

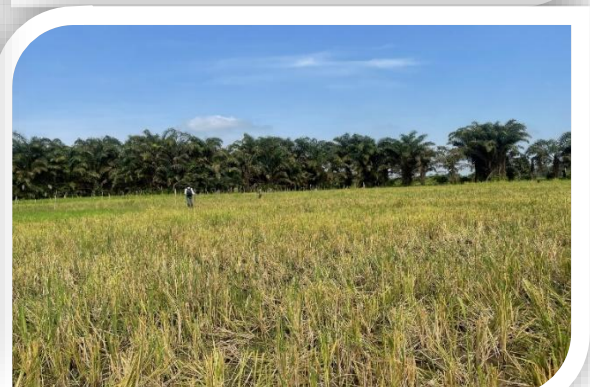


Republic of Ghana

**WEST AFRICA FOOD SYSTEM RESILIENCE PROGRAM
(FSRP2)**

**PHASE 2 OF A MULTIPLE-PHASE PROGRAMMATIC APPROACH
(P178132)**

**Improvement of Selected Inland Valleys
(Ashanti Region Lot 3)**



**Final Environmental and Social Impact Assessment
(ESIA) Report**

July 2026

ACRONYMS

AIDS	Acquired Immune Deficiency Syndrome
AoI	Area of influence
CHPS	Community Health and Planning Services
CO	Carbon Monoxide
DOVSUU	Domestic Violence and Victims Support Unit
EA	Environmental Assessment
ECOWAS	Economic Community of West African States
EHS	Environment, Health and Safety
EIA	Environmental Impact(s) Assessment
EPA	Environmental Protection Authority
ESF	Environmental and Social Framework
ESIA	Environmental and Social Impact Assessment
ESIS	Environmental and Social Impact Statement
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
ESS	Environmental and Social / Standards
FAO	Food and Agriculture Organisation (of the United Nations)
FID	Factories Inspectorate Department
FSRP	Food System Resilience Project
FSRP2	Food System Resilience Project Phase 2
GBV	Gender-based Violence
GHG	Greenhouse Gases
GIDA	Ghana Irrigation Development Authority
GIDA	Ghana Irrigation Development Authority
GIIP	Good International Industry Practice
GIS	Geographical Information System
GMet	Ghana Meteorological Agency
GNFS	Ghana National Fire Service
GoG	Government of Ghana
GSA	Ghana Standards Authority
GSEHPR	Ghana Standards for Environment and Health Protection Requirements
GSS	Ghana Statistical Service
Ha	hectares
HIV	Human Immunodeficiency Virus
HSSE	Health, Safety, Security and Environment
IDA	International Development Associations
ILO	International Labour Organization / Organisation
IPMP	Integrated Pesticide Management Plan
IUCN	International Union for the Conservation of Nature
JHS	Junior High School
Kg	kilogram(s)
Km	kilometre(s)
LMP	Labour Management Procedures
LI	Legislative Instrument

M/A	Municipal Assembly
MCE	Municipal Chief Executive
METASIP	Medium Term Agriculture Sector Investment Plan
mm	millimetres
MMDAs	Metropolitan, Municipal, and District Assemblies
MoFA	Ministry of Food and Agriculture
MPA	Multi-phase Programmatic Approach
NCCP	National Climate Change Policy
NCoS	National Centers of Specialization
NDCs	Nationally Determined Contributions
NO2	Nitrogen Oxides
NPK	Nitrogen Phosphorous Potassium
°C	degrees Celsius
OSH	Occupational Safety and Health
PAD	Project Appraisal Document
PAPs	Project Affected Persons
PDO	Project Development Objective
PHC	Population and Housing Census
PIU	Project Implementation Unit
PMU	Project Management Unit
PNDC	Provisional National Defense Council
PwD/PWDs	Persons with Disability
RPF	Resettlement Policy Framework
SDGs	Sustainable Development Goals
SEA/SH	Sexual Exploitation and Abuse and Sexual Harassment
SEP	Stakeholder Engagement Plan
SHS	Senior High School
SO2	Sulphur Oxides
SSP	Superphosphate
TSP	Triple superphosphate / Total Suspended Particles
UN	United Nations
UNEP	United Nations Environment Programme
WB	World Bank
WBG	World Bank Group
WFO	World Food Organisation
WHO	World Health Organization
WRC	Water Resources Commission
WUA	Water Users Association

TABLE OF CONTENTS

ACRONYMS	i
LIST OF FIGURES	x
LIST OF TABLES	xi
EXECUTIVE SUMMARY	xiii
1.0 INTRODUCTION	21
1.1 Background	21
1.1.1 Project Development Outcomes	23
1.1.2 The FSRP Beneficiaries and Coverage	23
1.2 The ESIA Preparation Assignment	23
1.3 Objectives of the Assignment	24
1.4 Scope of the Assignment	25
1.5 Methodology for the ESIA Study	26
1.6 Outline of the Environmental and Social Impact Assessment (ESIA)	27
2.0 KEY POLICIES, LEGISLATIONS AND INSTITUTIONAL REQUIREMENTS	28
2.1 National Environmental Policy and Related Requirements	28
2.1.1 National Environmental Policy, 2013	28
2.1.2 Environmental Protection Authority Act, 2025 (Act 1124)	28
2.1.3 Environmental Assessment Regulations, 2025 (LI 2504)	29
2.1.4 Fees and Charges (Miscellaneous Provisions) Act, 2022 (Act 1080)	29
2.1.5 National Climate Change Policy, 2013	29
2.1.6 National Climate Change Adaptation Strategy, 2010-2020	30
2.2 Agriculture and Irrigation Sector Policies and Requirements	30
2.2.1 Food and Agriculture Sector Development Policy (FASDEP II), 2007	30
2.2.2 Plants and Fertilizer Act, 2010 (Act 803)	30
2.2.3 Ghana Investment Promotion Centre Act, 2013 (Act 8658)	30
2.2.4 National Irrigation Policy, 2010	30
2.2.5 Dam Safety Regulations, 2016 (LI 2236)	31
2.2.6 Irrigation Development Authority (Irrigation Water Users Association) Regulations, 2016 (LI 2230)	31
2.3 Water and Sanitation Sector Policies and Requirements	31
2.3.1 National Water Policy, 2007	31
2.3.2 Water Resources Commission Act, 1996 (Act 522)	32
2.3.3 Water Use Regulations, 2001 (LI 1692)	32
2.3.4 Riparian Buffer Zone Policy for Managing Freshwater Bodies in Ghana, 2013	32
2.3.5 National Environmental Sanitation Policy, 2010	32
2.3.6 National Environmental Sanitation Strategy and Action Plan, 2010	32
2.4 National Planning and Development Requirements	33

2.4.1	National Land Policy, 1999.....	33
2.4.2	Lands Commission Act, 2008 (Act 767).....	33
2.4.3	Land Use and Spatial Planning Act, 2016.....	33
2.4.4	Land Act, 2020 (Act 1036).....	34
2.4.5	Local Governance Act, 2016.....	34
2.4.6	National Building Regulations, 1996 (LI 1630).....	34
2.5	National Labour, Gender, and Human Requirements	34
2.5.1	The Constitution of Ghana, 1992.....	34
2.5.2	Local Government Services Policy on SEA/SH, 2025	34
2.5.3	Domestic Violence Act, 2007 (Act 723).....	35
2.5.4	Labour Act, 2003 (Act 651)	35
2.5.5	Labour Regulations, 2007 (LI 1833)	35
2.5.6	National Employment Policy, 2014	35
2.5.7	The Children's Act, 1998 (Act 560)	36
2.5.8	Hazardous Child Labour Activity Framework, 2016.....	36
2.5.9	Inter-Sectoral Standard Operating Procedures (ISSOP) for Child Protection and Family Welfare, 2020	36
2.5.11	Workmen's Compensation Law, 1987	36
2.5.12	Persons with Disability Act, 2006.....	37
2.6	National Health and Safety Requirements.....	37
2.6.1	National Workplace HIV/AIDS Policy, 2012.....	37
2.6.2	National HIV and AIDS Policy, 2019.....	37
2.6.3	National Health Policy, 2020	37
2.6.4	Public Health Act, 2012 (Act 851).....	38
2.6.5	Ghana National Fire Service Act, 1997 (Act 537).....	38
2.6.6	Fire Precaution (Premises)(Amendments) Regulations, 2003 (LI 1724)	38
2.6.7	Control and Prevention of Bushfires Act, 1990 (PNDCL 229).....	38
2.6.8	Hazardous, Electronic and Other Wastes (Classification) Control and Management Regulations 2016, (LI 2250).....	38
2.6.9	Factories, Offices and Shops Act, 1970 (Act 328)	39
2.7	National Environmental Quality Standards.....	39
2.7.1	Ghana Standard on Health Protection - Requirements for Ambient Noise Controls, (GS 1222:2018)	39
2.7.2	Ghana Standard on Environment and Health Protection - Requirements for Ambient Air Quality and Point Stack/Emissions (GS 1236:2019).....	39
2.7.3	Ghana Standard for Environment Protection– Requirements for Effluent Discharge (GS 1212:2019)	40
2.8	World Bank Requirements.....	40
2.8.1	ESS1: Assessment and Management of Environmental and Social Risks and Impacts	40
2.8.2	ESS2: Labour and Working Conditions.....	40
2.8.3	ESS3: Resource Efficiency and Pollution Prevention and Management.....	41
2.8.4	ESS4: Community Health and Safety.....	41
2.8.5	ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement.....	41
2.8.6	ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.....	41
2.8.7	ESS8: Cultural Heritage.....	42
2.8.8	ESS10: Stakeholder Engagement and Information Disclosure	42
2.8.9	WBG EHS Guidelines for Air Emissions and Ambient Air Quality	42
2.8.10	WBG EHS Guidelines for Noise Management.....	42
2.8.11	WBG EHS Guidelines for Occupational Health and Safety	42

2.8.12	WBG EHS Guidelines for Community Health and Safety.....	43
2.8.13	WBG EHS Guidelines for Construction and Decommissioning	43
2.8.14	WBG Industry Sector Guidelines for Annual Crop Production.....	43
2.8.15	Detailed Comparison of World Bank ESSs and Ghana's Legal Framework	43
2.9	International Requirements and Conventions.....	45
2.10	Institutional Framework	47
2.10.1	Ministry of Food and Agriculture	47
2.10.2	Environmental Protection Authority.....	48
2.10.3	Water Resources Commission.....	48
2.10.4	Ministry of Labour Jobs and Employment.....	48
2.10.5	Ministry of Gender, Children and Social Protection.....	49
2.10.6	Atwima Nwabiagya and Sekyere South District Assemblies and Juaben and Ejisu Municipal Assemblies	49
3.0	PROJECT DESCRIPTION.....	50
3.1	Revised Data Informing the Design of the Inland Valleys.....	50
3.2	Description of Scope of Works.....	50
3.2	Characteristics of the Stream Flows and Crop Water Requirements.....	54
3.3	Land Use and Tenure/Ownership of the Valley	54
3.4	Soil Series and Characteristics of the Valley	56
3.5	Project Design Details – All Valleys.....	59
3.5.1	Construction of Low-Head Concrete Weirs and Sump	59
3.5.2	Pump Station – Odaho Valley.....	60
3.5.3	Supply Pipelines – Odaho Valley.....	61
3.5.4	Reservoir – Odaho Valley.....	61
3.5.6	Closure Flood Protection Embankments	61
3.5.7	Canal Intake Structure.....	62
3.5.8	Canals	63
3.5.9	Laterals	63
3.5.10	Water Control Structures.....	64
3.5.11	Infield Drains – Drainage Systems	64
3.5.12	Watershed Management	64
3.5.13	Land Preparation and Bunding	64
3.5.14	Equipment and Machinery.....	65
3.5.15	Operations of the Inland Valley.....	65
3.5.16	Labour Force and Employment	65
3.6	Scheme Locations and Layout Maps – All Valleys	66
3.6.1	Locations Maps of the Valley.....	66
3.6.2	Scheme Layout Maps of the Valleys.....	69
4.0	PROJECT ALTERNATIVES.....	74
4.1	Headworks Structures	74
4.2	Canals and Drainage Structures.....	75
4.3	Alternative Irrigation Systems.....	75
4.4	Alternative Cropping.....	76
5.0	PROJECT BASELINE INFORMATION	77
5.1	The Project Baseline Methodology	77
5.2	The Ejisu Municipal.....	77

5.2.1	<i>Socio-economic Conditions</i>	78
5.2.1a	<i>Role of Women, Gender-Based Violence, Poverty, and Social Protection</i>	79
5.2.2	<i>Demography</i>	79
5.2.3	<i>Education</i>	79
5.2.4	<i>Health</i>	80
5.2.5	<i>Water and Sanitation</i>	82
5.2.6	<i>Climate</i>	82
5.2.7	<i>Geology and Soils</i>	84
5.2.8	<i>Topography and Drainage</i>	84
5.2.9	<i>Oda River and Water Quality Analysis</i>	86
5.2.9	<i>Vegetation (Flora and Fauna)</i>	89
5.3	Juaben Municipal	91
5.3.1	<i>Socio-economic Conditions</i>	92
5.3.1a	<i>Role of Women, Gender-Based Violence, Poverty, and Social Protection</i>	92
5.3.2	<i>Demography</i>	92
5.3.3	<i>Education</i>	92
5.3.4	<i>Health</i>	92
5.3.5	<i>Water and Sanitation</i>	93
5.3.6	<i>Climate</i>	93
5.3.7	<i>Geology and Soils</i>	94
5.3.8	<i>Topography and Drainage</i>	94
5.3.9	<i>Vegetation (Flora and Fauna)</i>	97
5.4	Sekyere South Municipal	98
5.4.1	<i>Socio-economic Conditions</i>	99
5.4.1a	<i>Role of Women, Gender-Based Violence, Poverty, and Social Protection</i>	99
5.4.2	<i>Demography</i>	100
5.4.3	<i>Education</i>	100
5.4.4	<i>Health</i>	100
5.4.5	<i>Water Supply and Sanitation</i>	101
5.4.6	<i>Climate</i>	101
5.4.7	<i>Geology and Soils</i>	102
5.4.8	<i>Topography and Drainage</i>	103
5.4.9	<i>Vegetation (Flora and Fauna)</i>	106
5.5	Atwima Nwabiagya North District	108
5.5.1	<i>Socio-economic Conditions</i>	108
5.5.1a	<i>Role of Women, Gender-Based Violence, Poverty, and Social Protection</i>	109
5.5.2	<i>Demography</i>	109
5.5.3	<i>Education</i>	109
5.5.4	<i>Health</i>	109
5.5.5	<i>Water and Sanitation</i>	110
5.5.6	<i>Climate</i>	110
5.5.7	<i>Geology and Soils</i>	112
5.5.8	<i>Topography and Drainage</i>	112
5.5.9	<i>Vegetation (including Flora and Fauna)</i>	117
6.0	STAKEHOLDER ENGAGEMENT	119
6.1	Purpose of Stakeholder Involvement	119
6.2	Objectives of Stakeholder Involvement	119
6.3	Key Stakeholders Engaged	119

6.3	Outcome of Stakeholder Consultations.....	120
6.4	Key Recommendations from the Stakeholder Engagements	125
6.5	Validation Engagements.....	126
7.0	POTENTIAL BENEFICIAL AND ADVERSE ISSUES IDENTIFIED.....	128
7.1	Potential Opportunities and Beneficial Impacts.....	128
	Beneficial Environmental and Social Impacts	128
7.1.1	<i>Food Security Improvement.....</i>	<i>129</i>
7.1.2	<i>Efficient Water Use in Inland Valleys and Flood Prevention.....</i>	<i>129</i>
7.1.3	<i>Employment Opportunities for Project Communities.....</i>	<i>129</i>
7.1.4	<i>Reduction in Post-Harvest Losses</i>	<i>130</i>
7.1.5	<i>Improvement in Climate Change Adaptation Measures</i>	<i>130</i>
7.2	Potential Adverse Impacts and Risks – All Valleys.....	130
7.2.1	<i>Potential Disruption of Livelihoods.....</i>	<i>131</i>
7.2.2	<i>Impacts on Water Resources.....</i>	<i>132</i>
7.2.3	<i>Occupational Health and Safety Risks.....</i>	<i>133</i>
7.2.4	<i>Waste Handling and Disposal Impacts.....</i>	<i>135</i>
7.2.4	<i>Inappropriate Handling, Usage, Storage and Disposal of Agrochemicals</i>	<i>136</i>
7.2.5	<i>Potential Labour Issues</i>	<i>138</i>
7.2.6	<i>Potential Child Labour.....</i>	<i>139</i>
7.2.7	<i>Public/Community Health and Safety Risks.....</i>	<i>140</i>
7.2.8	<i>Risk of Gender-Based Violence</i>	<i>142</i>
7.2.9	<i>Risk of Spread of HIV/AIDS and STIs.....</i>	<i>143</i>
7.2.10	<i>Potential Socio-Cultural Conflict</i>	<i>143</i>
7.2.11	<i>Flood Risks and Associated Diseases</i>	<i>144</i>
7.2.12	<i>Disease Outbreak and Pest Infestation.....</i>	<i>145</i>
7.2.13	<i>Biodiversity/Vegetation Impacts</i>	<i>147</i>
7.2.14	<i>Greenhouse Gas Emissions and Climate Change.....</i>	<i>147</i>
7.2.15	<i>Fire Risk.....</i>	<i>147</i>
8.0	ENVIRONMENTAL AND SOCIAL MITIGATION PLAN	150
8.1	Prevention of Livelihood Disruptions– All Valleys	150
8.2	Water Resources Protection.....	151
8.3	Waste Management.....	152
8.4	Safe Use and Disposal of Agrochemicals.....	154
8.5	Integrated Pests and Disease Management (IPDM).....	154
8.6	Occupational Health and Safety Measures	155
8.7	Labour Management Plan.....	157
8.8	Child Labour Prevention.....	158
8.9	Fire Prevention and Control	159
8.10	Public/Community Health and Safety.....	159
8.11	Prevention of Gender-Based Violence.....	161
8.12	HIV/AIDS and STIs Prevention Measures	161
8.13	Social Conflict Prevention Measures.....	162
8.14	Flood Prevention Measures	162
8.15	Prevention of Vegetation/Biodiversity Loss.....	162
8.16	Reduction in Greenhouse Gas Emissions.....	163
8.17	Residual Impacts Characteristics	163

9.0	ENVIRONMENTAL AND SOCIAL MONITORING	166
9.1	Monitoring Livelihood Disruptions Prevention Measures	166
9.2	Water Resource Quality Monitoring.....	167
9.3	Vegetation/Biodiversity Loss Prevention Monitoring.....	167
9.4	Waste Management Monitoring	167
9.5	Occupational and Public Health and Safety Monitoring.....	168
9.6	Integrated Pests and Disease Management Monitoring (IPDM).....	168
9.7	Prevention of Labour Concerns and Child Labour Monitoring.....	169
9.8	Flood Prevention Monitoring.....	169
9.9	HIV/AIDS and STI Prevention Monitoring.....	169
9.10	Gender-Based Violence Prevention Monitoring.....	170
9.11	Environmental and Social Monitoring Plan	172
10.0	PROVISIONAL ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN.....	174
10.1	Introduction	174
10.2	Key ESMP Objectives.....	174
10.3	PESMP Implementation	175
10.3.1	<i>Roles and Responsibilities</i>	<i>175</i>
10.3.2	<i>Formation of Water User Associations.....</i>	<i>175</i>
10.3.3	<i>Capacity Building and Orientation.....</i>	<i>176</i>
10.3.4	<i>Compliance Monitoring and Inspections.....</i>	<i>176</i>
10.3.5	<i>Documentation and Reporting.....</i>	<i>176</i>
10.4	Livelihood Preservation and Protection Plan	177
10.5	Provisional Environmental and Social Management Plan – Applicable to All Valleys	178
11.0	EMERGENCY PREPAREDNESS AND RESPONSE PLAN	185
11.1	Roles and Responsibilities	185
11.2	Emergency Types and Protocols.....	185
11.2.1	<i>Environmental and Social Emergencies</i>	<i>185</i>
11.2.2	<i>Accidents (Injury, Fatality, Drowning, Fire, Flooding)</i>	<i>185</i>
11.2.3	<i>GBV/SH and Security-Related Emergencies.....</i>	<i>186</i>
11.2.4	<i>Medical and Health Emergencies.....</i>	<i>186</i>
11.3	General Emergency Response Principles.....	186
11.4	Alarm Raising Procedures	186
11.4.1	<i>Manual Alarm Systems</i>	<i>186</i>
11.4.2	<i>Alarm Raising Responsibilities</i>	<i>187</i>
11.4.3	<i>Workers Responsibilities Upon Hearing the Alarm.....</i>	<i>187</i>
11.4.3	<i>Evacuation Procedures.....</i>	<i>187</i>
11.5	Communication with Emergency Responders.....	188
11.5.1	<i>Communication Systems and Channels</i>	<i>188</i>
11.6	Escalation and Client Notification	189
11.7	Training and Drills.....	189
12.0	GRIEVANCE MECHANISM.....	190
12.1	Grievance Mechanism Process.....	191
12.2	Grievance Committee	191
12.2.1	<i>Municipal/District Level</i>	<i>191</i>
12.2.2	<i>Regional Level</i>	<i>192</i>

12.3	Gender-Based Violence - Sexual Exploitation and Abuse and Sexual Harassment.....	193
12.4	Child Labour	196
12.5	Training of Grievance Committees and Sensitisation of Communities.....	197
12.6	Grievance Mechanism Monitoring.....	198
ANNEXES		199
Annex 1: References		199
Annex 2: Stakeholder Engagements		200

LIST OF FIGURES

FIGURE 1:	ODAHO VALLEY AT DONUASO	52
FIGURE 2:	ODAMU VALLEY	52
FIGURE 3:	KUMKUM VALLEY	53
FIGURE 4:	OFFINHO VALLEY	53
FIGURE 5:	WAAMU KUMI VALLEY	53
FIGURE 6:	TYPICAL CROSS-SECTION OF THE WEIR.....	60
FIGURE 7:	LAYOUT OF WEIR, SUMP AND PUMP STATION IN THE ODAHO VALLEY.....	61
FIGURE 8:	OFFTAKE PENSTOCK GATE OF THE INTAKE STRUCTURE	62
FIGURE 9:	CROSS-SECTION OF IRRIGATION CANAL	63
FIGURE 10:	CROSS-SECTIONS OF LATERAL EMBANKMENT: WITHOUT ROAD	63
FIGURE 11:	CROSS-SECTIONS OF LATERAL EMBANKMENT:) WITH ROAD.....	63
FIGURE 12:	CROSS-SECTION OF THE LATERAL CHECK-STRUCTURE	64
FIGURE 13:	INFIELD DRAIN CROSS-SECTION	64
FIGURE 14:	LOCATIONS OF THE FIVE (5) VALLEYS IN THE ASHANTI REGION, FSRP/ESSERM 2024	66
FIGURE 15:	LOCATION AT ODAHO VALLEY (DONUASO AND KRAPA) WITHIN THE EJISU MUNICIPAL, FSRP2, 2024	66
FIGURE 16:	LOCATION OF ODAHU VALLEY (YAW NKRUMAH) WITHIN THE JUABEN MUNICIPAL, FSRP2, 2024.....	67
FIGURE 17:	LOCATION OF OFFINO VALLEY AT BAREKESE/AMAKYE BARE - ATWIMA NWABIAGYA DISTRICT, FSRP2, 2024.....	67
FIGURE 18:	LOCATION OF WAAMU/KUMI VALLEY (ANINKROMAH) - ATWIMA NWABIAGYA DISTRICT, FSRP2	68
FIGURE 19:	SCHEME LAYOUT FOR THE ODAHO INLAND VALLEY, FSRP2, 2024	69
FIGURE 20:	SCHEME LAYOUT FOR THE ODAHU INLAND VALLEY, FSRP2, 2024	70
FIGURE 21:	SCHEME LAYOUT FOR THE KUMKUM INLAND VALLEY, FSRP2, 2024	71
FIGURE 22:	SCHEME LAYOUT FOR THE OFFINHO INLAND VALLEY, FSRP2, 2024	72
FIGURE 23:	SCHEME LAYOUT FOR THE WAAMU/KUMI INLAND VALLEY, FSRP2, 2024.....	73
FIGURE 24:	MAP OF EJISU MUNICIPAL. SOURCE: EJISU MUNICIPAL ASSEMBLY	78
FIGURE 25:	HEALTH FACILITIES IN THE EJISU MUNICIPAL AREA	82
FIGURE 26:	RAINFALL VALUES FOR EJISU, 2024.....	83
FIGURE 27:	MINIMUM TEMPERATURE VALUES FOR EJISU, GMET, 2024	83
FIGURE 28:	MAXIMUM TEMPERATURE VALUES FOR EJISU, GMET, 2024	84
FIGURE 29:	THE ODA CATCHMENT AREA	85
FIGURE 30:	DRAINAGE MAP OF THE ODAHO VALLEY, ESSERM CONSULT, 2024.....	86
FIGURE 31:	WATER SAMPLING FROM THE ODA STREAM	87
FIGURE 32:	NEARBY VEGETATION TYPES AFRICAN OIL PALM/RAPHIA PALM AT ODAHO VALLEY	90
FIGURE 33:	MAP OF JUABEN MUNICIPAL, JUABEN MUNICIPAL, 2024.....	91
FIGURE 34:	ODAMU CATCHMENT AT YAW NKRUMAH, FSRP2 2024.....	94
FIGURE 35:	DRAINAGE MAP OF THE ODAHU VALLEY WITH WATER SAMPLING POINTS, ESSERM, 2024	95
FIGURE 36:	WATER SAMPLING FROM THE ODAHU STREAM	96
FIGURE 37:	MAP OF SEKYERE SOUTH MUNICIPAL AREA, FSRP, 2024	99
FIGURE 38:	RAINFALL VALUES FOR SEKYERE SOUTH DISTRICT, GMET, 2024	101
FIGURE 39:	MEAN MINIMUM TEMPERATURE VALUES FOR SEKYERE SOUTH DISTRICT, GMET 2024,.....	102
FIGURE 40:	MEAN MAXIMUM TEMPERATURE VALUES FOR SEKYERE SOUTH DISTRICT. GMET, 2024	102
FIGURE 41:	DRAINAGE MAP OF THE KUMKUM VALLEY WITH WATER SAMPLING POINTS, ESSERM CONSULT, 2024	104
FIGURE 42:	WATER QUALITY SAMPLING FROM THE KUMKUM STREAM,	104
FIGURE 43:	MAP OF ATWIMA NWABIAGYA NORTH DISTRICT, (ANND, 2024)	108

FIGURE 44:	RAINFALL VALUES FOR ATWIMA NWABIAGYA NORTH DISTRICT, GMET, 2024	111
FIGURE 45:	MEAN MINIMUM TEMPERATURE VALUES FOR ATWIMA NWABIAGYA NORTH DISTRICT, GMET,2024	111
FIGURE 46:	MEAN MAXIMUM TEMPERATURE VALUES FOR ATWIMA NWABIAGYA NORTH DISTRICT, GMET 2024	112
FIGURE 47:	OFFIN CATCHMENT AREA, FSRP2 2024	113
FIGURE 48:	DRAINAGE MAP OF OFFINHO/WAAMU/KUMI VALLEY, ESSERM 2024	114
FIGURE 49:	WATER SAMPLING FROM THE OFFIN/WAAMU RIVERS	115
FIGURE 50:	ENGAGEMENT WITH EJSU MUNICIPAL ASSEMBLY	120
FIGURE 51:	CONSULTATIONS WITH JUABEN MUNICIPAL ASSEMBLY	123
FIGURE 52:	ENGAGEMENT WITH SEKYERE SOUTH DISTRICT ASSEMBLY	124
FIGURE 53:	CONSULTATIONS WITH ATWIMA NWABIAGYA DISTRICT ASSEMBLY	124
FIGURE 54:	ENGAGEMENT WITH FARMERS IN ODAHO (L) AND ODAMU VALLEYS IN EJSU/JUABEN DISTRICTS	124
FIGURE 55:	ENGAGEMENT WITH FARMERS IN KUMKUM (L) AND WAAMU/KUMI (R) VALLEYS	125
FIGURE 56:	VALIDATION WORKSHOP AT BAREKESE (L) AND ANINIKRUMAH (R) IN ATWIMA NWABIAGYA NORTH DISTRICT	127
FIGURE 57:	SEA/SH MECHANISM (SOURCE: FRSP2 SEP, 2023)	195
FIGURE 58:	MECHANISMS FOR DEALING WITH CHILD LABOUR CASES	197

LIST OF TABLES

TABLE 1:	DETAILS OF LOT 3 SCHEMES IN THE ASHANTI REGION	23
TABLE 2:	ACCEPTABLE AMBIENT NOISE LEVELS	39
TABLE 3:	ACCEPTABLE AMBIENT AIR QUALITY – MAXIMUM LIMIT FOR 24 HOURS	39
TABLE 4:	ACCEPTABLE LEVELS FOR EFFLUENT DISCHARGE	40
TABLE 5:	DETAILED COMPARISON OF WORLD BANK ESSs AND GHANA LEGAL FRAMEWORK	43
TABLE 6:	RELEVANT INTERNATIONAL CONVENTIONS	45
TABLE 7:	INFORMATION ON THE INLAND VALLEYS FOR DEVELOPMENT	50
TABLE 8:	PROPOSED DESIGN AND INTERVENTIONS FOR VALLEY DEVELOPMENT	51
TABLE 9:	STREAM FLOWS AND CROP WATER REQUIREMENTS	54
TABLE 10:	LAND-USE AND TENURE/OWNERSHIP OF THE VALLEYS	55
TABLE 11:	SOIL SERIES AND CHARACTERISTICS OF THE VALLEYS	56
TABLE 12:	SOIL SERIES AND NUTRIENT PROPERTIES OF THE VALLEYS	57
TABLE 13:	WEIR DESIGN DISCHARGE INFORMATION	59
TABLE 14:	WEIR DESIGN PARAMETER OF THE VALLEYS	60
TABLE 15:	WEIR FLOOD PROTECTION EMBANKMENT DIMENSIONS	62
TABLE 16:	PROPOSED LIST AND NUMBERS OF EQUIPMENT AND MACHINERY FOR EACH VALLEY	65
TABLE 17:	HEALTH FACILITIES IN EJSU MUNICIPALITY	80
TABLE 18:	HEALTH STATISTICS OF THE PROJECT AREA – ONWE SUB-METRO	80
TABLE 19:	HEALTH STATISTICS OF THE EJSU SUB-METRO	81
TABLE 20:	HEALTH STATISTICS OF THE EJSU METRO	81
TABLE 21:	KEY CHARACTERISTICS OF THE ODA CATCHMENT AREA	86
TABLE 22:	WATER QUALITY SAMPLING LOCATIONS	87
TABLE 23:	WATER QUALITY RESULTS_ODA RIVER	87
TABLE 24:	FLORISTIC COMPOSITION OF THE PROJECT SITE	90
TABLE 25:	JUABEN HEALTH FACILITIES BY TYPE AND OWNERSHIP	93
TABLE 26:	JUABEN HEALTH DIRECTORATE STATISTICS	93
TABLE 27:	KEY CHARACTERISTICS OF THE ODA CATCHMENT AT YAW NKRUMAH	95
TABLE 28:	WATER QUALITY SAMPLING LOCATIONS	95

TABLE 29:	WATER QUALITY RESULTS.....	96
TABLE 30:	FLORISTIC COMPOSITION OF THE PROJECT SITE.....	98
TABLE 31:	SEKYERE SOUTH HEALTH DIRECTORATE STATISTICS.....	100
TABLE 32:	WATER QUALITY SAMPLING LOCATIONS.....	104
TABLE 33:	WATER QUALITY RESULTS.....	105
TABLE 34:	FLORISTIC COMPOSITION OF THE PROJECT SITE.....	107
TABLE 35:	ATWIMA NWABIAGYA NORTH HEALTH DIRECTORATE STATISTICS.....	109
TABLE 36:	KEY CHARACTERISTICS OF THE OFFIN CATCHMENT AT AMAKYEBARE.....	115
TABLE 37:	WATER QUALITY SAMPLING LOCATIONS.....	115
TABLE 38:	WATER QUALITY RESULTS.....	115
TABLE 39:	FLORISTIC COMPOSITION OF THE PROJECT SITE.....	118
TABLE 40:	STAKEHOLDERS ENGAGED.....	120
TABLE 41:	SUMMARISED OUTCOME OF STAKEHOLDER ENGAGEMENT.....	121
TABLE 42:	KEY RECOMMENDATIONS AND SUGGESTIONS.....	125
TABLE 43:	POTENTIAL OPPORTUNITIES AND BENEFICIAL IMPACTS.....	128
TABLE 44:	POTENTIAL ADVERSE IMPACTS AND RISKS.....	130
TABLE 45:	SOURCES, EFFECTS AND RECIPIENTS FOR WASTE HANDLING AND DISPOSAL IMPACTS.....	136
TABLE 46:	SOURCES, EFFECTS AND RECIPIENTS FOR GENDER-BASED VIOLENCE.....	142
TABLE 47:	SOURCES, EFFECTS AND RECIPIENTS FOR RISK OF SPREAD OF HIV/AIDS AND STIs.....	143
TABLE 48:	SOURCES, EFFECTS, RECIPIENTS FOR DISEASE OUTBREAK AND PEST INFESTATION.....	145
TABLE 49:	EXTENT OF DAMAGE OF SIGNIFICANT PESTS AND DISEASES.....	146
TABLE 50:	IMPACTS CHARACTERISATION: PRE-MITIGATION.....	148
TABLE 51:	IMPACTS CHARACTERISATION: POST-MITIGATION.....	164
TABLE 52:	ENVIRONMENTAL AND SOCIAL MONITORING PLAN.....	172
TABLE 53:	ROLES AND RESPONSIBILITIES FOR PESMP.....	175
TABLE 54:	LIVELIHOOD PRESERVATION AND PROTECTION PLAN.....	177
TABLE 55:	CONSTRUCTION PHASE.....	178
TABLE 56:	OPERATIONS PHASE.....	182
TABLE 57:	ROLES AND RESPONSIBILITIES.....	185
TABLE 58:	SUMMARY OF GRIEVANCE MECHANISM PROCEDURE AND TIMELINES.....	193

EXECUTIVE SUMMARY

Background

The Government of Ghana (GoG) in collaboration with ECOWAS and the World Bank is implementing the Food System Resilience Project (FSRP) Phase 2 under the World Bank Multi-Phase Programmatic Approach (MPA) for Investment Project Financing Instrument. The Food Systems Resilience Project is organized around five core distinct but interrelated components to help achieve the objectives of the project. The project components include:

- Component 1: Improving digital advisory services to support timely agriculture and food crisis prevention and management;
- Component 2: Sustainability and adaptive capacity of Ghana's food systems productive base;
- Component 3: Enhancing regional food market integration and agricultural inputs and output trade;
- Component 4: Contingency emergency response; and
- Component 5: Project management.

The FSRP2 Project environmental and social risk level is substantial.

Project Development Objectives

The Project Development Objective (PDO) of the FSRP is to increase preparedness against food insecurity and improve the resilience of food system actors, priority landscapes and value chains in programme areas. - The expected outcomes at the end of the programme include:

- Program direct beneficiaries reach 300,000; of which 40% are women;
- Proportion of food-insecure households in the targeted areas reduced by 25%;
- Food system actors accessing hydro and agrometeorological advisory services reach 211,200; of which 40% are women;
- Producers adopting supported climate-smart agricultural technologies and services reach 240,000; of which 40% are women;
- Surface area under integrated landscape management increased by 4,850 ha; and
- Share of intra-regionally traded production in selected value chains (maize, rice) increased from 20% to 30%.

Project Details - Ashanti Region Lot 3

As part of contributing to the project's development objectives, the following selected inland valleys in the Ashanti Region of Ghana grouped under Lot 3 are expected to be improved to increase their rice productivity:

No.	Name of District	Name of Valley	Location of Valley	Name of River / Stream	Estimated Cropped Area (Ha)	Potential Area (Ha)	Surveyed Area (Ha)	Final Designed Area (Ha)
1	Ejisu Municipal	Odaho	Donuaso	Oda	50	110	115.638	114.50
2	Juaben Municipal	Odamu	Yaw Nkrumah / New Bonfa	Odamu	80	120	64.849	42.00
3	Sekyere South	Kumkum	Tano Odumase	Kumkum	70	100	35.886	36.00

No.	Name of District	Name of Valley	Location of Valley	Name of River / Stream	Estimated Cropped Area (Ha)	Potential Area (Ha)	Surveyed Area (Ha)	Final Designed Area (Ha)
4	Atwima Nwabiagya North	Offin	Barekese/ Amakye-bare	Offin	40	60	81.379	77.00
5		Waamu /Kumi	Aninkromah	Waamu	70	160	130.00	114.00
	TOTAL				310	550	427.8	383.5

KEY POLICIES, LEGISLATIONS AND INSTITUTIONAL REQUIREMENTS

The following policy, legal and institutional frameworks and requirements were considered in detail under the environmental and social impact assessment for the Ashanti Region Lot 3 valleys:

- 1) National environmental policy;
- 2) Agriculture and irrigation sector policies;
- 3) Water and sanitation sector policies;
- 4) National planning and development;
- 5) National labour, gender and human;
- 6) National health and safety;
- 7) National environmental quality standards;
- 8) World Bank Environmental and Social Framework;
- 9) International requirements and conventions; and
- 10) Institutional frameworks.

Project Description

The following provides the specific proposed details of works to be carried out in each of the valleys under the Ashanti Region Lot 3 construction works.

No	Name of Valley	Interventions
1	Odaho	1. Headworks (weir, intake structures, sump, pump station, closure embankment) 2. Canal and laterals 3. Drains (main, secondary, catchment drains, field drains) 4. Stream channelisation with protection dyke 5. Roads (access, field roads) 6. Land development (clearing, removal and stockpiling of topsoil, levelling, spreading of topsoil, bunding) 7. Crossing bridge 8. Provision of borehole 9. Sanitary facility
2	Odamu/ Kumkum/ Offin/ Waamu/Kumi (4-valleys)	1. Headworks (weir, intake structures, closure embankment) 2. Canal and laterals 3. Drains (main, secondary, catchment drains, field drains) 4. Stream channelization with protection dyke 5. Roads (access, field roads) 6. Land development (clearing, removal and stockpiling of topsoil, levelling, spreading of topsoil, bunding)

No	Name of Valley	Interventions
		7. Provision of borehole 8. Sanitary facility

The valley lands are owned by traditional authorities and allocated for rice cultivation. District Assemblies have reflected these existing uses in their land-use maps. Current land ownership and tenure arrangements are not expected to adversely impact the project development in the four valleys.

Project Baseline

The FSRP2 Inland Valley Lot 3 projects are located in the Ejisu, Juaben, Sekyere South and Atwima Nwabiagya Districts in the Ashanti Region. The baseline information-gathering methodology combines data collection methods such as document reviews, institutional and community consultations, focus group discussions and field surveys of the existing environment. The following specific document sources were reviewed as part of the methodology among others:

- Ghana Statistical Service (GSS), 2021. Population and Housing Census, General Report Vol 3A_Population of Regions and Districts.
- The Ejisu, Juaben, Sekyere South and Atwima Nwabiagya North Districts Assemblies Composite Budgets within 2020-2026 Programme-Based Budget Estimates;
- Assemblies Draft Medium-Term Development Plans for 2018-2021; and
- Ghana AIDS Commission, 2022. National and Sub-National HIV and AIDS Estimates and Projections.

The environmental and social impact assessment contained the baseline information covering the socio-economic-cultural, physical and biological environment for the four (4) districts which are organised and presented under the following thematic areas:

- Socio-economic conditions;
- Climatic (rainfall, temperature and humidity) conditions;
- Water resources, drainage and flooding;
- Topography, geology and soil characteristics;
- Water and sanitation; and
- Biophysical environment.

Stakeholder Engagement

Stakeholder involvement is a key aspect of the Environmental and Social (E&S) assessment process. Its significance is accordingly captured in Ghana's Environmental Laws; EPA Act 2025 (Act 1124) and LI 2504 and the World Bank's E&S requirements, ESS 10. Stakeholder engagements were carried out with the objectives of providing information to stakeholders and receiving their inputs to inform its implementation; elicit information that would help identify the potential and actual environmental and social issues in the project area; deriving baseline data that may be anecdotal, but which could complement data obtained from published documents; picking up cues that would help develop key aspects of the environmental and social management plans such as Grievance Mechanism, compliance monitoring, etc.; providing information to

project stakeholders on the environmental and social impact assessment process and seeking their participation and input; and establishing cooperation and encouraging their participation in the impact assessment and mitigation processes among other.

The following key stakeholders were engaged in the environmental and social impact assessment:

- Ministry of Food and Agriculture;
- District Directorate of Agriculture;
- Environmental Protection Authority (EPA);
- Ejisu Municipal Assembly (EMA);
- Sekyere South District Assembly (SSDA);
- Juaben Municipal Assembly (JMA);
- Atwima Nwabiagya North District Assembly (ANNDA);
- Municipal and District Chief Executives;
- Municipal and District Directors of Agriculture;
- Municipal and District Co-ordinating Directors;
- Municipal and District Health Directorates;
- Municipal and District Agriculture Extension Officers;
- Rice Farmers;
- Anchor Farmers; and
- Traditional Authorities.

Potential Beneficial and Adverse Issues Identified

The methodology for the evaluation and assessment of environmental and social risks and impacts included field visits, community and public stakeholder engagements and baseline data analysis among others. The evaluation considered the potential beneficial impacts and other enhancement measures expected to be derived from the improvement works for the Odaho, Odamu, Kumkum and Waamu/Kumi, Offincho Valleys.

The identification of impacts focused on significant key issues associated with the improvement works within the inland valleys. The impact identification was based largely on the contributions and inputs from various stakeholders and insights by the consultants. These included both beneficial impacts and opportunities as well as adverse impacts and risks associated with the project activities.

Potential Opportunities and Beneficial Impacts

The main beneficial impacts likely to arise from the implementation of the various valley's rehabilitation works would include:

1. Food security improvement;
2. Efficient water use in the inland valleys and flood prevention;
3. Employment opportunities for project communities;
4. Reduction in post-harvest losses; and
5. Improvement in climate change adaptation measures.

Potential Adverse Impacts and Risks

Due to the similarity of the practices in each of the five valleys in the Ashanti Region Lot 3, and their location in the same catchment areas, similar environmental and social risks and impacts are associated with these valleys and this is also as a result of the similar designs being proposed for the construction works in each valley. Detailed assessments of the impacts are provided in the report for construction and operation phases for the valleys for the following potential impacts and risks:

Construction Phase

- Disruption of livelihoods;
- Impacts on water resources;
- Waste handling and disposal impacts;
- Occupational health and safety risks;
- Labour concerns;
- Potential child labour;
- Community health and safety risks;
- Risk of gender-based violence;
- Risk of spread of HIV/AIDS and STIs;
- Socio-cultural conflict;
- Flood risk;
- Vegetation/biodiversity and
- Greenhouse gas emissions and climate change.

Operations Phase

- Impacts on water resources;
- Waste handling and disposal impacts;
- Inappropriate handling, usage, storage and disposal of agrochemicals and pesticides;
- Disease outbreak and pest infestation;
- Occupational health and safety risks;
- Labour concerns;
- Potential child labour;
- Public/community health and safety risks;
- Socio-cultural conflict;
- Flood risk; and
- Fire risk.

Environmental and Social Mitigation Measures

The environmental and social mitigation measures are designed to address the significant potential environmental and social impacts and risks identified by the assessment. The proposed mitigation measures are expected to ensure environmental soundness, social acceptability, health and safety as well as project sustainability at both the construction and operation phases. While some of the measures were built into project design, others would be implemented during project execution. Other measures will also aim at enhancing project opportunities. Details on the following mitigation measures which apply to all five inland valleys to ensure environmental and social sustainability of the construction works, and the operations of the valleys are provided in the report:

1. Livelihood disruptions prevention;

2. Water resources protection;
3. Waste management;
4. Safe use and disposal of agrochemicals;
5. Integrated pests and disease control;
6. Occupational health and safety;
7. Labour management;
8. Child labour prevention;
9. Fire prevention and control;
10. Public/community health and safety;
11. Gender-based violence prevention;
12. HIV/AIDS and STIs prevention;
13. Social conflict prevention;
14. Flood prevention measures;
15. Prevention of vegetation/biodiversity loss; and
16. Reduction in Greenhouse Gas Emissions.

Environmental and Social Monitoring Measures

The objective of environmental and social monitoring is to ensure follow-up on environmental and social commitments and performance during the implementation of the construction works and operations in the Ashanti Region Lot 3 rice valleys. Environmental and social monitoring defines the relevant indicators or indicator parameters that characterize an impact. These parameters must be measurable and verifiable to enable accurate comparison, since monitoring activities occur throughout the life of the project.

The following areas of monitoring will be carried out throughout the construction works in the Odaho, Odamu, Kumkum, Offinhu and Waamu/Kumi Valleys and those indicated as required during operations will be carried out during the operations/farming activities in the valleys:

1. Livelihood disruptions prevention;
2. Water resource quality protection;
3. Biodiversity/vegetation loss prevention;
4. Waste management;
5. Occupational and public health and safety;
6. Integrated pests and disease management;
7. Prevention of labour concerns and child labour;
8. Flood prevention;
9. HIV/AIDs and STI prevention; and
10. Gender-based Violence prevention.

Provisional Environmental and Social Management Plan (PESMP)

The Provisional Environmental and Social Management Plan (PESMP) for the improvement of the Odaho, Odamu, Kumkum, Offinhu and Waamu/Kumi Valleys outlines the mitigation and monitoring measures and other related risk management commitments in an actionable mode for sustainable project implementation.

The PESMP includes Action Plans and respective objectives to address the evaluated risks and adverse impacts associated with construction works in the valleys.

The primary objective of the PESMP is to implement the appropriate mechanisms that will address the risks and adverse impacts likely to be associated with the implementation of the project. The Action Plans constituting the PESMP define the approaches for project implementation that will ensure the achievement of desired outcomes and enhance project sustainability.

Site-specific ESMPs for each of the five inland valleys assessed in the ESIA follow the Provisional ESMP, integrating relevant findings and mitigation measures for Odaho, Odamu, Kumkum and Waamu/Kumi, Offinho Valleys to assist in ensuring the highest level of environmental and social risks and impacts management.

PESMP Implementation - Roles and Responsibilities

As part of the PESMP implementation, there are respective roles and responsibilities for key parties involved in the Ashanti Region Lot 3. The following are the key entities whose roles and responsibilities have been clearly spelt out in the PESMP to ensure smooth implementation and environmental and social risk management compliance:

- FSRP2 PCU;
- Agriculture Extension Officers (AEO);
- Water Users Association (WUAs);
- Contractors;
- Supervising Consultants; and
- EPA.

Further details have also been provided for the implementation of the provisional environmental and social management plans which include:

- Environment and social risks and impacts/issues;
- Mitigation measures;
- Monitoring frequency/timeframe;
- Performance criteria;
- Responsibilities; and
- Cost estimates for the implementation of the activity.

Emergency Preparedness and Response Plan (EPRP)

The Emergency Preparedness and Response Plan (EPRP) for the Ashanti Region Lot 3 Inland Valley Schemes outlines procedures, responsibilities, and resources for managing sudden or unexpected incidents. Its primary objectives are to prevent fatalities and injuries, minimize damage to property and infrastructure, protect the environment and surrounding communities, and ensure a swift return to normal operations. The plan details step-by-step responses to various critical events, including general emergencies, agrochemical poisoning, workplace accidents, fire outbreaks on farms, drowning incidents in flooded rice fields and drainage canals, and security breaches or violent disturbances. Each scenario is supported by specific protocols, designated roles, and resource allocations to ensure coordinated and effective emergency management.

Grievance Mechanism

The overall objective of the Grievance Mechanism (GM) is to provide a framework/system to manage complaints and grievances from internal and external stakeholders (employees, farmers and the public that may be affected) in relation to the Inland Valley Lot 3 projects and its operations/activities in a systematic, fair, timely and transparent manner. The PIU has a Grievance Committee (GC) that is set up to handle issues related to the PIU. Also, each construction site has a separate GM and GC to handle workplace grievances. Under this arrangement, once the contractor is engaged and deploys workers, a GC will be established to handle grievances for the inland valley. The GM procedure for this project was adapted from the FSRP GM as contained in the Stakeholder Engagement Plan (2023) for the project. A Grievance Mechanism for Workers will be through the Workplace GC as the practice under this project and in line with the Labour Management Procedures under the Project. This Grievance Management Procedure will be used during the construction. Overall, the GM:

- Provides affected people with avenues for making a complaint and/or resolving any dispute that may arise during the implementation of the project;
- Ensures that appropriate and mutually acceptable redress actions are identified and implemented to the satisfaction of complainants;
- Helps community members build a relationship of trust with the project staff, reduces social risk, and enables more responsive and responsible management;
- Ensures transparency in dealings amongst stakeholders including affected parties through a proper communication system; and
- Provides an avenue for vulnerable groups and victims of SEA/SH to have equal access to the grievance redress process and support.

The Inland Valley Lot 3 will rely on the already established channels under FSRP2 for receiving grievances through walk-ins, emails, phone calls, WhatsApp, SMS and complaints boxes. The emails and phone contacts for registering grievances will be made available or known to the public through signposts and billboards in the project areas.

1.0 INTRODUCTION

1.1 Background

The Government of Ghana (GoG) in collaboration with ECOWAS and the World Bank is implementing the Food System Resilience Project (FSRP) Phase 2 under the World Bank Multi-Phase Programmatic Approach (MPA) for Investment Project Financing Instrument. Phase 2 consists of three countries namely: Sierra Leone, Chad, and Ghana and three regional partners, (ECOWAS¹, CILSS² and CORAF³. The FSRP2 is expected to be implemented over a 5-year period.

The development objective of the FSRP2 programme is to increase preparedness against food insecurity and improve the resilience of food system actors, priority landscapes and value chains in programme areas. The Food Systems Resilience Project which has an environmental and social risk rating of substantial is organized around five core distinct but interrelated components to help achieve the objectives of the project.

The project components include:

Component 1: Improving digital advisory services to support timely agriculture and food crisis prevention and management - This component aims at strengthening national capacity to provide demand-driven digital advisory services. This will include agro-advisory and impact-based hydromet/climate information and early warning services, and promote their use for food crisis prevention, management, and response.

This Component has two **sub-components**. Sub-component 1.1 will specifically, roll out interventions to; i) improve national capacity to deliver reliable information services on vulnerability, nutrition, and food security; ii) reorganize and improve national pest and disease monitoring and management mechanisms; and iii) strengthen regional collaboration for food crisis prevention.

Sub-component 1.2 seeks to; i) strengthen digital hydromet and agro- advisory services for agriculture producers; ii) improve the production of climate, hydromet, agromet, and impact-based information for use by decision-makers, farmers, pastoralists, and other actors in the food system; iii) support the timely delivery and use of essential agro-hydro-meteorological information to key users; and iv) strengthen the institutional and financial sustainability of agro-hydro-meteorological service providers.

Component 2: Sustainability and adaptive capacity of Ghana's food systems productive base - This component consolidates the regional agricultural innovation systems and strengthens regional food security through integrated landscape management. These include strengthening regional research and extension systems to deliver improved technological innovations including climate-smart, nutrition-sensitive, gender and youth-friendly technologies in a sustainable manner, as well as a combination of natural resource

¹ ECOWAS – Economic Community of West African States

² CILSS – Comité permanent inter-Etat de lutte contre la sécheresse au Sahel (translated as Permanent Inter-State Committee for Drought Control in the Sahel). CILSS invests in research for food and nutritional security and fight against the effects of desertification and climate change in the Sahel and West Africa.

³ CORAF – Conférence de responsable Recherche Agronomique Africain (West & Central Africa Council for Agriculture Research and Development). CORAF is responsible for improved efficiency and effectiveness of smallholder producers and to promote agribusiness sector.

management with environmental and livelihood activities using the integrated landscape management approach.

This Component has two **Sub-components**. Sub-component 2.1, will address the following by; i) consolidating regional agriculture innovation system; ii) strengthening the national and regional research centers; iii) deepening and expanding regional research and development networking; and iv) modernizing national extension services and promoting technology access and exchange

Sub-component 2.2 will strengthen regional food security through the use of Integrated Landscape Management (ILM) systems through i) the promotion of participatory ILM practices and techniques ii) enhancing the resilience of ecosystems and food systems in priority landscapes and iii) securing resilient eco- and food systems beyond priority landscapes.

Component 3: Enhancing regional food market integration and agricultural inputs and output trade -

This component aims at expanding food trade in West Africa to enable an effective distribution of surplus produce to deficit regions. It will facilitate production and commercialization of agricultural products, inputs, and technologies within and across national borders.

There are two **Sub-components** under Component 3. Sub-component 3.1 aims at facilitating trade across key corridors and consolidating food reserve systems by supporting the preparation and implementation of sound regional policies and regulations to strengthen the enabling environment for expanding regional agricultural output and input markets through i) harmonization of national agricultural trade policies with regional instruments; ii) building national capacity for agricultural trade negotiations; iii) developing an ECOWAS agricultural trade and market scorecard as well as; iv) improving regional food reserve system performance.

Sub-component 3.2 seeks to support the development of strategic and regional value chains i.e., (a) rice; (b) maize and (c) livestock (Poultry) with backward integration with the soya bean value chains through i) strengthening multi-stakeholder coordination and promotion of enabling environment for the private sector to thrive; ii) strengthening value chain organization and financing; and iii) supporting agricultural competitiveness and market access infrastructure.

Component 4: Contingency emergency response – This component aims at making available resources to strengthen the response capacity of the Government of Ghana in case of emergency. This involves making available funding to respond to eligible emergencies or crises, including pest and disease infestation such as the Fall Army Worm, locusts, swine fever, bird flu and other pandemics such as COVID-19; extreme droughts or floods; widespread and severe bush and wild land fires.

Component 5: Project management - This component involves establishing an effective coordination, management, and monitoring and evaluation system for the project. These will include: (i) establishing and maintaining financial management and procurement systems; (ii) reporting on program activities; (iii) ensuring the full implementation of environmental and social risks and impacts management; (iv) maintaining and ensuring the performance of the monitoring and evaluation system; and (v) developing and implementing a knowledge management and communication strategy for development and study tours, among others.

1.1.1 Project Development Outcomes

The expected outcomes at the end of the programme include:

- vii. Program direct beneficiaries reach 300,000; of which 40% are women;
- viii. Proportion of food insecure households in the targeted areas reduced by 25%;
- ix. Food system actors accessing hydro and agrometeorological advisory services reach 211,200; of which 40% are women;
- x. Producers adopting supported climate-smart agricultural technologies and services reach 240,000; of which 40% are women;
- xi. Surface area under integrated landscape management increased by 4,850 ha; and
- xii. Share of intra-regionally traded production in selected value chains (maize, rice) increased from 20% to 30%.

1.1.2 The FSRP Beneficiaries and Coverage

The primary programme beneficiaries are smallholder and medium scale farmers, including: (i) stakeholders who engage in selected value chains (rice, maize, soybean and poultry) (ii) other stakeholders engaged in other crops and livestock value chains within the selected landscapes as an integral part of their livelihoods (iii) vulnerable groups in the targeted areas, particularly women and youth, (iv) key public institutions involved in agricultural support services, such as the Ministry of Food and Agriculture; (v) the service providers participating in project implementation, (vi) food system actors who access agro/hydro-meteorological information and (vii) private agribusiness investors as well as operators of farmers' organizations and micro, small, and medium enterprises (MSMEs) in the targeted areas. The project will seek to address issues with women and youth drawn from the Gender Action Plan developed for the programme. In total, the programme will have at least 300,000 beneficiaries (40% female).

1.2 The ESIA Preparation Assignment

As part of Component 2.2 which seeks to strengthen food security through sustainable practices in targeted areas, FSRP2 intends to improve some selected existing inland valleys currently used for crop cultivation in the Ashanti Region of Ghana.

Table 1 indicates the sites which have been identified by the Ministry of Food and Agriculture (MOFA) for Environmental and Social Impact Assessment Studies and possible subsequent development for improved rain-fed agricultural production in the Ashanti Region under the Inland Valley Development Lot 3 sub-project.

Table 1: Details of Lot 3 Schemes in the Ashanti Region

Lot	District	Locality	Name of Valley	Name of Stream/River	Estimated Cropped Area (ha) ⁴	Potential Available Area (ha) ⁵
3	Atwima Nwabiagya North District Assembly	Aninkrumah	Waamu/ Kumi	Waamu	70	160
		Barekese/ Amakye-bare	Offino	Offin	40	60

⁴ Estimate cropped area (Ha): This refers to the current extent of land under cultivation within the valley, based on field observations or farmer-reported data.

⁵ Potential available area (Ha): It refers to an area in hectares that is currently unused but capable of being used or developed in the future.

	Sekyere South District Assembly	Tano Odumasi	Kumkum	Kumkum	70	100
	Juaben Municipal Assembly	Yaw Nkrumah/ New Bomfah	Odamu	Odamu	80	120
	Ejisu Municipal Assembly	Donuaso	Odaho	Oda	50	110
Total					310	550

The following specific activities are expected to be undertaken in these selected inland valleys:

- Development of water control and conveyance systems;
- Construction of drainage system to collect water out of command areas;
- Construction of access roads into the valleys; and
- Land development for crop cultivation.

1.3 Objectives of the Assignment

The objective of the ESIA is to assess the environmental and social risks and impacts associated with the detailed design, construction and operation of the selected inland valleys/floodplains. It proposes practical and effective mitigation measures to prevent or reduce any potential negative implications of the sub-project.

The specific objectives of the ESIA are:

- a) Assess environmental and social risks and impacts associated with the selected sites at the earliest planning stage possible. The environmental and social risks and impacts to be investigated and examined include factors that impact on public/community health and safety as well as the natural environment, such as air, water, soil, waste, chemical usage, accidents, water usage, ecosystems, biota, etc. Social concerns include impacts on land and potential physical and/or economic displacement (and associated involuntary resettlement) of the population, if any, cultural heritage, landscape, gender, and social norms and practices, particularly those which are harmful to women and girls and that may be exacerbated as a result of project implementation, potential health and safety risks, traffic impacts, labour management issues including prevention of child labour and forced labour, pastoralists/herders/farmers conflicts, sexual exploitation and abuse/sexual harassment, social exclusion including exclusion of poor and vulnerable women, persons with disabilities, youth, migrant farmers and other vulnerable groups, stakeholder holder engagement and meaningful consultations, grievance mechanisms;
- b) Assessment of direct and immediate impacts, indirect, cumulative and residual impacts associated with the inland valleys/floodplains' development works at pre-construction, construction and operational phases;
- c) Assess the potential risks and impacts of any associated facilities (that is other facilities which meet the definition of associated facilities as per the World Bank ESF);
- d) Analysis of alternatives to the project and its components to prevent or minimize adverse impacts. In the examination of measures, priority will be given to the prevention of adverse environmental and social impacts, and when this is not possible, minimization and reduction of impact must be considered next;

- e) Review feasibility studies report of the inland valleys/floodplains and collaborate with the design engineers to effectively include mitigation measures using the mitigation hierarchy for each selected site;
- f) Define the technical and institutional arrangements for the effective implementation of risk mitigation measures;
- g) Develop a public consultation (including specific consultations for vulnerable groups including women and girls in a safe and culturally appropriate space) and stakeholder engagement strategy for the construction contractors/supervising consultants, farmers and beneficiary communities in and around the selected inland valleys sites with guidance from FSRP2 Stakeholder Engagement Plan (SEP);
- h) Identify roles and responsibilities of stakeholders in the management of the consideration guidelines from the SEP, and the Citizen Engagement Plans requirements;
- i) Propose a grievance redress mechanism sensitive to SEA/SH complaints to manage grievances that might arise at all stages of the sub-project;
- j) Assess the availability and accessibility of safe and ethical GBV response services, including medical care, psychosocial services, legal aid, protection services and livelihood opportunities.
- k) Define appropriate environmental and social standards performance indicators for the monitoring and evaluation of the identified environmental and social risks and impacts;
- l) Provide practical information for implementing the ESIA and ESMPs;
- m) Make proposals for capacity enhancement as appropriate for the effective implementation of the ESIA;
- n) Provide estimates for the budget for the implementation of the proposed mitigation measures in the ESIA; and
- o) Obtain Environmental Permit from the Environmental Protection Authority for the Lot 3 Inland Valley Schemes.

1.4 Scope of the Assignment

The general scope of the assignment involves the preparation of one comprehensive ESIA for the development of 5 inland valleys/floodplains all grouped under Lot 3 of Ashanti Region of Ghana. In addition, a standalone site-specific Environmental and Social Management Plan (ESMP) has been prepared for each inland valley. In principle, this ESIA involves but not limited to the following:

- Assessment of environmental and social risks and impacts associated with the selected sites starting from planning stage. The environmental and social risks and impacts investigated and examined included factors that impacted public health and safety as well as the natural environment, such as water, soil, air, waste, accidents, water usage, ecosystems, biota, chemical usage etc. Social concerns include potential physical and/or economic displacement (and associated involuntary resettlement) of the population, cultural heritage, landscape, gender, potential health risks, traffic impacts etc.
- Assessment of direct and immediate impacts, indirect, cumulative and residual impacts associated with the development of these inland valleys works.
- Alternative proposals or analyses evaluation for their environmental and social impacts, prioritising prevention. Where prevention is not possible, minimisation, reduction, and mitigation measures considered.

- Assessment of potential risks and impacts associated with valley development and utilization. The Consultant worked collaboratively with the Engineering Design Team, assessed risks and impacts, and incorporated mitigation measures into the report.
- Assessment of the environmental and social (E&S) impacts included analysis of E&S costs and benefits in quantitative and qualitative terms, as much as possible, while taking into consideration economic, financial, institutional, social and technical aspects.
- Appropriate follow-up environmental and social management and monitoring plans prepared as part of the ESIA.
- Estimated costs of implementing the plans including communication and associated financial resources determined.

1.5 Methodology for the ESIA Study

The methodology and approach for the ESIA included:

- **Scoping field visits** – scoping visits were carried out for initial stakeholder consultations and to collect social, demographic, biophysical and other environmental data that could be impacted by the project. Subsequently, a Scoping Report was prepared and cleared by the EPA which led to the conduct of ESIA. The Scoping Report was disclosed in the Daily Graphic Newspaper, March 15 edition.
- **Desk studies and literature reviews** – as part of the methodology, the consultant carried out desk studies and reviews of relevant literature in connection with the project. This included project-related documents such as;
 - Environmental and Social Management Framework (ESMF),
 - Stakeholder Engagement Plan (SEP),
 - FSRP Project Appraisal Document (PAD),
 - Resettlement Policy Framework (RPF),
 - Labour Management Plan (LMP),
 - Integrated Pest Management Plan (IPMP),
 - Environmental and Social Commitment Plan (ESCP),
 - Documents/reports on the existing environmental (biophysical, socio-economic, and cultural) conditions as well as relevant policies, laws, regulations and applicable standards.
 - Review of the national legal framework and the WB Environmental and Social Framework.
- **Stakeholder consultations** - consultation and engagement with stakeholders including relevant government institutions/regulatory agencies, traditional authorities / local communities and Project Affected Persons (PAPs). The consultations carried out with relevant stakeholders including Department of Agriculture, Water Users Associations (WUAs), nearby communities, Ministries, Departments and Agencies (MDAs), Atwima Nwabiagya North, Atwima Mponua, Juaben and Ejisu Metropolitan/Municipal/District Assemblies and all persons or groups of persons as well as businesses who are likely to be affected, positively or negatively, by the irrigation scheme rehabilitation works.
- **Fieldwork/baseline information gathering** - field baseline investigations were carried out within the project's sphere of influence on relevant bio-physical and socio-economic conditions to determine baseline information.
- **Data analysis and report preparations** - Analysis of data sets collected and preparation of the ESIA report which also included analysis of the most relevant and significant environmental and social issues of concern with proposed mitigation and enhancement measures cognisance of the environmental and socio-economic baseline and outcomes of the consultations The ESIA report is

additionally based on the outcomes of the scoping study (disclosed in Daily Graphic, March 15 edition) and in line with Ghana’s Environmental Assessment Regulations, 2025 (LI 2504) and in compliance with the World Bank’s Environmental and Social Framework including the applicable Environmental and Social Standards and Guidelines on Environment, Social, Health and Safety.

