposes directly and indirectly contributing to the mining operation, including actual exploration and exploitation works; worker housing; transportation infrastructure; waste storage; water and power works; and others. However, the occupation of lands under Article 73 is still subject to any relevant legislation specific to a particular use, and to certain important provisions of the Decree of Application (see below).

Article 74 provides an option for lands required for all the above purposes to be "declared State-approved in the conditions foreseen by the relevant legislation", which in effect allows access to be obtained through expropriation. However, the law does not require an expropriation process to be engaged, and provides other mechanisms for obtaining or negotiating land access, through Article 73 and the related articles of the Decree of Application.

Under Article 75, the occupation of land outside of the mining title perimeter for less than one year requires a Ministerial decree and if for more than one year requires a Presidential decree.

Article 81 states that "The holder of a mining title is under an obligation to compensate the State or any legal entity [physical or moral person] for material damages and loss caused by it."

Article 83 of the Mining Code requires any applicant for a mining concession "to prepare at his own expenses an environmental impact study in accordance with the Environment Code and the application decrees."

4.1.2.3 Mining Code Application Decree (2004)

The Application Decree sets out further regulations and procedures for applying the Mining Code. Relevant sections include:

- Article 26, specifies that an application for a mining concession must include, among other things, "a feasibility study indicating the characteristics of the project and its socio-economic impact" and "an environmental impact study";
- Articles 86 through 91, requires that a permit holder obtain authorization for each occupation of land, both inside and outside the permit area, and define the relevant application procedures. Each application for land occupation must include "the description of the planned activities and their impact on the environment";
- Articles 89, 90, 92 and 93, reaffirms the obligation of the permit holder to compensate owners and occupants, including the State, for any damages or losses resulting from mining operations; and
- Article 93, outlines a process for determining compensation for losses by "mutual agreement", while distinguishing two cases:

  - In the case of private land, the permit holder is to seek agreement with the holder of the land rights. In the absence of such an agreement, the permit holder may apply to the relevant tribunal, under the conditions for expropriation in the public interest.

  - In the case of State land, the permit holder is to seek agreement with the local government concerned. Failing such an agreement, a special commission is to be constituted to determine compensation.

In either case, if an agreement on compensation has not been reached within six months of the authorization to occupy land, the Minister of Mines shall authorise the permit holder to occupy the lands, in exchange for a financial deposit, while waiting for an agreement to be reached or for the relevant tribunal to deliver its decision.

Article 93(b) of the Decree is particularly significant as it implies that a voluntary agreement with the local government is the preferred option for determining compensation for losses caused to owners or occupants of land.

4.1.3 Land Tenure

Land in Senegal falls into three main categories, regulated by different laws:

- Land in the national domain, governed by Law No. 64-578 (1964) and its decree of application. This category covers most of the land in Senegal;

- Land in the state domain, governed by Law No. 76-66 (1976) and its decree of application. Under this law, the state domain comprises the public domain and the private domain. In this case, 'private' refers to the private domain of the state, not private property of non-state entities; and,
- Private land which is non-state land. Land registered to individuals and other non-state entities is still governed by the French Civil Code, and a colonial-era decree of 1932, which sets out the process of registering private land.

Senegal's national domain lands are in turn subdivided into four categories:

- Urban zones (zones urbaines) – urban areas or commune lands;
- Classified zones (zones classes) – land that is governed by specific statutes, such as classified forests, national parks, and other government protected areas;
- Territorial lands (zones de terroir) – lands that were regularly used, at the date of publication of the 1964 law on the national domain, for agriculture, pasture, and rural settlement, and non-classified forests; or,
- Pioneer zones (zones pionnières) – all remaining land.

According to the 1964 law (64-46) on the national domain, the state owns all lands in the national domain to ensure their rational and productive use in conformity with its land use and development plans.

Territorial lands are therefore managed under the authority of the state by the Municipal Councils. The decree for application (64-573) sets the conditions by which territorial land is allocated. Under this decree, the Municipal Council has the power to allocate and re-allocate lands conditional on the productive use of those lands.

The land in the Project footprint is in the national domain and in a classified zone, specifically the Classified Forest of Thiès. The Project will be granted a special authorisation for use of land in the Classified Forest by the Directorate of Water and Forests.[1]

4.1.4 Environmental Code of Senegal

Table 4-1 provides a summary of the relevant aspects of the Environmental Code.

The Law on the Environment Code and accompanying Decree of 2001 set out rules and procedures for any project that may have an impact on the environment. Impacts to be considered include not only biophysical impacts, but also: social impacts; impacts on human health, welfare and needs; impacts on renewable and non-renewable resources; and displacement impacts (Decree Article 39).

Table 4-1 Environmental Code of Senegal

Reference	Contents
Impact Assessment	Projects having an environmental impact are subject to either an authorisation or a declaration, depending on the severity of the impacts and the risks associated with the project (Law Articles 10 and 11). Industrial-scale mines are considered as having severe impacts (first class), and therefore require an authorisation from the Minister of Environment. Article 6 of the Law reaffirms that responsibility for matters of the environment and natural resources has been decentralised to the regions and local governments, as provided by the 1996 law on decentralisation. However, the Law and Decree do not make clear how this principle is to be applied in

[1] CIMAF confirmed (27.07.2021) receipt of a Presidential Decree authorizing their use of land in the Classified Forest; documentation has not been shared to date.

Reference	Contents
	practice. On the other hand, Article 27 of the Decree allows the Minister to delegate the power of granting authorisations or receiving declarations to the Governor of a Region, where regional services for the environment exist. Any project or activity which may have an impact on the environment is required to carry out an impact assessment, as part of the authorisation or approval process (Law Chapter 5). In the Decree (Article 9), it is specifically stated that projects of the first class must be preceded by an impact assessment. Article 48 of the Law states that the impact assessment procedures should aim to avoid and to minimise any negative impacts, and if appropriate provide for public participation in the process. Article 51 goes further to state that the impact assessment must include the proposed measures to avoid, reduce or compensate any negative impacts, as well as the cost of these measures. Similar language is used in Article 10 of the Decree. The impact assessment process must include public audiences and participation of the population (Law, Articles 82 and 83). In Article 2, the participation of the population is defined as engagement in the decision-making process, and includes three steps: information, consultation and a public audience. The Decree (Article 40 and Annexes) defines two categories of project, requiring either an in-depth or a basic (“initial”) impact assessment. Extractive and mining industries are listed under category 1 (in-depth impact assessment).
Procedures for classified installations	Article L9 of the environmental code stipulates that “factories, workshops, depots, construction sites, mines and, in general, industrial, craft or commercial facilities operated or owned by any natural person. or moral, public or private, and all other activities which present either dangers for health, safety, public sanitation, agriculture, are subject to the provisions of this law “. Title I of Decree No. 2001 - 282 of 12 April 12 2001 implementing the Environmental Code requires the following conditions to be met: ▪ Protection of workers in terms of health, safety and hygiene; ▪ Purify its wastewater in accordance with Senegalese standards before discharging it into the natural environment. ▪ Explicitly mention the wastewater evacuation, dust removal or gas filtration system in the production diagram in order to achieve this objective of controlling and monitoring ecosystems and the quality of natural resources.
Water resources: ▪ Emissions to the atmosphere ▪ Atmospheric pollution ▪ General aspects	R9 stipulated that: “Prior impact making it possible to assess the direct or indirect effects of said installation on the ecological balance of the site's environment. Any first-class installation which, because of its size, the nature of its activities or its impact on the natural environment, is likely to harm the environment, must be the subject of a study. The preliminary impact study is established and submitted by the applicant. It is at his expense, and it is carried out by a design office approved by the Minister responsible for the environment ". R10 specifies that the Minister responsible for the environment is responsible by ministerial decree to indicate the content, methodology and procedure of the impact study.

Reference	Contents
Protection and enhancement of receiving environments (Article L 59)	Water constitutes a public good, an environmental resource, the protection of which is subject, among other things, to the provisions of this law. The discharge of wastewater into the public sewerage network must not harm the conservation of structures or the management of these networks, especially in Dakar. All installations must treat the wastewater before the final discharge.
Protection and enhancement of receiving environments (Article L 63)	All discharges, flows, discharges, direct or indirect deposits of any kind likely to cause or increase pollution of continental waters and / or sea waters within the territorial limits are prohibited.
The Atmosphere: Atmospheric pollution (Article L76)	Air pollution is subject to the provisions of this law and the regulations adopted for its application or odors which inconvenience the populations, compromise health or public safety, harm agricultural production, the conservation of buildings and monuments or the character of sites and natural ecosystems.
The Atmosphere: Atmospheric pollution (Article L78)	In order to avoid atmospheric pollution, buildings, agricultural and industrial establishments are built, operated or used in such a way as to meet the technical standards in force or taken in application of this law
Air pollution (Article R72)	When the polluting emissions from installations can cause, due to observed or foreseeable meteorological conditions in the short term, an increase in the level of atmospheric pollution constituting a threat to people or property, the operators of these installations must implement all the necessary measures to eliminate or reduce their polluting emissions.
Ground Pollution and degradation of soil and subsoil	The protection of soil, subsoil and the wealth they contain, as limited resources, renewable or not, against all forms of degradation is ensured by the State and local communities. (L81) The state and local communities have an obligation to protect the soil and the subsoil. They must put in place appropriate monitoring and control arrangements. (L82)
Pollution and degradation of soils and subsoil (Article L82 l)	A joint decree, taken by the ministers concerned, in application of this law, states: ▪ The special conditions of protection intended to preserve the components of biological diversity, to fight against desertification, erosion, loss of arable land and pollution of the soil and its resources by chemicals, pesticides and fertilisers; ▪ The list of fertilisers, pesticides and other chemical substances the use of which is authorised or encouraged in agricultural work; ▪ The authorised quantities and the methods of use so that the substances do not affect the quality of the soil or other receiving environments; ▪ The state and local communities have an obligation to protect the soil and the subsoil. They must put in place appropriate monitoring and control arrangements
Waste and Waste management (Article L 30)	Waste must be disposed of or recycled in an environmentally sound manner in order to eliminate or reduce its harmful effects on human health, natural resources, flora and fauna or the quality of the environment.
Waste and Waste management (Article L 31)	Anyone who produces or holds waste must ensure its own elimination or recycling or have it eliminated or recycled at companies approved by the

Reference	Contents
	Minister responsible for the environment. Otherwise, they must deliver this waste to the local community or to any company approved by the state for waste management. This company, or the local authority itself, can sign contracts with the producers or holders of waste with a view to their elimination or recycling. Recycling must always be done according to the Senegal standards.
Waste management (Article L 37)	Disposal of waste by industrial, production and / or processing structures must be carried out with the authorization and supervision of the Ministry responsible for the environment.
Noise and noise pollution (Article L 9), (Article L.10)	Factories, workshops, depots, construction sites, mines and, in general, industrial, craft or commercial installations operated or owned by any natural or legal person, public or private, and all other activities which present either dangers to health, safety, public sanitation, agriculture, nature and the environment in general, or inconvenience to the convenience of the neighborhood. The installations referred to in Article L 9 are divided into two classes. Depending on the danger or the seriousness of the inconveniences that their operation may present, they are subject to either authorization or declaration.
Prevention and fight against pollution and nuisances (Article L 11)	The first class includes installations which present serious dangers or inconveniences for the interests referred to in Article L 9. The operation of these installations may only be authorised on condition that measures specified, by ministerial decree, are taken to prevent these dangers or inconveniences.
Prevention and fight against pollution and nuisances (Article L 13)	The installations classified in the first class must be the subject, before their construction or their commissioning, of an operating authorization issued by order of the Minister in charge of the environment under the conditions fixed by decree. This authorization is obligatorily subordinated to their remoteness, over a radius of at least 500 m, from dwellings, buildings usually occupied by third parties, establishments open to the public and areas intended for habitation, from a watercourse, a lake, a communication route, a water catchment. The operator must renew his request for authorization or his declaration either in the event of transfer, or in the event of an extension or significant modification of the installations. In the event of a change in operating rights, the new operator is required to make a declaration addressed to the Minister responsible for the environment.
Prevention and fight against pollution and nuisances (Article L 16)	The application for authorization of a first-class installation must be the subject of a public inquiry prescribed by decision of the State representative under these conditions set by decree.
Prevention and fight against pollution and nuisances: Technological risks (Article L 26)	The amount of each of these taxes is set according to the classification, nature, volume, toxicity of materials and products, the degradation caused and the size of the facilities. In the event of pollution observed by the competent services of the Ministry responsible for the environment or any other authorised structure, the site is repaired by the polluter(s). If the person responsible for the pollution has not been identified, the remediation is carried out by the environmental services. In this case, the works are paid from the environmental protection fund.

Reference	Contents
Prevention and fight against pollution and nuisances: Technological risks (Article L 27)	The annual duties and taxes relating to classified installations are collected by the Ministry of the Environment. They consist of area taxes, taxes on steam and gas pressure devices and pollution taxes. The annual fees are calculated as follows: a) Fixed rights: – 30,000 F for the 1st class and 10,000 F for the 2nd class. b) Area taxes: – for the equipped surface 150 F CFA / m² / year – for the unequipped surface 75 F CFA / m² / year
Prevention and fight against pollution and nuisances: Technological risks (Article L 56)	The operator of any classified installation subject to authorization is required to establish an internal operation plan to ensure the alert of the competent authorities and neighboring populations in the event of a disaster or threat of disaster, the evacuation of personnel and the means of circumscribing the causes of the incident. The operator of any classified installation subject to declaration may, by order of the Minister responsible for the Environment taken after consultation with the other ministers concerned, be required to establish an internal operation plan for the same purposes. The internal operation plan must be approved by the Ministry of the Interior and the Ministries responsible for the Environment, Industry as well as the Ministry of Public Health and any other concerned Ministry. These Ministries periodically ensure the effective implementation of the prescriptions issued by the internal operation plan and the good condition of the equipment assigned to these tasks.
Prevention and fight against pollution and nuisances: Technological risks (Article L 57)	Inter-ministerial decrees set the conditions for the development, content and implementation modalities of emergency plans and internal operations. In the implementation of these plans, it may in particular be carried out by the administrative authorities: a) The requisition of people and goods; b) Temporary occupation and crossing of private property. These acts of the administrative authorities must in all cases comply with the laws and regulations in force.

4.1.5 Forestry Code

Law n ° 2018-25 of 02/11/2018, Article 27 of the forest code stipulates that downgrading of a forest or land intended for forestry can only take place for reasons of general interest or for the transfer of responsibilities from the State in terms of forest management for the benefit of a local authority, which guarantees the sustainability of the forest. "

Article 28 states that any occupation of the classified forest domain by extractive and industrial activities, in particular quarrying, excavation or exploration, likely to alter the soil or forest formations, is subject to prior authorization from the Ministry in charge of Water and Forests. The operation must respect the procedure provided for by the clearings. The restoration of the premises must be done by the operator at his expense following the agreement provisions. "

4.1.6 The Labour Code

The following table describes the relevant Labour Legislation, outlined in the Labour Code.

Table 4-2 Labour Code of Senegal

Reference	Contents
Law No. 97-17 of December 1, 1997 Labor Code Article L.3: Any natural or legal person under public or private law employing one or more workers within the meaning of Article L.2 is subject to the provisions of this code.	The company in charge of the project is required to respect the provisions prescribed in the labor code. Thus, it must bring to the attention of the labor all the processes, substances and materials that may lead to the exposure to occupational risks. This information must include appropriate instructions in order to prevent any risk. In addition, it is required to regularly monitor compliance with regulatory safety and health standards, and to periodically carry out measurements, analyses and evaluations of ambient conditions and, if necessary, undertake protective measures, collective or individual in order to prevent attacks on the health and safety of workers. In addition, it is required to organise a social work safety service and a health and safety committee. And when the company hires more than 500 workers, social service is compulsory. It is also required to respect the legal working time which in Senegal must not exceed forty hours (40h) per week. All in all, it is under an obligation not to infringe the rights and freedoms granted to workers.
Decree No. 2006-1251 of November 15, 2006 relating to work equipment Article 1 "This decree applies to employers, workers and establishments falling within the scope of the Labor Code."	In accordance with this decree, the company's work equipment must be installed so that their stability is ensured but also and above all be appropriate for the tasks to be performed so that the health and safety of workers are guaranteed. In addition, all dangerous moving parts of the equipment must be made inaccessible to workers. In addition, work equipment must be installed and equipped in such a way that workers are not exposed to risks due to projections of objects, particles or dust associated with the normal use of work equipment, in particular splashes of chips, incandescent welding products, waste, or resulting foreseeable use of work equipment, including projection of machined parts, tooling fragments. Finally, when it is technically impossible to completely eliminate the nuisance caused by work equipment, the company must provide workers with suitable personal protective equipment.
Decree No. 94-244 of March 7, 1994 setting the organizational and operating procedures for occupational health and safety committees	In relation to this provision, if CIMAF recruits 80 employees during the operational phase, it has the obligation to have in the establishment a health and safety committee set up by the Labor and Safety Inspector. Social responsibility of Thiès comes under its authority or that of its representative.

Reference	Contents
Article 1: An occupational health and safety committee must be established in the establishments mentioned in Article 2 of the Labor Code employing equal or more than fifty (50) employees.	The mission of the committee will be: to contribute to the protection of the health and safety of the establishment's employees and those made available to it by an external establishment, including temporary workers, as well as to the improvement of conditions working; to carry out or to have carried out an investigation on the occasion of each industrial accident or serious occupational disease which has resulted in death or which appears to result in permanent incapacity or which has revealed the existence of a serious danger to the worker 'occasion of a series of repeated accidents or accidents involving several workers; to ensure the application of legislative and regulatory requirements and instructions concerning health and safety as well as the proper maintenance of protective measures. Failure to respect these rights recognised to workers by CIMAF is liable to sanctions.
Decree n ° 2006-1252 of November 15, 2006 fixing minimum requirements for the prevention of certain physical environmental factors Article 1 This decree applies to employers, to workers and establishments falling within the scope of the Labor Code.	This text sets the minimum requirements intended to protect workers against any kind of accident that may result from insufficient lighting, thermal stress or a level high sound. As such, it recommends a number of measures based on the general principles of noise, heat and lighting prevention. Therefore, CIMAF must ensure that: the sound level is not an obstacle to the intelligibility of communications or constitute an annoyance and subsequently cause, in the long term, occupational deafness.
Decree No. 2006-1258 of November 15, 2006 setting the missions and rules of organization and operation of the Occupational Medicine services Article I Are subject to the provisions of this decree and the decrees for its application, public and private establishments of any kind where workers are employed within the meaning of Article 2 of the Labor Code.	In accordance with this decree, CIMAF is required to organise an inter-company occupational medical service or to join an inter-company occupational medical service. The occupational physician will be the adviser to the head of the company or his representative, employees, representatives, staff and social services with regard to, in particular: a) improvement of living and working conditions in the establishment; b) the adaptation of positions, techniques and working rhythms to human physiology; c) the protection of employees against all nuisances and, in particular against the risk of work accidents or the use of dangerous products; d) the general hygiene of the establishment; e) Health prevention and education within the establishment, in connection with professional activity. In order to carry out these missions, the occupational physician will carry out actions in the workplace and carry out medical examinations.
Decree No. 2006-1250 of November 15, 2006 relating to the movement of vehicles and machinery within companies Article I Establishments of any kind where workers are employed within the meaning of Article L.3	As CIMAF is an employee within the meaning of Article L 3 of the Labor Code, it is required to respect the principles laid down by this decree. Thus, within its operating perimeter, the traffic lanes as well as the traffic, loading and unloading, waiting and parking areas must have suitable dimensions, bordered by a visible line and equipped with signage. The establishment of safety distances and information will protect workers at their workstations against the risks of the movement of machinery.

Reference	Contents
of the Labor Code are subject to the provisions of this decree.	
Decree No. 2006-1261 of November 15, 2006 setting general health and safety measures in establishments of all kinds Article I This decree applies to employers, workers and establishments falling within the scope of the Labor Code	Since CIMAF is subject to the provisions of the Labor Code, it is required to preserve the safety and health of workers by carrying out technical maintenance of workplaces and installations, so that any defects observed and likely to affect safety and workers' health are eliminated. It must also maintain the premises on a regular basis by checking the operation of existing safety devices and clear the traffic lanes leading to exits and emergency exits to be used at any time.
Decree No. 2006-1257 of November 15, 2006 setting the minimum requirements for protection against chemical risks Article 1 This decree applies to employers, workers and establishments falling within the scope of the Labor Code. Article 2. Its object is the protection of workers against risks to their health and safety. The prevention of such risks is mandatory.	This decree, which supplements the regulatory arrangements relating to the import, handling, transport, storage and sale of dangerous chemicals and pesticides taken on the joint proposal of the ministers responsible for agriculture and Environment, determines the conditions of use of chemicals in companies as well as the means of protecting workers against any harm. Thus, for any activity likely to present a risk of exposure to chemical risks, the nature, degree and duration of workers 'exposure must be determined in order to be able to assess any risk to workers' health and to determine the measures to take. If the nature of the activity allows it, the employer must avoid the use of a dangerous chemical, by replacing it with a chemical which, depending on the conditions of use and in the current state of knowledge, is not dangerous or is less dangerous for the health of the workers. If the results of the evaluation carried out reveal the existence of a risk to the safety of workers, their exposure must be avoided. When this is not technically feasible, taking into account the activity, the risk of exposure should be reduced to a level low enough to adequately protect the health and safety of the workers concerned.
Decree n ° 2006-1256 of November 15, 2006 fixing the obligations of employers in terms of safety at work Chapter II. - Obligation of employers - Art. 6. The employer shall take the necessary measures to ensure the promotion of the safety and health of workers, including activities for the prevention of occupational risks, information and training, as well as the establishment of an organization and of necessary means.	CIMAF must ensure that these measures are adapted to take account of changed circumstances and to improve existing situations. CIMAF must implement the measures provided for in the first paragraph of this article on the basis of the following general prevention principles: a) avoid risks; b) assess the risks that cannot be avoided; c) combat risks at source; d) adapt work to humans, in particular with regard to the design of workstations, work as well as the choice of work equipment, work and production methods, in particular with a view to reducing monotonous work, rhythmic work and reduce the adverse effects thereof on health; e) take into account the state of the art; f) replace what is dangerous with what is not dangerous or with what is less dangerous;

Reference	Contents
	g) planning prevention by aiming for a coherent whole that integrates technique, work organization, working conditions, social relations and h) the influence of environmental factors at work; i) take collective protection measures as a priority over individual protection measures; j) give appropriate instructions to workers.
Decree No. 89-1539 of 12/19/1989 relating to the manufacture, import, conservation, transport and use of explosive substances Article 4: Any natural or legal person using explosive substances in mining and quarrying work is subject to the provisions of this decree.	In accordance with this provision, CIMAF must prepare a list of the explosives it will use in order to allow immediate control at all stages of storage and use. It is also required to comply with the conditions for transporting explosives in accordance with article R 121 of this decree.
Ministerial Order No. 852 dated February 8, 2002 establishing the National Commission for the Management of Chemicals ARTICLE 1 Pursuant to the law establishing the Environmental Code, in article L 45, a national chemical products management commission is created, the composition of which is set by order of the Minister responsible for the Environment. The task of this commission will be to control and monitor the import, use, production and movement of chemical, harmful or dangerous substances.	In accordance with this provision, CIMAF cannot and must not use chemicals that do not appear in the list of chemicals and active ingredients authorised by the National Commission for the Management of Chemicals.
Urbanism Law n ° 2013-10 of December 28, 2013 on the general code of local authorities Article 304	Competence of the mayor to issue the building permit
Sanitation Law No. 2009-24 of July 8, 2009 on the Sanitation Code Article L.3	Any discharge, runoff, deposit, throwing, burial and direct or indirect immersion of liquid waste, of domestic and industrial origin in the natural environment must be subject to prior decontamination under the conditions set by the texts in force.

Reference	Contents
Article L.61	When the classified installation is supplied with water in whole or in part from a source other than the public network, it must install and maintain, at its expense, a device for counting the volumes of water consumed. The sanitation service has access to the various water meters consumed.

4.1.7 Emissions Standards

Air Emissions

The following section describes the air emissions legislation for Senegal, the Senegalese Standard NS05-062, October 2003, Air pollution: Discharge standard (Table 4-3).

Table 4-3 Air Emissions Standards for Senegal

Subject	Description
Emissions characteristics	Limit values for emissions from existing and new stationary installations. The existing and new stationary installations must be equipped and operated in such a way as to respect the maximum limitation of emissions set in appendices I, II, III of the Senegalese standard. ▪ Capture and evacuation of emissions; ▪ Emissions are captured as completely and as close to their source as possible, and exhausted in such a way that excessive emissions do not result; ▪ The operator must take all necessary measures in the design and operation of installations to reduce air pollution at the source; and ▪ Apparatus, indicating the direction and speed, if necessary, of the wind must be installed near installations liable to emit dangerous substances into the atmosphere in the event of a malfunction.
Discharge monitoring	▪ The operator must put in place a program to monitor its releases. The measurements are carried out under the responsibility of the operator and at his expense under the conditions set by the authorization order; ▪ The authorization order may, for certain specific pollutants and certain processes, state the requirement for the replacement of certain monitoring measures by continuously monitoring of a parameter representative of the pollutant. In this case, control and calibration measurements are carried out periodically, at a frequency set in agreement with the competent administrative authority, by a competent external body; ▪ When the quantities of pollutants discharged are greater than the limit values, the authorization order must set the list of parameters to be measured and the frequency of measurements as well as the sampling conditions. At least once a year, these measurements should be carried out by an approved body or one chosen in agreement with the competent administrative authority; and ▪ The results of the measurements must be sent at least quarterly to the competent administrative authority, accompanied by comments, if necessary, on the causes of the violations observed as well as on the corrective actions implemented or envisaged"

The tables below (Table 4-4, Table 4-5 and Table 4-7) describe the maximum limit values for emissions for stationary ‘and special’ installations as well as the limit values emissions from cement kilns and hydraulic lime kilns.

Table 4-4 Concentration of Emissions of Air Polluting Substances

Substances	Flow rate	Rejection Limit Values
Total Dust	D <= 1 kg/h D > 1 kg/h	100 mg/m^3 50 mg/m^3

Table 4-5 describes the maximum limit values for emissions for installations.

Table 4-5 Limit Values for Dust Emissions from Gaseous Emissions from Cement Kilns & Hydraulic Lime Kilns

Origin	Limit
Oven	50 mg/m^3
Cooler	100 mg/m^3
Other	50 mg/m^3

Table 4-6 Limit Values for Other Gaseous Emissions from Cement Kilns & Hydraulic Lime Kilns

Nature	Limit
Sulphur oxides	800 mg/m^3
Nitrogen oxides	1,300 mg/m^3

Table 4-7 describes the maximum emission limit values for stationary combustion engines.

Table 4-7 Emission Limit Values in Boilers

Substance mg/Nm^3	Natural Gas	GPL	Coke Gas	Gas HF	Liquid	Solid	Biomass
	Thermal strength more than 20 MWTH less than or equal to 50 MWTH						
SO_2	35	5	800	800	175	1,700	2,000
NO_X	180	200	200	200	200	600	600
Dust	5	5	10	10	50	100	75
CO	100	100	250	250	100	100	200
	Thermal strength more than 50 MWTH less than 100 MWTH						
SO_2	35	5	800	800	1,700	2,000	200
NO_X	180	200	200	200	400	400	400
Dust	5	5	10	10	50	50	50
CO	100	100	250	250	100	200	200
	Thermal strength more than 100 MWTH less than 300 MWTH						
SO_2	35	5	800	800	1,700	2,400	200
NO_X	180	200	200	200	200	200	300
Dust	5	5	10	10	50	50	50

CO	100	100	250	250	100	200	200
	Thermal strength more than 300MWTH less than 500MWTH						
SO_2	35	5	800	800	3,650	1,200	200
NO_X	180	200	200	200	200	200	200
Dust	5	5	10	10	50	50	50
CO	100	100	250	250	100	200	200
	Thermal strength greater than 500 MWTH						
SO_2	35	5	800	800	400	200	200
NO_X	180	200	200	200	200	200	200
Dust	5	5	10	10	50	50	50
CO	100	100	250	250	100	200	200

Wastewater

The following section describes the wastewater emissions legislation for Senegal, Senegalese Standard NS 05-061.

Published in July 2001, Standard NS 05-061 sets the limit for the quality of wastewater before discharge into the natural environment and before connection to a collective wastewater treatment plant. The standard also sets the conditions for spreading effluents and residual sludge. These limit values are presented in Table 4-8 and Table 4-9.

Table 4-8 Limit Values for the Discharge of Wastewater into the Natural Environment

Parameter	Value Limit
Total suspended solids	50 mg/l
DBO5	80 mg/l if the maximum authorised daily flow does not exceed 30 kg/d, 40 mg/l beyond
DCO	200 mg/l if the maximum authorised daily flow does not exceed 100 kg/d; 100 mg/l above
Total nitrogen	30 mg/l in monthly average concentration when the maximum daily flow is equal to or greater than 50 kg/day
Total phosphorus	10 mg/l in monthly average concentration when the maximum authorised daily flow is equal to or greater than 15 kg/day
Phenol index	0.5 mg/l if the discharge exceeds 5 g/d
Phenols	0.5 mg/l if the discharge exceeds 5g/d
Chrome hexavalent	0.2 mg/l if the discharge exceeds 5 g/d
Cyanides	0.2 mg/l if the release exceeds 3 g/d
Arsenic (As)	0.3 mg/l if the discharge exceeds 3 g/d
Chrome total (Cr^3)	1.0 mg/l if the release exceeds 10 g/d

Parameter	Value Limit
Total Hydrocarbons	15 mg/l if the discharge exceeds 150 g/d

Table 4-9 Wastewater Quality Limit Values before Connection to a Collective WWTW Plant

Parameter	Value Limit
Total suspended solids	600 mg/l
DBO5	800 mg/l
DCO	2,000 mg/l
Nitrogen total	150 mg/l
Phosphor total	50 mg/l

4.1.8 Relevant International Conventions and Treaties

In the area of environmental and natural resource management, Senegal is a signatory to almost all international conventions and is committed to regional and international organizations in the implementation of sustainable development strategies. Project relevant conventions and treaties are:

- The United Nations Framework Convention on Climate Change (UNCAC) signed in June 1992 and ratified on June 14, 1994;
- The Geneva Convention (13/11/1979) for Long-Range Transboundary Air Pollution (LRTAP) and its protocols:
- Kyoto Protocol;
- Helsinki Protocol relating to the reduction of sulphur emissions or their transboundary flows by at least 30% (07/08/1985);
- Sofia Protocol relating to the reduction of nitrogen oxides and their transboundary flows (31/10/1998);
- Geneva Protocol relating to the control of emissions of volatile organic compounds (18/11/1991);
- Oslo Protocol on Further Reduction of Sulphur Emissions (06/14/1994);
- Gothenburg Protocol on the reduction of acidification, eutrophication and tropospheric ozone (reduction of sulphur dioxide, ammonia, NO_x and VOC emissions (2010)) (01/02/1998),
- The Convention on Biological Diversity (CBD) signed in June 1992 and ratified on June 14, 1994; The United Nations Convention to Combat Desertification ratified in March 1995;
- The African Convention on the Conservation of Nature and Natural Resources, adopted in Algiers on March 15, 1968, ratified in 1971;
- The Convention concerning the protection of the world cultural and natural heritage adopted in Paris on November 16, 1972;
- The Convention on International Trade in Endangered Species of Wild Fauna and Flora, adopted in Washington on March 3, 1973, (CITES);
- The Vienna Convention for the Protection of the Ozone Layer adopted in Vienna on March 22, 1985; - The Montreal Protocol on Substances that Deplete the Ozone Layer, adopted in Montreal on September 16, 1987;
- The Convention on Climate Change adopted in Rio on June 5, 1992;

- The International Convention to combat desertification in countries seriously affected by drought and / or desertification, in particular in Africa, signed in Paris on June 14, 1994;
- The Convention on Persistent Organic Pollutants, adopted in Stockholm (Sweden) on May 22, 2001: This convention regulates certain organic pollutants.
- Convention 155 on health and safety in the workplace;
- Convention 187 on the promotional framework for occupational safety and health;
- Regulation 18/2003 / cm / West African Economic and Monetary Union (UEMOA) adopting the UEMOA community mining code: governs all operations relating to prospecting, research, exploitation, possession, circulation, treatment, transport, possession, processing and marketing of mineral substances on the entire territory of the Union, with the exception of liquid or gaseous hydrocarbons. Senegal being a member country of the Union obliges the Project to comply with the provisions of this code.
- The Extractive Industries Transparency Initiative (EITI): The EITI sets an international standard for companies to disclose what they pay and for governments to disclose what they receive. The government of Senegal has established a standing committee to conduct mining revenue audits and to publish audited information on mines in the country. It has engaged in capacity building exercises directed at key people in public institutions and private companies involved in revenue data management, in order to master the requirements of the EITI process.

4.2 International Standards

4.2.1 IFC Performance Standards

The IFC, a division of the World Bank Group, released their Sustainability Policy and Environmental and Social Performance Standards (January 2012).

The IFC Performance Standards (PSs) are regarded as the global benchmark for best international E&S practice for projects seeking lender funding.

The PSs are directed towards providing guidance on how to identify risks and impacts, and are designed to help avoid, mitigate and, manage risks and impacts as a way of doing business in a sustainable way, including stakeholder engagement and disclosure obligations of the client in relation to project-level activities. In the case of direct investments for the IFC (including project and corporate finance provided through financial intermediaries), the IFC requires that its clients apply the PSs to manage environmental and social risks and impacts so that development opportunities are enhanced.

A summary of the requirements of each of the eight IFC PSs are presented in Table 4-10 below.

Table 4-10 IFC Performance Standards

Performance Standards	Key Requirement
IFC PS1: Assessment and Management of Environmental and Social Risks and Impacts	This PS relates to integrating and managing environmental and social performance throughout the life of a project in line with national regulations and international standards. The standard requires the development of an Environmental and Social Management System (ESMS) that entails a structured approach to managing environmental and social risks and impacts. Moreover, the PS describes how environmental and social issues are to be handled in project development and serves as the core around which the other standards are framed. This standard requires that nearby communities be appropriately engaged on issues that could potentially affect them. Key requirements to this end include:

Performance Standards	Key Requirement
	▪ Conducting an informed consultation and participation process with affected communities; ▪ Working in an inclusive and culturally appropriate manner; ▪ Addressing the needs of disadvantaged or vulnerable groups; and ▪ Making available an effective grievance management system.
IFC PS2: Labour and Working Conditions	This PS aims to ensure that the client establishes, maintains and improves a worker-management relationship that promotes the fair treatment, non-discrimination and equal opportunity of workers, and compliance with national labour and employment laws and international standards (as defined by the International Labour Organisation (ILO). In particular, PS2 addresses child labour and forced labour, and promotes safe and healthy working conditions, and protecting and promoting the health of workers by recognising the role of employees.
IFC PS3: Resource Efficiency and Pollution Preventions	This PS aims to abate pollution to air, water, and land that may threaten people and the environment at the local, regional, and global levels. This PS promotes the ability of private sector companies to adopt resource (energy, water, other resources) efficiency and manage wastes by implementing efficient technologies and practices where feasible.
IFC PS 4: Community, Health, Safety and Security	The role of this PS is to anticipate and avoid adverse impacts on the health and safety of the affected communities throughout the life of the project as a result of routine and none routine events. The PS also requires an assessment of how use of security by the project to safeguard personnel and property could impact on community security taking into account considerations of human rights.
IFC PS5: Land Acquisition and Involuntary Resettlement	PS5 refers to the management of physical and economic displacement resulting from project-related land acquisition through resettlement and livelihood restoration processes. Objectives are to: a) To avoid, and when avoidance is not possible, minimise displacement by exploring alternative project designs. b) To avoid forced eviction. c) To anticipate and avoid, or where avoidance is not possible, minimise adverse social and economic impacts from land acquisition or restrictions on land use by: d) Providing compensation for loss of assets at replacement cost; and e) Ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected. f) To improve, or restore, the livelihoods and standards of living of displaced persons. g) To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.
IFC PS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	This PS aims to protect and conserve biodiversity based on the Convention on Biological Diversity. It divides habitat into three categories, modified, natural, and critical. For projects in natural habitat, mitigation measures should be designed to achieve no net loss of biodiversity where feasible. For projects in critical habitats, the project's mitigation strategy should be described in a Biodiversity Action Plan and be designed to achieve net gains of those biodiversity values for which the critical habitat was designated.

Performance Standards	Key Requirement
IFC PS7: Indigenous Peoples	This PS deals with safeguarding Indigenous Peoples. The aim of this PS is to protect the interests of Indigenous Peoples during project implementation. On a broader scale, it requires project implementation to avoid adverse impacts on Indigenous Peoples as well as ensuring their participation and consent.
IFC PS8: Cultural Heritage	Cultural heritage, according to this PS, refers to tangible forms of cultural heritage, such as tangible movable or immovable objects, property, sites, structures, or groups of structures, having archaeological (prehistoric), paleontological, historical, cultural, artistic, and religious values; unique natural features or tangible objects that embody cultural values, such as sacred groves, rocks, lakes, and waterfalls; and certain instances of intangible forms of culture that are proposed to be used for commercial purposes, such as cultural knowledge, innovations, and practices of communities embodying traditional lifestyles.

4.2.2 WBG General EHS Guidelines

The EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP) and are referred to in the World Bank's Environmental and Social Framework and in IFC's Performance Standards.

The EHS Guidelines contain the performance levels and measures that are normally acceptable to the World Bank Group, and that are generally considered to be achievable in new facilities at reasonable costs by existing technology.

Table 4-11 WBG EHS General Guidelines

WBG General EHS Guidelines	
Environmental	Air Emissions and Ambient Air Quality
	Energy Conservation
	Wastewater and Ambient Water Quality
	Water Conservation
	Hazardous Materials Management
	Waste Management
	Noise
	Contaminated Land
Occupational Health and Safety	General Facility Design and Operation
	Communication and Training
	Physical Hazards
	Chemical Hazards
	Biological Hazards
	Radiological Hazards
	Personal Protective Equipment (PPE)
	Special Hazard Environments

	Monitoring
Community Health and Safety	Water Quality and Availability
	Structural Safety of Project Infrastructure
	Life and Fire Safety (L&FS)
	Traffic Safety
	Transport of Hazardous Materials
	Disease Prevention
	Emergency Preparedness and Response
Construction and Decommissioning	Environment
	Occupational Health & Safety
	Community Health & Safety

4.2.3 WBG EHS Guidelines for Construction Materials Extraction

In the WBG EHS Guidelines for Construction Materials Extraction the following aspects are given specific management actions relevant to construction materials extraction activities such as limestone extraction.

Table 4-12 WBG EHS Guidelines Construction Materials Extraction

Industry-Specific Impacts and Management		
Environment	Air Emissions	Particulate Matter
		Other Air Pollutants
	Noise and Vibrations	Noise
		Vibrations
	Water	Consumption
		Hydrology
		Wastewater Discharge
		Hazardous Materials
		Acid Drainage
	Waste	Solid Waste
	Land Conversion	-
Occupational Health and Safety	Respiratory Hazards	-
	Noise	-
	Physical Hazards	Machine / Equipment Use & Safety
		Explosives
	Land Instability	-

Community Health and Safety	Water	-
	Explosives Safety	-
	Decommissioning	Physical Integrity
		Chemical Integrity
		Ecological Habitat Integrity
Performance Indicators and Monitoring		
Environment	Emission and Effluent Guidelines	-
	Environmental Monitoring	-
Occupational Health and Safety	Occupational Health and Safety	-
	Accident and Fatality Rates	-
	Occupational Health and Safety	-

4.2.4 WBG EHS Guidelines for Cement and Lime Manufacturing

The WBG EHS Guidelines for Cement and Lime Manufacturing are outlined in this document. The environmental issues in cement and lime manufacturing projects primarily include the items described in Table 4-13 below.

Table 4-13 WBG EHS Guidelines for Cement and Lime Manufacturing

Aspect	Potential Impact Source
Air Emissions	Exhaust Gases
	Particulate matter
	Nitrogen Oxides
	Sulphur Dioxides
	Greenhouse gases
	Heavy Metals and Other Air Pollutants
	Waste fuels
Energy Consumption and Fuels	Kilns
	Coolers
	Fuels
Wastewater	Industrial Process Wastewater Treatment
	Other Wastewater Streams & Water Consumption
Solid Wastes	
Noise	
OHS	Dust
	Heat

	Noise and Vibrations
	Physical hazards
	Radiation
	Chemical Hazards and other Industrial Hygiene Issues

5. THE ESIA PROCESS

5.1 Introduction

The purpose of impact assessment is to identify and evaluate the significance of potential impacts on identified receptors (baseline) and resources according to defined assessment criteria, and to develop and describe mitigation measures / recommendations that will be taken to avoid or minimise any potential adverse effects and to enhance potential benefits.

Impacts for both construction and operation were considered.

The potential impacts of the proposed Project were identified based on the findings of stakeholder consultation, the existing baseline conditions, the proposed Project activities and professional knowledge of the consultants. Impacts were distinguished as either positive or negative.

5.2 Gap Assessment

Both the IFC and ERM undertook a review and gap analysis of the existing Project ESIA and outcomes in order to identify the gaps in alignment with the requirements of the IFC PSs, and to identify where further action was necessary in order to adhere to the requirements of the said standards.

5.3 Scoping

The purpose of the scoping stage was to identify key sensitivities and those activities with the potential to contribute to, or cause, potentially significant impacts to environmental and socio-economic receptors and resources, and to evaluate siting, layout and alternatives for the proposed Project. The key objectives of scoping were to:

- Identify the potentially most significant impacts;
- Obtain stakeholder views through consultation; and
- Develop an understanding of the context for the ESIA through consultation to ensure that the ESIA process and associated reporting output are focused on the key issues.

The ESIA process focuses on these key issues through the collection of information on existing environmental and social conditions; engagement with stakeholders; understanding the potential impacts to the physical, biophysical and social environment; and developing the measures to avoid/control and monitor these impacts.

5.4 Baseline Data Collection

One of the main objectives of the ESIA process will be to collect *suitable* data on the physical, biophysical and social environments, so as to understand what receptors and resources have the potential to be *significantly* affected by the Project. It will also describe baseline conditions that have been used to make the assessment of both social and environmental impacts. The description of the baseline will be aimed at providing sufficient detail to meet the following objectives:

- Identify the key conditions and sensitivities in areas potentially affected by the Project;
- Provide a basis for extrapolation of the current situation, and development of future scenarios without the Project;
- Provide data to aid the prediction and evaluation of possible impacts of the Project;
- Understand stakeholder concerns, perceptions and expectations regarding the Project;
- Allow the Project to develop appropriate mitigation measures later in the ESIA process; and

- Provide a benchmark to assess future changes and to assess the effectiveness of mitigation measures.

5.5 Stakeholder Engagement

The key principle of engagement is to ensure that the views of stakeholders are taken into account and reported throughout the ESIA process. The objective is to ensure the assessment is robust, transparent and has considered the full range of issues or perceptions, and to an appropriate level of detail. All stakeholder engagement activities have taken gender sensitivities into consideration, particularly when engaging with local communities.

5.6 Impact Types and Definitions

An impact is any change to a resource or receptor brought about by the presence of a Project component or by the execution of a Project related activity. The evaluation of baseline data provides crucial information for the process of evaluating and describing how the Project could affect the biological, physical and socio-economic environment.

Impacts are described according to their nature or type, as summarised in Table 5-1.

Table 5-1 Impact Nature and Type

Nature or Type	Definition
Positive	An impact that is considered to represent an improvement on the baseline or introduces a positive change.
Negative	An impact that is considered to represent an adverse change from the baseline or introduces a new undesirable factor.
Direct impact	An impact that results from a direct interaction between a planned project activity and the receiving environment/receptors (e.g. between occupation of a site and the pre-existing habitats or between an effluent discharge and receiving water quality).
Indirect impact	An impact that results from other activities that are encouraged to happen as a consequence of the Project (e.g. in-migration for employment placing a demand on resources).
Induced impact	An impact that results from other activities (which are not part of the Project) that happen as a consequence of the Project (e.g. influx of camp followers resulting from the importation of a large Project workforce).
Cumulative impact	An impact that acts together with other impacts (including those from concurrent or planned future third-party activities) to affect the same resources and/or receptors as the Project.

5.6.1 Assessing Significance

Impacts are described in terms of ‘significance’. Significance is a function of the magnitude of the impact and the sensitivity/vulnerability/importance of resource/receptor.

5.6.2 Determining Impact Magnitude

Impact magnitude (sometimes termed severity) is a function of the type, extent, duration, scale and frequency of the impact. These characteristics apply to both planned and unplanned events/ impacts and are briefly described in Table 5-2.

An additional characteristic that pertains only to unplanned events is likelihood. The likelihood of an unplanned event occurring is designated using a qualitative scale, as described in Table 5-3.

Table 5-2 Impact Characteristics Terminology

Characteristic	Definition	Designations
Type	A descriptor indicating the relationship of the impact to the Project (in terms of cause and effect).	Direct Indirect Induced
Extent	The "reach" of the impact (e.g., confined to a small area around the Project Footprint, projected for several kilometres, etc.).	**Local** - impacts that affect an area in a radius of 20km around the development site. **Regional** - impacts that affect regionally important environmental resources or are experienced at a regional scale as determined by administrative boundaries, habitat type/ecosystem. **International** - impacts that cross national borders, affect nationally important environmental resources or affect an area that is nationally important/or have macro-economic consequences.
Duration	The time period over which a resource / receptor is affected.	**Temporary** - impacts are predicted to be of short duration and intermittent/occasional. **Short-term** - impacts that are predicted to last only for the duration of the construction period. **Long-term** - impacts that will continue for the life of the Project, but ceases when the Project stops operating. **Permanent** - impacts that cause a permanent change in the affected receptor or resource (e.g. removal or destruction of ecological habitat) that endures substantially beyond the Project lifetime.
Scale	The size of the impact (e.g., the size of the area damaged or impacted, the fraction of a resource that is lost or affected, etc.)	[no fixed designations; intended to be a numerical value or a qualitative description of "intensity"]
Frequency	A measure of the constancy or periodicity of the impact.	[no fixed designations; intended to be a numerical value or a qualitative description]

Table 5-3 below describes the various likelihood designations related to the impacts.

Table 5-3 Definition for Likelihood Designations

Likelihood	Definition
Unlikely	The event is unlikely but may occur at some time during normal operating conditions.
Possible	The event is likely to occur at some time during normal operating conditions.
Likely	The event will occur during normal operating conditions (i.e., it is essentially inevitable).

The overall magnitude of an impact is a combination of the above characteristics. The universal magnitude designations are:

- Negligible;
- Small;
- Medium; and
- Large.

5.6.3 Determining Sensitivity/Vulnerability/Importance of Resource/Receptor

There are a range of factors to be taken into account when defining the sensitivity/ vulnerability /importance of the resource/receptor, which may be physical, biological, cultural or human. Other factors may also be considered when characterising sensitivity/vulnerability/importance, such as legal protection, government policy, stakeholder views and economic value.

As for the case of magnitude, the sensitivity/vulnerability/importance designations themselves are universally consistent, but the definitions for these designations vary on a resource/receptor basis. The sensitivity/vulnerability/importance designations used herein for all resources/receptors are:

- Low;
- Medium; and
- High.

Table 5-4 presents an illustrative example of the sensitivity/ vulnerability/ importance of the resource/ receptor.

Table 5-4 Illustrative Example of Sensitivity/Vulnerability/Importance of the Resource/Receptor

Designation	Receiving environment	
	Biophysical environment	Socio-economic environment
Low	The impact affects the environment in such a way that natural functions and processes are not affected.	People/communities are able to adapt with relative ease and maintain pre-impact livelihoods.
Medium	Where the affected environment is altered but natural functions and processes continue, albeit in a modified way.	People/communities are able to adapt with some difficulty and maintain pre-impact livelihoods but only with a degree of support.
High	Where natural functions or processes are altered to the extent that they will temporarily or permanently cease.	Affected people/communities will not be able to adapt to changes or continue to maintain-pre impact livelihoods.

5.6.4 Determining Impact Significance

As earlier stated above, Impact Significance is a function of the magnitude of the impact and the sensitivity/vulnerability/importance of resource/receptor. As presented in Table 5-5 below, the impact significance can be Negligible, Minor, Moderate or Major.

Table 5-5 Impact Significance

SIGNIFICANCE				
		Sensitivity/Vulnerability/Importance of Resource/Receptor		
		Low	Medium	High
MAGNITUDE	Negligible	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major

Table 5-6 below presents a brief description of the different categories of Impact Significance.

Table 5-6 Significance Definitions

Significance definitions	
Negligible significance	An impact of negligible significance (or an insignificant impact) is where a resource or receptor (including people) will not be affected in any way by a particular activity, or the predicted effect is deemed to be 'negligible' or 'imperceptible' or is indistinguishable from natural background variations.
Minor significance	An impact of minor significance is one where an effect will be experienced, but the impact magnitude is sufficiently small (with and without mitigation) and well within accepted standards, and/or the receptor is of low sensitivity/value.
Moderate significance	An impact of moderate significance is one within accepted limits and standards. The emphasis for moderate impacts is on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that 'moderate' impacts have to be reduced to 'minor' impacts, but that moderate impacts are being managed effectively and efficiently.
Major significance	An impact of major significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. A goal of the EIA process is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long term or extend over a large area. However, for some aspects, there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). An example might be the visual impact of a development. It is then the function of regulators and stakeholders to weigh such negative factors against the positive factors such as employment, in coming to a decision on the Project.

Note: It is important to note that the positive impacts are not rated, merely stated. It is considered sufficient for the purpose of the Impact Assessment to indicate that the Project is expected to result in a positive impact, without characterising the exact degree of positive change likely to occur. However, positive impacts are presented quantitatively where possible

5.7 Identification of Mitigation and Enhancement Measures

For activities with significant impacts, the Supplementary ESIA process will identify suitable and practical mitigation measures that can be implemented. Mitigation that can be incorporated into the Project design, in order to avoid or reduce the negative impacts or enhance the positive impacts, were defined in agreement with the Project Proponent.

Mitigation measures will be identified and recommended by the various specialists involved in the ESIA. These measures will then be described in the ESIA in the form of an Environmental and Social Management and Monitoring Plan (ESMMP).

The implementation of the mitigation is ensured through compliance with the ESMMP is included in this ESIA Report.

5.8 Residual Impact Evaluation

After first assigning significance in the absence of mitigation, each impact is re-evaluated assuming the appropriate mitigation measure(s) is/are effectively applied, and this results in a significance rating for the residual impact.

6. STAKEHOLDER ENGAGEMENT

6.1 Introduction

Stakeholders are persons or groups who:

- Are directly or indirectly affected by a project;
- Have an interest in a project; and/or
- Have the ability to influence the outcomes of, either positively or negatively.

This section presents the approach taken to stakeholder engagement in support of the development of the Supplementary ESIA and summarises stakeholder feedback collected during the consultation process in March 2021. It also includes an analysis of stakeholders to be engaged by the Project and recommendations on engagement going forward.

6.2 Approach

ERM and Harmony Group undertook a data collection process in March 2021 to inform preparation of the Supplementary ESIA. Engagement with local stakeholders was coordinated by Harmony Group through the Mayor of the Commune of Keur Moussa and then directly with the Village Chiefs of the communities in the Project's Area of Influence. In each community, efforts were made to conduct focus group discussions or key informant interviews with the following groups:

- Village Chief and elders;
- Farmers and herders;
- Women; and
- Youth.

Each discussion began with a presentation of the context for the consultation (i.e., development of a Supplementary ESIA for the CIMAF Project in accordance with lender requirements), given by Harmony Group. Harmony Group provided translation from French to local dialects (specifically Wolof and Serer) as needed. As noted above, a semi-structured interview technique was used to allow participants to guide the discussion. At the end of each discussion, participants were asked if they had any questions or additional comments. Consultation was scheduled to ensure adequate time for meaningful participation by all stakeholders; each focus group discussion took between 60 and 90 minutes. One hundred and eight (108) people participated in the consultations. Photos and participant lists are included in Annexes A and B.

The data collection process also included a household survey to establish a socioeconomic baseline in four settlements that are likely to be significantly affected by the Project. Where possible, the surveys were carried out only after the initial consultation was done by ERM and Harmony Group so that stakeholders were aware of the objectives of the data collection process and had a chance to ask questions or raise any concerns before surveyors arrived. In each case, the Village Chief was asked to inform local residents in advance of the surveyors' arrival to facilitate participation and ensure their availability.

Surveys were carried out by two experienced surveyors (one male, one female) from Harmony Group. Surveys were conducted with the Head of Household (or his/her representative in case of absence) in the presence of other household members, who were invited to supplement responses as needed. Forty-nine (49) households participated in the survey process, covering 226 household members (data was collected on household members 15 years and older).

As per Table 6-1 below the consultation process itself was a key point of concern raised by various stakeholders.

Specifically, many stakeholders voiced frustration at being included in previous ESIA consultation processes by other project proponents in the area and then having no further contact with them. Stakeholders also noted concerns over project proponents sharing information through commune-level government bodies or representatives, which fails to reach them at the village level. Stakeholders consistently requested that CIMAF adopt the consultation approach utilised by ERM and Harmony Group in March 2021: direct engagement through focus group discussions.

6.3 Stakeholder Analysis

Nine (9) communities are located within the Project's AoI; population estimates are provided below as reported by each Village Chief and reflecting the most recent census data (2015).[2]

Table 6-1 Project-Affected Communities

Community	Estimated population
Gap	1,300
Lene	1,100
Nangane	150
Palal	3,000
Palal Peulh	38
Soune Serer	3,015
Soune Wolof	410
Thiambokh	2,000[3]
Thiambokh Peulh	300
TOTAL	**9,275**

The communities of Gap, Lene, Palal, Soune Serer, Soune Wolof and Thiambokh are predominantly Serer - the third largest ethnic group in Senegal (approximately 17% of the national population) with a distinct language and cultural practices.[4] The Serer people live predominantly in western Senegal and are the dominant ethnic group in the Project Area. These communities are interconnected – through marriage and small-scale trade and commerce. No inter-community conflicts were reported, with the exception of tension between Soune Wolof and Thiambokh (see footnote).

Three (3) Peulh communities are located within the Project's AoI: Nangane - a hamlet of Daral Peulh, which is located on the northern side of the RN2 and outside the Project's AoI; Thiambokh Peulh - a hamlet of Soune Wolof, located to its east; and Palal Peulh - a hamlet of Palal, located to its south, on the western edge of the Classified Forest.[5]

Traditionally, Peulh in Senegal were a nomadic people whose livestock migration routes crossed the country from north to south in accordance with the availability of fodder throughout the dry season. In

[2] An updated census for the Commune of Keur Moussa is underway but has been delayed due to COVID restrictions.

[3] Estimate

[4] https://www.cia.gov/the-world-factbook/countries/senegal/#people-and-society

[5] As noted above, the village of Thiambokh was not willing to participate in the March 2021 data collection process as it was excluded from the original ESIA process. It is understood – though not yet confirmed – that Thiambokh Peulh was originally a hamlet of the village of Thiambokh. It is also assumed that Soune Wolof was a hamlet of Thiambokh, but due to its population growth in recent years and the disassociation of Soune Wolof and Thiambokh that resulted from the construction of the A1 highway, Soune Wolof assumed village status and at that time, declared Thiambokh Peulh as its hamlet.

recent years, some Peulh communities have established semi-permanent structures in peri-urban areas where they maintain year-round residency, as is the case in the communities of Nangane, Thiambokh Peulh, and Palal Peulh, though pastoralism remains their sole livelihood activity. The Peulh in Senegal have a distinct language and cultural practices, and despite adopting more sedentary lifestyles, continue to generally live apart from other ethnic groups. As is the case in the Project Area, Peulh are not often represented in local and regional governance structures or decision-making bodies. In the case of Nangane, Thiambokh Peulh and Palal Peulh, no inter-community conflict was reported. Though administratively, all three communities are considered hamlets of larger villages, the Peulh communities see themselves as distinct and largely self-reliant.

Each of the communities in the Project Area is led by a hereditary Village Chief, who is supported by a group of elders. Village Chiefs and elders are typically male, with women rarely being represented or able to participate directly in traditional decision-making structures. The communities in the Project Area fall within the Commune of Keur Moussa, which is led by an elected Mayor. Overall, local leaders expressed support for the Project, though in all cases Village Chiefs and elders noted some level of frustration with other projects in the area that have consulted them as part of the ESIA process, making numerous promises and commitments, and then have not been heard from again nor created many jobs for local residents (see more details in Table 6-2 below). This was particularly true in the case of Soune Serer, where the Village Chief explained he was inclined to refuse the request for the consultation by ERM and Harmony Group for this reason. The Village Chief claimed to be preparing a letter to the Prefect of the Region of Thiès to share his frustration in this regard.

Community associations within the Project Area include women's groups and youth groups (with male members only), which are organised at the village level to work on issues of common concern. Women's groups often practice revolving savings and loans schemes amongst their members to provide financing for small-scale livelihood activities. The women's group in Soune Sere was particularly well organised and active, and reported receiving capacity building from the Non-Governmental Organization (NGO) ENDA Tiers Monde on issues including deforestation and financial management. ENDA Tiers Monde was established in 1972 with a mission to address rural poverty and environmental degradation, and is the only NGO reported to be active in the Project's AoI.[6]

Many male youths from the Project Area are students in Dakar, who are able to live in or more frequently visit their home communities due to the recently constructed highway system. Youth group leaders reported their primary priorities to be employment and more generally, advocating with government to increase their communities' access to land and services. During consultation in March 2021, youth shared their frustration with the unkept promises of other projects in the area, specifically in terms of creating jobs and economic benefits for their communities. The youth representatives in the Village of Palal voiced particular concerns around allocation of land in the Classified Forest to private sector developers, while local residents cannot access to these lands for agriculture or other livelihood activities. They noted their intention to engage the Mayor of the Commune of Keur Moussa in this regard.

Herders in the area have recently established an association at the level of the Commune, which is beginning to organise in order to advocate on behalf of the needs and priorities of its members. Despite agriculture being reported as the primary livelihood activity in Serer communities, the farmers in the area did not report being organised into any type of group or association.

Table 6-2 below presents the key stakeholders in the Project Area and identifies their level of interest in and potential influence over the Project (1 below lowest, 5 being highest), based on the data collected by ERM in March 2021.

[6] https://www.facebook.com/EndaTiersMonde/

Table 6-2 Stakeholder Analysis

Stakeholder	Level of Interest (1-5)	Level of Influence (1-5)
Mayor of Keur Moussa	4	5
Village Chief - Gap	3	2
Village Chief - Lene	4	3
Village Chief - Nangane	3	2
Village Chief - Palal	4	3
Village Chief - Soune Serer	5	3
Village Chief - Soune Wolof	4	3
Village Chief - Thiambokh	5	3
Women's Group – Soune Serer	3	2
Women's Groups (others)	3	1
Youth Group - Palal	5	3
Youth Groups (others)	5	2
Association of Herders of Keur Moussa	5	3
ENDA Tiers Monde	3	3

6.4 Stakeholder Feedback

Overall, stakeholders were open to participating in the consultation process and appreciated the opportunity to provide input at this stage of the Project. As noted above, however, there is a general sense of frustration within the communities in the Project Area over the allocation of land within the Classified Forest to private sector projects, while local residents face increasing challenges in accessing land for their household growth and livelihood activities. Similar frustration was noted regarding the failure of previous project proponents in the area to engage residents in a meaningful way following their own ESIA processes, which suggests a high risk of consultation fatigue and underscores the importance of the Project putting in place an effective engagement program going forward.

Table 6-3 below summaries the feedback provided by stakeholders during the consultation carried out in March 2021 by ERM and Harmony Group. As per the scope of the assignment, ERM and Harmony Group did not provide detailed responses to questions raised or attempt to address stakeholder concerns, with the exception of explaining the objectives of the current consultation process, how data would be used to inform recommendations to CIMAF, and how national regulations and international lender standards would apply to the impact assessment process.

Table 6-3 Stakeholder Feedback

Stakeholder	Key Questions & Concerns
Mayor of Commune of Keur Moussa + representatives	▪ Job creation for youth of the Commune and from directly-affected communities specifically Rationale for Supplementary ESIA, tasks to be undertaken and timeline ▪ Cumulative impacts: land acquisition for the airport and highway causing land pressure, concerns among population of dust and impacts on agricultural yields

Stakeholder	Key Questions & Concerns
	▪ Impacts of land use restrictions for herders who rely on Classified Forest for grazing livestock
Village Chief - Nangane	▪ Youth employment ▪ Land use restrictions on grazing in the Classified Forest ▪ Compensation for impacts on economic activities
Women – Nangane	▪ Youth employment ▪ Access to water for domestic use and livestock ▪ No inclusion of women in previous project consultation (CIMAF and others) ▪ Displacement of the community as a result of the Project's land acquisition ▪ Land use restrictions on livestock grazing in the Classified Forest ▪ Impacts on access to surrounding villages ▪ Impacts of dust on human and animal health ▪ Request for training on revenue-generating activities
Village Chief and Elders – Soune Serer	▪ Employment and training opportunities for youth ▪ CIMAF consultation process ▪ Land acquisition precedents and unmitigated impacts (airport and highway) ▪ Land pressure and impacts of land use restrictions in the Classified Forest on livelihood activities ▪ Flooding in village as a result of airport water management system ▪ Impact on sacred site in the Classified Forest
Farmers and Herders – Soune Serer	▪ Youth employment ▪ Land acquisition precedents and unmitigated impacts (airport and highway) ▪ Land pressure and impacts of land use restrictions in the Classified Forest on livelihood activities ▪ Impact mitigation / compensation measures for livelihood impacts ▪ Flooding in the village and surrounding areas ▪ Access to water ▪ CIMAF consultation process ▪ Impact on sacred site in the Classified Forest
Women – Soune Serer	▪ Use of Classified Forest for collection of firewood, medicinal plants, spices, fruit ▪ Access to markets (for small-scale trade) ▪ Access to water ▪ Training and capacity-building on economic activities ▪ Support for community development projects ▪ Access to public services (health and education) ▪ Decreasing production of fruit trees due to environmental changes ▪ Flooding in the village as a result of airport water management system ▪ Land pressure due to cumulative impacts of multiple projects in the area ▪ Access to land by women ▪ Representation of women in village-level decision-making

Stakeholder	Key Questions & Concerns
	▪ CIMAF consultation process
Youth – Soune Serer	▪ Employment opportunities ▪ Support for community development projects ▪ CIMAF consultation process
Owner of cultivated plots (near SEN'EAU pumping station)	▪ Impacts of dust on agricultural yields and worker health ▪ Consultation by CIMAF on impact mitigation measures
Village Chief, Elders, Farmers and Herders – Gap	▪ Access to water ▪ Access to public services (health, education, electricity) ▪ Employment ▪ Impacts of dust on agricultural yields and human health ▪ CIMAF consultation process
Youth – Gap	▪ Creation of training and employment opportunities ▪ Support for community development ▪ Protection of the environment ▪ CIMAF consultation process
Women – Gap	▪ Access to water ▪ Access to land for livelihood activities ▪ Loss of fruit trees species / reduced production as a result of dust
Village Chief and Elders - Palal	▪ Employment ▪ Access to water ▪ Frustration over impacts of existing projects (requests for support / employment unanswered, dust affecting health and fruit tree production, use of land in the Classified Forest) ▪ Access to land for urban growth ▪ Access to services (water and electricity)
Farmers, Herders and Women – Palal	▪ Employment Access to water for livestock and agriculture ▪ Access to land for grazing and agriculture ▪ Access to services (health)
Youth – Palal	▪ Employment (transparent recruitment process) ▪ Access to land for urban growth / land use restrictions due to existing projects ▪ Waste management ▪ Frustration over allocation of land in the CF to industry and not to communities
Village Chief and Elders - Lene	▪ Support for community development ▪ Access to water ▪ Access to land for agriculture / trend of conversion to urban land due to low yields and revenue

Stakeholder	Key Questions & Concerns
	▪ Access to the CF, impacts on access to ecosystem services (collection of wood, plants, fruit) ▪ Flooding due to airport water management ▪ CIMAF consultation process
Farmers, Herders and Youth – Lene	▪ Employment Access to agricultural land / conversion to urban land ▪ Access to CF for grazing / access to grazing land impeded by projects (airport, highway, Fruta Italia) ▪ Access to water ▪ Flooding due to airport water management ▪ CIMAF commitments made at public audience in 2019, request for signed agreement to ensure accountability
Women – Lene	▪ Employment ▪ Access to water for agriculture, market gardening ▪ Abandonment of livelihood activities due to obstacles to accessing CF (collection of fruit, plants, leaves) ▪ Environmental changes (dust, flooding, deforestation) ▪ Security ▪ Support for community development (health, education, training) ▪ CIMAF consultation process
Village Chief, Elders, Farmers and Herders – Soune Wolof	▪ Employment for youth ▪ Access to services (education, health, water, electricity) ▪ Compensation for previous displacement impacts (airport, highway) ▪ Access to land for agriculture, grazing ▪ Environmental changes: dust, reduced rainfall, desertification, low fruit tree production ▪ Considerations for grazing in CIMAF Project design / closure ▪ CIMAF consultation process
Women – Soune Wolof	▪ Employment for youth ▪ Access to services (health, education, water) ▪ Access to water for household use and livelihood activities ▪ Flooding during rainy season ▪ Training and capacity-building support
Youth – Soune Wolof	▪ Employment ▪ CIMAF consultation process
Village Chief and Representatives - Thiambokh	▪ Exclusion from CIMAF 2019 ESIA process

Of the topics raised by stakeholders during the March 2021 consultation (as presented in Table 6-3), the following were raised most frequently and have the highest potential to impact the Project's social license to operate:

- Land pressure and negative perceptions of the State's allocation of land in the Classified Forest for private sector projects;
- Employment for youth;
- Access to water for household use and livelihood activities; and
- Access to public services and requests for community development support.
- An additional round of consultation was carried out in June and July 2021 to solicit input from government, community and civil society stakeholders on proposed livelihood restoration measures. The consultation process and feedback collected are detailed in the Project's Livelihood Restoration Plan (LRP).
- The Project carried out a final series of consultation with stakeholders in September 2021 in order to present and validate the key contents of the ESIA and LRP. The validation sessions were attended by representatives of CIMAF, Harmony Group, ERM and the IFC.

The table below summarizes the feedback collected through the validation process. Participant lists for each session are provided in Annexure B.

Table 6-4 Stakeholder Validation

Date	Location	Participants	Subjects Addressed	Stakeholder Feedback
06.09.2021	Keur Moussa	Institutional Actors	Presentation of the ESIA and LRP Open discussion with participants	▪ Overall satisfaction with the contents of the presentation ▪ CIMAF consulted broadly and involved all the relevant actors ▪ CIMAF followed the appropriate procedure as per the Environment and Forest Codes ▪ Acknowledgement that the concerns and recommendations of institutional actors were taken into consideration, specifically on support for herders and women ▪ Appreciation of the inclusion of programs for herders, which are expected to have a benefit for the whole community if managed effectively ▪ Questions over whether Harmony will remain involved as an interface between the promoter and the projects that have been proposed ▪ Recommendation not to fence the site entirely and to leave some of the unused land for the benefit of the population, as other cement projects in the area have done ▪ Local Monitoring Committee already exists in Keur Moussa and should be involved to ensure all commitments towards communities are respected, they meet annually and CIMAF can use this opportunity to engage with the State and communities ▪ The final report of the ESMP has a contractual nature and CIMAF will be required to ensure compliance with its contents ▪ CIMAF is requested to provide support to the technical services to enable environmental monitoring as they have limited financial means ▪ Representative of herders noted satisfaction with the projects proposed, specifically the Agricultural Store, but requested training for herders on management of the store and more details on the vaccination parks, proposing a new park in Soune Peulh rather than rehabilitation of the existing park in Thiambokh ▪ Recommendation that the livestock watering points be connected to the national water network (SEN'EAU) as they will not be useful outside of the rainy season if they are rain-fed ▪ Important to ensure programs are developed with input from the population ▪ Request for annual vaccination programs, rather than just three ▪ Recommendation to include a tree nursery in the livelihood restoration programs ▪ Exclusion of the program to grow fodder will create problems for livestock given the use of land in the Classified Forest by the Project ▪ Request for improved breeds of cattle in order to have milk ▪ Request for support on transformation of products

				▪ Population is keen for the Project to begin as they see the revenue it will generate, already raising questions to the Sub-Prefect about the Project ▪ Question on whether the Project will affect the water table, and specifically potential impacts on the neighboring market garden activities ▪ Local employment is a top priority and there are high expectations for job creation by CIMAF, request for training to increase employability ▪ Acknowledgement of CIMAF's corporate social responsibility activities, requests for continued financing of community projects ▪ Reports are available at various locations but generally they are not read by the population, instead the population raises questions and receives answers from the authorities, including through discussions with the Local Consultation Committee
07.09.2021	Dakar	Directorate of Environment and Classified Installations (DEEC)	Feedback on the Project Compliance with national procedures Monitoring	▪ Confirmed that two studies have been done and the Project received its certificate of conformity ▪ Initial analysis of the grinding unit is underway and authorities are waiting for the final report ▪ Environmental monitoring will be the next phase, including monitoring of the ESMP by the DEEC and the Regional Directorate in Thiès ▪ There will be a detailed monitoring in the case of this Project, as requested by the President of the Republic ▪ Confirmed stakeholders were consulted in the course of the ESIA, which was also validated by the Technical Committee through a public audience that involved local residents ▪ Concerns from the DEEC have been on monitoring the implementation of the actions and recommendations stemming from the ESMP and LRP ▪ Technical Committee recommended benchmarking, giving technical actors the chance to visit one of CIMAF's cement factories to better understand the environmental aspects and improve monitoring (visit was scheduled but did not take place due to COVID) ▪ Population requests ongoing support for health, economic activities, etc. ▪ Important to support the social dimension of the Project in order to keep peaceful relationships with the population ▪ Noted that the ESMP is required but CSR is voluntary ▪ Employment for youth and engagement of youth through CSR activities will help create good relationships with the population ▪ Regarding cumulative impacts, this is taken into account by the DEEC during monitoring, additional studies are done where data is unclear
07.09.2021	Dakar	Directorate of Water and Forests	Feedback on the Project	▪ Confirmed the Project followed the appropriate procedure ▪ Explained that land in the Classified Forest can be allocated for private sector projects if they are deemed in the national interest

			Compliance with national procedures Monitoring	▪ Following studies by CIMAF, the Regional Commission of Thiès and subsequently the National Commission agreed to the use of the land by CIMAF ▪ A Presidential Decree declassifying the land from the Classified Forest was issued ▪ The mining industry in Senegal is growing and some parts of mines are located in the forest, it's a matter of balancing the exploitation of resources with the protection of forests ▪ Regarding the impacts on herders, typically a MOU (protocole d'accord) is signed that takes into account the social dimensions of the project and provides for the interests of the population ▪ Confirmed the local population is informed of the declassification process for the land CIMAF will use, as they have been informed during field visits by the Regional Commission of Thiès ▪ The Regional Commission consulted relevant actors before making their decision on the declassification of the land, process was started in 2016 and only completed in 2021 ▪ Role of the Water and Forests Directorate is to manage the multiple uses of the forests and ensure their protection and production as needed ▪ This year, 9 new forests were classified in Senegal to compensate for the overall pressure on forests in the country ▪ Rehabilitation of forests after their use is a high priority for the Directorate, this is done through consultation and signature of a MOU with the Directorate of Mines ▪ State is in the process of putting in place a rehabilitation fund to ensure rehabilitation of lands and forests when companies fail to fulfill this obligation
08.09.2021	Keur Moussa	Representatives of villages affected by the Project	Presentation of the ESIA and LRP Open discussion with participants	▪ Municipality ("mairie") voiced support for the Project and its appreciation of the programs that will be put in place to address impacts on herders and women ▪ General acceptance of the Project among community representatives, but insistence that CIMAF respect the promises it has made, specifically the livelihood restoration programs ▪ Youth representative expressed dissatisfaction over the measures proposed for livelihood restoration (insufficient overall, placement of store and water points will cause tension between communities) ▪ High level of interest and expectation among youth for jobs, and concerns over how recruitment will be managed to ensure equitable access among affected communities ▪ Concern that water points for livestock will not be connected to wells or boreholes; rain-fed water points are simply basins and that is not what's needed ▪ Agricultural store will be useful, given that livestock will have less grazing land ▪ Recognition of issues with other project developers in the region, agreement that CIMAF is not responsible for these but must respect the commitments it has made to communities ▪ Particular interest in the production of fodder and the agricultural store ▪ Doubt over whether the Project will lead to lower cement prices ▪ Concern over recruitment procedure, want assurances local workers will be prioritized

				▪ Important to involve the State in the recruitment procedure so they can help resolve any issues through dialogue, including the Municipality that will monitor the Project ▪ Need to provide youth with training so they are qualified for available jobs, though recognition that if skills aren't available locally then the Project will hire from elsewhere ▪ Need further consideration on the programs proposed for herders, there may be other projects in the context of community development to consider ▪ Representative of women agreed training and employment of youth is critical ▪ Question on whether the land for the production of fodder would be allocated from the Project footprint or if would require additional land ▪ Representative of women requested support for replanting ▪ Need for communities to work together in a coalition, not to be divided ▪ Communities also face issues with roads and lack of transportation, request support from CIMAF to help address isolation of the area and improve productivity ▪ Concern over generation of dust and impacts on crops, request for further study ▪ LRP is missing projects on health, education, and training, which is critical to employment ▪ Important to respect the traditions of the area, such as by giving the Project a traditional name drawn from the Classified Forest, and ensuring ongoing consultation with communities
09.09.2021	Thies	Technical Services of Thies	Presentation of the ESIA and LRP Solicitation of general impressions of the Project	▪ At an administrative level, the Project is validated, it followed the appropriate legal steps ▪ Confirmed their comments and concerns were addressed by the Project ▪ As the Project is located in the Commune of Keur Moussa, arrangements should be made accordingly for transporters who will lodge in the area while waiting for shipments ▪ Technical Services should be involved in the support to be provided to communities ▪ A budget for the LRP should be provided in order to assess the proposed activities ▪ Livelihood restoration should allow the population to continue to carry out their activities in the Forest ▪ For production of fodder, crops that will grow quickly should be planted, as well as a protective zone ▪ Construction of an Agricultural Store is an important initiative, CIMAF will have to provide materials to enable start up ▪ The Project must put in place monitoring indicators to measure economic and social progress (education, health, water resources) and importantly, the vegetation and regeneration of species that are disappearing ▪ The Project will maintain its MOU with the Directorate of Water and Forests even though its contents are not captured within the ESIA and ESMP

				▪ Question of whether there is a need to review the ESIA now that the land has been declassified (no further comment following reply from Harmony that this is not necessary as there has been no change to the Project or the site, only the land status) ▪ Project will be closely monitored by the Technical Services as it is an important project with extensive benefits for the country ▪ Overall, Project was well conceived and consultation of institutional stakeholders was broad and well appreciated

7. PHYSICAL ENVIRONMENT BASELINE

It is important to gain an understanding of the physical, biological and social attributes of the area in which the ICP is proposed and its surroundings. The description of the baseline environment is essential in that it represents the conditions before the construction of the proposed ICP. The description of the baseline environment therefore provides a description of the current or *status quo* environment against which social and environmental impacts of the proposed Project are assessed and future changes monitored.

The information presented in Chapters 7, 8 and 9 has been collected from desktop studies and site visits along the alignment of the proposed ICP. The aforementioned Chapters are organised as follows:

Chapter 7 – Physical Environment:

- Climate;
- Topography;
- Geology and Natural Hazards;
- Land Cover;
- Soils;
- Landscape and Visual;
- Air Quality;
- Noise; and
- Climate Change.

Chapter 8 – Biological Environment:

- Biodiversity; and
- Ecosystem Services.

Chapter 9 – Social Environment:

- Socio-economic;
- Traffic; and
- Cultural heritage.

7.1 Climate

The Project Area lies within the Sudano-Sahelian climatic domain. Two distinct seasons exist for the area; a rainy season from June to October, and a dry season prevailing during the remainder of the year.

The data presented within the framework of this study were collected at the level of the synoptic station of Thiès located about 10 km from the site.

The average temperature recorded over 34 years is slightly above 26 °C, with the month of July being the hottest (28.2 °C), and the months of December and January being the coolest with respectively

25.1 °C and 23.9 °C. The average annual precipitation recorded between 1930 and 2015, was 587.6 mm at the Thiès station, peaking in August and September.

The maximum hydrometric degree has its lowest values between November and April and associated with the presence of the easterly flow. From April, the values increase to reach the maximum in September in relation to the presence of the westerly flow. The minimum is noted in January and February. The minimum relative humidity experiences the same trend with a minimum in February and a maximum in August-September. It is always above 50% except during incursions of the Harmattan, which is a hot and dry wind coming from the east.

Wind data (speeds and directions) is essential for a mining project. They will condition the dispersion of dust generated by the extraction activities on the mining site but also those emitted at the level of the tracks by the transport of the ore. The wind regime in the area makes it possible to distinguish two (2) wind seasons:

- A season from October to May, with prevailing north to northeast winds; and
- A second season from June to September, during which southerly and westerly winds are very much more frequent.

Wind speeds, although variable throughout the year, are high and remain greater than or equal to 2.7 m/s. The maximum is recorded between the months of March (4.1375 m/s) and May (4.06 m/s). It is only in August, September and October that the speeds remain relatively low, the minimum being reached in September-October with 2.8 m/s. The annual average is 3.5 m/s. The prevailing wind direction throughout the year is westerly. Thus, the analysis of the influence of winds in the sector of the Project Area makes it possible to note that:

- From November to June, with the exception of the Peulh Hamlet, no village will be under the influence of the prevailing winds. These winds will be from an East, North or North-East direction and will carry dust; and
- Between July and September, the winds will be north-westerly or westerly. The villages of Palal, Soun, Soun Wolof, Gap and Léne will be influenced by the prevailing winds during this time of year.

From the above, it is clear that special measures must be taken between the months of November and June. This period corresponds to high temperatures, high wind speed, low relative humidity, high insolation and high evapotranspiration. These elements constitute factors favourable to the dispersion of dust and a loss of water resources.

7.2 Topography

Senegal is an extremely flat country with an altitude rarely exceeding 40 m. Apart from the Mamelles, which culminate at more than 100 m around Dakar, the Diass massif and the cliffs of Thiès, in or on the edge of the Cape Verde peninsula (the only regions with appreciable relief) are located in Eastern Senegal, where elevation may reach 400 m.

The region of Thiès presents relatively flat relief except for the plateau of Thiès, which culminates at 105 m of altitude, the massif of Diass, which rises to 90 m of altitude and the basin of Thiès, which extends on an area of 65 km^2. These areas contain an abundance of mineral wealth (limestone, basalt, phosphate, etc.).

The upper parts lie on a plateau. The slopes extend from the hills of Keur Moussa to the edge of Lake Tanma. Below the plateau to Lake Tanma, is a relatively low area where marl, marl-limestone, papyraceous clays with flint and degradation clays from attapulgites emerge.

In the Municipality of Keur Moussa, the relief is hilly. Irregularities in the terrain can be explained by the presence of the Thiès Plateau, which occupies a large part of the area. In the southern part of the Municipality, there are numerous depressions. The commune of Keur Moussa contains low plateaus, lagoon deposits, cliffs and valleys (Figure 7-1).

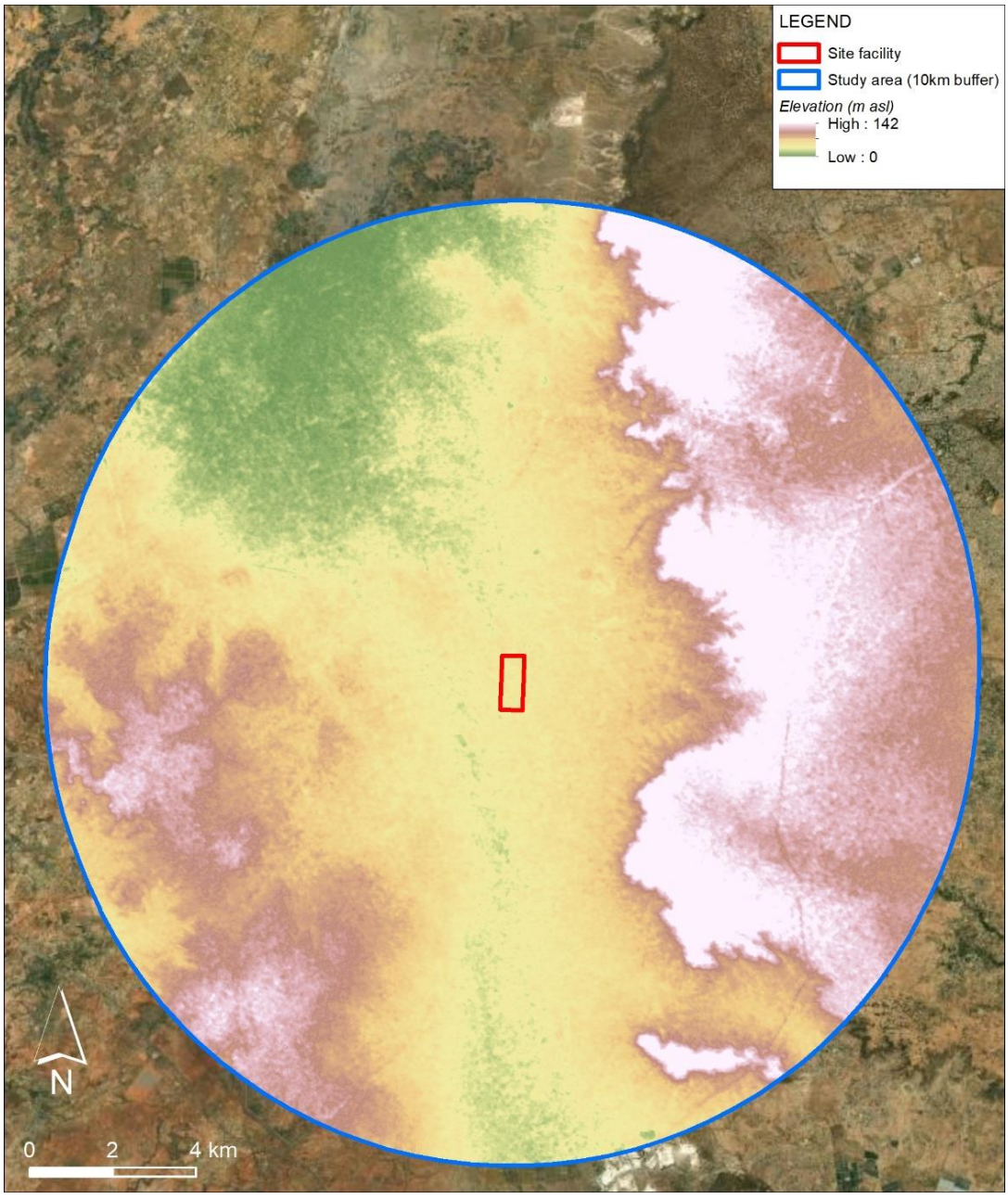


Figure 7-1 Topography

7.3 Geology

The Municipality of Keur Moussa is mainly occupied by Maestrichtian sandstones to the southwest of the Municipality, while marine and fluvial deposits of the Quaternary occupy its entire western part. The eastern part of the commune of Keur Moussa is covered by limestone and marine sedimentary formations of marl that range from the Upper Cretaceous to the Middle Eocene (Upper Lutetian).

The geological description of the site was developed from data from the various hydraulic surveys carried out in the area. Paleocene limestone formations predominate in the Project Area. According to the results of surveys carried out by CIMAF in the perimeter of the site of the future quarry, the limestone is located under cover with a thickness of about 16 m. Estimates reveal reserves of 53,000,000 ton of High Titer limestone and 4,400,000 ton of siliceous limestone.

Below this layer lie clays, marls and limestone with phosphate levels. The limestone located at the quarry is a sedimentary rock composed of calcium carbonate ($CaCO_3$) to which can be added varying amounts of silica (SiO_2) and clay.

Limestone is a material widely used in the raw or fired state, particularly in the cement industry, the steel industry or in the glass, chemical and pharmaceutical industries. Of course, as resistant stones, limestones are actively exploited for the manufacture of rubble, marble and any other type of ornamental stone.

7.4 Geological Hazards

7.4.1 Landslides

Landslides evolve as the result of various passive and active factors. Passive factors include those existing permanently in the environment: slopes, lithology, land use and the density of the lineaments. Active factors influence the area periodically and may act as triggers, adding to or impacting existing conditions: rainfall, density of the hydrographic network, proximity to the roads (vibration factor). Both passive and active factors may lead to the decrease of the shear strength of the materials forming the slope.

The AoI is located in a rather flat area without significant natural slope, which is a north-south oriented depression between two elevated areas: Dias Horst (65m asl) and Thiès Cliff (142m asl). Signs of land movement on the slopes is detected in the area of Thies (a city 10 km east of the AoI).

Vibration might trigger a landslide activation, as the limestone will be mined by blasting (one explosive event per week). Ndoye, et al. (2017) report observed landslides less than 1 km to the east from the planned quarry. Taking into account the passive factors, particularly high landslide susceptibility is given to the slopes of Dias Horst and Thiès Cliff. The rainfall appears to be one of the most influential factors.

In recent years, heavy rainfalls occurring in Senegal resulted in catastrophic flood events that are currently the major natural hazard in the country. The rain season lasts from April to September. As reported in 2009, flooding is closely linked to the geological setting of the area, which might be the case as the quarry will be located within a relatively low area. Average annual rainfall is 550 - 600 mm, with annual maximum daily rainfall in the area of 40 - 50 mm up to 95 mm. According to forecasts, annual daily rainfall will increase in 2050 compared to 1990.

7.4.2 Rockfalls

Although in the area there are no exposed rocks on the slopes, an artificially constructed steep slope of the quarry might become a hazard.

According to the results of surveys carried out by CIMAF, the limestone is deposited under 16 m of the overlaying cover. The bench depth will grow from initial 10 - 50 m.

It is necessary to ensure that the slopes of the quarry are safe during the operation and after the closure of the site.

The increasing rainfall may result in waterlogging at the bottom of the quarry. It is advisable to set up a reservoir for surface water collection and eventually pump it out. The surface water should be diverted away from the edge of the quarry to avoid extra water collection.

7.4.3 Karst

At the moment there is no evidence of karst processes in the Project's AoI. However, in 1986 karst was reported 25 km west from the AoI, net to the city Bargny. Therefore, during annual monitoring special attention should be paid to the subsidence processes near the quarry.

7.5 Soils

Senegal is marked by the existence of several types of soil that have a formation linked to geology, geomorphology and climatic condition. They play an important role in agriculture and the preservation of the environment.

The Pout and Keur Moussa quarries are located on the lateritic ironstone zone.

The soils of the Thiès plateaus are lithosols or of the red-brown ferruginous type when the cuirass is not deep, and of the clayey type if the parent rock is marl-limestone. The Municipality of Keur Moussa is largely occupied by:

- Tropical ferruginous soils with little or no leaching on so-called "Dior" colluvium. These soils are found in the centre and south-west of the commune of Keur Moussa and are characterised by a sandy texture comprising more than 95% of total sands. They have a particulate structure, which becomes dry melted. Their carbon content is very low (0.20%) as is their nitrogen content (0.15%). They have a pH between 5.4 and 6.1, and a low buffering capacity;
- Hydromorphic soils: These types of soils are encountered east of Keur Moussa. This class includes all the soils whose evolution is dominated by the presence of an excess as a result of either temporary waterlogging, depth or overall, or the presence or rise of a water table. These soils developed in flood zones; and
- Lithosol and rigosols on dismantled breastplate on sandstone; these soils are in the southwest of the town.

7.6 Hydrology

7.6.1 Methodology

A preliminary desktop study was conducted by the Harmony group, which involved review of information related to water resources in the study area. Various sources were consulted including the following:

- The Senegal Water Resources Management and Planning Department (DGPRE);
- SEN'EAU, a management company for the operation and distribution of drinking water in urban and peri-urban areas, which operates several boreholes in the project area;
- From the Harmony Group hydrogeological database.

The information collected provided a general information on water resources in the project area, the location of existing boreholes and their characteristics (static water level, pumping rate, total depth of boreholes).

This data was subsequently used to produce a map showing the spatial distribution of the boreholes over a radius of 1 km from the project site.

A map of irrigated areas was also produced from satellite data as part of the preparation of the field phase. Images from the Sentinel 2 satellite with a spatial resolution of between 10 and 60 m were used to detect areas to be investigated during the field phase (due to the possible existence of boreholes in the irrigated areas).

7.6.2 Surface Water

Senegal is a country where the bulk of surface water reserves are located in the basins of the Senegal and Gambia rivers, whose waters come from the Fouta Djallon massif, in the Republic of Guinea. Alongside these two large rivers, there are smaller rivers characterised by intermittent flows. These are the Casamance, the Kayanga with its main tributary the Anambé, the Sine, the Saloum and the coastal backwaters.

A certain number of lakes and ponds complete this hydrographic network, the most important being the lake of Guiers, the bolongs[1] of the estuary zones, and the ponds of the Niayes region of the North coast and Ferlo.

The data collected showed that the hydrographic network of the Thiès region is organised from the plateau from which a set of rivers form and supply the regional territory. These rivers are fed by the abundant rains during the rainy season and then dry up during the dry season.

The hydrographic network of the site area is characteried by the absence of permanent flows. It is most often represented by loosely networked thalwegs, which drain runoff areas with little hierarchy. The rivers are temporary and are only supplied with water during the rainy season.

Global mapper15 and Arcgis 10.3.1 software enabled the delineation of the watershed in which the project site is located. This fan-shaped watershed covers an area of approximately 16,785 ha.

[1] Bolong means a river tributary in the Mandinka language. The most famous bolong is the Bintang which goes north and south into Senegal.

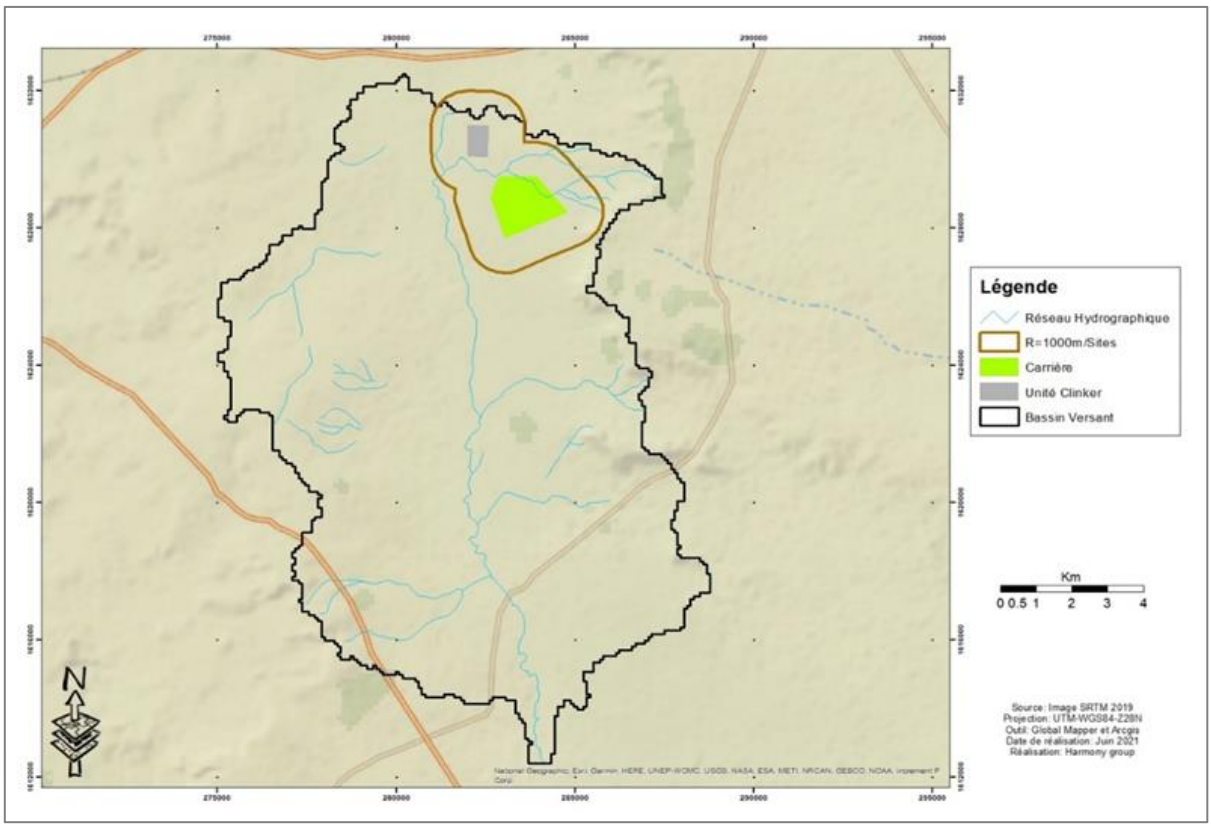


Figure 7-2 Map of Watershed

7.6.3 Groundwater

According to SANE (2015), the sedimentary terrains of Senegal consist of the Triassic, Middle to Upper Jurassic, Cretaceous, Tertiary and Quaternary formations, resting on the pre-Mesozoic crystalline substratum. These formations are characterised by an alternation of deposits whose lithological characteristics (sands, clays, limestones, etc.), and geographic extensions result mainly from the power of the various marine transgressions that have affected the region over geological time.

