

# **ENVIRONMENTAL ASSESSMENT & MANAGEMENT PLAN**

## **KATO HYDROPOWER PROJECT**



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Prepared by  
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## Table of Contents

|  |           |
|--|-----------|
| <b>ACRONYMS .....</b>  | <b>8</b>  |
| <b>EXECUTIVE SUMMARY .....</b>   | <b>11</b> |
| <b>1.0 INTRODUCTION .....</b>  | <b>18</b> |
| 1.1 Background .....   | 18        |
| 1.2 Objective and Scope of the EAMP .....                              | 18        |
| 1.3 Methodology .....  | 19        |
| 1.4 Organisation of the EAMP .....                                     | 20        |
| 1.5 Challenges .....   | 20        |
| <b>2.0 PROJECT DESCRIPTION .....</b>                                   | <b>22</b> |
| 2.1 Background .....   | 22        |
| 2.2 Project Overview .....   | 23        |
| 2.3 Location of the Project .....                                      | 23        |
| 2.4 Project Life and Sustainability .....                              | 26        |
| 2.5 Project Components .....   | 26        |
| 2.6 Hydrological Demand .....  | 28        |
| 2.6.1 Hydrological Recording, Flow Duration and Rain Correlation ..... | 28        |
| 2.6.2 Hydro-Energetic Data .....                                       | 29        |
| 2.6.3 Water Levels .....   | 30        |
| 2.7 Transmission and Distribution Network .....                        | 30        |
| 2.8 Cost of Electricity and Principal Consumers .....                  | 32        |
| 2.9 Construction Phase .....   | 32        |
| 2.10 Employment Opportunities .....                                    | 33        |
| 2.11 Environmental Benefits .....                                      | 33        |
| 2.12 Socio-Economic Benefits .....                                     | 33        |
| 2.13 Planning Permission and Regulatory Approval .....                 | 34        |
| <b>3.0 PROJECT ENVIRONMENT .....</b>                                   | <b>35</b> |
| 3.1 Physical Environment .....   | 35        |
| 3.1.1 Geology .....  | 35        |
| 3.1.2 Soils .....  | 38        |
| 3.1.3 Topography .....   | 40        |
| 3.1.4 Hydrology .....  | 42        |
| 3.1.5 Climate .....  | 45        |
| 3.1.6 Surface Water Quality .....                                      | 46        |
| 3.1.7 Noise .....  | 49        |
| 3.2 Biological Environment .....                                       | 52        |
| 3.2.1 Biogeographic Provinces .....                                    | 52        |
| 3.2.2 Landscapes and Ecosystems .....                                  | 53        |
| 3.2.3 Habitats and Species .....                                       | 55        |
| 3.2.4 Critical Endangered and Endangered Species .....                 | 60        |
| 3.2.5 Areas of Biological Interest .....                               | 61        |
| 3.3 Socio-economic Environment .....                                   | 64        |
| 3.3.1 Access .....   | 64        |
| 3.3.2 Economic Activities/Land Use .....                               | 66        |
| 3.3.3 Population and Demographics .....                                | 69        |

|  |           |
|--|-----------|
| 3.3.4 Education .....  | 69        |
| 3.3.5 Employment Status .....  | 70        |
| 3.3.6 Health Services .....  | 71        |
| 3.3.7 Other Services and Utilities.....  | 71        |
| 3.3.8 Administration and Governance .....  | 72        |
| 3.3.9 Cultural and Anthropological Environment .....   | 73        |
| <b>4.0 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK .....</b>                                     | <b>76</b> |
| 4.1 National Policies and Strategies .....   | 77        |
| 4.1.1 Green State Development Strategy: Vision 2040.....                                       | 77        |
| 4.1.2 Guyana National Energy Policy .....  | 77        |
| 4.1.3 Green Paper for a Draft National Energy Policy.....                                      | 78        |
| 4.1.4 Guyana Power Sector Policy and Implementation Strategy.....                              | 78        |
| 4.1.5 Unserved Areas Electrification Programme.....  | 79        |
| 4.1.5.1 Hinterland Electrification Strategy.....   | 79        |
| 4.1.6 Guyana Energy Agency Strategic Plan 2016 – 2020 .....                                    | 79        |
| 4.1.7 Low Carbon Development Strategy .....  | 80        |
| 4.1.8 National Development Strategy .....  | 80        |
| 4.1.9 Guyana Poverty Reduction Strategy (PRSP) .....   | 81        |
| 4.1.10 National Environmental Action Plan .....  | 81        |
| 4.2 Legal Framework .....  | 81        |
| 4.2.1 The Constitution of the Cooperative Republic of Guyana, 1980, and 2003 Reforms .....     | 82        |
| 4.2.2 Environmental Protection Act (1996) .....  | 82        |
| 4.2.2.1 Environmental Protection Regulations, 2000.....  | 83        |
| 4.2.2.2 EPA Guidelines .....   | 85        |
| 4.2.2.3 Environmental Management Plan (EMP) Guidelines .....                                   | 86        |
| 4.2.3 Guyana Energy Agency (GEA) Act, 1997 .....   | 86        |
| 4.2.4 Hydro-Electric Power Act, 1956.....  | 86        |
| 4.2.5 Amerindian Act, 2006.....  | 87        |
| 4.2.6 Labour Act, 1942.....  | 87        |
| 4.2.7 Occupational Health and Safety Act, 1997.....  | 87        |
| 4.2.8 Additional Legislation .....   | 88        |
| 4.3 Institutional Framework.....   | 88        |
| 4.3.1 Environmental Protection Agency.....   | 88        |
| 4.3.2 Ministry of Public Infrastructure.....   | 89        |
| 4.3.3 Guyana Energy Agency .....   | 89        |
| 4.3.4 Hinterland Electrification Company Inc.....  | 90        |
| 4.3.5 Ministry of Communities (RDC of Region 8).....   | 90        |
| 4.3.6 Public Utilities Commission.....   | 91        |
| 4.3.7 Kato Village Council .....   | 91        |
| 4.4 International and Regional Policy Framework.....   | 91        |
| 4.4.1 Agenda 21 and Rio +20 .....  | 91        |
| 4.4.2 United Nations Framework Convention on Climate Change (UNFCCC) and Paris Agreement ..... | 92        |
| 4.4.3 Sustainable Development Goals (SDGs) - Agenda 2030 .....                                 | 93        |
| 4.4.4 The CARICOM Energy Policy (2013) .....   | 94        |
| 4.4.5 The Caribbean Sustainable Energy Road Map and Strategy (2015).....                       | 94        |
| 4.4.6 Draft Caribbean Community Environment and Natural Resources Policy Framework .....       | 94        |
| 4.5 Other Policies and Guidelines .....  | 95        |
| 4.5.1 IDB Policies.....  | 95        |
| 4.5.2 International Hydropower Association Sustainability Guidelines .....                     | 96        |
| 4.5.3 The Hydropower Sustainability Assessment Protocol.....                                   | 96        |

|   |            |
|---|------------|
| 4.5.4 The Hydropower Sustainability ESG Gap Analysis Tool ..... | 97         |
| <b>5.0 STAKEHOLDER FEEDBACK .....</b>                           | <b>98</b>  |
| <b>6.0 ENVIRONMENTAL IMPACT ASSESSMENT.....</b>                 | <b>102</b> |
| 6.1 Physical Environment .....                                  | 102        |
| 6.1.1 Geology and Soils .....                                   | 102        |
| 6.1.2 Surface Water .....                                       | 103        |
| 6.1.3 River Flow .....  | 104        |
| 6.1.4 Groundwater .....   | 105        |
| 6.1.5 Noise .....   | 105        |
| 6.1.6 Air Quality .....   | 105        |
| 6.1.7 Climate and Climate Change .....                          | 106        |
| 6.2 Biological Resources .....                                  | 107        |
| 6.2.1 Vegetation .....  | 107        |
| 6.2.2 Terrestrial and Aquatic Fauna.....                        | 108        |
| 6.3 Socioeconomic Environment .....                             | 111        |
| 6.3.1 Land Take and Land Use.....                               | 111        |
| 6.3.2 Community Conflicts .....                                 | 111        |
| 6.3.3 Cultural Change .....                                     | 112        |
| 6.3.4 Archaeological Resources .....                            | 113        |
| 6.4 Health and Safety .....                                     | 113        |
| 6.4.1 Workers Health and Safety .....                           | 113        |
| 6.4.2 Public Safety .....                                       | 114        |
| 6.5 Cumulative Impacts .....                                    | 115        |
| 6.5.1 National-Level Renewable Energy .....                     | 115        |
| 6.5.2 Agricultural Development of Kato .....                    | 115        |
| 6.5.3 Traffic .....   | 116        |
| <b>7.0 ENVIRONMENTAL MANAGEMENT PLAN .....</b>                  | <b>120</b> |
| 7.1 Physical Environment .....                                  | 120        |
| 7.1.1 Erosion, Sedimentation and Compaction .....               | 120        |
| 7.1.2 Dust .....  | 121        |
| 7.1.3 Noise and Vibration.....                                  | 121        |
| 7.1.4 Waste Management .....                                    | 122        |
| 7.1.5 Fuel, Lubricants and other Hazardous Materials.....       | 123        |
| 7.2 Biological Environment .....                                | 124        |
| 7.2.1 Flora .....   | 124        |
| 7.2.2 Fauna .....   | 124        |
| 7.3 Socioeconomic Environment .....                             | 125        |
| 7.3.1 Conflict Prevention .....                                 | 125        |
| 7.3.2 Stakeholder Engagement .....                              | 126        |
| 7.3.3 Conflict Resolution (Grievance Mechanism) .....           | 127        |
| 7.3.4 Cultural Change .....                                     | 128        |
| 7.3.5 Archaeological Finds.....                                 | 128        |
| 7.4 Health and Safety .....                                     | 128        |
| 7.4.1 Workers Health and Safety .....                           | 128        |
| 7.4.2 Public Safety .....                                       | 129        |
| 7.5 Emergency Response.....                                     | 129        |
| <b>8.0 EAMP IMPLEMENTATION FRAMEWORK.....</b>                   | <b>131</b> |

|   |            |
|---|------------|
| 8.1 Roles and Responsibilities.....                                     | 131        |
| 8.2 Contractor’s ESMP .....   | 133        |
| 8.3 Environmental Monitoring .....                                      | 134        |
| 8.4 Reporting.....  | 136        |
| 8.5 Orientation and Training .....                                      | 137        |
| 8.6 Mitigation and Monitoring Budget .....                              | 137        |
| <b>REFERENCES.....</b>  | <b>139</b> |
| <b>APPENDIX A: EAMP TEAM .....</b>                                      | <b>142</b> |
| <b>APPENDIX B: TERMS OF REFERENCE FOR PREPARATION OF THE EAMP.....</b>  | <b>143</b> |
| <b>APPENDIX C: CONCEPT DRAWINGS FOR PROJECT COMPONENTS.....</b>         | <b>153</b> |
| <b>APPENDIX D: GENERAL ALIGNMENT OF TRANSMISSION NETWORK ROUTE.....</b> | <b>163</b> |
| <b>APPENDIX E: APPROVALS.....</b>                                       | <b>164</b> |
| <b>APPENDIX F: WATER QUALITY ANALYSES LABORATORY REPORT .....</b>       | <b>168</b> |
| <b>APPENDIX G: RECORDS OF STAKEHOLDERS ENGAGEMENTS.....</b>             | <b>170</b> |

## List of Tables

|   |     |
|---|-----|
| Table 1: Relevant Legislation, Policies and Strategies .....                                | 14  |
| Table 2-1: Chronology of Events .....   | 22  |
| Table 2-2: Summary of Main Parameters of the Hydro-Power Plant .....                        | 23  |
| Table 2-3: Hydro-Energetic Data .....   | 30  |
| Table 3-1: Rainfall Amount at Kato – November 2009 to July 2019 .....                       | 45  |
| Table 3-2: Description of Surface Water Sample Locations .....                              | 46  |
| Table 3-3: Results of Physiochemical Analyses .....   | 48  |
| Table 3-4: Noise Levels Recorded .....  | 49  |
| Table 3-5: Birdlife International IBAS Proposed for Guyana .....                            | 62  |
| Table 3-6: Population of Kato and Neighboring Villages .....                                | 69  |
| Table 3-7: School Attendance of the Village Populations .....                               | 70  |
| Table 3-8: Level of Education by Villagers .....  | 70  |
| Table 3-9: Level of Employment by Villagers .....   | 71  |
| Table 3-10: Resident Employment Status for Selected Villages .....                          | 71  |
| Table 4-1: Relevant Legislation, Policies and Strategies .....                              | 76  |
| Table 4-2: Regulations relevant to the project under the Environmental Protection Act ..... | 83  |
| Table 4-3: The Project's Compliance with IDB Policies .....                                 | 95  |
| Table 5-1: Schedule of Stakeholder Engagements .....  | 98  |
| Table 5-2: Environmental and Social Issues Raised by Stakeholders .....                     | 99  |
| Table 6-1: Summary of Potential Impacts of the Kato Hydropower Plant .....                  | 117 |
| Table 8-1: Summary of Environmental related Responsibilities .....                          | 132 |
| Table 8-2: Environmental Monitoring .....   | 135 |
| Table 8-3: Budget for Mitigation and Monitoring .....                                       | 138 |

## List of Figures

|   |    |
|---|----|
| Figure 2-1: Location of the Kato Hydroelectric Project .....                    | 24 |
| Figure 2-2: Project Site and Components within the Kato Village .....           | 25 |
| Figure 2-3: Kato Hydropower Project Layout .....                                | 27 |
| Figure 2-4: Power and Flow Duration Curves .....                                | 28 |
| Figure 2-5: Flow and Hydro Generation during Year One with Demand Profile ..... | 28 |
| Figure 2-6: FDC with a Mean Flow of 1.43m <sup>3</sup> /second .....            | 29 |
| Figure 2-7: Secondary School and NAREI (Demand Centre 1) .....                  | 31 |
| Figure 2-8: Kato Village (Demand Centre 2) .....                                | 32 |
| Figure 3-1: Geology of the Wider Project Area .....                             | 37 |
| Figure 3-2: Soil Classes at and around the Project Area .....                   | 39 |
| Figure 3-3: Topography of the General Project Area .....                        | 40 |
| Figure 3-4: Topography of the Wider Project Area .....                          | 41 |
| Figure 3-5: Small Drainage Feature leading to the Chiung .....                  | 42 |
| Figure 3-6: Larger Stream flowing to the Chiung .....                           | 42 |
| Figure 3-7: The Chiung Falls .....  | 42 |
| Figure 3-8: Sections of the Chiung River .....                                  | 43 |
| Figure 3-9: Drainage Network around the Project Area .....                      | 44 |
| Figure 3-10: Monthly Rainfall from 2009 to 2019 at Kato .....                   | 46 |
| Figure 3-11: Surface Water Sample Locations .....                               | 47 |
| Figure 3-12: Water Sample Collection from the Chiung River .....                | 49 |
| Figure 3-13: <i>In-Situ</i> Water Quality Analyses .....                        | 49 |
| Figure 3-14: Noise Levels Measurement .....                                     | 50 |

|   |    |
|---|----|
| Figure 3-15: Noise Measurement Locations.....   | 51 |
| Figure 3-16: Location of Project Area in relation to the Guiana Shield Region .....               | 53 |
| Figure 3-17: The Concession and the National Forest Regions of Guyana .....                       | 55 |
| Figure 3-18: Vegetation Types within the Wider Project Area .....                                 | 57 |
| Figure 3-19: Vegetation and Habitats of the Project Area.....                                     | 59 |
| Figure 3-20: Location of Project Area in relation to Protected Areas, IBAs and Ramsar Sites ..... | 63 |
| Figure 3-21: Communities in Proximity to Kato .....   | 65 |
| Figure 3-22: Residences in Kato .....   | 67 |
| Figure 3-23: Land Use of the Surrounding Areas.....   | 68 |
| Figure 3-24: Government Buildings at Kato .....   | 73 |
| Figure 3-25: Archaeological Sites in the vicinity of Kato .....                                   | 74 |
| Figure 3-26: Plateau on which Historical Burial Site is Located.....                              | 75 |

## Acronyms

|         |   |
|---------|---|
| ATV     | All-Terrain Vehicles                                  |
| BOD     | Biological Oxygen Demand                              |
| C-SERMS | Caribbean Sustainable Energy Roadmap and Strategy     |
| CESMP   | Construction Environmental and Social Management Plan |
| COD     | Chemical Oxygen Demand                                |
| CREDP   | Caribbean Renewable Energy Development Programme      |
| CSME    | CARICOM Single Market and Economy                     |
| DO      | Dissolved Oxygen                                      |
| EAB     | Environmental Assessment Board                        |
| EAMP    | Environmental Assessment and Management Plan          |
| EBA     | Endemic Bird Area                                     |
| EIA     | Environmental Impact Assessment                       |
| EMC     | Environmental Management Consultants                  |
| EMP     | Environmental Management Plan                         |
| EPA     | Environmental Protection Agency                       |
| ERP     | Emergency Response Plan                               |
| ESMP    | Environmental and Social Management Plan              |
| EU      | European Union  |
| FAO     | Food and Agriculture Organisation                     |
| FDC     | Flow Duration Curve                                   |
| GDP     | Gross Domestic Product                                |
| GEA     | Guyana Energy Agency                                  |
| GEF     | Global Environment Facility                           |
| GNBS    | Guyana National Bureau of Standards                   |
| GoG     | Government of Guyana                                  |
| GPL     | Guyana Power and Light Inc.                           |



|         |   |
|---------|---|
| GSDS    | Green State Development Strategy                      |
| GTZ     | German Technical Cooperation                          |
| GUYSUCO | Guyana Sugar Corporation Inc.                         |
| HECI    | Hinterland Electrification Company Inc.               |
| HEP     | Hinterland Electrification Programme                  |
| HESG    | Hydropower Sustainability ESG Gap                     |
| HSAP    | Hydropower Sustainability Assessment Protocol         |
| IBA     | Important Bird Area                                   |
| IDB     | Inter-American Development Bank                       |
| IFC     | International Finance Corporation                     |
| ITCZ    | Inter-tropical Convergence Zone                       |
| IUCN    | International Union for the Conservation of Nature    |
| KUI     | Kwakwani Utilities Inc.                               |
| kV      | Kilovolt  |
| kW      | Kilowatt  |
| LCDS    | Low Carbon Development Strategy                       |
| LCOE    | Levelized Cost of Electricity Generation              |
| LECI    | Linden Electricity Company Inc.                       |
| LMPC    | Lethem Power Company Inc.                             |
| MDG     | Millennium Development Goal                           |
| Monenco | Montreal Engineering Company Ltd.                     |
| MoPI    | Ministry of Public Infrastructure                     |
| MPL     | Mahdia Power & Light Inc.                             |
| MRPL    | Matthew's Ridge Power & Light Inc.                    |
| NAREI   | National Agriculture Research and Extension Institute |
| NDC     | Nationally Determined Contribution                    |
| NDS     | National Development Strategy                         |

|        |  |
|--------|--|
| NEAP   | National Environmental Action Plan                           |
| NGO    | Non-Governmental Organisation                                |
| NICIL  | National Industrial and Commercial Investments Ltd.          |
| NPTAB  | National Tender & Procurement Administration Board           |
| PEU    | Project Execution Unit                                       |
| PKPL   | Port Kaituma Power & Light Inc.                              |
| PPE    | Personal Protective Equipment                                |
| PRSP   | Poverty Reduction Strategy Paper                             |
| PUC    | Public Utilities Commission                                  |
| RDC    | Regional Democratic Council                                  |
| REDD+  | Reducing Emissions from Deforestation and Forest Degradation |
| SDG    | Sustainable Development Goal                                 |
| SECO   | Secretariat for Economic Affairs                             |
| TDS    | Total Dissolved Solids                                       |
| TSS    | Total Suspended Solids                                       |
| UAEP   | Unserved Areas Electrification Programme                     |
| UNCED  | United Nations Conference on Environment and Development     |
| UNDP   | United Nations Development Programme                         |
| UNFCCC | United Nations Framework Convention on Climate Change        |
| V      | Volt   |

## EXECUTIVE SUMMARY

### Introduction

The Government of Guyana (GoG) is pursuing the installation of small hydropower projects in selected hinterland communities to provide clean and renewable power to those communities. One such project is being implemented in the Kato village, Region 8, where a 150kW hydropower plant is being installed. The objectives of the Kato Hydroelectric project are to promote and increase the use of renewable energy in Guyana; to supply electricity from a renewable indigenous energy source to the village of Kato with focus areas being the school, Government buildings and where possible, private homes within close proximity of the local grid; and to support the social and economic development of Kato village.

The GoG, through the Ministry of Public Infrastructure as represented by the Hinterland Electrification Company Inc. (HECI), and with support from the Inter-American Development Bank (IDB) has secured technical assistance for the preparation of an Environmental Assessment and Management Plan (EAMP). In June 2019, Environmental Management Consultants (EMC) was engaged to prepare the EAMP. The EAMP will identify and assess potential impacts arising from construction and operation of the hydroelectric project and, identify appropriate mitigation measures for potential adverse impacts.

### Project Description

The hydroelectric project is expected to comprise the following components:

- A 150-kilowatt (kW) run-of-the river power plant at the Kato waterfall site located on the Chiung River.
- A 13.8-kilovolt (kV) primary distribution network from the power plant to the Kato Secondary School and thence to the Kato village.
- A 120/220-volt (V) secondary distribution network in the Kato village.

The main parameters of the hydropower plant are as follows<sup>1</sup>:

|                               |   |
|-------------------------------|---|
| Location:                     | Region 8  |
| Name of River:                | Chiung River  |
| Mean River Discharge:         | $Q_{\text{mean}} = 1.43 \text{ m}^3/\text{s}$                     |
| Rated Turbine Discharge:      | $Q_{\text{Turbine\_Net}} = 0.601 \text{ m}^3/\text{s}$ (one unit) |
| Gross Head:                   | $H_g = 35 \text{ m}$  |
| Rated Head:                   | $H_r = 33 \text{ m}$  |
| Annual Plant Output:          | 1,233 MWh / year  |
| Rated Capacity:               | 150 kW  |
| Load Factor:                  | 94 %  |
| Total Power Plant Efficiency: | 72.5 %  |
| Elevation of Weir Crest:      | 688.00 meters (above sea level)                                   |
| Width of Weir Crest:          | 26 meters   |
| Dam Height:                   | 2 meters maximum  |
| Type of Turbines:             | Cross Flow  |
| Length of Transmission Line:  | 1.1 km to Kato Secondary School, 3.9 km to the Kato Village       |
| Voltage Level:                | 13.8 kV   |
| Distribution Network:         | Kato Power Grid   |
| Distribution Network:         | Kato Power Grid   |
| CO <sub>2</sub> Savings:      | 900,000 kg/year   |
| Cost Estimation:              | 1,986,000 USD May 2018  |

<sup>1</sup> GEA 2018. Hydropower Feasibility Study 150 kW Kato Hydropower Station. pg 4.

The feasibility study indicates that an economic selling price for the electricity generated would be, at maximum, G\$ 30/kWh (approximately US\$0.15/kWh) compared to G\$ 120/kWh (approx. US\$.58 kWh) being the current cost of electricity in Region 8<sup>2</sup>. This, however, is still to be determined by the utility, Public Utilities Commission (PUC) and Government of Guyana. Rates are expected to be based on a Levelized Cost of Electricity Generation (LCOE) of 12.89 cent/kWh as a baseline in formulating the cost.<sup>3</sup>

The main consumer for the electricity would be the Government since a significant amount of electricity would be supplied to Government-owned institutions such as the proposed education complex, and other existing buildings, including the guesthouse, offices and living quarters of the regional administration and the police outpost.

## **Project Environment**

### *The Physical Environment*

The village of Kato is located within the Highlands, Mountains and Plateau physiographic region, but also forms part of the North Rupununi Savannahs. The Pakaraima Mountains, where Kato is located, are part of the Roraima sedimentary table lands, which is a huge sheet of sedimentary conglomerates and sandstones that has been substantially eroded. The formation represents sedimentary fill in a shallow oceanic basin with material that was derived from erosion of the mountains to the north and north east and is interpreted as a rift-sag setting formed during an extensional tectonic phase in which north to south general event was responsible for the development of normal east to west faults and transfer faults. Further, tuffaceous jaspers (jasper stones) are present in the Kato-Orinduik area and are usually dark red, with local variations to greenish grey.

The northern savannah plain lies at an altitude of about 100-110m, but the Pakaraima Mountains rise abruptly from the plain to altitudes of 610m and reach heights of 990m at their highest. The average elevation at the project site is between 549 meters (1800 ft) to 884 meters (2900 ft). According to the Food and Agriculture Organisation (FAO) Soil Classification, at the project area the soil type falls within the 2f Mapping Unit. Based on the Land Capability Classification the soils fall within Class IV, which is not suitable for agricultural purposes.

The general project area is drained by the Chiung River which eventually discharges in the Ireng River. The average stream width is about 3 to 9 meters in some places. Water flows via small ditches and small streams to the River. To gain a better understanding of the water quality within the Chiung River water quality analyses were conducted at three sites: upstream of the proposed weir/intake structure, waterfall head, and downstream of the proposed power-house. Ambient noise levels were also recorded at these locations and at the Kato Secondary School. Sections 3.1.6 and 3.1.7 detail the findings of these measurements.

Mean temperatures in Kato are cooler than the rest of the country and range between 20 to 23°C throughout the year, as compared to between 25 to 27.5°C for most of the country. The annual rainfall is usually between 1500-2000 mm per year, of which 70-80 % falls during the wet season from May-September.

### *The Biological Environment*

The Kato Hydropower Project is located in the Pakaraima Mountains considered as part of the Guiana Shield Region. The project site lies within the Pakaraima highlands of mainly (sub) montane forest and

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<sup>2</sup> GEA 2018. Hydropower Feasibility Study 150 kW Kato Hydropower Station. Section 13 Sustainability and Operation of the Project, pg 37.

<sup>3</sup> Adapted from GEA Presentation, 2019

shrublands from 300-1500 m altitude. According to the Vegetation Map of Guyana, the landscape of the Project site is characterized by lowland shrub savannas of Southwest Pakaraima and the Rupununi. These savannas are by extension part of the larger tropical and subtropical, grasslands, savannas, and shrublands eco-region of northern Brazil, Venezuela, and Guyana. This eco-region is traversed by streams with gallery forests and extensive savannas. The vegetation of the Pakaraima Mountains is greatly influenced by variations in altitude and isolation caused by the rugged landscape.

There are no known documented studies of biodiversity of the project site. Species accounts of the project landscape were obtained from field interviews with residents of the Kato Village and referenced from studies of areas that share similar habitat characteristics and species. Faunal diversity of the project landscape is typical of the lowland savannas of the Gran Sabana, part of which includes the Rupununi Savannas. The Rupununi is a unique collection of ecosystems that are home to over 1400 species of vertebrates, 643 species of birds (Watkins, et al., 2010<sup>4</sup>); 433 species of fish (De Souza, et al., 2012<sup>5</sup>). Faunal species known to occur within the Rupununi Savannas are also typical of the lowland (and upland) savannas of the project landscape.