- **Environmental Permit from EPA** - facilitate the acquisition of an environmental permit.

The first stage in the environmental and social impact assessment for the Lot 3 Inland Valley was a scoping visit during which initial field consultations were carried out. The scoping visit was followed by the main field visits which offered an understanding of site-specific biophysical and socioeconomic baseline situations. The main field visits investigated into details the range, depth and trend of key issues which are captured in this ESIA report.

The scoping and main field visits identified, categorized and prioritized the environmental and social risks and impacts/issues, and project alternatives. The environmental and social assessment covered all areas of influence (AOI) of the proposed activities, including infrastructure and utilities, land uses, and economic activities as well as the presence of structures and persons in and around the sites.

1.6 Outline of the Environmental and Social Impact Assessment (ESIA)

The following is the main outline of the ESIA:

- Executive summary;
- Introduction and background information;
- Key policies, legislations and institutional requirements;
- Project and alternatives description;
- Environmental and social setting/baseline;
- Stakeholder engagements and consultations;
- Assessment of environmental and social risks and impacts;
- Mitigation and monitoring measures;
- Provisional environmental and social management plans;
- Grievance mechanism;
- Annexes.

2.0 KEY POLICIES, LEGISLATIONS AND INSTITUTIONAL REQUIREMENTS

This section identifies and highlights the key policy, legal and institutional frameworks that are applicable to the FSRP2, as well as institutional requirements for environmental assessment and management for the improvement of the selected inland valleys in the Ashanti Region (Lot 3). The policy, legal and institutional frameworks and requirements have been grouped under ten broad themes as follows:

- 1) National environmental policy and related requirements.
- 2) Agriculture and irrigation sector policies and requirements.
- 3) Water and sanitation sector policies and requirements.
- 4) National planning and development requirements.
- 5) National labour, gender, and human requirements.
- 6) National health and safety requirements.
- 7) National environmental quality standards.
- 8) World Bank Environmental and Social Framework and WBG EHS requirements.
- 9) International requirements and conventions.
- 10) Institutional frameworks.

The distinctions between the World Bank Environmental and Social Framework (ESF) and Ghana's Environmental Assessment Regulations will be examined, and measures suggested to address any identified gaps in the ESIA.

2.1 National Environmental Policy and Related Requirements

The following policies and legal frameworks relating to environmental management were reviewed and applied in the assessment:

2.1.1 *National Environmental Policy, 2013*

The National Environmental Policy (2013) is formulated for a comprehensive management of the environment, where people have access to clean air and water, decent housing, and other necessities of life. The policy seeks to promote sustainable development through ensuring a balance between economic development and resource conservation.

Additionally, assessing the potential environmental impacts of projects and advanced planning to mitigate impacts will decrease environmental costs to the economy and promote cost-effective use of the country's resources.

The ESIA addressed the policy requirements for holistic management of the environment where people have access to clean air and water by providing measures to minimise particularly dust and other emissions, contamination of the respective rivers, inappropriate use of agrochemicals, and poor handling and disposal of waste.

2.1.2 *Environmental Protection Authority Act, 2025 (Act 1124)*

This is an Act to amend and consolidate laws relating to environmental protection, establish the Environmental Protection Authority, to regulate and protect the environment, provide for pesticide control and regulation;

provide for the control, management and disposal of hazardous waste and electrical and electronic waste; provide for the co-ordination of climate change responses and for related matters.

The Act 1124 creates a stronger, centralized Environmental Protection Authority with expanded powers for environmental assessment, permitting, monitoring, hazardous waste and pesticide control, and a new National Environment Fund — it repeals the EPA Act 1994 (Act 490) and the Hazardous and Electronic Waste Act 2016 (Act 917)

The project has been registered with the EPA and undergoing the EIA process in order to be issued an Environmental Permit. The project will comply with the conditions of the permit.

2.1.3 Environmental Assessment Regulations, 2025 (LI 2504)

Ghana's Environmental Assessment Regulations, 2025 (L.I. 2504), replaces the 1999 EIA Regulations (L.I. 1652) and modernizes Ghana's environmental permitting and compliance framework.

The L.I. 2504 (Environmental Assessment Regulations, 2025) modernizes Ghana's ESIA system: it makes registration mandatory for all likely-impact undertakings, sets environmental permits valid for 24 months with renewal applications due 3 months before expiry, requires periodic EMP and Annual Environmental Report (AER) submissions, and introduces explicit sanctions (500–15,000 penalty units) for repeated non-compliance

According to the LI, the Authority shall not issue an environmental permit for an undertaking specified in the First Schedule unless the applicant in accordance with these Regulations, conduct an environmental impact assessment and submit to the Authority, an Environmental Impact Statement as set out in in Part B of the Third Schedule.

The project falls under First Schedule (i.e., EIA mandatory undertaking), hence has complied with the ESIA process through preparation of a Scoping Report (Terms of Reference) which has been accepted by EPA and now the ESIA is being prepared for approval.

2.1.4 Fees and Charges (Miscellaneous Provisions) Act, 2022 (Act 1080)

The Fees and Charges (Miscellaneous Provisions) Act outlines the fee structure, per type of undertaking, for environmental permits linked to the Environmental Assessment Regulations. The EPA issues invoices for these fees, which must be settled before obtaining an environmental permit.

Invoices for the processing and permit fees will be issued and paid before the EPA grants an environmental permit, in accordance with the Act.

2.1.5 National Climate Change Policy, 2013

The National Climate Change Policy reaffirms Ghana's commitment to reducing the potential challenges posed by climate change on sustainable development. It offers strategic guidance on climate change matters in Ghana, recognizing their connection with development goals. The objective of the policy is to mitigate and ensure effective adaptation in key sectors of the economy, such as agriculture, natural resources, energy, industry and infrastructure.

2.1.6 National Climate Change Adaptation Strategy, 2010-2020

The primary objective of the National Climate Change Adaptation Strategy is to enhance Ghana's ability to withstand the effects of climate change both presently and in the coming years. This involves enhancing Ghana's infrastructure and expertise to manage climate change impacts and minimize vulnerability in critical sectors, ecosystems, districts, and regions across the nation.

In line with the National Climate Change Policy and National Climate Change Adaptation Strategy, appropriate mitigation measures have been provided in Sections 8.2.13 and 8.2.14 to address issues relating to flooding and greenhouse gas emissions respectively.

2.2 Agriculture and Irrigation Sector Policies and Requirements

The identified relevant policy, legislation, and other requirements in the agriculture and irrigation sector include:

2.2.1 Food and Agriculture Sector Development Policy (FASDEP II), 2007

The FASDEP II highlights the sustainable use of resources and the promotion of market-driven growth through commercial activities in the sector. However, it focuses on a smaller range of commodities to ensure food security and income diversification, particularly for farmers with limited resources. The policy aims to improve existing irrigation schemes, aiming to increase irrigation water productivity from 30% to 80%.

The project will significantly advance the achievement of the FASDEP objectives through improved efficiency and management of the scheme. The project will ensure sustainable utilisation of resources, land and environmental management with a more efficient irrigation system.

2.2.2 Plants and Fertilizer Act, 2010 (Act 803)

The Plants and Fertilizer Act ensures effective plant protection to prevent the spread of pests and diseases, oversees imports and facilitates exports of plants and planting materials, and regulates fertilizers and associated matters. Additionally, it instituted the Plant Protection Advisory Council, which is tasked with developing and advancing a national plant protection system, as well as managing collaboration between public and private sectors in plant protection and related affairs.

Measures to prevent and control the spread of diseases and pests' infestation in an integrated manner have been provided in Section 8.2.4.

2.2.3 Ghana Investment Promotion Centre Act, 2013 (Act 8658)

The Ghana Investment Promotion Centre Act compels all prospective investors, in evaluating investment projects or enterprises in the country, to consider the potential environmental impact of their initiatives and propose measures to prevent and manage any adverse effects on the environment. For activities under FSRP2 that allow investor involvement, adherence to environmental considerations is mandatory for participating investors.

2.2.4 National Irrigation Policy, 2010

The National Irrigation Policy aims to tackle the limitations and enhance the potentials encompassing the entire irrigation sub-sector, including informal, formal, and commercial irrigation. Its objective is to ensure sustainable expansion and improved efficiency within irrigation and support Ghana's agricultural sector

objectives. This policy is structured to create opportunities for increased and varied irrigated crop cultivation in Ghana and is aimed at resolving the following key issues:

- Low agricultural productivity and slow rates of growth.
- Constrained socio-economic engagement with land and water resources.
- Environmental degradation associated with irrigated production.
- Lack of irrigation support services.

The project includes the construction of irrigation infrastructure such as pumping stations, headworks, canals, etc., as means of ensuring adequate water supply to the farm plots. The beneficiary farmers will have all year-round water supply thereby increasing productivity and enhancing livelihoods which is consistent with the policy's goal of expanding irrigation and improving water-use efficiency.

2.2.5 Dam Safety Regulations, 2016 (LI 2236)

The Dam Safety Regulations aim to guarantee the secure planning and design, building, operation, maintenance, and dismantling of dams across the nation. These regulations encompass all dams and associated structures posing safety risks.

The design and construction of weirs will be subject to the relevant safety standards in line with the regulations.

2.2.6 Irrigation Development Authority (Irrigation Water Users Association) Regulations, 2016 (LI 2230)

The Irrigation Development Authority (Irrigation Water Users Association) Regulations prescribe that a group of at least fifteen individuals utilizing irrigation water can establish an association. This entails forming a provisional initiative team to identify the association's service area and a founders' committee comprising no more than twelve potential members. Eligible individuals to form the association own land under a landholding system and utilize water provided by the irrigation infrastructure. The regulations also apply to associations established on government irrigation infrastructure.

A Water Users Association will be established for the rehabilitated schemes, as mandated by the regulations, to manage water distribution and other related matters.

2.3 Water and Sanitation Sector Policies and Requirements

The identified water and sanitation sector policies, plans and other requirements include:

2.3.1 National Water Policy, 2007

The National Water Policy strives to foster a well-organised and eco-friendly approach to developing water resources for sustainable use in Ghana and enhancing health and livelihoods. By tackling issues in urban water supply, community water and sanitation, the policy emphasises environmental sanitation and decentralised water and sanitation services delivery.

In line with the policy, the project will promote the efficient use of water and reduce transmission losses.

2.3.2 *Water Resources Commission Act, 1996 (Act 522)*

The Water Resources Commission Act establishes and empowers the Water Resources Commission as the exclusive entity responsible for regulating and managing the use of water resources as well as overseeing the coordination of policies concerning these resources. Section 13 explicitly prohibits any unauthorized use of water resources, including diversion, damming, storage and abstraction without permission. Additionally, Section 24 stipulates that anyone who pollutes or contaminates a water resource beyond the level set by the EPA commits an offense, punishable by a fine, imprisonment, or both upon conviction.

In line with Act 522, measures to protect water resources in the various valleys have been provided in Section 8.2.1.

2.3.3 *Water Use Regulations, 2001 (LI 1692)*

The Water Use Regulations require individuals to acquire Water Use Permits from the Water Resources Commission for agricultural water usage. Additionally, the Commission is obligated to verify that an approved environmental impact assessment or environmental management plan from the EPA is provided before granting the Water Use Permit.

The project will comply with these regulations in obtaining a Water Use Permit from the Water Resources Commission.

2.3.4 *Riparian Buffer Zone Policy for Managing Freshwater Bodies in Ghana, 2013*

The Riparian Buffer Zone Policy aims to sustainably manage all specified buffer zones adjacent to rivers, streams, lakes, reservoirs, and other water bodies. Its goals include conserving, safeguarding, restoring, and upholding the ecological balance of these areas. Additionally, the policy aims to introduce vegetation within riparian buffer zones to enhance water quality by regulating activities along riverbanks and throughout surface water catchment areas.

In line with the policy, buffer zones of at least 10m will be observed between areas for land clearance and the various waterbodies.

2.3.5 *National Environmental Sanitation Policy, 2010*

The National Environmental Sanitation Policy (revised) rectifies the shortcomings of the previous 1999 policy to align with present development objectives. It focuses on fostering a clean, secure, and enjoyable physical environment across human settlements, consequently enhancing the social, economic, and physical welfare of all demographic groups. Key aspects of the policy involve waste management encompassing solid and liquid waste, excreta, and hazardous materials collection and disposal.

2.3.6 *National Environmental Sanitation Strategy and Action Plan, 2010*

The National Environmental Sanitation Strategy and Action Plan (NESSAP) addresses the necessity to redirect focus towards environmental sanitation in Ghana. It offers suggestions and detailed action plans spanning the entire country, establishing a framework to progress towards fulfilling the objectives of the Environmental Sanitation Policy. NESSAP transforms the policy objectives into achievable targets and implementation strategies to be executed by Metropolitan, Municipal, and District Assemblies (MMDAs).

In line with both the National Environmental Sanitation Policy and National Environmental Sanitation Strategy and Action Plan, Measures have been provided in Section 8.2.2 for managing waste during both the construction and operation phases. Measures have also been provided in Section 8.2.3 for the safe disposal of agrochemical containers.

2.4 National Planning and Development Requirements

The relevant policies and legislations on land-take for sector activities identified include:

2.4.1 National Land Policy, 1999

The National Land Policy spells out comprehensive guidelines and a framework for the administration and use of land, with objectives including:

- Ensuring socio-economic activities are aligned with principles of sustainable land use.
- Protecting the rights of landowners and their descendants.
- Providing a mechanism for reducing and settling land disputes.
- Promoting community participation in and public awareness of sustainable land management and development practices to ensure the highest and best use of land.

In line with the policy, any land acquisition will be done transparently, ensuring that land tenure rights are respected.

2.4.2 Lands Commission Act, 2008 (Act 767)

The Lands Commission Act established the Lands Commission, mandating it to responsibly manage and oversee state and vested lands. The proprietary plan covering the site acquired for the project is plotted by the Commission in the government records.

Land registration and documentation will be done in accordance with the Act.

2.4.3 Land Use and Spatial Planning Act, 2016

The Land Use and Spatial Planning Act establishes the Land Use and Spatial Planning Authority, assigning it the following responsibilities:

- Strengthening the capabilities of District Assemblies and other institutions to effectively manage spatial planning and human settlements.
- Regulating physical development in unregulated or less regulated yet environmentally sensitive zones like forest reserves, nature reserves, wildlife sanctuaries, green belts, coastal wetlands, water bodies, catchment areas, open spaces, and public parks.
- Ensuring that the exploitation of natural resources for agriculture, mining, industry, and related activities does not detrimentally impact human settlements.

Project design and siting will conform to district spatial plans and planning permits will be obtained from local authorities.

2.4.4 Land Act, 2020 (Act 1036)

The Land Act, 2020 (Act 1036) consolidates Ghana's land laws and provides a comprehensive legal framework for land administration, acquisition, ownership, and use. The project will ensure that land acquisition will be undertaken in line with the provisions spelt out in Chapter 7 of the Act.

2.4.5 Local Governance Act, 2016

The Local Governance Act mandates MMDAs to spearhead the comprehensive development within their specific territories. The Assemblies are designated as the planning authority, responsible for spatial planning, approval of planning schemes, and exercising development control by issuing permits for developments.

2.4.6 National Building Regulations, 1996 (LI 1630)

The National Building Regulations govern the construction of buildings, ensuring that buildings are not put up in a haphazard manner, negatively impacting the nation's scenery. Under the regulations, it is unlawful for anyone to initiate development without obtaining a Building Permit from the appropriate District Assembly. This requirement ensures that buildings are thoughtfully designed and align with the Assembly's planned layout for an area.

In line with the regulations, all buildings and structures will comply with building codes and obtain necessary building permits.

2.5 National Labour, Gender, and Human Requirements

The identified legal and policy provisions for workers, gender and social protection include:

2.5.1 The Constitution of Ghana, 1992

Article 28 of the Constitution affirms the right of every child to be safeguarded against labour that endangers their health, education, or development. It also advocates for the creation of laws to shield children. As per this article, a "child" refers to an individual under the age of eighteen.

The project will uphold constitutional rights including labour protections for workers and measures to prevent child labour.

The primary aim of the National Gender Policy is to integrate gender equality considerations into Ghana's development processes. It seeks to enhance the social, legal, civic, political, economic, and socio-cultural conditions of Ghanaian individuals, specifically focusing on women, girls, children, vulnerable groups, and individuals with special needs (such as persons with disabilities and people from marginalised communities).

Measures have been provided in Section 8.2.10 regarding gender-based violence. Again, women empowerment through access to economic opportunities will be promoted by encouraging the contractor to employ women during the implementation of project activities.

2.5.2 Local Government Services Policy on SEA/SH, 2025

The Local Government Service's SEA/SH policy sets mandatory prevention, reporting, and response measures for sexual exploitation, abuse and sexual harassment across Metropolitan, Municipal and District Assemblies (MMDAs), including a Code of Conduct, grievance mechanisms, referral pathways and staff training. The

policy applies to Local Government Service staff, contractors and project partners working with MMDAs; it addresses sexual exploitation and abuse (SEA) and sexual harassment (SH) in workplace and project settings.

The introduction of this policy at the MMDAs enables the better understanding of the measures for the prevention of SEA and SH. The referral pathways and staff training programmes at the MMDA will guide and be utilised as part of the implementation of the project.

2.5.3 Domestic Violence Act, 2007 (Act 723)

The Domestic Violence Act, 2007 (Act 732) gives victims in Ghana clear legal protection against physical, sexual, emotional, economic and psychological abuse, creates civil protection orders and criminal remedies, and establishes a Victims of Domestic Violence Fund and Management Board to support survivors.

The Act covers violence within a domestic relationship, including marriage, cohabitation, engagement, courting, or other intimate relationships.

The provisions of the Act have informed the establishment of project level Action Plan for the prevention of Gender-Based Violence which has informed this environmental assessment.

2.5.4 Labour Act, 2003 (Act 651)

The objective of the Labour Act is to revise and unify the current legislation concerning labour, employers, trade unions and industrial relations. It guarantees equitable treatment of workers to prevent any form of discrimination and offers specific incentives to employers hiring individuals with disabilities. Part XV of the Act, which covers Occupational Health, Safety, and Environment, expressly outlines an employer's responsibility to ensure that all workers operate in favourable, secure, and healthy environments.

2.5.5 Labour Regulations, 2007 (LI 1833)

The Labour Regulations stipulate that an employer must not involve a young person in tasks that include manual lifting of loads exceeding twenty-five kilograms and handling hazardous chemicals or substances emitting radiation, toxic gases or fumes, among other specified activities. Additionally, the regulations require employers to implement suitable measures to protect the health and safety of their employees.

In line with Act 651 and LI 1833, measures to protect labour rights and ensure good and safe working environments for workers have been provided in Section 8.2.6.

2.5.6 National Employment Policy, 2014

The National Employment Policy highlights that the primary demand for labour arises from the productive sectors of the economy: agriculture, industry and services. Among the key strategies outlined in the policy is the encouragement of both agricultural and non-agricultural employment in rural areas through agricultural modernization, enhancing farmer productivity, implementing contract farming arrangements, and fostering efficient connections between agricultural and non-agricultural pursuits.

The contractors will be required to issue employment contracts to all workers as per the requirements of the Labour Act and the National Employment Policy.

2.5.7 *The Children's Act, 1998 (Act 560)*

The Children's Act aims to overhaul and unify legislation concerning children. It ensures the protection of children's rights, addresses issues of maintenance and adoption, regulates child labour and apprenticeship, and addresses other matters related to children. Section 87 explicitly prohibits subjecting a child to exploitative labour.

2.5.8 *Hazardous Child Labour Activity Framework, 2016*

The primary aim of the Hazardous Child Labour Activity Framework is to create a comprehensive, age-appropriate, and culturally suitable framework specifically addressing hazardous child labour. The framework is designed to guide research, interventions, monitoring, and enforcement measures. It aims to offer effective intervention strategies and assessment methods to ensure the protection of children's health, safety, development, and education. The enumerated hazardous child labour activities include:

- Work involving exposure to harmful chemical agents (such as toxic substances, lead, asbestos, pesticides, e-waste, etc.).
- Operating motor vehicles, tractors forklifts, or farm machinery.
- Engaging in physically demanding or hazardous occupations for more than 4 hours per day.

2.5.9 *Inter-Sectoral Standard Operating Procedures (ISSOP) for Child Protection and Family Welfare, 2020*

The Inter-Sectoral Standard Operating Procedures for Child Protection and Family Welfare have been created for universal adoption by both Government and Non-Governmental Institutions dedicated to children's welfare. This encompasses individuals, supervisors, formal and informal institutions offering services to children who have experienced or are at risk of encountering diverse forms of violence, abuse, exploitation, or involved in legal conflicts.

2.5.10 *Accelerated Action Plan Against Child Labour (Third National Plan of Action, 2023–2027)*

This is a five-year, government-led strategy to eliminate the worst forms of child labour by tackling root causes (poverty, limited schooling, hazardous work), strengthening coordination across ministries and partners, and scaling prevention, protection and livelihood measures. The following are the core pillars and priority areas:

- **Prevention:** expand access to quality education, reduce school-to-work transitions, and strengthen social protection for vulnerable households.
- **Protection & withdrawal:** identify children in hazardous work, remove them from harmful environments, provide rehabilitation, education re-entry and family support.
- **Coordination & systems strengthening** scale the Ghana Child Labour Monitoring System, revitalise District Child Labour Committees, and improve data, case management and referral pathways.
- **Livelihoods & economic measures:** support household income generation and youth decent work to reduce economic drivers of child labour

In line with the above-mentioned frameworks on child protection and child labour, mitigation measures have been provided in Section 8.2.7 to prevent instances of child labour, including age verification of all workers and community sensitisation on child labour.

2.5.11 *Workmen's Compensation Law, 1987*

The Workmen's Compensation Act places responsibility on employers to provide compensation to employees for personal injuries resulting from accidents occurring during their employment duties. If an employee

experiences personal injury due to a work-related accident, the employer is obliged, as per this Act, to provide compensation in accordance with its provisions.

In cases of injuries arising out of and during employment, provisions for workers' compensation have been made in Section 8.2.5.

2.5.12 *Persons with Disability Act, 2006*

The Persons with Disability Act grants specific rights aimed at safeguarding individuals with disabilities. According to the Act, it is prohibited for a person or employer to:

- Discriminate against or subject a person with a disability to degrading treatment.
- Discriminate against a potential or current employee based on their disability.
- Use derogatory terms when referring to a person with a disability.
- Assign a person with a disability to an area within an establishment that is not suitable for them.

Per the requirements of the Act, measures to safeguard the rights and protection of the PWDs employed during the project implementation have been provided in Section 8.2.6.

2.6 National Health and Safety Requirements

The relevant policies that ensure the general well-being, health promotion and safety of workers and the public include:

2.6.1 *National Workplace HIV/AIDS Policy, 2012*

The objectives of the National Workplace HIV/AIDS Policy include, among others, safeguarding individuals living with HIV and AIDS from stigma and discrimination in the workplace, preventing the transmission of HIV and AIDS among workers, and offering care, support, and counselling for those affected.

2.6.2 *National HIV and AIDS Policy, 2019*

The National HIV and AIDS Policy focus on establishing a supportive setting for implementing effective and efficient interventions to combat HIV and AIDS. The policy endeavours to achieve four primary objectives:

- Empower the populace to prevent new HIV infections.
- Guarantee the availability and accessibility of prevention, treatment, care, and support services.
- Alleviate the social and economic impact of HIV on affected individuals.
- Secure adequate funding to implement the policy strategies.

To prevent workplace discrimination against persons with HIV and ensure the basic human rights of all workers are protected, relevant measures, e.g., institution of a workplace HIV policy have been provided in Section 8.2.11. Again, community awareness programmes on HIV/AIDS and STIs will be undertaken.

2.6.3 *National Health Policy, 2020*

The National Health Policy aims to promote, restore, and preserve good health for all residents of Ghana. This policy outlines five key objectives:

- Enhance the resilience of the healthcare delivery system.
- Encourage the adoption of healthier lifestyles among residents.
- Enhance the quality of the physical environment.

- Improve the socio-economic status of the population.
- Ensure sustainable financing for health initiatives.

Within the scope of enhancing the physical environment, the policy strives to guarantee that residents have access to safe drinking water, enhanced sanitation facilities, unpolluted air, and minimized exposure to detrimental noise levels and hazardous substances.

2.6.4 Public Health Act, 2012 (Act 851)

Ghana's Public Health Act was enacted to prevent diseases, promote, preserve, safeguard, and ensure the health of humans and animals. The Act covers different areas such as environmental sanitation, communicable diseases, and more.

In line with the National Health Policy and Public Health Act, measures have been provided in Sections 8.2.5 and 8.2.9 to safeguard the health and wellbeing of workers and the public respectively.

2.6.5 Ghana National Fire Service Act, 1997 (Act 537)

The Ghana National Fire Service (GNFS) Act mandates the GNFS to manage fires and address associated concerns. To fulfil its goal, the GNFS conducts activities such as public fire education initiatives and offers technical guidance for building designs and structural arrangements towards aiding fire escape, rescue operations, and fire control.

2.6.6 Fire Precaution (Premises)(Amendments) Regulations, 2003 (LI 1724)

The Fire Precaution (Premises) Regulations expect that premises utilized as public spaces or workplaces be covered by a fire certificate. It is the responsibility of any project developer to implement sufficient measures and arrangements to minimize or eliminate the risk of fire outbreaks.

2.6.7 Control and Prevention of Bushfires Act, 1990 (PNDCL 229)

The Control and Prevention of Bushfires Act prohibits individuals from intentionally starting bushfires for any reason. A bushfire is defined as the uncontrolled burning of farmlands, forests, or grasslands resulting from a person's actions. The Act mandates the creation of a fire volunteer squad in each town, area, or unit, with the National Fire Service responsible for training these squads.

In line with the above-mentioned frameworks on fire, a Fire Permit/Certificate will be acquired from GNFS for the scheme to ensure adequate fire prevention and suppression provisions in accordance with LI 1724. Measures have also been provided in Section 8.2.8 regarding fire prevention and control.

2.6.8 Hazardous, Electronic and Other Wastes (Classification) Control and Management Regulations 2016, (LI 2250).

The following are the provisions of LI 2250: (a) Regulates the classification, control, and management of waste; (b) establishes a mechanism and procedure for the listing of waste management activities that do not require a Waste Management Permit; (c) prescribes requirements for the establishment of takeback systems, (d) prescribes requirements and timeframes for the management of wastes listed in the First Schedule; (e) prescribes general duties of waste generators, waste transporters and waste managers; and (f) prescribes requirements for the disposal of wastes.

Measures have been provided in Section 8.2.3 on the safe handling and use of agrochemicals as well as disposal of agrochemical containers.

2.6.9 Factories, Offices and Shops Act, 1970 (Act 328)

The Factories, Offices and Shops Act is a key occupational health and safety legislation. It provides for the health, safety, and welfare of workers employed in factories, offices, shops, and construction sites and is enforced by the Department of Factories Inspectorate (DFI) under the Ministry of Employment and Labour Relations.

2.7 National Environmental Quality Standards

The relevant environmental quality standards identified include:

2.7.1 Ghana Standard on Health Protection - Requirements for Ambient Noise Controls, (GS 1222:2018)

The Ambient Noise Control Requirements (GS 1222:2018) establish the highest acceptable noise levels for different zones, as detailed in Table 2. Additionally, the standard outlines noise regulations for construction sites, encompassing:

- Putting up an acoustic barrier around a construction site.
- Making sure that the maximum noise level near the construction site does not surpass 66dB(A) Leq (5min) in areas other than industrial areas.

Table 2: Acceptable Ambient Noise Levels

Zone	Permissible Noise Level in dB(A)	
	Day (6:00am-10:00pm)	Night (10:00pm-6:00am)
Residential Area	55	48
Educational and health facilities, offices, and law courts	55	50
Mixed used	60	55
Area with some light industry	65	60
Commercial Areas	75	65
Light Industry Areas	70	60
Heavy Industry Areas	70	70

2.7.2 Ghana Standard on Environment and Health Protection - Requirements for Ambient Air Quality and Point Stack/Emissions (GS 1236:2019)

The Ghana Standard for Environment and Health Protection Requirements for Ambient Air Quality and Point Source/Stack Emissions (GS 1236:2019) specifies the uppermost threshold acceptable for ambient air pollutants (Table 3).

Table 3: Acceptable Ambient Air Quality – Maximum Limit for 24 Hours

Substance	Maximum Limit ($\mu\text{g}/\text{m}^3$)
Sulphur Dioxide (SO_2)	50
Nitrogen Oxide (NO_2)	150
Total suspended particulate matter	150
PM_{10}	70
$\text{PM}_{2.5}$	35

Black Carbon	25
Lead	1

2.7.3 Ghana Standard for Environment Protection– Requirements for Effluent Discharge (GS 1212:2019)

The Ghana Standard for Environmental Protection Requirements for Effluent Discharge (GS 1212:2019) mandates every operation to set up a pollution control system for treating effluent discharges using the best available technology. In situations where pollution control equipment is not available, the operation must implement measures to manage pollution. Any effluent released from a facility must comply with the prescribed acceptable levels as shown in Table 4.

Table 4: Acceptable Levels for Effluent Discharge

Parameter	Unit	Maximum Acceptable Level
Colour (TCU)	TCU	200
pH	pH Units	6 - 9
Conductivity	µ8/cm	1500
Total Suspended Solids (TSS)	mg/l	50
Total Dissolved Solids (TDS)	mg/l	1000
COD	mg/l	250
Oil and grease	mg/l	5
Aluminium	mg/l	1.0
Copper	mg/l	5
Lead	mg/l	0.1

2.8 World Bank Requirements

The relevant World Bank standards and guidelines identified for the development of the inland valleys include:

2.8.1 ESS1: Assessment and Management of Environmental and Social Risks and Impacts

ESS1 delineates the responsibilities of the Borrower in evaluating, handling, and overseeing environmental and social (E&S) risks and effects linked to every phase of a project funded by the Bank through Investment Project Financing. This is aimed at attaining E&S outcomes aligned with the ESSs.

The conduct of this ESIA complies with ESS1 as all material impacts and risks associated with the project have been assessed with mitigation, management and monitoring measures provided.

2.8.2 ESS2: Labour and Working Conditions

ESS2 acknowledges the significance of generating employment opportunities and income as part of efforts to reduce poverty and foster inclusive economic growth. Borrowers can advance positive worker-management relationships and amplify the developmental advantages of a project by ensuring equitable treatment of project workers and offering secure and healthy work environments.

The project will involve the use of direct workers, contracted workers and occasionally primary supply workers who deliver materials such as cement to site. Some of the proposed project activities will present occupational health and safety risks which have been addressed in line with the requirements of ESS2.

2.8.3 ESS3: Resource Efficiency and Pollution Prevention and Management

ESS3 acknowledges that economic activities and urbanization are frequently associated with air, water, and land pollution, and also consume finite resources, posing potential threats to people, ecosystem services, and the environment. The existing and anticipated concentration of greenhouse gases (GHG) poses risks to the well-being of present and future generations. Improved resource utilization, pollution prevention, GHG emission reduction, and mitigation technologies and practices can eliminate or curtail the negative risks.

Measures have been provided to address waste management (Section 8.2.2), greenhouse gas emissions (Section 8.2.14), air pollution (Sections 8.2.5 and 8.2.9), etc.

2.8.4 ESS4: Community Health and Safety

ESS4 acknowledges that project undertakings, equipment, and infrastructure can heighten community vulnerability to risks and impacts. Furthermore, communities already affected by climate change may encounter an escalation or magnification of these impacts as a result of project activities.

Project activities during the construction/rehabilitation and operation phases could pose potential health and safety risks and impacts to the inhabitants of surrounding communities. Measures have been provided in Section 8.2.9 to safeguard community health and safety.

2.8.5 ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement

This ESS emphasizes that involuntary resettlement should be avoided. Where involuntary resettlement is unavoidable, it will be minimized and appropriate measures to mitigate adverse impacts on displaced persons (and on host communities receiving displaced persons) will be carefully planned and implemented.

Involuntary resettlement is not expected or foreseen currently during the construction phase as the land to be used for the project (in the various valleys) have been set aside by the various traditional authorities (in whom ownership of the respective lands are vested) to be used for rice cultivation only. The MMDAs have designated these inland valleys for rice farming within the spatial planning scheme. Nevertheless, the current land issues are detailed in section 3.3, and the necessary provisions have been put in place such as work scheduling to prevent temporary displacements as detailed in section 7.2.1 in line with the principles of ESS 5 as well as local laws on land acquisition.

2.8.6 ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources

ESS 6 acknowledges the vital role of safeguarding and preserving biodiversity and responsibly managing living natural resources in promoting sustainable development. It focuses on the sustainable management of primary production and extraction of living natural resources. It also emphasizes the importance of considering the livelihoods of project-affected parties, including indigenous groups, whose access to or utilization of biodiversity or living natural resources might be impacted.

The vegetation at the project sites has been significantly altered by prior agricultural activities; the ESS6 is relevant and the various vegetation and fauna species expected to be impacted identified and their significance assessed.

2.8.7 ESS8: Cultural Heritage

ESS8 acknowledges that cultural heritage, in both tangible and intangible forms, maintains a link between the past, present, and future. It establishes procedures aimed at safeguarding cultural heritage throughout the duration of a project.

Measures have been provided in Section 8.2.12 to safeguard the cultural heritage of the various project communities.

2.8.8 ESS10: Stakeholder Engagement and Information Disclosure

ESS10 acknowledges the significance of open and transparent communication between the Borrower and project stakeholders. Engaging stakeholders effectively can enhance the environmental and social sustainability of projects, bolster project acceptance and significantly contribute to successful project design and execution.

The project involves many stakeholders with various interests. All relevant stakeholders were consulted as part of the ESIA process. In addition, all project related information will be disclosed to relevant stakeholders and there will be a GM available to PAPs, project communities and stakeholders.

2.8.9 WBG EHS Guidelines for Air Emissions and Ambient Air Quality

This guideline is relevant to facilities or projects that produce emissions into the air at any phase of their life cycle. It expects projects with substantial sources of air emissions – capable of causing notable effects on surrounding air quality – to prevent or diminish impacts. This is achieved by ensuring that emissions do not lead to pollutant concentrations surpassing pertinent ambient quality guidelines and standards. To do so, projects must adhere to national legislated standards. In their absence, the current WHO Air Quality Guidelines or other globally recognized sources should be followed.

The ESIS incorporated measures spelt out in the EHS Guidelines to mitigate impacts associated with dust and other emissions in Sections 8.2.5 and 8.2.9.

2.8.10 WBG EHS Guidelines for Noise Management

The noise management guideline recommends actions aimed at mitigating noise effects extending beyond facility premises. It specifies that measures for noise prevention and mitigation should be implemented if the projected or measured noise impacts from a project's facility or operations surpass the relevant noise level guideline at the most sensitive reception point.

In line with the EHS Guidelines on noise, the project will ensure noise levels are kept within the permissible levels to curb the effects on workers and the public.

2.8.11 WBG EHS Guidelines for Occupational Health and Safety

The occupational health and safety guidelines stipulate that employers and supervisors must take all necessary precautions to safeguard the health and safety of workers. This guideline specifically emphasizes implementing precautions to manage primary risks concerning occupational health and safety during construction and decommissioning activities. Additionally, it covers diverse aspects of occupational health and safety, encompassing risk assessment, hazard recognition, preventive measures, training, emergency readiness, and monitoring and assessment.

The ESIA incorporated measures (Section 8.2.5) in line with the EHS Guidelines on Occupational health and safety to ensure a safe and healthy working environment for all workers including construction workers, farmers and scheme staff.

2.8.12 WBG EHS Guidelines for Community Health and Safety

The guideline focuses on certain aspects of project activities that extend beyond the usual project boundaries but remain linked to the project operations. It covers various safety concerns such as traffic, life and fire safety, water quality and availability, transportation of hazardous materials, and disease prevention. Additionally, it includes provisions for emergency readiness and response. These concerns might arise at any phase of the project's life cycle and may have consequences extending beyond the project's duration.

The project addresses risks associated with community health and safety in Section 8.2.9.

2.8.13 WBG EHS Guidelines for Construction and Decommissioning

The guideline centres on averting and managing potential health and safety impacts on both the community and workers, which might arise during new project development, project conclusion, or when expanding or altering existing project facilities.

2.8.14 WBG Industry Sector Guidelines for Annual Crop Production

The Industry Sector Guidelines for Annual Crop Production provide pertinent details concerning the extensive commercial cultivation of primary annual crops such as cereals, pulses, roots and tubers, oil-bearing crops, fibre crops, vegetables, and fodder crops across temperate, subtropical, and tropical regions.

In line with this guideline, measures have been provided for waste management (Section 8.2.2), pest management (Section 8.2.4), air quality (Sections 8.2.5 and 8.2.9), greenhouse gas emissions (Section 8.2.14) and use and management of pesticides (Sections 8.2.1 and 8.2.3).

2.8.15 Detailed Comparison of World Bank ESSs and Ghana's Legal Framework

The Table below provides the comparison of the requirements of the World Bank's Environmental and Social Standards and those of Ghana's legal framework.

Table 5: Detailed Comparison of World Bank ESSs and Ghana Legal Framework

ESS / Theme	Key WB ESS requirements	Ghana's Legal Framework	Main gaps vs. ESS	Gap-filling measures
ESS1 – Assessment and management of E&S risks and impacts	Integrated ESIA/ESMP; risk-based approach; cumulative and indirect impacts; climate, vulnerability, and monitoring; ESCP and adaptive management.	L.I. 2504 provides full EA framework: registration, screening, scoping, EIA, public participation, EMP, AER, permitting and renewal.	Limited explicit focus on cumulative impacts, climate risk, vulnerability analysis, and systematic monitoring indicators.	(1) ESIA/ESMP prepared and fully aligned with ESS1 (incl. cumulative, indirect, climate and vulnerability analysis). (2) Detailed monitoring framework prepared (indicators, responsibilities, budget).
ESS2 – Labor and working conditions	Labour Management Procedures (LMP); terms and conditions; OHS; worker GRM; prohibition of child/forced labour; contractor management.	Protection for workers is captured under the Labour Act 2003 (Act 651). Children's Act, 1998 prohibits subjecting a child to exploitative labour. Other provisions are captured in the Labour Act, 2003 (Act 651), Workmen's Compensation Act,	No dedicated requirement for LMP, worker GM, contractor labour audits.	(1) LMP prepared for the FSRP, and provisions have guided the formulation of mitigation and enhancement measures consistent with ESS2, covering direct, contracted, and primary supply workers. (2) Worker and community GM prepared as part of this ESIA.

ESS / Theme	Key WB ESS requirements	Ghana's Legal Framework	Main gaps vs. ESS	Gap-filling measures
		1987, Factories, Shops and Offices Act, 1970, (Act 328)		
ESS3 – Resource efficiency and pollution prevention and management	Resource efficiency (energy, water, raw materials); GHG estimation (where relevant); pollution prevention; waste and hazardous materials management.	L.I. 2504 requires identification and management of pollution, effluents, and waste; links to air quality and effluent regulations and EMP/AER obligations.	Resource efficiency and GHG accounting are not systematically required; climate mitigation and circularity are not explicit; no explicit requirement for project-level GHG screening.	(1) Resource efficiency analysis included in the (water, materials) in ESIA/ESMP. (2) Screening carried out for GHG significance.
ESS4 – Community health and safety	Community health and safety; traffic and road safety; emergency preparedness; security personnel management; infrastructure and dam safety where relevant.	The 1992 Constitution of Ghana ensure the protection of public health. Public Health Act, 2012 (Act 851) sets to prevent disease, promote and protect human and animal health. L.I. 2504 requires assessment of social and health impacts and public safety risks as part of ESIA; public participation and disclosure are mandated.	There are no explicit provisions for traffic safety planning, emergency response arrangements, security force conduct, or dam safety frameworks, and GBV/SEA/SH risks are not clearly articulated as community health and safety concerns and the regulation gaps for handling cases.	(1) Emergency Preparedness and Response Plan prepared as part of the ESIA. (2) Integrated SEA/SH risk mitigation into the mitigation plan and stakeholder engagement tools. The GM has provision for the handling of GBV/SEA/SH risks.
ESS5 – Land acquisition, restrictions on land use and involuntary resettlement	Avoid/minimize displacement; compensation at replacement cost; livelihood restoration; special support for vulnerable groups; RAP/RPF; consultation and GM.	The Lands Act 2020 (Act 1036) has provisions for handling land acquisition and compensation in line with ESS5. The L.I. 2504 requires identification of social impacts, including displacement, but detailed resettlement principles and procedures are governed by broader land laws and not fully embedded in EA regulations.	No provision for compensation of squatters and undocumented settlers.	The requirements of the FSRP RPF which included the necessary compensation to any identified squatters and undocumented settlers guided the assessment and evaluation of potential displacement impacts as part of the ESIA process.
ESS6 – Biodiversity conservation and sustainable management of living natural resources	Biodiversity hierarchy (avoid–minimize–restore–offset); critical habitats; ecosystem services; sustainable management of living natural resources; supply chain risks.	L.I. 2504 requires assessment of impacts on natural resources, protected areas, and ecosystems; and EPA oversight for sensitive sites.	No explicit critical habitat framework, biodiversity offsets policy, or detailed ecosystem services assessment; supply chain biodiversity risks not addressed.	The ESIA included biodiversity baseline and critical habitat assessment aligned with ESS6.
ESS7 – Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities	Identification of Indigenous Peoples FPIC in specific circumstances; culturally appropriate benefits; avoidance of adverse impacts.	L.I. 2504 does not contain a dedicated Indigenous Peoples framework; vulnerable groups are considered more generally under social impact assessment and participation.	No specific criteria for identifying Indigenous People, no FPIC requirement.	This is not applicable
ESS8 – Cultural heritage	Identification and protection of tangible and intangible cultural heritage; chance finds procedures; consultation with affected communities and authorities.	Provisions are captured under the Museums & Monuments Board Act 387 which mandates the Board to acquire, protect, conserve, and document Ghana's cultural heritage. Additionally, the L.I. 2504 requires identification of impacts on cultural and historical sites as part of ESIA and consultation with relevant authorities; chance finds are often handled through generic conditions but not always standardized.	Intangible cultural heritage and community practices are not systematically addressed; chance finds procedures may not be detailed or project specific.	(1) Chance Finds Procedure integrated into the ESIA (2) Provision made in the ESIA for the engagement with the relevant authorities such as the Museums and Monument Board and traditional authorities and custodians in protection of any identified.
ESS9 – Financial intermediaries	FI-level ESMS; screening, categorization, and	L.I. 2504 is project/undertaking-focused and does not create a specific ESMS requirement for	No requirement for FI ESMS, E&S screening procedures, or portfolio-	This is not relevant.

ESS / Theme	Key WB ESS requirements	Ghana's Legal Framework	Main gaps vs. ESS	Gap-filling measures
	monitoring of subprojects; reporting to the Bank.	financial intermediaries beyond general compliance with EA procedures for subprojects that require permits.	level reporting aligned with ESS9.	
ESS10 – Stakeholder engagement and information disclosure	Early and continuous stakeholder engagement; SEP; inclusive and culturally appropriate methods; project-level GM; ongoing disclosure.	L.I. 2504 mandates public participation at key EA stages (screening, scoping, EIA review, public hearings) and disclosure of key documents; timelines and procedures are defined. The Lands Act 2020 (Act 1036) also makes provision for adequate stakeholder engagement with all interested parties.	Engagement is often event-based (hearings, notices) rather than continuous; no explicit requirement for a SEP, project-level GM design, or tailored engagement for vulnerable groups.	(1) Stakeholder Engagement Plan (SEP) prepared for the FSRP, and the provisions integrated in the ESIA with mapping, methods, schedule, and responsibilities. (2) Project GM (including SEA/SH-sensitive channels) is established, and the processes and procedures are integrated into the ESIA report. (3) The ESIA provisions ensure continuous engagement across project life cycle.

2.9 International Requirements and Conventions

The relevant international requirements and conventions to which Ghana is a signatory have been presented in Table 6.

Table 6: Relevant International Conventions

Convention	Main Characteristics	Participation of Ghana
Labour Rights		
International Labour Organization Conventions (ILO)	<i>Minimum Age Convention</i> The Minimum Age Convention, 1973 (No .138) states that the minimum age for admission to any type of employment or work which by its nature or the circumstances in which it is carried out is likely to jeopardise the health, safety or morals of young persons shall not be less than 18 years.	R= 6 th June 2011
	Article 7 of the Convention states that national laws or regulations may permit the employment or work of persons 13 to 15 years of age on light work which is: a) Not likely to be harmful to their health or development; and b) Not such as to prejudice their attendance at school, their participation in vocational orientation or training programmes approved by the competent authority, or their capacity to benefit from the instruction received.	R=13 th June 2000
	<i>Worst Forms of Child Labour Convention</i> The ILO Convention of Worst Forms of Child Labour, 1999 (No. 182) was acceded to by Ghana on June 13, 2000. The Convention charges all ratified members to provide effective and time-bound measures to prevent the engagement of children in the worst forms of child labour. The Convention further defined the worst forms of child labour to include the engagement of children in works that are likely to affect their health, safety, or morals. According to the Worst Forms of Child Labour Recommendation (No. 190), the ILO provides the following guidelines for work considered unsafe for children, this includes work involving toxic chemicals or fumes, work taking place in direct sunlight, carrying heavy loads, work that involves the presence of dangerous animals or insects, etc.	R=20 th May 1957
	<i>Forced Labour Convention</i> Forced Labour Convention, 1930 (No. 29) advocates for the suppression of all forms of forced labour. This means that States ratified this convention must not only criminalize	R=14 th March, 1973

Convention	Main Characteristics	Participation of Ghana
	and prosecute forced labour but also take effective measures to prevent forced labour and provide victims with protection and access to remedies, including compensation. <i>Right of Association (Agriculture) Convention</i> Right of Association (Agriculture) Convention, 1921 (No. 11) secures all those engaged in agriculture the same rights of association and combination as to industrial workers, and to repeal any statutory or other provisions restricting such rights in the case of those engaged in agriculture.	
Child/Human Rights		
African Charter on the Rights and Welfare of the Child	Article 15 of the African Charter on the Rights and Welfare of the Child, 1990 states that every child shall be protected from all forms of economic exploitation and from performing any work that is likely to be hazardous or to interfere with the child's physical, mental, spiritual, moral, or social development. State Parties are required to take all appropriate legislative and administrative measures to ensure the full implementation of this Article. For the purposes of this Charter, a child means every human being below the age of 18 years.	S=18 th August 1997 R=10 th June, 2005
Convention on the Rights of the Child, 1989	Commitment to defend and guarantee the rights of children and to meet these commitments before the international community. States which are members of the Convention are required to develop and implement measures and policies which consider the best interests of the child.	R=5 th February 1990 S=5 th February, 1990
Convention on the Elimination of All Forms of Discrimination against Women (CEDAW), (1979)	The Convention defines the term "discrimination against women" as any distinction, exclusion or restriction made based on sex which has the effect or purpose of impairing or nullifying the recognition, enjoyment or exercise by women, irrespective of their marital status, on a basis of equality of men and women, of human rights and fundamental freedoms in the political, economic, social, cultural, civil or any other field.	S=18 th December 1979 R=2 nd January, 1986
Convention on Discrimination (Employment and Occupation), 1958	Article 2 of the Convention on Discrimination (Employment and Occupation), 1958 states that each Member for which this Convention is in force undertakes to declare and pursue a national policy designed to promote, by methods appropriate to national conditions and practice, equality of opportunity and treatment in respect of employment and occupation, with a view to eliminating any discrimination in respect thereof.	R=4 th April, 1961
Protocol to the African Charter on Human and Peoples' Rights on the Rights of Women in Africa (Maputo Protocol), 2003	Article 2 of the Protocol to the African Charter on Human and Peoples' Rights on the Rights of Women in Africa (Maputo Protocol) indicates that States Parties shall enact and effectively implement appropriate legislative or regulatory measures, including those prohibiting and curbing all forms of discrimination, particularly those harmful practices which endanger the health and general well-being of women.	Adopted on 1 st July 2003 S=17 th September, 2019
Convention on the Rights of Persons with Disabilities, 2006	The Convention is intended as a human rights instrument with an explicit, social development dimension. It adopts a broad categorization of persons with disabilities and reaffirms that all persons with all types of disabilities must enjoy all human rights and fundamental freedoms. It clarifies and qualifies how all categories of rights apply to persons with disabilities and identifies areas where adaptations have to be made for persons with disabilities to effectively exercise their rights and areas where their rights have been violated, and where protection of rights must be reinforced.	S=30 th March, 2007
Protection of Biodiversity		
Convention on Biological Diversity (CBS, 1992)	The Convention on Biological Diversity underlines those threats to biological diversity had increased everywhere in the world, mainly as a result of the continuing destruction of natural habitats. It has 3 main objectives, conservation of biological diversity, sustainable use of the components of biological diversity and fair and equitable sharing of the benefits arising out of the utilization of genetic resources.	R=29 th August 1994 S=12 th June, 1992

Convention	Main Characteristics	Participation of Ghana
African Convention for the Conservation of Nature and Natural Resources, 2003	The Convention seeks to enhance environmental protection, foster the conservation and sustainable use of natural resources, and harmonize and coordinate policies in these fields with a view to achieving ecologically rational, economically sound and socially acceptable development policies and programmes.	Adopted on 11 th July 2013 S=October 15 th , 2020
International Plant Protection Convention	Aims to secure coordinated, effective action to prevent and to control the introduction and spread of pests of plants and plant products. The Convention extends beyond the protection of cultivated plants to the protection of natural flora and plant products. It also takes into consideration both direct and indirect damage by pests, so it includes weeds.	A=22 nd February, 1991
The Ramsar Convention	The Ramsar Convention was the first of the modern instruments seeking to conserve natural resources on a global scale. It is still the only world-wide treaty which restrains the countries joining it from the unthinking, selfish exploitation of their sovereign natural patrimony. It is concerned with that most threatened group of habitats, the wetlands. These are shallow open waters - lakes, ponds, rivers and coastal fringes - and any land which is regularly or intermittently covered or saturated by water - marshes, bogs, swamps, flood plains and the like. For centuries mankind had viewed wetlands as places to drain and convert to more obvious uses, such as agriculture. But the process had gone so far in the developed countries that the disappearance of wetlands was leading to undesirable consequences - to the loss of groundwater reserves and the consequent need for irrigation, to flash floods, to shoreline destruction, to the accumulation of pollutants and to other subtle disturbances.	February 2, 1971
Climate Change		
UN Framework Convention on Climate Change (Rio, June 1992)	To stabilize the concentration of greenhouse gases in the atmosphere at a level that should prevent dangerous anthropogenic interference with the climate system. This level should be reached in sufficient time for ecosystems to adapt naturally to climate change, food production would not be threatened, and economic development could continue in a sustainable manner.	S=12 th June 1995 AR=6 th September, 1995
Pesticides/Hazardous Chemicals		
International Code of Conduct for The Distribution and Use of Food and Agriculture Organisation (FAO) Pesticides	The International Code of Conduct for the Distribution and Use of FAO Pesticides (Revised 2002) serves as a framework and point of reference for the judicious use of pesticides for all those involved in pesticide matters. The objectives of this Code include establishing voluntary standards of conduct for all public and private entities engaged in or associated with the distribution and use of pesticides and addressing the need for a cooperative effort between governments of pesticide-exporting and importing countries to promote practices that minimize potential health and environmental risks associated with pesticides while ensuring their effective use	Adopted in November, 2002
Rotterdam Convention	The Rotterdam Convention provides Parties with a first line of defence against hazardous chemicals. It promotes international efforts to protect human health and the environment as well as enables countries to decide if they want to import hazardous chemicals and pesticides listed in the Convention. Together with the Stockholm and Basel Conventions and FAO's voluntary Code of Conduct, the Rotterdam Convention promotes a life cycle approach and provides the necessary tools for managing pesticides.	S=11 th Sept 1998 R=30 th May 2003 AA=30 th May, 2003
Signature = S; Ratification = R; Accession = A; Authorisation for ratification or accession = AR, Letters of ratification = LR; Participation = P; Letters of Accession = LA.		

2.10 Institutional Framework

The relevant institutions identified for the project include:

2.10.1 Ministry of Food and Agriculture

The Ministry of Food and Agriculture (MoFA) is the lead agency and focal point of the Government of Ghana, responsible for developing and executing policies and strategies for the agriculture sector within the context

of a coordinated national socio-economic growth and development agenda. Based on a sector-wide approach, the Ministry's plans and programmes are developed, coordinated and implemented through policy and strategy frameworks. The sub-vented organization under the ministry with a role to play in the project is the Ghana Irrigation Development Authority (GIDA).

The PIU is established by the MoFA to oversee and coordinate the implementation of FSRP and its sub-activities including the Ashanti Region Lot 3 Inland Valley Schemes.

2.10.1a Ghana Irrigation Development Authority

The Ghana Irrigation Development Authority (GIDA) is primarily responsible for formulating, developing and implementing irrigation and drainage plans for all year-round agriculture production in Ghana. The functions of the GIDA include:

- Developing design standards for irrigation infrastructure.
- Designing irrigation infrastructure and related facilities e.g. dams, ponds, tube-wells, conveyance structures, etc.
- Carrying out land-use planning in areas earmarked for irrigation development.
- Providing public irrigation facilities.
- Providing technical services for the development of irrigation facilities.
- Providing technical and managerial services for the effective use of irrigation facilities.
- Liaising with other agencies to safeguard the health and safety of all people living within and around irrigation project areas.

2.10.2 Environmental Protection Authority

The Environmental Protection Authority (EPA) is the body responsible for regulating the environment as mandated by EPA Act, 2025 (Act 1124), and ensuring the implementation of government policies on the environment. The functions of the Authority include:

- Ensuring compliance with laid down environmental assessment regulations.
- Promoting effective planning in the management of the environment.
- Controlling and monitoring the generation, treatment, and disposal of waste, and advising on regulation and management of hazardous substances.
- Acting in liaison and co-operation with government agencies, District Assemblies and other bodies and institutions to control pollution and generally protect the environment.

2.10.3 Water Resources Commission

The Water Resources Commission (WRC) is responsible for granting licenses for any water use activity and the procedures as laid down in the WRC Act 1996 (Act 522) will be followed. The commission is also responsible for Planning for water resources development and management within river basins (catchments) as the natural units of planning collating, storing and disseminating data and information on water resources in Ghana.

2.10.4 Ministry of Labour Jobs and Employment

The Ministry of Labour Jobs and Employment (MLJE) is mandated to formulate policies on labour and employment issues, develop sector plans, coordinate employment and labour-related interventions across

sectors, promote harmonious labour relations and workplace safety, monitor & evaluate policies, programmes / projects for accelerated employment creation for national development.

2.10.5 Ministry of Gender, Children and Social Protection

The Ministry of Gender, Children and Social Protection (MoGCSP) is the lead agency responsible for implementing the National Gender and Children's Policy. The Ministry is mandated to coordinate and ensure gender equality and equity, promote the survival, social protection and development of children, vulnerable and excluded and persons with disabilities and integrate fulfilment of their rights, empowerment and full participation into national development.

2.10.6 Atwima Nwabiagya and Sekyere South District Assemblies and Juaben and Ejisu Municipal Assemblies

The Assemblies were established under the Local Governance Act, 2016, (Act 936). The Assemblies are tasked with improving the quality of life of the people through effective mobilisation and utilisation of human and material resources by involving the people in the provision of the needed services.

3.0 PROJECT DESCRIPTION

3.1 Revised Data Informing the Design of the Inland Valleys

Table 7 below provides information on the available areas for irrigation in the five Inland Valleys.

Table 7: Information on the Inland Valleys for Development

No.	Name of District	Name of Valley	Location of Valley	Name of River / Stream	Estimated ⁶ Cropped Area (Ha)	Potential Area ⁷ (Ha)	Surveyed Area ⁸ (Ha)	Final Designed Area ⁹ (Ha)
1	Ejisu-Juaben Municipal	Odaho	Donuaso	Oda	50	110	115.638	114.50
2	Juaben Municipal	Odamu	Yaw Nkrumah / New Bonfa	Odamu	80	120	64.849	42.00
3	Sekyere South	Kumkum	Tano Odumase	Kumkum	70	100	35.886	36.00
4	Atwima Nwabiagya North	Offin	Barekese/ Amakye-bare	Offin	40	60	81.379	77.00
5		Waamu /Kumi	Aninkromah	Waamu	70	160	130.00	114.00
	TOTAL				310	550	427.752	383.5

3.2 Description of Scope of Works

Table 8 below provides details on the proposed designs and descriptions of the interventions for the various inland valleys. The technical designs for the various valleys were informed by the following key considerations among others:

1. Energy requirement for water abstraction;
2. Water conveyance and use;
3. Maintenance requirement;
4. Farmers' ease of adoption;
5. Investment cost (capital and operational cost); and
6. Environmental and social impacts and risks.

⁶ Estimate cropped area (Ha): current extent of land under cultivation within the valley, based on field observations or farmer-reported data.

⁷ Potential available area (Ha): refers to an area in hectares that is currently unused but capable of being used or developed in the future.

⁸ Surveyed area (Ha) during feasibility reflects the technically viable area after excluding unsuitable portions.

⁹ Final designed area (Ha) to be developed: represents the actual area to be developed with irrigation infrastructure under the project.

Table 8: Proposed Design and Interventions for Valley Development

No	Name of Valley	Proposed Design	Interventions
1	Odaho	Low-head weir + Sump + Hybrid Energy Pump Station (Solar & National Grid) + Reservoir + Main Pipelines + Concrete Laterals + Drains <i>Details:</i> - Weir on the Oda Stream at about 360m downstream of the Kumasi – Donuaso road. 2No. trapezoidal earth-lined reservoir with 3000 m³ capacity. - Canal (PVC) length of about 3500m. - Trapezoidal laterals of about 11,036 m (11.036 km).	- Headworks (weir, intake structures, sump, pump station, closure embankment) - Canal and laterals - Drains (main, secondary, catchment drains, field drains) - Stream channelisation with protection dyke - Roads (access, field roads) - Land development (clearing, removal and stockpiling of topsoil, levelling, spreading of topsoil, bunding) - Crossing bridge - Provision of borehole - Sanitary facility
2	Odamu	Low-head weir + Intake Chamber + Main lined Canal (open) + Unlined Lateral + Drains. <i>Details:</i> - Weir on the Oda Stream at about 100m upstream of the Baman – Juaben road. - Canal (earth lined) length of about 3080m. - Trapezoidal laterals of about 3,319m (3.32km).	- Headworks (weir, intake structures, closure embankment) - Canal and laterals - Drains (main, secondary, catchment drains, field drains) - Stream channelization with protection dyke - Roads (access, field roads) - Land development (clearing, removal and stockpiling of topsoil, levelling, spreading of topsoil, bunding) - Provision of borehole - Sanitary facility
3	Kumkum	Concrete weir + Intake (Pipe Conduit) + Chamber + Main Lined Canal (open) + Unlined Lateral + Drains.	- Headworks (weir, intake structures, closure embankment) - Canal and laterals - Drains (main, secondary, catchment drains, field drains) - Stream channelization with protection dyke - Roads (access, field roads) - Land development (clearing, removal and stockpiling of topsoil, levelling, spreading of topsoil, bunding) - Provision of borehole - Sanitary facility
4	Offinho	Contour Bunding (Water conservation system) + Bridge.	- Drains (main, secondary, catchment drains, field drains) - Stream channelisation with protection dyke - Roads (access, field roads) - Bridge - Land development (clearing, removal and stockpiling of topsoil, levelling, spreading of topsoil, bunding) - Provision of borehole - Sanitary facility

No	Name of Valley	Proposed Design	Interventions
5	Waamu/Kumi	Road weir + Intake (Pipe Conduit) + Chamber + Main Lined Canal (open) + Unlined Lateral + Drains. <i>Details:</i> - Weir on the Waamu Stream at about 200m downstream of the Aninkromah -Kumi feeder road. - Canal (earth lined) length of about 3469m (3.47km). - Trapezoidal laterals of about 8,831m (8.8km).	- Headworks (weir, closure embankment) - Canal and laterals - Drains (main, secondary, catchment drains, field drains) - Stream channelisation with protection dyke - Roads (access, field roads) - Land development (clearing, removal and stockpiling of topsoil, levelling, spreading of topsoil, bunding) - Provision of borehole - Sanitary facility



Figure 1: *Odaho Valley at Donuaso*



Figure 2: *Odamu Valley*





Figure 3: *Kumkum Valley*



Figure 4: *Offinho Valley*



Figure 5: *Waamu Kumi Valley*



3.2 Characteristics of the Stream Flows and Crop Water Requirements

The flows for the various streams were measured before the peak of the rains. This provided the approximate flows in the rivers to estimate the sufficiency or otherwise of the water in the streams/rivers. The stream/river flow measurements and the crop water requirements revealed there is sufficient water in the various streams in all the valleys to continue to cultivate rice for both major and minor seasons, except at Waamu/Kumi which has to continue to follow irrigation scheduling to enable farmers crop in the minor season. All the Inland Valley sites (Odaho, Odamu, Kumkum, Offinho and Waamu/Kumi) do not have any major water demand such as community needs and water treatment facilities downstream which could be adversely affected. There is no comparison of calculated and measured discharge for Offinho Valley because it has been designed as a banded scheme (water is directly supplied and temporarily stored into the field bunds) with no water storage. Table 9 provides information on the measured flows.

Table 9: Stream Flows and Crop Water Requirements

Parameters		Valleys				
		Odaho	Odamu	Kumkum	Offinho	Waamu /Kumi
Discharge as at June 2024 (m ³ /s)		0.59	0.11	0.38	9.38	0.11
Min depth of flow from Field Observation (m)		0.2	0.3	0.2	1.2	0.2
Peak Unit Water Requirement (m ³ /s/ha)		0.002	0.002	0.002	0.002	0.002
Total Area to be Irrigated (Ha)	100%	115	42	47	87	113
	50%	57.50	21.0	23.50	43.5	56.50
	25%	28.75	10.5	11.75	21.75	28.25
Total Discharge corresponding to area in Peak Season (m ³ /s)	100%	0.230	0.084	0.094		0.226
	50%	0.115	0.042	0.047		0.113
	25%	0.0575	0.021	0.0235		0.0565
Remarks		Sufficient	Sufficient	Sufficient	-	Sufficient

3.3 Land Use and Tenure/Ownership of the Valley

The various land areas in the valleys are under the ownership of the traditional authorities who have given these areas out for rice cultivation only. These have also prompted the various District Assemblies to develop their land use maps for these areas incorporating these existing land uses. All the existing land ownership arrangements as detailed in Table 10 below will not impede the project development in the 4 districts. There are no anticipated adverse impacts expected from the existing land tenure arrangements in any of the four valleys on the project development.