- Previous work carried out on the sedimentary basin of Senegal has identified a simplified series, summarizing the main lithological and hydrogeological characteristics. They have thus made it possible to define four (4) stratigraphic sets and three major aquifer systems:
- The upper complex which brings together the geological foundations of the Neogene and the Quaternary, containing the aquifer system of the "Terminal Complex";
- The intermediate set, formed from the Paleocene and Eocene, contains the Paleogene aquifer system, productive only in karstified areas;
- The entire Upper Cretaceous, made up of the Maastrichtian, Campanian, Lower Senonian and Turonian stages, contains the "Maastrichtian aquifer system" which includes all the predominantly sandy production levels. The Maastrichtian aquifer is limited in its wall, by the black clays of the Turonian.
- The lower unit is mainly composed of the Turonian to the basement, of clayey sediments or compact carbonates, presenting poor hydrogeological characteristics.

7.6.3.1 Local Perspective

The hydrogeological context of the study area is illustrated by Figure 7-3 and shows its division by tectonics into four (4) compartments which include:

- The Sébikotane compartment in the west with the presence of a large aquifer contained in the karstified limestone formations in relation in its northwest part with the aquifer of the quaternary sands of the north coast;
- The outcrop zone of the Maastrichtian formations at the heart of the horst of Diass which are recognised as being more permeable to the east and more or less impermeable to the west;
- The compartment of Pout and its extension to the south until after Mbour, where the aquifer of the Paleocene limestones and that of the Maastrichtian sands are present;
- East of the Pout compartment to the limit of the study area where the main aquifer present is that of the Maastrichtian sands.

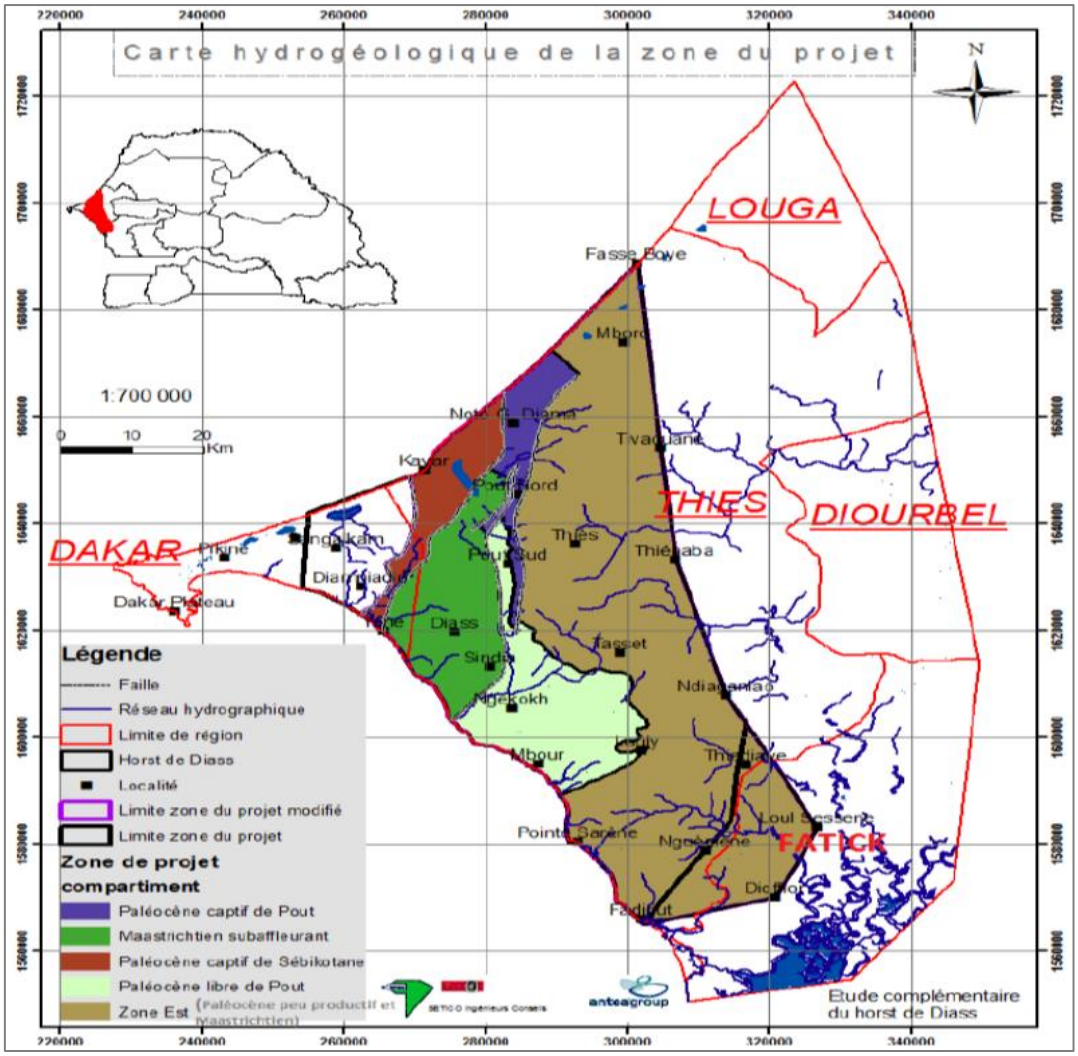


Figure 7-3 Hydrogeological map of project area (DGPRE, 2018)

During the desktop study several water abstraction structures were identified in the vicinity of the project area. A list of these are presented in the Table 7-1 below.

Table 7-1 List of Hydraulic Structures in the Site Area[1]

Name of Borehole	UTM Coordinates	Static Water Level	Pump Rate (m^3/h)	Total Depth (m)	Date of Installation
Pout Sud F3 Bis	X= 282887 Y= 1629803	42.40	35	80	21-11-1980 06-01-1981
Forage Pout Sud F3 Ter	X= 283111 Y= 1631369	46.21	276	270.60	28-11-1983 27-01-1987
Pout Sud SE 112	X= 283921 Y= 1628257	-	-	68	02-01-1964 29-01-1964
Pout F2	X= 282155 Y= 1631501	-	-	70	18-11-1964 10-01-1965
Pout S8	X= 281799 Y= 1632026	-	-	358	16-04-1974 27-05-1974
Pout F1	X= 282459 Y= 1632113	-	-	70	10-07-1963 24-09-1963
SE 102 M	X= 283504 Y= 1631950	-	-	159	16-04-1963 18-06-1963
Pout Sud F8 Bis	X= 279167 Y= 1631989	-	-	338.14	-
Pout Kirène F9 Bis	X= 279162 Y= 1631374	69.45	253	270	28-04-1987 11-07-1987
Pout Sud F7 Bis	X= 279920 Y= 1632597	73.40	252	320	-
Pout Sud F3	X= 281997 Y= 1630580	-	-	70	05-02-1969 02-04-1969

The map of the cartographic distribution of the hydraulic structures (Figure 7-4) listed by the DGPRE during the years 2008-2009 shows that five (5) of the hydraulic structures located in the South Pout area are located in the area within a radius of 1,000 m from the project site.

[1] Source : DGPRE (2008-2009)

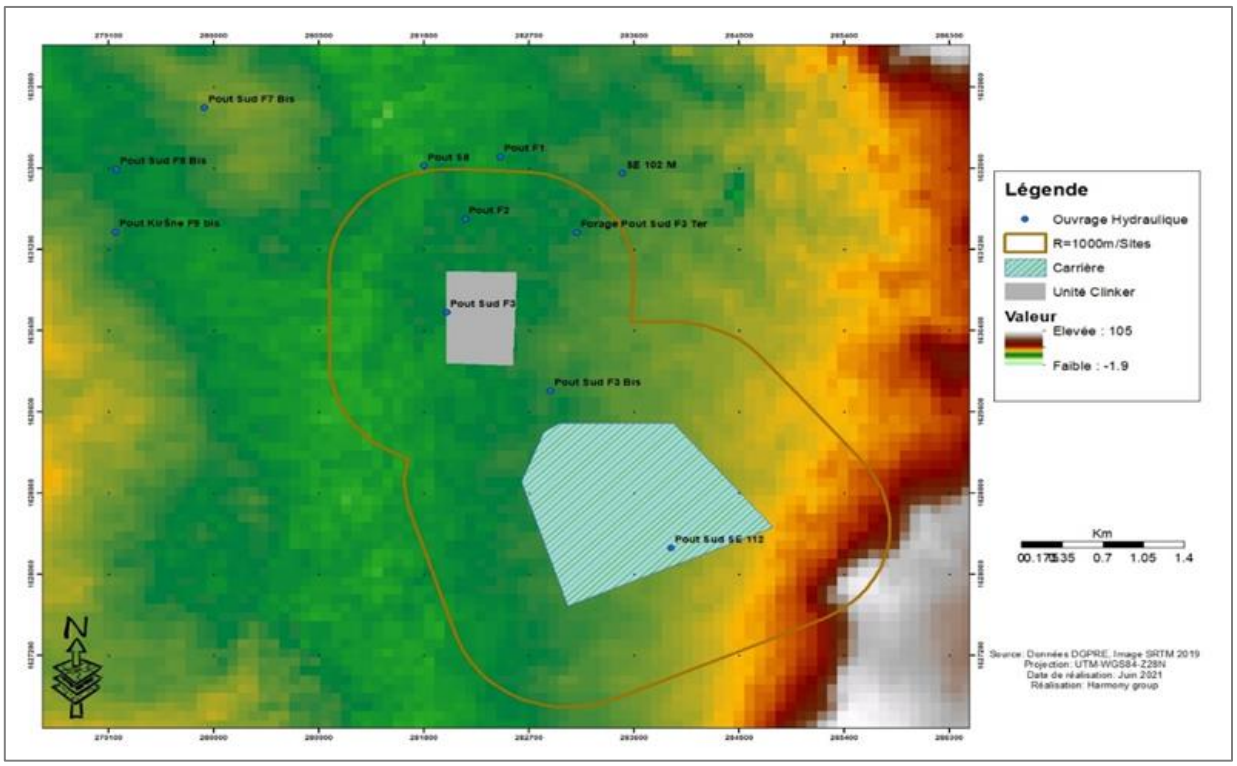


Figure 7-4 Geographical distribution of hydraulic structures[1]

Table 7-2 below describes the boreholes identified by the Harmony Group team on a joint mission with SEN'EAU in 2017. The mapping of the boreholes carried out using these data shows that two (2) of the hydraulic structures (Figure 7-4) located in the area of Pout Sud, are located in the area within the radius of 1,000 m from the project site. Refer to Annexure G for the Hydrocensus Report completed by Harmony Group.

Table 7-2 Characteristics of Hydraulic Structures in Pout & Pout-Kirène Areas

Bore-hole	Coordinates		Aquifer captured	Production yield (m^3/h)	Direction from Site	Distance to Quarry (km)	Distance to Clinker (km)
	X	Y					
PS1	283080	1630299	Maastricht	125	North	0.8	0.5
PS2	283134	1631310	Maastricht	150	North	1.85	0.66
PS3	283349	1631863	Paléocène	115	North	2.39	1.1
PS4	283199	1632314	Maastricht	165	North	2.82	1.4
PS5	282366	1632720	Maastricht	175	North	3.31	1.7
PS6	282370	1632644	Paléocène	160	North	3.21	1.6

[1] (Source DGPRE, 2008-2009)

PS7	280476	1632770	Maastricht	Non-functional	North-northwest	4.18	2.3
PK1	279321	1633063	Maastricht	Non-functional	North-northwest	5.19	3.37
PK2	279247	1632100	Maastricht	119	North-northwest	4.59	3.9
PK3	279294	1631173	Maastricht	89	North-northwest	4	2.7
PK4	283199	1632314	Maastricht	Non-functional	North / West	3.39	2.5
PK5	278112	1632926	Maastricht	173	North-northwest	6	4.3
PK6	279301	1631682	Maastricht	147	North-northwest	4.31	2.7
PK7	279389	1630320	Maastricht	140	North-northwest	3 .63	2.6
PK8	278691	1632744	Maastricht	94	North-northwest	5.47	4
PK9	279059	1632565	Maastricht	86	North-northwest	5.08	3.3
PK10	279807	1632034	Maastricht	158	North-northwest	4.07	2.4

Beyond the hydraulic structures operated by SEN'EAU for the supply of drinking water to the general public, there are also hydraulic structures used for industrial and commercial purposes, which are registered by the DGPRE. The map below shows that these structures are located to the south of the Project site, with the closest is located approximately 1,200 m from the boundary of the quarry. With the exception of the AIBD boreholes, which tap the Maastrichian aquifer, all the other boreholes identified tap into the Paleocene. Depth to water level and groundwater flow information is not currently available.

Table 7-3 List of Hydraulic Structures for Industrial & Commercial Use

Operator	UTM Coordinates	Aquifer	Pump Rate (m^3/h)	Direction from Site	Distance from Quarry (km)	Distance from Clinker (km)
Groupe SIAGRO KIRENE	X= 277744 Y= 1620322	Paléocène	30	South-west	8.97	10.66
Groupe SIAGRO KIRENE	X= 277633 Y= 1620147	Paléocène	30	South-west	9.10	10.81
Groupe SIAGRO KIRENE	X= 278405 Y= 1620125	Paléocène	30	South-west	8.66	10.49
AIBD	X= 279425 Y= 1621844	Maestrichien	50	South-west	6.71	8.56
AIBD	X= 278460 Y= 1620759	Maestrichien	50	South-west	8.18	9.93
Qualite Végétaux Senegal	X= 283672 Y= 1626680	Paléocène	150	South	1.2	3.57

Qualite Végétaux Senegal	X= 283310 Y= 1625953	Paléocène	150	South	1.8	4.18
VAN OERS	X= 281809 Y=1621085	Paléocène	150	South	6.59	8.92
VAN OERS	X= 281811 Y= 1621022	Paléocène	150	South	6.69	8.99
VAN OERS	X= 281213 Y= 1620959	Paléocène	150	South	6.79	9.14
VAN OERS	X= 281015 Y= 1620896	Paléocène	150	South	6.93	9.15
VAN OERS	X= 280717 Y= 1620833	Paléocène	150	South	7.01	9.18
VAN OERS	X= 280419 Y= 1620770	Paléocène	150	South	7.21	9.40
VAN OERS	X= 280121 Y= 1620707	Paléocène	150	South	7.43	9.51
VAN OERS	X= 289823 Y= 1624618	Paléocène	150	South	6.62	9.11
VAN OERS	X= 289890 Y= 1624600	Paléocène	150	South	6.53	9.13
VAN OERS	X= 289957 Y= 1624582	Paléocène	150	South	6.53	9.13
VAN OERS	X= 290024 Y=1624564	Paléocène	150	South	6.53	9.13
CRBC Autoroute	X= 279755 Y= 1619840		15	South	8.37	10.42
Ciment du saahel	X= 282092 Y= 1623407	Maastrichien	80	South	4.22	6.59

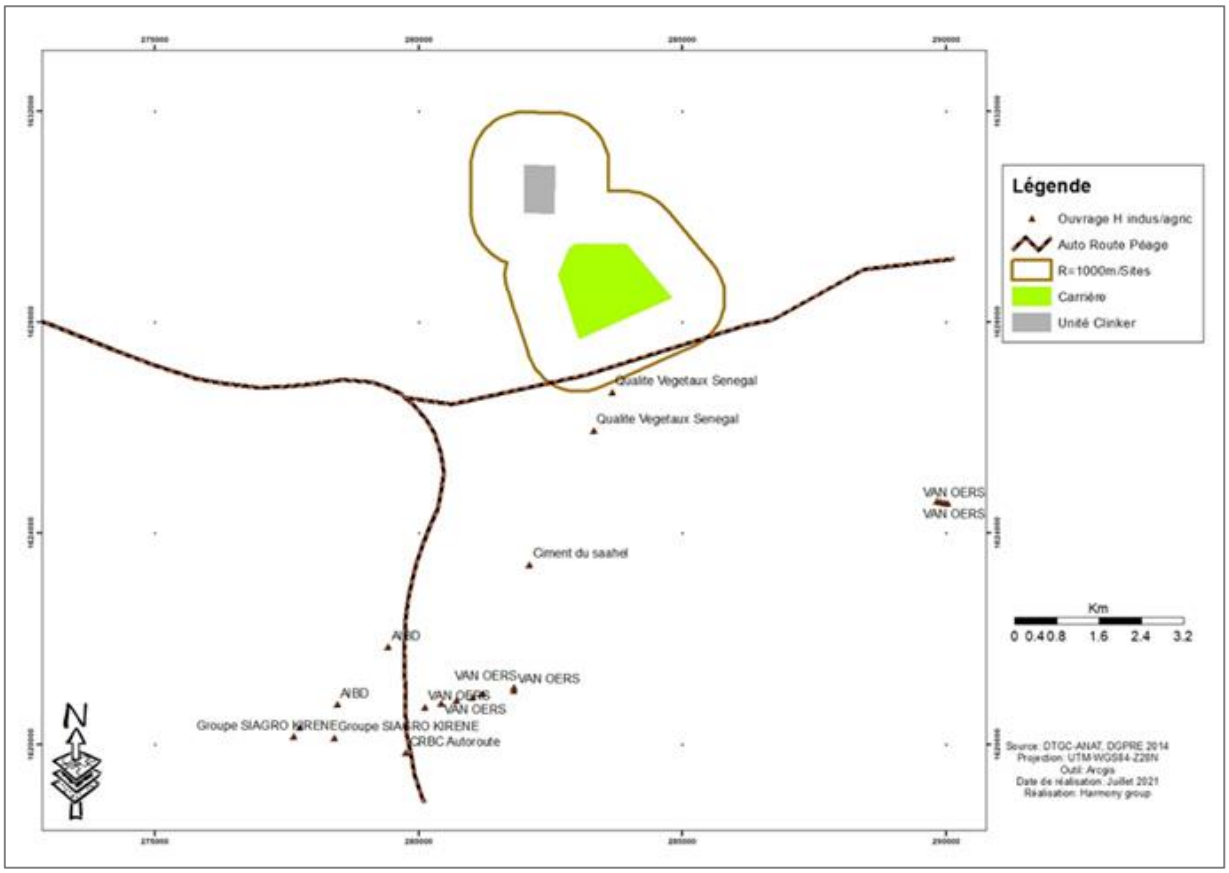


Figure 7-5 Distribution of Hydraulic Structures for Industrial & Agricultural Use

Error! Reference source not found. below describes the boreholes identified by the Harmony Group team on a joint mission with SEN'EAU in 2017. Figure 7-6 maps the boreholes carried out using these data shows that two (2) of the hydraulic structures located in the area of Pout Sud are located in the area within 1,000 m of the Project site. According to the hydrocensus study conducted by Harmony Group (2021), there is one (1) borehole in close proximity to the site that is supplying water to surrounding communities (forming part of the network of 7 boreholes in Pout Sud sector). This borehole, known as PS2, is located approximately 620 m from the Project site boundary. It should be noted that another borehole (PS1) is also located in the Project area, however, the hydrocensus study noted that is was not functional. No further information was available.

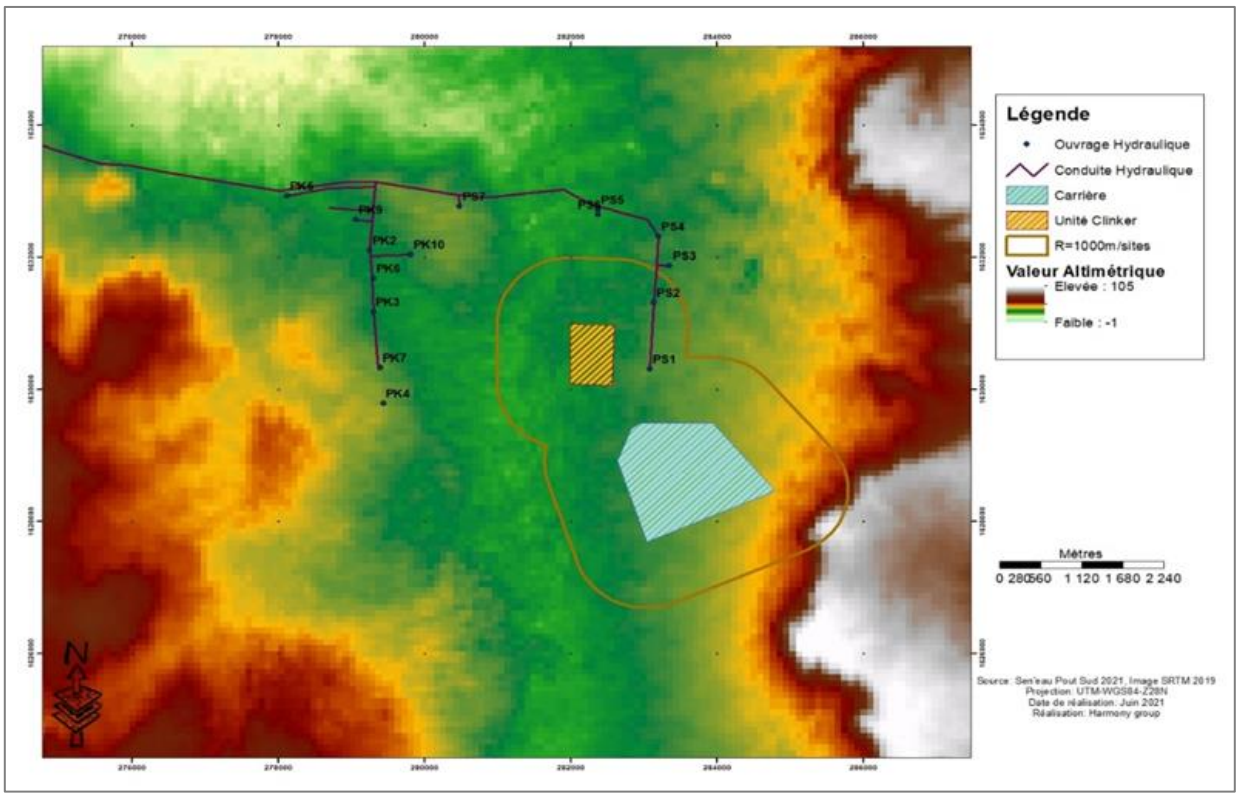


Figure 7-6 Geographical distribution of hydraulic structures[1]

7.7 Land Cover

Since knowledge of land cover is important for many planning and management activities, land cover analysis is often an essential component of large projects. Land cover modelling can provide a foundation for assessing environmental and social impacts of projects by showing where and how much critical habitat, agricultural fields, and built-up areas may be affected.

To create a land cover map, ERM performed both supervised and unsupervised classification using multispectral imagery products produced by the Sentinel-2 mission (Figure 7-7).

[1] (Source: HG / SENEAU, 2017)

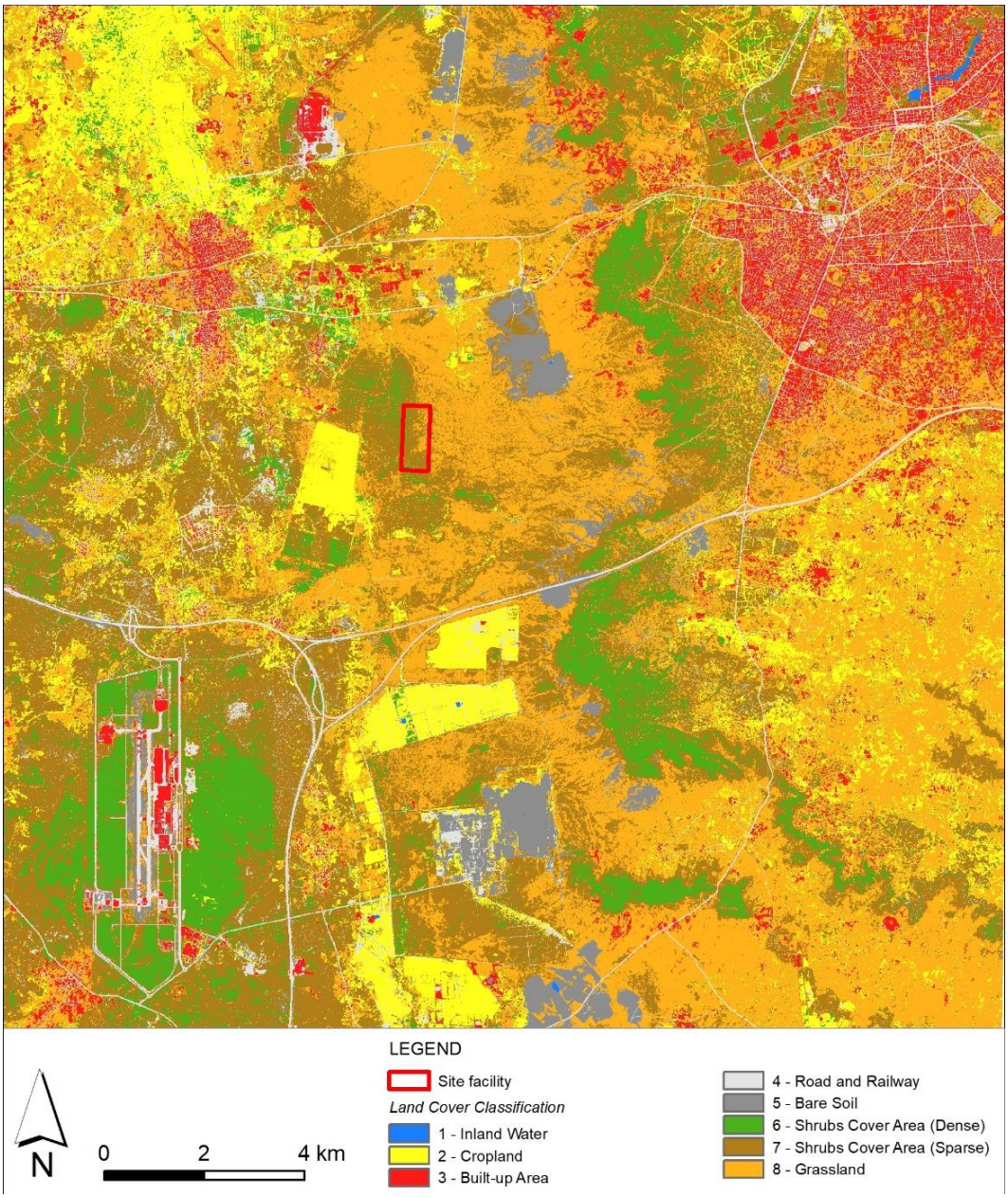


Figure 7-7 Land Cover Map

The Project is located in an area mainly characterised by grassland and cropland. The area close to the Project has a strong human presence with evidence on human modifications. There are a village to the west and a larger one to the east, an airport to the south-west.

7.7.1 Methodology

A land cover analysis was performed in the 6.5-km radius circle (~13,244 ha) around the proposed cement plant and quarry, and a 10-meter resolution fit-for-purpose land cover model (Figure 7-8) was generated from Sentinel 2 satellite imagery (captured on April 17, 2021).

7.7.2 Baseline Findings

The landscape was classified into the following classes: barren, shrub/scrub, agriculture, mining area, residential area, and road. The agriculture class was further separated into large-scale industrial agriculture and small-scale agriculture. The area breakdown of these classes within the circle is provided in Table 7-4.

Table 7-4 Different Land Cover Classes & Area within 6.5-Km Radius of the Project Site

Land Cover Class	Area (ha)	Percentage (%)
Barren	7,221	54.52
Shrub/scrub	925	6.98
Small-scale agriculture	3,207	24.22
Large-scale agriculture	997	7.52
Mining area	355	2.68
Residential area	293	2.21
Road	246	1.86
Total	**13,244**	**100.00**

The study area is highly developed and heavily modified by agriculture and mining activities. Large- and small-scale agriculture classes combined make up ~32% of the study area and occupy most of the western half of the land cover model (Figure 7-8). Aside from the populated areas adjacent to the study area to the east (Thiès and Thiès Quest), most residential area is on the western side of the study area. There are two major areas used for mining with facilities associated with them, one to the north and one to the south of the proposed project footprint.

The shrub/scrub represents the only vegetation class, which mainly grows on the small hills found in the eastern side of the study area. Since the classification of the vegetation class was aided by the Normalised Difference Vegetation Index (NDVI), the distribution and area size of shrub/scrub may change slightly if satellite imagery from a different season was used. Two (2) land cover classes–barren and shrub/scrub–were found under the proposed project footprint, and roughly 12% area of the project footprint is covered by shrub/scrub (Table 7-5).

Table 7-5 Area Breakdown of Barren & Shrub/Scrub Classes under the Project Footprint

Land Cover Class	Integrated Cement Plant (ha)	Quarry (ha)	Total (ha)
Barren	46.85	245.17	292.02
Shrub/scrub	6.73	33.08	39.81
Total	53.58	278.25	331.83

Additionally, there are many industrial activities and structures in proximity to the Project site (see Figure ***7-9***).

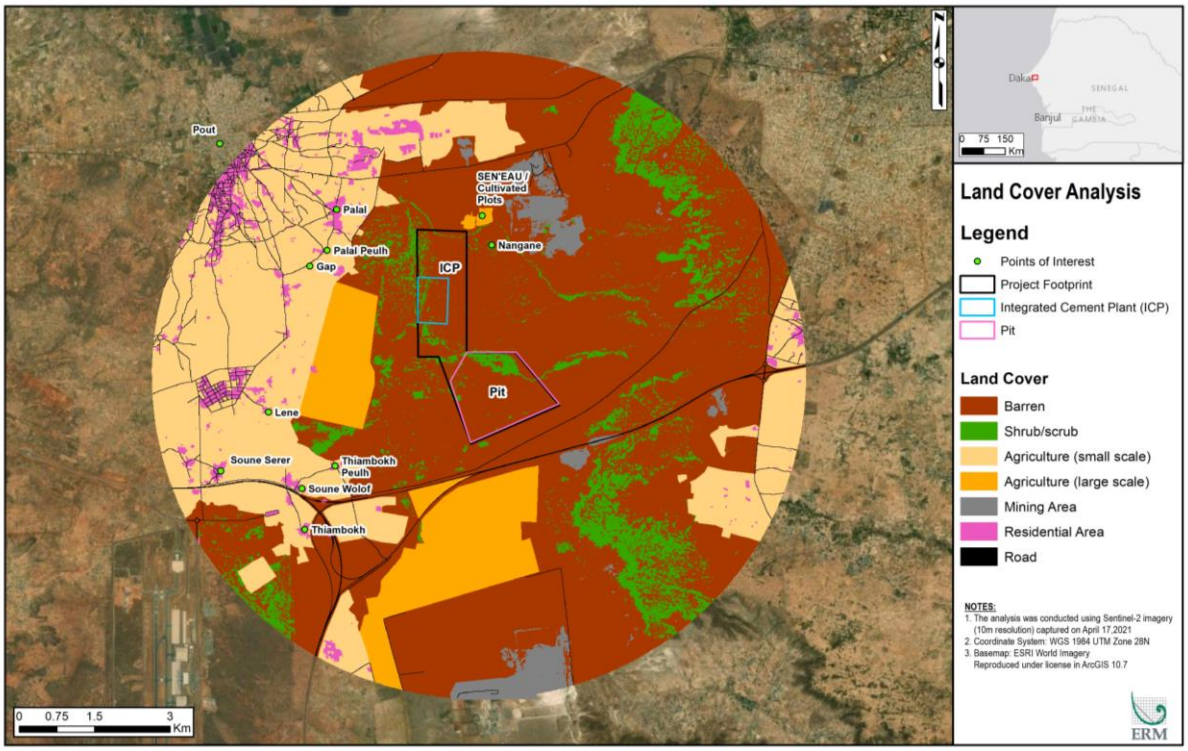


Figure 7-8 Land Cover Model Developed within 6.5-Km Radius of the Proposed Project Area

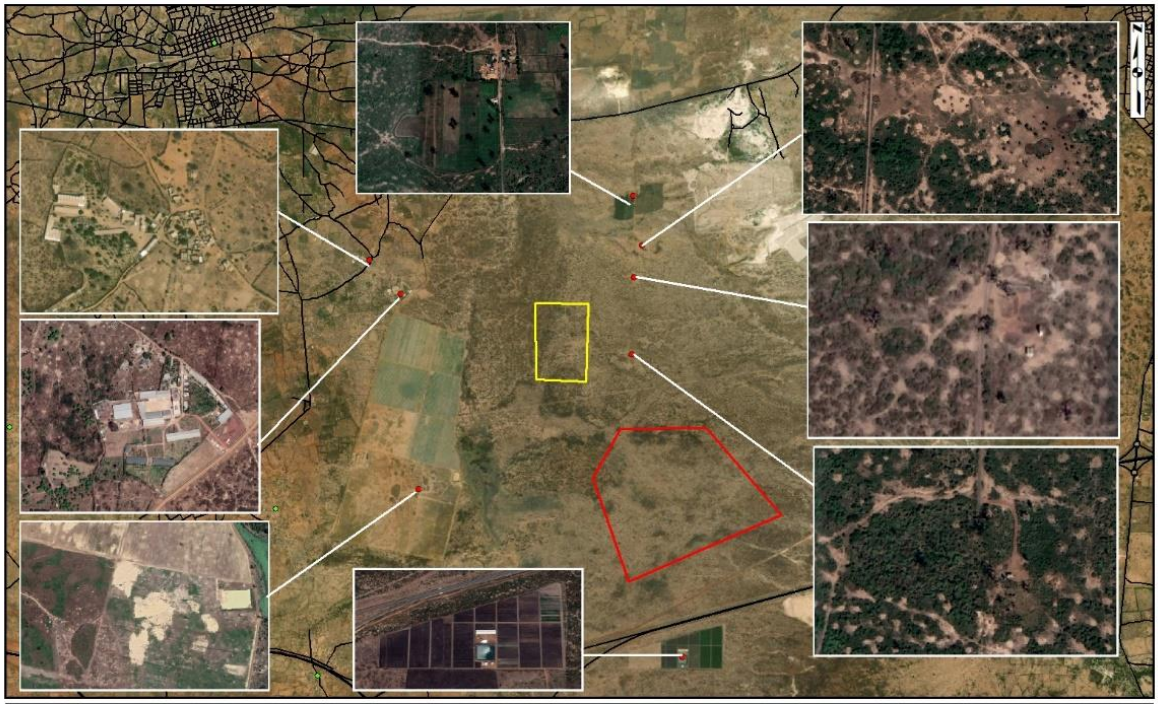


Figure 7-9 Structures nearby the Project Site

The following figures show some of the main features, which distinguishes the landscapes.



Figure 7-10 Landscape close to the Project Site



Figure 7-11 Residential/Commercial Area



Figure 7-12 Industrial Area

During the desktop baseline review, the following national and international protected areas have been considered:

- BirdLife International Important Bird Areas and Endemic Bird Areas;
- IUCN Protected Areas;
- RAMSAR Wetlands of International Importance;
- UNESCO Man and Biosphere (MAB) Reserves;
- World Heritage Sites; and
- World Commission on Protect Areas.

Based on the outcomes of the desktop review of an 11 km buffer around the Project Area, it overlaps with the landscapes of the Foret de Thiès.

7.8 Landscape and Visual

7.8.1 Methodology

The visual study area is defined as the area within which the Project could be discernible by the human eye and could interfere with the main sensitivities identified in the local context.

To identify the landscape study area, the Zone of Theoretical Visibility (ZTV) has been determined through computer analysis of topographical mapping to establish the theoretical distance from which the cement plant and the quarry could be visible in each direction.

The ZTV was determined through a viewshed analysis using a Geographic Information System (GIS) modelling tool available within the ESRI ArcGIS 10.8 package. The viewshed analysis is based only on topography (i.e. digital elevation model), and represents the areas where the Project could be potentially

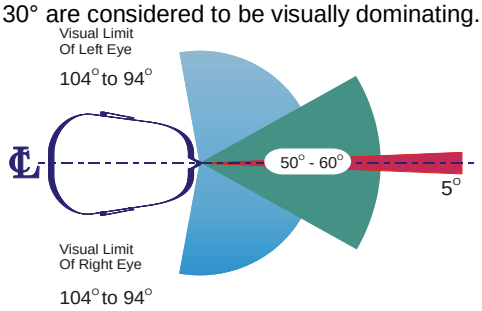
visible. For this specific assessment SRTM (Shuttle Radar Topography Mission) 30 m Digital Elevation Model has been utilised.

Defining an appropriate viewshed helps understand the visual impacts of the Project. The area of the viewshed will vary depending on the nature and scale of the proposed facility. Larger facilities produce larger viewsheds, as it will be more visible from a greater distance. The viewshed is therefore the area that is most likely to be visually impacted.

Figure 7-13 explains how a viewshed is defined and identified depending on the horizontal and vertical field of views.

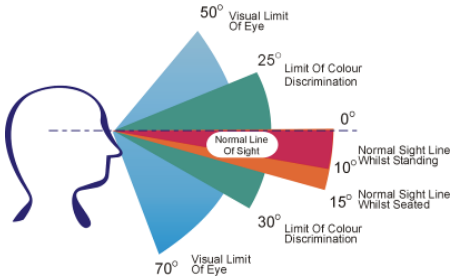
A. Horizontal Field of View

For most people, the horizontal central field of vision covers an angle of between 50° to 60°. Within this angle, both eyes observe an object simultaneously but from a slightly different angle. This creates a central field of greater magnitude than that possible by each eye separately. This central horizontal field of vision is termed the 'binocular field' (see green zone). Within this field images are sharp, depth perception occurs and colour discrimination is possible. Research suggests that the visual impact of a Project component will vary according to the proportion the binocular field it occupies. Project components which occupy 5% or 2.5° or less of the horizontal central binocular field of vision are usually perceived as insignificant objects, whereas components which occupy 30° are considered to be visually dominating.



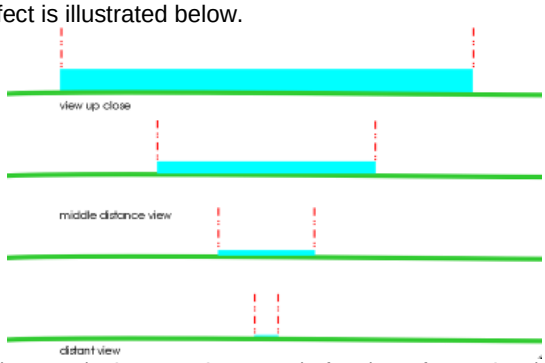
B. Vertical Field of View

The vertical central field of vision has a similar set of parameters. The vertical binocular field is normally 25° above the vertical and 30° below the vertical. When project components exceed the 50° upper visual limit of the eye, they are considered to dominate the vertical central field of vision. When project components occupy 0.5° they are not considered dominant, nor are they usually perceived as a significant change to the existing baseline condition when they are located within an anthropogenically modified landscape.



C. Horizontal versus Vertical Visibility Over Distance

As a person moves further away from a project component, the visibility of the vertical dimension tends to reduce more significantly than the visibility of the horizontal dimension. This effect is illustrated below.



Source: Human Dimension & Interior Space – A Source Book of Design Reference Standards, Julius Panero and Martin Zelnik, The Architectural

Figure 7-13 Field of View

Based on the Project characteristics the main interferences could occur from:

- Temporary construction compound;
- Movement of large construction vehicles;
- Clearing of vegetation; and
- Erection of the proposed Limestone Quarry and an Integrated Cement Plant (ICP).

Depending of the location of the viewers, the highest infrastructures of the cement plant shall be the major visual element of the proposed development and may visually impact on the surrounding. As the viewer moves further away from these components, the visual impact decreases until it is no longer visible. However, before the point of non-visibility is reached, the Project has reduced in scale such that they no longer have a significant visual impact.

As suggested in the calculations presented in Table 7-6, the impact of a 90 m infrastructure would reduce to insignificance at about 10.3 km (physical parameters are illustrated in Figure 7-13).

Table 7-6 Vertical Field of View

Vertical Line of Sight	Impact	Distance from Observer to a 150 m Tall Dam
< 0.5° of vertical angle	A thin line in the landscape	>10.3 km
0.5° – 2.5° of vertical angle	The degree of visual intrusion will depend on the development's ability to blend in with the surroundings	2.1 – 10.3 km
> 2.5° of vertical angle	Usually visible, however the degree of visual intrusion will depend of the width of the object and its placement within the landscape	<2.1 km

The study area was identified as a buffer of 11 km from the proposed Limestone Quarry and an ICP where it is assumed that most of the potential impacts will occur.

Arc Map 10.8 was used to determine the ZTV for the Project. The current visibility within the ZTV will vary depending on the presence of intervening local topography, and features such as vegetation and buildings. The present viewshed analysis has been based solely on topography and did not take into account the potential screening granted by the local vegetation patches, which would further reduce the actual viewshed. Moreover, it should be highlighted that a typical viewshed assessment does not take typical meteorological conditions into account that can result in changes to real visibility. For example, rainfall and other atmospheric conditions (e.g. sand transported by the wind) will alter the visibility of the Project. The diminution of visual clarity bought about by atmospheric conditions also increases with distance and cloudy days can result in a natural attenuation of the visibility of the Project.

It should be emphasised that intervening vegetation is not included in this mapping is likely to partially reduce the visibility of Project, in whole or in part, and therefore reduce the impact identified

The result of the viewshed assessment to see that the project is not visible in the area to the west because the topography of the area could mitigate these values.

In order to assess the visual baseline, several viewpoints have been identified along the Study Area, in order to different components of the landscape. These viewpoints are referred to as Visual Sensitive

Receptors (VSRs); they represent points within the viewshed from where people will be able (or not) to see the Project, and where the quality of the landscape and visual resources of people could be affected by the presence of the Project.

Figure 7-14 shows the locations of the VSRs representative of the general landscape character of the area, from representative location among the Study Area.

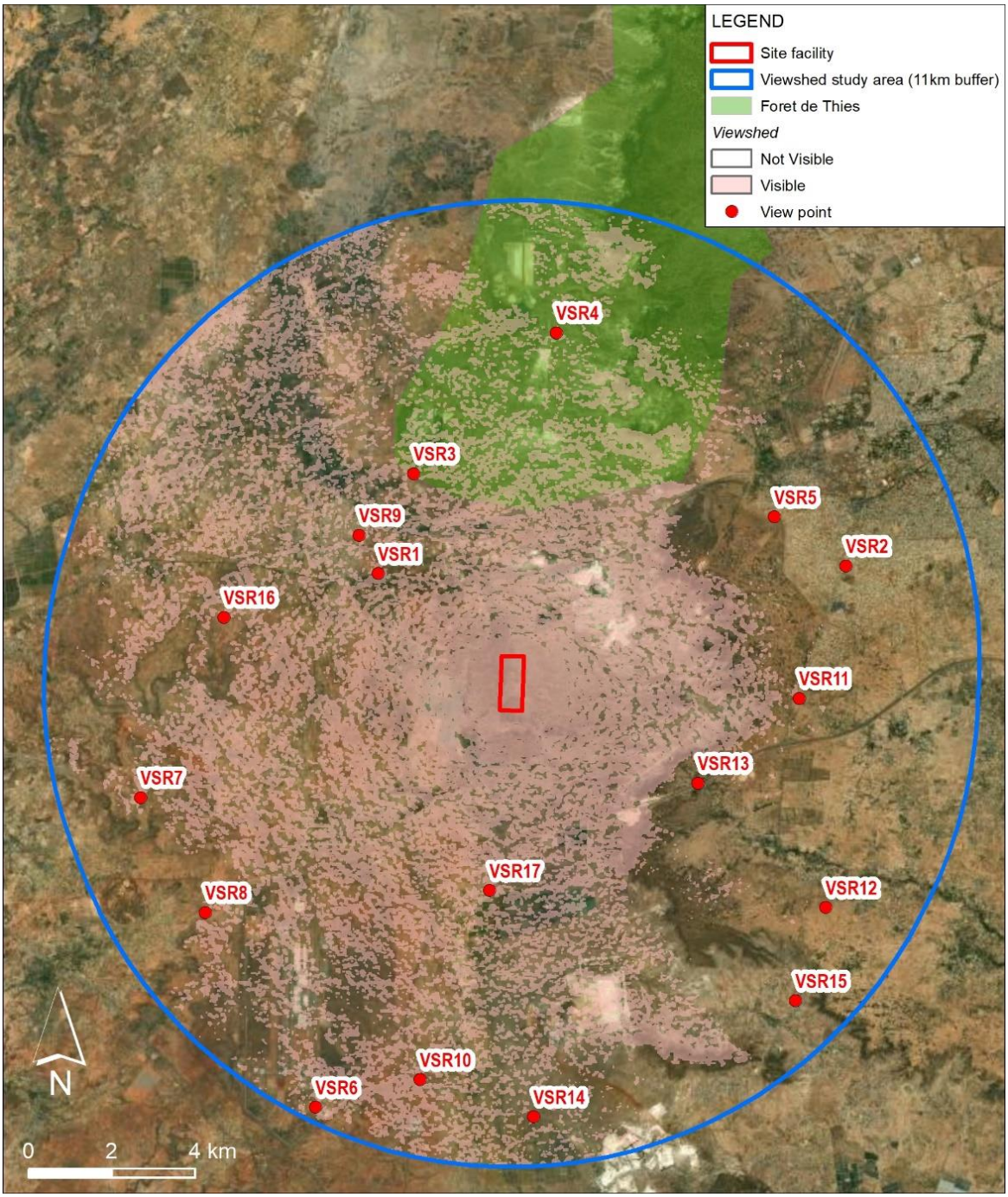


Figure 7-14 Viewpoints locations

7.8.2 Baseline Findings

The landscape is characterised by different components: topography, land use and potentially sensitive areas with regards to landscape (e.g. cultural heritage sites) and it has been categorised according to the presence of common elements.

Visual interferences may occur when new elements are introduced into a landscape or existing elements are altered or removed leading to a change in the way that stakeholders' access, perceive or experience landscape resources.

Therefore, the proposed assessment has been developed according to the following tasks:

- Description of the baseline landscape and topography in the study area;
- Study Area and Viewshed analysis; and
- Mapping and description of View Points (VPs);

The VPs have been categorised according to the presence of common elements. These include factors such as:

- Topography;
- Vegetation type (both species and age);
- Built forms;
- Evidence on human modifications;
- Land use.

During the scoping field survey, photographs of the site and surrounding landscape were taken in order to have a global view of the landscape characteristics.

7.9 Air Quality

The following section describes the potential impacts to air quality as a result of the proposed Project.

7.9.1 Assessment Framework

7.9.1.1 Pollutants for Consideration

The process of identifying the pollutants required for assessment was informed in the following way:

- IFC guidance on Environmental, Health, and Safety Guidelines for Cement and Lime Manufacturing was reviewed to identify the key pollutants of interest;
- National Senegalese Emission Standards and Ambient Air Quality Standards;
- A process description and emissions data provided by the proponent highlighting individual activities; and
- Review of Australian NPi[1] Mining guidance and AP-422 to identify individual activities with a potential for air emissions.

[1] Australian Government (2012) National Pollution Inventory Emission Estimation Technique Manual for Mining Version 3.1

[2] United States Environmental Protection agency (various dates) AP 42, Fifth Edition, Volume I Chapter 13: Miscellaneous Sources

Based on the above, the following pollutants were considered in the AQ study:

- Sulphur dioxide (SO_2);
- Nitrogen dioxide (NO_2);
- Particulate matter less than 10 microns aerodynamic diameter (PM_{10});
- Hydrogen Chloride (HCl);
- Hydrogen Fluoride (HF);
- Total Organic Compounds (TOC); and
- Heavy Metals:
  - Arsenic (As);
  - Lead (Pb);
  - Cobalt (Co);
  - Copper (Cu);
  - Manganese (Mn)
  - Nickel (Ni);
  - Vanadium (V); and
  - Antimony (Sb).

An assessment of $PM_{2.5}$ is not undertaken as the sources of particulate emissions are dominated by mechanical sources (i.e. dust created by material handling, blasting, and movement of vehicles over surfaces), the particulates will be concentrated into the 2.5 – 10 µm size range. This is acknowledged by NPi and USEPA who do not set emission factors for $PM_{2.5}$.

Senegal has listed carbon monoxide (CO) as a pollutant with an air quality standard. However, elevated CO emissions will only arise in a limited number of circumstances such as incomplete combustion or from specialised processes where carbon is used as a reducing agent for ores. Neither of these bear particular relevance to this project and CO has not been considered further in this report. The WHO / IFC does not include CO as a pollutant of interest for cement manufacturing.

7.9.1.2 Air Quality Standards

A review has been undertaken of applicable Air Quality Standards (AQS). The following sources have been considered:

- National standards in force in Senegal;
- International standards based on the relevant International Finance Corporation (IFC) guidance;
- World Health Organisation (WHO) air quality guidelines;
- United Kingdom (UK) Guidance for risk assessment for environmental permit;
- European Commission;
- US EPA; and
- International and national dust deposition guidelines.

A comparison of the different AQS for the various pollutants are presented in the following sections. The IFC guidelines stipulate that national standards should be used where these are reasonable and based on sound science. Therefore, where a national standard for a specific pollutant in a specific averaging period exists, that was used as the applicable AQS. However, in practice it is advisable to also use standards and guidelines from the IFC, WHO and other bodies to demonstrate robust compliance.

7.9.1.3 IFC Air Quality Guidelines

The applicable IFC/WHO air quality guidelines appropriate for the project are shown in Table 7-7 below.

Table 7-7 IFC / WHO Air Quality Standards

Pollutant	Averaging Period	Basis	Ambient Concentration (µg/m^3)
As (Arsenic)	Annual	WHO lifetime risk	0.00066
Mn (Manganese)	Annual	Guideline	0.15
Ni (Nickel)	Annual	WHO lifetime risk	0.0025
NO_2 (Nitrogen dioxide)	1 hour	Guideline	200
	Annual	Guideline	40
$PM_{2.5}$ (Particulate matter less than 2.5microns)	24 hour	Interim target 1	75
	Annual	Interim target 1	35
PM_{10} (Particulate matter less than 10microns)	24 hour (99th percentile)	Interim target 1	150
	Annual	Interim target 1	70
SO_2 (Sulphur Dioxide)	10 minutes	Guideline	500
	24 hour	Guideline	125
	Annual	Guideline	50
TOC (Benzene)	Annual	WHO lifetime risk	0.17
V (Vanadium)	24 hour	Guideline	1

1. As, Ni and Benzene are known carcinogens. The guideline value used was based on the lifetime risk of 1/1,000,000
2. Guideline values are based on WHO limits for substances with effects other than cancer or odour/annoyance

The compliance with the 10-minute SO_2 AQS is determined by the power law relationship using the 1- hour average concentration. The adoption of Interim 1 targets is appropriate for the project, given that national standards around the world and in other parts of Africa are comparable. The IFC 24-hour PM_{10} standard is measured as the 99th percentile which allows three (3) exceedances.

A relevant total organic compounds (TOC) guideline was not available, in lieu of which the benzene guideline was used, which is a very conservative estimation as benzene is a known carcinogen with a lower limit.

7.9.1.4 Senegalese Air Quality Standards

The Senegalese standard is a national document specifying the regulations and standards[1] regarding air pollution. The document outlines the air quality limits for Senegal. The standards relevant to the project are set out in Table 7-8 below.

Table 7-8 Senegalese Air Quality Standards

Pollutant	Averaging Period	Value (µg/m^3)[a]	Value (µg/m^3)[b]
$PM_{2.5}$	24 hour	-	75
	Annual	-	25
PM_{10}	24 hour	260	150
	Annual	80	40
SO_2	10 minutes	125[a] / 50[b]	500
	24 hour	50	50
NO_2	1 hour	200	200
	Annual	40	40
Pb	Annual	2	0.5

a – Based on NS-05-062 (2003) as shown on the ministry website: http://www.denv.gouv.sn/index.php/air-et-climat/centre-de-gestion-de-la-qualite-de-l-air-cgqa/reglementations-et-normes

b – Based on NS-05-62 (2019) these limits could not be verified as no direct link to the ministry website was found.

Air quality standards for $PM_{2.5}$ were not given in the NS-05-062 (2003) version.

For the sake of this report the more stringent of the two (NS-05-62) limits were considered.

The limits for the NS-05-062 (2019) were considered further in this report as these are the more stringent values.

The Senegalese emission limits (NS-05-062 (2003)) were used for comparison to the project emission discharges and found to be within compliance of the limits.

7.9.1.5 Other Relevant Guidelines - UK and US EPA

For some pollutants of interest there are no air quality standards/guidelines set out by the IFC, WHO or Senegalese Government. Where this is the case, standards and guidelines have been used from other international bodies.

As summarised in Table 7-9 below;

1 Republique Du Senegal, Direction de l'Environnement et des Etablissements classés Senegalaise, Norme Senegalaise, Pollution atmosphérique - Norme de rejets, NS 05-062, Octobre 2003

- The UK has developed a risk assessment guideline[1] for environmental permits. The document includes an extensive list of pollutants and environmental assessment levels. For the purposes of simplicity these will be considered as AQS for the remainder of this report.
- The US EPA[2] has produced dose response assessment tables for chronic and acute effects from various pollutants. Chronic limits were used as annual values and acute limits as 1-hour limits. The table below provides of a list of the AQS used for the AQ study.

Table 7-9 UK / US EPA AQS

Pollutant	Averaging Period	Source	Value (µg/m^3)
Co	1hr	US EPA	2,000
	Annual	US EPA	0.1
Cr	1hr	US EPA	25,000
	Annual	US EPA	83.3
Cu	1hr	UK	200
	Annual	UK	10
HCl	1hr	UK	750
HF	1hr	UK	160
	Monthly	UK	16
Sb	1hr	UK	150
	Annual	UK	5

The following are noteworthy provisos regarding the table above:

- Co refers to total cobalt compound limit;
- Chromium value refers to total chromium IV compounds with carcinogenic effect for chronic exposure. This is an obvious overestimate but was used as a conservative limit;
- The copper limit covers both dusts and mists;
- The guideline for HF is a monthly guideline but for comparison purposes was considered against the daily average; and
- The antimony guideline includes Antimony and compounds (as antimony) but not antimony trisulphide and antimony trioxide.

[1] UK Environment Agency, Guidance: Air emissions risk assessment for your environmental permit, February 2016, https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit
[2] US EPA: Dose-Response Assessment for Assessing Health Risks Associated With Exposure to Hazardous Air Pollutants, https://www.epa.gov/fera/dose-response-assessment-assessing-health-risks-associated-exposure-hazardous-air-pollutants

7.9.1.6 Dust Deposition Guidelines

Dust deposition guidelines are included as an indication of the potential for nuisance to arise due to soiling. The IFC and WHO do not set out guidelines as dust deposition is a perception and nuisance issue, rather than an issue that directly affects health. The Senegalese standard provides a national limit for dust deposition. There are several standards and guidelines published by various bodies and these are set out in Table 7-10.

Table 7-10 Dust Deposition Guidelines

Potential for complaint	Deposition rate (g/m^2/day)	Data source
Serious nuisance	0.200	Senegalese standard
Possible Nuisance	0.600[1] (30-day average)	South Africa National Standards for residential areas
Possible Nuisance	0.350 (monthly mean)	TA-Luft (Germany)
Serious nuisance	0.200	UK recommended nuisance dust deposition rate
Very Likely Nuisance	0.650	TA-Luft (Germany)
First Loss of Amenity	0.133 (monthly mean)	West Australia Nuisance Standard
Unacceptable reduction in air quality	0.333	West Australia Nuisance Standard
Nuisance dust deposition	0.133	Malaysia air quality standard

The national deposition rate limit of 0.200 g/m^2/day was used for assessment purposes.

7.9.2 Baseline findings

7.9.2.1 Meteorology of the proposed site

The climate of Senegal has a distinct dry season and wet season. The dry season is characterised by the Harmattan, which brings hot dry and dusty air from the continental interior. As such, during the dry season naturally occurring dust and PM_{10} is elevated and will typically be in excess of air quality standards and potentially dust deposition guidelines. Furthermore, the dry weather will mean that dust emissions from industrial sources are exacerbated.

The meteorological data for the area was sourced for the last five years (2016-2020). The wind data was assessed and a composite annual average wind plot was created as shown in **Figure *7-15*** below. The predominant wind direction (both in frequency and wind speed) is from the north. The highest frequency of wind speed class is in the 4.00-6.00 m/s range (at 35.3% frequency) followed closely by the 2.00-4.00m/s range (at 32.3% frequency).

[1] For residential areas can be exceeded 3 times in a year and not in consecutive months.

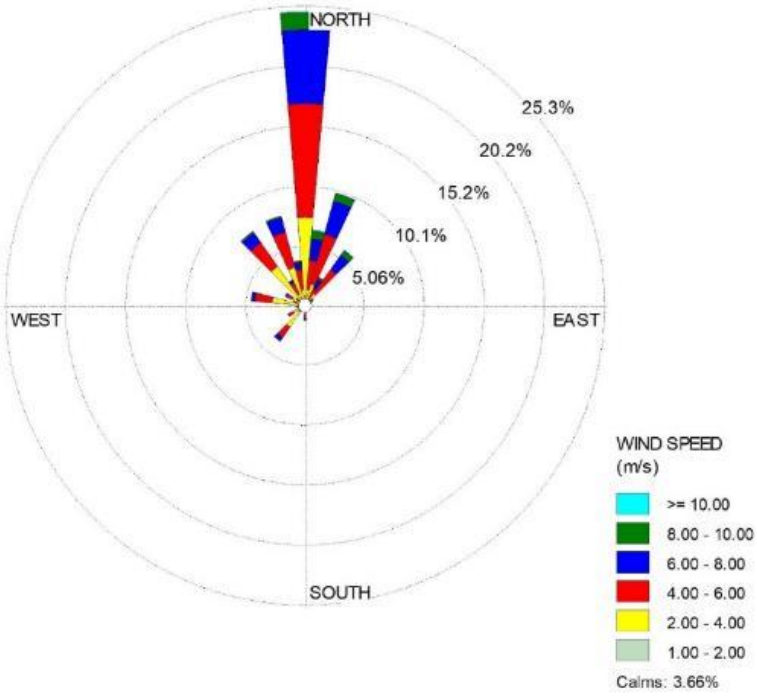


Figure 7-15 Wind Rose Annual Average

7.9.2.2 Baseline Study

A site visit to the proposed site was undertaken in November 2020 by Harmony Group to undertake a baseline survey. The following observations were made:

- Dust generation observable from the SSPT quarry;
- Dangote and Kirin cement operations are potential dust generators; and
- Small quarry sites are dotted along the A1 and N2 roads.

Baseline monitoring was undertaken for SO_2, CO, NO_2, PM_{10} and $PM_{2.5}$. Each pollutant was measured for ten consecutive days (during April 2021) across 12 monitoring stations as shown in **Figure *7-16*** below. Gaseous pollutants were measured using diffusion tubes and hand analysers, PM_{10} and $PM_{2.5}$ was measured using continuous monitoring equipment. Further information on the monitoring methodology is provided in the Annexure F.

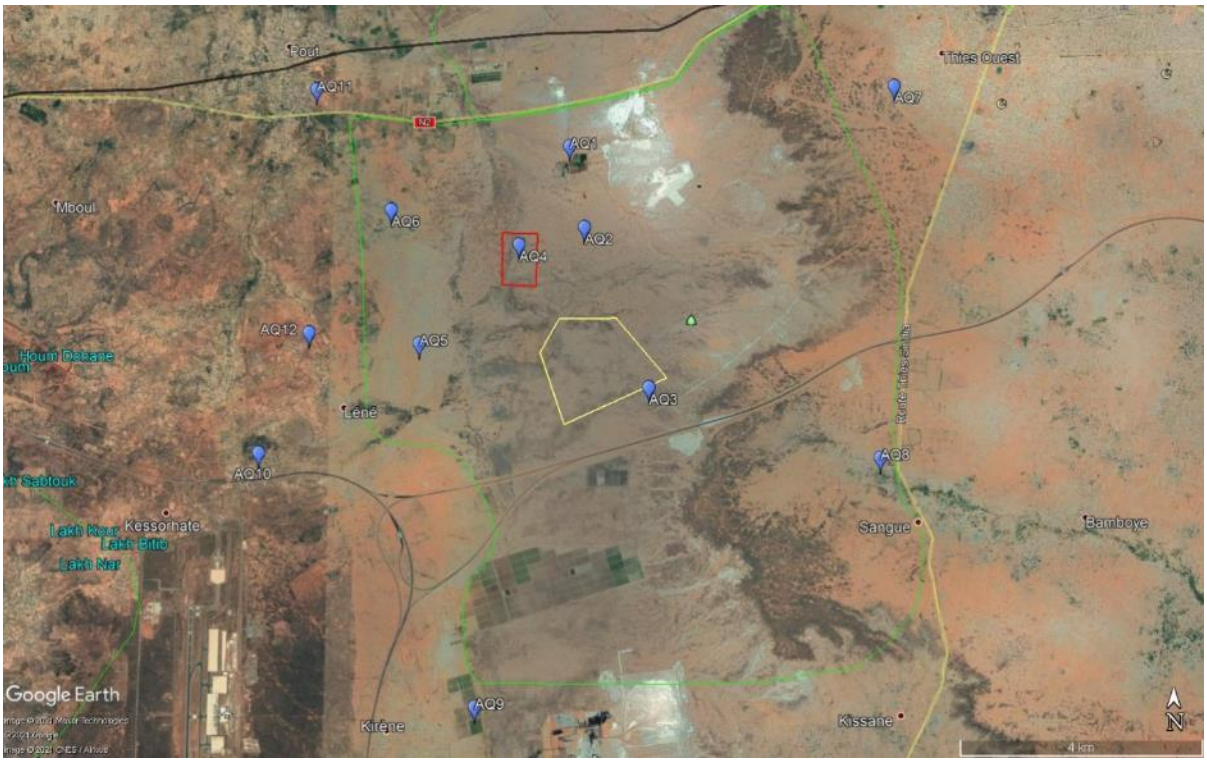


Figure 7-16 Location of AQ Monitoring Stations

The summary of the pollutant average results is shown in the Table 7-11 and further explained below.

Table 7-11 Baseline Ambient Concentration

Pollutant (µg/m^3)	AQ 1	AQ 2	AQ 3	AQ 4	AQ 5	AQ 6	AQ 7	AQ 8	AQ 9	AQ 10	AQ 11	AQ 12	Mean
PM_{10}	20.6	16.3	41.0	14.9	21.3	33.5	12.6	17.5	24.4	26.0	21.0	17.4	22.2
SO_2	4.4	4.4	1.2	0.2	3.6	10.1	24.6	0.0	80.6	18.6	91.5	6.7	20.5
NO_2	4.9	5.4	16.7	195.5	3.6	27.9	4.9	0.0	5.7	26.7	4.4	4.9	9.6

Note: underlined value refers to highest pollutant average

- The highest SO_2 was recorded at AQ11, which is near the RN2. SO_2 arises from the combustion of fuel containing sulphur either in vehicles or industrial stack emissions;
- Average SO_2 was below the IFC/WHO and Senegalese daily limit of 125 and 50 µg/m^3 (interim target 1 and 2 respectively);
- NO_2 emissions are typically associated with industrial combustion, traffic sources and localised combustion associated with dwellings. The highest NO_2 average was recorded at AQ4. The station was not located nearby any obvious source that could warrant such a high value. The result is therefore believed to be erroneous and has been excluded from the average calculation. In general, NO_2 concentrations are well below the 1-hour and annual mean air quality standards;

- The $PM_{2.5}$ ambient concentrations were all lower than the Senegalese daily limit of 25 µg/m^3. The highest values were obtained at AQ11 and AQ6, which is expected given their proximity to the roads.
- The highest PM_{10} (41 µg/m^3) was measured at AQ3. This is expected due to the proximity to the nearby road (A2). The Senegalese daily limit for PM_{10} is 260 µg/m^3. The average PM_{10} is less than 10% of the AQS and in general is well below relevant air quality guidelines; and
- The baseline study was done in April which is just outside of the Harmattan period (end November until around the middle of March). The baseline for $PM_{2.5}$, PM_{10}, and dust is likely to be significantly higher during this period and the $PM_{2.5}$ and PM_{10} AQS values are very likely to be exceeded during this time. To account for this effect, it was conservatively assumed that the airshed is degraded during the entire year for $PM_{2.5}$ and PM_{10}.

7.9.3 Methodology

7.9.3.1 Introduction

The proposed development will result in new emissions arising primarily from the quarry activities, the ICF and interconnecting haul road. An emissions inventory has been prepared on the basis of the proposed activities and production rates, using emissions factors and equations from the Australian NPi[1] Mining guidance and USEPA AP-42[2]. This guidance allows site-specific factors to be included, such as wind speed and precipitation.

The emissions inventory has been used to prepare dispersion models to predict the impacts at receptors. Five years of meteorological data are used to allow quantification of inter-year variation, and the worst-case year has been used in the assessment.

7.9.3.2 Emissions Inventory

Activity Data

CIMAF provided the following that was used to inform the emission inventory:

- Stack and emissions data for the three stacks as described below:
  - Stack parameters including: stack height, stack diameter, dry gas volumetric flow rate, stack temperature
  - Vendor guaranteed pollutant concentrations: Kiln Stack (PM_{10}, oxides of nitrogen, sulphur dioxide, hydrogen chloride, hydrogen fluoride, metals and volatile organic compounds).
  - Charcoal/coke stack (PM_{10}).
  - Cement mill stack (PM_{10})
- Quarry:
  - Drilling and blasting schedule and details
  - Tonnages of limestone and waste rock
  - Material handling

[1] Australian Government (2012) National Pollution Inventory Emission Estimation Technique Manual for Mining Version 3.1

[2] United States Environmental Protection agency (various dates) AP 42, Fifth Edition, Volume I Chapter 13: Miscellaneous Sources

- Details of types and numbers of mobile plant

- Haul road:
  - Details of types and numbers of mobile plant
  - Number of journeys

The production rates for the quarry is show in Table 7-12 below.

Table 7-12 Quarry Production Capacities

Parameter	Unit	Value
Total Rock	tonnes/year	897,000
Total Ore	tonnes/year	780,000
Waste Rock	tonnes/year	117,000
Quarry Area	m^2	50,000 (initial)

1. The quarry area at any one time is expected to be a maximum of 5 ha. The operational area is dynamic and will move in a segments at a time with backfilling before proceeding.

The anticipated access road traffic data has been provided by CIMAF for both operational and construction phases. Traffic on the interconnecting road has been estimated by ERM using the expected load transfers over the road.

7.9.3.3 Activities Considered

The proposed mining activity has been used to compile an emissions inventory. In this section the input information derived from information provided. Activities included in the emissions inventory are:

- Drilling
- Blasting
- Loading of ore and waste rock at mining areas into dump trucks
- Excavator / shovels activity in the quarry
- Transport of the ore from quarry to ICF along interconnecting road
- Emissions from the ICF:
  - Cement kiln stack
  - Cement mill stack
  - Charcoal mill stack

7.9.4 Point Emission Sources

The stack emission concentration values were provided as vendor guarantees and is shown in Table 7-13 below.

Table 7-13 Point Source Emission Limits (mg/Nm^3)

Pollutant	Main Chimney Kiln	Coal / Petcoke Mill	Cement Mill
SO_2	50	NA	NA
NOx	500	NA	NA
TSP	10	10	10
PM_{10}	10	10	10
$PM_{2.5}$	10	10	10
HCl	10	NA	NA
TOC	10	NA	NA
HF	1	NA	NA
Sum total (As, Pb, Co, Cr, Cu, Mn, Ni, V, Sb)	0.5	NA	NA

Note: Dust was emission was vendor guaranteed (TSP) and the same value was modelled conservatively used for PM_{10}.
Total metals although not explicitly given as a vendor guarantee will be the limit for IFC compliance (ref: Environmental, Health, and Safety Guidelines: Cement and Lime Manufacturing).

7.9.5 Fuels

- Blasting will be undertaken using nitrate type fuel for the weekly blasting exercise. There will no storage of explosives or detonators on site.
- The lime kiln will use petcoke as the main fuel. The kiln burner design allows for multichannel flow to allow alternative fuels for the future if required. The petcoke will be ground in the coal mill (horizontal ball mill).
- Diesel will be stored onsite (maximum 60 kl) will be used for kiln start-up if required, the driven machinery at the quarry, onsite vehicles and the standby generator.

7.9.6 Limitations and Assumptions

The following assumptions and limitations were considered during the emission inventory:

- Quarry Area: The quarry area although 50 ha will commence with a working area of approximately 5 ha in the first year. The centre of the total quarry was modelled area was as the source area and 5 ha in area. It is understood that the working area is dynamic during the life cycle of the project and this assumption was valid especially for the first year. This effectively provides as higher emission rate per unit area but is a reasonable assumption as the total mass emission is the same.

- Stockpiles and handling: CIMAF has stated that there will be no ore stockpiling at the quarry area. Waste rock and ore will be loaded directly onto dump trucks for delivery to the ICF.
- Waste rock: The waste rock generated will be temporary stockpiled for 2-3 years and later used as backfill.
- Precipitation: Precipitation has an attenuating effect on TSP and PM_{10}. The relevant NPi / AP42 equations does consider this mitigating effect, however from previous modelling experience, this can result in under reporting of PM_{10} and TSP emissions. Therefore, the emission inventory ignores the rainfall in the area and consequently is conservative.
- ICF emission sources: The only emission sources from the ICF are from the three stacks. The remaining area of the factory is enclosed (as per CIMAF). Dust extraction systems (with bag filters) will be installed at conveyor points and other potential source of dust emissions.
- ICF stacks:
  - The stack height for each of the three stacks was considered against the US EPA Good Engineering Practice (GEP).
    - The calculated GEP height for each of the three ICF stacks was determined to be 115 m. The main stack height is designed for 120m while the other two stacks are designed for 36 m (each). While the rationale for GEP (to minimise the effects of downwash, wakes, and eddy effects) is understood, it is the main stack that poses the higher environmental risk due to the nature of the kiln operation and emissions. The other two stacks are basically for discharge associated with ball mill grinding operations. The expectation to build the other two stacks to GEP is not considered necessary due to the excessive cost and generally lower environmental risk. This conclusion is supported by the modelled results (discussed in subsequent report sections) that indicate minimal source contribution from all of the stacks.
  - ERM was provided with stack emission test data from another CIMAF operated cement facility in Morocco. CIMAF indicated that this data can be used due to the processes being essentially identical and scope of both these cement operations. Stack testing data provided the dry gas volumetric flow rate through each stack.
  - CIMAF has received vendor guarantee emission rates for each of the pollutants. These limits in conjunction with the dry gas flow (see above bullet) was used to determine the emission rate of the pollutant. Continuous analyser equipment / opacity monitors will be installed on all stacks to ensure the guarantees are fulfilled.
- Electricity for the site will be sourced from SENELEC (National Electricity Company of Senegal). A standby generator of 1,000 kVA generator will be installed on site as a backup system.

7.9.7 Model Methodology

7.9.7.1 Overview

The impact assessment was undertaken using the USEPA Aermod model. Aermod is widely accepted for use in this type of study, and is recognised by the USEPA, IFC, World Bank, international Lenders and national regulatory bodies.

AERMOD is a steady-state plume model incorporating air dispersion taking into account both surface and profile meteorological data, AERMET. AERMET uses standard meteorological measurements and

surface parameters representative of the modelling domain to compute boundary layer parameters used to estimate profiles of wind, turbulence and temperature used by AERMOD.

AERMAP processes terrain data in conjunction with a layout of receptors and sources for input into AERMOD air dispersion model.

The model can be applied to rural and urban areas, flat and complex terrain, surface and elevated releases, and multiple sources, including, point, area and volume sources, in the stable boundary layer (SBL), AERMOD assumes the concentration distribution to be Gaussian in both the vertical and horizontal.

The impacts of the project are calculated using dispersion modelling. The modelling considers the following information:

- Emissions inventory;
- Site layout (including conceptual buildings);
- Site specific meteorology;
- Terrain; and
- Land use.

7.9.7.2 Sources Modelled

The source modelling encompassed multiple sources as described below:

- Quarry area source:
  - Drilling, blasting, wind erosion, excavators and shovels on overburden
- Quarry point source:
  - Exhaust emissions from front loaders, shovels and drills
- Interconnecting haul road:
  - Emissions from vehicle movement on the road
  - Emissions from vehicle exhausts on the road
- Integrated cement factory:
  - Emissions from three stacks

7.9.7.3 Model Input Parameters

The key parameters used in the setting up of the model are listed in Table 7-14 below.

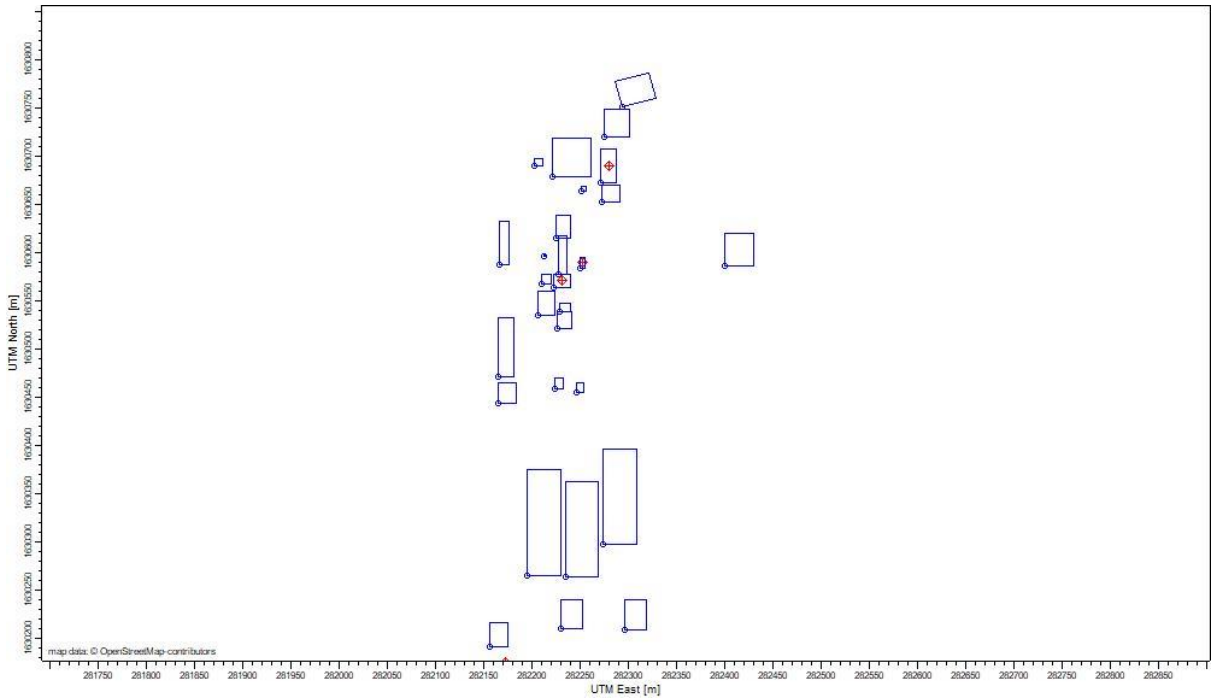
Table 7-14 Model Parameters

Parameter	Value	Notes/ Comments
Dispersion model	USEPA AERMOD	
Number of Sources	120	3 Points Sources at ICF (all pollutants) 1 Area source for quarry (PM_{10} and dust) 1 Point source at quarry (machinery and vehicles at quarry)

Parameter	Value	Notes/ Comments
		1 Line volume source for road (PM_{10} and dust) 114 Point sources for road (Gaseous vehicle exhaust)
Model domain	40 km x 40 km	
Receptor grid : Nested	50 m resolution	In primary grid box 4 km x 4 km
	100 m resolution	In secondary grid box 8 km x 8 km
	200 m resolution	In tertiary grid box 20 km x 20 km
Buildings	Included	See Section 7.9.7.4
Terrain	Flat	Terrain is flat with no sustained gradients of greater than 1:10
Albedo	0.3275	
Bowen Ratio	7.75	
Surface Roughness	0.2	
NOx to NO_2 conversion ratio	Hourly conversion: 35% Annual conversion: 70%	Power law relationship
Plume depletion	Enabled (for dust modelling)	Dry and wet depletion for dust modelling)

7.9.7.4 Buildings

The building layout used in the modelling exercise is shown in Figure 7-17. The location and physical parameters of the buildings were provided by CIMAF. Buildings less than one third of the lowest stack height will not have a significant effect on plume downwash and was not considered in the model.



Note: Buildings are in blue outline and the three point sources in red

Figure 7-17 Layout of Buildings

7.9.7.5 Assumptions and limitations

The following assumptions and limitations during the model setup were used:

- Road layout: As the exact road layout is not known the shortest path between the quarry and the crushers at the ICF was mapped and modelled accordingly.
- The operational periods of some of the sources are limited to approximately 12 hours per day such as the quarry activities and road transport. The ICF was assumed to operate continuously.
- ICF stack parameters: The stack diameter, height, volumetric flow and temperature was provided by CIMAF.
- Vehicular exhaust emissions along the interconnecting road was modelled as point sources distributed evenly along the path. This method was used due to the potential overestimation of gaseous emissions using volume line sources. A similar approach was used for vehicle emissions at the quarry. Particulate emissions from the road were modelled as line volume sources.
- Construction phase activities were not included in the modelling, as construction activities cannot be accurately defined within a model environment. These activities are transient and can be adequately managed with appropriate mitigation.
- Dust was modelled using only the fugitive sources as emission sources. Wet and dry plume depletion options were chosen. Particle data assumed 50% of the TSP to be in the 30 micron range and 50% in the 10 micron range.

7.9.7.6 Meteorology

In order to undertake the model, 5 years of hourly sequential meteorological data is required. This data must be representative of the general site conditions and locale, and include a number of parameters including: wind speed; wind direction; precipitation; relative humidity; temperature; and information relating to the atmospheric stability and inversion height. The model requires several specific parameters that are not recorded on site. It should be noted that reliable meteorological data from the area is limited as such data from the Léopold Sédar Senghor International Airport was sourced for five years of hourly data. While it is understood that the airport is approximately 50 km away on a peninsular, this data is based on physical measurements. The alternative would have been to choose calculated data using prognostic tools such as The Weather Research and Forecasting (WRF) Model.

7.9.7.7 Terrain

Terrain can have a significant impact on the dispersion of emissions. Typically, terrain is included in the model where there are sustained gradients of >1:10. Terrain has not been included in the model as the land surrounding the site locality is flat.

7.9.7.8 Land Use

The land use surrounding the emission source will affect how the air moves across the landscape and in particular the degree of mixing and turbulence in the air column. The land use around the proposed site is varied, comprising of largely open scrubland and some nearby quarry activities. The land use used in the model reflects these differing land uses.

7.9.7.9 Sensitive Receptors and Sensitivity

The site is located between a road network comprising of the N2 and A2 on the north and south respectively. The area is approximately 4-5 km south from the nearby town of Pout and about 60 km east of Dakar. The closest residential receptors is the Fulani hamlet to the west of the site.

In terms of residential areas, these are defined as ‘medium’ sensitivity receptors; this is reflective of the general population. A graphical representation of the nearest receptors are shown in Figure 7-18 below.

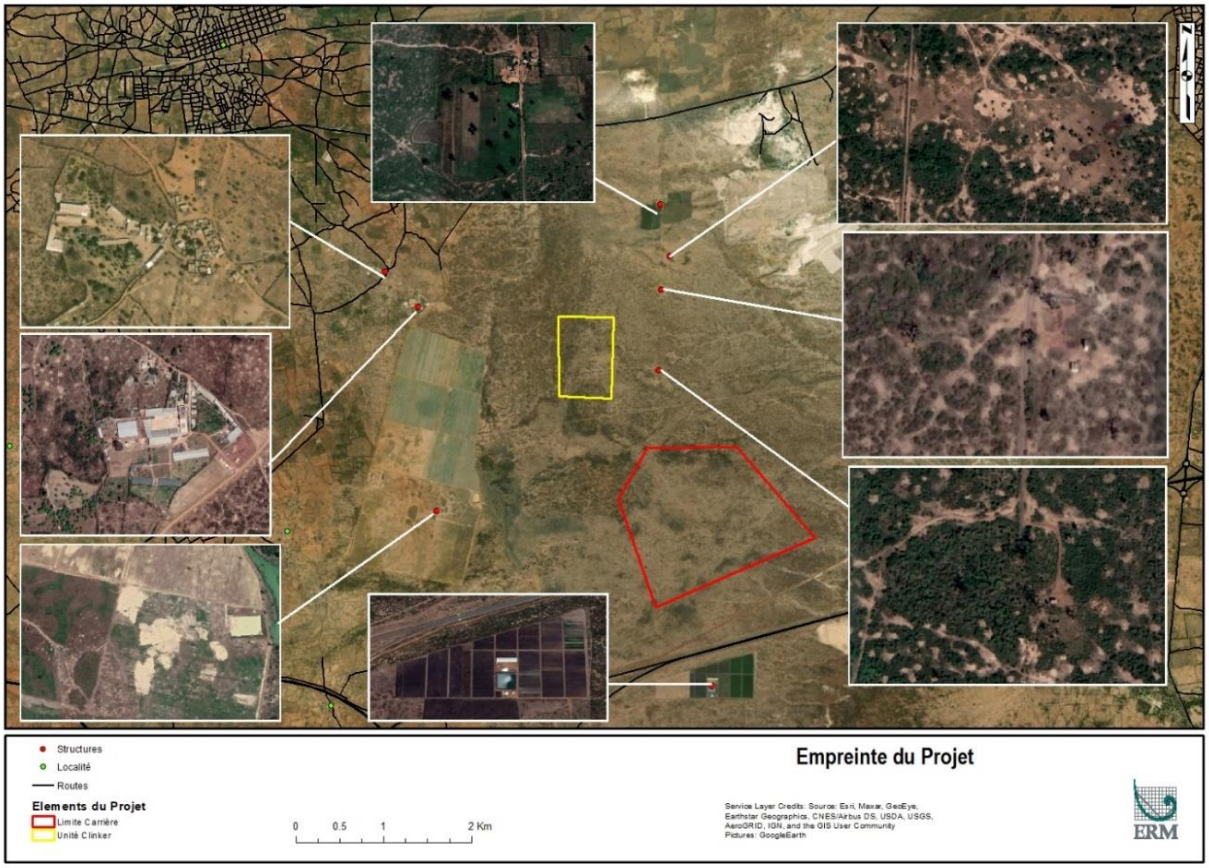


Figure 7-18 Location of Receptors

7.9.8 Embedded Mitigation

7.9.8.1 Quarry operations and Road

The quarry operation and the road activities were compared to the IFC EHS Guidelines for construction material extraction. The proposed operations will conform to the EHS guidance as described below:

- Blasting will be properly planned (arrangement, diameter, and depth and direction of blast holes)
- Trucks on interconnecting road will be speed limited
- The modelling takes into account the reduction in NO_2 emissions due to the use of Tier 2 vehicle type engines for the dump truck, front end loaders, shovels and drills

7.9.8.2 Integrated Cement Factory

The factory activities were compared to the IFC EHS Guidelines for Cement and Lime Manufacturing. The proposed operations will conform to the EHS guidance as described below:

- Simple linear layout for material handling reducing transfer points;
- Raw material stockpiles will be stored undercover;
- Petcoke, once delivered, will be stored undercover, then ground in the petcoke mill. The product (fine petcoke) will be stored in silos.

- Material transport within the factory will be undertaken by means of covered conveyors and drop points with extraction systems;
- Clinker will be stored in silos;
- Use of dust extraction and recycling systems to remove dust from work areas, especially in grinding mills. Bag filtration systems will be located at various points in the factory;
- The kiln design is a 5-cyclone stage preheater and Low NO_x Precalciner (preheating and precalcination – PHP) which is the preferred option for environmental performance (PHP kilns). They have the lowest heat consumption (due to the high heat recovery from kiln gas in the cyclones, and the low kiln heat losses), and no water to evaporate (compared to wet kiln which uses slurry), while also offering the highest production capacity; and
- Vendor guarantees and continuous analysers / opacity monitors will be installed for the stacks to ensure emission targets are met.

7.10 Noise

7.10.1 Introduction

This section describes the Noise study. It presents the methodology, results and findings of the noise modelling conducted for the construction and operation of the Project.

7.10.2 Scope of Analysis

The scope of work is limited to the supplied Project design, noise modelling, analysis and associated reporting conducted to document the methodology and findings for the assessment of the construction and operation of the Project. The assessment scope of works include:

- Reviewing national and international noise standards;
- Identifying the closest and/or potentially most affected receptors situated within the potential area of influence of the project;
- Establishing a noise model to predict noise levels at the nearby noise sensitive receptors associated with the construction and operation of the Project and associated infrastructure and more specifically with:
  - the construction of the Project and the construction traffic;
  - the operation of the Project, the primary crusher and the quarry, and the associated traffic.
- Providing a comparison of predicted noise levels to the noise limits.

During road construction, vibration may be noticeable at times when construction equipment passes close to individual receptors. Noise and vibration effects from road construction are expected to be short-lived at individual receptors as works progress along the route of the proposed road and are scoped out of assessment.

In addition, due to great distances between the Project's infrastructure and the receptors, vibration due to operation, other than blasting, is anticipated to be insignificant and therefore scoped out.

7.10.3 Relevant Documents, Standards and Guidelines

The NIA has been undertaken with due regard to, and in accordance with, the following acoustics standards and guidelines:

- Decree 01-282 of 12 April 2001 relating to the application of Environment Code. ART 84;
- International Finance Corporation's (IFC) Environmental, Health, and Safety (EHS) Guidelines – Section 1.7 – Environmental Noise Management (IFC EHS Guidelines 1.7 Noise);
- International Organisation for Standardisation (ISO) 9613-2:1996 (ISO9613:2) - Acoustics - Attenuation of Sound during Propagation Outdoors - Part 2: General Method of Calculation; and
- Australian and New Zealand Environment and Conservation Council (ANZECC) Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration (ANZECC, 1990).

7.10.4 Noise Criteria

This Section presents the approach taken to develop Project-specific noise criteria adopted for the NIA. These values have been determined with due regard to the standards guidelines and permits discussed in Section 7.10.3.

Senegal's Environmental Code stipulates that "the maximum thresholds of noise not to be exceeded without exposing the human organism to dangerous consequences are 55 to 60 decibels during the day and 40 decibels at night".

Senegal's noise guidance defines noise limits with different time periods. However, the guidance does not define the times and duration of the assessment periods. Hence guidance is sought from the IFC EHS Guidelines 1.7 Noise (IFC 1.7 Noise) where the daytime period is defined as 7:00am to 10:00pm and night time period from 10:00pm to 7:00am. Therefore the following period definitions and noise criteria outlined in Table 7-15 have been form the basis of the noise impact assessment.

Table 7-15 Summary of Noise Criteria and Period Definitions

Receptor	Environmental Noise Limit (dBA)	
	Daytime 07:00 – 22:00	Night 22:00 – 07:00
Residential; institutional; educational	55	40

As the construction period will take place over a period of 2 years, the criteria for the construction assessment will be the same as operational criteria of the Project.

7.10.5 Blasting Criteria

7.10.5.1 Airblast

The proposed design criteria for blast emissions associated with the Project are shown in Table 7-16. These criteria have been proposed based on the Australian and New Zealand Environment and Conservation Council (ANZECC) Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration and were. The criteria are proposed with the intention of ensuring the adequate protection of existing sensitive land uses whilst permitting the operations to be conducted in a practical manner.

The criteria for airblast are presented as 95 percentile limits and maximum limits for human comfort in occupied buildings in Table 7-16. The lower 95% compliance level has been adopted as the design

criteria for this Project and should be adhered to at all times during normal operations. The Maximum Level should never be exceeded, even in exceptional circumstances.

Due to the nature of blasting emissions, compliance with these criteria would result in impacts that are unlikely to be significant (but the potential remains for local community objections and complaints to arise). Exceeding any of these recommended levels would result in significant impacts and the potential for regulatory issues.

Table 7-16 Airblast - During Blasting Operations

Receptor Type		Airblast (dB Linear)	
		95% Compliance Level	Maximum Level
Residential	Day	115	125
	Night	105	115

7.10.5.2 Vibration

The criteria for ground vibration are considered both in terms of the risk of cosmetic and structural damage to buildings and structures and the effects of disturbance to building occupants. These criteria are given in Table 7-17. The lower 95% compliance level for disturbance has been adopted as design criteria for this Project.

The most stringent design criterion in Table 7-17 is the 2 mm/s criterion for night-time residential areas. As such, if blasting activities can be designed to not exceed this criterion at any time, blasting could occur at day or night and would not be likely to cause significant adverse impacts. However, it is also recognised as good practice to avoid blasting at night. It is not always practical to achieve a level less than 2 mm/s and hence regulators typically recommended a 95% compliance level, which should be adhered to at all times during normal, planned operations, and a maximum level, which should not be exceeded at any time. However, it is recommended that a level of 2 mm/s be considered as the long term goal for the control of ground vibration.

It is noted that this is a stringent approach and recognises the fact that frequent blasting would be noticeable at these levels although damage to buildings would not take place until levels were much higher.

Table 7-17 Vibration - During Blasting Operations

Receptor Type		Peak Particle Velocity (mm/s)	
Occupied Buildings (Disturbance)		95% Compliance Level	Maximum Level
Residential	Day	5	10
	Night	2	5

7.10.6 Noise Sensitive Receptors

Based on the review of the available Project Design Data, the Noise Sensitive Receptor (NSR) locations have been selected at short and at great distances from the Project's different components, to ensure all potential impacts are covered within this study. Figure 7-19 shows the NSR locations in relation to the social AoI.

These receptors have been selected so that they are representative of the closest and/or potentially most affected locations where worst case emissions may occur. Project Noise Levels (PNL) are predicted at these locations and impacts determined based on those levels.

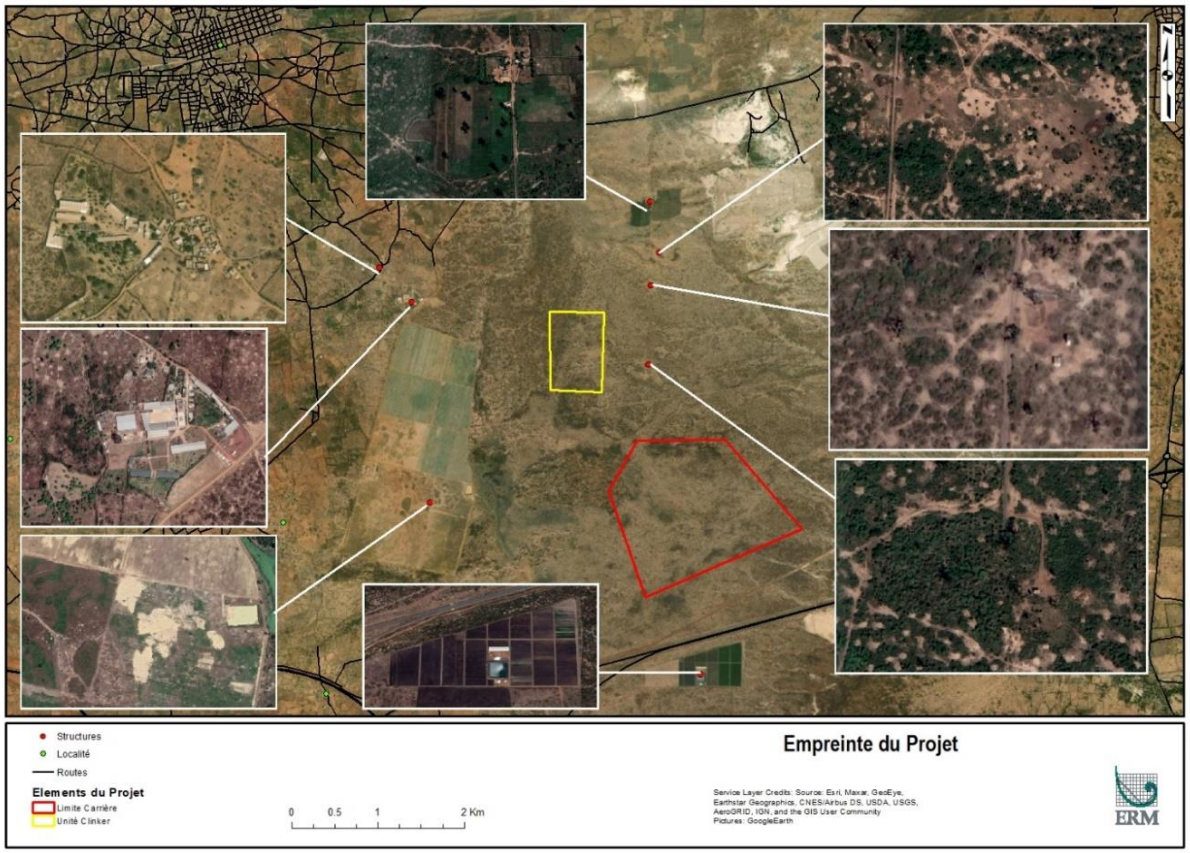


Figure 7-19 Noise Sensitive Receptors

7.10.7 Impact Significance

Noise Impact Assessment standards and guidelines generally give threshold levels that have the potential to create nuisance or disturbance. In addition, typical noise impact assessment methodologies require an approach that combines impact magnitude with receptor sensitivity to determine impact significance.