Based on the list of endangered species of the Convention on International Trade in Endangered Species of Flora and Fauna (CITES), there are no endangered faunal species in the project area. The plant species *Trichilia surumuensis*, *Aniba rosaedora*, *Virola surinmensis*, listed as Endangered and *Vouacapoua Americana* listed as Critically Endangered are abundant and widespread in the interior forested lands of Guyana.

The landscape of the project has not been identified by the GoG as a priority for conservation interest. Further, there are no recognized areas of global importance to biodiversity within the landscape of the project. There are no Zero Extinction Sites, proposed or listed Ramsar Wetland Sites within Guyana or officially designated areas in Guyana identified as Important Bird Areas (IBAs). However, the Pakaraima Mountains (the areas of the Rio Branco gallery forest, and Tepuis) is listed as an endemic bird area (EBA) by Birdlife International.

### *The Socio-Economic Environment*

Kato is a titled Amerindian community located in Region 8 in the foothills of the Pakaraima Mountains at approximately 310 km South West of the capital city of Georgetown. The administration of the village lands falls directly under the jurisdiction of the Village Council. Kato is populated by the Patamona People who have historically inhabited the Pakaraima Mountains and the Siparuni Delta. Based on data collected in 2019 during the community engagements, the village has a population of 485 and is growing. It was indicated that there are more females than males. There are 105 households in Kato. The village can be accessed from Georgetown by air and land transportation. Paramakatoi and Kurukabaru villages are in proximity and are accessed by walking, all terrain bikes and four-wheel drive vehicles. Other surrounding communities can also be accessed via these means.

The main economic activity in the village is subsistence farming of vegetables, peas, various seasonal crops including kidney beans and black eye peas. Livestock farming is also practiced at a subsistence level. Further, there are no mining, crafts or tourism initiatives in the village. Some persons are employed in Government-related jobs. Many young men travel to Brazil or to the mines in other parts of Region 8 for work resulting in migration out of the village. Currently, there is no influx of foreign nationals into the village. There are four shops in the village one of which is run by the Village Council. There is ecotourism potential at the waterfall since it is often visited by villagers and visitors to the community.

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<sup>4</sup> Watkins, G; Oxford, P; Bish, R, 2010; Rupununi, Rediscovering the Lost World; Earth in Focus Editions/ILCP

<sup>5</sup> De Souza, L. S., Armbruster, J. W. and D.C. Werneke. 2012. The influence of the Rupununi portal on distribution of freshwater fish in the Rupununi district, Guyana. Cybium.pp.31-43

There are three schools located within Kato: a Nursery School; a Primary School; and a Secondary School. Other students who attend the Secondary School come from villages within the sub-region. There is a Kato Learning Resource Centre and a Library at the Kato Secondary School which are utilized by villagers. There is a Cottage Hospital in Kato which is staffed with one Doctor, a Medic, a Community Health Worker and a cleaner. The village also has a Police Station which is manned by two police officers. The Regional Democratic Council (RDC) is also based in Kato.

There is no phone signal in the village. However, internet and radio communication are available. There are four radios in the village and free wireless internet connection is available at the Kato Secondary School. There are also private service providers in the village. Some persons have satellite television. Power is currently provided mainly by solar panels. In the past, all households received 65-watt solar panels from the Government and this is presently used for electricity. For water supply, residents collect water from a spring, wells within the village and solar-powered points at various locations throughout the village. There are no known archaeological sites located in proximity to the waterfall.

### Policy, Legal and Institutional Framework

The Kato Hydropower Project is required to be in compliance with Guyana's national environmental and energy related policies, legislation, and institutional frameworks, international treaties and conventions to which Guyana is signatory, and the environmental and social safeguards of the IDB. The relevant policies, legislations and institutions considered are listed in Table 1 below.

**Table 1: Relevant Legislation, Policies and Strategies**

| <b>Policies, Strategies, Plans</b>                            | <b>Legislation</b>  | <b>Institutions</b>                     |
|---|---|---|
| Guyana Green State Development Strategy: Vision 2040 (2019)   | The Constitution of the Cooperative Republic of Guyana (1980 and 2013)  | Ministry of Public Infrastructure       |
| Guyana National Energy Policy (1994)                          | Guyana Energy Agency Act (1997)   | Guyana Energy Agency                    |
| Green Paper for a Draft National Energy Policy (2017)         | Hydro-Electric Act (1956)   | Hinterland Electrification Company Inc. |
| Guyana Power Sector Policy and Implementation Strategy (2010) | Environmental Protection Act (1996)                                     | Environmental Protection Agency         |
| Unserved Areas Electrification Programme (2010 – 2014)        | Environmental Protection Authorizations Regulations (2000)              | Ministry of Communities (RDC Region 8)  |
| Draft Hinterland Electrification Strategy (2007)              | Environmental Protection Air Quality Regulations (2000)                 | Kato Village Council                    |
| Guyana Energy Agency Strategic Plan 2016 – 2020               | Environmental Protection Water Quality Regulations (2000)               | Public Utilities Commission             |
| Low Carbon Development Strategy (2009, 2010, 2013)            | Environmental Protection Noise Management Regulations (2000)            |   |
| National Development Strategy (2001 – 2010)                   | Environmental Protection Hazardous Wastes Management Regulations (2000) |   |
| Poverty Reduction Strategy Paper (2005)                       | Environmental Protection (Litter Enforcement) Regulations (2013)        |   |
| National Environmental Action Plan (1994)                     | EPA Guidelines for EIAs and EMPs  |   |
|   | Amerindian Act (2006)   |   |
|   | Labour Act (1942)   |   |

| Policies, Strategies, Plans | Legislation                               | Institutions |
|-----------------------------|---|--------------|
|                             | Occupational Health and Safety Act (1997) |              |

Relevant international and regional conventions, treaties and policies were also examined including: Agenda 21 and Rio +10; the UN Framework Convention on Climate Change and the Paris Agreement; the Sustainable Development Goals – Agenda 2030; the CARICOM Energy Policy; the Caribbean Sustainable Energy Road Map and Strategy and the draft CARICOM Environment and National Resources Policy Framework. Other relevant policies which were examined include the IDB policies and Sustainability Guidelines from the International Hydropower Association among others.

## Environmental Impact Assessment

The impact assessment identifies and describes project impacts that typify the construction and operation phases. From the assessment of impacts, it is clear that most impacts can be prevented or minimised if good environmental management are employed throughout the construction phase of the project. Impacts was assessed based on whether they are localised or extensive, short- or long-term, avoidable or unavoidable, significant or insignificant, and mitigable or unmitigable.

A summary of the impacts which may arise during the construction and operational phases which may arise as a result of the project includes:

### *Physical Impacts*

- Accelerated erosion on the hillside where construction activities will require the clearing of natural vegetation and the excavation soils.
- Instability of the hillside proximate to the river and waterfall head.
- The use of heavy-duty construction machinery can result in soil compaction beyond the ability of permeable limits of the soil.
- Soils and surface waters being contaminated by the accidental or intentional discharge of fuels, waste oils, lubricants or other hazardous wastes.
- Sedimentation of the water bodies during the construction operational phases due to erosion and storm water runoff.
- Diversion of approximately 20% of the annual flow of the Chiung River from the riverbed to the headrace channel via the weir.
- Noise and dust levels during the construction phase may have potential negative impacts on nearby receptors.
- Changing weather patterns associated with global warming and climate change may result in variable precipitation which may have potential negative impacts on the project.
- Positive impacts of climate change mitigation under the project.

### *Biological Impacts*

- Potential impacts to the vegetation will occur during the construction phase when the vegetation cover will be directly impacted by land clearing of the project site. Plant species that will be impacted by land clearing are not species of special conservation interest.
- Activities relating to the construction may potentially have some limited localised effect on the wildlife including limited displacement or mortality of some species, hunting of targeted species by workers, and changes in the water quality and flow impacting on fishes.
- During the operational phase aquatic fauna may also potentially be impacted as a result of reduced water quality and flow within the river.

### *Socio-Economic Impacts*

- The project could support diversification of the local economy and increase income while at the same time improve traditional economic activities such as subsistence farming.
- Conflicts between the community and the contractor and implementing agency can arise if established procedures are not complied with and community expectations are not fulfilled.
- Increased and reliable power supply to be provided by the project once operational could result in long term change in the culture of the community.
- There is the possibility that artefacts are present at the project site which can be affected during the construction phase of the project

### *Health and Safety*

- Workers health and safety is always a major concern during the construction and operational periods.
- The safety of the community members could be compromised by the project's activities if guidelines and best practices are not followed.

### *Cumulative Impacts*

- The Kato Hydropower plant will positively contribute to the achievement of Guyana's pledge for 100% of electricity generation being from renewable energy by 2025.
- Electricity generated from hydropower at Kato will support the research station being developed by the National Agricultural Research and Extension Institute (NAREI) and in the longer term, farmers in the village of Kato.
- During the construction phase of the project, traffic volumes traversing the roads (possibly for the transportation of construction equipment and materials) will increase, thereby contributing to an overall increase in traffic and concomitant impacts.

## **Environmental Management Plan**

The Environmental Management Plan (EMP) recommends activities to be undertaken in an effort to mitigate the principal adverse effects of the project and describes the way in which the main potential environmental and safety impacts of the project can be managed, and recommends appropriate mitigation measures that should be adopted by the contractors during the construction phase of the project, as well as measures to be applied during the operation phase. The activities to be conducted for the implementation of this project, especially during the construction phase, must be carried out in a manner which is in compliance with the legislation and guidelines.

The EMP outlines:

- Measures to mitigate impacts to the soil resulting from erosion, compaction and sedimentation;
- Measures to mitigate impacts from dust emissions and noise nuisance;
- Measures for proper management of wastes including liquid wastes, solid wastes and hazardous wastes;
- Measures for management of fuel, lubricants and hazardous wastes;
- Procedures for documenting archaeological finds in the project site;
- Measures for mitigating potential impacts to flora and fauna in the project site;
- Measures to prevent conflicts with the Village Council and village;
- Measures for conflict resolution including a Grievance Mechanism;
- Measures to engage stakeholders and respect cultural differences;
- Measures to ensure workers' health and safety;
- Recommendations to be incorporated into the contractor's Emergency Response Plan.



## **Implementation Framework for the Environmental Management Plan**

This chapter provides the management framework for the implementation of the EMP. The activities to be conducted for the implementation of the project, especially during the construction phase, should be carried out in a manner which is in compliance with the legislation and guidelines outlined in chapter 4, and in particular, with the requirements of the EPA as set out in the Environmental Permit.

The Implementation Framework outlines roles and responsibilities of the key agencies which will be involved in the execution of the project namely: HECI, Guyana Energy Agency (GEA) the supervisory consultants and the contractors. It also provides guidance on the key elements of the Environmental and Social Management Plan (ESMP) will have to be prepared by the contractor to guide their operations and ensure that all activities are conducted in an environmentally friendly manner. Finally, the Framework outlines an environmental monitoring plan for the implementation of the project and creates an indicative budget for the execution of the Implementation Framework.

## 1.0 INTRODUCTION

### 1.1 Background

The GoG is seeking to expand programmes in rural electrification through micro-grids, solar photovoltaic systems with batteries, run-of-river and river dam hydro, and hybrid renewable energy systems. At the national level, development of a hydropower programme is intended to solve the long-term energy problems that would see the construction of hydropower stations (micro, mini, small or large) for the supply of power for industrial, commercial, domestic, recreational, and other uses<sup>6</sup>. Small hydropower projects are considered a non-polluting renewable energy source which have high conversion efficiency and allow for great flexibility and provides operational and economic superiority over other power generation sources. The GoG is pursuing the installation of small hydropower projects in selected hinterland communities to provide clean and renewable power to those communities. One such project is a 150kW hydropower plant at Kato, Region 8. The objectives of the Kato Hydroelectric project are:

- To promote and increase the use of renewable energy in Guyana;
- To supply electricity from a renewable indigenous energy source to the village of Kato with focus areas being the school, Government buildings and where possible, private homes within close proximity of the local grid; and
- To support the social and economic development of Kato village.

The GoG, through the Ministry of Public Infrastructure (MoPI) as represented by HECI, and with support from the IDB has secured technical assistance for the preparation of an EAMP consistent with the Guidelines for EMP's as established by Guyana's Environmental Protection Agency (EPA). In June 2019, EMC was engaged to prepare the EAMP.

### 1.2 Objective and Scope of the EAMP

The focus of the EAMP is to identify and assess potential impacts arising from construction and operation of the hydroelectric project and, for those adverse impacts which cannot be avoided, to identify appropriate mitigation actions.

Specifically, the EAMP seeks to:

- Present a description of the project including its location, scale, components, phases, benefits, etc.
- Assemble relevant physical and biological baseline information on the project area including its geology, soils, hydrology, topography, climate, water quality, noise levels and terrestrial and aquatic flora and fauna (including endangered, rare or threatened species and species of commercial importance).
- Assemble relevant socioeconomic baseline information on the project area including communities, population, land use, economic activities, availability of services, historical and archaeological sites, etc.
- Assess the policy, regulatory and institutional framework for the project, including identifying the relevant national policies, legislation, standards and guidelines that define the implementation framework of the project, as well as the responsible institutions.

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<sup>6</sup> Green Paper for a Draft National Energy Policy 2017

- Present and address feedback and concerns of key stakeholders, including the community within which the project will be implemented.
- Identify, as far as is possible, and assess the potential impacts of the Kato Hydroelectric project on the physical, biological and socioeconomic environment, distinguishing construction and post construction phase impacts, as well as cumulative impacts.
- Prepare an EMP that recommends measures to prevent or reduce adverse impacts to acceptable levels, for both the construction and operation phases of the project.
- Prepare an implementation framework for the EMP, including outlining roles and responsibilities, contractor plans, monitoring and reporting requirements, grievances mechanism, training, etc.

### 1.3 Methodology

EMC commissioned a multidisciplinary team to prepare the EAMP. The team composition is outlined in Appendix A. The preparation of the EAMP was guided by the Terms of Reference for the Consultancy, attached as Appendix B, and EPA's Guidelines for preparing EMPs. The EAMP was conducted/prepared during the period June to August 2019 and was undertaken in three phases as follows:

#### **Phase 1      *Establishing the Baseline***

Collection of primary and secondary data on the physical environment and socio- economic context of the project area. Activities included:

- Reviewing existing reports and background documents on the Kato Hydroelectric Project along with applicable national policies, strategies, plans and legislation. Existing information relating to the project environment such as on climate, biodiversity, geomorphology, etc. were also reviewed;
- Analysis of maps and plans;
- Site visits and field investigations to collect primary data. Visits were conducted to collect baseline data on the project environment, and these included:
  - Water quality sample collection to determine effluent quality and laboratory analysis to assess various parameters.
  - Noise level assessment to determine both the ambient noise levels and noise generated by the Kato Hydroelectric Project.
  - Socio-economic information through engagement with village of Kato.
- Stakeholders' engagement were done to determine concerns and recommendations of stakeholders so these can be addressed in the EAMP. Engagements were done with the Kato community representatives and selected Government Agencies.

#### **Phase 2      *Impact Analysis***

The potential environmental and social impacts of project activities during the construction and operational phases were then assessed using an impact assessment matrix to predict the significance of the impacts. This was done by establishing the potential interactions between the activities and the characteristics of the existing physical, biological and socio-economic environment and within the effective area of direct and indirect influence. The impacts prediction matrix was utilized to identify short-term and long-term impacts, positive and negative impacts, unavoidable, or irreversible; and direct and indirect impacts.

### **Phase 3      *Mitigation and Management Planning***

Mitigation and management planning was conducted to identify feasible and practical measures to reduce and mitigate the potential negative impacts as well as maximise the positive impacts. Procedures to be undertaken in the event of an emergency situation were examined, and a framework proposed to implement, monitor and assess the effectiveness of the mitigation measures recommended.

#### **1.4 Organisation of the EAMP**

The EAMP is organized in eleven (10) main sections as outlined below:

- **Chapter One** – This Chapter provides an introduction to the EAMP, including its scope and methodology employed.
- **Chapter Two** – This Chapter provides a brief description of the project.
- **Chapter Three** – This Chapter provides a description of the project environment, including the physical, biological and socio-economic environment.
- **Chapter Four** – This Chapter provides a description of the national policies relevant to the project, the various legislation the project will have to comply with, and the regulatory bodies which will have oversight of the activities.
- **Chapter Five** – This Chapter documents the feedback and concerns from engagements with stakeholders.
- **Chapter Six** – This Chapter assesses the potential impacts of the project on the physical, biological and socio-economic environments. In addition, this section also outlines health and safety and cumulative impacts of the project.
- **Chapter Seven** – This Chapter outlines recommendations for the management of potential environmental and social issues relating to the project. Recommendations for emergency response and demobilising are also included.
- **Chapter Eight** – This Chapter presents an implementation framework for the EMP outlined in Chapter 7.
- **References**
- **Appendices**

#### **1.5 Challenges**

The following were the key challenges which were experienced in the completion of this EAMP:

**Time Constraints**– The duration of this consultancy was three months with rigid timeline for submission of reports on select chapters of the EAMP. Logistical and communication limitation was also a feature in accessing the project site for fieldwork. However, these challenges were addressed through continuous engagement with HECI and the GEA and their support for several site visits which facilitated engagement with the Kato village representative and the collection of baseline information.

- **Key Project Details Not Available** – Most of the potential impacts of the project relates to the construction phase. However, the methodology to be employed by the contractor, which is essential to fully determine and understand the construction impacts, was not made available to the EAMP Team. This could have affected the impact assessment and management planning since there was not a clear determination of the specifics such as sourcing of construction materials, transport of materials to the Kato, plans for workers, etc. This, however, has been addressed through the provision of broad guidelines and recommendations for inclusion in a Construction Environmental and Social Management Plan (CESMP) to be prepared by the contractor.

## 2.0 PROJECT DESCRIPTION

### 2.1 Background<sup>7</sup>

The potential for hydropower at Kato was first identified by the Montreal Engineering Company Ltd. (Monenco) in 1976 as part of a comprehensive study that identified 67 sites from which hydropower could be generated in Guyana. Consideration of the potential for generating electricity from hydropower in Kato recommenced in the mid-2000s from which time GoG has been actively pursuing the project. The chronology of events outlined below in Table 2-1 provides a snapshot of the efforts which were undertaken to facilitate development of hydropower at Kato.

**Table 2-1: Chronology of Events**

| Year | Activity/Study   |
|------|--|
| 2007 | A study on the hydropower potential of the Chiung River near Kato was commissioned by the German Technical Cooperation (GTZ).  |
| 2008 | GoG published a Request for Proposals to conduct feasibility studies on two hydropower sites although the scope of work was reduced to only one site. This was jointly financed by IDB through the Caribbean Renewable Energy Development Programme (CREDP) and the GoG's Unserved Areas Electrification Programme (UAEP).               |
| 2009 | Spanish consultancy firm (Ingeniería, Estudios y Proyectos NIP, S.A.) was contracted to conduct the feasibility study on the Chiung River. It was funded exclusively through a grant provided under the CREDP, made available through the United Nations Development Programme (UNDP) & executed by the Caribbean Community Secretariat. |
| 2010 | GoG successfully received co-financing from the European Union (EU) to embark on a 330kW Hydropower project and Irrigation Infrastructure.   |
| 2013 | GoG advertised the tender for the Design and Construction of the 330kW Hydropower Plant (Lot 1) and Irrigation Infrastructure (Lot 2). However, none of the bids qualified due to lack of technical capacity and bid prices exceeding the project budget.  |
| 2014 | A consultant was contracted to review the cost estimates and design for the proposed project to facilitate retendering. However, by this time, the EU financing had expired.   |
| 2016 | GEA assessed all reports and updated documentation to facilitate tendering for the design and construction of a 300-kW hydropower plant at Kato with funding committed by the IDB under the Global Environment Facility (GEF) Sustainable Energy Programme for Guyana.   |
| 2017 | GoG advertised the tender for the design and construction of the 300-kW hydropower plant. One bid was received but was annulled due to lack of technical capacity and bid prices exceeding the project budget.   |

<sup>7</sup> Adapted from GEA Presentation, 2019

|      |   |
|------|---|
| 2018 | GEA redesigned the project to facilitate a supply and installation contract and the project was reduced from 300kW to 150kW. A Feasibility Study for a 150kW hydropower plant was completed in July 2018 and the tender was advertised. |
| 2019 | Bids were evaluated and the report was finalised. As of August 30, 2019, HECI is awaiting award of the Contract from the National Tender & Procurement Administration Board (NPTAB).  |

## 2.2 Project Overview

The Kato Hydroelectric project is being designed as a 150-kW run-of-the river system and is expected cover an area of approximately 700 m<sup>2</sup>. The waterfall at which the hydropower plant will be located has a gross waterfall head of 35 metres. Table 2-2 provides a summary of the main parameters of the hydropower plant.

**Table 2-2: Summary of Main Parameters of the Hydro-Power Plant<sup>8</sup>**

|                                |   |
|--------------------------------|---|
| Location:                      | Region 8  |
| Name of River:                 | Chiung River  |
| Mean River Discharge:          | $Q_{\text{mean}} = 1.43 \text{ m}^3/\text{s}$                     |
| Rated Turbine Discharge:       | $Q_{\text{Turbine\_Net}} = 0.601 \text{ m}^3/\text{s}$ (one unit) |
| Gross Head:                    | $H_g = 35 \text{ m}$  |
| Rated Head:                    | $H_r = 33 \text{ m}$  |
| Annual Plant Output:           | 1,233 MWh / year  |
| Rated Capacity:                | 150 kW  |
| Load Factor:                   | 94 %  |
| Total Power Plant Efficiency:  | 72.5 %  |
| Elevation of Weir Crest:       | 688.00 meters (above sea level)                                   |
| Width of Weir Crest:           | 26 meters   |
| Dam Height:                    | 2 meters maximum  |
| Type of Turbines:              | Cross Flow  |
| Length of Transmission Line:   | 1.1 km (Kato Secondary School, 3.9 km (Kato Village)              |
| Voltage Level:                 | 13.8 kV   |
| Distribution Network:          | Kato Power Grid   |
| Distribution Network:          | Kato Power Grid   |
| CO <sub>2</sub> Savings:       | 900,000 kg/year   |
| Levelized Cost of Electricity: | 12.89 Cent/kWh (including transmission line)                      |
| Cost Estimation:               | 1,986,000 USD <small>May 2018</small>                             |

## 2.3 Location of the Project<sup>9</sup>

The project is located in Guyana's hinterland in Region 8, Potaro-Siparuni, approximately 20 km from the Brazilian border. The coordinates of the proposed project site are Latitude 04°39'43.28"N; Longitude 059°51'4.75"W and the location can be observed in figure 2-1. The primary energy source for the power station will be an approximately (35m) gross head waterfall in the Chiung River in the vicinity of Kato village. The location of the project site within the village can be observed in figure 2-2.

<sup>8</sup> GEA 2018. Hydropower Feasibility Study 150 kW Kato Hydropower Station. pg 4.

<sup>9</sup> GEA 2018. Hydropower Feasibility Study 150 kW Kato Hydropower Station. Section 2.3 The Site, pg 10.





Figure 2-1: Location of the Kato Hydroelectric Project



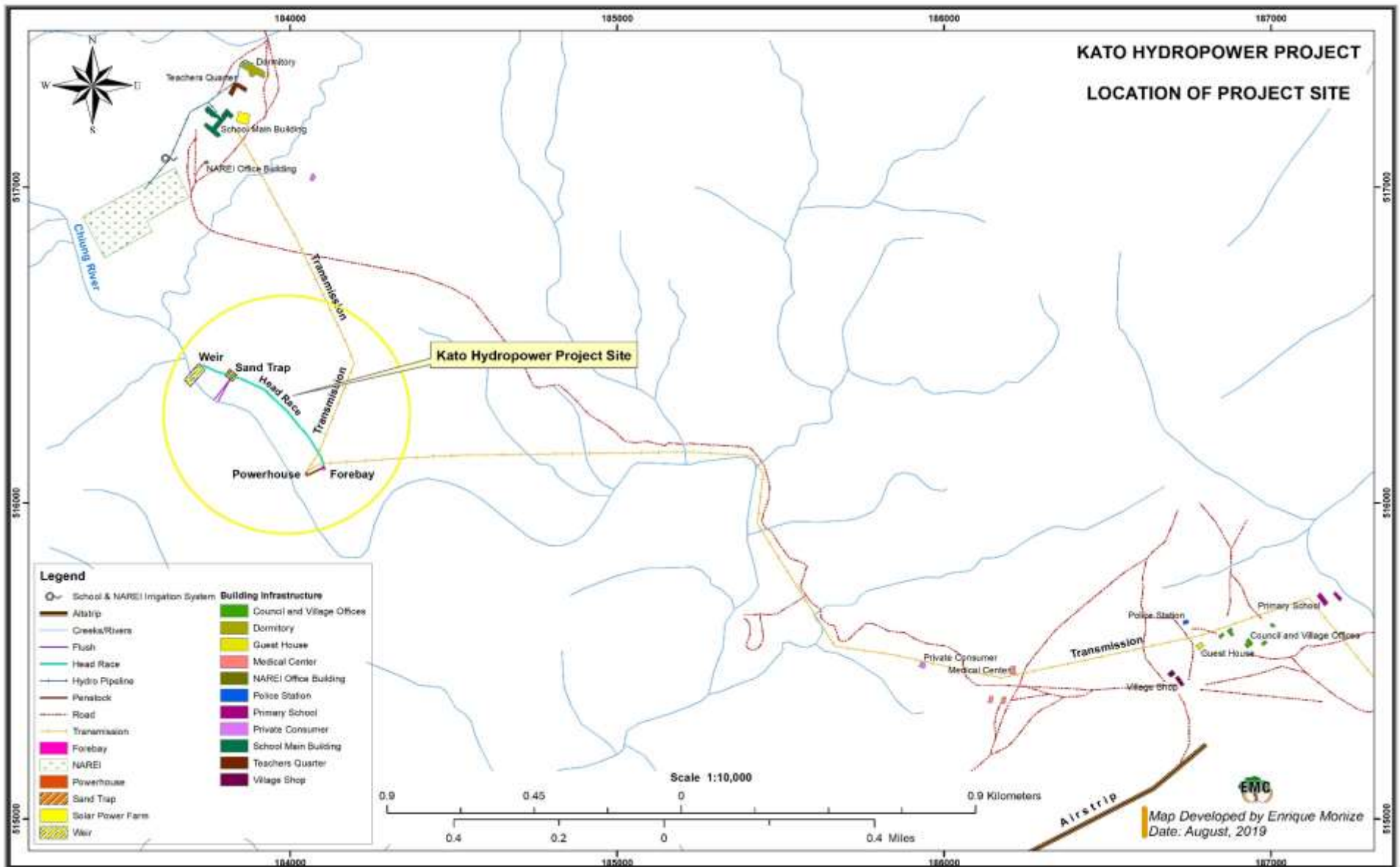


Figure 2-2: Project Site and Components within the Kato Village

## 2.4 Project Life and Sustainability<sup>10</sup>

The hydroelectric project is being built with an economic life span of 20 years. A Government-owned company will be established by HECI to manage the power plant. The company will be managed by a board consisting of members of the Region 8 Administration and selected residents of the Kato village. Operations, maintenance and management of the facilities will be financed from revenues generated from the sale of electricity from the said facilities.