Table 10: *Land-Use and Tenure/Ownership of the Valleys*

No.	District	Valley	Location of Valley	Land Use	Land Tenure / Ownership
1	Ejisu	Odaho	Donuaso	Part of the valley cultivated with rice (Donuaso) and the other is mainly fallow (Krapa).	Odaho valley is a stool land with a possessory title vested in the Chiefs of Donuaso and Krapa. Land ownership is determined by both customary and statutory laws. There is no dispute, landowners have already released the land for the use by farmers who pay land rent on seasonal basis. These are verbal arrangements between the landowners and community farmers. These arrangements are firmed up with written agreements to be signed by the respective stakeholders.
2	Juaben	Odamu	Yaw Nkrumah / New Bonfa	Rice fields with fallow	Land ownership is vested in the Chief of Yaw Nkrumah. There is no dispute, landowners have already released the land for the use by farmers who pay royalties on seasonal basis. These are verbal arrangements between the landowners and community farmers. These arrangements are firmed up with written agreements to be signed by the respective stakeholders.
3	Sekyer South	Kumkum	Tano Odumase	Rice fields with fallow	Land ownership is vested in the Chief of Tano Odumase. There is no dispute, landowners have already released the land to be used for the project. Farmers pay royalties on seasonal basis. These are verbal arrangements between the landowners and community farmers. These arrangements are firmed up with written agreements to be signed by the respective stakeholders.
4	Atwima Nwabiagya North	Offinho	Barekese/ Amakye-bare	Rice fields with fallow	Ownership is vested in traditional authority, the Chief of Amakye-Bare. There is no dispute, landowners have already released the land for

No.	District	Valley	Location of Valley	Land Use	Land Tenure / Ownership
					the use by farmers who pay royalties on seasonal basis. These are verbal arrangements between the landowners and community farmers. These arrangements are firmed up with written agreements to be signed by the respective stakeholders
5		Waamu /Kumi	Aninkromah	Rice fields with fallow	A stool land with a possessory title vested in the Chief of Aninkromah. There is no dispute, landowners have already released the land for the use by farmers who pay royalties on seasonal basis. These are verbal arrangements between the landowners and community farmers. These arrangements are firmed up with written agreements to be signed by the respective stakeholders

3.4 Soil Series and Characteristics of the Valley

All the soil types in the valleys are very highly suitable based on the climate and soil physical properties to produce rice as analysed during the feasibility studies. Tables 11 and 12 provide detailed characteristics of the soils in the various valleys.

Table 11: *Soil Series and Characteristics of the Valleys*

Soil Series	Valley	Characteristics
<i>Nta series</i> (Eutric-Gleysol)	Odaho	It consists of dark greyish brown to Dark brown loamy sand, slightly plastic, slightly sticky topsoil (0 – 40 cm) with no coarse fragments. The topsoil is moderately well-drained with underlying layers of poorly drained clayey soils (40 – 120 cm). The subsoil is plastic when moist and sticky. Deeper layers become fluid during the wet season.
<i>Offin series</i> (Stagni-Dystric Gleysol)	Odamu/Odaho/Kumkum	Texture of Offin series is uniform grey to light brown to brownish fine sandy clays. They are slightly plastic, and sticky through the top 100 cm with no coarse fragments. The top 100 cm is poorly drained water-logging conditions. Hydraulic conductivity indicates that internal drainage is very slow. Offin series has very low available moisture.
<i>Densu series</i> (Vertic-Eutric Gleysol)	Odaho/Odamu	Texture of Densu series is similar to Offin series, except that Densu has some gritty texture indicating sandier fractions. It consists of pale brown, yellowish brown to grey sandy loams to sandy clays. The soil is mostly non-plastic but slightly sticky

		with no coarse fragments. Hydraulic conductivity measurements indicate that internal drainage is very slow.
<i>Oda series</i> (Eutric Gleysol)	Offinno/Waamu/ Kumi	The soil is mostly sticky and plastic throughout the top 100 cm with no coarse fragments. The soil is poorly drained, with seasonal flooding and water-logging conditions. It is mostly dark-brown silty loam to clay loam topsoils to light olive-brown clays within the subsoils.
<i>Kakum series</i> (Eutric Fluvisols)	Waamu/ Kumi	It consists of very dark brown to yellowish-brown silty-clay loams. The soil is mostly non-plastic and non-sticky within 0 - 20 cm depth. It is non-plastic and sticky from 20 – 45 cm depth after which the layers become plastic and sticky. The soil is very poorly drained, with seasonal flooding and water-logging conditions. Internal drainage is slow

Table 12: Soil Series and Nutrient Properties of the Valleys

Nta series (Eutric-Gleysol) soils		
Soil properties	Desirable	Nta series (Eutric-Gleysol)
¹ Electrical conductivity ($\mu\text{S}/\text{cm}$)	<1000	Favorable (43 – 189)
Texture	SC, SiC, SCL, SiC, CL, C	Favorable SCL to SC
² Bulk density (g cm^{-3})	1.1 – 1.4 g/cm^3 desirable. Not > 1.6 mg/m^3 .	Desirable (average of 1.4 g/cm^3)
³ Available water Capacity mm/ 100 cm depth	>120	Good (116.0 – 123.45)
³ Conductivity class cm/hr	<1.5	Favourable (0.29)
³ Basic infiltration rate (cm/h)	<0.3	Suitable (0.2)
³ Soil pH level	5.0 – 7.5	Favorable range (5.4 – 6.8)
⁴ Total Nitrogen %	> 0.5	Too low (0.05 -0.11)
⁴ Organic matter (%)	3 - 7	Low (0.89 -1,78)
⁴ Organic carbon	2 - 4	Low (0.5 – 1.19)
⁵ Phosphorus ppm P	40 - 80	Too low (0.07 – 1.81)
Exchangeable cations	⁶ Desirable proportions (Cmol (+)/kg)	Nta series
Na	0 – 0.3	0.08 (Non saline)
K	0.7 - 2	Low (0.11 – 0.3)
Ca	10 - 20	Very Low (1.4 -2.76)
Mg	3 - 8	Very Low (0,2 – 1.16)
Source: ¹ Horneck et al. (2011), ² Warrick (1999), ³ FAO (1963), ⁴ Hill Laboratories (2023), ⁵ New Brunswick Land Development. (2003), ⁶ Hazelton and Murphy (2007), ⁷ Landon (1991).		

Offin Series (Stagni-Dystric Gleysol)		
Soil properties	Desirable	Offin series (Stagni-Dystric Gleysol)
¹ Electrical conductivity ($\mu\text{S}/\text{cm}$)	<1000	Favorable (40 – 112)
Texture		
	SC, SiC, SCL, SiC, CL, C	Favorable SCL, S, SL, SC
² Bulk density (g cm^{-3})	1.1 – 1.4 g/cm^3 desirable. Not > 1.6 mg/m^3 .	May affect root development (1.4 – 1.7 g/cm^3)
³ Available water Capacity mm/ 100 cm depth	>120	Good (116.0 – 123.45)
³ Conductivity class cm/hr	<1.5	Slow drainage (0.3 - 10)
³ Basic infiltration rate (cm/h)	<0.3	Suitable (0.2)
³ Soil pH level	5.0 – 7.5	Within favorable range (5.4 – 6.8)
⁴ Total Nitrogen %	> 0.5	Too low (0.03 -0.10)
⁴ Organic matter (%)	3 - 7	Low (0.41 -1.65)
⁴ Organic carbon	2 - 4	Low (0.4 – 0.80)
⁵ Phosphorus ppm P	40 - 80	Too low (0.07 – 2,61)
Exchangeable cations	⁶ Desirable proportions (Cmol (+)/kg)	Offin series
Na	0 – 0.3	Non saline (0.06 -0.15)
K	0.7 - 2	Low (0.11 – 0.32)
Ca	10 - 20	Very Low (1.08 -2.39)
Mg	3 - 8	Very Low (0,11 – 0.95)
Source: ¹ Horneck et al. (2011), ² Warrick (1999), ³ FAO (1963), ⁴ Hill Laboratories (2023), ⁵ New Brunswick Land Development. (2003), ⁶ Hazelton and Murphy (2007), ⁷ Landon (1991).		
Densu series (Vertic-Eutric-Gleysol)		
Soil properties	Desirable	Densu series
¹ Electrical conductivity ($\mu\text{S}/\text{cm}$)	<1000	Favorable (40 – 112)
Texture		
	SC, SiC, SCL, SiC, CL, C	Generally favorable (LS, SCL, SC)
² Bulk density (g cm^{-3})	1.1 – 1.4 g/cm^3 desirable. Not > 1.6 mg/m^3 .	Impedes root development. Rotovate (1.4 -1.68 g/cm^3)
³ Available water Capacity mm/ 100 cm depth	>120	Good (116.0 – 124.0)
³ Conductivity class cm/hr	<1.5	Manageable with puddling Slow (0.2 - 10)
³ Basic infiltration rate (cm/h)	<0.3	Suitable (0.2)

³ Soil pH level	5.0 – 7.5	Favorable range (5.5 – 7.69)
⁴ Total Nitrogen %	> 0.5	Too low (0.03 - 0.13)
⁴ Organic matter (%)	3 - 7	Low (0.48 -2.48)
⁴ Organic carbon	2 - 4	Low (0.28 – 1.44)
⁵ Phosphorus ppm P	40 - 80	Too low (0.07 – 6.11)
Exchangeable cations	⁶ Desirable proportions (Cmol (+)/kg)	Densu series
Na	0 – 0.3	Non saline (0.05 – 0.1)
K	0.7 - 2	Low (0.11 – 0.34)
Ca	10 - 20	Very Low (1.0 -58)
Mg	3 - 8	Very Low (0.49 – 2.29)
Source: ¹ Horneck et al. (2011), ² Warrick (1999), ³ FAO (1963), ⁴ Hill Laboratories (2023), ⁵ New Brunswick Land Development. (2003), Hazelton and Murphy (2007), ⁷ Landon (1991),		

3.5 Project Design Details – All Valleys

The proposed water management structures for the five valleys will be a water diversion gate (for irrigation canals and Laterals); with a small weir(s) with emergency gate and closure embankments to be constructed on the upstream portions of the natural stream. The natural stream(s) channel will be deepened to allow for enhanced drainage of water in the field. Embankment dykes are proposed to be constructed at the banks to prevent flooding of the fields during rainy season. In-field drains are proposed to convey excess water from the fields to improve drainage and aeration of the fields. Each plot is designed to be 0.2 ha (40m × 50m). Weirs and stream channels were designed for 50 years return periods. To minimise inundation, the crest levels of the weirs are placed approximately 1.0m above the existing ground level for all the valleys.

3.5.1 Construction of Low-Head Concrete Weirs and Sump

The valley development will involve the construction of weirs in the valleys with the exception of Offino Valley. The weir designs are based on 50-year flood return period. The approaches and exits of the weirs are designed with adequate stream channels to allow for free flows to avoid water impounding at the locations. Table 13 below shows the discharge information for the valleys whereas Table 14 gives the weir design parameters. Figure 6 provides the cross-section view of the weirs.

Table 13: Weir Design Discharge Information

No.	Valley	Probable Max. Flood (PMF), m ³ /s	Bedwidth of Stream Channel (b), m	Weir Width (L), m	Head (h), m
1	Odaho	144.948	45	55	0.5
2	Odamu	103.45	25	25	0.8
3	Kumkum	58.391	15	15	1
4	Offinho	396.117	64	-	-
5	Waamu/Kumi	44.496	15	15	1

Table 14: Weir Design Parameter of the Valleys

No	Design Parameter	Odaho	Odamu	Kumkum	Offinbo	Waamu/Kumi
1.	Canal offtake invert level	56.12	245.0	252.0	-	245.0
2.	Crest level of weir embankment	58.12	247.3	254	-	247
3.	Maximum flood level (max pool level)	57.12	246.3	253	-	246
4.	Maximum flood water head,	0.5	0.8	0.503	-	0.5
5.	Crest of level weir	56.62	245.5	252.5	-	245.5
6.	Ground level at the Centre of weir (GL)	56.12	244.5	251.5	-	244.5
7.	Water depth (for storage)	0.5	1.0	1.00	-	1.00
8.	Height of weir(m)	0.5	1.5	1.50	-	1.50
9.	Concrete weir crest width(m)	0.5	0.5	0.5	-	0.5
10.	Length of weir(m)	50	18	20	-	15.5
11.	Crest Width of Embankment	3	3	3	-	3

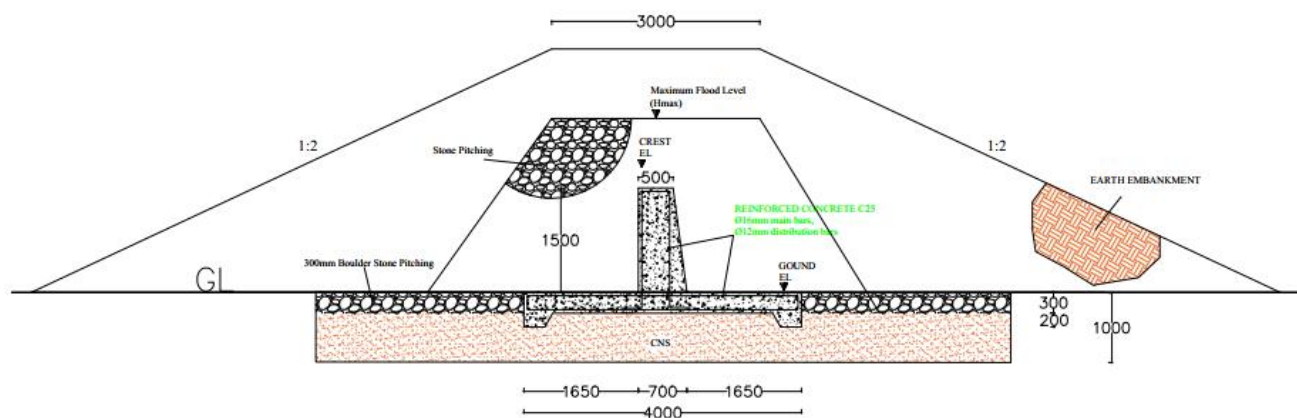


Figure 6: Typical Cross-Section of the Weir

3.5.2 Pump Station – Odaho Valley

A pump station will be situated 360m downstream of the Ejisu-Donuaso Road to house 3 No. submersible hybrid (solar/electric) pumps (672 m³/hr; 37 kW each; two for operation, and one for spare). The pump station will be located and elevated at a height that would be safe from flood inundation. Figure 7 is a cross-section of the pump station.

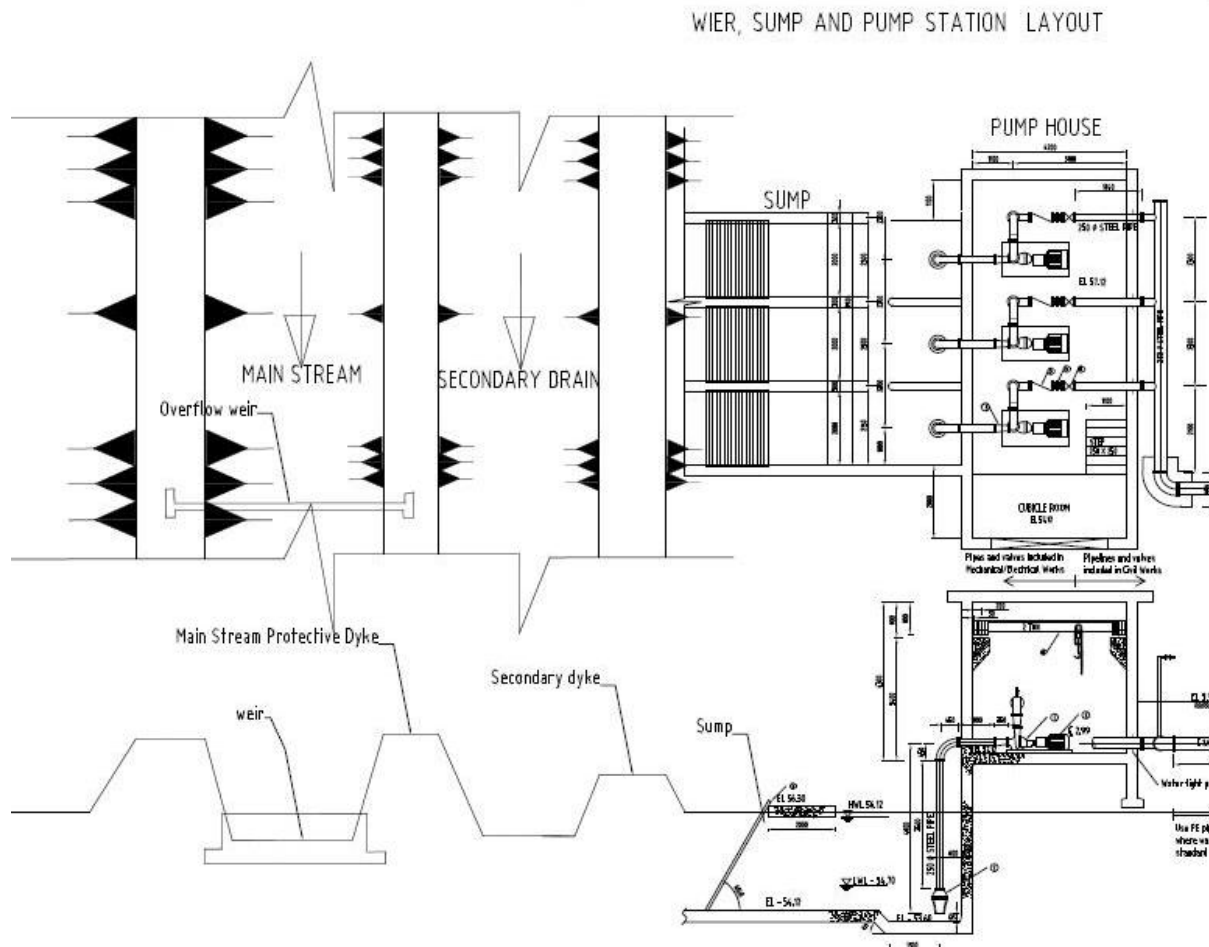


Figure 7: *Layout of Weir, Sump and Pump Station in the Odaho Valley*

3.5.3 Supply Pipelines – Odaho Valley

A High-Density Polyethylene (HDPE) pipeline of diameter 0.6 m and pressure rating of PN 10 will be used to supply water to an earth engineered reservoir. The supply pipeline will be aligned along a field lateral to avoid disturbance by farmers during farming operations and also held in place by thrust concrete at 25 m intervals.

3.5.4 Reservoir – Odaho Valley

A 2 No. trapezoidal earth lined reservoir with 3000m³ capacity each will be provided for field irrigation water supply. The capacity of the reservoirs was sized based on the estimated daily irrigation water requirement of the field. The reservoirs will be positioned at the highest elevation of the field to allow flow by gravity to command the fields.

3.5.6 Closure Flood Protection Embankments

Embankments have been designed on both sides of the weirs. The side slope of the embankment is 1.1 for all sites. Table 14 provides the summary dimensions of the proposed weir closure embankments.

Table 15: *Weir Flood Protection Embankment Dimensions*

Items	Odaho	Odamu	Kumkum	Offinbo	Waamu/Kumi
Crest level of weir embankment	58.12	247.3	254	-	247
Ground level at the Centre of weir (GL)	56.12	244.5	251.5	-	244.5
Length of embankment (both sides) (m)	36.00	411	231	-	294
Top width of embankment (m)	3	3	3	-	3

3.5.7 Canal Intake Structure

The intake structure will consist of a 300mm pipe through the weir with penstock gate (Figure 8) at the downstream side of the weir with walkway platform for the operation of the penstock. An intake structure will be constructed with control valve to offtake the water through a supply pipeline to the proposed irrigation canal.

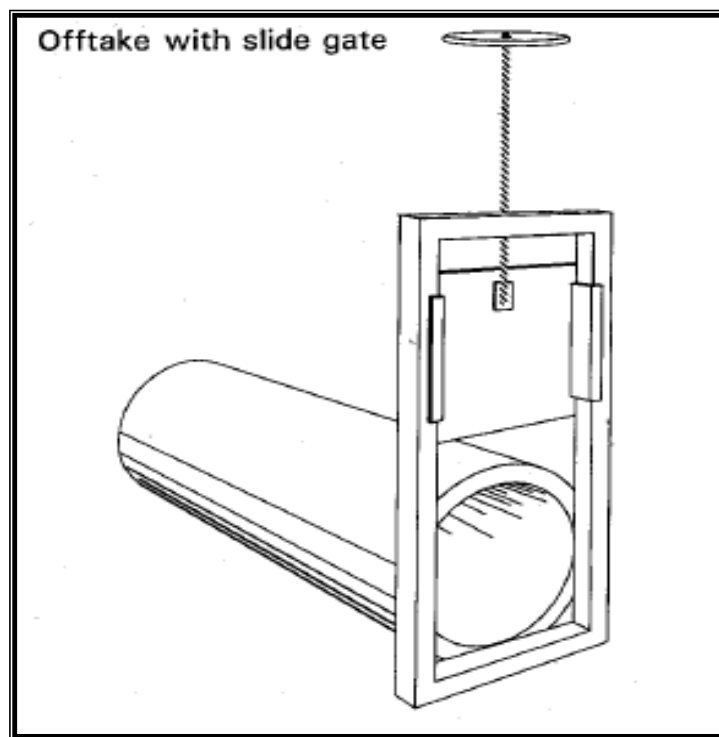


Figure 8: *Offtake Penstock Gate of the Intake Structure*

In-Field Structures

3.5.8 Canals

Water will be conveyed from the source to the field using lined trapezoidal canals in all the sites. To minimise losses, the canal banks have been designed to be built from clayey soil and constructed in layers, with each layer to be compacted. Where the canal crosses the access roads and drains, culverts have been provided. The access roads have been designed along the canal to permit the use of small two-wheeled agricultural machinery in the cropping zone for tillage, delivery of inputs and carting of produce.

A typical cross-section of the lined irrigation canal with an access road used for the design of the system is shown in the Figure 9 below.

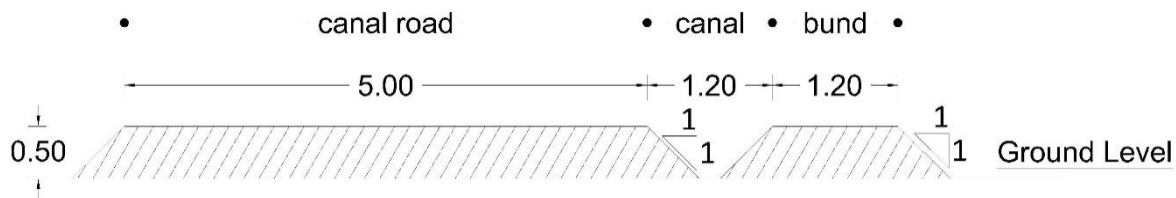


Figure 9: Cross-Section of Irrigation Canal

3.5.9 Laterals

V-shaped unlined laterals have been designed to supply water to adjacent plots. The total area of the adjacent plots was used to determine the discharge. A typical cross-section of the unlined laterals with and without roads used for the design is shown in Figures 10 and 11. Those with roads occur after every two consecutive laterals without roads.

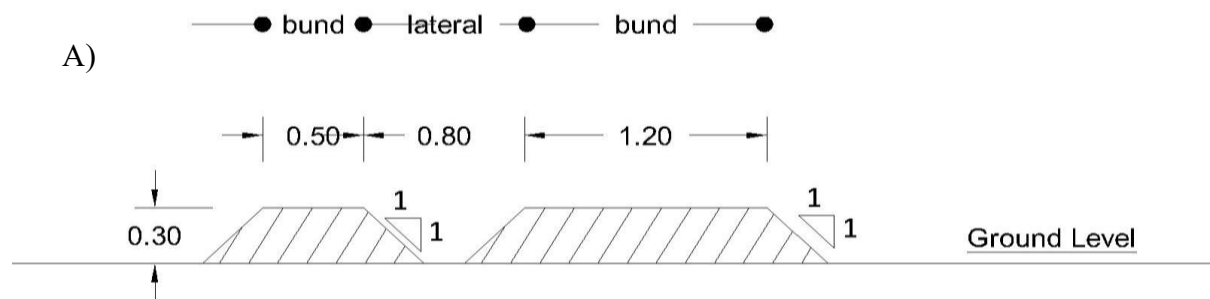


Figure 10: Cross-Sections of Lateral Embankment: Without Road

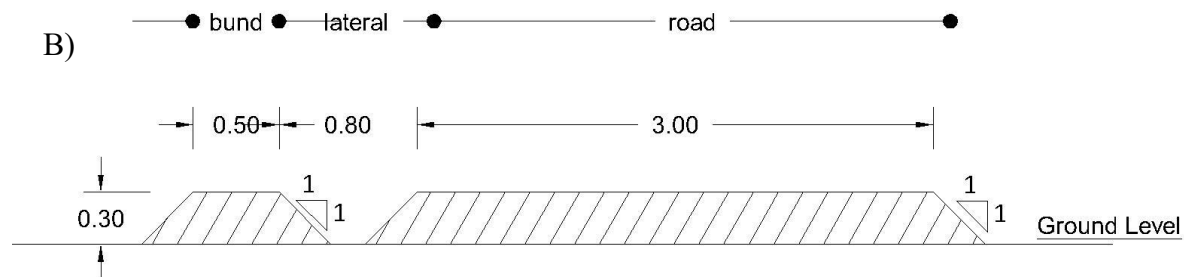


Figure 11: Cross-Sections of Lateral Embankment: With Road.

3.5.10 Water Control Structures

To ensure effective irrigation water management practices, concrete water level control structures (Figure 12) will be provided in the canals after every two laterals. The concrete check structures with treated wooden/metallic gate sheets will be provided to obstruct flow in the laterals to increase the water levels. The check structures in the laterals will be permanent. Control valves will be provided on the main pipelines to regulate water flow into the connecting laterals. The check structures in the laterals control the water level for the field intake.

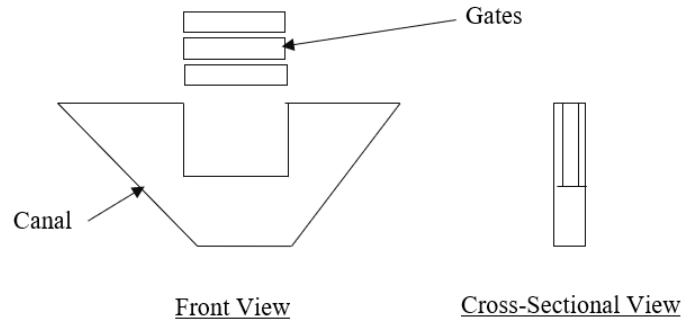


Figure 12: Cross-section of the Lateral Check-structure

3.5.11 Infield Drains – Drainage Systems

Infield drains (unlined) are designed to transport excess water from the plots. The infield drains are designed to discharge water into the secondary drains which in turn discharges water into the main drainage channels. The infield drains are formed by two bounds in Figure 13.

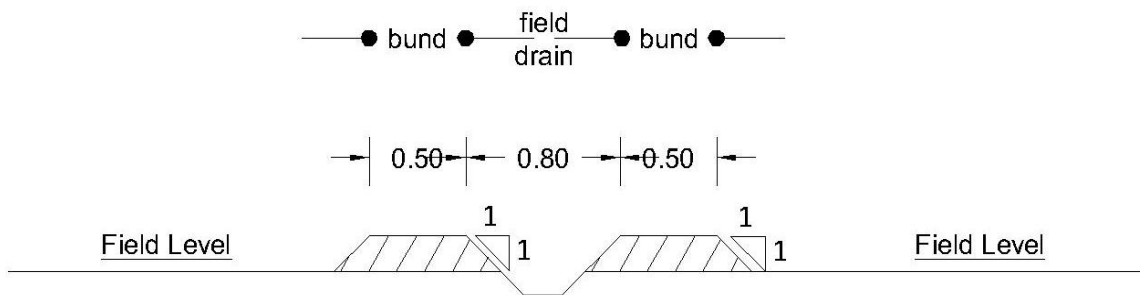


Figure 13: Infield Drain Cross-Section

3.5.12 Watershed Management

The watershed management for the sustainable functioning of the weirs are outlined as follows:

- The downstream section will be re-channelized in order to allow for unobstructed flow of water.
- Trees will be planted along the banks of the stream and the reservoir to conserve water.
- Watershed silt control programme will be instituted and the farmers educated to preserve the watershed from siltation.

3.5.13 Land Preparation and Bunding

The land preparation will involve the removal of shrubs, some bamboo groves and grass, being the significant vegetation on the land. For areas where there would be cut and fill, the topsoil would be removed/heaped and

restored when the land levelling is completed. The plots will be formed to conform to the direction of the contours, thus reducing the earth movement during bunding and levelling to the minimum. The levels of the plots will be set to balance cut and fill. Bunding and land levelling will form the major activities in plot formation. Pegging out of plot boundaries to the standard size of plots will be required during the levelling. All levelled plots would be portioned and bunded by in-field contour bunds into plots of 0.2ha (40mx50m). A total of 383.5ha of plots will be developed for the five valleys. The lands in Lot 3 earmarked for development fall under the following traditional authorities: Barekese, Pasoro, Juaben, Ejisu and Krapa. Agreements are prepared to be signed by the stakeholders that will guide tenurial arrangements and plots allocation with which farmers that are currently working on the land are considered paramount.

3.5.14 *Equipment and Machinery*

Excavators will be used for dredging and construction of the stream channels and lateral canals. There will also be the use of tractors mounted with ploughs and harrows for land clearing and preparation. A dozer would be required to remove old tree stumps where necessary. Table 16 provides the lists of the proposed equipment and machinery anticipated for use at each of the sites.

Table 16: Proposed List and Numbers of Equipment and Machinery for each Valley

No	Name	Number
1.	Excavator for drainage canals	2
2.	Grader	1
3.	Plainer/ scraper	2
4.	Tractors with ploughs/ harrows	4
5.	Contouring machine	1
6.	Dozer	1
7.	Truck	1

3.5.15 *Operations of the Inland Valley*

Water Users Associations (WUAs) will be established for each valley, comprising farmers from all farming zones within the respective catchment. Each WUA will include elected executives to represent the collective interests of its members. Targeted training will be conducted within each valley to equip WUA members with the skills necessary to regulate and operationalise the water control structures effectively. This initiative is critical to ensuring the efficient use, management, and maintenance of the irrigation infrastructure. It is anticipated that all farmers operating within each valley will be enrolled into their respective WUA, with ongoing capacity-building support provided by the Ministry of Food and Agriculture—through the Ghana Irrigation Development Authority—and the Environmental Protection Authority (EPA).

3.5.16 *Labour Force and Employment*

During the construction phase, temporary job creation is also expected for local communities. Activities such as field demarcation, bund construction, concrete works for weir formation, and development of access roads are projected to engage an average of 20 casual labourers and 30 skilled workers per valley, directly contracted by each implementing firm. Collectively, these interventions are estimated to generate over 250 employment opportunities across the five valleys, with approximately 40% of these roles allocated to local residents.

3.6 Scheme Locations and Layout Maps – All Valleys

3.6.1 Locations Maps of the Valley

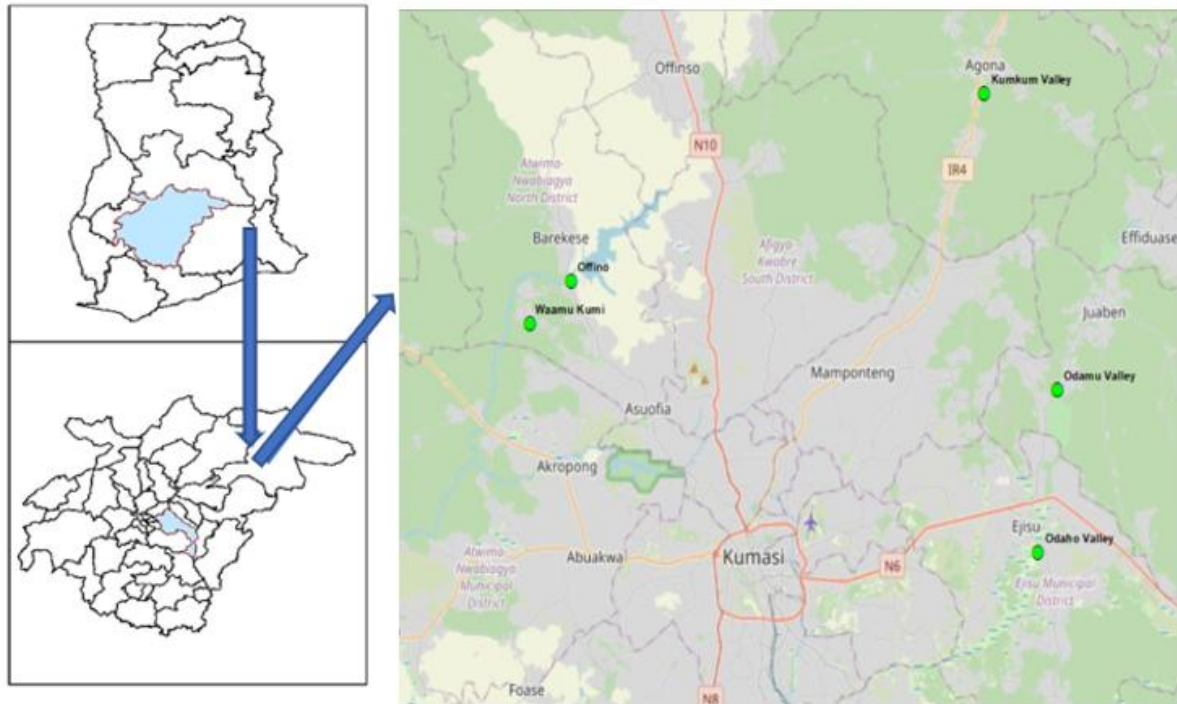


Figure 14: Locations of the five (5) valleys in the Ashanti Region, FSRP/ESSERM 2024

The following figures (Figures 15, 16, 17 and 18) detail the locations of the five (5) valleys.

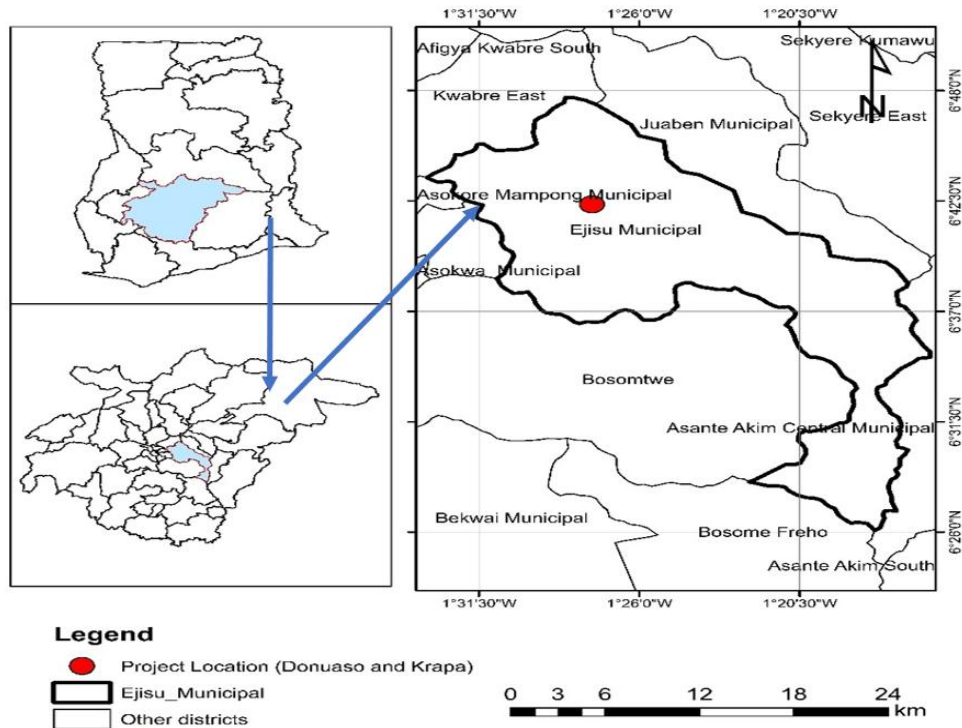


Figure 15: Location at Odaho Valley (Donuaso and Krapa) within the Ejisu Municipal, FSRP2, 2024

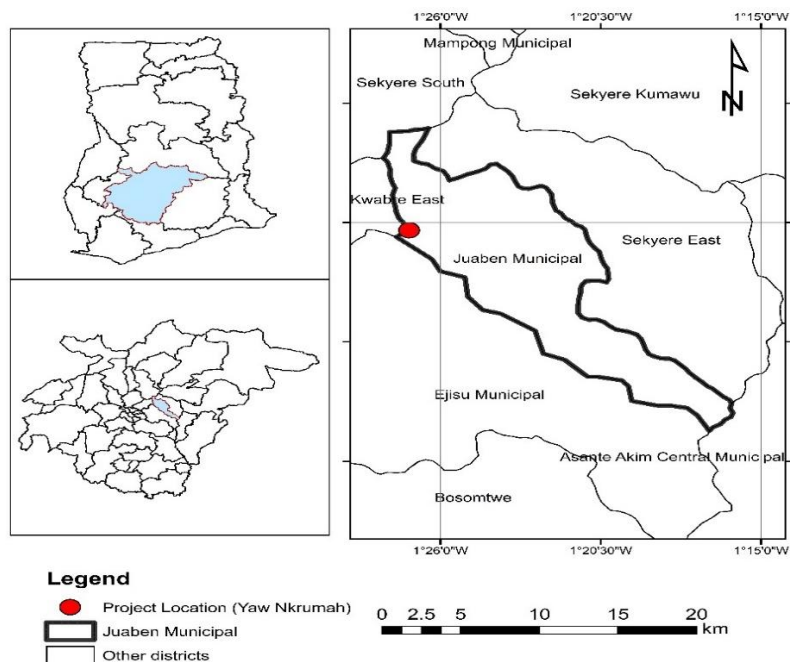


Figure 16: Location of Odamu Valley (Yaw Nkrumah) within the Juaben Municipal, FSRP2, 2024

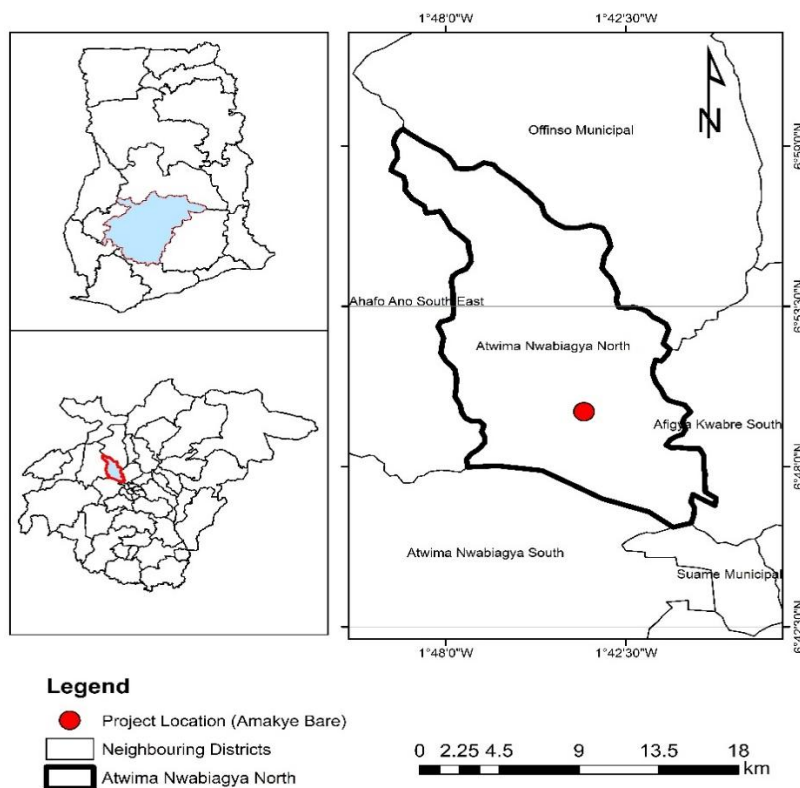


Figure 17: Location of Offino Valley at Barekese/Amakye Bare - Atwima Nwabiagya District, FSRP2, 2024

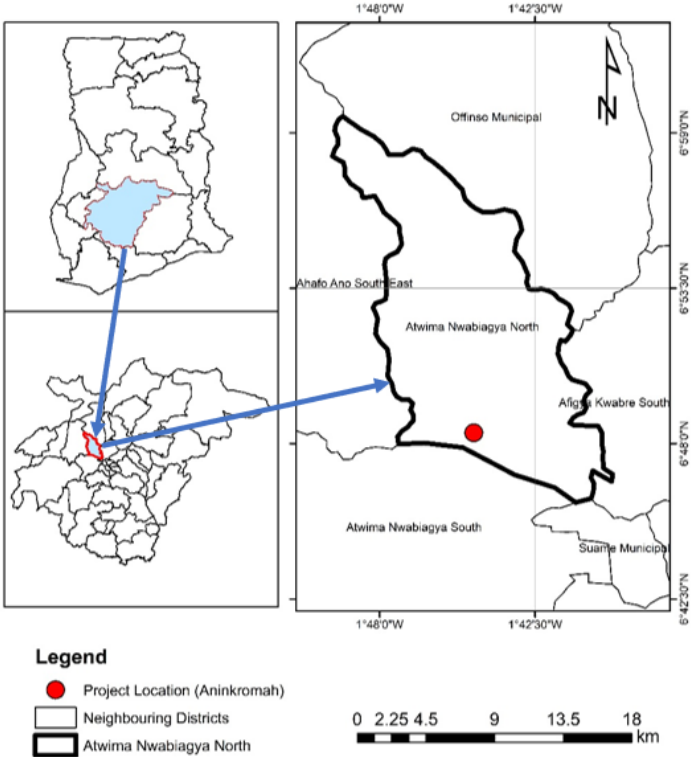


Figure 18: *Location of Waamu/Kumi Valley (Aninkromah) - Atwima Nwabiagya District, FSRP2*

Figures 14 through 18 illustrate the locations of the valleys included in the Lot 3 schemes. Figure 14 provides an overview of all five schemes in relation to both the Ashanti Regional map and the map of Ghana. Figures 15 to 18 present the locations of each scheme within their respective district maps and the national context.

3.6.2 Scheme Layout Maps of the Valleys

Figures 19, 20, 21, 22 and 23 provide the scheme layout maps for the five valleys.

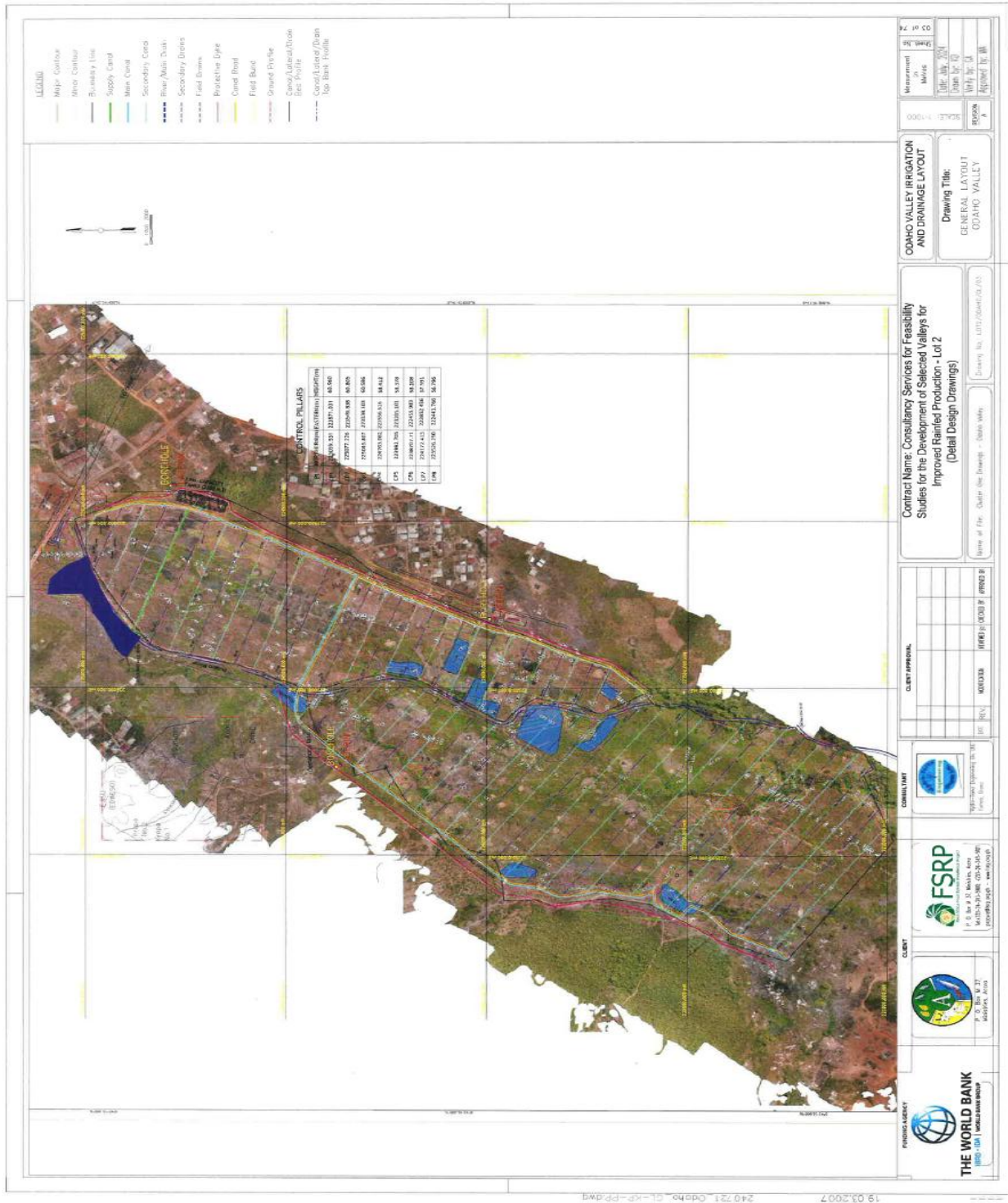


Figure 19: Scheme Layout for the Odaho Inland Valley, FSRP2, 2024

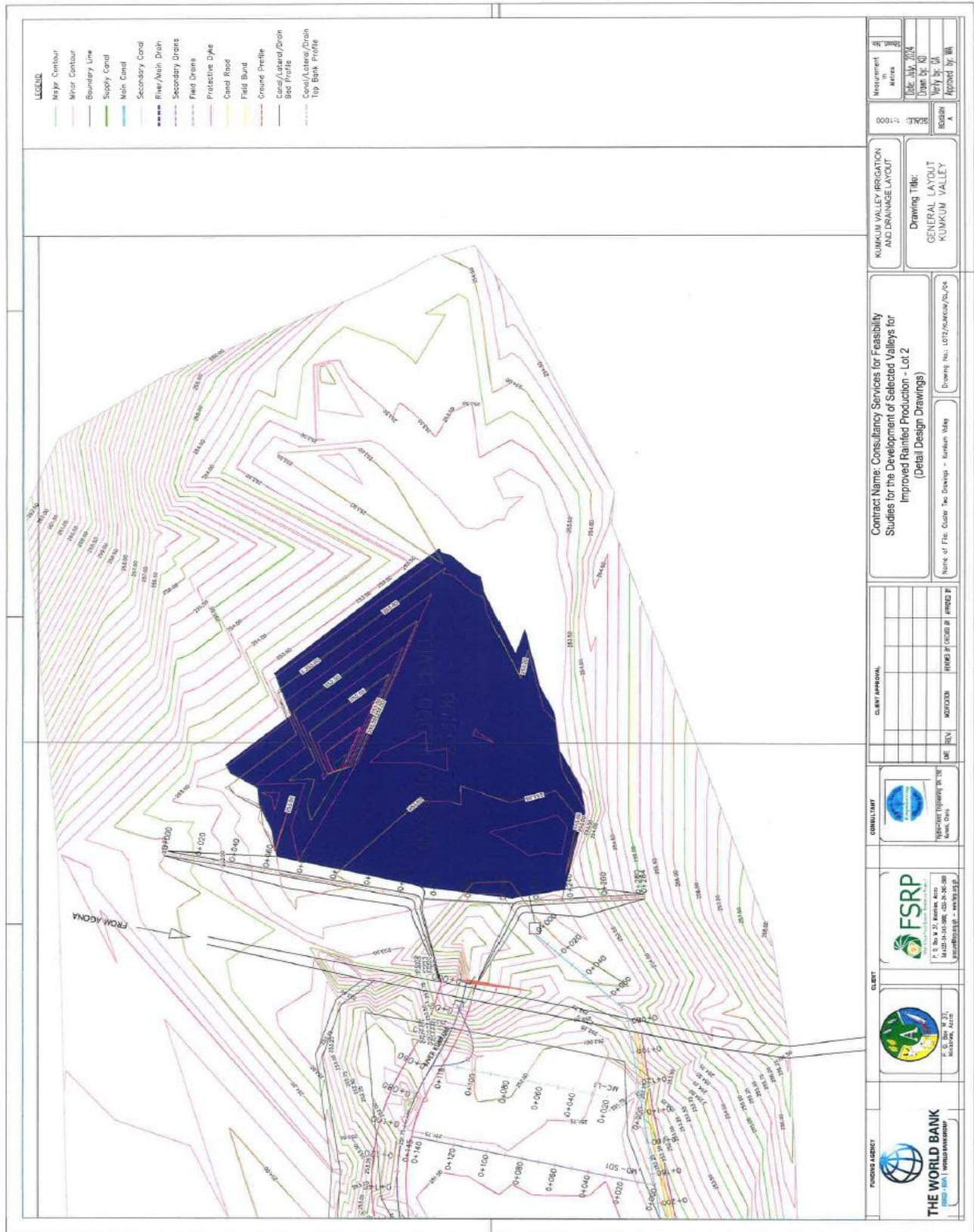


Figure 21: Scheme Layout for the Kumkum Inland Valley, FSRP2, 2024





4.0 PROJECT ALTERNATIVES

The project alternatives considered the following proposed aspects of the works and cropping systems in the various valleys:

- a) Headwork structures;
- b) Canals and drainage facilities;
- c) Alternative irrigation systems; and
- d) Alternative cropping in the valley other than rice.

4.1 Headworks Structures

Currently, none of the valleys at Waamu/Kumi Valley and the Offino Valley in the Atwima Nwabiagya North District, Kumkum Valley in the Sekyere South District, Odamu Valley in the Juaben District and the Odaho Valley in the Ejisu Municipal Assembly is operated with headworks hence there are no water storage structures for use by farmers during the lean periods. During the rainy season, the lack of headwork structures leads to excessive water inflows into the rice fields leading to flooding. This option therefore will not be able to solve the flooding issues with the field. Therefore, not constructing headwork structures is not a viable option.

The alternative is to construct low-head weir(s), emergency gates and closure embankments to be on the upstream portions of the field along the natural streams. The natural streams/channels will be deepened to improve drainage in the fields with the addition of the embankment dykes which will prevent flooding of the rice fields and will improve yields of farmers. This will also help farmers to be able to cultivate rice all year round with better water management structures which will help them to cope with climate change and weather variability. The headwork structures design also considered the water demand along the various stream channels to ensure there is adequate water for downstream users. The weirs and stream channels are designed to discharge 50-year flood flows (life period of the water structures) to adequately support the valley in rice cultivation.

The following are the benefits of the selected alternative to farmers in enhanced water management and climate resilience:

- The improved regulation of water through low-head weirs and emergency gates strengthens farmers' ability to manage water year-round.
- Deepened natural streams and controlled embankments reduce vulnerability to erratic rainfall, helping farmers cope with climate variability and long-term climate change.
- The design's consideration of downstream water demand supports equitable and sustainable water allocation across the catchment.
- Maintaining a steady flow of water helps to prevent stagnation, which in turn reduces the risk of mosquito breeding and the associated health problems.
- The resultant improved water retention and distribution can support wetland functions and microhabitats along the stream channels.
- Designing the structures to safely discharge 50-year flood flows enhances long-term flood protection for the entire valley.

4.2 Canals and Drainage Structures

The current canals in the valleys are unlined and not properly distributed in the fields. Additionally, most of the canals are silted with sand and other debris. Not lining the required sections and deepening the canals and constructing additional ones will worsen the flooding situation of the fields. This will continue to limit the area available for rice farming. The eventual result will however make the valleys not viable for rice farming.

The selected alternative is to construct more field canals and drains to facilitate water distribution into the fields and in the downstream portions of the various valleys. Field drains are provided to receive excess water from canals and laterals. Frequent flooding of the rice fields is therefore prevented through improved channel sections and dikes of appropriate levels which have been proven to be cost-effective and will require less maintenance.

Preventing frequent flooding in these valleys not only protects the health and safety of farmers but also helps avoid drowning incidents and other related hazards.

4.3 Alternative Irrigation Systems

The following alternative irrigation systems were analysed for the various valleys:

- Sprinkler irrigation systems;
- Centre pivot irrigation systems;
- Surface irrigation systems;
- Drip irrigation systems.

The sprinkler irrigation systems use pressurised water to spray water from nozzles, mimicking rainfall and providing water to plants. Since these valleys are always flooded, the use of sprinkler systems would not be appropriate. Additionally, this system requires pumping and the use of electricity which is more sophisticated and costlier for the smallholder farmers in the various valleys.

The centre pivot irrigation system uses overhead sprinkler irrigation consisting of several segments of pipe (usually galvanized steel or aluminium) joined together and supported by trusses, mounted on wheeled towers with sprinklers positioned along its length. This is also not ideal because of the high initial cost and the mushy landscape nature of the valleys which cannot support the movement of the centre pivot system.

Drip irrigation systems involve dripping water onto the soil at very low rates (2-20 litres/hour) from a system of small-diameter plastic pipes fitted with outlets called emitters or drippers. Drip irrigation delivers water only to the plant root zone hence not proposed as an alternative for these valleys because these areas have been designated rice valleys and already experience inundation for almost the whole year.

Surface irrigation systems deliver water to crops using a gravity-fed, overland flow of water. This is proposed and for Waamu/Kumi Valley and the Offino Valley in the Atwima Nwabiagya North District, Kumkum Valley in the Sekyere South District, Odamu Valley in the Juaben District and the Odaho Valley in the Ejisu Municipal Assembly since these valleys support this system of irrigation.

The following are the environmental and social benefits expected to be derived from the selected surface irrigation system for the valleys:

- The method is simple and low-cost technology which is accessible to the smallholder farmers. This is also the system they are currently used to hence does not require extended training periods.
- This method can easily be adapted to local conditions and traditional farming practices.
- The surface irrigation system supports groundwater recharge through infiltration.
- It may also lead to uneven water distribution and higher water use if not well managed by the farmers.

4.4 Alternative Cropping

Other crops that can be considered for cultivation in the valleys may include maize, vegetables such as okra, pepper among others. This can be in addition to the rice cultivation in these valleys. These other crops other than rice may be considered for areas that experience fewer inundation since these proposed alternative crops do not grow well in waterlogged areas.

The environmental and social benefits of cultivating other crops like maize, okra, and pepper in the valleys alongside rice include enhancing food security and income diversification for smallholder farmers, improving dietary diversity and nutrition, and reducing economic vulnerability by providing alternative livelihoods. Environmentally, these crops can be grown in less inundated areas, optimizing land use and reducing risks related to waterlogging and soil degradation.

Crop diversification also helps interrupt pest and disease cycles common in monocultures and may lower methane emissions compared to continuous flooded rice cultivation, contributing to climate mitigation. These diversifications support community resilience and can stimulate local market development and value chains, strengthening rural economies.

5.0 PROJECT BASELINE INFORMATION

5.1 The Project Baseline Methodology

The FSRP2 Inland Valley Lot 3 projects are located in the Ejisu, Juaben, Sekyere South and Atwima Nwabiagya Districts in the Ashanti Region. The baseline information-gathering methodology combines data collection methods such as document review, institutional and community consultations, focus group discussions and field surveys of the existing environment. The following specific document sources were reviewed as part of the methodology:

- Ghana Statistical Service (GSS), 2021. Population and Housing Census, General Report Vol 3A_Population of Regions and Districts.
- The Ejisu, Juaben, Sekyere South and Atwima Nwabiagya North Districts Assemblies Composite Budgets within 2020-2026 Programme Based Budget Estimates;
- Assemblies Draft Medium-Term Development Plans for 2018-2021; and
- Ghana AIDS Commission, 2022. National and Sub-National HIV and AIDS Estimates and Projections.

The information gathered from these sources has formed part of the baseline information covering the four districts in this Environmental and Social Impact Assessment (ESIA). The baseline information has also been used in the environmental analysis. Detailed results of the stakeholder consultations and involvement are attached in the appendices.

The baseline information covering the socio-economic, cultural, physical and biological environment for the four (4) districts is presented under the following categories:

- Socio-economic conditions;
- Climatic (rainfall, temperature and humidity) conditions;
- Water resources, drainage and flooding;
- Topography, geology and soil characteristics;
- Water and sanitation; and
- Flora and fauna.

5.2 The Ejisu Municipal

The Ejisu Municipal Assembly was established by the Local Government Instrument 2297 (2017) having been established earlier as part of the Ejisu-Juaben Municipal Assembly through the revoked Local Government Law (PNDC Law 2007). The Municipality is one of the 261 Metropolitan, Municipal and District Assemblies (MMDAs) in Ghana, and forms part of the 43 MMDAs in the Ashanti Region with Ejisu as its administrative capital.

The Municipality is located in the central part of the Ashanti Region and was earmarked for the creation of an inland port for Ghana to serve the northern section of the country. It is located within longitudes 1°5'W and 1°39' W and latitudes 7°9' N and 7°36'N. It has a large land size of about 1,782.2sq.km. (690.781sq. miles) and is the fifth largest district in the Ashanti region's 30 districts.

The Ejisu Municipal Assembly derives its authority as the highest administrative and political body exercising deliberative, legislative and executive functions in the Municipal Assembly from the Local Government Act 2016, Act 936 (specifically Section 3 of Act 936). The Assembly operates an eight-tier structure with vertical

linkages between the various hierarchies and a consultative relationship between units on the same level. There is the Municipal General Assembly at the apex; the Executive Committee is at the second level, followed by the Municipal Chief Executive who is a nominee of the President subject to the confirmation of the Assembly. The Municipal Chief Executive is the chairperson of the Executive Committee and also the political and administrative head of the Municipal Assembly. The Municipality is divided into six (6) zonal councils with a total of ninety-three (93) communities and twenty-eight (28) electoral areas. The Assembly has forty-two (42) Assembly members made up of twenty-eight (28) elected Ejisu Municipal Assembly 6 and twelve (12) appointed members, one Member of Parliament and the Municipal Chief Executive.

The Ejisu Municipal shares boundaries with six (6) other Districts in the Region. To the north-east and north-west of the Municipal are Sekyere East District and Kwabre East Municipal respectively. In the south are Bosomtwe District and Asante Akim South Municipal, to the east is the Asante Akim North Municipal and to the west is the Kumasi Metropolitan. Figure 24 is a map of Ejisu.

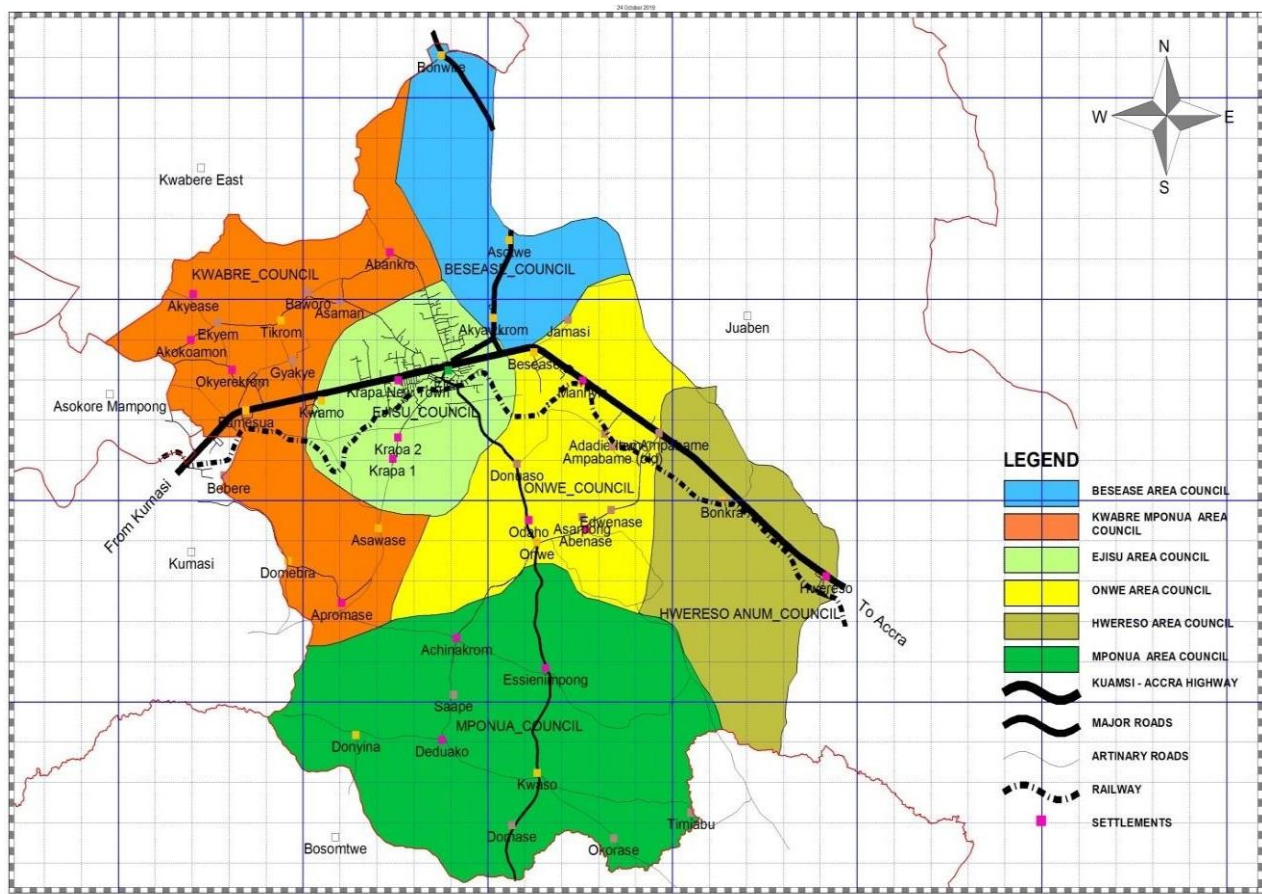


Figure 24: Map of Ejisu Municipal. Source: Ejisu Municipal Assembly

5.2.1 Socio-economic Conditions

The district economy is agriculture-dominated; however, it is increasingly becoming service and commerce-based. The service sector ranks second to agriculture in terms of the number of people it employs. This sector includes education, health, banking, hospitality, tourism, trade, ICT, etc.

Agriculture dominates the local economy by the greater number of people it employs, with about 87.2% of the people engaged full-time. There are two main types of agricultural practices in the Municipality, namely, crop farming (food and cash crops farming) and animal husbandry. Most households practice a mixture of the two. However, the majority of farmers (more than 90%) are food crop farmers. Some of the produce include cereals such as maize, rice and tubers such as cassava, and cocoyam yams. The area is also conducive to livestock production such as poultry, sheep, goats and pigs.

The strategic location of the Assembly has made it a preferred destination when it comes to trading of farm produce, as there is always fresh produce readily available for the market women who travel from neighbouring towns like Kumasi and Konongo etc, with some coming from as far as Accra to buy the farm produce and other foodstuffs and grains on market days to their respective places. The Municipality has four main market centres, notably, the Ejisu market, Boama-Dumase, Onwe market and Abenase market. There are twelve financial institutions in the Ejisu municipality namely Ghana Commercial Bank, Juaben Rural Bank, Best Point, Agricultural Development Bank, Yaa Asantewaa Rural Bank, Consolidated Bank of Ghana, Multi credit, Quick Credit, Abenaase Cooperative Union, Kumawuman Rural Bank, Ramsey Credit Union, and Assemblies of God Credit Union.

5.2.1a Role of Women, Gender-Based Violence, Poverty, and Social Protection

Approximately 64% of employed women are engaged in agriculture, primarily in crop farming (maize, plantain, cassava, cocoyam, vegetables, cocoa, oil palm, and rice) and livestock rearing.

While district-specific GBV prevalence data are scarce, regional and national surveys according to 2021 Population and Housing Census (PHC) indicate that approximately 24–30% of women aged 15–49 in Ghana have experienced physical or sexual violence, with emotional violence also widespread.