7.10.8 Determining Significance

7.10.8.1 Noise

In applying guidance such as IFC 1.7 Noise and Senegal's environmental code Art 84 it is necessary to scale impact magnitude into ranges required for an impact assessment. ERM adopts a standard noise

assessment matrix presented in Table 7-18 that compares predicted PNLs, i.e. the noise level attributable to the Project, to the relevant criteria to evaluate impacts at potential receptor locations.

Table 7-18 Noise Impact Assessment Criteria

Period	Noise Impact Scale dBA					
	Negligible	Minor		Moderate		Major
	PNL<	PNL>	PNL<	PNL>	PNL<	PNL>
Daytime	55	55	60	60	65	65
Night time	40	40	45	45	50	50

7.10.8.2 Blasting

International standards and guidelines for airblast and vibration have also been reviewed to establish criteria for assessment of impacts from blasting. The resulting criteria are set out in Table 7-19. No distinction is made between minor and moderate impacts because of the nature of impacts from blasting and the response of receptors.

Table 7-19 Criteria for Evaluation of Impacts from Blasting

Period	Airblast dB(Z) 95 percentile			Vibration PPV mm/s 95 percentile		
Significance	Negligible	Minor/ Moderate	Major	Negligible	Minor/ Moderate	Major
Daytime	<115	>115-125	> 125	<2	>2-5	> 5
Night time	<105	>105-115	>115	<1	>1-2	>2

7.10.9 Impact Terminology

The meaning of the 4 impact significance ratings used in Table 7-19, in the context of a Noise Impact Assessment, is as follows:

Negligible – no detectable effects, no need to consider in decision making, no mitigation required;

Minor – the effect may be detectable, but small enough that noise management measures would ensure impacts are reduced to be Negligible;

Moderate – a detectable effect, an impact that is significant, noise management practices and/or mitigation should be considered. Mitigation is likely to affect design and cost;

Major – a detectable effect, an impact that is significant, noise management practices and mitigation must be considered. Mitigation will alter the Project Design and Cost. Impacts are undesirable if not addressed.

Hence, impacts rated as *Moderate* or above will be mitigated where practicable, feasible and reasonable with proportionately more emphasis as the rating increases. These criteria will provide the basis for developing performance standards and acoustic specifications for the Project. Mitigation may not eliminate an impact, but would be expected to reduce its severity.

7.10.10 Modelling Scenarios

7.10.10.1 Construction Noise

The following have been incorporated into the noise model:

- Construction activities will take place only during day time, 8 hrs per day, 6 days per week for 2 years;
- 70 truck material delivery per day; and
- 20 buses for the transportation of the construction site personnel per day.

No construction activities are anticipated undertaken on the quarry. All activities on the quarry have been assessed as operation.

Equipment Sound Power Levels

For each item of equipment, a Sound Power Level (LW) value has been determined for the purposes of noise modelling. The LW has been determined from measurements conducted by CIMAF and ERM's database. A summary of the significant noise sources for and their LW used in the noise model for construction is presented in Table 7-20.

Table 7-20 Equipment Sound Power Levels - Construction

Equipment	Number	Lw dB(A)
Loader	3	109
Shovel	4	103
Small Shovel	3	93
Grader	2	102
Fixed Tower Crane (electric)	2	100
Mobile Crane	13	109
Forklift	8	93

7.10.10.2 Operation Noise

The following operational assumptions have been incorporated into the noise model:

- Project will operate 24 hours per day, seven days per week;
- Project's equipment, primary crusher and conveyors are all enclosed;
- Quarry and primary crusher will operate 8hrs per day, 6 days per week;
- 66 truck daily delivery of raw material between the quarry and primary crusher; and
- 100 trucks per day will be exporting the product from the ICP.

Equipment Sound Power Levels

For each item of equipment, a Sound Power Level (LW) value has been determined for the purposes of noise modelling. The LW has been determined from measurements conducted by CIMAF. A summary

of the significant noise sources for and their LW used in the noise model for operation is presented in Table 7-21 for the integrated cement plant and in Table 7-22 for the Quarry.

Table 7-21 Equipment Sound Power Levels – ICP & Primary Crusher

Equipment	Number	Lw dB(A)
Crusher Building	1	91
Corrective long distance park	1	63
Long coal park	1	63
Pre-homo park	1	77
Raw Mill Building	1	92
Cyclone Support Building	1	100
Preheating tower	1	92
Common filter building	1	87
Silo Homo	1	79
Oven	1	89
Scanner	1	93
Cooler	1	92
Coal Crusher	1	83
Clinker circuit	1	90
Incuit silo	1	61
Clinker Park	1	73
Oven cooling tower	1	54
Cooking compressor room	1	73
Pump room	1	62
Cement cooling tower	1	53
Coke receiving hopper	1	72
Cement Crusher Building	1	92
Cement silo	1	87
Bagging building	1	74
Workshop	1	84
Administrative and technical building	1	54
Corrective reception hopper	1	72

Table 7-22 Equipment Sound Power Levels - Quarry

Equipment	Number	Lw dB(A)
Loader	4	105
Trucks	4	105
Shovel	3	103
Forklift	3	93

Predictive Noise Modelling

Brüel & Kjær's Predictor 7810 (Version 2020.1) noise modelling software package has been utilised to calculate noise emissions from the Bonikro mining operations using *ISO 9613-2:1996 (ISO9613:2) - Acoustics* - Attenuation of Sound during Propagation Outdoors - Part 2: General Method of Calculation noise propagation algorithms (international method for general purpose, 1/1 octaves).

The Predictor software package allows topographic details to be combined with ground regions, water, foliage, significant building structures etc. and receptor locations, to create a detailed and accurate representation of the site and surrounding area. The noise model allowed for the quantification of noise levels from multiple sources, based on the sound characteristics (overall level, frequency data etc.) emitted from each source to predict the contributed noise levels from mining operations at the nearest potentially affected receivers for various operating scenarios.

The inputs and assumptions used in the predictive noise modelling are outlined below:

- Ground factor of 0 was applied for the study area (0.0 is acoustically hard, 1.0 is soft);
- Temperature 26˚C; and
- Relative Humidity of 70%.

All noise levels were predicted at a height of 1.5m (representing the typical height the ear level), are presented in decibels, dB(A) and rounded to the nearest whole integer or decimal place where necessary.

All Sound Pressure Levels (LP) values are expressed as dB(A) re: 2 x 10^{-5} Pascals (Pa) and all Sound Power Level (LW) values are expressed as dB(A) re: 10 $^{-12}$ Watts (W).

The operational scenario has not taken into account the bench depths that will be created on the quarry area, excluding any screening effect due to quarry's topography.

Blasting

Generally, the prediction of blasting impacts, airblast and vibration involves the analysis of site blasting monitoring data, however in this case such data is not available for the Project site. Therefore ground vibration and airblast levels have been predicted using the methodology outlined in the ICI Blasting Guide (ICI 1995) to provide an understanding of the potential of impacts from blasting.

According to CIMAF, blasting will be subcontracted to specialised company and modern blasting technic (with micro-delay) will be used. Blasting will take place twice per week and each time 20 to 30 holes will be used, with a micro delay of 25 milliseconds between blasting of each hole. Blasting will take place only during day time. Each blasting event will be using 1.5 to 2.0 tons of nitrate fuel type.

Airblast

The 95th percentile airblast site law, which may be exceeded up to 5% of the total annual blasts is defined by the peak airblast level (SPL) measured in dB (Z) and is defined as:

$$\text{Airblast OP (95\%)} = 165.3 - 24 \log10(SD)$$

where scaled distance $SD = \frac{d}{\sqrt[3]{MIC}}$

MIC is the maximum explosive charge mass (kilograms) detonated per delay at any 8 millisecond interval; and

d is the distance between the charge (blast location) and receptor.

7.10.10.3 Ground Vibration Prediction

Ground vibration levels depend on the maximum charge mass (effective charge per delay) and not the total charge weight, provided the effective delay interval is appropriate.

When blasting is to carried out to a free face in average field conditions the following equation may be used to estimate the mean vector peak particle velocity.

$$PVV\ (mm/s) = 1140(SD)^{-1.6}$$

where scaled distance $SD = \frac{d}{\sqrt[3]{MIC}}$

MIC is the maximum explosive charge mass (kilograms) detonated per delay at any 8 millisecond interval; and

d is the distance between charge and receptor.

7.11 Greenhouse Gas Emissions

7.11.1 Introduction

The greenhouse gas (GHG) assessment estimates the emissions contributing to climate change from the limestone quarry and the cement plant during the operational phase. The estimation of the emissions are associated with the combustion of fuel used in the equipment, process emissions for the cement production and offsite production of electricity used by the limestone quarry and cement plant.

7.11.2 Methodology

The calculation of GHG emissions arising from the limestone quarry and the cement plant has been calculated using the design specifications provided by CIMAF. The GHG emissions for the operational phase have been estimated using the documents listed below:

- Greenhouse Gas (GHG) Protocol: Corporate Accounting & Reporting Standard (World Resources Institute/World Business Council for Sustainable Development; and
- Intergovernmental Panel on Climate Change (IPCC) 2006 GHG Inventory guidelines.

The GHG Protocol Corporate Accounting & Reporting Standard divides emissions into three ‘Scopes’, which are defined as:

- Scope 1: direct emissions from sources owned or under the operational control of the company;
- Scope 2: indirect emissions from the consumption of purchased electricity; and
- Scope 3: indirect emissions an optional reporting category allowing for other indirect emissions associated with, but not controlled by the company.

According to the IFC's PS 3, direct emissions from facilities owned and controlled and indirect emissions from purchased steam or electricity is required to be quantified. Emission estimates for the limestone quarry and the cement plant cover those which are under direct operational control (Scopes 1 & 2). The magnitude of GHG emissions is defined as the tonnes of carbon dioxide equivalent (tCO_2e), emitted. The greenhouse gases covered by the Kyoto protocol and will be covered for the Project are:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)

The quantity of these gases emitted must be multiplied by the global warming potential (GWP) to convert this into tonnes CO_2e.

7.11.3 Findings

The following emissions sources below were calculated for the limestone quarry and cement plant.

Scope 1 - Combustion Emissions (Cement Plant):

- Petcoke used for the kiln.

Diesel used for heating of the kiln and operational diesel engines.Scope 1 - Process Emissions (Cement Plant):

- Process emissions associated with clement production.

Scope 2- Combustion Emissions (Limestone Quarry and Cement Plant):

- Electricity requirement for the limestone quarry.
- Electricity requirement for clinker production, cement grinding and cement packing and dispatch.

Table 7-23 below shows the total GHG emissions for the Project during the operational phase.

Table 7-23 Total GHG Emission for Project (Operational Phase)

Source	Estimated Annual Emission (tCO_2e/year)
Scope 1	
Petcoke	508,264
Diesel	324
Cement production process emissions	572,000
Scope 2 (1)	

Electricity - Limestone quarry	1,258
Electricity - Cement plant	84,237
Total emissions	**1,166,083**

(1) IEA Grid emission factor for Senegal (2018) - 0,000806tCO_2e/kWh

The total emissions for the operational phase of the Project are calculated to be 1,166,083 tCO_2e/year. The IFC's PS3 defines a reporting threshold for annual GHG emissions of 25,000 tonnes of CO_2 equivalent (tCO_2e). CIMAF is therefore above the reporting threshold as defined by the IFC.

Given that the Project involves an estimation of a future GHG assessment for activities yet to begin, a number of assumptions have been made. Some of the assumptions and limitations are shown below:

- The design production capability of the cement plant was used and not the forecasted actual production per year.
- The main fuel to be used is petcoke for the kilns. However, CIMAF will explore the use of alternative fuels in the future.

7.12 Climate Change

7.12.1 Introduction

This section describes the climate change study. It includes the methodology used in assessing the baseline.

7.12.2 Methodology

Climate change was assessed both in terms of impact of the Project in the increasing of climate change risk and in terms of risks represented by climate change to Project's operations.

7.12.3 Baseline Findings

As noted by the Task Force on Climate-Related Financial Disclosures (TCFD), physical climatic risks can be driven by climate change as a result of acute and longer-term shifts in climatic patterns. This section will outline the potential impacts that future projected changes in climate could have upon the climate hazards present at the proposed location, and resultant construction and operational phases of the Project.

7.12.3.1 Climate Data

A number of baseline data sources have been consulted by ERM within this assessment, sourced from weather stations and a number internationally leading scientific organisations (e.g. European Space Agency, United Nations Environment Programme). Climate projections data used within this assessment is sourced from the Intergovernmental Panel on Climate Change (IPCC) and from a series of other data sources (including the World Resource Institute, United Nations Environment Programme and ThinkHazard).

The IPCC is the UN's leading body for assessing the science related to climate change. The IPCC provides Assessment Reports (AR) reviewing the available literature on climate change and, in-part, climatic hazards. With each new AR comes a new round of climate models and data developed by the

IPCC and Coupled Model Intercomparison Project (CMIP). The last AR (AR5) was published in 2014 marking the latest set of finalised, fully reviewed, and fully published of climate data (CMIP5) by the IPCC and CMIP.

The IPCC has set out a series of 'Representative Concentration Pathways' (RCPs), each of which represents scenarios that vary on the basis of projected GHG concentrations over the next century. With increasing projected GHG concentrations, there is potential for a change in the climatic conditions at any given area (e.g. temperature and/or precipitation changes) that can vary depending on the amount of projected emissions associated with each RCP and chosen timeframe. RCPs are used in this assessment to indicate the impact of varying degrees on warming on the risk associated with each event type.

Scenarios are selected on the basis of their appropriateness for any given assessment being undertaken. The technical guidance on physical scenario analysis from the TCFD and other sources advise the use of a 'business as usual' scenario best aligned to RCP 8.5, with an additional scenario reflecting a lower emissions outcome to align most closely with the Paris Agreement (most often RCP 4.5) is also typically advised. The approximate temperature increases above pre-industrial levels for each of these RCPs are provided within Table 7-24.

Table 7-24 Scenarios Selected for Inclusion

Scenarios used for this Assessment	Approximate Temp. by 2100 Outcome of the Scenario
RCP 4.5	2.5 °C
RCP 8.5	4 °C

Scenarios have been selected at various time-steps most suited to the lifecycle of the project. It is understood that the lifespan of the quarry is currently estimated to exceed 100 years, and even if current estimated production capacity was doubled this would only result in the closure of the site by 2070. Therefore, three time steps have been consulted to provide insight into the impact of climate change on climatic hazards:

- Early 21st century: 2030
- Mid-21st century: 2050
- Late-21st century: 2080

7.12.3.2 Description of Climate Data

This section undertakes a review of the key trends in the hazard data associated with the proposed locations of the Project. This section will also identify which climate hazards are expected to have the potential to causes risks to the Project, however the specific detail of risks associated with each climate hazard will be referred to in detail within Section 7.12.4**.**

7.12.3.3 Extreme Heat

Baseline maximum air temperatures within this region are 41.7°C and are projected to increase with climate change by 0.9 and 1.1°C by 2030, 1.3 and 1.7°C by 2050 and 1.8 and 3°C by 2080, under RCP 4.5 and RCP 8.5 respectively. Similarly, the duration of warm spells are projected to increase under all RCP's and timeframes, indicating an increase in the longevity of extreme heat events with climate change. Baseline maximum air temperatures are already high enough to have the potential to cause

disruption to on-site operations, and the climate data collated by ERM indicates the potential for an increase in the intensity of this hazard in the future.

7.12.3.4 Extreme Cold

Baseline minimum air temperatures within the region are 12.5°C, and minimum air temperatures are projected to increase within future projected climate change, by 2030 (1 to 1.2°C under RCP 4.5 and 8.5 respectively), 2050 (1.5 to 2 °C under RCP 4.5 and 8.5 respectively) and 2080 (2 to 3.5°C under RCP 4.5 and 8.5 respectively). Baseline minimum air temperatures indicate that the potential for risks associated with extreme cold events (typically associated with sub-zero temperatures) are minimal, and climate trends indicate that the risks associated with this event type are not expected to increase with climate change. Therefore, this climate hazard will not be assessed further within the risk review section.

7.12.3.5 Flooding

- **Fluvial flooding:** The site is not located within proximity to any perennial watercourses, and therefore is expected to be at minimal risk from fluvial flooding.
- **Pluvial flooding:** Baseline maximum 1-day precipitation is 40.9 mm/day and is not projected to change significantly under any RCP or timeframe included within this assessment (-1.5 to +0.6 mm/day). It is noted, “the project site is crossed in its northern part by a temporary watercourse following an east-west axis” and that there are a network of dry valleys and gullies that can become temporarily wet during particularly intense periods of rainfall (pre-disposing this site to risks associated with pluvial flooding). Similarly, the changing of the proposed sites landscape as a result of the construction of facilities associated with the Project (e.g. mining facilities, quarries, paving roads and carparks with impermeable materials) increases the sites risk from pluvial flooding.
- **Coastal flooding:** This site is located ~19 km away from the nearest coastline, with an elevation of ~37 - 42 m above sea-level, indicating that this site is not considered to be at material risk from coastal flooding under baseline conditions. Even when considering the largest and most extreme future projections for sea-level rise (+80cm compared to 2,000 sea level by 2,100 under RCP 8.5) on the nearest coastline, the risk from coastal flooding on this area is not expected to increase.

7.12.3.6 Tropical Cyclones and Storms

This site is not located within a tropical cyclone basin, and historically has not been located within 100 km of a tropical cyclone track. Therefore, this site is expected to be at minimal risk from tropical cyclones.

Additionally, this site is located within an arid area, within a recognised sand and dust storm region. Climate change is noted as an important driver of future sand and dust storm events, especially regarding extreme wind events and the movement to drier climates in some regions. Climate Change is projected to lead to an increase in sand and dust storm activity, which has the potential to affect the risks associated with this climate hazard.

7.12.3.7 Wildfires

This site is located within a region that historically has experienced wildfire activity, with a maximum burned area value of 6.4%. Similarly, the Limestone quarry is located within the immediate proximity of susceptible land cover (trees, shrubland and herbaceous cover), whilst the Clinker plant is located 110 m away from susceptible land cover. Climate change projections data shows a minimal change in average springtime precipitation, under all RCP’s and timeframes (-1.3 mm/month to +1.5 mm/month).

7.12.3.8 Landslides

This site is located within a region that historically has a low frequency of precipitation-induced landslides (using UNEP's precipitation-induced landslide frequency dataset). A 'Very Low' rating for landslides reflects this low regional risk associated with landslides by GFDRR's online 'ThinkHazard' tool. Climate change projections do not indicate a significant change in maximum five-day precipitation (-2.4 to +2.5 mm/5-day) under any timeframes or RCPs included within this assessment, being a key indicator of landslide activity.

7.12.3.9 Water Stress and Drought

This site is located within a region that is recognised as having high/extremely high baseline water stress, which is projected to increase by 2x by 2030 (under all RCP's) and 2.8x by 2040 (under all RCP's). This represents an increase in water stress within this already highly water stressed region of Senegal.

7.12.4 Summary of Climate Change Material Risks

The table below gives a summary of the Climate Change Material Risks.

Table 7-25 Summary of Climate Change Material Risks

Climate Hazard		Is this likely to be of material risk to the site?	Rationale
Extreme Heat		Yes	Baseline maximum air temperatures within this region are 41.7°C and are projected to increase with climate change by up to 1.7°C by 2050 and 3°C by 2080. Similarly, the duration of warm spells are projected to increase under all RCP's and timeframes, indicating an increase in the longevity of extreme heat events. Baseline maximum air temperatures may have the potential to cause disruption to on-site operations, with future projected climate data suggesting the risks associated with this hazard may increase in the future.
Extreme Cold		No	Baseline minimum air temperatures within the region are 12.5°C, and minimum air temperatures are projected to increase in future. Baseline minimum air temperatures indicate that the potential for risks associated with extreme cold events (typically associated with sub-zero temperatures) are minimal, and climate trends indicate that the risks associated with this event type are not expected to increase with climate change.
Flooding	Fluvial	No	The Project is located within proximity to any perennial watercourses, and therefore is expected to be at minimal risk from fluvial flooding.
	Pluvial	Yes	Across both sites, baseline maximum 1-day precipitation is 40.9 mm/day and is not projected to change significantly under any timeframe or RCP. It is noted that a temporary water course crosses the northern part of the project site, and that there are a network of dry valleys and gullies that can become temporarily wet during intense period of rainfall. ERM interprets these morphological characteristics as pre-disposing the site to risks

			associated with pluvial flooding. Similarly, the changing landscape of the proposed site as a result of the construction of facilities associated with the Project (e.g. mining facilities, quarries, paving roads and carparks with impermeable materials) increases the risk of pluvial flooding.
	Coastal	No	The Project is located ~19km away from the nearest coastline, with an elevation of ~37-42m above sea-level, suggesting indicating that these sites are not considered to be at material risk from coastal flooding under baseline conditions. Even when considering the largest and most extreme future projections for sea-level rise (+80cm compared to 2000 sea level by 2100 under RCP 8.5) on the nearest coastline, the risk from coastal flooding on this area is not expected to increase.
Tropical Cyclones and storms	Tropical cyclone	No	Neither site are located within a tropical cyclone basin, nor historically has this area been located within 100 km of a tropical cyclone track. Therefore, this site is expected to be at minimal risk from tropical cyclones.
	Storms	Yes	The Project is located within a sand and dust storm region. Climate change is projected to lead to an increase in sand and dust storm activity and therefore operational and health and safety risks associated with this climate hazard should be considered.
Wildfires		Yes	Climate data indicates that the Project is located within a region that historically has experienced wildfire activity and are also located within proximity to land cover types which are identified as being susceptible to wildfires – indicating the potential risk from wildfires present at both sites.
Landslides		No	The Project is located within a region that historically has a low frequency of precipitation-induced landslides due to the region being mostly flat. Climate change projections regarding intense precipitation (maximum 5-day precipitation) do not indicate a change in the level of risk associated with this climate hazard.
Water stress and drought		Yes	Both sites are located within a highly water stressed region, and climate projections indicate that this is expected to become an exacerbated issue by 2030 and 2040. Therefore, risks associated with this climate hazard will be considered within this assessment.

8. BIOLOGICAL BASELINE

This Chapter comprises the Biodiversity, Vulture and Ecosystems Services Assessment Baseline descriptions.

8.1 Biodiversity

This section describes the findings regarding biodiversity for the Project. This section draws on information in the Biodiversity Report and the Vulture Assessment Report found in Annexure D and Annexure E, respectively.

8.1.1 Methodology

According to the IFC gap-analysis, the existing ESIA documentation's biodiversity assessment lacked detail on the depth of the survey, and the implications of the time of year it was undertaken, with an emphasis to confirm if records collected were fully representative of the total biodiversity that can be expected on the site, or not. In addition, fauna studies appeared to be desk based and superficial, warranting only a poor understanding of impacts.

The following components informed the biodiversity findings in this report:

- A desktop review undertaken by ERM;
- A field survey conducted (March 2021) and biodiversity report compiled by Harmony, included in Annex A;
  - Vegetation Surveys were conducted using pre-determined sampling sites, recording species present, their cover percentage, vegetation structure, as well as tree stem diameter and –density
  - Terrestrial fauna and avifaunal surveys were undertaken by transect surveys, directed at crossing potential migration paths (e.g. across ephemeral drainages). Observations focused on direct sightings as well as signs of species presence, such as scat, tracks, burrows and nests.
  - Sentinel Imagery of January 2021 was used to map the distribution of the shrub-and tree stratum (refer to the Biodiversity Report, Figure 8)
- Stakeholder engagement was undertaken during field surveys; and
- A Specialist Vulture Report, which was a follow-up study that was conducted as a result of the findings of the Harmony Survey. This survey was undertaken by a team of Ornithologists, specifically focussed on the presence of vultures.
- It is acknowledged that the survey was conducted during a dry period, when vegetation was not in peak growing condition, with herbaceous vegetation being either dormant or not identifiable. This would also influence faunal observations, as indigenous fauna (including avifauna) is expected to frequent the area more if the vegetation resource is in full growth. However, due to project timeline restrictions beyond the control of ERM or the specialists, a wet-season survey could not be conducted prior to compilation of the final reports.

8.1.1.1 Desktop

ERM reviewed all documentation collated up to date as part of the Project and as supplied by CIMAF. A high-level review of all biodiversity studies for the Project was conducted and compared to readily-available secondary data as provided by Integrated Biodiversity Assessment Tool (IBAT) to determine if the depth of studies conducted sufficiently verified and described anticipated biodiversity sensitivities, and to which degree knowledge gaps will need to be investigated by further field surveys.

Existing scientific literature, past studies carried out in the area, national and regional conservation planning and data/information from existing conservation programs around or within the potential Project AoI) were reviewed to address as much of the knowledge gaps as possible.

The review aimed to gain an understanding of potential vegetation cover, determine flora and fauna species potentially present - including threatened or range-restricted species (species of conservation concern), Invasive Alien Species, proximity to protected and/or sensitive habitats, and the linkage to priority ecosystem services.

8.1.1.2 *Field Surveys*

Building on information and insights gathered during the desktop review and interviews, site verification visits were conducted between 17 and 22 March 2021. This is regarded as a dry season survey.

Vegetation study overview:

- Five (5) days of fieldwork by a specialist on terrestrial plants; and
- Description and mapping of vegetation habitats and associations as outlined above;
- Recording species of conservation concern

Fauna study overview:

- Five (5) days of fieldwork; and
- Three (3) specialists, investigating mammals, herpetofauna and avifauna, respectively.

8.1.1.3 *Critical Habitat Screening, Recommended Mitigation, Management and Monitoring Measures*

Gathered information was used to gain an understanding of the potential for Critical Habitat (CH) being present. Furthermore, to:

- Inform and update the constraints mapping, as well as produce a representative sensitivity map of the site;
- Identify opportunities for positive impacts and/or no net loss where natural and/or critical habitats could be verified;
- Assess the potential negative impacts of all Project related activities, including:
  - Alternatives during the construction and operational phase of the Project and transportation routes (in collaboration with the social team, e.g. loss of ecosystem services or induced impacts due to people influx):
  - Loss of terrestrial habitats, flora and fauna specimens or populations;
  - Degradation of terrestrial habitats, disturbance of flora and fauna, loss of habitat functionality and associated ecosystem services (including disturbance due to changes in surface runoff patterns, but also air quality, noise, vibration, illumination, soil and ground water quality – please see relevant sections of the report); and
  - Potential for the introduction and/or spread of Alien Species.
- Determine the most practical necessary mitigation and management measures to avoid, minimise or mitigate negative impacts. In the case of offsets being required, motivate why and how such should be determined; and
- Recommend monitoring measures to be followed from construction to decommissioning.

The above will inform the ESMP, as well as rehabilitation and revegetation requirements as may be applicable.

Table 8-1 was used to determine if the presence of identified species and those that potentially occur in the Project Area could lead to habitats being classified as ‘critical habitat’.

Table 8-1 IFC Critical Habitat Criteria (GN6, 27 June 2019)

Criteria	Threshold	Note
1: Critically Endangered & Endangered Species	(a) (GN72(a)) Areas that support globally important concentrations of an IUCN Red-listed EN or CR species (**≥0.5%** of the global population AND **≥5** reproductive units of a CR or EN species).	National/regional IUCN CR/EN species determined on project-by-project basis with competent professionals.
	(b) Areas that support globally important concentrations of an IUCN Red-listed Vulnerable (VU) species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet the thresholds in GN72(a).	
	(c) As appropriate, areas containing important concentrations of a nationally or regionally listed EN or CR species.	
2: Endemic & Restricted-range Species	(a) Areas that regularly hold **≥10%** of the global population size AND **≥10** reproductive units of a species.	**Terrestrial vertebrates & plants:** EOO is <50,000 km^2. **Marine:** EOO is <100,000 km^2. **Coastal, riverine, aquatic:** Where habitats <200 km wide at any point, EOO is <500 km long
3: Migratory & Congregatory Species	(a) Areas known to sustain, on a cyclical or otherwise regular basis, **≥1%** of the global population of a migratory or congregatory species at any point of the species' lifecycle.	▪ Species forming colonies, either for breeding purposes and/or where large numbers of individuals of a species gather at the same time for non-breeding purposes. ▪ Species that utilise a bottleneck site where significant numbers of individuals of a species occur in a distinct and repeated period, e.g. for migration). ▪ Species with large (often seasonal) congregations in a single or a few sites while the rest of the species is largely dispersed. ▪ Source populations where certain sites hold populations of species that make an inordinate contribution to recruitment of the species elsewhere.
	(b) Areas that predictably support **≥10%** of the global population of a species during periods of environmental stress.	
4: Highly Threatened/ Unique Ecosystems	(a) Areas representing **≥5%** of the global extent of an ecosystem type meeting the criteria for IUCN status of CR or EN.	Where IUCN assessments do not exist, may use assessments using systematic methods at the national/regional level, carried out by government/academic/NGOs. Projects located within internationally and/or nationally recognised areas of high biodiversity value may qualify as critical habitat. Examples include the following: ▪ Areas that meet the criteria of the IUCN's Protected Area Categories Ia, Ib and II.
	(b) Other areas not yet assessed by IUCN but determined to be of high priority for conservation by regional or national systematic conservation planning.	

Criteria	Threshold	Note
		▪ Key Biodiversity Areas (KBAs), amongst which are Important Bird and Biodiversity Areas (IBAs).
5: Key Evolutionary Processes	▪ Landscapes with high spatial heterogeneity ▪ Environmental gradients ▪ Edaphic interfaces ▪ Connectivity between habitats ▪ Sites of demonstrated importance to climate change adaptation	Significance of structural attributes in a landscape determined on case-by-case basis, and determination of critical habitat will be heavily reliant on scientific knowledge. In majority of cases, criterion will apply in areas that have been previously investigated and that are already known or suspected to be associated with unique evolutionary processes.

8.1.2 Ecologically Appropriate Area of Analysis

The desktop review of data, combined with preliminary maps of Project components and layouts (including potential alternatives) as supplied by CIMAF, informed identification of the relevant Ecologically Appropriate Area of Analysis (EAAA) prior to the start of field surveys. This also took into consideration landscape-scale ecological processes, of which the most important were main rainfall runoff and run-on areas (which may also act as local/regional migration corridors), respectively east to south-east and west of the Project area.

The direct impact of the Project activities on the biodiversity is not anticipated to extend much beyond the Project Footprint, but due to potential indirect impacts such as noise disturbance, dust and light pollution at night, as well as potential disturbances to surface runoff and migration patterns, the EAAA was delineated as a 4.5 km radius from the midpoint of the combined Project Area (Figure 8-1). This EAAA was chosen to extend somewhat beyond the anticipated (opposed to potential) impacts of the Project on biodiversity. It must be noted that due to the dry-season survey, the diversity of species present was lower than would be the case during the wet season. The EAAA will thus need to be verified during a follow-up wet-season survey.

8.1.3 Habitat Types

The Thiès Region consists of slightly undulating landscapes, and has a rich subsoil that supports a variety of habitats. Two distinct seasons exist for the area, a rainy season from June to October and a dry season prevailing during the remainder of the year. The average temperature recorded over 34 years is slightly above 26 °C, with the month of July being the hottest (28.2 °C), and the months of December and January being the coolest with respectively 25.1 °C and 23.9 °C. The average annual precipitation recorded between 1930 and 2015, was 587.6 mm at the Thiès station, peaking in August and September.

Desertification processes, resulting from recurring droughts and human activities in the area, have led to changes in the composition and/or abundance and structure of much of the vegetation. If the modification in species composition is significant enough to regard the entire area as ‘modified’ sensu the IFC PS6 classification[19], is contested – but the wider area has already undergone significant degradation, resulting in a significant reduction of the original indigenous faunal diversity, and from a floristic perspective as discussed further. From existing remote imagery, the ‘patchiness’ of vegetation is very conspicuous. Often referred to as ‘Tiger bush’, such distinct patterned or clumped vegetation,

[19] “*Modified habitats* are areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area’s primary ecological functions and species composition. Modified habitats may include areas managed for agriculture, forest plantations, reclaimed coastal zones, and reclaimed wetlands. *Natural habitats* are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area’s primary ecological functions and species composition” (IFC PS 6 Par. 11 and 13, 2012).

consisting of alternating patches of trees (often stunted in height), shrubs, or grass separated by bare ground or low herb cover, is typical for areas where plant growth is limited by water availability during the year - this prevents vegetation from covering the entire landscape (Tongway & Ludwig, 2001). The distinct habitat modification factor would be the substantial increase in the presence/density of less palatable shrubs such as *Senegalia* (formerly *Acacia*) *ataxacantha*. Such bush-encroachment is generally a result of long-term over-utilisation of the herbaceous layer, providing opportunity for more invasive (indigenous) shrubs to establish and further displace herbaceous vegetation. In addition, due to the reduction of the herbaceous layer, soils become less permeable, increasing surface runoff and associated sheet erosion during the limited times of rainfall. Such habitats usually have lost a notable proportion of original species composition, as well as a significant proportion of the natural (pre-encroachment) functionality, and are in a less productive stable state that is only reversible with intense human intervention. Where such shrubs are then cut down, bare soil patches remain, in which mostly short-lived pioneer species emerge after sufficient rainfalls.

During the dry season, many of the species present may not be observable due to having migrated to more favourable areas (fauna), or being dormant in the form of seeds or belowground storage organs (flora).

Five major habitat types have been identified to exist within the AoI. These habitats are as follows:

- Thicket Vegetation;
- Potential Ephemeral Vegetation;
- Agricultural Fields (modified by transformation);
- Wetlands; and
- Drainage Lines with Riparian Vegetation.

All habitats, with the exception of Agricultural fields, are at this stage considered natural, with the understanding that this needs to be confirmed by a wet-season survey, preferably comparing such survey results to historical descriptions (>20 years ago) of the vegetation as may be available. Below, Figure 8-1 illustrates the habitats within the AoI.

As drainage lines are not very distinct, but rather represent areas of seasonal moisture accumulation, these and associated riparian vegetation is difficult to separate spectrally from thicket vegetation (which is hence all mapped as natural vegetation).

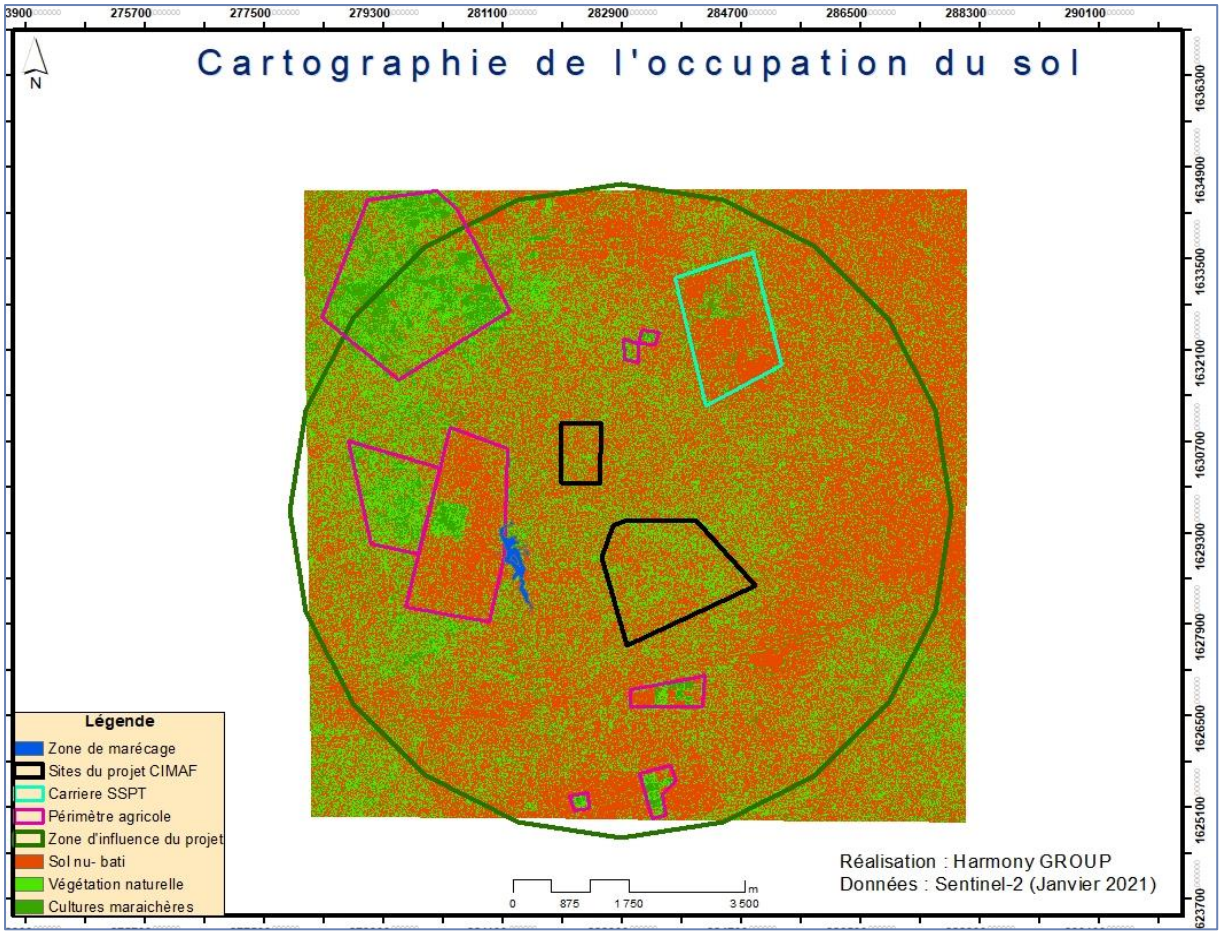


Figure 8-1 Habitats within the Ecologically Appropriate Area of Analysis

Habitat 1: Thicket Vegetation

Thicket vegetation covered the majority of the Project Area. This habitat was dominated by a layer of stunted trees and woody shrubs, in general not more than 2-3 m in height. The highest trees, remnants of what was historically expected to be a more extensive high-canopy woodland/forest landscape, were the Baobabs (*Adansonia digitata*).

The thicket is fully accessible to surrounding communities, who rely on it heavily for their livelihoods (this is covered further in the ecosystem services section).

Many of the trees are fruit bearing and therefore attractive to both humans and animals. Dominant species are *Senegalia* (formerly *Acacia*) species*, Boscia senegalensis* and *Combretum micranthum.* Other tree species include *Dichrostachys cinerea, Combretum aculeatum, Piliostigma reticulatum, Saba senegalensis, Azadirachta indica (an Alien Invasive plant), Vachellia* (formerly *Acacia*) *seyal, Diospyros mespiliformis, Feretia apodanthera, Ziziphus mauritiana and Senegalia* (formerly *Acacia*) *ataxacantha.* Under favourable/natural conditions, most of the above species would reach an average height of between 3 and 6 m or higher. The highest stratum is formed by *Adansonia digitata* (Baobab), with individual trees scattered across the entire AoI, including the Project area.

The current vegetation structure and composition reflects the high levels of persistent drought and water deficiency in the area. In addition, the human-induced disturbance, compared to remaining (albeit also disturbed) protected Thiès Forest patches was clearly noticeable. The vegetation is not entirely transformed but heavily degraded, and considered to not be able to regain its natural (historical) configuration, species composition or original ecological functionality/productivity without intensive human intervention.

There is also already a significant element of alien invasive species present. A modified state of vegetation was assumed by the specialists that undertook the vegetation survey due to the evidence of heavy reliance on the vegetation by locals in the area, particularly for timber, grazing and fodder. However, unless this can be verified by a wet-season survey compared to historical data that may be available, this habitat will be classified natural for the time being.

Herbs and grasses were not identified. The ground was marked by an almost complete absence of an herbaceous layer. This was attributed to the timing of the field survey, during which these plants were not in flower or fruit or actively growing, thus accurate identification of these species was not possible.

8.1.3.1 Habitat 2: Potential Ephemeral Vegetation

This habitat constitutes open, bare ground. Sufficient rainfalls may result in a short-lived flush of vegetation dominated most likely by short-lived grasses and forbs. However, this could not be confirmed due to the timing of the survey. Considering the patterned nature of vegetation, sheet erosion is most likely a common phenomenon during events of high rainfall, further reducing the viable soil seed reserve.

8.1.3.2 Habitat 3: Agricultural Fields

Due to agriculture not being allowed in the Thiès Forest, agricultural fields were identified only outside the Project Area, within the AoI.

Crops that are being cultivated include melons, vegetables (carrots, onions, and peppers), papaya as well as millet, peanuts, and cowpea. The majority of the crops grown were annual, and it was not clear if the fields are cultivated every year, or are left fallow (hence becoming bare patches) during less favourable rainfall years. This habitat is clearly modified due to the complete absence of the previously natural vegetation.

8.1.3.3 Habitat 4: Wetlands

The only wetland area that could be confirmed during the dry season survey is situated in the western periphery of the AoI, but outside the Project Footprint. These wetlands consist of shallow depressions in the landscape, which accumulate seasonal inputs of water after larger rainfall events. Seasonal wetlands are naturally very dynamic systems, and hence are considered to still be natural vegetation. It must be noted that most of this surface runoff appears to originate from areas east-south-east of the wetlands – notably across the proposed quarry area up to the proposed plant area. These wetlands are seasonal, and may hold surface water for variable periods of time, depending on the amount of and timing of freshwater inputs. During periods of increased soil water availability or even surface water, a unique species assemblage for both fauna and flora can be expected in these wetlands. Seasonally moister areas can also be identified to the north-eastern periphery of the proposed quarry area from historical (wet-season) satellite imagery, but this could have to be confirmed during a wet-season survey. Whilst in these areas seasonally elevated soil moisture enables the persistence of (denser/higher) riparian vegetation (as discussed below), the presence of typical wetland species there is questionable.

8.1.3.4 Habitat 5: Drainage Lines with Riparian Vegetation

A number of ephemeral drainage lines, referred to as ‘loosely networked thalwegs’, cross the Project Area. These are generally marked by higher/denser vegetation compared to surrounding plains (enabled by seasonally higher soil moisture levels) around smaller depressions or runoff channels – the latter sometimes with the presence of grasses and sedges. The presence and overall landscape functionality of these was difficult to establish through remote sensing imagery alone, and therefore would need to be confirmed during a wet season survey. In these areas, water runoff accumulates after sufficiently large rainfall events, and drains to the North and West-North-West, as confirmed by the hydrological investigation.

Similar to Habitat 2, it could at this stage not be confirmed if this is vegetation is in a natural state of vegetation, thus a conservative approach would be to regard this as natural. The potential extent of riparian habitats, with a focus on the quarry-area and haul road route area from the quarry to the plant, as well as their connectivity from east to west is shown in Figure 8-2.

8.1.3.5 Alien Vegetation

Azadirachta indica was identified to occur within the area. Sufficient rainfalls may result in an increased presence of Alien Vegetation within the herbaceous plant layer as well. However, this could not be confirmed at the time of the survey, as such species may be short-lived annuals.

8.1.3.6 Threatened Flora

IBAT and Global Biodiversity Information Facility (GBIF) records were consulted for the potential occurrence of threatened flora within the Project Area. This resulted in two (2) threatened flora species, which could potentially be present in the Indirect Impact area defined for the Project (see Table 8-2 below). Their presence, however, has not been confirmed and is based only on existing literature about their distribution. This will be verified during the anticipated wet-season survey.

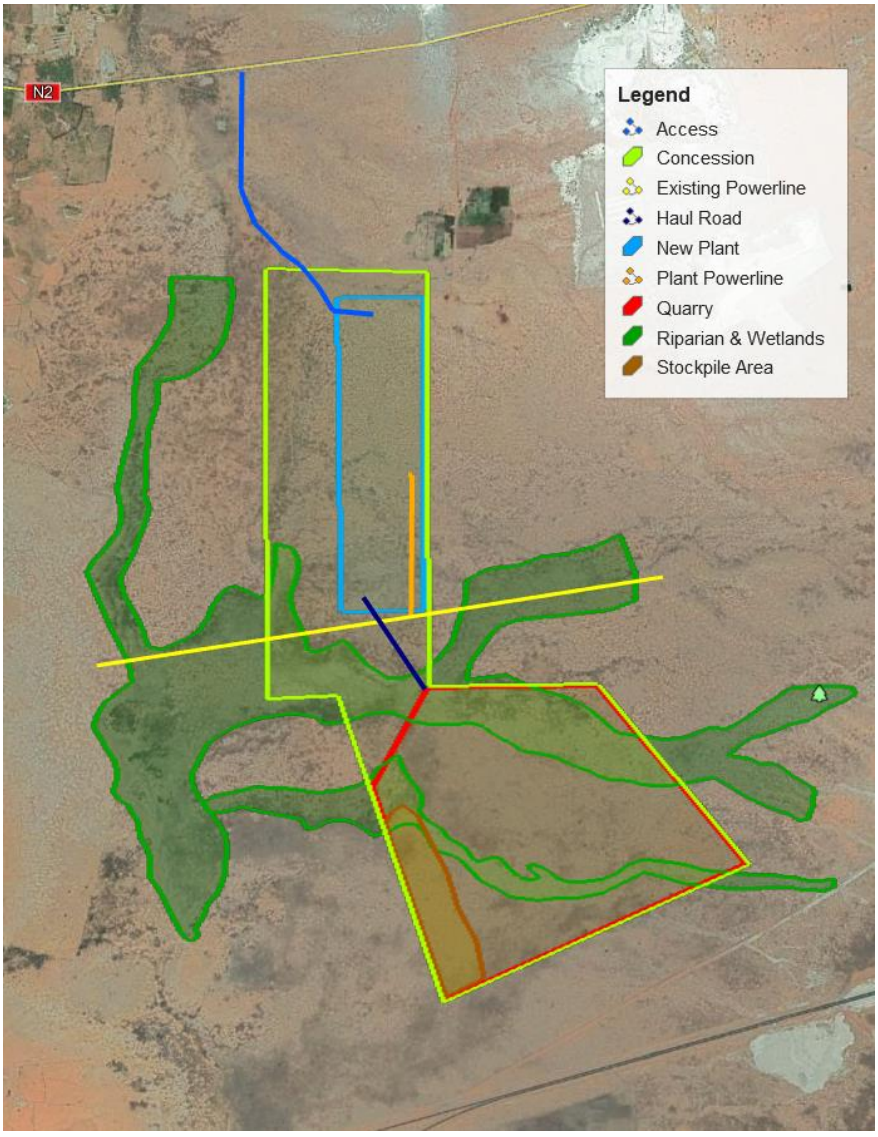


Figure 8-2 Potential extent of Riparian Habitats across the quarry and haul-route areas

Table 8-2 Threatened Flora Species Potentially Present in the Project Area

Species	Common Name	IUCN Status	Habitat	IFC Critical Habitat Criteria 1,2,3
Bolboschoenus grandispicus	Sedge	CR	Seasonal wetlands – mostly on edge of swamps in freshwater depressions behind coastal dunes, sometimes appears on abandoned rice fields (i.e. modified wetlands), highly unlikely to be within the Project Footprint Area due to no suitable habitat	Criteria 1a
Pterocarpus erinaceus	Barwood/ Kosso	EN	A tree up to 11 m high, found in forest fringes, commercially exploited. Could not be confirmed in the Project Footprint Area, and highly unlikely to occur there, as it would have been identifiable even during the dry season	Criteria 1a

8.1.3.7 Protected and Internationally Recognised Biodiversity Areas

Three Nationally Protected Forests exist within and close to the AoI, with an additional Internationally Recognised Key Biodiversity Area 15 km North of the Project, as described in Table 8-3 below.

Table 8-3 Protected and Internationally Recognised Biodiversity Areas

Name	Location	Importance
Foret de Thiès	Project falls within this area	Classified Forest, formally protected Nationally
Foret de Bandia	Immediately adjacent South of the Foret de Thiès	Classified Forest, formally protected Nationally
Foret de Pout	Immediately adjacent North of the Foret de Thiès	Classified Forest, formally protected Nationally
Niayes	17 km north of the Project Area	IBA, Internationally recognised Key Biodiversity Area

Bandia and Pout Forests

The Project Area lies in the Thiès Region, which contains 13 classified forests. These are community Nature Reserves that promote conservation, whilst allowing the continued use of natural resources. Very little information regarding the species for these areas is publically available. The Foret de Bandia and Foret de Pout lie south and north of the Project Area and the Thiès Forest, respectively. The vegetation in these areas is similar to the thicket vegetation that was found in the Thiès Forest, where the Project Area lies.

Thiès Forest

Despite being a Classified Forest, occasional development has been authorised to be undertaken in the Thiès Forest. The implementation of the Project would not be subject to a de-classification but to an authorization and Memorandum of Understanding (MoU) from the Minister responsible for water and forests.

CIMAF Senegal signed such MoU in 2017 with the Department of Water, Forests, Hunting and Soil Conservation (DEFCCS) for the opening and operation of a quarry covering an area of 727 ha in the Thiès classified forest. This authorization is valid for 25 years and is renewable.

Key requirements of the MoU provide for:

- The development of a reforestation program a part of a wider biodiversity management plan, which can also be used to some extent for dust screening
- Progressively rehabilitation of sites where quarrying is terminated in proportion to hectares disturbed
- Prevention of further degradation of forest resources and wetlands, and/or avoidance of such as far as is feasible

Notes: ***Diospyros mespiliformis***, which was observed in moderate numbers across the area investigated and most likely will be more abundant/vigorous in Riparian habitats. It is formally protected in Senegal, and authorisation is required for activities that potentially destroy these trees. It is assumed that the destruction of such trees, where necessary, is authorised under the MoU as described above. It is an important source of food for man and fauna, and also has medicinal uses. **It can be propagated, although being a slow grower[20].**

Adansonia digitata **(Baobab) is a slow-growing tree**, which is known to reach ages of well over 2000 years. As a stem-succulent, it is able to facilitate hydraulic lift of moisture (moisture drawn up from deeper water resources and released through the root system near the soil surface). This ability, together with shade and other resources provided (medicine, food, fibre), makes this species a '**keystone' species**, especially in arid climate. Due to its presence and resources, it can create a micro-habitat around it, which enables the persistence of other species (fauna and flora), and therefore greatly contributes to the overall ecosystem resilience, even though its density is low compared to other woody vegetation (Figure 8-3). The loss of such trees will thus contribute to the overall degradation of the Forest of Thiès. Due to its height, it is also a very important nesting resource for birds, including vultures. **Fortunately, being a stem succulent, Baobab trees can be transplanted successfully, no matter their size.[21]** This basically includes the excavation of the core of the root ball (as a percentage of the crown), and relocating into a suitably prepared hole.

[20] Propagate *Diospyros mespiliformis* from seed, coppice or root suckers. To break seed dormancy, soak seeds in hot water for a few minutes. Sow during the wet season. Germination is very good. *Diospyros mespiliformis* prefers moist areas and grows well in red loam soil. It is fairly slow growing and requires sufficient water to speed up the growth rate.

[21] Examples of Baobab Transplanting:
https://www.trees-sa.co.za/2019/07/04/how-to-successfully-transplant-a-mature-tree/
https://www.debeersgroup.com/creating-stories/2016/moving-story-of-a-giant-baobab-tree
https://www.linkedin.com/pulse/case-study-no2-relocation-baobab-from-salvage-harvest-josef
https://www.abc.net.au/gardening/factsheets/boab-transplant/9429080

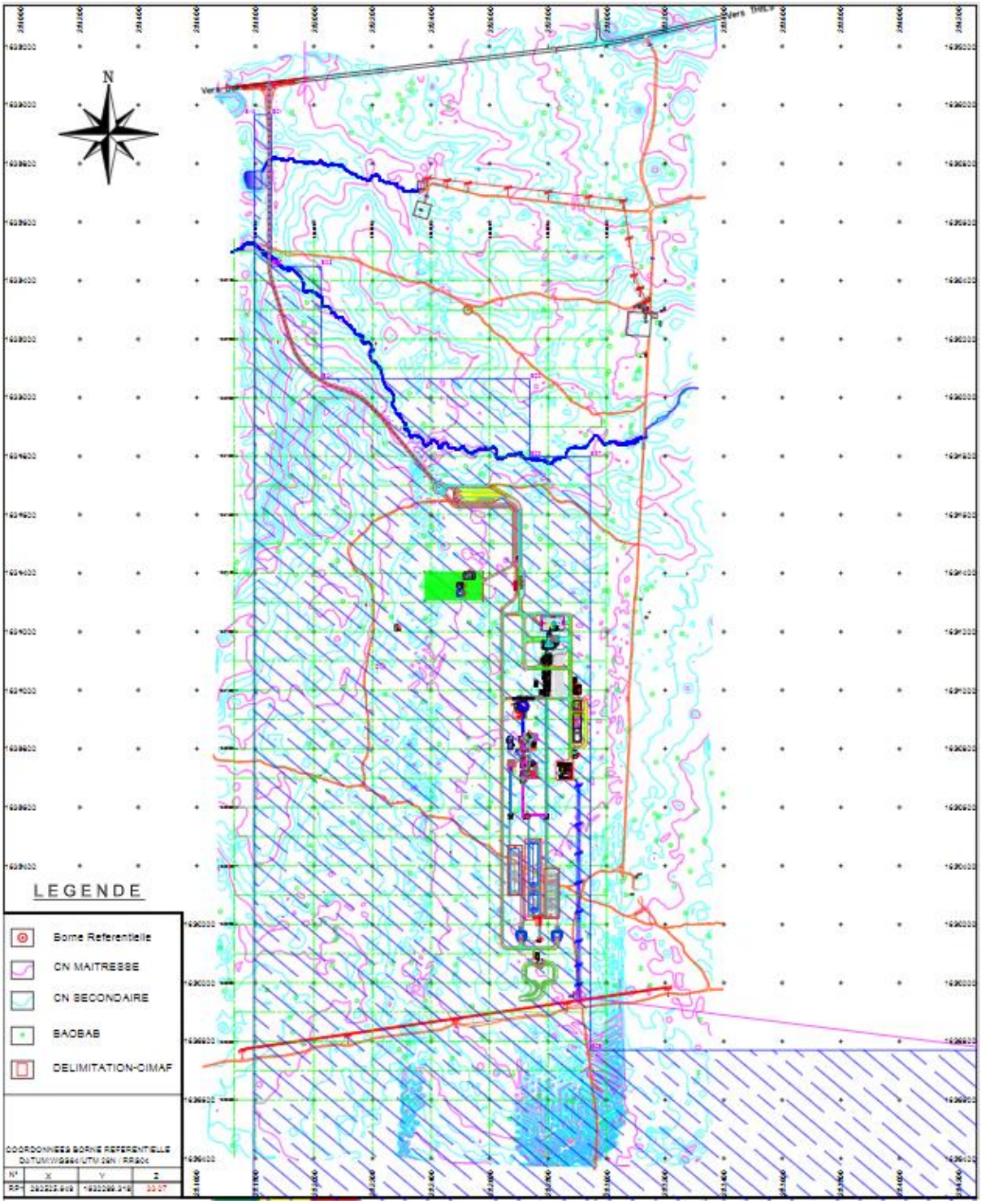


Figure 8-3 Location of Baobab Trees Relative to the Project Site

Note: Similar mapping for the quarry area is still to be undertaken by CIMAF.

Niayes

One Important Birding Area (IBA), the Niayes ecosystem, starts about 15 km north of the Project Area, along the northern coastline of Senegal. This is not within the AoI; however, its importance is noted as species that are attracted to this area *could potentially pass through the Project Area*.

This site consists of an interlinked series of permanent freshwater lakes and seasonally wet depressions (niayes) positioned along a line running north-east from the outskirts of Dakar to around 60 km south-west of St Louis. The lakes are situated inland of the coastal sandy dune belts, in shallow depressions at 1–4 m above sea level, extending over a distance of approximately 150 km.

The wetlands are replenished both by rainfall and from the underlying shallow aquifer. The wetlands cover 40 km² at low tide; at high tide, all the lakes can increase their surface area five-fold. The largest lakes lie at the southern end and include Nhiarhol Pool and the lakes Mbao, Mbeubeussé, Retba, Tanma, Youyi (or Malika) and Ourouaye. Lake Retba is the largest, with an open water surface of 5 km by 1.7 km wide at low water. Niaye Hann Mariste consists of a depression covering a surface area of about 30 ha (1.3 km by 200 m), but this dried out completely in 1997 due to evaporation, compounded by abstraction of water for agriculture and building construction. The surrounding vegetation is subjected to seasonal inundation and the area is characterised by the oil-palm *Elaeis guineensis*. There are also elements of vegetation more typical of the Sudan–Guinea Savanna biome and Guinea–Congo Forests biome (e.g. *Prosopis africana* and *Ficus capensis*).

The vegetation here is able to flourish due to the high moisture content of the soils, which results from the water table lying close to the surface and the moisture-bearing Alizé winds blowing in from the Atlantic. The whole site is important in terms of human use, for cattle-grazing, fishing, vegetable, fruit and rice growing and market gardening (estimated at 90% of national production). Many of the individual lakes also have religious and cultural significance.

Phoenicopterus ruber is a regular winter visitor and the site appears to be a key congregation and/or resting site for migrating birds coming from regions further north. Other species overwintering here in significant numbers include *Egretta garzetta* and *Anas clypeata*. There are records of large numbers of overwintering and migrating flocks of *Sterna sandvicensis* and *S. albifrons*. Breeding birds recorded on the site include *Phalacrocorax africanus*.

8.1.4 Fauna

Limited presence of indigenous fauna and also low diversity of species were observed in the Project Area and AoI. This could, potentially, be as a result of the timing of the survey during the dry season, but most likely is more significantly impacted by the current high levels of human disturbance in the area.

8.1.4.1 Mammals

Four mammal species were identified in the Project Area and EAAA. None of these species were listed as threatened according to the IUCN. This will need to be verified during the anticipated wet-season survey.

8.1.4.2 Avifauna

Sixty-six (66) bird species were identified. One of these species, the African/White-backed Vulture (*Gyps africanus*) is Critically Endangered (CR).

As the identification of this species is of concern and it potentially would trigger the Project Area to be regarded *Critical Habitat* according to PS6[22], a follow up survey was undertaken to further assess the African/White-backed Vulture (*Gyps africanus*) potential within the EAAA.

[22] Note that both natural or modified habitats could qualify as Critical Habitat, subject to availability of habitat resources for CR, EN and VU species, or use by migratory species, large species congregations of any other significant ecosystem process.

The Vulture Survey found no trace of vultures and no identification of vultures was made. Vultures have a large range and it is typical that they move across the landscape in search of food.

These findings were further confirmed during consultation with the local community. It was confirmed that vulture species do occur in the area, should there be a dead animal/food source available. However, these birds were not known to roost or remain in the Project Area.

As a result, it was concluded that despite the identification of the African/White-backed Vulture (*Gyps africanus*) during the first field survey, undertaken by Harmony, these species are expected to have been transiently present and not resident in the area.

The West Coast of Senegal is an important migratory flyway and overwintering area for birds. Some of the potential bird species that could frequent the Project Area are migratory, and therefore it is recommended that a wet- to late wet season (between July and November) survey is undertaken to confirm the presence of Palaearctic migrants. None of the species expected to be present are IUCN Red Listed. However, due to the timing of the field survey, the avifauna species that typically occur in the area, especially when resources are high during the wet season, could not be confirmed. Additionally, the lack of clear understanding of the potential presence of seasonal water on site is important in defining potential habitat that might attract species. This will need to be verified during the anticipated wet-season survey.

8.1.4.3 Herpetofauna

Four (4) herpetofauna species were identified. None of these is listed as threatened. The extremely low species diversity observed was largely attributed to the timing of the survey. This will need to be verified during the anticipated wet-season survey.

8.1.4.4 Threatened Fauna

The IBAT and GBIF information database records were consulted for the potential occurrence of threatened fauna within the Project Area. These records listed historical sightings or potential distribution of 12 threatened avifaunal species that could potentially be present for the Project Area (see Table 8-4 below). Of these, only one (1) could be confirmed. This will need to be verified during the anticipated wet-season survey.

Table 8-4 Threatened Avifauna Species Potentially Present in the Project Area

Species	Common Name	IUCN Status	Present within Project Area	IFC CH Criteria 1,2,3
Gyps africanus	African/White-backed Vulture	CR	Two individuals were sighted during the fauna survey (17 – 22 March 2021). A follow-up survey was undertaken to investigate the presence of the species by a vulture specialist. No evidence was found. It is assumed that these species were passing through the Project Area.	Criteria 1a
Gyps rueppelli	Rüppell's Vulture	CR	Possible	Criteria 1a
Necrosyrtes monachus	Hooded Vulture	CR	Possible	Criteria 1a
Trigonoceps occipitalis	White-headed Vulture	CR	Possible	Criteria 1a
Neophron percnopterus	Egyptian Vulture	EN	Possible	Criteria 1a
Polemaetus bellicosus	Martial Eagle	EN	Possible	Criteria 1a
Terathopius ecaudatus	Bateleur	EN	Possible	Criteria 1a
Torgos tracheliotos	Lappet-faced Vulture	EN	Possible	Criteria 1a
Acrocephalus paludicola	Aquatic Warbler	VU	Unlikely	Criteria 1b
Aquila rapax	Tawny Eagle	VU	Possible	Criteria 1b
Bucorvus abyssinicus	Northern Ground-Hornbill	VU	Possible	Criteria 1b
Streptopelia turtur	European Turtle-dove	VU	Possible	Criteria 1b

Source: IUCN Red List, 2021.

8.1.5 Critical Habitat Assessment

8.1.5.1 Habitat Evaluation against IFC's PS 6 Categories

Because the IFC's Performance Standard 6 includes specific requirements for certain types of habitat (i.e. critical habitat, natural habitat and modified habitat), it is important to evaluate if any of these types of habitat are present within the project's EAAA.

This evaluation is referred to as the Critical Habitat Assessment (CHA), although a consideration of potential natural and modified habitat is also included.

8.1.5.2 Critical Habitat Determination

Critical habitat is a description of the most significant and highest priority areas of the planet for biodiversity conservation. It considers both global and national priority setting systems and builds on the conservation biology principles of 'vulnerability' (degree of threat) and 'irreplaceability' (rarity or uniqueness). Determination of critical habitat is based upon quantitative thresholds of biodiversity priority which are largely based on globally accepted precedents such as IUCN Red List (IUCN, 2012) criteria and Key Biodiversity Area (KBA) thresholds.

The identification of critical habitat is based on five criteria (IFC 2012) and is linked to quantitative thresholds for some of the criteria, as summarised below.

To determine if critical habitat is present, the following key steps were undertaken:

- Step 1: Preliminary critical habitat determination – The desk study data search has been used to inform this step;
- Step 2: Define the Ecologically Appropriate Area of Analysis (EAAA) – The EAAA has been defined for each species or habitat type and is described in the text for each feature. It should be noted that the EAAA may be influenced by the area of occurrence or range of a given species as shown on the IUCN website, species profiles; however, often these ranges are often quite general, based at a regional level and don't take in to account habitat availability at a more local level;
- Therefore, the EAAA used here, for the assessment of each species takes in to account the availability of habitat at a local level; and
- Step 3: Confirming which features qualify as critical habitat – The results of this determination are provided in Table 8-5.

Table 8-5 Critical Habitat potentially present in the Project Area

Type of Critical Habitat	Status
Habitat of significant importance to critically endangered and/or endangered species	For the vegetation assessment, the EAAA is assessed to include all habitats and species of plant occurring within 4.5km of the Project location/area. No evidence of the 2 Potential Threatened Flora Species were identified within the EAAA, and it is unlikely that they will be present. For the faunal species, 12 Threatened Avifauna Species potentially occur in the EAAA. Two individuals of White-backed Vulture (*Gyps africanus*) were sighted during the faunal survey (17 – 22 March 2021). A follow-up survey was undertaken to investigate the presence of the species by a vulture specialist. No evidence was found. It is assumed that these species were passing through the Project Area. In addition, the distribution range of the White-backed Vulture reaches across Senegal and beyond, thus its survival is not dependent on the habitat impacted, nor will its conservation status change due to the anticipated impacts. No evidence of any of the other 11 Threatened Avifauna Species was identified during the faunal survey. It is therefore assumed that no Threatened Fauna Species are permanently resident within the EAAA, although it is acknowledged that such may on occasion frequent the area. This will need to be verified during the anticipated wet-season survey.
Habitat of significant importance to endemic and/or restricted-range species, where restricted range refers to a limited extent of occurrence (EOO).	No habitats of significant importance to endemic or restricted-range species were identified within the EAAA for flora or fauna. Confidence for this finding is low as a wet season survey has not yet been undertaken for the EAAA.
Habitat of significant importance to concentrations of migratory and congregatory species.	No habitats of significant importance to concentrations of migratory and congregatory species were identified within the EAAA for fauna. Confidence for this finding is medium as a wet season survey has not yet been undertaken for the EAAA.
Threatened and/or unique ecosystems.	Degraded areas of the Foret de Thiès ecosystems exist within the EAAA.

Areas associated with key evolutionary processes.	No areas associated with key evolutionary processes were identified within the EAAA.

8.2 Ecosystem Services

Ecosystem services valued by humans are often underpinned by biodiversity. Impacts on biodiversity can therefore often adversely affect the delivery of ecosystem services (IFC, 2012).

The ecosystem services within the Project Area and immediate surrounds are largely related to the natural vegetation that occurs in the Forest of Thiès. Despite this vegetation being regarded as modified, impacted by use by the local communities it still provides numerous valuable services.

The IFC defines ecosystem services as being organised into four (4) types:

- provisioning services, which are the products people obtain from ecosystems;
- regulating services, which are the benefits people obtain from the regulation of ecosystem processes;
- cultural services, which are the nonmaterial benefits people obtain from ecosystems; and
- supporting services, which are the natural processes that maintain the other services'

The following sections describe the provisioning, regulatory, socio-cultural and supporting services that are provided by this ecosystem.

8.2.1 Provisioning Services

Provisioning services are defined as the tangible products derived from ecosystems, such as food, fuel, materials or medicines for human and veterinary health (hundreds of species of medicinal plants, often in decline or threatened with extinction).

Although the Project Area is inside a Nationally Protected Area, the law, in particular the Forest Code in force in Senegal, grants a certain number of user rights. These rights relate mainly to ecosystem services provision. The primary use is for grazing.

The livestock of the populations living near the Classified Forest of Thiès.

At the start of the dry season, before the bush fires pass, the populations devote themselves to the collection of grasses, which they store for livestock. According to the few pastoralists met in the field, the irregularity of the rains and the decrease in the amounts of rainfall received in this part of Senegal have ended up making the extensive livestock farming practiced in the area extremely vulnerable. This strategy of collecting herbaceous vegetation is the only possibility open to them to manage the increasingly long lean season in the Sahel.

The sustainable use of the resource is all the more essential for pastoralists as with the high cost of livestock feed that it is no longer within everyone's reach. The goods and services provided by nature have become essential for the survival of livestock.

Harvesting of firewood is noted in the area, as is the collection of Wild Jujube fruit (from the *Ziziphus mauritania*) and Monkey Bread for local consumption.

Baobab fruits and leaves are regularly harvested, processed and used for domestic needs. Fibres from baobab plants are also frequently collected. They are used in traditional pharmacopoeia and in the repair of livestock enclosures and dwellings.

Desert Date fruits, Jujube and *Boscia senegalensis* are exploited by the population for local consumption and to a lesser extent for sale on the market.

Groundwater is accessed through a number of wells throughout the area (not in the Project Area). When these wells dry up in the dry season the local population resorts to using municipal water, accessed from taps.

8.2.2 Regulatory Services

Woody vegetation plays an important role against dust heaving. The trees have become real ramparts against the invasion of dust in the homes. They also mitigate the impact of water erosion on the degradation of the top layer of land, which is largely the source of declining soil fertility. Thus, the natural habitats of ecosystems significantly contribute to the attenuation of rainwater runoff on homes and indirectly fight, at the same time, against the degradation of arable land located upstream and downstream, according to the direction of runoff of rainwater.

8.2.3 Socio-cultural Services

The Thiès Forest is an area where cultural beliefs are practised. Nature serves as a place of meditation, which, from a sociological point of view, represents a cultural value of great significance for African societies.

In this rural area, people give significant credit to trees and especially to Baobab (*Adansonia digitata*). The Baobab, beyond the emblematic aspect represents for the Republic of Senegal, is the subject of special protection by the rural population. Rituals and prayers, and other forms of incantations are often formulated under the Baobab Trees for the welfare of society.

8.2.4 Supporting Services

Supporting ecosystem services are the underlying natural processes that maintain ecosystems. Supporting ecosystem services include services such as photosynthesis, nutrient cycling, the creation of soils, and the water cycle. These processes within the Project Area and surrounds allow for the basic maintenance of life forms, as well as ecosystems and people. The supporting ecosystem services sustain and maintain the provisional, regulating and cultural services within the Project Area and surrounds.

9. SOCIAL BASELINE

9.1 Socio-economic

This *Chapter* describes the social, cultural and socio-economic environment for the proposed ICP. The baseline provides a contextual component for identifying and assessing any potential social impacts of the Project.

9.1.1 Introduction

This section describes the Socio-Economic study. It includes the methodology used in assessing the baseline. Furthermore, the potential impacts and recommendations regarding mitigation of these impacts are also described.

9.1.2 Methodology

ERM undertook a supplemental data collection process in order to update the project's socio-economic baseline. Data collection was undertaken in accordance with the principles of PS1 related to informed consultation and participation by stakeholders.

Key activities included:

- Desktop review of project documentation and any relevant secondary data sources (including commune level demographic data), including aerial imagery analysis;
- Key informant interviews with individual stakeholders, including but not necessarily limited to relevant government authorities, technical service agents, community leaders or civil society representatives;
- Household survey with representative sample of directly and indirectly affected households (see details below); and
- Focus group discussions with key stakeholder groups, including women, herders, and livelihood associations where applicable.

Detailed engagement records were kept by ERM; photos and participant lists are provided in Annexes A and B.

All consultations were undertaken by ERM's Social Specialist and a member of the Harmony Group team. In line with local practice, ERM and Harmony Group requested a meeting with the Prefect before initiating consultation. As requested by Harmony Group, efforts were made not to duplicate engagement with government agencies that were previously consulted by Harmony Group in the context of the project and from whom no additional pertinent information was likely to be collected. To this end, ERM's data collection and engagement process focussed on community and government stakeholders at the local level.

All consultations began with a presentation of the context (i.e., the update to the ESIA), which was provided by the Harmony Group team member in the local dialect. ERM's Social Specialist then proceeded with the interview / discussion / survey in French, with translation being provided by the Harmony Group team member as needed. At the end of each interaction, the participant(s) were given the chance to ask any questions about the ESIA process or the project more generally. Where appropriate, answers were provided by ERM or Harmony Group; where needed, a record of the questions were made for follow-up by CIMAF as appropriate.

Key informant interview and focus group discussions used a semi-structured approach to solicit input on specific topics while allowing for an open discussion with the participant(s). Focus group discussions were limited to five (5) participants and held outdoors, in keeping with ERM's COVID-19 protocols. Topics for interviews and focus group discussions included:

- Demographics and population data;
- Land use and land tenure;
- Resettlement / land acquisition precedents ;
- Traditional livelihood activities;
- Ecosystem services;
- Cultural heritage sites;
- Gender and vulnerability;
- Civil society actors;
- Traffic issues/sources;
- Air Quality issues/sources in the area; and
- Noise sources in the area.

Surveys were conducted with the head of household and efforts were made to ensure other household members were present, particularly women, so as to increase the likelihood of accurate and comprehensive results. The household survey was completed on a tablet; data was included in an Excel database at the end of each day and results were kept confidential. The survey questionnaire is provided as an attachment to the present report.

9.1.3 Baseline Findings

This section presents a macro-level socio-economic profile of the communities in the Project Area. It has been prepared on the basis of data collected in March 2021 and secondary sources (as cited herein and in Section 0).

9.1.3.1 Project Area of Influence

The 2019 ESIA identified the Project's Social AoI as including three zones:

- Direct Social AoI – the 305 ha that would be occupied by the clinker, grinding unit and quarry;
- Indirect Social AoI – the area that will be directly affected by the Project, including the ecological zones that could be disturbed as a result of operations; and
- Extended Social AoI – the zone covered in the socio-economic analysis, including surrounding villages.

The 2019 ESIA identified the following villages as falling within the Project's extended Social AoI:

- Palal – 2 km from the clinker and 3 km from the quarry;
- Gap – 2.6 km from the clinker and 3.8 km from the quarry;
- Lene – 4 km from the clinker and 4.3 km from the quarry;
- Soune (Serere) – 4.5 km from the clinker and 4.9 km from the quarry;
- Soune Wolof – 4.2 km from the clinker and 3.6 km from the quarry.

A subsequent data collection process undertaken in March 2021 by ERM and Harmony Group (see Baseline Data Collection below), identified four additional communities within a 5 km radius of the Project site:

- Nangane – a Peulh hamlet located approximately 1 km northeast of the clinker and 2 km north of the quarry;

- Thiambokh Peulh – a Peulh hamlet of the village of Soune Wolof, located approximately 3 km southwest of the clinker and 2.2 km southwest of the quarry;
- Palal Peulh – a Peulh hamlet of the village of Palal, located approximately 1.8 km northwest of the clinker and 3.3 km northwest of the quarry; and
- Thiambokh – incorrectly considered a hamlet of Soune Wolof in the 2019 ESIA, but in fact an independent village located approximately 4.4 km southwest of the clinker and 3.5 km southwest of the quarry.

In accordance with the spatial extent of the potential direct and indirect impacts of the Project's activities (to be detailed in the Supplementary ESIA), the Project's Social AoI is considered to include a 5 km radius from the center of the Project site (Figure 9-1), which includes all core and associated components of the Project as well as the geographic area in which environmental and social impacts of the Project are likely. The figure below demarcates an area of 5 km from the approximate center of the Project site.

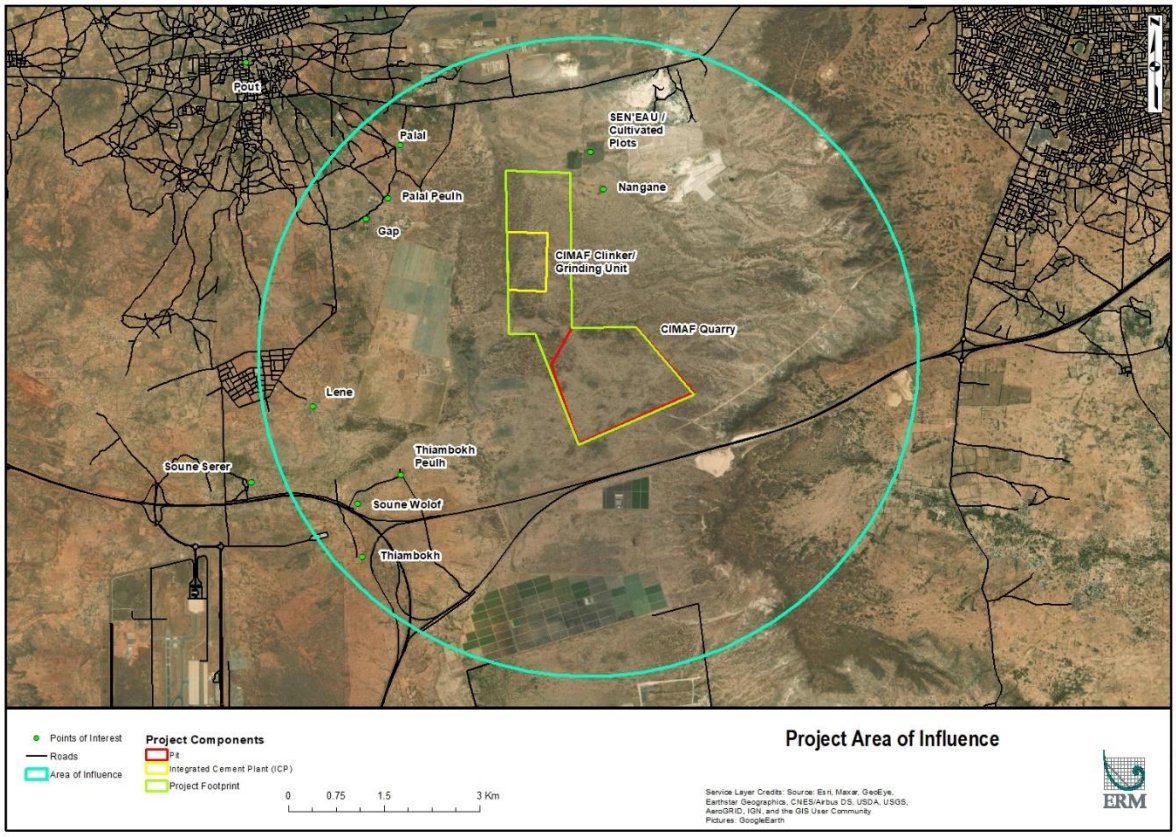


Figure 9-1 Project Social Area of Influence

Soune Serer is included in the Social AoI as some residences on its eastern edge fall within the 5 km radius; it is also the largest village in the area and the hub for economic activities and public services such as a health post and secondary school for surrounding villages. Residents of Soune Serer also use land within the Social AoI for livelihood activities.

This section presents a macro-level socio-economic profile of the communities in the Project Area. It has been prepared on the basis of data collected in March 2021 and secondary sources (as cited herein and in Section 0. It will be complemented in the Supplementary ESIA with data from the 2019 ESIA in order to provide a comprehensive socio-economic baseline for the Project going forward.

9.1.3.2 Demographics

Senegal has a total population of 13,508,715, which is roughly 51% male and 49% female. Approximately 48% of the population lives in urban areas, while 62% live in rural areas.[23] Senegal has a high illiteracy rate (40%) and unemployment rate (48%), even among university graduates.[24] As per the table below, more than 60% of Senegal's population is under the age of 25.

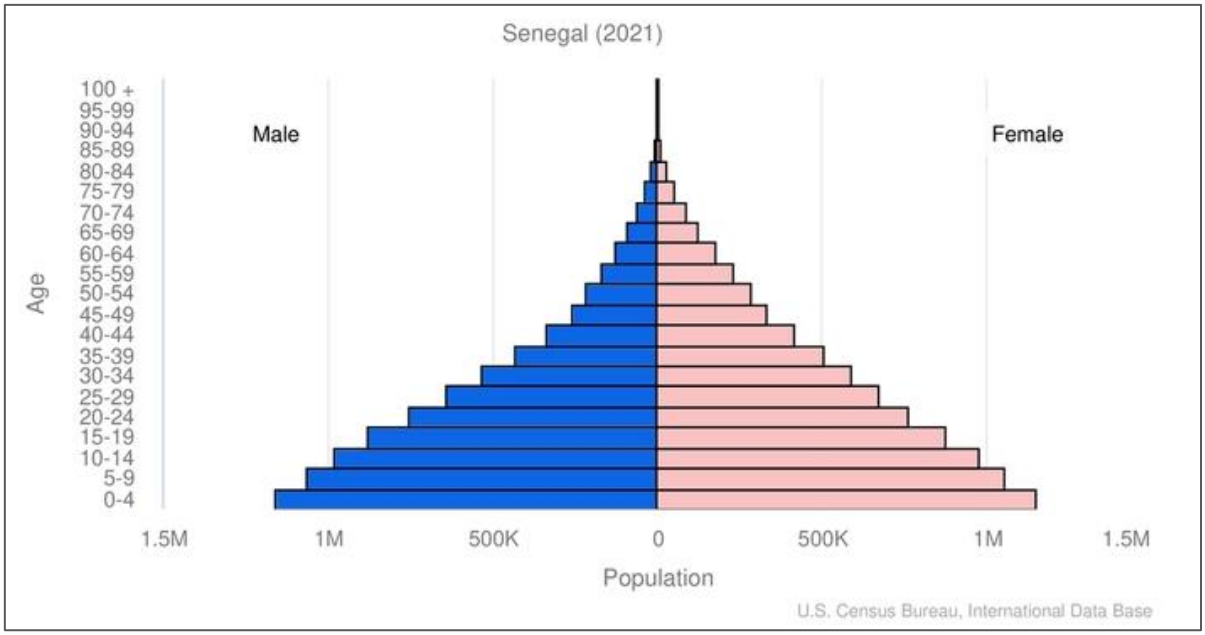


Figure 9-2 Population of Senegal

Approximately 46% of the population in Senegal lives below the poverty line, which in urban areas (excluding Dakar) is calculated as 1.86 USD / day; in rural areas the poverty line is calculated as 1.11 USD / day.[25]

The population of the Commune of Keur Moussa is estimated at be 46,908 (2019), with a roughly equal number of men and women. The dominant ethnic group in the Commune is Serer (63%), followed by Wolof (30%) and Peulh (7%). The vast majority of the population of the Commune is Muslim, though several important religious sites for Catholics are located in the Commune, including two monasteries and a convent.

Population estimates for the communities in the Project's Social AoI are provided in Figure 9-2 above. The six (6) villages in the Project's Social AoI are predominantly Serer (Palal, Gap, Lene, Soun Serere, Soun Wolof, and Thiambokh); three of the villages have hamlets that are Peulh (Nangane, Thiambokh Peulh, and Palal Peulh). The Project's Social AoI also includes a privately owned land parcel (referred to as the SEN'EAU cultivated plots given location immediately adjacent to the SEN'EAU pumping station located northeast of the Project site) that is being cultivated by 13 workers who reside on site. The workers are all male between the ages of 19 and 39 who live alone on site (i.e., without their families).

The following demographic data was collected through the household survey, conducted with 49 households and capturing data on 226 household members (all members above the age of 15), including the Heads of Household. The survey was conducted in the four settlements expected to be

[23] https://www.cia.gov/the-world-factbook/countries/senegal/#people-and-society

[24] https://www.cia.gov/the-world-factbook/countries/senegal/#economy

[25] https://www.ansd.sn/ressources/publications/SEN_PovMap_160512_rapport%20Version%20Anglaise.pdf

most significantly affected as a result of the Project's land use restrictions – Nangane, Thiambokh Peulh, Palal Peulh and the cultivated plots:

- The average household has seven members. Fourteen (14) households (29%) have only one member (the 13 residential workers of the cultivated plots, plus one household headed by a 52 year old male in the hamlet of Palal Peulh); six (6) households (12%) have between two and five members; 13 households (27%) have between six (6) and ten (10) members; 16 households (33%) have between 11 and 15 members. The largest household surveyed has 15 members.
- Of the 49 households surveyed, 43 (88%) are headed by men and six by women. The average age of the Head of Household (HoH) is 39; the youngest HoH is 18 years old and the oldest is 76. Eight (8) HoH are under the age of 25; three (3) are over the age of 60.
- Forty (40) of the HoH (82%) report to be married (two did not provide a response); 28 (57%) with one spouse and seven with two spouses (four did not provide a response).[26] Of the six female-headed households, four reported to be married.
- The average number of children per household is four and the largest number of children per household is ten (10). Eleven (11) households (22%) include no children, 20 households (41%) have between one and five children, six (6) households (1%) have between six (6) and ten (10) children.
- Thirty nine (39) of the surveyed households (80%) are Peulh. The remaining households - including seven Soussou, two Bambara, and one Sonike – are all residential workers of the cultivated plots near the SEN'EAU pumping station and reportedly all from Mali originally.
- All surveyed households (100%) reported to be Muslim.
- Wolof is reported as the most widely spoken language amongst surveyed households; 23 households (47%) report it as their primary language and 18 households (37%) report is as their secondary language. Peulh is spoken as the primary language in 17 households (35%) and the secondary language in 18 households (37%). Additional languages spoken include Soussou, Soniké and Bambara, which were reported by the residential workers of the cultivated plots.
- Twenty-two (22) HoH reported to be literate (45%). Of the 177 household members surveyed (15 years and older), 99 reported to be literate (56%). In terms of the highest level of schooling completed amongst HoH and household members, 61% completed Koranic school, 15% completed elementary school, and 24% completed secondary school.

9.1.3.3 Vulnerable Groups

Overall, the communities in the Project's Social demonstrate characteristics suggesting a high level of vulnerability to any significant economic shocks, including low levels of literacy and formal education and a dependence on seasonal and land-based livelihood activities. In addition, surveyed households reported low levels of savings (35% of surveyed households reported having any savings – 15 through their family and two through microcredit programs) and relatively low levels of social capital or organization (35% of surveyed households reported being a member of any type of association or community group, only one NGO was reported as being active in the area).

Two specific groups within the communities in the Social AoI have the potential to be differentially or disproportionately affected by the Project because of their marginalised status within the dominant social structure and their dependence on the Classified Forest for their livelihood activities: women and Peulh communities.

[26] It was noted by Harmony Group in advance of the survey process that there would be some questions that some respondents – specifically in Peulh communities – would be reticent or would refuse to answer as culturally, they do not disclose this type of information to outsiders.

Women

Senegal established its Ministry of Women, Families, Gender and the Protection of Children in 1974. The Constitution of Senegal (2001) guarantees equality between men and women.

The country has ratified the UN Convention on the Elimination of All Forms of Discrimination against Women (1985), the Optional Protocol on Violence Against Women (2000), and the Protocol to the African Charter on Human and Peoples' Rights on the Rights of Women in Africa (2005). The Senegal Emerging Plan (PSE), which serves as the country's policy framework for development, specifically commits the country to the goals of non-discrimination and equality of opportunity for men and women.[27]

Despite the presence of a strong legal and political framework, gender equality is hampered in Senegal due to a prevailing patriarchal culture and women's continued exclusion from traditional governance structures, decision-making, and formalised economic opportunities. For example, women in rural areas in Senegal are often active in the cultivation and resale of agricultural products, however, they are typically unable to own land.[28]

In a 2016 study by UN Women, a high prevalence of gender-based violence was recorded in Senegal, with 65% of cases of violence occurring in the home and sexual violence reported in 58% of cases of gender-based violence.[29] Further research has found that 31% of Senegalese girls are married before age 18 and 37% of women are less educated than men.[30]

It was not possible to address questions related to gender-based violence as part of the consultation carried out by ERM and Harmony Group in March 2021.[31] That said, focus group discussions with women confirmed that in addition to the formal barriers to women's economic empowerment in Senegal (such as barriers to access to land and land tenure), women in the Project Area are excluded from formal decision-making bodies, are impeded in their economic activities due to their domestic burden, and overall are attributed a lower social status than men. With specific relevance to the Project, the informal and undocumented nature of women's economic activities makes it difficult to quantify impacts on women.

The following data on female headed households and female household members was collected through the household survey process:

- Six (6) households are headed by women. All are Peulh households located in Nangane (5) or Thiambokh Peulh (1). Of the 177 household members surveyed, 94 were female (53%).
- All six (6) female HoH are married with one spouse and between three and eight children. Their household size ranges from 5 to 15 members.
- Of the six (6) female HoH, two are literate, having completed primary school. Of the 94 female household members surveyed, 55 are literate (59%).
- The primary livelihood activities reported by female headed households are sale of milk products (4) – with average monthly household revenue ranging from 45,000 to 90,000 FCFA; herder (1) – with an average monthly household revenue of 60,000 FCFA; and traditional healer (1) – with an average monthly household revenue of 120,000 FCFA.

[27] https://www.presidence.sn/pse

[28] https://africa.unwomen.org/en/where-we-are/west-and-central-africa/senegal

[29] https://africa.unwomen.org/en/where-we-are/west-and-central-africa/senegal

[30] https://equitas.org/where-we-work/west-africa/senegal/

[31] After consulting with Harmony Group, ERM determined it would not be appropriate to raise questions related to gender-based violence within the context of the consultation being carried out. Specifically, the topic is not openly discussed in Senegalese society and certainly not with outsiders who have no familial connection to the communities. Not only would women not be comfortable discussing these issues in this context, but asking questions on this topic could alienate or offend participants and jeopardize their relationship with the Project.

- Among female household members, primary vocations are sale of milk (47%) and students (21%). One female household member reported practicing market gardening, though not as part of the cultivate parcel near the SEN'EAU pumping station (where all employees are male).
- All six (6) female headed households report having livestock: all six report having cows and goats; four report having chickens; and two reported having donkeys.
- Three of the six (6) households reported not being able to meet their household's consumption needs four months of the year.
- All female HoH reported collecting wood, fruit and plants from the Classified Forest.
- The average monthly income reported by the female headed households are 45,000 FCFA (2), 60,000 FCFA (2), 90,000 FCFA (1) and 120,000 FCFA (1).
- None of the female headed households have formal ownership or any documentation of their right to use or occupy the land on which they live; all occupy their land on the basis of an authorisation by the Directorate of Water and Forests.
- None of the female HoH reported having any savings or belonging to any associations.

Peulh

The status of Peulh communities in Senegal varies significantly in accordance with their relationship with residents of surrounding villages and towns. Traditionally, Peulh communities were largely nomadic, traveling with their livestock along established migration routes in accordance with the seasons. Conflict arose along these routes between local residents and Peulh herders along who cut trees or branches to feed their livestock or whose livestock entered agricultural fields and destroyed crops. This in turn led to mistrust and prejudice against the Peulh in many cases.

In recent years, Peulh communities who have been able to access consistent sources of fodder for livestock have built semi-permanent or permanent structures and live in the same location year-round. This is the case in the Project's Social AoI where the Peulh communities of Nangane. Thiambokh Peulh and Palal Peulh have settled and graze their livestock exclusively in the Classified Forest. All three communities are hamlets of a larger village – Daral Peulh in the case of Nangane, Soune Wolof in the case of Thiambokh Peulh, and Palal in the case of Palal Peulh – and are represented by those villages' hereditary Chiefs.

During the consultation carried out by ERM and Harmony Group in March 2021, no inter-community conflict or security issues were reported. However, Peulh hamlets were not necessarily represented among village leadership (i.e., Village Chief and elders) and special arrangements had to be made to ensure their participation in the consultation.

Pastoralism was reported as the primary livelihood activity in all three communities – including by women who sell milk from livestock along the RN2 and in local markets, meaning a high likelihood of impacts for all households in both Nangane (150 persons), Thiambokh Peulh (300 persons) and Palal Peulh (40 persons). The dependence of these communities on the Classified Forest for grazing livestock – and the fact of pastoralism being their dominant if not sole livelihood activity - will make them particularly vulnerable to the Project's impacts.

Of the 37 Peulh households surveyed, 24 households (78%) reported herding or the sale of livestock or milk as their primary livelihood activities. Other primary activities include guard (2), market garden (2), driver (1), sale of water (1), and traditional healer (1). All of the households practicing pastoralism reported to graze their livestock in the Classified Forest. The average monthly revenue reported by herders was 88,000 FCFA. Among all surveyed households, residents of the community of Nangane reported the lowest monthly revenue (between 45,000 FCFA and 60,000 FCFA).

9.1.3.4 Infrastructure

Infrastructure in the Project Area is limited. In all consultation sessions, community members reported challenges in access public services. This is due in part to the limited facilities in the Project's Social AoI, specifically health posts and schools, but is compounded by the absence of any paved roads between the RN2 and A1 Highway and the relatively high cost of transportation, which makes travel in the area difficult, particularly during the rainy season. Table 9-1 below presents the infrastructure identified in each community consulted in March 2021.

Table 9-1 Infrastructure in the Social AoI

Community	Health	Education	Water	Electricity	Waste Management
Gap	None	Primary School	Well, SEN-EAU piped water	Streetlights only	None
Lene	None	Primary School	2 wells, 3 public taps (only 1 functions), SEN-EAU piped water	Streetlights only	None
Nangane	None	None	None (use well at SEN-EAU pumping station)	None	None
Palal	None	Primary School	SEN-EAU piped water, private taps on large concessions	Available but very few houses connected	None
Soune Serer	Health Post	Primary School, College	Well (broken), public taps, SEN-EAU piped water	Yes (in 10 out of 12 hamlets)	None
Soune Wolof	None	None	SEN-EAU piped water	Streetlights only	None
Thiambokh Peulh	None	None	Public tap	None	None

The household survey provided the following findings on infrastructure and access to public services:

- The majority of households (65%) must travel between 2 and 5 km to access health services; 18% must travel more than five km. A health centre and hospital are located in Pout and Thiès, respectively. A health post is located in Soune Serer and the Société sénégalaise des phosphates de Thiès (SSPT) project located on the RN2 north of the community of Nangane also provides basic nursing services for local residents.
- 27% of surveyed households have access to a source of water for domestic use within their compound; 47% have access within their village and 27% must go outside of their village to access water for domestic use, including 15 households who must travel more than 1 km to access water.
- Thirteen (13) surveyed households (27%) have access to electricity via the national energy provider, SENELEC, and four have solar panels (less than 1%); the majority (63%) use torches or candles for light.
- There is no waste management system in place in the Project's Social AoI; households collect and either burn their garbage or dump it on the outskirts of their settlement area.