## 2.5 Project Components<sup>11</sup>

The hydroelectric project infrastructure is expected to comprise the following components:

- A 150-kW run-of-the river power plant at the Kato waterfall site located on the Chiung River.
- A 13.8-kV primary distribution network from the power plant to the Kato Secondary School and thence to the Kato village.
- A 120/220-V secondary distribution network in the Kato village.

The hydropower plant is being designed with a gravity concrete dam and integrated intake comprising:

- **Weir/Intake Structure:** which is expected to be constructed approximately 185 meters upstream of the waterfall head and will facilitate diversion of water from the Chiung River to the headrace channel. The width of the weir will be approximately 26 metres with an elevation of 688 metres above sea level. The height of the dam will be approximately two metres. Approximately 20% of the annual flow of water in the Chiung River is projected to be diverted to the hydropower turbines via the weir.
- **Headrace Channel with Sand Trap:** The headrace channel will run almost parallel to the existing river bed with the length of the channel being approximately 550 metres. It is expected that the channel will be buried and therefore, not visible on the surface. The channel will be constructed using a combination of concrete and PVC pipes. The de-sander/ sand trap is to be placed approximately 140m away from the weir so as to prevent sedimentation of the headrace. The sand trap will include a flush outlet leading to the Chiung River.
- **Forebay:** The Forebay is a pond-like structure at the top of the penstock, which regulates the fluctuation of water. It forms the connection between the head race channel and the penstock. Additionally, it allows the last particles to settle before the water enters the penstock.
- **Penstock:** The penstock is expected to be approximately 80 metres in length and will control the flow of water exiting the forebay through the turbines located in the powerhouse. This is then returned to the stream through the tailrace.
- **Powerhouse:** The powerhouse is expected to comprise one x 150 kW cross flow hydropower turbine. The powerhouse will be located approximately 347metres downstream of the waterfall head. All of the extracted water passing through the powerhouse will flow back into the stream through the tailrace.

Figure 2-3 shows the layout of the proposed hydropower plant, indicating the locations of the key components. The conceptual design for each component is attached as Appendix C.

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<sup>10</sup> GEA 2018. Hydropower Feasibility Study 150 kW Kato Hydropower Station. Section 13 Sustainability and Operation of the Project, pg 37.

<sup>11</sup> GEA 2018. Hydropower Feasibility Study 150 kW Kato Hydropower Station. Section 2.2 Project Components, pg 9.

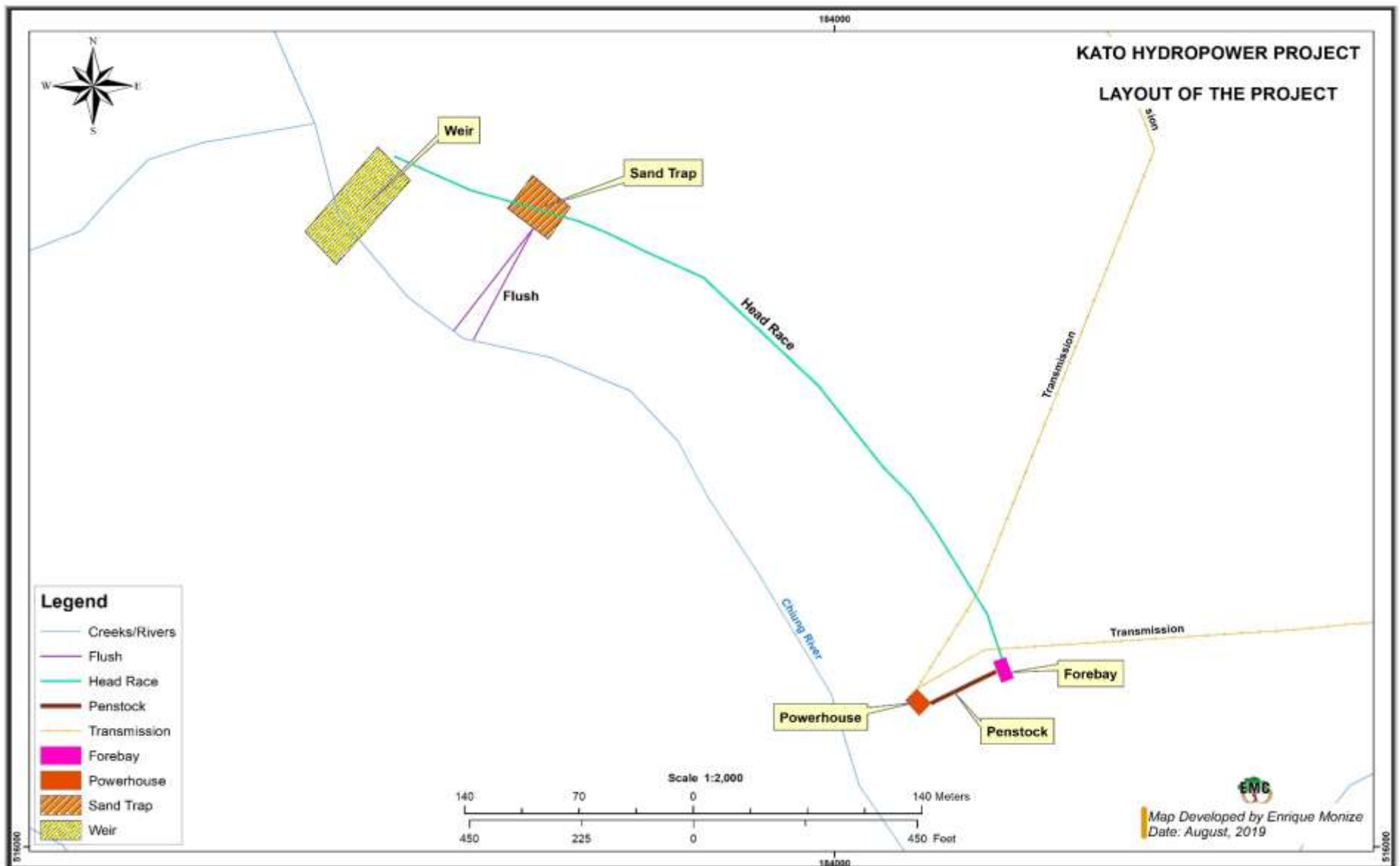
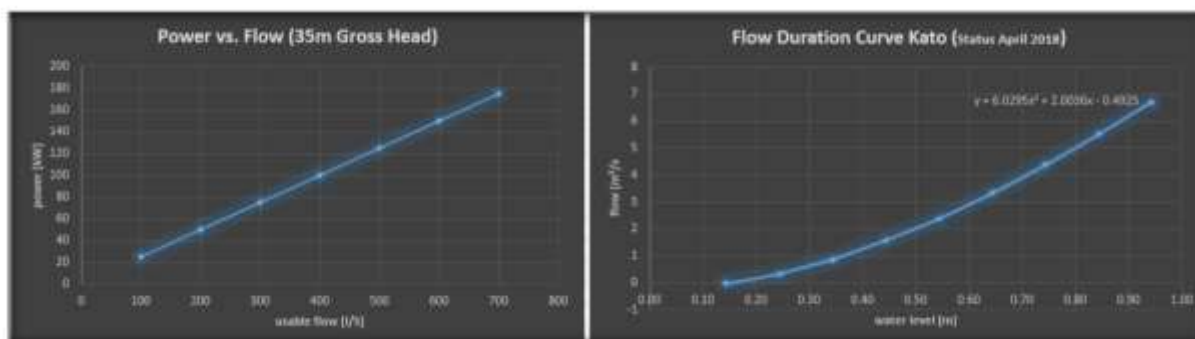


Figure 2-3: Kato Hydropower Project Layout

## 2.6 Hydrological Demand

### 2.6.1 Hydrological Recording, Flow Duration and Rain Correlation<sup>12</sup>

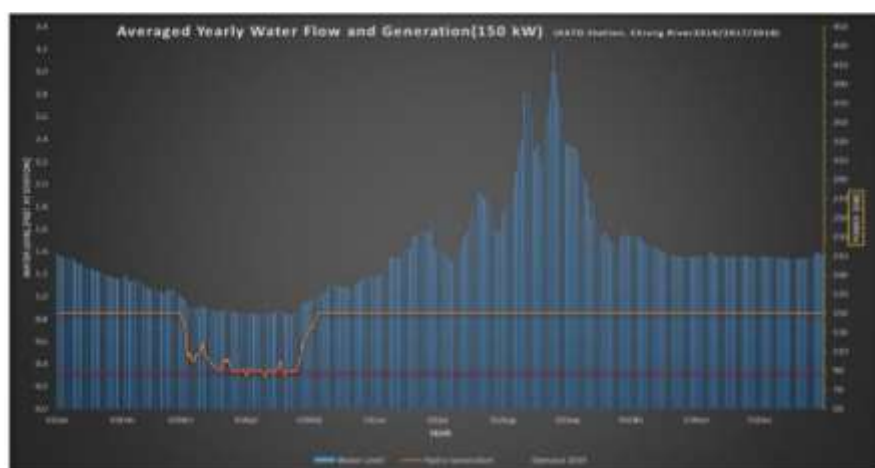
Water levels at the site of the proposed hydropower plant were recorded by the Hydrometeorological Department of Guyana, Ministry of Agriculture. These water levels, in combination with several spot measurements (flow measurements), supported the development of a Flow Duration Curve (FDC) and a generation profile.



Source: GEA Feasibility Study (2018)

**Figure 2-4: Power and Flow Duration Curves**

Average water levels show that during two months in the dry season the water level falls below the required flow for the net rate. During the remaining 10 months of the year the maximum power of 150 kW could be generated consistently to provide more than 7200 hours of energy per annum. This corresponds to a load factor of greater than 94%. Expected demand in the first year after commissioning is expected to be at 88 kW (daily average). Therefore, the complete current demand can be covered by 100% from the hydro without any diesel generation or storage system.

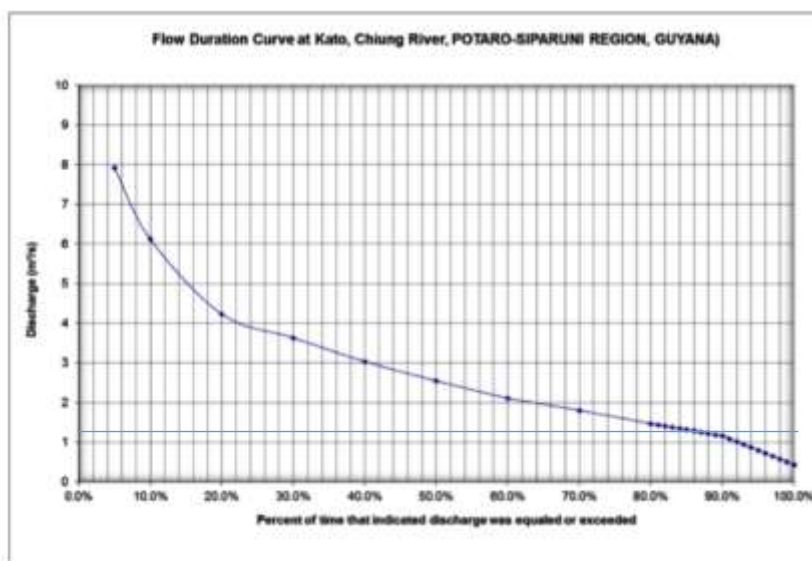


Source: Feasibility Study (2018)

**Figure 2-5: Flow and Hydro Generation during Year One with Demand Profile**

<sup>12</sup> GEA 2018. Hydropower Feasibility Study 150 kW Kato Hydropower Station. Section 6 Hydrology, pg 24.

The FDC was developed based on the hydrological records at the logger station. The mean flow is 1.43 m<sup>3</sup>/s. The discharge flow of the 150-kW turbine is 0.6 m<sup>3</sup>/s or 42% of the mean flow. Thereby the water discharge is at a very low level compared with standard hydropower plants.



Source: Feasibility Study (2018)

**Figure 2-6: FDC with a Mean Flow of 1.43m<sup>3</sup>/second**

### 2.6.2 Hydro-Energetic Data<sup>13</sup>

The total efficiency is projected to be at 72%. Therefore, a discharge of 601 litres/second will be needed. At a gross head of 35 metres the net power output will be 150 kW. The efficiency breakdown of all components is listed below. A turbine efficiency grade at net power rate of 84% will be required.

<sup>13</sup> GEA 2018. Hydropower Feasibility Study 150 kW Kato Hydropower Station. Section 7 Hydro Energetic Data, pg 27.



**Table 2-3: Hydro-Energetic Data**

| Basic Energy Data - Kato 150 kW Hydro Station |           |                          | Cross Flow Unit 150 kW |        |
|---|-----------|--------------------------|------------------------|--------|
| Gross Head                                    | 35        | m                        | Efficiency Breakdown   |        |
| Discharge                                     | 0.601     | m <sup>3</sup> /s        | Intake                 | 99.50% |
| Overall efficiency at Net Rate                | 72.48%    |                          | Head Race Canal        | 99.34% |
| Gross Power                                   | 206.35    | kW_gross                 | Desander               | 99.50% |
| Gross Power                                   | 0.2       | MW_gross                 | Head Race Pipe         | 98.83% |
|   |           |                          | Forebay                | 99.50% |
| 0.150 MW                                      |           |                          | Pennstock              | 97.00% |
| Net_Efficiency                                |           |                          | Turbine                | 84.00% |
|   |           |                          | Generator              | 93.85% |
| Energy / Time                                 | 0.1       | MWh                      | Gearbox                | 98.00% |
| Water consumption / Time                      | 2,164     | m <sup>3</sup> /h        | Transformer            | 99.50% |
| Water Consumption / Energy                    | 14,467    | m <sup>3</sup> / MWh     | 72.5%                  |        |
| Energy Content / Volume                       | 6.912E-05 | MWh / m <sup>3</sup>     |                        |        |
| Energy Content / Volume                       | 0.0691239 | kWh / m <sup>3</sup>     |                        |        |
| Flow / Power                                  | 4.0185501 | (m <sup>3</sup> /s) / MW |                        |        |
| Power / Flow                                  | 0.248846  | MW / (m <sup>3</sup> /s) |                        |        |

### 2.6.3 Water Levels<sup>14</sup>

The system elevation levels are to be determined by the topographical survey. For the detailed construction design the defined elevation system is expected to be used. It is envisaged that the direct gross water level head (Forebay Reservoir Level – Turbine Shaft Level) will be 33.2 m while the net water pressure head at the turbine will be at 32.21 head.

#### All Levels at Rated Operation Flow

|                                |                          |
|--------------------------------|--------------------------|
| Weir Crest/Intake              | 688.00 m (at sea level)  |
| Sand Trap/Desander Water Level | 687.368 m (at sea level) |
| Forebay Water Level            | 686.204 m (at sea level) |
| Level of Turbine               | 653.00 m (at sea level)  |
| Gross Head (System)            | 35 m                     |
| Gross Head (Forebay – Turbine) | 33.203 m                 |
| Net Head                       | 32.21 m (net flow)       |

### 2.7 Transmission and Distribution Network<sup>15</sup>

The main demand centres of the new Kato Power Grid are the Kato Secondary School and the National Agriculture Research and Extension Institute (NAREI) which are the Demand Centre 1, and the Kato Village Centre which is the Demand Centre 2. The expected average demand will start at about 80 kW. The hydro project is expected to generate a maximum power of 150 kW during 10 months of the year. A minimum guaranteed power of 80 kW will be able to support all connected off-takers throughout the year.

<sup>14</sup> GEA 2018. Hydropower Feasibility Study 150 kW Kato Hydropower Station. Section 8 Water Levels, pg 27.

<sup>15</sup> GEA 2018. Hydropower Feasibility Study 150 kW Kato Hydropower Station. Section 9 Demand Analysis, pg 29.

From the powerhouse, electricity will be transmitted to a pole mounted transformer located in the compound of the Kato Secondary School approximately 1.1 kilometres away from the powerhouse. Electricity will be provided on a 24-hour basis directly to the Kato Secondary School which is also proximate to the agricultural project being implemented by NAREI.

A 3.9 kilometre primary distribution network will be constructed from the power station to the village centre of Kato where most Government buildings have been centralized. Within the village centre, a secondary distribution network will be established to provide power to the intended recipients. While it has been determined, at the time of preparing this EAMP the details on the route of the transmission network from the substation to the village and the distribution network in the village were not available. Since residences are scattered throughout the village, the final location of the grid will determine the number of household/buildings that will be able to be connected. However, a general route is shown in Appendix D.



**Figure 2-7: Secondary School and NAREI (Demand Centre 1)**





## 2.10 Employment Opportunities<sup>19</sup>

The project is expected to generate approximately 52 jobs during construction and 17 jobs during operation. The following are the possible areas for employment:

### Construction

Laborers - 20  
Electricians - 3  
Engineers - 2  
Masons - 3  
Carpenters - 3  
Surveyors - 1  
Security - 3  
Drivers - 5  
Cleaners - 3  
Caterers - 3  
Supervisors - 2  
Managers - 1  
H&S Officer - 1  
Logistics - 1  
Accountant - 1

### Operation

Maintenance Personnel - 2  
Operators - 2  
Engineers - 1  
Cleaners - 2  
Security - 3  
Electrician - 1  
Drivers - 1  
Linesmen - 5

The contractor will be required to hire local persons, including women, based on their experience and skills to support the construction phase of the project.

## 2.11 Environmental Benefits

The project will not require or contribute to deforestation during the construction or operation phases since the project is situated in the savannah grassland. The operation of the power plant is expected to have no emissions and the production of 1,233 MWh/year could save 950,000 kg of CO<sub>2</sub> per year.<sup>20</sup>

## 2.12 Socio-Economic Benefits

The hydropower project is expected to have positive socio-economic benefits through the provision of affordable, stable and reliable supply of electricity throughout the year. Similar to other Amerindian villages, the economic activities of Kato are subsistence in nature. Government institutions such as the Regional Administrative buildings, schools and medical centre either receive electricity from stand-alone photovoltaic systems or from small diesel generators that provides electricity for just a few hours per day. At the household level, residents have stand-alone photovoltaic systems, small generators and, in most cases, small kerosene lamps for lighting.

The proposed project will be focused on providing electricity at the community level for productive, income-generating activities, especially relating to agro processing, thereby moving the villages from a subsistence economy to a cash economy. Private consumers will be able to connect to the sub grid. The project is also envisaged to enhance the tourism and agro-processing potential of the village.

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<sup>19</sup> GEA Presentation, 2019

<sup>20</sup> GEA 2018. Hydropower Feasibility Study 150 kW Kato Hydropower Station. Section 5.4 Emissions, pg 21.

Importantly, the recently constructed secondary school which serves Kato and surrounding villages, including providing accommodation and meals for students, will benefit greatly.

### **2.13 Planning Permission and Regulatory Approval**

The village of Kato, through a decision of the Village Council in 2017, has granted permission for the construction of the hydropower project.

The EPA, in 2017, following an application by the GEA for environmental authorization of the project, informed that an Environmental Risk Assessment and Management Plan is required to facilitate environmental authorization. The EPA Guidelines for preparing EMPs were provided as guidance.

The RDC – Region # 8 has also given its No Objection for the project.

These permissions and no objections are provided in Appendix E.

### 3.0 Project Environment

#### 3.1 Physical Environment

The village of Kato is located within the Highlands, Mountains and Plateau physiographic region, but also forms part of the North Rupununi Savannahs.

##### 3.1.1 Geology

Guyana is located on the northeast coast of South America and is entirely comprised or underlain by rocks of the Precambrian Guiana Shield. The Guiana Shield lies between the Orinoco and Amazon Rivers and encompasses all or portions of neighbouring countries Suriname, French Guiana, Venezuela, Brazil and Columbia, aggregating to an area of 1.6 million km<sup>2</sup>. The Guiana Shield has been correlated with the Leo-Man Shield of West Africa and it is generally accepted that prior to the opening of the Atlantic during the Mesozoic the two shields formed a contiguous craton. The Archaean Imataca Complex can be correlated with the Archaean Liberian Province, the Central Guyana Granulite Belt with the Dimbroko Zone in Ivory Coast, the Barama-Mazaruni greenstones with the Birimian greenstones and the Trans-Amazonian tectono-thermal event with the Eburnean Orogeny. However, one very important difference between the two shields is that the Leo-Man Shield lacks the well-developed, undeformed Mesoproterozoic supracrustals.

The Roraima Supergroup is part of the Pakaraima Sedimentary Block, forming a continuous area of sedimentary rocks covering some 73,000 km<sup>2</sup> of the Guiana Shield in parts of Venezuela, Brazil and Guyana, and has maximum and minimum ages of 1.95 and 1.78 billion years, respectively<sup>21</sup>. The Pakaraima Mountains, where Kato is located, are part of the Roraima sedimentary table lands, which is a huge sheet of sedimentary conglomerates and sandstones that has been substantially eroded. The formation represents sedimentary fill in a shallow oceanic basin with material that was derived from erosion of the mountains to the north and north east and is interpreted as a rift-sag setting formed during an extensional tectonic phase in which north to south general event was responsible for the development of normal east to west faults and transfer faults. These form an asymmetrical basin of rhombohedral geometry controlled by NW-SE faults, referred to as the Avanavero Suite Gabbro sills and dykes. The Roraima Group geological unit comprises two rock formations: sedimentary rocks (sandstone and conglomerates) and volcanic jasperoid rocks.

Keats (1974) identified and defined nine layers/depositional units. These units were named from the oldest to the youngest (and the lowest to the highest), as Units I, II, III, IV etc. to Unit IX. Unit I rocks are the oldest and bottommost layer. Units I to VI rocks are considered the lower strata of the tabular sandstone mountains of the Pakaraima. The units' thicknesses vary from 25 to 360 metres and are sometimes conformable, i.e. formed without interruption of the depositional process, and sometimes disconformable, a disconformity representing an interruption in deposition of sediments for a period of time before it restarts. Units VII to IX are the middle member layers. With respect to unit IX, sandstone and conglomeratic sedimentation in this unit were similar to that of Unit VIII with the addition of volcanic intercalations (new structures) in the already formed unit. This took the form of jasper-like vitric tuff falls (tuffs being sedimentary rocks formed by the accumulation of volcanic ashes).

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<sup>21</sup> Stratigraphy of the Roraima Supergroup along the Brazil-Guyana border in the Guiana shield, Northern Amazonian Craton - results of the Brazil-Guyana Geology and Geodiversity Mapping Project – Brazil Journal of Geology. Vol.47 No.1 São Paulo, Jan-Mar 2017

In the Kato-Orinduik area, the tuffaceous jaspers (jasper stones) are usually dark red, with local variations to greenish grey.

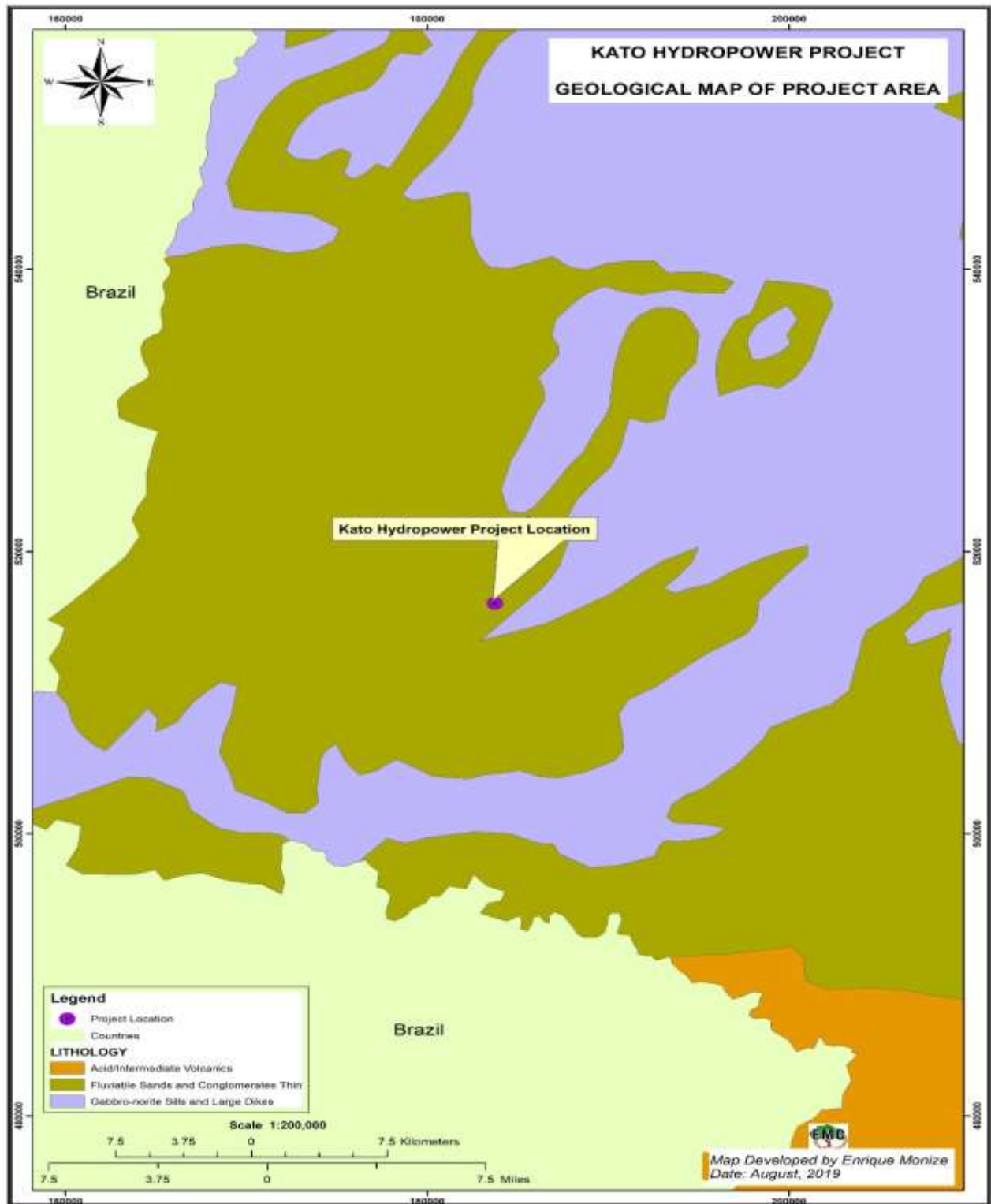


Figure 3-1: Geology of the Wider Project Area

### **3.1.2 Soils**

According to the FAO Soil Classification, at the project area the soil type falls within the 2f Mapping Unit which is Ustchrepts. These are Lithosols acidic rock phase and are associated with Ustorthents and Kanhaplustults. This is one of the most extensive soil mapping units occurring in large areas of south-west Guyana including the southern Pakaraima Mountains. These soils are very shallow, very well to excessively drained and low in fertility. These soils are also highly susceptible to erosion. Based on the Land Capability Classification the soils fall within Class IV, which is not suitable for agricultural purposes. The soil classes occurring at and around the project site can be observed in figure 3-2.