According to the 2021 PHC, 13.5% of Ejisu’s population lives in multidimensional poverty, with an average intensity of 43.6%. The main deprivations are in improved toilet facilities (67.6%), health insurance coverage (40.5%), and overcrowding (35.3%). Women, especially widows, divorced, and single mothers, are disproportionately affected, as are persons with disabilities and children in female-headed households. Only 36.4% of women have secondary sources of income, mainly related to agriculture.

Social protection programs such as Livelihood Empowerment Against Poverty (LEAP) and the National Health Insurance Scheme (NHIS) provide some relief.

5.2.2 Demography

The population of the Municipality according to the 2021 Population and Housing Census stands at 180,723 with 87,836 males and 92,887 females. The Ejisu Municipal has 39.8% of its population between the ages of day one (1) and fourteen (14) consisting of 20.2% males and 19.6% females. The ages of 15 to 64 also account for 58.3% which is the active population.

5.2.3 Education

The municipality has one (1) private university and a vocational institute. There are 137 kindergarten schools: 56 public and 81 private. There exist 136 primary schools made up of 56 public and 80 private schools. There are 52 public Junior High School(s)(JHS) as against 41 private ones. Amongst 6 Senior High Schools, 1 is privately managed. There exist 2 TVET institutions.

5.2.4 Health

The Municipality can boast of twenty-eight (28) health facilities (Clinics, hospitals and CHPS) located at 25 communities. There are nine (9) public health facilities located at Achiase, Ejisu, Fumesua, Kwaso, Onwe, Peminase, Tikrom, New Koforidua and Nkerapoaso. The private health facilities are thirteen (13) in number while the missionaries constitute six (6) in number. The Doctor-patients ratio of the Municipality is 1:7,616 and Nurse - Patient ratio is 1:936 while the Midwife - Patient ratio is 1:2,220. The total staff strength stood at 948. The twenty-eight (28) health facilities in the municipal are detailed in Table 17 below.

Table 17: Health Facilities in Ejisu Municipality

Type of Facilities	Number 28
Hospital	9 (Govt -2, CHAG – 4, Private - 3)
Health Centres	2 (all Govt)
Government Maternity Home & Clinic	2
Private Maternity Homes	11
Mission Clinics	1
Community-based Health Planning & Services (CHPs) compounds	3

The Ejisu Municipal Health Directorate is divided into three divisions namely: Ejisu Metro, Onwe Sub-Metro and Ejisu Sub-Metro. The Donuaso Project site is located in the Onwe Sub-Metro which for data accessed for 2020, 2021 and 2022 had Severe Malaria as the most recorded Out-Patient Department (OPD) diagnosis for the three years.

Other top ten OPD diagnoses recorded in 2020, 2021 and 2022 in the Ejisu Municipality included Severe Malaria, Hypertension, Pneumonia, Gastroenteritis, Orchitis and Anaemia.

Tables 18, 19, and 20 provide the top ten (10) OPD cases for the various sub-metros in the Municipality for 2020, 2021 and 2022 according to the Municipal Health Directorates.

Table 18: Health Statistics of the Project Area – Onwe Sub-Metro

Onwe Sub-Metro						
No	Principal Diagnosis	2020	Principal Diagnosis	2021	Principal Diagnosis	2022
1	Severe Malaria	64	Severe Malaria	121	Severe Malaria	472
2	Hypertension	48	Hypertension	48	Causes of Morbidity Unknown and	143
3	Gastroenteritis	34	Unspecified	24	Unspecified	142
4	Causes of Morbidity Unknown and	34	Anaemia	21	Hypertension	99
5	Unspecified	22	Pneumonia	18	Orchitis	82
6	Infection of Urinary Tract (UTI)	19	Causes of Morbidity Unknown and	18	Pneumonia	54
7	Pneumonia	12	Unspecified	13	Anaemia	43
8	Anaemia	11	Gastritis	13	Gastroenteritis	34
9	Gastritis	10	Malaria	12	Infection of Urinary Tract (UTI)	30
10	Enteric Fever	10	Infection of Urinary Tract (UTI)	11	Gastritis	27

(Source: Ejisu Municipal Health Directorate, Ejisu, 2024)

Table 19: Health Statistics of the Ejisu Sub-Metro

Ejisu Sub-Metro						
No	Principal Diagnosis	2020	Principal Diagnosis	2021	Principal Diagnosis	2022
1	Severe Malaria	223	Malaria	182	Hypertension	90
2	Malaria	172	Severe Malaria	114	Severe Malaria	89
3	Gastroenteritis	122	Hypertension	83	Gastroenteritis	72
4	Hypertension	120	Gastroenteritis	51	Neonatal Sepsis	45
5	Causes of Morbidity Unknown and	91	Enteric Fever	34	Neonatal jaundice	43
6	Unspecified	62	Causes of Morbidity Unknown and	34	Fever (Unspecified)	41
7	Hyperglyceamia	60	Unspecified	31	Myoma Uteri	37
8	Neonatal Asphyxia	54	Neonatal Asphyxia	29	Pneumonia	36
9	Enteric Fever	45	HIV Infection	27	Malaria	34
10	Neonatal Sepsis	43	Gastritis	25	Asthma	26

(Source: Ejisu Municipal Health Directorate, Ejisu, 2024)

Table 20: Health Statistics of the Ejisu Metro

Ejisu Metro						
No	Principal Diagnosis	2020	Principal Diagnosis	2021	Principal Diagnosis	2022
1	Malaria	287	Severe Malaria	235	Severe Malaria	561
2	Severe Malaria	176	Malaria	195	Hypertension	232
3	Hypertension	168	Hypertension	131	Causes of Morbidity Unknown and	151
4	Gastroenteritis	156	Gastroenteritis	57	Unspecified	118
5	Infection of Urinary Tract (UTI)	125	Causes of Morbidity Unknown and Unspecified	52	Pneumonia	115
6	Anaemia	64	Enteric Fever	46	Gastroenteritis	109
7	Enteric Fever	64	Pneumonia	46	Orchitis	64
8	Causes of Morbidity Unknown and Unspecified	60	Gastritis	45	Anaemia	60
9	Gastritis	57	Anaemia	39	Malaria	60
10	Diabetes Mellitus	54	Neonatal Asphyxia	31	Neonatal jaundice	54

(Source: Ejisu Municipal Health Directorate, Ejisu, 2024)



Figure 25: *Health Facilities in the Ejisu Municipal Area*

5.2.5 Water and Sanitation

The main sources of water in the Municipality are boreholes, public taps and pipe-borne water. However, more than half of the households in the Municipality (60.9%) drink water from boreholes. The most widely used method of solid waste disposal is by dumping in open space accounting for 65 percent. About one in ten households (4.4%) dump their solid waste indiscriminately (Ghana PHC 2021). House-to-house waste collection accounts for 1.3 percent. For liquid waste disposal, throwing waste onto the compound (34.9%) and onto the street (43.4%) are the two most common methods used by households in the Municipality. About 6.4 percent of the population in the Municipality has no toilet facilities. Zoomlion Company is in the district helping to manage the sanitation situation.

The Ejisu Municipal Assembly currently has an un-engineered landfill site at Kwapah in the district which currently serves as the final disposal site under the management of Zoomlion Waste Management Company of Ghana. The management of the Ejisu Municipal Assembly is currently exploring available land to construct an engineered landfill site (with consultations far advanced) with financial support from Zoomlion Ghana.

5.2.6 Climate

The Municipality lies within the semi-deciduous forest zone with characteristics similar to those of the rain forests in Ghana. Most tree species shed their leaves during the dry season at varying periods in the season. The Municipality is characterised by two well-defined major and minor rainfall seasons. The major rainfall season begins in March and ends in July with the month of September recording the highest rainfall over the past eleven years (2013 – 2023) according to data from the Ghana Meteorological Agency. This is indicated in the rainfall pattern in the figure below. The minor rainfall season commences in September and ends in November, with a peak rainfall in the month of September.

The mean annual rainfall for the area ranges between 1050mm to 1300mm. In the past eleven years (2013 – 2023), June 2018 has recorded the highest average monthly rainfall of about 430mm. The mean minimum annual temperatures range between 22-23°C and the mean maximum annual temperatures range between 30 - 32°C according to data from Ghana Meteorological Agency for the past eleven years (2013 – 2023).

Figures 26, 27, and 28 show the rainfall and temperature distributions for the Ejisu Municipality for the past eleven years (2013 – 2023) according to the Ghana Meteorological Agency.

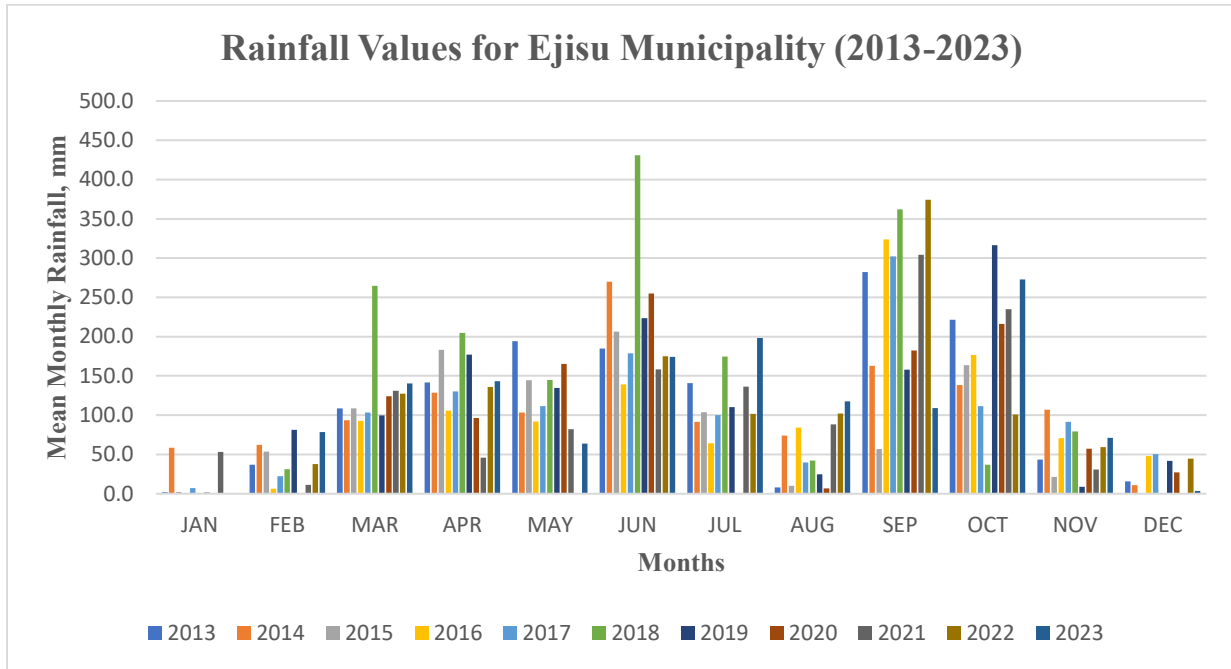


Figure 26: *Rainfall Values for Ejisu, 2024*

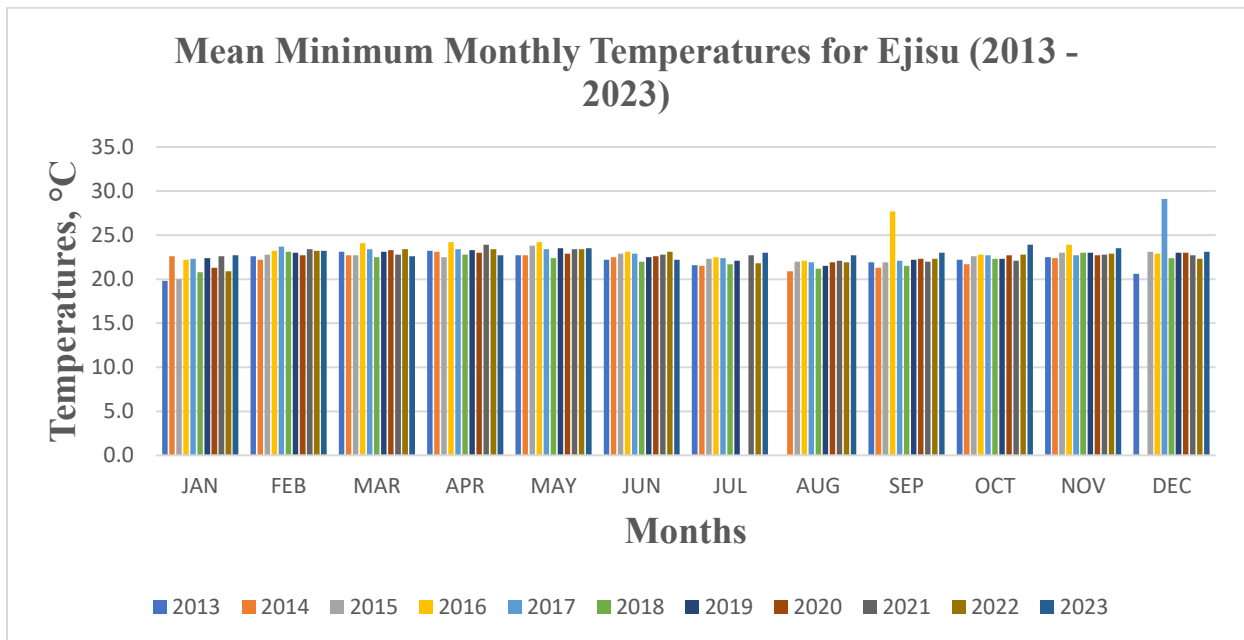


Figure 27: *Minimum Temperature Values for Ejisu, GMET, 2024*

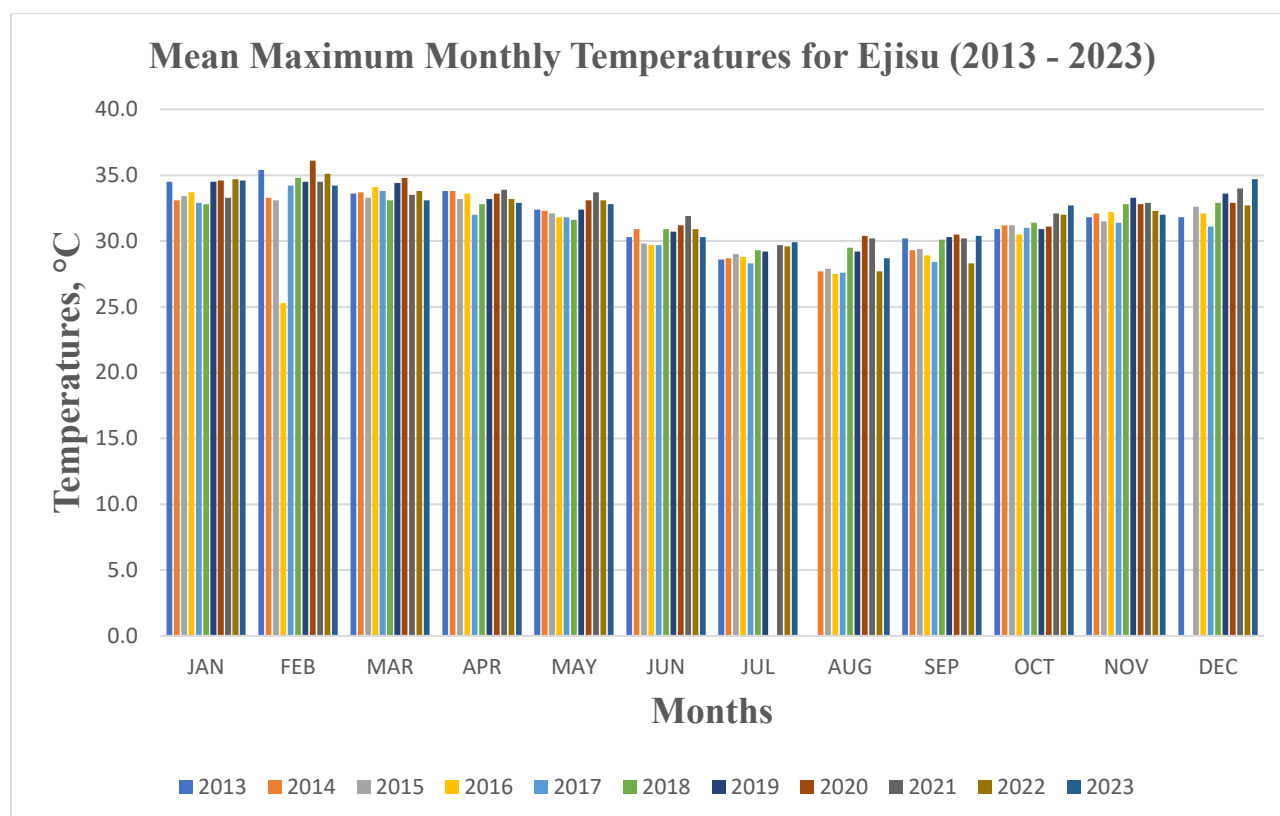


Figure 28: Maximum Temperature Values for Ejisu, GMET, 2024

5.2.7 Geology and Soils

The geology and soil types in the Municipality offer vast opportunities for the cultivation of traditional and non-traditional cash crops and other staple foodstuffs and thus present the municipality as one of the food baskets in Ghana. The geology and soil types found in the Municipality include the Kumasi-Offin Compound Association, Bomso-Offin Compound Association, Swedru-Nsuba Simple Association, and Boamang-Suko Simple Association. Bekwai-Oda Compound Association, Kobeda-Eschiem-Sobenso-Oda Compound Association, Atunkrom-Asikuma Association (Adu 1999).

5.2.8 Topography and Drainage

The Municipality falls within the forest-dissected plateau terrain region. This region is underlain by the pre-cambrian rocks of the Birimian and Tarkwaian formations. It rises from about 240 metres to 300 metres above sea level. The area is generally undulating and is drained by a number of rivers, notable among them being Oda, Anum, Bankro, Hwere and Baffoe. In the rainy season, occasional flooding is experienced in the inland valleys along the river basins which is as a result of the siltation of the drainage channels.

The Oda Inland Valley at Donuaso is drained by the Oda River, a perennial water source which is used by the farmers for rice irrigation in the inland valley. Figure 29 is a map of the Oda River catchment area. Table 20 shows the characteristics of the Oda catchment area.

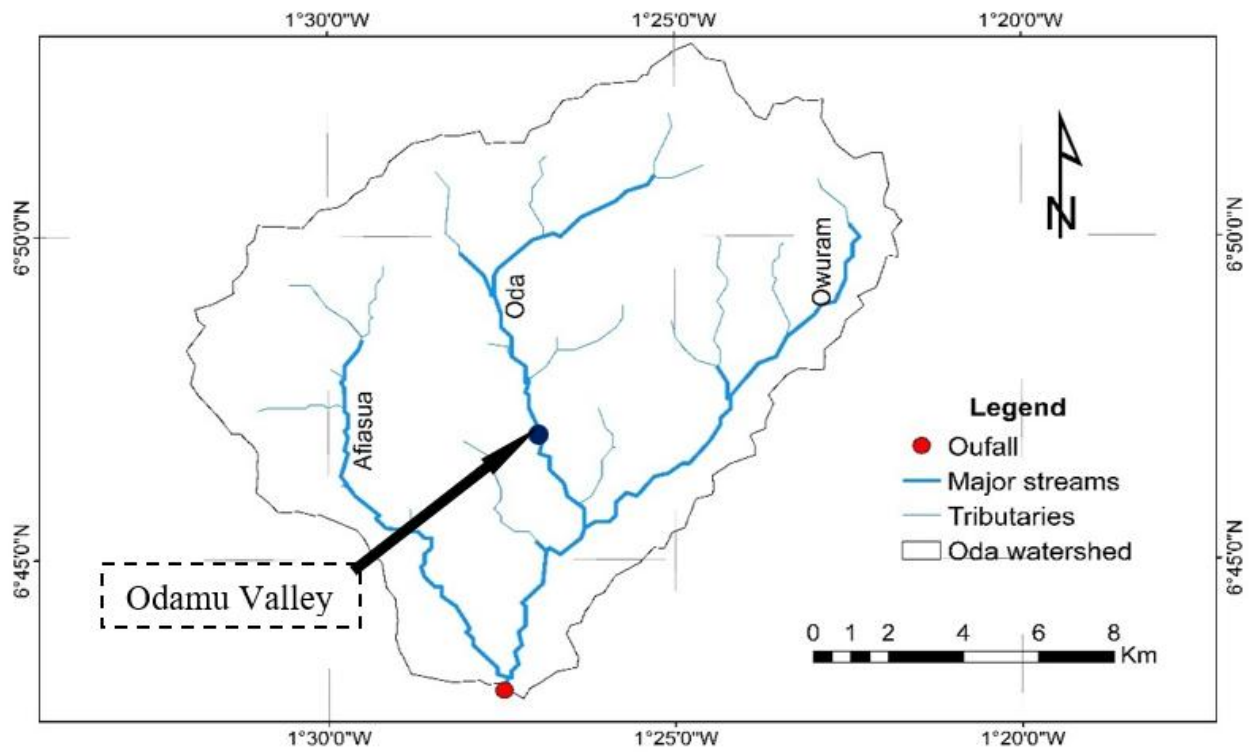


Figure 29: *The Oda Catchment Area*

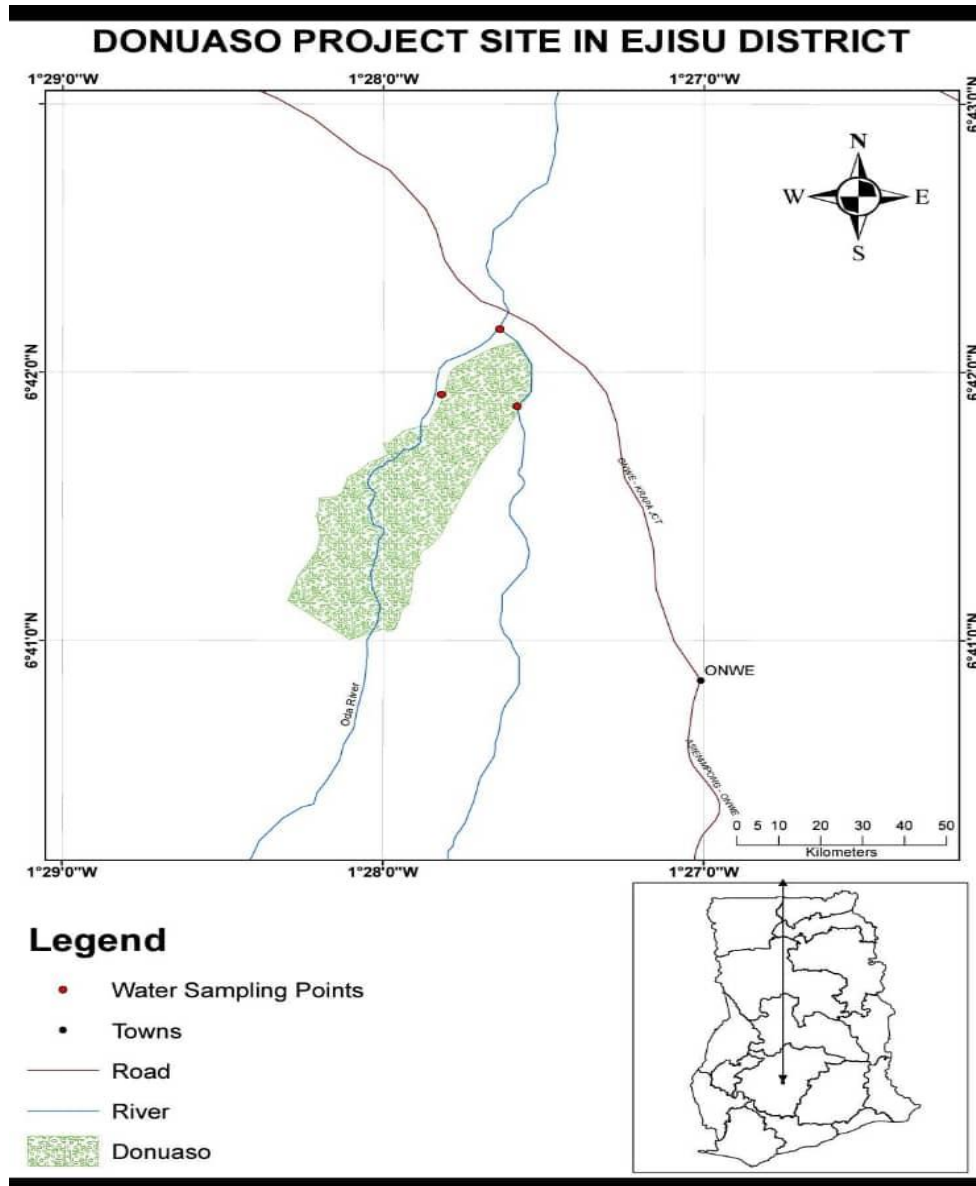


Figure 30: *Drainage Map of the Oda Valley, ESSERM Consult, 2024*

Table 21: *Key Characteristics of the Oda Catchment Area*

Parameter	Value	Unit
Catchment area	199	km ²
Longest flow path	26	km
Minimum elevation	253	m
Maximum elevation	307	m
Average catchment slope	0.26	-

5.2.9 Oda River and Water Quality Analysis

Three (3) geo-referenced sampling points were used in establishing water quality baseline conditions of the Oda River. These points described in Table 22 are located upstream, mid-stream and downstream of the main field at Donuaso.

The field water samples were taken into two different sample holding containers for the different analyses. The sample holding containers for the micro-bacteriological assay had been autoclaved (sterilised). The stations were geo-referenced with a Garmin Etrex GPS.



Figure 31: *Water Sampling from the Oda Stream*

The water samples were kept in an ice chest containing ice blocks (to inhibit biological and other processes) and subsequently taken for laboratory analyses at the Water Research Institute (WRI) of the Council for Scientific and Industrial Research (CSIR), Accra. The descriptions of the sites and parameters analysed are shown in Tables 22 and 23 respectively.

Table 22: *Water Quality Sampling Locations*

No	Codes	Description	GPS Coordinates	
			N/°	W/°
1	ED 1	Oda River entering the Donuaso field	06.70543	001.46034
2	ED 2	Oda River in the Donuaso field (midstream)	06.70135	001.46336
3	ED 3	Oda River downstream the Donuaso field	06.70063	001.45943

Table 23: *Water Quality Results_Oda River*

Parameter	Unit	Location Values			FAO Irrigation Water Guideline	GSA – Raw Water Specification	WHO Guideline
		ED 1	ED 2	ED 3			
Turbidity	NTU	10.3	6.55	8.12	-	5	5
Colour (apparent)	Hz	10.0	7.50	7.50	-	-	15
Odour	-	-	-	-	-	Shall be Unobjectionable	Inoffensive
pH	pH Units	6.99	7.00	6.26	6.0-8.5	6.5-8.5	6.5-8.5
Conductivity	μS/cm	124	129	64.8	0-3000	-	-
Tot. Susp. Solids (SS)	mg/l	9.00	7.00	8.00	-	0	-

Parameter	Unit	Location Values			FAO Irrigation Water Guideline	GSA – Raw Water Specification	WHO Guideline
		ED 1	ED 2	ED 3			
Tot. Dis. Solids (TDS)	mg/l	74.4	77.4	38.9	0-2000	500max	1000
Sodium	mg/l	10.5	10.5	5.80	0-920	-	200
Potassium	mg/l	6.20	6.70	0.500	0-2	-	30
Calcium	mg/l	9.46	8.90	5.77	0-400	-	200
Magnesium	mg/l	2.76	1.89	2.03	0-60.8	-0.4	150
Total Iron	mg/l	1.46	0.759	1.58	5.0	0.3	0.3
Ammonia (NH ₄ - N)	mg/l	0.126	0.063	<0.001	0-5	-	0.00 – 1.5
Chloride	mg/l	9.43	10.3	5.06	0-1050	<250	250
Sulphate (SO ₄)	mg/l	4.29	2.72	5.74	0-960	<250	250
Phosphate (PO ₄ - P)	mg/l	0.123	0.025	0.092	0-2	-	-
Manganese	mg/l	0.083	<0.005	<0.005	-	0.4 (Max)	0.4
Nitrite (NO ₂ -N)	mg/l	0.003	<0.001	0.002	-	3.0 (Max)	1.0
Nitrate (NO ₃ -N)	mg/l	0.091	0.095	0.040	0-10	50 (Max)	10
Total Hardness (as CaCO ₃)	mg/l	35.0	30.0	22.8	0-610	500 (Max)	500
Total Alkalinity (as CaCO ₃)	mg/l	48.4	48.0	22.8	-	-	-
Calcium Hardness (as CaCO ₃)	mg/l	23.6	22.2	14.4	-	-	-
Mag. Hardness as CaCO ₃)	mg/l	11.4	7.76	8.37	-	-	-
Fluoride	mg/l	0.180	0.290	<0.010	0 – 1	-	1.5
Bicarbonate (as CaCO ₃)	mg/l	57.1	58.9	27.8	0-610	-	-
Carbonate	mg/l	0.00	0.00	0.00	0-30	-	-
SAR	mg/l	0.773	0.834	0.529	-	-	-
Total Coliform (TC) Method: APHA 9222A	(cfu/100ml)	1860	1488	1116		10	0
Faecal Coliform (FC)	(cfu/100ml)	36	112	46	-	-	0

Parameter	Unit	Location Values			FAO Irrigation Water Guideline	GSA – Raw Water Specification	WHO Guideline
		ED 1	ED 2	ED 3			
(cfu/100ml) Method: APHA 9222D							
Escherichia coli (cfu/100ml) Method: APHA9260F	(cfu/100ml)	26	84	30	-	10	0
Total Heterotrophic Bacteria (cfu/l ml) Method: APHA 9215B	(cfu/100ml)	468	676	936	-	10	-

WRI (2023)

From water quality analysis from the table above, the Oda River at the Odaho Valley recorded high values for turbidity, total iron (against WHO and GSA guidelines but below FAO guidelines) and total coliform, faecal coliform and Escherichia coli. These values are way beyond the recommended guidelines by the World Health Organization (WHO) for drinking water and Ghana Standards Authority's (GSA) specifications for raw water. Values for turbidity are from 6.55 to 10.3NTU in the river against the WHO guideline value of 5NTU and GSA guidelines (5NTU) for raw water.

High total coliform values range from 1116cfu/100ml to 1860cfu/100ml, while faecal coliform and E. coli (as a result of human and animal excreta) range from 36cfu/100ml to 112cfu/100ml and 26cfu/100ml to 84 cfu/100ml respectively as against the WHO recommended values for drinking water of 0.0cfu/100ml and GSA's guidelines of 10.0cfu/100ml for raw water. These water sources which are not wholesome for consumption are not used for drinking by the communities.

5.2.9 Vegetation (Flora and Fauna)

The flora and fauna species in the Ejisu Municipality are diverse and composed of different species of both economic and ornamental tree species with varying heights and game and wildlife. The Bobiri Forest Reserve located in the district, which is about 25km from the site, is renowned for its butterfly species, greenery and varied flora and fauna.

The surrounding of the project site is mainly grassland, and the area is marshy during the peak rainy season of the year. The flora is dominated by aquatic species such as *Typha domingensis*, *Ipomoea aquatica*. There are pockets of thickets dominated by bush willows and neem. Most widely occurring and distributed grass species include *Sporobolus pyramidalis* and *Andropogon gayanus*. Other flora species are detailed in Table 24.

Animals usually seen in the area are rats (*Rattus*), grasscutters (*Thryonomys swinderianus*), squirrels (*Rodentia sciurus*) and snakes.

Table 24: Floristic Composition of the Project Site

Scientific Name	Common Name	Habit	Family	Distribution	Conservation Status (IUCN)
<i>Bambusa vulgaris</i>	Bamboo	Grass	Poaceae	Occasional	Not threatened
<i>Elaeis guineensis</i>	African oil palm	Fruit	Arecaceae	Occasional	Not threatened
<i>Raphia hookeri</i>	Raphia palm		Arecaceae	Occasional	Not threatened
<i>Borassus aethiopum</i>	African fan palm	Shrub	Arecaceae	Occasional	Not threatened
<i>Solanum torvum</i>	Pea eggplant	Shrub	Solanaceae	Rare	Not threatened
<i>Sporobolus pyramidalis</i>	Giant rat tail grass	Herb	Poaceae	Dominant	Not threatened
<i>Andropogon gayanus</i>	Gamba grass	Herb	Poaceae	Abundant	Not threatened
<i>Azadirachta indica</i>	Neem	Tree	Meliaceae	Frequent	Not threatened
<i>Sida acuta</i>	wireweed	Herb	Malvaceae	Occasional	Not threatened
<i>Clausena anisata</i>	Horsewood	Shrub	Rutaceae	Occasional	Not threatened
<i>Combretum racemosum</i>	Bush willows	Shrub	Combretaceae	Dominant	Not threatened
<i>Ipomoea aquatica</i>	Water Spinach	Herb	Convolvulaceae	Frequent	Not threatened
<i>Ctenium newtonii</i>	-	Herb	Poaceae	Abundant	Not threatened
<i>Typha domingensis</i>	Cattail/ bulrush	Herb	Typhaceae	Abundant	Not threatened

(ESSERM Consult, 2024)



Figure 32: Nearby Vegetation Types African Oil Palm/Raphia Palm at Odaho Valley

5.3 Juaben Municipal

The Juaben Municipal is located in the Ashanti Region and forms part of the 43 Metropolitan, Municipal and District Assemblies (MMDAs) in the region.

The Juaben Municipal Assembly is carved out of the Ejisu-Juaben Municipal Assembly as one of the 38 newly created and upgraded District Assemblies in 2018 with LI 2296. The Juaben Municipal Assembly has its capital as Juaben.

The Juaben Municipality occupies a land area of 364,674 area (365 sq. km.) and lies in the central part of the Ashanti Region within latitudes 1 15 N and 1 45 N and longitudes 6 15 W and 7 00 W.

The Municipality shares boundaries to the north-east with the Sekyere East and Kwabre East Municipal on the north-west; Ejisu Municipal to the west, Bosomtwe District on the south-west; Asante Akim Central Municipal on the east and the Kumasi Metropolitan Assembly on the north. Figure 33 is a map of the Juaben Municipal area.

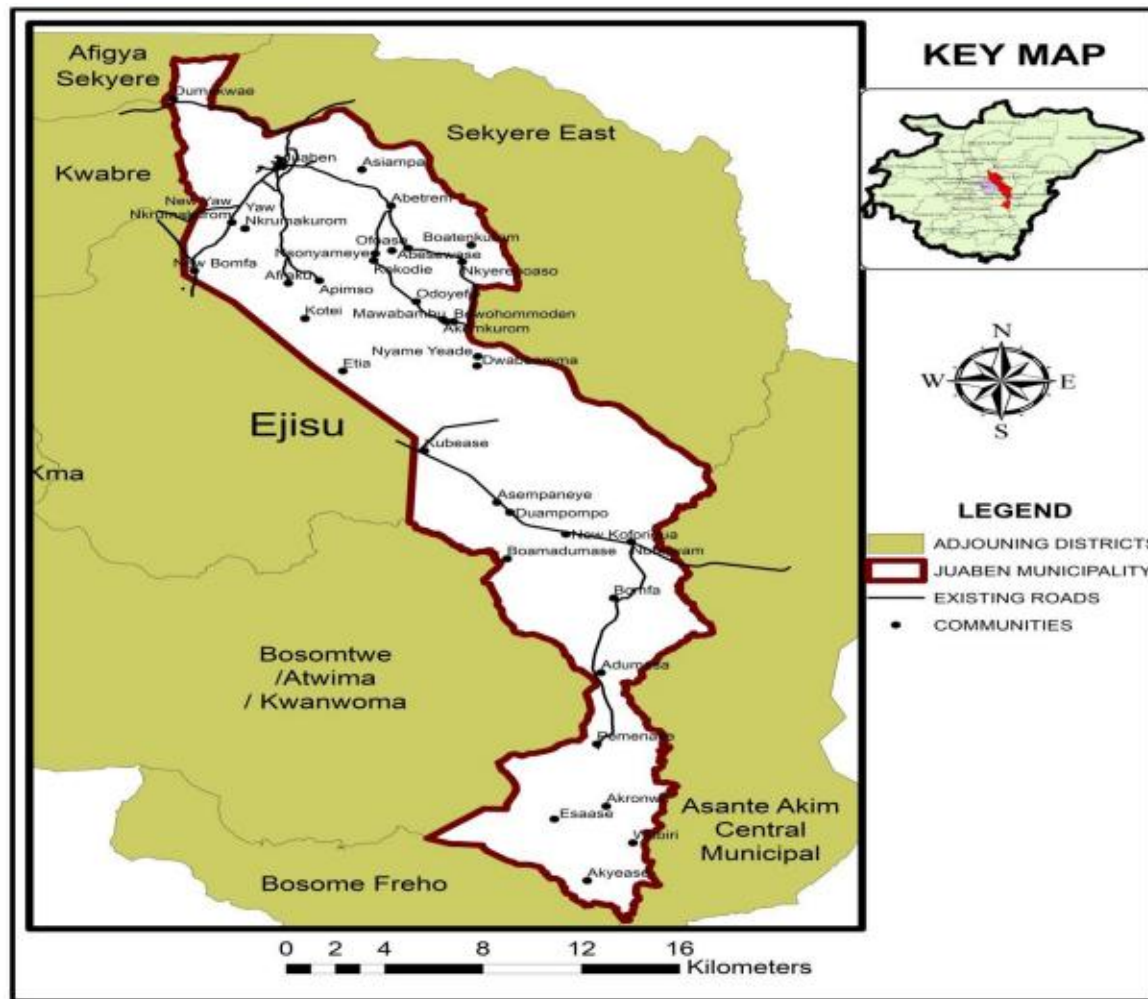


Figure 33: Map of Juaben Municipal, Juaben Municipal, 2024

5.3.1 Socio-economic Conditions

The local economy is agriculture dominated followed by service and commerce activities. Most of the Municipality are engaged in crop farming (96%), with about 20% engaging in livestock rearing, fish farming and tree planting. Most of these crops are cultivated on small-scale basis with only a few individuals engaged in medium to large-scale farming. Farmers cultivate maize, plantain, rice, cocoyam, tree crops and vegetables like pepper, tomatoes, garden eggs, cabbage, carrots cucumber, green pepper and okra on a relatively large scale. The average farm size is as low as 1.9 acres per farmer as against the national average of 5 acres. There is a large oil palm plantation in Juaben which feeds the oil mills situated at Juaben. Only a small portion of agricultural produce such as cassava and maize are processed into gari and corn dough respectively.

There are two (2) major markets in the Municipality namely Juaben and Boamadumasi. Farmers are able to transport farm produce to the market centres and not sell at farm gate prices.

5.3.1a Role of Women, Gender-Based Violence, Poverty, and Social Protection

Women are active in crop and livestock farming, petty trading, and small-scale processing.

The district has a multidimensional poverty incidence of 20.9% and an intensity of 43.1%. The main deprivations are in improved toilet facilities (86.5%), health insurance (51.6%), and cooking fuel (43.3%). Vulnerable groups include women, children, the elderly, and persons with disabilities.

Social protection programs such as LEAP and NHIS are present.

5.3.2 Demography

The population of the Municipality according to the 2021 Population and Housing Census stands at 63,929 with 31,203 males and 32,726 females. The Juaben Municipal has 39.8% of its population within the ages of day one (1) and fourteen (14) consisting of 20.2% males and 19.6% females.

The ages of 15 and 64 also account for 58.3% which is the active population.

5.3.3 Education

There are one hundred and fifty-eight (158) schools with sixty-three (63), fifty-four (54), thirty-six (36) and five (5) KG, Primary, J.H.S and S.H.S respectively. Forty-three (43) out of the sixty-three (63) KG are public schools representing 62.9% and 20 private schools. Also (34) out of the (54) basic schools in the Municipality are public schools with the remaining (20) representing 37% being private schools. There are twenty-nine (29) public J.H.S representing 80.5% and seven (7) private J.H.S representing 19.4%. Currently, there are two (2) functioning S.H.S and newly renewed schools yet to receive students in the Municipality. There are no higher institutions in the Municipality.

5.3.4 Health

There is a total of 12 health facilities in the Juaben Health Directorate. Out of which 7 are public health facilities. There are three private health facilities comprising one health centre, a clinic and a maternity home which serve Boama Dumasa and the adjoining communities and support the SDA Clinic and Bomfa Health Center in Nobewam and Bomfa. Also, there is one (1) hospital, four (4) health centres, three (3) clinics and 3 CHPS compounds including both private, NGO's (Christian Health Association of Ghana (CHAG)) and public facilities. Tables 25 and 26 show health facility types and health statistics in the district respectively. Malaria

remains the leading cause of illness reported across health facilities in Juaben Municipal, consistently accounting for the highest number of recorded disease cases, as shown in Table 26.

Table 25: Juaben Health Facilities by Type and Ownership

Facility by type	Hospitals	Health Centres	CHPS Compound	Maternity Homes	Clinic
Government	1	2	3	0	1
Private	0	1	0	1	1
CHAG	0	1	0	0	1
Total	1	4	3	1	3

Table 26: Juaben Health Directorate Statistics

Juaben Health Directorate Statistics						
No	Principal Diagnosis	2020	Principal Diagnosis	2021	Principal Diagnosis	2022
1	Malaria	9883	Malaria	11077	Malaria	10339
2	Rheumatism & Other Joint Pains	4255	Upper Respiratory Tract Infections	6027	Upper Respiratory Tract Infections	5750
3	Upper Respiratory Tract Infections	4016	Rheumatism / Other Joint Pains / Arthritis	4131	Rheumatism / Other Joint Pains / Arthritis	3899
4	Anaemia	1996	Anaemia	2515	Diarrhoea Diseases	2192
5	Diarrhoea Diseases	1936	Diarrhoea Diseases	2151	Acute Urinary Tract Infection	2010
6	Skin Diseases	1917	Acute Urinary Tract Infection	2013	Skin Diseases	1837
7	Acute Urinary Tract Infection	1728	Skin Diseases	1776	Anaemia	1693
8	Intestinal Worms	1543	Intestinal Worms	1477	Intestinal Worms	1080
9	Ulcer	802	Acute Eye Infection	1069	Ulcer	1041
10	Acute Eye Infection	700	Ulcer	972	Acute Eye Infection	897

(Source: Juaben Health Directorate, Ejisu, 2024)

5.3.5 Water and Sanitation

The main sources of potable water in the Juaben Municipality are hand-dug wells and boreholes. The Assembly through the Government of Ghana and Safe Water Foundation has provided water systems and boreholes in some communities in the Municipality. According to the Community Water and Sanitation Agency (CWSA, 2022) water coverage in the Municipality stood at 56.1 percent whilst the regional coverage stood at 72.6%. In all, the Municipality has about 347 boreholes, 68 Hand-dug wells fitted with hand pumps. Water and Sanitation (WATSAN) committees have been formed in various communities in the Municipality. There is the presence of a small-town water system at Juaben and Atia.

5.3.6 Climate

As in the case of most of the middle belt in Ghana, the Juaben Municipality experiences tropical rainfall that is a bi-modal rainfall pattern and wet semi-equatorial climate. It is characterised by double maxima rainfall lasting from March to July and again from September and normally ends in the later part of November. The mean annual rainfall is 1200mm. Temperatures range between 20°C in August and 32°C in March. Relative humidity is fairly moderate and high during rainy seasons and early mornings.

5.3.7 Geology and Soils

The geology and soil types in the Juaben Municipality offer vast opportunities for the cultivation of traditional and non-traditional cash crops and other staple foodstuff and thus present the municipality as one of the food basket cases in Ghana. The geology and soil types found in the Municipality include the Kumasi-Offin Compound Association, Bomso-Offin Compound Association, Swedru-Nsuba Simple Association, Boamang-Suko Simple Association, Bekwai-Oda Compound Association, Kobeda-Eschiem-Sobenso-Oda Compound Association, Atunkrom-Asikuma Association.

5.3.8 Topography and Drainage

The Juaben Municipality falls within the forest-dissected plateau terrain region. This region is underlain by the pre-cambrian rocks of the Birimian and Tarkwaian formations. It rises from about 240 metres to 300 metres above sea level. The area is generally undulating and is drained by a number of rivers, notable among them being Oda, Anum, Bankro, Hwere and Baffoe. In the rainy season, occasional flooding is experienced in the inland valleys along the river basins. Figure 34 is a map of the Oda catchment area and Figure 35 is the drainage map at Yaw Nkrumah.

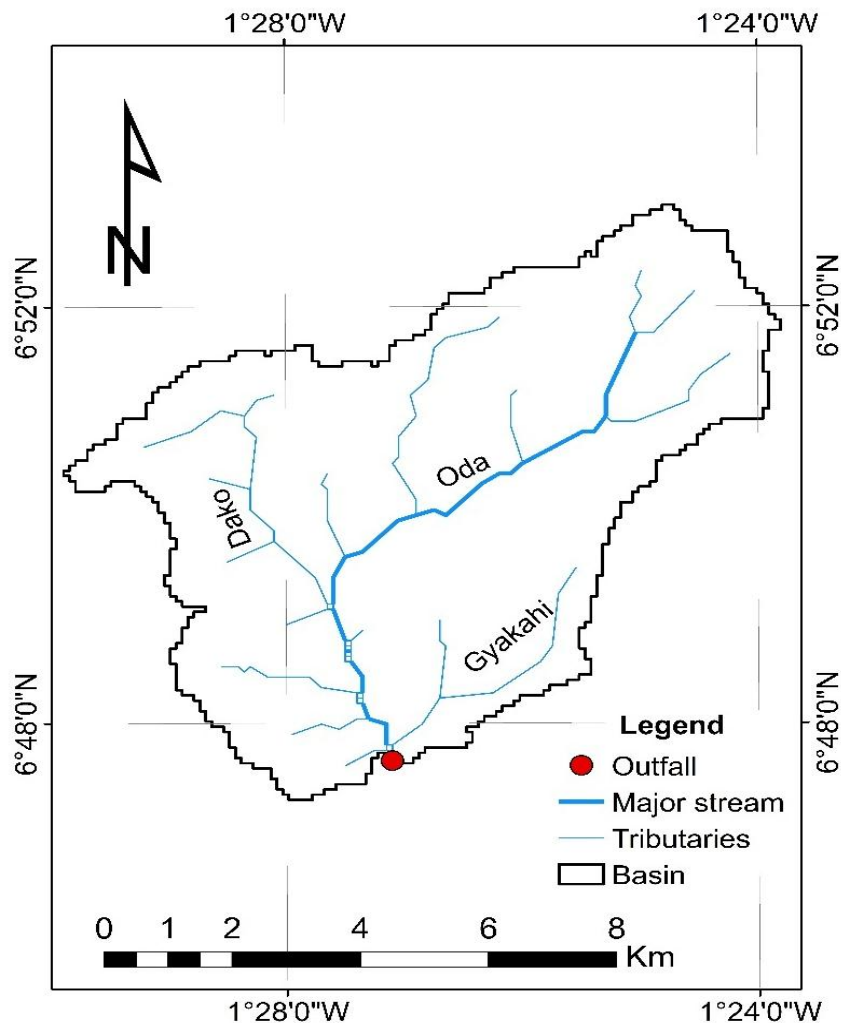


Figure 34: Odamu Catchment at Yaw Nkrumah, FSRP2 2024

YAW NKRUMAH PROJECT SITE IN JUABEN MUNICIPAL

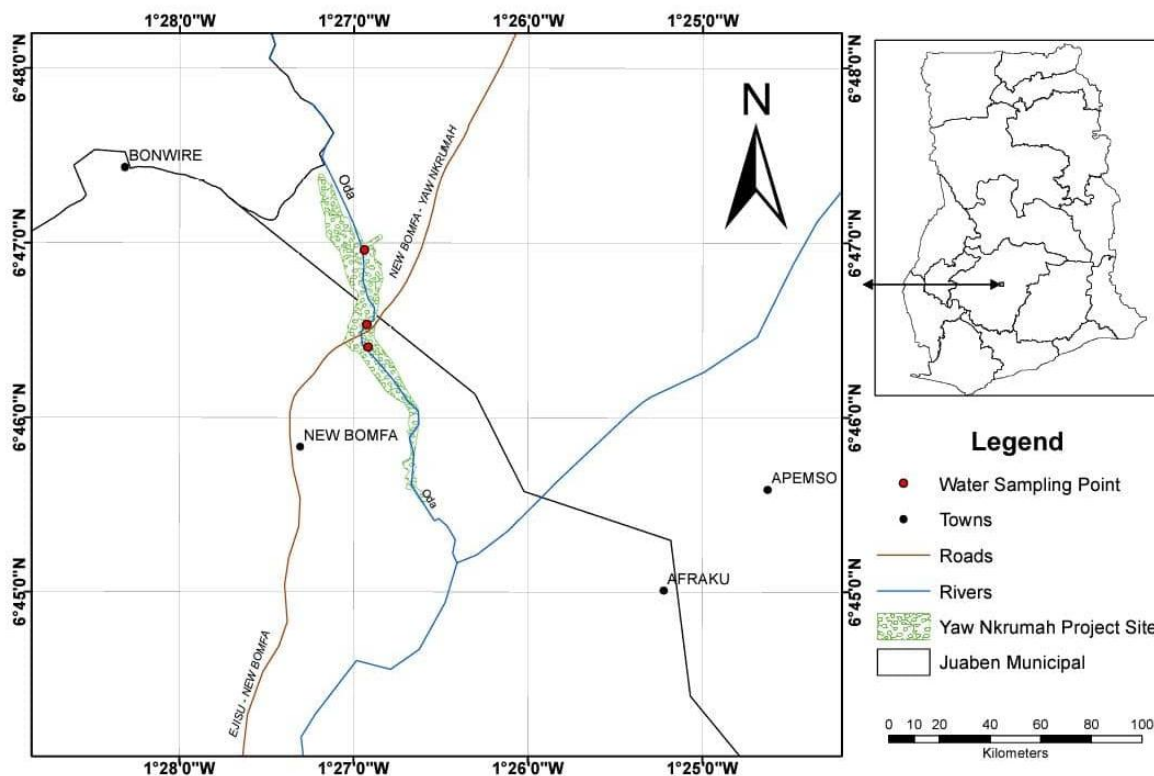


Figure 35: Drainage Map of the Odamu Valley with Water Sampling Points, ESSERM, 2024

The characteristics of the Odamu catchment at Yaw Nkrumah are shown in Table 27. Water sampling locations are shown in Table 28 whereas the results of water quality analysis are shown in Table 29 respectively.

Table 27: Key Characteristics of the Oda Catchment at Yaw Nkrumah

Parameter	Value	Unit
Area	60.68	km ²
Longest flow path	13.3	km
Minimum elevation	275	m
Maximum elevation	367	m
Average catchment slope	1.30	-

Table 28: Water Quality Sampling Locations

No	Codes	Description	GPS Coordinates	
			N/°	W/°
1	JYN 1	Oda/Odamu River entering the Odamu field	06.78541	001.44872
2	JYN 2	Oda/Odamu River in the Odamu field (midstream)	06.77828	001.44849
3	JYN 3	Oda/Odamu River downstream the Odamu field	06.77612	001.44836



Figure 36: Water Sampling from the Odamu Stream

Table 29: Water Quality Results

Parameter	Unit	Location Values			FAO Irrigation Water Guideline	GSA Raw Water Specifications	WHO Guideline
		JYN 1	JYN 2	JYN 3			
Turbidity	NTU	9.87	7.02	8.54	-	5	5
Colour (apparent)	Hz	10.0	7.50	7.50	-	-	15
Odour	-	-	-	-	-	Unobjectionable	Inoffensive
pH	pH Units	6.96	7.00	7.07	6.0-8.5	6.0-8.5	6.5-8.5
Conductivity	μS/cm	97.3	92.6	8.00	0-3000	-	-
Tot. Susp. Solids (SS)	mg/l	10.0	7.00	57.5	-	0	-
Tot. Dis. Solids (TDS)	mg/l	58.4	55.6	87.0	0-2000	500 Max	1000
Sodium	mg/l	8.20	8.90	4.80	0-920	-	200
Potassium	mg/l	4.70	4.60	7.30	0-2	-	30
Calcium	mg/l	7.21	7.30	1.89	0-400	-	200
Magnesium	mg/l	3.39	2.13	1.20	0-60.8	0.4	150
Total Iron	mg/l	2.03	1.63	0.117	5.0	0.3	0.3
Ammonia (NH ₄ -N)	mg/l	0.162	0.146	8.24	0-5	-	0.00 – 1.5
Chloride	mg/l	8.14	8.24	4.32	0-1050	<250	250
Sulphate (SO ₄)	mg/l	6.54	5.52	0.236	0-960	<250	250
Phosphate (PO ₄ -P)	mg/l	0.047	0.067	<0.005	0-2	-	-
Manganese	mg/l	0.078	<0.005	0.002	-	0.4 (Max)	0.4
Nitrite (NO ₂ -N)	mg/l	0.006	<0.001	0.064	-	3.0 (Max)	1.0
Nitrate (NO ₃ -N)	mg/l	0.079	0.072	26.0	0-10	50 (Max)	10
Total Hardness (as CaCO ₃)	mg/l	32.0	27.0	38.4	0-610	500 (Max)	500
Total Alkalinity (as CaCO ₃)	mg/l	40.2	38.2	18.2	-	-	-

Parameter	Unit	Location Values			FAO Irrigation Water Guideline	GSA Raw Water Specifications	WHO Guideline
		JYN 1	JYN 2	JYN 3			
Calcium Hardness (as CaCO ₃)	mg/l	18.0	18.2	7.76	-	-	-
Mag. Hardness as CaCO ₃)	mg/l	14.0	8.76	0.620	-	-	-
Fluoride	mg/l	0.480	0.080	0.469	0 – 1	-	1.5
Bicarbonate (as CaCO ₃)	mg/l	49.0	46.6	0.00	0-610	-	-
Carbonate	mg/l	0.00	0.00	0.742	0-30	-	-
SAR	mg/l	0.631	0.745	-	-	-	-
Total Coliform (TC) Method: APHA 9222A	(cfu/100ml)	1488	1116	1488	-	10	0
Faecal Coliform (FC) (cfu/100ml) Method: APHA 9222D	(cfu/100ml)	16	70	44	-	10	0
E. Coli (cfu/100ml) Method: APHA9260F	(cfu/100ml)	12	36	24	-	10	0
Total Heterotrophic Bacteria (cfu/l ml) Method: APHA 9215B	(cfu/100ml)	520	416	1404	-	10	0

WRI (2023/24)

At Yaw Nkrumah in the Juaben Municipality, the water quality analysis from the Oda River at the Odamu Valley recorded elevated values for turbidity total coliform, faecal coliform and Escherichia coli against WHO and GSA guidelines. These values are above the recommended drinking water guidelines by the World Health Organization (WHO) and Ghana Standards Authority Guidelines for raw water. Values for turbidity are from 7.02 to 9.87NTU in the river against the WHO and GSA guideline value of 5NTU.

High total coliform values range from 1116cfu/100ml to 1488cfu/100ml, while faecal coliform and E. coli (as a result of human and animal excreta) range from 16cfu/100ml to 70cfu/100ml and 12cfu/100ml to 36 cfu/100ml respectively as against the WHO recommended values of 0.0cfu/100ml for drinking water and GSA's specification of 10.0cfu/100ml for raw water.

5.3.9 Vegetation (Flora and Fauna)

The flora and fauna are diverse and composed of different species of both economic and ornamental tree species with varying heights and game and wildlife. The Bobiri Forest Reserve for example is renowned for its butterfly species, greenery and varied flora and fauna.

Table 30: Floristic Composition of the Project Site

Scientific Name	Common Name	Habit	Family	Distribution	Conservation Status (IUCN)
<i>Raphia hookeri</i>	Raphia palm		Arecaceae	Occasional	Not threatened
<i>Borassus aethiopum</i>	African fan palm	Shrub	Arecaceae	Occasional	Not threatened
<i>Bambusa vulgaris</i>	Bamboo	Grass	Poaceae	Occasional	Not threatened
<i>Elaeis guineensis</i>	African oil palm	Fruit	Arecaceae	Occasional	Not threatened
<i>Azadirachta indica</i>	Neem	Tree	Meliaceae	Frequent	Not threatened
<i>Sida acuta</i>	wireweed	Herb	Malvaceae	Occasional	Not threatened
<i>Clausena anisata</i>	Horsewood	Shrub	Rutaceae	Occasional	Not threatened
<i>Solanum torvum</i>	Pea eggplant	Shrub	Solanaceae	Rare	Not threatened
<i>Sporobolus pyramidalis</i>	Giant rat tail grass	Herb	Poaceae	Dominant	Not threatened
<i>Andropogon gayanus</i>	Gamba grass	Herb	Poaceae	Abundant	Not threatened
<i>Combretum racemosum</i>	Bush willows	Shrub	Combretaceae	Dominant	Not threatened
<i>Ipomoea aquatica</i>	Water Spinach	Herb	Convolvulaceae	Frequent	Not threatened
<i>Ctenium newtonii</i>	-	Herb	Poaceae	Abundant	Not threatened
<i>Typha domingensis</i>	Cattail/bulrush	Herb	Typhaceae	Abundant	Not threatened

(ESSERM Consult, 2024)

5.4 Sekyere South Municipal

The Sekyere South District (formerly Afigya Sekyere District) is one of the 261 Metropolitan, Municipal and District Assemblies (MMDAs) in Ghana, and forms part of the 43 MMDAs in the Ashanti Region and has its administrative capital as Agona.

The Sekyere South Municipal Assembly (formerly Afigya Sekyere District) is located in the northeastern part of the Ashanti Region is 37 kilometers from Kumasi, along the Kumasi-Mampong trunk road.

The Municipal Assembly has a total land area of 416.8 square kilometers representing about 1.7 percent of the total land size of the Region of 24,389 square kilometers. The district lies between latitude 6° 50'N and 7° 10'N and Longitude 10° 40'W and 10° 25' W.

It shares common borders with Ejura Sekyedumase Municipal to the north, Mampong Municipal and Sekyere East District to the east, Kwabre East Municipal to the south and Offinso Municipality to the west. Figure 37 is a map of the Sekyere South Municipal area.

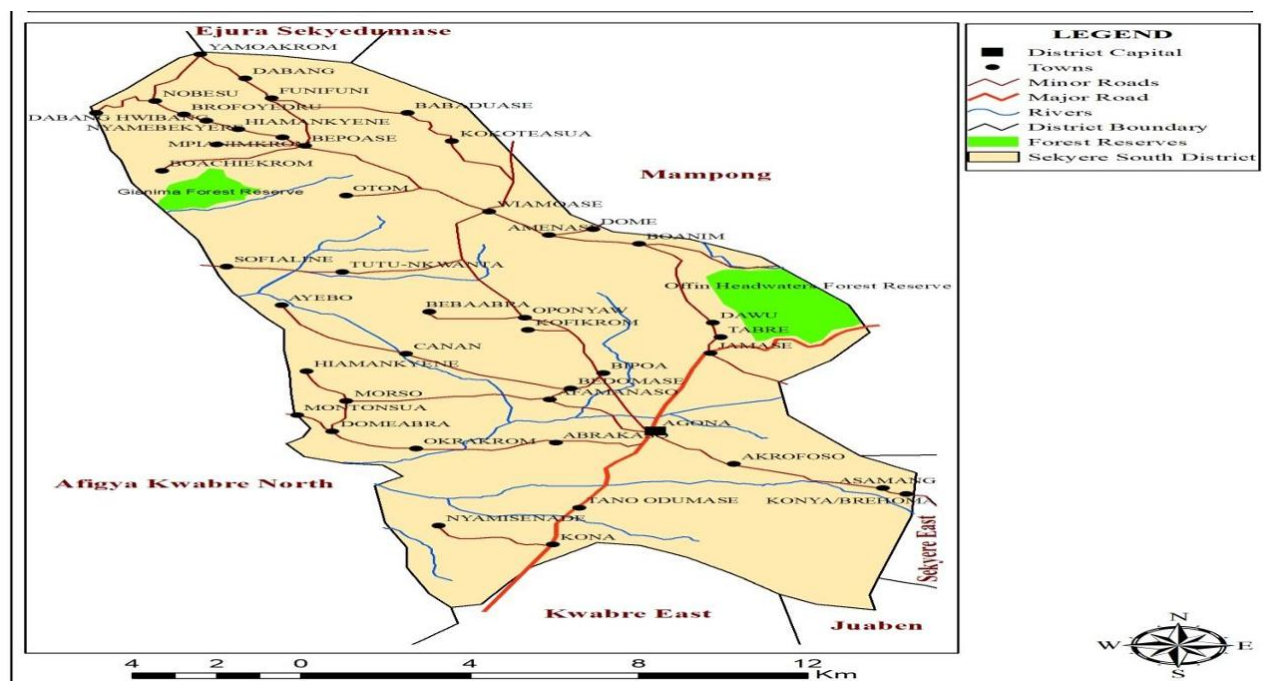


Figure 37: Map of Sekyere South Municipal Area, FSRP, 2024

5.4.1 Socio-economic Conditions

The main economic activity of the district is agriculture which employs 45% of the active population. The major cash and food crops cultivated are; cocoa, cassava, cocoyam, plantain, rice and vegetables.

The district currently has three major weekly markets which are well organised and patronised by people in and outside the region, namely; the Agona market which falls on Tuesdays, Wiamoase market which also falls on Thursdays and Bepoase market which falls on Wednesdays. Alongside these major marketing centres are smaller daily markets found in communities such as Jamasi, Asamang and Kona. Agricultural produce which are normally from the farming centers dominate the trading activities. Commodities such as plantain, banana, cocoyam, maize, cassava and a variety of vegetables besides meats and fish usually dominate the trading activities in these market centres. Also, finished goods such as footwear, clothes, provision items and electronic gadgets are traded in most of these market centres.

The district has a 12km asphalted road which stretches from Asonomaso Junction through Agona to Jamasi, 25km of 2nd class road (tarred) and 125km of feeder roads that link various towns and rural communities. The district has a good road network in most of the communities, notwithstanding some areas and communities are hard to reach, especially in the rainy or wet seasons.

5.4.1a Role of Women, Gender-Based Violence, Poverty, and Social Protection

Women in Sekyere South are engaged in agriculture, services, and small-scale industry. Female employment in the services sector increased from 40.8% (1991–2000) to 50.3% (2001–2010), then declined to 36.5% (2011–2020), while employment in industry grew significantly, surpassing men's employment growth in recent years.

The district has a multidimensional poverty incidence of 22.6% and an intensity of 42.8%, among the highest in the region. The main deprivations are in improved toilet facilities (84%), health insurance (52.5%), and

cooking fuel (44.2%). Vulnerable groups include women, widows, children, the elderly, and persons with disabilities.

Social protection programs such as LEAP and NHIS are present.

5.4.2 Demography

The population of the Sekyere South District according to the 2021 Population and Housing Census stands at 120,076 with 58,065 males and 62,011 females representing 48% and 52% respectively.

5.4.3 Education

The district has 91 kindergartens, 92 primary schools, 65 JHS, 6 Senior High School (SHS), 1 vocational school, 1 College of Education, 1 Special School of Education, one Midwifery Institution and one Private University College.

The district has 2,397 teachers spread across the various basic schools, the 6 SHS and the only vocational school in the district.

5.4.4 Health

There are 6 health centres and 4 hospitals which are fairly distributed in a manner that patients do not need to travel beyond 5km to access healthcare in the district. The district has one (1) CHPS compound and 1 maternity clinic. The top 5 prevalent diseases in the district are Malaria, Diarrhoea, Hypertension, Anaemia and Rheumatism. The district has only 2 doctors and a doctor-patient ratio of 2:57,418. Table 31 shows the health statistics of the district.