- The majority of surveyed households (67%) have no access to any sanitation facilities; 32% reported having access to a simple or ventilated latrine.

In terms of access to piped water, multiple communities reported relying on the national water agency – SEN'EAU – that built a pipe through the area in order to connect a water tower sourced by the network of Kirene to the BDIA. Communities are connected to the pipe via public taps and in some cases, household connections. However, community members reported experiencing regular disruptions (normally once a month for 2 to 3 days) to the water supply, which is perceived to be due to SEN'EAU cutting their access in order to meet the airport's increased water needs.

9.1.3.5 Economy and Livelihoods

Primary livelihood activities reported during the consultation carried out in March 2021 were seasonal (rain-fed) agriculture and pastoralism (herding). Environmental changes, specifically desertification, have contributed to increasing challenges for both activities in recent years. Many participants in focus group discussions commented on the gradual reduction in agricultural yields and fruit trees production in recent years. These challenges are perceived to be compounded by the presence of numerous industrial projects in the area, which residents claim have their affected access to water (due to a lowering of the water table), agricultural land and grazing land. Dust generated by industrial projects in the area, specifically the SSPT quarry, is also thought to be contributing to lower yields, as well as health problems among livestock and residents.

Common agricultural crops grown by households in the Social AoI include millet, peanuts, and cowpea (niebe). Farmers in all communities noted worsening growing conditions, specifically due to unpredictable rainfall and lack of access to water for irrigation. Community members consistently expressed an interest in diversifying their livelihood activities through market gardening, but reported they are unable to do so due to a lack of access to water. Farmers in the village of Lene explained that many of them have opted to convert their agricultural land to urban land due to limited income from rain-fed agriculture, though they continue to cultivate the land up until the moment it is sold.

Of the 49 households surveyed, 40 (81%) reported owning livestock. Questions on the number of livestock by type were not readily answered (as noted above this type of data is often not shared by Peulh households with outsiders) but the following data was collected:

- On average, households own 17 cows;
- On average, households own 12 goats;
- On average, households own 12 chickens;
- On average, households own 11 donkeys;
- Only one (1) household reported having pigs (2);
- Two (2) households reported having sheep (two and five respectively); and
- Three (3) households reported having horses (two households had one each, one household had two).

All pastoralist activities were reported to depend in part of in full on the Classified Forest. When asked where specifically animals graze, the answer was consistently "freely in the forest", suggesting there is no one area of the Classified Forest that is of higher value for livestock than any other. A former quarry located northeast of the Peulh hamlet of Nangane was cited as the only waterpoint remaining for livestock within the Classified Forest.

The Project's Social AoI includes 15 ha of cultivated parcels, located next to a SEN'EAU facility between the RN2 and the community of Nangane (referred to as the SEN'EAU cultivated plots due to their proximity to the existing SEN'EAU pumping station, located approximately 1 km northeast of the ICP – see Figure 7-5). The two parcels were allocated to two private owners by the Directorate of Water and

Forests in 1990 and 2014 respectively. Thirteen (13) men are employed full-time as labourers and reside at the site of the parcels (without their families); women from surrounding communities are hired as day labourers during the harvest season. The full-time workers are reportedly all of Malian origin. Products grown on these parcels include cabbage, onions, carrots, peppers and papaya.

The 13 workers were included in the household survey and reported average monthly revenue between 45,000 and 100,000 FCFA. All but one of the 13 respondents confirmed being able to meet monthly household needs.

The primary – and almost exclusive – livelihood activity of women in the Project's Social AoI is small-scale commerce. Among women in Peulh communities, this is specifically the sale of milk from livestock.

Women in other communities report collecting forest products or buying small goods such as vegetables and sugar and reselling them in surrounding villages or along the RN2. Women's activities are directly linked to communities' access to ecosystem services in the Classified Forest, as illustrated in the household survey results:

- 98% of households use wood from the CF for cooking;
- 82% of households use wood from the CF for construction;
- 67% of households collect fruit from the CF for consumption or sale; and
- 73% of households consume plants from the CF.

Youth consulted in March 2021 reported high levels of unemployment; the training and recruitment of youth was the most common request made by community members in terms of their expectations of the CIMAF Project. Youth cited having diverse and advanced qualifications, but claimed they are unable to find any employment opportunities in the area. Recent projects, including construction of the A1 Highway and the BDIA, reportedly hired only a small number of labourers from the Project's Social AoI and even then, only as day labourers for short periods of time.

The following data on average monthly household revenue was collected through the survey: [32]

- Five households reported average monthly revenue below 50,000 FCFA;
- 21 households reported average monthly revenue between 50,000 and 100,000 FCFA;
- 11 households reported average monthly revenue between 100,000 and 200,000 FCFA;
- One (1) household reported an average monthly revenue of over 200,000.

The majority of households (71%) reported their revenue being sufficient to meet household needs. Eleven (11) households reported they cannot meet their needs between 2 and 5 months of the year.

Low levels of savings were reported among surveyed households; only 17 households (35%) reported having any type of savings. Of the 17 households with savings, 15 save within their family and only two reported saving through a microcredit program.

9.1.3.6 Land Tenure

Land in Senegal is commonly accessed through formal, traditional and informal ownership structures. The majority of residents in rural communities not have a formal land title but have customary rights to their residential and agricultural lands, allocated by traditional community leaders. Customary land ownership is passed down to male heirs; women in the Project's Social AoI do not typically own land, though it is reportedly possible in exceptional circumstances.

[32] Household revenue data is often unreliable as respondents are unable or unwilling to provide accurate data. For this reason, the household survey included a number of questions on the number and type of household assets, which can provide a more balanced data set against which changes in households' economic status can be monitored.

Of the 49 households surveyed, the majority (59%) report having been allocated the right to reside on their land by the Directorate of Water and Forests, with the remainder having been allocated land by the Village Chief or choosing not to respond. Eighteen (18) households (37%) – all of which are located in the community of Thiambokh Peulh (which falls just outside the southern boundary of the Classified Forest) - reported having formal ownership of their land and of those, all but three reported having documentation to support their ownership claim.

Consultation with residents of Nangane, which is located within the Classified Forest, provided further insight to the precarious nature of the community's land tenure status. Though the Village Chief said he recognises the "illegal" nature of their occupancy, Nangane was granted authorisation by the Directorate of Water and Forests to reside at its current site in 1994. He further explained that restrictions prevent the construction of any permanent structures within the CF, which is reportedly why houses in Nangane





are built primarily with straw and only a small amount of cement for structural integrity (see Figure ***9-3***). Other community members consulted by ERM and Harmony Group in March 2021 noted they originally feared the purpose of the meeting was to inform them that the community had to move.

Figure 9-3 Structures in Nangane

Land Acquisition and Resettlement Precedents

There is intense land pressure in the Project's Social AoI as a result of an increasing number of private sector projects with large land use footprints. Figure 9-4 below identifies specific projects in the area that were cited by residents in March 2021 as having affected their access to land.

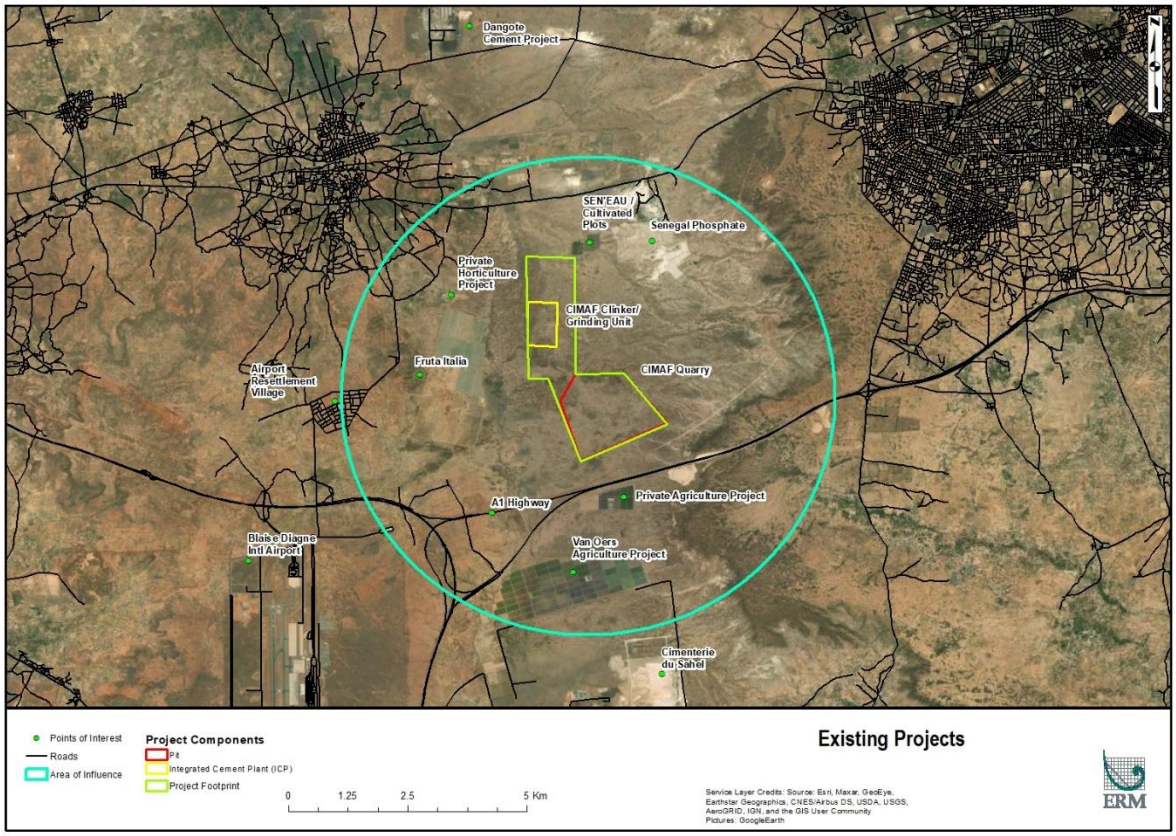


Figure 9-4 Existing Projects

Within the Classified Forest specifically, multiple private sector projects have been allocated land by the Government through a process of declassification administered by the Directorate of Water and Forests. In 2013, the total area of the Classified Forest was 11,081.2 ha; at that time, 474.3 ha had been declassified.[33] Today, the total area of the CF is reported to be 8,700 ha, suggesting more than 2,300 ha has been declassified in the last eight years.

During the consultation process, residents in multiple villages - specifically Village Chiefs, elders and youth - expressed frustration over the declassification of land in the Classified Forest for private sector projects, without any allocation of lands to the local population for their own agricultural use.

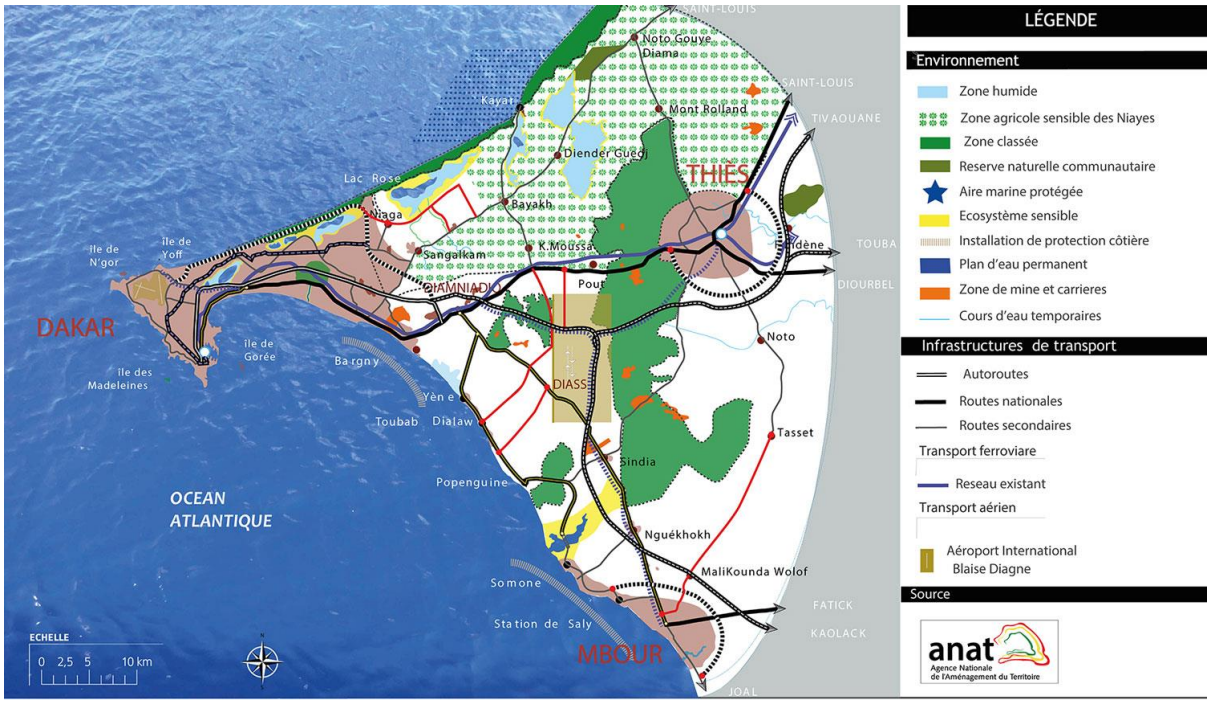
Villages on the southern edge of the Project's Social AoI also voiced intense frustration and disappointment over the management of the resettlement process for the BDIA and the A1 Highway, completed in 2017 and 2018 respectively. Key concerns included:

- Displacement from agricultural land and households unable to acquire replacement land due to scarcity of arable land in the area;
- Partial or outstanding compensation payments;
- Disparity in compensation rates (specifically, compensation for land being paid at national rates for some components of the A1 Highway and at higher rates for other components that were financed by international lenders);
- Displacement from lands (reportedly without compensation) acquired by the Government and reallocated as part of the entitlements to households displaced by construction of the AIBD; and
- Declassification of 300 ha of land from the Classified Forest by the Government and allocated as part of entitlements to households displaced by construction of the BDIA (which has since been

[33] https://www.ansd.sn/ressources/ses/chapitres/8-ressources-forestieres-Thiès2013.pdf

leased to the Fruta Italia project and its perimeter fenced off, which some communities claim is creating a barrier to their access to the remaining area of the Classified Forest).

A media scan and review of secondary sources confirmed two additional projects may have further impacts on land access in the Project's Social AoI: an extension of the BDIA (with plans for the construction of logistics and training facilities, hotels, and leisure centres) and the construction of a paved road connecting the A2 Highway and the RN2 road at Pout. Figure 9-5 below presents the approximate location of these projects, though specific land use implications cannot be configured based on available information.



Source: National Agency for Land Management (2014)

Figure 9-5 Regional Land Use Plan

9.2 Traffic

9.2.1 Description of Major Roads

Major roads in the Project Area include the RN2, A1, and A2 motorways. The RN2 is a paved, 2-lane road with a typical paved width of 7 - 8 m, frequent at-grade intersections, occasional paved or unpaved shoulders, and no regular sidewalks or other pedestrian facilities. The RN2 between Dakar and Thiès is the most travelled road in Senegal, and is the route used by buses, coaches, and other travellers from Dakar to all other destinations in Senegal. The RN2 has no sidewalks or other pedestrian facilities, and pedestrians often walk along the shoulders of the road.

The A1 is a 4-lane divided highway with a limited number of grade-separated interchanges. It has typical paved width of 23 - 24 m, including four (4) total travel lanes, a concrete centre median, and paved shoulders. The A1 links Dakar to AIBD and the coastal city of Mbour. The A2 is a 4-lane divided highway, with similar dimensions to the A1. It links the A1 near the airport to Touba. The A1 and A2 are also referred to as the Toll Roads (Autoroutes à péage).

Local road networks are more limited, with many rural roads in poor condition or unpaved (OSAC 2020). Unregulated transportation services (typically vehicles in poor condition, known locally as "illegal taxis") provide services between smaller communities not linked by regulated buses and coaches (2019 EIES).

9.2.2 Existing Traffic Data

Traffic data collection occurred on 24, 25, 27, and 28 March 2021. Table 9-2 summarises traffic data collected at two locations in the Project Area (see Figure 9-6). Traffic volumes on these major roads were generally low—equivalent to a maximum of 900 vehicles per hour on the RN2 near the Project Site access road, and a maximum of 564 vehicles per hour at Exit 1 on the A2. Weekend traffic volumes were modestly higher than weekday volumes. Heavy vehicles (buses, trucks, etc.) comprised between 6 and 25 percent of total traffic, depending on location and time of day. The highest volume of heavy vehicle traffic occurred on the A2 on weekdays, with a peak of 201 heavy vehicles during a one-hour period.

Table 9-2 Traffic Data, March 2021

RN2 at Site Access Road								
	Weekday (Average, 24-25 March)				Weekend (Average, 27-28 March)			
Time of Day	Autos	Mopeds/ Motorcycles	Heavy Vehicles	Total	Autos	Mopeds/ Motorcycles	Heavy Vehicles	Total
08h00-08h20	136	35	25	195	140	28	33	200
12h00-12h20	142	57	26	224	200	25	33	258
16h00-16h20	146	48	26	219	184	26	24	234
18h00-18h20	155	38	26	218	233	30	37	300
19h00-19h20	170	52	25	247	224	22	38	283
20h00-20h20	103	37	15	155	167	19	26	212
Toll Road A2 Exit 1 (at interchange with the Thiès-Sindia road)								
	Weekday (Average, 24-25 March)				Weekend (Average, 27-28 March)			
Time of Day	Autos	Mopeds/ Motorcycles	Heavy Vehicles	Total	Autos	Mopeds/ Motorcycles	Heavy Vehicles	Total
08h00-08h20	50	17	46	113	99	13	14	126
12h00-12h20	63	16	54	133	143	11	23	177
16h00-16h20	50	17	44	111	143	18	28	188
18h00-18h20	65	19	57	141	137	14	25	175
19h00-19h20	71	19	67	157	143	12	31	186
20h00-20h20	32	6	29	67	129	9	14	152

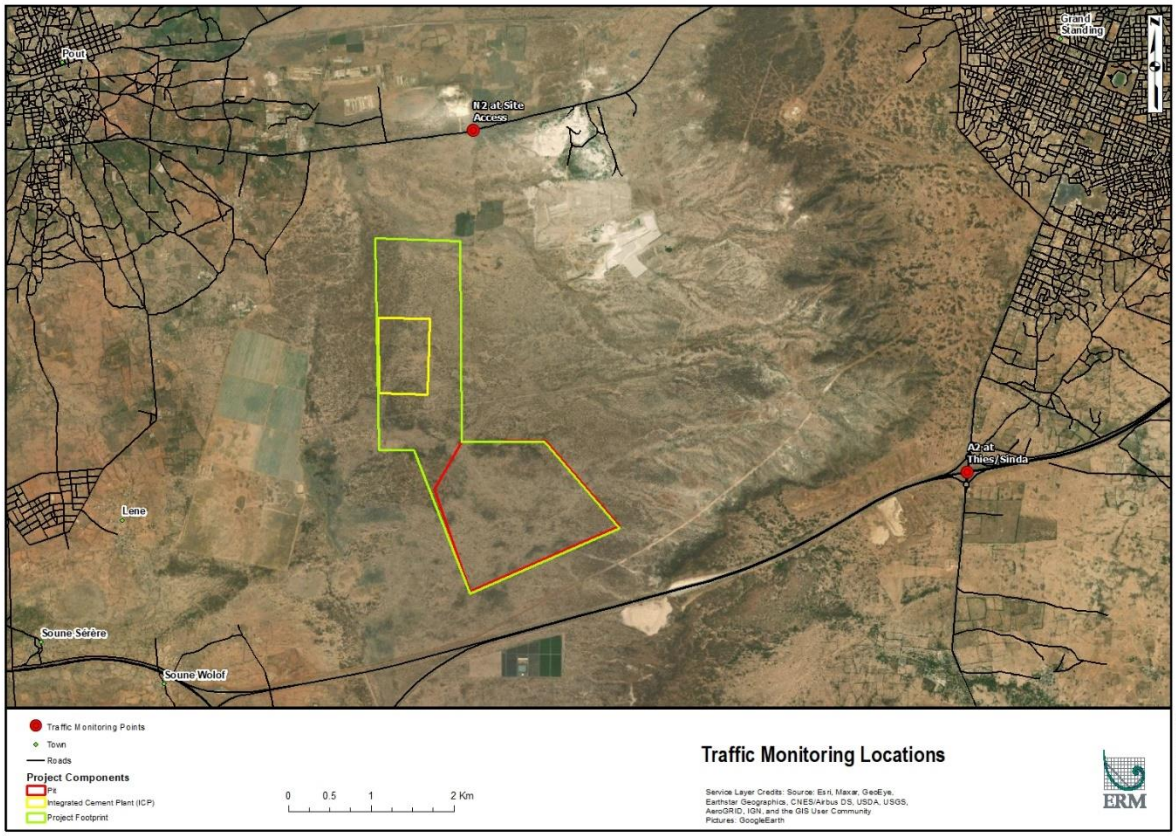


Figure 9-6 Traffic Count Location

No traffic safety data or reports for the RN2, A1, or A2 near the Project Site were readily available to the public. Overall, Senegal recorded 23.4 traffic fatalities per 100,000 population in 2016; by comparison, all of sub-Saharan Africa recorded 27.2, while the world average was 18.1 (World Bank 2021). The U.S. Department of State's description of driving conditions in Senegal states that "poor traffic markers; changing traffic patterns; the presence of animals or people in the road; and random, unannounced road construction confuse even the most experienced drivers. Many local drivers are aggressive, unpredictable, and untrained," and road safety issues compound during the rainy season (OSAC 2020). The World Bank rates Senegalese efforts to enforce traffic safety (including speed limits, drink-driving laws, motorcycle helmet laws, and seat belt laws) as 3 to 6 out of 10 (World Bank 2018).

9.3 Cultural Heritage

9.3.1 Introduction

This section describes the Cultural heritage study. It includes the methodology used in assessing the baseline. Furthermore, the potential impacts and recommendations regarding mitigation of these impacts are also described.

9.3.2 Methodology

For the purposes of this report, the study area comprises the following area:

- The main Project Site containing the AoI (Figure 9-1) identified in the 2019;
- A 2 km buffer of the direct AoI for Cultural heritage review.

9.3.3 Baseline Methodology and Approach

All Cultural Heritage sites within the study area with the potential to be directly or indirectly affected were considered. The extent and value (significance) of Cultural heritage in the form of archaeological, palaeo-environmental remains, historic buildings, Intangible heritage sites and the built environment and historic landscape were also considered.

9.3.4 Data Sources

The following information and sources were consulted as part of the desk study of the Cultural heritage in the Project Area:

- National Legislation of Senegal;
- International regulations and conventions;
- Published academic research of the region;
- Cartographic materials and remote sensing data including satellite imagery, historic mapping and topographic data.
- Freely available internet resources.

9.3.5 Geographic/ Topographic Context

The Project Area lies within the Sudano-Sahelian climatic domain. Two seasons can be distinguished: a rainy season from June to October and a dry season for the remaining months of the year. Senegal is a relatively flat country, with Mamelles, which rises to approximately 100 m around the City of Dakar. Forest shrub vegetation dominates the Project Area, however the most prominent trees are the Baobab. The Thiès Forest, a classified forest, is open to surrounding grazers who rely on this access for their lively hood and is an area where cultural beliefs are practiced. Within the forest, communities place importance on specific baobab tree for rituals, prayers and burials.

The communities identified within the Project's AoI are predominantly Serer and Peulh, in terms of ethnic makeup. Traditionally, Peulh communities are largely nomadic, travelling with their livestock along established migration routes in accordance with the seasons. In recent years, Peulh communities have built semi-permanent structures in the villages of Nangane, Thiambokh Peulh, and Palal Peulh, and live a more sedentary lifestyle, grazing their livestock exclusively in the Classified Forest. Pastoralism was reported during the consultation by ERM and Harmony Group in March 2021 as the primary activity in all three Peulh communities.

9.3.6 Archaeological and Historical Background

The archaeology and history of Senegal can be divided into a number of periods spanning the prehistoric era, colonial period and contemporary time.

9.3.6.1 Prehistoric

The presence of Palaeolithic occupation has been identified historically on the peninsular of Cap Vert as well as in the low and middle valleys of Senegal such as the Faleme in the east. Recent research has focussed increasingly on the Neolithic and Paelaeolithic sites such as the Tiemassas, to the south of Dakar, with evidence of occupation sharing a common environmental signature of coinciding with peaks of regional humidity identified in marine records. The significant shift in resource exploitation between Middle and Later Stone Age in West African generally can be inferred given the shift from open Savannah habitats to diverse forested ecologies (Niang et al, 2018).

For the past 12,000 years, the climate of the Sudano- Sahel has experienced cooler and wetter periods, and hotter, dryer period of varying duration and intensity (Douglas et al, 2017). Historic records indicate that extended drought drove migration from marginal environments to more productive agro-pastoral

environments where rainfall was more reliable for consumption, livestock and crops (Darkoh 1996). Traditional agricultural practices within the region have developed in response to periods of drought of the Sudano-Sahelian region.

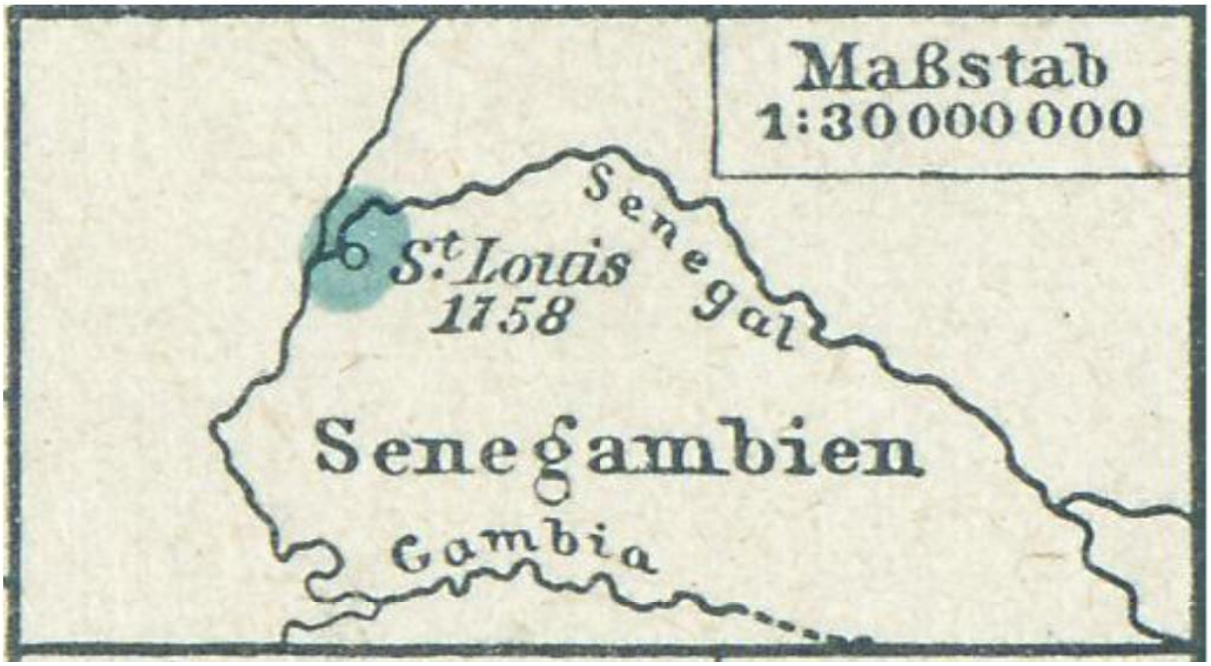


Figure 9-7 Historic map of the Kingdoms, illustrating Senegambia and St Louis, 1758

9.3.6.2 Colonial

Precolonial to colonial Senegal relies largely on archaeological excavation, recordings of early geographers and oral traditions. Evidence suggests that Senegal saw historic migrations from the north and east in several waves with the most recent being from the Wolof, Peulh and Serer. The Serer are thought to have moved southwards in the first millennium AD from the Senegal River Valley (Wright 2010). Prior to the arrival of Europeans Senegal comprised of three main empires: the Ghana Empire, the Mali empire and the Songhai Empire, whose centres were territorially divided. Colonial presence brought with it autonomy of small kingdoms and the removal of younger local inhabitants to the Americas in the Atlantic slave trade. Senegal was frequented by Portuguese Dutch and Anglo French navigators and trading companies throughout the 16th 17th and 18th Centuries, (Hesseling 1985).



Figure 9-8 Historic Topographic Map of Foret De Thiès, 1905

9.3.6.3 Contemporary

Various European nations competed for trade in coastal Senegal from the 15th century onward until France retained possession of a slave trade departure point, today known as Goree Island on the outskirts of Dakar. Senegal gained independence from France in 1960.

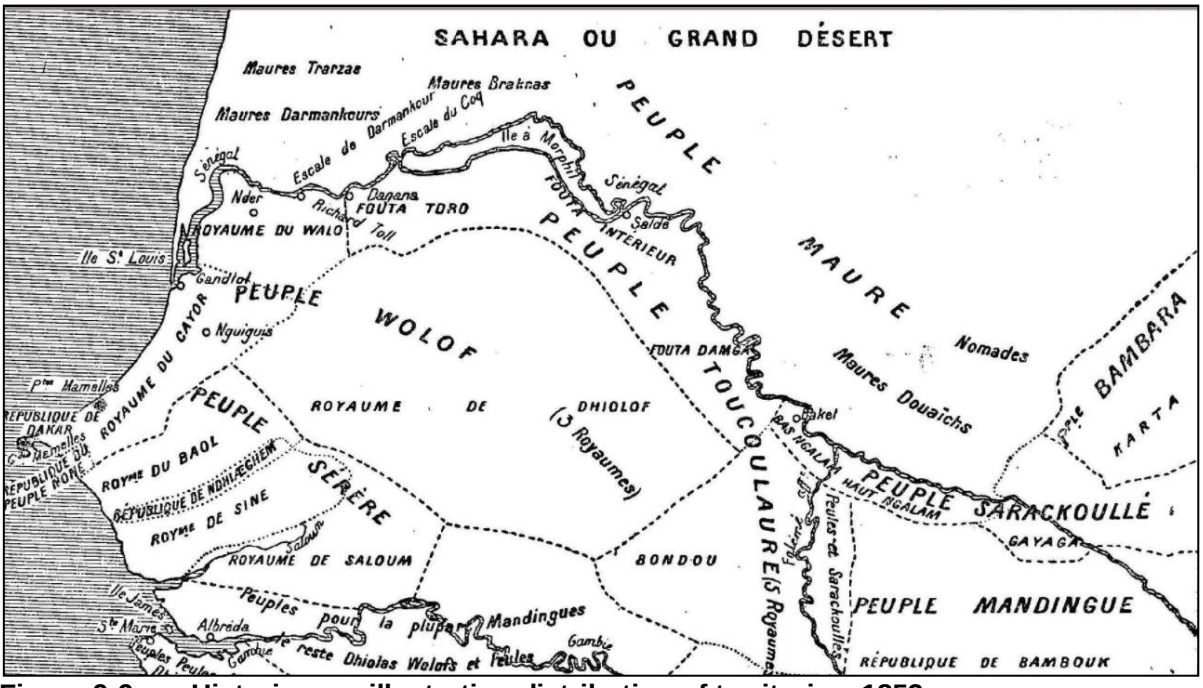


Figure 9-9 Historic map illustrating distribution of territories, 1853

9.3.7 Oral Traditions in Senegal

Though some limited archaeological research was conducted along the coastal areas surrounding Dakar, not much is known about the oral traditions in the Project Area. The most prevalent research of oral traditions is migrations and westward movement of large groups of Senegambia and Mandinka communities. Research suggests that migration occurred from traditional homelands east and south

east of present locations of Mandinka and Senegambia resulting in long term settlement in Foret De Thiès (Wright 1985).

There are detailed records of Senegal's past in languages of the Manding, Wolof, Serer and Soninke (N'Diaye 1990). Agreed reasons for the widespread westward migrations and subsequent settlement is the historic linguistic arrangement between western Mandinka and Senegambia communities. The Mandinka constitute one of Senegambia's major ethnic groups. Persons who identify themselves as Mandinka occupy a band of territory that cuts across southern Senegambia, widening in the interior and narrowing to a point at the north near the Gambia River (Figure 9-9). In the eastern Mandinka belt it stretches into Western Sudan (Wright 1985).

9.3.7.1 Key Baseline Findings

All identified potential cultural heritage sites (assets), tangible and intangible within the study area were given a unique reference code (for example CH01). A full list and further detail on these assets can be found in the gazetteer in Table 9-3. Maps showing the location of all cultural heritage assets identified in the baseline study can be found in Figure 9-10.

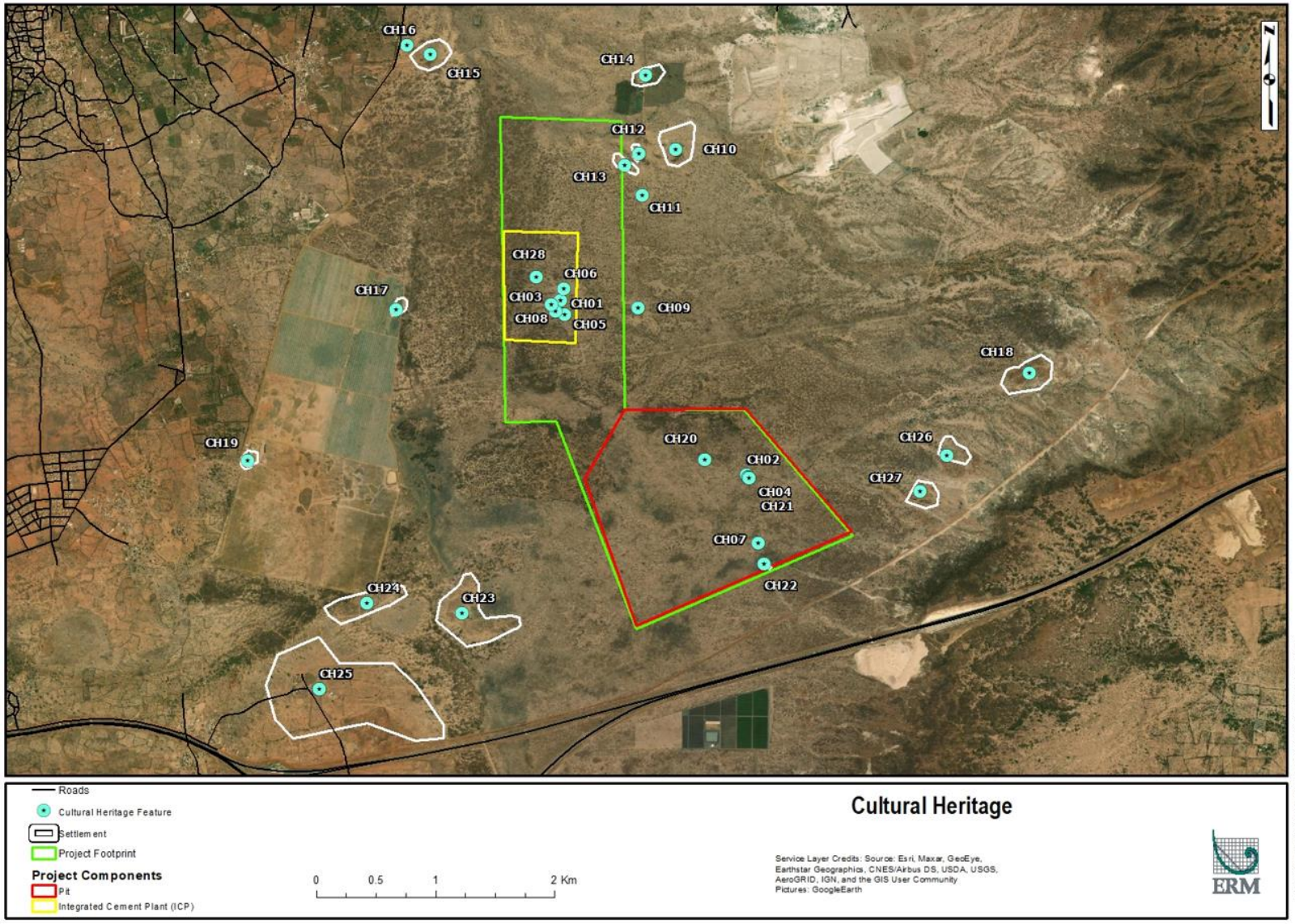


Figure 9-10 Cultural Heritage Features Identified within the Study Area

9.3.8 Designated Cultural Heritage Sites

No designated cultural heritage sites were identified in the Department of Thiès.

9.3.9 Non-Designated Cultural Heritage Sites

Twenty-eight (28) non-designated cultural heritage features were identified within the study area. These features include numerous structures and settlements that may be associated with agro- pastoralism. The settlements comprised small villages of circular dwellings and enclosures for livestock. The structures within the settlements may be historic or modern, but importantly may form part of a larger intangible heritage in the form of traditions associated with an agro-pastoral way of life. Literature review revealed that the settlements are likely associated with traditional agro-pastoralism and a transhumance corridor from west to North Senegal, as detailed in the Archaeological and Historic background above.

Assessment of the cultural heritage features identified within the study area and review of academic records indicate that a transhumance corridor (seasonal movement of people and animals) traditionally passed close to the Project Area to the west. Corridors are important, as the historic tradition is under threat by settled agricultural communities with an increase in conflict. A field visit may be required to confirm the exact location of the sacred baobab trees as well as the larger migration pathways between the Forest de Thiès and Western Senegal to appropriately assess impact.

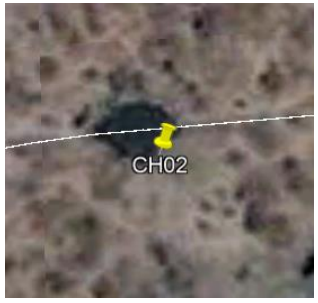
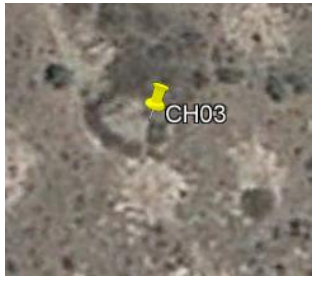
Results of a field visit in March 2021 by Harmony and ERM revealed an intangible cultural heritage Asset of a Baobab tree located, based on an approximation received from local residents, at 14°42'58.13"N 17° 1'53.72"W. Interviews with local communities confirmed its significance as a burial ritual site for the community of Soune Serer. A second Baobab tree located at the start of the route followed to reach the sacred Baobab was also identified by locals (Figure 9-11).

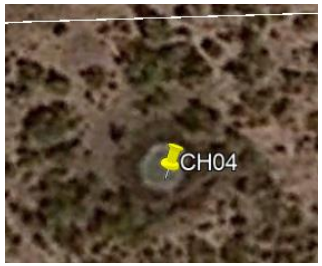
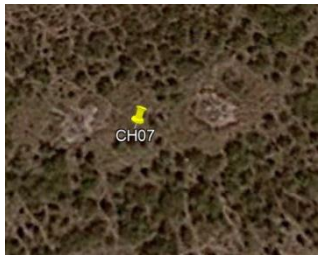


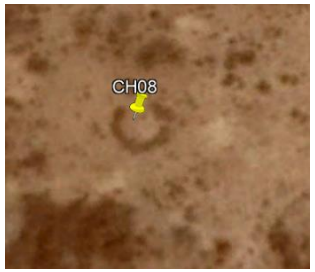
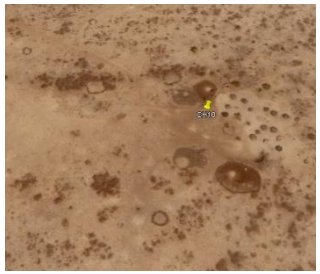
Source: E. Nunn – March 2021

Figure 9-11 Baobab Tree Associated With Path to Sacred Baobab Tree

Table 9-3 Gazetteer of Identified Cultural Heritage Features

Unique identifier	Type	Source	Description	Photograph	Coordinates
CH01	Enclosure	Remote Sensing (11/2012)	Circular enclosure approx. 6m diameter. Footpath running east west to the north of enclosure. Surrounded by similar sized enclosures.		14°44'15.72"N 17° 1'13.54"W
CH02	Enclosure	Remote Sensing (03/2006)	Circular enclosure, approx. 10m diameter, dark soil indicating burning has occurred. Road running east west through the feature		14°43'32.29"N 17° 0'24.10"W
CH03	Enclosure	Remote Sensing (03/2009)	Circular enclosure, approx. 14m diameter with opening to the south into a second clearing, pathway running through both		14°44'19.73"N 17° 1'14.79"W

CH04	Enclosure	Remote Sensing (11/2011)	Circular enclosure, approx. 7m diameter, darker earth surrounding a clearing with path running east-west to the north of the feature		14°43'31.58"N 17° 0'23.64"W
CH05	Enclosure	Remote Sensing (11/2011)	Circular enclosure, approx. 11m diameter with a footpath running east west just north of the feature		14°44'16.77"N 17° 1'15.98"W
CH06	Enclosure	Remote Sensing (11/2011)	Circular enclosure, approx. 11m in diameter with footpath to the north of the feature		14°44'22.86"N 17° 1'13.89"W
CH07	Enclosure	Remote Sensing (03/2012)	Two circular enclosures next to each other, approx. 14m diameter with foot paths running north south on either side of the features		14°43'13.64"N 17° 0'21.06"W

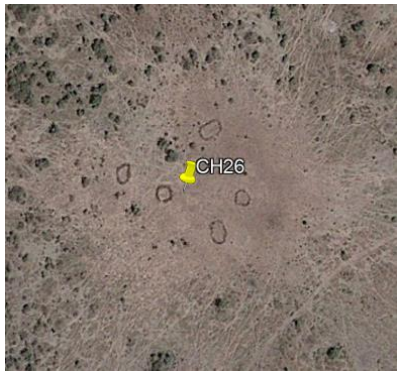
CH08	Enclosure	Remote Sensing (04/2012)	Circular enclosure, approx. 10m diameter with footpath to the north, accompanied by other potential enclosures		14°44'18.59"N 17° 1'17.13"W
CH09	Settlement	Remote Sensing (04/2012)	Potential modern settlement, 2 rectangular buildings and a water tower, a dirt road runs through the area with right angle bends in the road.		14°44'17.51"N 17° 0'53.66"W
CH10	Settlement	Remote Sensing	Settlement with several enclosures of various sizes and approx. 16 round dwellings. Enclosures dotted to the north and west of the dwellings. Some enclosures contain smaller ones within. Road running north south to the west of the settlement		14°45'0.66"N 17° 0'43.34"W

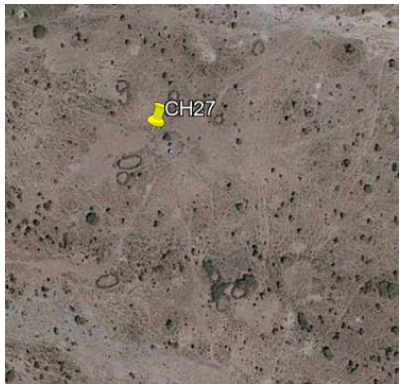
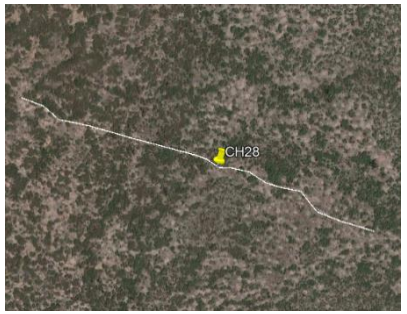
CH11	Settlement	Remote Sensing	Potential modern settlement, 2 rectangular buildings and a water tower, a road runs north south to the west of the settlement.		14°44'48.12"N 17° 0'52.60"W
CH12	Settlement	Remote Sensing	Settlement with 3 circular enclosures, 2 adjacent to each other and one to the north. 2 round dwellings in between the north and south enclosures, a road running north south to the east of settlement		14°44'59.46"N 17° 0'53.46"W
CH13	Settlement	Remote Sensing	Settlement with approx. 24 round dwellings, no enclosures, with a road running north south to the east of the settlement		14°44'56.45"N 17° 0'57.20"W

CH14	Settlement	Remote Sensing	Potential modern settlement with 5 rectangular dwellings and a rectangular enclosure. To the north east a circular enclosure. A dirt road runs north south through the settlement		14°45'20.84"N 17° 0'51.71"W
CH15	Settlement	Remote Sensing	A settlement with 1 visible round dwelling and approximately 6 circular enclosures surrounding the dwelling of various sizes. A footpath runs east west through the centre of the settlement		14°45'26.55"N 17° 1'49.96"W
CH16	Settlement	Remote Sensing	Cluster of approx. 8 round dwellings with footpaths extending away from all sides. No circular enclosures included but some to the south east		14°45'29.03"N 17° 1'56.44"W

CH17	Enclosure	Remote Sensing	Circular enclosure with a feature within, potential round dwelling, clearing surrounds with second smaller enclosure to the south. Footpath running north south through the centre		14°44'17.24"N 17° 1'59.32"W
CH18	Enclosure	Remote Sensing (11/2012)	Cluster of approx. 15 circular enclosures of various sizes, no round dwellings identified in satellite imagery. River system running east west to the south		14°43'59.96"N 16°59'7.44"W
CH19	Enclosure	Remote Sensing (11/2012)	Two circular enclosures approx. 40m in diameter, no round dwellings visible, foot paths leading to an agricultural area		14°43'36.08"N 17° 2'39.70"W
CH20	Linear feature, footpath	Remote Sensing (02/2014)	Linear feature, well-worn footpath approx. 5.6km in transcribed length running east to west across the study area. Subsidiary footpaths lead off in different directions along its length.		14°43'36.27"N 17° 0'35.59"W

CH21	Enclosure	Remote sensing (02/2014)	Circular enclosure approx. 20m diameter south of a footpath running east west. Dark earth indicates potential burning		14°43'31.40"N 17° 0'23.56"W
CH22	Enclosure	Remote Sensing (04/2014)	Circular enclosure with footpath running north south to the southeast. Darkened soil indicating possible burning		14°43'8.09"N 17° 0'19.36"W
CH23	Settlement	Remote Sensing	Cluster of circular enclosures with cleared areas in between and a few round dwellings can be identified in multiple time frames of satellite imagery potentially indicating long term seasonal occupation		14°42'54.79"N 17° 1'41.37"W
CH24	Settlement	Remote Sensing	Cluster of circular enclosures with cleared areas in between and a few round dwellings identified on multiple time frames of satellite		14°42'57.43"N 17° 2'7.24"W

			imagery, potentially indicating long term but seasonal occupation		
CH25	Settlement	Remote Sensing	A group of large, circular and rectangular enclosures, approx. 12, 1 circular enclosure surrounded to the south, east and west by a combination of circular and rectangular dwellings, indicating potentially a combination of older and more modern settlement patterns.		14°42'34.07"N 17° 2'20.08"W
CH26	Settlement	Remote Sensing (11/2012)	A cluster of circular enclosures, visible only in some time frames of satellite imagery, indicating potential seasonal occupation. One or two round dwellings visible in the centre of the group of enclosures. Footpath running east west to the south of the settlement		14°43'37.54"N 16°59'29.88"W

CH27	Settlement	Remote Sensing (11/2012)	A cluster of circular enclosures, visible only in some time frames of satellite imagery, indicating potential seasonal occupation. One or two round dwellings visible in the centre of the group of enclosures. Footpath running east west to the south of the settlement		14°43'27.79"N 16°59'36.99"W
CH28	Linear feature, footpath	Remote Sensing (11/2012)	Linear feature, well-worn footpath approx. 2km in transcribed length running east to west across the study area. Subsidiary footpaths lead off in different directions along its length.		14°44'26.07"N 17° 1'21.19"W

10. PHYSICAL ENVIRONMENT IMPACT ASSESSMENT

The following chapter assess the potential positive and negative impacts associated with planned project activities, prior to the implementation of mitigation measure, on the physical environment and its sensitive receptors as identified in the physical baseline. Mitigation and management measure are then proposed to apply the impact mitigation hierarchy as described in the IFC PS 1 by anticipating and avoiding impacts, or where avoidance is not possible, minimise. Where residual impacts remain, thus after mitigation, compensate or offset for risks and impacts will be considered.

Various alternatives were considered as described in Section 3 to optimise on operation, but also avoid or minimise the impact on the physical environment.

CIMAF undertook various geological studies to understand the quantities, depths and feasible accessibility of the limestone in these areas. The preferred site location was selected as it was judged to be the most geologically attractive and feasible location.

Five (5) options were investigated for the location of the processing plant. Proximity to the quarry, the topography and permit options were all considered. The current plant site was chosen as it was the closest to the quarry site, allowing greater efficiency, with suitable topography for construction of infrastructure. The selected site was also the only one that fell within the CIMAF mining permit.

In addition, the position of the plant allows a direct connection of the SENELEC network, located adjacent to the proposed plant. This will reduce potential avifaunal collision risks.

The close proximity of the crusher and plant to the pit enables the shortest haul road possible, thus significantly reducing associated negative impacts such as increased emissions and dust, further reach of noise disturbance as well as increased risk of collision with livestock, wildlife and/or humans that may have been created with a longer haul route should the plant be located outside the mining concession.

10.1 Soils

The following section describes the various activities, sensitive receptors and potential impacts on soils in the Project Area (Table 10-1). Mitigation and management actions are proposed and the resulting residual impacts, post mitigation and management are described.

10.1.1 Proposed Project Activities

Table 10-1 Proposed Project Activities that Potentially Impact Soils

Activity	Phase	Impact
Soil Stripping	Construction and operation	Accelerated (unnatural high levels of) erosion due to clearing of surfaces.
Soil stockpiling	Construction and operation	Potential loss of fertile soil with high nutrient value. Potential sedimentation of drainage lines in the event of high rainfall incidence.
Accidental spills, contamination and compaction of soils	Contamination and operation	Decline of soil quality suitable for the support of vegetation/habitat
Soil replacement	Operation/rehabilitation	Positive impact should the stripping, stockpiling and replacement be undertaken correctly

10.1.2 Sensitive Receptors

The fertile topsoil layer is regarded to be the primary sensitive receptor. The importance of this is that it holds all the nutrients and growth medium that supports vegetation. Without a healthy topsoil layer vegetation cannot be established.

10.1.3 Significance of Impact (Pre-Mitigation)

Based on the analysis provided above, the impact from soil stripping will be a ***Moderate Negative Impact*** pre-mitigation (refer to Table 10-2). The activity of soil stripping for the development of the Project will have a direct negative impact on the soil.

This impact could be increased if effective soil stock piling is not undertaken sequentially. Incorrect sequencing of soil stocks and lack of management of stockpiles results in an almost total loss in fertility of soil as well as sedimentation of surrounding water bodies.

Table 10-2 Rating of Impacts Related to Soil (Pre-Mitigation)

Type of Impact		
Direct Negative Impact		
Rating of Impacts		
Characteristic	**Designation**	**Summary of Reasoning**
Extent	Local	Soil stripping and removal will be undertaken in areas of the Project development.
Duration	Long-term	The effect of this activity will be long term as it will last the duration of the mining and processing activity
Scale	Project Footprint	Up to 331,83 ha of topsoil is expected to be directly impacted and permanently modified.
Frequency	Continuous	This impact will be manifested from the construction to post-mining phase.
Likelihood	Possible	There is a possibility the Project's activities will impact soil quality should mitigation measures not be adhered to.
Magnitude		
Medium **Magnitude**		
Sensitivity/Vulnerability/Importance of the Resource/Receptor		
Medium **Sensitivity**		
The fertile topsoil layer is regarded to be the primary sensitive receptor. The importance of this is that it holds all the nutrients and growth medium that supports vegetation. Without a healthy topsoil layer vegetation cannot be established.		
Significant Rating Before Mitigation		
Moderate Negative **Impact**		

10.1.4 Mitigation/Management Measures

Avoid and Minimise

- Soil stripping will be done in a successional manner for the infrastructure development and mining area just prior to need, to allow present species more time to provide the essential ecosystem functions; and
- All topsoil stockpiles should have a vegetation cover to ensure fertility, whilst all (also unvegetated) stockpiles should be surrounded by silt traps to prevent runoff and erosion resulting in sedimentation of surrounding water bodies.

Reduce

- Areas where spillage of soil contaminants occurs, must be excavated (to the depth of contamination) and suitably rehabilitated. If any other minor spillage occurs the spillage must be cleaned as soon as possible, but within the same shift and the contaminated area must be reinstated. All contaminated material should be suitably treated and cleaned or disposed of;
- Delineate all permissible areas so that all movement of vehicles and heavy machinery can be restricted to such areas only, these being designated access roads, maintenance roads, turning points and parking areas. No off-road driving beyond designated areas may be allowed; and
- Parking and operational areas must be regularly inspected for oil spills and covered with an impermeable or absorbent layer or grease pans (with the necessary storm water control) if oil and fuel spillages are highly likely to occur.

Rehabilitate

- To aid a more rapid and early decommissioning of mined areas, pits should be backfilled as soon as possible, landscaped to surroundings and re-vegetated (but strictly without the alien invasive species that may have been present prior to mining).

Monitor

- A Soil Stockpile Management Plan should be developed in order than soils are effectively managed and conserved.

10.1.5 Residual Impact (Post-mitigation)

Based on the implementation of the proposed mitigation measures, the significance of the impact to soils will be a "***Minor Impact***" post mitigation (refer to Table 10-3).

Table 10-3 Rating of Residual Impacts Related to Soil (Post-Mitigation)

Rating of Impacts		
Characteristic	**Designation**	**Summary of Reasoning**
Extent	*Local*	Soil stripping and removal will only be undertaken in area of the Project development.
Duration	*Temporary*	The effect of this activity will be temporary as concurrent rehabilitation, implementing effective soil management techniques will allow for successful rehabilitation.
Scale	Project Footprint	Up to 331,83 ha of topsoil is expected to be directly impacted and permanently modified.
Frequency	Continuous	This impact will be manifested from the construction to post-mining phase.

Likelihood	Possible	There is a possibility the Project's activities will impact soil quality should mitigation measures not be adhered to.
Magnitude		
Small **Magnitude**		
Significant Rating After Mitigation		
Minor **Impact**		

10.2 Hydrology

10.2.1 Proposed Project Activities

The Project has the potential to impact shallow aquifers in the Project area. With regard to groundwater, the impact methodology focused on groundwater level and flow, groundwater quality, and impact on groundwater resources and sensitive receptors.

The hydrogeology impact assessment is based on the source-pathway receptor approach (SPR). For there to be an identifiable impact, there must be a source i.e. a contaminant or an activity; a receptor; and, a pathway, which allows the source to impact on a receptor. All three elements must be present before a linkage and a potential impact can be realised. The preliminary conceptual model for the site identifies the following for the SPR linkages discussed below.

The principal **sources** of potential impact are:

- Release of soluble contaminants used in construction and/ or production (e.g. oil, chemicals, solvents and effluent) from surface activities in the aquifer.

The main **pathways** for the sources to impact on the receptors are:

- Infiltration of surface soluble contaminants and percolation to the groundwater surface; and
- Migration of soluble contaminants (e.g. oil, chemicals, solvents) entering the groundwater.

The main **receptors** potentially at risk from these sources are:

- Existing boreholes and abstraction wells in the vicinity of the study area.

The significance of hydrogeological impacts should be evaluated in terms of their magnitude and receptor sensitivity. Impacts should be assessed from the perspective of the groundwater level and flow, groundwater quality and impact on regional groundwater resources.

It should be recognised that similar receptors, such as existing groundwater wells, could have different sensitivities depending on their proximity to individual elements of the project.

Table 10-4 Potential Ground & Surface Water Impact Summary per Project Phase

Description of Impact	Project Phase	Impact Magnitude on Sensitive Receptors	Significance
Runoff and erosion from exposed soil surface - Earth working areas and stockpiles	Construction and operation	Low – deterioration in groundwater quality unlikely due to substantial depth to water level	Negligible
Groundwater contamination as a results oil and hazardous chemicals spills from chemical storage.	Construction and operation	Low – deterioration in groundwater quality unlikely due to substantial depth to water level	Negligible

Release of cement materials with rain wash	Construction and operation	Low – deterioration in groundwater quality unlikely due to substantial depth to water level	Negligible
Sewage effluent if formal municipal infrastructure will not be used resulting in groundwater contamination	Construction and operation	Low – deterioration in groundwater quality unlikely due to substantial depth to water level	Negligible
Oil, fuel and lubricants from maintenance of construction vehicles and mechanical equipment leading groundwater contamination	Construction and operation	Low – deterioration in groundwater quality unlikely due to substantial depth to water level	Negligible
Particulate Matter transported in air and deposited on surface water bodies	Construction and operation	Medium – nearest surface water boy is greater than 2km from the project site boundary	Low
Impact on groundwater availability	Operation	High – additional pressure will be exerted on existing water resources in the area should a new borehole be installed for industrial abstraction purposes	Severe

10.2.2 Significance of Impact (Pre-Mitigation)

Based on the analysis provided above, the impact on surface and groundwater sources will be a ***Major Negative Impact*** pre-mitigation (refer to Table 10-5). The activity of potential surface and groundwater resources during construction and operation of the Project will have a direct negative impact on the hydrology in the project area if not managed.

Table 10-5 Rating of Impacts Related to Surface and Groundwater (Pre-Mitigation)

Type of Impact		
Direct and Indirect Negative Impact		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reasoning**
Extent	Local	All communities in the Project's AoI could be directly affected
Duration	Permanent	Impacts could be experienced during the construction and operations phases, and persist beyond the end of the life of the Project should the water supply aquifer be contaminated
Scale	Mining Footprint area and habitats in close proximity	All nine communities within the Project's AoI could be affected
Frequency	Continuous	Impacts will be continuous during the construction and operations phases of the Project
Likelihood	Possible	There is a possibility the Project's activities will impact the deep water supply aquifer should mitigation measures not be adhered to.
Magnitude		
Medium		

Sensitivity/Vulnerability/Importance of the Resource/Receptor
High
Households in the Project's AoI already report challenges in access to water via the limited public and private sources available, and have limited financial means to access alternate sources. Should the aquifer become contaminated by Project activities this will place more strain on the already limited groundwater resource.
Significant Rating Before Mitigation
Major Negative **Impact**

10.2.3 Mitigation Measures

Avoid and Minimise

- Pre-construction, determine how flows will best be diverted around the Project infrastructure and Quarry, and across the concession, taking natural runoff patterns via loosely networked thalwegs and inputs into seasonal wetlands into consideration, with the aim to retain the latter whilst preventing flooding of quarry and infrastructure
- Design stormwater runoff structures and drainages under roads accordingly
- As far as possible, incorporate water saving- and recycling measures into the daily construction and operational activities
- Ensure water effluent from Project separator plants and sewage treatment plants is adequately contained and treated, and no discharge of contaminated water to the environment allowed
- No historic groundwater levels are available and therefore trend analysis regarding potential groundwater sustainability in the area cannot be inferred and current pumping regimes are unclear. Although potential impacts are regarded as negligible, it is recommended to obtain a baseline against which potential impacts of the Project can be monitored and quantified
- A combination of social research and more detailed Critical Risk Assessment would be needed to assess the local community's reliance on water and how indirect impacts from the Project and climate change influences may affect them
- Further recommendations include a full hydrology assessment including pump tests on the proposed new water supply borehole at the project site – this will enable a sustainable yield to be calculated to avoid any negative impacts to existing groundwater users over the long term
- Store all fuels and hazardous materials with appropriate containment including impermeable areas, bunding and drip trays
- Develop procedures for fuel and hazardous material transfers and personnel training on emergency response
- To avoid any leachate that might impact groundwater, wastes generated from the project activities should be managed in accordance with the site Waste Management Plan
- Comply with and adhere to permitted groundwater abstraction volumes

Reduce

- Make spill kits available at all storage locations for hazardous chemical materials
- Supply chemicals and hazardous liquids in dedicated tanks made of sufficiently robust construction to prevent leaks/spills.

Rehabilitate

- Ensure that the slopes of the quarry are safe during the operation and after the closure of the site. That can be achieved by:
  - Diverting the surface water from the top of the cut
  - Implementing other mitigation measures when the monitoring proves it necessary
- After closure of the site or as the quarry is progressively exploited:
  - Backfill the quarry pits, preferably in a progressive manner as soon as possible, and landscape to surrounding environment
  - Maintain the drainage system
  - Rehabilitate and revegetate the area as per progressive rehabilitation plan

Monitor

- Obtain a base reading of groundwater levels and water quality of both the proposed new water supply boreholes and existing boreholes in close proximity to the Project Site
- Establish a groundwater monitoring plan

10.2.4 Residual Impacts (Post Mitigation)

Based on the implementation of the proposed mitigation measures, the significance of the impact to ground and surface water will be "***Medium***" post mitigation (refer to Table 10-6).

Table 10-6 Rating of Residual Impacts Related to Surface and Groundwater (Post-Mitigation)

Rating of Impacts		
Characteristic	**Designation**	**Summary of Reasoning**
Extent	Local	A sustainable borehole yield is to be calculated based on the proposed new water supply borehole production volume to limit the impact of lowering groundwater levels in the study area
Duration	Temporary	The effect of this activity will be temporary as implementing sustainable groundwater abstraction practices[34] and the proposed water management plan will mitigate adverse impacts to the existing groundwater supply
Scale	Project Footprint	Water demand volumes have been estimated at 30,000 litres per day. A full hydrology study will be required to calculate the sustainable yield of the project's proposed water supply borehole. Other entities water demand within the surrounding area should also be made available to determine relevant impact of such activities.
Frequency	Continuous	This impact will be manifested from the construction to post-mining phase.
Magnitude		
Medium		
Significant Rating After Mitigation		

[34] A full hydrology assessment should be conducted to confirm that the sustainable yield of the proposed project water supply borehole is adequate for both the project's current and future operational requirements

10.3 Landscape and Visual

Visual Impacts refers mainly to the changes to the visual character of available views resulting from project development that include obstruction of existing views; the introduction of new elements into the views of the visual receptors and intrusion of foreign elements into the viewshed of landscape features.

The construction activities for the infrastructures will have an impact on the visual character of the landscape. This is anticipated to be due to the following aspects:

- Clearance of the sporadic vegetation along construction yards and access roads;
- Presence of large construction vehicles and equipment;
- Worker presence and activity; and
- Dust emissions resulting from construction activities and traffic.
- During operation, the impacts are mainly related to enhanced traffic in the area related to cement factory management and maintenance.

10.3.1 Sensitive Receptors

10.3.1.1 Sensitivity of visual receptors

Visual receptors are people and must be assessed in terms of their sensitivity, combining judgements on their susceptibility to the specific change proposed and the value attached to a view or their visual amenity. Susceptibility refers to the degree to which a particular visual receptor can accommodate change arising from the Project, without detrimental effects on the visual amenity, and will vary with the:

- Occupation or activity of people experiencing the view;
- Location and context of the view; and
- Extent to which their attention or interest may be focused on the view and their visual amenity.

Judgements about the sensitivity of visual receptors should be recorded on a scale (e.g., low, medium and high) with clearly stated criteria. Table 10-7 indicate the relative sensitivities of a number of visual receptors.

The following section described the potential impacts regarding air quality for the CIMAF ICP Project Area.

Table 10-7 Sensitivity of Visual Receptors

Sensitivity	Visual Receptor
Low	Presence of receptors such as roads, industrial areas and similar. Viewers with a passing interest not specifically focussed on the landscape (e.g. road users). The sensitivity is assessed as being low.
Medium	Presence of receptors like settlements, small villages, and peri-urban areas. The sensitivity is assessed as being medium.
High	Presence of important receptors, such as recreational areas, cities and big towns. The sensitivity is assessed as being high.

10.3.1.2 Magnitude of visual effects

The magnitude of change affecting visual receptors depends on the nature, scale and duration of the particular change that is envisaged in the landscape and the overall effect on a particular view. The

magnitude of change in views will depend on the scale of the development and the distance from the viewpoint, the angle of view occupied by the development, the extent of shielding by intervening features, the degree of obstruction of existing features, and the degree of contrast with the existing view, and the frequency or duration of visibility (Table 10-8).

Table 10-8 Magnitude of Visual Effect

Visual magnitude	Criteria
Negligible	A change which is barely visible, at very long distances, or visible for a very short duration, perhaps at an oblique angle, or which blends with the existing view.
Small	Minor changes in views, at long distances, or visible for a short duration, perhaps at an oblique angle, or which blends to an extent with the existing view.
Medium	Clearly perceptible changes in views at intermediate distances, resulting in either a distinct new element in a significant part of the view, or a wider ranging, less concentrated change across a wider area.
Large	Major changes in view at close distances, affecting a substantial part of the view, continuously visible for a long duration, or obstructing a substantial part or important elements of the view.

Table 10-9 presents the photos of each viewpoint, its descriptions such as its location, the land cover, and the topography. In general, the landscape is arid and is characterised by natural vegetation. Some points are closed to urban and peri-urban areas, others closed to waste dump, industrial areas and the AIBD. None of them are closed or inside protected areas.

Table 10-9 Viewpoints

VSR1	
North 	East 
South 	West 

The viewpoint is located along N2 Road, 500 m east of Pout, Senegal. The coordinates are 14°45'48.46"N 17° 3'7.42"W. The topography is mainly flat, and the arid landscape is characterised by natural vegetation along asphalted road in peri-urban area. The land cover is composed of:

- Built-up: Settlement/villages;
- Vegetation: Trees and Scrub/thicket; and
- Infrastructures: Footpath, Track, Road-major, Walls, Power lines and Waste dump.

The N2 is the only asphalted road in the area and the main transportation corridor between the capital (Dakar) and the City of Thiès. This point is 500 m east of the town of Pout; it is a peri-urban area with footpaths, sand roads, built walls, structures, power lines, and waste dumps. There are no Protected Areas.

Sensitivity: Medium	**Magnitude: Medium**

VSR2

North



East



South



West



The viewpoint is located in Thiès, Senegal, on the main asphalted road that runs through the center of the city. The coordinates are 14°45'57.72"N 16°56'52.93"W

The land cover is composed of:

- Built-up: Urban
- Infrastructures: Road-main, Road-minor, Power lines, and Commercial structures

The topography is mainly flat, and the arid landscape is characterised by urban areas. There are no Protected Areas.

Sensitivity: High	**Magnitude: Negligible**

VSR3

North



East



South



West



The viewpoint is located 1.5 km northeast of the town of Pout, Senegal. The area has some paths used primarily by carts and pedestrians.

The coordinates are 14°47'6.69"N 17° 2'39.81"W

The land cover is composed of:

- Vegetation: Trees, and Scrub/thicket
- Infrastructures: Track

The topography is mainly flat, and the arid landscape is characterised by natural vegetation (scrub/bush, sparse trees). There are no Protected Areas.

Sensitivity: Low	**Magnitude: Medium**

VSR4

North



East



South



West



The viewpoint is located in an industrial area being developed as part of the Dangote, 6 km northeast of Pout (Dangote Cement site).
The coordinates are 14°48'57.62"N 17° 0'46.73"W
The land cover is composed of:

- Built-up: Industry
- Vegetation: Trees, and Scrub/thicket
- Infrastructures: Road-major/minor, and Power lines

The topography is mainly flat, and the arid landscape is characterised by natural vegetation (scrub/bushes, sparse trees), and by the plateau of Thiès to the northeast.
There are no Protected Areas.

Sensitivity: Low	**Magnitude: Medium**

VSR5

North



East



South



West



The viewpoint is located Western edge of Thiès, Senegal, along a public laterite road that runs along the outskirts of the west side of the city. The north side of the road is residential development while the south side is used as a waste dump. The coordinates are 14°46'35.43"N 16°57'50.71"W

The land cover is composed of:

- Built-up: Urban
- Vegetation: Scrub/thicket
- Infrastructures: Road-minor, Footpaths, Power lines, and Waste dumps

The topography is mainly flat, and the landscape is arid, on the periphery of an urban area. There are no Protected Areas.

Sensitivity: Medium	**Magnitude: Small**

VSR6

North



East



South



West



The viewpoint is located in an industrial area on an asphalt road that serves as the southern entry to the AIBD. Southern access road to AIBD. The coordinates are 14°38'51.88"N 17° 3'53.87"W.

The land cover is composed of:

- Built-up: Industry
- Infrastructures: Road-major/minor

The topography is mainly flat and plain, and the landscape is arid and characterised by industrial area (entry to the AIBD) natural vegetation (scrub/bushes, sparse trees). There are no Protected Areas.

Sensitivity: Low	**Magnitude: Negligible/Small**

VSR7

North



East



South



West



The viewpoint is located on the A1 Highway, northeast of the AIBD.

The coordinates are 14°42'52.09"N 17° 6'15.94"W

The land cover is composed of:

- Vegetation: Trees, and Scrub/thicket
- Infrastructures: Road-major, and Power lines

The topography is mainly flat, and the arid landscape is characterised by natural vegetation (scrub/bushes, sparse trees) on either side of the highway.

There are no Protected Areas.

Sensitivity: Low	**Magnitude: Negligible/Small**

VSR8

North



East



South



West



The viewpoint is located on a sand road used by local residents. There are signs of subdivision of land for urban development. An abandoned residential development project is located approximately 130 m to the north of this point. The point is 1 km west of AIBD.
The coordinates are 14°41'22.98"N 17° 5'23.52"W
The landcover is composed of :

- Vegetation: Trees, and Scrub/thicket
- Infrastructures: Abandoned residential development

The topography is mainly flat and plain, and the arid landscape is characterised by natural vegetation (scrub/bush, sparse trees).
There are no Protected Areas.

Sensitivity: Low	**Magnitude: Negligible/Small**

VSR9

North



East



South



West



The viewpoint is located on a sand road that runs through the town of Pout, Senegal. The area includes residential structures and walls, as well as community infrastructure, including railway tracks, power lines and waste dumps.
The coordinates are 14°46'18.34"N 17° 3'23.13"W
The land cover is composed by:

- Built-up: Urban
- Infrastructures: Footpath, Track, Road-minor, Railway tracks, Power lines, Waste dumps

The topography is mainly flat, and the landscape is characterised by urban areas.
There are no Protected Areas.

Sensitivity: High	**Magnitude: Negligible/Small**

VSR10

North



East



South



West



The viewpoint is located on a public asphalt road connecting the AIBD to the industrial area to the east (agriculture, cement). The point is south of the village of Kirene, Senegal in a developing residential area and is 2.5 km east of AIBD.

The coordinates are 14°39'14.07"N 17° 2'30.42"W

The land cover is composed by:

- Built-up: Industry
- Vegetation: Trees, and Scrub/thicket
- Infrastructures: Road-minor

The topography is mainly flat, and the arid landscape is characterised by peri-urban and industrial areas. There are no Protected Areas.

Sensitivity: Low	**Magnitude: Small**

VSR11

North



East



South



West



The viewpoint is located on a sand road that connects nearby villages to the main asphalted road to the city of Thiès (0.75 km to the north). The area includes residential structures, walls, power lines, and waste dumps. The coordinates are 14°44'14.19"N 16°57'29.53"W

The land cover is composed by:

- Built-up: Settlement/Villages
- Vegetation: Trees, and Scrub/thicket
- Infrastructures: Road-minor, Power lines, and Waste dumps

The topography is mainly flat, and the arid landscape is characterised by natural vegetation (scrub/bushes, sparse trees), and peri-urban areas.

There are no Protected Areas.

Sensitivity: Medium	**Magnitude: Small**

VSR12

North



East



South



West



The viewpoint is located on a public laterite road, connecting nearby villages to the asphalted Thiès -Sindia Road (600 m east). Signs of subdivision of land for residential development. The point is 400 m south of village of Sangue, Senegal.
The coordinates are 14°41'31.21"N 16°57'6.54"W
The land cover is composed by:

- Built-up: Settlement/Villages
- Vegetation: Scrub/thicket, and Trees
- Infrastructures: Road-minor

The topography is mainly flat, and the landscape is arid with limited vegetation, located on south of residential area.
There are no Protected Areas.

Sensitivity: Medium	**Magnitude: Negligible/Small**

VSR13

North



East



South



West



The viewpoint is located on the A1 Highway, northeast of AIBD. The southern boundary of the Classified Forest of Thiès is located to the north of the highway.

The coordinates are 14°43'7.28"N 16°58'50.03"W

The land cover is composed by:

- Vegetation: Trees, and Scrub/thicket
- Infrastructures: Road-major

The topography is mainly flat, and the arid landscape is characterised by natural vegetation (scrub/bushes, sparse trees) on either side of the highway.

There are no Protected Areas.

Sensitivity: Low	**Magnitude: Medium**

VSR14

North



East



South



West



The viewpoint is located on northern edge of private agricultural site, Kirene, Senegal. In particular, on sand road used to access a private agricultural project bounded by natural fences (bushes). This is an industrial area: agriculture project to the south, cement projects to the north and east.
The coordinates are 14°38'45.91"N 17° 0'58.96"W
The land cover is composed by:

- Built-up: Industry
- Farming: Industrial agriculture, and Boundaries – fence lines/hedges
- Vegetation: Scrub/thicket, and Trees
- Infrastructures: Track

The topography is mainly flat, and the arid landscape is characterised by natural vegetation (scrub/bushes, sparse trees). There are no Protected Areas.

Sensitivity: Low	**Magnitude: Negligible/Small**

VSR15

North



East



South



West



The viewpoint is located on the asphalted Thiès-Sindia Road, 70 m north of the village of Kissane, Senegal. A walled land parcel with cultivated mango trees is located immediately to the east of this point. The coordinates are 14°40'18.22"N 16°57'30.19"W. The land cover is composed by:

- Farming: Cultivated trees
- Vegetation: Trees, and Scrub/thicket
- Infrastructures: Road-major

The topography is mainly flat, and the arid landscape is characterised by natural vegetation (scrub/bushes, relatively dense treed area – including cultivated mango trees). There are no Protected Areas.

Sensitivity: Low	**Magnitude: Small**

VSR16

North



East



South



West



The viewpoint is located on a sand road through the village of Khinnine, Senegal. The area includes numerous residential structures (houses, outbuildings, walls) both built and under construction, and community infrastructure (footpaths, sand roads, well, power lines, mosque).
The coordinates are 14°45'13.26"N 17° 5'10.65"W
The land cover is composed by:

- Built-up: Settlement/Villages
- Infrastructures: Footpath, Track, Road-minor, Power lines, and Water point

The topography is mainly flat, and the landscape is characterised by urban areas. There are no Protected Areas.

Sensitivity: High	**Magnitude: Negligible/Small**

VSR17

North



East



South



West



The viewpoint is located in the northern edge of agricultural site, 150 m southeast of A1 Highway, area of Kirene, Senegal, on a sand road built to access an industrial agriculture project, which is fenced off to the south. The A1 Highway passes to the northeast. The coordinates are 14°41'42.18"N 17° 1'36.10"W
The land cover is composed by:

- Farming: Industrial agriculture, and Boundaries – fence lines/hedges
- Vegetation: Trees, and Scrub/thicket
- Infrastructures: Track

The topography is mainly flat, and the arid landscape is characterised by natural (scrub/bushes, sparse trees) and cultivated vegetation (industrial agriculture project).
There are no Protected Areas.

Sensitivity: Low	**Magnitude: Large**

10.3.2 Significance of Impact (Pre-mitigation)

When determining the significance of visual effects, the following is taken into account:

- Large scale changes which introduce new discordant or intrusive elements into the view are more likely to be significant than small changes or changes involving features already present in the view;
- Changes in views from recognised and important viewpoints or amenity routes are likely to be more significant than changes affecting less important paths and roads; and
- Changes affecting large numbers of people are generally more significant than those affecting a relatively small group of users. However, in wilderness landscapes the sensitivity of the people who use the areas may be very high and this will be reflected in the significance of effect.

The significance matrix below (Table 10-10) illustrates the relationship between the sensitivity of a visual receptor and the magnitude of the visual effect. The significance of a visual effect may be adverse or beneficial dependent upon the nature of the change. Each case is assessed on its own merits using professional judgement and experience, and there is no defined boundary between levels of effects. What level of effect constitutes a significant effect will vary on a project-by-project basis.

Table 10-10 Significance of Visual Effect

Viewpoint	Sensitivity	Magnitude	Significance
VSR 1	Medium	Medium	Moderate
VSR 2	High	Negligible	Negligible
VSR 3	Low	Medium	Minor
VSR 4	Low	Medium	Minor Moderate
VSR 5	Medium	Small	Minor
VSR 6	Low	Negligible/Small	Negligible
VSR 7	Low	Negligible/Small	Negligible
VSR 8	Low	Negligible/Small	Negligible
VSR 9	High	Negligible/Small	Minor
VSR 10	Low	Small	Negligible
VSR 11	Medium	Small	Minor
VSR 12	Medium	Negligible/Small	Minor
VSR 13	Low	Medium	Minor
VSR 14	Low	Negligible/Small	Negligible
VSR 15	Low	Small	Negligible
VSR 16	High	Negligible/Small	Minor
VSR 17	Low	Large	Moderate

10.3.3 Assessment of Impacts: Construction

As per the current settings of the project area, the proposed Limestone Quarry and an Integrated Cement Plant (ICP) will cause great change to existing views since these will be deeply modified. However, the number of residents in the area is not high, narrowing in this way the number of people affected by the altered views.

Despite the impact of additional construction vehicles on site is direct and negative, it will be temporary and local.

Table 10-11 Rating of Impacts Related to Visual (Pre-Mitigation): Construction

Characteristic	Designation	Summary of Reasoning
Extent	*Local*	The visual impact extent depends on the topography of the area. For this reason the visual impact is considered local.
Duration	*Temporary/Short-term*	During construction phase, large construction vehicles would be in the project area. This can affect the visual impact due mainly to dust presence.
Scale	*Local scale*	The impact is considered as small (local) scale.
Frequency	*Continuous*	The visual impact will be affected continuously during the construction phase mainly due to traffic movements, materials excavation and storage. The construction phase is however limited in time.
Likelihood	-	-
Resource/ Receptor Sensitivity	*Low*	The surrounding areas has an arid landscape with urban area not immediately close to the project area. The construction will affect mainly arid and shrub areas with no interest from a community perspective.
Impact Magnitude	*Small*	Based on the above the impact magnitude is considered small.
Impact Significance	*Negligible*	Considering the impact magnitude is small and the sensitivity is low, the overall significance is considered to be Negligible.

10.3.4 Assessment of Impacts: Operation

The proposed project will take place in an area almost completely arid, without important human features altering, in this way, the viewshed experience of the local sensitive receptors. Due to the local settings, the pristine environment and the presence of unique landscape features, it should be confirmed the low sensitivity of the project area. The assessment is strongly related to the local topography, which continually modifies the visual perception from different viewpoints. Moreover, this influences the visual absorption capacity of the landscape.

Based on the analysis provided above, the visual impact and change of landscape will be of negligible significance.

Table 10-12 Rating of Impacts Related to Visual (Pre-Mitigation): Operation

Characteristic	Designation	Summary of Reasoning
Extent	*Local*	The impact will be limited to the immediate surroundings of the project features.
Duration	*Long-term*	The impact duration will be permanent as the life cycle for the project
Scale	*Regional scale*	The impact is considered as medium (Regional) scale. Visual impacts will not only impact people who live near the, but also people who are travelling daily.
Frequency	*Continuous*	The visual impact will be affected continuously during the operational phase. There are many factors that are, for example, dust due to vehicles and materials management and the building presence.
Likelihood		Not applicable to landscape and visual
Resource/ Receptor Sensitivity	*Medium*	The surrounding areas has an arid landscape with urban area not immediately close to the project area with no relevant uses for local communities. The area is also characterised by the presence of other industrial facilities.
Impact Magnitude	*Small*	Based on the above the impact magnitude is considered small.
Impact Significance	*Minor*	Considering the impact magnitude is Small and the sensitivity is Medium, the overall significance is considered to be Minor.

10.3.5 Mitigation/Management Measures

Impact assessment is designed to ensure that decisions on Projects are made in full knowledge of their likely impacts on the environment and society, but as importantly to identify measures that can be taken to ensure impacts are as low as technically and financially feasible.

The objective of mitigation is to minimise visual scarring of the landscape and to enhance absorption of the development into the surrounding environment.

Specific recommended measures during operation as best practices include:

- No debris or waste materials will be left at the work sites, good housekeeping on site to avoid litter and minimise waste.
- Infrastructures should have a non-reflective finish and the colour should be appropriate in order to merge itself as much as possible within the landscape.
- Design of fixed night lighting to the minimum level necessary for operations and safety and/or use of low flux lamps and direction of fixed lights towards the ground, where practical.
- On completion of the earth works the excavated or disturbed areas should be restored immediately especially through back filling, levelling and planting of suitable vegetation.
- All solid waste from the construction site should be cleared on completion and disposed suitably bin to the approved dumpsites.
- The project should be blended in a way to merge with the existing environment.

10.3.6 Residual Impact (Post-mitigation)

Based on the implementation of the proposed mitigation measures, the significance of the impact to visual will be a “Minor” post mitigation (refer to Table 10-13).

Table 10-13 Rating of Residual Impacts Related to Visual (Post Mitigation)

Rating of Impacts		
Characteristic	**Designation**	**Summary of Reasoning**
Extent	*Local*	The impact will be limited to the immediate surroundings of the project features.
Duration	*Long-term*	The impact duration will be permanent as the life cycle for the project
Scale	*No fixed designation*	
Frequency	*Continuous*	The visual impact will be affected continuously during the operational phase. There are many factors that are, for example, dust due to vehicles and materials management and the building presence.
Likelihood		Not applicable to landscape and visual

10.4 Air Quality

10.4.1 Construction Phase Assessment

Construction Phase Assessment of the Project considers the following aspects:

- Construction traffic;
- Construction dust;
- Emissions from off-road mobile and non-mobile plant on site.
- The impacts from these activities are assessed on a semi-quantitative basis as impacts are typically not significant, or can be mitigated to the point at which residual impacts are negligible.

10.4.1.1 Construction Traffic

The process for the air quality assessment for construction traffic impacts is the same process as described in Dust Assessment . This assessment was informed by the traffic study undertaken by ERM.

During construction phase and month of maximum activity, daily employee transport would generate 39 vehicle round-trips (78 vehicle individual trip movements), consisting of 16 large coaches, three (3) small coaches, and 20 automobiles. Delivery of equipment, supplies and components needed for construction; waste removal; and movement of vehicles used in construction from contractor yards to the site would generate heavy truck trips during a 12-month period, with the total number of daily deliveries generating between 10 and 70 round-trips (20 - 140 individual trip movements) per day during the peak month. Therefore maximum trip movements per day of heavy duty vehicles is 178 trips per day and is less than 440 for Annual Average Daily Traffic (AADT).

The access road will be paved and no receptors closer than 120 m from the road. The impact is considered to negligible.

10.4.1.2 Construction Dust

The process for the air quality assessment for construction dust impacts is the same process as described in Section 10.4.3. The infographic shown in Figure 10-2 indicates the key steps in

determining the significance of dust generation. In lieu of specific construction phase data general expectations for similar facilities were considered

The magnitude of dust generation is was determined by the following:

- The number of vehicles on the unpaved roads expected to be more than 5 per day;
- The nearest receptor is approximately 120 m from the plant boundary;
- Earthworks expected to be more than 53 ha (factory area alone); and
- Material volume handling likely to exceed 100,000m^3.

On the basis of the above parameters the construction phase dust generation is determined to be of large magnitude. Mitigation measures are outlined in the Section 10.4.6. An air quality management plan will be developed which will include a section on construction phase dust management to ensure commitments are upheld.

10.4.1.3 Construction Mobile and Non-Mobile Plant

The emissions from mobile plant will not generally result in significant impacts to air quality when best practice is implemented. Of note is the engines are typically small, and in this case receptors are somewhat distance (>100 m) from the site boundary. Mitigation measures are set out in Section 10.4.6.

10.4.2 Determination of significance of impacts

The significance of impacts will be determined based upon guidelines set out by the IFC. The IFC EHS) Guidelines are relevant in terms of understanding the project impacts. The guideline states:

"Projects with significant sources of air emissions, and potential for significant impacts to ambient air quality, should prevent or minimise impacts by ensuring that:

Emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying national legislated standards, or in their absence, the current WHO Air Quality Guidelines;

Emissions do not contribute a significant portion to the attainment of relevant ambient air quality guidelines or standards. As a general rule, this Guideline suggests 25 percent of the applicable air quality standards to allow additional, future sustainable development in the same airshed."

An airshed is an area that shares a common flow of air and that is exposed to the same conditions, which may become uniformly polluted or stagnant.

The overall significance and magnitude are determined on the basis of the Magnitude and the Sensitivity as set out in the tables below, based on interpretation of the IFC guidelines.

Table 10-14 Determination of Magnitude

Magnitude of impact	Undegraded airshed (i.e. baseline < AQS)	Degraded airshed (i.e. baseline > AQS)
Negligible	PC <25% of AQS	PC <10% of AQS
Small	PC between 25% and 50% of AQS and PEC <100% of AQS	PC between 10% and 25% of AQS
Medium	PC between 50% and 100% of AQS, and PEC <100% AQS; or	PC between 25% and 50% of AQS
	PC between 25% and 50% of AQS, and PEC >100% of AQS	
Large	PC > 100% of AQS; or	PC > 50% of AQS

	PC > 50% of AQS, and PEC >100% of AQS	

PC: Process Contribution
PEC: Predicted Environmental Concentration
AQS: Air Quality Standard

Table 10-15 Determination of Significance

Magnitude of impact	Receptor Sensitivity		
	Low	**Medium**	**High**
Negligible	Negligible	Negligible	Negligible
Small	Negligible	Minor	Moderate
Medium	Minor	Moderate	Major
Large	Moderate	Major	Major

- ERM has undertaken a traffic assessment for both route options encompassing both construction and operational phases. For the AQ assessment phase the methodology as described in Figure 10-1 was used.

10.4.2.1 Air Quality Assessment of Traffic Movement

The traffic study undertaken by ERM on the proposed access road options, the study showed that there would be a maximum of 328 trips per day; this is worst case for two months of the year when petcoke deliveries occur. For the remaining 10 months of the year, approximately 212 trips daily are expected.

Assuming the worst-case scenario, using 328 trips as the annual average daily traffic (AADT) is less than 440 heavy-duty vehicles per day. This indicates the magnitude for this activity is negligible.

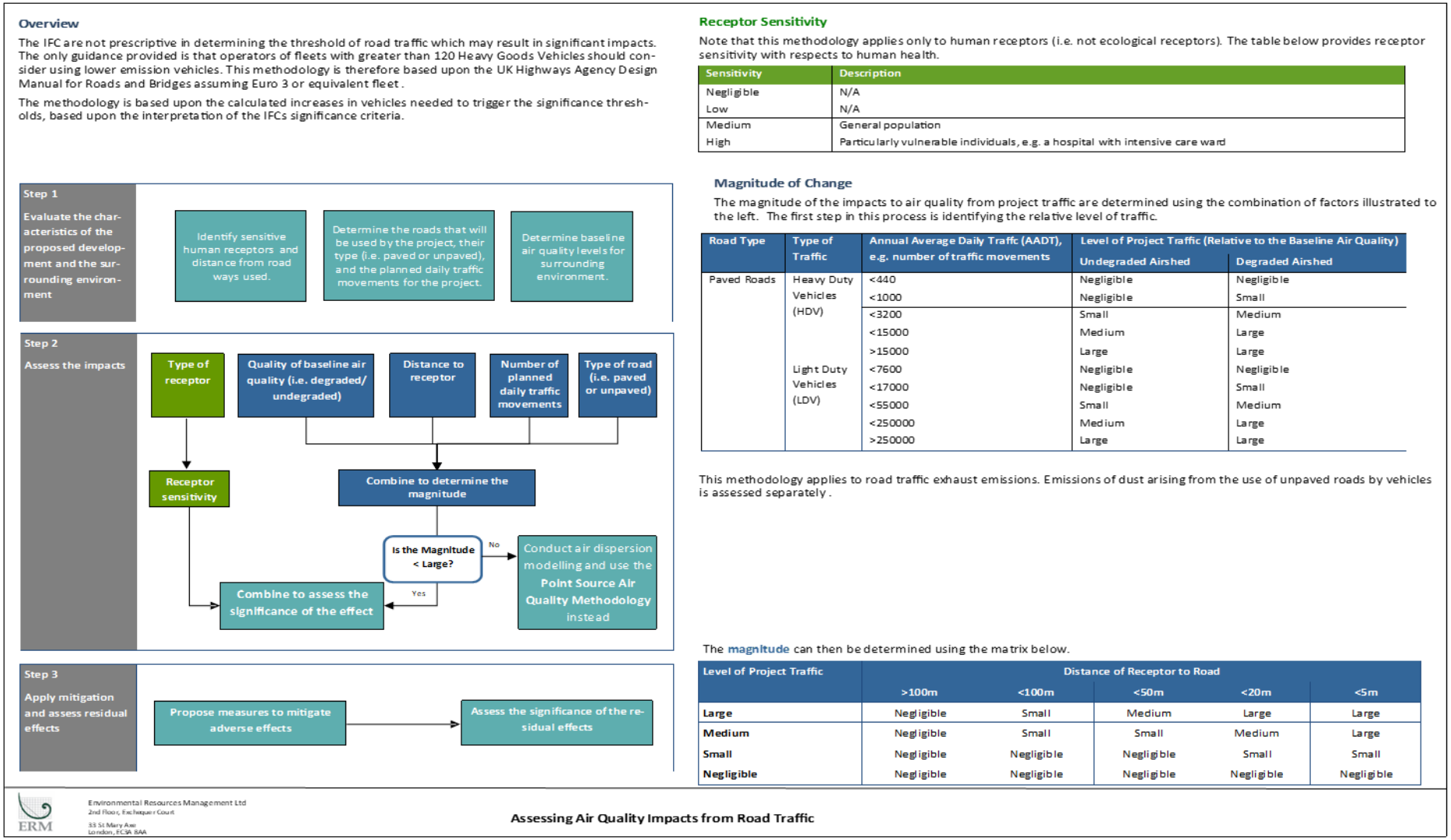


Figure 10-1 Air Quality Assessment Infographic for Road Traffic

10.4.3 Dust Assessment

The site operations have the potential for dust, notably the quarry operations and the interconnecting unpaved road. The infographic shown in Figure 10-2 indicates the key steps in determining the significance of dust generation.

The magnitude of dust generation is was determined by the following:

- The number of vehicles on the unpaved road (approximately 72 x 2 return trips per day);
- The nearest receptor is approximately 120 m from the plant boundary;
- Earthworks approximately 5 ha per annum; and
- Material volume handling exceeding 250,000m^3.

On the basis of the above parameters the dust generation is determined to be of large magnitude. Mitigation measures are outlined in the Section 10.4.6. An air quality management plan will be developed which will include a section on dust management to ensure commitments are upheld.