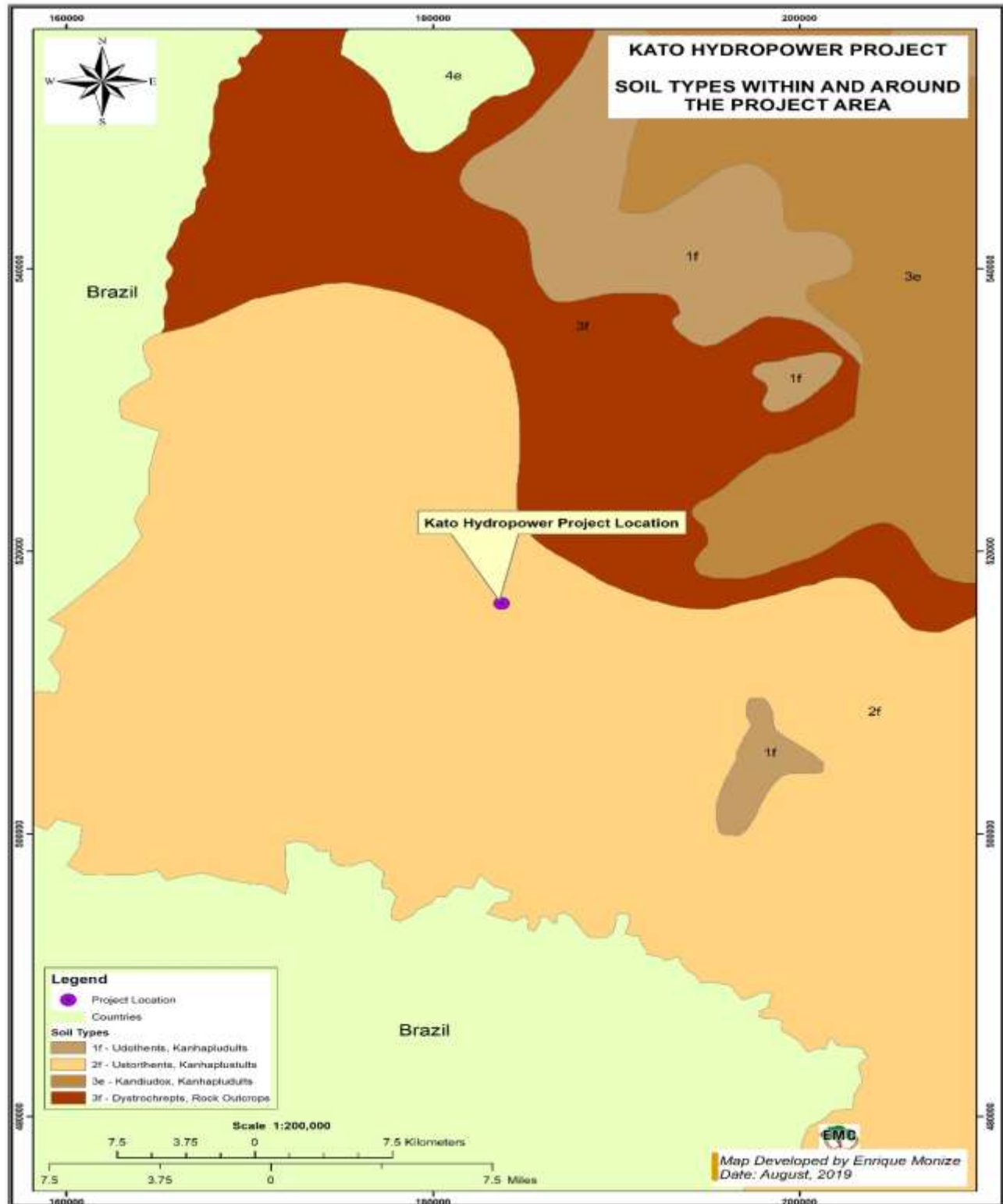


Figure 3-2: Soil Classes at and around the Project Area

### 3.1.3 Topography

The area around Kato is dominated by savannah on table mountain plateaus given its location within the North Rupununi Savannahs and on the South Pakaraimas. The northern savannah plain lies at an altitude of about 100-110m, but the Pakaraima Mountains rise abruptly from the plain to altitudes of 610m and reach heights of 990m at their highest<sup>22</sup>. The general project area, which can be observed in figure 3-3, presents two wide flat parts bordered by the Chiung River and separated by the valley excavated by the River and its small tributaries. These areas are Kato Plateau (South) and Chiung Plateau (Northwest)<sup>23</sup>. The environment is generally hilly to mountainous but can be flat in some areas. The topography of the wider project area can be observed in figure 3-4.

The average elevation at the project site is between 549 meters (1800 ft) to 884 meters (2900 ft).



**Figure 3-3: Topography of the General Project Area**

<sup>22</sup> Guyana National Land Use Plan 2013

<sup>23</sup> GEA 2018. Hydropower Feasibility Study 150 kW Kato Hydropower Station



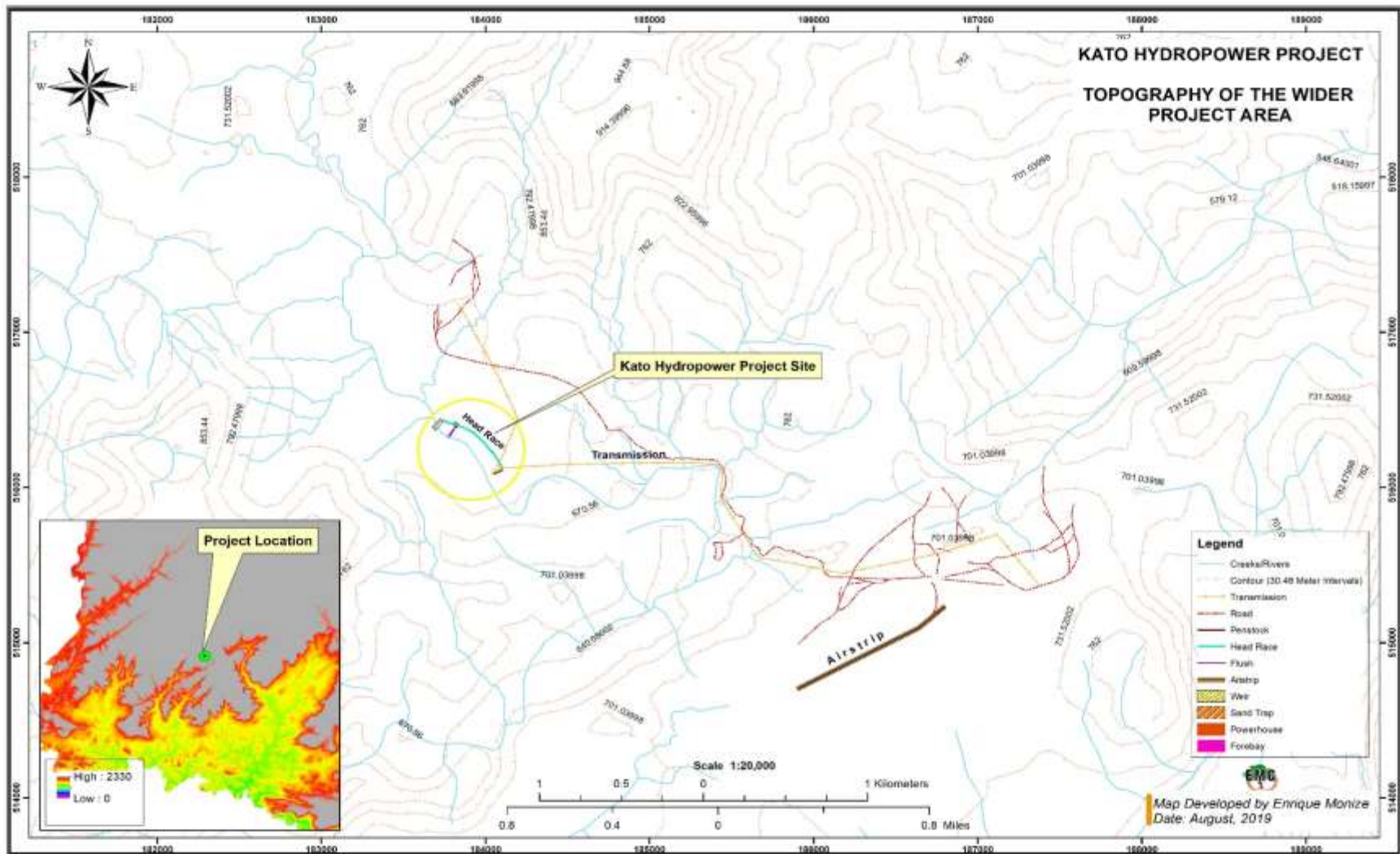


Figure 3-4: Topography of the Wider Project Area

### 3.1.4 Hydrology

The general project area is drained by the Chiung River which eventually discharges in the Ireng River. The drainage that drains the watershed of the Chiung River is radial in shape and the Chiung River, in most places depicts a V-shaped river valley, but can be flat at various points (figure 3-8). Slope locations are mostly steep but are inclined at a few areas. The average stream width is about 3 to 9 meters in some places. Water flows via small ditches (figure 3-5) and small streams (figure 3-6) to the River. There are several falls along the River alignment but the Chiung Falls (figure 3-7) located at Kato is the highest. Figure 3-9 shows the drainage network of the wider project area.



**Figure 3-5: Small Drainage Feature leading to the Chiung**



**Figure 3-6: Larger Stream flowing to the Chiung**



**Figure 3-7: The Chiung Falls**



**Figure 3-8: Sections of the Chiung River**



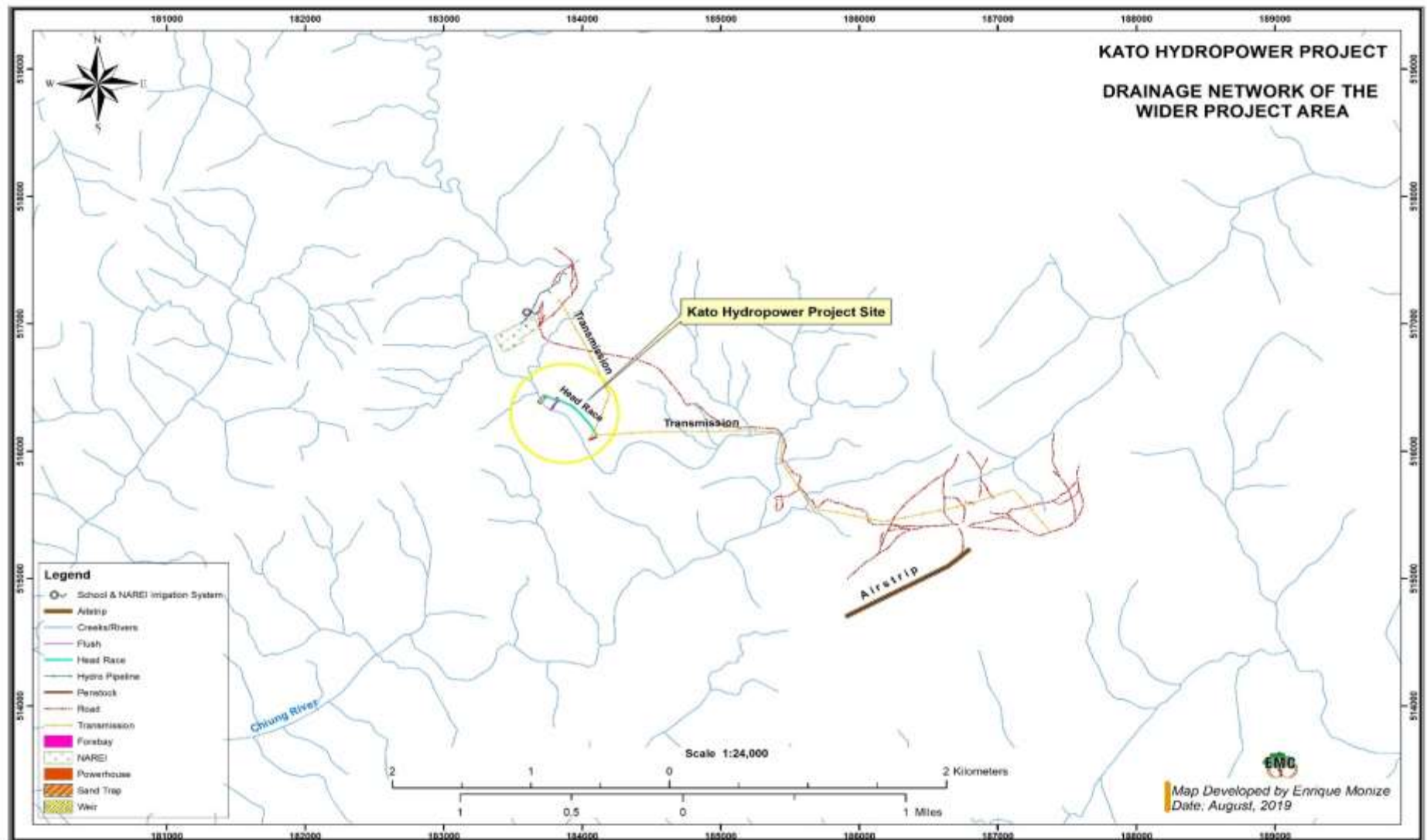


Figure 3-9: Drainage Network around the Project Area

### 3.1.5 Climate

Mean air temperature ranges between 25 to 27.5°C throughout the year in most regions except the upland regions in the interior/west of the country,

The climate in Guyana is strongly influenced by the Inter-tropical Convergence Zone (ITCZ). Due to the movement of the ITCZ, most climate variables show a bi-modality through the year. Most areas experiences two wet seasons and two dry seasons. However, some areas experience a long wet season and a long dry season. Kato, being located in the North Rupununi Savannas, experiences only one wet and one dry season. The El Niño/La Niña phenomena is primarily responsible for inter-annual variations in rainfall. However, the project area, like the rest of Guyana has a tropical climate and is not subject to extreme variations in temperature and humidity.

The annual rainfall is usually between 1500-2000 mm per year, of which 70-80 % falls during the wet season from May-September. The Hydrometeorological Department of the Ministry of Agriculture operates a weather station at Kato. Data available for the last 10 years is presented in Table 3-1 and represented in figure 3-10. The data, although there are gaps, shows rainfall commencing in March and ending in September, with most of the rainfall occurring between April and August. June is the wettest month, with figures exceeding 300 mm. The driest period is between the months of December to February.

Mean temperatures are cooler within this area and range between 20 to 23°C throughout the year, as compared to between 25 to 27.5°C for most of the country<sup>24</sup>.

**Table 3-1: Rainfall Amount at Kato – November 2009 to July 2019**

| Month | Jan. | Feb. | Mar.  | Apr.  | May   | Jun.  | Jul.  | Aug.  | Sep.  | Oct. | Nov.  | Dec.  |
|-------|------|------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|
| 2009  |      |      |       |       |       |       |       |       |       |      | 8.8   | 41.1  |
| 2010  | 32.6 | 17.1 | 84.5  | 221.5 | 331.7 | 351.8 | 356.3 | 275.7 | 161.8 | 70.8 | 149.9 | 52.4  |
| 2011  | 41.4 | 24.1 | 140.3 | 41.1  | 358.0 | 252.2 | 163.2 | 101.6 | 33.1  | 51.2 | 71.6  | 11.0  |
| 2012  |      |      |       |       |       |       |       |       |       |      |       |       |
| 2013  |      |      |       |       |       |       |       |       |       |      |       |       |
| 2014  |      |      |       |       |       |       |       |       |       |      |       |       |
| 2015  |      |      |       |       |       |       |       |       |       |      | 20.0  | 40.9  |
| 2016  | 1.3  | 36.9 | 28.7  | 162.5 | 185.4 | 211.2 | 353.4 | 60.7  | 125.3 | 1.0  | 7.7   | 109.1 |
| 2017  | 32.0 | 42.2 | 8.2   | 37.8  | 313.1 | 342.9 | 268.1 | 143.2 | 90.4  |      |       | 72.3  |
| 2018  | 31.3 | 0.0  | 100.2 | 239.0 | 170.4 | 381.2 | 54.4  | 20.0  | 66.8  | 10.3 | 18.4  | 1.8   |
| 2019  |      |      |       |       | 272.2 | 72.1  | 35.6  |       |       |      |       |       |

Source: Hydrometeorological Department (2019)

<sup>24</sup> Guyana National Land Use Plan 2013

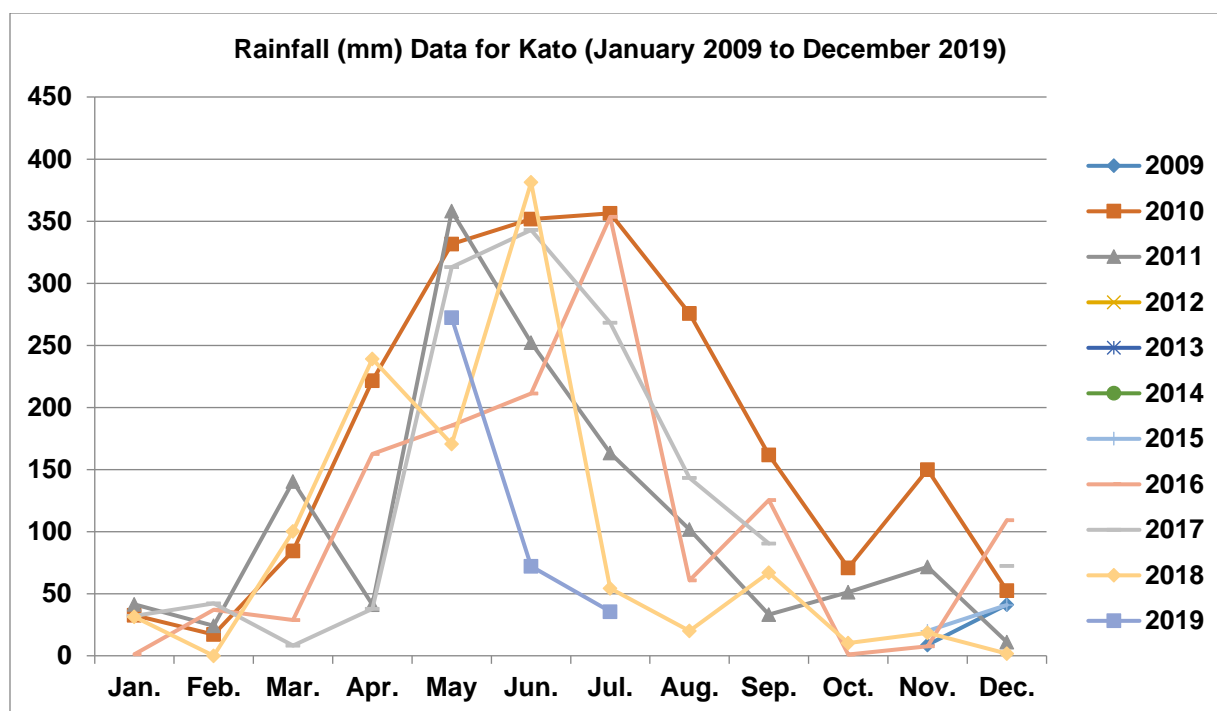


Figure 3-10: Monthly Rainfall from 2009 to 2019 at Kato

### 3.1.6 Surface Water Quality

To gain a better understanding of the water quality within the Chiung River water quality analyses were conducted. The River was sampled in the vicinity of the project location. The location of the water quality sample collection points are shown in figure 3-11 and a description of each location, and the date, time and weather condition at the time of sampling are presented in table 3-2.

Table 3-2: Description of Surface Water Sample Locations

| Sample ID | Location                                    | Time Sampled | Weather | GPS Point          |
|-----------|---|--------------|---------|--------------------|
| SW 1      | Upstream of Proposed Weir Location          | 11:33 hrs.   | Sunny   | 0183634<br>0516521 |
| SW 2      | Waterfall Head                              | 11:42 hrs.   | Sunny   | 0183733<br>0516372 |
| SW 3      | Downstream of Proposed Power Plant Location | 12:00 hrs.   | Sunny   | 0184069<br>0515937 |

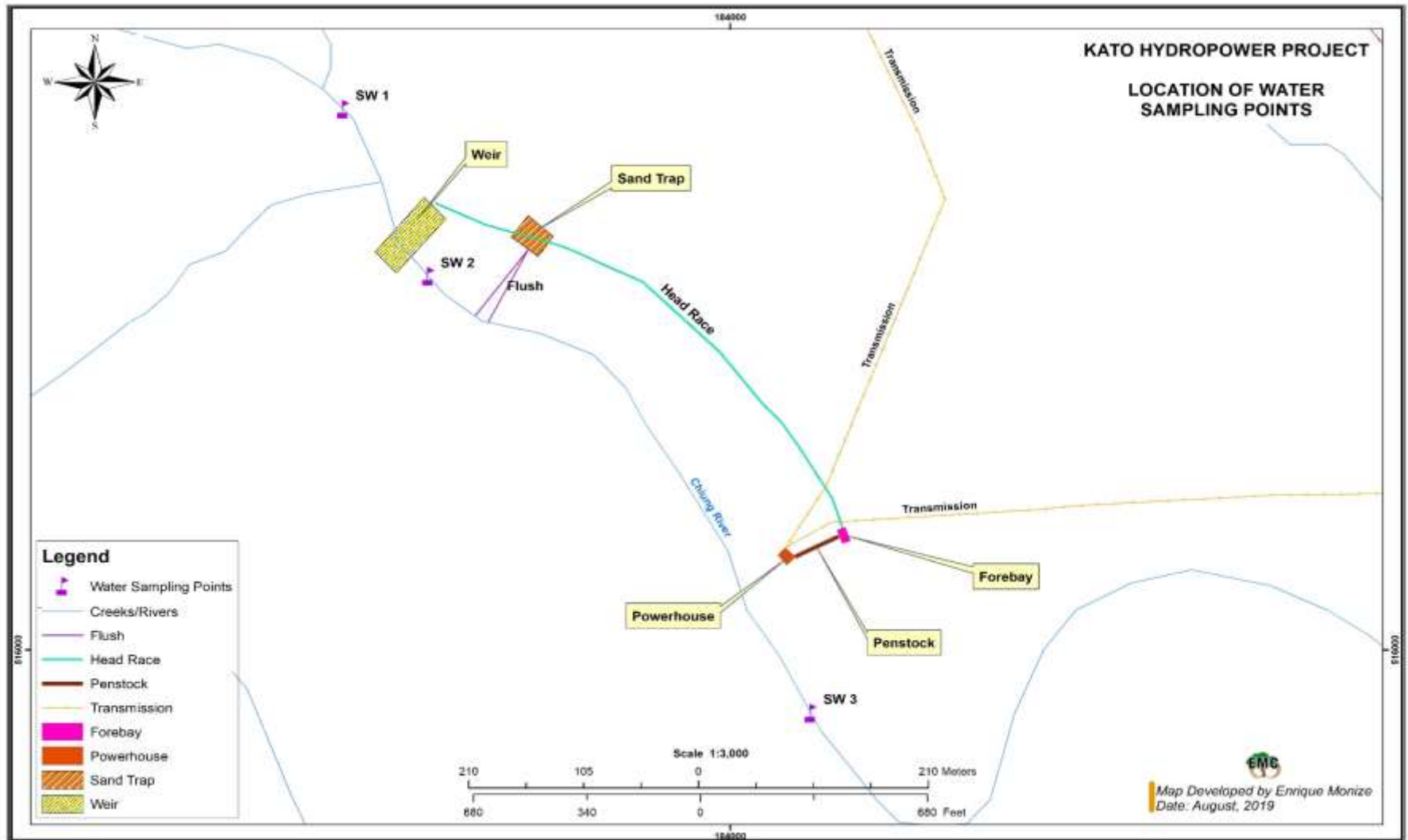


Figure 3-11: Surface Water Sample Locations



The sampling exercise can be observed in figure 3-12. Three sets of samples were collected for each location. The first set of samples was analysed *in-situ* (figure 3-13) and was tested for pH, Temperature, Turbidity, Total Suspended Solids (TSS), Dissolved Oxygen (DO), Total Dissolved Solids (TDS) and Conductivity. The second set of samples was sent to the Guyana Sugar Corporation Inc. (GUYSUCO) Laboratory for analyses and was tested for Oil and Grease and Chemical Oxygen Demand (COD). The third set of samples was sent to Kaizen Environmental Services Laboratory to test for Biological Oxygen Demand (BOD). The results of the water quality analysis are presented in the table 3-3.

Since there is no background water quality standard in Guyana to compare the results, to assist in understanding the results from the analyses conducted the levels detected were compared with the limits prescribed in the Guyana National Bureau of Standards (GNBS) GYS 262:2004 - Specification for Drinking Water and the GYS 207:2002 - Interim Guidelines for Industrial Effluent Discharge into the Environment, and the Mining (Amendment) Regulation 2005. Limits are prescribed for pH, Temperature, DO, TSS, Oil and Grease, BOD and COD in the Interim Guidelines for Industrial Effluent Discharge into the Environment. TDS results were compared to the limits prescribed in the Specification for Drinking Water while Turbidity levels were compared with the limit prescribed in the Mining (Amendment) Regulation 2005. The limits are included in the results tables. The laboratory analyses report is attached as Appendix F.

**Table 3-3: Results of Physiochemical Analyses**

| Parameters                           | Sample ID |        |        |
|--------------------------------------|-----------|--------|--------|
|                                      | SW 1      | SW 2   | SW 3   |
| <b>pH</b><br>5-9                     | 7.8       | 7.6    | 7.0    |
| <b>Temp (°C)</b><br><40              | 26.3      | 26.5   | 26.7   |
| <b>DO (mg/L)</b><br>>4               | 7.70      | 7.70   | 7.85   |
| <b>ECw (ms/cm)</b>                   | 14.12     | 14.35  | 12.33  |
| <b>TDS (mg/L)</b><br>500             | 6.36      | 6.51   | 5.57   |
| <b>TSS (mg/L)</b><br>100             | 350       | 260    | 250    |
| <b>Turbidity (NTU)</b><br>25         | 137       | 130    | 139    |
| <b>Oil and Grease (mg/L)</b>         | 0.07      | 0.08   | 0.12   |
| <b>COD</b><br>250                    | 136       | 128    | 20     |
| <b>BOD (mg.L<sup>-1</sup>)</b><br>50 | <3.00*    | <3.00* | <3.00* |

TSS - Total Suspended Solids; TDS - Total Dissolved Solids; ECw - Conductivity;  
DO – Dissolved Oxygen; COD – Chemical Oxygen Demand;  
BOD – Biological Oxygen Demand

As can be observed in the table above, the results of the water quality analyses shows the water quality within the River to be very good, excepting for a high presence of sediments which also resulted in some discolouration. It should be noted that there was significant rainfall leading up to the sampling exercise which could have contributed to the high sediment load through runoff. During an earlier visit to the site during dry conditions there was significantly less discolouration.