Table 31: Sekyere South Health Directorate Statistics

<i>Sekyere South Health Directorate Statistics</i>						
No	Principal Diagnosis	2020	Principal Diagnosis	2021	Principal Diagnosis	2022
1	Malaria	18464	Malaria	18840	Malaria	22789
2	Rheumatism / Other Joint Pains / Arthritis	16302	Rheumatism / Other Joint Pains / Arthritis	14468	Rheumatism / Other Joint Pains / Arthritis	13577
3	Upper Respiratory Tract Infections	9567	Upper Respiratory Tract Infections	12351	Acute Eye Infection	11380
4	Acute Urinary Tract Infection	7316	Acute Urinary Tract Infection	8268	Upper Respiratory Tract Infections	10143
5	Anaemia	6327	Anaemia	6547	Acute Urinary Tract Infection	9086
6	Acute Eye Infection	4535	Pregnancy Related Complications	5049	Anaemia	5901
7	Diarrhoea Diseases	4031	Pneumonia	4540	Pregnancy Related Complications	4578
8	Pregnancy Related Complications	3418	Typhoid Fever	3995	Typhoid Fever	4135
9	Skin Diseases	3284	Diarrhoea Diseases	3933	Pneumonia	4105
10	Typhoid Fever	2895	Skin Diseases	3713	Diarrhoea Diseases	3565

(Source: Sekyere South Health Directorate, 2024)

5.4.5 Water Supply and Sanitation

The Assembly has a designated area as a final waste disposal site which has helped to improve the sanitation of the district. There are also modern pit latrines in the communities in the district.

5.4.6 Climate

The climate of the district is equatorial. It has a double rainfall maxima regime- with the major rainy season occurring between March and July. The minor rainfall season commences in September and ends in November, with a peak rainfall of about 2800mm in the month of June from the year 2013 to 2023. For the same 11-year period, January recorded an average rainfall of about 210mm. Mean annual rainfall for the area ranges between 1290mm and 1,900mm according to Ghana Meteorological Agency recorded figures for the past eleven years (2013 – 2023).

The mean minimum annual temperatures range between 22-23°C and the mean maximum annual temperatures range between 31 - 32°C according to data from Ghana Meteorological Agency for the past eleven years (2013 – 2023). Figures 38, 39 and 40 show the rainfall, minimum and maximum temperature patterns in the district.

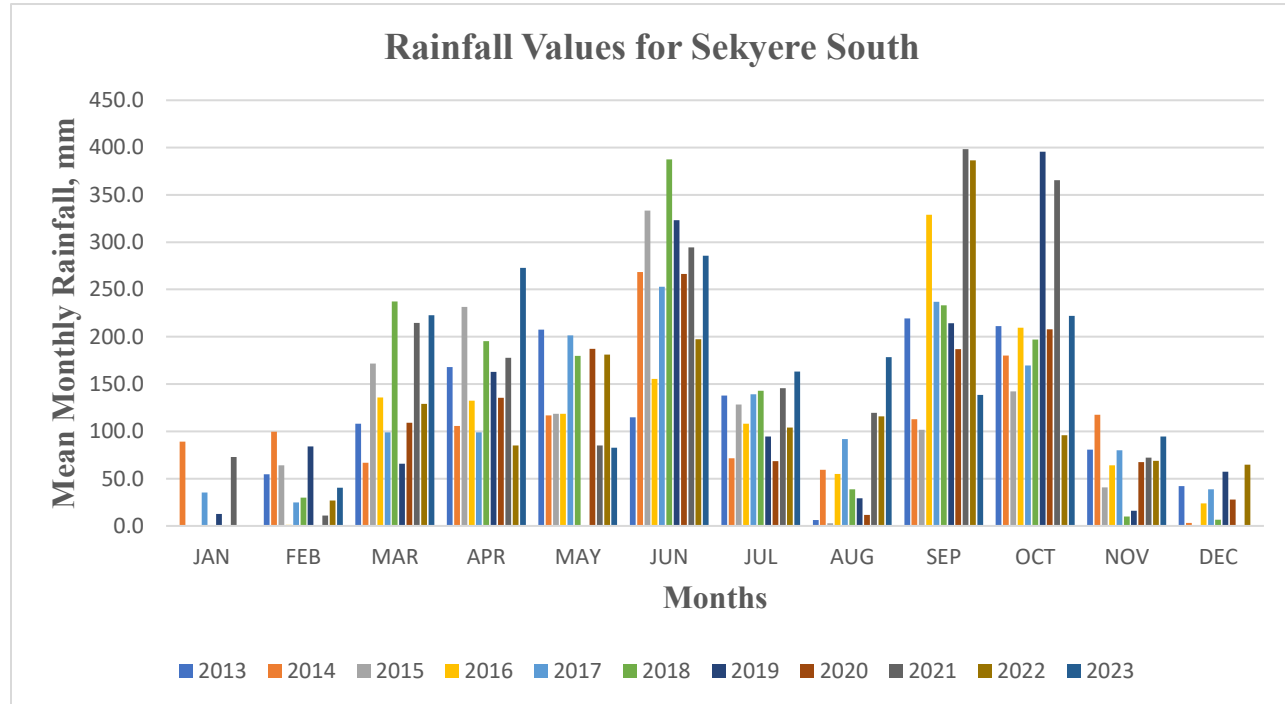


Figure 38: Rainfall Values for Sekyere South District, GMET, 2024

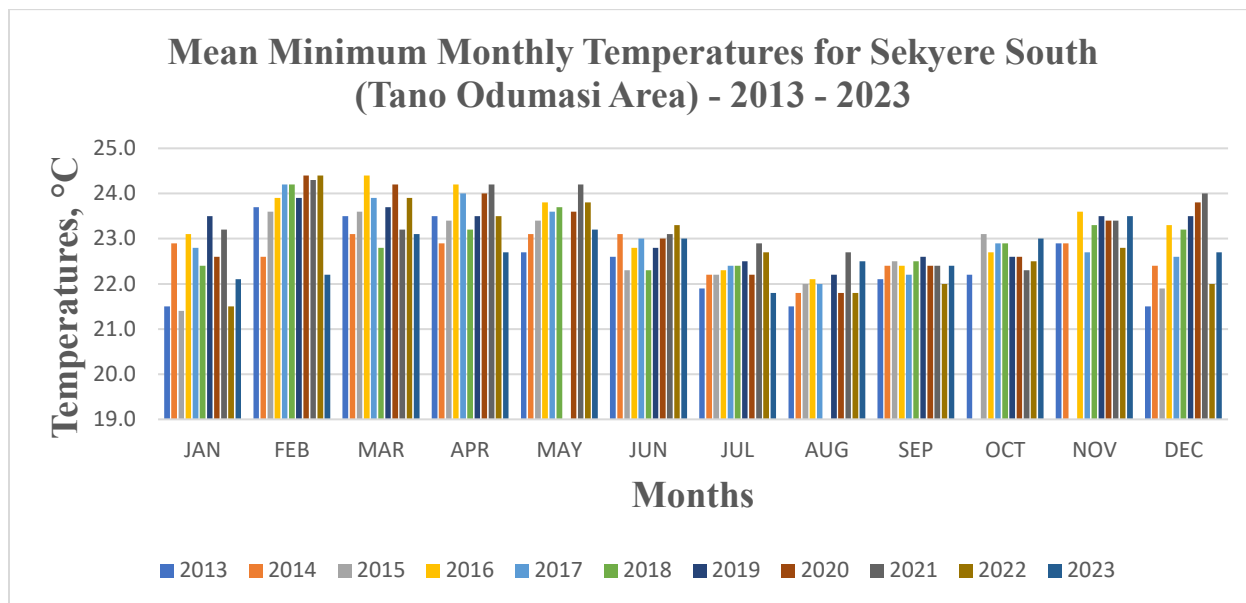


Figure 39: Mean Minimum Temperature Values for Sekyere South District, GMET 2024,

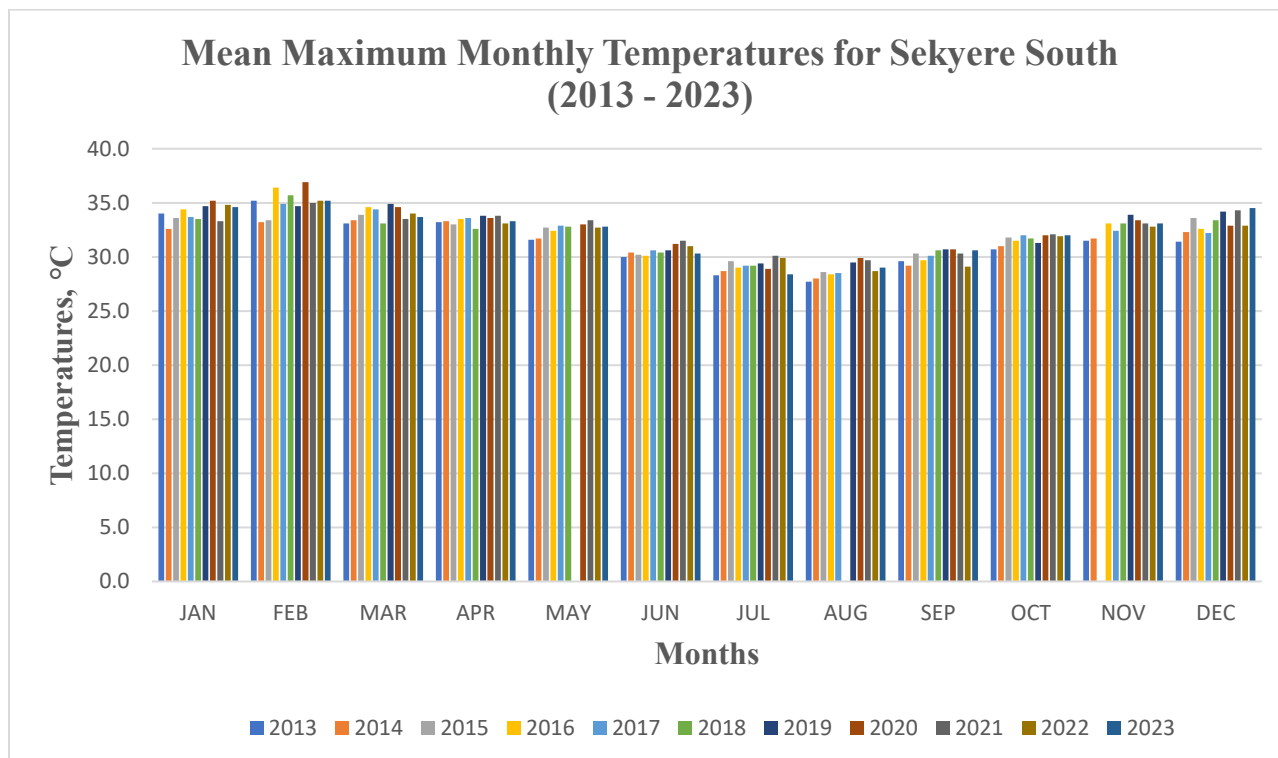


Figure 40: Mean Maximum Temperature Values for Sekyere South District. GMET, 2024

5.4.7 Geology and Soils

There are two geological formations in the district, namely, the Voltaian and Dahomeyan formations. The Voltaian formation was formed through deposition of sediments over a period of time. This mainly consists

of sandstones, shale, mudstone and Limestone. The Dahomeyan formation is one of the oldest formations and it consists mainly of metamorphic rocks such as gneiss and schist.

The main soil types of the district consist of the Kumasi-Offin Compound Association, Bomso-Offin Compound Association, Jamasi Simple Association, Boamang Simple Association, Bediesi-Sutawa Association and Yaya-Pimpimso Association.

The Kumasi-Offin compound soil is ideal for the cultivation of tree crops such as cocoa, citrus, coffee and oil palm. They can also be cultivated for food crops such as plantain, cassava and cocoyam. The Boamang Simple Association is suitable for mechanised and subsistence agriculture but is highly susceptible to erosion and hence control of erosion on such soils is necessary. The Bediesi-Sutawa Association has adequate water-holding capacity and is suited for mechanised agriculture. They support crops such as maize, yams, legumes, cassava, plantain and groundnuts.

5.4.8 Topography and Drainage

The greater part of the district falls within a dissected plateau with heights reaching 800m to 1200m above sea level. The plateau forms part of the Mampong-Gambaga scarp. Many years of erosion have reduced the area to uniformly low heights between 480m and 600m above sea level.

The district is drained by many rivers and streams. Notable among them are the Offin, Oyon and Abankro rivers. The Offin River takes its source from the Mampong scarp and flows between Boanim and through Bipoa to Afamanaso to Duaponkor and Amoako. At Nsuotem, it is joined by the Abankro River. The Oyon also flows from Banko in the Sekyere East District through Yonso in the Sekyere West District to Agona and joins the Offin River at Afamanaso. River Kunkum flows from Obomeng in the Sekyere East District through Asamang to Tano Odumasi and joins the Offin River. Table 32 shows water sampling locations on the Kunkum River. The water quality test results are presented in Table 33.

TANO ODUMASE PROJECT SITE IN SEKYERE SOUTH DISTRICT

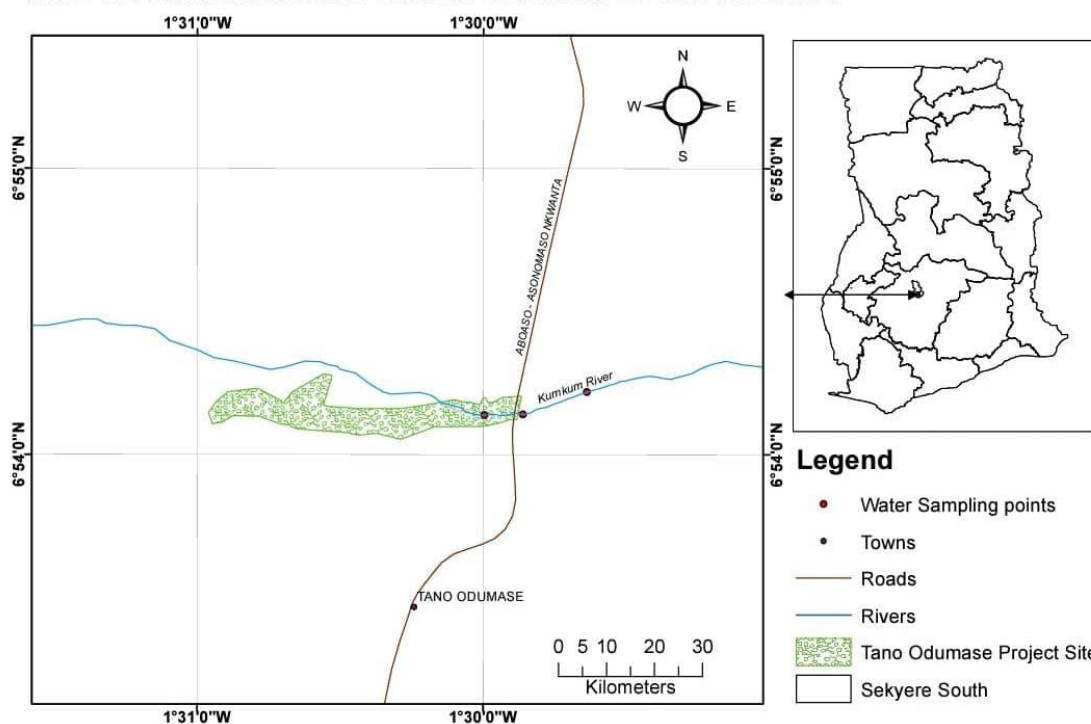


Figure 41: Drainage Map of the Kumkum Valley with Water Sampling Points, ESSERM Consult, 2024

Table 32: Water Quality Sampling Locations

No	Codes	Description	GPS Coordinates	
			N/°	W/°
1	KUM 1	Kumkum River entering the Kumkum field	06.90640	001.49367
2	KUM 2	Kumkum River in the Kumkum field (midstream)	06.9051	001.49739
3	KUM 3	Kumkum River downstream the Kumkum field	06.90506	001.49964



Figure 42: Water Quality Sampling from the Kumkum Stream,

Table 33: Water Quality Results

Parameter	Unit	Location Values			FAO Irrigation Water Guideline	GSA Raw Water Specifications	WHO Guideline
		KUM 1	KUM 2	KUM 3			
Turbidity	NTU	9.41	11.1	9.97	-	5	5
Colour (apparent)	Hz	10.0	10.0	10.0	-	-	15
Odour	-	-	-	-	-	Unobjectionable	Inoffensive
pH	pH Units	6.88	6.84	6.93	6.0-8.5	6.5-8.5	6.5-8.5
Conductivity	μS/cm	144	141	139	0-3000	-	-
Tot. Susp. Solids (SS)	mg/l	9.00	10.0	10.0	-	0	-
Tot. Dis. Solids (TDS)	mg/l	86.4	86.4	83.4	0-2000	500 (Max)	1000
Sodium	mg/l	11.3	11.2	11.0	0-920	-	200
Potassium	mg/l	6.10	6.10	6.00	0-2	-	30
Calcium	mg/l	12.4	12.6	13.5	0-400	-	200
Magnesium	mg/l	5.43	4.89	2.75	0-60.8	0.4	150
Total Iron	mg/l	2.30	2.88	1.93	5.0	0.3	0.3
Ammonia (NH ₄ -N)	mg/l	0.276	0.368	0.316	0-5	-	0.00 – 1.5
Chloride	mg/l	5.86	6.35	6.85	0-1050	<250	250
Sulphate (SO ₄)	mg/l	5.98	7.70	6.29	0-960	<250	250
Phosphate (PO ₄ -P)	mg/l	0.089	0.053	0.204	0-2	-	-
Manganese	mg/l	0.074	0.015	0.049	-	0.4 (Max)	0.4
Nitrite (NO ₂ -N)	mg/l	0.002	0.005	0.005	-	3.0 (Max)	1.0
Nitrate (NO ₃ -N)	mg/l	0.055	0.091	0.067	0-10	50 (Max)	10
Total Hardness (as CaCO ₃)	mg/l	53.4	51.6	45.2	0-610	500 (Max)	500
Total Alkalinity (as CaCO ₃)	mg/l	63.6	61.6	60.2	-	-	-
Calcium Hardness (as CaCO ₃)	mg/l	31.1	31.5	33.9	-	-	-
Mag. Hardness as CaCO ₃)	mg/l	22.3	20.1	11.3	-	-	-
Fluoride	mg/l	0.140	0.680	0.090	0 – 1	-	1.5
Bicarbonate (as CaCO ₃)	mg/l	77.6	75.2	73.4	0-610	-	-
Carbonate	mg/l	0.00	0.00	0.00	0-30	-	-

Parameter	Unit	Location Values			FAO Irrigation Water Guideline	GSA Raw Water Specifications	WHO Guideline
		KUM 1	KUM 2	KUM 3			
SAR	mg/l	0.674	0.679	0.713	-	-	-
Total Coliform (TC) Method: APHA 9222A	(cfu/100ml)	1302	2232	1860	-	10	0
Faecal Coliform (FC) (cfu/100ml) Method: APHA 9222D	(cfu/100ml)	76	72	50	-	10	0
E. Coli (cfu/100ml) Method: APHA9260F	(cfu/100ml)	44	44	36	-	10	0
Total Heterotrophic Bacteria (cfu/l ml) Method: APHA 9215B	(cfu/100ml)	583	676	676	-	10	-

WRI (2023/24)

The water quality analysis of the Kumkum River at the Kumkum Valley near Tano Odumasi in the Sekyere South District recorded high values for turbidity, total coliform, faecal coliform and Escherichia coli. These values are above the recommended guidelines by the World Health Organization (WHO) for drinking water and Ghana Standards Authority guidelines for raw water. Values for turbidity are from 9.41 to 11.10NTU in the river against the WHO and GSA guideline value of 5NTU.

High total coliform values range from 1302cfu/100ml to 2232cfu/100ml, while faecal coliform and E. coli (as a result of human and animal excreta) range from 50cfu/100ml to 76cfu/100ml and 36cfu/100ml to 44 cfu/100ml respectively as against the WHO recommended values of 0.0cfu/100ml for drinking water and GSA guideline of 10.0cfu/100ml for raw water. The Kumkum River is not dependent on as a source of drinking water, and these values have confirmed its unwholesome nature for drinking.

5.4.9 Vegetation (Flora and Fauna)

The district lies within the rainforest belt; the vegetation can best be described as moist semi-deciduous. The rainforest consists of three layers namely the upper, middle and lower layers. The upper layer consists of the tallest trees, whereas the Middle and Lower layers consist of trees of lower height respectively. The forest abounds in different species of tropical woods of high economic value. These include Wawa, Odum, Mahogany Sapele, etc.

The project area has been under cultivation for several years for mainly rice. Peasant farmers usually use simple tools such as hoes and sometimes power tillers to prepare the land. Areas left to fallow mainly consist of shrubs and grassland and are mostly marshy during the rainy seasons. The surroundings of the project sites are mainly grassland and are also marshy during the rainy season of the year. The flora in the area is dominated by aquatic species such as *Ipomoea aquatica*, *Typha domingensis*. Other areas are dominated by pockets of thickets dominated by bush willows and neem. Most widely occurring and distributed grass species include *Andropogon gayanus*, *Sporobolus pyramidalis*. Details of other flora species are shown in the table below.

Animals usually seen in the area are grasscutters (*Thryonomys swinderianus*), rats (*Rattus*), squirrels (*Rodentia sciurus*) and snakes. Occasionally, livestock, mostly cattle, graze on the surrounding fields.

Table 34: Floristic Composition of the Project Site

Scientific Name	Common Name	Habit	Family	Distribution	Conservation Status (IUCN)
<i>Raphia farinifera</i>	Ruffia Palm		Arecaceae	Occasional	Not threatened
<i>Andropogon gayanus</i>	Gamba grass	Herb	Poaceae	Abundant	Not threatened
<i>Bambusa vulgaris</i>	Bamboo	Grass	Poaceae	Occasional	Not threatened
<i>Azadirachta indica</i>	Neem	Tree	Meliaceae	Frequent	Not threatened
<i>Typha domingensis</i>	Cattail/ bulrush	Herb	Typhaceae	Abundant	Not threatened
<i>Sporobolus pyramidalis</i>	Giant rat tail grass	Herb	Poaceae	Dominant	Not threatened
<i>Elaeis guineensis</i>	African oil palm	Fruit	Arecaceae	Occasional	Not threatened
<i>Borassus aethiopum</i>	African fan palm	Shrub	Arecaceae	Occasional	Not threatened
<i>Solanum torvum</i>	Pea eggplant	Shrub	Solanaceae	Rare	Not threatened
<i>Sida acuta</i>	wireweed	Herb	Malvaceae	Occasional	Not threatened
<i>Clausena anisata</i>	Horsewood	Shrub	Rutaceae	Occasional	Not threatened
<i>Combretum racemosum</i>	Bush willows	Shrub	Combretaceae	Dominant	Not threatened
<i>Ipomoea aquatica</i>	Water Spinach	Herb	Convolvulaceae	Frequent	Not threatened
<i>Ctenium newtonii</i>	-	Herb	Poaceae	Abundant	Not threatened

(ESSERM Consult, 2024)

5.5 Atwima Nwabiagya North District

The Atwima Nwabiagya North District is one of the 261 Metropolitan, Municipal and District Assemblies (MMDAs) in Ghana, and forms part of the 43 MMDAs in the Ashanti Region.

The Atwima Nwabiagya North Assembly is carved out of the Atwima Nwabiagya District Assembly as one of the 38 newly created and upgraded District Assemblies in 2018.

Created with LI 2327, the District Assembly has its capital as Barekese. Atwima Nwabiagya North District is situated in the western parts of the Ashanti Region.

The Municipality shares common boundaries with the Atwima Nwabiagya Municipality to the west, the Ahafo Ano Southwest District to the west, the Offinso Municipality to the north, the Kumasi Metropolis to the south, and the Afigya Kwabre South District to the East. Figure 43 is a map of the district.

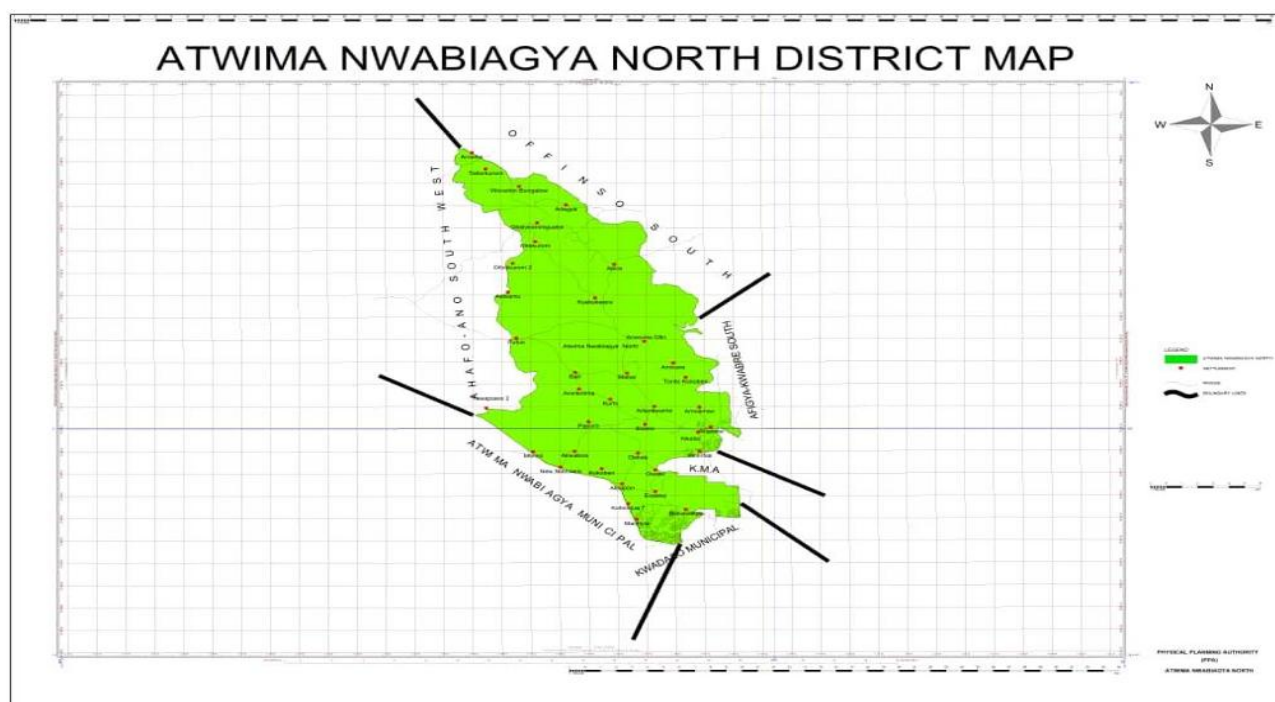


Figure 43: Map of Atwima Nwabiagya North District, (ANND, 2024)

5.5.1 Socio-economic Conditions

The main occupation of the people in the district is agriculture consisting of crop farming, livestock rearing, poultry farming and aquaculture (fish farming). Maize, cassava, yam, cocoyam, oil palm, rice, citrus, cocoa and plantain are the main crops grown in the district. Most of these crops are cultivated on a small-scale basis.

The district can also boast of the presence of large-scale poultry and piggery farms. These include Topman Farms (Ntensere), Louis Gyamfi Farms (Achiase), Nketia Farms (Kokoben), Boogies Farms (Abrafo Kokoben), the Fufuo, Dabaa, Akropong and Barekese piggery farm, etc. There are also many medium and small-scale poultry farms scattered all over the district.

People also engage in brick making, production of earthenware consisting of coolers, mashing bowls and pots.

There are four (4) organised markets in the district. This is the Barekese Market, Koforidua, Asuofua and Mfensi. There are other relatively smaller markets in the district. These include Akropong, Achiase, and Fufuo, among others. Apart from a few who trade in defined marketplaces, most trading activities in the district are located along the main roads.

5.5.1a Role of Women, Gender-Based Violence, Poverty, and Social Protection

Women constitute 52% of the farmer population and are active in crop and livestock farming, processing, and marketing. The district is noted for its poultry, ginger, and citrus production, with women playing key roles in both production and processing.

The district has a multidimensional poverty incidence of 13.5% and an intensity of 43.1%, among the lowest in the region. The main deprivations are in improved toilet facilities (69.2%), health insurance (40.3%), and overcrowding (37.3%). Vulnerable groups include women, children, the elderly, and persons with disabilities.

Social protection programs such as LEAP and NHIS are present.

5.5.2 Demography

The population of the district per the 2021 Population and Housing Census stood at 155,025 out of which 76,877 are males and 78,148 are females with an annual growth rate of 2.6%. The population growth of the district is influenced mostly by its proximity to Kumasi.

The district has an urban population of 100,372 with 49,501 males and 50,871 females and a rural population of 54,653 with 27,376 males and 27,277 females.

5.5.3 Education

The Atwima Nwabiagya North District has a total of one hundred and eighty – five (185) educational institutions spread across the district. Pre-school and Primary schools constitute one hundred and six (106). Also, Junior High Schools constitute forty (40) public and thirty –three (33). In terms of ownership there are forty-six (46) public and Sixty (60) private schools in the district.

5.5.4 Health

The district health directorate is divided into four (4) sub-districts, the sub-districts are further divided into 17 zones for easy access to health services delivery. The district has sixteen (16) health facilities, comprising of six (6) hospitals, five (5) health centres, five (5) CHPS compounds and one (1) maternity home. Table 35 shows the health statistics of the district. Malaria remains the leading cause of illness reported across health facilities in the Atwima Nwabiagya North, consistently accounting for the highest number of recorded disease cases, as shown in Table 35.

Table 35: Atwima Nwabiagya North Health Directorate Statistics

No	Principal Diagnosis	2020	Principal Diagnosis	2021	Principal Diagnosis	2022
1	Malaria	28600	Malaria	51965	Malaria	47366
2	Upper Respiratory Tract Infections	8779	Upper Respiratory Tract Infections	8943	Upper Respiratory Tract Infections	7616
3	Rheumatism / Other Joint Pains / Arthritis	5885	Rheumatism / Other Joint Pains / Arthritis	6572	Rheumatism / Other Joint Pains / Arthritis	6016

4	Skin Diseases	4738	Acute Urinary Tract Infection	4912	Typhoid Fever	5425
5	Acute Urinary Tract Infection	4736	Skin Diseases	4436	Anaemia	3884
6	Anaemia	3624	Anaemia	4352	Acute Urinary Tract Infection	3827
7	Diarrhoea Diseases	2930	Pneumonia	3968	Diarrhoea Diseases	3729
8	Hypertension	2492	Typhoid Fever	3808	Pneumonia	3691
9	Typhoid Fever	2315	Diarrhoea Diseases	3537	Skin Diseases	3182
10	Intestinal Worms	2252	Hypertension	3041	Severe Malaria (Lab-Confirmed)	2838

(Source: Atwima Nwabiagya North Health Directorate, 2024)

5.5.5 Water and Sanitation

There are two main sources of potable water in the district. These two are pipe-borne and boreholes. In total, the coverage of potable water in the district is 76% of households.

Solid waste in the district is generated by domestic (households), commercial (market and trading) and institutional activities. About 70% of the solid waste generation in the district is organic. Plastic waste is also high.

Open dumping of refuse is the main method of refuse disposal in most communities in the district. The Assembly has acquired a site designated as a permanent dumping site for waste management.

5.5.6 Climate

The ANND Municipality lies within the wet semi-equatorial zone in Ghana. The district is characterised by two well-defined major and minor rainfall seasons. The major rainfall season begins in March and ends in July with the month of June recording the peak rainfall of about 2900mm over the past eleven years (2013 – 2023) according to data from Ghana Meteorological Agency. This is indicated in the rainfall pattern in the figure below. The minor rainfall season commences in September and ends in November, with a minor peak rainfall in the month of September.

The mean annual rainfall for the area ranges between 1020mm to 2900mm. In the past eleven years (2013 – 2023), April 2023 has recorded the highest average monthly rainfall of about 550mm. The mean minimum annual temperatures range between 21-23°C and the mean maximum annual temperatures range between 30 - 34°C according to data from Ghana Meteorological Agency for the past eleven years (2013 – 2023).

The district like any part of Ghana experiences climate change vulnerability as indicated in Ghana's fourth National Communication to the United Nations Framework Convention on Climate Change (UNFCCC) in 2020 and the country's ND-GAIN index of vulnerabilities to climate change and other global challenges.

The figures below show the rainfall and temperature distributions for the Atwima Nwabiagya North for the past eleven years (2013 – 2023) according to the Ghana Meteorological Agency. Figures 44, 45 and 46 show the rainfall and temperature patterns of the district.

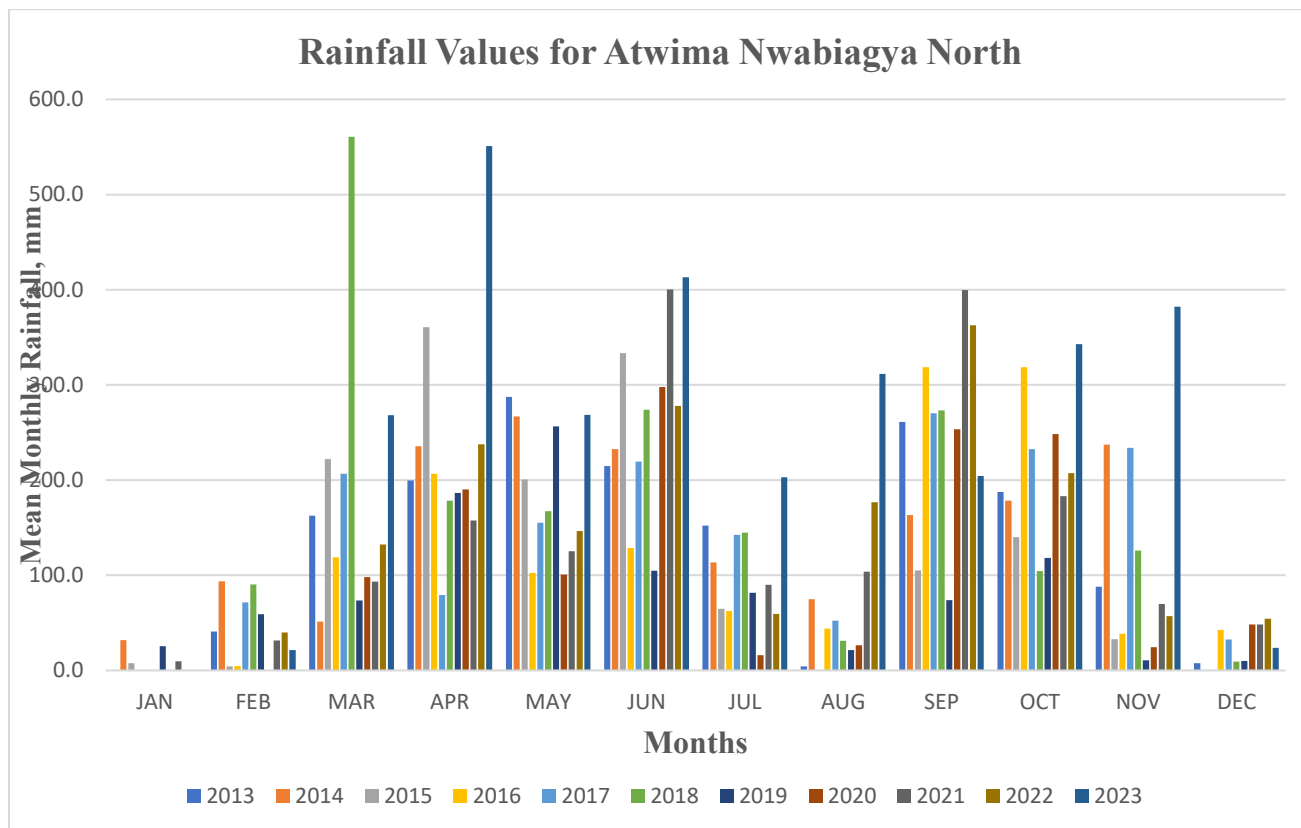


Figure 44: Rainfall Values for Atwima Nwabiagya North District, GMET, 2024

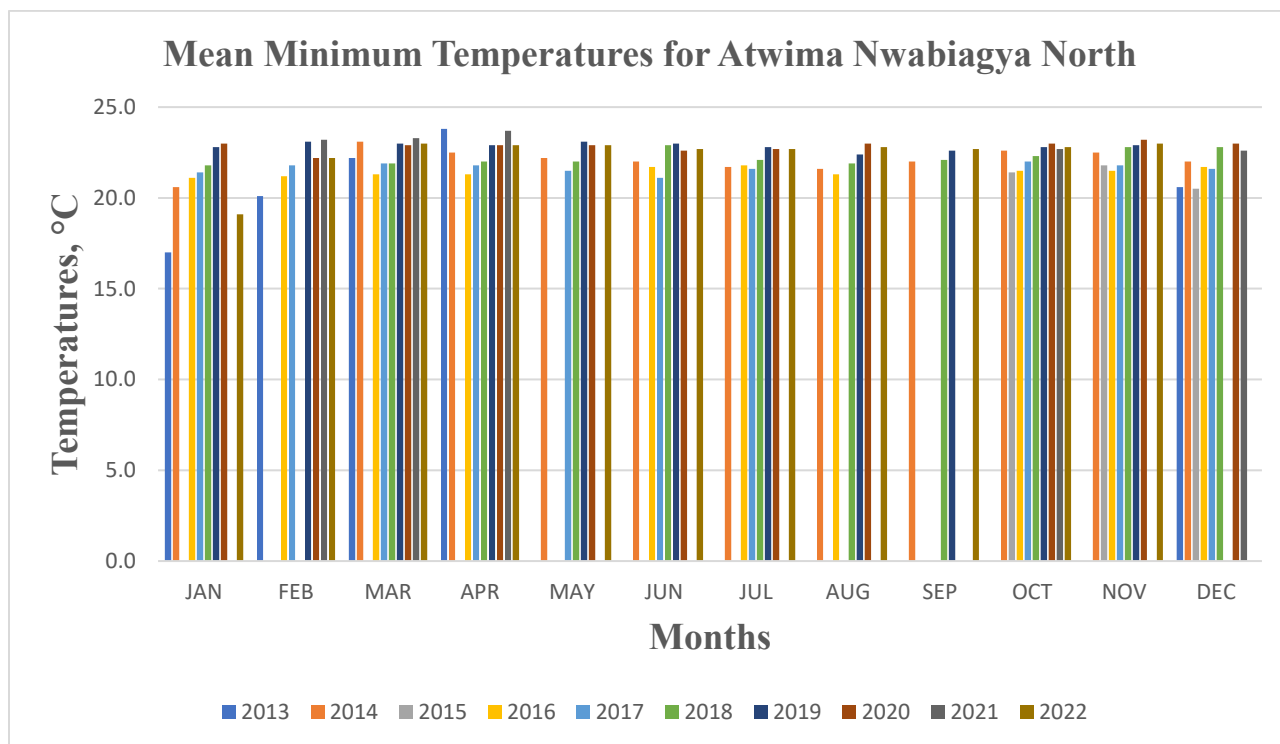


Figure 45: Mean Minimum Temperature Values for Atwima Nwabiagya North District, GMET, 2024

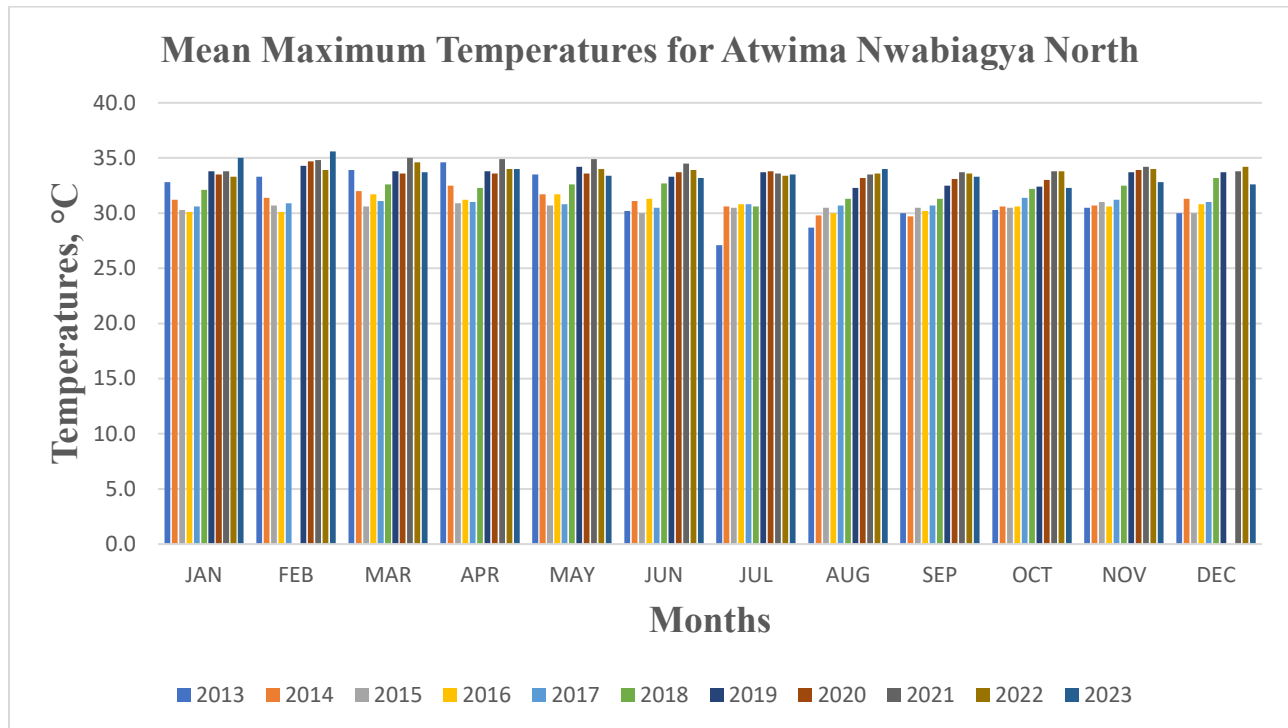


Figure 46: Mean Maximum Temperature Values for Atwima Nwabiagya North District, GMET 2024

5.5.7 Geology and Soils

The ANND is underlain by the Lower Birimian rocks, which consist of phyllites, greywackes, achists and gneiss, and Cape Coast granite. Both the Lower Birimian rocks and Cape Coast granite contain gold and clay deposits for making ceramics and bricks.

The predominant soils in the district are the Kumasi-Asuansi/Nta-Ofin Compound Associations and the Bekwai- Nzema/Oda Complex Associations. Soils of the Kumasi-Asuansi Compound Associations are found at places like Ntesere, Atwima Koforidua and Akropong. The Bekwai- Nzema/Oda Complex Associations developed over Birimian phyllites, greywackes, schist and gneisses are very deep, red, well-drained, and brown. Soils of the Bekwai- Nzema/Oda Complex Associations are found at places like Fufuo, Mfensi, Barekese, Adankwame, Akropong, Besease and Wurapong.

5.5.8 Topography and Drainage

The ANND has an undulating topography with an average height of 77m above sea level. The highest points in the district can be found in the Barekese and Tabere areas.

The district is drained by several rivers and streams such as Offin River, Owabi River, Kobi Stream and Dwahyen Stream. The Owabi and Berekese dams constructed over the Owabi and Offin Rivers respectively supply pipe-borne water to the residents in the district and its environs. Additionally, about 76% of the households in the area have access to potable water. Figure 47 below is a map of the Offin catchment with reference to the Barekese and Amakye Bare communities.

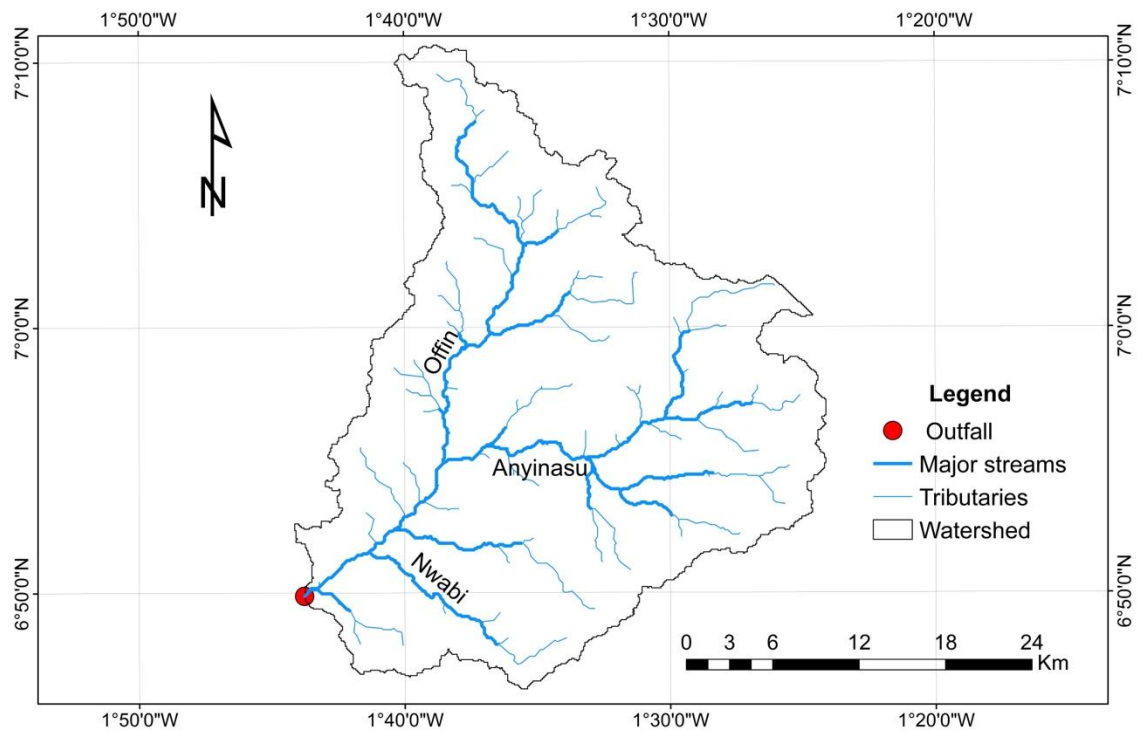


Figure 47: Offin Catchment Area, FSRP2 2024

ANINKRUMAH AND AMACHI-BARE PROJECT SITES IN ATWIMA NWABIAGYA DISTRICT

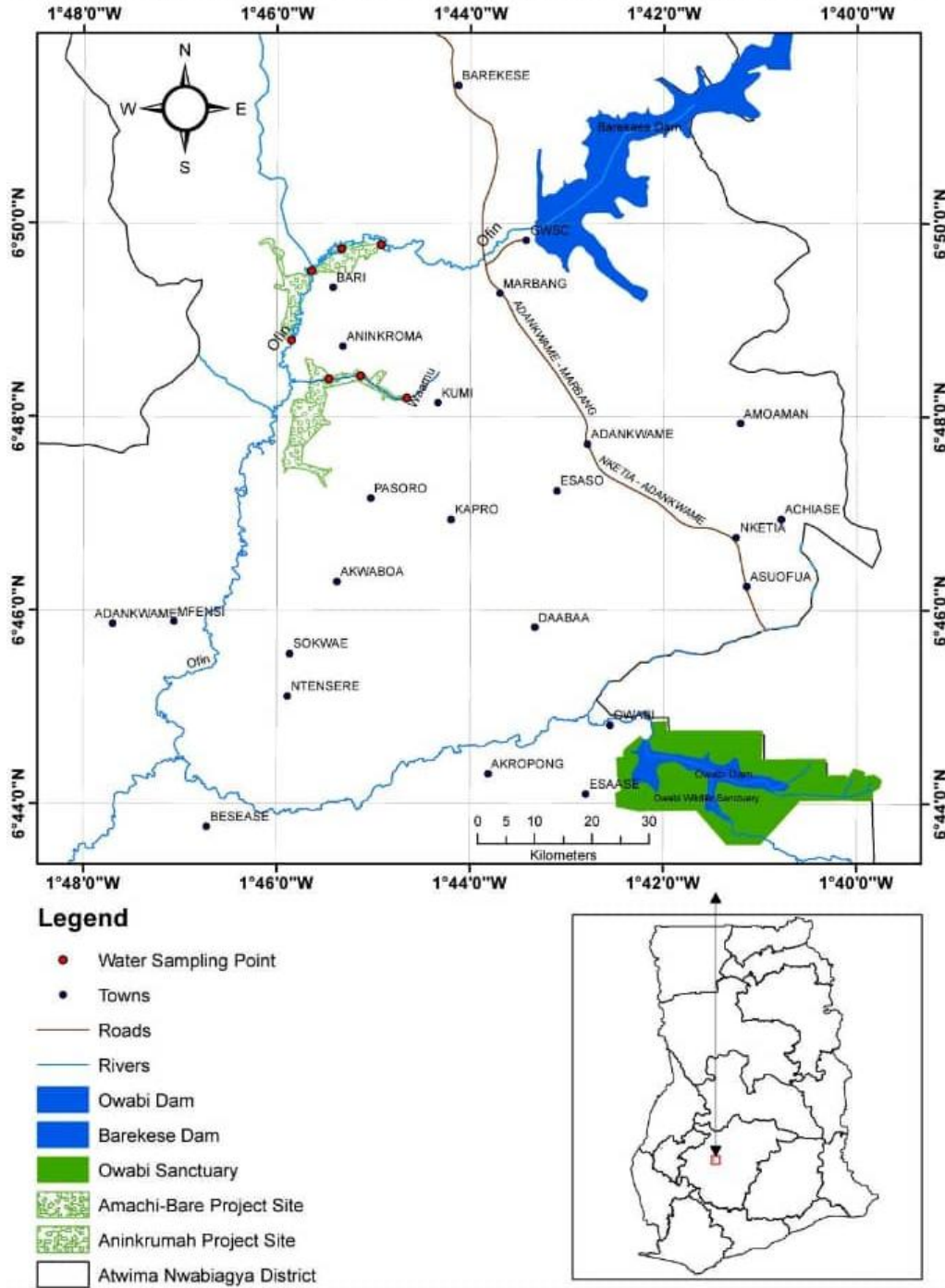


Figure 48: Drainage Map of Offin/Waamu/Kumi Valley, ESSERM 2024

Table 36 shows the catchment characteristics of the Offin River. Tables 37 and 38 show the sampling locations and water quality test results of the Offin respectively.

Table 36: Key Characteristics of the Offin Catchment at Amakyebare

Parameter	Value
Area (km ²)	924
Longest flow path (km)	56
Minimum elevation (m)	208
Maximum elevation (m)	312
Average catchment slope	0.27

Table 37: Water Quality Sampling Locations

No	Codes	Description	GPS Coordinates	
			N/°	W/°
1	OFFIN 1	On the Offin River	06.83074	001.73027
2	PRAN/OFFIN 3	Pranpranadan Stream and Offin intersection	06.82283	001.73185
3	PRAN 1	Pranpranadan Stream upstream	06.83370	001.73143
4	PRAN 2	Pranpranadan Stream downstream	06.83225	001.73125
5	WAAMU 1	Waamu Stream entering the Waamu field	06.80592	001.74395
6	WAAMU 2	Waamu Stream in the Waamu field (midstream)	06.80967	001.75197
7	WAAMU 3	Waamu Stream downstream the Waamu field	06.80917	001.75740



Figure 49: Water Sampling from the Offin/Waamu Rivers

Table 38: Water Quality Results

Parameter	Unit	Location Values							FAO Irrigation Water Guidelines	GSA Raw Water Specifications	WHO Guideline
		OFFIN 1	PRAN / OFFIN 3	PRA N 1	PRA N 2	WAAM U 1	WAAM U 2	WAAM U 3			
Turbidity	NTU	12.1	7.92	30.6	22.4	37.1	6.61	45.6	-	5	5
Colour (apparent)	Hz	10.0	7.50	30.0	25.0	40.0	7.50	50.0	-	-	15
Odour	-	-	-	-	-	-	-	-	-	-	Inoffensive
pH	pH Units	6.96	6.86	7.15	7.19	6.87	6.05	6.82	6.0-8.5	6.5-8.5	6.5-8.5
Conductivity	µS/cm	106	95.8	185	184	132	63.7	130	0-3000	-	-

Parameter	Unit	Location Values							FAO Irrigation Water Guidelines	GSA Raw Water Specifications	WHO Guideline
		OFFIN 1	PRAN / OFFIN 3	PRA N 1	PRA N 2	WAAM U 1	WAAM U 2	WAAM U 3			
Tot. Susp. Solids (SS)	mg/l	11.0	8.00	28.0	23.0	33.0	7.00	46.0	-	0	-
Tot. Dis. Solids (TDS)	mg/l	63.6	57.5	111	110	79.2	38.2	78.0	0-2000	500 (Max)	1000
Sodium	mg/l	7.00	10.2	13.6	13.8	10.8	9.00	12.3	0-920	-	200
Potassium	mg/l	4.60	4.60	8.40	8.50	4.90	0.800	5.10	0-2	-	30
Calcium	mg/l	8.18	6.17	21.3	17.6	12.0	3.29	9.22	0-400	-	200
Magnesium	mg/l	3.64	2.28	0.946	3.28	3.00	1.02	2.86	0-60.8	0.4	150
Total Iron	mg/l	1.01	1.31	2.14	2.34	2.30	1.08	2.75	5.0	0.3	0.3
Ammonia (NH ₄ -N)	mg/l	0.366	0.195	0.322	0.217	0.499	0.105	0.499	0-5	-	0.00 – 1.5
Chloride	mg/l	5.56	8.24	12.9	13.8	9.93	5.96	8.64	0-1050	<250	250
Sulphate (SO ₄)	mg/l	7.74	4.23	8.84	7.85	11.0	3.67	11.7	0-960	-	250
Phosphate (PO ₄ -P)	mg/l	0.042	0.161	0.118	0.084	0.186	0.074	0.027	0-2	-	-
Manganese	mg/l	0.024	0.024	0.199	0.303	0.054	0.066	0.082	-	0.4 (Max)	0.4
Nitrite (NO ₂ -N)	mg/l	0.057	0.004	0.104	0.108	0.027	0.005	0.037	-	3.0 (Max)	1.0
Nitrate (NO ₃ -N)	mg/l	0.057	0.099	1.01	1.04	0.531	0.147	0.514	0-10	50 (Max)	10
Total Hardness (as CaCO ₃)	mg/l	35.4	24.8	57.2	57.4	42.4	12.4	34.8	0-610	500 (Max)	500
Total Alkalinity (as CaCO ₃)	mg/l	40.4	37.8	67.0	66.2	50.2	22.0	50.0	-	-	-
Calcium Hardness (as CaCO ₃)	mg/l	20.4	15.4	53.3	43.9	30.1	8.22	23.0	-	-	-
Mag. Hardness as CaCO ₃)	mg/l	15.0	9.37	3.89	13.5	12.3	4.18	11.8	-	-	-
Fluoride	mg/l	<0.010	0.180	0.260	0.080	<0.010	0.380	<0.010	0 – 1	-	1.5
Bicarbonate (as CaCO ₃)	mg/l	49.3	46.1	81.7	80.8	61.2	26.8	61.0	0-610	-	-
Carbonate	mg/l	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0-30	-	-

Parameter	Unit	Location Values							FAO Irrigatio n Water Guidelin e	GSA Raw Water Specification s	WHO Guideline
		OFFIN 1	PRAN / OFFI N 3	PRA N 1	PRA N 2	WAAM U 1	WAAM U 2	WAAM U 3			
SAR	mg/l	0.512	0.892	0.78 3	0.79 2	0.723	1.11	0.907	-	-	-
Total Coliform (TC) Method: APHA 9222A	(cfu/100ml)	1674	2046	2046	2604	2790	1874	2046	-	10	0
Faecal Coliform (FC) (cfu/100ml) Method: APHA 9222D	(cfu/100ml)	50	130	930	744	1302	30	930	-	10	0
E. Coli (cfu/100ml) Method: APHA9260 F	(cfu/100ml)	28	90	558	558	1116	26	744	-	10	0
Total Heterotroph ic Bacteria (cfu/1 ml) Method: APHA 9215B	(cfu/100ml)	520	624	728	884	780	676	1404	-	10	-

WRI (2023/24)

The water quality analysis of the Offin River, Pranpranadan and Waamu Streams in the Waamu and Offino Valleys in the Atwima Nwabiagya North recorded high values for turbidity, total coliform, faecal coliform and Escherichia coli. Values for turbidity range between 6.61 to 45.60NTU in the water bodies as against the WHO and GSA guideline value of 5NTU. High total coliform values range from 1674cfu/100ml to 2790cfu/100ml, while faecal coliform and E. coli (as a result of human and animal excreta) range from 30cfu/100ml to 1302cfu/100ml and 26cfu/100ml to 1116cfu/100ml respectively as against the WHO recommended values of 0.0cfu/100m for drinking water and GSA values of 10.0cfu/100m for raw water.

These values are above the recommended guidelines by the World Health Organization (WHO) for drinking water and GSA raw water specifications.

5.5.9 Vegetation (including Flora and Fauna)

The vegetation found in the district is predominantly the semi-deciduous type. The vegetation type has largely been disturbed by human activities (logging, farming, bushfires etc), thus, depriving it of its original valuable tree species (e.g odum, sapale), fauna and other forest products.

There are some pockets of forest reserves available in the district. These include the Owabi Water Works Forest Reserves and Barekese Water Works Forest Reserve, which serve as watershed protection for the Offin and Owabi Rivers. These forest reserves are at least 15km from the project sites.

The project sites are mainly grassland and marshy mainly throughout the year. Species such as *Ipomoea aquatica*, *Typha domingensis* are the dominant flora species. Other areas are dominated by pockets of thickets dominated by neem and bush willows. The following are the most widely occurring and distributed grass species *Andropogon gayanus*, *Sporobolus pyramidalis*. Details of other flora species are shown in the Table 39.

Animals usually seen in the area are squirrels (*Rodentia sciurus*), grasscutters (*Thryonomys swinderianus*), rats (*Rattus*) and snakes.

Table 39: Floristic Composition of the Project Site

Scientific Name	Common Name	Habit	Family	Distribution	Conservation Status (IUCN)
<i>Sida acuta</i>	Wireweed	Herb	Malvaceae	Occasional	Not threatened
<i>Clausena anisata</i>	Horsewood	Shrub	Rutaceae	Occasional	Not threatened
<i>Raphia farinifera</i>	Ruffia Palm		Arecaceae	Occasional	Not threatened
<i>Andropogon gayanus</i>	Gamba grass	Herb	Poaceae	Abundant	Not threatened
<i>Bambusa vulgaris</i>	Bamboo	Grass	Poaceae	Occasional	Not threatened
<i>Combretum racemosum</i>	Bush willows	Shrub	Combretaceae	Dominant	Not threatened
<i>Ctenium newtonii</i>	-	Herb	Poaceae	Abundant	Not threatened
<i>Azadirachta indica</i>	Neem	Tree	Meliaceae	Frequent	Not threatened
<i>Andropogon gayanus</i>	Gamba grass	Herb	Poaceae	Abundant	Not threatened
<i>Typha domingensis</i>	Cattail/ bulrush	Herb	Typhaceae	Abundant	Not threatened
<i>Sporobolus pyramidalis</i>	Giant rat tail grass	Herb	Poaceae	Dominant	Not threatened
<i>Elaeis guineensis</i>	African oil palm	Shrub	Arecaceae	Occasional	Not threatened
<i>Borassus aethiopum</i>	African fan palm	Shrub	Arecaceae	Occasional	Not threatened
<i>Solanum torvum</i>	Pea eggplant	Shrub	Solanaceae	Rare	Not threatened

(ESSERM Consult, 2024)

6.0 STAKEHOLDER ENGAGEMENT

6.1 Purpose of Stakeholder Involvement

Stakeholder involvement is a key aspect of the Environmental and Social (E&S) assessment process. Its significance is accordingly captured in Ghana’s Environmental Protection Authority Act, 2025 (Act 1124) and LI 1652 and the World Bank’s E&S requirements, ESS 10. In line with the E&S assessment process’ objective of preventing or reducing adverse effects of the Ashanti Region Lot 3 under the FSRP2 on the environment and people, key stakeholders who are associated with the subproject are in the sole position to express concern or offer advice which can guide successful project execution.

The involvement of persons and institutions with regard to the project promotes transparency and affords all parties the opportunity to scrutinise the project and pick up potential red flags that might hinder or interfere with project implementation. Host communities hold “social capital” which is the goodwill and support of the community for the project. Promoting transparency of the project through engagements builds trust in the communities and makes it more likely to get their support for the project.

The involvement of stakeholders helps to identify the diverse interests or potential conflicts that could arise because of the project and offers an opportunity to minimise potential misinformation and unnecessary agitation. It promotes a feeling or sense of ownership or ease of identification with the project. It helps to establish good rapport and cooperation with the project proponent. A major activity in the assessment process is therefore the identification and engagement with the relevant stakeholders – institutional, community, civil society, etc. The engagement methodology included formal meetings, one-on-one interviews, and focus group discussions.

6.2 Objectives of Stakeholder Involvement

The objectives of stakeholder involvement were:

- To provide information on the project to stakeholders and receive their inputs to inform its implementation;
- To elicit information that would help identify the potential and actual environmental and social issues in the project area;
- To derive baseline data that may be anecdotal, but which could complement data obtained from published documents;
- To pick up cues that would help develop key aspects of the environmental and social management plans such as Grievance Mechanism, compliance monitoring, etc.;
- To provide information to project stakeholders on the environmental and social impact assessment process and seek their participation and input; and
- To establish cooperation and encourage participation of the stakeholders in the impact assessment and mitigation process.

6.3 Key Stakeholders Engaged

The institutions identified for consultation are those with regulatory mandate, (environmental protection, local administration, permitting, health and safety, etc.), advisory or oversight responsibility on development projects such as the Ashanti Region Lot 3 under FSRP2. Members of the public identified for consultation were farmers living in the host communities who have and work on farms in designated inland valleys and as such are within the project’s sphere of influence.

Stakeholder identification and mapping established during the scoping phase informed the Environmental Impact Assessment (ESIA) confirming the organisations, groups and individuals potentially affected by the project both positively and negatively and the extent to which they can influence and impact it. Table 40 lists the stakeholder groups engaged, and Table 41 provides a summarised outcome of stakeholder engagement. A total of approximately 332 persons including 148 females and 184 males were consulted.

Table 40: *Stakeholders Engaged*

Stakeholder category	Institution
Project Proponent/Partners	Ministry of Food and Agriculture
Sector Agencies	District Directorate of Agriculture
Environmental Protection	Environmental Protection Authority (EPA)
Local Government Authorities	• Ejisu Municipal Assembly (EMA) • Sekyere South District Assembly (SSDA) • Juaben Municipal Assembly (JMA) • Atwima Nwabiagya North District Assembly (ANND)
Local Agencies/Community members	• Municipal and District Chief Executives • Municipal and District Directors of Agriculture • Municipal and District Co-ordinating Directors • Municipal and District Agriculture Extension Officers • Rice Farmers including women farmers groups • Anchor Farmers • Traditional Authorities

6.3 Outcome of Stakeholder Consultations

Table 39 below provides a summary of the key issues from the stakeholders engaged at the various inland valleys designated for project intervention. Some pictures of the consultations are shown in Figures 50 to 56.