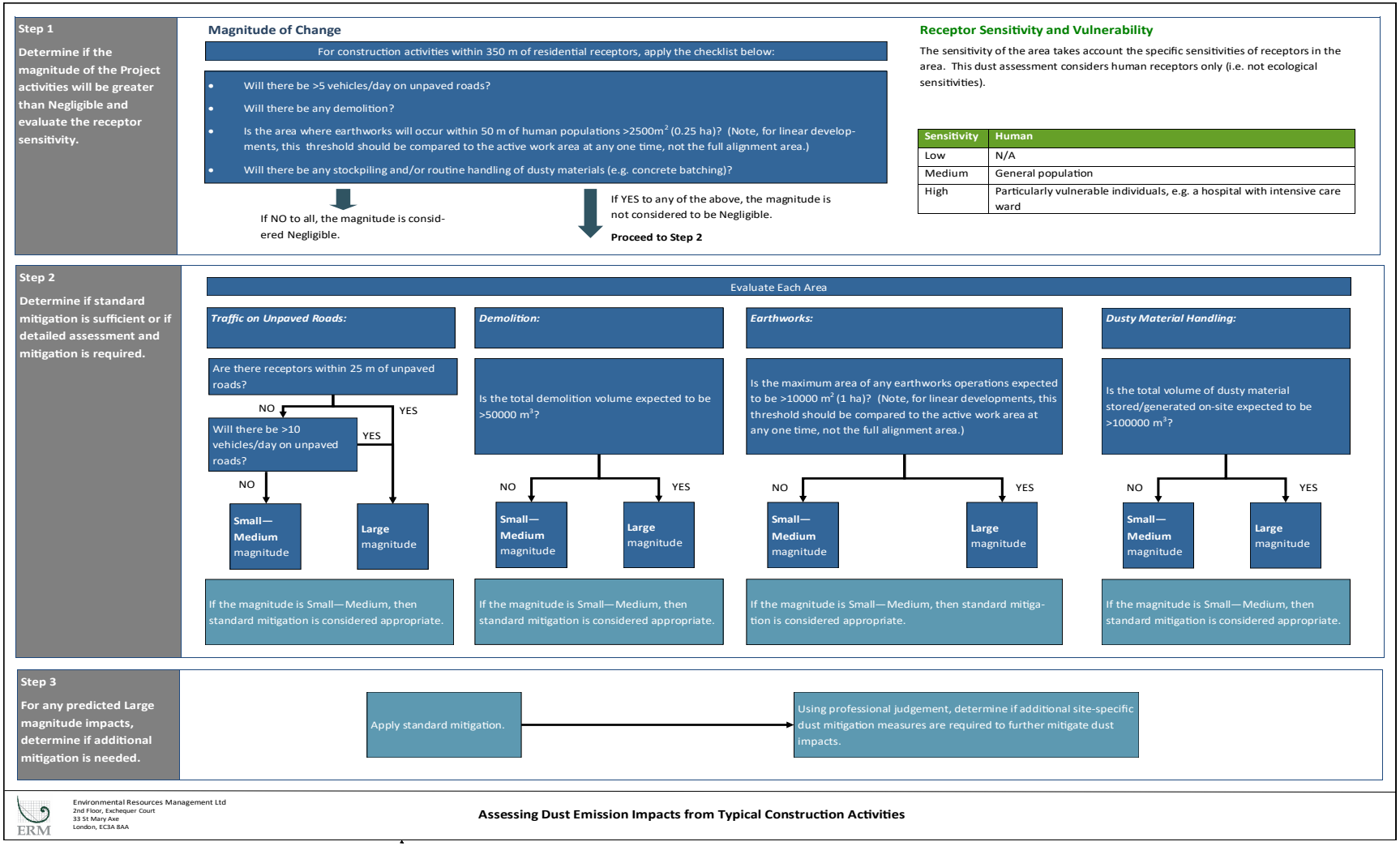


Figure 10-2 Air Quality Assessment for Dust - Infographic

10.4.4 Modelling Results

10.4.4.1 Pollutants with Maximum PEC < 25% AQS

The modelling results are summarised below. Each of the pollutants listed in Table 10-16 show a maximum predicted environmental concentration less than 25% of the AQS. The % PEC / AQS is generally compared to the maximum value at a plant boundary and therefore the % PEC / AQS in this table is over estimated. The airshed is not considered degraded for any of these pollutants. Graphical representation using isopleths of the pollutants list below are deemed unnecessary. The significance of impact of each of these pollutants is negligible.

Table 10-16 Predicted Environmental Concentration Maximum (PEC) < 25% AQS

Pollutant	Averaging Period	AQS Value (µg/m^3)	AQS Reference	Max Modelled Value (µg/m3)	% of AQS	PEC (µg/m^3)	PEC % of AQS
HCl	1hr	750	UK	0.653	$8.71*10^{-02}$	0.653	$8.71*10^{-02}$
HF	1hr	160	UK	0.123	$7.70*10^{-02}$	0.123	$7.70*10^{-02}$
	Monthly (based on 24hr)	16	UK	0.0223	0.139	0.0223	0.139
Pb	Annual	0.5	SG	$4.74*10^{-04}$	$9.48*10^{-02}$	$4.74*10^{-04}$	$9.48*10^{-02}$
Co	1hr	2,000	US EPA	$6.85*10^{-03}$	$3.42*10^{-04}$	$6.85*10^{-03}$	$3.42*10^{-04}$
	Annual	0.1	US EPA	$4.74*10^{-04}$	0.474	$4.74*10^{-04}$	0.474
Cr	1hr	25,000	US EPA	$6.85*10^{-03}$	$2.74*10^{-05}$	$6.85*10^{-03}$	$2.74*10^{-05}$
	Annual	83.3	US EPA	$4.74*10^{-04}$	$5.69*10^{-04}$	$4.74*10^{-04}$	$5.69*10^{-04}$
Cu	1hr	200	UK	$6.85*10^{-03}$	$3.42*10^{-03}$	$6.85*10^{-03}$	$3.42*10^{-03}$
	Annual	10	UK	$4.74*10^{-04}$	$4.74*10^{-03}$	$4.74*10^{-04}$	$4.74*10^{-03}$
Mn	Annual	0.15	IFC /WHO	$4.74*10^{-04}$	0.316	$4.74*10^{-04}$	0.316
Ni	Annual	0.0025	WHO	$4.74*10^{-04}$	19.0	$4.74*10^{-04}$	19.0
V	24hr	1	WHO	$1.24*10^{-03}$	0.124	$1.24*10^{-03}$	0.124
Sb	1hr	150	UK	$6.85*10^{-03}$	$4.57*10^{-03}$	$6.85*10^{-03}$	$4.57*10^{-03}$
	Annual	5	UK	$4.74*10^{-04}$	$9.48*10^{-03}$	$4.74*10^{-04}$	$9.48*10^{-03}$

Background data is assumed to be represent short-term baseline and annual baseline is approximately half based on IFC cited guidance from the Environment Agency for England[35].
Background concentration assumed to be negligibly small for all pollutants in this table hence PC = PEC

Predicted environmental concentration (PEC) = Modelled process contribution (PC) + Background Concentration

[35] Environment Agency for England (accessed May 2021) Air emissions risk assessment for your environmental permit

10.4.4.2 TOC and Arsenic

The pollutant contributions of TOC and Arsenic are shown in Table 10-17 and have a maximum Predicted Environmental Concentration (PEC) of less than 25% of the relevant AQS at the plant boundary. Graphical representation of these pollutants is deemed unnecessary, as the significance of impact of each of these pollutants is negligible.

Table 10-17 TOC and Arsenic Pollutant Contributions

Pollutant	Averaging Period	AQS Value (µg/m^3)	AQS Reference	PEC (µg/m^3) at plant boundary	PEC % of AQS
TOC (Benzene)	Annual	0.17	IFC / WHO	$2.69*10^{-02}$	15.8%
As	Annual	0.00066	IFC / WHO	$1.11*10^{-04}$	16.8%

Baseline concentrations expected to be negligible hence PC = PEC
The AQS for benzene (known carcinogen) was used to represent total TOC which is an overestimate

10.4.4.3 NO_2, $PM_{2.5}$, PM_{10} and SO_2

A summary table showing the modelled concentrations of NO_2, $PM_{2.5}$, PM_{10} and SO_2 is shown in Table 10-18 below.

Table 10-18 Predicted Environmental Concentration for NO_2, PM_{10} and SO_2

Pollutant	Averaging Period	AQS Value (µg/m^3)	AQS Reference	Plant boundary Modelled Value (µg/m^3)	% of AQS	Baseline (µg/m^3)	PEC (µg/m^3)	PEC % of AQS
NO_2	1hr	200	IFC / WHO	20.0	10.0%	9.56	29.6	14.8
	Annual	40	IFC / WHO	4.00	10.0%	4.78	8.78	22.0
PM_{10}	24hr	150	SG	32.0	21.3%	22.2	54.2	36.2
	3rd highest 24hr	150	IFC / WHO Interim target 1	18.0	12.0%	22.2	40.2	26.8
	Annual	80	SG	5.00	12.5%	11.1	16.1	40.3
$PM_{2.5}$	24 hour	75	IFC / WHO / SG	3.20	4.27%	13.5	16.7	22.3
	Annual	25	SG	1.80	7.20%	13.5	15.3	61.3
SO_2	10min	500	IFC / WHO / SG	6.00	1.20%	20.5	20.5	5.30
	24hr	50	SG	2.00	4.00%	20.5	20.5	45.00
	Annual	50	IFC / WHO	0.600		10.3	10.3	21.70

10.4.4.4 NO_2

The results for 1-hour maximum are shown in Table 10-18 and Figure 10-3. This illustrates that predicted impacts at the plant boundary are less than 25% of the AQS. The main source of NO_2 is in the quarry area

and therefore emissions will move around over time. Even when the quarry working area moves around, it is expected the worst case PEC will still be no greater than 25% of the AQS at the plant boundary.

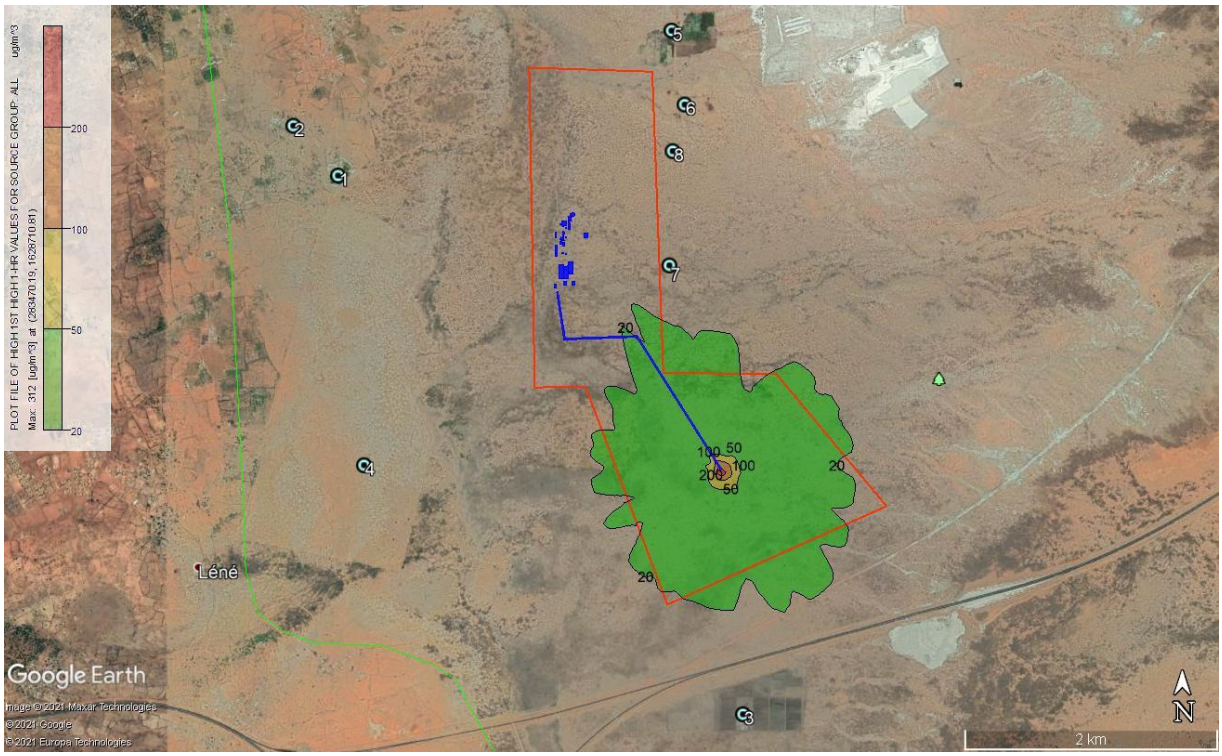


Figure 10-3 NO_2 1-hr (IFC/WHO/SG AQS)

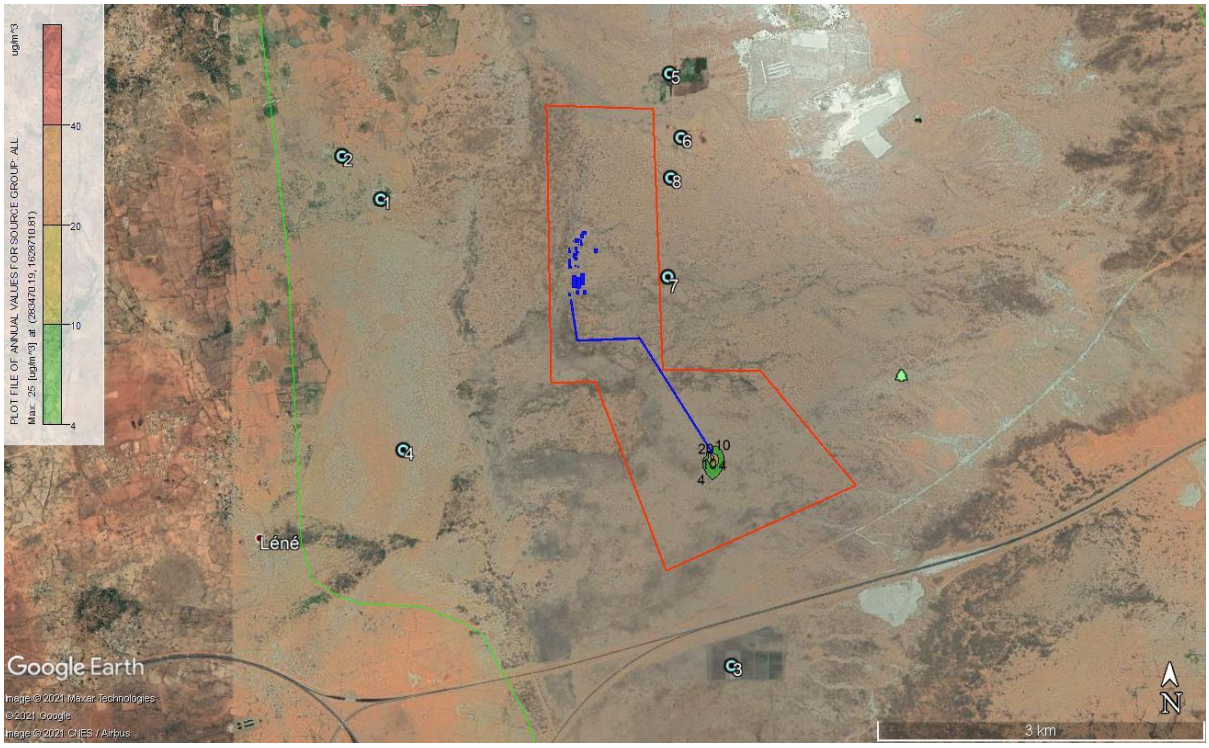


Figure 10-4 NO_2 Annual (IFC/WHO/SG AQS)

For NO_2 annual average PC is less than 10% of the AQS at the plant boundary as shown in Figure 10-4 above and PEC is less than 25% AQS at plant boundary.

The baseline study showed the airshed is not considered degraded for NO_2. The significance of the impact of NO_2 emissions is deemed to negligible.

10.4.4.5 $PM_{2.5}$

The results for 24-hour $PM_{2.5}$ was 22.3% of the AQS at the plant boundary. Please note that the interconnecting road layout and plant boundary was based on a notional understanding at the time of modelling. The plant boundary concentrations in the table above have been subsequently estimated on a proposed realignment of the interconnecting road along the centre line along the northern apex of the quarry.

10.4.4.6 PM_{10}

The results for 24-hour PM_{10} as the 24-hour maximum and 3rd highest 24-hour are shown in Figure 10-5 and Figure 10-6. The PEC for 24hr is about 36% of AQS at the plant boundary and about 27% of AQS for the 3rd highest value. Please note that the interconnecting road layout and plant boundary was based on a notional understanding at the time of modelling. The plant boundary concentrations in the table above have been subsequently estimated on a proposed realignment of the interconnecting road along the centre line along the northern apex of the quarry.

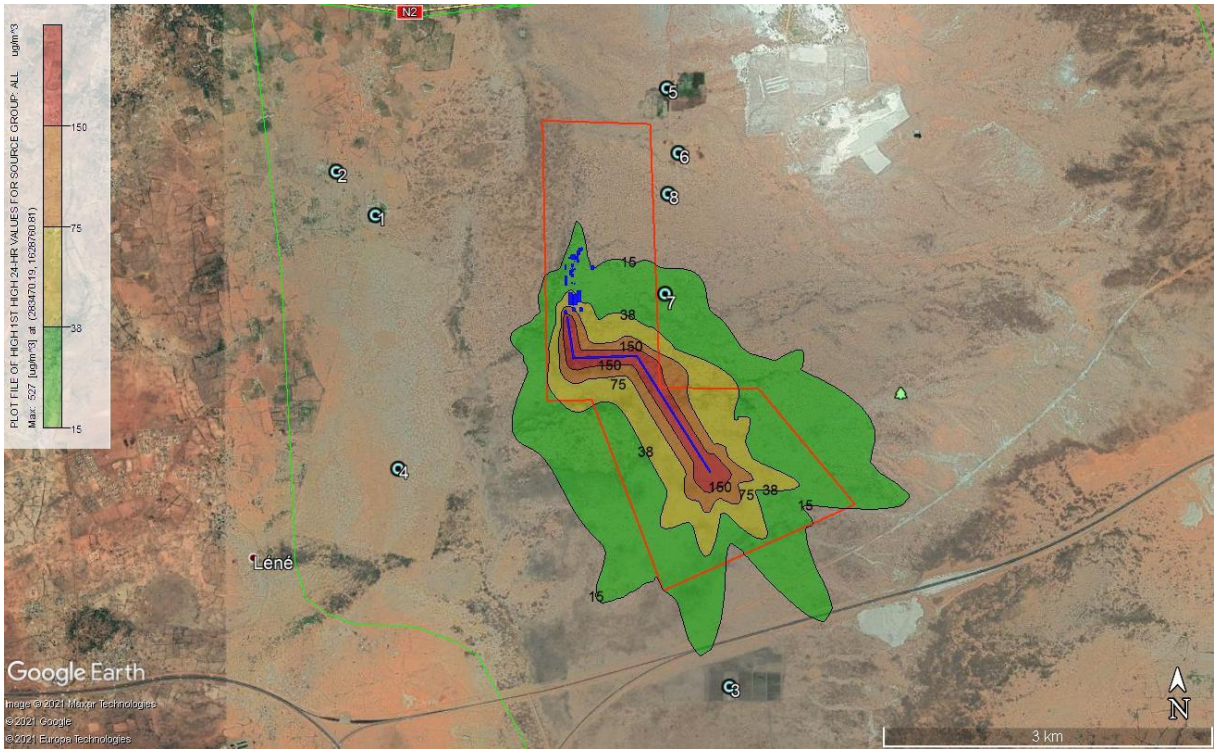


Figure 10-5 PM_{10} 24hr (SG AQS)

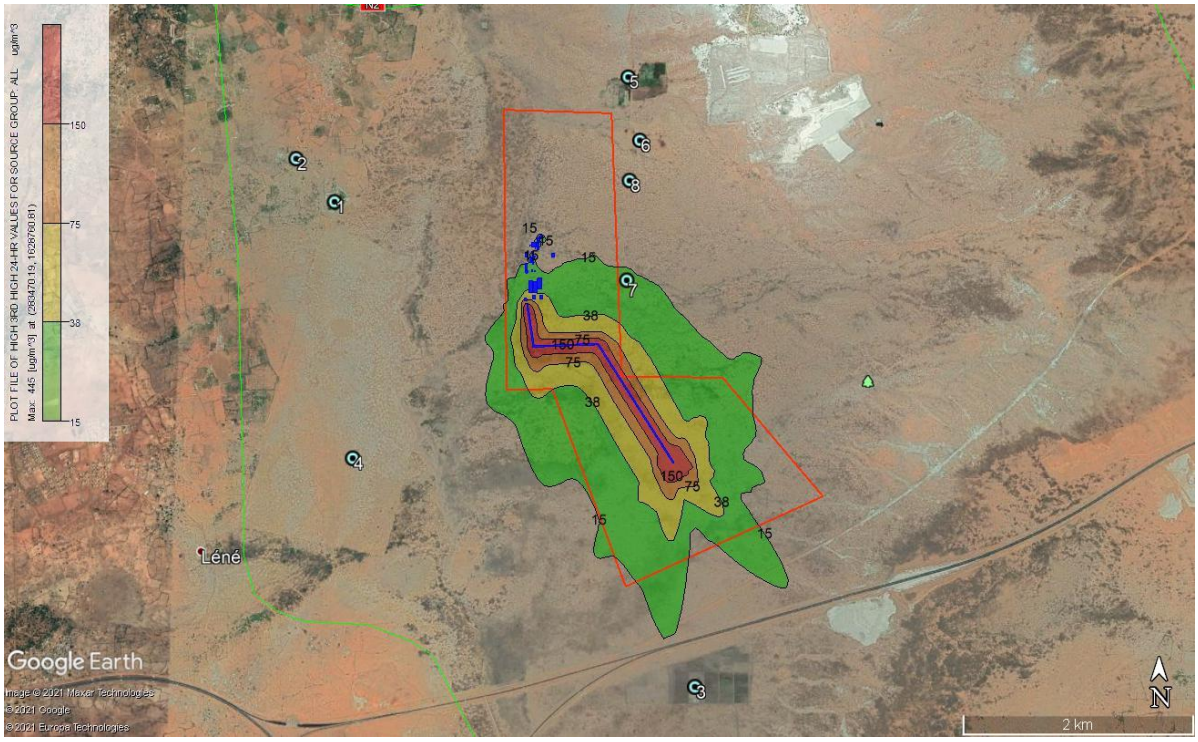


Figure 10-6 PM_{10} Third Highest 24hr (IFC /WHO AQS)

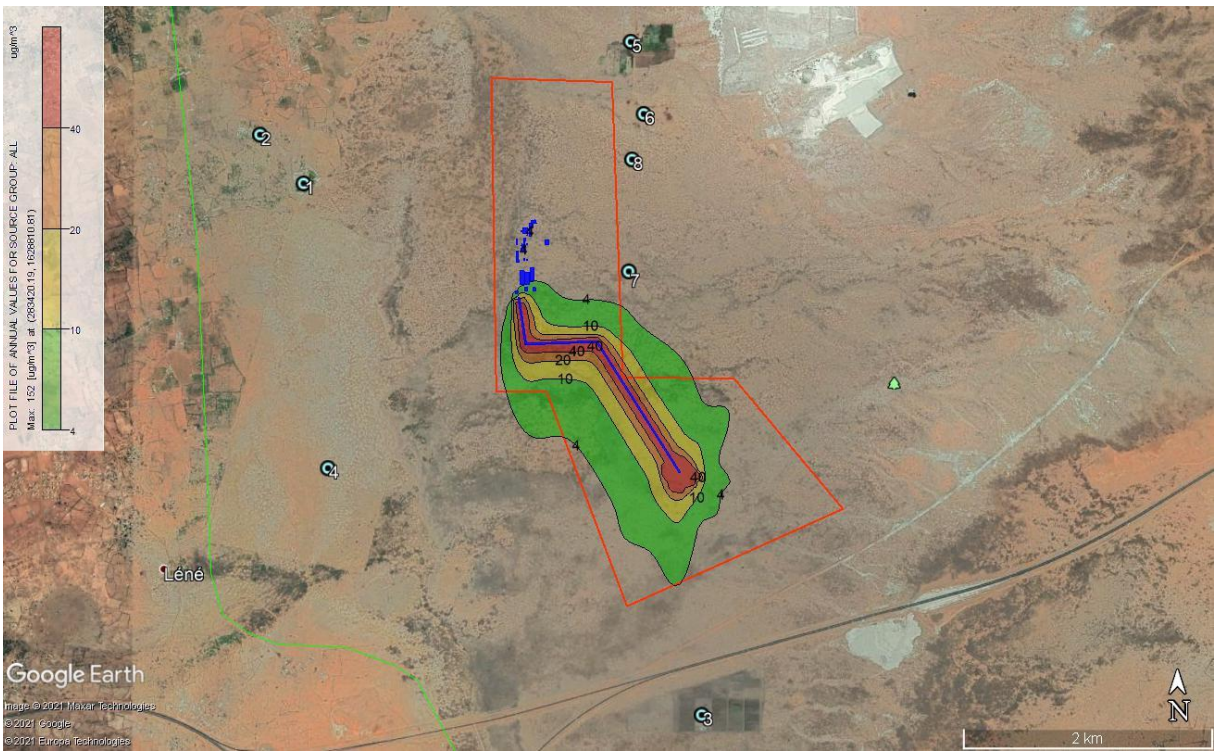


Figure 10-7 Annual PM_{10} (SG AQS)

The annual 24hr PM_{10} concentrations (PEC) are less than 25% of the AQS at the boundary as shown in Figure 10-7 above.

The airshed for PM_{10} is considered to be degraded due to the Harmattan effect. The predicted impacts are considered to be moderate.

10.4.4.7 SO_2

The concentration plots for SO_2 are shown in Figure 10-8, Figure 10-9 and Figure 10-10.

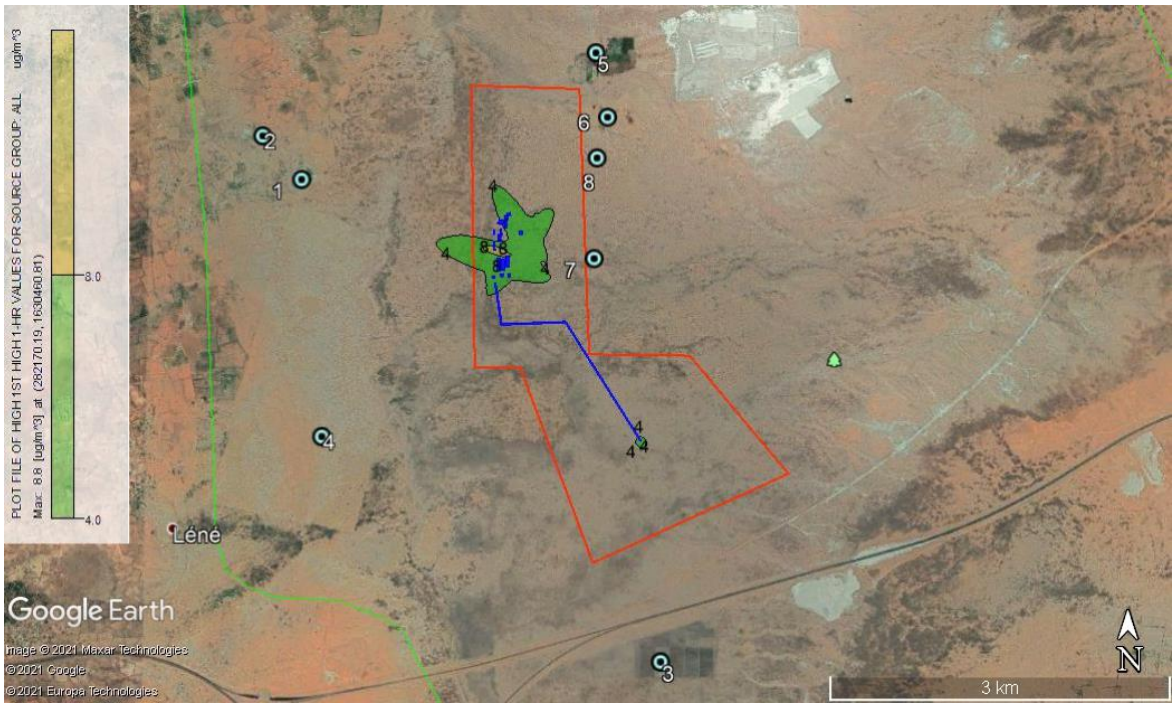


Figure 10-8 SO_2 10min (IFC / WHO / SG)

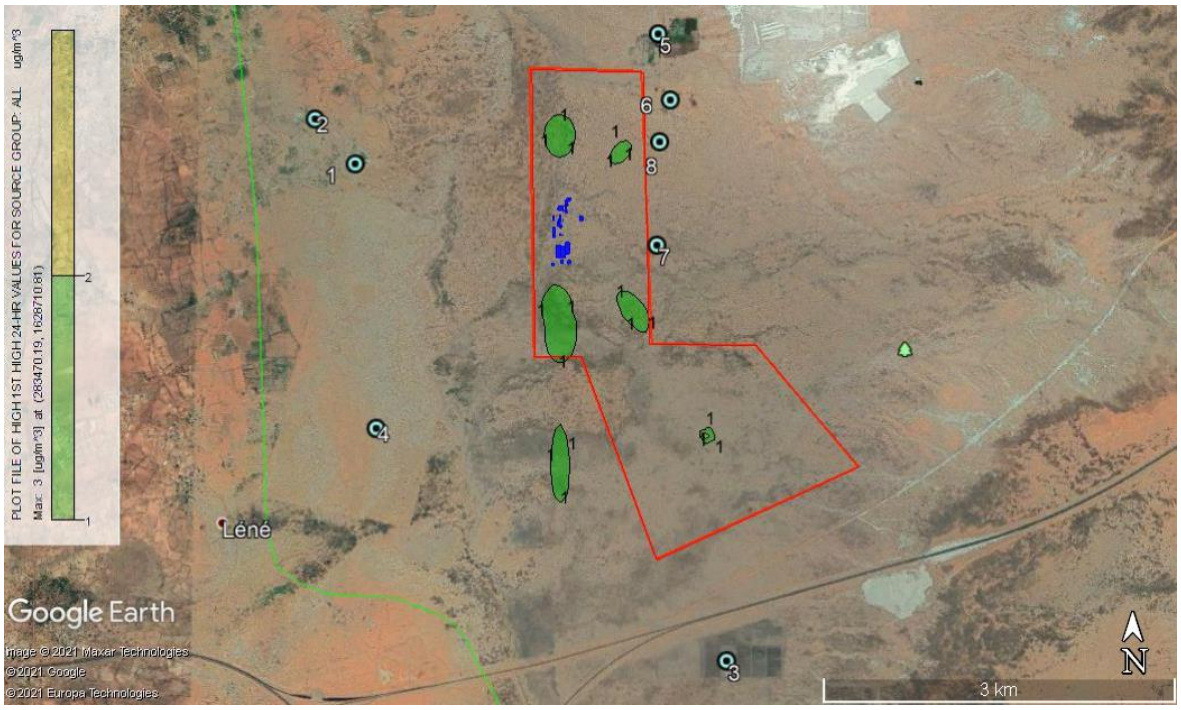


Figure 10-9 SO_2 24hr (SG)

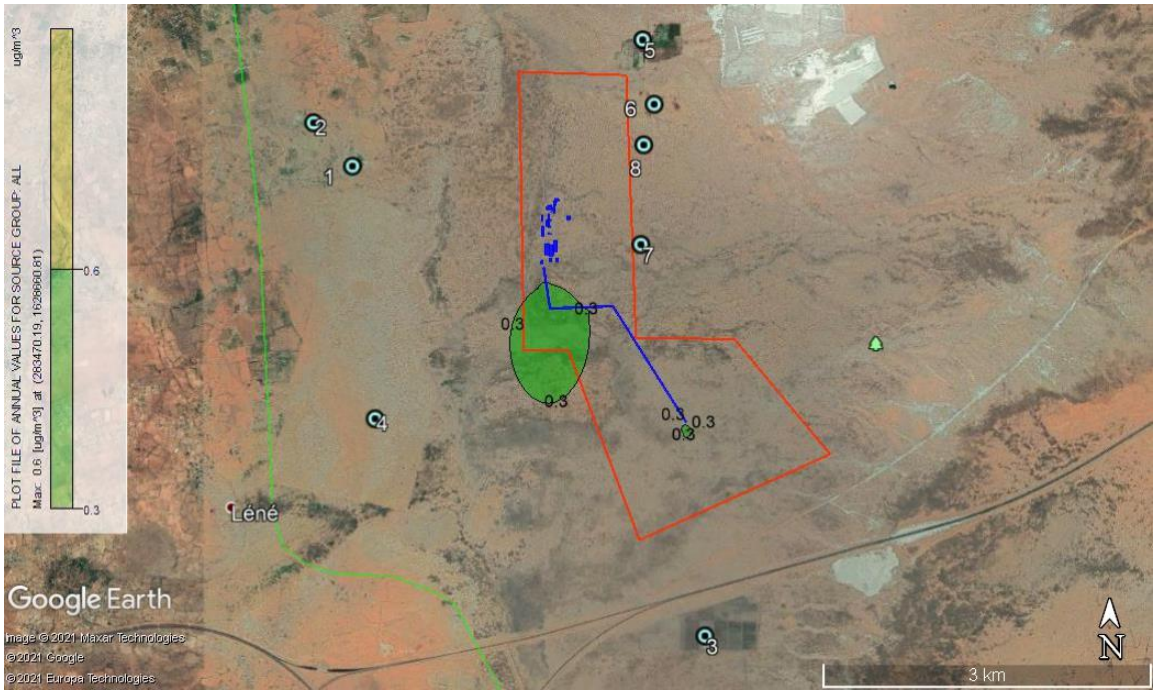


Figure 10-10 SO_2 Annual (IFC / WHO)

The % PEC of AQS for the 10 min and annual is below 25% while the 24 hour is 45%. This is considered a minor impact for SO_2.

10.4.5 Dust Deposition

The results for dust deposition are shown in Figure 10-11. As noted above, the interconnecting road layout and plant boundary was based on a notional understanding at the time of modelling. The plant boundary concentrations in the table above have been subsequently estimated on a proposed realignment of the interconnecting road along the centre line along the northern apex of the quarry

The modelling predicts the process contribution is about 50% of the national AQS at the plant boundary. The main source of dust is in the quarry area and haul road therefore emissions will move around over time. Given that, the airshed is considered degraded for dust and the impact is considered to be large.

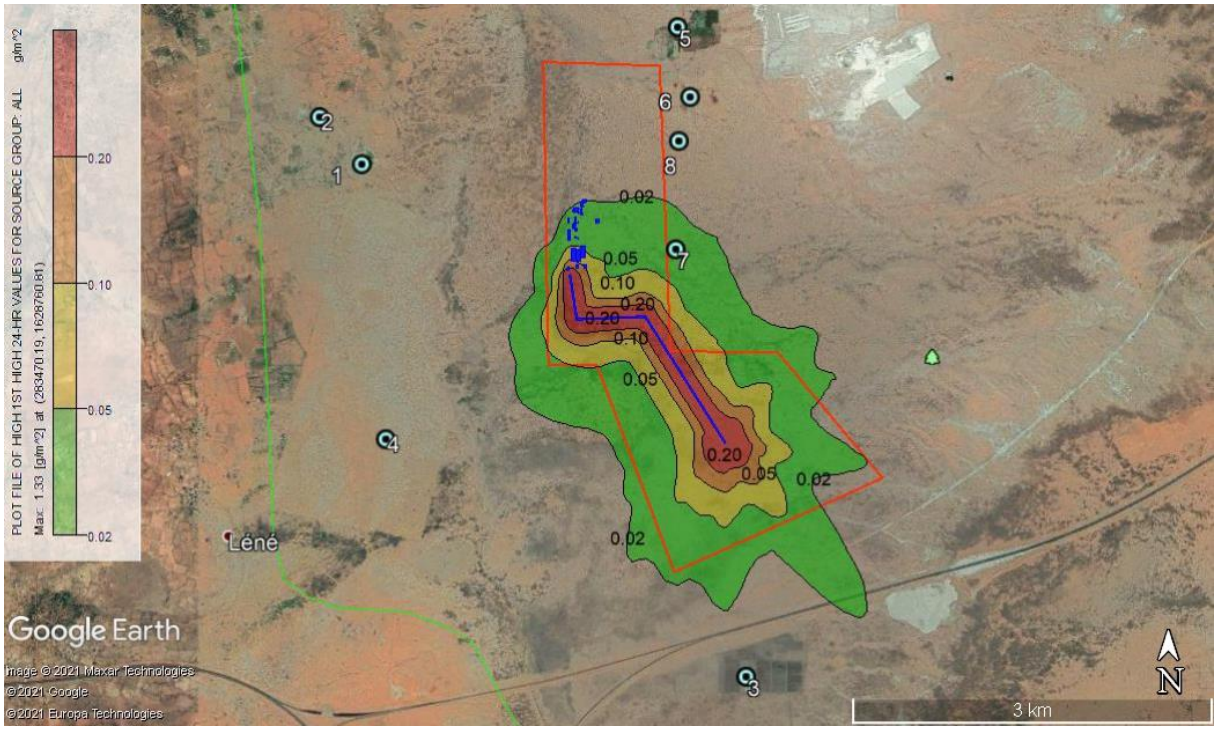


Figure 10-11 Dust Deposition 24hr (SG AQS)

10.4.6 Mitigation and Monitoring

10.4.6.1 Construction Traffic

- Vehicle routing should be considered to avoid passing through settlements and close to residential areas as far as practicable;
- A travel plan should be put in place to minimise congestion on public roads and avoid peak times as far as practicable;
- Where the access road meets the public highway consideration should be made of junction improvements, signage and traffic lights to minimise queuing times. Where there is the potential for queueing elsewhere due to the influx of construction traffic changes to junctions to facilitate flows may be required;
- Vehicles used during the construction phase should be modern and as far as possible meet up to date emission limits (i.e. less than 5 years old);
- Vehicles should be well maintained to minimise emissions; and
- Low sulphur fuels should be used.

10.4.6.2 Construction Dust

Without mitigation, there is the potential for substantial dust emissions to arise from the site during construction. The measures required to mitigate dust during construction phase are set out in Table 10-19 below.

Alongside these mitigation, site boundary monitoring should be undertaken during the construction phase to allow dust emissions to be actively quantified and controlled.

Table 10-19 Dust Management and Mitigation Measures

Construction Phase Mitigation
Management Measures
Develop and implement a Dust Management Plan (DMP) including monitoring of dust deposition, dust flux, real-time PM_{10} continuous monitoring (if possible or deemed essential) and visual inspections. The DMP should also include 'action levels' for triggering further dust mitigation when exceeded (feed-back loop)
Develop and implement a stakeholder communications plan that includes community engagement before work commences on site
Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken
Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in a log book
Monitoring
Undertake daily on-site and weekly off-site inspection, where receptors (including roads) are nearby, to monitor dust and record inspection results
Carry out regular site inspections to monitor compliance with the DMP, record inspection results and identify any events that require further investigation or actions
Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions
Undertake real-time PM_{10} monitoring around the site boundary, agreeing locations regulatory authorities and lenders. Where possible commence baseline monitoring at least three months before work commences on site
Site Planning
Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible
Recommend erecting solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.
Consider fences and enclosures around specific operations where there is a high potential for dust production and the site is actives for an extensive period
Avoid site runoff of water or mud
Keep site fencing, barriers and scaffolding clean using wet methods (if possible).
Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site, recommend cover as described below
Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided)
General Operational Measures
Where construction compounds cannot be hardstanding, use lignin-based surface sealants or watering as required to supress dust generation
Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays (if possible) or local extraction, e.g. suitable local exhaust ventilation systems

Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate
Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate
Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods
Avoid bonfires and burning of waste materials
Mitigation Specific to Earthworks
Re-vegetate or hard stand earthworks and exposed areas and open soils to stabilise surfaces as soon as practicable
Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable
Only remove the cover in small areas during work and not all at once
Mitigation Specific to Construction
Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place
Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery
For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust.
Mitigation specific to Track out on Hardstanding Public Roads
Use water-assisted dust sweeper(s) on hardstanding access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.
Avoid dry sweeping of large areas.
Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport
Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.
Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).

10.4.6.3 Construction Mobile and Non-Mobile Plant

The following best practice and mitigation measures should be implemented for mobile and non-mobile plant.

- Mobile Plant:
  - Use of modern plant meeting, as a minimum, USEPA Tier 2 emission limits
  - Use of low sulphur fuels, if available
  - Undertake routine maintenance to maximise engine performance and minimise black smoke
- Non-mobile plant:
  - Use of low sulphur fuels, if available
  - Position generators away from the site boundary and downwind and away from sensitive receptors as far as practicable

- Use lower emission engines in generators meeting IFC emission limits of 1,850 mg/Nm^3
- Equip engines with vertical, uncapped stacks, preferably with a minimum stack height of building height +3 m (if isolated from other structures the 'building' is the generator itself)
- Undertake routine maintenance to maximise engine performance and minimise black smoke

10.4.6.4 Mitigation and Monitoring - Operational Phase

The quarry, factory and road will be operated with the embedded mitigation as described earlier. In addition the operations and potential impacts of the quarry, haul road and cement plant will be kept under review including site boundary monitoring to verify that the operations of the process are not resulting in significant impacts on air quality.

One of the key sources of dust and PM_{10} emissions will be the haul road. Given that the area is arid, the use of water for dust mitigation may be undesirable as water will be a constrained resource. The use of a lignin-based dust suppressant will substantially reduce the need for watering (typically this needs to be applied only once per 7 – 14 days).

In the initial phase when the waste rock dump is in use, localised mitigation may be appropriate. The use of bunds or netting upwind, revegetation or other covering is recommended to reduce windblown dust from the exposed waste rock dumps.

In addition to the mitigation measures set out, the following are also noted.

- Dust emissions are greatly affected by weather conditions. The planning of quarry activities should therefore aim to undertake activities at locations furthest from receptors during the dry season periods and be monitored for the potential need for additional mitigation.
- Monitoring using active monitors and daily visual inspection should be undertaken. Monitoring is an important element is managing the emissions and impacts from the quarry on a day-to-day basis.
- The findings of the monitoring should be used to identify dust-generating events, and actively inform operations to allow for implementation of localised mitigation as needed.
- As the baseline is likely to be elevated during Harmattan exceeding the air quality standards therefore it is unreasonable (and impossible) for CIMAF to be asked to meet ambient air quality standards. Instead, CIMAF should be focussing on undertaking monitoring that allows for the quantification of the site contribution or 'delta', this being the difference in PM_{10} and dust at upwind versus downwind locations[36]. The 'delta' is then the appropriate metric for assessing whether the site emissions are having a significant impact on air quality. Following IFC guidelines no project should take up more than 25% of air quality standards, and an Action Level based on a 'delta' of 25% (i.e. a delta of 12.5 µg/m^3) of the 24-hour mean PM_{10} standards is appropriate. This approach:
  - Separates out the site emissions and impacts, which are within the control of CIMAF, from the variable baseline which is not
  - Allows identification of occasions when site emissions increase and therefore can be used to understand trends and inform mitigation
  - Requires analysis of PM_{10} and meteorological monitoring data. Ideally, this uses monitoring sites that are positioned so that there are few sources of emissions between the site and the monitoring location. This will allow the PM_{10} and dust concentrations to be calculated when the wind is blowing from the direction of the site, and when the wind is blowing towards the site. The delta can be then be calculated.

[36] This is achieved by deploying monitors at locations around the site and analysing meteorological data from the site to calculate the difference in concentrations between upwind and downwind sites. As local sources contribute to emissions the monitoring should be undertaken close to the site perimeter to capture only the impacts of site activities

The generation of dust and PM_{10} from the site will be variable depending on the meteorological conditions, ground conditions and the location and type of activities being undertaken on site. During the wet season, the potential for dust to be generated is much lower than in the dry season (particularly during Harmattan) also some site activities are much closer to receptors than others. The emissions and impacts from the site therefore need to be dynamically managed noting and mitigating particularly dusty activities and increasing mitigation when site activity is closer to receptors.

On the basis of this impact assessment and findings, a comprehensive AQ management plan will be developed to encompass both construction and operational phase impacts.

10.4.7 Conclusion

The Air Quality Impact assessment process has been conducted using available data from CIMAF, internationally accepted methodology for emission quantification and modelling, and ERM expertise and judgement. While necessary care has been taken in this process, it should be noted that modelled results should not be taken as an absolute. The results serves as reliable indicator of pollutant concentrations and potential concern areas that may require additional mitigation and monitoring.

Based upon IFC Guidelines, the national AQS take precedence for this project. The PEC for all pollutants are shown to be below the relevant AQS.

A meaningful mitigation strategy to attenuate the AQ impacts from the interconnecting road, would be to align the road away (as much as possible) from the plant boundary near the quarry northern apex. This would significantly reduce any pollutant contributions near the plant boundary.

Dust emissions are greatly affected by weather conditions in addition to the specific location and nature of the activities being undertaken at any one time. Of particular concern is elevated baseline during Harmattan periods. Therefore, the recommendation is made that site activities are actively managed through both active air quality monitoring and routine visual inspection. Particular attention should be paid to:

- Periods of unfavourable weather, in particular the dry season and Harmattan;
- When the site activities are at a peak, or are being undertaken on areas where the ground conditions are dry; and
- When quarry activities are undertaken close to sensitive receptors and plant boundary.

10.5 Noise

10.5.1 Noise Assessment

10.5.1.1 Construction

Predicted noise levels at nearby receptors due to construction of the Project are presented in Table 10-20 and Table 10-21. This figure presents noise contours as significance values for the day time periods.

Noise levels are predicted to comply with the relevant criteria at all locations during construction. Therefore, no mitigation measures are suggested for the construction of the Project.

Table 10-20 Predicted Noise Levels – Construction

Receptor	Predicted Noise Level LAeq, dB(A)	Criteria Day LAeq, dB(A)	Compliance
R1	47	55	Yes
R2	44	55	Yes
R3	33	55	Yes
R4	38	55	Yes

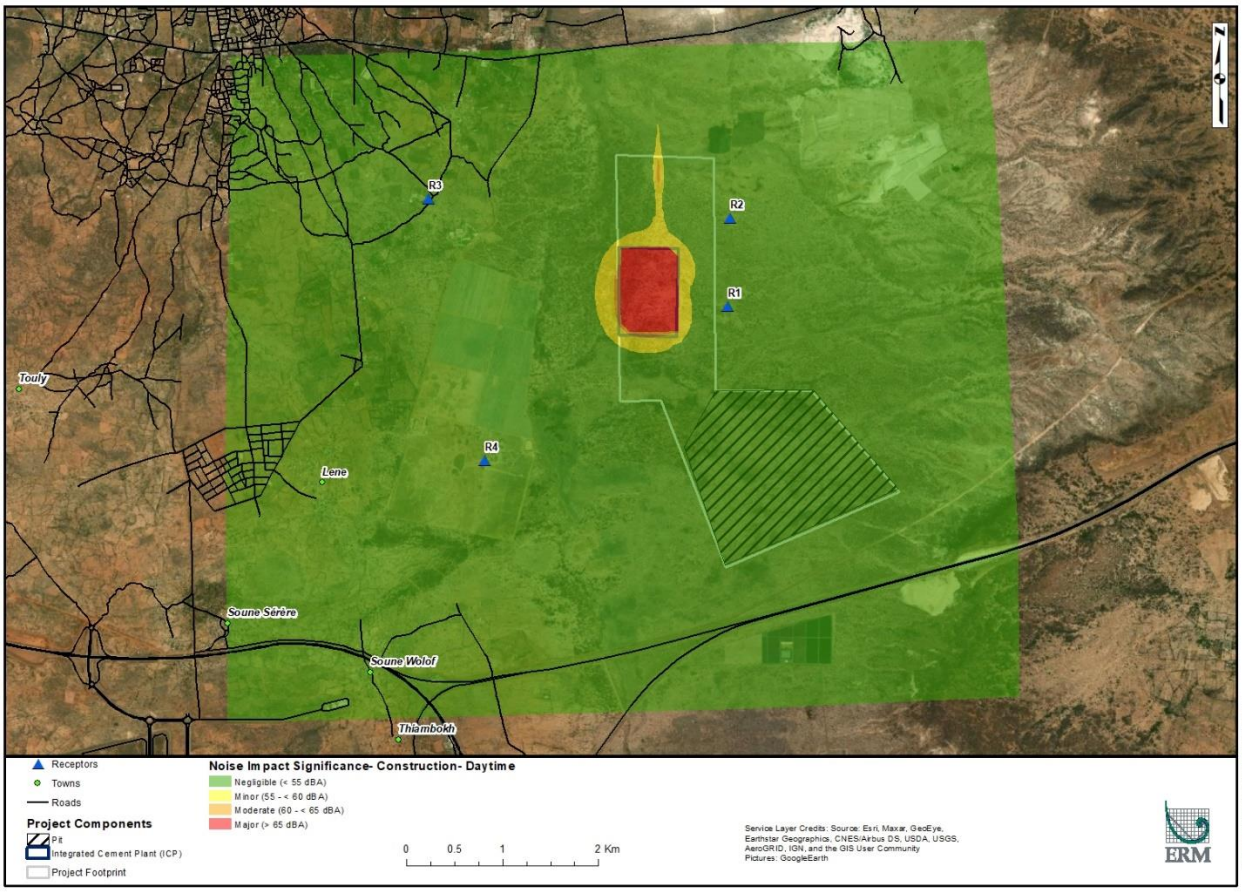


Figure 10-12 Predicted Construction Noise Levels – Day

10.5.1.2 Operation

Predicted noise levels at nearby receptors due to operation of the Project are presented Table 10-21 and from Figure 10-13 to Figure 10-14. The figures present noise contours as significance values for the day and night time periods, as per the values outlined in Table 10-21.

Noise levels are predicted to comply with the relevant criteria at all locations for all time operating periods. Therefore, no mitigation measures are suggested for the operation of the Project.

It is, however recommended that compliance monitoring should be undertaken on a regular basis (weekly) via direct measurement at critical receptor locations. In the event of an exceedance of the criteria being identified, an Operational Noise Management Plan (ONMP) needs to be implemented to investigate the cause of the noise source, and to implement corrective actions to minimise the impact.

Table 10-21 Predicted Noise Levels – Operation

Receptor	Calculated Noise Level LAeq, dB(A)		Criteria, LAeq, dB(A)		Compliance	
	Day	Night	Day	Night	Day	Night
R1	39	31	55	40	Yes	Yes
R2	37	28	55	40	Yes	Yes
R3	27	-*	55	40	Yes	Yes
R4	34	-*	55	40	Yes	Yes

*Where predicted noise levels lower than 25 dB(A) values are not presented.

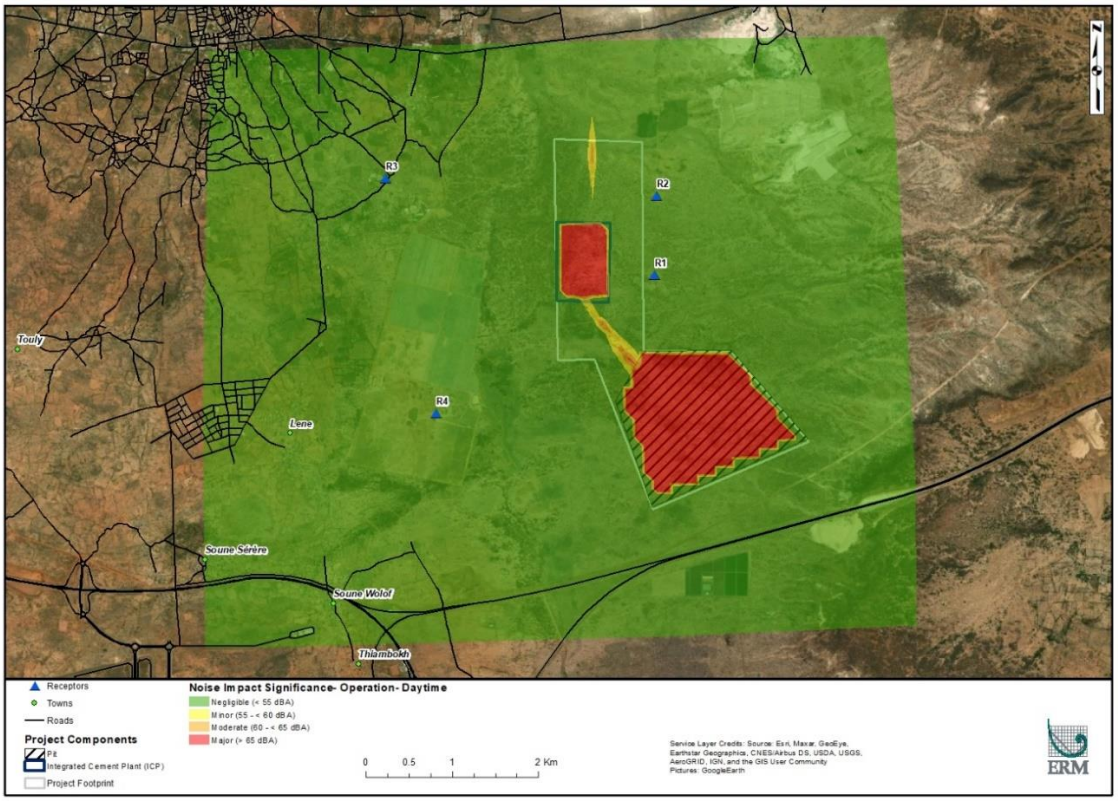


Figure 10-13 Predicted Operation Noise Levels – Day

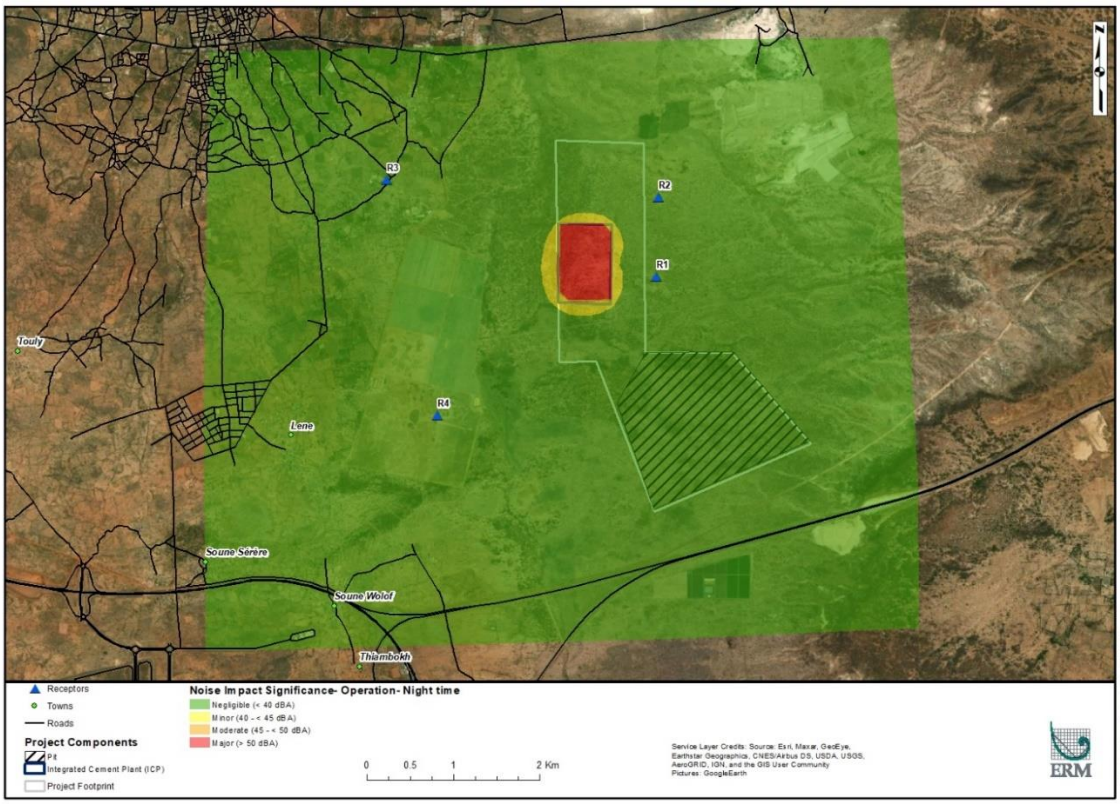


Figure 10-14 Predicted Operation Noise Levels – Night

10.5.1.3 Blasting

Acceptable Maximum Instantaneous Charges (MIC), at which the criteria will be met, have been predicted based on distances between 100 and 1,500 m, with a step of 100 m, from the blasting location. The results of these calculations are presented in Table 10-22 for airblast and in Table 10-23 for ground vibration.

Table 10-22 Airblast Calculation

Distance (m)	Airblast dB(Z)	MIC (kg)	Airblast dB(Z)	MIC (kg)
100	115	0.5	125	9
200	115	4	125	73
300	115	14	125	248
400	115	33	125	587
500	115	64	125	1,147
600	115	111	125	1,981
700	115	177	125	3,146
800	115	264	125	4,696
900	115	376	125	6,687
1,000	115	516	125	9,173
1,100	115	687	125	12,209
1,200	115	891	125	15,851
1,300	115	1,133	125	20,153
1,400	115	1,415	125	25,170
1,500	115	1,741	125	30,958

Table 10-23 Ground Vibration Calculation

Distance (m)	Ground Vibration PPV (mm/s)	MIC (kg)	Ground Vibration PPV (mm/s)	MIC (kg)
100	2	3.6	5	11
200	2	14	5	45
300	2	32	5	102
400	2	57	5	181
500	2	90	5	282
600	2	129	5	406
700	2	176	5	553
800	2	230	5	722
900	2	291	5	914
1000	2	359	5	1,129
1,100	2	434	5	1,366
1,200	2	517	5	1,625
1,300	2	607	5	1,908
1,400	2	704	5	2,212
1,500	2	808	5	2,540

The shortest distance between the boundaries of the quarry and receptors is 870 m. In order to avoid any major impact (airblast or vibration), MIC should be less than 272 kg, and less than 840 kg.

Based on the worst-case scenario and the data provide by CIMAF, the maximum amount charge (not the MIC) per hole is expected to be between 67 to 100 kg, therefore no significant impacts are anticipated due to blasting activities.

10.5.2 Conclusion

The construction and operational scenarios of the Project are predicted to comply with noise and blasting limits as stated in Section 10.5.1.1 and 10.5.1.2. Therefore, no noise mitigation measures have been recommended for the construction and operation of this Project.

It is advised, that during operation noise monitoring should be conducted on a regular basis to check compliance, and where exceedances are detected, implement corrective actions to minimise noise impacts, particularly during the night time. Regular noise compliance monitoring will allow CIMAF to effectively manage noise and blasting emissions from the operation.

10.6 Climate Change

The Table 10-24 gives an understanding of potential impacts of the various climate hazards that could potentially occur and provides recommendations regarding the mitigation and management of them.

Table 10-24 Climate Change Potential Hazards, Potential Impacts and Recommendations

Climate Hazard	Potential Impact	Recommendations
Extreme Heat	Increases in periods of extreme heat could impact site personnel working during the construction and operation phases. High temperatures could also interfere with the processes on site, such as concrete manufacturing.	The risks of disruption as a result of extreme heat could be reduced by adopting an adverse weather policy, which specifies a work-rest schedule and advised water consumption based on temperatures. If possible, the site should make drinking water readily available to site personnel in case of emergency, e.g. heat stress. It is recommended that air conditioning, and rest areas with shade, are provided to site personnel. Sufficient cooling systems should be installed in operations areas to ensure that materials used in the concrete process do not overheat.
Water Stress and Drought	Water Stress and Drought events could lead to lower water availability in consideration of site needs. This could occur in both construction and operational phases of the Project. Restrictions may be placed on water sources, reducing the amount of water the Project may be able to abstract.	The Project should explore historically high and low groundwater levels at the site and look for any trends in groundwater levels over the past 10 - 20 years. The project site could use these levels to predict future levels of risk and arrange for alternative water sources accordingly.
Pluvial Flooding	Increasing levels of precipitation could lead to surface water flooding on the small drainage channels running through the site. Steep slopes and piles of debris created during blasting may become unstable during periods of heavy rains.	It is recommended that a full assessment be undertaken on the flood risk and drainage capacity of the project site. Depending on the results of this assessment, further flood mitigations may be required on site. During the rainy season, it is recommended that steep slopes and piled of debris are secured to avoid ground instability issues.
Dust and Sand Storms	Dust and Sand Storms could impact visibility and working-from-height activities in both construction and operational phases of the Project. Dust could lead to respiratory and other health issues, potentially leading to a temporary site shut down and evacuation.	Dust storms could be mitigated by planting vegetation around the site to capture the particles. However, this may increase the risk of wildfires reaching site, therefore it is recommended that further studies are undertaken, and a technical expert supports with mitigation efforts. The Project could ensure there is adequate protection from dust storms such as sealed rooms, mask provision and first aid equipment for example. The risks to personnel could

		further be managed by creating a robust working-at-height and emergency preparedness plans, which prepares personnel for the risk of dust storms and what to do during an event.
Wildfires	Wildfires can damage infrastructure during both the construction and operational phases of the Project. Smoke and dust can impact site personnel health and safety. Wildfires could also lead to total evacuation of the project site.	It is recommended that a distance be maintained between vegetation and the site to prevent wildfires occurring in close proximity to the project site, known as a fire break. Existing local or national regulations should be reviewed to check for specific fire break regulations such as the width of the break and maintenance schedules. Specific guidance on maintenance should be sought to reduce the risk of damage to electricity pylons both on and off site and where the responsibility lies to maintain fire breaks. A technical expert could also assist in the mitigations against wildfires.
GHG emissions	Greenhouse gases causes climate change by trapping heat. This can contribute to respiratory disease from smog and air pollution and also cause extreme weather conditions.	CIMAF have included low-carbon requirements in their standard design criteria including: ▪ Low clinker/cement ratio ▪ Vertical mills ▪ Five- stage preheater ▪ BAT standard of low thermal energy use ▪ Potential use of alternative fuels, such as green power (wind or solar)

11. BIOLOGICAL ENVIRONMENT IMPACT ASSESSMENT

The following chapter assess the potential positive and negative impacts associated with planned project activities, prior to the implementation of mitigation measure, on the biological environment and its sensitive receptors as identified in the physical baseline. Mitigation and management measure are then proposed to apply the impact mitigation hierarchy as described in the IFC PS 1 by anticipating and avoiding impacts, or where avoidance is not possible, minimise. Where residual impacts remain, thus after mitigation, compensate or offset for risks and impacts will be considered.

11.1 Biodiversity

The following section describes the activities, sensitive receptors and impacts on biodiversity, as well as drivers to biodiversity persistence and/or ecosystem integrity in the Project Area. Mitigation and management actions are proposed and the resulting residual impacts, post mitigation and management are described.

11.1.1 Vegetation

All *natural* vegetation within the EAAA will be at risk of incurring negative impacts as a result of the proposed activities. Modified habitats are situated outside the proposed project footprint, and will not be impacted. The four (4) habitat types that would be affected by direct and indirect impacts are: Thicket Vegetation, Potential Ephemeral Vegetation, Wetlands; and Drainage Lines with Riparian Vegetation.

11.1.1.1 Proposed Project Activities

The following table (Table 11-1) describes the proposed Project activities and the impacts expected for the development of the Project.

Table 11-1 Construction and Operation Phase Impacts on Vegetation

Project Activity	Phase	Impact
Clearing of vegetation and topsoil for construction of plant, quarry, and associated haul roads	Construction	Reduction in the extent of the classified Foret de Thiès Direct destruction of natural habitats and their vegetation, and potential loss of seed-storing topsoil; Reduction of numerous specimens of keystone species (Baobabs) and related niche habitats and ecosystem services; Alteration and/or complete disruption of surface runoff patterns, potential depletion or reduction of seasonal moisture input into riparian vegetation and wetlands, with anticipated complete loss of some of these habitats. For such habitats not directly obliterated, indirect impacts include a significant loss of the functionality of such habitats, the loss of diversity of associated species as well as associated ecosystem services; Reduction in available grazing and access to natural medicines, food, fuelwood and fibre (also due to loss of Baobab trees), especially around riparian areas (that usually retain productivity longer into the dry season), which will concentrate overexploitation along reduced access routes and increase exploitation pressure in remaining open spaces.
	Construction and Operation	Potential accelerated (unnatural high levels) of erosion due to clearing of surfaces. Increased dust during times of high winds due to loss of dust-trapping vegetation.

		Note: With the placement of the plant and crusher as close as possible to the quarry, the generation of dust and emissions will be reduced to the lowest levels possible, as well as the need for clearing more natural vegetation for haul roads.
Disturbance of areas not within the allocated footprint – construction materials storage and temporary access roads	Construction	Potential increase in Alien Invasive Vegetation by providing a window of opportunity for its establishment in and around disturbed areas, and associated degradation of natural vegetation and displacement of species; Deposition of excess dust on soil and vegetation (see "Movement of large machinery generating dust, as well as all other activities related to the pit excavation" below).
Stockpiling of soil	Construction and Operation	Potential loss of fertile soil with high nutrient value and soil seed reserves. Potential sedimentation of drainage lines and/or wetlands in the event of high rainfall events.
Construction of infrastructure and excavation of quarry	Construction and Operation	Increase of edge effect and increased loss or fragmentation of unique niche habitats and plant species of conservation concern, increasing the impact of existing surrounding anthropogenic activities
	Construction	Destruction of the natural configuration of unique niche habitats and all species dependent on such habitats within the extent of new mining infrastructure
	Construction	Potential loss of large indigenous trees (impacts assessed separately in Table 11-4), particularly the Baobab (*Adansonia digitata*) that provide ecosystem services and/or habitat for associated species, and are keystone species contributing to the overall functionality of the Thiès Forest
	Construction	Continued loss of plant species of conservation concern due to a reduction of individuals of keystone species, threatened and/or protected species, leading to loss of genetic diversity and gradual decline of sub-populations remaining
	Construction	Potential increase in Alien Invasive and indigenous invasive vegetation by providing a window of opportunity for its establishment in and around disturbed areas, and associated degradation of remaining natural and near-natural or modified habitats, and displacement of indigenous desirable species
	Construction and Operation	Possible degradation of adjacent or downstream sensitive and natural habitats due to indirect and induced impacts (water abstraction, pollution, changed surface hydrological flows), resulting in a decline of habitat extent and quality suitable for the persistence of a higher diversity of indigenous species and/or species of conservation concern, and loss of associated ecosystem services (grazing, seasonal open water)
Potential spills and contamination	Construction and Operation	Possible degradation of adjacent or downstream sensitive and natural habitats due to indirect and induced impacts by seepage of contaminants to such habitats, resulting in a decline of habitat quality suitable for the persistence of a higher diversity of indigenous species and/or species of conservation concern, and loss of associated ecosystem services (grazing, seasonal open water)

Movement of large machinery generating dust, as well as all other activities related to the quarry excavation	Construction and Operation	Deposition of dust on vegetation has a negative effect on stomatal functioning and general photosynthetic functioning, leading to a decline in plant vigor. In addition, deposition of fine dust particles on the soil surface may not only lead to a chemical and textural change of the soil surface, but significantly contributes to sealing (capping) of the soil surface (a phenomenon most pronounced in arid environments). This increases surface runoff, and significantly reduces rainfall infiltration and seed storage into the soil, hence potentially creating a zone of decreased vegetation persistence and loss of ecosystem functionality in areas with significant dust deposition.
Movement of heavy vehicles, potential spills	Construction and Operation	Potential reduced re-establishment of indigenous vegetation layer due to compaction and/or pollution of soils, which further reduces infiltration of precipitation into the soil (by compacted/sealed soils or hydrophobic layer creation from hydrocarbons) and promotes overall ecosystem degradation.
Abstraction of groundwater	Construction and Operation	Some of the larger trees may depend on the groundwater table, especially if such is shallower than 5 m. No data is currently available on historical and existing groundwater levels. Although there are pre-existing challenges with regard to access to water, the Project's abstraction of groundwater will highly unlikely create any significant change on the ground water table, but this will be monitored during the life of the Project.

11.1.1.2 Sensitive Receptors

The main sensitivity receptors and their importance are described in Table 11-2 below.

Table 11-2 Vegetation Sensitivity Receptors and their Importance

Receptors	Sensitivity/vulnerability/importance of the receptor
Classified Forest	Foret de Thiès is a classified forest, but management is left to the communities in the area (thus not actively managed by authorities as a reserve). Considering the extensive degradation of the forest habitats, it is not clear if any active management except resource utilisation and retention of baobab specimens is being implemented.
Thicket Vegetation	Provision of terrestrial habitat, provisioning by keystone species, provisioning of fruit, grazing, medicinal resources, wood and fibre Lower vegetation layer contributes to slowing of runoff and increased infiltration of rainfall
Potential Ephemeral Vegetation	Provision of terrestrial habitat, provisioning of grazing, herb layer contributes to slowing of runoff and increased infiltration of rainfall
Wetlands	Provision of habitat, regulating ecosystem service provision (e.g. attenuation of floods), water source, source of grazing for longer periods beyond the rainfall season
Drainage Lines and Riparian Vegetation	Provision of habitat, providing connectivity between water catchment and water accumulation areas, facilitating water infiltration, source of grazing, fruit and other resources for longer periods beyond the rainfall season

Large Indigenous Trees (*Adansonia digitata*)	Provision of niche-habitat, especially for Bird Species, including threatened species potentially frequenting the area as these trees are the tallest in the area and known to be preferred roosting locations; Provision of medicinal, food and fibre resources; Contributes to overall ecosystem resilience
Potential individuals of threatened and/or protected plant species	Maintenance of species diversity and species-specific genetic diversity
Dense stands of undesirable invasive indigenous woody shrubs and/or alien invasive trees	Long-term overutilisation of grazing and changes in rainfall events have led to the undesirable increase in unpalatable woody shrubs and/or alien invasive species, which further contribute to habitat degradation processes. Removal of such within the Project area to allow the indigenous herbaceous layer to regenerate will be beneficial to the ecosystem.
Protected Internationally Recognised Biodiversity Areas	▪ Provision of habitat and associated ecosystem services; ▪ Maintenance of species diversity; ▪ Facilitation of species migration and retention of important congregation/resting sites for such migrating species

11.1.1.3 Significance of Impact (Pre-mitigation)

Based on the analysis provided above, the impact on vegetation habitats will be ***Major Negative Impact*** pre-mitigation (refer to Table 11-3). The impact to Baobabs and protected tree species (collectively 'Large Trees') will be ***Major Negative Impact*** pre-mitigation (refer to Table 11-4).

Table 11-3 Impacts Rating Related to Impacts on Vegetation Habitats (Pre-Mitigation)

Type of Impact		
Direct and Indirect Negative Impact		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reasoning**
Extent	Local	The activities assessed are expected to be limited to the processing infrastructure, access/haul roads and mining footprint area, but may extend to especially the wetlands west of the above. Should there be shallow aquifers (less than 5 m), large trees may depend to some degree on this and may be affected if the water table permanently drops by more than 1 m due to increased abstraction by the Project.
Duration	Permanent	Modified habitats will take a long time to recover to their original state (if at all) despite rehabilitation efforts, due to modified surface runoff patterns, modified upper soil characteristics, slow growth rates of indigenous trees, compounded by an unpredictable rainfall regime and the aridity of the region, and may naturally revert to a lower stable state (e.g. ephemeral grassland) after rehabilitation, especially if subjected again to the current land use system after mining. Although riparian and wetland habitats may be more resilient as they are accustomed to seasonal fluctuations of moisture input. However, if the physical structure as well as seasonal moisture replenishment by surface runoff and sub-surface seepage is modified, natural persistence

		and/or regeneration will only be possible with human intervention, and full restoration (i.e. representing the former natural state and/or ecosystem functionality) will be slow.
Scale	Mining Footprint area and habitats in close proximity	Up to 331,83 ha of natural habitat are expected to be directly impacted and permanently modified by the development of the Project Footprint. *An additional 2 to 5 ha is anticipated to be modified for two-directional access and haul roads.*
Frequency	Continuous	This impact will manifest from the construction to post-mining phase. The longer rehabilitation efforts will be delayed, the longer regeneration will take.
Magnitude		
Medium Magnitude		
Sensitivity/Vulnerability/Importance of the Resource/Receptor		
High		
Although the Project Area is already heavily utilised and has been subject to large-scale degradation of natural habitats, remaining ecosystem functionality and associated services could be indirectly adversely impacted without suitable mitigation (see also Table 11-4).		
Significant Rating Before Mitigation		
Major Negative **Impact**		

Table 11-4 Impacts Rating Related to Impacts on Large Trees (Pre-Mitigation)

Type of Impact		
Direct and Indirect Negative Impact		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reasoning**
Extent	Regional	The activities assessed are expected to be limited to the processing infrastructure, access/haul roads and mining footprint area, but loss of such trees will indirectly negatively impact fauna and communities depending on the resources provided by such trees. Loss of the trees may further reduce overall species diversity due to loss of niche habitats. The ecosystem services and niche-habitats provided by such trees will also be lost and reduce the overall availability of such, and hence increase pressure on remaining trees, across the remainder of the Thiès Forest.
Duration	Permanent	Both above tree species are very slow growers, and regeneration is further limited due to an increasingly unpredictable rainfall regime and the aridity of the region. On average, Baobabs only start to flower and bear fruit from the age of about 20 years. Young trees are also more susceptible to die-off during prevailing droughts and other impacts such as over-harvesting of leaves – being more reachable to man and livestock due to the low height of saplings. Replacement of such trees may thus take longer than the anticipated 100 year's Life of Mine.
Scale	Mining Footprint area and habitats in close proximity	It is estimated that between 50 and 150 Baobab trees may be lost in all areas directly affected, but change of surface runoff may also impact some trees west of the pit, which may suffer a significant reduction of

		soil water replenishment. It is not known how many of the protected *Diospyros mespiliformis* trees may potentially be lost.
Frequency	Continuous	This impact will manifest from the construction to post-mining phase. The longer rehabilitation efforts will be delayed, the longer regeneration will take.
Magnitude		
Large **Magnitude**		
Sensitivity/Vulnerability/Importance of the Resource/Receptor		
High		
The Project area is situated within the classified Foret de Thiès. Despite the Project Area having been subjected to long-term degradation of natural habitats, keystone species such as Baobabs are harvested and their growth may be stunted by harvesting, but so far have been retained by communities. As these trees are extremely slow growing, the loss of every tree will contribute to overall further loss of resilience and species diversity, and loss of the extent of natural habitat and potential disruption of surface runoff regimes, will lead to continued degradation of the Thiès Forest and wider area.		
Significant Rating Before Mitigation		
Major Negative **Impact**		

11.1.1.4 Mitigation/Management Measures

Avoid and Minimise

- As part of the anticipated wet-season survey to be commissioned post this ESIA, conduct a pre-construction survey to geo-reference all Baobab as well as other protected species that will be directly impacted. Verify if potentially threatened plant species are within the Project footprint area and/or will be indirectly affected if near the footprint area, and determine if and where-to such can be relocated if present;
- The placement of the plant will aim to avoid run-on areas and minimise the need for transplanting Baobab trees, whilst also enabling at least 200 ha of forest to be retained and directly managed by CIMAF;
- The placement and design of the haul road between the plant and pit will be aimed to avoid disruption of surface runoff, and find a balance between avoiding riparian habitats and Baobab trees whilst at the same time keeping the route as short as possible;
- Loss of keystone species will be avoided by the timely removal and replanting (in areas with similar soil conditions) of Baobab trees, and incorporating such Baobab relocation into the annual reforestation program as required by the DEFCCS.

  - Vegetation clearance of the pit and stockpile areas will be done in a successional manner, preferably during the dry season prior to mining, to allow present species more time to provide ecosystem functionality, and allow indigenous fauna potentially present adequate time to relocate;

- Compile the first version of a Biodiversity Action Plan (BAP) plan that will cover the reforestation implementation and ecosystem conservation actions (as required by the DEFCCS) preferentially prior to the start of vegetation clearing and start of construction activities, considering how all areas within the mining concession that will not be directly and/or permanently be impacted, could be incorporated into an opportunity for No Net Loss or even Positive impact:

  - Placement of temporary infrastructure in areas densely encroached with *Senegalia* (formerly *Acacia*) *ataxacantha* and/or *Azadirachta indica* (but retaining Baobabs if present) will allow

clearing of such undesirable vegetation. Non-impacted or temporarily impacted areas can then possibly be fenced and actively managed. The aim of management would be to allow the herbaceous layer and desirable woody species to regenerate during the growing season, whilst providing access to communities during the end of the dry season (for grazing and harvesting *wood from undesirable* species), when natural resource levels are at their lowest (acting as emergency resource reserve) and so contribute to improving a sizeable portion of the ecosystem.

- As part of the reforestation program, the placement of relocated Baobabs and initial reforestation should take into consideration areas that will be most affected by dust – Baobab species are to be planted outside such dust-reception areas, but other species that are expected to reach a height of about 3-6 m should be planted as a dust screen.

- In line with IFC PS6 requirements, all species used for dust-screening and reforestation must be indigenous species (not alien species as suggested by DEFCCS).

- Clearly delineate where fire risks will be highest, and where fire-breaks need to be created and maintained. As part of the management plan, clearly describe how such firebreaks will be maintained, and ensure such do not interfere with natural surface runoff processes.

- Draft an initial progressive rehabilitation plan, based on the successive pit excavation plan, to be incorporated into the overall reforestation implementation and ecosystem conservation management plan. This should also incorporate use and placement of topsoil and potential overburden.

- Should it not be possible to draft a full BAP prior to construction, the Initial Biodiversity Management Plan as part of the ESMP must be fully implemented during construction, and a full BAP drafted within one year of start of operation.

- Minimise clearing of all indigenous trees with a bole of >20 cm diameter where such trees are outside the mining pit area;
- Avoid completely or maintain a buffer of preferably 500 m around edges of any potential ephemeral water bodies that do not fall within the infrastructure and pit area, and ensure no runoff from processing/mining infrastructure/pit area gets directly into any remaining potential ephemeral water bodies (without being cleaned);
- To avoid siltation of drainage lines and other surface water bodies, soil stockpiles should be located away from potential ephemeral water bodies and surrounded by silt traps; and
- To the furthest extent possible, the disturbance of the natural topography and catchment characteristics should be minimised (e.g. limit large-scale earthworks, vegetation removal, soil compaction etc.), so as to not alter the natural surface drainage flow of the landscape.

  - Due to the north-eastern extent of the pit being across an ephemeral drainage with riparian vegetation, it would be recommended to divert surface runoff to pass north or south of the pit, with adequate drainage structures that will distribute rather than concentrate runoff installed under the haul road. Over time, this will enable the re-establishment of a more resilient riparian vegetation along a more significant drainage north of the pit, whilst seasonal moisture replenishment of the wetlands west of the mining concession will not be intercepted and impact on wetlands thus avoided (also in line with DEFCCS requirements).

Reduce

- Woody vegetation cleared for construction or mining, especially where such vegetation does not consist of suitable fire-wood or regenerative material of alien plants, should be shredded, and such

material can be used for dust suppression around offices and staff facilities, and/or mulch in areas to be reforested;

- It is advisable that an alien invasive plant management program be drafted prior to start of the construction phase, to be implemented and updated during the operational phase;
- Areas where spillage of soil contaminants occurs must be excavated (to the depth of contamination) and suitably rehabilitated. If any other minor spillage occurs the spillage must be cleaned as soon as possible, but during the same (work-) shift, and the contaminated area must be reinstated. All contaminated material should be suitably treated and cleaned, preferably by bioremediation, or disposed of;
- All Project vehicles must be washed at designated wash bays on site. These wash bays need to be fully bunded and/or fitted with oil/grease and sediment traps for grey water – the latter being cleaned at a separator plant;
- All machinery and vehicles are to be maintained in an optimal condition to prevent or reduce hydrocarbon spills, as well as reducing emissions.
  - Workshops and fuel storage areas are to be fully bunded, with all runoff directed to a suitable separator plant to remove hydrocarbons and contaminants from water before discharge into the environment.
- Parking and operational areas must be regularly inspected for oil spills and covered with an impermeable or absorbent layer or grease pans (with the necessary storm water control) if oil and fuel spillages are highly likely to occur;
- No open fires may be lit for cooking or any other purposes, unless in specifically designated and secured areas;
- Delineate all permissible areas so that all movement of vehicles and heavy machinery can be restricted to such areas only, these being designated access roads, maintenance roads, turning points and parking areas. No off-road driving beyond designated areas may be allowed;
- Design and create berms and storm water management structures to prevent runoff from the mining areas during/after a periodic extreme rainfall events to enter directly into existing water bodies;
  - Similarly, ensure potential runoff into the pit from higher lying areas south and east of the pit is suitably diverted around the pit to the wetlands west of the mining concession
- Topsoils should ideally not be stored in heaps higher than 2 m, may never be compacted and the growth of natural vegetation on such piles during storage should be encouraged, as this continually builds up soil seed banks in such soil, which will be useful for the rehabilitation process;
  - Alien invasive plants, however, must be eradicated on an ongoing basis when germinating on any stockpiles or open areas within the mining footprint, and before being able to produce more regenerative material;
- Wheels of large machinery should be checked prior to entering topsoil storage sites and cleared of alien plant seed or any other alien plant material (especially of species with spiny or bur-like seeds) to reduce the introduction and spread of alien invasive plants. All such plant material removed must be incinerated;
- The following must be strictly prohibited:
  - Harvesting for own use, trade, purchase or transport of any threatened or protected wildlife/indigenous plant products from/with local communities or passing traders; and
  - Any unauthorised driving to areas not directly affected by the mine nor intended for driving.

- Efforts will be taken to minimise the footprint of short-duration activities and/or linear infrastructure during construction, operation and decommissioning phases of the mine. Efforts to minimise such footprints will include grouping all infrastructure to the same servitude and/or as close as possible to existing and planned long-term physical disturbances.

Rehabilitate

- Compile the first version of the reforestation implementation and ecosystem conservation management plan (as required by the DEFCCS), preferentially prior to the start of vegetation clearing and start of construction activities, at the latest within one year of operation as outlined under 'Avoid and Minimise' above.

  - Incorporate the above into the annual plans of restoration and conservation of forest ecosystems in a part of the Classified Forest of Thiès, in agreement with and required by DEFCCS

  - Ensure a rigorous monitoring program is in place (as part of the BAP) to record annual progress and achievements of the reforestation implementation and ecosystem conservation management plan, and enable CIMAF to quantify and unambiguously demonstrate (in non-monetary terms) their contribution to No Net Loss and/or positive impacts

- Mine Management will work with specialists to conduct vegetation monitoring surveys every 5 years, which will evaluate the rehabilitation and reforestation efforts as implemented and documented by CIMAF, and advise on additional actions that may be required to improve the rehabilitation-, reforestation and conservation work as deemed necessary;

- To aid a more rapid and early decommissioning of mined areas, pits should be backfilled as soon as possible, landscaped to surroundings and re-vegetated (but strictly without the alien invasive species that may have been present prior to mining);

  - Obtain a representative baseline of soil fertility and texture prior to clearing to aid rehabilitation of soils by being able to ameliorate soil conditions to resemble pre-mining conditions;

  - Prior to rehabilitation, landscaping of disturbed areas needs to be undertaken in a way that ensures sufficient surface roughness, but also blend in with natural runoff and drainage patterns, whilst still preventing the start of rill- or gully erosion (or worse); and

  - Rehabilitate and revegetate all areas that have been disturbed progressively during all phases of the mine, i.e. construction, operation and decommissioning. This will be according to a Rehabilitation Plan that needs to be compiled by a suitably qualified specialist and aligned to the Biodiversity Action Plan (BAP).

Monitor

- A Biodiversity Monitoring Plan will be part of the BAP, and implemented at the start of construction, and be revised and/or updated every 5 years until at least 5 years post mining.

11.1.1.5 Residual Impact (Post-mitigation)

Habitat loss or modification to a modified state will still occur as a residual impact on mined areas, but could be reduced with effective mitigation. Based on the estimated areas of loss, approximately 331,83 ha of natural habitat will be lost to the Project Footprint. Even with mitigation, mining will result in a permanent and irreversible modification of habitat. However, if the remainder of the mining concession can be actively managed to improve the ecological function and vegetation composition of those remaining natural habitats, in addition to rehabilitating an equal amount of forest as will be modified

(as per DEFCCS MoU), over the anticipated 100 years of operation, it could recreate a substantially improved and fully functional forest section to counter-act the magnitude of the negative impacts.

Based on the implementation of all the proposed mitigation measures – especially actively managing and rehabilitating remaining natural habitats, the significance of the impact on local vegetation is anticipated to be a "**Minor Negative Impact**" post mitigation per the assessment below.

Table 11-5 Impacts Rating Related to Impacts on Vegetation (Post-Mitigation)

Rating of Impacts		
Characteristic	**Designation**	**Summary of Reasoning**
Extent	Local	Disturbances will be reduced to the smallest footprint possible, with large trees retained where such are between mining infrastructure, or replanted to outside the footprint area as part of the reforestation program
Duration	Long term	Impacts will continue throughout construction and operations, and pending on post-project landuse, receptors may recover to a near-natural state within 25 years following completion of the rehabilitation phase. Facilitated by a 100-year window of active forest rehabilitation and management on the undisturbed mining concession, this area is anticipated to become a source-area for desirable species to facilitate further rehabilitation and maintain the overall functionality and resilience of the Foret de Thiès over the long term
Scale	Medium	This impact will be manifested within the Project Footprint, positive impacts will develop on the remainder of the mining concession area, possibly beyond
Frequency	Continuous	This impact will be manifested from construction to rehabilitation phase
Magnitude		
Medium		
Sensitivity/Vulnerability/Importance of the Resource/Receptor		
High		
Despite the modification of much of the Project Area during the Life of Mine, the parallel reforestation and progressive rehabilitation is aimed to gradually reverse much of the current degradation of at least the remaining Thiès Forest *within* the Mining Lease area. Communities will still have access to ecosystem services, although these will be controlled – grazing will only be allowed during the later dry season, whilst wood harvesting will be limited to undesirable 'encroacher' species, facilitating the re-establishment of more desirable species, e.g. palatable grasses.		
Significant Rating After Mitigation		
Minor Negative Impact		

11.1.2 Fauna

Limited indigenous fauna were identified within the EAAA. This is largely attributed the timing of the survey (dry season), but is most likely also a factor of the high anthropogenic presence/usage of the area.

The limited presence and low diversity of indigenous fauna observed in the Project Area would be affected by the development of the Project primarily through the loss of natural habitat and displacement

or disturbance by high noise and light-levels. The impacts of the proposed activities are described in the following sections.

Note that this section may have to be updated after the anticipated wet-season survey.

11.1.2.1 Proposed Project Activities

Table 11-6 below describes the construction and operation phase impacts on fauna and faunal habitats.

Table 11-6 Construction and Operation Phase Impacts on Fauna and Faunal Habitats

Project Activity	Phase	Impact
Construction of infrastructure	Construction	Direct destruction of natural habitats and displacement of fauna Potential reduced access of fauna to specific niche habitats or natural foraging grounds Potential severance of movement corridors for terrestrial fauna
Quarry development	Construction	Wildlife species living within the Project footprint, including sedentary species such as invertebrates, reptiles, burrowing rodents and amphibians, and mammals will be directly displaced or may even be lost from the area due to loss of trees and other vegetation or specific resources (e.g. nesting sites)
Construction of Powerlines	Construction and operation	Powerlines may lead to a loss of avifauna due to collision and/or electrocution – the latter also when roosting/nesting on pylons *Note: The powerline will be adjacent to (east of) the plant and connected directly to the existing powerline, so additional negative impacts by the powerline should be minimal*
Influx of workers	Construction and operation	Potential influx of people and higher accessibility of areas, may potentially increase reliance on surrounding natural areas for natural resources, and indirectly cause further displacement or loss of indigenous fauna (e.g. by illicit snaring) Potential attraction of scavenging species due to an increase of poorly managed organic waste may occur
Quarry and crusher	Operation	Noise caused by movement of earth moving machines and the plant, as well as high light levels (at night) may be a disturbing factor to fauna Potential loss of wildlife by falling into unprotected excavated areas *Note: With the placement of the plant and crusher as close as possible to the quarry, the generation of noise and emissions that are major disturbances to wildlife will be reduced to the lowest levels possible, as well as reducing the collision risk with terrestrial fauna by the operation of potentially longer haul roads should the plant be located further away.*
General operation	Operation	Possible degradation of adjacent or downstream sensitive and natural habitats due to indirect and induced impacts (water abstraction, pollution, changed surface hydrological flows), resulting in a decline of habitat quality and/or availability for indigenous fauna
	Operation	Direct destruction of natural habitats and displacement of fauna Potential reduced access of fauna to specific niche habitats or natural foraging grounds, potential severance of movement corridors for terrestrial fauna

	Operation	Potential complete or partial disruption and/or loss of functional wildlife corridors, habitat fragmentation and reduction of suitable habitat outside the mining footprint due to the edge effect
	Operation	Potential attraction of scavenging species due to an increase of poorly managed organic waste Potential attraction of fauna and increased collision risks in the case of permanent availability of surface water (e.g. if evaporation ponds are used) Potential attraction of high insects numbers to high light sources at night, with an associated increased attraction and risk of injury to avifauna being attracted by such insects
Dust creation, spills	Operation	Potential reduction and/or pollution of surface water resources available to wildlife
Traffic on the Project Area	Construction and Operation	Potential increased rate of collisions due to moving vehicles or moving machinery leading to death and injury of livestock and indigenous fauna, especially at night Disturbance of indigenous fauna due to noise levels of traffic *Note: With the placement of the plant and crusher as close as possible to the quarry, the above impacts on wildlife will be reduced to the lowest levels possible*
		Noise caused by movement of transport and general increased traffic to and from the site, may be a disturbing and/or disorientating factor to fauna, potentially leading to loss of specimens due to collisions at night. Limited traffic at the quarry will be limited at night.

11.1.2.2 Sensitive Receptors

The main fauna receptors and the sensitivity/vulnerability/importance of the receptor are listed in Table 11-7 below:

Table 11-7 Fauna Receptors and Sensitivity/Vulnerability/Importance of Receptor

Receptors	Sensitivity/vulnerability/importance of the receptor
Thicket vegetation	Provision of terrestrial habitat and associated resources such as forage, nesting sites and shelter
Potential Ephemeral Vegetation	Provision of terrestrial habitat and associated resources such as forage
Wetlands	Provision of habitat, and associated resources such as forage and water
Drainage Lines and Riparian vegetation	Provision of terrestrial habitat and associated resources such as forage, nesting sites, potential migration corridors and shelter
Large Indigenous Trees (*Adansonia digitata*)	Provision of habitat, especially for Red listed Bird Species as they are the tallest trees in the area and known to be preferred roosting location
Potential individuals of threatened fauna	Loss or displacement of fauna and biodiversity

Protected Internationally Recognised Biodiversity Areas	Habitat provision, biodiversity maintenance

Significance of Impacts on Fauna

Based on the analysis provided above, impacts on local fauna during the construction and operations phase will be "***Moderate Negative Impact***" pre-mitigation as per the assessment below.

Table 11-8 Impacts Rating Related to Impacts on Fauna (Pre-Mitigation)

Type of Impact		
Direct Negative Impact		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reasoning**
Extent	Regional	Although mining activities will be limited to the mining footprint area, the disruption of faunal movement corridors as well as displacement of fauna from ongoing disturbance factors will extend to the region
Duration	Long Term	Modified habitats will take a long term to recover to their original state despite rehabilitation efforts due to slow growth rates or trees, and faunal species may be permanently displaced due to the loss of suitable habitat or fragmentation thereof
Scale	Greater than the Prospecting Licence Area	The impacts may be felt by wildlife depending on the extent of cleared vegetation and modified landscapes, some of which may be outside the Project Footprint area
Frequency	Continuous	This impact will be manifested from the construction to post-mining phase.
Magnitude		
Medium		
Sensitivity/Vulnerability/Importance of the Resource/Receptor		
Medium		
Within the classified Foret de Thiès, which still provides some habitat and specific resources such as forage, shelter and high trees for nesting sites to fauna. The Project Area is heavily utilised by the local population, hence large-scale degradation of natural habitats has already occurred and the presence of forest habitat specialist species is assumed to be low. However, the potential diversity of fauna frequenting the area during more favourable seasons could not be determined, and above impact ratings are thus based on a precautionary approach. This is because small pockets of niche natural habitats and large indigenous trees that some faunal species depend on, and the connectivity between such habitats for fauna still exists, which may be further reduced and/or habitats isolated by the mining and processing activities.		
Significant Rating Before Mitigation		
Moderate Negative Impact		

11.1.2.3 Recommended Mitigation Measures

Avoid and Minimise

- Vegetation clearance will be done in a successional manner for each phase of construction and mining to allow fauna present time to relocate;

- Avoid electrocution of avifauna by electrical infrastructure by installing roosting deterrents on pylons and fitting powerlines with devices make such visible to all avifauna;
- Follow avoidance measures as listed in the Vegetation mitigation measures to retain and improve as much faunal habitat and - resources as possible, and prevent their further degradation (e.g. due to fire);
- Where possible, avoid or aim to maintain a buffer of preferably 50 m around edges of any drainage lines, and at least 100 m, preferably 200+ m, around ephemeral wetlands that do not fall within the quarry pit area (and west of the Project concession, and ensure no runoff from the quarry operations and infrastructure/operational area gets into such drainage lines or ephemeral wetlands without being cleaned;
- Avoid and/or minimise loss of fauna by:
  - either ensuring pass-under structures are installed where roads cross potential migration routes (e.g. along riparian vegetation), or ensure terrestrial fauna cannot access such routes
  - Maintaining strict speed limits on site at all times
  - Ensuring all excavations are adequately protected to prevent faunal access
  - Avoiding attraction of fauna by using only downward lighting and not creating any open water surfaces (regardless if contaminated water or not) within the active operational area
- Prior to the quarry operations, map and delineate all ephemeral drainages and wetlands during a wet season survey within the Project Area of Influence. Set up a monitoring protocol for all such ephemeral water bodies that may be directly or indirectly (latter by reduced fresh-water input) impacted by the mine, by creating a species baseline; and
- Investigate areas to be cleared just prior to earthworks starting for the presence of indigenous fauna, including burrowing fauna, to relocate such as needed by suitably qualified staff to avoid loss of wildlife.