**Figure 3-12: Water Sample Collection from the Chiung River**



**Figure 3-13: In-Situ Water Quality Analyses**

### 3.1.7 Noise

Noise measurements were taken around the project site and at the Kato Secondary School to determine the current decibel levels. These locations can be observed on figure 3-15. The noise levels were recorded using an Extech 407727 Digital Sound Level Meter (figure 3-14). The locations and noise levels recorded are presented in the table below.

At the project site the noise levels were recorded without noisy activities occurring. However, the flow of the River and the falls contributed to the noise levels. At the school the generator was operational at the time. At the project site the noise levels averaged around 70 dB, while at the school, even with the generator operating, the level was within the allowable limit. For comparison, the GNBS Noise Guidelines stipulates 75 dB during the day for residential areas.

**Table 3-4: Noise Levels Recorded**

| Sample ID | Date Sampled | Location                                    | Reading dB | Coordinates        |
|-----------|--------------|---|------------|--------------------|
| N 1       | 03/08/2019   | Chiung Falls                                | 70.3       | 0183813<br>0516365 |
| N 2       | 03/08/2019   | Upstream of Proposed Weir Location          | 69.3       | 0183640<br>0516521 |
| N 3       | 03/08/2019   | Downstream of Proposed Power Plant Location | 71.0       | 0184072<br>0515937 |

| Sample ID | Date Sampled | Location              | Reading dB | Coordinates        |
|-----------|--------------|-----------------------|------------|--------------------|
| N4        | 03/08/2019   | Kato Secondary School | 61.4       | 0183798<br>0517231 |



**Figure 3-14: Noise Levels Measurement**

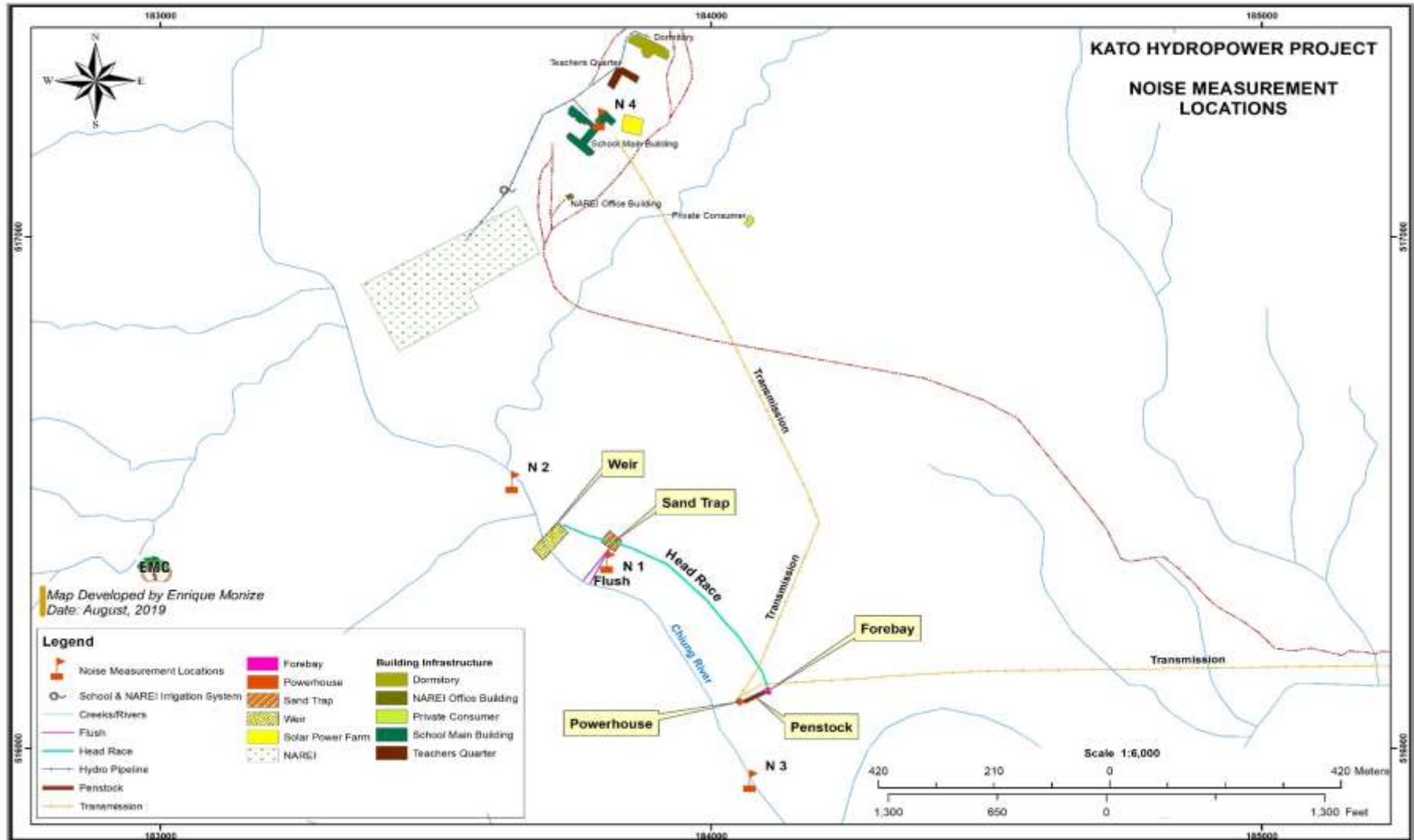


Figure 3-15: Noise Measurement Locations

## 3.2 Biological Environment

This section describes the biological resources of the project area and its surrounding landscape.

Biological data was collated through:

- Assembling available secondary data on the landscape of the Project and areas with similar habitat characteristics;
- A site reconnaissance visit on July 13, 2019; and
- Desktop review of documentation on the project and project area.

Biodiversity data focused on the flora and fauna of the landscape of the project, critically endangered and endangered species, the presence and proximity to national protected areas, and areas of international biological conservation importance. The conservation threat level of species that occur in Guyana was determined through review of the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species. This baseline considers biodiversity at three levels of scale: the regional and biogeographic provinces; the project landscape and ecosystems; and habitats and species of the project site.

### 3.2.1 Biogeographic Provinces

Four main geographical regions can be distinguished within Guyana (FAO<sup>25</sup>). These are:

- The northern coastal belt, consisting of low-lying alluvium with a varying width up to a maximum of 65 km in land (in the east);
- The lowland region of undulating land covering most of the northern and central parts of the country, generally with an elevation below 150 m;
- The Pakaraima mountain region in the west, an elevated table land of sandstone escarpments between 300 and 1200 m in elevation corresponding to similar formations in the south-east of the Venezuelan Guyana and the Brazilian territory of Roraima; and
- The southern uplands consisting of a vast area mostly over 150 m in elevation covered with undulating forest land.

The Kato Hydroproject site is in the Pakaraima Mountains region in the west of Guyana, an elevated table land of sandstone escarpments between 300 and 1200 m in elevation as described in the third division above. The Pakaraima Mountains is considered part of the Guiana Shield Region as defined in regional studies by Hollowell and Reynolds (2005<sup>26</sup>). The Guiana Shield is in northeastern South America and it includes the large mountain systems that form the watershed between the Amazon and Orinoco Rivers.

The Guiana Shield accounts for more than 25 % of tropical forests remaining in the world. Its diverse landscapes have been recognized for their biological endemism, unique ecosystems, pristine forests and cultural diversity. The highlands of the Shield are characterized by flora and fauna with numerous endemic species. Some tepui endemic species occur as low as 300 m in elevation, with increasing numbers by 1500 to 1800 m, and fully developed communities occurring by 2000 m (Hollowell and Reynolds, 2005).

The lowlands of the Guiana Shield are biogeographically distinct from the Guiana Shield Highland centers of endemism. The lowlands of the Guianas are much more closely related to the forested

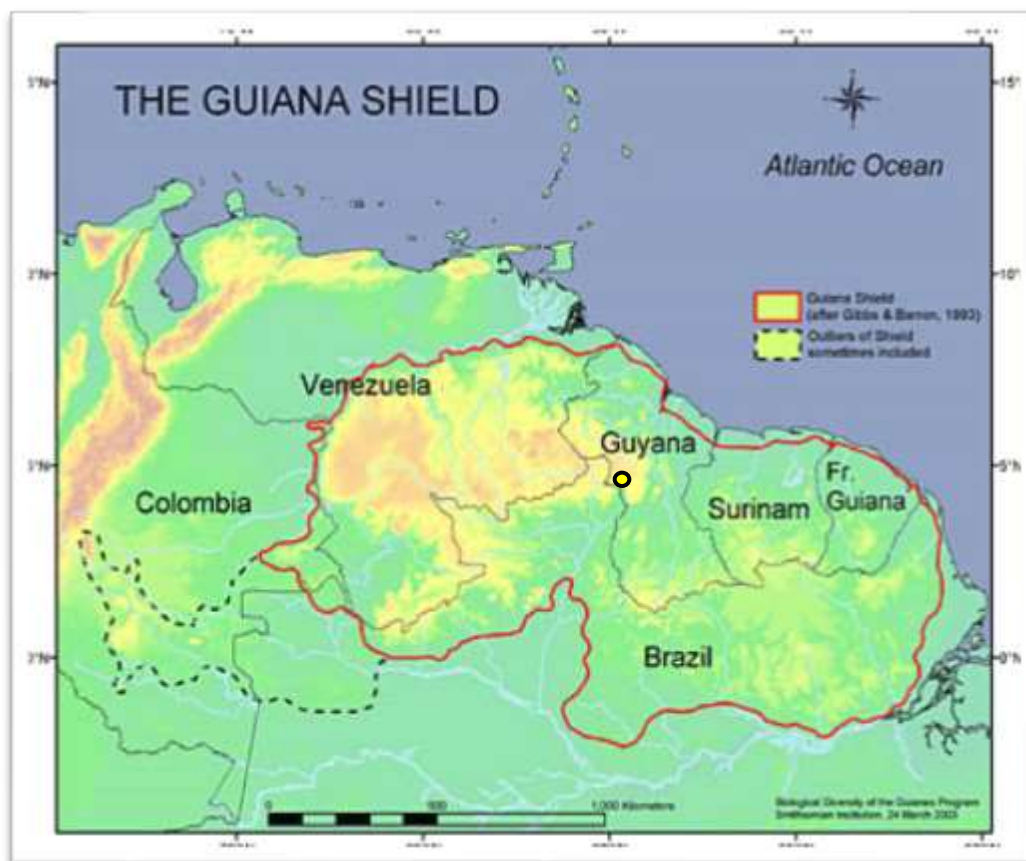
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<sup>25</sup> <http://www.fao.org/forestry/country/18310/en/guy/> - Downloaded in July 2019

<sup>26</sup> Hollowell, T., and R. P. Reynolds, eds. 2005. Checklist of the Terrestrial Vertebrates of the Guiana Shield. Bulletin of the Biological Society of Washington, no.13.



lowlands of the Amazon basin. According to Steege (2003<sup>27</sup>), the lowland rainforest on brown sandy soils, loams or laterites is the major vegetation type of the Amazon valley and the Guiana Shield. Faunal diversity of the Guiana Shield lowlands is comprised largely of species found widespread across the lowland humid forests of the Amazon Basin.



Map taken from the Smithsonian Museum of National History  
Downloaded from: <http://botany.si.edu/bdg/program.html>

#### KEY

- Guiana Shield Region
- Outliers of the Guiana Shield (sometimes included)
- Project Area

**Figure 3-16: Location of Project Area in relation to the Guiana Shield Region**

### 3.2.2 Landscapes and Ecosystems

The Kato project site lies within the Pakaraima highlands of mainly (sub) montane forest and shrublands from 300-1500 m altitude. The vegetation of the Pakaraima Mountains is greatly influenced by variations in altitude and isolation caused by the rugged landscape (Huber, 1995<sup>28</sup>). There are also very sharp gradients in rainfall with as little as 1700 mm y<sup>-1</sup> in the south-eastern Pakaraima (bordering

<sup>27</sup> Steege, H. ter., 2003. Plant Ecology, in *Conservation Priorities of the Guayana Shield, 2002 Consensus*. Conservation International, Centre for Applied Biodiversity Science.

<sup>28</sup> Huber, O. 1995. Vegetation, pp 97-160 in P.E. Berry. Holst and K. Yatskievych (eds), *Flora of Venezuela Guayana*. Volume 1, Introduction. Missouri Botanical Garden, St Louis, USA.

the north Rupununi Savanna) to as much as 4000 mm y<sup>-1</sup> on the high mountain sides facing the north east trade winds (Persaud, 1994<sup>29</sup>). Differences in soil types also contribute to the heterogeneity of the landscape. The forest types of the Pakaraima Mountains region consists of the following features:

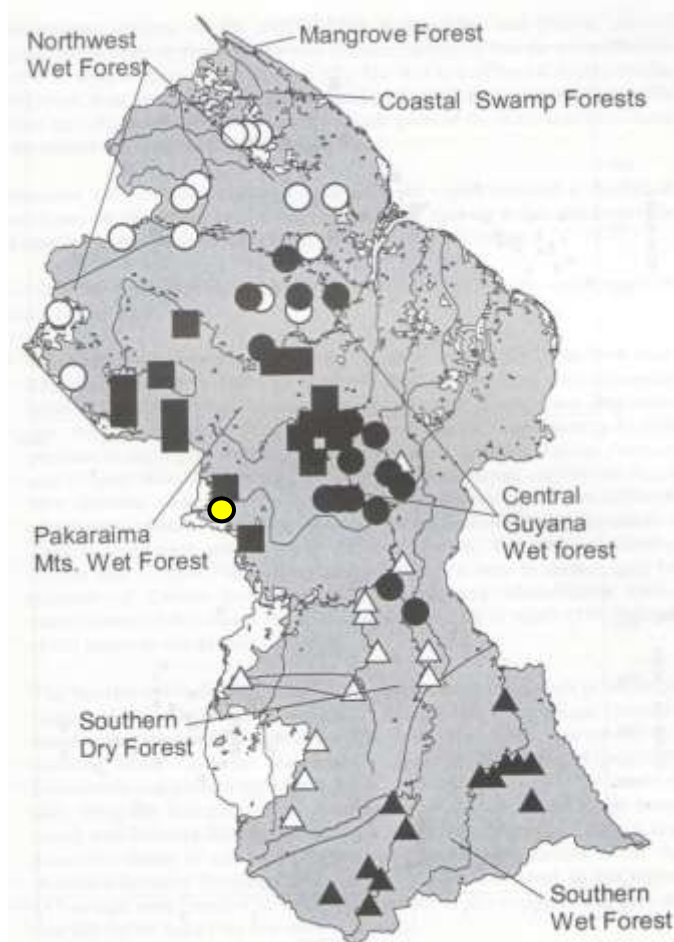
- Lowland forests (0-500 m) – According to Fanshawe (1952<sup>30</sup>), the lowland forests of the Pakaraima Mountains region can be broadly classified into two groups: rainforest on brown sands derived from intrusive volcanic rocks and rainforest on the sandstones and sediments of the Kaieteurian series (white sands). The lowland forests of the northern part of the Pakaraima Mountains are mainly dominated by *Eschweilera*, *Licania*, *Alexa*, and *Mora gonggrijpii*. In the eastern parts, *Dicymbe* is one of the striking components. In the southern part, deciduous forests with *Cordia* and *Centrolobium* can be found. On the white sands typical Wallaba forest is found dominated by *Eperua falcata* and *E. grandiflora*.
- Montane or Upland Forests (500-1500 m) – Montane or upland forest cover only a very small area in Guyana. Sapotaceae and Lauraceae, in general, are overwhelmingly abundant at higher elevations. Legumes, such as *Eperua falcata*, *Eperua grandiflora*, *Dicymbe altsonii*, etc. dominate the white sands derived from weathering table mountains.
- Pantepui (Highlands) – Pantepui is defined as that part of the Guiana Shield that is over 1500 m altitude. There are four main vegetation formations that make up Pantepui (Huber, 1997):
  - Upper Montane Forests (1500-2000 m) found on the three highest table mountains, Mountains Roraima, Ayanganna, and Wokomung;
  - Tepuis Scrub (2200-2700 m) at higher altitudes the forest finally grades into tepui scrub which, in Guyana, is only found on Mts. Roraima and Ayanganna;
  - Alpine Meadows (1500-2500 m), in Guyana it is only found in the upper reaches of the Kamarang River of Mts Holitipu and Lamotai; and
  - Open Rock vegetation – the high summits of tepuis are usually bare but with small pockets of Bromeliaceae, and Orchidaceae.
- Lowland (and upland) savannahs – These savannahs are dominated by the grasses *Trachypogon*, and *Axonopus* and the shrubs *Curatella* and *Byrsonima* are found in the southern parts where the Pakaraima Mts border the Rupununi and Rio Branco Savannahs.

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<sup>29</sup> Persaud, C. (1994). Mean annual and monthly rainfall maps of Guyana. Caribbean Climate Centre, Barbados.

<sup>30</sup> Fanshawe, D.B. (1952). The Vegetation of British Guyana. A preliminary review, Imperial Forestry Institute, Oxford, United Kingdom





Source: *Plant Diversity of Guyana; Tropenbos Series 18; Edited by Steege (2000)*

#### LEGEND

- ▲ Southern Wet Forest
- Northwest Guyana Wet Forests
- Central Guyana Wet Forest
- Pakaraima Mountains Wet Forests
- △ Southern Dry Forest; Light grey areas: area under forest cover
- Project Area

**Figure 3-17: The Concession and the National Forest Regions of Guyana**

#### 3.2.3 Habitats and Species

There are no known documented studies of biodiversity of the project site. Species accounts of the project landscape were obtained from field interviews with residents of the Kato Village and referenced from studies of areas that share similar habitat characteristics and species.

According to the Vegetation Map of Guyana, after Hubert et al. (1995<sup>31</sup>), the landscape of the Project site is characterized by lowland shrub savannas of Southwest Pakaraima and the Rupununi. These savannas are by extension part of the larger tropical and subtropical, grasslands, savannas, and

<sup>31</sup> Huber, Otto, Gharbarran, G., & Funk, V., 1995; Vegetation Map of Guyana, Preliminary Version – Centre for the Study of Biological Diversity, University of Guyana

shrublands eco-region of northern Brazil, Venezuela, and Guyana (WWF, 2018<sup>32</sup>). The ecoregion occupies an area of approximately 40,300 Sq. miles within the Roraima formation distinguished by extensive savannas and scrubby vegetation. This eco-region is traversed by streams with gallery forests, and extensive savannas. Recurrent fires and extremely poor soils are the most important factor in the advance of savannas in place of forest and the processes that are derived by these changes. Comparing with Guyanan Tepuis, endemism is low; however, an important number of endemics are found.

The savanna of the eco-region encompasses the treeless and tree patch mosaic of the Gran Sabana of Venezuela, and occurs as three distinct outliers:

- the largest spanning northern Brazil (the Rio Branco Savannas), southeastern Venezuela, and southwestern Guyana (the Rupununi savannas – also several small patches extending north along the Pakaraima foothills);
- a smaller patch bordering northern Brazil and extending into southern Suriname; and
- the smallest and most elongate outlier, that occurs in eastern Brazil north of the Amazon extending from near Macapa to near Calcoene.

The plant cover of the Gran Sabana, is an intricate mosaic, constituted by numerous types of vegetation. Except for the continuous forests at the foot of the Tepuis, forests occur in patches or islands, encircled by extensive grasslands and meadows, as well as by shrub formations (Dezzeo, 1994<sup>33</sup>). The savannas dominated by grasses are essentially free of shrubs and trees; but in some cases, low shrubby or suffrutescent elements may be present, thus classifying as shrubby meadows or scrub savannas (Dezzeo 1994).

The most common plant species in the Venezuelan savannas are: *Euphorbia guianensis*, *Humiria balsamifera*, *Clusia* sp., *Calliandra* sp., *Chamaecrista* sp., *Bonnetia sessilis*, *Myrcia* sp., *Ternstroemia pungens* (scrublands), *Axonopus pruinosis*, *A. kaletukensis*, *Trachypogon plumosus*, *Echinolaena inflexa*, *Bulbostylis paradoxa*, *Rhynchospora globosa*, *Hypolytrum pulchrum* (open savannas), *Hypogynium virgatum*, *Andropogon* sp., *Panicum* sp., *Byttneria genistella*, *Miconia stephananthera*, *Mahurea exstipitata* and *Mauritia flexuosa* (palm savannas), *Chalepophyllum guianense*, *Digomphia laurifolia*, *Tococa nitens* and *Poecilandra retusa* (meadows) (Huber and Alarcon 1988<sup>34</sup>; Dezzeo 1994). Most of the elements of the flora reported to Venezuelan savannas are also present in northern Brazil, Guyana and Surinam (Steyermark, 1977<sup>35</sup>).

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<sup>32</sup> WWF, 2018; World Wildlife Fund; Ecological Regions; <https://www.worldwildlife.org/ecoregions/nt0707> - Downloaded on July 30, 2019.

<sup>33</sup> Dezzeo, N. 1994. Ecología de la Altiplanicie de la Gran Sabana (Guayana Venezolana). Investigaciones sobre la Dinámica Bosque-Sabana en el Sector Sureste: Subcuencas de los Ríos Yuruaní, Arabopó y Alto Kukenan. Scientia Guianae, No. 4.

<sup>34</sup> Huber, O., and C. Alarcón. 1988. Mapa de vegetación de Venezuela. 1:2,000,000. Ministerio del Ambiente y de los Recursos Naturales Renovables and Fundación BIOMA, Caracas, Venezuela

<sup>35</sup> Steyermark, J.A. 1977. Future outlook for threatened and endangered species in Venezuela. In G.T. Prance, and T. S. Elias, editors, Extinction is forever. The New York Botanical Garden, New York

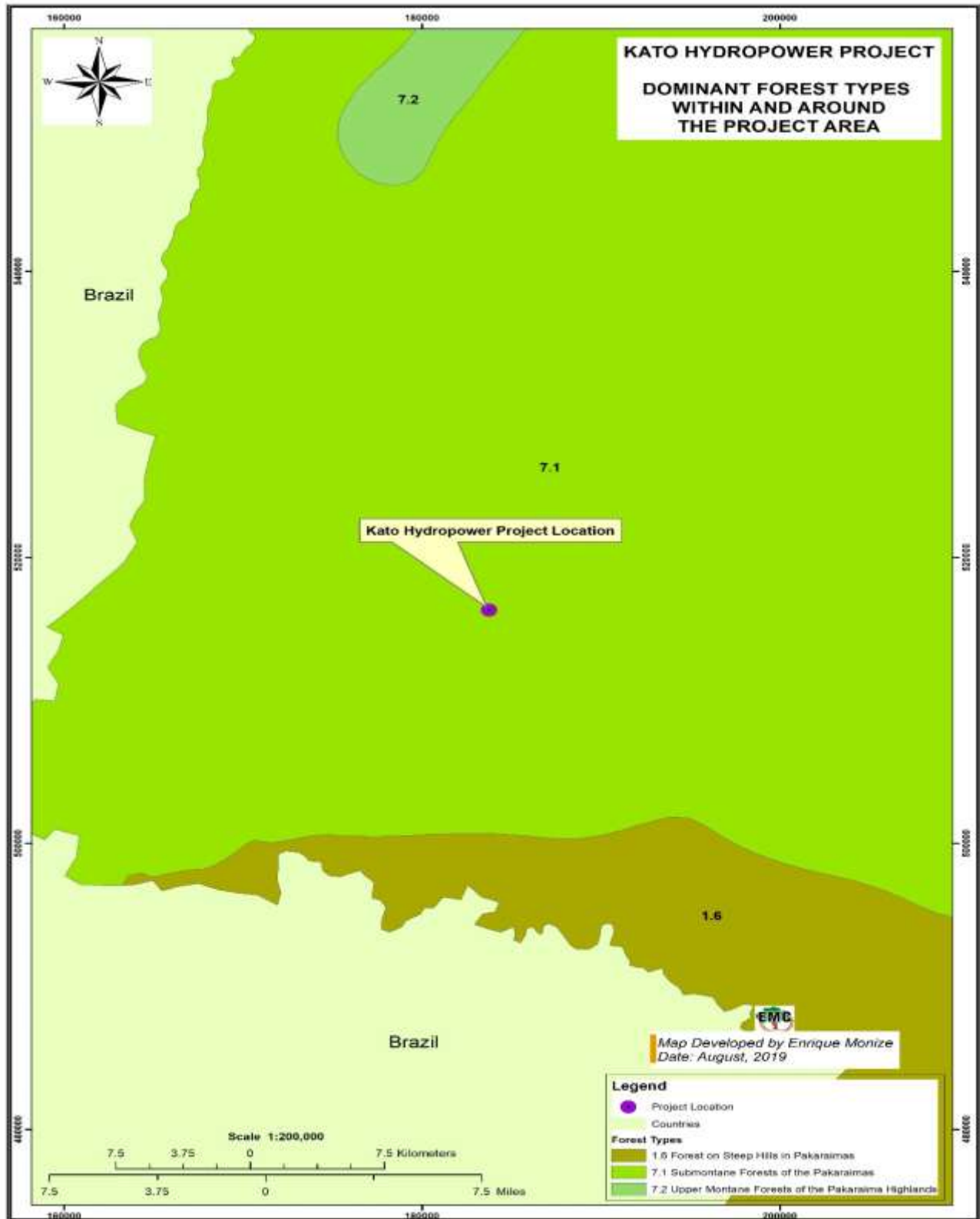


Figure 3-18: Vegetation Types within the Wider Project Area

Faunal diversity of the project landscape is typical of the lowland savannas of the Gran Sabana, part of which includes the Rupununi Savannas. The Rupununi is a unique collection of ecosystems that are home to over 1400 species of vertebrates (Watkins, et al., 2010<sup>36</sup>). Fish surveys conducted in the Rupununi by De Souza, et al. (2012<sup>37</sup>) recorded 433 species representing 13 orders and 41 families with the dominant species being from Characiformes, Suliformes, Perciformes and Gymnotiformes. Approximately 643 species of birds are known to occur in the Rupununi, representing over 75% of the bird species found in Guyana (Watkins, et al., 2010). Faunal species known to occur within the Rupununi Savannas are also typical of the lowland (and upland) savannas of the project landscape.

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<sup>36</sup> Watkins, G; Oxford, P; Bish, R, 2010; Rupununi, Rediscovering the Lost World; Earth in Focus Editions/ILCP

<sup>37</sup> De Souza, L. S., Armbruster, J. W. and D.C. Werneke. 2012. The influence of the Rupununi portal on distribution of freshwater fish in the Rupununi district, Guyana. *Cybium*.pp.31-43



**Figure 3-19: Vegetation and Habitats of the Project Area**

Lowland (upland) savannas characteristic of the Project site and landscapes of the tropical and subtropical, grasslands, savannas, and shrublands eco-region of northern Brazil, Venezuela, and Guyana

### 3.2.4 Critical Endangered and Endangered Species

The IUCN Red List of Threatened Species (Version 2019.1. <[www.iucnredlist.org](http://www.iucnredlist.org)>) was examined to assess whether there are critically endangered or endangered species existing within the landscape of the Project.