Figure 50: *Engagement with Ejisu Municipal Assembly*

Table 41: *Summarised Outcome of Stakeholder Engagement*

No	Agency /Institution/ Participant	Key Issues Discussed
1.	Director of Agric – Ejisu District MoFA	• The rice valley spans across Donuaso, Krapa I and Krapa II communities. • The district office has had several discussions with the Donuaso traditional authorities about the project, and they have given their blessing for the project to go on. • The Anchor Farmer system was introduced to farmers in the valleys and some of them are with that scheme. Anchor farmers mobilize inputs such as fertilizers, insecticides and seeds from the district or regional office and in turn, redistribute to farmers with a little addition to the cost to cater for transportation.
2.	Ejisu Municipal Assembly	• The Assembly welcomes the project to improve inland valleys to maximize rice production and looks forward to its implementation • On land tenure, the community chiefs are custodians of the lands and give them out to farmers on a lease basis. Terms of the lease are negotiated between the farmers and the chiefs. • The Community Development Officer indicated that they have recorded a few cases of some children of school-going age are not in school because their parents cannot afford uniforms or school fees. • The Assembly operates an un-engineered dumpsite at Krapa, which is getting full. An alternate dumpsite is being secured by the Assembly
3.	Ghana Irrigation Development Authority (GIDA)	• The resources of GIDA are limited so their operations do not involve inland valleys. • GIDA currently focuses on Small- and Large-Scale Irrigation Schemes throughout the country. • This is also because inland valley schemes do not require technical skills and knowhow for its operation unlike other schemes which are under the technical guidance of the Authority.
4.	Environmental Protection Authority (EPA)	• The Authority is aware of some of the challenges of smallholder farmers face in the compliance with environmental requirements hence officers from the Authority have programmes with AEOs to offer training in good agricultural practices and environmental safeguards. • These supports will be intensified for these valleys even after the FSRP2 project life. • The Authority is prepared to continue to work with FSRP2 in ensuring good environmental practices in the valleys.
5.	Donuaso Valley Anchor Farmers (Ejisu)	• As an anchor farmer, I purchase farm inputs from the MoFA office and other places and supply the farmers who are signed unto my scheme. I also support the farmers with capital input on agreement to pay back after a given time when they have their harvest • One of the requirements to sign on to my scheme is for farmers to use only organic fertilizers in the rice cultivation. Once a farmer fulfills all the requirements, I purchase all the rice they harvest at the end of the planting season. This provides them with a ready market and quick returns on their investment. • Main concern is the planning of work so as not to disrupt farming activities and hence affecting farmers' incomes.

No	Agency /Institution/ Participant	Key Issues Discussed
6.	Juaben Municipal Assembly	• The Assembly has an approved layout of the municipality which has designated Yaw Nkrumah Valley as a reserve. Due to it being a wetland, the only profitable use that it could be put to is rice farming • The land is under the custody of the community chiefs; Yaw Nkrumah valley is under the Santaahene. There is an overlord chief in the municipality, the Daasebre, to whom all the community chiefs report. The Assembly has had deliberations with the chiefs about the project, and they have expressed their support • There is substantial involvement of women in rice farming in the municipality. A lot of the farmers are women who own the farms and have direct arrangements with the chiefs on the lease of the land • Farmers do not take their children to the farms during school hours, however, during vacation, however, some farmers might take their children along with them, not particularly to ‘work’ on the farm. This cannot be regarded as child labour. • The Community Development Unit of the Assembly has embarked on a lot of education and awareness creation in the communities on the need to send all children of school-going age to school
7.	Agric Extension Officer – Juaben Municipal Agriculture Department	• Some excavation was done on the water channel that runs in the valley, and this has led to blocking of a culvert that carries water across the Ejisu-Juaben highway leading to increased flooding of the valley. • Farmers have challenges with getting adequate inputs for their activity mostly due to challenges with capital
8.	Sekyere South District Assembly	• A major challenge in the rice valleys is flooding during heavy rains • The valleys are designated as wetlands where no buildings are allowed • Women are involved in the rice cultivation in the valleys • The Assembly supports women with tarpaulins for preparation of drying platforms • The Assembly, in 2022 partnered with the Japan International Development Agency (JICA) to supply a growth-enhancing fertilizer called Biochar to rice farmers in the Kumkum Valley • The farmers, after harvesting, leave the rice husks/grass to dry up and then they burn them on the field • The Social Welfare Unit in the year 2023 has recorded 11 cases of children who dodge school to engage in work on cocoa farms. The Unit on each of these occasions have taken the children back to school and keeping tabs on them to ensure they do not go back. There is continuous education and awareness creation in the communities on child labour
9.	Atwima Nwabiagya North District Assembly	• The Agric MoFA office has been receiving complaints from farmers on difficulty in getting genuine farm inputs such as organic and inorganic fertilizers, weedicides, viable seeds • Land in the valley is held by families, and the Assembly has oversight to maintain its use for rice cultivation and other farming activities and not for any other use • There are 17 health facilities in the district. Malaria is prevalent in the district

No	Agency /Institution/ Participant	Key Issues Discussed
10.	Farmers - Ejisu – Donuaso/Juaben/Sekyere and Aninkrumah Valleys	• The cultivable land in this valley is large, however only a section of it is currently being farmed due to the high cost of land preparation for rice cultivation. • Two water bodies, the Oda River and the Dona Stream run adjacent to the Ejisu and Juaben sites. These rice fields get flooded during heavy rains. • It is expensive to channel water from the stream and river into the fields as it required the use of pumps that run on fuel • The Chiefs are the custodian of the land and all arrangements on use of land are agreed upon with their support. • Unavailability of viable seeds and organic fertilizers for immediate use is a major concern to the farmers. • Suppliers sometimes sell us fake agro-chemical weedcides which are ineffective on the weeds we intend to use them to control. • The primary concern is to ensure that work activities are scheduled in a manner that avoids disruption to ongoing farming operations, thereby safeguarding farmers' livelihoods and income streams
11.	Donuaso Traditional Authority	• The traditional authority has been consulted by MoFA officers on the project and support the project. If a person wants a piece of land, they have to contact the landowners and negotiate the terms • The valley is for agricultural purposes only the traditional authority will ensure it is used for this purpose. • Traditional authorities are the landowners who have allocated these valleys for rice farming.



Figure 51: Consultations with Juaben Municipal Assembly



Figure 52: *Engagement with Sekyere South District Assembly*



Figure 53: *Consultations with Atwima Nwabiagya District Assembly*



Figure 54: *Engagement with Farmers in Odaho (L) and Odamu Valleys in Ejisu/Juaben Districts*



Figure 55: Engagement with Farmers in Kumkum (L) and Waamu/Kumi (R) Valleys

6.4 Key Recommendations from the Stakeholder Engagements

The following are some of the key suggestions and recommendations from the stakeholders engaged.

Table 42: Key Recommendations and Suggestions

No	Agency /Institution/ Participant	Key Suggestions and Recommendations	Areas of Incorporation of Suggestions and Recommendations
1.	Department of Agriculture and Ejisu Traditional Representative	- Commitment should be received from the landowners/chiefs on the proposed areas for weirs and other infrastructure per the proposed designs so as to prevent any future encroachment. - Suggest appropriate rice cultivation and seed selection techniques to farmers. - Interventions should consider the provision of potable water and sanitary facilities. - The proposed designs on the weirs to make provisions for frequent de-silted of weirs, which is currently being done to prevent overflow and flooding. - The proposed interventions should consider the implementation timelines so that farmers do not lose significant farming time. - Man-hours should be factored into the cost analysis for socio-economic purposes.	- The Department of Agriculture will be in-charge of providing technical support to farmers and work closely with the District Planning Officers and landowners on preservation of the farmlands. - Borehole and places of convenience are all part of the design for construction at all sites. - Stakeholder engagements prior to commencement of construction to would involve discussions on the appropriate time and work phasing.
2.	District Assemblies Land Use and Spatial Planning Units	- All the Assemblies are aware of these areas which are properly documented in the Land Use and Spatial Planning systems. - District Assemblies issue Planning Permits and Development Permits under Section 113 of Act 925 and Section 91 of Act 936. The process involves submission of applications, vetting, site inspections, and consideration by the technical sub-committee and the Spatial Planning Committee.	- All district plans have designated these areas for inland rice cultivation. - Permits are not given for any other activity in these areas.

No	Agency /Institution/ Participant	Key Suggestions and Recommendations	Areas of Incorporation of Suggestions and Recommendations
		These areas are reserved for inland rice cultivation and will continue to be protected as such.	
3.	Juaben Municipal Assembly	- The Municipal Coordinating Director suggested that farmers should be introduced to how composting is done to enhance the use of organic fertilizers. - There should be equity in the disbursement of farm inputs. Also, there should be a monitoring division under the ministries to help check and eliminate fake agro-chemical products from the local market. - Reducing child labour risks among farmers who bring their children to work during school holidays.	- To be implemented as part of Department of Agriculture's capacity building plans. - The Department of Agriculture, the Department of Social Welfare and the PIU to intensify monitoring during the operations of the values to monitor/report and educate parents against abuses leading to child labour concerns. Farmers groups to be guided and assisted by PIU to provided sheds for children while their parents work on the farms to protect such children from the elements of the weather.
4.	Atwima Nwabiagya North District Assembly	- Provisions should be made for compensation of owners of structures and farms to be potentially affected. - Notices should be served to encroachers of impending intervention to prevent any hindrances to be project. - The project should consider making provisions for mechanization to help farmers. - Ensure buffer between the fields/valley and any adjoining water resources.	- As per the designs there is no anticipated compensations as the design is expected to avoid all areas with assets. - All designated buffers are expected to be observed according to the recommendation by the Riparian Buffer policy requirements.
5.	Sekyere South District Assembly	The Social Welfare Unit to continue to identify students who dodge school to engage in work on cocoa farms and provided them with incentives such as school uniforms to keep them in school.	Training for the communities to include highlighting the importance of school/formal education and assistance from PIU to sustain some of the incentives.
6.	Offino-Waamu/Kumi Farmer Groups	- The project implementation team should consider the timing of the intervention due to issues of excessive flooding during rainy seasons. - Proper planning should be done by farmers on their investments and farming process (planting, marketing) to avoid loss of farmers' investments. - The intervention should consider the provision of sanitary areas for farmer convenience.	- This is adequately indicated in the mitigation measures to be implemented, - Department of Agriculture's capacity building for farmers involve a value chain approach covering investment planning and marketing.

6.5 Validation Engagements

As part of the final engagement of the key landowners and farmers on the final environmental and social assessments and the designs, validation sessions were held to update project beneficiaries on the progress of

the various studies and designs in the valleys. The communities and farmers were also shown the designs and the project's areas of influence. Farmers were also sensitized on the importance of forming a Water User Association (WUA) to facilitate access to farm inputs and post-harvest services.

The main concern from the communities was the need for the valley developments to be carried out in phases to allow farmers to continue farming while construction works are carried out in other areas in order not to lose farming seasons. The farmers also requested adequate advanced notices of about four months to the commencement of the construction works.



Figure 56: *Validation Workshop at Barekese (L) and Aninikrumah (R) in Atwima Nwabiagya North District*

7.0 POTENTIAL BENEFICIAL AND ADVERSE ISSUES IDENTIFIED

The methodology for the evaluation and assessment of environmental and social risks and impacts included field visits, community and public stakeholder engagements and baseline data analysis among others. The evaluation considered the potential beneficial impacts and other enhancement measures expected to be derived from the improvement works for the Odaho, Odamu, Kumkum and Waamu/Kumi, Offinno Valleys. In addition, the issues and concerns raised by the various stakeholders engaged during the assessment process were also taken into consideration for the assessment of the impacts and risks of the rehabilitation works and operations of these valleys.

The risks and impacts magnitude evaluations were based on data gathered from the field assessment studies via situation analysis based on the consultants' experiences and community, public and institutional appraisal and participatory processes the included formal meetings, one-on-one interviews, and focus group discussions. Information from literature surveys and knowledge of similar projects buttressed the analysis. The environmental and social impacts section is presented into the potential project benefits and the risks and negative impacts for the valleys.

The identification of impacts focused on significant key issues associated with the improvement works within the inland valleys. The impact identification was also informed by the contribution and inputs from various stakeholders and insights by the consultants. These included both beneficial impacts and opportunities as well as adverse impacts and risks associated with the project activities.

7.1 Potential Opportunities and Beneficial Impacts

The main beneficial impacts likely to arise from the implementation of the various valley's rehabilitation works would include:

1. Food security improvement;
2. Efficient water use in the inland valleys and flood prevention;
3. Employment opportunities for project communities;
4. Reduction in post-harvest losses; and
5. Improvement in climate change adaptation measures.

Table 43: Potential Opportunities and Beneficial Impacts

No	Valley	Beneficial Environmental and Social Impacts				
		Food security improvement	Efficient water use in the inland valleys and flood prevention	Employment opportunities for project communities	Reduction in post-harvest losses	Improvement in climate change adaptation measures
1	Odaho	✓	✓	✓	✓	✓
2	Odamu	✓	✓	✓	✓	✓
3	Kumkum	✓	✓	✓	✓	✓
4	Offino	✓	✓	✓	✓	✓
5	Waamu/Kumi	✓	✓	✓	✓	✓

7.1.1 Food Security Improvement

The development of additional areas for rice cultivation will increase from the current 310Ha to approximately 384Ha. With a target of about at least 6.5Mt/Ha, a total of close to 2,500 metric tonnes of rice are expected from these five valleys. This is expected to help improve food security in rice production and also contribute to achieving the government's target for rice production.

The 2,500 metric tonnes of rice are expected to generate at least 2,500 metric tonnes of straw and 500 metric tonnes of husks from the rice which could be used by the Donuaso, Yaw Nkrumah/ New Bonfa, Tano Odumase Barekese/Amakye-bare and Aninkromah communities as feed for their cattle and poultry animals.

According to the engagement from the farmers from all the valleys, with improved water supply and reliability, there is potential for some of these sites to be used for the production of vegetables such as tomatoes, onions, pepper, garden eggs production which can serve as an additional source of income for these farmers. The farmers have estimated that they will be capable of utilising about 10% (approximately 38Ha) of the areas under these valleys for vegetables since these are not suited for inundated areas.

7.1.2 Efficient Water Use in Inland Valleys and Flood Prevention

The construction of additional canals, lateral, drains and land levelling are expected to improve water management practices at the valleys. This is also expected to ensure water conservation and also serve as a climate change adaptation measure by the farmers. Adequate canals, laterals and drains will facilitate efficient movement of water in the valleys to all the cultivated fields at the appropriate time. In addition to training for farmers, this will enhance proper and efficient irrigation water management in the inland valley.

During the peak rainy seasons, all the five valleys get flooded. However, with the provision of adequate drainage canals to take water from the fields through the canals and laterals, flooding situations in the valleys are expected to be prevented. This will afford farmers additional farming areas to improve productivity.

7.1.3 Employment Opportunities for Project Communities

Current conditions in the inland valleys necessitate significant manual labour to manage and channel water to rice fields. This labour-intensive approach has proven discouraging to many farmers, particularly younger individuals, whose participation in these sites remains limited.

The planned construction and improvement work across the five valleys are expected to enhance irrigation infrastructure, thereby attracting increased farmer participation—especially among the youth—and promoting rice cultivation in the inland valleys. This shift is anticipated to generate broader employment opportunities and stimulate demand for rice marketers to handle post-harvest distribution.

During the construction phase, temporary job creation is also expected for local communities. Activities such as field demarcation, bund construction, concrete works for weir formation, and development of access roads are projected to engage an average of 20 casual labourers and 30 skilled workers per valley, directly contracted by each contractor. Collectively, these interventions are estimated to generate over 250 employment opportunities across the five valleys for the total of 12months duration of the rehabilitation works, with at least 40% of these roles allocated to local residents.

7.1.4 Reduction in Post-Harvest Losses

The provision of accessways into the field to allow for small field tractors to convey farm equipment and produce in and out will ensure that harvested produce is easily transported out of the field to the nearest storage and processing centres such as rice mills and warehouses. This is expected to reduce post-harvest losses and improve the quality of the harvested rice produced from these valleys.

7.1.5 Improvement in Climate Change Adaptation Measures

The impact of climate change and variability is expected to affect the availability of water all year round in these valleys. However, these impacts are expected to be lessened with the construction of canals, laterals and drains to properly and efficiently distribute water in the fields in the five valleys. The effective water distribution systems in the valleys resulting in less water demand per acreage is an effective climate change adaptation and coping mechanism in the utilisation of water resources in these valleys.

7.2 Potential Adverse Impacts and Risks – All Valleys

The potential adverse impacts and risks associated with the improvement of the five inland valleys are highlighted in Table 44. Due to the similarity of the practices in each of the five valleys in the Ashanti Region Lot 3, and their location in the same catchment areas, similar environmental and social risks and impacts are associated with these valleys and this is also as a result of the similar designs being proposed for the construction works. According to the nature of these valleys, no additional land acquisition is required, and therefore no significant land-related impacts are anticipated. The targeted valleys have historically undergone periodic rehabilitation, and the current works constitute improvements within already previously developed areas. The proposed road rehabilitation/construction works will be confined to the existing right-of-way, thereby eliminating the need for additional land acquisition.

Detailed assessments of the impacts are provided for construction and operation phases for the valleys in the subsequent sub-chapters.

Table 44: Potential Adverse Impacts and Risks

No	Potential Adverse Impacts and Risks	Valleys				
		Odaho	Odamu	Kumkum	Offino	Waamu/Ku mi
	<i>Pre-Construction Phase</i>					
	<i>Construction Phase</i>					
1	Disruption of livelihoods	✓	✓	✓	✓	✓
1	Impacts on water resources	✓	✓	✓	✓	✓
2	Waste handling and disposal impacts	✓	✓	✓	✓	✓
3	Occupational health and safety risks	✓	✓	✓	✓	✓
4	Labour concerns	✓	✓	✓	✓	✓
5	Potential child labour	✓	✓	✓	✓	✓
6	Fire risk	✓	✓	✓	✓	✓
7	Community health and safety risks	✓	✓	✓	✓	✓
8	Risk of gender-based violence	✓	✓	✓	✓	✓

No	Potential Adverse Impacts and Risks	Valleys				
		Odaho	Odamu	Kumkum	Offino	Waamu/Ku mi
9	Risk of spread of HIV/AIDS and STIs	✓	✓	✓	✓	✓
10	Socio-cultural conflict	✓	✓	✓	✓	✓
11	Flood risk	✓	✓	✓	✓	✓
12	Vegetation/biodiversity impacts	✓	✓	✓	✓	✓
13	Greenhouse gas emissions and climate change	✓	✓	✓	✓	✓
	Operations Phase					
1	Impacts on water resources	✓	✓	✓	✓	✓
2	Waste handling and disposal impacts	✓	✓	✓	✓	✓
3	Inappropriate handling, usage, storage and disposal of agrochemicals and pesticides	✓	✓	✓	✓	✓
4	Disease outbreak and pest infestation	✓	✓	✓	✓	✓
5	Occupational health and safety risks	✓	✓	✓	✓	✓
6	Labour concerns	✓	✓	✓	✓	✓
7	Potential child labour	✓	✓	✓	✓	✓
8	Public/community health and safety risks	✓	✓	✓	✓	✓
9	Socio-cultural conflict	✓	✓	✓	✓	✓
10	Flood risk	✓	✓	✓	✓	✓
11	Fire risk	✓	✓	✓	✓	✓

7.2.1 Potential Disruption of Livelihoods

The mobilisation and assemblage of equipment and machinery in the five valleys, movement of same on access roads and other activities related to the project in the valleys would create an unconducive environment for farmers to continue with their farming activities during construction. The project plans to develop the current cultivated areas in all the valleys as part of the overall total areas in the valleys marked to undergo project intervention. This would mean that farmers would have to eventually stay off their farms to allow for the work to be done. Such an arrangement would, however, cause significant disruption in farming activities and affect the livelihoods of farmers. Given that the rice farms serve as the main source of income for most of the farmers across the 4 districts, any such disruptions would cause significant economic hardship for the farmers.

However, no significant livelihood disruptions or adverse impacts are expected from the existing land tenure arrangements in any of the four valleys, as these areas have been designated exclusively for rice cultivation by the Traditional Authorities, who are the landowners, and are reflected as such in the land-use plans of the respective District Assemblies.

7.2.2 Impacts on Water Resources

Construction Phase

During the construction phase, there will be land preparation which will involve clearing, levelling and excavation, for the construction of the canals and laterals, in-field drains, concrete weirs in all five valleys. Only Oda Valley will involve the construction of a pump station that will be located within the existing farmland land in the valley to feed the plots. A total of about 384Ha of existing farmlands in the 5 inland valleys will be rehabilitated and these lands which are owned by the traditional authorities and allocated to farmers are expected to be rehabilitated in phases at the various valleys. The land preparation will involve the removal of shrubs, bamboo groves and grass, disturbing the top and sub-soil layers, particularly for areas that will be excavated. Land preparation activities tend to expose, loosen, and disturb the soil, making it susceptible to erosion, especially during the rainy season. The likelihood of erosion is high since the municipality is in the semi-deciduous forest zone with high mean annual rainfall. Sediments of the exposed soil can be washed by runoff into the Oda, Odamu, Kumkum, Offin and Waamu Rivers, leading to increased siltation of the riverbeds and increasing the turbidity of the rivers. Baseline water quality analysis of all five rivers revealed the turbidity level to be higher than the permissible threshold prescribed by the WHO hence not wholesome for human consumption. Any further increase in turbidity owing to the deposition of soil sediments from erosion would reduce the overall quality of these rivers. An increase in turbidity could result in the clogging of fish gills or the filter-feeding systems of other aquatic organisms, decreasing light penetration into water and thereby the ability of submerged aquatic plants to photosynthesize and reducing biomass and growth rates of aquatic plants. Suspended particles can also absorb more heat, potentially increasing water temperatures, which holds less dissolved oxygen and further stresses aquatic life, particularly species sensitive to temperature changes. Higher turbidity also makes water unsafe for drinking by humans and animals.

Most residents (i.e., more than half of residents) in the various communities in these valleys rely on boreholes for drinking water with the remaining relying on public taps and pipe-borne water. Therefore, only a few households might rely on these rivers directly for drinking water. Again, the construction phase is expected to last for approximately 18 months, thereby limiting the risk of contamination from erosion in the short term. Also, as part of the project design, areas where there would be cut and fill, the topsoil would be removed/heaped and restored when the land levelling is completed.

Operation Phase

During the operation phase of the valleys, agrochemical residues (e.g., from the use of pesticides, weedicides and inorganic fertilizers) in the soil could be washed away, in the event of heavy rainfall, into the Oda, Odamu, Kumkum, Offin and Waamu Rivers. Agrochemical residues could also be leached into the existing groundwater table and subsequently affecting the borehole and other groundwater sources in the areas. Soil sediments could also be transported and deposited into the rivers by run-off. This could result in sedimentation and reducing the carrying capacity of these rivers.

Fertilizers can introduce high levels of nutrients like nitrogen, phosphorus and potassium into the water, leading to eutrophication, which can cause harmful algal blooms that deplete oxygen levels, harming organisms in the rivers. Pesticides and herbicides, on the other hand, contain toxic substances that can harm fish and amphibians. Contamination of the five rivers from agrochemical residues also poses health risks to humans and animals relying on the river for drinking water and other uses.

Water quality analysis on the rivers in all the valleys indicated that potassium levels were above the permissible level per the FAO's Irrigation Water Guidelines, whereas the levels for phosphate, nitrite and nitrate were below the thresholds. These levels would likely increase during the lifespan of the project as the use of agrochemicals is inevitable. The significance is therefore ranked high.

7.2.3 Occupational Health and Safety Risks

Construction Phase

The use of excavators, graders, plainers/scrapers and contouring machines for land development, construction of headwork structures, canals, laterals, drains roads and other construction work would generate noise levels between the range of 88.5dB(A) - 61.5dB(A) with a 15m radius. Machine operators and other workers close to the various machinery and equipment would be exposed to high noise levels for 8 working hours continuously, which could cause stress, hearing loss, reduce productivity, interfere with communication and concentration, and contribute to workplace accidents and injuries by making it difficult to hear warning signals (OSHA, 2020).

Increased noise from the use of machinery often goes along with vibration effects. The operation of the bulldozer and other machines could produce vibrations resulting in Whole Body Vibration (WBV) of workers. High levels of vibration from these heavy-duty machines could be transmitted to the operator's hands and may affect muscles and joints of the hand, wrist, and arm and in more severe cases, lead to Hand-Arm Vibration Syndrome (HAVS)¹⁰.

Since the valleys are inland areas which are always inundated or wet throughout the year, dust generation which could impact the health of the workers and other passers-by would be insignificant. However, dust could be generated from the movement of trucks on untarred road sections to the sites, emptying of cement bags, tipping and stockpiling of sand and aggregates as well as the concrete mixing process for construction works would lead to dust generation. Workers involved could be at risk of exposure to/inhaling high levels of cement dust. Short-term exposure to dust could result in sneezing, coughing, eye irritation, lung tissue swelling, asthma attack and throat infections, while long-term exposure could lead to permanent illness or injuries (Habybabady et al., 2018). Workers could also be exposed to wet cement (which contains alkaline compounds such as lime (calcium oxide), trace amount of crystalline silica and chromium) which has irritant and corrosive properties when in contact with the skin (HSE, 1994; ELCOSH, 2011).

The combustion of fuel by construction machinery like excavators and graders when in use could release exhaust fumes which consist of particulate matter, carbon monoxide, sulphur and nitrogen dioxides. According to the WHO, both short and long-term exposure to these pollutants can result in health problems including cardiovascular and respiratory diseases (WHO, 2022).

During the land clearing activities and main construction works, obstacles such as vegetative debris, tools and poor levelling of the work surface could cause workers to slip, fall and sustain cuts. Lower back pain may occur as a result of repetitive forceful movements, awkward postures and over-exertion on the back of workers through manual lifting of heavy construction materials e.g., cement bags.

¹⁰ Occupational Safety and Health Administration. (n.d.). eTool: Woodworking – Assembly – Vibration. U.S. Department of Labour. <https://www.osha.gov/etools/woodworking/assembly/vibration>.

The use of heavy-duty machinery during land clearing, and construction of the access roads could present safety risks to workers. Unsupervised manoeuvring of machinery could lead to the knockdown of workers, as they may be on the blind side of the machine operators. Other contributing factors may include disregard for site safety precautions and the nonchalant attitude of drivers. These accidents could lead to broken bones, fractures, spinal injuries and in the worst case, death. Workers involved in the welding of handrails, scour, sluice gates, etc. could be exposed to burns welding sparks and electrical shocks from spatter (hot metals) or unearthed cables.

Site preparation works will involve clearing and removal of vegetation onsite. However, snakes and, scorpions could have their habitats destroyed during this process. The disturbance might lead to heightened risks, as these reptiles could react defensively, potentially posing a threat to workers. Such encounters could result in severe paralysis, difficulty in breathing and extreme cases, lead to fatalities. Also, insects like bees, wasps, etc., could sting workers resulting in pain, swelling, and itching of the affected area.

The occupational health and safety risks from noise and vibration, dust and other emissions, workplace accidents and potential snakebites though localized, the associated health implications could be dire, therefore the significance of the impact is ranked high.

Operation Phase

Agricultural work involves doing several tasks at different places on the farm and around the farm every day, and this has enormous health and safety implications for the farmers. The International Labour Organisation (ILO, 2014) observed that agricultural workers experience the broadest and most extensive exposure to injuries and diseases, more than any occupation worldwide. Asamani (2020) found that rice farmers are exposed to various safety hazards, including the use of agrochemicals, tree stumps, slippery bonds, and broken snail shells in the rice field, among others.

During the operation phase, agrochemicals such as pesticides, herbicides, N-P-K fertilizer, Urea, etc. will be applied to the rice plants, thus exposing farmers to health risks. Occupational hazards could emanate from the inappropriate use/indiscriminate spraying of chemicals without the necessary safety apparel as well as the burning of pest-treated agricultural wastes and by-products (e.g., pesticide containers). This would result in the emission of pollutants that could be directly inhaled by the farmers. These chemicals could also be ingested if farmers do not wear gloves or practice regular handwashing. Exposure effects include irritation of the skin and eyes, headache, nausea, dizziness, and in the long run damage the liver, kidneys, lungs and other body organs.

The use of the powertillers for ploughing the farmlands would generate noise of 76.5dB(A) at a 15m radius. The noise produced could affect the health of machine operators and other farmers on the scheme throughout the operation phase. Short-term effects of high noise levels could cause psychological stress, anxiety, annoyance, increased risk of accidents and progress into tinnitus/hearing loss, hypertension, heart diseases from prolonged exposure. Farmers could also suffer from WBV and HAVS due to the intensity of vibration of the machines. Long hours of exposure can result in musculoskeletal disorders and nerve damage in the hands and arms.

Also, farmers operating powertillers over extended periods could be at a higher risk of direct exposure to emissions (CO, NO_x, and other pollutants), resulting in dire consequences.

The processes of land preparation, transplanting seedlings and harvesting (which is mostly done manually) will require farmers to be in a flexed/stooped posture for hours. Lifting heavy bags of seeds, fertilizer or harvested rice could pose back pains over time. This, among other factors, could expose farmers to work-related lower back disorders. Long-term effects could include back injuries, sprains and even physical deformities. Rice fields can be wet and muddy, increasing the risk of slips, trips, and falls. Uneven terrain and the presence of water can contribute to accidents, especially during planting and harvesting seasons. Farmers not being mindful of the surrounding area could be at risk of falling into the existing canals on site.

Farmers could also suffer from cut injuries by using sharp farm tools. The use of machinery such as tractors, combine harvesters, etc. could present the risk of accidents/ knockdowns. Farmers could experience heat stress from working under hot temperatures without taking adequate breaks, hydration, and protective measures which could lead to heat-related illnesses such as headache, fever and heat stroke.

The swampy nature of the rice fields could serve as breeding grounds for mosquitoes and other vector-borne diseases. Also, the existence of open canals and the stagnant conditions created by the proliferation of aquatic weeds may provide breeding grounds for mosquitoes. This condition could be exacerbated by poor maintenance of the canals thereby increasing weed growth and creating attractive breeding grounds for disease vectors. Hence, the farmers would be susceptible to malaria which is already the highest OPD cases in the four (4) districts where these valleys are located and other diseases from these conditions. Health effects of malaria include fever, muscle aches, diarrhoea, anaemia and jaundice (yellow colouring of the skin and eyes), kidney failure, or even death if not promptly treated).

7.2.4 Waste Handling and Disposal Impacts

Construction Phase

The construction phase of the valleys would generate vegetative waste made up of trees, shrubs, grasses, twigs and leaves from the clearing of the project site. The trees and shrubs can be used for fuel wood, and therefore not considered waste. The cleared twigs and leaves could be pushed into unsightly heaps scattered on land outside the cleared areas. Excavation works could generate a substantial amount of topsoil and excavated spoils from the road and foundation works as well as the construction of drainage systems.

The construction of the canals, weir, sanitary facility, drains and roads will generate waste including concrete, wood, gravel, etc. Again, installation works (intake structures, etc.) may also generate waste such as scrap metal, etc. Construction debris could be disposed of inappropriately within the construction sites and the fringes of drains. The waste could be washed by runoff and potentially silting the drains, thereby reducing their water-holding capacities and potentially causing flooding during a heavy rainfall event.

The different waste types could be disposed of indiscriminately around the construction areas leading to littering of the surroundings. The organic portion of the waste could cause odour nuisance and proliferation of vermin, maggots and flies with repulsive stench at the construction site, which could potentially result in an increase in diarrhoea and typhoid cases in the communities. Empty cement bags discarded inappropriately can be blown by the wind and lead to littering the project site and its environs.

Scrap wastes such as discarded equipment components, batteries, and worn-out tyres will be generated from maintaining construction vehicles. The improper disposal of these wastes could lead to soil and groundwater

contamination, littering and visual pollution. The tyres could also serve as breeding grounds for disease vectors such as mosquitoes, which facilitate the spread of malaria within the communities.

The effect of improper disposal of vegetative waste, excavated spoil, construction, domestic and liquid wastes as well as spent oils and other waste would be expected to be localised and temporary, lasting throughout the construction phase which would take approximately 18 months.

Operation Phase

In the operation phase, waste types to be generated may include crop residues and domestic waste by farmers. Farmers could also practice open defecation on farms. The inappropriate handling and disposal of these wastes could result in contamination of the soil and nearby rivers in the five valleys which recorded high levels of Faecal and Total Coliform values from the baseline water quality analysis. The potential sources of the impact, effects and recipients are outlined in Table 45.

Table 45: Sources, Effects and Recipients for Waste Handling and Disposal Impacts

Sources of Impacts	Effects of the Impacts	Impacts Recipients
<i>Operation Phase</i>		
• Crop residues after harvesting • Liquid and domestic solid waste generated by farmers	• Littering in drainage channels • Open defecation in drainage channels • Contamination of nearby streams/rivers	• Downstream users of the Kumkum Stream

The use of agrochemicals such as fertilisers (i.e. NPK, Urea, etc.) and pesticides (i.e. Adwumawura, Chemosate, etc.) as part of cropping practices could lead to the generation of agrochemical containers. The agrochemical containers could be disposed of unsafely on the fields and could be washed by runoff into the canals, laterals, drains, and eventually into the rivers. The accumulation of these containers in the water bodies could affect the quality of the water sources, thereby making it unsafe for domestic uses.

Other domestic wastes will consist of plastics, papers, leftover food, food scraps, etc. from farmers. The different waste types could be disposed of indiscriminately around the farms leading to littering. The organic portion of the waste could putrefy, causing odour nuisance and other health risks to the farmers.

The silt from periodic desilting of the drains, canals and laterals could be heaped at the banks and could be washed back into the drains by rainwater and runoff. This could pose flood risks to the farms. With the quantity of domestic and crop residue to be generated, the effects of improper disposal may be minimal (short term), however, given the health effects of inappropriate disposal of waste type - liquid and agrochemical waste, the significance of waste handling and disposal impact at the operation phase is ranked moderate.

7.2.4 Inappropriate Handling, Usage, Storage and Disposal of Agrochemicals

Operation Phase

Agriculture has been cited as among the most hazardous occupations in the world (ILO, 2010). Rice farming in Ghana involves extensive manual activities and the use of a wide variety of agrochemicals in crop management processes (L. Asamani, 2022). Although agrochemicals such as fertilizers, herbicides, and pesticides enhance crop growth and yield and protect crops from pests and diseases, the inappropriate use,

handling, storage, and disposal of these chemicals can have adverse environmental and health impacts. The potential sources of the impacts during the operation phase of farming activities in these valleys could include:

- Inappropriate storage, handling, and use of agrochemicals.
- Use of sub-standard/unlicensed agrochemicals.
- Improper disposal of agrochemical containers.

Inappropriate Storage, Handling, and Use of Agrochemicals

Agrochemicals (NPK fertilizers, pesticides, etc.) of various chemical compositions will be utilized on the rice farms. The absence of a storage facility for these chemicals after use could cause farmers in these valleys to store them unsafely in their homes. Household members could inhale the chemicals if not covered properly leading to dire health consequences. Children could also have easy access to these chemicals which could have severe health risks and impacts when they come into contact with or ingest the contents. Prolonged exposure due to unsafe storage could lead to skin and respiratory diseases, cancer, depression, neurological deficits, diabetes, genetic disorders, or even death (Tago D et al, 2014).

Unsafe application and handling of agrochemicals can result in various conditions, including eye and skin irritation, corneal injury upon contact with eyes and skin, and chemical poisoning when ingested. Long-term health effects include dermatitis, low sperm count in males, birth defects, cancers and endocrine disruptions (PAN International, 2007).

The indiscriminate use of agrochemicals, particularly pesticides, can harm non-targeted organisms like soil invertebrates (e.g., earthworms, predatory mites, centipedes, and carabid beetles). Pesticide residues in the soil, while eliminating or reducing parasitic microbes, can also prove toxic to non-parasitic and ecologically valuable soil microbial and invertebrate populations. Accumulation of pesticide residues and their metabolites can alter soil chemical properties, diminishing soil fertility and its ability to sustain life (Iyaniwura TT, 1991).

Use of Sub-standard/Unlicensed Agrochemicals

The high cost and inaccessibility of farm inputs for crops could present the risk of the proliferation of sub-standard/unlicensed fertilizers, pesticides, and other agrochemicals by covert industries. These usually cheap products could easily thrive and capture the market. As such, farmers with limited financial resources or those who may opt for cheaper options to reduce input costs may resort to buying these sub-standard/unlicensed chemicals.

Other contributory factors could be inadequate extension services, as a result, farmers on the scheme may face difficulties in accessing genuine/licensed products. These unlicensed chemicals mostly have their instructions in languages other than English, making it cumbersome to know their chemical content to address a safety/health issue when a user is exposed. The use of these chemicals could increase the cases of upper respiratory tract infections, in the project's districts.

Improper Disposal of Agrochemical Containers

The use of agrochemicals would generate empty chemical containers and sacks which could be disposed of indiscriminately on the farms. The containers could also be used for various purposes including as drinking containers, storage and for fetching water from nearby streams/rivers. This would be dangerous as the residue of chemicals could adhere to the containers and get into the bloodstream of users with its consequent health

challenges. The containers could also be carried by runoff into nearby streams and other water bodies. For containers dumped at the dumpsite and disposed of without triple rinsing, scavengers at dumpsites in search of plastics could come into contact with such containers.

The impacts associated with agrochemical storage, handling, use and disposal are largely localized. However, the environmental implications and health risks are deleterious, therefore the significance of the impact could be high.

7.2.5 Potential Labour Issues

Construction Phase

The construction works in the five valleys are expected to engage about two hundred and fifty (250) workers by the Contractor in the four districts, i.e., 50 workers per valley for the construction works. Construction workers are usually informal workers who typically are not offered employment contracts meaning that their labour rights, such as fair compensation, could be infringed upon. The marginalization of women and other vulnerable groups is frequently observed in employment situations during construction works.

The construction activities will require both formal and informal workers, with the latter usually having less employment protections, making informal workers susceptible to infringement of their labour rights. The main sources of labour concerns during the construction phase could include:

- Non-issuance of employment contracts to workers.
- Unfair compensation for workers.
- Marginalisation of women and PWD.

Often, casual, informal workers typically do not receive written contracts from their employers. The lack of written agreements exposes employees to potential exploitation, granting employers unchecked discretion over employment terms. Informal workers may encounter issues such as insufficient wages, inadequate compensation for overtime, and gender-based pay disparities, particularly impacting female workers. Unjust compensation practices not only erode worker motivation but also hinder project completion by diminishing overall productivity.

In the construction sector, which is predominantly male-oriented, gender bias remains prevalent, resulting in a preference for male recruitment and the possible exclusion of competent female workers from roles traditionally associated with men. Likewise, PWD may face discrimination, affecting both job opportunities and compensation, and encounter difficulties in accessing essential accommodations. Construction sites may lack necessary facilities, such as gender-segregated sanitary facilities and those accessible to persons with disabilities. This environment of exclusion not only impedes the professional progress of women and PWD but also cultivates feelings of disengagement, frustration, and a lack of motivation.

Based on the above, informal workers are more susceptible to violations of labour rights compared to their formal counterparts, given the informal and inherently precarious nature of their work. Additionally, women and individuals with disabilities (PWD) may face discrimination in potential employment opportunities, with male preference being a prevalent factor in the industry. Despite the existence of the Labour Act designed to safeguard the rights of all worker categories, employers often do not comply with its provisions, and violations

are seldom penalized. Consequently, there may be significant labour-related issues and working conditions during the construction phase.

At the community level, the disproportionate allocation of job slots could lead to discontentment within the Donuaso, Yaw Nkrumah, New Bonfa, Barekese, Amakye-bare and Aninkrumah communities which could lead to possible agitations. In its worst form, agitations could lead to members standing against the implementation of works. This could disturb planned work schedules and hence delay project implementation.

7.2.6 Potential Child Labour

Construction Phase

Engaging children in work that robs them of their childhood, potential, and dignity, as well as work that impairs their physical and mental development is considered child labour. It poses social and moral risks to children and may disrupt their education, educational prospects, and achievements. Consequently, child labour can influence the pathways of youth transitioning into adulthood, limiting their chances of obtaining decent work while exposing them to poverty. Additionally, children involved in labour may face injuries and physical violence if assigned tasks exceed their physical capabilities.

The potential source of child labour during the construction phase could be children being engaged in menial activities such as carrying loads, pushing wheelbarrows, etc., during the construction of drains, canals and water control structures.

While there are no official records documenting the employment of children at construction sites, children in the communities could be engaged as inexpensive labour. They may be tasked with performing labour-intensive jobs, such as carrying loads and tools, and engaging in masonry work for the construction of drains and canals, among other tasks.

Children from low-income families in these communities are at a higher risk of facing such exploitation, as parents may pressure them to seek income opportunities to support themselves and their families. The Community Development Officer of the Ejisu, Juaben, Sekyere South Atwima Nwabiagya North Districts indicated that there have been a few cases of children of school-going age not able to remain in school because their parents cannot afford uniforms or school fees. Such children could easily be employed on the construction site. Contractors may also opt to employ children because they are easier to manage and less likely to demand higher wages or improved working conditions compared to adults. This, in turn, can boost the profit margin for the contractor.

The utilisation of heavy equipment on formalised construction projects typically results in a low incidence of employing children. Consequently, the probability of children being engaged in this project is low. The impact during the construction phase is deemed high, taking into account the health and developmental consequences, including deformities and the disruption of their education, experienced by child labour victims.

Operation Phase

During the operation phase, farming activities in these valleys will include planting and harvesting which are mostly carried out manually and this could require lots of labour which could cause farmers to engage the services of the children including their children. The employment of these children in the farming activities could expose them to agrochemicals, physical hazards (like injuries) and parasites infections (like snake bites),

causing respiratory illnesses, skin diseases and musculoskeletal injury among others. This could also deprive them of attaining education as they would stay away from school during the planting and harvesting of agricultural produce. These could affect the paths of the youth and their eventual employment outcomes, minimizing their opportunities for decent work in adulthood, therefore perpetuating a cycle of poverty by limiting their future earning capacity.

Again, with agriculture being the main economic activity in these project communities, produce from the harvest would need to be marketed for the farmers to make economic gains from their yields. In view of this, farmers could employ the services of children in the communities to assist them in the marketing of produce in the marketplaces.

7.2.7 Public/Community Health and Safety Risks

Construction Phase

Hazards arising from the project activities could impair the health and well-being of the public/community. Such risks can manifest in various forms, ranging from loud machinery noise, knockdowns, infectious diseases, chemical exposures, etc. The potential public health and safety concerns at the construction phase include:

- Accidents/knockdowns by haulage trucks.
- Dust and emissions from haulage trucks along untarred access roads.
- Noise and vibration.

Truck drivers delivering construction materials such as gravel, sand, etc., to the work sites could indulge in reckless driving such as speeding, tailgating, and non-adherence to road signs. These could cause road accidents and potential knockdowns of pedestrians and inhabitants in project communities or along the roads. Also, the breakdown of trucks along the community roads could serve as death traps especially at night for other road users. Road accidents of these forms could result in severe injuries and loss of life.

Haulage trucks transporting construction materials to the project site will pass through communities, hence fly-offs/blow-ups of fine aggregates from uncovered trucks and movements on untarred and dusty road sections could generate dust. This could affect nearby communities, pedestrians, or food vendors along the road corridors. Additionally, the combustion of fuel by trucks while in transit would release exhaust emissions containing carbon monoxide, sulphur, and nitrogen oxides. Health effects from prolonged exposure to dust and exhaust emissions could include respiratory tract infections such as asthma, bronchitis, pneumonia and tuberculosis, as well as gritty eyes, impaired vision, and other health problems.

Noise-generating machines deployed in the land development (clearing, levelling and terracing), construction of headwork structures, drainage systems (canals and laterals) and access roads could exacerbate noise effects. Also, the simultaneous use of machines such as excavators, bulldozers, trucks, concrete mixers, etc. for the various construction works could produce high noise levels ranging from 88.5dB(A) - 61.5dB(A) at a 15m radius. These activities will be done for a short period and exposure to noise levels will be minimal since the farms would be far from the communities/residents.

Other sources of noise could emanate from the movement and unnecessary honking of trucks delivering construction materials to the site. This would add to the existing road traffic noise (from vehicles plying the

community roads). The noise generated would be transient to pedestrians, the travelling public, traders and schools along the haulage route. Noise often goes along with vibration. The neighbouring facilities could be exposed to intermittent vibrations from the use of heavy machines at the various project sites.

The effects of noise and vibration would cause disturbance, cognitive impairment, affect the sleep pattern and pose stress to the receptors. These conditions could increase the risk of hypertension in the inhabitants close to the site. The rate of hypertension in Ghana is increasing, and as such has become a highly prevalent chronic disease in Ghana. In 2016, hypertension was listed among the top five and top ten causes of hospital admissions and hospital mortalities respectively in Ghana. It has also been among the top 10 causes of outpatient morbidity for the past decade (GHS 2017). However, the project activities could aggravate cases of hypertension in the project districts.

The health and safety risks will be felt extensively during the construction phase and the associated health implications could be dire; therefore, the significance of the impact is ranked high.

Operation Phase

During operations, open irrigation canals could present safety risks to the public/community members. Factors such as poor security at the irrigation sites, absence of guardrails/barriers along the edges of the canals, and absence of warning signages could induce frequent drowning in the canals. Children and other persons who could access the sites at the blind side of security personnel could be at risk of drowning which could pose fatal injuries depending on the depth of the canals. This could result in hypoxemia, loss of consciousness and ultimately cardiac arrest.

The use of farm machinery such as powertillers and combined harvesters could pose a noise nuisance to the project communities and their environs. Since these activities will be done for a short period and the scheme is not too close to the communities, exposure to noise levels will be low.

Synthetic pesticides are extensively used in farming to control harmful pests and prevent crop yield losses or product damage. Wind direction could enable the spread of pesticides in the air. These chemicals applied to crops could volatilize and may be blown by winds into nearby areas or off-targeted areas, potentially posing a threat to the communities/people in surrounding farms. Exposure could cause short-term and chronic health effects. The acute health effects include stinging eyes, rashes, and blindness while long-term exposure could pose cancers, birth defects, neurodevelopmental disorders in children and developmental toxicity (Riaz Shah, 2020).

Poor maintenance of the canals could create conducive environments for vector breeding and facilitate the spread of diseases. The headworks also pose a potential risk of mosquito and vector proliferation, particularly due to the creation of slow-moving and stagnant waterbodies. These conditions are favourable breeding grounds for disease-carrying mosquitoes, especially *Anopheles*, which transmits malaria. This risk is heightened by the high rainfall and warm temperatures recorded across the four valleys, especially in Sekyere South and Atwima Nwabiagya.

Mosquito infestations could affect nearby communities by increasing the cases of malaria. Malaria has always been on the top list as Ghana's most common cause of outpatient department (OPD) attendance for decades and the top ten causes of death for children under five years (GHS, 2017). Malaria may cause fever, muscle

aches, diarrhoea, and anaemia and jaundice (yellow colouring of the skin and eyes because of the loss of red blood cells). If not promptly treated, the infection can become severe and may cause kidney failure, seizures, mental confusion, coma, and death. The significance of the adverse health and safety project activities on nearby communities is ranked high.

7.2.8 Risk of Gender-Based Violence

Construction Phase

Gender-based violence (GBV) stems from gender inequality, power abuse, and harmful norms, targeting individuals based on their gender. Women and girls are predominantly affected, with about one in three women globally experiencing sexual or physical violence in their lifetime (UNHCR, 2021). Non-standard forms of work like temporary and informal work contribute to power imbalances that enable GBV against women workers. Women in construction projects face potential violence from colleagues/supervisors due to male dominance and perpetuation of harmful gender stereotypes.

The construction works in the five valleys likely to involve the housing of over 250 construction workers spread in the five valleys in the communities (averagely 50 workers per valley with about 40% of these workforce coming from the communities) who will mainly be males will regularly engage with other community members especially females which might results in relationships with associated conflicts likely to be gender-based. If proper orientation and trainings are not offered these construction workers who might be staying longer periods from their original homes, the potential for cases of gender-based violence to be recorded is a reality.

The issues of gender-based violence can be significant if these construction workers engage in activities such as drinking and smoking especially after their daily routine works. Workers under such influence often have poor judgements and often engage in violent acts which can affect the smooth relationship with the local folk. Cases of gender-based violence can be significant and result in potential reputational risk to the project, the Ministry of Food and Agriculture and the World Bank which can result in the suspension of the project.

Additionally, women and girls in the Donuaso, Yaw Nkrumah, New Bonfa, Tano Odumase, Barekese, Amakye-bare and Aninkrumah communities are at risk of abuse from project workers. The potential sources of the impact, effects and recipients during the construction phase are outlined in Table 46.

Table 46: Sources, Effects and Recipients for Gender-Based Violence

Impacts Sources	Impacts Effects	Impacts Recipients
<i>Construction Phase</i>		
• Inappropriate behaviour by colleagues/supervisors/workers • Sexual abuse and harassment • Physical violence	• Physical injury • Mental health problems • Sexual and reproductive health problems • Sexually transmitted infections (STIs) • Reduced productivity • Decreased job satisfaction • Job loss • Unwanted/teenage pregnancy	• Construction workers • Women and girls in project communities

7.2.9 Risk of Spread of HIV/AIDS and STIs

Construction Phase

According to the ILO Guidelines published in 2016, construction workers are at a high risk of contracting HIV/AIDS and STIs. The contributing factors include:

- Stress due to working and living conditions.
- Male-dominated profession and a predominantly masculine environment, with openness to occasional sexual relations.
- High mobility, resulting in long periods spent away from home and family.
- Isolation and working in confined environments and limited contacts; and
- Misinformation or lack of information about HIV.

The HIV/AIDS infection can be a major threat if education and sensitisation is not offered to the construction workers and the local community. Migration - short term or long term, increases opportunities to have sexual relationships with multiple partners. This becomes a critical factor in the spread of HIV/AIDS.

Although awareness of the disease is said to be very high among the Ghanaian population, behavioural change lags far behind this awareness. It could be of particular concern to the local people in these rural communities who may be vulnerable to potential infection through interaction with migrant workers and job seekers out of ignorance.

The risks of the spread of HIV/AIDs and Sexually Transmitted Infections (STIs) may pose a serious threat that must engage the attention of the Contractors in the management of its workers and nearby communities.

Apart from these contributing factors, workers may also hide their HIV status for fear of being stigmatized. These workers could engage in unprotected sexual acts, contributing to the spread of infection. The introduction of migrant workers into the community during the construction and operation phase, coupled with the expected increase in income levels could cause an increase in the recorded cases of HIV and AIDS. The potential source of the impact is outlined in Table 47.

Table 47: Sources, Effects and Recipients for Risk of Spread of HIV/AIDS and STIs

Impacts Sources/Causes	Impacts Effects	Impacts Recipients
<i>Construction Phase</i>		
• Presence of migrant workers • Male-dominated profession • Presence of commercial sex workers • Young women lured into sexual relationships • Stress due to working and living conditions • Non-disclosure of HIV status	• Increased spread of HIV/AIDS and STIs	• Construction workers • Farmers on the scheme • Residents of the nearby communities

7.2.10 Potential Socio-Cultural Conflict

Construction Phase

Often, people from different geographical and social environments have different belief systems and views concerning religion, sacred objects and traditional practices. There is a potential for a breakdown in the reverence and upholding of cultural beliefs, norms and practices of the communities as migrant workers on the project could be prone to flouting and disregarding the cultural heritage of Donuaso, Yaw Nkrumah, New

Bonfa, Barekese, Amakye-bare, Aninkrumah and Offinaho communities. The observance of ‘sacred days’, when no one is supposed to work in the communities, is a ritual practised by the communities, e.g. Tuesdays for Aninkrumah and Wednesdays for Offinaho. Other valleys do not have any known sacred days to be observed. Project activities could flout this ritual, for instance, when persons employed by these communities are to work all the days of the week. The sensibilities of the traditional leaders and elders of the communities would be offended if these beliefs they hold are flouted as it is on these days that they sacrifice and pay homage to their gods. Anecdotal evidence from people in the communities abound that implications for flouting such beliefs could be anything from the perpetrators getting missing or suffering a bad fate to machinery breakdown and strange accidents for the company whose workers flout these beliefs.

The contractor, and consequently the workers, particularly those who are not native to the communities, might ignore established taboos or cultural guidelines in their pursuit to carry out construction activities promptly and prevent financial losses linked to construction equipment downtime. Such actions could result in disapproval and heightened tensions within the local communities, as community members are deeply committed to their beliefs and traditional way of life. This has the potential to cause delays in the implementation schedule of the project.

Operation Phase

Certain farmers and labourers may not belong to the local communities and, therefore, might be unaware of any community taboos and other norms. For these individuals, following these norms could be viewed as an impediment to productivity. This situation has the potential to generate tensions between the project workers and the local residents of the community.

The likelihood of the impact occurring during the operation phase would be low as most workers/farmers would be the local farmers who operate in the valleys.

7.2.11 Flood Risks and Associated Diseases

Construction Phase

The five valleys are flood-prone areas which are muddy throughout the year. During the construction works, water canals and channels will be diverted or blocked. This has the potential of causing flooding in the valleys with the associated problems as breeding grounds for Malaria. According to data from the five District Health Directorates, Malaria has constituted the topmost OPD cases for the years 2020, 2021 and 2022. Any prolonged flooding of the valleys is expected to contribute significantly to the Malaria cases in the areas.

During the construction period, if adequate flood control measures are not implemented, works could be affected by the flooded valley which could result in delays in the execution of the construction works resulting in delays in handing over the valleys to the farmers for their cropping activities on time.

Operation Phase

The project involves the construction of including headworks, canals, pump stations, weirs, and related works. While these components are essential for effective water conveyance and storage, their potential failure or mismanagement, particularly during peak rainfall periods, poses a risk of flooding in adjacent or downstream communities.

In the event of a failure or breach of the headworks or dam structures, there exists a moderate to high risk of downstream flooding, particularly if significant volumes of water are stored during the irrigation season. A sudden release of this water could result in a high-energy flood wave capable of inundating downstream settlements, destroying crops, damaging property, and threatening human safety. The severity of this impact would be heightened if the valleys are steep and settlements are located within or near the downstream floodplain.

Similarly, while weirs typically impound less water than full dam structures, their collapse can still trigger short-duration localised flooding with potential adverse impacts on communities and infrastructure situated immediately downstream, although the risk is generally lower than with dam failure. With respect to the irrigation canals and laterals, the risk of widespread flooding is low and would be localised. If multiple breaches occur or if canal overflows coincide with intense rainfall events, the impact may become more severe.

7.2.12 Disease Outbreak and Pest Infestation

Operation Phase

Disease outbreaks and pest infestation are major concerns on rice farms in the various valleys. Pest infestations can be devastating on rice fields if not managed properly or if proper husbandry practices are not employed. Other pests include birds, snails, thrips, and rice weevils. Rice fields can be attacked by diseases including yellow mottle, blast and leaf blight. Rising temperatures, associated with climate change, could also increase the incidence of pest infestations and disease outbreaks.

The infestation of pests and disease outbreaks could lead to crop damage, resulting in low yields and poor-quality produce. This, in turn, could cause financial losses for the farmers. The potential causes of the impact, effects and recipients are outlined in Table 48.

Table 48: Sources, Effects, Recipients for Disease Outbreak and Pest Infestation

Impacts Sources	Impacts Effects	Impacts Recipients
<i>Operation Phase</i>		
• Improper pest and disease management • Poor husbandry practices • Lack of pest and disease monitoring system • Increasing temperatures	• Uncontrolled infestation • Damage to crops	• Crops • Farmers

Pests and diseases that affect crops pose a significant threat to agricultural productivity and food security. These challenges can manifest in various forms, including insect infestations, fungal infections, bacterial diseases, and viral outbreaks. The impact of pests and diseases on crops extends beyond yield reduction; it can lead to economic losses, disruption of supply chains, and compromised nutritional quality of harvested produce. In Ghana, pests and diseases are named among the main sources of agriculture production risk and the cause of about 25% of total yield loss (Wessel & Quist-Wessel, 2015). Table 49 presents significant pests and diseases of rice crops and the extent of damage.

Table 49: *Extent of Damage of Significant Pests and Diseases*

Crop	Pests/Diseases	Extent of Damage
Rice	Stem borers, rice water weevils, brown planthoppers, rice seed bug, rice blast, sheath blight, brown spot, etc.	• Diseases like bacterial leaf blight and sheath blight can lead to discolouration, reduced grain size, and overall poor grain quality. • Brown planthoppers and stem borers can cause direct damage to the plant, affecting its ability to produce grains.

Factors that could contribute to the spread of pests and diseases during the operation phase include:

- Climate change and extreme weather conditions.
- Use of susceptible plant varieties.
- Inadequate extension services.

Climate change and extreme weather events have a major impact on crop production and agricultural pests. The rising effects of temperature could trigger an expansion of the geographic range of pests and diseases, increase the number of generations, increase their risk of invasiveness, as well as changes in their interaction with host plants. Changes in rainfall patterns, including more intense and frequent rainfall or extended periods of drought, can impact the distribution and abundance of pests and diseases. Excessive rainfall may create conducive conditions for the proliferation of certain pests, while drought stress weakens rice plants, making them more susceptible to diseases.

Future maximum and minimum temperatures as well as rainfall for the valleys are expected to increase (FSRP Draft Engineering Design Report, 2024). Therefore, it is likely that incidences of disease outbreaks and pest infestation could increase.

The use of susceptible plant varieties and other unimproved seedlings in rice cultivation could contribute to increased pest and disease infestations. Farmers could grow these varieties that lack resistance or tolerance to specific pests and diseases which creates conditions favorable for the proliferation and spread of rice plant diseases. Continuous cultivation of susceptible varieties could lead to the accumulation of pests in the soil between planting seasons, thereby posing a continual threat to subsequent crops. This plight could result in high farm losses and have economic implications for farmers.

The absence of extension services could contribute to increased pest and disease infestations of crops through several interconnected factors. Extension services play a crucial role in providing farmers with knowledge, resources, and support for sustainable agricultural practices. When these services are insufficient, it could lead to a lack of awareness, improper pest management, and reduced capacity for farmers to adopt preventative measures. Farmers may lack the ability to monitor and detect early sightings of pests and diseases before they escalate facilitate pest and disease surveillance, helping to monitor and detect outbreaks early to control the situation before it escalates. Also, a lack of proper extension support could enable farmers to resort to over-reliance on chemical pesticides, leading to pesticide resistance and environmental harm.

The likelihood of the occurrence of pests and diseases infestation is high. However, the project objective aims to incorporate integrated pest management (IPM) techniques into the rice farming system to control the emergence of pests and other diseases. Therefore, the significance of the impact is ranked moderate.

7.2.13 Biodiversity/Vegetation Impacts

Construction Phase

The rehabilitation of rice valleys, although focused on enhancing agricultural productivity, may result in adverse impacts on vegetation and biodiversity. These include the potential loss of remnant native plant species which may still exist in riparian zones or uncultivated patches and could be cleared during earthworks without proper supervision of workers during the rehabilitation work. Soil fauna and microhabitats, including termite mounds and burrowing organisms, may be disturbed by leveling activities, affecting ecological functions like nutrient cycling.

Operations Phase

During the operation phase, the dominance of rice monoculture without crop rotation or intercropping can suppress plant diversity and reduce habitat heterogeneity, limiting the presence of associated fauna. Additionally, the use of agrochemicals poses risks of runoff and eutrophication, potentially harming adjacent wetlands and aquatic ecosystems. Rehabilitation works may also fragment remaining ecological corridors, impeding the movement of pollinators and small wildlife, while disturbed soils and altered hydrology can promote the spread of invasive plant species that outcompete native flora.

7.2.14 Greenhouse Gas Emissions and Climate Change

Anthropogenic methane emissions are a leading cause of the increase in global average temperatures, often referred to as global warming. Flooded soils play a significant role in methane production, where the anaerobic conditions promote the production of methane by methanogenic microorganisms (Rajendran et al, 2023). Construction and farming periods that contribute to the flooding of the valleys can contribute to methane emissions leading to greenhouse gas emissions with the resultant impacts on climate change.

7.2.15 Fire Risk

Operation Phase

In the valleys, farmers do not engage in slash and burn in the rice field. The valleys during most of the year are flooded or muddy hence any form of fire will not be able to thrive in the waters. From the engagement with the farmers and those who farm near the valleys, bush or wildfires are not a threat. Therefore, fire risks and impacts in the Kumkum Valley are insignificant.

Table 50:

Impacts

Characterisation: Pre-Mitigation

N o	Characteristics Impacts	Nature			Duration			Magnitude				Extent			
		Direct	Indirect	Cumulat ive	Short- term	Mid- term	Long- term	Negligib le	Minor	Medium	Major	Local- ised	Regional	National	Trans- boundary
	Construction Phase														
1.	Disruption of livelihoods	✓	-	-	✓	-	-	-	-	-	✓	✓	-	-	-
2.	Impacts on water resources	-	✓	-	✓	-	-	-	-	-	✓	✓	-	-	-
3.	Waste generation	✓	-	-	✓	-	-	-	✓	-	-	✓	-	-	-
4.	Occupational health and safety risks	✓	-	-	✓	-	-	-	-	-	✓	✓	-	-	-
5.	Labour concerns	✓	-	-	✓	-	-	-	-	✓	-	✓	-	-	-
6.	Potential child labour	✓	-	-	✓	-	-	-	-	-	✓	✓	-	-	-
7.	Public/community health and safety risks	✓	-	-	✓	-	-	-	-	✓	-	✓	-	-	-
8.	Risk of gender-based violence	-	✓	-	✓	-	-	-	-	-	✓	✓	-	-	-
9.	Risk of spread of HIV/AIDS and STIs	-	✓	-	✓	-	-	-	-	✓	-	-	✓	-	-
10.	Socio-cultural conflict	-	✓	-	✓	-	-	-	✓	-	-	✓	-	-	-
11.	Flood risk and associated diseases	✓	-	-	-	-	✓	-	-	-	✓	✓	-	-	-
12.	Vegetation/biodiversity loss	✓	-	-	✓	-	-	-	-	-	✓	✓	-	-	-
13.	Greenhouse gas emissions and climate change	✓	-	-	✓	-	-	-	-	✓	-	✓	-	-	-
	Operation Phase														
14.	Impacts on water resources	✓	✓	-	-	-	✓	-	-	✓	-	✓	-	-	-
15.	Waste handling and disposal impacts	✓	-	-	✓	-	✓	-	-	✓	-	✓	-	-	-
16.	Inappropriate handling, usage, storage and disposal of agrochemicals and pesticides	✓	✓	-	-	✓	-	-	-	-	✓	✓	-	-	-
17.	Disease outbreak and pest infestation	-	✓	-	-	-	✓	-		✓	-	✓	-	-	-
18.	Occupational health and safety risks	✓	-	-	-	-	✓	-	✓	-	-	✓	-	-	-
19.	Labour concerns	✓	-	-	-	-	✓	-	✓	-	-	✓	-	-	-
20.	Potential child labour	✓	-	-	-	-	✓	-	-	-	✓	✓	-	-	-
21.	Public/community health and safety risks	✓	-	-	-	-	✓	-	-	✓	-	✓	-	-	-
22.	Socio-cultural conflict	-	✓		✓	-	-	-	✓	-	-	✓	-	-	-
23.	Flood risk	✓	-	-	-	-	✓	-	-	✓	-	✓	-	-	-

No	Impacts	Nature			Duration			Magnitude				Extent			
		Direct	Indirect	Cumulative	Short-term	Mid-term	Long-term	Negligible	Minor	Medium	Major	Localised	Regional	National	Trans-boundary
24.	Greenhouse gas emissions and climate change	✓	-	-	-	-	✓	-	-	✓	-	✓	-	-	-
25.	Fire risk	-	✓	-	-	-	✓	✓	-		-	✓	-	-	-

8.0 ENVIRONMENTAL AND SOCIAL MITIGATION PLAN

The assessment revealed some significant potential impacts and risks for which mitigation measures will be required to ensure environmental soundness, social acceptability, health and safety as well as project sustainability at both the construction and operation phases. The mitigation measures are guided by the provisions outlined in FSRP2's Integrated Pest Management Plan (IPMP), Labour Management Procedures (LMP), Stakeholder Engagement Plan (SEP). For the 5 inland valleys assessed in this ESIA, a standalone site-specific Environmental and Social Management Plan (ESMP) has been developed for each site to provide mitigation measures for the specific risks and impacts identified in each valley. These ESMPs will be consulted upon and disclosed before commencement of works on the ground. The ESMPs and this ESIA will serve as reference materials for contractors, who are required to prepare Contractor's Environmental and Social Management Plans (C-ESMPs) to address project-related risks and impacts, including those pertaining to occupational and public health and safety. While some of the measures were built into project design, others would be implemented during project execution. Other measures will also aim at enhancing potential project opportunities. The baseline characteristics, farming practices, design characteristics and impacts of the construction work among others are similar to all the five inland valleys. Therefore, the following mitigation measures apply to all five inland valleys to ensure environmental and social sustainability of the construction works and the operations of the valleys:

1. Prevention of livelihood disruptions.;
2. Water resources protection measures;
3. Waste management;
4. Safe use and disposal of agrochemicals;
5. Integrated pests and disease control;
6. Occupational health and safety measures;
7. Labour safeguard measures;
8. Child labour prevention;
9. Fire prevention and control;
10. Public/community health and safety;
11. Prevention of gender-based violence;
12. HIV/AIDS and STIs prevention measures;
13. Social conflict prevention measures;
14. Flood prevention measures;
15. Prevention of vegetation/biodiversity loss; and
16. Reduction in Green House Gas Emissions.