Reduce

- No open fires may be lit for cooking or any other purposes, unless in specifically designated and secured areas;
- Speeding should not be allowed and signage should be installed to reduce accidental collision with animals. In the event of roadkill, the roadkill should be removed from the Project Area immediately and disposed of in a sanitary manner;
- Delineate all permissible areas so that all movement of vehicles and heavy machinery can be restricted to such areas, these being designated access roads, maintenance roads, turning points and parking areas. No off-road driving beyond designated areas may be allowed, and appropriate speed limits maintained in the quarry area;
- Reduce fragmentation of natural habitat by avoiding the blockage of or increased impact on sensitive habitats, and keeping riparian corridors open and functional, if need be increasing their functionality by widening the riparian woodlands and buffer of no-disturbance around them;
- Baobabs (*Adansonia digitata*) should be conserved as part of the overall Biodiversity Action Plan;
- The following must be strictly prohibited:
  - Purchase or transport of any bush-meat products from local communities or passing traders;
  - Any form of ensnarement of wildlife; and

- Any unauthorised driving to areas not directly affected by the mine nor intended for driving.

- Handling of snakes or wildlife that may become entrapped in quarry areas must be done by suitably qualified staff;
- Staff need to be made aware of and trained to recognise and report any snares to enable the immediate and safe removal thereof;
- Staff should also be made aware of and encouraged to report sightings of fauna to the mine environmental office for general monitoring and inclusion into the Biodiversity Action Plan, especially as faunal movement and presence will be highly dependent on the amount and timing of rainfall; and
- The disposal of waste must at all times be controlled, especially organic waste that could attract unwanted species such as rats but more importantly scavengers such as the red listed vulture species that potentially occur in the area.

Rehabilitate

- Follow the mitigation measures as recommended for vegetation, which will improve and/or retain faunal habitat

Monitor

- A Biodiversity Management Plan should be established and be revised every 5 years;
- A Vulture Monitoring Plan should be developed by a specialist; and
- Regularly conduct inspections of mine area peripheries to detect and remove any snares.

11.1.2.4 Residual Impact (Post-mitigation)

Habitat loss and faunal displacement will still occur as a residual impact but could be reduced with effective mitigation as discussed above.

After implementation of the proposed mitigation measures, the significance of the impact on local indigenous fauna will be a "***Minor Negative Impact***" as per the assessment below.

Table 11-9 Impacts Rating Related to Impacts on Fauna (Post-Mitigation)

Rating of Impacts		
Characteristic	**Designation**	**Summary of Reasoning**
Extent	Local	The likely impacts will be specific to the mine site and habitats proximal to the site, with attempts to retain as many of the larger indigenous trees as possible
Duration	Medium term	Impacts will continue for at least the Life of Mine, and pending on post-mine landuse, receptors may recover to a near-natural state within 20 years following completion of the rehabilitation phase. However, the impact duration and severity could be reduced by the establishment of a suitable biodiversity corridor to offer alternative routes for wildlife
Scale	Significantly smaller than the Prospecting Licence Area	This impact will be manifested within the quarry operations footprint, with most wildlife having alternative and/or retained habitats and movement corridors, hence less suffering due to lost or degraded habitats

Frequency	Ongoing	The impact impacts will be most significant during initial clearing and construction, but should be significantly less during operation, when risks remain mainly due to moving machinery and/or unforeseen circumstances
Magnitude		
Small		
Significant Rating After Mitigation		
Minor **Negative Impact**		

11.2 Ecosystem Services

11.2.1 Proposed Project Activities

The following table describes the various activities (during both construction and operation phase) that will potentially impact Ecosystem Services.

Table 11-10 Proposed Project Activities that Potentially Impact Ecosystem Services

Proposed Activity	Phase	Impact
General development of Project	Construction and operation	▪ From an ecological perspective, the Project will result in habitat degradation, -fragmentation and -loss ▪ The loss of regulatory services provided by this habitat would also result in increased dust, erosion, soil infertility and diminished water attenuation ▪ Likely to increase the strain on remaining areas of the Classified Forest as residents will be concentrating their activities on a smaller surface area. This has the potential to lead to environmental degradation and the potential exhaustion of some resources from within the Classified Forest
General development of Project	Construction and operation	▪ Acquisition and clearing of 331.83 ha of land within the Classified Forest, conversion of an existing 2.9 km pathway to a paved access road (extending from the RN2 to the Project site) extended by 500 m. ▪ Loss of access to this area and destruction of trees and plants within it. While this represents < 5% of the total area of the Classified Forest, access for residents of the Project's AoI to the areas of the Classified Forest to the north of the NR2 and to the south of the A1 has been impeded by the construction of industrial projects and public infrastructure (see Section 13 – Cumulative Impact Assessment). Most residents have limited access to transportation and are unable to reach more remote areas of the Classified Forest on foot.

Proposed Activity	Phase	Impact
		▪ Restrictions on access to remaining resources, as residents will have to circumvent the Project site to reach the other side. ▪ There would be a loss of socio-cultural services – removal of access to sacred Baobab Trees (*Adansonia digitata*)
Disturbance and clearing of natural vegetation	Construction	▪ Influx of invasive alien species
Influx of workers	Construction and operation	▪ Overexploitation of the existing resources may occur through
Accidental spills, increased traffic, operation of Project	Construction and operation	▪ Pollution of natural habitat that provides ecosystem services, negatively impacting biodiversity and the use by local populations.

11.2.2 Sensitive Receptors

The following table descries the sensitive receptors that will be impacted by the proposed activities described above.

Table 11-11 Sensitive Receptors Related to Ecosystem Services

Receptors	Sensitivity/vulnerability/importance of the receptor
Natural vegetation providing ***provisioning services***	Active grazing provision, dry fodder provision, provision of food (fruit harvested by locals), raw materials and fuel (wood and fibre), habitat provision for biodiversity Households in the Project's AoI rely on access to natural resources to meet some of their basic needs. Of the households included in the socio-economic survey, 98% reported using wood from the Classified Forest for cooking, 82% reported using wood from the Classified Forest for construction, 67% reported collecting fruit from the Classified Forest for consumption or sale, and 73% reported collection plants from the Classified Forest for household use. Restrictions on access to these resources is likely to force the women typically responsible for their collection to travel greater distances in order to find them, which can in turn create risks to and potential impacts on their health and safety.
Natural vegetation providing ***regulatory services***	Attenuation of dust, water attenuation during extreme rainfall events limiting erosion and soil infertility, pollination (important for natural vegetation and agricultural crops)
Natural vegetation providing ***socio-cultural services***	Value of natural vegetation for meditative, spiritual purposes, especially the Baobab Trees (*Adansonia digitata*)

Natural vegetation providing ***supporting services***	Biodiversity maintenance

11.2.3 Significance of Impact (Pre-mitigation)

Based on the analysis provided above, the impact from development of the Project on the ecosystem services will be a "***Moderate Negative Impact*"** pre-mitigation (refer to Table 11-12).

The development of the Project will result in a loss of natural areas of the Forest of Thiès and result in the local population, accustomed to using this resource suffering a decreased use of this area. They will be forced to use other areas or else seek financial gains to make up for this loss.

Table 11-12 Impacts Rating Related to Ecosystem Services (Pre-Mitigation)

Type of Impact		
Direct Negative Impact		
Rating of Impacts		
Characteristic	**Designation**	**Summary of Reasoning**
Extent	*Local*	The extent of the reduction of ecosystem services will be felt by those living in close proximity to the Project Area (all nine (9) communities, including six (6) villages and three hamlets, with an estimated total population of 9,275), using this area on a daily/weekly basis
Duration	*Permanent*	The duration of the impact will be long term as it will extend beyond operation. With rehabilitation the ecosystem services will hopefully be reinstated however this will take a number of years (for trees etc. to become mature enough)
Scale	*All communities*	Residents from all nine communities within the Project's AoI are expected to be affected (total estimated population of 9,275)
Frequency	*Continuous*	This impact will be manifested from construction to rehabilitation phase, although access for communities will cease as soon as the land is formally acquired and under the control of the Project
Magnitude		
Medium		
Sensitivity/Vulnerability/Importance of the Resource/Receptor		
High Sensitivity		
Despite this area being a small part of the greater Forest of Thiès, the local community will no longer be able to use this area for the ecosystem services it provides due to the development. Households in the Project's AoI depend on access to natural resources to meet their basic needs, women are typically responsible for collection of forest products		
Significant Rating Before Mitigation		
Moderate Impact		

11.2.4 Mitigation/Management Measures

Many of the measures described in the Biodiversity Report are repeated here. This is due to the fact that ecosystem services valued by humans are often underpinned by biodiversity.

Avoid and minimise

- Prior to the initiation of construction, the Project should consult with local stakeholders on any feasible measures that could be taken to mitigate impacts on their access to ecosystem services within the Classified Forest. These measures may include timing of construction activities in accordance with harvest periods for specific fruit or plants, the collection and delivery of all cut wood to communities within the AoI for equitable distribution, and/or strategic placement of perimeter fencing around the site to facilitate pedestrian access between facilities or around the site to the extent possible.

  Consultation with stakeholders on the above should be carried out in accordance with the policies, procedures and mechanisms defined in the Project's SEP. The SEP should establish simple procedures for documenting all consultation and any resulting commitments (for example in a commitments register) to ensure a consistent record of engagement is maintained throughout the life of the Project.

  Specific measures that will be taken to mitigate the impact on access to ecosystem services in the Classified Forest should be recorded in and monitored through the Project's ESMP.
- Prior to construction, the exact locality of sacred Baobab trees within the Project area, and the routes people take to them should be established and ways determined, with communities, on ensuring such trees are preserved, either throuigh avoidance or relocation.
- As the mining and infrastructure footprint does not occupy the whole Project Area, it is recommended that the community are still allowed access to these areas not being used by CIMAF. This would allow them to enjoy the use of the ecosystem services in these areas;
- Conserve Baobab Trees (*Adansonia digitata*) where possible. Protect and maintain the trees that do not fall in the infrastructure and quarry footprint through adequate fencing around tree trunk, descriptive signage and training of workers and subcontractors;
- Minimise Dust Pollution;
- Where possible, avoid completely or maintain a buffer of preferably 500 m around edges of any potential ephemeral water bodies that do not fall within the infrastructure and quarry area, and ensure no runoff from processing/mining infrastructure/area gets directly into any remaining potential ephemeral water bodies (without being cleaned);
- To avoid siltation of drainage lines and other surface water bodies, soil stockpiles should be located away from potential ephemeral water bodies and surrounded by silt traps;
- To the furthest extent possible, the disturbance of the natural topography and catchment characteristics should be minimised (e.g. limit large-scale earthworks, vegetation removal, soil compaction etc.), so as to not alter the natural surface drainage flow of the landscape;
- No recruitment will happen at the Project gate, which will reduce the number of people traveling between the N2 and the Project site; and
- No workers or contractors may harvest natural vegetation, wood, natural resources for personal use within the Project Area.

Reduce

- Areas where spillage of soil contaminants occurs, must be excavated (to the depth of contamination) and suitably rehabilitated. If any other minor spillage occurs the spillage must be cleaned as soon as possible, but within the same shift and the contaminated area must be reinstated. All contaminated material should be suitably treated and cleaned or disposed of;
- All Project vehicles must be washed at designated wash bays on site. These wash bays need to be fitted with oil/grease and sediment traps for grey water; and
- No open fires may be lit for cooking or any other purposes, unless in specifically designated and secured areas.

Management

- Management of areas within the Project Boundary to be accessible and used by the local population for the ecosystem services. This would mean that security needed to be effective In order to ensure that there was no movement of livestock or people into the development areas.
- Adequate fencing and signage would need to be installed. Furthermore it is recommended that checks of the fences is undertaken to ensure that efficacy and that no perimeter breaks occur; and
- Minimise dust generated by construction and cooperation vehicles through Dust Management Plan.
- The Project has prepared a Livelihood Restoration Plan (LRP) that will mitigate impacts on the local population's access to ecosystem services currently used as part of household livelihood strategies, namely grazing land, fodder and watering points for livestock and the collection and use or sale of forest products (wood, fruit and medicinal plants). Livelihood restoration measures have been designed to strengthen traditional livelihood activities while reducing household dependence on the use of natural resources from within the Classified Forest to the extent possible. They will include a Livestock Development Program (including construction of an agricultural store, water points, vaccination parks and campaigns, etc.) and a Women's Economic Development Program focused on diversifying the economic activities of women living in the AoI. Details on the mitigation of impacts on traditional livelihood activities are provided in Section 12.1.2.

11.2.5 Residual Impact (Post-mitigation)

Based on the implementation of the proposed mitigation measures, the significance of the impact to ecosystem services will be a "***Minor Negative Impact***" post mitigation (refer to Table 11-13).

Table 11-13 Residual Impacts Rating Related to Ecosystem Services (Post-Mitigation)

Rating of Impacts		
Characteristic	**Designation**	**Summary of Reasoning**
Extent	*Local*	Disturbance of the existing use of ecosystem services will be reduced to the smallest footprint possible, that of the mining and infrastructure footprint. Residents from the Project's AoI currently using resources within the Classified Forest will be directly affected
Duration	*Permanent*	Impacts will continue for at least the Life of Mine, and receptors may recover to a near-natural state within 20 years following completion of the rehabilitation phase. Ecosystem services will only be reinstated with rehabilitation. The Project's land acquisition will result in the destruction and permanent loss of access to natural resources

Scale	*All communities in the Project's AoI*	Residents from all nine communities within the Project's AoI are expected to be affected (total estimated population of 9 275)
Frequency	*Continuous*	This impact will be manifested from construction to possibly post rehabilitation phase
Magnitude		
Small		
Sensitivity/Vulnerability/Importance of the Resource/Receptor		
High		
Mitigation measures aim to decrease impacts on households that depend on access to natural resources		
Significant Rating After Mitigation		
Moderate Impact		

12. SOCIAL ENVIRONMENT IMPACT ASSESSMENT

The following chapter assess the potential positive and negative impacts associated with planned project activities, prior to the implementation of mitigation measure, on the socio-economic environment and its sensitive receptors as identified in the physical baseline. Mitigation and management measure are then proposed to apply the impact mitigation hierarchy as described in the IFC PS 1 by anticipating and avoiding impacts, or where avoidance is not possible, minimise. Where residual impacts remain, thus after mitigation, compensate or offset for risks and impacts will be considered.

12.1 Socio-economic

12.1.1 Traditional Livelihood Activities

A primary livelihood activity of residents in both Peulh and Serer communities in the Project's AoI is pastoralism. Livestock are reared and sold, and include cows, goats, and sheep.

In the Peulh communities of Nangane, Thiambokh Peulh, and Palal Peulh, pastoralism was reported as the primary livelihood activity of the majority (78%) of surveyed households. In these communities, men are responsible for herding while women collect and sell milk.

Herders reported grazing their livestock exclusively in the Classified Forest year-round. Herders also reported depending on one watering point located to the northeast of the SEN'EAU pumping station for their livestock – a former quarry that fills with water during the rainy season. Some herders also explained they pay for water from public taps for their livestock when needed.

Women from non-Peulh communities in the Project's AoI collect and sell fruit from trees in the Classified Forest as part of their livelihood activities. This activity is reportedly practiced year-round, in accordance with fruit harvest periods.

12.1.1.1 Proposed Project Activities

Construction of the Project will result in the acquisition and clearing of 331.83 ha of land within the Classified Forest, in addition to conversion of an existing 2.9 km pathway to a paved access road (extending from the RN2 to the Project site) and construction of an additional 500 m of road between the access road and the cement plant.

Acquisition of this land will result in the loss of this area as grazing land for herders, resulting in impacts on access to fodder year-round for livestock, as well as restrictions on herders' ability to access the watering point northeast of the SEN'EAU pumping station.

The Project's land acquisition will result in a loss of area from which women collect fruit for sale and restrictions on access to remaining fruit trees on either side of the Project site.

The Project's acquisition of land within the Classified Forest is also likely to increase the strain on remaining natural resources, as residents will be concentrating their activities within a smaller area. This has the potential to lead to increased environmental degradation of the Classified Forest over time.

12.1.1.2 Sensitive Receptors

Peulh communities in the Project's AoI report practicing herding to be their primary livelihood activity, generating revenue from the sale of livestock and milk. Community members report grazing their livestock exclusively in the Classified Forest year-round. Restrictions on their ability to practice this activity could therefore have significant impacts on their livelihoods and household wellbeing.

The Peulh communities in the Project's AoI – Nangane, Thiambokh Peulh, and Palal Peulh – appear to have largely abandoned their traditional nomadic habits, illustrated by the permanent structures built in

their villages. As a result, it may be possible for Peulh herders to find new sources of fodder by grazing their livestock outside of the Classified Forest but the distances they could travel would be limited if they are to maintain their current residences.

Availability of grazing land in the Classified Forest and in the Region of Thiès more generally has been increasingly limited by the installation of a growing number of industrial projects. Some residents from the communities located to the southwest of the Project site report having lost agricultural and grazing land as a result of the recent land acquisition for the AIBD and the A1 Highway.

The collection and sale of fruit from the Classified Forest is an important source of revenue for (non-Peulh) women from communities in the Project's AoI. Women in the Project's AoI typically have few opportunities to participate in the formal economy as a result of a myriad of socio-economic factors, including traditional gender roles, high levels of illiteracy and the inability to inherit land. Women's primary livelihood activity is small-scale commerce practiced in local markets or on the roadside; the collection of wild fruit provides a critical input to this revenue-generating activity.

The vulnerable status of both Peulh communities and women, in light of their marginalization from traditional leadership roles and decision-making bodies, also reduces their level of resiliency and ability to adapt to restrictions on their livelihood activities

12.1.2 Significance of Impact (Pre-mitigation)

The impact on traditional livelihood activities practiced within the Classified Forest will be a ***Major Negative Impact*** pre-mitigation. As presented in the table below, this is assessment is informed by the permanent duration of the impacts on highly sensitive stakeholder groups.

Table 12-1 Impacts Rating Related to Traditional Livelihood Activities (Pre-Mitigation)

Type of Impact		
Direct negative impact		
Rating of Impacts		
Characteristic	**Designation**	**Summary of Reasoning**
Extent	Local	Residents from the Project's AoI practicing livelihood activities within the Classified Forest will be directly affected
Duration	Permanent	The Project's land acquisition will result in a permanent loss of access to land and restrictions on access to remaining resources within the Classified Forest
Scale	AoI	It is expected that all Peulh communities within the AoI (36 households) and up to 75% of women from all non-Peulh communities within the AoI (966 households) will be affected,
Frequency	One-time	The Project will acquire all land required for construction of and access to the site at one time
Likelihood	N/A	This is a planned impact
Magnitude		
Large		
Sensitivity/Vulnerability/Importance of the Resource/Receptor		
High		

Peulh communities and women are marginalised groups with limited resiliency as a result of socio-economic conditions
Significant Rating Before Mitigation
Major

12.1.2.1 Mitigation/Management Measures

A Livelihood Restoration Plan (LRP) has been prepared by the Project in accordance with national regulations on land acquisition and the requirements of IFC PS5. This process included extensive consultation with affected communities and relevant government and civil society stakeholders to confirm the scope of displacement and inform the development of appropriate livelihood restoration measures to mitigate the impacts on access to communal resources.

The LRP aims to strengthen traditional livelihood activities before introducing new activities. Measures will address the Project's displacement impacts on herders and women, who will lose access to natural resources within the Classified Forest as a result of the Project. Livelihood restoration measures have been validated with government and community stakeholders and will include:

- A Livestock Development Program, involving:
  - Construction and operation of a store where agricultural products will be sold, including fodder and other products to support the health of livestock;
  - Construction of six (6) livestock watering points within the Project's AoI;
  - Rehabilitation of two existing vaccination parks and support for livestock vaccination and information campaigns; and
- A Women's Economic Development Program, focused on the diversification of economic activities of women living in the Project's AoI which will include:
  - An assessment of women's needs and interests in terms of alternative livelihood activities;
  - Provision of training and materials to undertake new small-scale economic activities;
  - Training sessions on financial management for small businesses; and
  - Monitoring missions and ongoing technical support by the NGO(s).

In addition to livelihood restoration measures, the Project has agreed to allow grazing of livestock within some of the fenced areas of the site in order to minimize displacement impacts during the initial Project stages. These provisions will depend on the ability of the Project to ensure human and livestock safety within the site.

Detailed implementation plans for the livelihood restoration programs will be developed in consultation with stakeholders and implemented by a qualified specialist with experience in land-based livelihood programs, pastoralist livelihoods, and gender. The LRP identifies local partners that will be involved to the extent possible in order to minimise the risk of creating a dependence on the Project for ongoing support. Implementation of the LRP will be monitored until it can be confirmed that reasonable steps have been taken to restore livelihoods of affected households to pre-Project levels.

At a high-level, implementation of the LRP will also be monitored as part of the Project's ESMP to keep information centralised and facilitate external reporting on environmental and social commitments.

12.1.2.2 Residual Impact (Post-mitigation)

Based on the implementation of the proposed mitigation measures, the significance of the impact to access to traditional livelihood activities will be a ***Minor Negative Impact*** post-mitigation, as per the table below. The rating is informed by the expected change in the sensitivity of the receptor that will result from successful implementation of the LRP.

Table 12-2 Impacts Rating Related to Traditional Livelihood Activities (Post-Mitigation)

Type of Impact		
Direct negative impact		
Rating of Impacts		
Characteristic	**Designation**	**Summary of Reasoning**
Extent	Local	Residents from the Project's AoI practicing livelihood activities within the Classified Forest will be directly affected
Duration	Permanent	The Project's land acquisition will result in a permanent loss of access to land and restrictions on access to remaining resources within the Classified Forest
Scale	AoI	It is expected that all Peulh communities within the AoI (36 households) and up to 75% of women from all non-Peulh communities within the AoI (966 households) will be affected
Frequency	One-time	The Project will acquire all land required for construction of and access to the site at one time, grazing will be allowed within some fenced areas to minimize displacement impacts during the initial stages of the Project
Likelihood	N/A	This is a planned impact
Magnitude		
Large		
Sensitivity/Vulnerability/Importance of the Resource/Receptor		
Low		
Displaced households will be able to adapt to changes in livelihood activities and maintain pre-impact livelihoods as a result of implementation of the LRP		
Significant Rating After Mitigation		
Minor		

12.1.3 Ecosystem Services

The Classified Forest of Thiès provides access to natural resources for surrounding residents who collect wood for fuel, fruit for household consumption, and medicinal plants for their own use. These activities are undertaken year-round in accordance with availability of the products. Collection of forest products is permitted under the national regulations governing use of the Classified Forest. Due to the strong overlap with ecological processes, this impact was evaluated under the Biological Environmental Impact (see Section 11.2 above)

12.1.4 Community Health and Safety

Nine communities are located within the Project's AoI, defined as a 5 km radius from the centre of the Project site. All but one community – the Peulh village of Nangane - is located to the northwest, west or southwest of the Project Area, at a distance of between 1.8 and 4.5 km from the outer perimeter of the proposed site of the ICP. The communities in the Project's AoI are peri-urban with limited infrastructure and access to public services. The nearest urban centres are the town of Pout (approximately 5 km northwest of the cement plant) and the City of Thiès (approximately 6 km northeast of the quarry).

Nangane is located 1 km northeast of the cement plant and 400 m southeast of the SEN'EAU pumping station and cultivated plots. Nangane is a Peulh community, though residents have abandoned their traditional nomadic lifestyle and built permanent structures. There is no infrastructure in place and residents of Nangane must travel to other villages to access public services.

The two cultivated plots within the Project's AoI are worked by 13 male labourers who reside on-site. Local women are sometimes hired as day labourers to assist with harvest.

The SEN'EAU pumping station is accessed from the RN2 by an existing road that is paved for the first 605 m but in a state of disrepair. At the SEN'EAU station the road turns to sand and continues south, passing 200 m west of the residences on the western edge of Nangane. The road gradually narrows; it is used primarily by cattle grazing in the Classified Forest.

12.1.4.1 Proposed Project Activities

Construction of the Project will require the acquisition and progressive clearing of 331.83 ha of land within the Classified Forest for construction of the Project.

The Project will utilise an existing access road that runs between the RN2 and the SEN'EAU pumping station. The road is currently used to access the facility, the two cultivated parcels that surround the pumping station, and the village of Nangane. The initial 605 m of the road running south from the N2 is paved but in poor condition and will require rehabilitation prior to use by the Project. The remainder of the road will have to be widened in order to reach the quarry, located approximately 2.3 km south of the SEN'EAU pumping station. The existing road roads approximately 200 m west of residential structures built on the western side of Nangane. A new 500 m road will have to be constructed to connect the access road (between the RN2 and the quarry) with the site of the cement plant. During operations, the access road is expected to be used regularly by both passenger cars and large transport trucks traveling between the RN2 and the Project site.

The Project is expected to create 800 jobs during construction and up to 250 jobs during operations. The Project has made a commitment to prioritizing local employment, though it is expected that development of the Project will attract job seekers from outside the Study Area.

12.1.4.2 Sensitive Receptors

The village of Nangane is located approximately 200 m from the access road that will be used to reach the Project site, 1 km northeast of the site of the cement plant, and 2 km north of the quarry. The community's primary livelihood activity is livestock herding and the sale of milk; they currently graze their cattle exclusively in the Classified Forest. Residents of Nangane and their livestock will be at particular risk of impacts of the Project as a result of traffic accidents during construction and operations, as well as potential real or perceived health impacts resulting from the generation of dust from the road or Project activities during operations.

Additional communities within the Project's AoI are located between 1.8 and 4.4 km to the northwest, west and southwest of the Project site, but residents enter the Classified Forest on foot to collect wood, fruit and medicinal plants.

The communities in the Project's AoI report a high level of land pressure due to increasing industrialization and limits on access to the Classified Forest (due to previous declassifications and allocation of land for other private sector projects). In some cases, residents report not being able to access land to build or expand their households, while others say agricultural land is being subdivided and sold as residential plots due to decreasing revenue from seasonal agriculture. While an influx of job seekers to these communities may generate some positive impacts through rental accommodation and the purchase of goods and services, the low levels of economic resiliency in these communities coupled with limited infrastructure, public services and land, suggests that communities in the Project's AoI do not have the absorptive capacity to benefit from in-migration over the long term.

The owners and residential workers of the cultivated plots surrounding the SEN'EAU pumping station may also experience impacts associated with increased traffic on the road that runs between the two fields, depending on the route selected by the Project (see Section 3.3). If the existing access road used by the SEN'EAU pumping station is selected, impacts would be particularly significant during construction of the Project, though it is understood their day-to-day activities would not be directly affected by work on the road. During Project operations, the road would continue to be used for access to the Project site, with small and large vehicles passing in close proximity to workers and crops.

12.1.4.3 Significance of Impact (Pre-mitigation)

The impact on community health and safety will be a ***Major Negative Impact*** pre-mitigation. As presented in the table below, this assessment is informed particularly by the scale, likelihood and magnitude of impacts and the sensitivity of the receptor.

Table 12-3 Impacts Rating Related to Community Health and Safety (Pre-Mitigation)

Type of Impact		
Direct negative impact		
Rating of Impacts		
Characteristic	**Designation**	**Summary of Reasoning**
Extent	Local	Residents of all communities in the Project's AoI could be directly affected
Duration	Long-term	Impacts will be most significant during construction, but will continue during operations
Scale	All communities in the Project's AoI	All nine communities within the Project's AoI could be affected
Frequency	Continuous	Impacts will be continuous during the construction and operations phases of the Project
Likelihood	Likely	In accordance with the nature of the activities in the construction and operations phases
Magnitude		
Large		
Sensitivity/Vulnerability/Importance of the Resource/Receptor		
High		

Households in the Project's AoI have limited infrastructure and access to public services, are not economically resilient, and currently use the Project site and surrounding areas to meet household needs
Significant Rating Before Mitigation
Major

12.1.4.4 Mitigation/Management Measures

Prior to the initiation of construction, the Project should consult with local stakeholders on any feasible measures that could be taken to mitigate impacts on community health and safety during the construction and operations phases of the Project. These measures may include coordinating rehabilitation work on the access road with the owners of the cultivated plots to minimise impacts on their workers and crops, launching an information campaign to raise awareness among residents of safety risks associated with the Project, and working with local authorities to promote the Project's local employment policy in order to reduce in-migration by job seekers. These measures will be taken in addition to those already planned by the Project to minimise impacts on community health and safety during operations, such as the erection of a perimeter fence around the Project site and dust control measures to minimise impacts on air quality.

On the basis of consultation with community stakeholders and collaboration with its own specialists and contractors, the Project should develop and implement the following:

- **Traffic Management Plan:** This plan has been prepared for construction activities and takes into account the full transportation corridor for delivery of materials to the Project site. The plan states clear policies to promote the health and safety of community members and other external stakeholders, and include mechanisms for monitoring and enforcement. See Annexure I.
- **Framework Local Content Plan (LCP):** This framework outlines the Project's commitment to increasing Project benefits for local residents by prioritizing local hiring and local procurement where possible. The plan states the Project's policies and procedures for hiring recruitment of skilled and unskilled workers, which should be developed with input from relevant external stakeholders to ensure it is locally appropriate. The plan also establishes the procedures that will be followed for the procurement of goods and services from local providers, including a clear definition of "local". The number and type of jobs to be created by the Project, as well as available information on supplier opportunities should be detailed in the plan and should be widely disseminated to ensure residents are aware of opportunities and to manage expectations. See Annexure K.
- **Influx Management Plan:** This plan will assist the Project in understanding and managing the impacts of project-induced in-migration. The plan will detail steps the Project can take to reduce the level of influx by migrants seeking jobs and other economic opportunities with the Project, and the negative impacts that the settlement of these migrants could have on communities in the AoI. The plan will align with the procedures set out in the Project's LCP and will utilise the mechanisms outlined in the SEP in order to involve local government and other relevant stakeholders in its implementation. See Annexure J.

Any future consultations with stakeholders on the above and any resulting agreements should be documented in accordance with the procedures set out in the Project's SEP (Annexure H).

Specific measures that will be taken to mitigate the impact on community health and safety should be recorded in and monitored through the Project's ESMP, in addition to any monitoring measures stipulated in the various management plans.

12.1.4.5 Residual Impact (Post-mitigation)

Based on the implementation of the proposed mitigation measures, the significance of the impact to community health and safety will be a ***Moderate Negative Impact*** post mitigation, as per the table below. The rating is informed by the expected change in magnitude and sensitivity of the receptor following the implementation of recommended mitigation measures informed by community consultation.

Table 12-4 Residual Impacts Rating Related to Community Health and Safety (Post-Mitigation)

Type of Impact		
Direct negative impact		
Rating of Impacts		
Characteristic	**Designation**	**Summary of Reasoning**
Extent	Local	Residents of all communities in the Project's AoI could be directly affected
Duration	Long-term	Impacts will be most significant during construction, but will continue during operations
Scale	All communities in the Project's AoI	All nine communities within the Project's AoI could be affected
Frequency	Regularly	Impacts will be continuous during the construction and operations phases of the Project
Likelihood	Possible	With effective management plans in place, it is possible there will be residual impacts
Magnitude		
Medium		
Sensitivity/Vulnerability/Importance of the Resource/Receptor		
Medium		
With effective management plans in place, communities in the Project's AoI will be better able to manage and adapt to any residual impacts		
Significant Rating After Mitigation		
Moderate		

12.1.5 Cultural Heritage

The Foret de Thiès is open to surrounding grazers who rely on this access for their lively hood and is an area where cultural beliefs are practiced. Within the forest, communities place importance on the Baobab tree for rituals, prayers and burials. Pastoralism is practised throughout the forest, with some semi-permanent settlements and numerous enclosures appearing scattered across the wider area.

Twenty-eight (28) potential cultural heritage features were identified by ERM within the study area. These features include structures and settlements that may be associated with agro- pastoralism. The settlements comprised small villages of circular dwellings and enclosures for livestock. The structures within the settlements may be historic or modern, but importantly may form part of a larger intangible heritage in the form of traditions associated with an agro-pastoral way of life.

One specific site with confirmed cultural significance was recorded in the Project's AoI. The site is composed of two baobab trees located to the southeast of the quarry; the first tree marks the entry point to the path followed to the second tree, which is used in rituals by members of the community of Soune Serer.

12.1.5.1 Proposed Project Activities

Construction of the Project will result in the acquisition and clearing of 331.83 ha of land within the Classified Forest, in addition to conversion of an existing 2.9 km pathway to a paved access road (extending from the RN2 to the Project site) and construction of an additional 500 m of road between the access road and the cement plant.

It is possible, though unlikely, that any sites or objects with archaeological cultural heritage value will be identified within the area to be cleared and utilised by the Project. However, Project activity impacts will directly impact some important cultural sites; there are also indirect impacts where public access to important cultural heritage sites could be restricted. During operation, there is the potential for the Project to permanently restrict public access to important cultural heritage sites. The activities, phases and potential impacts are described Table 12-5 below.

Table 12-5 Activities per Project Phase Potentially Impacting Cultural Heritage

Construction Phase	Operation Phase
Disturbance due to ground disturbance (earthworks): Construction activities have the potential to impact tangible cultural heritage resources such as archaeological sites, built heritage (i.e. historic or culturally significant buildings or structures) resources, and living heritage resources (i.e. shrines, cemeteries, religious/ritual sites, etc.). Potential impacts to cultural heritage resource include, but are not limited to the following: ▪ Ground disturbing activities associated with the Project Footprint are the most likely source of direct physical impacts to undiscovered archaeological sites, if present, ▪ Built heritage and living heritage resources are also susceptible to direct physical impacts if buildings, shrines, or other resources will be removed or damaged during road construction. Impacts could occur if resources are removed during construction or due to ancillary impacts from increased vibration and pollutants caused by increased vehicle traffic. ▪ Built and living heritage resources are also susceptible to indirect impacts through the introduction of intrusive visual or auditory elements to their physical environment or "setting". These resources are also susceptible to indirect impacts associated with noise and vibrations caused by increased vehichle traffic. These impacts could include increased noise, vibrations and/or exhaust and dust during construction and functioning of the Project ▪ The creation of construction restriction zones associated with the Project could also restrict user access to existing cultural heritage sites.	Restricted public access to important heritage sites, for example blocking traditional routeways which cross through the AoI that are used to access these sites.

▪ Restricted public access to important heritage sites, for example blocking traditional routeways which cross through the AoI that are used to access these sites.	

12.1.5.2 Sensitive Receptors

Serer is the dominant ethnic group in the Project's AoI and is well represented in both formal (elected) and informal (traditional) leadership structures. Any impacts on cultural heritage sites belonging to Serer communities could likely be effectively managed in collaboration with the Project.

The vulnerable status of Peulh communities in the Project's AoI suggests they would have less capacity to manage impacts on any cultural heritage sites belonging to their communities and would require assistance from the Project in this regard.

Tangible Cultural Heritage

Cultural heritage features within the Project footprint will be physically impacted by the development. Utilising the Cultural Heritage definitions set out in the IFC's PS8, cultural heritage features within the Project area have been categorised as 'Non-Replicable Cultural Heritage', and can be attributed a 'medium' sensitivity.

No evidence for additional buried archaeology was identified by the study, although there is a residual risk of such remains being present. While very little archaeological work has been undertaken in the area, the history of settlement and movement of communities in Senegal shows the potential for further archaeological sites to survive below the surface.

Intangible Cultural Heritage

Cultural heritage features within the 2 km study area and Project Area will not be physically impacted by the development, however public access to the classified forest for grazing, and seasonal movement, will be restricted through the construction of perimeter fencing around the footprint of the development. Utilising the cultural heritage definitions set out in the IFC's PS 8, Intangible cultural heritage features within the Project Area have been categorised as 'Non-Replicable Cultural Heritage', and can be attributed a 'high' sensitivity given the importance to the local communities.

12.1.6 Significance of Impact (Pre-mitigation)

Based on the analysis provided above, the impact from the construction phase (earthworks and other ground disturbance activities, and restricted public access) will be a ***Moderate, Negative Impact*** pre-mitigation for the tangible cultural heritage and a ***High, Negative Impact*** for the intangible cultural heritage. The impact from the operation phase (restricted public access for intangible cultural heritage) will be a ***High, Negative* Impact** pre-mitigation.

Table 12-6 Impacts Rating Related to Foret de Thiès Tangible Cultural Heritage (Pre-Mitigation)

Project Phase: Construction		
Direct Negative Impact		
Rating of Impacts		
Characteristic	**Designation**	**Summary of Reasoning**
Extent	Local (project area)	Impact limited to the Project Area

Duration	Permanent	Construction earthworks associated with the Project will permanently alter the landscape and remove any buried archaeology
Scale	Moderate	Construction activities disturbing traditional lands or burials / archaeology will cause significant distress to the associated communities
Frequency	Once-off	Construction activities will only occur once
Likelihood	Likely	Earthworks associated with the Project will directly impact the landscape and remove any buried archaeology
Magnitude		
Medium **Magnitude**		
Sensitivity/Vulnerability/Importance of the Resource/Receptor		
Medium **Sensitivity**		
Cultural Heritage features within the Project footprint will be physically impacted by the development. The history of settlement and movement of communities in Senegal shows the potential for further archaeological sites to survive below the surface.		
Significant Rating Before Mitigation		
Moderate Impact		

Table 12-7 Impacts Rating Related to Foret de Thiès Intangible Cultural Heritage (Pre-Mitigation)

Project Phase: Construction		
Direct Negative Impact		
Rating of Impacts		
Characteristic	**Designation**	**Summary of Reasoning**
Extent	Local (project area)	Impact limited to the Project Area
Duration	Temporary	Construction earthworks associated with the Project may impede traditional access routes to the Cultural Heritage sites.
Scale	High	Restricted access could cause significant distress to ancestral people undertaking ritual processions or following traditional routes to the sacred sites.
Frequency	Once-off	Lasts for the duration of the construction of the Plant
Likelihood	Likely	Construction works for the Plant will cause potential disruption to traditional routes to the sacred sites.
Magnitude		
Large		
Sensitivity/Vulnerability/Importance of the Resource/Receptor		
High **Sensitivity**		
The Foret de Thiès is open to surrounding grazers who rely on this access for their lively hood and is an area where cultural beliefs are practiced. Within the forest, communities place importance on the Baobab tree for		

rituals, prayers and burials. Pastoralism is practised throughout the forest, with some semi-permanent settlements and numerous enclosures appearing scattered across the wider area.
Significant Rating Before Mitigation
Major **Impact**

Table 12-8 Impacts Rating Related to Foret de Thiès Intangible Cultural Heritage (Pre-Mitigation)

Project Phase: Operation		
Direct Negative Impact		
Rating of Impacts		
Characteristic	**Designation**	**Summary of Reasoning**
Extent	Local (Project Area)	Impact limited to the Project Area
Duration	Permanent	Operation of the Project may impede traditional access routes to the CH sites. This would last the lifetime of the Project.
Scale	High	Restricted access could cause significant distress to ancestral people undertaking ritual processions or following traditional routes to the sacred sites.
Frequency	Recurring	Operation of the Project for its lifetime
Likelihood	Likely	Operation of Project design may restrict traditional access routes to the sacred sites
Magnitude		
Large		
Sensitivity/Vulnerability/Importance of the Resource/Receptor		
High Sensitivity		
The Foret de Thiès is open to surrounding grazers who rely on this access for their lively hood and is an area where cultural beliefs are practiced. Within the forest, communities place importance on the Baobab tree for rituals, prayers and burials. Pastoralism is practised throughout the forest, with some semi-permanent settlements and numerous enclosures appearing scattered across the wider area.		
Significant Rating Before Mitigation		
Major Impact		

12.1.6.1 Mitigation/Management Measures

The following mitigation measures are recommended during the construction phase:

- A Cultural Heritage Management Plan (CHMP) will be developed for the Project to ensure all cultural heritage issues are addressed and managed adequately. Items to be addressed in the plan include (but not limited to) regulator engagement, further field survey, access management, Community Grievance Mechanism, Grave Relocation Plan, Chance Finds Procedure, mitigation control and management of Intangible heritage through community engagement. The Chance Finds Procedure will be designed and implemented to manage any unexpected discovery of archaeological material in-line with national and international requirements and guidelines. The Grave Relocation Plan is to

be developed as part of the Chance Find Procedure and will be designed and implemented with the agreement of the local communities where relevant;

- Monitoring of the CHMP to maintain existing traditional public access routes to Foret de Thiès;
- Access arrangements will be made to the satisfaction of the local communities through a MoU, which will allow them to use the intangible heritage unrestricted, where relevant. This MoU should be in place before the commencement of site clearance and construction activities.

The following mitigation measures are recommended during the operation phase:

- Monitoring of a management plan to maintain existing traditional public access routes to Foret de Thiès.

12.1.6.2 Residual Impact (Post-mitigation)

Based on the implementation of the proposed mitigation measures, the significance of the impact to Foret de Thiès cultural heritage will be a ***Moderate, Negative Impact*** post mitigation for the tangible cultural heritage and a ***Negligible, Negative Impact*** for the intangible cultural heritage.

The impact from the operation phase (restricted public access for intangible cultural heritage) will be a ***Negligible, Negative Impact*** for the intangible cultural heritage post mitigation.

Table 12-9 Residual Impacts Rating Related to Foret de Thiès Tangible Cultural Heritage (Post-Mitigation)

Project Phase: Construction		
Direct Negative Impact		
Rating of Impacts		
Characteristic	**Designation**	**Summary of Reasoning**
Extent	Local (Project Area)	Impact limited to the Project Area
Duration	Permanent	Construction earthworks associated with Project will permanently alter the landscape and remove any buried archaeology
Scale	Moderate	Mitigation measures will not reduce the impact of construction.
Frequency	Once-off	Construction activities will only occur once
Likelihood	Likely	Earthworks associated with the the Project will directly impact the landscape and remove any buried archaeology
Magnitude		
Medium		
Sensitivity/Vulnerability/Importance of the Resource/Receptor		
Medium Sensitivity		
Cultural Heritage features within the Project Area will be physically impacted by the development. The history of settlement and movement of communities in Senegal shows the potential for further archaeological sites to survive below the surface.		
Significant Rating Post- Mitigation (Residual)		
Moderate Impact		

Table 12-10 Impacts Rating Related to Foret de Thiès Intangible Cultural Heritage (Post-Mitigation)

Project Phase: Construction		
Direct Negative Impact		
Rating of Impacts		
Characteristic	**Designation**	**Summary of Reasoning**
Extent	Local (Project Area)	Impact limited to the Project Area
Duration	n/a	Traditional access is maintained as before, and public processions and ceremonies along traditional access routes are maintained.
Scale	Low	Traditional access is maintained as before, and public processions and ceremonies along traditional access routes are maintained
Frequency	n/a	Access Management plan ensures the traditional access routes to the sacred sites are open and undisturbed.
Likelihood	Unlikely	Monitoring of Access Management plan will remove this potential impact
Magnitude		
Negligible		
Sensitivity/Vulnerability/Importance of the Resource/Receptor		
High Sensitivity		
The Foret de Thiès is open to surrounding grazers who rely on this access for their lively hood and is an area where cultural beliefs are practiced. Within the forest, communities place importance on the Baobab tree for rituals, prayers and burials. Pastoralism is practised throughout the forest, with some semi-permanent settlements and numerous enclosures appearing scattered across the wider area.		
Significant Rating Post- Mitigation		
Negligible Impact		

12.1.7 Access to Water

Water sources used by communities in the Project's AoI include public wells, public taps (fed by the national water agency, SEN'EAU), and a limited number of private water connections at residences or agricultural plots. 27% of the households surveyed reported having to go outside of their village to collect water for domestic use. Stakeholders also reported continuous issues in the water supply due to broken equipment, low water levels during the dry season, and periodic shut offs of the SEN'EAU water network.

Only one water point for livestock was reported in the Project's AoI – a former quarry located northeast of the SEN'EAU pumping station that fills during the rainy season. Otherwise, herders rely on public water taps to provide water to their livestock.

Residents in the AoI voiced significant concerns over access to water in the future, given the increasing number of industrial projects in the area that dig their own wells and contribute to lowering the water table. Project will require 30m^3/day and the total production capacity of the identified boreholes per study is 43,000m^3/day. The likely impact from project is this minimal. The quarry depth does not reach highest water table per the study, hence minimal chances groundwater intrusion.

12.1.7.1 Proposed Project Activities

Following a review of various alternatives, the Project has opted to drill a borehole within the 331.83 ha area it will acquire in order to secure its own water supply. The impact assessment on the water table and its quality has been included in Section 10.2, will have a direct negative impact on the hydrology in the project area if not managed.

12.1.7.2 Sensitive Receptors

Access to water is a common challenge across rural and peri-urban communities in Senegal. While the national water agency, SEN'EAU, continues to expand its piped water network, water is not provided for free (even at public taps) and the cost can be prohibitive for poor households.

Access to water was consistently raised by residents in the Project's AoI as a major concern – both in terms of their current access and potential impacts the Project could have on the water table.

Increasingly unpredictable rainfall levels in Senegal have contributed to reduced yields from seasonal agriculture, a traditional livelihood activity in the Project's AoI, as well as a reduction in water points for livestock. Herders report paying for water from public taps for their livestock when natural water points cannot be accessed or dry up. Access to water adds an additional layer of vulnerability to traditional livelihood activities in the Project Area.

12.1.7.3 Significance of Impact (Pre-mitigation)

The impact on access to water will be a ***Major Negative Impact*** pre-mitigation. As presented in the table below, this assessment is informed particularly by the duration, scale, frequency and likelihood of impacts.

Table 12-11 Impacts Rating Related to Access to Water (Pre-Mitigation)

Type of Impact		
Direct negative impact		
Rating of Impacts		
Characteristic	**Designation**	**Summary of Reasoning**
Extent	Local	All communities in the Project's AoI could be directly affected
Duration	Long-term	Impacts will be experienced during the construction and operations phases, until the end of the life of the Project
Scale	All communities in the Project's AoI	All nine (9) communities within the Project's AoI could be affected
Frequency	Continuous	Impacts will be continuous during the construction and operations phases of the Project
Likelihood	Likely	Although there are pre-existing challenges with regard to access to water, the Project's abstraction of groundwater will highly unlikely create any strain on the water table.
Magnitude		
Medium		
Sensitivity/Vulnerability/Importance of the Resource/Receptor		
High		

Households in the Project's AoI already report challenges in access to water via the limited public and private sources available, and have limited financial means to access alternate sources
Significant Rating Before Mitigation
Low

12.1.7.4 Mitigation/Management Measures

As part of the technical planning process for the drilling of its borehole, the Project should consider any feasible options to identify, minimise, and monitor the impact it will have on access to water by communities in the Project's AoI. At a minimum, this should include monthly monitoring of the Project's water usage.

As appropriate, these options should be shared with external stakeholders to raise awareness of the steps the Project has taken to manage this impact and to agree on any additional measures to be taken (potentially through a Social Investment Plan (SIP)) as well as reporting that will be expected or required going forward. These activities and any commitments made should be recorded in accordance with the mechanisms set out in the Project's SEP.

Specific measures that will be taken to mitigate the impact on access to water by communities in the AoI should be recorded in and monitored through the Project's ESMP.

12.1.7.5 Residual Impact (Post-Mitigation)

Based on the implementation of the proposed mitigation measures, the significance of the impact to access to water will still be a ***Moderate Negative Impact*** post mitigation, despite expected changes in likelihood and magnitude of residual impacts following the implementation of mitigation measures.

Table 12-12 Residual Impacts Rating Related to Access to Water (Post-Mitigation)

Type of Impact		
Direct negative impact		
Rating of Impacts		
Characteristic	**Designation**	**Summary of Reasoning**
Extent	Local	All communities in the Project's AoI could be directly affected
Duration	Long-term	Impacts could be experienced during the construction and operations phases, until the end of the life of the Project
Scale	All communities in the Project's AoI	All nine (9) communities within the Project's AoI could be affected
Frequency	Regularly	Impacts would be continuous during the construction and operations phases of the Project
Likelihood	Possible	Project activities may still impact access to water by communities in the AoI even with the successful implementation of measures to minimise those impacts
Magnitude		
Medium		
Sensitivity/Vulnerability/Importance of the Resource/Receptor		
High		

Households in the Project's AoI already report challenges in access to water via the limited public and private sources available, and have limited financial means to access alternate sources
Significant Rating After Mitigation
Moderate

12.2 Economic Development

There are nine communities located within the Project's AoI, all of which have limited infrastructure and report significant challenges in accessing public services. The communities traditionally practice seasonal agriculture and herding as primary livelihood activities, though these activities are becoming increasingly difficult in the face of industrialization and land pressure in the area. Households surveyed in the Project's AoI report high levels of poverty, illiteracy, and unemployment.

Residents of the AoI and government officials alike have high expectations for the direct and indirect contributions the Project will make to economic development in the area. Specifically, stakeholders noted the importance of job creation and support for community development projects. These expectations – and the attitude of some local residents towards the Project - are informed by previous experiences these communities have had with other private sector project proponents, many of which have led to disappointment and distrust on the part of many residents.

12.2.1 Proposed Project Activities

Construction of the Project will result in the acquisition and clearing of 331.83 ha of land within the Classified Forest, in addition to conversion of an existing 2.9 km pathway to a paved access road (extending from the RN2 to the Project site) and construction of an additional 500 m of road between the access road and the cement plant. Permission to use the land has been granted to the Project given that industrial activities are otherwise forbidden within the boundaries of the Classified Forest.

Employment opportunities include direct employment by the Project and indirect employment through the Project's suppliers and jobs associated with increased spending in the local economy. The Project is expected to create 800 jobs during the construction phase and up to 280 jobs during operations.

CIMAF will offer more than 700 hours of formalized training per year to help ensure continued learning opportunities and facilitate know-how and skills transfers among different plants within the CIMAF Group. All new employees of the Senegal company will go through an initial induction and skills training before starting their positions, which will allow these companies to hire local employees with no prior experience in the industry.

All staff will also have access to a wide range of training programs, covering more than 50 specialized and technical topics. For instance, most of the employees recruited during the construction phase and then sent on training to the Group's CIMAT plant in Morocco for several weeks before returning to work in the new plant. The Group's HR policy also encourages intra-group mobility and professional growth by offering continuous opportunities for training and rotation. Over the life of the Project, all the new employees for the greenfield operation in Senegal will be required to go through a formalized training program.

In addition to direct jobs, the Project is expected to support about 5,100 jobs in Senegal through indirect and induced effects in the value chain. Many of the indirect jobs involve individuals who will be engaged in mining, transportation, and other business services.

Employment opportunities – direct, indirect and induced - will result in increased income and spending in the economy, and additional benefits associated with developing and enhancing work skills and experience on a major project according to international standards.

In addition to direct employment, each Project phase will be associated with the purchase of equipment and goods and services necessary to support construction and operations. Although not all specialised goods will be able to be sourced in-country, the Project will endeavour to prioritise Senegalese companies to the fullest extent possible, which will add an additional benefit to the national economy.

Growth in household income derived from direct and indirect employment is likely to improve the lives and living conditions of those who are able to benefit from these opportunities. This is especially likely where individuals are able to leverage these benefits into new or long-term income generating opportunities.

Economic contributions such as employee wages, supplier contracts, and payments to the government from tax contributions and permitting fees are all expected to further increase Senegal's GDP.

12.2.2 Sensitive Receptors

The communities in the Project's AoI have high expectations for the Project in terms of the contribution it will make to local economic development. Specifically, residents are hopeful for opportunities for employment with the Project, particularly for youth who experience high levels of unemployment even following completion of secondary education.

Community members and leaders also shared numerous areas in which investments by the Project could have meaningful impacts for local residents, including contributions to basic services such as healthcare, education, and electricity.

12.2.3 Significance of Impact (Pre-management measures)

Based on the analysis provided above, the impact on economic development will be a ***Moderate Positive Impact*** pre-mitigation.

Table 12-13 Impacts Rating Related to Economic Development (Pre-Mitigation)

Type of Impact		
Direct positive impact		
Rating of Impacts		
Characteristic	**Designation**	**Summary of Reasoning**
Extent	Local / Regional	Residents from the Project's AoI will be directly affected, the broader region (specifically the Commune of Keur Moussa and the Region of Thiès) will benefit indirectly
Duration	Long-term	The Project's contributions to economic development will have long-term impacts for communities in the AoI and the broader region
Scale	All communities in the Project's AoI	All nine communities within the Project's AoI may be affected
Frequency	Continuous	The impacts will be experienced over the life of the Project
Likelihood	Likely	In accordance with the Project's CSR policy, commitment to sustainable development and commitment to local employment
Magnitude		
Medium		
Sensitivity/Vulnerability/Importance of the Resource/Receptor		
Medium		

Residents in the Project's AoI have high expectations for employment with and social investment by the Project, however communities have limited capacity and resources to take ownership over development investments
Significant Rating Before Mitigation
Moderate

12.2.4 Mitigation/Management Measures

In accordance with its corporate commitment to supporting sustainable development, the Project should prepare the following:

- **Framework Local Content Plan (LCP):** This framework should outline the Project's commitment to increasing Project benefits for local residents by prioritising local hiring and local procurement where possible. The Plan should include the Project's policies and procedures for recruitment of skilled and unskilled workers, which should be developed with input from relevant external stakeholders to ensure it is locally appropriate. The Plan should also establish the procedures that will be followed for the procurement of goods and services from local providers, including a clear definition of "local". The number and type of jobs to be created by the Project, as well as available information on supplier opportunities should be detailed in the Plan and widely disseminated in order to ensure residents are aware of opportunities and to manage expectations. Procedures to monitor and report on recruitment and procurement data over the life of the Project should also be detailed in the LCP.

  A Framework Local Content Plan has been included in Annexure K.

- **Framework Social Investment Plan (SIP)[1]:** A SIP sets the priorities, objectives, and criteria that will determine the level and type of contribution the Project will make to supporting community development. The plan should outline a clear procedure for the selection of initiatives to receive financial or in-kind support from the Project. These initiatives should align with local development priorities (such as access to water) and existing government plans where possible. Investments made by the Project should aim to build local capacity and ownership over the development process. Partners – both from government and civil society – should be sought where appropriate to avoid creating a dependence on the Project for ongoing support. The plan should be prepared in consultation with relevant external stakeholders, including representatives of marginalised and vulnerable groups. The process for selecting, monitoring and reporting on social investments made by the Project should be broadly disseminated to enable equal access among communities and groups, as well as to manage expectations and strengthen the Project's social license to operate.

  A Framework Social Investment Plan has been included in Annexure L.

Consultation on the above should be carried out and any resulting commitments recorded in accordance with the mechanisms set out in the Project's SEP (Annexure H).

Specific measures that will be taken to manage impacts on economic development should be recorded in and monitored through the Project's ESMP, in addition to any specific monitoring measures stipulated in the various management plans.

[1] Can also be called a Corporate Social Responsibility Plan or Community Development Plan, to be determined by CIMAF.

Table 12-14 Impacts Rating Related to Economic Development (Post-Mitigation)

Type of Impact		
Direct positive impact		
Rating of Impacts		
Characteristic	**Designation**	**Summary of Reasoning**
Extent	Local / Regional	Residents from the Project's AoI will be directly affected, the broader region (specifically the Commune of Keur Moussa and the Region of Thiès) will benefit indirectly
Duration	Long-term	The Project's contributions to economic development will have long-term impacts for communities in the AoI and the broader region
Scale	All communities in the Project's AoI	All nine communities within the Project's AoI may be affected
Frequency	Continuous	The impacts will be experienced over the life of the Project
Likelihood	Likely	In accordance with the Project's CSR policy, commitment to sustainable development and commitment to local employment
Magnitude		
Medium		
Sensitivity/Vulnerability/Importance of the Resource/Receptor		
Medium		
Residents in the Project's AoI have high expectations for employment with and social investment by the Project, however communities have limited capacity and resources to take ownership over development investments. Management measures will help local residents capture employment opportunities and promote broad-based, sustainable socio-economic development of the Project area.		
Significant Rating After Mitigation		
Moderate		

12.3 Traffic

The following section describes the proposed activities, sensitive receptors and impacts, which will result in traffic being generated.

12.3.1 Proposed Project Activities

The Project activities generating traffic would include the following:

12.3.1.1 Construction

- Employee transportation at the start and end of work shifts (08h00 and 18h00, respectively) would be provided by large coaches (50 seats each), small coaches (20 seats each) and private automobiles. During the 24-month construction period, CIMAF estimates that employees would require between 14 and 39 total vehicle roundtrips for each shift. During the month of maximum activity, employee transport would generate 39 vehicle round-trips (78 vehicle individual trip movements) per shift, consisting of 16 large coaches, 3 small coaches, and 20 automobiles. The

workers would be picked up from nearby villages (e.g., Pout, Thiès, etc.), and would be carried to the Project Site via the RN2.

- Delivery of equipment, supplies and components needed for construction; waste removal; and movement of vehicles used in construction from contractor yards to the site would generate heavy truck trips during a 12-month period, with the total number of daily deliveries generating between 10 and 70 round-trips (20 to 140 individual trip movements) per day during the peak month. This assessment assumes that most of these vehicle movements would be on weekdays and not during the morning or evening peak commuting times.

12.3.1.2 Operations

- Operations phase workers would be transported by bus or automobile. Typical operations would generate 15 vehicle round trips on the RN2 during morning and afternoon peak hours (30 individual trip movements per shift), consisting of two (2) large coaches and 13 automobiles.
- Inbound deliveries to the plant, as follows:

  - Petcoke deliveries: approximately 1,500 deliveries (3,000 individual trip movements) per month for two months (corresponding with petcoke deliveries by vessel), resulting in an average of 58 delivery round-trips (116 individual trip movements daily) during these two months, and no deliveries during the remaining 10 months.

  - Bauxite and gypsum delivery: Six (6) delivery round trips per day (12 individual trip movements).

  - Diesel fuel and other supplies, plus waste removal: One (1) truck round trip per day (Two individual trip movements).
- Outbound product trips, as detailed below, resulting in 200 trip movements per day, year-round:

  - Clinker: 50 dump truck roundtrips (100 individual trip movements).

  - Cement: Five (5) tanker truck roundtrips (10 individual trip movements).

  - Dry cement: 45 flatbed truck roundtrips (90 individual trip movements).
- Local traffic between the quarry and plant: 76 dump truck loads daily (152 individual trip movements). These movements would use roads that are accessible to local residents, primarily pedestrians.
- As described in Section 2.3, clinker from the Project would be distributed within Senegal, and would also be exported by truck to neighbouring countries, specifically Mali. These exports from the Project site would replace existing truck trips from the Port of Dakar, effectively removing trips that currently pass through Dakar. Removal of traffic from roads serving the Port of Dakar are discussed in Section 13.3.7.

12.3.2 Sensitive Receptors

Receptors for the Project's transportation-related impacts include users of and residents or business owners with property adjacent to the RN2, A2, and local roads. Receptor sensitivity is characterised as either Low, Medium, or High, based on the ability of these receptors to adapt to Project-related changes in road traffic volumes, transportation safety risk, and degradation of road infrastructure. Table 12-15 describes potential receptor sensitivity levels.

Table 12-15 Receptor Sensitivity to Transportation Impacts

Receptors	Sensitivity/vulnerability/importance of the receptor
Low	Receptors can easily adapt to Project traffic because they are accustomed to anticipated traffic volumes and heavy vehicle traffic, are comfortable sharing the road with Project-related vehicles, or are able to reach their destination using alternative routes not affected by Project traffic.
Medium	Somewhat frequent or regular users of the affected roads, and residents/business owners for properties impacted by Project traffic, but whose property is not adjacent to Project roads. These receptors can adapt to Project traffic with some difficulty, either because of lack of comfort with frequent heavy vehicle traffic or lack of alternative routes. These receptors may choose to delay or reschedule trips due to Project traffic.
High	Frequent, regular users of the affected roads and residents/business owners of properties adjacent to Project roads. These receptors would have great difficulty adapting to Project traffic, either because of lack of comfort with frequent heavy vehicle traffic, lack of alternative routes, or concerns about direct access to their property. These receptors may avoid travel altogether, or may find even limited travel on Project roads to be highly stressful.

12.3.3 Significance of Impact (Pre-mitigation)

Project construction and operation would result in three types of traffic-related impacts during construction, operations, and closure, as described below.

- Marginal increases in traffic congestion and delay, due to Project-related vehicle trips. These impacts would primarily occur along the RN2—the only road connecting the Project to the regional road network;
- Marginal increases in deterioration of public roads, due to Project-related vehicle trips, especially heavy vehicle trips. This deterioration is most likely to occur on the Project access road and the RN2, the roads that will carry the largest share of Project vehicles; and
- Increased transportation safety risks due to crashes involving Project vehicles on public roads. Settlements near the RN2 and access road will be more vulnerable to these impacts. Due to their size, weight, and limited manoeuvrability, trucks, buses, and other heavy vehicles are typically associated with higher likelihoods of crashes and other incidents..

12.3.4 Traffic Increases

Project construction and operation would increase traffic volumes on the Project access road and the RN2 near the Project access road. Table 12-16 summarises these impacts.

The 78 employee-commuting trip movements per peak hour would increase existing peak-hour traffic volumes by approximately 11 percent of the maximum estimated weekday peak hour volume of 740 vehicles per hour (three (3) times the maximum 20-minute weekday counts shown in Table 9-2). This analysis assumes that other construction-phase deliveries would be spread across the day, and thus would not meaningfully increase existing traffic volumes. During operations, the estimated 70 employee vehicle trips during the morning and evening commute would increase the background traffic level by about 10 percent.

Anticipated truck traffic would be highest during operations, with 212 trips daily during 10 months of the year, and 328 trips daily during the two (2) months of the year when petcoke deliveries occur. Assuming inbound and outbound truck trips are distributed over a 10-hour workday, this activity would equate to 21 to 33 truck trip movements per hour.

It should be noted that existing peak hour traffic volumes do not reflect congested conditions. The estimated peak hour volume of 740 vehicles per hour (three (3) times the maximum 20-minute counts) is approximately 12 vehicles per minute, which does not reflect congested conditions. Thus, while Project-related trips would represent a substantial percentage-increase over existing conditions, Project traffic volume alone would not lead to widespread, regular, congestion on the RN2 or other roads.

The Project traffic described above would contribute to delays at the intersection of the Project access road and RN2 during morning and evening peak hours, which coincide with the start and end of work shifts. Other periodic, short-term, localised delays could occur on the RN2 or other roads due to slow moving heavy vehicles, truck convoys, or occasional traffic incidents or road repairs.

Based on the analysis provided above, the Project would have a Minor Negative Impact on traffic operations pre-mitigation.

Table 12-16 Impacts Rating Related to Traffic Operations (Pre-Mitigation)

Type of Impact		
Direct Negative Impact		
Rating of Impacts		
Characteristic	**Designation**	**Summary of Reasoning**
Extent	Local	All Project traffic would use the Project access road and RN2. Beyond that point, Project traffic would disperse along the RN2 to local and regional roads (employees) or the A1, A2, and other major national roads (deliveries), at which point Project-related traffic volumes are unlikely to be discernible from the background traffic levels. As a result, the Project's primary effects on traffic operations would be localised, specifically near the intersection of the RN2 with the Project access road.
Duration	Short-term and long-term	Construction would result in short-term impacts on traffic volume and road congestion. Operations would result in long-term impacts.
Scale	Locally significant	Impacts on traffic operation would be most acute on RN2 at the Project access road, which could experience delays due to employee vehicles queuing to turn onto the access road during the morning commute, or during the evening commute as employee vehicles turn onto the RN2. Periodic, short-term delays and congestion could result from heavy vehicle movement or high volumes of deliveries. Traffic that leaves the RN2 would disperse over a wider road network, and Project-related traffic volumes are unlikely to be discernible from the background traffic levels.
Frequency	Continual	Traffic would occur daily during project construction and operation.
Likelihood	Possible	Crashes, breakdowns, or other unplanned events involving Project vehicles on the roads could lead to road closures or partial blockages that result in temporary traffic congestion and delays
Magnitude		

Small **Magnitude**
Sensitivity/Vulnerability/Importance of the Resource/Receptor
Medium **Sensitivity**
Residents and users of the RN2 and the access road would have medium sensitivity. These residents are accustomed to moderate traffic volumes, heavy vehicles, and traffic disturbances on RN2; however, alternative routes may be very limited or not available, making these residents more sensitive to road delays or closures.
Significant Rating Before Mitigation
Minor **Impact**

12.3.5 Infrastructure damage

Project-related heavy truck traffic would result in incrementally faster wear and deterioration of road surfaces. Table 12-17 summarises these impacts. The wear would be most prominent on RN2 and the Project access road. Deteriorated road surfaces can lead to delays, vehicle damage, increased risk of traffic incidents and stressful travel conditions. The applicant has committed to upgrading the Project access road, and has also committed to adhering to established per-axle weight limits for public roads (in contrast to the common practice by other operators of overloading heavy vehicles). Based on the analysis provided above, the Project would have a will be ***Negligible Negative Impact*** on road conditions, pre-mitigation.

Table 12-17 Impacts Rating Related to Transportation Infrastructure (Pre-Mitigation)

Type of Impact		
Direct Negative Impact		
Rating of Impacts		
Characteristic	**Designation**	**Summary of Reasoning**
Extent	Local	The greatest impacts would be on RN2 and the Project access road, which would be travelled by all Project-related traffic. Once out of the immediate Project Area, heavy vehicle traffic would be dispersed to numerous regional and national highways and Project traffic impacts would not be discernible.
Duration	Long-term	Road condition impacts would be observed over the long term, from Project construction through operations.
Scale	Locally significant	Incremental road degradation could occur on RN2 near the Project site, as well as the Project access road. Beyond this intersection, Project traffic would be dispersed over a broader road network. Degradation from Project construction traffic would be in addition to wear from existing traffic. Degradation from project operations may not be distinguishable from existing hauling of clinker between Dakar and points east.
Frequency	Continual	Heavy vehicle traffic would occur throughout Project construction and operation, resulting in continual deterioration of road surfaces.
Likelihood	Unlikely	Unplanned events are unlikely to change the Project's impact on road condition.
Magnitude		

Negligible **Magnitude**
Sensitivity/Vulnerability/Importance of the Resource/Receptor
Medium **Sensitivity**
Residents and users of the N2 and the access road would have medium sensitivity to road conditions on the RN2 and access road. These residents are accustomed to the current, fair to good condition of the RRN2 and the primarily unpaved access road. Alternative routes may be very limited or not available, making these residents more sensitive to road deterioration. Users of roads in the Dakar metropolitan area, Thiès, and other towns or settlements would have low sensitivity because they have greater access to alternative routes.
Significant Rating Before Mitigation
Negligible Impact

12.3.6 Accidents and risks associated with traffic

Table 12-18 summarises the Project's transportation safety impacts. The RN2 has sufficient width to safely carry heavy vehicles; however, transportation safety risks generally rise along with the increase in traffic volumes, and especially the increase in truck traffic volumes. This is particularly true where no pedestrian facilities exist, as is the case along the RN2 near the Project site, where pedestrians frequently walk along the road shoulders. As a result, Project-related traffic would lead to increased transportation safety risks. These risks could include property damage, injury, and in rare cases, death of pedestrians or vehicle occupants.

The Project access road is used to access market garden plots and water utility facilities. Users of these facilities are accustomed to very low traffic on the access road, and to its current, primarily unpaved condition. CIMAF intends to pave the road with a surface adequate for Project traffic. Current road users and persons who use the forest preserve for herding and foraging (and who may walk along the road) would experience substantially increased personal safety risks due to lack of familiarity with the road's use for Project traffic.

The Toll Roads (A1 and A2) are designed to safely carry high traffic volumes and heavy vehicles, and are not typically used by pedestrians. Moreover, to the degree that Project operations traffic would essentially replace existing truck traffic (see Section 13.6.7), the transportation risk on RN2 would be negligible.

Nonetheless, based primarily on the risk to pedestrians along the access road, the Project would have a ***Moderate Negative Impact*** on transportation safety, pre-mitigation (refer to Table 12-17).

Table 12-18 Impacts Rating Related to Transportation Safety (Pre-Mitigation)

Type of Impact		
Direct Negative Impact		
Rating of Impacts		
Characteristic	**Designation**	**Summary of Reasoning**
Extent	Local	The greatest impacts would be on the Project access road, which would be travelled by all Project-related traffic. Once out of the immediate Project Area, heavy vehicle traffic would be dispersed to numerous regional and national highways and Project traffic impacts would not be discernible.
Duration	Long-term	Road safety impacts would be continual during construction and operations. The gravest safety impacts would occur during

		construction, when local road users would be unfamiliar with Project traffic schedules and volumes.
Scale	Locally significant	Impacts on transportation safety would be potentially significant on the Project access road, where pedestrians would be exposed to heavy vehicle traffic.
Frequency	Continual	The increased vehicle traffic, in particular for heavy vehicles, would occur throughout Project construction and operation.
Likelihood	Possible	Unplanned events such as crashes would substantially increase the Project's impacts on transportation safety.
Magnitude		
Medium **Magnitude**		
Sensitivity/Vulnerability/Importance of the Resource/Receptor		
Medium **Sensitivity**		
Residents and users of the RN2 and the access road would have medium sensitivity transportation safety risks on the RN2 and access road. These residents are accustomed to the current, moderate levels of traffic on the RN2. Project traffic would represent an incremental increase in volume and a substantial increase in the heavy vehicle traffic. Users of the Project access road would have high sensitivity when the road use changes, but would become accustomed to the new traffic patterns on the road. Users of roads in the Dakar metropolitan area, Thiès, and other towns or settlements would have low sensitivity because they have greater access to alternative routes.		
Significant Rating Before Mitigation		
Moderate **Impact**		

12.3.6.1 Residual Impact (Post-Mitigation)

This section summarises the residual traffic and transportation impacts after implementation of the embedded controls and other recommended mitigation measures described in Table 12-18.

Implementation of the proposed mitigation measures would not change the significance of the Project's impacts on traffic operations, which would remain a ***Minor Impact*** post mitigation or road infrastructure degradation, which would remain a ***Negligible Impact*** post mitigation.

Based on the implementation of the proposed mitigation measures, the significance of the impact on transportation safety would be a ***Minor Impact*** post mitigation (refer to

Table 12-19).

Table 12-19 Residual Impacts Rating Related to Transportation Safety (Post-Mitigation)

Rating of Impacts		
Characteristic	**Designation**	**Summary of Reasoning**
Extent	Local	The greatest impacts would be on RN2 and the Project access road, which would be travelled by all Project-related traffic. Once out of the immediate Project Area, heavy vehicle traffic would be dispersed to numerous regional and national highways and Project traffic impacts would not be discernible.

Duration	Long-term	Road safety impacts would be continual during construction and operations. The gravest safety impacts would occur during construction, when local road users would be unfamiliar with Project traffic schedules and volumes.
Scale	Locally significant	The recommended study of haul routes prior to construction, if completed and improvements are implemented, would improve safety for heavy vehicles. Stakeholder education and relationships would be essential for local road users along RN2 and the Project access road, and the ongoing grievance mechanism would provide accountability for Project managers and drivers. Mitigations related to driver training and behaviour and vehicle condition would reduce risk for all road users, including drivers and pedestrians.
Frequency	Continual	The increased vehicle traffic, in particular for heavy vehicles would occur throughout Project construction and operation, and would result in a continued increase in travel risk on the Project access road and RN2.
Likelihood	Possible	Unplanned events such as crashes would substantially increase the Project's impacts on transportation safety.
Magnitude		
Medium		
Significant Rating After Mitigation		
Minor **Impact**		

13. CUMULATIVE IMPACT ASSESSMENT

13.1 Introduction

The IFC Performance Standard 1 (Paragraph 5) defines the broader Project area to include "… areas potentially impacted by cumulative impacts from further planned development of the Project, any existing project or condition, and other project-related developments that are realistically defined at the time the Social and Environmental Assessment is undertaken."

In addition, the IFC Performance Standard 1 (Paragraph 6) states that the *"… assessment will also consider potential trans-boundary effects, such as pollution of air, or use or pollution of international waterways, as well as global impacts, such as the emission of greenhouse gases."*

The present Cumulative Impact Assessment (CIA) follows the IFC's Good Practice Handbook - Cumulative Impact Assessment and Management: Guidance for Private Sector in Emerging Markets (IFC 2013). Its proposed preliminary approach is applicable to private sector project developers or financers in emerging markets, identifying the most significant cumulative impacts through a methodology known as rapid cumulative impact assessment.

This methodology focuses on environmental and social components rated as critical by the Affected Communities and the scientific community, which are cumulatively impacted by the project under evaluation, by other projects, and by natural environmental and social external drivers (IFC 2013).

Cumulative impacts occur when a Project activity acts together with other projects or third party activities to impact the same environmental or social resource or receptor. The IFC defines cumulative impacts as 'impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted'. Significant cumulative impacts can result from individually minor but collectively major actions taking place over a period of time. Cumulative impacts are contextual and encompass a broad spectrum of impacts at different spatial and temporal scales. In some cases, cumulative impacts occur because a series of projects of the same type are being developed; for example, when several hydroelectric projects are constructed or planned on the same river or within the same watershed.

Cumulative effects are often difficult to predict since they are the result of complex interactions between multiple projects or activities. This difficulty is compounded by the fact that details of future developments are largely unknown at this stage; in addition, whether or not a potential future development actually occurs is dependent on a number of factors that are unknown at the time of the assessment.

External pressure sources include socio-economic activities of the population (agriculture, fisheries, and ecotourism), environmental management, natural disaster (earthquake, flood, volcanic activity and drought) and climate change.

This Chapter considers the cumulative impacts that would result from the combination of the Project and other actual or proposed future developments in the broader Project Area.

13.2 Objectives of the CIA

The objective of this Cumulative IA is to assess cumulative impacts in the CIMAF Project Area and identify the contribution of other projects in its vicinity. The specific objectives are:

- Identify other existing and planned projects and external environmental and social drivers that could cumulatively impact Valued Environmental and Social Components (VECs) in the CIMAF Project Area.
- Identify the VECs that could be impacted cumulatively, considering the results of the stakeholder consultation process.

- Using the IFC methodology, assess the cumulative impacts on VECs, considering the other projects and external drivers in the area, and identify the contribution from other projects in the vicinity.

13.3 Scope of the Cumulative Assessment

For CIA to be a useful tool to decision-makers and stakeholders, it must be limited to effects that can be meaningfully evaluated, rather than explore infinite possibilities. Three important aspects that require consideration prior to the evaluation of cumulative impacts are listed below:

- Determining the appropriate spatial boundaries for evaluation;
- The identification of relevant, past, existing, and future activities for consideration; and
- Identifying the resources and/ or receptors at risk or likely to experience interactions with the Project.

13.4 Methodology

As noted above, the present Cumulative Impact Assessment follows the methodology established by the IFC's Good Practice Handbook - Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets (IFC 2013). The methodology is consistent with IFC Performance Standards (PS).

Unlike an ESIA, a CIA focuses on VECs as receptors of impacts from different projects and activities and not on a project as a generator of impacts on various environmental and social receptors. In addition, an ESIA estimates the significance of an impact using indicators to reflect incremental changes on a receptor (for example, loss of forest cover area). In a CIA, the indicators reflect the overall resulting condition of the receptor (for example, total forest cover) and its resulting viability.

This Cumulative IA was based on a desktop review of information provided by CIMAF, publicly available information and satellite imagery, in addition to information obtained during a site visit and key stakeholder interviews. Based on the IFC methodology, the assessment carried out by ERM was developed following the six steps for a rapid cumulative impact assessment (see **Figure *13-1***). The process is iterative and therefore steps, although sequential, were revised and adjusted in the process of information collection and analysis. The steps are described in detail below.

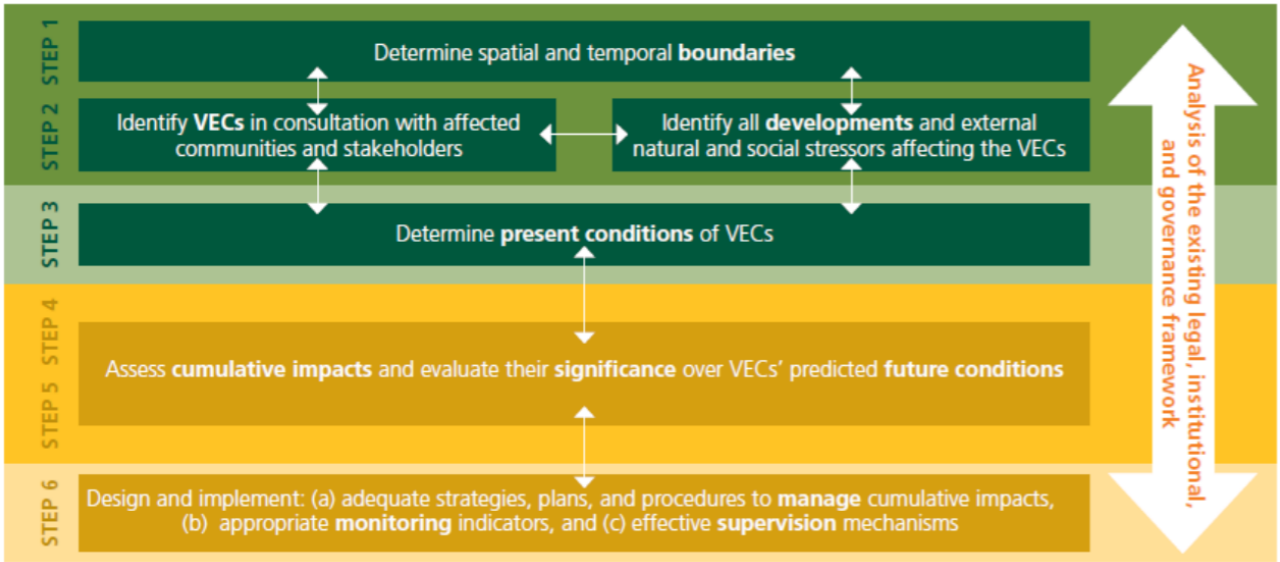


Figure 13-1 Rapid Cumulative Impact Assessment Methodology

13.4.1 Selection and Description of VECs

VECs are environmental and social components that reflect public concerns about social, cultural, economic, or aesthetic values, considered as the end receptors of cumulative impacts. A preliminary list of VECs was prepared based on the environmental and social receptors identified during the site visit and interviews. Based on the definition of VECs and the available information, components with the greatest importance or value were selected. The list of VECs identified covers environmental, social, and cultural components:

- Air Quality;
- Soils;
- Biodiversity;
- Ecosystem services;
- Traditional livelihood activities;
- Lowering of water table as a result of industrialization;
- Traffic; and
- Cultural heritage.

13.4.2 Limitations

IFC's rapid cumulative impact assessment methodology takes into consideration the limitations that a private developer or private sector financial institution may face carrying out this type of analysis, including: (i) limitations of the institutional capacity of the national and regional government; (ii) incomplete information about other projects and activities (for example, the information is not available in the public domain); (iii) uncertainty with respect to the implementation of future projects; (iv) lack of national or regional strategic plans or use of resources; (v) limited baseline information on VECs; and (vi) biased or incomplete stakeholder information due to lack of a formal census and/or household survey data.

13.5 The Development Context

A number of other developments surround the CIMAF ICP Project Area l that could potentially result in cumulative impacts include those shown on Figure 13-2. As previously described in the report, there is intense land pressure in the Project's AoI as a result of an increasing number of private sector projects with large land use footprints. The following are considered to be primary causes of cumulative impacts:

- **Regional Development:** The area between the cities of Dakar, Thies and Mbour has been targeted by the Government of Senegal for urban, commercial, and industrial development. This triangle is recognised as having rich natural resources ideal for mining, agriculture, and fishing activities. This area has become a hub for the extractive sector, with multiple quarries and cement factories in production and under development. The area has also seen the construction of the AIBD, the extension of the A1 Highway, and the development of the Diamniadio industrial zone, and further investments are planned in projects including a train line from Dakar to the AIBD, a Special Integrated Economic Zone, and the second university of Dakar. One objective of this development is to reduce urbanisation rates in Dakar and associated pressure on its strained infrastructure by encouraging more settlement in surrounding areas.

  In order to manage development in this area, the National Agency for Land Management (ANAT) prepared a Directive Scheme for Land Management and Development (SDADT) of the Dakar-Thies-Mbour triangle in 2015.[1] The SDADT recognises the area's challenges associated with land pressure, industrial risks, degradation of forests, unplanned settlements, and lack of infrastructure. It aims to, among other things, improve land use by equipping local communities with the necessary planning tools and by surveying and securing land reserves. In terms of economic development, the SDADT commits to strengthening the

[1] http://www.anat.sn/triangle-dtm/

agricultural value chain and protecting agricultural areas; creating modern farms to promote intensive herding; and promoting the knowledge economy by creating a hub of professional training in line with economic activities of the region.

The expansion of the AIBD provided for in the SDADT includes construction of logistics and training facilities, an international exposition hall, hotels, and leisure centres. It is expected this development will occur to the west of the Project site and in close proximity to numerous communities in the Project's Direct AoI, though no definitive plans have been made public. In addition, the construction of a paved road connecting the A1 Highway and the N2 road at Pout has been announced, which will lead to increased traffic in the area.

- **Multiple quarries and cement production facilities generating dust:** Existing projects within the Study Area include Senegal Phosphate (northeast of the Project site), Dangote Cement (north of the Project site), and Ciment du Sahel (south of the Project site). These projects currently generate air pollution, dust, traffic etc.
- **Land Pressure:** Within the Classified Forest specifically, multiple private sector projects have been allocated land by the Government through a process of declassification administered by the Directorate of Water and Forests. In 2013, the total area of the Classified Forest was 11,081.2 ha; at that time, 474.3 ha had been declassified.[1] Today, the total area of the CF is reported to be 8,700 ha, suggesting more than 2,300 ha has been declassified in the last eight years.
- Stakeholders report intense land pressure in the Study Area as a result of increasing industrialization and private sector development. Residents of communities in the Project's AoI report having experienced economic displacement as a result of land acquisition for the construction of the AIBD and the A1 Highway. This displacement is reported to have resulted in a loss of land for seasonal agriculture and grazing livestock. Residents also voiced frustration over the declassification of 300 ha of land from the Classified Forest of Thiès in order to allocate it to the households that were physically displaced by construction of the Airport; the resettled community then leased the land to Fruta Italia, which fenced off the area and is using it for cultivation of fruit trees.

[1] https://www.ansd.sn/ressources/ses/chapitres/8-ressources-forestieres-Thiès2013.pdf

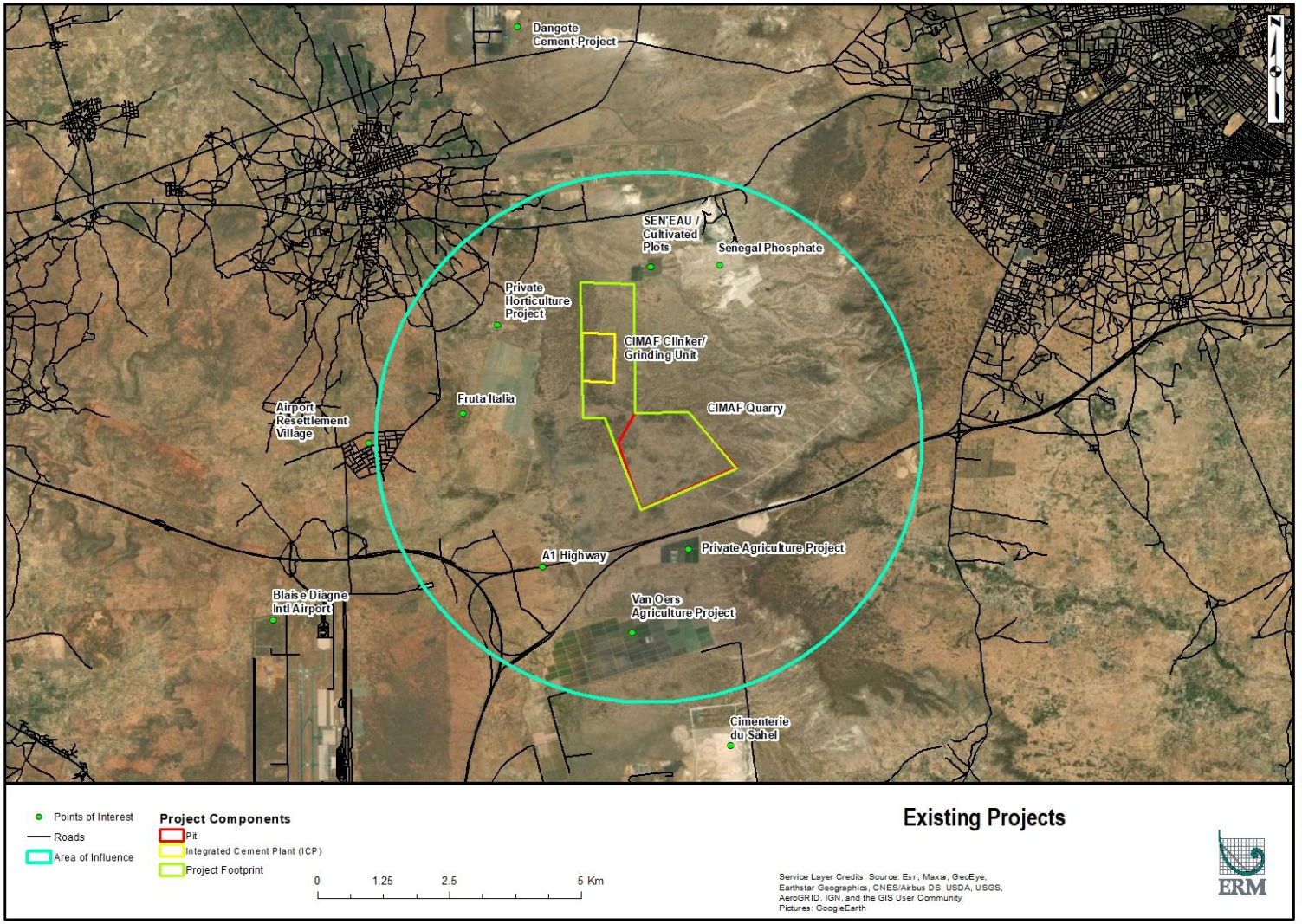


Figure 13-2 Project Location Relative to Other Developments in the Broader Study Area

13.6 Identified Cumulative Impacts

Preliminarily, ERM identified environmental and social recipients based on existing environmental and social studies. Then, we evaluated the input from the stakeholders interviewed. ERM carried out interviews with key stakeholder including government agencies, international organizations, local communities, local industries, cultural heritage sites, and project developers in order to identify importance and value of receptors. The stakeholders interviewed by ERM and Harmony Group are presented in Table 6-4; these interviews were conducted during the site visit of March 2021.

To be included in this Cumulative IA, an environmental and social component must first be demonstrated to be valued by some identifiable stakeholder group, be it the scientific community or any group of national, regional and local stakeholders. Second, the VEC must be reasonably expected to be affected by both the projects under evaluation (here, the ICP) and some combination of Other Projects and External Drivers. This second requirement is that the VEC should be expected to be affected by cumulative impacts; if the VEC is affect only by the CIMAF Project and not by Other Projects and/or External Drivers or vice-versa, it can be “scoped out” of the Cumulative IA.

The cumulative impact assessment describes impacts that would result from a combination of the Project and other actual developments in the broader Project Area include:

- Air Quality;
- Soils;
- Biodiversity;
- Ecosystem services;
- Traditional livelihood activities;
- Lowering of water table as a result of industrialization;
- Traffic; and
- Cultural heritage.

As discussed below, the Project will identify and monitor to the extent possible the activities of surrounding projects that may contribute to the real or perceived level of its own impacts. As outlined in the Project’s Stakeholder Engagement Plan (SEP), it will work with relevant government or community representatives to address emerging concerns related to social and environmental conditions in the Project Area, including those that may not be wholly attributable to its own activities but are influenced by developments and/or legacies in the broader Project Area.

13.6.1 Cumulative Impacts to Air Quality

The baseline monitoring undertaken represents the ambient concentrations of the receiving environment. Existing pollution sources are considered in the baseline monitoring. The modelling exercise predicts the contribution of the project on the receiving environment.

The cumulative impact is represented by the modelling and current baseline as no other developments in the vicinity of the site have been planned. Information on process changes to existing pollution sources that may affect the current baseline is not available.

13.6.2 Cumulative Impacts to Soils

With the increased number of developments in the Broader Project Area, there will be an increased negative impact on soil as topsoil is cleared and lost through ineffective management, erosion and runoff sedimentation.

13.6.2.1 Soils Management Considerations

The management considerations described in Section 10.1.4 would generally address the Project's contribution to cumulative impacts.

13.6.3 Cumulative Impacts to Biodiversity

Increased loss of natural areas which results in reduction in natural habitat

Cumulative loss of habitat within the greater area will result in loss of biodiversity. This is due to reduction of ecosystems and vegetation types. There is also potential for a loss in species richness. Distribution ranges could potentially be negatively affected, increasing the risk of local and regional population changes thereby posing threats to species conservation. .

Increased air pollution that would affect greater areas of natural vegetation

Cumulative impacts of air and dust pollution due to the multiple quarry and processing operations in the area will have a negative impact on vegetation. This will directly affect both biodiversity and ecosystem service provision.

Potential increased possibility of groundwater or surface water pollution to greater area which would affect biodiversity

Water resources affected by potential pollution at various projects within the region will potentially have a cumulative impact on the biodiversity linked to these freshwater systems. Especially as the region is regarded as water stressed.

Increased traffic that would impact fauna species with higher possibility of accidental collision

Increased traffic as a result of movement between the various projects would result in higher possibility of incidence of collisions between moving vehicles and fauna species.

13.6.3.2 Biodiversity Management Considerations

The management considerations described in Section 11.1.2 would generally address the Project's contribution to cumulative impacts. Management of cumulative impacts should include:

- Protection and conservation of areas within the Project Area that are not being developed;
- Dust management measures incorporated in Air Quality Report to be implemented to reduce the cumulative impacts felt by this on the greater area;
- Effective management of accidental spills and other sources of pollution that might affect groundwater and surface water in region; and
- Effective Traffic Management and enforcement of speeding limits.

13.6.4 Cumulative Impacts to Ecosystem Services

Cumulative impacts to ecosystem services will occur due to the decrease in the area of the Thiès. The natural areas are being reduced and resultantly there is increasingly limited forest available for locals to benefit from the use of ecosystem services. Similarly, the maintenance of ecosystem services in the greater area will be cumulatively negatively affected.

13.6.4.1 Ecosystem Services Management Considerations

The management considerations described in Section 12.1.4.4 would generally address the Project's contribution to cumulative impacts. As described in Section 12.1.4.4 it is recommended that access to the areas within the Project boundary that are not being used for the Project should be allowed.

This would allow them to benefit from the ecosystem services in these areas. Management would require effective signage, fencing and management will be required to ensure safety.

13.6.5 Cumulative Impacts to Traditional Livelihood Activities

Stakeholders report intense land pressure in the Study Area as a result of increasing industrialization and private sector development. Residents of communities in the Project's AoI report having experienced economic displacement as a result of land acquisition for the construction of the AIBD and the A1 Highway. This displacement is reported to have resulted in a loss of land for seasonal agriculture and grazing livestock. Residents also voiced frustration over the declassification of 300 ha of land from the Classified Forest of Thiès in order to allocate it to the households that were physically displaced by construction of the Airport; the resettled community then leased the land to Fruta Italia, which fenced off the area and is using it for cultivation of fruit trees. The Project's utilization of more than 300 ha within the Classified Forest has the potential to contribute to existing frustration among residents, in addition to the displacement impacts that will result from restrictions on access to land and resources.

In accordance with the SDADT, continued public and private sector investment in agricultural, commercial, and industrial development is expected in the Dakar-Thiès-Mbour triangle. New projects will require acquisition of land with some level of unavoidable impacts on natural resources. While no new projects have been publicly announced for development within the AoI, expansion of existing agricultural projects to the southeast of the AoI is expected in the near term (less than 5 years). This will contribute further to reported challenges of land scarcity in the area and further reduce the availability of land for the practice of traditional livelihood activities by local residents, namely agriculture and herding. Construction and development of additional projects is also expected to increase the strain on public infrastructure (e.g., roads, electricity, water, etc.) and generate risks to human and livestock health as a result of increased traffic (e.g., dust, speeding, accidents, etc.). While the Project is not directly responsible for these impacts, it must consider cumulative impacts in the design of its own management plans and be mindful of the broader development context when engaging with local stakeholders.