There are no known Critically Endangered mammals occurring in Guyana. The only Endangered mammal that occurs in Guyana is the Giant River Otter (*Pteronura brasiliensis*). The giant otter (*Pteronura brasiliensis*) is considered Endangered due to an ongoing population reduction as a result of habitat loss. According to Duplaix (1980)<sup>38</sup>, the Giant otter select their habitat according to prey abundance, availability and vulnerability and prefers slow flowing clear black water creeks and rivers of pristine environments of interior forested lands, particularly rivers with low levels of human activity. Low sloping banks with good cover and close access to prime fishing areas are preferred by the Giant otters for their campsites where they rear their cubs. In Guyana, these habitat conditions are met in the interior rivers, particularly the Rupununi River where giant otters are present in reasonable numbers (Duplaix, 2004)<sup>39</sup>.

The rivers and creeks of the Pakaraima Mountains region generally contain the prime habitats features of the giant river otter. The steep banks and water fall of the area of the Chiung River to be affected by the project does not meet the preferred giant otter habitat as described by Duplaix. The project site is situated in the vicinity of the Kato Secondary School and the Village Centre, an area of relative levels of human activity. Moreover, interviews with villagers did not indicate the presence of the giant river otter within the area of the project.

The sun parakeet (*Aratinga solstitialis*), the hoary-throated spinetail (*Synallaxis kollari*), and the red siskin (*Carduelis cucullata*) are the only Endangered bird species listed for Guyana. All of these birds are associated primarily with habitats of the interior savanna or dry forest landscapes, that is, the Rupununi savannas within Guyana.

Guyana has no listed critically endangered or endangered terrestrial or freshwater vertebrates. The only non-avian reptiles listed by the IUCN Red List as endangered or critically endangered for Guyana are marine species of sea turtles found nesting within the Shell Beach protected area located in north western Guyana, and other nesting areas along the Guyana coastline. No endangered or critically endangered amphibians are known to occur in Guyana.

The plant species *Trichilia surumuensis*, *Aniba rosaedora*, *Virola surinamensis*, listed as Endangered and *Vouacapoua Americana* listed as Critically Endangered are abundant and widespread in the interior forested lands of Guyana. These species are not commercially targeted in Guyana. The habitat range and occurrences of these species are as follows:

- *Trichilia surumuensis* is known only from the Roraima area in Brazil and Guyana.
- *Aniba rosaedora* is known to occur in Brazil, Guyana, French Guiana, Suriname, Peru, Venezuela, and Colombia. Populations throughout the species range have seriously declined because of rosewood oil extraction. *Aniba rosaedora* is not an economically targeted species in Guyana.
- *Virola surinamensis* occurs in the near interior and Rupununi district and is abundant to frequent in marsh forest, Mora forest, and swamp forest. *Virola surinamensis* occurs in Brazil, Costa Rica, Ecuador, French Guiana, Guyana, Panama, Peru, Suriname, Venezuela and is especially abundant in Suriname.

<sup>38</sup> Duplaix, N. 1980. Observations of the ecology and behaviour of the giant river otter *Pteronura brasiliensis* in Suriname. *Revue d'Ecologie (La Terre et La Vie)* 34: 495-620.

<sup>39</sup> Duplaix, N., (2004) Guyana Giant Otter Project, 2002-2004 Research Results. Report to the Oceanic Society, San Francisco, CA. 40 pages



- *Vouacapoua Americana* occurs in Brazil, French Guiana, Guyana, Peru and Suriname. The species is a slow growing timber species that is not economically targeted in Guyana.

The ecological features and functions of the project area are replicated across the lowland savannas of the Pakaraima Mountains region and by extension the larger Gran Sabana of Venezuela, the Rupununi Savannas and the Rio Branco Savannas of Brazil. The IUCN listed threatened species that are known to occur in the savanna eco-systems are widely distributed within lowland southwestern Guyana, and by extension the lowland forest and savanna habitats of Guyana, the Guiana Shield and lowland Amazonia. Moreover, the anticipated transformation of the habitats at the Kato Hydro-power project site is not expected to impact the long-term survivability of these species in Guyana or globally.

### **3.2.5 Areas of Biological Interest**

Areas of biological interest within Guyana were considered in this assessment to determine whether the project site is identified as a priority area for conservation interest. This includes consideration of legally protected areas and biodiversity priority areas within Guyana.

The landscape of the project has not been identified by the GoG as a priority for conservation interest. The conservation initiatives in Guyana are largely focused on the larger forested landscapes of central and southern Guyana or in the Rupununi Savannas region. The conservation priority sites identified by the GoG include the legally protected areas of the Kanuku Mountains, the Shell Beach Protected Area, the Kaieteur National Park, the Iwokrama Rainforest Reserve, and the Community Owned Conservation Area at Konashen, and other areas of biological interest not legally protected including the Guyana Forestry Commission Moraballi and Mabura Reserves, the Orinduik Falls and Roraima Mountains. None of the legally protected areas and other areas of biological interest are located within the landscape of the project.

There are no recognized areas of global importance to biodiversity within the landscape of the project. There are no Zero Extinction Sites, proposed or listed Ramsar Wetland Sites within Guyana or officially designated areas in Guyana identified as Important Bird Areas (IBAs). However, Birdlife International has proposed a total of 10 IBAs for Guyana. Table 3-5 identifies the proposed IBAs for Guyana. None of the IBAs proposed for Guyana is located near or within the Pakaraima (Potaro-Siparuni District) landscape of the project. One proposed IBA is in the Pakaraima Mts, Cuyuni-Mazaruni District. The Pakaraima Mts (the areas of the Rio Branco gallery forest, and Tepuis) is listed as an endemic bird area (EBA) by Birdlife International.



**Table 3-5: Birdlife International IBAS Proposed for Guyana**

| IBA NAME                       | ADM UNIT                     |
|--------------------------------|------------------------------|
| Shell Beach                    | Barima-Waini                 |
| Karaw/Aruka                    | Barima-Waini                 |
| Ireng River                    | Upper Takatu-Upper Essequibo |
| North Rupununi-Karanambu Ranch | Upper Takatu-Upper Essequibo |
| Mapari-Kanuku Mountain         | Upper Takatu-Upper Essequibo |
| South Central Rupununi         | Upper Takatu-Upper Essequibo |
| Iwokrama                       | Potaro-Siparuni              |
| Karasabai                      | Upper Takatu-Upper Essequibo |
| Northeast Coastline            | Mahaica-Berbice              |
| Pakaraima Mountains            | Cuyuni Mazaruni              |

**Data obtained from BirdLife International (2019) Country profile: Guyana.**

**Website:** <http://www.birdlife.org/datazone/country/guyana> **Checked 2019/07/31**

The location of the project site in relation to the national Protected Areas, IBAs and recommended Ramsar Wetland Sites are shown in figure 3-20.

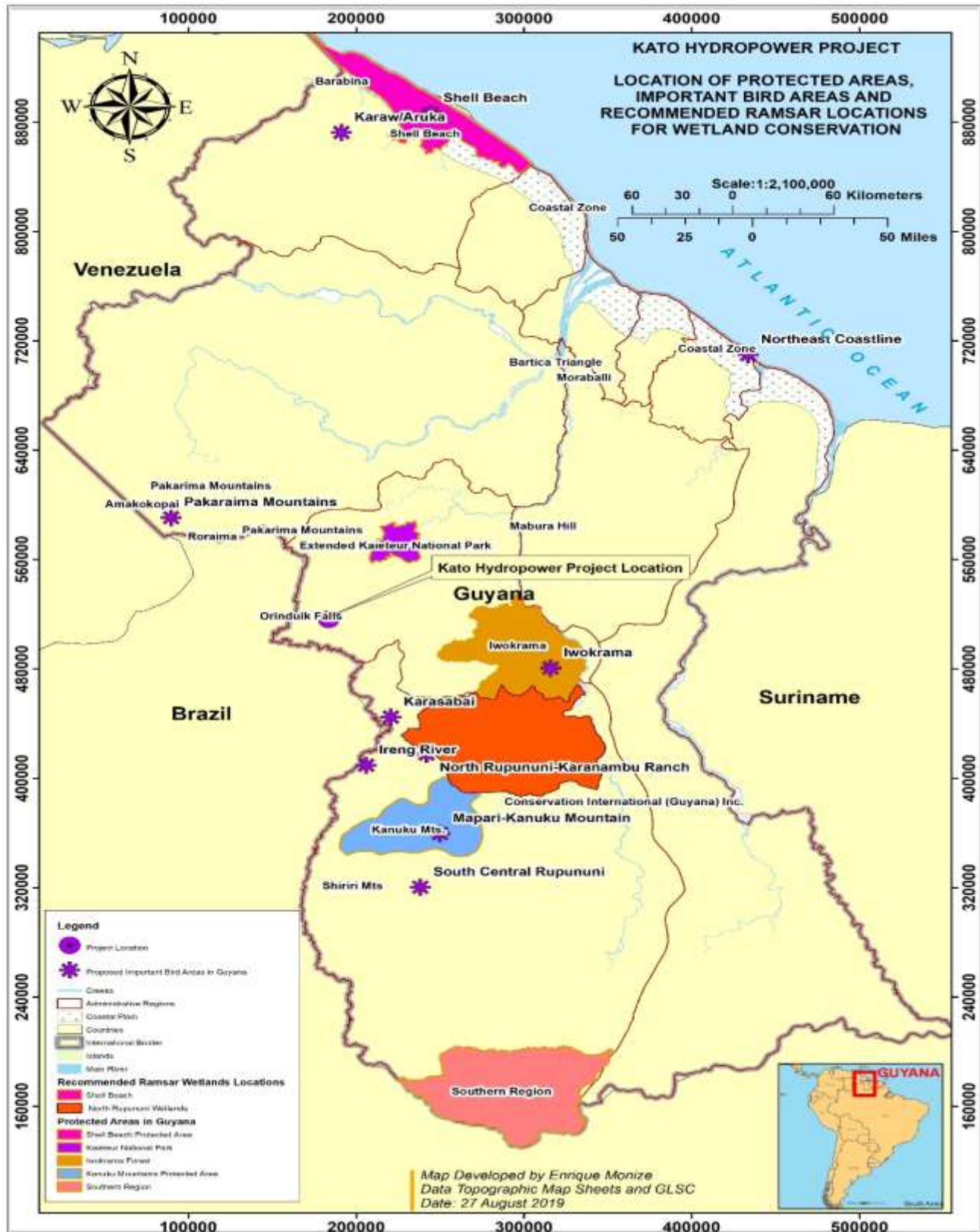


Figure 3-20: Location of Project Area in relation to Protected Areas, IBAs and Ramsar Sites

### 3.3 Socio-economic Environment

The village of Kato, where the project will occur is the main stakeholder regarding the hydroelectric project. As such, this section provides a socioeconomic profile of the community. Kato is a titled Amerindian community located in Region 8 in the foothills of the Pakaraima Mountains at approximately 310 km South West of the capital city of Georgetown.

In some instances the neighbouring villages of Kurukabaru and Paramakatoi are also used in the analysis to provide a greater understanding of the socioeconomic environment of the area. These villages are in close proximity to Kato and have residents with family ties.

#### 3.3.1 Access

The village of Kato can be accessed by air and land transportation.

There are four return flights per week on the Ogle to Kato route on Sundays, Mondays, Wednesdays and Fridays. These flights may be cancelled before leaving Ogle if there are not enough persons booked to fly.

Other forms of transportation out of the area include by road to Lethem which is the closest town located approximately 120 km away and for which the journey currently takes 8 hours by all terrain bikes, or 5 days by walking. Most persons prefer to travel to Brazil overland which is closer.

Paramakatoi and Kurukabaru villages are in proximity and are accessed by walking, all terrain bikes and four wheel drive vehicles. Other surrounding communities can also be accessed via these means. The communities surrounding Kato can be observed in figure 3-21.

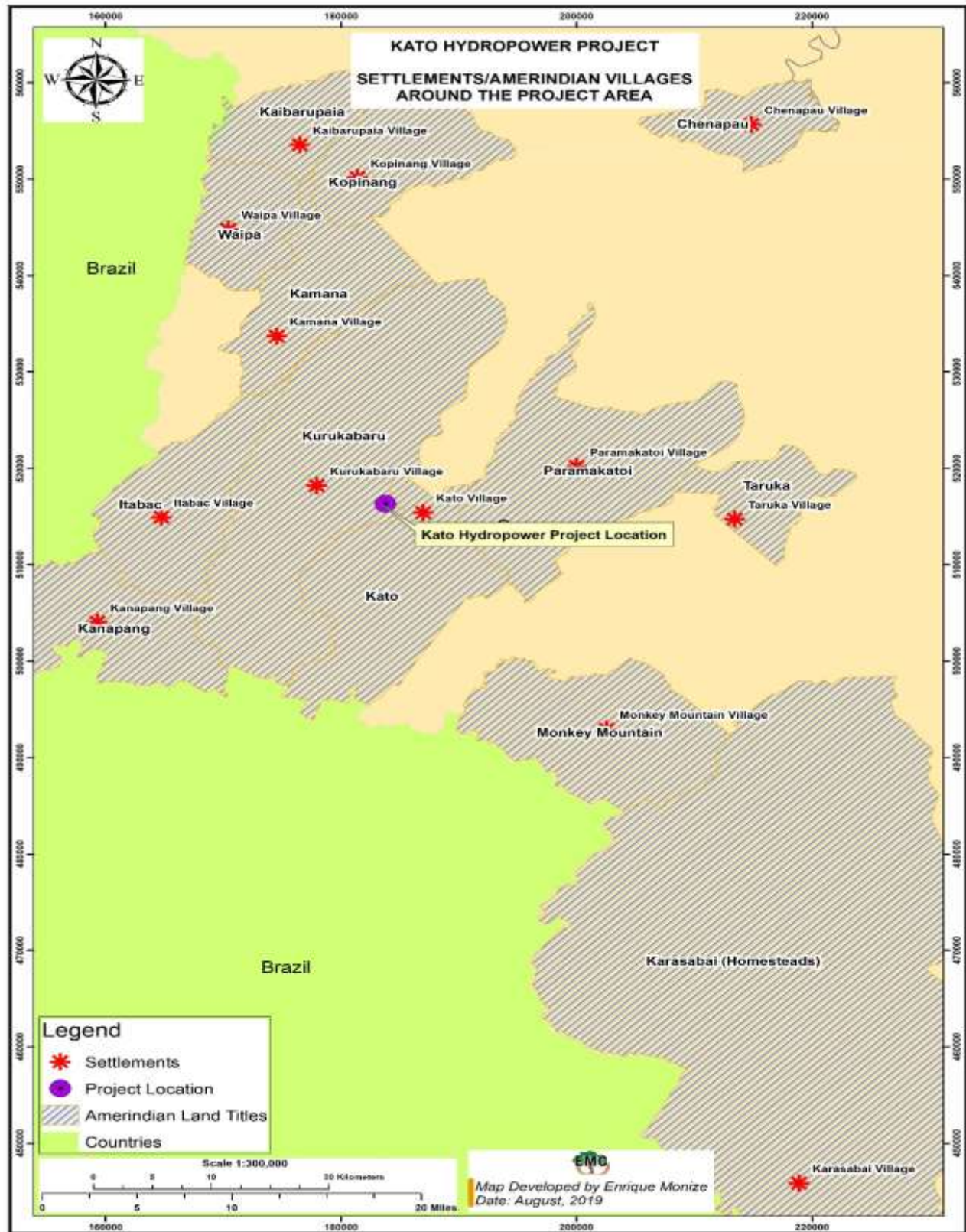


Figure 3-21: Communities in Proximity to Kato



### **3.3.2 Economic Activities/Land Use**

Within the community of Kato most persons reside in the area referred to as the plateau, followed by the valley, and then the farms.

The main economic activity in the village is subsistence farming of vegetables, peas, various seasonal crops including kidney beans and black eye peas. Crops are grown in the valleys and hill slopes that are not as dry as the table mountain plateaus. In the years previously, there was a Government operated farm which experimented on growing imported foods such as Irish potatoes. More recently, NAREI commenced activities to establish a research facility in Kato and a representative from NAREI is based in the village. The soil has been tilled on the identified land but there has been no further progress as there have been delays with the Ministry of Agriculture.

Livestock farming is also practiced at a subsistence level. There are approximately 60 heads of cattle in the village and some sheep are grazed in the valley. In addition, 'creole' chicken is reared for subsistence use and there is a project proximate to the school to rear the 'black giant' chickens.

Further, there are no mining, crafts or tourism initiatives in the village. Many young men travel to Brazil or to the mines for work resulting in migration out of the village. Currently, there is no influx of foreign nationals, such as Venezuelans, into the village.

There are four shops in the village one of which is run by the Village Council. There is a lot of trade occurring with communities located close to the border in Brazil.

There is ecotourism potential at the waterfall since it is often visited by villagers and visitors to the community. Residents of Kato use the falls for swimming and fishing. The main species of fish caught are sunfish, silverfish and hassar.

Within the wider project area the land use is similar to that which occur at Kato. The surrounding communities are mainly titled Indigenous communities that practice subsistence agriculture. The land use of the surrounding area can be observed in figure 3-23. As can be observed on the map some areas were allocated for mining activities.



**Figure 3-22: Residences in Kato**

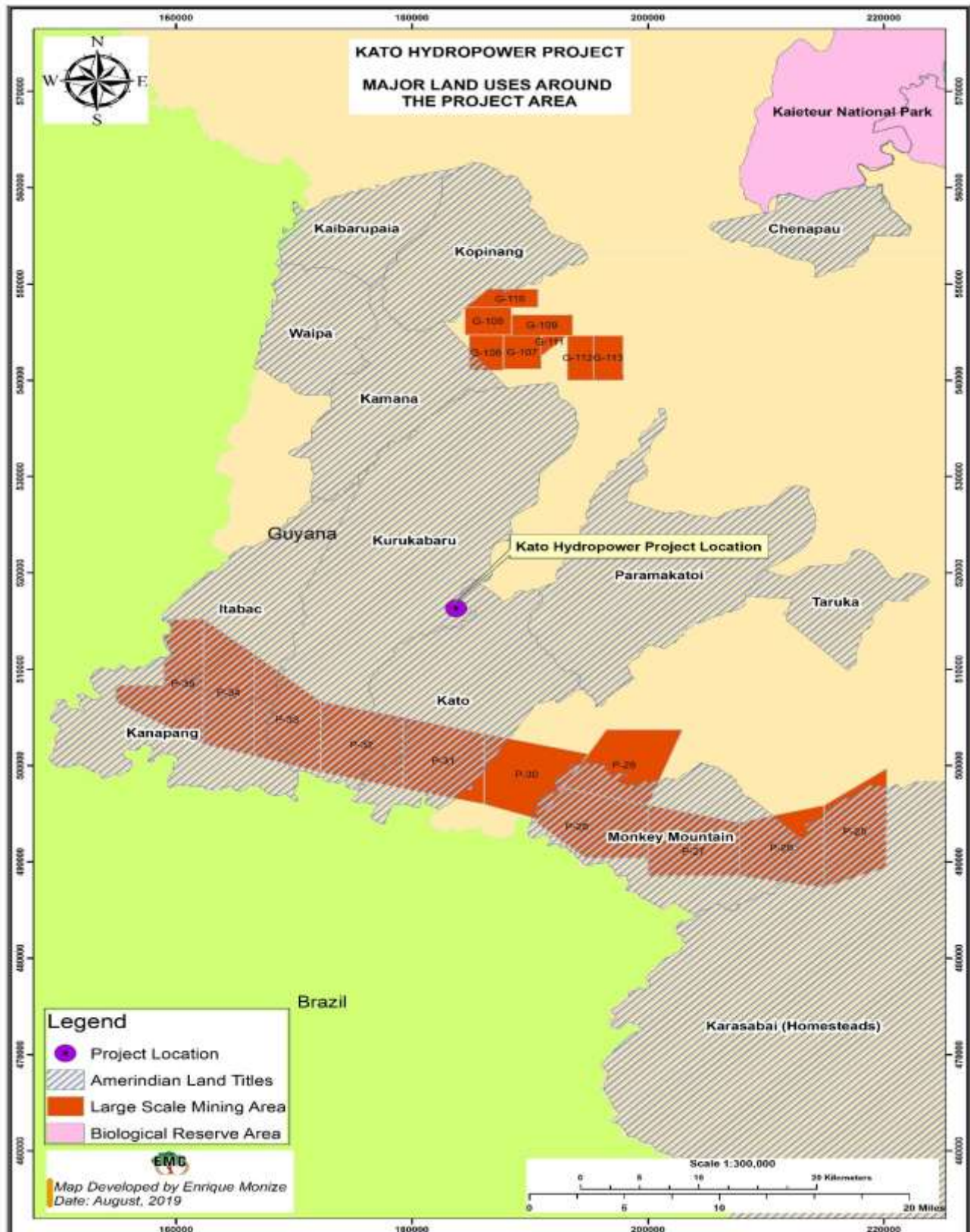


Figure 3-23: Land Use of the Surrounding Areas



### 3.3.3 Population and Demographics

Kato is populated by the Patamona People who have historically inhabited the Pakaraima Mountains and the Siparuni Delta.

Based on data collected in 2019 during the community engagements, the village has a population of 485 and is growing. It was indicated that there are more females than males. There are 105 households in Kato.

According to the 2012 National Census Report, the population of Kato was four hundred and twenty-four persons of whom two hundred and seven (49%) were males and two hundred and seventeen were females. Two hundred and forty-three (57%) of the total population of Kato were nineteen years old or under.

In the neighbouring Kurukabaru village, there were a total of six hundred and eighty-six persons of whom three hundred and seventy-two persons (54%) were male and three hundred and fourteen were female. A total of four hundred and twelve (60%) persons were nineteen years or younger in 2012. In Paramakatoi, there were a total of one thousand two hundred and twenty-three persons of whom six hundred and eighty-four persons (48%) were male and seven hundred and thirty-nine persons were female. Of the total population of Paramakatoi there were a total of seven hundred and seventy-five persons (54%) were nineteen years or younger in 2012.

**Table 3-6: Population of Kato and Neighboring Villages**

| VILLAGE     | MALE | FEMALE | TOTAL |
|-------------|------|--------|-------|
| Kato        | 207  | 217    | 424   |
| Kurukabaru  | 372  | 314    | 686   |
| Paramakatoi | 684  | 739    | 1423  |

*Source: Bureau of Statistics, Population & Household Census, 2012*

The three villages have almost balanced gender distributions with a greater percent of the people upwards fifty percent of nineteen years and younger. The gender distribution of Kato is most balanced with Kurukabaru having more males and Paramakatoi having more females in their respective populations.

### 3.3.4 Education

There are three schools located within Kato: a Nursery School with 16 students all of whom are from Kato; a Primary School with 94 students all of whom are from Kato; and a Secondary School with 304 students, 36 of whom are from Kato<sup>40</sup>. Other students who attend the Secondary School come from villages within the sub-region.

The villagers noted that only a few students sit the National Grade 6 Examinations resulting in lower rates of enrollment in Secondary School. However, more students are taking the examinations and the largest batch of Grade 6 students sat the examinations in 2019.

Youths from Kato who have completed secondary school have also attended the Kuru Kuru Training Centre and have qualifications in electrical, masonry and carpentry skills.

There is a Kato Learning Resource Centre and a Library at the Kato Secondary School which are utilized by villagers.

<sup>40</sup> Source: Community Consultations 2019

In 2012, there were one hundred and fifty-seven students from the village of Kato in school on a full time basis. In Kurukabaru there were a total of two hundred and eighty-one students in school while in Paramakatoi there were five hundred and thirty-five students in school. Paramakatoi also has a secondary school. However, the students have the choice to attend the school at Kato.

**Table 3-7: School Attendance of the Village Populations**

| VILLAGE     | FULL TIME | PART TIME | NO SCHOOL | TOTAL |
|-------------|-----------|-----------|-----------|-------|
| Kato        | 157       | 1         | 229       | 387   |
| Kurukabaru  | 281       | 0         | 337       | 618   |
| Paramakatoi | 535       | 1         | 759       | 1295  |

*Source: Bureau of Statistics, Population & Household Census, 2012*

In 2012, there were forty-six persons from Kato who did not attend school at any primary, secondary or any other level. There were eighty-nine persons who had attended primary school and two hundred and thirty-nine persons (62%) who has attended secondary school. Eleven persons had tertiary education inclusive of university.

In Kurukabaru, there were seventy-eight persons who had no formal education. One hundred and eighty-one persons had attended primary school and three hundred and fifty-three persons (57%) had attended secondary school. The percent of residents who attended secondary school is lower than that of Kato and rightly so considering that the school is located just out of Kato and approximately six hours walk away from Kurukabaru.

In Paramakatoi, there were one hundred and seventy-five persons who had not attended any school. A further one hundred and ninety-one residents had only attended primary school. A total of eight hundred and ten persons (62%) had attended secondary school and twenty persons had attended a tertiary level institution or university.

**Table 3-8: Level of Education by Villagers**

| VILLAGE     | NONE | PRIMARY | SECONDARY | TERTIARY/UNIVERSITY | TOTAL |
|-------------|------|---------|-----------|---------------------|-------|
| Kato        | 46   | 89      | 239       | 11                  | 387   |
| Kurukabaru  | 78   | 181     | 353       | 3                   | 618   |
| Paramakatoi | 175  | 291     | 810       | 20                  | 1,295 |

*Source: Bureau of Statistics, Population & Household Census, 2012*

### 3.3.5 Employment Status

Most persons within the Kato are engaged in subsistence agriculture. However, there are some persons employed in Government related jobs including at the RDC sub office, the schools, Cottage Hospital, etc. It is expected that the number of students attending the Kato Secondary School will increase and the number

In 2012 the village had 86 adults (79%) employed and twenty-two unemployed. In this same period Kurukabaru had thirty-seven persons (38%) and fifty-nine persons unemployed and Paramakatoi had one hundred and forty-one persons (67%) employed and seventy persons unemployed.

**Table 3-9: Level of Employment by Villagers**

| VILLAGE     | EMPLOYED | UNEMPLOYED | TOTAL |
|-------------|----------|------------|-------|
| Kato        | 86       | 22         | 108   |
| Kurukabaru  | 37       | 59         | 96    |
| Paramakatoi | 141      | 70         | 211   |

*Source: Bureau of Statistics, Population & Household Census, 2012*

In 2012, there were two hundred and seven persons (90%) either working or performing home duties at Kato. In Kurukabaru there were two hundred and sixty-five persons (78%) working or performing home duties and in Paramakatoi there were six hundred and seven persons (75%) working or performing home duties. Of the selected villages Kato had the highest percent of persons employed and the lowest number of persons in school (of work age) and performing home duties. Kato can absorb the employment opportunities provided by the project from its growing youthful population and also from the unemployed persons of the village.