8.1 Prevention of Livelihood Disruptions– All Valleys

Involuntary resettlement is not expected or foreseen currently during the construction phase as the land to be used for the project (in the various valleys) have been set aside by the various traditional authorities (in whom ownership of the respective lands are vested) to be used for rice cultivation only. The MMDAs have designated these inland valleys for rice farming within the spatial planning scheme. Nevertheless, all works will adhere to the applicable local laws and ESS5 requirements on impacts livelihood displacement.

However, to minimize livelihood disruptions during construction activities in the valleys, the works have been strategically designed to allow ongoing farming in cultivated areas while other portions of the valleys and headworks are developed in phases. This phased approach will ensure that farmers can continue agricultural operations with minimal interference. In valleys such as Odamu, Waamu/Kumi, and Kumkum, upstream channel works will be prioritized to prevent prolonged blockage and maintain water supply to downstream cultivated fields. To further safeguard livelihoods, temporary alternative access routes will be established for machinery and vehicles to reduce the risk of conflict and interference with farming activities. Construction zones will be cordoned off to protect farmers and ensure safe coexistence of farming and project operations. Additionally, construction intensity will be increased during post-harvest periods when farmers are primarily engaged in drying and milling, thereby reducing direct impact on cultivation. Farmers interested in participating in construction activities will be engaged by the contractor, providing short-term income opportunities. A collaborative work phasing schedule will be developed through continuous engagement with farmers, led by the Department of Agriculture and coordinated by the supervising consultant and FSRP2. Farmers will also be sensitized on the concurrent farming and construction arrangements and trained on safety protocols to ensure their wellbeing and sustained livelihood throughout the project implementation.

8.2 Water Resources Protection

As part of the mitigation measures against impacts on the water resources from the construction works in the various valleys, only the required area of 384Ha will be cleared for the development of canals, laterals and drains. This is expected to be done in phases to limit any impact as a result of run-off into the water bodies. The minimum buffer zones of at least 10m – 20m in line with Water Resources Commission recommended standards for riparian buffer zones will be observed between areas for land clearance and the various water bodies. The works will be scheduled to be carried during the dry seasons from November to March as per the rainfall pattern for the valleys to minimise and avoid the impact of runoff that is associated with the peak rainfall months.

The irrigation canals to be constructed are expected to improve the drainage situation in the valleys thereby minimising flooding after the construction works and during the operations of the various valleys. The canal will also serve as drainage control measures to prevent soil erosion through the improvement of the normal flow of the Oda, Odamu, Kumkum, Offin and Waamu Rivers through dredging and enforcement of the stream banks with appropriate indigenous grasses. These measures are to prevent the further enrichment of the sediments of the rivers which from the baseline have high turbidity values. Proper and adequate embankment provisions for the canals are also expected to minimize the amount of sediment and agro-chemical laden run-off likely to eventually reach the water bodies from the rice plots in the valleys.

Additionally, the Department of Agriculture Extension Officers in the four districts will continue to teach farmers to always use only the approved list of agrochemicals by EPA with guidance in the FSRP Pesticide Management Plan. Additionally, the adoption of integrated pesticide management practices will be prioritized by the farmers. Agrochemicals will be applied sparingly on the farm by well-trained farmers. The herbicides (Propanil and Glyphosate) will be applied only when very necessary and the NPK and Urea fertilizers on the soil only at the onset of planting seasons to curb abuse.

Adequate waste collection systems and places of convenience will be provided during the construction period (mobile toilet facilities) and operations (permanent facilities) in the form of water closet toilets to manage domestic wastes in the valleys.

The FSRP through the Departments of Agriculture at the various District Assemblies will liaise with District Health Directorates (DHD) to facilitate community education programmes to create more awareness about proper waste disposal and sanitation and the prevention of water-related diseases. This will help improve sanitation in the area. The communities will also be educated on simple water purification techniques (like the use of clean white cloth, boiling, etc) to help reduce the incidence of waterborne diseases in the area.

8.3 Waste Management

In compliance with the objectives and the specific guidelines for environmental sanitation services of the Environmental Sanitation Policy (2010), measures would be put in place to minimise the impact of waste on the environment. The waste management measures are grouped into the construction phase and operation phase and are expected to be guided by the projects ESMPs prepared for each valley and these are to be included in the Contractors Environmental and Social Management Plans (C-ESMPs):

Construction Phase

The pulled-down trees and shrub stems will be stockpiled and made available to the various project communities within the four selected districts and other interested parties for collection and use as fuelwood. The leaves and twigs will be spread and ploughed into soil or allowed to decompose.

Excavated material will be used for the backfilling of roads, canals, etc. Excess excavated material will also be used in reclaiming borrow pits sites. During the construction phase, all stockpiled excavated material will be covered with tarpaulin, to prevent being washed by runoff, silting drains and nearby water bodies, and potentially causing flooding.

The topsoil generated will be stockpiled to enrich the soil for rice cultivation. Landscaping activities would take place almost simultaneously with construction activities to promote early greenery and minimize topsoil losses.

Waste segregation will be adopted to separate wastes from construction materials, domestic, scrap metals, containers of oil, lubricants and paints and oily rags, etc. Once segregated, the wastes could become potential resources for re-use or recycling after treatment, and thus, no longer pose any of the assessed environmental and health risks.

At the construction site, waste bins will be clearly labelled, or colour-coded for ease of identification and use for waste segregation and placed at vantage points. The wastes will be segregated at source into two major categories, i.e. organic and inorganic such as plastic containers and packaging materials and labelled as follows:

- Blue Bin – plastics, glass and bottles.
- Green Bin – organic (food left over), wood, other miscellaneous waste.

The Green labelled waste bins consisting of organic and paper wastes, will be destined for outright disposal or composting. Orientation training particularly on waste segregation and the use of colour-coded bins will be conducted for workers at the construction phase.

Other segregated construction waste including the following will be outsourced to Zoomlion Company Limited who are the accredited waste management contractor for removal and appropriate handling in the various district assemblies:

- Cement paper bags, paper, cardboard, etc.
- Pieces of iron rods and scrap metals, etc.
- Recyclable plastics, bottles, etc.
- Metal cans and containers of paints, lubricants, solvents, etc.

Machine servicing and maintenance works on major construction equipment will be outsourced to third-party contractors to ensure proper management of waste oils and scrap waste (discarded engine components, batteries, and worn-out tyres from machinery and vehicle servicing and other repair work during the construction phase of the project. For machines that will be serviced on site, the activities will be carried out in designated service sites with impervious surfaces. The oils generated from these activities will be collected in sumps. Oil waste will then be collected and sent to treatment service facilities.

During the construction phase, workers will be provided with mobile toilet units, separated for gender, for use. Also, severe sanctions (including summarily dismissal) will be applied to workers who engage in bush/open defecation.

Operation Phase

During the operation phase, farmers would be provided with two coloured waste bins (green and blue). The green bin will be designated for receiving organic waste while the blue bin will be designated for receiving other waste such as plastics, bottles, etc. The recyclable materials will be collected by accredited recycling companies, while the green-labelled waste bin consisting of organic waste will be destined for outright disposal. Orientation training particularly on waste segregation and the use of colour-coded bins will be conducted for the farmers at the operation phase.

Machine servicing and maintenance works on the pumps at the pumping station at the Odaho Valley will be outsourced to a third-party contractor to ensure proper management of waste oils and scrap waste (discarded engine components, batteries, and worn-out tyres from machinery and vehicle servicing and other repair work during the construction phase of the project. All other farm equipment will also be serviced in the various towns at the appropriate service areas to avoid field contamination. This arrangement will be supervised by the Agriculture Extension Officers of the Department of Agriculture in the various districts.

During the operation phase, toilets with septic tank facilities will be constructed for use at the respective project sites. The septic tanks would be dislodged when about 2/3 full by an accredited liquid waste management company.

Crop residue comprising of process residue (straw, husks, skins, trimmings, cobs and bran of cereals) and field residue (stalks and stubble/stems, leaves of crops) will be tilled into the soil to improve the soil structure and organic matter content and also carted to feed animals.

8.4 Safe Use and Disposal of Agrochemicals

A comprehensive Integrated Pest Management Plan (IPMP) has been prepared as a standalone document to guide farmers and other stakeholders on the safe use of agrochemicals and the management of pests under the FSRP2 implementation.

During the operations phase, farmers who will be applying agro-chemicals will be required to wear the appropriate Personal Protective Equipment (PPE) which includes overalls, wellington boots, nose masks, and gloves on the farms at all times. The use of PPE will be mandatory. Farmers will be educated on the correct use, handling, storage, and application of pesticides and agro-chemicals. Education on correct farm working posture will be given to reduce the occurrence of back pains among workers.

The Department of Agriculture Officers in the various districts shall provide training in agrochemical (pesticide) handling, and the wearing of adequate protective gear prior to pesticide application and would be enforced in all the valleys. To facilitate enforcement, MSDS on the agrochemicals shall be prominently displayed. Proper timing of weather conditions (including wind direction and speed) would be considered so as to avoid pesticide or fertilizer application during windy periods (to prevent spray drift) or prior to the onset of the rains. Chemical containers would be properly stored at designated areas and returned to dealers for recycling and proper tracking in line with ESS3 and EHS Guidelines.

8.5 Integrated Pests and Disease Management (IPDM)

The pests and disease control measures for the various valleys will be guided by the Integrated Pest Management Plan (IPMP) for the FSRP. The IPDM will combine biological, chemical, physical and crop specific (cultural) management strategies and practices to grow healthy crops and minimize the use of pesticides, reducing or minimizing risks posed by pesticides to human health and the environment for sustainable pest management. The following principles will be promoted among farmers in the five valleys in the promotion of IPDM with the associated benefits:

- Sustainable pest control measures that build on ecosystem services such as pest predation while protecting others, such as pollination. This will contribute to increased farm productivity and food availability by reducing pre- and post-harvest crop losses.
- Reduction in pesticide residues which will contribute to food and water safety, as reducing the number of pesticides used in turn reduces residues in food, and the environment in the valleys.
- Less application of inorganic fertilizers will result in increased income levels for farmers.

The following FSRP2 IPMP specific strategies will be adopted for the valleys to achieve effective pest and pesticide management:

- Formation of safeguard teams to provide support to farmers on the IPMP;
- Registration and training of all interested pesticide distributors/resellers;
- IPMP communication and orientation workshops for the relevant stakeholders;
- Education and awareness creation to all farmers and other stakeholders;
- Participatory pests inventory and monitoring measures;
- Stakeholder and interest group consultation and involvement;
- Prevention of new pest infestations;
- Management of established pests;
- IPM capacity building;

- Institutional arrangements and training responsibilities;
- Participatory monitoring and evaluation;
- Reporting;
- Management reviews; and
- Institutional arrangements for the implementation and monitoring of the IPMP.

Additional measures to mitigate the pest and disease situation, and the adverse impact on productivity and produce quality shall include the promotion of disease-tolerant and climate-resilient plant varieties to farmers and the training of farmers on climate-smart agricultural practices.

8.6 Occupational Health and Safety Measures

The Labour Act 2003 (Act 651), of Ghana under Part XV (Occupational Health, Safety and Environment) which outlines the duties of an employer to ensure that every worker works under satisfactory, safe, and healthy conditions will guide the occupational health and safety measures to be adopted at the valleys. In addition, the provisions in the World Banks EHS Guidelines and the FSRP2's LMP will also be applied to ensure the safety of workers, farmers and community members. The following measures will be implemented to ensure the health and safety of workers engaged for the construction works in the five valleys.

Construction Phase

During the construction phase, Personal Protective Equipment (PPEs) such as overall, nose masks, ear plugs, gloves, goggles and wellington boots will be provided for all works. Operators of machinery would be required to wear ear plugs to protect their ears from noise generation. Reverse alarms will be installed on all the machinery used to alert people when the machines are backing up to avoid accidents. All drivers will be entreated to comply with the speed limits especially in the delivery of materials to site. First aid kits will be provided at the Contractors camp with trained personnel in charge. Education on health and safety for workers will be conducted by the Contractors EHS unit team twice a month in collaboration with the district health directorate in addition to their daily toolbox meetings. The Contractors EHS unit will collaborate with the district health who will provide health officials to form part of the health and safety educational awareness creation team.

In addition, the following specific measures will be adopted to make the construction works in all the valleys safe and incident-free: These also expected to be included in the C-ESMPs as part of a detailed labour management plan.

Noise and Vibration Reduction Measures

- Operators of machinery will be required to switch off idling engines.
- Machinery and equipment will undergo scheduled servicing for efficient output and reduction in potential frictional noise from moving parts.
- Installation of suitable silencers/mufflers on engine exhausts of construction machinery.
- Operators of noisy and vibratory equipment and machinery such as bulldozers, excavators, etc., will operate a 4-hour scheduled shift.
- Padded seats will be fitted in mobile equipment and worn-out pads promptly replaced to limit the effect of vibration transmission to drivers.
- Provision of vibration reduction gloves for handheld equipment operators.
- Workers on site will be provided with and required to use earplugs.

Dust and other Emissions Control Measures

- Trucks transporting construction materials to the project site and stockpiled materials will be covered with tarpaulin to prevent dust fly-off.
- All trucks and other equipment will follow a maintenance regime and records kept for inspection and auditing.
- The appropriate PPE will be supplied and provided for construction workers and painters to reduce the impacts of dust, wet cement and VOCs in their line of work. These will include nose mask, respirators, safety goggles, overalls hand gloves and boots.
- Workers will undergo pre-employment health screening for respiratory diseases, general health examination and then regular health checks will be repeated annually to form part of the health surveillance program.
- Periodic toolbox meetings will be organised to provide safety orientation for all workers (e.g., construction workers, painters, etc.) to raise awareness, for instance on the dangers of exposure to chemicals and solvents.

Workplace Accidents Minimization Measures

- Construction machinery will be equipped with reverse alarms to alert workers when reversing or backing up.
- Haulage trucks and other construction machinery, equipment and vehicles will be required to follow a strict maintenance regime and recording.
- Use of flagmen on site to supervise the movement of construction machinery.
- Adherence to a speed limit of 20km/hr for vehicles within the site.
- Use of lifting aids such as wheelbarrows to prevent manual handling and the associated musculoskeletal injuries.
- Orientation of workers on the basic site rules/health and safety measures (e.g., hazard awareness, safe work practices, etc.).
- Observance of good housekeeping practices, inspected by a supervisor, including ensuring that hand tools are not haphazardly left after use.
- Provision and use:
 - Personal protective equipment (PPE) including helmets, reflectors, fall arrest, hard-toe boots, welding clothing, gloves, ear plugs, etc.
 - Toolbox for the storage of hand tools.
- Ensure appropriate training and enforcement of the proper use of PPE by all workers.
- First Aid will be provided to cater for injured workers before they are sent to the nearest hospital depending on the level of injury.
- A select few of the workers will also be trained to act as First Aid Attendants to respond immediately to all work-related injuries.
- A pre-employment medical examination followed by a periodic medical examination at least twice annually.
- All accidents/injuries/near misses and training will be reported, recorded and documented.
- The Contractor is required to procure a Workmen's Compensation Policy (Insurance) to cover all workers in cases of residual accidents, in accordance with the Workmen's Compensation Act, 1987 (PNDCL 187).

Control of Snakebites

- Workers will be provided with the appropriate footwear such as Wellington boots and protective clothing (long sleeves and pants, gloves, etc.) against insect bites.
- In the event of an incident occurring the following measures will be implemented:
 - Victims of snakebites will be sent to the nearest health facility for anti-venom treatment.
 - All injuries/snake bites will be reported and recorded.

8.7 Labour Management Plan

The labour management procedures will cover the issuance of employment contracts, fair compensation for all workers and non-marginalisation of women and PWD.

Construction Phase

The contractor, as part of their contractual responsibilities, will comply with the FSRP2 Labour Management Procedures (LMPs) and develop a Labour Management Plan as part of the Contractors Environmental and Social Management Plan (CESMP). Within the framework of the Labour Management Plan, the contractor will introduce measures to handle labour-related issues and improve working conditions. The management of the Contractor in conjunction with the officers from the Department of Agriculture and leaders of the farmer groups will oversee any local content recruitment and employment. A committee comprising of representative of the farmers, landowners and District Assembly will be in charge of recruitment and will be tasked to ensure that only ‘qualified’ members from the communities are considered for employment. The involvement of farmers and the officers from the Department of Agriculture at the Sekyere South District Assembly in the employment process would earn the trust and confidence of the community and hence forestall potential agitations.

The Contractors are expected to implement the following as a way to provide a safe and healthy workplace to workers to be engaged in all the valleys:

Issuance of Employment Contracts

The contractor will be obligated to provide employment contracts to all classes of workers. The Labour Act stipulates the provision of a copy of the worker's employment contract without any bias.

Fair Compensation

To guarantee equitable remuneration for the work performed, the contractor must fulfill the following obligations explicitly outlined in the employment contract with workers:

- Pay all workers compensation that is equal to or above the national minimum wage.
- Pay workers full compensation for overtime work.
- Pay male and female employees on the same work schedule equal compensation.

Non-marginalisation of Women and PWD

To promote the empowerment of women and PWD, the following measures will be implemented:

- The contractor will employ women and PWDs, where feasible.
- The contractor will provide -
 - Adequate and suitable PPEs for any PWD workers.

- Adequate access aids for any PWD workers.
- Adequate and separate sanitary facilities for women and PWDs.

8.8 Child Labour Prevention

In addition to the measures below, all engagement of casual and skilled workers will follow the guideline specified in ESS2 in relation to child labour.

Construction Phase

In ensuring the non-employment of underaged children and compliance with the FSRP2 LMPs, the Contractors for the valleys shall:

- Verify the ages of all project employees by examining national identification documents such as the ECOWAS Identity Card (Ghana Card), birth certificate, and national driver's license.
- Maintain detailed records of employees, including verified dates of birth.
- Terminate the employment of any underage employee discovered to be working on the project and follow the national standard operating procedure for remediation of such incident.

The project will implement the FSRP grievance mechanism, aligning with the Child Act, 1998 (560) and MoGCSP Standard Operating Procedures (SOPs) for Child Protection and Family Welfare cases. Additionally, Section 16 of the Children's Act mandates the MMDAs to safeguard and uphold the welfare and rights of children within their jurisdiction. Consequently, collaboration among FSRP, the DSWCD of the assemblies will involve the following actions:

- Conduct community education to discourage child labour and prevent children from participating in construction activities.
- Carry out spontaneous monitoring of construction activities to eradicate all forms of child labour during the construction phase.
- Remove children who are below the minimum age of 15 years and below 18 years for hazardous activities from the construction site, reporting to the District Command of Domestic Violence and Victims Support Unit (DOVVSU) of the Ghana Police Service in cases related to trafficking or classified as high-risk. For other such cases not related to trafficking or forced labour, follow the Standard Operating Procedures for child labour remediation developed by the MoGCSP and involve the Social Welfare Department.
- With the help of MMDA Department of Social Welfare, identified tailored supports to parents to reduce economic pressures to engage children in labour.
- Raise awareness in local communities about the project's grievance mechanism and emphasize the importance of utilizing the grievance mechanism specifically for cases involving children.

In the event that underage workers are discovered working on the project, the following measures will be implemented:

- Report the case to the World Bank within 24hrs following the Environmental and Social Incident Reporting Protocol.
- Immediate termination of the contract and services agreement with the contractor, in accordance with the Labour Act of 2003 (Act 651).
- Arrange a meeting with the child following age-appropriate consultation process to understand the reasons for seeking employment.

- Refer the child through his/her family to additional support services, including social services and the Ministry of Education.
- If the child's family is identified as vulnerable or in dire circumstances, contemplate employing another adult member of the family.

Operation Phase

- The District Agriculture Extension Officers and the Executives of the Water Users Association of farmers in the valleys will oversee and address instances of child labour violations associated with the various valleys. They will also undertake educational efforts to raise awareness among farmers about the detrimental effects of child labour, such as its impact on a child's education and health, as well as the negative repercussions for the reputation of the irrigation scheme and farm produce.
- Farmers found guilty of employing children on their farms will face the following sanctions, contingent on the severity of their offence:
 - Suspension from participating in the valley.
 - Imposition of fines or other penalties.
 - Reporting to the closest Social Welfare Department if the activity the child was performing is not hazardous and to the Domestic Violence and Victim Support Unit (DOVVSU) of the Ghana Police Service and DSWCD for investigation and prosecution, in accordance with the Children's Act, if the employment is classified as high risk (involving hazardous work like applying insecticides on the farm).

8.9 Fire Prevention and Control

Operation Phase

- Farmers will be sensitized ahead of each dry season to create fire belts around their farms if threats exist.
- Awareness creation and education will be conducted for farmers on the causes of bushfires, their effects and prevention.
- Firefighting drills will be conducted for the farmers and workers annually to prepare in the unlikely event of fires.

8.10 Public/Community Health and Safety

Construction Phase

The following measures will be implemented to safeguard communities/public health and safety during the construction phase of the project:

- Prevention measures against knockdowns/accidents.
- Dust and emissions control measures.
- Noise and vibration reduction measures.

Prevention Measures - Knockdowns/Accidents

- All drivers/operators will be trained on defensive driving to avoid frequent knockdowns.
- Speed limit restrictions (40km/hr) would be observed for the trucks when moving on the community road.
- Banksmen will be deployed to control the movement of haulage trucks when exiting and entering the site.

- Education/sensitisation of community members and neighbouring facilities on impending haulage activities and safety impacts.
- Installation of construction notices close to the project site.
- Appropriate phone contacts will be inscribed on the truck for purposes of reporting careless and inconsiderate driving or excessive speeding.
- Truck drivers will be provided with communication devices (handheld transceivers or cell phones) to be able to report any accident or anomaly in the vehicle immediately.
- A towing arrangement will be instituted for the prompt removal of broken-down trucks within 30 minutes of reporting.

Dust and Emissions Control Measures

- Haulage trucks conveying materials will be covered with tarpaulins to prevent fly-offs and blow-ups of fine aggregates.
- Haulage trucks would be required to comply with a strict maintenance regime and recording, to reduce exhaust emissions.

Noise and Vibration Reduction Measures

- Use of site machines and trucks will be restricted to daylight hours.
- Operators of the machines will be required to switch off idling engines.
- Haulage truck drivers will be encouraged to avoid unnecessary honking when moving within the community.
- Scheduling of machinery and truck movements so that persons are not exposed to periods of continuous noise.
- Machinery will undergo scheduled servicing for efficient output and reduction in potential frictional noise from moving parts.

Operation Phase

The following measures will be implemented to safeguard communities/public health and safety at the operation phase of the project.

- Measures to prevent drowning in canals.
- Noise and vibration reduction measures.
- Appropriate handling of pesticides.
- Control measures against the risk of malaria.

Measures to Prevent Drowning in Canals

- Warning signs (pictorial) prohibiting swimming would be posted at vantage points along canals.
- Installation of guardrails around the main canals.
- Appropriate notices and warning signs will be erected around working areas and public areas to warn prospective trespassers of any danger or risk.
- Ensuring proper security at the sites to prevent unauthorized entries.

Noise and Vibration Reduction Measures

- Use of farm machinery e.g. power tillers and combine harvesters will be restricted to daylight hours.

- Operators of the machines will be required to switch off idling engines.
- Machinery will undergo scheduled servicing for efficient output and reduction in potential frictional noise from moving parts.

Appropriate Handling of Pesticides

- Farmers will be trained on the safe handling and application of pesticides including the type of dress codes to use, adherence to labels on containers and determination of ideal application weather conditions.
- Farmers will be trained to have the requisite training and necessary certification to apply pesticides.

Control Measures Against the Risk of Malaria

- Frequent removal of aquatic weeds from canals and desilting of drains.

8.11 Prevention of Gender-Based Violence

Contractors must comply with the FSRP GBV/SEA/SH prevention action plan to address gender-based violence, including sexual exploitation, abuse, and harassment, as 24–30% of women aged 15–49 in Ghana have experienced physical or sexual violence according to the 2021 PHC, highlighting the need for focused intervention. In addition to the project GBV/SEA/SH Action Plan and Labor Management Procedures (LMP) which have been developed as standalone documents with mitigation measures on GBV/SEA/SH, all contractors will develop C-ESMP which will incorporate GBV/SH policy and mitigation measures. Code of conduct will be signed by all workers on the prevention of GBV including SEA/SH and training on the protection of human rights. Additional provisions shall include:

- Grievance Mechanism (GM) with specific provision for the receipt of GBV/SEA/SH incidents and following the Project existing referral pathway for handling. The contractor will develop and institute a GBV and SEA/SH policy. This policy will ensure the following:
 - Reported cases will be followed up on to ensure resolution;
 - Suspension of all perpetrators pending investigations and court proceedings. Reported workers will only be dismissed after proven guilty; and
 - Victims are aided in receiving support.
- Education campaigns and sensitization programs on SEA/SH will be organized.

The FSRP PIU will review all the CESMPs to ensure they all contain the above provisions as the minimum in addition to the provisions in the project's Gender Action Plan, LMP among others.

8.12 HIV/AIDS and STIs Prevention Measures

During the construction phase of the various valleys and in line with the national strategic plan for HIV/AIDS prevention, the contractors will develop plans as part of their CESMPs for the prevention and awareness creation on HIV/AIDS. Additionally, all workers engaged by the contractor will undergo HIV/AIDS education and sensitisation which will be led by the various District Health Directorates. The education, and awareness creation will include the following measures:

- Condom use promotion and distribution;
- Counselling and care for people living with AIDS (PLWAs);
- Facilitation of voluntary counselling and testing of HIV status of workers;
- Provisions for the management of sexually transmitted infections (STIs); and

- HIV/AIDS education to nearby communities and communities in which workers of the company live.

The Contractor shall implement of HIV/AIDS Workplace Policy which among other things shall include the following:

- Awareness creation among workers on HIV and AIDS risks and dangers
- Implement preventive programs including
- Incorporation of the HIV Workplace Policy into working conditions to prevent discrimination or stigmatisation of workers.

8.13 Social Conflict Prevention Measures

Construction Phase

The construction phases of the various valleys will adopt the following strategies and implement the following measures to avert conflicts between the project and local communities:

- Conducting sensitization sessions for the contractors and workers regarding the cultural norms, including taboos, of the communities.
- Encouraging the contractor to hire a significant portion of the workforce from the local community.
- Employing the project Grievance Mechanism (GM) to address grievances and facilitate conflict resolution between workers and locals.
- Migrant workers engaged during the operational phase will undergo awareness programs on the cultural norms and values prevalent in the project community.
- Utilizing the project GM to handle grievances and settle conflicts between workers and residents of the various communities.
- The grievance resolution mechanisms captured under section 11.20 will guide all conflict resolution processes.

8.14 Flood Prevention Measures

Since all the valleys are flood prone areas that are muddy throughout the year, the construction of canals will help properly channel the excess water downstream. Adequate canals have the potential to minimize water stagnation hence reducing mosquito breeding grounds which contribute to the malaria cases in the areas.

Although there might be issues of flooding during construction if the water diversions are not properly done, this is expected to be resolved with the construction works. Farmers are also expected to be trained on proper water management in the valley to prevent flooding during the operations of the various valleys. Again, adequate spillways, drainage and lining for the canals will be ensured to minimise the risk of flooding from headworks/weir/canal failures. Regular inspections and maintenance will be conducted on all structures including the headworks during the operation phase to maintain their integrity.

8.15 Prevention of Vegetation/Biodiversity Loss

Construction Phase

To mitigate the biodiversity and vegetation impacts associated with rice valleys, during construction, ecological screening should be conducted to identify and protect remnant native vegetation and sensitive habitats, particularly in riparian zones. Vegetation clearance must be supervised by trained personnel to

prevent unnecessary loss, while low-impact levelling techniques should be adopted to minimize disturbance to soil fauna and microhabitats. Workers should also receive training on biodiversity protection protocols.

Operation Phase

In the operations phase, promoting crop diversification through intercropping and cultivation of vegetables where feasible or rotation can help counteract the ecological limitations of monoculture. Integrated pest and nutrient management practices should be adopted to reduce agrochemical runoff and its effects on adjacent ecosystems. The maintenance of ecological corridors and vegetated buffer strips in line with the Water Resources Commissions Buffer Zones Policy will support wildlife movement and habitat connectivity. Regular monitoring and control of invasive species, along with careful water management planning, are essential to maintain ecological balance and prevent further degradation of native flora and fauna.

8.16 Reduction in Greenhouse Gas Emissions

Greenhouse methane emissions from rice fields are mostly mitigated with water and fertilizer management, as well as rice variety selection. However, the effectiveness of water and fertilizer management techniques is often dependent on their economic feasibility (Gupta et al, 2015). Practices such as mid-season drainage, intermittent drainage, and alternative drying and wetting which have shown significant reductions in methane emissions (Malyan et al, 2016) will be promoted for farmers by the Department of Agriculture Extension Officers.

Transplanting methods such as direct-seeded rice and the system of rice intensification which have shown potential for lower methane emissions compared with transplanted rice (Jain et al, 2014) will be explored with the farmers in the five valleys.

Farmers will also be trained on appropriate fertilizer management which has proven to yield good results in reducing methane emissions in rice fields, with nitrogen fertilizers like ammonium-based fertilizers showing the potential to reduce methane emissions by up to 50% (Dong et al, 2011; Linquist et al, 2012).

8.17 Residual Impacts Characteristics

The Consultant has also adopted the following risks and impact ranking methodology to assess and evaluate the residual risks and impacts after the implementation of the above respective mitigation and enhancement measures.

After the adoption of the appropriate mitigation measures, the impacts were assessed based on their nature as direct, indirect, or cumulative. Additionally, the duration of the residual impacts was also assessed and classified as either short-term, mid-term, or long-term. The residual impact magnitude of either negligible, minor, medium or major in addition to their impact of either local, national, regional or transboundary were also assessed and evaluated as part of the mitigation issues evaluation.

The Table 51 below provides the details on residual risks and impacts characterization for the project after the application of the mitigation measure

Table 51:

Impacts

Characterisation: Post-Mitigation

No	Characteristics Impacts	Nature			Duration			Magnitude				Extent			
		Direct	Indirect	Cumulative	Short-term	Mid-term	Long-term	Negligible	Minor	Medium	Major	Localised	Regional	National	Trans-boundary
	Construction Phase														
1.	Disruption of livelihoods	✓	-	-	✓	-	-	-	✓	-		✓	-	-	-
2.	Impacts on water resources	-	✓	-	✓	-	-	-	✓	-		✓	-	-	-
3.	Waste generation	✓	-	-	✓	-	-	-	✓	-	-	✓	-	-	-
4.	Occupational health and safety risks	✓	-	-	✓	-	-	✓	-	-		✓	-	-	-
5.	Labour concerns	✓	-	-	✓	-	-	✓	-		-	✓	-	-	-
6.	Potential child labour	✓	-	-	✓	-	-	✓	-	-		✓	-	-	-
7.	Public/community health and safety risks	✓	-	-	✓	-	-	-	✓	-	-	✓	-	-	-
8.	Risk of gender-based violence	-	✓	-	✓	-	-	-	✓	-	-	✓	-	-	-
9.	Risk of spread of HIV/AIDS and STIs	-	✓	-	✓	-	-	-	✓	-	-	-	✓	-	-
10.	Socio-cultural conflict	-	✓	-	✓	-	-	✓		-	-	✓	-	-	-
11.	Flood risk and associated diseases	✓	-	-	✓	-	-	-	✓	-	-	✓	-	-	-
12.	Vegetation/biodiversity loss	✓	-	-	✓	-	-	✓	-	-	-	✓	-	-	-
13.	Greenhouse gas emissions and climate change	✓	-	-	✓	-	-	✓	-	-	-	✓	-	-	-
	Operation Phase														
14.	Impacts on water resources	✓	✓	-	-	-	✓	-	✓	-	-	✓	-	-	-
15.	Waste handling and disposal impacts	✓	-	-	✓	-	✓	✓	-	-	-	✓	-	-	-
16.	Inappropriate handling, usage, storage and disposal of agrochemicals and pesticides	✓	✓	-	-	✓	-	-	✓	-	-	✓	-	-	-
17.	Disease outbreak and pest infestation	-	✓	-	-	-	✓	-	✓	-	-	✓	-	-	-
18.	Occupational health and safety risks	✓	-	-	-	-	✓	✓		-	-	✓	-	-	-
19.	Labour concerns	✓	-	-	-	-	✓	-	✓	-	-	✓	-	-	-
20.	Potential child labour	✓	-	-	-	-	✓	-	-	-	-	✓	-	-	-
21.	Public/community health and safety risks	✓	-	-	-	-	✓	-	✓	-	-	✓	-	-	-
22.	Socio-cultural conflict	-	✓		✓	-	-	-	✓	-	-	✓	-	-	-
23.	Flood risk	✓	-	-	-	-	✓	✓	-	-	-	✓	-	-	-

No	Impacts	Nature			Duration			Magnitude				Extent			
		Direct	Indirect	Cumulative	Short-term	Mid-term	Long-term	Negligible	Minor	Medium	Major	Localised	Regional	National	Trans-boundary
24.	Greenhouse gas emissions and climate change	✓	-	-	-	-	✓	✓	-	-	-	✓	-	-	-
25.	Fire risk	-	✓	-	-	-	✓	✓	-	-	-	✓	-	-	-

9.0 ENVIRONMENTAL AND SOCIAL MONITORING

The objective of environmental and social monitoring is to ensure follow-up on environmental and social commitments and performance during the implementation of the construction works and operations in the rice valleys. The relevance of an environmental and social monitoring plan is to enable prompt remedial action to correct deviations from anticipated impacts and re-enforcement of mitigation measures, as well as to address unanticipated impacts. Environmental and social monitoring defines the relevant indicators or indicator parameters that characterizes an impact. These parameters must be measurable and verifiable to enable accurate comparison, since monitoring activities occur throughout the life of the project.

The following areas of monitoring will be carried out throughout the construction works in the Odaho, Odamu, Kumkum, Offincho and Waamu/Kumi Valleys and those indicated as required during operations will be carried out during the operations/farming activities in the valleys:

1. Livelihood disruptions prevention;
2. Water resource quality protection;
3. Biodiversity/vegetation loss prevention;
4. Waste management;
5. Occupational and public health and safety;
6. Integrated pests and disease management;
7. Prevention of labour concerns and child labour;
8. Flood prevention;
9. HIV/AIDs and STI prevention; and
10. Gender-Based Violence prevention.

9.1 Monitoring Livelihood Disruptions Prevention Measures

Monitoring of livelihood protection measures will include regular site inspections and progress reporting to confirm adherence to the phased construction schedule and verify that cultivated areas remain accessible; weekly or biweekly compliance checks will document active work zones versus farm-accessible sections. Water supply continuity to downstream fields will be tracked through flow checks or temporary flow meters and by recording any irrigation interruptions and corrective actions. Temporary access routes will be inspected routinely for condition and usability, with incident logs maintained for any farmer–vehicle conflicts or access disruptions. Construction zone safety will be monitored through safety audits that confirm cordoning, signage, and barriers are in place and effective. Alignment of construction intensity with agricultural calendars will be reviewed monthly using project activity logs and farmer feedback to ensure major works occur during post-harvest windows where planned. Records of farmers engaged in project-related work will be kept (disaggregated by gender and location), and periodic satisfaction surveys will assess the adequacy of employment terms and incomes. Coordination will be evidenced by minutes and attendance lists from multi-stakeholder phasing meetings led by the Department of Agriculture and coordinated by the supervising consultant and FSRP2, with any schedule changes logged. Sensitization and safety training will be monitored through attendance registers, distribution of materials, and pre-/post-training checks of participant comprehension. Finally, the grievance mechanism will be monitored by tracking the number, type, response time, and resolution of complaints related to livelihood disruptions, and by reporting these metrics in monthly monitoring summaries for adaptive management.

9.2 Water Resource Quality Monitoring

Water resources quality monitoring in all the five (5) valleys would initially be the responsibility of the Environment, Health and Safety Officer of the respective Contractors during the construction period. The water quality baseline surveys established sixteen (16) reference sampling sites (geo-referenced in baseline information per site). The Contractors will re-establish or confirm the water sampling sites for the project monitoring in the five valleys.

Monitoring is also expected during the operation phases of the valleys. Additional sampling points or any site observed to be relevant in the course of the project implementation may be included in the sampling locations (if found necessary). The following baseline parameters will be used as indicators and will be monitored on quarterly basis (in February, June & October) to reflect seasonal variability:

1 pH	4 BOD	7 NH ₄	10 Conductivity
2 TSS	5 COD	8 Colour	11 Turbidity
3 TDS	6 NO ₃	9 Coliform	

The monitoring activities will aim principally at capturing the following sources of impacts on the water bodies.

The analysed results will be compared with WHO's drinking water standards and GSA's raw water specification as well as the baseline data on FAO Irrigation Water Guidelines. The results of the analysis of these parameters will be published in the WUA's monitoring report and submitted annually to the EPA.

9.3 Vegetation/Biodiversity Loss Prevention Monitoring

Monitoring of biodiversity and vegetation mitigation measures should include regular ecological inspections to verify the preservation of riparian buffers and remnant native vegetation prior to and during earthworks. Supervision logs should be maintained to document the presence of environmental officers during vegetation clearance and levelling activities. Soil health assessments, including checks for termite mound integrity and borrowing activity, should be conducted periodically to track microhabitat stability. During operations, monitoring should focus on crop diversification records, including rotation schedules and intercropping practices, as well as agrochemical usage logs to ensure compliance with integrated pest and nutrient management protocols. Water quality testing should be performed near irrigation and drainage outlets to detect runoff and eutrophication risks. Additionally, invasive species monitoring should be carried out through field observations and species mapping, with control actions documented and evaluated for effectiveness.

9.4 Waste Management Monitoring

The waste monitoring will involve the vegetative matter from the valleys that are re-plough into the topsoil and preserved for use as mulching materials. This is to ensure the preservation of the topsoils in all the five valleys. This is expected to be contained in the monthly monitoring report of the Contractors.

Records will also be kept of the training on waste segregation for all workers. EHS Officer will ensure that each member has adequate knowledge on the segregation of waste at source. Waste will be checked every week to ensure that workers are complying with the segregation policy of the contractor.

The monitoring will involve the quantities of solid wastes stored near the farm huts in waste bins which are collected and disposed of at the various District Assemblies designated waste disposal sites by the farmer groups or the Water User Associations (WUA). The number of awareness/education sessions carried out for farmers against waste littering will also be monitored and reported. In addition, the number of times the waste bins in the valleys are emptied by the Zoomlion Waste Company will be monitored and reported by the farmer groups under the supervision of the Officers from the District Department of Agriculture.

The farmer representatives in the valleys shall inspect waste bins every other day to ensure that the bins are not overfilled as well as ensuring general waste management oversight. Septic tanks will be watertight and shall be inspected every six months in order to dislodge as soon as it is 75% full. Mobile toilets will be inspected once a week to ensure that their waste is emptied regularly.

9.5 Occupational and Public Health and Safety Monitoring

Weekly health and safety meetings will be held for all workers of the contractors which will include reporting of accidents, incidents, fatalities, hazards and near-misses encountered the previous week. The issues and their causes will be collated as well as the appropriate preventive measures recommended for implementation. This will be reported in the monthly progress reports from the Supervising Consultants.

Supervisors of the contractors and consultants will ensure that workers use appropriate PPEs, so as to prevent or minimise exposure to hazards. Availability and use of PPEs will be continuously monitored daily, while all damaged and defective ones will be replaced promptly or on schedule. There will be appropriate sanctions instituted against offenders on the use of PPE, to serve as a deterrent to others. Vehicular movement in and around the various communities will be monitored to keep to speed limits (below 30km/hr) and comply with traffic regulations. This will help to prevent the incidence of vehicular accidents in communities.

Other parameters such as workers' health (hospital attendance) and equipment maintenance would be monitored. All accidents and injuries will be recorded and included in the monthly environmental and social report to FSRP2 Management.

9.6 Integrated Pests and Disease Management Monitoring (IPDM)

The monitoring of Integrated Pest and Disease Management in the Odaho, Odamu, Kumkum, Offincho and Waamu/Kumi Valleys will be under the responsibility of the District Agriculture Department in the various districts. The IPDM reporting during the operations of valleys will cover the number of biological, chemical, physical and crop-specific (cultural) management strategies and practices employed to grow healthy crops that resulted in the minimization of the use of pesticides.

Additionally, the following principles which are expected to be promoted under the IPDM among farmers in the valleys will be monitored and reported on by the Department of Agriculture:

- Number of sustainable pest control measures introduced to the farmers and being practiced including the number of farmers involved; and
- Quantities and types of organic fertilizers being applied by the farmers in the various valleys.

The monitoring will also cover the following FSRP2 IPMP-specific strategies in the five valleys to achieve effective pest and pesticide management:

- Environmental and Social Risk Management Team¹¹ providing support to farmers on the IPMP in each valley;
- Number of registered pesticide distributors/resellers trained in IPMP in each valley;
- IPMP communication and orientation workshops for the relevant stakeholders; and
- Number of educations, awareness creation and capacity-building sessions carried out for all farmers and other stakeholders.

9.7 Prevention of Labour Concerns and Child Labour Monitoring

The monitoring of labour issues and measures for the prevention of child labour will be under the supervision of FSRP and the employment committee (this is expected to include representatives from the farmers, assembly, FSRP PIU and Department of Agriculture) in the respective valleys. Daily monitoring will be carried out by the local management team of the valley and the Department of Agriculture and FSRP will conduct monthly and quarterly monitoring respectively. The monitoring will cover the number of workers engaged by each contractor from Donuoso, Yaw Nkrumah/New Bonfa, Tano Odumase, Barekese/Amakye-bare, Aninkrumah and other nearby communities including women. The number of labour-related cases reported to the committees and those resolved will also be monitored and reported in the monthly progress reports from the Consultant for each Contractor. Monitoring will also involve the Code of Conduct including the prevention of Sexual Exploitation and Abuse and Sexual Harassment signed by the workers and the number of refresher trainings conducted for the workers with regards to compliance.

The monthly monitoring report will provide details with regard to the ages, sex and communities of habitation of all workers to ensure the non-engagement of underaged workers.

9.8 Flood Prevention Monitoring

Monitoring of flood prevention measures in the Odaho, Odamu, Kumkum, Offincho and Waamu/Kumi Valleys will be in two phases; during the construction period and the operations period. Any flooding situation and the duration in the valley will be monitored and reported in the monthly progress report of the contractor. The necessary measures undertaken and their effectiveness to minimize the flooding will also be reported. This monitoring will be intensified in the valleys during the defects liability periods to enable the Contractors and Supervising Consultants to provide remedies since they will be under contract during the period.

During the operation phase, farmers are to report flooding situations that arise as a result of the designs, work scheduling, etc., to the officers of the Department of Agriculture in the District Assemblies who will capture that in their monitoring reports to FSRP2 of the Ministry of Agriculture.

The number of trainings carried out for farmers on proper water management in the valley to prevent flooding during the operations of the Kumkum Valley will be monitored and reported.

9.9 HIV/AIDS and STI Prevention Monitoring

All the Contractors for various valleys under the supervision of the Consultants will organize HIV/AIDS sensitization workshops before the commencement of works and every quarter. The sensitisation workshops will be conducted by the various District Health Directorates in the respective valleys with reports captured in

¹¹ Environmental, Social and GBV Specialists of PIU

the appropriate monthly reports to FSRP2. The Contractors and the Consultants will liaise with the respective District Health Directorates to evaluate the level of awareness among the workers and the communities. This will take place in the form of workshops. The findings will be included in the quarterly environmental and social report to the client.

Other aspects of the HIV/AIDS and STI prevention monitoring for all the valleys will cover the following:

- Number of condoms distributed during the sensitisation sessions;
- Number of counselling sessions for people living with AIDS (PLWAs);
- Number of voluntary counselling and testing of HIV status recorded by the various DHD of workers and community folk; and
- Number of HIV/AIDS education sessions conducted for nearby communities and communities in which workers of the contractors and consultants live.

9.10 Gender-Based Violence Prevention Monitoring

Contractor GBV policy monitoring requires the contractor to submit a written GBV/SEA/SH policy for approval prior to mobilization and to include compliance clauses in contract performance evaluations and payment milestones. Project GBV/SEA/SH Specialist will verify policy implementation through monthly site inspections that check for supervisor training records, visible PSEA/SH reporting information, and functioning safe reporting channels. The Supervising Consultant and Project Environmental and Social Risk Management Team will review quarterly contractor compliance reports and may withhold payments or require remedial actions for non-compliance.

Code of conduct monitoring will be maintained through a centralized register of signed codes that records each worker's name, role, signature method, and date against payroll and contractor staff lists to ensure completeness. Quarterly random spot-check interviews should be conducted to assess staff understanding of core obligations and induction timing for new hires.

Grievance Mechanism monitoring will use a confidential GM database with coded intake forms that capture modality, protection needs, consent for referrals, timestamps for receipt and acknowledgement, and a log of actions taken. The dedicated GM officer will conduct real-time tracking of acknowledgements and action-plan generation, while a multidisciplinary panel will perform quarterly case reviews and an independent audit annually to evaluate accessibility, confidentiality, and case-handling quality.

The following shall further constitute the monitoring indicators on the GBV Prevention measures:

- Number of workers who signed the code of conduct on the prevention of GBV and SEA/SH;
- Number of training sessions organised for workers on the prevention of GBV and SEA/SH;
- Number of workers disaggregated by gender who participated in the GBV and SEA/SH prevention;
- Contractor's policy on the prevention of GBV including SEA/SH;
- Number of GBV/SEA/SH cases reported;
- Number of GBV/SH cases referred to service providers;
- Number of suspensions as a result of GBV/SEA/SH cases;
- Percentage of GBV/SEA/SH cases referred to appropriate services with documented consent-based referral;
- Number of survivors given support;

- Average time from complaint receipt to case resolution or closure; and
- Percentage of complainants reporting satisfaction with GM process and safety (from confidential survey).

9.11 Environmental and Social Monitoring Plan

Table 52: Environmental and Social Monitoring Plan

Monitoring Area	Monitoring Parameters	Mode/Method	Responsibility	Frequency
Livelihood Disruptions Prevention	- Site/Farm access inspections - Phase construction schedules - Farming disruption records - Field water flow checks - Incident logs - Safety audits - Farmer feedback - Satisfaction surveys - Meeting minutes - Training attendance - Grievance tracking	- Regular inspections - Reporting - Logs - Surveys - Training registers - Grievance mechanism	Dept. of Agriculture, Supervising Consultant, FSRP2	Weekly for all except safety audits, and satisfaction surveys which will be quarterly
Water Resource Quality	- pH, TSS, TDS, BOD, COD, NO3, NH4, Colour, Coliform, Conductivity, Turbidity	- Water sampling - Laboratory analysis - Comparison with standards	EHS Officer (Contractor), District Assemblies, EPA	Quarterly
Vegetation/Biodiversity	- Ecological inspections - Supervision logs - Soil health assessments - Crop diversification records - Agrochemical usage logs - Water quality tests - Biodiversity surveys - Invasive species monitoring	- Field inspections - Logs - Surveys - Mapping - Water testing	Environmental Officers, Dept. of Agriculture	Monthly
Waste Management	- Waste segregation training - Waste bin inspections - Waste disposal records - Awareness sessions - Septic tank/mobile toilet inspections	- Training - Inspections - Records - Reporting	EHS Officer, Farmer Groups, District Dept. of Agriculture, Zoomlion Waste Company	- Waste segregation training - Monthly - Waste bin inspections - Daily - Waste disposal records - Monthly - Awareness sessions - Quarterly - Septic tank/mobile toilet inspections – Every 6 months
Occupational & Public Health/Safety	- Health & safety meetings - PPE use - Accident/incident records - Vehicular movement monitoring - Hospital attendance - Equipment maintenance	- Meetings - Daily monitoring - Reporting - Inspections	Contractors, Supervising Consultants	- Health & safety meetings - Weekly - PPE use - Daily - Accident/incident records - Monthly - Vehicular movement monitoring - Monthly - Hospital attendance - Monthly

Monitoring Area	Monitoring Parameters	Mode/Method	Responsibility	Frequency
				- Equipment maintenance – Quarterly.
Integrated Pest & Disease Management (IPDM)	- Pest control measures - Organic fertilizer use - IPMP strategies - Training/workshops - Awareness sessions	- Field monitoring - Records - Workshops - Support sessions	District Agriculture Dept., Environmental & Social Risk Management Team	Continuous during operations
Labour & Child Labour Prevention	- Worker engagement records - Labour case reports - Code of conduct compliance - Training records - Worker demographics	- Reporting - Registers - Training - Progress reports	FSRP, Employment Committee, Dept. of Agriculture, Consultant	- Worker engagement records – Monthly - Child labour - Daily - Labour case reports - Bimonthly - Code of conduct compliance - Daily - Training records - Weekly - Worker demographics - Monthly
Flood Prevention	- Flooding incidents - Duration - Effectiveness of measures - Training sessions	- Incident reporting - Monitoring - Training	Contractor, Supervising Consultant, Dept. of Agriculture	Monthly, Intensified during defects liability period
HIV/AIDS & STI Prevention	- Sensitization workshops - Condom distribution - Counselling sessions - HIV testing - Education sessions	- Workshops - Distribution - Reporting - Evaluation	Contractors, Consultants, District Health Directorates	- Sensitization workshops - Weekly - Condom distribution - Daily - Counselling sessions - Weekly - HIV testing – Continuous - Education sessions-before works, and Monthly.
Gender-Based Violence (GBV) Prevention	- Code of conduct signing - Training sessions - Participation records - Policy compliance - Case reporting - Referrals - Survivor support - Complaint resolution time - Satisfaction surveys	- Registers - Site inspections - Interviews - Confidential database - Case reviews - Audits	Contractor, Environmental & Social Risk Management Team, Supervising Consultant, Project Safeguards Team	- Code of conduct signing – Before works - Training sessions - Weekly - Participation records - Weekly - Policy compliance - Continuous - Case reporting - Continuous - Referrals - Continuous - Survivor support - Continuous - Complaint resolution time - Continuous - Satisfaction surveys – Biannually.

10.0 PROVISIONAL ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

10.1 Introduction

The Provisional Environmental and Social Management Plan (PESMP)¹² for the improvement of the Odaho, Odamu, Kumkum, Offincho and Waamu/Kumi Valleys outlines the mitigation and monitoring measures and other related risk management commitments in an actionable mode for sustainable project implementation. The ESMP includes Action Plans and respective objectives to address the evaluated risks and adverse impacts associated with construction works in the valleys. The Action Plans cover the specific environmental, social and related risk management for livelihood preservation, water resources, waste management, agrochemicals, pests and diseases, occupational and public health and safety, child labour prevention, gender-based violence, HIV/AIDS and STIs, social conflicts prevention and flood risks for the construction/rehabilitation and operation phases for the valleys.

10.2 Key ESMP Objectives

The primary objective of the ESMP is to implement the appropriate mechanisms that will address the risks and adverse impacts likely to be associated with the implementation of the project. The Action Plans constituting the ESMP define the approaches for project implementation that will ensure the achievement of desired outcomes and enhance project sustainability. The specific objectives of the Action Plans are listed below:

- To minimize the impacts on water resources;
- To minimize the impacts of waste on the environment and reduce the likelihood of odour nuisance and unsanitary surroundings;
- To improve the usage, handling and disposal of agrochemicals;
- To control pests and diseases;
- To protect the health and safety of workers by minimizing exposure to noise and emissions, accident risks and hazards;
- To provide safeguards for the rights of workers, including fair treatment, non-discrimination and equal opportunity;
- To avoid the exploitation of children as labour and prevent any form of child abuse;
- To prevent fire incidences and provide effective fire safety during the construction/rehabilitation and operation of the project;
- To ensure public/community health and safety (particularly near project site and communities along haulage routes) is not compromised, by minimizing noise, dust and emission generation;
- To prevent any form of gender-based violence in the workplace and community;
- To minimise the potential risk of spread of HIV and STIs among workers and in the community;
- To ameliorate project-induced social changes and manage community apprehension; and
- To minimise the impacts of flooding.

¹² This is a Provisional ESMP because a site-specific ESMP has been developed for each of the five inland valleys assessed in the ESIA, incorporating relevant findings and mitigation measures.

10.3 PESMP Implementation

10.3.1 Roles and Responsibilities

The PESMP implementation will have entities from the farmers, the district departments of agriculture, and the Safeguards Officers of FSRP2 PIU playing key roles. The roles and responsibilities of key parties involved in the project are highlighted in Table 53.

Table 53: Roles and Responsibilities for PESMP

Entity	Responsibilities
FSRP2 PIU	- Overall coordination of project construction activities; - Responsible for collaborating with local authorities (MMDAs) in the respective districts where the inland valleys are located
FSRP2 Environmental and Social Risk Management Team (Environmental, Social and Gender Specialists)	- Responsible for oversight of the implementation of environmental and social safeguard actions of the PESMP - Provide backstopping for the activities of the contractor's Health, Safety, Social and Environment (HSSE) Team - Training and orientation of contractor's HSSE Team on the E&S requirements - Training and orientation of WUAs and AEOs on the E&S requirements
Agriculture Extension Officers (AEO)	- Liaison between farmers and the FSRP2 on good farm practices - Farmer sensitization on agrochemical application, waste disposal and Integrated Pest management in general - General technical backstopping to farmers - Assist in the resolution of grievances
Water Users Association (WUAs)	- Routine maintenance of the stream channels and irrigation canals - Removal of debris from the canals
Contractors	- Barricading of site for earthworks, structural works, etc. - Construction management including site management, control and inspection of all construction activities, and safety management. - The contractor will employ an HSSE Team to implement the PESMP for the construction phase - Training for workers and community folk on required environmental and social standards
Supervising Consultants	- Ensure compliance of the contractors with the applicable environmental and social safeguard requirements. - Supervision of contractors' works and reporting to FSRP2 on requirements of the PESMP
EPA	- Issue environmental permits for the projects in all the valleys - Ensure that monitoring and reporting requirements (as indicated in the PESMP are in accordance with EPA standards and guidelines).

10.3.2 Formation of Water User Associations

Water User Associations (WUAs) will be formed by FSRP in collaboration with GIDA and the Departments of Agriculture at the valleys which do not have them; and where they exist, they will be revamped or

strengthened. Farmers will constitute the core membership of the WUAs. Each WUA would have a chairman, a secretary and a treasurer. The Department of Agriculture in the various districts and municipal assemblies would provide supervisory support and technical backstopping for the WUAs through the Agriculture Extension Officers (AEO).

The WUAs will be trained to take up the daily operations of the irrigation facilities and activities related to maintaining an environmentally sound farming environment. The WUAs will have the following responsibilities:

- Ensure all farmers observe good practices and behaviour when working in the valleys;
- Keep the irrigation canals free of debris or obstruction;
- Mobilize members to undertake basic maintenance of the canals, channels, and appurtenant facilities;
- Ensure proper waste management in the valleys;
- Monitor the proper use of agrochemicals in the farms as recommended/required by the MoFA/AEO
- Carry out any other actions regarding facility maintenance, environmental and social risk management, fertilizer/pesticide use, farmer safety, etc. as required by the MoFA/AEOs.

10.3.3 Capacity Building and Orientation

The contractor's HSSE Team will be trained on the E&S action requirements for the construction phase of the project. The contractor and key staff will be given an orientation by the FSRP2 Environmental and Social Specialists on the PESMP actions. The requirements will be transcribed into toolbox bulletins for workers during the construction phase.

The E&S Specialists will orientate farmers on the observance of safety measures to ensure a safe working area. In collaboration with the FSRP2, the supervising consultants, contractor and farmers' capacity will be built in the areas of waste management, stream channel and irrigation canal maintenance, proper handling and application of agrochemicals, etc.

10.3.4 Compliance Monitoring and Inspections

The FSRP2 ESRM Team will undertake internal audits during project implementation to ascertain the contractor's compliance with the required environmental and social mitigation actions and to ensure that the requirements of the PESMP are being undertaken in full. External audits and inspections by regulating authorities (e.g. the EPA) or the World Bank Safeguards Team would also be undertaken throughout the project implementation in the valleys.

10.3.5 Documentation and Reporting

The contractor will be required to submit, at the start of construction, monthly reports on the implementation of risk management actions to the FSRP2 ESRM Team. The contractor would document all toolbox talks delivered to workers, environmental incidents, accidents and near misses and include these in the reports. The FSRP2ESRM Specialists would document all the trainings done for all personnel including the supervising consultants, contractor's personnel, farmers and AEOs.

The lessons learned as derived from the reports and documentation will be used by the FSRP2 ESRM Specialists to develop more efficient monitoring and training to be incorporated into the risk management actions on the project.

10.4 Livelihood Preservation and Protection Plan

The objective of this plan is to implement measures to preserve the livelihoods of the farmers during the construction phase of the projects in the Odaho, Odamu, Kumkum, Offincho and Waamu/Kumi Valleys. Details of the plan are presented in Table 54.