13.6.5.1 Traditional Livelihood Management Considerations

The management considerations described in Section 16.3 would generally address the Project's contribution to cumulative impacts on traditional livelihood activities. Management of cumulative impacts include:

- Ensure baseline data on air quality, traffic, and water access are collected prior to the start of construction in order to accurately monitor and report on the Project's impacts;
- Develop a Livelihood Restoration Plan in accordance with national regulations on land acquisition and the requirements of IFC PS5 and in consideration of the broader development context of the AoI (currently underway);
- Design livelihood restoration measures that are not dependent on access to land or other natural resources in order to minimize risks to the viability and sustainability of economic activities;
- Involve affected communities and relevant government and civil society stakeholders in development of appropriate livelihood restoration measures to mitigate the impacts on access to communal resources, through mechanisms outlined in the SEP;
- Monitor implementation of LRP as part of the Project's ESMP;
- As per the SEP, carry out a program of continuous engagement with stakeholders and actively promote and manage the Project's grievance mechanism in order to build strong and constructive relationships with communities in the AoI;
- Maintain a high level of awareness of the construction or expansion of projects in the Dakar- Thiès -Mbour triangle that could contribute to impacts on traditional livelihoods by communities in the AoI

and where possible, engage with project developers to understand their approach to the management of associated impacts.

13.6.6 Cumulative Impacts of the Lowering of Water Table as a Result of Industrialization

Stakeholders report that access to water from existing community wells has become increasingly challenging as a result of the number of industrial projects in the surrounding area that have dug wells and boreholes for commercial use. Local residents claim the water table has been negatively affected and their wells often run dry as a result. The Project's decision to drill its own borehole is likely to be perceived by affected communities as an additional burden on local water supply.

13.6.6.1 Ground and Surface Water Contamination Considerations

Management of potential surface and groundwater contamination due to above ground Project activities can be addressed by the application of the mitigation and management measure proposed in Section 16.1.3.

13.6.7 Cumulative Impacts to Traffic

Development of, or continued or increased activity at the cumulative projects would generally lead to increased vehicle traffic on public roads used by Project vehicles, particularly the RN2. This includes, among other projects, the Senegal Phosphate Project, which also uses the RN2 for its primary access. Completion and increased use of the A1 and A2 auto routes could draw traffic away from the RN2, thus reducing traffic volume, congestion, and delay.

Continued or increased traffic on the RN2 could lead to both increased degradation of the road infrastructure, as well as increased transportation safety risks. This is particularly true of industrial projects that generate substantial truck traffic such as the Senegal Phosphate Project.

As discussed in Section 2.4, Project activities are intended to replace existing clinker imports to the Port of Dakar, and related truck trips between the port and surrounding nations, specifically Mali. Project operations traffic would, to a large degree, replace existing trips along the RN2 between the Project site and the Mali border. As a result, Project operations would result in negligible changes in traffic volumes and congestion, road infrastructure degradation, and transportation safety risk on the RN2 and other major roads. Moreover, Project operations would reduce these impacts on the RN2 and other major roads west of the Project site.

13.6.7.1 Traffic Management Considerations

The management considerations described in Section 12.3 would generally address the Project's contribution to cumulative impacts, along with its direct impacts. In particular, the TMP would ensure that Project-related transportation activities adhere to international best practice for transportation safety.

13.6.8 Cumulative Impacts to Cultural Heritage

Removal of Tangible Cultural Heritage

Complete or partial removal of tangible cultural heritage sites and the significant change of their setting will have a cumulative impact to the cultural heritage of the Foret de Thiès.

Impede Traditional Access Routes across the Foret de Thiès

The collective developments within the Foret de Thiès will cumulatively restrict traditional access routes to cultural heritage sites. Restriction of available land across the Foret de Thiès: The collective developments within the Foret de Thiès will cumulatively restrict or squeeze traditional lands associated

with traditional agro-pastoralism and the transhumance corridor from west to North Senegal. Management Considerations

The continued development within the Foret de Thiès will have a cumulative impact on the tangible cultural heritage. There will be complete or partial removal of cultural heritage assets and significant change of the setting. Traditional lands associated with traditional agro-pastoralism and the transhumance corridor will be restricted or squeezed from west to North Senegal across the Foret de Thiès.

13.6.8.1 Cultural Heritage Management Considerations

The CHMP should take into consideration the wider area and include existing impacts from the surrounding projects. Through the measures to be included within the CHMP, cumulative impacts can be mitigated.

The CHMP will need to address the continued contraction of traditional lands across the wider area and take access routes into account in the formation of measures to address this concern.

14. STAKEHOLDER ENGAGEMENT PLAN

A Stakeholder Engagement Plan (SEP) will define a strategy for engagement that will present suggested phasing of engagement with affected stakeholders throughout the Project planning, construction, operation and decommissioning phases. Strategy development will build on the preparation and mapping of stakeholders that was undertaken as part of the ESIA process, as well as insights from the Client team.

Please refer to Annexure H for the SEP.

15. ENVIRONMENTAL AND SOCIAL MANAGEMENT SYSTEM STRUCTURE

This Supplementary ESIA has identified potential impacts (both positive and negative) to the physical, bio-physical and socio-economic environments. In order to avoid, minimise and reduce negative impacts, and to ensure opportunities for the enhancement of positive impacts are realised, Environmental and Social Management and Monitoring Plans (ESMMP) have been prepared, and are listed and described in Section 16. The Management Plans described in Section 16 include:

- Air Quality Management
- Soil Management
- Water Management
- Biodiversity Management
- Management of Socio-Economic Impacts
- Traffic and Transport Management
- Waste Management
- Blasting Management

The above plans may be combined or included in an overall environmental plan as appropriate to streamline the execution of the Project. Each management plan listed above provides the following:

- The objectives and purpose of the plan;
- Applicable phases of the Project when the Management Plan is required;
- The Project related activity resulting in the impact, requiring the elaboration of each Plan;
- An overview of the responsibility for the implementation of each Plan;
- A summary of the Performance criteria to which the Plan must aim to comply (which included Kenyan legal requirements, the IFC performance standards, or applicable good practice), that is relevant to each Plan;
- Mitigation measures (actions) required during various Project phases (viz. pre-construction, construction and operational phases), that were identified and described in the ESIA; and
- Monitoring requirements, including targets, performance indicators and reporting requirements.

The vehicle for the integrated management and implementation of these Management Plans is an Environmental and Social Management System (ESMS). Therefore, the ESMS is a key component of this ESIA.

An ESMS is also a requirement of the IFCs Performance Standards (PS1: Assessment and Management of Environmental and Social Risks and Impacts). The objective of PS1 is to:

"*Identify and evaluate environmental and social risks and impacts of the project, adopting a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimise, and, where residual impacts remain, compensate/offset for risks and impacts to workers, affected communities, and the environment, ...*" *(undertaken as part of this ESIA process)..... "and to promote improved environmental and social performance of clients through the effective use of management systems*...."

The main elements of an ESMS are provided in Figure 15-1 and comprise the following four phases, also described below.



Planning: Establishing the objectives and processes necessary to deliver results in accordance with the Project Guideline for Environmental Management.

Doing: Implementing the processes through defining mitigation measures and assigning responsibilities for undertaking or implementing such mitigation measures, typically through suites of Management Plans.

Checking: Monitoring and measuring these processes against the policy, objectives and targets, legal and other requirements (such as those of the IFC), and reporting of the results.

Acting: Taking actions to continually improve performance of the ESMS through the training of personnel and auditing of results.

Figure 15-1 Main Elements of an ESMS

As part of the ESMP and related framework, ERM identified the proposed ESMS structure (Figure ***15-2***), as applicable, that will be followed for the project. The ESMS requirements will be included in detail for all the parties involved, including, the Sponsor, EPC and O&M contractor; the latter will be aligned with the principles of ISO 14001 and OSHAS 18001/ISO 450001. In addition, include the need for future development of management plans in line with the applicable requirements for the key aspects identified in the ESIA. Project-specific CESMP and a Framework ESMP (including a framework for the SEP) for the operational phase of the project in compliance with the applicable requirements, as a section in the supplementary ESIA Report.

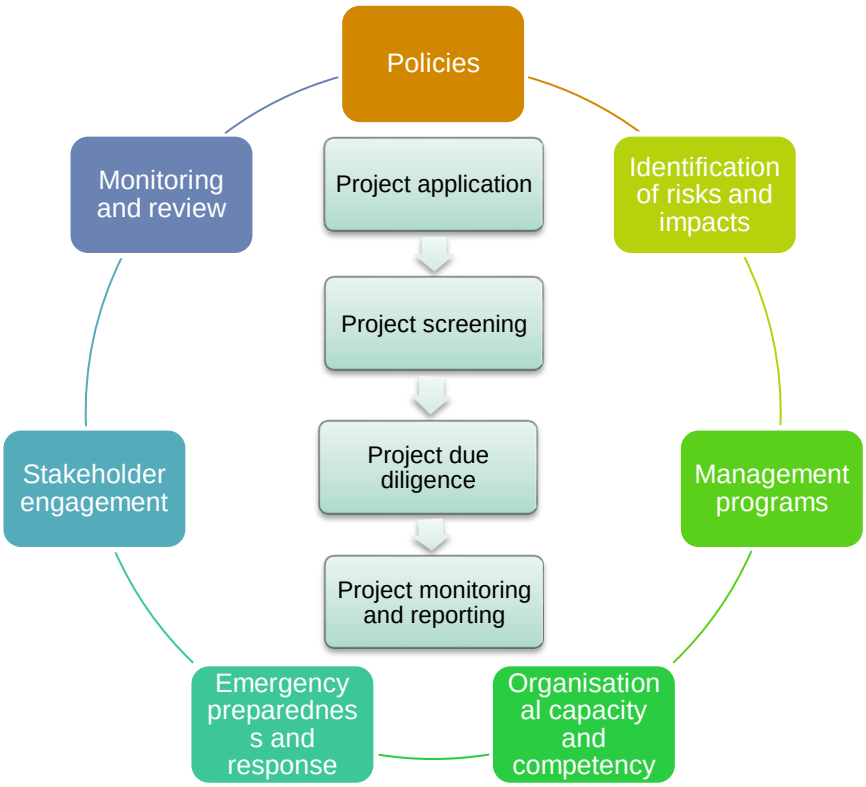


Figure 15-2 ESMS Structure Framework

The ESIA process has undertaken most of the initial planning aspects required by an ESMS by identifying environmental and social impacts and formulating Management Plans.

Further elements of an ESMS related to its implementation (doing, checking and acting), are described in under the following sections:

- Planning / Doing: Section 4 provides the institutional framework, organisational frameworks and specific roles and responsibilities for implementing the ESMS.
- Planning / Doing: Section 14 (SEP) outlines plans for on-going stakeholder engagement including the management of community grievances and concerns.
- Checking / Acting: Section 15 introduces key components for the implementation of the ESMS including training, monitoring, audits and inspections, and reporting.
- Acting: Section 15 introduces key components for the implementation of the ESMS; Section 6.4.5 explains the system for the management of change during the implementation of the proposed Project.

As such, an ESMS is implemented to:

- Assist management in establishing priorities for environmental and social impacts;
- Provide a mechanism for ensuring that measures identified in the ESIA and listed in each management plan, are addressed and implemented;
- Track changes in Kenyan legislation and/or Lender standards so that they can be addressed in a timely manner;
- Provide a framework for compliance auditing and inspection programmes;
- Ensure environmental and social (including Project induced health issues) continue to be integrated into business decisions;
- Provide a framework for mitigating impacts that may be unforeseen or unidentified until construction or operation is underway;
- Encourage and achieve appropriate environmental and social performance and awareness from all employees and contractors; and
- Provide assurance to regulators, stakeholders and lenders that their requirements with respect to environmental and social performance are being managed.

Aligned with IFC PS1, as the Project owner CIMAF, is responsible for the development of an ESMS under which the Project will be implemented and shall include:

- **Policy Statement** – which described the environmental and social objectives which will guide the Project in achieving environmental and social performance.
- **Process for Risk Identification** – which, in addition to the ESIA, shall include a defined process for evaluating and managing environmental and social risks through life of Project.
- **Management Programs** – for environmental and social performance execution which are, in part, detailed below.
- **Organisation Capacity/Competency** – demonstrated through clear division of responsibility and vetting of individual roles holding responsibility and accountability for environmental and social performance execution.
- **Emergency Preparedness and Response** – a plan which addresses how potential risk impacts resulting in emergency response will be managed for life of Project.
- **Stakeholder Engagement Program** – a program which includes stakeholder analysis and planning, disclosure and dissemination of information, consultation and participation, grievance mechanism, and ongoing reporting to Affected Communities through life of Project.

- **Monitoring and Review System** – which will detail the process by which the Project will monitor and measure the effectiveness of the management program, including compliance with any regulatory requirements, legal requirements and/or contractual obligations.

15.1 Key Components for the Implementation of the ESMS

Mitigation, management, and monitoring measures are described in the ESIA in Sections 10, 11 and 12, and provided in this ESMMP in the applicable environmental and social Management Plans in Section 16. In addition to these commitments, other key components of the ESMS include training, audits and inspections and reporting. These measures all represent the doing (training), checking (audits and inspections) and acting (reporting) processes of the ESMS framework is depicted in Figure ***15-1***.

15.1.1 Training

One of the most important mechanisms for the enhancement of the Project's environmental and social performance will be the continued implementation of a training programme for all Project personnel including all subcontractors and third parties.

The key components of training requirements are to ensure that all Project personnel, including all subcontractors and third parties understand the:

- Environmental and social policy of the Project;
- Environmental and social requirements of the Project and how these will be implemented and monitored on site;
- Contents and relevant requirements of Project actions contained within the applicable Management Plans;
- Environmental and social sensitivities of the Project Footprint and surrounds;
- Procedures to be followed in the event of non-compliance with the environmental and social requirements;
- Process for addressing unforeseen environmental and social incidents; and
- Responsibilities with respect to environmental and social issues applicable to their roles.

Training should include:

- Induction training for all staff including modules on: health and safety, environmental awareness, accommodation rules, worker code of conduct, stakeholder engagement, grievance mechanisms and cultural heritage awareness;
- Training on the EHS legal requirements and EHS compliance commitments of the Project. It is critical that all staff on the Project understand the laws and regulations and rules the Project has committed to, and that staff understand the consequences of breaking these rules;
- Toolbox training for specific topics and tasks; and
- Training for individuals involved in tasks with specific responsibilities.

Refresher training programmes will also need to be implemented to ensure continual improvement in environmental awareness for all Project personnel.

Training should be provided at each stage of the Project, from initial establishment of logistical facilities through to construction and (to a lesser degree) operation. The training function will assist managers in developing and coordinating training programmes as required.

Training records should be maintained by the Project and an assessment of the effectiveness of the training programmes should be included as part of the internal audit procedures.

15.1.2 Emergency Responses and Incident Reporting

An Emergency Response Plan (ERP) must be in place for the Project, covering all incidents such as, but not limited to:

- Work Place accidents;
- Traffic accidents;
- Wild fires;
- Flooding;
- Hazardous materials spills and containment; and
- Community and/or Employee uprisings or strikes etc.

The Project will conduct drills on a periodic basis to test the planned response actions.

An incident is any occurrence that has caused, or has the potential to cause, a negative impact on people, the environment, property or production (or a combination thereof). It also includes any significant departure from standard operating procedures. The reporting and investigation of all potential and actual incidents that could have a detrimental impact on human health, the natural environment or property is required so that remedial and preventive steps can be taken to reduce the potential, or actual impacts, as a result of all such incidents.

All incidents will be investigated for identification of causes and preventative actions. The actions resulting from any formal or informal investigations will be used to update the ERP.

15.1.3 Audit and Inspection

An audit programme detailing the aspects to be audited, the area (relevant department or section), and the frequency of audits will be established. The audits will be based on appropriate protocols prepared by the various environmental, social and health and safety functions.

Regular environmental, social and health audits and random spot checks will be undertaken by selected audit team members throughout all phases of the Project. The audit and inspection frequencies will be defined, and may be increased or decreased according to the audit findings and degree of confidence in the audit programme, and will need to adapt to the Project work scope and locations, and project activities (some of which will have higher risks). Audits will also assess compliance with agreed objectives and targets as well as the effectiveness of the management plans and their implementation.

Audit findings will be reviewed by the applicable management functions and where corrective actions are deemed necessary; the relevant management plans will be updated.

15.1.4 Reporting

The Project will develop a system of internal reporting that allows for appropriate assessment of the effectiveness of the ESMS. Public reports will also be prepared on defined issues of interest or concern to local communities and /or stakeholders.

During the construction phase, Bechtel and its subcontractors should take all appropriate measures detailed in the Project ESMS and related plans and procedures to identify and document incidents of environmental, social and health and safety non-conformance. Non-conformity reports should be produced at an appropriate frequency to ensure non-conformances are corrected. Non-conformity reports should identify the nature of the non-conformities and any subsequent actions taken, and review the results or successes of any corrective actions taken. The resultant records will be reviewed in the appropriate management meetings so that required corrective actions can be taken, the results of any such corrective action can be recorded, and to increase management awareness of any opportunities for improvement.

These records are intended to facilitate the purposeful reduction of incidents of non-conformance, leading to a consequential reduction of the root causes of such incidents.

Section 16.5 presents the monitoring plan, which details parameters that will be monitored. The results from this data will be reviewed by CIMAF.

Annual reporting will be undertaken to review performance over the previous year and to set targets and objectives for subsequent years.

15.1.5 Management of Change

The ESIA process does not stop with the submission of the Final ESIA report. Therefore, the ESMMP will require a mechanism to manage change. At times these changes may be material, potentially influencing the original findings of the ESIA, and hence, the basis for its approval. A change management system should ensure that changes to the scope of the proposed Expressway are subjected to a robust social and environmental assessment process that reviews the change against the ESMMP.

As mentioned in Chapter 3, the siting of certain Project infrastructure / activities are not yet known. Moreover, even with a final design and an unchanging environment, impacts are difficult to predict with certainty. Uncertainty stemming from on-going development of the Project design is inevitable, and the social and biophysical environment is typically variable from season to season and year to year. Similarly, the organisational structure and roles and responsibilities may also change as the Project progresses. Where such uncertainties are material to ESIA findings, they will be clearly stated and conservatively approached (‘the precautionary approach’) in order to identify the broadest range of likely residual impacts and necessary mitigation measures.

Any changes to Project scope or new substantive environmental and social findings through ongoing monitoring will be evaluated for their degree of significance, and will be incorporated into the appropriate Project documentation as follows:

- Minor changes will be reflected in updates to the applicable Management Plans included in the overall ESMMP; and
- Substantive design changes that might potentially alter the ESIA findings (i.e. those that result in changes to the predicted significance of environmental and social impacts) will be subject to re-assessment, further stakeholder consultation, supplementary reporting and revision of the Project’s ESMMP. Typically, such substantive changes will be submitted as an addendum to the ESIA.

16. ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN (ESMMP) FOR CONSTRUCTION AND OPERATION

This section will include a Construction Environmental and Social Management Plan (CESMP) and Framework ESMP for the operational phase of the project. The following standalone management plans have been developed:

- Stakeholder Engagement Plan (Annexure H)
- Traffic Management Plan (Annexure I)
- Influx Management Plan (Annexure J)
- Framework Local Content Plan (Annexure K)
- Framework Social Investment Plan (Annexure L)

This Chapter includes the environmental and social management measures for Contractors (and associated Subcontractors) to be implemented as appropriate during the pre-construction and construction phase of the ICP.

Please note: This ESMMP has been developed as a framework, which aims to address the specific impacts that are anticipated to occur as a result of the construction and operation, as well as associated activities as identified in the ESIA and associated impact assessment.

These management measures set out a formal system by which the Project can manage mitigation measures that will reduce impacts to the receiving physical, biological and social environments.

This ESMMP should be considered to be "living document that is aimed at mitigating potential impacts as anticipated, but which will need to be amended and/or updated in the event of insights gained, unforeseen challenges or events experienced on the ground. Such amendments or updates, however, should at all times consider the mitigation hierarchy of avoid, minimise, and mitigate.

Each management plan provides the following detail:

Objective	The management objective that applies to each aspect or impact.
Timing and Frequency	During detailed Project design phase, the pre-construction (site establishment) phase, construction phase of the Project or operation phase of the Project.
Project Activity	Project related activities resulting in the impact.
Responsibility	The party responsible for implementing the management plan.
Performance Criteria	Measurable performance criteria (outcomes) for each element.
Mitigation Measures	The strategies, tasks or action program (to nominated operational design standards) that will be implemented to achieve the performance criteria.

This Chapter includes the following management and monitoring measures:

Physical Environmental Management

- Air Quality (refer to Section 16.1.1); and
- Soils (refer to Section 16.1.2); and
- Water Management Plan (refer to Section 16.1.3).

Biodiversity Management

- Flora, fauna and habitats (refer to Section 16.2)

Social Management

- Socio-economic such as traditional livelihood activities (refer to Section 16.3.1.1),
- Ecosystem Services (refer to Section 16.3.1.2);
- Community Health and Safety (refer to Section 16.3.1.3);
- Cultural heritage (refer to Section 16.3.1.4); and
- Traffic and Transportation (refer to Section 16.3.2).

General

- Waste Management (refer to Section 16.4.1); and
- Blasting Management (refer to Section 16.4.2).

Subject-specific management and monitoring plans that will need to be developed and/or developed in more detail over the course of the Project are indicated in below:

No	Management Plan	When Developed	Notes
	Occupational Health and Safety, including Emergency Response Plan	Pre-Construction	To be updated for operation after construction
	Traffic Management	Pre-Construction	Developed, to be updated after construction
	Air Quality and Dust Management	Pre-Construction	To be updated for operation after construction
	Water Management	Pre-Construction	To be updated for operation after construction
	Biodiversity Management including Vulture Monitoring	Pre-Construction	Alternatively follow conceptual plan provided and have detailed plan ready within one year of operation To be aligned to Ecosystem Services, DEFCCS MoU and relevant standards
	Alien Plant Control	Pre-Construction	To be updated for operation after construction, and implemented as part of the overall Biodiversity Action Plan
	Ecosystem Services	Pre-Construction	To be updated for operation after construction if necessary
	Social Management Plan, which includes: ▪ Stakeholder Engagement Plan ▪ Grievance Procedure ▪ Livelihood Restoration ▪ Cultural Heritage Management plan (including Chance Find Procedure and Grave Relocation Plan)	Pre-Construction	To be continued and updated for the remainder of the Project Life Cycle

No	Management Plan	When Developed	Notes
	Local Content	Pre-Construction	To be updated for operation after construction as necessary
	Influx Management	Pre-Construction	To be updated for operation after construction as necessary
	Waste Management, including spill response	Pre-Construction	To be updated for operation after construction as necessary.
	Noise and Vibration Management	Pre-Operation	Emphasis will be on monitoring and taking action as and where required
	Soil and Stockpile Management	Pre-Operation	Conceptual mitigation provided for design and construction phase
	Progressive Rehabilitation	Pre-Operation	To be aligned to Biodiversity-, Soil- and water management, as well as the DEFCCS MoU and applicable standards
	Social Investment Plan	Pre-Operation	Developed in collaboration with local stakeholders
	Blasting Management	Pre-Operation	To be aligned to noise and vibration monitoring

16.1 Physical Environmental Management Plans

16.1.1 Air Quality Management

Objectives

The objective of the Air Quality management plan (AQMP) is to set out the measures needed to control or reduce emissions (including dust) to air during the construction and operational phases to avoid significant impacts to sensitive receptors. This is verified by site boundary and visual monitoring.

The impacts of the Project will change over time as a result of changing weather conditions, and the relative locations of emissions to receptors as the construction and quarry activities progress. As such, the management of emissions to air and impacts need to be dynamic, and relies on monitoring and active control of emissions.

Project Activities Resulting in Air Quality Impacts

- Construction preparation phase:
- Construction phase
- Operational phase

Responsibility

For the preconstruction phase and construction phase, the Primary Contractor will be the responsible person. The relevant duties are likely to be developed by a local EHS site officer.

For the operational phase, the proponents EHS site officer will be responsible for compliance with this document.

Performance Criteria

The Project must be conducted in compliance to relevant air quality standards. The following Air Quality standards (AQS) were considered during the assessment:

Table 16-1 Applicable Project Air Quality Standards

Pollutant	Averaging Period	Basis	Ambient Concentration (µg/m^3)
As (Arsenic)	Annual	WHO lifetime risk	0.00066
Co	1hr	US EPA	2,000
Co	Annual	US EPA	0.1
Cr	1hr	US EPA	25,000
Cr	Annual	US EPA	83.3
Cu	1hr	UK	200
Cu	Annual	UK	10
Dust	Monthly	Senegalese standard	0.2
HCl	1hr	UK	750
HF	1hr	UK	160
HF	Monthly	UK	16
Mn (Manganese)	Annual	Guideline	0.15
Ni (Nickel)	Annual	WHO lifetime risk	0.0025
NO_2	1 hour	SG AQS / WHO Guideline	200
NO_2	Annual	SG AQS / WHO Guideline	40
Pb	Annual	SG AQS	0.5
PM_{10}	24 hour	SG AQS	150
PM_{10}	24 hour (99th percentile)	WHO Interim target 1	150
PM_{10}	Annual	SG AQS	40
Sb	1hr	UK	150
Sb	Annual	UK	5
SO_2	10 minutes	SG AQS / WHO Guideline	500
SO_2	24 hour	SG AQS	50
SO_2	Annual	Guideline	50
TOC (Benzene)	Annual	WHO lifetime risk	0.17
V (Vanadium)	24 hour	Guideline	1

1. As, Ni and Benzene are known carcinogens. The guideline value used was based on the lifetime risk of 1/1,000,000
2. Guideline values are based on WHO limits for substances with effects other than cancer or odour/annoyance

Management Measures

The management measures included in Table 16-2 and Table 16-3 will be implemented to reduce impacts resulting from the Project to minimise the impact of operations on ambient air quality.

Table 16-2 Air Quality Management – Construction Phase

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
1	Grievances	▪ The Project will develop and implement a grievance procedure in the event of any dust complaints being received.	Pre-Construction	Grievance Procedure
		▪ All potentially impacted receptors will be informed of the nature of works to be carried out, the duration, as well as contact details of a Project representative that be contacted in the event of a complaint. All complaints will be managed as part of the Project's external feedback and grievance mechanism (mentioned above). ▪ The Project will make efforts to prevent grievances by monitoring conditions and surroundings and taking action to prevent dust emissions off the project site. ▪ Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken. ▪ Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in a logbook.	Throughout construction	Engagement records and grievance procedure
2	Construction Traffic	▪ Vehicle routing should be considered to avoid passing through settlements and close to residential areas as far as practicable ▪ A travel plan should be put in place to minimise congestion on public roads and avoid peak times as far as practicable ▪ Where the access road meets the public highway consideration should be made of junction improvements, signage and traffic lights (where possible) to minimise queuing times. Where there is the potential for queueing elsewhere due to the influx of construction traffic, changes to junctions to facilitate flows may be required ▪ Vehicles used during the construction phase should be modern and as far as possible meet up to date emission limits (i.e. less than 5 years old)	Pre-construction	Adequate traffic flow

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
		▪ Vehicles should be well maintained to minimise emissions ▪ Low sulphur fuels should be used (if available)		
3	Construction Dust (Site Planning)	▪ Develop site layout so that machinery and dust causing activities are located away from receptors, as far as is possible ▪ Recommendation: erecting solid or dense netted screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site. ▪ Consider fences and enclosures around specific operations where there is a high potential for dust production and the site is active for an extensive period ▪ Avoid site runoff of water or mud ▪ Keep site fencing, barriers and scaffolding clean using wet methods ▪ Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below ▪ Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided)	Pre-construction	Visible dust generation, Dust incidents, AQ complaints
4	Construction Dust (General Operational)	▪ Where construction compounds cannot be hardstanding, use lignin-based surface sealants or watering as required to supress dust generation ▪ Recommendation: use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays (if possible) or local extraction, e.g. suitable local exhaust ventilation systems ▪ Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment ▪ Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event	Prior to construction and during construction	Visible dust emissions

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
		▪ Avoid bonfires and burning of waste materials, unless such can be done in dedicated incinerators with emission control		
5	Construction Dust (Earthworks)	▪ Only remove the existing vegetation cover in limited areas during preparation and construction as work progresses, and not all at once ▪ Re-vegetate or hard stand earthworks and exposed areas and open soils to stabilise surfaces as soon as practicable ▪ Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable	Prior to construction and during construction	Visible dust emissions
4	Construction Dust (Construction Activities)	Mitigation to Construction ■ Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional dust control measures are in place, especially during high-wind events ■ Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust.	Prior to construction and during construction	Visible dust emissions
6	Dust (Mitigation specific to track out on hardstanding public roads)	■ Use water-assisted (if possible) dust sweeper(s) on hardstanding access and local roads to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use. ■ Avoid dry sweeping of large areas. ■ Ensure loads on vehicles entering and leaving sites are covered to prevent escape of materials during transport ■ Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.	Prior to construction, during construction	Visible dust emissions

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
7	Vehicle and Engine related emissions (mobile plant)	**Mobile plant:** ■ Use modern plant, meeting as a minimum, USEPA Tier 2 emission limits ■ Use of low sulphur fuels (if available) ■ Undertake routine maintenance to maximise engine performance and minimise black smoke **Non-mobile plant:** ■ Use low sulphur fuels (if available) ■ Position generators away from the site boundary and downwind and away from sensitive receptors as far as practicable ■ Use lower emission engines in generators meeting IFC emission limits of 1,850mg/Nm^3 ■ Equip engines with vertical, uncapped stacks, preferably with a minimum stack height of building height +3m (if isolated from other structures the 'building' is the generator itself) ■ Undertake routine maintenance to maximise engine performance and minimise black smoke	Prior to construction, during construction	Emission standards (where applicable) and ambient AQS
8	Project Design	Develop and implement a Dust Management Plan (DMP) including monitoring of dust deposition, dust flux, and visual inspections. The DMP should also include 'action levels' for triggering further dust mitigation when exceeded (feed-back loop). In preparedness of possible persistent complaints or concerns arising regarding dust and other emissions, it is recommended to investigate possibilities for the rapid deployment (during construction and/or operation) of a real-time PM_{10} continuous or periodic monitoring system to monitor the effectiveness of control measures, enable rapid responses where needed, and limit Project liabilities related to such concerns.	Pre-construction	

Table 16-3 Air Quality Management – Operational Phase

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
1	Grievances	The Project will develop and implement a grievance procedure in the event of any dust complaints being received. This will be a continuation of the grievance procedure as implemented during the construction phase.	Operational Phase	Grievance Procedure
		■ All potentially impacted receptors will be informed of the nature of works to be carried out, the duration, as well as contact details for a Project representative that be contacted in the event of a complaint. All complaints will be managed as part of the Project's external feedback and grievance mechanism (mentioned above). ■ The Project will make efforts to prevent grievances by monitoring conditions and surroundings and taking action to prevent dust emissions off the project site. ■ Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken. ■ Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in a log book.	Throughout Operational Phase	Engagement records and grievance procedure
2	Dust	Mitigation specific to track out on hard standing public roads ■ Use water-assisted (if possible) dust sweeper(s) on hard standing access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use. ■ Avoid dry sweeping of large areas. ■ Ensure loads on vehicles entering and leaving sites are covered to prevent escape of materials during transport ■ Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.	Operational Phase	Visible dust emissions
3	Vehicle and Engine related emissions	**Mobile plant** ■ Use modern plant, meeting as a minimum, USEPA Tier 2 emission limits	Operational phase	Emission standards (where applicable) and ambient AQS

		■ Use of low sulphur fuels (if available) ■ Undertake routine maintenance to maximise engine performance and minimise black smoke **Non-mobile plant** ■ Use low sulphur fuels (if available) ■ Position generators away from the site boundary and downwind and away from sensitive receptors as far as practicable ■ Use lower emission engines in generators meeting IFC emission limits of 1850mg/Nm^3 ■ Equip engines with vertical, uncapped stacks, preferably with a minimum stack height of building height +3m (if isolated from other structures the 'building' is the generator itself) ■ Undertake routine maintenance to maximise engine performance and minimise black smoke		
4	Dust	**Haul road between quarry and ICF** ■ Haul road must be constructed away from the plant boundary to ensure no exceedance of any AQS to the surrounding environment. ■ Dust suppression: Water is a constrained resource in the area. The use of a lignin-based dust suppressant will substantially reduce the need for watering (typically this needs to be applied only once per 7 – 14 days). ■ As per DEFCCS requirement, the planting of dust-screening woody vegetation should be implemented as soon as possible, and maintained as part of dust-control measures ■ Impose and signpost a maximum-speed-limit of 10 mph on unsurfaced haul road. **Quarry area: Waste rock dump area** ■ Recommendation: use bunds or netting upwind, revegetation or covering to reduce wind-blown dust from the exposed waste rock dumps. ■ As per DEFCCS requirement, the planting of dust-screening woody vegetation should be implemented as soon as possible, and maintained as part of dust-control measures	Operational phase	Visible dust generation. Relevant emission standards and ambient AQS

		■ The active site location must be planned to ensure activities are not undertaken near the north-eastern boundary during the dry season as background dust is elevated during this time. **ICF** ■ Minimise material transfer points by using a simple, linear layout for materials handling operations ■ Use enclosed belt conveyors for materials transportation and emission controls at transfer points ■ Raw materials (crushed and pre-blended) must be stored in covered or closed bays ■ Pulverised coal and petroleum coke (pet–coke) must be stored in silos ■ Clinker must be stored in covered / closed bays or silos with automatic dust extraction ■ Cements must be stored in silos with automatic reclaiming ■ Implement routine plant maintenance program and good housekeeping to keep small air leaks and spills to a minimum ■ Conduct material handling (e.g. crushing operations, raw milling, and clinker grinding) in enclosed systems maintained under negative pressure by exhaust fans. ■ Collecting ventilation air and removing dust using cyclones and bag filters ■ Implementation of automatic bag filling and handling systems to the extent possible, including: - Using a rotary bag filling machine with automatic paper bag feeder and fugitive emission control - Using automatic weight control for each bag during discharge to reduce the incidence of bag breakages and overfills - Using conveyor belts for transporting bags to a palletizing machine - Storing the finished pallets in covered bays for subsequent shipping ■ Capture kiln and cooler dusts using filters and recycling the recovered particulates into the kiln feed and into the clinker, respectively ■ Use fabric filter systems (baghouses) to collect and control fine particulate emissions in kiln gases		

		■ Use cyclones to separate large particulates of cooler gases, followed by fabric filters ■ Capture mill dust by fabric filters and use for recycling within the mill		
5	Stack Emissions	■ Use a dry process kiln with multistage preheating and precalcination (PHP) to minimise NO_x formation ■ Installation of continuous emission monitoring systems (CEMS) on the kiln stack, coal stack and cement stack are recommended to confirm emission limits are complied with at all times and reduce Project liabilities	Operational phase	Relevant emission standards and ambient AQS

16.1.2 Soil Management

Soil management is essential to retain the fertile nutrient topsoil layer of all topsoil cleared from the footprint area, as well as prevent accelerated erosion and related potential adverse impacts caused by such beyond the Project boundary. In addition, risks related to increasing extreme rainfall events, associated risks of flooding and soil movement will need to be taken into consideration in overall soil management. It is understood that during construction, soil management will be based on essential measures as listed below, as the site will be in a dynamic flux of movement until construction is ended. As such, at this stage only initial construction mitigation recommendations are listed, and not a full soil management plan.

Nearing the end of construction, however, as quarry operational plans and associated rehabilitation plans will be in a more progressed stage, a detailed soil management plan, with emphasis on topsoil management and overall erosion control, will need to be developed. This can be a subsection of the progressive rehabilitation plan, and further should be aligned to the dust suppression management as well as the storm-water management plans.

Objectives

The objectives are:

- To conserve topsoil and subsoil (waste rock) resources as best possible for later rehabilitation or other uses by adequate planning of excavation and earthmoving activities, as well as planning of short-term (during construction) and long(er)-term storage
- Avoiding the contamination of soil resources
- Ensure stability of soils (and geology) on and around the Project footprint to reduce risks to the Project and the receiving environment
- Maintain the overall quarry slope around 45° to avoid bench failure
- Ensuring that stripped topsoils and waste rock materials are stored in a manner that will:
  - Minimise handling needs and prevent compaction of topsoils
  - Not obstruct any natural wetland, drainage or runoff channels outside the Project's footprint area, either directly or by sedimentation from erosion
  - Not cause the accumulation of water within the Project footprint area during rainfall events
  - Not contribute to excessive dust creation, especially during high-wind events
- Monitor quarry's slopes during operation and after closure of the facility

Responsibility

CIMAF, as Project owner, will assume responsibility for ensuring implementation of soil management throughout the life of Project. During construction, field implementation of the soil management controls will be managed and executed by the Contractor. During operation, the management of soil will become the responsibility of the proponent's EHS department.

Performance Criteria

- Soil management plan to be compiled and ready at the start of operation
- Topsoil stockpiles covered with vegetation
- No sign of erosion off stockpiles or sedimentation 'downstream' of stockpiles
- Stable landscapes and no flooding across the Project footprint

Table 16-4 Soil and Stockpile Management

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
1	Ground Works / Site Clearance	Pre-construction, an estimate will be made of the volumes of soil to be stripped, and a suitable area delineated for storage of such soil, taking into consideration the above objectives. Random placement of heaps of stripped soil and subsoil should be avoided as far as possible, especially where such could obstruct natural surface flows of water after large rainfall events	Pre-construction	Correct placement of stockpiles according to Stockpile Management Plan
2	Ground Works / Site Clearance / Quarry and plant operation	▪ Soil stripping will be done in a successional manner for the infrastructure development and quarry area. ▪ Subsoils can be used, where necessary, in the control of storm water, or to temporarily protect excavations ▪ To the furthest extent possible, the disturbance of the natural topography and catchment characteristics should be minimised (e.g. limit large-scale earthworks, vegetation removal, soil compaction etc.), so as to not alter the natural surface drainage flow of the landscape ▪ Design and create berms and storm water management structures to prevent runoff from the footprint areas during/after a periodic extreme rainfall events to enter directly into existing water bodies; ▪ Similarly, ensure potential runoff into the quarry from higher lying areas south and east of the pit is suitably diverted around the pit to the wetlands west of the Project concession ▪ Due to the north-eastern extent of the pit being across an ephemeral drainage with riparian vegetation, it is recommended to divert surface runoff to pass north or south of the pit, with adequate drainage structures that	Pre-construction, construction and operation	Correct ordering of stockpiles according to Stockpile Management Plan Optimal use of soil resources

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
		will distribute rather than concentrate runoff installed under the haul road. ▪ Delineate all permissible areas so that all movement of vehicles and heavy machinery can be restricted to such areas only, these being the construction footprint, designated access roads, maintenance roads, turning points and parking areas. No off-road driving beyond designated areas will be allowed unless an emergency situation would justify such.		
3	Ground Works / Site Clearance / Quarry and plant operation	▪ The establishment of an indigenous vegetation cover on topsoil stockpiles should, as far as possible, be facilitated (by seeding, placement of berms and/or limited landscaping) to reduce erosion and ensure continued fertility. ▪ All stockpiles should be surrounded by silt traps to prevent runoff, and erosion that may result in sedimentation of nearby drainages and wetlands needs to be monitored – especially after large rainfall events, and mitigated as soon as possible. Immediate controls could involve brush packing: using cleared woody shrubs and placing such – braches facing upslope – onto the lower edges of such stockpiles	Construction and operation	Vegetated topsoil stockpiles No erosion off stockpiles
4	Site Preparation and operation	Areas where accidental or other spillage of contaminants such as hydrocarbons has occurred, must be excavated to the depth of contamination and suitably rehabilitated. Bioremediation methods are recommended. If any other minor spillage occurs, the spillage must be cleaned as soon as possible, but within the same shift and the contaminated area must be reinstated. All contaminated material should be suitably treated and cleaned or disposed of.	Pre-construction, construction and operation	Contaminated soil management according to management procedures

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
5	Vehicle and Machinery Movement	▪ Parking and operational areas must be regularly inspected for oil spills that could potentially contaminate the ground. Grease pans are to be placed under vehicles or machinery if oil and fuel spillages are highly likely to occur, especially where such vehicles are not owned and/or maintained by the Project itself (e.g. delivery vehicles) ▪ All machinery and vehicles are to be maintained in an optimal condition to prevent or reduce hydrocarbon spills, as well as reducing emissions. ▪ Workshops and fuel storage areas are to be fully bunded, with all runoff directed to a suitable separator plant to remove hydrocarbons and contaminants from water before discharge into the environment	Pre-construction, construction and operation	Inspection logbook to illustrate findings
6	Rehabilitation	To aid a more rapid and early decommissioning of mined areas, pits should be backfilled as soon as possible, landscaped to surroundings and re-vegetated (but strictly without the alien invasive species that may have been present prior to mining).	operation	Concurrent rehabilitation according to Rehabilitation Plan for quarry
7	Project Design and Operation	In order to avert potential risks posed by soil instability, unforeseen flooding events and other potential geological hazards, pre-operation, a more detailed Soil management Plan needs to be drafted, which, in addition to above points, will also consider following: ▪ Field observations to define the particular slopes in the proximity of the Project Area that may be prone to mass movements, e.g. during unforeseen flooding events	Pre-operation and during operation and post closure	Soil Management Plan including detailed Stockpile Management Plans (Topsoil and Waste Rock)

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
		▪ Use of drainage techniques to reduce the impact of potential extreme rainfall events, with regular cleaning of the drainage structures to prevent clogging ▪ Stabilization of slopes where necessary, e.g. by gabion walls or geotextile, depending on inclination and risk ▪ Combining mechanical and biological elements (plants) to further stabilise the slope and prevent erosion		
8	Quarry Operation	It is necessary to ensure that the slopes of the quarry are safe during the operation and after the closure of the site. That can be achieved by: ▪ Aim to maintain the overall quarry slope around 45° to avoid bench failure ▪ Maintain a bench width of 4 m and construct drainage ditches on the surface of benches to divert water away from the slope ▪ Install catch fences where necessary over the slope to avoid rock detachments and to provide safety to personnel and operational of mining equipment ▪ Divert the surface water from the top of the cut ▪ Clean the unstable rock ▪ Implement other mitigation measures when the monitoring proves it necessary After the closure of the site or as the quarry is progressively exploited:	Pre-operation and during operation and post closure	Soil Management Plan including detailed Stockpile Management Plans (Topsoil and Waste Rock) Progressive Rehabilitation Plan

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
		▪ Backfill the quarry pits, preferably in a progressive manner as soon as possible, and landscape to surrounding environment ▪ Secure the slopes (e.g. geogrid reinforcement) ▪ Maintain the drainage system ▪ Rehabilitate and revegetate the area as per progressive rehabilitation plan		

16.1.3 Water Management

16.1.3.1 Objectives

The Water Management Plan will have the following objectives:

- Prevent pollution of natural water resources
- Monitor water use: The Plan will set procedures for estimating water used by the Project, identifying activities that use this resource, and will document water use reporting needs.
- Minimise water use: The Plan will provide a series of measures to be considered for minimising the use of water;
- Document water sources; and
- Record all communications with Water Authorities.
- The Water Management Plan will be developed following CIMAFs policies and will consider all the relevant local legislation and IFC PSs.
- Finally, the Plan will include provisions for the training of all workers on how to use water efficiently.

16.1.3.2 Responsibility

CIMAF, as Project owner, shall assume responsibility for ensuring full development and implementation of the water management system throughout life of Project. During construction, implementation of the water management controls will be managed and executed by the Contractor. Other parties, such as the Engineer, will also assume certain responsibilities in the design of e.g. stormwater runoff, e.g. ensuring runoff from the plant does not discharge to the environment without being adequately cleaned.

16.1.3.3 Performance Criteria

- No contamination of aquifer waters and surface waters attributable to the Project
- No deterioration of general water availability in the area surrounding the Project attributable to the Project

Table 16-5 Water Management Plan

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
1	Design / Ground Works / Site Clearance	■ Pre-construction, determine how flows will best be diverted around the Project infrastructure and Quarry, and across the concession, taking natural runoff patterns via loosely networked thalwegs and inputs into seasonal wetlands into consideration, with the aim to retain the latter whilst preventing flooding of quarry and infrastructure ■ Design stormwater runoff structures and drainages under roads accordingly	Pre-construction	Optimal placement of stormwater management structures and retention of natural flows into seasonal wetlands and to riparian areas
2	Design	■ As far as possible, incorporate water saving- and recycling measures into the daily construction and operational activities ■ Ensure water effluent from Project separator plants and sewage treatment plants is adequately contained and treated, and no discharge of contaminated water to the environment allowed	Pre-construction, construction, operation	Water Management Plan
3	Site Preparation, construction and operation	No historic groundwater levels are available so trend analysis regarding potential groundwater sustainability in the area cannot be inferred, and current pumping regimes are unclear. Although potential impacts are regarded as negligible, it is recommended to obtain a baseline against which potential impacts of the Project can be monitored and quantified ■ Obtain a base reading of level and water quality of existing boreholes in close proximity of the Project Site ■ Establish a groundwater monitoring plan	Pre-construction, construction, operation and post-closure	Ground water management and monitoring plan
4	Site Preparation, construction and operation	■ All fuels and hazardous materials should be stored with appropriate containment including impermeable areas, bunding and drip trays	Pre-construction, construction and operation	Contaminated soil management according to management procedures

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
		■ Chemicals and hazardous liquids should be supplied in dedicated tanks made of sufficiently robust construction to prevent leaks/spills. ■ Develop procedures for fuel and hazardous material transfers and personnel training on emergency response ■ Spill kits should be made available at all storage locations for hazardous chemical materials ■ To avoid any leachate that might impact groundwater, wastes generated from the project activities should be managed in accordance with the site Waste Management Plan ■ All wastes should be removed and disposed of at dedicated waste treatment facilities in accordance with the Waste Management Plan.		
5	Quarry Operation	It is necessary to ensure that the slopes of the quarry are safe during the operation and after the closure of the site. That can be achieved by: ■ Divert the surface water from the top of the cut ■ Implement other mitigation measures when the monitoring proves it necessary After the closure of the site or as the quarry is progressively exploited: ■ Backfill the quarry pits, preferably in a progressive manner as soon as possible, and landscape to surrounding environment ■ Maintain the drainage system ■ Rehabilitate and revegetate the area as per progressive rehabilitation plan	Pre-operation and during operation and post closure	Part of Soil management and Progressive Rehabilitation Plan

16.2 Biodiversity Management

Biodiversity management actions are proposed based on the findings of the potential adverse impacts identified, but also on the requirements as set out in the MoU from the DEFCCS. The initial Biodiversity Management Plan as outlined below will ensure that biodiversity issues are adequately addressed from the start of construction. However, a more detailed Biodiversity Action Plan, including an Alien Plant Control Plan, will need to be drafted within one year of start of operations, and this should be aligned to and facilitate all requirements as set out the DEFCCS MoU, progressive quarrying- and rehabilitation planning, as well as comply to IFC PS6.

16.2.1 Objectives

Whilst allowing for development, to promote the sustainable management of biodiversity resources, optimise rehabilitation success whilst reducing costs thereof, conserve as much of the natural habitat and keystone species as possible, maintain the ecological functionality of landscapes and so retain benefits from ecosystem services through the adoption of practices that integrate conservation needs and development priorities.

At the same time, the spread of alien invasive plants should be avoided, and such plants eradicated as much as possible.

16.2.2 Responsibility

CIMAF, as Project owner, shall assume responsibility for ensuring implementation of the biological management system throughout life of Project. During construction, field implementation of the biodiversity management controls will be managed and executed by the Contractor. Other parties, such as the Engineer, will also assume certain responsibilities in the design of the road, e.g. retaining natural runoff conditions and associated riparian areas as far as possible.

16.2.3 Performance Criteria

- Retained and/or rehabilitated biodiversity in areas not developed by CIMAF, within the Project boundary.
- Full compliance with the DEFCCS MoU Requirements and IFC PS6.
- Biodiversity Action Plan drafted and implemented within one year of start of operations.

Table 16-6 Initial Biodiversity Management

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
1	Design	■ The placement and design of the haul road between the plant and pit will be aimed to avoid disruption of surface runoff, and find a balance between avoiding riparian habitats and Baobab trees whilst at the same time keeping the route as short as possible ■ Avoid as far as possible or maintain a buffer of preferably 500 m around edges of any ephemeral water bodies (or 50 m from drainage lines) that do not fall within the infrastructure and quarry area, and ensure storm water management designs can avoid runoff from the Project footprint discharging directly into any remaining natural ephemeral water bodies without being cleaned first - Where necessary, design and create berms and storm water management structures to achieve the above ■ Determine, together with an ornithologist, the optimal amount and placing of bird deflectors and perch deterrents on the new and existing power line (the latter as possible during connection, and up to the seasonal wetlands west of the quarry) as well as substation, to reduce bird collisions and –electrocutions - Ensure such devices are ready for installation before powering the electrical infrastructure ■ Avoid attraction of fauna by using only downward lighting and not creating any open water surfaces (regardless if contaminated water or not) within the active operational area	Pre-construction	No obstruction of natural runoff patterns outside the project footprint Optimal retention of large Baobab trees Minimal loss of birds due to collisions with electrical infrastructure

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
2	Site preparation	■ As part of the anticipated wet-season survey to be commissioned post this ESIA, conduct a pre-construction survey to geo-reference all Baobab as well as other protected species that will be directly impacted. Verify if potentially threatened plant species are within the Project footprint area and/or will be indirectly affected if near the footprint area ■ Determine the risk of spreading alien invasive plants and draft an initial alien plant management and control procedure (or method statement) to avoid further spread during construction. ■ From the above information, determine how many Baobab trees (*Adansonia digitata*) can practically be avoided and relocated, and where to, and include this in the Construction and/or site clearance planning - Baobabs should be conserved and relocated (possible due to their stem succulence) as much as possible due to their slow growth rate, as part of the DEFCCS reforestation plan - The perimeter of large trees remaining between the Project Footprint elements should be fenced off, with signage indicating conservation importance ■ Determine if any additional and/or threatened species need to be relocated ■ Determine how best to use cleared biomass, e.g. for shredded mulch, composting or brush-packing, to avoid creating piles of cleared biomass that may attract unwanted scavenging species such as rodents, again attracting snakes	Pre-construction and Construction	■ Wet Season Survey completed ■ Accurate number and position of Baobab trees that will be directly impacted ■ Optimal relocation plan for and retention of Baobabs ■ Optimal use of cleared biomass ■ No further spread of alien plants during construction ■ Conservation actions recorded, and further monitored as part of the continued Biodiversity Action Plan post construction

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
		Other considerations to be taken into account: ■ Placement of temporary infrastructure in areas densely encroached with *Senegalia* (formerly *Acacia*) *ataxacantha* and/or *Azadirachta indica* (**but retaining Baobabs if present**) will allow clearing of such undesirable vegetation. Non-impacted or temporarily impacted areas can then possibly be fenced and actively managed. The aim of management would be to allow the herbaceous layer and desirable woody species to regenerate during the growing season, whilst providing access to communities during the end of the dry season (for grazing and harvesting *wood from undesirable* species), when natural resource levels are at their lowest (acting as emergency resource reserve) and so contribute to improving a sizeable portion of the ecosystem. ■ As part of the reforestation program, the placement of relocated Baobabs and initial reforestation should take into consideration areas that will be most affected by dust – Baobab species are to be planted outside such dust-reception areas, but other species that are expected to reach a height of about 3-6 m should be planted as a dust screen. ■ In line with IFC PS6 requirements, all species used for dust-screening and reforestation must be indigenous species (not alien species as suggested by DEFCCS). ■ Incorporate conservation measures into the general site induction programme		
3	Site preparation and ongoing clearing	■ Vegetation clearance of the footprint areas will be done in a successional manner, preferably during the dry season prior to construction and/or quarrying, to allow present species more time to provide ecosystem functionality, and	Pre-construction construction operation	■ Progressive site clearance ■ Optimal use of cleared biomass ■ No or minimal loss of wildlife and/or livestock

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
		allow indigenous fauna potentially present adequate time to relocate ■ Use cleared biomass as much as possible in dust- or erosion suppression ■ Investigate areas to be cleared just prior to earthworks starting for the presence of indigenous fauna, including burrowing fauna, to relocate such as needed by suitably qualified staff to avoid loss of wildlife ■ Ensure that excavations or areas with high machinery traffic are cordoned off to avoid any livestock or wildlife falling or meandering into such areas ■ As far as possible, wheels of large machinery should be checked prior to entering topsoil storage sites and cleared of alien plant seed or any other alien plant material (especially of species with spiny or bur-like seeds) to reduce the introduction and spread of alien invasive plants. All such plant material removed should ideally be incinerated		■ No spread of alien plants onto topsoil stockpiles
4	General On-Going Operation	■ No open fires may be lit for cooking or any other purposes, unless in specifically designated and secured areas ■ Clearly delineate where fire risks will be highest, and where fire-breaks need to be created and maintained. As part of the management plan, clearly describe how such firebreaks will be maintained, and ensure such do not interfere with natural surface runoff processes.	Pre-construction, construction, operation	No accidental fires caused by ignorance
5	General On-Going Operation	Alien invasive plants must be eradicated on an ongoing basis when germinating on any stockpiles or open areas within the Project footprint, and before being able to produce more regenerative material	Construction, operation	No spread of and gradual elimination of alien plants from the Project Area

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
6	General On-Going Operation	The following must be strictly prohibited: ■ Harvesting/hunting for own use, purchase or transport of any threatened or protected wildlife/indigenous plant products from the site, local communities or passing traders ■ Unauthorised driving to areas not directly affected by the Project footprint nor intended for driving. ■ The disposal of waste must at all times be controlled, especially organic waste that could attract unwanted species such as rats but more importantly scavengers such as the red listed vulture species that potentially occur in the area.	Construction, operation	General rule book and induction should incorporate such measures and inspection/checks should be undertaken by ECO
7	General on-going operation	Project Management will work with specialists to conduct biodiversity monitoring surveys every 5 years, as stipulated in the Biodiversity Action Plan to be drafted at the latest within one year of operation. The monitoring will include but not be limited to: ■ All requirements relating to site rehabilitation, reforestation, dust control and other measures as set out in the MoU with DEFCCS ■ Monitoring effectiveness of alien plant control ■ Monitoring progression and success of reforestation and rehabilitation efforts ■ Monitoring the integrity of natural habitat within and adjacent to the Project Area ■ Monitoring the overall composition of natural biodiversity and ecological state of habitats	Operation	Monitoring survey report for biodiversity every 5 years
8	General On-going Operation	A Biodiversity Action (or detailed Management) Plan should be established at the latest within one year of operation, and be	Pre-construction to pre-operation	Biodiversity Action or Management Plan Vulture Monitoring Plan

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
		revised every 5 years, incorporating the findings of the monitoring surveys. This should include a Vulture Monitoring Plan as developed by a suitably qualified specialist		
9	General On-going Operation	The following must be strictly prohibited: ■ Purchase or transport of any bush-meat products from local communities or passing traders ■ Any form of ensnarement or hunting of wildlife ■ Any unauthorised driving to areas not directly affected by the Project nor intended for driving Handling of snakes or wildlife that may become entrapped in Project areas must be done by suitably qualified staff	Pre-construction, construction, operation	Regular checks on site by ECO and communication with the local community
10	General On-going Operation	Regularly conduct inspections of Project area peripheries for detect and remove any snares	Pre-construction, construction, operation	ECO visual inspection of area for snares
11	Ground Works / Site Clearance	Topsoils should ideally not be stored in heaps higher than 2 m, may never be compacted and the growth of natural vegetation on such piles during storage should be encouraged or facilitated, as this continually builds up soil seed banks in such soil, which will be useful for the rehabilitation process	Construction, operation	Soil Stockpile Management Plan
12	Rehabilitation	Draft an initial progressive rehabilitation plan, based on the successive quarry excavation plan, to be incorporated into the overall reforestation implementation and ecosystem conservation management plan. This should also incorporate use and placement of topsoil and potential waste rock. To aid a more rapid and early decommissioning of mined areas, pits should be backfilled as soon as possible,	Operation	Incorporate into Rehabilitation Plan

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
		landscaped to surroundings and re-vegetated (but strictly without the alien invasive species that may have been present prior to quarrying)		
13	Rehabilitation	Obtain a representative baseline of soil fertility and texture prior to clearing to aid rehabilitation of soils by being able to ameliorate soil conditions to resemble pre-quarrying conditions	Pre-construction	Soil Fertility Test prior to quarrying
14	Rehabilitation	Prior to rehabilitation, landscaping of disturbed areas needs to be undertaken in a way that ensures sufficient surface roughness, but also blend in with natural runoff and drainage patterns, whilst still preventing the start of rill- or gully erosion (or worse).	Operation	Incorporate into Rehabilitation Plan
15	Rehabilitation and reforestation	Rehabilitate and revegetate all areas that have been disturbed progressively during all phases of the Project, i.e. construction, operation and decommissioning. This will be according to a Rehabilitation Plan that needs to be compiled by a suitably qualified specialist and aligned to the DEFCCS MoU	Construction, operation	Incorporate into Rehabilitation Plan

16.3 Social Management

16.3.1 Management of Socio-Economic Impacts

The management of socio-economic impacts associated with the Project will be undertaken in accordance with the following:

- Applicable legislative and regulatory requirements of Senegal;
- The requirements of the IFC Performance Standards; and
- The Corporate Social Responsibility policy of CIMAF and its commitment to sustainable development.

16.3.1.1 Traditional Livelihood Activities

Objectives

A Livelihood Restoration Plan (LRP) has been prepared to manage impacts on traditional livelihood activities resulting from the Project's use of land in the Classified Forest. Implementation of the LRP will be underway prior to land access by the Project (i.e. the start of construction).

Specific objectives of the LRP include the following:

- Identify the households and community groups that will be economically displaced as a result of the Project;
- Develop an engagement process to enable the meaningful participation of affected stakeholders in the livelihood restoration planning process;
- Involve relevant stakeholders and qualified local partners in the design and implementation of livelihood restoration measures;
- Strengthen traditional livelihood activities where possible;
- Identify vulnerable persons or marginalised groups who may be disproportionately affected by displacement impacts and put appropriate support measures in place;
- Enable ongoing monitoring of the effectiveness of livelihood restoration measures and inform adjustments to activities as needed; and
- Build constructive relationships with external stakeholders in the Project's Area of Influence (AoI) and strengthen the Project's social license to operate.

Livelihood restoration measures have been designed to strengthen traditional livelihood activities while reducing household dependence on the use of natural resources from within the Classified Forest to the extent possible. Consideration has been given to the need to avoid, minimize or mitigate any impacts that new livelihood activities would have on other natural or near-natural habitats in the Classified Forest.

Responsibility

As the owner and operator of the Project, CIMAF has responsibility for the management of impacts on traditional livelihoods. The development, implementation, and monitoring of the LRP will be contracted by CIMAF to a qualified third party if this capacity is not available internally.

Performance Criteria

As per the requirements of PS5, the LRP must be finalised and implementation underway in advance of land access. This means livelihood restoration measures must be initiated before the Project can begin any construction activities on the land it has been allocated within the Classified Forest. A close-

out audit should be conducted when livelihood restoration is complete to confirm the objectives set out in the LRP have been met. Livelihood restoration will be considered complete when the livelihoods of affected households have been restored to pre-Project levels; this normally requires a minimum period of two years.

The LRP includes key performance indicators (KPI) within its monitoring and evaluation program. As part of the development of detailed implementation plans for livelihood restoration programs, additional indicators will be developed in consultation with external stakeholders to ensure they reflect the local context and have value for affected households and other parties interested in the livelihood restoration process.

Community questions, concerns or issues related to impacts on traditional livelihood activities will be discussed through the procedures and mechanisms set out in the Project's Stakeholder Engagement Plan (SEP). Any related grievances will be recorded and resolved through the Project's Grievance Management System (GMS).

16.3.1.2 Access to Ecosystem Services

Objectives

Prior to initiation of construction the Project will identify and implement feasible measures to mitigate impacts on local residents' access to ecosystem services within the Classified Forest.

This process will involve consultation with stakeholders in accordance with the procedures and mechanisms defined in the Project's SEP and aims to build constructive relationships with external stakeholders in the AoI and strengthen the Project's social license to operate.

Responsibility

As the owner and operator of the Project, CIMAF has responsibility for the management of impacts on access to ecosystem services. Consultation with stakeholders on this topic will be contracted by CIMAF to a qualified third party if this capacity is not available internally. Implementation of specific measures may require coordination with and/or participation of contractors or other service providers involved in the Project.

Commitments made and procedures established by the Project to measures to avoid, minimise or mitigate impacts on access to ecosystem services over the life of the Project must be respected by contractors and their personnel. Procedures will be enforced and monitored by CIMAF.

Performance Criteria

Specific measures identified to mitigate impacts on local residents' access to ecosystem services will be recorded in the Project's Environmental & Social Action Plan (ESAP), with specific responsibilities, timelines, and resources allocated. The ESAP for the construction phase will be finalised prior to land access by the Project.

The management of impacts on access to ecosystem services will be actively monitored throughout the construction and operations phases. Any incidents related to access to ecosystem services will be recorded in the Project's Environmental, Health, Safety and Social (EHSS) database and addressed by the appropriate parties, including contractors and personnel.

Community questions, concerns or issues related to impacts on access to ecosystem services will be discussed through the procedures and mechanisms set out in the Project's SEP. Grievances will be recorded and resolved through the Project's GMS.

16.3.1.3 Community Health and Safety

Objectives

The Project will consult with relevant stakeholders on any measures that could be taken to mitigate impacts on community health and safety during its construction and operations phases. This consultation will be undertaken in accordance with the procedures and mechanisms set out in the SEP and will help build constructive relationships with external stakeholders in the AoI and strengthen the Project's social license to operate.

In addition, the Project has prepared the following plans to manage potential impacts on community health and safety:

- Traffic Management Plan (TMP) (Annexure I) to define and enforce policies to promote the health and safety of community members and other external stakeholders along the transportation corridor for delivery of materials to the Project site (to be prepared prior to the start of construction);
- Influx Management Plan (IMP) (Annexure J) to identify and manage the impacts of project-induced in-migration on host communities and associated risks to the Project (currently being finalised); and
- Framework Local Content Plan (LCP) (Annexure K) to formalise the Project's commitment to local recruitment and procurement and define and promote the process for hiring skilled and unskilled workers (to be prepared prior to the start of construction).

Responsibility

As the owner and operator of the Project, CIMAF has responsibility for the management of impacts on community health and safety. Consultation with stakeholders on this topic and the preparation of associated management plans (including the TMP, LCP and IMP) will be contracted by CIMAF to a qualified third party if this capacity is not available internally. Implementation of specific measures may require coordination with and/or participation by contractors or other service providers involved in the Project.

Commitments made and procedures established by the Project to measures to avoid, minimise or mitigate impacts on community health and safety over the life of the Project must be respected by contractors and their personnel. Procedures will be enforced and monitored by CIMAF.

Performance Criteria

Specific measures identified to mitigate impacts on community health and safety will be recorded in the Project's ESAP, TMP, LCP and IMP. Each will allocate specific responsibilities, timelines, and resources for implementation. The ESAP for the construction phase will be finalised prior to land access by the Project; the TMP, LCP and IMP will be finalised prior to construction.

The management of impacts on community health and safety will be actively monitored throughout the construction and operations phases. Any health and safety incidents involving community members will be recorded in the Project's EHSS database and addressed by the appropriate parties, including contractors and personnel.

Community questions, concerns or issues related to health and safety will be discussed through the procedures and mechanisms set out in the Project's SEP. Grievances will be recorded and resolved through the Project's GMS.

KPIs will be developed as part of the TMP, LCP, and IMP to monitor their respective implementation and evaluate associated outcomes.

16.3.1.4 Cultural Heritage

Objectives

Prior to the commencement of the site clearance activities, the Project will undertake a verification survey to confirm the presence and location of any cultural heritage sites that could be affected. Relevant stakeholders from surrounding communities should be consulted as part of this process, including the development of management measures for any identified sites to ensure they are locally appropriate.

The Project will prepare a Cultural Heritage Management Plan (CHMP) to ensure all cultural heritage issues are addressed and managed adequately. Items to be addressed in the plan include (but not limited to) regulator engagement, further field surveys if deemed necessary following community and stakeholder consultations, access management, Community Grievance Mechanism, a Chance Finds (including graves) Procedure, mitigation control and management of Intangible heritage through community engagement.

Consultation on cultural heritage management will be undertaken in accordance with the procedures and mechanisms set out in the Project's SEP and will help build constructive relationships with external stakeholders in the AoI and strengthen the Project's social license to operate.

Responsibility

As the owner and operator of the Project, CIMAF has responsibility for the management of impacts on cultural heritage. Management of cultural heritage impacts – including consultation with stakeholders, field surveys, and development of a Chance Finds Procedure - will be contracted by CIMAF to a qualified third party if this capacity is not available internally.

Commitments made and procedures established by the Project to measures to avoid, minimise or mitigate impacts on cultural heritage over the life of the Project must be respected by contractors and their personnel. Procedures will be enforced and monitored by CIMAF.

Performance Criteria

Prior to the commencement of the site clearance activities, the Project will undertake a verification survey to confirm the presence and location of any cultural heritage sites that could be affected. Specific measures identified related to management of any identified cultural heritage sites will be recorded in the Project's ESAP, with specific responsibilities, timelines, and resources allocated. The ESAP for the construction phase will be finalised prior to land access by the Project.

Cultural heritage management will be actively monitored throughout the construction and operations phases. Any chance finds or other incidents related to cultural heritage will be recorded in the Project's EHSS database.

Community questions, concerns or issues related to cultural heritage will be discussed through the procedures and mechanisms set out in the Project's SEP. Grievances will be recorded and resolved through the Project's GMS.

16.3.1.5 Access to Water

Objectives

During the technical planning process for the drilling of its borehole, the Project will consider feasible options to assess, minimise and monitor its impacts on access to water by communities in its AoI. Measures will be implemented prior to construction in order to minimise impacts on access to water to the extent possible.

Impacts will be monitored throughout the Project construction and operations phases and reported to external stakeholders regularly to contribute to transparency and accountability.

The Project will engage local stakeholders in order to raise awareness of the steps it is taking to manage impacts on access to water and to discuss any additional measures to be taken in this regard. Engagement will be undertaken in accordance with the procedures and mechanisms set out in the SEP and will help build constructive relationships with external stakeholders in the AoI and strengthen the Project's social license to operate.

Responsibility

As the owner and operator of the Project, CIMAF has responsibility for the management of impacts on access to water by residents in the Project's AoI.

Consultation with stakeholders will be contracted by CIMAF to a qualified third party if this capacity is not available internally. Implementation of specific measures may require coordination with and/or participation by contractors or other service providers involved in the Project.

Commitments made and procedures established by the Project to measures to minimise or monitor impacts on access to water over the life of the Project must be respected by contractors and their personnel. Procedures will be enforced and monitored by CIMAF.

Performance Criteria

Specific measures identified to minimise and monitor impacts on access to water by communities in the AoI will be recorded in the Project's ESAP, with specific responsibilities, timelines, and resources allocated. The ESAP for the construction phase will be finalised prior to land access by the Project.

The management of impacts on access to water will be actively monitored throughout the construction and operations phases. Any related incidents will be recorded in the Project's EHSS database and addressed by the appropriate parties, including contractors and personnel.

Community questions, concerns or issues related to health and safety will be discussed through the procedures and mechanisms set out in the Project's SEP. Grievances will be recorded and resolved through the Project's GMS.

16.3.1.6 Economic Development

Objectives

In accordance with CIMAF's Corporate Social Responsibility Policy, the Project will work to support sustainable development of communities in the Project's AoI as part of its activities during the construction and operations phases. This commitment will be realised through the following management plans, which will allow the Project to optimise its contribution to economic development in the Project's AoI:

- Framework Local Content Plan (LCP) (Annexure K): Formalizing the Project's commitment to local recruitment and procurement, this plan will define the process for the recruitment of skilled and unskilled workers from the Project's AoI and for the procurement of local goods and services (to be prepared prior to the start of construction); and
- Framework Social Investment Plan (SIP) (Annexure L): This plan will be developed in collaboration with local stakeholders and will define the criteria and procedure that will be followed by the Project for the selection of community development initiatives that will receive financial or in-kind support from the Project during the construction and operations phases (to be prepared prior to the start of construction).

Responsibility

As the owner and operator of the Project, CIMAF has responsibility for the management of impacts on and its contribution to economic development.

Consultation with stakeholders on economic development and the preparation of the LCP and SIP will be contracted by CIMAF to a qualified third party if this capacity is not available internally.

Commitments made and procedures established by the Project to manage local employment and procurement must be respected by contractors and their personnel. Procedures will be enforced and monitored by CIMAF.

Contractors or other service providers may be involved in the implementation of specific social investment measures that are supported by the Project.

Performance Criteria

Preparation of the LCP and SIP will include allocation of responsibilities, timelines, and resources for implementation. Each plan will also include KPIs to monitor their respective implementation and evaluate associated outcomes. The LCP and SIP will be finalised prior to construction.

Any incidents related to local employment, local procurement or social investment will be recorded in the Project's EHSS database and addressed by the appropriate parties, including contractors and personnel.

Community questions, concerns or issues related to these topics will be discussed through the procedures and mechanisms set out in the Project's SEP. Grievances will be recorded and resolved through the Project's GMS.

Table 16-7 Social Management Measures

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
Traditional Livelihood Activities				
1	Livelihood Restoration Planning	Preparation of LRP in accordance with the requirements of PS5	Prior to construction	■ Recruitment of a qualified specialist to prepare LRP ■ Consultation with stakeholders on design of livelihood restoration measures, in accordance with SEP ■ Validation of draft LRP with external stakeholders ■ Finalisation of LRP prior to construction
2	LRP Implementation	Initiation of livelihood restoration measures prior to land access	Prior to and throughout construction	■ Initiation of livelihood restoration measures prior to land access ■ Ongoing consultation as per SEP ■ Related grievances recorded in GMS
3	LRP Monitoring	Monitoring in accordance with requirements of LRP	Continuous throughout construction and operations	■ Monitoring in accordance with indicators and procedures set out in LRP ■ Evaluation of LRP upon completion
Access to Ecosystem Services				
4	Planning	Consultation with relevant community and government stakeholders on measures to mitigate impacts on access to ecosystem services	Prior to construction	■ Consultation with stakeholders on mitigation measures ■ Preparation of ESAP with specific measures and associated responsibilities, timelines and resources
5	Implementation	Implementation of measures in accordance with ESAP	Continuous throughout construction and operations	■ Measures implemented in accordance with ESAP ■ Incidents recorded in EHSS database ■ Ongoing consultation as per SEP ■ Related grievances recorded in GMS
6	Monitoring	Monitoring in accordance with ESAP	Continuous throughout	■ Monitoring and reporting in accordance with ESAP

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
			construction and operations	
Community Health & Safety				
7	General Planning	Consultation with local stakeholders on measures to mitigate impacts on community health and safety during the construction and operations phases	Prior to construction	■ Consultation with stakeholders on mitigation measures ■ Preparation of ESAP noting specific actions with associated responsibilities, timelines and resources
8	Traffic Management Planning	Development of TMP	Prior to construction	■ Recruitment of a qualified specialist to prepare TMP (if necessary) ■ Consultation with stakeholders on traffic management measures around settlement areas ■ Finalisation of TMP prior to construction
9	Local Content Planning	Development of LCP	Prior to construction	■ Recruitment of a qualified specialist to prepare LCP (if necessary) ■ Consultation with stakeholders on local employment procedure ■ Finalisation of LCP prior to construction
10	Influx Management Planning	Development of IMP	Prior to construction	■ Recruitment of a qualified specialist to prepare IMP ■ Consultation with stakeholders on influx management measures ■ Finalisation of IMP prior to construction
11	Implementation	■ Implementation of measures in accordance with ESAP ■ Implementation of TMP ■ Implementation of LCP ■ Implementation of IMP	Continuous throughout construction and operations	■ Implementation in accordance with ESAP, TMP, LCP, IMP ■ Incidents recorded in EHSS database ■ Ongoing consultation as per SEP ■ Related grievances recorded in GMS
12	Monitoring	Monitoring in accordance with ESAP, TMP, LCP, IMP	Continuous throughout	Monitoring and reporting in accordance with ESAP, TMP, LCP, IMP

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
			construction and operations	
Cultural Heritage				
13	Planning	■ Verification survey by project team (comprehensive walk-over reconnaissance of all proposed areas of ground works) ■ Consultation with local residents to identify intangible heritage (considering seasonality) ■ Engagement with relevant stakeholders on design of appropriate management measures (including with regulators on any permits) ■ Preparation of Chance Finds Procedure	Prior to construction	■ Recruitment of a qualified specialist for field surveys, and development of Cultural Heritage Management Plan (CHMP), Grave Relocation Plan and Chance Finds Procedure (if necessary) ■ Completion of field survey ■ Engagement of stakeholders on intangible heritage and management measures ■ Development of CHMP and Grave Relocation Plan and Chance Finds Procedure
14	Implementation	■ Implementation of management measures for any identified cultural heritage sites (if necessary) ■ Chance Finds Procedure, including enforcement of application by all personnel and contractors	Continuous throughout construction and operations	■ Measures implemented in accordance with CHMP and Chance Finds Procedure ■ Incidents recorded in EHSS database ■ Ongoing consultation as per SEP ■ Related grievances recorded in GMS
15	Monitoring	Monitoring in accordance with ESAP and Chance Finds Procedures	Continuous throughout construction and operations	Monitoring and reporting in accordance with CHMP and ESAP

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
Access to Water				
16	Planning	Identification of measures to assess, minimise and monitor impacts on access to water	Prior to construction	▪ Preparation of ESAP with specific measures and associated responsibilities, timelines and resources
17	Implementation	Implementation of measures in accordance with ESAP	Continuous throughout construction and operations	▪ Measures implemented in accordance with ESAP ▪ Incidents recorded in EHSS database ▪ Ongoing consultation as per SEP ▪ Related grievances recorded in GMS
18	Monitoring	Monitoring in accordance with ESAP	Continuous throughout construction and operations	Monitoring and reporting in accordance with ESAP
Economic Development				
19	Local Content Planning	See line 9 above	See line 9 above	See line 9 above
20	Social Investment Planning	Development of SIP	Prior to construction	▪ Recruitment of a qualified specialist to prepare SIP (if necessary) ▪ Consultation with stakeholders on criteria and procedure for social investment ▪ Finalisation of SIP prior to construction
21	Implementation	▪ Implementation of LCP ▪ Implementation of SIP	Continuous throughout construction and operations	▪ Implementation in accordance with ESAP, LCP, SIP ▪ Incidents recorded in EHSS database ▪ Ongoing consultation as per SEP ▪ Related grievances recorded in GMS

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
22	Monitoring	Monitoring in accordance with LCP, SIP	Continuous throughout construction and operations	Monitoring and reporting in accordance with LCP, SIP

16.3.2 Traffic and Transportation

Objectives

The purpose of the Traffic and Transportation Management Plan ("TMP") for the Project is to manage and reduce Project-related risks and impacts to infrastructure and human safety along roads used for Project transportation. Project construction and operation will generate additional traffic, including heavy truck trips, on public roads, primarily on the 25 km segment of the N2 between the A2 Toll Road and Route Theis-Sindia. The Project access road is shared with other users, including a water utility, market garden businesses, and persons using the Thiès Classified Forest for herding, foraging, and other uses.

The management strategies for infrastructure and traffic congestion focus on the Project access road and N2 segment described above. Beyond these road segments, project traffic would be dispersed along local roads (for employee transportation) or regionally or internationally (for deliveries to and from the Project site). The management strategies for traffic safety would enhance the safety of all project transportation, whether that traffic occurs on local roads or extends to the regional, national, and international transportation network.

The impact assessment identifies the most substantial transportation-related impacts (traffic congestion, degradation of road facilities, and road safety), during the Construction and Operations phases. This Plan presents the recommended strategies and measures to mitigate or eliminate potential safety and transportation risks and impacts for affected populations and areas.

Responsibility

- CIMAF is ultimately responsible for the execution and enforcement of the TMP.
- Construction contractors will be responsible for carrying out the physical work associated with the management plans and any work required to maintain compliance with the standards outlined herein throughout the construction project. During Project operations, CIMAF will manage all quarry and plant operations. For both phases, Standard Operating Procedures (SOPs) must be developed by the CIMAF Management Team in concert with construction contractors and CIMAF managers to ensure compliance.
- CIMAF will appoint appropriate individuals (Supervisors and Technicians) to oversee the monitoring programs and reporting of results and to serve as a point of contact for information dissemination.
- CIMAF will ensure that all employees and contractors involved in management of transportation-related activities have appropriate training. All new employees will receive a project specific induction that will summarise the requirements of the management plan, provide them with the appropriate resources to fulfil their relevant commitments, and direct them to the appropriate resources responsible for monitoring their individual activities and compliance.
- Whenever possible, there will be co-ordination between tasks that are common to the TMP and other management plans relevant to the project. Supervisors will have the authority to shut down a task or activity if there is non-compliance and/or infraction of the Traffic and Transportation Management Plan until that non-compliance and/or infraction is rectified.

Performance Criteria

Optimal integration of project-related traffic into national traffic networks, minimal secondary impacts by on-site traffic and contribution to road maintenance where applicable.

Table 16-8 Traffic Management

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
1	Road infrastructure maintenance	Conduct pre-construction and periodic surveys of the status of the N2 from the A2 Toll Road to the Route Thies-Sindia.	Within 6 months prior to start of construction; periodically thereafter	▪ Completion of initial and periodic surveys on only the road from N2 to the plant (including intersection) (as frequently as deemed necessary in collaboration with the relevant authorities) ▪ CIMAF maintains records of periodic physical road surveys; records are available to government agencies and the public.
2	Road infrastructure maintenance	Require drivers to immediately report deterioration in road condition to manager. In the same log or written record as the annual road surveys, provide form to facilitate manager notations of driver reports on changes in road conditions, including date, location and nature of change.	Ongoing during construction and operations	CIMAF maintains ongoing, complete record of driver observations during construction and operations; records are available to government agencies and the public.
3	Road infrastructure maintenance	Maintain the Project access road between the N2, the quarry, and clinker plants in good condition	As needed	Project access roads are in good condition at all times
4	Road infrastructure improvements for increased safety and reduced potential for congestion	To recommend corrections to the Roads Authorities such as widening, signage, and revised road geometry to ensure safe and efficient truck movements in unsafe conditions. Coordinate the study with appropriate government authorities. Specifically, consider the addition of turn lanes at	Once, within 6 months prior to start of construction	▪ Notify roads authorities of dangerous or unsafe road conditions ▪ CIMAF maintains record of completed road survey and study, as well as record of communication about road survey and study results with road users, community

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
		the intersection of the N2 and Project access road. Communicate study results with other road users, appropriate community groups, and road authorities.		groups and road authorities. Records are publicly available, with copies provided upon request.
5	Road infrastructure improvements for increased safety and reduced potential for congestion	Based on study results in Action #6, coordinate with appropriate authorities to identify and implement improvements.	Once, prior to commencement of construction	Completion of projects identified in Action #6.
6	Traffic management for improved safety and reduced road congestion	Work with appropriate authorities to provide active traffic management - police officers or others directing traffic to avoid congestion or dangerous driving behaviours - at the intersection of the N2 with the Project access road during peak travel times, such as morning and evening peak travel for employees and arrival of extensive truck transports.	Daily for ongoing construction or operations	Number of crashes or other traffic incidents at the intersection of N2 and Project access road during morning and evening peak hours.
7	Enhanced safety through stakeholder engagement and education	Maintain and enhance relationships with local stakeholders to understand risks particular to truck traffic on the Project access road and N2, and coach routes for employees on local roads within communities where employees live. Understand locations with higher crash incidence, risk factors, and community events that may lead to traffic congestion. Develop understanding of community traffic patterns and schedules, especially times when N2 is travelled	Community meeting at least 6 months prior to construction; periodic meetings until planning for safety measures and pre-construction road improvements are complete	▪ Periodic community meetings during pre-construction period ▪ CIMAF captures meeting notes, makes them available to the public, and follows up on concerns. Notes should specifically include information on use of roads by school children or buses and community events that would impact traffic

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
		by school children, school buses or other sensitive receptors, or when community events would result in high road use.		
8	Enhanced safety through stakeholder engagement and education	Maintain and enhance ongoing communication with stakeholders, such as road users and community residents. Meetings can be scheduled and advertised solely for communication on CIMAF transportation or can occur within the context of regularly scheduled community meetings.	In-person meetings annually or more frequently with stakeholders	▪ Annual or more frequent meetings. ▪ CIMAF maintains meeting records, makes them available to the public, and follows up on concerns.
9	Enhanced safety through stakeholder engagement and education	Provide a grievance mechanism that is easy to access, transparent, and responsive. Accept grievances in writing, electronically, by telephone, or verbally at community stakeholder meetings. Create written record of all grievances submitted verbally.	Ongoing availability; initial response within one week; timely resolution or final response	Number of grievances received CIMAF maintains records of grievances, initial response, and final resolution or disposition.
10	Enhanced safety through stakeholder engagement and education	Provide community education programmes on road safety and vehicle interactions. Increase road safety awareness for school children and community members.	Ongoing availability of training personnel and materials; in-person educational sessions at least twice annually	▪ Publication of safety and educational materials on road safety and driving or walking safely on roads used by Project traffic. ▪ In-person training at local schools and community meetings upon request.
11	Enhanced safety and reduced road congestion	Schedule truck trips to reduce safety risks and avoid conflicts and delays based upon community traffic patterns. Avoid truck trips during time periods	Continual during construction and operations	Availability of schedules that avoid Project truck traffic on N2 at times when school buses or school children are using road or when major community events that would affect N2 occur.

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
		when N2 is more likely used by school children, school buses or other sensitive receptors.		
12	Enhanced safety through driver training, both general and project-specific	Use only drivers with the required driving license. Enforce driver qualifications and training for all drivers, whether employees or sub-contractors. Include requirements in applicable contracts.	Continual during construction and operations	▪ Annual verification of all driving licenses for Project drivers. ▪ Provision of driver training to all Project drivers, including at least annual refresher training. ▪ CIMAF and contractors retain relevant records of licenses and training.
13	Enhanced safety through driver training, both general and project-specific	Establish driver training program specific to the vehicles, roads and risks encountered for the particular tasks. Require regular truck driver safety training, defensive driving training, and testing.	Annual trainings and briefings as needed for drivers during construction and operations	▪ Annual training. ▪ Briefings as needed. ▪ CIMAF and contractors retain driver training program materials and record of completion for all drivers
14	Enhanced safety through consistent safe driving practices	Establish and enforce rest and break standards that comply with industry and national standards.	Continual during construction and operations	CIMAF and contractors provide all drivers with written policies, and require drivers to sign agreement, indicating rest and break standards.
15	Enhanced safety through consistent safe driving practices	Structure contracts with truck contractors to avoid incentives for speeding or insufficient fatigue break	Continual during construction and operations	CIMAF contracts prioritise safe driver practices.
16	Enhanced safety through consistent safe driving practices	To the degree permissible by law, require daily or periodic drug and alcohol testing for all drivers.	Daily during construction and operations	▪ Daily or periodic drug and alcohol testing (to the degree possible). ▪ CIMAF and contractors provide drivers with written policies regarding drug and alcohol

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
		Enforce driver quality through loss of jobs or contracts for individual drivers for drug or alcohol offenses		use and testing. Retain records of testing as permissible by law.
18	Enhanced safety through consistent safe driving practices	If possible, equip trucks with speed governors or on-board GPS, and/or monitor vehicle speed and location. Enforce driver quality through loss of jobs or contracts for chronic or egregious speeding.	Continual during construction and operations	▪ Use of speed governors, GPS, or other monitoring efforts. ▪ CIMAF and contractors provide drivers with written policies regarding speeding; managers implement ongoing enforcement of policies.
19	Vehicles in good condition and safe to operate on public roads	If possible, Require scheduled, preventative vehicle maintenance according to manufacturers' recommendations for all Project vehicles, whether owned by Project or a contractor	Periodic during construction and operations	▪ Establishment of regular schedule for vehicle preventive maintenance. ▪ Documented completion of scheduled maintenance.
20	Vehicles in good condition and safe to operate on public roads	Complete a vehicle safety checklist weekly prior to vehicle operation on public roads	Weekly during construction and operations	CIMAF and contractor managers provide vehicle safety checklist to each driver weekly prior to vehicle operation.
21	Driver communication in case of emergencies	If possible, provide uniform in-vehicle communications systems that enable contact with truck traffic controllers and other drivers	Continual during construction and operations	CIMAF and contractors provide (or require, for independent truck operators) and ensure proper operation of in-vehicle communication systems, where possible.
22	Noise impact reduction	Require that noise-controlling devices be in good operating condition	Continual during construction and operations	CIMAF and contractors provide (or require, for independent truck operators) and ensure proper operation of noise-controlling devices.
23	Prevention of hazard and nuisance from airborne dust or dirt on roads or from truck spills	Securely cover loads on trucks (for quarrying and plant products and waste and deliveries of fuel and raw	Throughout construction and operations	CIMAF and contractors develop and enforce policies requiring truck load covers.

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
		materials) to minimise spillage and dust.		
24	Prevention of hazards and delays from truck spills	Do not overload trucks	Throughout construction and operations	CIMAF and contractors develop and enforce policies prohibiting truck overloading.
25	Prevention of nuisance and visibility hazard from airborne dust or dirt on roads	Use water trucks or other suitable means to reduce dust that would be carried onto the public roads by haul trucks and other vehicles	Throughout construction and operations	CIMAF and contractors use water trucks near quarry and clinker plant exit driveways to reduce dust that would be carried onto the Project access road or N2.

16.4 General Management

16.4.1 Waste Management Plan

Objectives

- The objectives for waste management are:
- To ensure that the waste strategy for the proposed project complies with the Senegalese legislative requirements.
- To ensure alignment with the good practice requirements set out in the International Finance Corporation (IFC) Performance Standards and IFC Environmental, Health and Safety Guidelines.
- Identify high-level waste streams associated with the construction phase of the proposed project.
- Categorise anticipated waste streams and ensure that the waste management hierarchy model is adopted for waste management, i.e., to REDUCE the amount of waste produced on site by procuring bulk goods rather than packaged goods and training workers on waste reductions, and to actively promote the REUSE, RECYCLE and RECLAIM waste management concept and subsequently minimising the amount of waste that needs to be disposed of.
- To ensure the end use of waste is as per its waste category assigned.
- To prevent and protect soil; surface water and groundwater from contamination through hazardous substance (including sewage) spills.
- To prevent and protect flora, fauna and people from indirect impacts associated with contaminated soil and water (both surface- and groundwater).
- To prevent health impacts arising via contact with general and/ or hazardous waste.
- To manage waste storage facilities in such a manner to minimise social as well as visual impacts.

Project Activities Resulting in Waste

Hazardous and non-hazardous wastes produced during the construction of the proposed project are listed in Table 16-9. The most typical hazardous waste likely to be generated during construction will include hydrocarbon contaminated waste (e.g., used oil containers; oil-contaminated soils and rags) as well as toilet sewage waste and solvents used to test asphalt mixes. Non-hazardous waste will include domestic litter and food waste; and wood and plastic packaging material.

Table 16-9 Waste Types Potentially Generated during Construction of the Project

HAZARDOUS WASTE	
Used batteries	Medical waste
Contaminated (soiled) rags	Creosote waste
Hydrocarbon contaminated soils	Bituminous mixture containing coal tar
Soiled drums	Sewage waste (from temporary toilets in active work areas)
Oil filters	Obsolete Electronics
Paint/ epoxy coating cans	Fluorescents tubes and other mercury containing waste (bulbs)
Printer cartridges	Untreated concrete truck washout waste water
Printer toner and drums	Untreated concrete batch plant waste water

Used solvents	Alkalines
Used oil	Acids (product with a pH of less than 6.5)
Used greases	Used absorbents
Used anti-freeze fluid	
NON-HAZARDOUS WASTE	
Textiles	Welding materials
Biodegradable food waste (and other biodegradable green waste)	Discarded PPE
Mixed plastics	Gypsum-based construction materials
Metals (scrap copper, brass, bronze and aluminium)	Concrete
Plastics	Ceramics
Wood	Unsoiled cloth
Paper and cardboard	Hardware (e.g. old tools, fasteners, etc.)
Conduit	Clean mechanical parts
Glass	Clean drums, pails, boxes
Insulation	Welding materials
Tyres	Discarded PPE

Responsibility

CIMAF, as Project owner, shall assume responsibility for ensuring the waste management systems are implemented and aligned with relevant Senegalese legal requirements. During construction, field implementation and management/storage/disposal of construction wastes are the responsibility of the Contractor. Other parties, such as the Engineer, will also assume certain responsibilities in this regard which are detailed below.

Table 16-10 Waste Management

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
Waste Management Method Statements				
1	Method Statements	Method Statements shall be prepared covering all waste activities at active work areas (including quarries and borrow pits) and the Construction Camp prior to start of waste generating activities. The Waste Management Method Statements will need to include methods associated with waste handling; waste transport; waste storage and segregation; and waste disposal / treatment / recycling / reclamation options identified for the proposed project.	Prior to construction	Waste method statements
Waste Handling				
2	Waste Segregation	Waste will be segregated according to its composition, source, and type at source and contained in appropriately labelled and/or colour coded waste containers or waste skips. The above will also aim to optimise recycling as far as possible.	Throughout construction	Proper segregation of waste in appropriately labelled waste containers
3	Waste containers	Appropriately labelled bins will be located in all locations onsite where waste is generated and will make provision for the sorting of solid waste.	Throughout construction	Adequate number of bins
4		All bulk waste containers on site (skips, bins, drums etc.) shall be appropriately labelled to show what class and type of waste can be disposed of in them.	Throughout construction	Appropriately labelled waste containers
5		Waste containers will be appropriately designed in terms of volume, composition, and shape. Containers that may react with the waste to produce a harmful substance will not be used. All waste containers will be secured to prevent spillage and interference from birds and animals.	Throughout construction	Provision of adequate waste containers
6		As far as possible, only one class or type of waste will be stored in each container.	Throughout construction	Waste separation and optimal recycling
7		All waste containers located in the main waste handling facility (located at the Construction Camp) will be closed with a lid and enclosed in an area that is fenced and access will be restricted.	Throughout construction	Enclosed waste containers in accessed controlled area

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
8	Mixing of Wastes	Solid and liquid wastes will not be mixed.	Throughout construction	Segregation of solid and liquid wastes
9	Waste Handling and Training	All waste will be handled in accordance with its class (hazardous or non-hazardous) and all personnel collecting, handling, transporting or disposing of waste will be trained in the proper procedures for dealing with the said waste class.	Throughout construction	Training records
10	Waste Management	To promote “4Rs” (Reduce, Reuse, Recycle and Reclaim) waste management concept, all waste will be sorted and managed as appropriate, either for reuse, recycling or disposal.	Throughout construction	Waste logs
11	Waste Water (including sewage)	All waste water (including sewage) will be treated onsite and treated waste water discharge will be in compliance with the ambient water quality criteria for the area where discharge will take place.	Throughout construction	
12	Concrete Waste Management	A concrete washing area will be set aside for concrete trucks, to avoid build-up of waste concrete in site areas.	Throughout construction	Concrete washing area. No build-up of waste concrete on site
13	Vehicular Repair and Maintenance	Vehicle repair and maintenance pits will be regularly cleaned and any liquid build-up will be removed and treated as necessary.	Throughout construction	Cleaning records and no build-up of liquids
Waste Transport				
Waste will be transported from source to the main waste handling facility at the Construction Camp and final disposal sites, or directly to final disposal sites, in an appropriate manner, taking the following into account:				
14	Transport Containers	The nature, composition and integrity of transport packaging and containers will be appropriate to the type and class of waste being transported.	Throughout construction	Designated and equipped waste transport vehicles
15	Transport Vehicles	Transport vehicles will cater for the type, class and quantity of waste being transported in terms of its composition, load capacity, covering etc.	Throughout construction	
16		All transport vehicles will be equipped with suitable materials or equipment to contain, manage and remove accidental spillages.	Throughout construction	

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
17		Vehicles carrying hazardous wastes shall be labelled appropriately.	Throughout construction	Labelling of waste trucks
18	Waste Loading and Unloading	Loading and unloading procedures to avoid waste loss will be followed.	Throughout construction	Training records, site inspection
19	Training	Employees associated with transport of waste will be trained in the correct procedure to address accidents and emergencies.	Throughout construction	Training records
Waste Storage and Segregation for Non-hazardous Waste				
The main waste storage facilities within the Construction Camp will be appropriately designed (to protect from direct sunlight, wind and rain and to avoid any nuisance in terms of smell, scavengers and to prevent windblown materials), and bunded where required to contain accidental spills or leaks. The following waste storage and segregation procedures will be undertaken for Non-hazardous waste:				
20	Waste Segregation	Non-hazardous waste will be segregated into specific waste types, for those waste types that can either be recycled, reused or reclaimed (for example, paper, plastics, metals, glass, organic waste, hazardous wastes, etc.).	Throughout construction	Waste segregation
21	Waste Storage Areas	Separate storage areas will be constructed and utilised where appropriate. Separate storage areas will be appropriately designated and labelled.	Prior to construction	Waste segregation
22	Mixing of Wastes	If by error a hazardous waste is mixed with non-hazardous waste, the entire consignment will be regarded as hazardous.	Throughout construction	Operating procedure and waste management records
Waste Storage and Segregation for Hazardous Waste				
The main waste storage facilities within the Construction Camp will be appropriately designed i.e. appropriate flooring/ lining, covered (to protect from direct sunlight, wind and rain), and bunded where required to contain accidental spills or leaks. The following waste storage and segregation procedures will be undertaken for Hazardous waste:				
23	Waste Storage Areas	Temporary hazardous waste storage facilities at the main waste handling facility at the Construction Camp will be appropriately designed to prevent any contamination of the physical, biological and social environments.	Prior to construction	Provision of adequate hazardous waste storage facilities
24		Where appropriate, hazardous waste will be stored in sealed containers and placed in a fenced and gated storage facility within the main waste handling facility at the	Throughout construction	

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
		Construction Camp. The facility will have an impermeable floor, bunded and be covered to prevent rain from entering.		
25		Hazardous waste storage facilities within the main waste handling facility at the Construction Camp will have the following precautionary measures: ▪ Materials and equipment for fire-fighting purposes and mountings for fire extinguishers. ▪ Cleaning equipment and a system for flushing out ducts, receptacles and containers. ▪ Sufficient quantities of absorbent material to absorb or collect spilled or leaking waste. ▪ All areas shall be tightly sealed in such a way that there is no risk of soil or groundwater becoming contaminated. These areas shall be tested for water-tightness at regular intervals. ▪ Appropriate signage will be erected in the various waste areas.	Throughout construction	
26	Hazardous Waste Storage Duration	Hazardous waste will be temporarily stored before being collected by an authorised contractor for removal and offsite disposal, in an accredited facility. Removal of hazardous waste from site will follow a regular schedule (frequency to be determined). In this respect, the Contractor will adopt the 'cradle to grave' principle. Tracking documents, proving that the disposal of hazardous wastes has been delivered to an accredited facility, and disposed of in such a facility, correctly, will be retained by the Project for audit and verification purposes.	Throughout construction	Record of up to date tracking documents
27	Biomedical Waste	For biomedical waste: ▪ Waste will be generated and collected at the medical centre only. ▪ Waste will be collected and stored in containers designed specifically for that purpose.	Throughout construction	Adequate management of biomedical wastes

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Target / Performance Indicator
		▪ No person will transport biomedical waste without a valid permit issued in consultation with the relevant lead agency.		
28	Sewage	Treated sewage will conform to recognised sewage effluent standards before discharge into the environment.	Throughout construction	
Disposal / Treatment / Recycling / Reclamation				
29	Auditing Waste Contractors	The Project will audit waste contractors prior to agreeing any formal contracts and will ensure that all facilities that receive wastes from the proposed project are suitable and in line with the Senegalese legislation and IFC EHS General Guideline for Waste management (1.6). Waste contractors will need to keep detailed records on how waste from the Project has been disposed, or a facility as approved by the local government.	Prior to construction	Audit records
30	Removal of Waste	All remaining waste including (but not limited to) used materials, broken concrete, redundant fencing, fence posts, and litter will be removed when construction sites are closed. Waste will not be buried within the protected areas.	At the end of the construction phase for a specific section of the proposed project	Audit records

16.4.2 Blasting Management

Objectives

The objectives for blasting management are:

- To undertake blasting activities with no health and safety incidents; and
- To undertake blasting activities in an environmentally and socially sensitive manner.