**Table 3-10: Resident Employment Status for Selected Villages**

| VILLAGE     | WORKED | ATTENDED SCHOOL | HOME DUTIES | RETIRED | DISABLED | OTHER | TOTAL |
|-------------|--------|-----------------|-------------|---------|----------|-------|-------|
| Kato        | 109    | 13              | 98          | 4       | 2        | 4     | 230   |
| Kurukabaru  | 87     | 21              | 178         | 21      | 7        | 35    | 339   |
| Paramakatoi | 178    | 55              | 429         | 41      | 7        | 92    | 802   |

*Source: Bureau of Statistics, Population & Household Census, 2012*

### 3.3.6 Health Services

There is a total of twenty-three health care facilities in Region 8. There are sixteen Health Posts, five Health Centers, one Cottage Hospital at Kato and one District Hospital at Mahdia.

At Kato the Cottage Hospital is staffed with one Doctor, a Medic, a Community Health Worker and a cleaner. The hospital is capable of deliveries and minor health complications including dental care when the dentist visits the location. Serious or medical complications are taken to Mahdia District Hospital or to Georgetown. Villagers in this part of the region do seek medical care in Brazil where some pregnant women prefer to have their babies. It was indicated that the doctor has been absent from the hospital for most of 2019, having been present for two months in 2018.

The villages also rely on traditional medicine taken from the numerous plants and animal sources. Regular cures are derived for various illnesses such as diarrhea, vomiting, fatigue, headaches, and others. The local people believe that the use of traditional medicines are on the increase mainly due to the lack of drugs at the Cottage Hospital.

### 3.3.7 Other Services and Utilities

There is no phone signal in the village. However, internet and radio communication are available. There are four radios in the village at the Village Office, RDC Office, Health Centre and Police Station. Free wireless internet connection is available at the Kato Secondary School but there are also private service providers in the village. Some persons have satellite television.

Power is currently provided by solar panels mainly. At present, all households received 65-watt solar panels from the Government and this is used for electricity. Most households have two light bulbs powered by these panels. Some persons have generators but these are costly to run as the cost of

fuel is high at GYD 2500 per gallon. At the household level, residents use wood fuel for cooking and, in most cases, small kerosene lamps for lighting purposes.

For water supply, residents collect water from a spring, wells behind the village and solar-powered points at various locations throughout the village. It was indicated that water pressure drops during the dry seasons.

The village houses the Administrative Center of the sub-region managed by the Assistant Regional Executive Officer who reports to the Regional Executive Officer at Mahdia.

The village has a Police Station manned by two police officers.

There is a playground within the village which residents use for sports and other recreational purposes.

### **3.3.8 Administration and Governance**

In titled Amerindian villages, local Councilors and a Toshao are elected to office for a period of two years. The Toshao sits on the National Toshao Council and represent their villages/district at the RDC when the body meets every month. Kato has a Village Council in place, chaired by the Toshao.

The administration of the village lands falls directly under the jurisdiction of the Village Council. The council deals with issues specific to land management in coordination with the RDC while the Ministry of Indigenous Peoples Affairs deals with issues on Amerindian lands and with proposed extensions.

The RDC administers health care and local governmental functions at the village level. The RDC instructs on how Government facilities are to be utilized in all villages under its jurisdiction. The RDC of Region 8 is governed by a Regional Chairman who reports to the Ministry of Communities. Government facilities within Kato include the nursery, primary and secondary schools, the Cottage Hospital, the District Office for the RDC, the Regional Guesthouse and the Police Station.



**Figure 3-24: Government Buildings at Kato**

### ***3.3.9 Cultural and Anthropological Environment***

Evans and Meggers (1960: 327-332) conducted site excavation in the Rupununi and found eleven (28%) of the 39 sites contained historic materials that included glass, metal fragments and European trade beads. These artifacts were dated to be between 1780 and 1900. Based on these materials the scientists established the chronology of the Rupununi phase sites as dating within the last 200 years.

It is expected that the Kato village and neighboring areas will have the same type of materials and will be equally matched in Amerindian cultural sites as the area was inhabited for hundreds of years by the Patamona People. This claim finds support in the writings of Schomburgh who visited the location during his travels and reported a similar distribution of the Amerindians in the general area. Sites of archaeological importance were found in areas surrounding Kato, as is shown in figure 3-25.

There are no archaeological sites located in proximity to the waterfall. However, there is an old burial site located at one of the plateaus in the village (figure 3-26), suspected to be an historic burial site for the ancestors of the villagers.



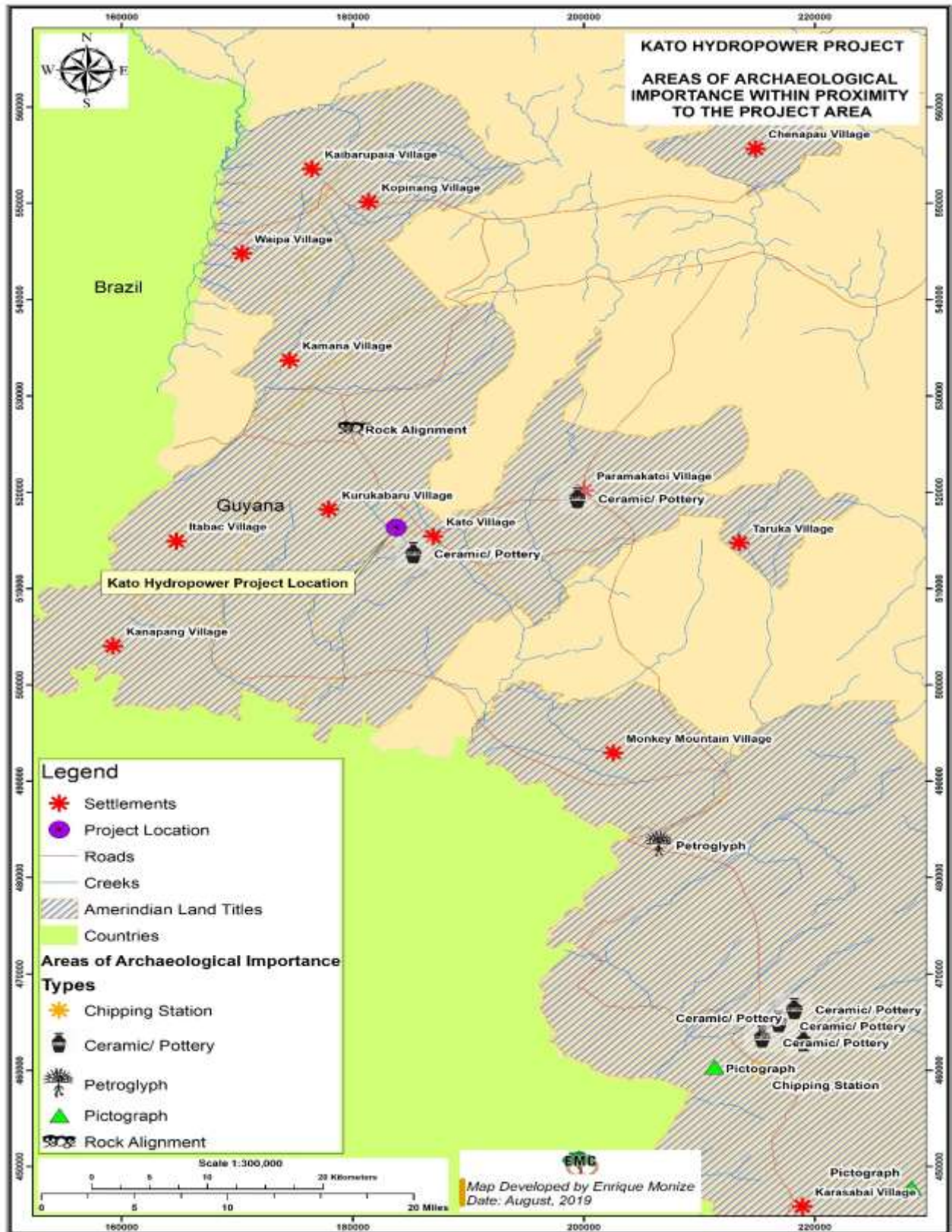


Figure 3-25: Archaeological Sites in the vicinity of Kato





**Figure 3-26: Plateau on which Historical Burial Site is Located**

#### 4.0 Policy, Legal and Institutional Framework

The 150 kW Kato Hydropower Project is required to be in compliance with Guyana's national environmental and energy related policies, legislation, and institutional frameworks, international treaties and conventions to which Guyana is signatory, and the environmental and social safeguards of the IDB. These are outlined in Table 4-1 below.

**Table 4-1: Relevant Legislation, Policies and Strategies**

|  |  |
|--|--|
| <b>Policies, Strategies, Plans</b>                 | Guyana Green State Development Strategy: Vision 2040 (2019)                  |
|  | Guyana National Energy Policy (1994)   |
|  | Green Paper for a Draft National Energy Policy (2017)                        |
|  | Guyana Power Sector Policy and Implementation Strategy (2010)                |
|  | Unserved Areas Electrification Programme (2010 – 2014)                       |
|  | Draft Hinterland Electrification Strategy (2007)                             |
|  | Guyana Energy Agency Strategic Plan 2016 – 2020                              |
|  | Low Carbon Development Strategy (2009, 2010, 2013)                           |
|  | National Development Strategy (2001 – 2010)                                  |
|  | Poverty Reduction Strategy Paper (2005)                                      |
| <b>Legislation</b>                                 | National Environmental Action Plan (1994)                                    |
|  | The Constitution of the Cooperative Republic of Guyana (1980 and 2013)       |
|  | Guyana Energy Agency Act (1997)  |
|  | Hydro-Electric Act (1956)  |
|  | Environmental Protection Act (1996)  |
|  | Environmental Protection Authorizations Regulations (2000)                   |
|  | Environmental Protection Air Quality Regulations (2000)                      |
|  | Environmental Protection Water Quality Regulations (2000)                    |
|  | Environmental Protection Noise Management Regulations (2000)                 |
|  | Environmental Protection Hazardous Wastes Management Regulations (2000)      |
|  | Environmental Protection (Litter Enforcement) Regulations (2013)             |
|  | EPA Guidelines for EIAs and EMPs   |
|  | Amerindian Act (2006)  |
|  | Labour Act (1942)  |
|  | Occupational Health and Safety Act (1997)                                    |
| <b>Institutional Framework</b>                     | Ministry of Public Infrastructure  |
|  | Guyana Energy Agency   |
|  | Hinterland Electrification Company Inc.                                      |
|  | Environmental Protection Agency  |
|  | Ministry of Communities (RDC Region 8)                                       |
|  | Kato Village Council   |
| <b>International and Regional Policy Framework</b> | Public Utilities Commission  |
|  | Agenda 21 and Rio +20  |
|  | UN Framework Convention on Climate Change and Paris Agreement                |
|  | Sustainable Development Goals - Agenda 2030                                  |
|  | The CARICOM Energy Policy (2013)   |
|  | The Caribbean Sustainable Energy Road Map and Strategy (2015)                |
|  | Draft Caribbean Community Environment and Natural Resources Policy Framework |
|  | IDB Policies   |

|                                      |  |
|--------------------------------------|--|
| <b>Other Policies and Guidelines</b> | International Hydropower Association Sustainability Guidelines |
|                                      | The Hydropower Sustainability Assessment Protocol              |
|                                      | The Hydropower Sustainability ESG Gap Analysis Tool            |

## 4.1 National Policies and Strategies

The importance of environment and energy to national development is reflected in the prominence and priority of these areas in several development policy documents and strategies over the last twenty plus years.

### 4.1.1 Green State Development Strategy: Vision 2040<sup>41</sup>

In 2019, the Green State Development Strategy: Vision 2040 (GSDS) was launched. The GSDS sets out to be a living example of Guyana's commitment to the planet, while ensuring the sustainable growth and economic well-being of its population. The GSDS built upon existing and prior national strategies, such as the National Development Strategy (NDS), the Poverty Reduction Strategy, and the Low Carbon Development Strategy (LCDS), among others, and whose principles are still relevant today. The GSDS is expected to guide the national development policies for the next 20 years with key sectors, such as renewable energy, infrastructure, and climate change resilience, among others.

One of the key longer-term goals for renewable energy in the GSDS is transitioning to near 100% renewable energy. The GSDS describes infrastructure development, including power generation from renewable energy sources, as a key driver for Guyana's economic transformation. In the immediate term, the intention is to assess and identify the most appropriate and cost-effective opportunities for renewable energy and at optimal sites.

Another key objective outlined in the GSDS relevant to the project is fortifying the national electricity grid in order to transmit and distribute a more reliable supply of energy in the short and medium term while at the same time placing focus on off-grid areas. Distributed or onsite generation is seen as a more flexible technology suited to serving dispersed communities of the hinterland in the short term and enabling the transition to renewable energy in the long term.

The GSDS also indicates that hinterland and rural electrification should focus on, where feasible, smaller, modular systems. This should involve expansion of the HECI/MoPI programmes in rural electrification through micro-grids, solar photovoltaic systems with batteries, run-of-river and river dam hydro, and hybrid renewable energy systems.

### 4.1.2 Guyana National Energy Policy<sup>42</sup>

In 1994, a National Energy Policy was prepared with policy objectives that were intended to provide stable, reliable and economic supply of energy; reduce dependency on imported fuels; promote where possible the increased utilization of domestic resources; and ensure energy is used in an environmentally sound and sustainable manner. Further, the Policy envisaged that hydropower, bagasse, wood waste and rice-husk would be promoted as future energy sources and more efficient use of energy would be promoted to satisfying energy demand over a ten years period. The Policy was expected to yield an increased utilization of national energy resources from 51.3 % to 61.5%, and reduced imported petroleum products from 48.7 % to 38.5% by 2004.

<sup>41</sup> Ministry of the Presidency, 2019. Green State Development Strategy, Vision 2040 Volume 1 – Policy Recommendations, Financial Mechanism & Implementation. Pg 5, 67 – 70.

<sup>42</sup> Government of Guyana, 1994. Energy Policy of Guyana. Pg 10.

#### **4.1.3 Green Paper for a Draft National Energy Policy<sup>43</sup>**

In 2017, a Green Paper for a Draft National Energy Policy was prepared to update the 1994 Energy Policy of Guyana. According to the Green Paper, the goal, consistent with the overarching goal of the GSDS, is to transition Guyana towards a goal of 100 percent renewable energy for electricity generation by the year 2025. The Green Paper recommended that the energy sector should be positioned as an engine of national economic growth. Among the policy objectives of the Green Paper is the diversification of energy sources away from imported fossil fuels to indigenous, renewable energy resources; achieving universal and equitable geographical distribution of green energy services at the least cost to consumers and enhancing environmental sustainability by minimizing the local and global negative environmental impact of the energy sector. Additional policy objectives include minimising the foreign exchange cost of energy to the national economy; increasing the efficiency of energy use per unit of Gross Domestic Product (GDP); and establishing a regional export trade of green energy services and commodities.

Hinterland electrification and hydropower were given significant consideration in the Green Paper. The HECL, within the MoPI, is expected to expand and improve its programmes for rural electrification with an emphasis on micro-grids, run-of-river and river-dam hydro, among other renewable sources of energy. At the national level, development of a hydropower programme is intended to solve the long-term energy problems that would see the construction of hydropower stations (micro, mini, small or large) for the supply of power for industrial, commercial, domestic, recreational, and other uses.

The Green Paper envisions that GoG will construct hydroelectric projects in hinterland regions. In addition, the Green Paper recommends collaboration between the GEA and EPA to ensure sustainable environmental management throughout the life cycle of hydropower projects including the impacts during planning, construction, and decommissioning phases; human health and safety impacts; water quality impacts; fish passage for migratory species; conservation and the protection of biodiversity; and monitoring and evaluation of mitigation measures. The Green Paper also suggest that the GEA develop and implement a community involvement strategy which would facilitate the application of the principles of “Free Prior and Informed Consent” in hinterland regions.

#### **4.1.4 Guyana Power Sector Policy and Implementation Strategy<sup>44</sup>**

The Guyana Power Sector Policy and Implementation Strategy was prepared in 2010. The Policy and Implementation Strategy had among its objectives the supply of reliable power at lowest possible sustainable costs with adequate energy security; utilization of local clean energy resources for electricity generation; development of efficient and environmentally sustainable energy production and consumption patterns; and increased households with access to electricity throughout Guyana.

It also outlined nine strategic areas of focus for the power sector over the medium term (2010 – 2014):

- Management and organization of the energy sector,
- Regulating the sector,
- Generation sources,
- National grid,
- Distribution,
- Hinterland electrification,
- Cost recovery,
- Self -generators,
- Energy conservation.

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43 Government of Guyana, 2017. Draft National Energy Policy of Guyana, Report 2, Green Paper. Pg 17 and 27

44 Klass, V, 2010. Guyana Power Sector Policy and Implementation Strategy. Pg 7 – 9, 11

In terms of electricity generation, the Implementation Strategy prioritized reducing the dependency on fossil fuel imports, and increasing renewable energy sources, with emphasis on developing hydropower potential, and other clean energy sources. Hinterland electrification efforts was also a priority in terms of institutional framework to create hinterland electrification infrastructure, and also to operate and maintain the supply system for securing reliable power supply at a price that the hinterland communities can afford. Energy efficiency and conservation measures were also addressed.

#### **4.1.5 Unserved Areas Electrification Programme<sup>45</sup>**

The UAEP was implemented by the GoG over the period 2004 – 2010 with loan support from the IDB. The UAEP focused on the expansion of the existing coastal electricity grid to unserved areas and examined ways in which hinterland areas could be provided with electricity in a cost effective and sustainable manner. With respect to the latter, there were several demonstration projects in hinterland communities to test their viability and possibility of replicating such projects in other hinterland communities.

##### **4.1.5.1 Hinterland Electrification Strategy<sup>46</sup>**

As part of the Hinterland Project Preparation Component of the UAEP there was a study of possible energy sources for various energy sources in the hinterland and the identification of electrification projects that would provide the basis for a comprehensive hinterland electrification programme. To this end, a Hinterland Electrification Strategy was prepared in 2007. The goals of the Strategy were to establish some form of electrification in each village (starting with social services and communal buildings) and supplying the entire village with electricity including working in collaboration with private initiatives/ investors.

The Strategy classified hinterland villages into three groups based on their existing access to electricity, population size, number of Government services and utilities located in the villages and subsequently identified potential energy sources and projects for various communities. With respect to hydropower, the Strategy aimed to implement a demonstration project for a micro or pico-hydro system using the run-of-the-river technology at the Chiung River over the period 2007 – 2009.

#### **4.1.6 Guyana Energy Agency Strategic Plan 2016 – 2020<sup>47</sup>**

The Strategic Plan for the GEA covering the period 2016 – 2020 outlines current initiatives in the energy sector and strategic objectives for the development of different sources of energy. With respect to hydropower, the Strategic Plan indicates that over the period 2016 – 2020 the GEA will:

- Develop and encourage the development and utilisation of sources of energy other than those sources presently in use.
- Conduct research into all sources of energy including those sources presently used will be conducted with the objective of generating energy.
- Review hydro-electric power projects to determine the suitability of design and conduct inspections during construction to ensure compliance with the plans in keeping with its mandate under the Hydroelectric Power Act.

In addition, the Plan indicates that the GEA will continue to support activities to develop hydropower sector and also work towards the development of run-of-the-river type hydropower stations under 100kW.

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<sup>45</sup> Ministry of Public Infrastructure: Hinterland Electrification Company Inc. Accessed August 2, 2019

<sup>46</sup> Government of Guyana, 2007. Hinterland Electrification Strategy. Pg. 6 and 15

<sup>47</sup> Guyana Energy Agency 2016. Guyana Energy Agency Strategic Plan. Pg. 40 – 41.

#### **4.1.7 Low Carbon Development Strategy<sup>48</sup>**

In June 2009, the GoG launched the LCDS, with the aim of transforming Guyana's economy on to a low carbon, sustainable development trajectory, while simultaneously assisting in combating climate change. The broad goals of the Strategy was transforming the economy to deliver greater economic and social development by following a low carbon development path. The key aspect of the LCDS was a payment for forest climate services model developed between Guyana and Norway and based on Reducing Emissions from Deforestation and Forest Degradation (REDD+). The LCDS was updated in 2010 and 2013 to reflect progress achieved in REDD+ results and the transition to a low-carbon economy.

The LCDS identified several priorities that would be the focus of Guyana's transition to a low carbon economy including renewable energy initiatives. Two such initiatives of direct relevance to this project include:

- The Amaila Falls Hydropower Project as the flagship project of the LCDS, and which was intended to deliver a steady source of clean, renewable energy that is affordable and reliable. The goal of the project was to eliminate at least 92% of Guyana's energy related greenhouse gas emissions. This project was put on hold in 2018.
- Hinterland Renewable Energy: The Hinterland Electrification Programme (HEP) supported the energy needs of households who do not have access to the national electricity grid through solar power home systems and investment in small-scale hydropower resources in the hinterland. Under this programme, the Government provided and distributed 11,000 65-watt solar home systems to Amerindian hinterland and riverine communities. This programme was implemented in collaboration with HECI.

The LCDS also indicated that a run-of-the river hydropower facility will be developed at Kato.

#### **4.1.8 National Development Strategy**

The NDS was launched in 1997 and outlined objectives and fundamental policy conditions for the country's development process over the next decade. Volume 3, Chapters 18 and 19 set out the overarching national policy framework and priorities for environment. The environmental policies promoted the sustainable management of natural resources and the preservation of a healthy environment as an integral part of Guyana's development agenda at that time. Environmental protection was not simply avoiding contamination, or cleaning up its after effects, but it also embraced efforts to manage renewable natural resources in a sustainable way, and that is why it was important that the Strategy incorporated new guidelines for management of fisheries and forests. In totality, environmental plans and policies covered the areas of liquid and solid waste management, coastal zone management, forest management, fisheries management, mining policies, Amerindian concerns, urban water supply, pesticide management, and protection of biodiversity, among others, as well as the institutional and legal aspects related to those issues. It also proposed the establishment of the EPA through the passage of the Environmental Protection Act.

Volume 5, Chapter 39 addressed the policy framework for the energy sector. Accordingly, some of key principal policy objectives for the energy sector were the following:

- To assure that an adequate and dependable supply of electricity is available for the country's future economic development. This includes improving both the quantity and the quality of the electricity supply.

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<sup>48</sup> Government of Guyana, 2013. The Low Carbon Development Strategy. Pg. 6 – 8.



- To reduce the dependency on imported petroleum products, where feasible.
- To provide increased utilization of new and renewable domestic energy resources.
- To ensure that energy is used in an environmentally sound and sustainable manner.
- To encourage, through public awareness programmes, energy conservation practices.

Renewable energy such as hydropower among other sources was given significant attention. The economic potential of hydropower was estimated to be in the region of 7000MW and was considered that a large part of the solution to the country's long-term power requirements would have relied on hydro-energy. It was evident that Hydro Power represented a major economic endowment and opportunity for Guyana both as a primary source of power for domestic consumption, and as the hub around which the development of the country's economic potential could revolve.

#### **4.1.9 Guyana Poverty Reduction Strategy (PRSP)<sup>49</sup>**

In 2001, the GoG embarked on the development of a Poverty Reduction Strategy with emphasis on policies to significantly reduce poverty. The first Poverty Reduction Strategy Paper (PRSP) aimed at generating economic growth, improving provision of social services, enhancing governance structures and progressing in a timely manner towards the achievement of the Millennium Development Goals (MDGs). Water resource protection and provision of access to electricity services to unserved rural coastal areas and communities in the hinterland interior were important areas of focus in the achievement of the strategy objectives.

Since the 2001 PRSP, Guyana has prepared two PRSP progress reports, one in 2004 and the other in 2005; and in 2008 prepared a second Poverty Reduction Strategy. A third PRSP was prepared in 2011 spurred on by changing economic and political developments that required a shift in strategy. This PRSP (2011-2015) focused achieving broad-based, low-carbon led job creation and economic growth and creating required infrastructure. One of the key pillars of the PRSP was the expansion and diversification of power supplies including the development of hydropower (including the Amaila Falls Hydropower Project) and establishing a Hinterland Electrification Unit to facilitate the implementation of the Hinterland Electrification Strategy.

#### **4.1.10 National Environmental Action Plan<sup>50</sup>**

A National Environmental Action Plan (NEAP) was first prepared in 1994 to identify the major environmental problems in Guyana and to formulate appropriate policies to address the causes and effects of the problems. A second NEAP was prepared and adopted in 2001. The second NEAP sets out the environmental management framework for Guyana in keeping with its commitment to international multilateral agreements. In addressing cross sectoral environmental issues related to land use, environmental health, integrated water resource management, and waste management, the NEAP committed to the implementation of several key actions. These include environmental education and public awareness, human resources development, institutional capacity building, inter-agency collaboration, public participation, information management and networking, acquisition of appropriate technology, and developing environmental legislation, and regulatory standards and controls. Importantly, it committed to executing environmental assessments for proposed development activities that may significantly affect the environment.

## **4.2 Legal Framework**

Several laws guide the energy and environment sectors in Guyana. These include the Constitution of Guyana (1980) with amendments (2003); the Environmental Protection Act, 1996; and Environmental

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<sup>49</sup> The Guyana Poverty Reduction Strategy Paper, 2001. Pg. 1 – 5, 129

<sup>50</sup> Government of Guyana, 1994; 2001. National Environmental Action Plan.

Protection Regulations 2000; and the Guyana Energy Agency Act (1997). This body of legislation offers a robust legal framework for the management of the environment and energy sectors.

#### **4.2.1 The Constitution of the Cooperative Republic of Guyana, 1980, and 2003 Reforms**

The Constitution of Guyana is the highest governing legal document and supreme law for the country. Articles 25, and 36 of the 1980 Constitution and 149 (J) of the 2003 amendments, outlines Guyana's environment related principles. Article 149(G) provides for the right to protection and preservation of Indigenous culture and way of life.

The importance of protection and management of the environment is also well recognized and given particular attention. This is outlined as follows:

- Article 25: *“Every citizen has a duty to participate in activities to improve the environment and protect the health of the nation.”*
- Article 36: *“The wellbeing for the nation depends upon preserving clean air, fertile soils, pure water and the rich diversity of plants, animals.”*
- Article 149J: (1) *“Everyone has the right to an environment that is not harmful to his or her health or wellbeing.”*
- Article 149(J): (2) *“The State shall protect the environment, for the benefit of present and future generations, through reasonable legislative and other measures designed to:*
  - *Prevent pollution and ecological degradation;*
  - *Promote conservation; And*
  - *Secure sustainable development and use of natural resources while promoting justifiable economic and social development”*
- Article 149(G): *“Indigenous peoples shall have the right to the protection, preservation, promulgation of their language, cultural heritage and way of life”*

#### **4.2.2 Environmental Protection Act (1996)**

The Environmental Protection Act, 1996, and the Environmental Protection Amendment Act 2005, establishes the basic institutional and regulatory framework within which all activities that may significantly impact on the natural, social, and cultural environments are assessed. The Act provides for the management, conservation, protection and improvement of the environment, the prevention or control of pollution, the assessment of the impact of economic development on the environment and the sustainable use of natural resources. The Act also provides that the EPA will be the central coordinating agency for environmental management in the relevant sectors in Guyana. The Act outlines the environmental authorisation process for new or existing projects being modified. Part IV of the Act addresses Environmental Impact Assessments (EIAs) and outlines the steps in seeking environmental authorization, the determination of whether a project will require an EIA, and the steps to be followed and scope of the EIA. Part 1V, section 11(1) of the Act set out that *“A developer of any project listed in the Fourth Schedule<sup>51</sup>, or any other projects which may significantly affect the environment, shall apply to the Agency for an environmental permit...”* This essentially means that investments and implementation of projects of the nature outlined in the fourth schedule or any other which has potential for significant impacts, an application has to be made to the EPA for an environmental permit.