Table 54: Livelihood Preservation and Protection Plan

Cause/Source	Mitigation Measures	Responsibility	Supervision
Restriction of access to farms due to construction works	• Divide the land to be developed into 2 sections • Allow the farmers to continue their farming on one section while the other section is being developed • Create alternative temporary access for farmers to avoid access conflict with construction vehicle movement • Install a barricade between the construction area and the farming area to ensure farmer safety • Sensitize farmers on safety measures to ensure farming and construction are done simultaneously and without issues	Contractors/ Extension Officers	FSRP E&S Specialists

10.5 Provisional Environmental and Social Management Plan – Applicable to All Valleys

Table 55: Construction Phase

No	Environment and Social Risks and Impacts/Issues	Mitigation Measures	Mitigation Responsibility	Monitoring	Frequency / Timeframe	Performance Criteria	Monitoring Responsibility	Cost (\$)
1	Water resources impacts – erosion from land clearing, levelling and excavations, destruction to Oda, Odamu, Kumkum, Offin and Waamu Streams embankment	- Land preparation to involve a phased approach to minimize exposure to erosion and runoff - Stream diversions to be carried out under the supervision of Consultants - Drains to be constructed will be fitted with silt traps - Excavated material will be used to backfill drains.	- Contractors - Supervising Consultants	- Land preparation works - Stream diversion works. - Buffer zones of 10m of the Kumkum Stream. - Excavated material disposal methods.	- Throughout the construction period. - Excavated materials quantities monitored daily.	- No blocking of water bodies and canals with excavated materials. - Undisturbed 10m wide buffer zones on both sides of the Kumkum Stream. - No oil traces in water bodies	- Contractors - Supervising Consultants - FSRP2 ESRM Team	Part of the contract cost for the valleys
2	General waste generation, handling and disposal – wastes dumping into stream channels, canals causing various water bodies contamination	- Prepare CESMP that include aspects on waste management. - Use of tree and shrub pieces as organic matter. - Waste bins placed at vantage points at the construction site to be emptied weekly to the district assembly waste disposal sites - Provision of mobile toilets - Policy on no littering of site - Provision of water closet toilet facilities at appropriate nearby locations	- Contractors - Supervising Consultants	- Number of waste bins at the sites in the various valleys - Frequency of disposal of waste to District Assembly's final disposal sites - Number and types of toilet facilities provided	- Weekly waste disposals from sites - Proper waste management throughout the construction periods	- Dustbins at vantage points. - All wastes collected regularly to final disposal sites.	- Contractors - Supervising Consultants - FSRP2 ESRM Team	5000 (1000/site)
3	Occupational, public health and safety – incidents, accidents to construction workers, vehicular accidents from delivery trucks, non-compliance with PPE use.	- Apply provisions in the projects LMP, SEP and prepare CESMP - Compliance with speed limit of 40km/hr by all construction vehicles - Provision and appropriate use of PPEs - Provision of first aid kits and training for all workers - Regular monthly toolbox meetings - Monitoring and reporting on incidents, accidents and near-misses in the monthly site meeting reports. - Scheduled maintenance of construction machinery	- Contractors - Supervising Consultants	- Incident, accident and near misses - Number of toolbox meetings held in a quarter - Loss days and causes - Workers register	Continuous	- Zero accidents during the construction works - Twelve (12) toolbox meetings in a year. - Zero loss days recorded. - Updated workers register.	- Contractors - Supervising Consultants - FSRP2 ESRM Team	Part of the contract cost for the valleys

No	Environment and Social Risks and Impacts/Issues	Mitigation Measures	Mitigation Responsibility	Monitoring	Frequency / Timeframe	Performance Criteria	Monitoring Responsibility	Cost (\$)
		- Install silencers/mufflers on machinery 4-hour shift system for operators of noisy and vibratory equipment						
4	Flood risks – potential blocking and diversion of water bodies, resulting in breeding grounds for mosquitoes and flooding of farms.	- Construction of canals to adequately improve drainage at sites. - Strict supervision of potential Kumkum diversion if necessary to avoid flooding.	- Contractors - Supervising Consultants	- Required canal length, depth and width. - Excavated materials used to construct stream embankments - Quantities of debris properly disposed of - not into Stream channels.	Throughout the construction period	- Constructed required canal lengths - No debris dumped in the Kumkum Stream	- Contractors - Supervising Consultants - WUAs - Agriculture Extension Agents - FSRP2 ESRM Team	Part of the contract cost for the valleys
5	Labour conflicts and use of children as workforce – non-issuance of employment contracts to workers, discrimination against workers including Persons with Disabilities.	- Comply with provisions in project LMP, SEP and prepare CESMP - Formation of recruitment committees with representatives of the farmers, community and contractor. - Employment contracts for all workers. - Policy to prohibit the engagement of underage children for all forms work at the sites. - Keep records of employees, including verified dates of birth. - Undertake community education against child labour to prevent children from engaging in construction works.	- Contractors - Supervising Consultants	- Functioning of recruitment committees for the Valleys. - Number of employment contracts. - Available policy of Contractor with management sign off. - Workers contract registry with verified date of births. - Number of community education against child labour.	Continuous	- Recruitment committee functioning. - All workers sign contract of employment - Contract registry for all workers - Four (4) community educations against child labour in a year in each valley.	- Contractors - Supervising Consultants - FSRP2 ESRM Team	Part of the contract cost for the valley
6	Gender-based violence – discriminations based on gender, lack of education for construction workers against GBV.	- Comply with provisions in project LMP, SEP, Gender Plan and prepare CESMP - Code of conduct for all workers on the prevention of GBV including SEA/SH - Grievance Mechanism (GM) with specific provision for the	- Contractors - Supervising Consultants - MOFA-FSRP2	- Number of workers who signed code of conduct. - Grievance channels and disclosure statuses. - Available policy for the prevention of GBV. - Number of sensitisation programmes on the	Continuous	- Code of Conduct signed by all workers. - Functional GM - Policy on prevention of GBV – SEA/SH. - Number of sensitisation programmes on the	- Contractors - Supervising Consultants - MOFA-FSRP2	Part of the contract cost for the valleys

No	Environment and Social Risks and Impacts/Issues	Mitigation Measures	Mitigation Responsibility	Monitoring	Frequency / Timeframe	Performance Criteria	Monitoring Responsibility	Cost (\$)
		receipt and dealing with GBV including SEA/SH cases. - Contractor to develop and implement policy on the prevention of GBV including SEA/SH. - Education campaigns and sensitization programs on SEA/SH will be organized.		prevention of GBV-SEA/SH.		prevention of GBV-SEA/SH. Four (4) sensitisation programmes on the prevention of GBV-SEA/SH/yr.		
7	HIV/AIDS and STI Spread – presence of migrant workers, lack of awareness on the dangers and non-disclosure of HIV status.	- Comply with provisions in project LMP, SEP and prepare CESMP - Contractors to implement HIV/AIDS Workplace Policy and incorporate prevention clauses in employment contracts for all workers at the Valleys. - Monthly awareness creation among workers on HIV and AIDS risks and dangers. - Consultants to ensure that the Contractors recruit the majority of workers from the nearby communities. - Contractors to incorporate HIV Workplace Policy into working conditions to prevent discrimination or stigmatisation of workers. - The RSRP2 to support the various Health Directorates to organise awareness campaigns on HIV in the communities.	- Contractors - Supervising Consultants - MOFA-FSRP2 - District Health Directorates.	- HIV/AIDS Workplace Policies developed by the contractors for the construction work in Valleys and operationalise during the construction. - Number of awareness creation for workers on HIV/AIDS and STIs. - Number of workers recruited from the nearby communities. - Number of awareness creation/sensitisations carried out with the various Health Directorates of the Ghana Health Services.	Continuous	- Contractor's workplace policy on HIV/AIDS for the Valleys. - Four (4) awareness creation trainings with the various DHDs in a year for workers.	- Contractors - Supervising Consultants - MOFA-FSRP2 - District Health Directorates.	25,000 (5000/site)
8	Socio-cultural conflicts-non-observance of local customs and traditions.	- Comply with provisions in project LMP, SEP and prepare CESMP. - Sensitization of the contractor and workers on the cultural norms of the communities. - Further engagement with the nearby community leaders in	- Contractors - Supervising Consultants - MOFA-FSRP2	- Sensitisation workshops carried out on cultural norms of the people of the Construction workers. - Number of locals with employment with the Contractors for the Valleys.	Continuous	- Sensitisation workshop for workers on cultural norms of the people of communities prior to site handing over. - Employment contracts for all construction workers.	- Contractors - Supervising Consultants - MOFA-FSRP2	Part of the contract cost for the valleys

No	Environment and Social Risks and Impacts/Issues	Mitigation Measures	Mitigation Responsibility	Monitoring	Frequency / Timeframe	Performance Criteria	Monitoring Responsibility	Cost (\$)
		the valleys on compensatory actions and negotiations with regard to cultural norms. - Encourage the contractor to employ the majority of the workforce from the communities. - Establishment of GM to address grievances and resolve conflicts.		Number of available Grievance Redress Channels and recorded and resolved cases.		Grievance Mechanism Channels established and functional.		
	Vegetation/Biodiversity loss	- Train workers on biodiversity protection protocols and ecological sensitivity. - Supervise vegetation clearance with trained environmental personnel.	- Contractors - Supervising Consultants - MOFA-FSRP2	- Pre-construction ecological inspections and mapping of riparian zones and sensitive habitats. •Daily supervision logs documenting vegetation clearance activities. - Periodic soil health assessments, including termite mound and burrow integrity checks. - Attendance records and evaluation of biodiversity training sessions for workers.	Continuous	- Number of remnant vegetation patches identified and protected. - Number of workers trained on biodiversity protocols. - Presence of environmental officer during vegetation clearance.	- Contractors - Supervising Consultants - MOFA-FSRP2	Part of the contract cost for the valleys

Table 56: Operations Phase

No	Environment and Social Risks and Impacts/Issues	Mitigation Measures	Mitigation Responsibility	Monitoring	Frequency / Timeframe	Performance Criteria	Monitoring Responsibility	Cost (\$)
1	Water resources impacts – erosion from land clearing for rice cultivation.	- No dumping of cleared vegetation matter into canals and Kumkum Stream channels. - Observation of 10m buffer zones on both sides of the Kumkum Stream. - Provision of places of convenience for males and females on the field.	- WUA - Agriculture Extension Agents of the District Assemblies.	- Buffer zones of at least 10m – 20m from both sides of the streams/streams. - Wastes levels in the canals and water channels.	Continuous	- Undisturbed 10m wide buffer zones on both sides of the rivers/stream. - No waste materials dumped in the canals and Kumkum Stream channels	- WUA - Agriculture Extension Agents of the District Assemblies. - MOFA-FSRP2	Part of the farming activities of farmers in the Valleys
2	Flood risks – potential blocking of rivers/stream, resultant breeding grounds for mosquitoes.	- Construction of canals to improve drainage in the valleys. - No dumping of materials in the drainage canals. - Ensure adequate spillways, drainage, and lining for canals. - Implement regular maintenance and inspections	- WUA - Agriculture Extension Agents of the District Assemblies.	- Required canal length in designs constructed. - Quantities of debris properly disposed not into Stream canals. - Adequacy of spillways, clear drainage and lining of canals. - Records of inspections and maintenance checks.	Continuous	- Constructed required canal lengths. - No dumping of waste in the water bodies. - Low incidence of flooding as a result of structural failures	- WUA - Agriculture Extension Agents of the District Assemblies. - MOFA-FSRP2	Part of the farming activities of farmers in the Valleys
3	General waste generation, handling and disposal – wastes dumping into stream channels, canals causing Kumkum Stream contamination.	- Use of tree and shrub pieces as organic matter. - Waste bins at the construction sites are to be emptied weekly to the district assemblies waste disposal sites. - Policy on no littering of site. - Maintenance of water closet toilet facilities constructed at the valleys.	- WUA - Agriculture Extension Agents of the District Assemblies.	- Number of waste bins at sites in good condition - Frequency of disposal of waste to assembly's final disposal sites. - Number and types of toilet facilities properly functioning.	- Weekly waste disposals from sites. - Proper waste management in the Valleys.	- Dustbins at vantage points in the Valleys. - All generated wastes are collected weekly.	- WUA - Agriculture Extension Agents of the District Assemblies. - MOFA-FSRP2	2,500 (500/yr/site)
4	Agrochemicals, handling and disposal – unsafe handling, use of unlicensed agrochemicals and improper disposal of used containers.	- Use of FSRP2 Pesticide Management Plan and comprehensive training for farmers. - Comply with provisions in project LMP and SEP - Use of integrated pests and disease control measures. - Promotion of the use of organic fertilizers. - Training of farmers on the safe use of agrochemicals.	- District Department of Agriculture. - Farmer groups/WUAs	- Number of trainings on the FSRP2's Pesticided Management Plans for farmers. - Number of integrated pests and disease management measures being implemented by farmers. - Records of types of PPEs for pesticide applications.	- Quarterly for trainings - Weekly agro-chemical container disposals.	- Four (4) times in a year training on FSRPS PMP for farmers in each valley. - Four (4) times a month disposals of pesticide containers from each Valley. - Full sets of PPEs to be always worn by farmers who apply pesticides.	- MOFA-FSRP2 - District Department of Agriculture. - Farmer groups/WUAs	25,000 (5000/yr/site)

No	Environment and Social Risks and Impacts/Issues	Mitigation Measures	Mitigation Responsibility	Monitoring	Frequency / Timeframe	Performance Criteria	Monitoring Responsibility	Cost (\$)
		- Use of appropriate PPEs during the handling and application of pesticides. - Implementation of a take-back system to manage empty chemical containers. - Collection of empty containers by an accredited waste company.		Frequency of disposal of pesticide containers to accredited waste companies.		At least once a month disposal of agrochemical containers.		
5	Pests and disease infestation – inadequate knowledge of proper pests and disease control measures and resistant pests and diseases.	- Comply with provisions in project IPMP - Adoption of Sustainable Integrated Pest and Disease Management (SIPDM) measures. - Training on the adoption of climate-smart agricultural practices to control pests and diseases. - Training on the appropriate selection and application of pesticides to limit pests and disease resistance.	- District Department of Agriculture. - Farmer groups/WUAs.	- Number of trainings on the sustainable pests and disease management measures - Percentage of farmers adopting sustainable pests and disease management measures.	Quarterly	- Four (4) times a year trainings for farmers in the various Valleys on SIPDM. - At least 25%, 50%, and 75% of farmers adopting SIPDM in 1st, 2nd, and 3rd years respectively in each valley.	- MOFA-FSRP2 - District Department of Agriculture. - Farmer groups/WUAs.	25,000 (5000/yr/site)
6	Occupational, public health and safety – incidents, accidents to farmers in the use of farm implements, snake bites, etc.	- Comply with the provisions in the projects LMP - Provision and appropriate use of PPEs - Provision of first aid kits and training for all farmers - District Health Directorates support to acquire anti-venom vaccines.	- District Departments of Agriculture. - Farmer Groups/WUAs - District Health Directorate	- Use of PPEs during use of farm implements - Incident, accident and near misses - Record of snake bites and treatments received.	Continuous	- Zero accidents during farming activities in the Valleys. - All snake bites received anti-venom vaccines promptly.	- District Departments of Agriculture. - Farmer Groups/WUAs - MOFA-FSRP2 - District Health Directorate	10,000 (2000/yr/site)
7	Waste generation, handling and disposal – domestic wastes from farmers.	- Supply of waste bins at vantage points in the Valleys. - Education for farmers and visitors against littering - Engagement of Zoomlion Company for the disposal of	- District Departments of Agriculture. - Farmer Groups - WUAs	- Number of waste bins at vantage points in each Valley - Weekly evacuation of waste from Valleys by Zoomlion tricycles. - Stream and canal ways devoid of debris.	Continuous	- Waste bins at vantage points - Contract between Zoomlion and farmer groups on waste evacuation from the Valleys.	- MOFA-FSRP2 - District Departments of Agriculture. - Farmer Groups - WUAs	10,000 (2000/site)

No	Environment and Social Risks and Impacts/Issues	Mitigation Measures	Mitigation Responsibility	Monitoring	Frequency / Timeframe	Performance Criteria	Monitoring Responsibility	Cost (\$)
		waste generated at sites on weekly basis. • No littering or blocking of water canals/channels.		• Emptying of septic tanks when at 75% full.				

11.0 EMERGENCY PREPAREDNESS AND RESPONSE PLAN

The emergency preparedness and response plan (EPRP) specify procedures for handling sudden or unexpected situations at the Ashanti Region Lot 3 Inland Valley Schemes, responsibilities and resources. The objective is to:

- Prevent fatalities and injuries;
- Reduce damage to property and other physical assets;
- Protect the environment and the community; and
- Accelerate the resumption of normal operations.

11.1 Roles and Responsibilities

The following are the roles and responsibilities for the emergency preparedness and response plan.

Table 57: Roles and Responsibilities

Party	Responsibility
WUA Leader & Head of Department of Agriculture	Coordinate all emergency responses, assign personnel, control access, ensure readiness, and maintain training programs
Contractor	Implement emergency protocols, maintain communication, escalate to Client as required
Emergency Response Team	Execute emergency procedures, assist victims, manage scene
All Staff/Farmers	Report emergencies, follow protocols, assist as directed
Client	Receive notifications for escalated emergencies, provide oversight

11.2 Emergency Types and Protocols

The emergencies are categorised into the following emergencies:

11.2.1 Environmental and Social Emergencies

The following protocols are expected to be observed for environmental contamination, agrochemical spills, pollution incidents and non-compliance with E&S Standards:

- Immediate containment of the hazard (e.g., stop source of pollution, use spill kits);
- Evacuate affected area if necessary;
- Notify WUA Leader and Head of Agriculture;
- Contractor must inform the Client as soon as possible and provide a written incident report within 24 hours;
- Cooperate with regulatory authorities and follow E&S Standards for remediation;
- Document all actions taken.

Responsible: Contractor (initial response and notification), WUA Leader, Head of Agriculture.

11.2.2 Accidents (Injury, Fatality, Drowning, Fire, Flooding)

The following protocols shall be observed for worker/farmer/visitor injury, drowning, fire outbreak, flooding.

- Secure personal and bystander safety;
- Call emergency services (ambulance, fire, police) and site emergency number;
- Administer first aid as trained; do not move injured unless necessary;
- Evacuate area if needed;
- Contractor must inform the Client immediately in case of serious injury, fatality, or major incident;
- Maintain a log of events and actions taken.

Responsible: All staff/farmers (initial actions), Emergency Response Team, Contractor (escalation), WUA Leader.

11.2.3 GBV/SH and Security-Related Emergencies

Gender-Based Violence (GBV), Sexual Harassment (SH), robbery, illegal entry, violence protocols include.

- Ensure victim safety and confidentiality;
- Report incident to designated GBV/SH focal point or security lead;
- Contractor must inform the Client as soon as possible for GBV/SH cases and serious security breaches;
- Do not confront perpetrators if unsafe; prioritize de-escalation;
- Call police/emergency services as needed;
- Provide support and referral to appropriate services for victims;
- Document incident and actions taken.

Responsible: All staff (reporting), GBV/SH focal point, Contractor (escalation), WUA Leader.

11.2.4 Medical and Health Emergencies

The following such as sudden illness, poisoning, medical emergencies are under this category.

Protocols:

- Stay calm and call clinic/emergency services;
- Provide first aid as trained;
- Do not move victim unless necessary;
- Contractor must inform the Client for severe or multiple casualty incidents;
- Comfort victim until help arrives;

Responsible: All staff (initial actions), Contractor (escalation), WUA Leader.

11.3 General Emergency Response Principles

The following principles should be followed for all other general emergencies:

- Stay calm and vigilant;
- Assess the situation and listen to professional advice;
- Allow professionals to take control if available;
- Protect life, property, and the environment;
- Assist others and manage the situation;
- Maintain contact with stakeholders;
- Provide accurate information to emergency services.

11.4 Alarm Raising Procedures

The Ashanti Region Lot 3 Inland Valley Schemes will have alarms triggered manually, depending on the specific type of emergency situation.

11.4.1 Manual Alarm Systems

The following manual alarm systems will be put in place:

- Hand-held radios used by WUA Leaders (to be provided by the contractors), Contractor Supervisors, and Emergency Response Team (ERT) members

- Whistles, megaphones, or bells for field-based alerts
- Direct verbal communication when electronic systems are unavailable
- Phone calls to designated emergency numbers (site emergency line, Ghana National Fire Service, Police, Ambulance Service).

11.4.2 Alarm Raising Responsibilities

All staff and farmers are responsible for reporting any emergency immediately using the nearest available method. Contractor supervisors must confirm the emergency, activate the site-wide alarm, and notify the WUA Leader.

The WUA Leader and Head of Agriculture will be tasked with triggering community-wide alerts and coordinating the response. Meanwhile, the Emergency Response Team (ERT) will be responsible for activating alarms during incidents they detect or manage.

11.4.3 Workers Responsibilities Upon Hearing the Alarm

Once an alarm is raised, all workers, farmers, and visitors must follow the procedures below:

1. Stop Work Immediately

- Cease all operations safely.
- Shut down equipment if safe to do so.

2. Follow Evacuation Instructions

- Move calmly to the designated assembly point.
- Follow directions from ERT members or supervisors.
- Assist vulnerable persons (elderly farmers, persons with disabilities).

3. Do Not Attempt to Investigate the Cause

- Only trained ERT members may approach the incident scene.

4. Remain at Assembly Point

- Wait for headcount and further instructions.
- Do not re-enter the area until the “all clear” is given by WUA Leader or emergency services.

5. Report Missing Persons

- Inform supervisors immediately if someone is unaccounted for.

11.4.3 Evacuation Procedures

The following evacuation procedures apply to all emergency types requiring movement away from danger (fire, flooding, chemical spill, violence, etc.):

1. Alarm Activation

- Alarm is raised manually or automatically.
- ERT initiates evacuation protocol.

2. Evacuation Route Use

- Workers follow pre-designated evacuation routes.
- Routes must be kept clear at all times.

- Signage must be visible and maintained by the Contractor.

3. Assembly Points

- Clearly marked safe zones away from hazards.
- WUA Leader ensures assembly points are known to all farmers and workers.
- Contractor maintains updated maps and posts them at key locations.

4. Accountability and Headcount

- Supervisors conduct roll call.
- Missing persons reported immediately to ERT and emergency services.

5. Controlled Re-entry

- Only WUA Leader or emergency services may declare the area safe.
- Workers return only after official “all clear”.

11.5 Communication with Emergency Responders

During emergency situations, clear communication roles are essential for effective response and coordination. The WUA Leader serves as the primary liaison with external agencies, including the Ghana National Fire Service, Police, NADMO, and Ambulance Service, ensuring rapid engagement with the appropriate authorities. The Contractor is responsible for providing detailed incident information, supporting the flow of communication, and escalating matters to the supervising Consultant and ultimately to the Client when necessary. The Emergency Response Team delivers real-time updates from the field, facilitating informed decision-making and timely interventions. Additionally, the GBV/SH Focal Point confidentially communicates with specialized gender-based violence/sexual harassment service providers and the police, ensuring sensitive cases are handled appropriately and discreetly.

11.5.1 Communication Systems and Channels

To ensure reliable communication during emergencies, a range of channels will be utilised. Mobile phones will serve as the primary means for contacting emergency services, with emergency numbers posted at all work areas for quick access. Two-way radios will be used by the Contractor’s Supervisors, Emergency Response Team, WUA Leaders enabling rapid communication across the site.

The incident reporting chain will follow a clear progression: staff or farmers inform their supervisor, who then escalates the issue to the WUA Leader, emergency services, and finally the Client. Community alert systems, such as whistles, megaphones, and bells, are deployed for swift, field-level communication.

Documentation channels will include incident logbooks and written reports that must be submitted to the Client within 24 hours by the Contractor. For cases involving gender-based violence or sexual harassment (GBV/SH), confidential channels are maintained, including a private reporting line to the GBV/SH focal point and secure documentation and referral pathways to ensure sensitive matters are handled discreetly.

11.6 Escalation and Client Notification

For the following emergencies, the Contractor is required to inform the Client immediately and take specified actions:

- Any fatality or life-threatening injury;
- Major environmental incident or E&S non-compliance;
- GBV/SH incident;
- Major security breach (robbery, violence); and
- Any incident likely to attract media or regulatory attention.

Actions:

- Immediate verbal notification to Client;
- Written incident report within 24 hours; and
- Cooperate with investigations and provide updates.

11.7 Training and Drills

The following shall constitute training and drills for the emergency preparedness and response planning:

- All staff, farmers, and contractors must receive regular training on emergency procedures, including E&S, accident, and GBV/SH protocols.
- Fire drills to be conducted with Ghana National Fire Service.
- Specialized training for Emergency Response Team and GBV/SH focal points.
- Training records must be maintained by the Contractor and reviewed by the Client.

12.0 GRIEVANCE MECHANISM

The primary objective of the Grievance Mechanism (GM) is to establish a structured system for addressing complaints and concerns raised by both internal and external stakeholders—including employees, farmers, and the general public—regarding the Inland Valley Lot 3 projects and their associated operations. The mechanism is designed to ensure that grievances are managed in a fair, timely, transparent, and systematic manner.

The PIU has a Grievance Committee (GC) that is set up to handle issues related to the PIU. Also, each construction site has a separate GM and GC to handle workplace grievances. Under this arrangement, once the contractor is engaged and deploys workers, a GC will be established to handle grievances for the inland valley. The GM procedure for this project was adapted from the FSRP GM as contained in the Stakeholder Engagement Plan (2023) for the project. A Grievance Mechanism for Workers will be through the Workplace GC as the practice under this project and in line with the Labour Management Procedures under the Project.

It will be made accessible to all employees and contractors and integrated into the Environmental and Social (E&S) training programs across all valleys. Specifically, the GM:

- Provides affected people with avenues for making a complaint and/or resolving any dispute that may arise during the implementation of the project;
- Ensures that appropriate and mutually acceptable redress actions are identified and implemented to the satisfaction of complainants;
- Helps community members build a relationship of trust with the project staff, reduces social risk, and enables more responsive and responsible management;
- Ensures transparency in dealings amongst stakeholders including affected parties through a proper communication system; and
- Provides an avenue for vulnerable groups and victims of SEA/SH to have equal access to the grievance redress process and support.

The Inland Valley Lot 3 will rely on the already established channels under FSRP2 for receiving grievances through walk-ins, emails, phone calls, WhatsApp, SMS and complaints boxes. The emails and phone contacts for registering grievances will be made available or known to the public through signposts and billboards in the project areas. The construction machinery and equipment will also be labelled with the contacts and email details. The steps of the grievance process include:

- Step 1: Receipt and registration of complaints and grievances;
- Step 2: Assessment and classification of grievances and complaints;
- Step 3: Investigation of causes;
- Step 4: Generation of options for solving the matter;
- Step 5: Dialogue with the parties involved in the complaints;
- Step 6: Resolution of complaints;
- Step 7: Drafting of reports and follow-up; and
- Step 8: Alternative actions for unresolved complaints.

12.1 Grievance Mechanism Process

The GM for the Inland Valley Lot 3 projects is largely based on the FSRP2 GM. The mechanism consists of a three-tier bottom-up system which includes the following:

- Municipal/District level - complaints, for example, disputes between project communities or neighbouring communities and the contractor/project;
- Regional level - unresolved Complaints at the municipality/district level; and
- National judicial system – dissatisfied complainant/or issues unable to be resolved at the project level.

A two-tier Grievance Committee (GC) will be set up to handle grievances received at the municipal/district and regional levels. Grievances that are unresolved at the municipal/district level will move to the next tier, thereafter, up to the highest and final tier (i.e., the national judicial system and the World Bank) for resolution. The mechanism ensures that complaints received are promptly reviewed to address project-related concerns. Complaints received at the project level will be sorted into four levels as follows:

- Level 1: Complaints and enquiries that can be responded to promptly, e.g., reason for road diversion, alternate road provided, and length of time diversion will be in place;
- Level 2: Complaints that border on disputes between communities and projects; public agencies and communities; investors and public agencies; amongst and within the communities as well as labour issues;
- Level 3: Complaints related to the valuation of project-affected properties/items; and
- Level 4: Complaints that border on the integrity of persons including fraud or crime – corruption, rape, GBV, SEA/SH and/or forced labour issues.

12.2 Grievance Committee

The PIU has a Grievance Committee (GC) that is set up to handle issues related to the PIU. Also, each construction site has a separate GM and GC to handle workplace grievances. Under this arrangement, once the contractor is engaged and deploy workers, a GC will be established to handle grievances for the inland valley. A Grievance Mechanism for Workers will be through the Workplace GC as the practice under this project and in line with the Labour Management.

At the site-specific level, the GC will be established to operate at two levels, namely the Regional and MMDAs levels, that is the Regional Grievance Committee (RGC) and the Municipal/District Grievance Committee (MGC). These will be assisted by a Focal Person (the Agric Extension Officer(s) of MoFA). The RGCs will serve as a referral point where issues that are not resolved at the MGC level are referred to for settlement. Individual complainants who do not obtain satisfactory outcomes would have the opportunity to proceed to the Court of Law.

12.2.1 Municipal/District Level

A Municipal/District Grievance Committee (MGC) will be constituted of members represented by members of institutions/bodies listed below. These institutions/bodies will be officially requested to nominate their respective representatives to the MGC for training prior to the start of work. The proposed representation of the MGC is as follows:

- The Metropolitan/Municipal/District Assembly

- The project's municipals/districts directorate (Departments of Agriculture);
- A representative of FBOs;
- Traditional Authorities;
- WUA;
- NGOs;
- Cattle farmers;
- Agric Extension Officer(s) (Focal Person);
- Construction Contractor; and
- Construction Supervising Consultants.

12.2.2 Regional Level

The Regional Grievance Committee (RGC) will consist of representatives from selected institutions/bodies. These institutions will be tasked to nominate their representatives to the RGC. These individuals will be trained prior to the start of work. The following institutions/bodies will have representation on the RGC:

- Regional Coordinating Council (RCC) – Chairperson;
- MoFA Regional Directorate – Secretary;
- Regional Lands Commission;
- Traditional Authorities;
- Farmer/Value Chain Actor;
- Judicial Service (Ghana Association of Mediators and Arbitrators); and
- Chairperson of a Municipal Grievance Committee (where grievance was filed).

The MGC will be the first tier of the grievance system for processing and addressing complaints. After receiving a complaint filed by a complainant/aggrieved person through the Focal Person/MGC directly, the Focal Person/MGC then categorizes the complaint into Levels 1 – 4 for redress. The MGC then informs the party/parties involved and initiates an investigation process if required. A Grievance Logbook will be kept at all levels of the grievance system, i.e. by the Focal Person, MGC and RGC in which all complaints received at the respective level will be logged. Walk-in and phone call complaints will be received by the Focal Person. If the investigations prove that the issue has to be processed, it does so by setting a date for the procedure. The MGC will then convene and handle the grievance so reported to have it resolved.

Once grievances are resolved, the Chairman of the committee will complete the grievance uptake form detailing and confirming the resolution. The form will be signed by the complainant and other parties. A complaint logbook will be opened for all complaints at the project level. All MGC minutes will be recorded and made available for review upon request. Table 58 provides a summary of the grievance mechanism procedure and timelines.

Table 58: Summary of Grievance Mechanism Procedure and Timelines

Steps	Process	Actions/ Description	Time Frame
1	Receipt & recording of complaints	Complaints (Project Affected Person/ Community) will be received through: (1) Walk in (2) phone (project MGC Offices, hotline) (3) letter/ e-mail (4) during public/ community interaction	Day 1 (after receipt of complaint)
		Complaint recorded	
		Receiver forwards the complaint to MGCs	
2	Assessment & Classification of complaint	Document complaint in Formal Logbook	2–3 Days after receipt of complaint
		Sort/ Classify complaint	
		Acknowledgement of complaint through appropriate medium	5 Days (within a day to 5)
		Level 1 complaints responded to and resolved	
3	Investigation of causes	MGC investigates the cause of complaint	8–10 Days
4	Generation of options for solving the matter	MGCs deliberates on suitable options for resolution of complaint	12–13 Days
5	Dialogue with the parties involved in the complaint/ claim	Parties agree on options adopted (Levels 2 & 3)	11 Days (After investigation is done)
6	Resolutions of complaint	Redress action is implemented and communicated to complainant (if the complainant is not present at time of redress)	15–17 Days
7	Drafting of report and follow-up	A detailed report on the resolution is prepared	20 Days (3 Days after the complaint is resolved)
8	Alternative actions for unresolved complaints.	If satisfactory resolution is not reached, issue is forwarded to the Regional Grievance Committee (RGC) for resolution	27–30 Days
		Documentation, tracking, reporting and monitoring	7 Days after final meeting where resolution was not reached
		If the complainant remains dissatisfied with the mediation effort by the RGC, the complainant may seek redress at the court of law.	Unknown

12.3 Gender-Based Violence - Sexual Exploitation and Abuse and Sexual Harassment

If the GM receives a case of gender-based violence including sexual exploitation and abuse (SEA) and sexual harassment (SH) related to the projects, the complaint will only be recorded after securing the full consent of the complainant. To support in confidential uptake and resolution of SEA/SH complaints, cases received from all outlets would be processed solely by the Social Specialist (SS) of the PIU of FSRP and Agriculture

Extension Officer(s) of MoFA at the construction and operation phases respectively and referred to the appropriate SEA/SH service provider in the municipality or relevant government authorities for the appropriate redress. Follow-ups would be made until the case is resolved and closed. Also, as part of the contractor's agreement, each contractor would be required to sign a code of conduct to mitigate the potential risk of SEA/SH. In cases, where the perpetrator(s) is linked to project activities then the contractor will take appropriate actions as per the provision of the contractor's contract agreement and under the effective law in Ghana. The procedure for GBV-SEA/SH mechanism is illustrated in Figure 57 and 57a below.

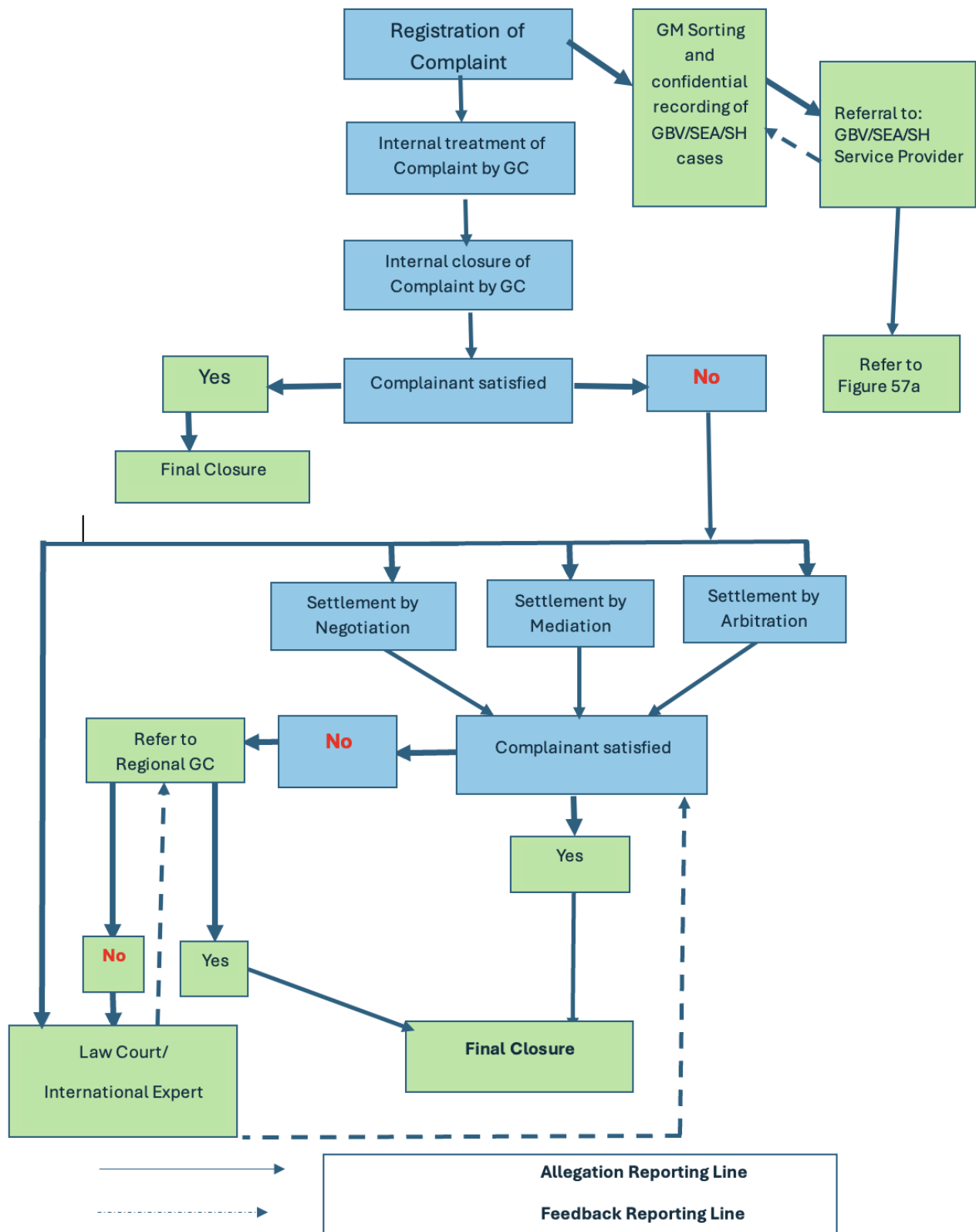


Figure 57: GBV- SEA/SH Grievance Mechanism (Source: FRSP2, 2026)

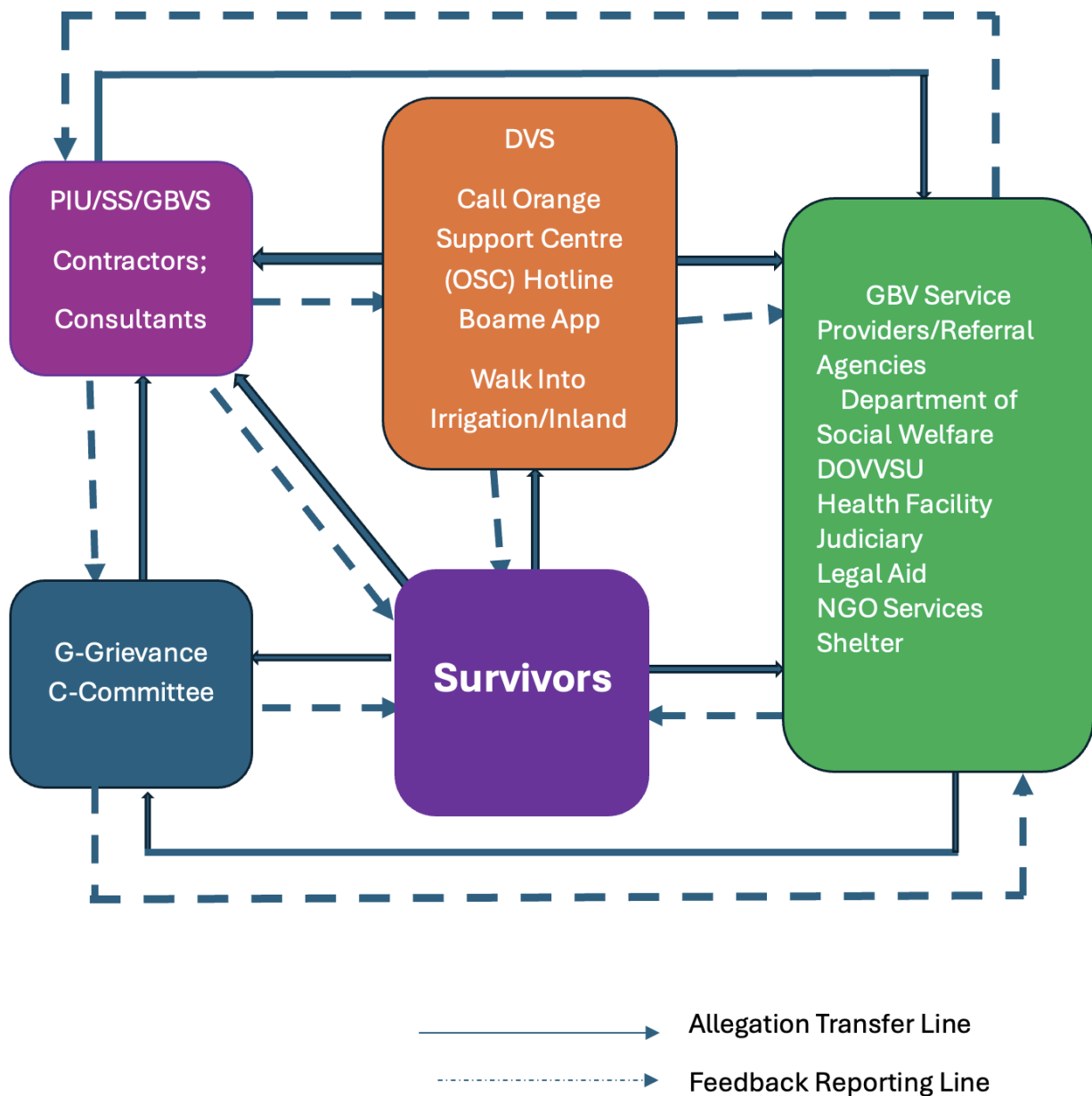


Figure 58a: GBV- SEA/SH Grievance Mechanism (Source: FRSP2, 2026)

12.4 Child Labour

Grievance cases that involve children under 18 will be given special consideration. A case involving a child will be reported to the Agriculture Extension Officer(s) of the site, for him/her to conduct a preliminary assessment and classification to determine the need for referral and remediation. When the grievance is found to be non-sensitive (no severe socioeconomic vulnerability, the child goes to school, the child is above 15 and the case is not a criminal case) the child will be removed from the situation, and the case will be remediated and reported to the DSWCD. However, when the case is a high-risk case (e.g., a child who is adversely socio-economically vulnerable, experiences multiple deprivations, and/or is under the minimum legal age for

employment (of 15 years for light work and 18 years for hazardous work) and is out-of-school), the case will be referred to the DSWCD. Also, If the case is suspected to be a criminal case (e.g., child trafficking, forced child labour) the case will be reported to the DOVVSU of the Ghana Police Service (Figure 58)

Higher-risk cases and criminal cases will require immediate reporting. All other cases will be reported within 48 hours and responded to within a week.

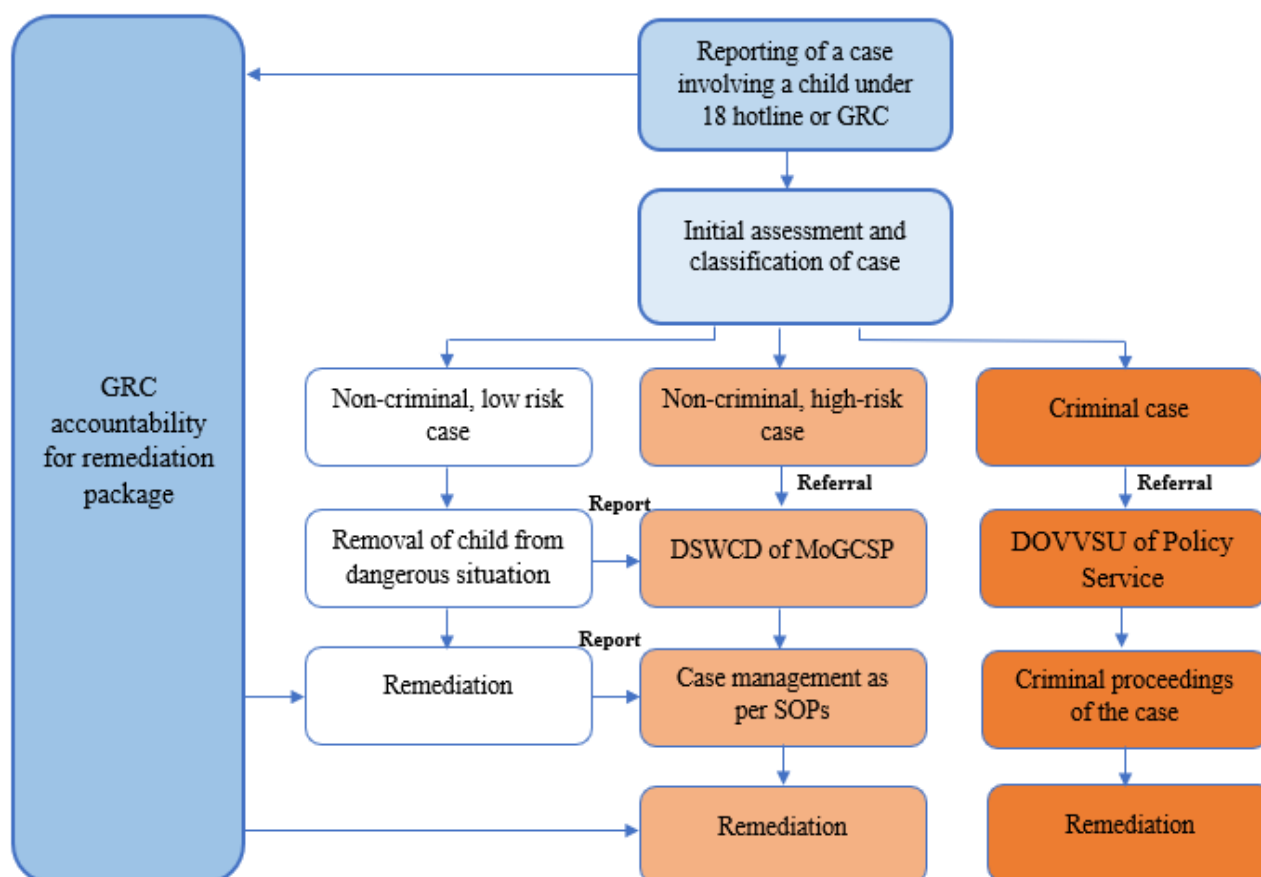


Figure 59: Mechanisms for Dealing with Child Labour Cases

12.5 Training of Grievance Committees and Sensitisation of Communities

The PIU of FSRP2 will sensitize the project communities, contractors and consultants on the need to resort to the GM to address issues that may arise under the Ashanti Region Lot 3 works. They will be informed of the application of GM. The project communities will be made aware of the establishment of the MGCs at the Municipal/District level. They will also be informed of the availability of Focal persons (community representatives) that they can reach and file complaints with. They will be again informed of the various means/channels through which they can present complaints for the needed attention and resolution. The GC will also be trained and taken through the GM process.

12.6 Grievance Mechanism Monitoring

As part of the grievance mechanism monitoring, a monthly grievance report will be generated and shared with the Project. The report will cover the following indicators:

- a) Number of new complaints received (disaggregated by type of cases);
- b) Number of open cases;
- c) Number of new cases during the period;
- d) Number of resolved cases at the end of the month;
- e) Open cases at the end of the month;
- f) Grievances by community and category of complaints;
- g) Average response time from the lodging of complaint to the agreement on solutions with complainants;
- h) Average response time from the lodging of complaint to the implementation of the agreed resolution.
- i) Percentage of true and false claims; and
- j) Number of grievances resolved by order of mechanisms.

ANNEXES

Annex 1: References

- (<https://mofa.gov.gh/site/directorates/district-directorates/central-region/215-twifo-herman-lower-denkyira>).
- (<https://www.ghanadistricts.com>)
- Ghana Statistical Service (GSS), 2021. Population and Housing Census, General Report Vol 3A_Population of Regions and Districts;
- Atwima Nwabiagya North District Assembly (ANNDA), 2023. Composite Budget for 2023-2026 Programme Based Budget Estimates;
- ANNDA, 2018. Draft Medium-Term Development Plan for 2018-2021; and
- Ghana AIDS Commission, 2022. National and Sub-National HIV and AIDS Estimates and Projections.

Annex 2: Stakeholder Engagements

Table A1: Engagement -Ejisu Department of Agriculture and Traditional Authorities

Assignment: Preparation of ESIA and ESMP – Improvement of Inland Valleys - Donauso (Odaho Valley).		
Date of Engagement: 31-10-2023		
Name of Respondents:	Designation	
• Dr. David Anambam • Nana Adu Bofour • Mr. Alex Frimpong • Mr. Joseph T. Asobro • Mr. Ebenezer K. Andrew • Mr. Adu Philip • Mr Johny Azaglo	• Municipal Director of Agric • Traditional Authority Representative • Anchor Farmer • MCO/EMA • MCO/Ejisu • MEHO • Farmer	
Main Discussions		
1. Land Ownership and Tenure System • The Municipal Director of Agric stated that the Odaho Valley belongs to the chiefs hence, stool land. He also indicated that there was no proper documented arrangement between the farmers and the chiefs. • However, plans are underway to develop a contractual agreement between the chiefs and the farmers regarding land usage. • A Memorandum of Understanding (MoU) between the Ministry, Chiefs, and the rice farmers will be carried out to enable farmers to maintain their farmlands.		
2. Farm Inputs • Farm inputs such as viable seeds and organic fertilizers can be made readily available at the district office for farmers to purchase and use. • Farmers indicated that the weedicides they normally use are of sub-standard quality and plead with the Ministry of Food and Agriculture to furnish them with the right type of weedicides. • The farmers were assured that plans are underway by the Government of Ghana and the Ministries to make readily available farm inputs to maximize rice production.		
3. Labour • Child labour is not common on the farms, but farmers indicated that their children usually assist them on the farm during school vacations which does not interfere with their education.		
4. Access Road Access roads exist but are not paved to allow access to parts of the valleys.		
5. Cultural Site There is a sacred grove around the Donuaso Valley. There are no farming activities in that area.		
6. Challenges Faced by Farmers • The lack of ready markets for rice makes it difficult for farmers to make returns on investments. • Issue of a dump site close to the valley that poses health and pollution risks to farmers and adjoining water bodies. • Farmers complained about the high cost of pumping water due to the increase in fuel prices.		
7. Timeline for the Commencement and Completion of the Project • Chiefs and rice farmers hope for the early commencement of the project to boost rice production.		
8. Suggestions/Recommendations • The possibility of sand-wined area reclamation should be looked into as a potential addition to the existing valley. • Commitment should be received from the landowners/chiefs on the proposed areas for weirs and other infrastructure per the proposed designs so as to prevent any future encroachment. • Suggest appropriate rice cultivation and seed selection techniques to farmers. • Interventions should consider the provision of potable water and sanitary facilities.		

- The proposed designs on the weirs to make provisions for frequent de-silted of weirs, which is currently being done to prevent overflow and flooding.
- The proposed interventions should consider the implementation timelines so that farmers do not lose significant farming time.
- Man, hours should be factored into the cost analysis for socio-economic purposes.



Table A2: Engagement – Atwima Nwabiagya North District (Including Traditional Reps)

Assignment: Preparation of ESIA and ESMP – Improvement of Inland Valleys – Aninkrumah (Waamu Valley)

Date of Engagement: 03-11-2023

Name of Respondents:

- Abdul Rahman
- Grace Achiaa
- Oduro Mensah Kwame
- Musah Mumuni
- Michael Owusu
- Patrick Mintah
- Kwaku Abochi Tawiah
- Fuseina Mustapha
- Barikisu Seidu
- Awuah Kingsford

Designation

- District Co-ordinating Director
- District Agriculture Director
- MISO
- Farmer
- Aninkrumah Okyeame
- Committee Chairman
- Abusuapanin Kumi
- Farmer
- Farmer
- Farmer

Main Discussions

1. Land Use

- The areas earmarked for the development of dams by the design team are characterized by residential facilities so the approved land use should be investigated to ensure no conflicts.

2. Land Ownership

- Families were said to be the custodians of the inland valleys in the Atwima Nwabiagya North District.
- The farmers have different payment terms with the landowners.
- Nevertheless, there is no documented evidence of rental arrangements between the farmers and the landowners.
- Traditional and local authorities will collaborate to ensure that all land tenure issues are resolved, and agreements are reached to ensure the smooth implementation of the project.

3. Concerns/Challenges

- The unavailability of viable seeds and other agrochemical products across the district offices of agriculture is a major worry to farmers in the district.
- The farmers alleged that the Offin River gets polluted occasionally by wastewater from the water treatment plant, hence not suitable for irrigation. As a result, the farmers depend on a stream known as Pranpramadan for irrigation.

4. Timeline for Commencement and Completion of the Project

- The timeline for the commencement and completion of the project is also of interest to the rice farmers. They anticipate early commencement and faster completion to increase rice production.

5. Suggestions/Recommendations

- Provisions should be made for compensation of owners of structures and farms to be potentially affected.
- Notices should be served to encroachers of impending intervention to prevent any hindrances to be project.
- The project should consider making provisions for mechanization to help farmers.
- Propose the allowance of a buffer between the fields/valley and any adjoining water resources.

Table A3: Engagement – Atwima Nwabiagya North District - Farmers

Assignment: Preparation of ESIA and ESMP – Improvement of Inland Valleys – Amakye-bare (Offino Valley)

Date of Engagement: 31-10-2023

Name of Respondents:	Designation	
• Alhassan Dauda • Collins Opoku • Thomas Amoah • Fuseini Seidu • Nana Adikro • • •	• Farmer • Farmer • Farmer • Farmer • Farmer • District Assembly Representative • Unit Committee Member • Regional Agric Director	

Main Discussions

1. Burrow Pits

- Two (2) potential sites for borrow pits are identified and available for borrowing.
- Potential sites for borrow pits can be facilitated by the traditional authorities.

2. Challenges Faced by Farmers

- Rice markets are biased towards a variety of rice which farmers need to consider before selecting a rice variety to cultivate.

3. Potential Issues

- Rechannelling of streams may result in the flooding of other parts of the communities or upland areas.

4. Suggestions/Recommendations

- The project implementation team should consider the timing of the intervention due to issues of excessive flooding during rainy seasons.
- Proper planning should be done by farmers on their investments and farming process (planting, marketing) to avoid loss of farmers' investments.
- The intervention should consider the provision of sanitary areas for farmer convenience.

Table A4: Engagement – Juaben Municipal

Assignment: Preparation of ESIA and ESMP – Improvement of Inland Valleys – Yaw Nkrumah (Odamu Valley)		
Date of Engagement: 01-11-2023		
Name of Respondents:	Designation	
• Omane Aboagye • Dr. Stephen Lurimuah • Alex Adu-Gyamfi • Priscilla Owusu • Abdullia Tari • Shadrack Asaana	• Municipal Chief Executive • Municipal Co-ordinating Director • Municipal Director of Agriculture • A.E.A • Farmer • Farmer	
Main Discussions		
1. Land Ownership and Tenure System • The Juaben land stool is the custodian of the inland valleys in the Juaben Municipality. • Farmers were concerned that their farmlands would be taken away after the completion of the project, but the Municipal Director of Agriculture indicated that the Municipal Directorate and the chiefs have developed a contractual agreement for farmers to sign.		
2. Land Encroachment and Sand Winning • There have been activities of land encroachment and sand winning on certain portions of the inland valleys by private developers. • The Municipal Planning Officer stated that the valleys have been marked in the municipal layout as nature reserves and agricultural land. Therefore, any unauthorized activities in the valleys will be curtailed.		
3. Farm Inputs • Farmers were assured that plans are underway by the Municipal Directorate (MD) to make readily available farm inputs for their use.		
4. Challenges Faced by Farmers • The lack of a ready market for rice produce makes it difficult for farmers to access and also service credit facilities. • Constant flooding of the valleys during peak rainy seasons is a challenge to the rice farmers at the Yaw Nkrumah Valley. The farmers were of the view that the flooding was a result of mud and other silted materials in the water course which needed to be dredged. • The unavailability of viable seeds and organic fertilizers at the MD is a major worry to the farmers since they are prepared to go fully organic farming.		
5. Potential Issues • The erection of weirs and other infrastructure may result in overflows and consequently, flooding which can destroy lives and properties.		
6. Timeline for Commencement and Completion of the Project The timeline for the commencement and completion of the project is of interest to the rice farmers. They anticipate early commencement and faster completion to increase rice production.		
7. Suggestions • The Municipal Coordinating Director suggested that farmers should be introduced to how composting is done to enhance the use of organic fertilizers. • The farmers stated that there should be equity in the disbursement of farm inputs. Also, there should be a monitoring division under the ministries to help check and eliminate fake agro-chemical products from the local market.		



Table A5: Engagement – Sekyere South District

Assignment: Preparation of ESIA and ESMP – Improvement of Inland Valleys – Tano-Odumasi (Kumkum Valley)		
Date of Engagement: 02-11-2023		
Name of Respondents:	Designation	
• Catherine Reckling • Bamando Tanko • Kesi Peprah • Maaku Tibe Roberta • Tibe Maaku Cosmas • Afari Kwame	• District Chief Executive (SSDA) • District Agric Officer Extension • Physical Planning Officer • Environmental Health Officer • District Disease Control Officer • Farmer	
Main Discussions		
1. Land Ownership and Tenure System • The Agona land stool is the custodian of the inland valleys in the Sekyere South District. • According to the farmers, the stool has leased the inland valleys to an aggregator, Western Deedew Limited. The farmers have a formal agreement with Western Deedew, and the documentation process is in progress.		
2. Land Encroachment • Portions of the inland valleys have been said to be encroached by private developers and sand winners. • The District Chief Executive gave assurance that all the chiefs are in support of the inland valleys reserved specifically for rice farming therefore any unauthorized activity will be stopped.		
3. Concerns/Challenges • The unavailability of viable seeds and agrochemical products at the district agric office is of concern to the farmers. Therefore, they are requesting that there should be equity in the disbursement of the farm inputs. • Farmers complain of constant flooding during the peak rainy season and are helpless during these seasons since their entire farm gets submerged in water. • It was noted that the stream does not have a definite course of flow therefore water channels should be created for the stream to help check the flooding.		
4. Labour • No incident of child labour was sighted at the rice field. • Farmers cited that their older children assist with harvesting when they are on vacation.		
5. Disease Control • The disease control officer was of the view that there would be an increase in the spread of malaria since rice farms are good breeding grounds for mosquitoes.		

- To address this potential issue, the communities will be sensitized by the district health directorate on the effectiveness of keeping their surroundings clean and sleeping under treated mosquito nets to prevent the spread of malaria.

6. Waste Management

- The district has an open land field disposal site which makes it easier for farmers to properly dispose of their waste agrochemical containers.
- However, the District Assembly allocated land to Zoomlion Limited for the construction of an engineering land field.

Table A6: Engagement -District Assembly – Sekyere South District

Assignment: Preparation of ESIA & ESMPs – Improvement of Selected Inland Valleys in the Ashanti Region – Lot 3		
Date of Engagement: 02-11-2023		
Name of Respondents:	Designation	
• Catherine Reckling • Bamando Tanko • Kwesi Peprah • Maaku Tibe Roberta • Tibe Maaku Cosmas • Afari Kwame • Salamatu Mumin	• District Chief Executive (SSDA) • District Agric Officer • Extension Officer • Physical Planning Officer • Environmental Health Officer • Farmer • Farmer	•
Main Discussions		
1. Land Ownership, Tenure and Encroachment Issues • The Occupants of the Agona stool are the custodians of the inland valleys in the Sekyere South District. The stool has leased the inland valleys to an aggregator, Western Deedew Limited who in turn enters into some agreement with farmers who want to use part of the valley for rice cultivation. The Assembly noted that it had plans to formalize these agreements. The Assembly further reiterated that there will be a memorandum of understanding between the parties to ensure that the farmers maintain their farmlands after the completion of the project. • Portions of the inland valleys have been encroached by private developers and sand winners. The Assembly is taking measures to stop all the chiefs who are in support of this activity		
2. Child Labour and Women Empowerment • The Assembly recorded 11 cases of child labour where children between the ages of 12-17 were found working on farms during school hours. The Community Development Department (CDD) took up the issue and consulted with the parents who cited economic hardship as the reason for not having the children in school. CDD embarks on periodic checks on farms and other workplaces to ensure children of school-going age are not out there when they are supposed to be in school. • The Assembly supports women engaging in rice farming. Currently, there is a programme with JICA to supply women with fertilizer (Biochar) for improving growth of rice seedlings at the nursery stage. Women are also supplied with tarpaulin to use as drying platform and also to form roofs over the platforms to protect harvested grains from the rains		
3. Waste Management The district presently has an open disposal site which serves as the final destination for all collected waste. There is, however, an on-going arrangement with Zoomlion Limited for the construction of an engineered land field.		
4. Flooding The Kumkum Valley and surrounding area experience flooding during the rains. This is due to the large volumes of water from upstream pouring into the valley. The stream channel has obstacles such as debris, fallen wood and some vegetation growing it, which causes the water not to have a free flow, causing it to spread out into numerous channels at various points. Farms sometimes get completely inundated and this causes great losses to the farmers		



Table A7: Engagement -District Health Directorate – Sekyere South District

Assignment: Preparation of ESIA & ESMPs – Improvement of Selected Inland Valleys in the Ashanti Region – Lot 3		
Date of Engagement: 02-12-2023		
Name of Respondents:	Designation	
- Gifty Twum-Antwi - Tibe Maakuu Cosmos - Kofi Damoah - Asare Joseph - Janet Ataa Amaniampong	- Director of Health - DDCO - NO - HPO - Accountant	
Main Discussions		
1. Health Facilities in the District There are 7 hospitals in the district: 2 private, 1 public and others such as the Christian Health Association of Ghana (CHAG). Tano Odumase is under the Kona District and has a health centre manned by a Health Assistant.		
2. Disease Prevalence and Control - Malaria is a major disease in the district and is likely to increase because rice farms are good breeding grounds for mosquitoes. The increased capacity to grow rice in the valley would mean a wider area for mosquitoes to breed. - The health directorate undertakes sensitization programmes on malaria prevention and cure in the communities to enlighten members. They are taught about the effectiveness of keeping their surroundings clean and sleeping under treated mosquito net to prevent the spread of malaria. - The DHD will furnish the consultants with a complete list of the disease prevalence rates in the district		
3. Challenges The DHD lacks logistics and funds to carry out its work efficiently. The sensitization programmes are not held in the communities as often as is supposed to because of lack of vehicles and audio-visual equipment and materials which would be used to facilitate the work. The directorate would be glad if it could be supported with such logistics by the FSRP2 project.		



Table A8: Engagement -Farmers – Kumkum Valley (Tano Odumase)

Assignment: Preparation of ESIA & ESMPs – Improvement of Selected Inland Valleys in the Ashanti Region – Lot 3		
Date of Engagement: 02-11-2023		
Name of Respondents:	Designation	
- Patrick Nyonyayere - Afari Kwame - Akua Serwaa - Salamatu Mumin	- Farmer - Farmer - Farmer - Farmer	
Main Discussions		
1. Land Tenure and Use Western Deedew Company has leased the lands in the valley and anyone who wants to farm must contact them for an area to be allocated to them. Farmers pay royalties to Deedew every year and the company in turn pays royalties to the chiefs. A farmer is required to pay approximately 340 Ghana Cedis for every 1-acre land cultivated which is equivalent to about 35kg of milled rice		
2. Demography of Farmers There are about 100 farmers working in the valley. Most farmers are migrants who have moved from other parts of the country, especially the Northern parts of Ghana and settled in communities in the district to engage in rice farming. Most of the farmers have rice cultivation as their mainstay		
3. Challenges in the Rice Value Chain - It is difficult to access good, viable seeds for cultivation. It is also challenging to obtain essential inputs for our farming activities, such as fertilizers and pesticides. The inputs that come from the MoFA office is genuine and at a moderate cost, but when we are not getting it from them, we must look elsewhere to purchase at a higher cost. Sometimes we end up getting poor quality inputs which affects our crop yield. The farmers lamented that they only hear about some farm inputs being distributed by the district argic office but do not get to them and therefore are requesting that there should be equity in the disbursement of the farm inputs. - We have a major challenge with keeping birds away from the rice especially during the panicle initiation and booting stages. Covering the rice with a net is an efficient method of protecting the rice from birds but it has a huge cost implication. Sometimes, birds can destroy all the crops, and a farmer can end up not getting anything out of all the hard work involved in the cultivation		
4. Use of child labour on the farms The farmers intimated that officers from the Assembly have been coming around in the communities from time to time to educate them on the need for their children to be in school. Our children are all in school during the day. Sometimes, we bring them along with us during their vacation, not to do any unreasonably hard work but to help with minor things on the farm. Bringing them to the farm also serves as a time of learning and bonding with them		
5. Flooding - The farmers complained of constant flooding during the peak raining season and therefore are helpless during these seasons since their entire farm get submerge in water. - It was noted that the stream does not have a definite course of flow therefore water channels should be created for the stream to help check the flooding.		

Table A9: Engagement -District Assembly – Atwima Nwabiagya North District

Assignment: Preparation of ESIA & ESMPs – Improvement of Selected Inland Valleys in the Ashanti Region – Lot 3		
Date of Engagement: 02-11-2023		
Name of Respondents: Abdul Rahman Saheed Mikail Eric Marfo Grace Achiaa Oduro Mensah Kwame Kyere Kwame Henchard Adjei Samuel	Designation • District Coordinating Director • District Agric Director • Disease Control Officer • MISO • D.A.D • D.A.D	
Main Discussions		
1. Land Ownership, Tenure and Encroachment Issues • Families are the custodians of the inland valleys in the Atwima Nwabiagya North District. The farmers enter into a land use agreement with the families with different payment terms, depending on the landowners. There is, however, no documented evidence of the lease arrangement between the farmers and the landowners • Portions of the inland valleys have been encroached on by private developers and sand winners. The Assembly is taking measures to stop all the chiefs who are in support of this activity		
2. Health • There are 17 health facilities in the district. Malaria is prevalent. There have been few incidents of Oncho and also black flies (the carrier of Oncho) have been found in water-logged areas in the district		
3. Farm Inputs • The district MoFA office has been considering promoting the use of organic fertilizers in preference to inorganic. For instance, ‘Greenfert’ pellets is an organic fertilizer applied 2 weeks before planting and has been found to be more effective than the inorganic fertilizer • ‘New Okaff’ is also an organic fertilizer produced in Ghana by AF Confidor; which also produces an organic-based liquid pesticide • The challenge with the use of organic agrochemicals is the increasing cost and the requirement of higher quantities that need to be applied to achieve the desired effect		
4. Flooding The Valleys and surrounding area also experience flooding during the rains. This is due to the large volumes of water from upstream pouring into the valley. The stream channel has obstacles such as debris, fallen wood and some vegetation growing it, which causes the water not to have a free flow, causing it to spread out into numerous channels at various points. Farms sometimes get completely inundated and this causes great losses to the farmers		

Table A10: Engagement -Farmers – Offinno Valley (Amakyebare)

Assignment: Preparation of ESIA & ESMPs – Improvement of Selected Inland Valleys in the Ashanti Region – Lot 3		
Date of Engagement: 03-11-2023		
Name of Respondents:	Designation	
• Ibrahim Aduuni • Salamatu Mumin • Adiana Yakubu • Emmanuel Kafo • Rexford K. Ankomah	• Farmer • Farmer • Farmer • Farmer • Farmer	
Main Discussions		
1. Land Tenure and Use • Land belongs to families and farmers negotiate with the landowners if they want to use a parcel of land. Although land belongs to families, the chiefs have oversight of the use of the land		
2. Pollution from water treatment plant • The farmers alleged that they sometimes see some change in coloration of Offin River which they suspect comes from wastewater from the water treatment plant upstream. The farmers are therefore apprehensive to pump water from the Offin River. The farmers depend on a stream that flows through the valley, known as Prampamadan which takes its source from the Bare Community, for irrigation.		
3. Challenges in the Rice Value Chain • Aside farm supplies that are not always available, farmers also have challenges with land preparation; the high cost of renting machinery such as the power tiller and thresher make it difficult for farmers to get the land properly prepared for cultivation. This ends up affecting the overall yield of the crops. • Flooding occurs extensively. Especially during the rainy season. Most of the time the entire field gets covered with all the crops. This leads to huge losses. Part of the cause of flooding is that there is a lot of weeds growing in the canals of the Prampamadan and Offin River, which obstructs the flow of water from upstream		
4. Timeline for commencement and Completion of the works • The farmers expressed their interest in knowing when the project would start. They mentioned that their expectation was for the works to start early and once it starts it should be seen to its completion and not to be left halfway through; in which case it could worsen their plight and disrupt their livelihood.		



Table A11: Engagement -Farmers – Waamu/Kumi Valley (Anninkrumah)

Assignment: Preparation of ESIA & ESMPs – Improvement of Selected Inland Valleys in the Ashanti Region – Lot 3		
Date of Engagement: 03-11-2023		
Name of Respondents:	Designation	
• Musa Mumuni • Nana Yawbio • Abubakar Larle • Siaka Ibrahim • Osman Alhassan • Abdulhamid Mumuni • Awuni Azure • Nuhu Awini	• Farmer • Farmer • Farmer • Farmer • Farmer • Farmer • Farmer • Farmer	
Main Discussions		
1. Land Tenure and Use • Land belongs to families and farmers negotiate with the landowners if they want to use a parcel of land. Although land belongs to families, the chiefs have oversight of the use of the land		
2. Pollution from water treatment plant • The farmers alleged that they sometimes see some change in coloration of Offin River which they suspect comes from wastewater from the water treatment plant upstream. The farmers are therefore apprehensive to pump water from the Offin River. The farmers depend on a stream that flows through the valley, known as pranpramadan which takes its source from the Bare Community, for irrigation.		
3. Challenges in the Rice Value Chain • Aside farm supplies that are not always available, farmers also have challenges with land preparation; the high cost of renting machinery such as the power tiller and thresher make it difficult for farmers to get the land properly prepared for cultivation. This ends up affecting the overall yield of the crops. • Flooding occurs extensively. Especially during the rainy season. Most of the time the entire field gets covered with all the crops. This leads to huge losses. Part of the cause of flooding is that there is a lot of weeds growing in the canals of the Prampamadan and Offin River, which obstructs the flow of water from upstream		
4. Timeline for commencement and Completion of the works • The farmers expressed their interest in knowing when the project would start. They mentioned that their expectation was for the works to start early and once it starts it should be seen to its completion and not to be left halfway through; in which case it could worsen their plight and disrupt their livelihood.		