Project Activities Resulting in the need for Blasting

Construction of the Project will require the blasting of the quarry.

Responsibility

CIMAF, as Project owner, shall assume responsibility for ensuring blasting operations for the Project are managed in line with the requirements under Senegalese law. As blasting operations are relatively restricted to construction related operations, field implementation of the blasting management controls will be executed by the Contractor. Other parties, such as the Engineer, will also assume certain responsibilities in the design of the road in this regard.

Performance Criteria

- No occupational or community health and safety incidents because of blasting.
- No complaints from communities in areas where blasting is taking place.

Table 16-11 Blasting Management

Ref No.	Aspect Activity	Management Measure	Timing and Frequency	Performance Indicator
1.	Method Statement	Method Statements will be produced for all activities associated with blasting (i.e. transport, storage, handling and use of explosives) together with emergency preparedness procedures. These Method Statements would need to be approved by the Project prior to commencement of the activity.	Start of construction	Method statement detailing all blasting management activities on site
2.	Grievances	The Project grievance procedure will be implemented in such way that the CLOs are able to manage and address any blasting complaints received.	Start of construction	Grievance register
3.	Training	No person will handle or use any explosive material unless that person is trained and authorised to use explosives.	Throughout construction	Training records
4.	Permitting	All permit / licensing requirements for the import (if necessary), transport, storage, use and disposal of explosives will be obtained prior to construction and will be in accordance with local legislation.	Prior to construction	Permits / licenses obtained and valid
5.	Storage and Transport	Explosives will be stored in appropriate (and licensed) magazines at secured, authorised locations and transported to work sites when needed. Detonators and bulk explosives will be stored and transported separately. Storage and transport will comply with the requirements of local legislation.	Throughout construction	No storage of explosives at active work sites
6.	Blasting Protocol	No person will bury, dump, hide or abandon any explosive.	Throughout construction	No unaccounted explosives
7.		Local residents and communities as well as nearby schools or other social gathering areas will be advised of the planned blasting schedule ahead of time. Noisy activities (e.g., blasting) are not to be scheduled around critical times (e.g., school exams, religious services/ celebrations). Local leaders, school principals, healthcare workers and religious leaders are to be consulted regarding times that may be negatively affected by noise.	Throughout construction	Tracking of grievances related to blasting or safety incidents, and regular and ongoing communication
8.	Secondary Blasting	The use of secondary blast will be minimised as far as possible. Rather hydraulic hammers or other mechanical methods will be used to the greatest extent to improve rock fragmentation and minimise fly-rock risks.	Throughout construction	Minimal use of secondary blast
9.	Minimise use of Explosives	Where feasible, mechanical ripping will be used, so as to minimise the use of explosives.	Throughout construction	Minimal use of explosives

16.5 Environmental and Social Monitoring

16.5.1 Introduction

The purpose of the environmental and social monitoring programme is to ensure that management measures, identified and described in Sections 16.1 to 16.3 are implemented and are effective at achieving an acceptable level of compliance with the ESMMP.

Table 16-12 and Table 16-13 presents the key aspects that will be monitored during the construction and operational phase.

Construction activities will be monitored on site by designated resources, with regular audits against the requirements of this ESMMP. The ultimate target is to achieve 100% compliance with the ESMMP.

Key aspects to monitor during the construction and operational phase include:

- Air Quality (Dust) Monitoring;
- Soil Monitoring;
- Water Monitoring;
- Biodiversity Monitoring;
- Social Monitoring;
- Traffic and Transport Monitoring;
- Noise Monitoring
- Waste Monitoring;
- Spill Monitoring; and
- Blasting Monitoring.

Contractor work sites must be monitored during construction, under the guidance of the Environmental Control Officer (ECO) and Community Liaison Officer (CLO) who are responsible for reporting the monitoring to the Environmental Manager and Social Manager, who in turn will be required to report to the CIMAF. CIMAF may undertake independent monitoring of selected parameters to verify the results of the Contractor and to audit the implementation of environmental mitigation measures contained in this ESMMP for the Project.

16.5.2 Construction Phase Monitoring

In accordance with the social management plans outlined in Section 3.3, monitoring of the following activities will be required during the construction phase:

- Stakeholder engagement;
- Grievance management;
- Implementation of livelihood restoration measures;
- Implementation of measures determined through consultation with local stakeholders and defined in the ESAP, including measures related to the management of impacts on:
  - Access to ecosystem services;
  - Community health and safety;
  - Access to water;
- Compliance with traffic management policies and procedures;
- Hiring of local skilled and unskilled workers;

- Population in-migration levels and settlement patterns;
- Purchase of goods and services from local suppliers; and
- Selection and delivery of support for community initiatives through the Project's SIP.

Incidents related to any of the above will be recorded in the Project's EHSS database.

16.5.2.1 Construction Phase

The primary pollutant of concern during construction is dust generation. The following monitoring steps are required:

- Undertake daily on-site and weekly off-site inspection, where receptors (including roads) are nearby, to monitor dust and record inspection results
- Carry out regular site inspections to monitor compliance with the DMP, record inspection results and identify any events that require further investigation or actions
- Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions
- It is recommended to undertake real-time PM_{10} monitoring around the site boundary, agreeing locations with regulatory authorities and lenders. Where possible, commence baseline monitoring at least three months before work commences on site

Stack Testing

The plant is fitted with a CEMS system for the purposes of monitoring emissions from the kiln, coal and cement stacks on a continuous basis. As part of the quarterly reporting the CEMS data should be reviewed and reported:

- Statistical data, reporting maximum and average emission concentrations
- Comparison to emission limits, flagging up any exceedances
- Data plot showing any peaks in emissions or periods when emission limits consistently exceeded

Periodic stack emissions testing should be undertaken on an annual basis whilst the plant is running in normal operating mode. The data from the stack tests should be used to adjust the CEMS system to eliminate any span drift that has occurred in the CEMS data.

Ambient Air Monitoring

Ambient air quality monitoring is required around the site boundary to verify that the operations are not leading to significant impacts at sensitive receptors.

- Pollutants and equipment
  - Gaseous pollutants (nitrogen dioxide and sulphur dioxide) using passive diffusion samplers
  - PM_{10} using continuous monitors (for example DustTrak, DM11, etc.) or periodic monitoring system if possible or deemed essential
  - Dust deposition using deposition monitored (dust bucket, sticky pad)
- Sampling plan
  - Continual throughout the project lifetime
- Sampling location
  - Operational phase: at a minimum of three locations on the site boundary representative of 'upwind' and 'downwind' locations based upon the prevailing wind direction.

- Given the wind direction is prevailing towards the north and northeast, monitoring locations should be to the south of the quarry and the north east of the quarry and north of the plant.

The purpose of the monitoring is to verify that on-site activities do not result in significant impacts at sensitive receptors. A key feature is that monitoring data feeds back into the active management of the on-site activities, and implementation of mitigation. This approach reflects the changes in emissions from the on-site activities over time as sources evolve and also captures short term changes in emissions due to changing weather conditions. The key parameter for monitoring is PM_{10}. Monitoring is undertaken at locations around the site boundary using real time monitors (for example, DustTrak, DM11, Dust Sentry, etc.).

The results of the PM_{10} monitoring are combined with meteorological data collected on site, and two analysis are undertaken:

- Firstly, concentrations at 'upwind' and 'downwind' monitoring sites are compared to ascertain the contribution from the on-site activities, noting that this can be done in near real time.
- Secondly, periodically, Pollution Roses are created for each monitoring site. This allows directional analysis of concentrations at each monitoring site, to identify whether elevated PM_{10} values are due to on-site sources of other, off site sources.

These analysis are done alongside the on-site activities to understand whether the site is having a significant impact, and inform mitigation.

This monitoring allows active management of emissions and mitigation, as well as providing data for reporting.

16.5.3 Operational Phase Monitoring

All environmental monitoring as initiated during the construction phase will be continued, possibly expanded, and requirements periodically updated as deemed necessary, during the operational phase. Social monitoring to continue during the operations phase, as per the social management plans, will include following activities:

- Stakeholder engagement;
- Grievance management;
- Implementation and completion of livelihood restoration measures;
- Implementation of measures determined through consultation with local stakeholders and defined in the ESAP, including any ongoing measures related to the management of impacts on:
  - Access to ecosystem services;
  - Community health and safety;
  - Cultural heritage;
  - Access to water;
- Compliance with traffic management policies and procedures;
- Hiring of local skilled and unskilled workers;
- Population in-migration levels and settlement patterns;
- Purchase of goods and services from local suppliers; and
- Selection and delivery of support for community initiatives through the Project's SIP.

Incidents related to any of the above will be recorded in the Project's EHSS database.

Table 16-12 Pre-construction & Construction Monitoring Measures (Engineer/ Contractor Responsibility)

Ref No.	Management Plan	Monitoring Measure	Responsibility	Timing and Frequency	Target / Performance Indicator
1	Air Quality and Dust Management Plan	Inspection of vehicle maintenance record. Visual inspection.	Environmental Manger	On ad hoc basis during dry conditions	A stable/dust free environment
2	Soil and Stockpile Management Plan	Visual inspection of soil stripping and stockpiling activity	Environmental Manager	Weekly, or according to activity	No loss of soil resources. No sign of accelerated erosion and sedimentation. No flooding of Project Area during unforeseen extreme rainfall events.
3	Water Management Plan	Ground water monitoring – levels and quality Surface water monitoring – quality	Environmental Manager	Pre-construction and during construction to obtain a seasonal baseline for capturing multi-seasonal data and 1-yr post construction Monthly	No demonstrable deterioration of water quality and availability due to Project activities
4	Biodiversity Management Plan	To be developed as part of the BAP	Environmental Manager	Monthly for first year during construction, to be adapted for operation as necessary	Intact biodiversity in areas not developed by CIMAF, within the project boundary. Optimal retention of Baobab trees.
5	Alien Vegetation Management Plan	To be developed following a thorough Alien Vegetation Assessment in the wet season.	Environmental Manager	Monthly	No alien vegetation present within the Project Area
6	Ecosystem Services Management	Visual inspection of perimeter fences Ensuring natural surface flows to wetlands outside the Project boundary are not entirely severed	Environmental Manager	Weekly	Effective protection of local users of natural areas within Project Area from the CIMAF ICP construction and operations

Ref No.	Management Plan	Monitoring Measure	Responsibility	Timing and Frequency	Target / Performance Indicator
7	Vulture Monitoring Plan	Identification of nesting sites within the Project footprint prior to clearing	Environmental Manager	According to requirements outlined in the Plan	No threats/impacts to Threatened Avifauna Species that potentially occur within the Project Area.
8	Stakeholder Engagement Plan (including Grievance Management System)	Monitoring measures to be defined in SEP will include: ▪ Stakeholder engagement activities recorded in EHSS database ▪ Tracking of resolution of grievances in GMS	Social Manager	▪ Engagement activities to be recorded in EHSS database within 48 hours ▪ Schedule for reporting on engagement and grievance management indicators to be defined in SEP	SEP finalised prior to land access
9	Livelihood Restoration Plan	Monitoring measures to be defined in LRP will include: ▪ Data collection to enable reporting against KPIs ▪ Updated socio-economic household surveys to track changes in household livelihoods and wellbeing ▪ Continuous consultation with displaced households and other stakeholders ▪ Tracking and resolution of related grievances in GMS	Social Manager	▪ Schedule for data collection to be defined in the LRP ▪ Consultation with stakeholders to be carried out continuously during the implementation of livelihood restoration measures and in accordance with the monitoring program defined therein ▪ Schedule for reporting on GMS to be defined in SEP	LRP finalised prior to land access
10	Environmental & Social Action Plan	Monitoring measures to be developed through consultation with stakeholders and defined in ESAP will include:	Social Manager	▪ Incidents to be entered into the EHSS database within 24 hours ▪ Schedule for reporting on GMS to be defined in	ESAP for construction phase finalised prior to land access

Ref No.	Management Plan	Monitoring Measure	Responsibility	Timing and Frequency	Target / Performance Indicator
		▪ Incidents to be recorded in the EHSS database ▪ Tracking of compliance with procedures by personnel and contractors ▪ Tracking and resolution of related grievances in GMS		SEP, related grievances to be reported on weekly during construction as part of EHSS report	
11	Traffic Management Plan	Monitoring measures to be defined in TMP will include: ▪ Incidents to be recorded in the EHSS database ▪ Tracking of compliance with procedures by personnel and contractors ▪ Tracking and resolution of related grievances in GMS	Social Manager	▪ Incidents involving external stakeholders to be reported to the Social Manager immediately ▪ Incidents to be recorded in the EHSS database within 24 hours ▪ EHSS report to be generated weekly during construction and to include data from GMS	TMP finalised prior to initiation of construction activities
12	Local Content Plan	Monitoring measures to be defined in LCP will include: ▪ Collection of data for reporting against KPIs, such as number of positions advertised, number of applications/profiles received, number of local persons hired, including disaggregation for skilled and unskilled labour, and number and type of goods	Social Manager	▪ EHSS report to be generated weekly during construction and to include employment data and data from GMS	LCP finalised prior to initiation of construction activities

Ref No.	Management Plan	Monitoring Measure	Responsibility	Timing and Frequency	Target / Performance Indicator
		and services purchased locally to the extent data is available ▪ Tracking of compliance with procedures by personnel and contractors ▪ Tracking and resolution of related grievances in GMS			
13	Influx Management Plan	Monitoring measures to be defined in IMP will include: ▪ Tracking of compliance with related policies and procedures (e.g., local employment, local procurement, worker accommodation and transport) by personnel and contractors ▪ Continuous consultation with displaced households and other stakeholders ▪ Tracking and resolution of related grievances in GMS	Social Manager	▪ Monitoring and reporting schedule to be defined in IMP ▪ EHSS report to be generated weekly during construction and to include data from GMS	IMP finalised prior to initiation of construction activities
14	Cultural Heritage Management Plan	▪ Monitoring of CHMP to maintain existing traditional public access routes to Foret de Thiès. ▪ Any chance finds of cultural heritage sites to be recorded in accordance with procedure	Environmental and Social Manager(s)	▪ Incidents to be recorded in the EHSS database within 24 hours ▪ EHSS report to be generated weekly during construction and to include data from GMS	CHMP and Chance Finds Procedure finalised prior to initiation of construction activities Effective management of cultural heritage assets Community involvement in cultural heritage finds

Ref No.	Management Plan	Monitoring Measure	Responsibility	Timing and Frequency	Target / Performance Indicator
		▪ Tracking of compliance with procedure by personnel and contractors ▪ Tracking and resolution of related grievances in GMS			
15	Social Investment Plan	Monitoring measures to be defined in SIP will include: ▪ Collection of data for reporting against KPIs, such as number of applications for support received, number/ type/ location of selected initiatives, amount/type of support provided ▪ Tracking and resolution of related grievances in GM	Social Manager	▪ Monitoring and reporting schedule to be defined in SIP ▪ EHSS report to be generated weekly during construction and to include data from GMS	SIP finalised during construction activities
16	Waste Management Plan	▪ Visual inspection of waste storage facilities. ▪ Review of waste manifestos. ▪ Review of contractor licenses. ▪ Review of waste inventory	Environmental and Social Manager(s) Contractors	Weekly (visual inspections)	▪ Effective waste management ▪ No pollution as a result of CIMAF activities

Table 16-13 Operational Monitoring Measures

Ref No.	Management Measure	Monitoring Measure	Responsibility	Timing and Frequency	Target / Performance Indicator
	Stakeholder Engagement Plan (including Grievance Management System)	Monitoring measures to be defined in SEP will include: ▪ Stakeholder engagement activities recorded in EHSS database ▪ Tracking of resolution of grievances in GMS	Social Manager	▪ Engagement activities to be recorded in EHSS database within 48 hours ▪ Schedule for reporting on engagement and grievance management indicators to be defined in SEP	Indicators to be defined in the SEP will include: ▪ Continuous consultation with stakeholders throughout the operations phase ▪ Satisfactory resolution of grievances within timeframes set in GMS
	Livelihood Restoration Plan	Monitoring measures to be defined in LRP will include: ▪ Data collection to enable reporting against KPIs ▪ Updated socio-economic household surveys to track changes in household livelihoods and wellbeing ▪ Continuous consultation with displaced households and other stakeholders ▪ Tracking and resolution of related grievances in GMS	Social Manager	▪ Schedule for data collection to be defined in the LRP ▪ Consultation with stakeholders to be carried out continuously during the implementation of livelihood restoration measures and in accordance with the monitoring program defined therein ▪ Schedule for reporting on GMS to be defined in SEP	Indicators to be defined in the LRP will include: ▪ Restoration of livelihoods of displaced households to pre-Project levels ▪ Continuous consultation with stakeholders during the livelihood restoration process ▪ Satisfactory resolution of related grievances within timeframes set in GMS
	Soil and Stockpile Monitoring Plan	Monitoring measures to be defined in the detailed operation and post-closure soil and stockpile management plan will include: ▪ Monitor quarry's slopes during operation and after closure of the facility	Environmental Manager	▪ Annual monitoring during the construction and operation of the quarry at the end of every rain season, and immediately after extreme rainfall events ▪ Bi-monthly monitoring to prevent the establishment (or early control)	▪ No loss of topsoil through erosion ▪ No infestation of topsoil with alien invasive plants or associated soil seed banks

Ref No.	Management Measure	Monitoring Measure	Responsibility	Timing and Frequency	Target / Performance Indicator
		▪ Monitor stability of stockpile slopes and establishment of stabilising vegetation where necessary ▪ Conduct an annual monitoring at the end of the raining season, also with emphasis on potential subsidence and water logging		of alien and invasive plants on topsoil stockpiles is recommended	
	Water Management Plan	▪ Ground water monitoring – levels and quality ▪ Surface water monitoring - quality	Environmental Manager	Monthly for first year during construction and operation, thereafter as set out in detailed management plan	No demonstratable deterioration of water quality and availability due to Project activities
	Biodiversity Action Plan	Project Management will work with specialists to conduct biodiversity monitoring surveys every 5 years, as stipulated in the Biodiversity Action Plan to be drafted at the latest within one year of operation. The monitoring will include but not be limited to: ▪ All requirements relating to site rehabilitation, reforestation, dust control and other measures as set out in the MoU with DEFCCS ▪ Monitoring effectiveness of alien plant control ▪ Monitoring progression and success of reforestation and rehabilitation efforts	Environmental Manager	As stipulated in the BAP, tasks will be divided into ad-hoc (or as necessary), monthly, annually and 5-yearly	Indicators to be defined in the BAP will include: ▪ Compliance with MoU (DEFCCS) ▪ Retention and re-establishment of as many Baobab trees as possible ▪ Improvement of retained natural habitats ▪ No adverse impacts on wetlands outside the Project footprint ▪ No loss of threatened fauna

Ref No.	Management Measure	Monitoring Measure	Responsibility	Timing and Frequency	Target / Performance Indicator
		▪ Monitoring the integrity of natural habitat within and adjacent to the Project Area ▪ Monitoring the overall composition of natural biodiversity and ecological state of habitats ▪ Detailed Vulture Monitoring plan to be developed by specialist			
	Environmental & Social Action Plan	Monitoring measures to be developed through consultation with stakeholders and defined in ESAP will include: ▪ Incidents to be recorded in the EHSS database ▪ Tracking of compliance with procedures by personnel and contractors ▪ Tracking and resolution of related grievances in GMS	Social Manager	▪ Incidents to be entered into the EHSS database within 24 hours ▪ Schedule for reporting on GMS to be defined in SEP, grievances to be reported on monthly during operations as part of EHSS report	ESAP for operations phase finalised prior to start of operations, including indicators that will include: ▪ Compliance with procedures defined therein ▪ Investigation of root causes of any incidents and implementation of corrective actions ▪ Satisfactory resolution of related grievances within timeframes set in GMS
	Traffic Management Plan	Monitoring measures to be defined in TMP will include: ▪ Incidents to be recorded in the EHSS database ▪ Tracking of compliance with procedures by personnel and contractors ▪ Tracking and resolution of related grievances in GMS	Social Manager	▪ Incidents involving external stakeholders to be reported to the Social Manager immediately ▪ Incidents to be recorded in the EHSS database within 24 hours ▪ EHSS report to be generated monthly during operations phase and to include data from GMS	Indicators to be defined in TMP will include: ▪ Compliance with traffic management procedures ▪ Investigation of root causes of any incidents and implementation of corrective actions

Ref No.	Management Measure	Monitoring Measure	Responsibility	Timing and Frequency	Target / Performance Indicator
					▪ Satisfactory resolution of related grievances within timeframes set in GMS
	Local Content Plan	Monitoring measures to be defined in LCP will include: ▪ Collection of data for reporting against KPIs, such as number of positions advertised, number of applications/profiles received, number of local persons hired, including disaggregation for skilled and unskilled labour, and number and type of goods and services purchased locally, to the extent data is available ▪ Tracking of compliance with procedures by personnel and contractors ▪ Tracking and resolution of related grievances in GMS	Social Manager	EHSS report to be generated monthly during operations phase and to include employment data and data from GMS	Indicators to be defined in LCP will include: ▪ Compliance with local employment and procurement procedures ▪ Satisfactory resolution of related grievances within timeframes set in GMS
	Influx Management Plan	Monitoring measures to be defined in IMP will include: ▪ Tracking of compliance with related policies and procedures (e.g., local employment, local procurement, worker accommodation and transport) by personnel and contractors	Social Manager	▪ Monitoring and reporting schedule to be defined in IMP ▪ EHSS report to be generated monthly during operations phase and to include data from GMS	Indicators to be defined in IMP will include: ▪ Compliance with policies and procedures defined or referenced therein ▪ Satisfactory resolution of related grievances within timeframes set in GMS

Ref No.	Management Measure	Monitoring Measure	Responsibility	Timing and Frequency	Target / Performance Indicator
		▪ Continuous consultation with displaced households and other stakeholders ▪ Tracking and resolution of related grievances in GMS			
	Social Investment Plan	Monitoring measures to be defined in SIP will include: ▪ Collection of data for reporting against KPIs, such as number of applications for support received, number/ type/ location of selected initiatives, amount/type of support provided ▪ Tracking and resolution of related grievances in GM	Social Manager	▪ Monitoring and reporting schedule to be defined in SIP ▪ EHSS report to be generated monthly during operations phase and to include data from GMS	Indicators to be defined in SIP will include: ▪ Compliance with procedures for selection and financing of community development initiatives ▪ Satisfactory resolution of related grievances within timeframes set in GMS

17. CONCLUSION

Development of the CIMAF ICP has been described in this ESIA Report. This has included a description of the Project and the relevant alternatives, a review of the relevant Senegalese legislation and international best practice requirements that have been adhered to / considered during the ESIA process.

The ESIA process has included stakeholder engagement and the findings presented. A description of the physical, biological and social characteristics of the Project Area and AoI has been presented.

The physical, biological and social impacts as well as recommended mitigation and management measures have been described. Furthermore the CIA has been undertaken and includes descriptions and mitigation and management measures for cumulative impacts.

A brief conclusion of the various specialist sections is described below.

Soils

A detailed Soil Study has not been undertaken for the Project Area. It is recommended that soil testing is undertaken prior to construction in order to understand the nature of the soil present. This will help in effective management of soils as well as the rehabilitation process.

The fertile topsoil layer will be impacted as a result of the Project. The importance of this is that it holds all the nutrients and growth medium that supports vegetation. Without a healthy topsoil layer vegetation cannot be established.

A Soil Management Plan should be developed to ensure effective management and conservation of the top soil layer.

Air Quality

The model results should be taken as indicative of area of potential concern. The impacts predicted are not absolute, but are intended as a guide to signpost towards activities and locations where additional mitigation may be required. In light of this, the interpretation of results is not absolute.

Based upon IFC Guidelines, the national AQS take precedence for this project. With reference to the significance criteria set out in Table 10-15, the assessment indicates that impacts at sensitive receptors are negligible at all but one receptor, where impacts are predicted to be minor (for PM_{10} and dust due to degraded airshed). The PEC for all pollutants are shown to be below the relevant AQS.

A meaningful mitigation strategy to attenuate the AQ impacts from the interconnecting road would be to align the road, as much as possible, away from the plant boundary near the quarry northern apex. We recommend developing the road along the centre line between the plant boundaries. This would significantly reduce any pollutant contributions near the plant boundary.

Dust emissions are greatly affected by weather conditions in addition to the specific location and nature of the activities being undertaken at any one time. Of particular concern is elevated baseline during Harmattan periods. Therefore the recommendation is made that site activities are actively managed through both active air quality monitoring and routine visual inspection. Particular attention should be paid to:

- Periods of unfavourable weather, in particular the dry season and Harmattan;
- When the site activities are at a peak, or are being undertaken on areas where the ground conditions are dry; and
- When quarry activities are undertaken close to sensitive receptors and the plant boundary.

Noise

A detailed Noise Baseline Study has been undertaken. Upon analysis of the modelling of the potential noise generated by the Project, the construction and operational scenarios of the Project are predicted to comply with noise and blasting limits. Therefore, no noise mitigation measures have been recommended for the construction and operation of this Project.

It is advised, that during operation noise monitoring should be conducted on a regular basis to check compliance, and where exceedances are detected, implement corrective actions to minimise noise impacts, particularly during the night time. Regular noise compliance monitoring will allow CIMAF to effectively manage noise and blasting emissions from the operation.

Climate Change

The Climate Change Study identifies various potential hazards that could potentially occur due to climate change in the future. Hazards identified include extreme heat, water stress and drought, pluvial flooding, dust and sandstorms and wildfires. Various recommendations regarding these potential impacts have been made.

Biodiversity

A Biodiversity Study was undertaken for the Project, including Specialist Study on the potential Threatened Species.

Five habitat types were identified. The status of the habitats is assumed modified. No Threatened Species were confirmed to inhabit the Project Area or EAAA. The EAAA is not regarded to host critical habitat.

The timing of the survey presents a knowledge gap regarding the understanding of the general biodiversity on site, including the habitats present (seasonal wetlands) and their potential to host other threatened species that potentially exist on site. Of particular concern is the potential for the site to attract and host migrant bird species.

A wet season survey is strongly recommended in order to gain higher confidence regarding baseline flora and fauna. The structure of the habitats and the general ecosystem functioning will allow for more effective management and mitigation of biodiversity impacts throughout the development of the Project

The following impacts are expected to occur loss of habitat: loss of species, fragmentation of habitat, influx of invasive species, dust generation and water pollution. Effective management and mitigation of these impacts can occur through actions described It is recommended that the mitigation and management measures described in this report and in the ESMP are implemented as well as an Alien Vegetation Management Plan.

Due to the possibility of red listed vulture species occurring on site it is recommended that a monitoring plan is developed in order to continually assess the possible presence of vultures within the EAAA. Monitoring should commence with construction. Furthermore, mitigation actions will be included in the EMP to manage potential vultures being attracted to the site during construction and operation.

Ecosystem services

There is strong reliance by the local population on the natural vegetation for the provisioning services. This includes fruit, fibres and firewood.

As CIMAF commences development of the Project, the local populations' access and use of the ecosystem services (particularly the provisioning services) will be reduced. This will include the decreased use of the area for grazing and fodder collection. Additionally it will include decreased possibility for firewood collection and fruit collection from the forest.

It is recommended that areas within the Project Area that are not being developed should remain open to the public for use. Barriers of entry should ensure that the public cannot enter dangerous

operations areas. Adequate signage and effective communication with the community should be undertaken to ensure that there is a common understanding regarding the use of these areas.

Socio-economic

The socio-economic impacts of the Project are expected to include the following:

- Impacts on traditional livelihood activities of an estimated 1,002 households reliant on access to resources within the Classified Forest, which could potentially be constituted as a major negative impact but are expected to be fully mitigated through the implementation of a Livelihood Restoration Plan in accordance with the requirements of IFC Performance Standard 5;
- Impacts on access to ecosystem services within the Classified Forest, which are expected to be reduced from a moderate negative impact to a minor negative impact through the design and implementation of mitigation measures informed by community consultation;
- Impacts on community health and safety, which are expected to be reduced from a major negative impact to a moderate negative impact through the design and implementation of mitigation measures informed by community consultation, including a Traffic Management Plan and LCP;
- Impacts on cultural heritage, which are expected to be reduced from a minor negative impact to a negligible negative impact through the design and implementation of mitigation measures informed by community consultation, including a Chance Finds Procedure;
- Impacts on access to water by communities in the AoI, which have the potential to be a major negative impact of the Project but could be mitigated to some extent through the technical design process, social investments, and ongoing monitoring and reporting to external stakeholders; and
- Impacts on economic development, which are expected to be a moderate positive impact of the Project that can be managed through the development and implementation of a LCP and SIP.

As noted throughout this document, the design of appropriate mitigation and management measures for socio-economic impacts will require consultation with affected communities and other external stakeholders. This consultation is critical to ensuring measures are appropriate for the local context and are going to have the desired effect. This consultation should take place as a matter of priority for the Project, to ensure that the ESMP and other management plans are in place prior to the start of construction.

Cultural heritage

Cultural heritage features within the Project will be physically impacted by the development. The history of settlement and movement of communities in Senegal shows the potential for further archaeological sites to survive below the surface.

The Foret de Thiès is open to surrounding grazers who rely on this access for their lively hood and is an area where cultural beliefs are practiced. Within the forest, communities place importance on the Baobab tree for rituals, prayers and burials. Pastoralism is practised throughout the forest, with some semi-permanent settlements and numerous enclosures appearing scattered across the wider area.

The development of a robust, detailed CHMP, to include further field surveys by qualified archaeologists and specific seasonal engagement with local communities, will be necessary in order to mitigate the impact of the Project on the cultural heritage.

18. REFERENCES

Autonomisation de jeunes de Keur Moussa : La Commune oriente les associations vers des projets de développement, Le Quotidien (2018) https://lequotidien.sn/autonomisation-de-jeunes-de-keur-moussa-la-commune-oriente-les-asc-vers-des-projets-de-developpement

Chevrier, B. et al. (2015). West African Palaeolithic history: New archaeological and chronostratigraphic data from the Falémé valley, eastern Senegal.

CIA World Factbook (2021) www.cia.gov/the-world-factbook/countries/senegal/#people-and-society

CIA World Factbook (2021) www.cia.gov/the-world-factbook/countries/senegal/#economy

Curtin, P. (2016). Goree and the Atlantic Slave Trade, Philip Curtin, *History Net*.

Darkoh M.B.K. (1996). The Human Dimension of Desertification in the Drylands of Africa, *Journal of Social Development in Africa*, 11, 2: 89-106.

Douglas, D., Homburg, J. and Vendrig, M. (2017). *Agricultural Sustainability in the Sudano-Sahelian Region*: Climate Change and the Application of Traditional Knowledge to Enhance Agricultural Productivity.

Enda Tiers Monde (2021) www.facebook.com/EndaTiersMonde/

Equitas Senegal (2021) https://equitas.org/where-we-work/west-africa/senegal/

EIES du projet d'ouverture et d'exploitation de calcaire et de fabrication de clinker dans la forêt classée de Thiès par CIMAF, 23/12/2019

Expansion de l'AIBD: Peur à Diass et à Keur Mousseu, Le Quotidien (2021) https://lequotidien.sn/expansion-de-laibd-peur-a-diass-et-a-keur-mousseu/

Hesseling, G. (1985). Histoire politique du Sénégal. Institutions, droit et société, Paris: Karthala, p. 103.

Mapping the Poor in Senegal: Technical Report, Agence Nationale de la Statistique et la Démographie (ANSD) / World Bank (2016)

Mapping the Poor in Senegal: Technical Report (2016) www.ansd.sn/ressources/publications/SEN_PovMap_160512_rapport%20Version%20Anglaise.pdf

Ngiang, K. et al. (2018). The Oldest Stone Age occupation of coastal West Africa and its implications for modern human dispersals: new insights from Tiemassas. *Quarternary Science Reviews*. Vol 188.

Peuls et Jihadisme au Sahel : le grand malentendu (2020) www.jeuneafrique.com/mag/1007217/politique/sahel-peuls-le-grand-malentendu/

Plan d'Aménagement et de Développement – Schéma Directeur d'Aménagement et de Dévelopmment Territorial de la zone Dakar-Thiès-Mbour, Agence Nationale de l'Aménagement du Territoire (2015)

Plan Emergent du Sénégal (2019) www.senegal-emergent.com

Perceptions des Populations sur les Violences faites aux Femmes au Sénégal, CAIRN INFO (2019)

Quand les Peuls, stigmatisés, font entendre leur voix (2020) www.jeuneafrique.com/mag/1007020/politique/quand-les-peuls-stigmatises-font-entendre-leur-voix

Reassessment of the Resources of a Deep Aquifer System under Physical and Chemical Constraints: The Maastrichtian Aquifer.

Situation Economique et Sociale Régionale, Service Régional de la Statistique et de la Démographie de Thiès, Agence Nationale de la Statistique et de la Démographie (2015)

Tongway, D. J. & Ludwig, J. A. (2001) Theories on the origins, maintenance, dynamics, and functioning of banded landscapes. Banded vegetation patterning in arid and semiarid environments : ecological processes and consequences for management (ed. by D.J. Tongway & C. Valentin & J. Seghieri), pp 20-31. Springer-Verlag, New York.

UN Women – Africa (2021) https://africa.unwomen.org/en/where-we-are/west-and-central-africa/senegal

World Health Organisation (2017). Guidelines for drinking-water quality, fourth edition (2017).

Wright, D. (1985). Beyond Migration and Conquest: Oral Traditions and Mandinka Ethnicity in Senegambia. *History in Africa*, 12, 335-348. doi:10.2307/3171727.

Wright, D.onald (2010). The World and a Very Small Place in Africa: A History of Globalization in Niumi, the Gambia (3rd ed.). M.E. Sharpe. p. 51.

ANNEXURE A SOCIO-ECONOMIC FIELDWORK PHOTOGRAPHS (MARCH 2021)



Consultation – Mairie Keur Moussa



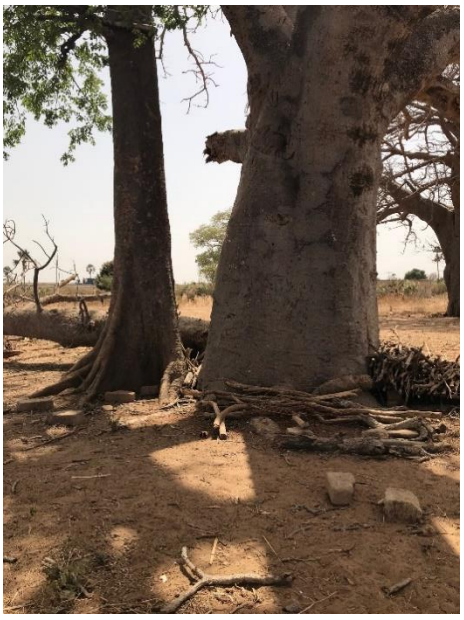
Consultation - Nangane



Consultation - Nangane



Consultation – Soune Serer



Sacred site of Soune Serer



Air Quality Monitoring – Harmony Group



Consultation – Gap



Consultation - Gap



Well and School - Lene



Consultation - Lene



Consultation – Palal



Cultivated Parcels near SEN'EAU Station



Consultation – Soune Wolof



Consultation – Soune Wolof



Meeting - Thiambokh



A2 Highway – Access Soune Wolof - Thiambokh

	
Thiambokh Peulh – looking on to CF	Thiambokh Peulh – on southern boundary of CF
	
Household Survey – Thiambokh Peulh	Household Survey – Thiambokh Peulh
	
Typical residential structure	Typical residential structure

ANNEXURE B PARTICIPANT LISTS (MARCH 2021)

	CONSULTATION PUBLIQUE	CIMAF
Harmony Group	Etude d'impact Environnemental et Social du projet d'ouverture et d'exploitation de calcaire et de fabrication de clinker dans la forêt classée de Thiès par CIMAF	Ciments d'Afrique

Village : SOUN

Catégorie d'acteurs rencontrés : Chef de Village + Notables

Date : 15.03.2021

Prénom (s) et Nom (s)	Statut/Fonction	Téléphone	Emargement
Nar FAYE	Chef de Village	70. 729.33.56	—
Modou CISS	Notable	77.149.51.43	—
Ousseynou CISS	Notable	70.337.90.74	—
Daouda CISS	Notable	70.711.60.92	—
Abdoulaye FALL	Notable	70.558.80.47	—

La consultante

La secrétaire de séance

Catégorie d'acteurs rencontrés : Agriculteurs + Eleveurs

Date : 15.03-2021

Prénom (s) et Nom (s)	Statut/Fonction	Téléphone	Emargement
Mor POUYE	Agriculteur	70.303.87.61	—
Ousmane DIOUF	Eleveur	70.792-56-19	—
Ibrahima FAYE	Agriculteur	70.592.88.09	—
Mbaye DIONE	Eleveur	70.054-13.91	—
Daouda CISS	Eleveur	——	—

La consultante

La secrétaire de séance

Harmony Group

CONSULTATION PUBLIQUE

Etude d'impact Environnemental et Social du projet d'ouverture et d'exploitation de calcaire et de fabrication de clinker dans la forêt classée de Thiès par CIMAF

CIMAF
Ciments d'Afrique

Catégorie d'acteurs rencontrés : Femmes
Date : 15.03.2021

Prénom (s) et Nom (s)	Statut/Fonction	Téléphone	Emargement
Seynabou SECK	Commerçante	77.586.20.55	—
Seynaba GNIGUE	Agriculteur	70.679.39.12	—
Seynabou SECK	Ménagère	70.888.22.75	—
Salimata GUEYE	Relais Communautaire	70.460.89.37	—
Fatou DIOUF	Relais Communautaire	70.721.30.76	—

La consultante

La secrétaire de séance

Catégorie d'acteurs rencontrés : Jeunes
Date : 15.03.2021

Prénom (s) et Nom (s)	Statut/Fonction	Téléphone	Emargement
Saliou FAYE	Etudient Electro-mecanicien	78.427.26.42	—
Daouda FAYE	Etudiant Electricien Bâtiment	77.476.86.07	—
Moussa POUYE	Etudent Electricien	77.684.56.91	—
Ousmane FAYE	Commerçant	77.996.11.06	—
Ibrahima CISS	Chauffeur	70.718.02.51	—

La consultante

La secrétaire de séance

	CONSULTATION PUBLIQUE	CIMAF
Harmony Group	Etude d'Impact Environnemental et Social du projet d'ouverture et d'exploitation de calcaire et de fabrication de clinker dans la forêt classée de Thiès par CIMAF	Ciments d'Afrique

Village : SOUN WOLOF

Catégorie d'acteurs rencontrés : Chef de Village + Notables

Date : 17-03-2021

Prénom (s) et Nom (s)	Statut/Fonction	Téléphone	Emargement
Saliou FALL	Chef de Village	77.417.14.58	—

La consultante

La secrétaire de séance

Catégorie d'acteurs rencontrés : Agriculteurs + Eleveurs

Date : 17.03.2021

Prénom (s) et Nom (s)	Statut/Fonction	Téléphone	Emargement
Daouda BALWA	Agriculteur	77.930.96.47	—
Médoune FALL	Agriculteur	78.479.69.12	—
Pape FALL	Agriculteur	70.915.83.24	—
Amadou DIA	Agriculteur	76.753.13.85	—
Issa KA	Président des Eleveurs de la Commune de KM	70.722.67.58 77.991.88.62	—
Bounana DIAW	Eleveur	76.485.16.40	—
Idy KA	Eleveur	76.338.17.41	—

La consultante

La secrétaire de séance

	CONSULTATION PUBLIQUE	CIMAF
Harmony Group	Etude d'impact Environnemental et Social du projet d'ouverture et d'exploitation de calcaire et de fabrication de clinker dans la forêt classée de Thiès par CIMAF	Ciments d'Afrique

Catégorie d'acteurs rencontrés : Jeunes
Date : 17.03.2021

Prénom (s) et Nom (s)	Statut/Fonction	Téléphone	Emargement
Samba Laobé FALL	Président de l'ASC a CVD de Sour Wolof	77.795.11.10	—
Pape Amary FALL	Chauffeur	77.483 93 62	—
Mbaye SECK FALL	Etudiant en Anglais	78-414-14-72	—

La consultante

La secrétaire de séance

Catégorie d'acteurs rencontrés : Femmes
Date : 17.03.2021

Prénom (s) et Nom (s)	Statut/Fonction	Téléphone	Emargement
Colamane FALL	Présidente GPF Sour WOLOF	70.936.46.25	—
Coumba THIAM	Matrone	70.852.78.03	—
Ndiagne KHOULE	Commerçante	—	—
Khady CISS	Ménagère	78.479.89.12	—
Sokhna Fatou MBAYE	Commerçante	—	—
Coumba DIOUF	Ménagère	—	—

La consultante

La secrétaire de séance

	CONSULTATION PUBLIQUE	CIMAF
Harmony Group	Etude d'Impact Environnemental et Social du projet d'ouverture et d'exploitation de calcaire et de fabrication de clinker dans la forêt classée de Thiès par CIMAF	Ciments d'Afrique

Village : PALAL

Catégorie d'acteurs rencontrés : Chef de Village + Notables

Date : 16.03.2021

Prénom (s) et Nom (s)	Statut/Fonction	Téléphone	Emargement
Babacar GUEYE	Chef du Village		—
Ibou CISS	Notable	77.213.39.13	—
Ibrahima POUYE	Notable	77.458.93.69	—
Mamadou GUEYE	Notable	77.289.73.29	—
Papa Abdou GUEYE	Notable	77.777.75.73	—

La consultante

La secrétaire de séance

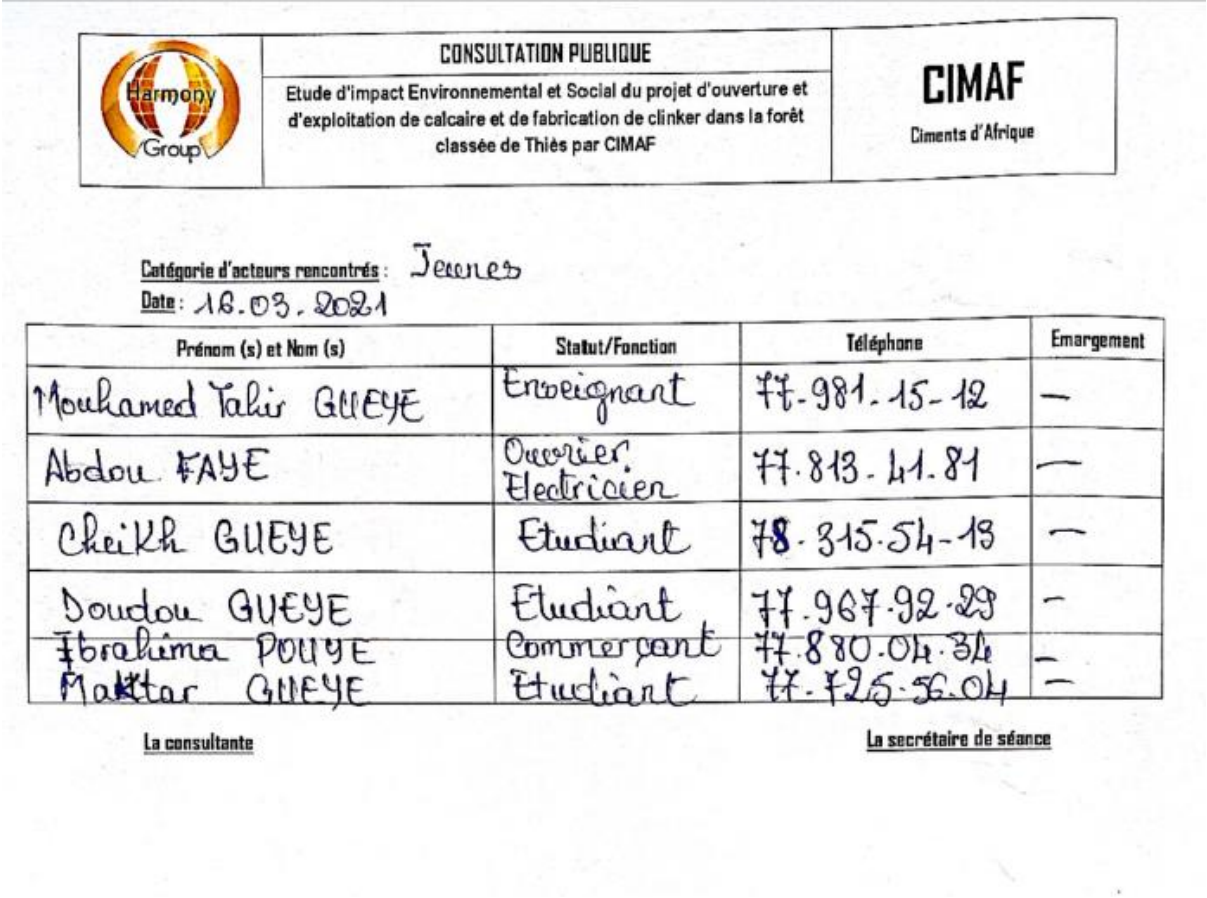
Catégorie d'acteurs rencontrés : Agriculteurs + Eleveurs

Date : 16.03.2021

Prénom (s) et Nom (s)	Statut/Fonction	Téléphone	Emargement
Aïssatou SOW	Eleveur	78.520.96.84	—
Alpha POUYE	Agriculteur	77.642.92.12	—

La consultante

La secrétaire de séance



CONSULTATION PUBLIQUE

Etude d'impact Environnemental et Social du projet d'ouverture et d'exploitation de calcaire et de fabrication de clinker dans la forêt classée de Thiès par CIMAF

CIMAF
Ciments d'Afrique

Catégorie d'acteurs rencontrés : Jeunes
Date : 18.03.2021

Prénom (s) et Nom (s)	Statut/Fonction	Téléphone	Emargement
Mouhamed Tahir GUEYE	Enseignant	77.981.15.12	—
Abdou FAYE	Ouvrier Electricien	77.813.41.81	—
Cheikh GUEYE	Etudiant	78.315.54.13	—
Doudou GUEYE	Etudiant	77.967.92.29	—
Ibrahima POUYE	Commerçant	77.880.04.34	—
Makhtar GUEYE	Etudiant	77.725.56.04	—

La consultante

La secrétaire de séance

	CONSULTATION PUBLIQUE	CIMAF
Harmony Group	Etude d'impact Environnemental et Social du projet d'ouverture et d'exploitation de calcaire et de fabrication de clinker dans la forêt classée de Thiès par CIMAF	Ciments d'Afrique

Village : GAP

Catégorie d'acteurs rencontrés : Chef de Village + Notables

Date : 16.03.2021

Prénom (s) et Nom (s)	Statut/Fonction	Téléphone	Emargement
Ibrahima CISS	Chef de Village	77.013.10.65	—
Issa CISS	Notable	77.523.70.51	—
Aliou DIOUF	Notable	76.476.50.26	—
Ndiogou DIOUF	Notable	77.594.85.38	—
Ismaïla CISS	Notable	77.599.61.96	—

La consultante

La secrétaire de séance

Catégorie d'acteurs rencontrés : Agriculteurs + Eleveurs

Date : 16.03.2021

Prénom (s) et Nom (s)	Statut/Fonction	Téléphone	Emargement
Aliou POUYE	Agriculteur	77.015.68.14	—
Malick DIOUF	Eleveur	77.498.19.42	—
Omar CISS	Agriculteur	76.925.02.19	—

La consultante

La secrétaire de séance

	CONSULTATION PUBLIQUE	CIMAF
Harmony Group	Etude d'impact Environnemental et Social du projet d'ouverture et d'exploitation de calcaire et de fabrication de clinker dans la forêt classée de Thiès par CIMAF	Ciments d'Afrique

Catégorie d'acteurs rencontrés : Jeunes
Date : 16-03-2021

Prénom (s) et Nom (s)	Statut/Fonction	Téléphone	Emargement
Abdou DIOUF	Etudiant	77.904.64.68	—
Daouda CISS	Maçon	77.949-48-76	—
Daouda CISS	Ouvrier	77.018.88-67	—
Mouhamed GUEYE	Menuisier Metallique	77.435.34-50	—
Mouhamed POUYE	Agriculteur	77.556-65.92	—

La consultante

La secrétaire de séance

Catégorie d'acteurs rencontrés : Femmes
Date : 16.03.2021

Prénom (s) et Nom (s)	Statut/Fonction	Téléphone	Emargement
Yandé POUYE	Présidente GIE Manio CISS	77.959-47-09	—
Amy Collé DIOP	Commerçante	———	—
Aissatou DIOUF	Commerçante	———	—

La consultante

La secrétaire de séance

	CONSULTATION PUBLIQUE	CIMAF
Harmony Group	Etude d'impact Environnemental et Social du projet d'ouverture et d'exploitation de calcaire et de fabrication de clinker dans la forêt classée de Thiès par CIMAF	Ciments d'Afrique

Village : LENE

Catégorie d'acteurs rencontrés : Chef de Village + Notables

Date : 17.03.2021

Prénom (s) et Nom (s)	Statut/Fonction	Téléphone	Emargement
El. Ndiogou CISS	Chef de Village	70.653.99.14	—
Moussa DIOUF	Notable	70.746.38.45	—
Ibrahima CISS	Notable	70.807.99.58	—
Aliou DIOUF	Notable	70.922.87.99	—
Abdou DIOUF	Notable	70-627-45-58	—

La consultante

La secrétaire de séance

Catégorie d'acteurs rencontrés : Femmes

Date : 17.03.2021

Prénom (s) et Nom (s)	Statut/Fonction	Téléphone	Emargement
Absa DIOUF	Animatrice de projet	77-462-69.95	—
Rokhaya CISS	Ménagère	70.981.18.84	—
Mariama CISS	Agricultrice	70.202-38.27	—
Seynabou DIOUF	Etudiante en Com. digitale	77.976-77.91	—
Rokhaya FAYE	Enseignante	77.277-66-98	—
Seynabou DIOUF	Etudiante en Adm. & Gestion des entreprises	70-369-75-40	—
Seynabou DIOUF	Agricultrice	70.976.15.66	—

La consultante

La secrétaire de séance

	CONSULTATION PUBLIQUE	CIMAF
Harmony Group	Etude d'impact Environnemental et Social du projet d'ouverture et d'exploitation de calcaire et de fabrication de clinker dans la forêt classée de Thiès par CIMAF	Ciments d'Afrique

Catégorie d'acteurs rencontrés : Agriculteurs + Eleveurs
Date : 17.03.2021

Prénom (s) et Nom (s)	Statut/Fonction	Téléphone	Emargement
Mbaye BA	Eleveur	77-442-45-54	—
Saliou POUYE	Eleveur	70.850.97.01	—
Abdou DIOUF	Agriculteur	—	—
Ibrahima CISS	Agriculteur	—	—

La consultante

La secrétaire de séance

Catégorie d'acteurs rencontrés : Jeunes
Date : 17.03.2021

Prénom (s) et Nom (s)	Statut/Fonction	Téléphone	Emargement
Issa CISS	Agriculteur	70.813.92.25	—
Mansour CISS	Agriculteur	70.644.59.74	—
Ousmane DIOUF	Agriculteur	77.655.12.13	—
Moustapha CISS	Electricien véhicule	76.147.99.22	—
Abdoulaye POUYE	Mécanicien	76.343.32.79	—
Adama CISS	Tapissier	77.999.93.33	—

La consultante

La secrétaire de séance

	CONSULTATION PUBLIQUE	CIMAF
Harmony Group	Etude d'impact Environnemental et Social du projet d'ouverture et d'exploitation de calcaire et de fabrication de clinker dans la forêt classée de Thiès par CIMAF	Ciments d'Afrique

Village : DARAL PEULHS = Hameau de Nangane

Catégorie d'acteurs rencontrés : Chef Village

Date : 13.03.2021

Prénom (s) et Nom (s)	Statut/Fonction	Téléphone	Emargement
Omar BA	Chef Village	77.434.05.39	—

La consultante

La secrétaire de séance

Catégorie d'acteurs rencontrés : Femmes

Date : 13.03.2021

Prénom (s) et Nom (s)	Statut/Fonction	Téléphone	Emargement
Penda BA	Eleveur	77.434.05.39	-
Yague BA	Eleveur	77.434.05.39	-
Fatou BA	Pas d'activité	—	-
Nare BA	Eleveur	—	-

La consultante

La secrétaire de séance

	CONSULTATION PUBLIQUE	CIMAF
Harmony Group	Etude d'impact Environnemental et Social du projet d'ouverture et d'exploitation de calcaire et de fabrication de clinker dans la forêt classée de Thiès par CIMAF	Ciments d'Afrique

Village : EXPLOITANTS MARAICHERS

Catégorie d'acteurs rencontrés :
Date : 15.03.2021

Prénom (s) et Nom (s)	Statut/Fonction	Téléphone	Emargement
Saliou KONTE	Responsable Exploitation Maraîchère Abdou DEME		—
Fodé CAMARA	Employé	77.759-14,87	-
Seydou SOUMA	Employé	78.388.73.08	-

La consultante

La secrétaire de séance

	CONSULTATION PUBLIQUE	CIMAF
Harmony Group	Etude d'impact Environnemental et Social du projet d'ouverture et d'exploitation de calcaire et de fabrication de clinker dans la forêt classée de Thiès par CIMAF	Ciments d'Afrique

Village : THIAMBOKH

Catégorie d'acteurs rencontrés :
Date : 18.03.2021

Prénom (s) et Nom (s)	Statut/Fonction	Téléphone	Emargement
Malick CISS	Chef de Village	77.506-44-79	—
Babacar CISS	Agent de Dvpmt	77.630 97.10	—
Awa CISS	Ménagère	70.854-95.48	—

La consultante

La secrétaire de séance

ANNEXURE C HOUSEHOLD SURVEY FORM

ENQUETE SOCIO-ECONOMIQUE

SEMAINE DU 15 AU 20 MARS - HARMONY-GROUP

PROFIL DE L'ENQUETE

1. Nom de l'enquêteur

2. Lieu de l'enquête
O 1. village O 2. commune

3. Date de l'enquête

4. Nombre de l'enquête

5. Nom et prénom du répondant

6. Numéro de téléphone

7. Chef de ménage
O 1. oui O 2. non

8. Si non, nom du chef de ménage

9. Si non, lien du répondant avec le chef de ménage

PROFIL CHEF DE MENAGE

10. Sexe
O 1. M O 2. F

11. Age

12. Ethnie
O 1. wolof O 2. sérère
O 3. diola O 4. socé
O 5. maure O 6. mancagne
O 7. peul O 8. autres à préciser

13. Religion
O 1. musulmane O 2. chrétienne O 3. animisme

14. Marié (e)
O 1. Oui O 2. Non

15. Nombre d'épouses

16. Nombre d'enfants

17. Nombre de personnes dans le ménage

18. Langue (s)
☐ 1. wolof ☐ 2. sérère
☐ 3. peul ☐ 4. diola
☐ 5. socé ☐ 6. mandingue
☐ 7. maures ☐ 8. autres à préciser
Vous pouvez cocher plusieurs cases.

19. Alphabétisation
O 1. oui O 2. non

20. Niveau d'étude complété
☐ 1. non scolarisé ☐ 2. coranique ☐ 3. primaire
☐ 4. moyen ☐ 5. secondaire ☐ 6. supérieur
Vous pouvez cocher plusieurs cases (2 au maximum).

21. Vocation/activité économique primaire?

22. Où entreprenez-vous cette activité?

23. Activité économique secondaire?

24. Où entreprenez-vous cette activité?

25. Handicap ou maladie chronique?
O 1. oui O 2. non

26. Si oui, précisez?

SITUATION DU MENAGE

27. En quoi est fait le toit de votre résidence primaire?
O 1. chaume O 2. tôle de zinc
O 3. ardoise O 4. tôle plastique
O 5. dalle en ciment O 6. autres à préciser

28. En quoi sont faits les murs de votre résidence primaire?
O 1. Chaume O 2. en ciment O 3. zinc
O 4. en argile O 5. autre à préciser

29. Où votre ménage a t-il accès aux soins de santé?

30. A quelle distance de votre résidence?

31. Votre ménage a t-il des moustiquaires pour les lits?
O 1. oui O 2. non

32. Si oui, quel est le ratio(nombre de moustiquaire par nombre de lits)

33. Où votre ménage a t-il accès à l'eau potable?
O 1. cours familiale O 2. dans le village
O 3. à l'exterieur du village

34. A quelle distance de votre résidence?

35. Cette source est'elle disponible toute l'année ou de façon saisonnière?
O 1. toute l'année O 2. saisonnier

36. Où votre ménage a t-il accès à l'eau pour un usage domestique général où pour le bétail?
O 1. cours familiale, dans le village, à l'extérieur du village

37. A quel distance est ce de votre résidence?

38. Cette source est-elle disponible toute l'année ou de façon saisonnière?
O 1. toute l'année O 2. saisonnière

39. Normalement qui sont les membres du ménage en charge d'aller chercher de l'eau?
☐ 1. hommes ☐ 2. femmes ☐ 3. enfants
Vous pouvez cocher plusieurs cases.

40. Quelle est le principal système d'assainissement de votre ménage?
O 1. Fosse septique ventilée O 2. fosse septique simple
O 3. nature

41. Comment gérez-vous les déchets produits dans votre ménage?
O 1. dépotoir sauvage
O 2. enfouissement
O 3. incinération
O 4. collecter par la commune
O 5. autre à préciser

42. Quelle est la principale source d'énergie de cuisson dans votre ménage?
O 1. gaz butane O 2. charbon de bois
O 3. bois de chauffe O 4. bouse de vache

43. Quelle est la principale source d'électricité(éclairage)de votre logement?
☐ 1. réseau senelec ☐ 2. solaire
☐ 3. groupe électrogène ☐ 4. bougie
☐ 5. lampe tempête ☐ 6. torche
☐ 7. autres à préciser
Vous pouvez cocher plusieurs cases.

44. Utilisez-vous du bois (énergie de cuisson) provenant de la commune?
O 1. oui O 2. non

45. Si oui, lieu de prélèvement

46. utilisez-vous du bois (construction) provenant de la commune?
O 1. oui O 2. non

47. utilisez-vous des fruits provenant de la commune?
O 1. oui O 2. non

48. Si oui, lieu de prélèvement

49. utilisez-vous du poisson provenant de la commune?
O 1. oui O 2. non

50. Si oui, lieu de prélèvement

51. Utilisez-vous dans votre ménage des animaux sauvages provenant de la commune?
O 1. oui O 2. non

52. si oui, lieu de chasses

53. utilisez-vous dans votre ménage des plantes (consommation) provenant de la commune?
O 1. oui O 2. non

54. Si oui, lieu de prélèvement

55. utilisez-vous dans votre ménage d'autres ressouces provenant de la commune?
O 1. oui O 2. non

56. Si oui, préciser

57. A quel titre occupiez-vous votre logement?
O 1. Propriétaire O 2. locataire,emprun
O 3. autres à préciser

58. Comment avez-vous acquis votre terrain?
O 1. Achat O 2. héritage O 3. don communal
O 4. autres à préciser

59. Disposez-vous d'un document officiel qui atteste le statut de votre terrain?
O 1. oui O 2. non

60. Si oui,préciser
O 1. Déliberation O 2. bail O 3. titre foncier
O 4. autres à préciser

61. Avez-vous des chambres ou des bâtiments en location?
O 1. oui O 2. non

62. Louez-vous des chambres ou des bâtiments de votre ménage à d'autres?
O 1. oui O 2. non

63. Votre ménage pratique t-il de l'épargne?
O 1. oui O 2. non

64. Si oui, expliquez comment
☐ 1. compte bancaire ☐ 2. programme de microcrédit
☐ 3. en famille
Vous pouvez cocher plusieurs cases.

65. Combien épargnez-vous mensuellement?

66. Des membres de votre ménage participe t-il à des associations ou groupements communautaires?
O 1. Oui O 2. non

67. Si oui, les quels?

68. Connaissez-vous des sites culturels sacrés dans cette zone?
O 1. oui O 2. non

69. Si oui, veuillez décrire quoi et où?

70. Combien des éléments suivants votre ménage possède-t-il?
☐ 1. ventilateurs
☐ 2. moustiquaires
☐ 3. radios
☐ 4. télévision
☐ 5. réfrigérateur
☐ 6. groupe électrogène
☐ 7. panneau solaire
☐ 8. smartphones
☐ 9. portable(non smartphones)
☐ 10. matelas en mousse
☐ 11. lits
☐ 12. vélos
☐ 13. motos
☐ 14. voitures
☐ 15. camions
Vous pouvez cocher plusieurs cases.

71. Quelle est le revenu mensuel moyen de votre ménage?

72. Est-ce saisonnier?
O 1. oui O 2. non

73. Si oui, expliquez?

74. Normalement quelle est la plus grosse dépense en espèce de votre ménage?

75. Normalement quelle est la deuxième plus grosse dépense en espèce de votre ménage?

76. Votre ménage est-il toujours en mesure de répondre à ces besoins en terme de consommation?
O 1. oui O 2. non

77. Si non, combien de mois par an votre ménage n'est pas capable de répondre à ces besoins de consommation?

78. Votre ménage a t-il du bétail?
O 1. oui O 2. non

79. Combien des éléments suivants:
☐ 1. vaches ☐ 2. chèvres ☐ 3. volailles ☐ 4. porcs
☐ 5. moutons ☐ 6. ânes ☐ 7. cheval
Vous pouvez cocher plusieurs cases.

CONTEXTE DU PROJET

80. Y a t-il d'autres projets dans la zone qui ont affecté votre ménage?
O 1. oui O 2. non

81. Si oui, quel étaient les projets

82. Si oui, quels ont été les impacts?

83. Connaissez-vous la nouvelle cimenterie proposée pour cette zone?
O 1. oui O 2. non

84. Si oui, qu'avez-vous entendu?

85. Avez-vous des commentaires ou des questions concernant le projet?

86. A l'avenir, comment souhaiteriez-vous recevoir des informations sur le projet?

PROFIL MEMBRE DU MENAGE

HARMONY-GROUP

PROFIL MEMBRE DU MENAGE(A REMPLIR POUR CHAQUE MEMBRE DU MENAGE)

1. Nom et prénom

2. Lien avec le chef de ménage

3. Sexe
O 1. M O 2. F

4. Age

5. Ethnie
O 1. wolof O 2. sérère
O 3. diola O 4. peul
O 5. socé O 6. mandingue
O 7. maure O 8. autres à préciser

6. Religion
O 1. musulmane O 2. chretienne O 3. animisme

7. Marié(e)
O 1. oui O 2. non

8. Nombre d'épouses

9. Nombre d'enfants

10. Langue
☐ 1. wolof ☐ 2. sérère
☐ 3. peul ☐ 4. diola
☐ 5. socé ☐ 6. mandingue
☐ 7. maures ☐ 8. autres à préciser
Vous pouvez cocher plusieurs cases (7 au maximum).

11. Alphabétisation
O 1. oui O 2. non

12. Niveau d'étude complété
☐ 1. non scolarisé ☐ 2. coranique ☐ 3. primaire
☐ 4. moyen ☐ 5. secondaire ☐ 6. supérieur
Vous pouvez cocher plusieurs cases (2 au maximum).

13. Vocation/activité économique primaire?(ex:étudiant)

14. Où entreprenez-vous cette activité?

15. Activité économique secondaire?

16. Où entreprenez-vous cette activité?

17. Handicap ou maladie chronique?
O 1. oui O 2. non

18. Si oui préciser?

ANNEXURE D BIODIVERSITY BASELINE REPORT

ANNEXURE E VULTURE SPECIALIST ASSESSMENT

ANNEXURE F AIR QUALITY METHODOLOGY

Air Quality Baseline Data Collection - Methodology

In this study, it is a question of carrying out a baseline situation of the ambient air quality around the impact zone of the project. A study of the distribution of sensitive receptors (villages and other infrastructures) located around the project area made it possible to choose a set of 12 measurement points that could be impacted by the project. The measurement points were chosen according to the prevailing winds, demography, and environmental sensitivity.

The behavior of local atmospheric pollutants (transport and accumulation) is strongly linked to climatic conditions (rainfall, wind, and temperature, sunshine). For the sake of representativeness and comparability with the standards in force, quality measurements must meet certain specific criteria. At least 13 hours of valid data must be collected for each measurement day according to European Directive 2001/752 / EC which lists, for air quality measurement stations, the fundamental criteria for aggregating data and calculating air quality. Statistical parameters

The measurement of emissions (resulting from different sources of pollution) in the ambient air was carried out through a detection and reception device. The data collected will be compared with the standards in force after laboratory treatment. Since we have measured over a 24-hour period, we will use the hourly and / or daily standards mentioned above for this purpose.

The pollutants were measured by stationary continuous air quality measurement devices fitted with electrochemical cell detectors. In order to carry out this study, everything was done in connection with assurance and quality control procedures.

The measuring devices were placed at least at the height of the respiratory tract, i.e. 1.5 m from the ground.

item	UTM X et Y (de base) Coordinate	UTM X et Y (updating)	Nearest source of pollution
AQ1	X= 14°45'18.87"N Y= 17° 0'51.75"O		National road
AQ2	X=14°44'32.40"N Y=17° 0'43.05"O		Latterite track
AQ3	X=14°43'2.47"N Y=17° 0'6.13"O		Toll Highway
AQ4	X= 14°44'22.60"N Y= 17° 1'20.80"O		Latterite track
AQ5	X=14°43'26.96"N Y=17° 2'17.60"O		Latterite track
AQ6	X=14°44'42.47"N Y=17° 2'35.01"O	X= 280374,121 Y = 1631251,041	Toll Highway
AQ7	X= 14°45'52.97"N Y=16°57'42.27"O	X= 2899137,3 Y=1633633,9	Next to the National road and in the area of influence the DANGOTE cement factory
AQ8	X= 14°42'23.85"N Y= 16°57'55.49"O		Mbour road
AQ9	X= 14°40'10.49"N		Latterite track

	Y= 17° 1'43.69"O		
AQ10	X= 14°42'26.58"N Y= 17° 3'47.56"O		Toll highway
AQ11	X= 14°45'51.98"N Y = 17° 3'20.05"O	X: 1476316445 Y: -1705662285	Next to the National road and in the area of influence the DANGOTE cement factory
AQ12	X= 14°43'33.01"N Y = 17° 3'20.65"O		Latterite track

	Points	#serie 1 equipement used	#serie 2 equipement used	#serie 1 date	#serie 2 date	measure period	Observation
X= 14°45'18.87"N Y= 17° 0'51.75"O	AQ1	GT1000-FC and MOT-M4		15-mars-21		11 days	Installation of the device at the SDE Pumping Station 1; the analyzer was installed at the level of the respiratory tract 1m50 above the ground
		EL USB CO / BTU E4500 S (CO ambient)		15-mars-21		11 days	
X=14°44'32.40"N	AQ2	GT1000-Y3		15-mars-21		10 days	Device installed on a tripod at the level of the respiratory tract (approximately 1.50m from the ground) at the level of the SDE pumping station. Presence of SDE drilling activity NB: one day shutdown due to a problem with the charging of the equipment
Y=17° 0'43.05"O		EL USB CO/ BTU E4500 S (CO ambient)		15-mars-21		10 days	
X=14°43'2.47"N Y=17° 0'6.13"O	AQ3	SKZ 1050E SO_2 Detector		12-avr		12 days	Large-scale farm with modern cultivation technique (presence of tractor, harvester, etc.) powered by a generator) the equipment has been installed away from sources of exogenous pollution such as the generator
		Dylos ($PM_{2.5}$; PM_{10})	CLARITY NODE-S ($PM_{2.5}$, PM_{10} NO_2)	10-avr-21	12-avr-21	12days	
X= 14°44'22.60"N Y= 17° 1'20.80"O	AQ4	SKZ 1050-E NO_2 CO		07-avr-21		10 days	Equipment installed, on a tree about 1m170 from the ground.
		GT1000 TMS dust & SO_2		07-avr-21		10 days	
X=14°43'26.96"N Y=17° 2'17.60"O	AQ5	EL USB CO/ BTU E4500 S (ambient CO)		26-avr		10 days	The analyzers are installed in the house of the village chief for the sake of safety and acceptance of measurement activities by the population.
		GT1000-Y3		26-avr-21		12 jours	
X= 280374,121 Y = 1631251,041	AQ6	SKZ 1050-E NO_2 / CO/ SO_2				10 days	A vacuum pump with a filter system was used for 5 days. These data were unsatisfactory and were replaced by real-time analyzes with the Nodes-S from Clarity for 7 days.
		CLARITY NODES ($PM_{2.5}$,PM_{10}, NO_2)		10-avr-21		7 days	
		GT 1000 TMS Dust & $S0_2$		17-avr-21		3 jdays	

X= 2899137,3 Y=1633633,9	AQ7	EL USB CO/ BTU E4500 S (ambient CO)		09-avr-21		10 days	The analyzers are housed (on a tripod adjusted to a height of 1.50m from the ground) in the village chief's house for the sake of safety and acceptance of the measurement activities by the population.
		GT1000-FC ET MOT-M4		06-avr-21		10 days	
X= 14°42'23.85"N Y= 16°57'55.49"O	AQ8	SKZ 1050E SO_2		30-avr-21		3 days	The measuring station is installed on a tripod at the level of the fixed point.
		OC 1000 Dust & gas detector		10-avr-21		10 days	
X= 14°40'10.49"N Y= 17° 1'43.69"O	AQ9	Filtre		09-avr-21		8 days	The analyzers are housed in a home and placed away from potential sources of pollution in the home. Initial measurements are made by analysis on a filter for 8 days for particles, these results are confirmed by real-time monitoring of air quality in the Kirène area. Note the proximity of the village to a cement plant (Sahel cement)
		SKZ-1050 E					
		$NO_2/SO_2/CO$					
		Dylos ($PM_{2.5}$, PM_{10})	CLARITY NODES ($PM_{2.5}$, PM_{10} NO_2)	18-avr-21	23-avr-21	4 & 5 days	
X= 14°42'26.58"N Y= 17° 3'47.56"O	AQ10	GT1000-Y3	CLARITY NODES ($PM_{2.5}$, PM_{10} NO_2)	07-avr-21	18-avr-21	10 & 6 days	For safety reasons, the measuring point is moved within 5 meters of the fixed point of origin because it is placed on a laterite path. The device is installed at the level of the respiratory tract, using a tripod in a henhouse at the level of the village of Thiambokh
		EL USB CO/ BTU E4500 S (ambient CO)		07-avr-21		10 days	
X= 14°45'51.98"N Y = 17° 3'20.05"O	AQ11	OC 1000 Dust & Gas		1er Avril		8 days	The station is installed on the roof of a house to ensure safety.
		Purple AIR PA-II-SD		10-avr-21		3 days	
		SKZ 1050 E NO_2 SO_2 CO		04-avr-21		10 days	
X= 14°43'33.01"N Y = 17° 3'20.65"O	AQ12	EL USB CO/ BTU E4500 S (ambient CO)		27-avr-21		10 days	The station is housed in the home of the neighborhood chief of the AIBD resettlement site. A one-day power failure was noted during the measurement period
		GT1000-FC ET MOT-M4		26-avr-21		12 days	

	Details	Observations
Standards	▪ NS-05-062 ▪ IFC General EHS Guidelines: Environmental; Air emissions and Air ambient emission ▪ Guidance on the Annexes to Decision 97/101/EC on Exchange of Information as revised By Decision 2001/752/EC	
Monitoring method	Continuously automatic real-time monitoring Device installed on a tripod at the level of the respiratory tract (approximately 1.50m from the ground) at the level of the SDE pumping station.	Clarity : download data each 3 mn Station MOT-M4 and portable detectors: download data each 1 mn
Metrology tehnology	Electrochimical cell with remote Calibration	≥ 200 ppb: ± 15% of measured value Correlation (R2) with USEPA FEM instrument > 0.7
Monitoring Schedule	At least 10 days for each point	Start date : 15 03 2021 End date : 26 04 2021
Pollutant studied	▪ $PM_{2.5}$ ▪ PM_{10} ▪ NO_2 ▪ SO_2 ▪ CO	Classic pollutants
Measuring points selected in number of (4) The prevailing wind direction is North to North-East for the Thiès region	12 AQ points	

Sampling Team

The team is made up of 4 members:

- Mr Serigne abdoul yade, Toxicologist, Phd in health and environment
- Miss Juice Niang, Master en bio-toxicology applied to health, environment and industries
- Miss Aissatou Sow, environmentalist
- Mr Ndoye, driver

Competency of staff including any training done

- Interferences

In order to limit interference, single gas detectors have often been used.

- QA/QC undertaken during sampling

Functional components	Details	Observations
Monitoring and data quality objectives	In our study, we chose to respect the criterion of 75% for the calculation of hourly values and of 50% for the calculation of daily values. On the other hand, the criterion of 6 consecutive hours is not systematically verified.	for 24-hour values: At least 13 one-hour values available, not more than six successive one hour values missing." according to **European Directive 2001/752 / EC**
Network, management and training system design	The Multifunctional air pollution detection system is composed of a detection end and a receiving end, The real time data can be display both on the detection end and receiving end at the same time, and the transmission distance can be up to 1.5km between the detection end and receiving end. Portabe detectors with electrocimical cell ▪ Zero calibration in clean air before each sampling after 24h ▪ Collect data each day ▪ Equipment selected in order to have continuous monitoring and enough data ▪ Sensors cleaning and detectors: electrochemical cell ▪ Permanent access to electricity for continuous operation of the detectors	Installation of the monitoring station and detectors at the measurement points Reliable power source Class ABC fire extinguisher First aid kit
Choice and location of the Site	En fonction de la position du point par rapport au site du projet En function de la démographie En function de la direction des vents dominants En function de la sensibilité environnementale du point de mesure En function de	très sensible au regard de la catégorie de population ciblée
Evaluation and choice of equipment	*Mulifunctional Air Pollution Detection System : Model:MOT-M4 (KORNO)* *BTUE4500 S (E instrument)* *Clarity NODE-S* *EL USB-CO* *GT 1000-Y3/ GT 1000-FC* *SKZ 1050 E (NO2, SO2 and CO)* *PATS+ (Barkley Air Monitoring)*	L'objectif est d'utilisesr des instruments faciles à minupler, très pratiques, adapter au terrain et peu consommateurs d'énergie. Avoir la possibilité de télécharger facilement les données.
Calibration certificate	*Available for all equipment*	To ensure the viability of instruments and data

HENAN OCEANUS CO., LTD

Certificate of Calibration and Test

"Gas detection made simple"

This *Certificate of Calibration and Test* confirms our continued commitment to product quality and reliability

Material Tested

Model Name. : OC-1000
Serial No. : 00210338469
Date : Mar 18, 2021
Calibration Gas : Fresh air

CO	0-1000ppm
NO2	0-50ppm
SO2	0-100ppm

Test Result

	Gas Type CO	NO2	SO2
Functional Test			
Start up	Pass	Pass	Pass
Self diagnosis	Pass	Pass	Pass
Zero Calibration	Pass	Pass	Pass
Span Calibration	Pass	Pass	Pass
Alarm Test			
First alarm	Pass	Pass	Pass
Second alarm	Pass	Pass	Pass
Response time for T90	25seconds	25seconds	25seconds
Accuracy(Value/Test gas)	999.8/1000	49.99/50	99.99/100
Low battery alarm	Pass	Pass	Pass
Data logger Test			
Data logging	Pass		

Tested by

QC PASS 01

Henan Oceanus Import & Export Trading Co., Ltd

Scanné avec CamScanner

KORNO 深圳科尔诺进出口贸易有限公司

Shenzhen Korno Import&Export Co.,Ltd

Portable Composite Detector Test Report

Report No.: SZKEN20210329004

Customer: BioTox labos Consulting
Description of sample: Portable Multi-Gas Detector
Manufacture: Shenzhen Korno Import&Export Co.,Ltd
Model: GT-1000-TFS
Date of sampling: **2021.3.29**
Way&Place(Organization) of Sampling : Shenzhen Korno Import&Export Co.,Ltd.
Professional judgement: qualified

Part I. Gas Test Report:

Main Equipments Used: Standard gas and calibration cover
1. Calibration System: **0701008**
2. Std. Gas: **1.Standard Concentration SO2 Gas: 20ppm**
2.Standard Concentration VOC Gas: 5000ppm
3.Standard Concentration CO2 Gas: 10000ppm

3. Environmental Condition:
Temperature: **25℃** Humidity: **30%RH**

4. Test Data:

Sensor Name	Zero	Measured Value	Target Value
SO2	0ppm	19.83ppm	20ppm

5.Reaction time: **20S**

6.Results of Calibration
Appearance Inspection:normal
Zero drift: ≤±1%（F.S/Year）
Concentration Indication Error:≤±3%F.S

For and on behalf of
Shenzhen Korno Import& Export Co. Ltd
深圳市科尔诺进出口贸易有限公司
Authorized Signature (s)

KORNO

深圳科尔诺进出口贸易有限公司
Shenzhen Korno Import&Export Co.,Ltd

Part Ⅱ. Dust Test Report:

1.Main Standards of Measurement Used

Equipment Name	Measuring Range	Uncertainty/Accuracy Class/Maximum Permissible Error	Equipment NO.
Electronic Balance	(0-31)g	U=5*10-6 g,k=2	SB12074
Digital Dust Meter	(0.001-150)mg/m3	----------	SB7377

2.Results of Calibration

Appearance Inspection:normal

Zero drift: 0 ug/m3

Concentration Indication Error:(concentration unit:ug/m3) [technical requirement:±20%]

Standard Value	Measurement Value	Relative Error
48	45	-6.3%
127	121	-4.7%

Concentration Measurement Repeatability [technical requirement: ≤10%]

PS:The relative extended uncertainty of concentration measurement error: Urel=15%,k=2

Blank Below

测试人员 Tested by:

For and on behalf of
Shenzhen Korno Import& Export Co. Ltd
深圳市科尔诺进出口贸易有限公司

下次检测日期 Next Test Date: **2022.3.29**

Authorized Signature (s)

E Instruments
850 Town Center Dr
Langhorne, PA 19047
Tel.: 215 750 1212, Fax.: 215 970 5200
Email: info@e-inst.com

CALIBRATION CENTER

Calibration Report No.: 20102121148 Page: 1 of: 1

Instrument Model No.: E4600-8 Calibration Date: 10/21/2020

Serial No.: 2148 Calibration Due Date: 10/21/2021

Standards:				
	O_2	Cert No.:	EB0041719	GASCO
	CO	Cert No.:	EB0114393	AIRGAS
	CO (H)	Cert No.:	EB-0015830	LIQUID TECHNOLOGY CORP
	NO	Cert No.:	ALM090498	AIRGAS
	NO_2	Cert No.:	CC502278	AIRGAS
	SO_2	Cert No.:	EB0071616	GASCO
	CO_2 (H)	Cert No.:	EB0095512	LIQUID TECHNOLOGY CORP
	H_2S	Cert No.:	CC151257	AIRGAS
	CH4	Cert No.:	CC293227	LIQUID TECHNOLOGY CORP

Temperature STD2.2.0002 E Instruments
Pressure STD2.2.0002 E Instruments

Parameter	Unit	Standard	Reading	Actual Error	Test Limit	Stated Accuracy
O_2	% vol	20.90	20.9	0.00	0.1 % vol	0.1 % vol
O_2	% vol				+/- 0.1 % vol	0.1 % vol
O_2	% vol				+/- 0.1 % vol	0.1 % vol
CO	ppm	198.00	198	0.00	8 ppm	10 ppm
CO	% vol				+/- .1%	+/- 10% rdg >.2%
CO	ppm				+/-(3.2% rdg) ppm	+/- 4 % rdg
NO	ppm	200.80	201	0.20	4 ppm	5 ppm
NO	ppm				+/-(3.2% rdg) ppm	5 ppm < 125 ppm
NO	ppm				+/-(3.2% rdg) ppm	+/- 4 % rdg
NO_2	ppm	97.40	n/a		4 ppm	5 ppm
NO_2	ppm				+/- (4% rdg) ppm	5 ppm < 125 ppm
NO_2	ppm				+/- (4% rdg) ppm	5 ppm < 125 ppm
SO_2	ppm	199.00	199	0.00	4 ppm	5 ppm
SO_2	ppm				+/- 4ppm	5 ppm < 125 ppm
SO_2	ppm				+/-(3.2% rdg) ppm	+/- 4 % rdg
CH_4	% vol				0.03 %	+/- 0.03 %
CH_4	% vol				+/- 0.25 %	+/- 5 % fs
CO2	% vol				+/- 3% rdg	+/- 3% rdg
H_2S	ppm				+/- 5 ppm	+/- 15 ppm
H_2S	ppm				+/- 5 ppm	+/- 5 ppm < 125 ppm
CO2	% vol				+/- 3% rdg	+/- 3% rdg
P	hPa	25.00	24.86	-0.14	+/- 1.6 hPa	+/- 2.3 hPa
P	hPa	90.00	89.93	-0.07	+/- 2 hPa	+/- 2.9 hPa
Tf	°F	122.00	121.60	-0.40	+/- 0.6° F	+/- 0.9° F
Tf	°F	158.00	157.50	-0.50	+/- 0.6° F	+/- 0.9° F

The gas reference standards used for this certificate are traceable to NIST through Scott Specialty Gas

Tech: _____ QA: _____

SKZ Industrial Co., Limited
Your Trusted Measuring Partner
D-11, No.9 Lanxiang road, Tianqiao District, Jinan, Shandong province, China. The eu compliance
Web: www.skzindustrial.com

Calibration Certification

Model： SKZ1050E-NO2 CO SO2	**Customer：**
Serial NO：210317D4	**Date of issue：2021-03-17**
Warranty Period：1 year	**Next Calibration：2022-03-16**
Version NO：V4.5	

Test Report

1.This instrument has been examined, the setup is qualified.

2. Calibration of sensor is qualified.

3.This instrument works properly and allowing release

Calibration

Measurement Unit

No.	Standard gas	Standard gas concentration	Value before calibration	Value after calibration	Response time	Remark
1	NO2	10PPM	10.1PPM	10PPM	<30second	
2	CO	250PPM	250.2PPM	250PPM	<30second	
3	SO2	10PPM	10.1PPM	10PPM	<30second	

Certification

We hereby certify that this equipment is qualified.

Stamp: 济南青强机电设备有限公司 SKZ INDUSTRIAL CO., LIMITED

SKZ Industrial Co., Limited
Your Trusted Measuring Partner
D-11, No.9 Lanxiang road, Tianqiao District, Jinan, Shandong province, China. The eu compliance
Web: www.skzindustrial.com

Calibration Certification

Model： SKZ1050E-NO2 CO	Customer：
Serial NO：210317D3	Date of issue：2021-03-17
Warranty Period：1 year	Next Calibration：2022-03-16
Version NO：V4.5	

Test Report

1.This instrument has been examined, the setup is qualified.

2. Calibration of sensor is qualified.

3.This instrument works properly and allowing release

Calibration

Measurement Unit

No.	Standard gas	Standard gas concentration	Value before calibration	Value after calibration	Response time	Remark
1	NO2	10PPM	10.1PPM	10PPM	<30second	
2	CO	250PPM	250.2PPM	250PPM	<30second	

Certification

We hereby certify that this equipment is qualified.

Stamp: 济南青强机电设备有限公司 SKZ INDUSTRIAL CO., LIMITED

SKZ Industrial Co., Limited
Your Trusted Measuring Partner
D-11, No.9 Lanxiang road, Tianqiao District, Jinan, Shandong province, China. The eu compliance
Web: www.skzindustrial.com

Calibration Certification

Model： SKZ1050E-NO2	Customer：
Serial NO：210317C1	Date of issue：2021-03-17
Warranty Period：1 year	Next Calibration：2022-03-16
Version NO：V4.5	

Test Report

1.This instrument has been examined, the setup is qualified.

2. Calibration of sensor is qualified.

3.This instrument works properly and allowing release

Calibration

Measurement Unit

No.	Standard gas	Standard gas concentration	Value before calibration	Value after calibration	Response time	Remark
1	NO2	10PPM	10.1PPM	10PPM	<30second	

Certification

We hereby certify that this equipment is qualified.

Stamp: 济南青强机电设备有限公司 SKZ INDUSTRIAL CO., LIMITED

Shenzhen Korno Import&Export Co.,Ltd

Portable Dust Detector Test Report

Report No.: SZKEN20200214005

Customer: BioTox labos Consulting

Description of sample: Dust Particle Counter

Manufacture: Shenzhen Korno Import&Export Co.,Ltd

Model: GT1000-FC

Date of sampling: **2020.2.14**

Way&Place(Organization) of Sampling : Shenzhen Korno Import&Export Co.,Ltd.

Professional judgement: qualified

1.Main Standards of Measurement Used

Equipment Name	Measuring Range	Uncertainty/Accuracy Class/Maximum Permissible Error	Equipment NO.
Electronic Balance	(0-31)g	U=5*10-6 g,k=2	SB12074
Digital Dust Meter	(0.001-150)mg/m3	----------	SB7377

2.Results of Calibration

Appearance Inspection:normal

Zero drift: 0 ug/m3

Concentration Indication Error:(concentration unit:ug/m3) [technical requirement:±20%]

Standard Value	Measurement Value	Relative Error
48	44	-6.3%
127	120	-4.7%

Concentration Measurement Repeatability [technical requirement: ≤10%]

PS:The relative extended uncertainty of concentration measurement error: Urel=15%,k=2

Blank Below

For and on behalf of Shenzhen Korno Import& Export Co. Ltd 深圳市科尔诺进出口有限公司

测试人员 Tested by: 王悦

下次检测日期 Next Test Date: **2021.2.14**

Shenzhen Korno Import&Export Co.,Ltd

便携式气体检测仪现场检测报告

Portable Gas Detector Test Report

Test Report

报告编号 Report No.：SZKEN20200214007

委托者 Customer： BioTox labos Consulting
样品名称 Description of sample：Multi-gas Detector
制造厂商 Manufacture：Shenzhen Korno Import&Export Co.,Ltd
型号 Model：GT1000-Y3
受样日期 Date of sampling： **2020.2.14**
受样方式/地点（单位）Way&Place(Organization) of Sampling : Shenzhen Korno Import&Export Co.,Ltd
检验结论 Professional judgement： qualified
批次号 Serial No.:00191020605

测试数据如下 Test data as below：
检测所用的主要测试设备 Main Equipments Used：标准气体及标定罩 Standard gas and calibration cover
1. 标定系统 Calibration System： **0701008**
2. 标准气体 Std. Gas： **1.Standard Concentration NO2 Gas：19.99PPM**
2.Standard Concentration SO2 Gas：19.99PPM
3.Standard Concentration CH2O Gas：9.99PPM

3. 检测时的环境条件 Environmental Condition：
温度 Temperature： **25℃** 湿度 Humidity： **30%RH**
4. 监测数据 Test Data：

Sensor Name	Zero	Measured Value	Target Value
NO2	0PPM	19.35PPM	19.99PPM
SO2	0PPM	19.43PPM	19.99PPM
CH2O	0PPM	9.73PPM	9.99PPM

5. Reation time： **20S**

测试人员 Tested by：王悦
For and on behalf of
Shenzhen Korno Import& Export Co. Ltd
深圳市科尔诺进出口贸易有限公司
下次检测日期 Next Test Date： **2021.2.14**

KORNO 深圳科尔诺进出口贸易有限公司

Shenzhen Korno Import&Export Co.,Ltd

Test Report

Report No.: SZKEN20200214008

Customer: BioTox labos Consulting

Description of sample: Portable Composite Detector

Manufacture: Shenzhen Korno Import&Export Co.,Ltd

Model: MOT-M4

Date of sampling: **2020.2.14**

Way&Place(Organization) of Sampling : Shenzhen Korno Import&Export Co.,Ltd.

Professional judgement: qualified

Part I. Gas Test Report:

Main Equipments Used: Standard gas and calibration cover

1. Calibration System: **0701008**

2. Std. Gas: **1.Standard Concentration CO Gas: 125mg/m3**
2.Standard Concentration NO2 Gas: 41.07mg/m3
3.Standard Concentration SO2 Gas: 57.14mg/m3

3. Environmental Condition:

Temperature: **25℃** Humidity: **30%RH**

4. Test Data:

Sensor Name	Zero	Measured Value	Target Value
CO	0mg/m3	120mg/m3	125mg/m3
VOC	0mg/m3	58.45mg/m3	57.14mg/m3
CO2	0mg/m3	38.89mg/m3	41.07mg/m3

5.Reaction time: **20S**

For and on behalf of
Shenzhen Korno Import& Export Co., Ltd
深圳市科尔诺进出口贸易有限公司

6.Results of Calibration

Appearance Inspection:normal

Zero drift: ≤±1%（F.S/Year）

ANNEXURE G HYDROCENSUS REPORT

ANNEXURE H STAKEHOLDER ENGAGEMENT PLAN

ANNEXURE I TRAFFIC MANAGEMENT PLAN

ANNEXURE J INFLUX MANANGEMENT PLAN

ANNEXURE K FRAMEWORK LOCAL CONTENT PLAN

ANNEXURE L FRAMEWORK SOCIAL INVESTMENT PLAN

ERM has over 160 offices across the following countries and territories worldwide

Argentina
Australia
Belgium
Brazil
Canada
Chile
China
Colombia
France
Germany
Ghana
Guyana
Hong Kong
India
Indonesia
Ireland
Italy
Japan
Kazakhstan
Kenya
Malaysia
Mexico
Mozambique
Myanmar
The Netherlands
New Zealand
Norway
Panama
Peru
Poland
Portugal
Puerto Rico
Romania
Russia
Senegal
Singapore
South Africa
South Korea
Spain
Sweden
Switzerland
Taiwan
Tanzania
Thailand
UAE
UK
US
Vietnam

ERM Senegal
12 Boulevard Djily Mbaye
Immeuble Azur
Dakar, Senegal

www.erm.com

The business of sustainability

ERM