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<sup>51</sup> Fourth schedule lists construction of any hotel, guest house or inn above ten rooms; installation for hydroelectric energy production, construction of road, harbours and airfields, dams, installation for treatment of waste water, industrial or domestic, importing of hazardous waste, release or keeping of genetically modified organisms, harvesting and utilisation of forest resources, and the extraction and conversion of mineral resources.

The GEA approached the EPA in 2017 for environmental authorization of the Kato Hydroproject. The EPA informed that an Environmental Risk Assessment and Management Plan is required to facilitate environmental authorization. The EPA Guidelines for preparing EMPs were provided as guidance.

#### 4.2.2.1 Environmental Protection Regulations, 2000

The Environmental Protection Act, 1996 comprises several subsidiary Environmental Protection Regulations. Those of direct relevance to the project are:

- The Environmental Protection Authorizations Regulations 2000
- The Environmental Protection Air Quality Regulations 2000
- The Environmental Protection Water Quality Regulations 2000
- The Environmental Protection Noise Management Regulations 2000
- The Environmental Protection Hazardous Wastes Management Regulations 2000
- The Environmental Protection (Litter Enforcement) Regulations 2013

These Regulations were developed to regulate and control the activities of development projects during construction and operation. The EPA has the responsibility to ensure the compliance of all new and existing activities to these Regulations by issuing the required authorizations and monitoring their operations.

**Table 4-2: Regulations relevant to the project under the Environmental Protection Act**

|   |  |
|---|--|
| <b>Environmental Protection (Authorizations) Regulations 2000</b> | The Regulations require development activities/facilities pertaining to industry (e.g. manufacturing, processing, handling, transport, storage, disposal) to be authorized by EPA, with specified conditions to avoid, minimise, and mitigate environmental impacts. It also provides for Environmental Impact Assessments (EIAs) where necessary (Section 3 of the Act). The EPA determined the types/categories of development that requires environmental authorization. The authorization process for both new and existing facilities including variances are outlined in these Regulations, Part 3, Section 17 and 20. |
|---|--|

| <b>Environmental Protection (Air Quality) Regulations 2000</b>                | <p>In accordance with these Regulations anyone who emits any air contaminant in the construction, installation, operation, modification or extension of any facility related to industry, commerce, agriculture or any institution shall apply to the EPA for an environmental authorization at least ninety days before the date on which the emission is to commence. In accordance with the Regulations the EPA shall establish the desirable air pollution limits. Currently, there are no nationally determined or established Air Quality standards, however the Agency is guided by and utilizes the World Health Organisation (WHO) and United States Environmental Protection Agency (USEPA) allowable limits. The Table below shows the WHO Air Quality Standards.</p> <p style="text-align: center;"><b>WHO Air Quality Standards</b></p> <table><tr><th>Element</th><th>Averaging Period</th><th>Acceptable Limit</th></tr><tr><td>Particulate Matter (PM 10)</td><td>24-hour</td><td>50 g/m<sup>3</sup></td></tr><tr><td>Particulate Matter (PM 2.5)</td><td>24-hour</td><td>25 g/m<sup>3</sup></td></tr><tr><td>Sulphur Dioxide</td><td>24-hour</td><td>20 g/m<sup>3</sup></td></tr><tr><td>Ozone (O<sub>3</sub>)</td><td>8-hour</td><td>100ug/m<sup>3</sup></td></tr><tr><td>Nitrogen Dioxide</td><td>1-hour</td><td>40ug/m<sup>3</sup></td></tr></table> | Element              | Averaging Period | Acceptable Limit | Particulate Matter (PM 10) | 24-hour | 50 g/m <sup>3</sup> | Particulate Matter (PM 2.5) | 24-hour | 25 g/m <sup>3</sup> | Sulphur Dioxide | 24-hour | 20 g/m <sup>3</sup> | Ozone (O <sub>3</sub> ) | 8-hour | 100ug/m <sup>3</sup> | Nitrogen Dioxide | 1-hour | 40ug/m <sup>3</sup> |
|---|--|----------------------|------------------|------------------|----------------------------|---------|---------------------|-----------------------------|---------|---------------------|-----------------|---------|---------------------|-------------------------|--------|----------------------|------------------|--------|---------------------|
| Element   | Averaging Period   | Acceptable Limit     |                  |                  |                            |         |                     |                             |         |                     |                 |         |                     |                         |        |                      |                  |        |                     |
| Particulate Matter (PM 10)  | 24-hour  | 50 g/m <sup>3</sup>  |                  |                  |                            |         |                     |                             |         |                     |                 |         |                     |                         |        |                      |                  |        |                     |
| Particulate Matter (PM 2.5)   | 24-hour  | 25 g/m <sup>3</sup>  |                  |                  |                            |         |                     |                             |         |                     |                 |         |                     |                         |        |                      |                  |        |                     |
| Sulphur Dioxide   | 24-hour  | 20 g/m <sup>3</sup>  |                  |                  |                            |         |                     |                             |         |                     |                 |         |                     |                         |        |                      |                  |        |                     |
| Ozone (O <sub>3</sub> )   | 8-hour   | 100ug/m <sup>3</sup> |                  |                  |                            |         |                     |                             |         |                     |                 |         |                     |                         |        |                      |                  |        |                     |
| Nitrogen Dioxide  | 1-hour   | 40ug/m <sup>3</sup>  |                  |                  |                            |         |                     |                             |         |                     |                 |         |                     |                         |        |                      |                  |        |                     |
| <b>Environmental Protection (Hazardous Waste Management) Regulations 2000</b> | <p>These Regulations outline the rules and procedures for transport, storage, treatment and disposal of hazardous wastes and are intended to ensure, through the environmental authorization process, that all operations that generate, transport, treat, store and dispose of hazardous wastes are managed in a manner that protects human health and the environment. The Regulations allow for the provision of information on the types of facilities and quantity of hazardous waste generated, treatment standards and efforts to reduce the waste generated. An Emergency Preparedness Plan is required for anyone who operates a hazardous waste facility. These regulations also apply to any activity that generates Hazardous waste. Hazardous waste is defined and a schedule of materials considered hazardous is provided in these regulations.</p>   |                      |                  |                  |                            |         |                     |                             |         |                     |                 |         |                     |                         |        |                      |                  |        |                     |
| <b>Environmental Protection (Noise Management) Regulations 2000</b>           | <p>Under these Regulations operations that emit noise in the execution of various activities such as construction, transport, industry, commerce and any institution are required to apply to the Agency for an environmental authorization. The EPA is responsible for the establishment of standards for permissible noise levels in industry, construction and other areas. The EPA may grant authorization for noise emission unconditionally or subject to conditions and may require environmental audit procedures. The GNBS and the EPA together with other relevant agencies developed standards for noise emissions into the environment. Residential, Institutional, and Educational daytime and night-time decibel limits are 75 and 60 respectively. Industrial and transportation limits are set at 100 and 80 dB, Commercial at 80 and 65, Construction at 90 and 75, and Recreational at 100 (between 18:00-01:00hrs), and 75 (01:00-08:00hrs).</p>  |                      |                  |                  |                            |         |                     |                             |         |                     |                 |         |                     |                         |        |                      |                  |        |                     |
| <b>Environmental Protection (Water Quality) Regulations 2000</b>              | <p>These Regulations require an environmental authorization for construction, installation, operation, modification/extension of facilities that discharge effluents. Requirements and guidelines on the discharge of effluents and disposal of sludge are provided. The EPA and Guyana National Bureau of Standards (GNBS) developed Interim Guidelines for Industrial Effluent</p>   |                      |                  |                  |                            |         |                     |                             |         |                     |                 |         |                     |                         |        |                      |                  |        |                     |

|   | <p>Discharges into the Environment and these are currently being used by the EPA. The EPA also adopts the WHO and USEPA standards for surface and potable water when applicable. Draft Water Quality Guidelines have also been developed by the EPA.</p> <p style="text-align: center;"><b>GNBS Industrial Effluent Discharge Limits</b></p> <table border="1"> <thead> <tr> <th>Parameter</th><th>Acceptable Standard</th></tr> </thead> <tbody> <tr> <td>Ph</td><td>5.0 – 9.0</td></tr> <tr> <td>Conductivity</td><td>53 (ms/cm)</td></tr> <tr> <td>Total Suspended Solids</td><td>10 mg/l</td></tr> <tr> <td>Dissolved Oxygen</td><td>&gt;50 mg/l</td></tr> <tr> <td>Turbidity</td><td>&lt;25 NTU</td></tr> <tr> <td>Temperature</td><td>&lt;40</td></tr> <tr> <td>Oil and Grease</td><td>25 mg/l</td></tr> <tr> <td>Aluminum</td><td>0.03 mg/l</td></tr> <tr> <td>Sulphate</td><td>400 mg/l</td></tr> <tr> <td>Copper</td><td>0.05 mg/l</td></tr> <tr> <td>Iron</td><td>0.3 mg/l</td></tr> <tr> <td>Zinc</td><td>5 mg/l</td></tr> </tbody> </table> | Parameter | Acceptable Standard | Ph | 5.0 – 9.0 | Conductivity | 53 (ms/cm) | Total Suspended Solids | 10 mg/l | Dissolved Oxygen | >50 mg/l | Turbidity | <25 NTU | Temperature | <40 | Oil and Grease | 25 mg/l | Aluminum | 0.03 mg/l | Sulphate | 400 mg/l | Copper | 0.05 mg/l | Iron | 0.3 mg/l | Zinc | 5 mg/l |
|---|---|-----------|---------------------|----|-----------|--------------|------------|------------------------|---------|------------------|----------|-----------|---------|-------------|-----|----------------|---------|----------|-----------|----------|----------|--------|-----------|------|----------|------|--------|
| Parameter   | Acceptable Standard   |           |                     |    |           |              |            |                        |         |                  |          |           |         |             |     |                |         |          |           |          |          |        |           |      |          |      |        |
| Ph  | 5.0 – 9.0   |           |                     |    |           |              |            |                        |         |                  |          |           |         |             |     |                |         |          |           |          |          |        |           |      |          |      |        |
| Conductivity  | 53 (ms/cm)  |           |                     |    |           |              |            |                        |         |                  |          |           |         |             |     |                |         |          |           |          |          |        |           |      |          |      |        |
| Total Suspended Solids  | 10 mg/l   |           |                     |    |           |              |            |                        |         |                  |          |           |         |             |     |                |         |          |           |          |          |        |           |      |          |      |        |
| Dissolved Oxygen  | >50 mg/l  |           |                     |    |           |              |            |                        |         |                  |          |           |         |             |     |                |         |          |           |          |          |        |           |      |          |      |        |
| Turbidity   | <25 NTU   |           |                     |    |           |              |            |                        |         |                  |          |           |         |             |     |                |         |          |           |          |          |        |           |      |          |      |        |
| Temperature   | <40   |           |                     |    |           |              |            |                        |         |                  |          |           |         |             |     |                |         |          |           |          |          |        |           |      |          |      |        |
| Oil and Grease  | 25 mg/l   |           |                     |    |           |              |            |                        |         |                  |          |           |         |             |     |                |         |          |           |          |          |        |           |      |          |      |        |
| Aluminum  | 0.03 mg/l   |           |                     |    |           |              |            |                        |         |                  |          |           |         |             |     |                |         |          |           |          |          |        |           |      |          |      |        |
| Sulphate  | 400 mg/l  |           |                     |    |           |              |            |                        |         |                  |          |           |         |             |     |                |         |          |           |          |          |        |           |      |          |      |        |
| Copper  | 0.05 mg/l   |           |                     |    |           |              |            |                        |         |                  |          |           |         |             |     |                |         |          |           |          |          |        |           |      |          |      |        |
| Iron  | 0.3 mg/l  |           |                     |    |           |              |            |                        |         |                  |          |           |         |             |     |                |         |          |           |          |          |        |           |      |          |      |        |
| Zinc  | 5 mg/l  |           |                     |    |           |              |            |                        |         |                  |          |           |         |             |     |                |         |          |           |          |          |        |           |      |          |      |        |
| <b>Environmental Protection (Litter Enforcement) Regulations 2013</b> | <p>These Regulations provide for the enforcement against litter offences. It is an offence under these regulations to (a) place litter in a public place; (b) permit or cause another person to litter a public place or; (c) have litter on private premises that pose a health risk. The fine for an individual found littering in a public place is \$50,000, while for body corporate it is \$100,000. A fixed penalty of fifteen thousand dollars (\$15,000) is offered to offenders who accept liability for the offence committed. Under the Litter Prevention Regulations, the NDCs and RDCs are to provide receptacles in public places. Further, every Council shall make appropriate provision for the prompt, efficient and regular emptying of the contents of the receptacles and for the removal and disposal of those contents.</p>   |           |                     |    |           |              |            |                        |         |                  |          |           |         |             |     |                |         |          |           |          |          |        |           |      |          |      |        |

#### 4.2.2.2 EPA Guidelines

The EPA has several Environmental Management Guidelines for varying activities in keeping with the Environmental Protection Regulations of 2000. The Guidelines relevant to this project are outlined below.

#### **EPA Environmental Impact Assessment Guidelines, Volume 1, Rules and Procedures for Conducting and Reviewing EIAs, 2004<sup>52</sup>**

The intention of these guidelines is to provide to the EPA, Environmental Assessment Board (EAB), sector agencies, private sector, Non-Governmental Organisations (NGOs), members of the public and consultants a set of approved guidelines for the conduct and review of EIAs in Guyana.

The EPA's permitting process varies depending on the type of project, its scale and potential environmental impacts. The environmental permit process is initiated by an application through a prescribed authorization application form. The Form outlines specific and general information required by the EPA for screening of the project. Following an application for environmental permit along with

<sup>52</sup> Environmental Protection Agency, 2004. Environmental Impact Assessment Guidelines, Volume 1, Rules and Procedures for Conducting and Reviewing EIAs.

the required documentation, the EPA will review and determine if the project will not significantly affect the environment, and therefore exempt from the requirement for an EIA; or the project may significantly affect the environment and will require an EIA. If an EIA is required the process to be followed is outlined in section 11 of Act, and guidelines provided by the EPA. Either of these decision triggers a public notification and participation in the decision-making. If an EIA is not required the EPA may request an environmental assessment and accompanying ESMP. Both the EIA and the ESMP will assist the EPA, along with the results of public inputs, and in the case of an EIA, recommendations from the Environmental Assessment Board<sup>53</sup>, to make its decision to reject the project or approve and set appropriate terms and conditions in the environmental permit.

The process to obtain the environmental authorization can take from 2 to 6 months, sometimes longer where an EIA is required. After the EIA/ESMP approval, EPA will issue an Environmental Permit (EIA projects), or Construction, or Operations permit (EIA not required projects) with stipulated conditions.

The GEA submitted the required application and supporting documents and the project received environmental authorization. The conduct of an environmental assessment and preparation of an ESMP was a main condition under which the authorization was granted.

#### **4.2.2.3 Environmental Management Plan (EMP) Guidelines**

An EMP provides a description of the methods and procedures for mitigating and monitoring impacts, and contains environmental objectives/targets which the developer needs to accomplish in order to reduce or eliminate negative impacts.

The objectives of the EMP are to:

- Place the proposed or existing activity in the context of the local and regional environment;
- Adequately describe all components of the proposed/existing activity, so that the Agency can consider approval of a well-defined project, and prescribe relevant and adequate Permit Conditions for the monitoring of the activity;
- Identify the environmental issues/risks associated with the proposed/existing activity;
- Provide the basis of the developer's environment management program, which shows that the environmental impacts resulting from the proposed/existing activity, including cumulative impacts, can be acceptably managed; and
- Provide a document that clearly sets out the reasons why the proposed/existing activity should be considered environmentally acceptable.

#### **4.2.3 Guyana Energy Agency (GEA) Act, 1997**

The GEA Act 1997 (Act No. 31 of 1997) established the GEA. The GEA Act was amended in 2004, 2005, and 2011. The Act outlines the functions of the Agency and makes provisions for the Agency to exercise function under the Hydro- Electric Power Act. The GEA Act is supported by the Petroleum and Petroleum Products Regulations 2014.

#### **4.2.4 Hydro-Electric Power Act, 1956**

The Hydro-Electric Power Act makes provisions for granting licenses for authorising the use of Guyana's waters for the generation of electrical energy. The Act applies to, inter alia, all State water-powers (water powers in lakes, falls, rivers or streams which can be used to generate electricity) and

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<sup>53</sup> Section 18 of the Act established an Environmental Assessment Board, and third schedule outlines the constitution of the Board. Section 19 of the Act articulates the functions of the Board which includes the conduct of public hearings into appeals; and as may be necessary into EIA to make recommendations to the EPA whether an EIA should be accepted, rejected or amended; whether an environmental permit should be issued; and what terms and conditions should be included in the permit.



lands and properties which may be acquired in connection with State water-powers. Under the Act, the President may grant a licenses for the diversion, storage and use of rivers for generating electrical energy; the construction and maintenance of the plant; establishment of the transmission and distribution network; and the purposes for which generated energy may be utilised. Licenses may also specify the price at which electricity will be sold to consumers and any other terms such as rents or royalties. Grounds for waiving licenses and cancelling licenses are also provided for in the Act. The Act also makes provisions for the expropriation of titles or interests to privately owned land, consistent with the provisions of the State Lands Resumption Act, for creating, protecting or developing any water-power. All plans of proposed works must be filed with the Chief Works and Hydraulics Officer and approved by the Minister before construction commences. In practice, the GEA fulfils the role of the Chief Works and Hydraulics Officer. The Hydro-Electric Power Act was amended in 2013.

#### **4.2.5 Amerindian Act, 2006**

The Amerindian Act, 2006 provides for the recognition and protection of the collective rights of Amerindian Villages and Communities, the granting of lands to Amerindian Villages and Communities, and the promotion of good governance within Amerindian Villages and Communities. The Act gives Amerindian villages legal rights to manage and conserve their lands. A village can prohibit or control entry and access to its territory and traditional knowledge, prohibit or control mining, zone its lands, protect sacred sites, regulate hunting, fishing, tourism, research etc. All Amerindian lands are owned collectively by the whole community (technically called a “Village”) and administered through a Village Council. The Village Council is elected by the community and is a recognised legal entity.

Other key provisions of the Act addressed Environmental Protection. The Amerindian Act supports the need for the communities to use their natural resources in a way that lends support to the concept of sustainability. Impact Assessments are required to be completed in accordance with the Environmental Protection Act. Other provisions include Intellectual Property Rights, good governance, rights to traditional mining and role in determining forest harvesting licenses on their lands and on what terms, and consultations.

The project site identified for the construction and operation of the hydropower plant is in the titled Amerindian village of Kato. The Government has obtained formal approval from the Village Council to move forward with the project.

#### **4.2.6 Labour Act, 1942**

The Labour Act of 1942 specifies the conditions that an employer must observe in the contracting employees. Part V specifies that the entire wages of the employee must be paid as money and not otherwise. However, in occupations where it is customary to make partial payment of allowances in the form of food, toiletries, housing etc. these are acceptable and not considered illegal, if both the employer and employee are agreed on such terms.

This Act will come into forces in particular during the construction phase of the hydropower plant and the establishment of the transmission and distribution system and will be applicable so as to ensure that workers under the project are not mistreated, paid adequately in accordance with the Laws of Guyana and have proper representation.

#### **4.2.7 Occupational Health and Safety Act, 1997**

The Occupational Safety and Health Act 1997 defines the responsibilities of management and workers with respect to safety and health and applies to every workplace in Guyana. The Act makes provisions for the registration of industrial establishments, the establishment of an Occupational Safety and Health Authority, the establishment of a National Advisory Council on Occupational Safety and Health,

the duties of employers, workers and other persons, treatments of accidents and occupational diseases, and occupational safety and health regulations. The Act authorises OH&S inspectors to enter and inspect workplaces.

Under this Act the employer has a responsibility to establish a joint workplace safety committee consisting of four (4) persons. When the workplace has more than fifty (50) persons, the committee should consist of six (6) persons of which at least half the numbers should be workers who do not exercise managerial functions and should be selected by the workers themselves. Employers also have duties of providing protective devices for workers, providing instructions and supervision to ensure the safety of workers, maintaining a medicine chest and establishing an occupational health service for workers. At a construction site, employers must ensure that the requirements of the Act are implemented and that the safety and health of workers are protected onsite.

This Act will apply especially during the construction phase of the hydropower plant and the installation of the transmission and distribution system.

#### **4.2.8 Additional Legislation**

Other pieces of legislation which may be applicable include:

- Wildlife Conservation and Management Act 2016
- Wild Birds Protection Act 1973
- Prevention of Discrimination Act 1997
- Employment of Young Persons and Children Act 1983
- National Insurance and Social Security Act 1969
- Energy Sector (Harmonization of Laws) Act 2002
- Hydro-Electric Power Act, 1956 with amendments in 1988
- Electricity Sector Reform Act 1999 with amendments in 2010
- Public Utilities Commission Act 1999 with amendments in 2010.

### **4.3 Institutional Framework**

The Institutional arrangement for energy and environment straddles several Ministries of Government and Agencies. The key players that contribute to development and achievement of policy and legislative objectives relevant to energy and environment in Guyana are identified below.

#### **4.3.1 Environmental Protection Agency**

The EPA oversees the effective management, conservation, protection and improvement of the environment and takes the necessary measures to ensure the prevention and control of pollution, assesses the impact of economic development on the environment and the sustainable use of natural resources. The Agency is governed by a Board of Directors but falls under the direct supervision of the Department of Environment, Ministry of the Presidency. The Agency was established in 1996 by the Environmental Protection Act and is responsible for the development and enforcement of national environmental legislations and advises the GoG on the development and implementation of environmental policies and standards. It also undertakes the inspection and enforcement of matters dealing with the environment, conservation and natural resources and administers the environmental permitting process in Guyana.

In Sec. 4 (1) (a), of the Act, the EPA is given the mandate to *“take such steps as are necessary for the effective management of the natural environment so as to ensure conservation, protection and sustainable use of its natural resources”*. In addition the Agency is given the overall responsibility to ensure management of the natural environment to ensure conservation, protection and sustainable

use of its natural resources; assess any developmental activity, which may cause an adverse effect on the natural environment before such activity commences; and coordinate and maintain a programme for the conservation of biological diversity and its sustainable use. The EPA is mandated to ensure that any project that may have a significant impact on the environment must acquire an Environmental Authorisation from the EPA. Projects are considered to have an environmental impact when they threaten the health, safety and natural life supporting systems of humans and other living things.

The EPA will be responsible for the issuance of environmental authorisation for the project through an Environmental Permit, and to monitor compliance in accordance with the provisions of the Environmental Permit.

#### **4.3.2 Ministry of Public Infrastructure**

The MOPI is responsible for the planning, creation and maintenance of major public civil works infrastructure throughout Guyana. Several key agencies fall under the Ministry, including the GEA, HECI, Works Services Group, Maritime Administration Department, Guyana Civil Aviation Authority, Guyana Power and Light Inc. (GPL), etc. The MOPI is the Minister responsible for energy and electricity and gives directions as to the policy to be followed by the GEA in the performance of its functions. The MOPI has principal policy-making and regulatory responsibility in the sector, including granting licenses to the public utilities and independent power producers and approval of development and expansion plans and operating standards and performance targets for GPL, the principal supplier of electricity.

#### **4.3.3 Guyana Energy Agency**

The GEA falls under the purview of the Minister of Public Infrastructure as the Minister responsible for energy and electricity. GEA's organization structure consists of a Board of Directors, Chief Executive Officer, Deputy Chief Executive Officer (unfilled), Secretariat and the following five Divisions:

- Energy & Energy Statistics Division,
- Legal & Licensing Division,
- Fuel Marking Division,
- Administration/Human Resource Division, and
- Finance Division.

GEA's mission is to ensure the rational and efficient use of imported petroleum-based energy sources, while encouraging where economically feasible and environmentally acceptable, increased utilization of indigenous new and renewable sources of energy. The Act makes provisions for the core functions of the Agency, the following of which are relevant to the project:

- To advise and make recommendations to the Minister regarding any measures necessary to secure the efficient management of energy and the source of energy in the public interest and to develop and encourage the development and utilisation of sources of energy other than sources presently in use;
- To develop a national energy policy and secure its implementation;
- To carry out research into all sources of energy including those sources presently used in Guyana for the generation of energy, and securing more efficient utilisation of energy and sources of energy;
- To monitor the performance of the energy sector in Guyana, including the production, importation, distribution and utilisation of petroleum and petroleum products;
- To disseminate information relating to energy management, including energy conservation and the development and utilisation of alternative sources of energy.

- To study and keep under review matters relating to the exploration for, production, recovery, processing, transmission, transportation, distribution, sale, purchase, exchange and disposal of energy and sources of energy;
- To report and recommend to the Minister measures the Agency considers necessary or in the public interest for the control, supervision, conservation, use and marketing and development of energy and sources of energy;
- To prepare studies and reports at the request of the Minister on any matter relating to energy or any source of energy, including research into alternative sources of energy, or the application of such research, and to recommend to the Minister the making of such arrangements as the Agency considers desirable for cooperation with governmental or other agencies in or outside Guyana in respect of matters relating to energy and sources of energy;
- To advise the Minister or assigned authority on matters relating to the administration and discharge of the functions of the Electricity Sector Reform Act 1999.

The GEA was integral in the conceptualization and development of the project and is expected to assist HECI in overseeing its implementation.

#### ***4.3.4 Hinterland Electrification Company Inc.***

The HECI has its genesis in the Project Execution Unit (PEU) of the Office of the Prime Minister, Guyana. The PEU was established in 2004 to manage the implementation of the GoG/IDB sponsored UAEP. The main objectives of the UEAP were (i) to expand existing coastal electricity grids to unserved areas within a feasible distance from the grids, and (ii) to examine ways in which hinterland areas could be provided with electricity in the most cost effective and sustainable manner. With regard to the latter, the PEU implemented several demonstration electricity projects in hinterland communities to test their viability for possible replication in other communities.

In 2015 HECI was incorporated as a subsidiary of the National Industrial and Commercial Investments Ltd. (NICIL) for holding of all satellite electricity companies owned by NICIL. The satellite companies are as follows:

- Linden Electricity Company Inc. (LECI)
- Kwakwani Utilities Inc. (KUI)
- Lethem Power Company Inc. (LMPC)
- Port Kaituma Power & Light Inc. (PKPL)
- Mahdia Power & Light Inc. (MPL)
- Matthew's Ridge Power & Light Inc. (MRPL)

The HECI is now part of the MoPI. The HECI's mission is to maintain the steady extension and upgrade of electricity supply systems across the hinterland, progressively improving operations and merging isolated services as appropriate.

HECI is overseeing the development and implementation of the project. During the operational phase HECI plans to establish a Government owned company to manage the facility.

#### ***4.3.5 Ministry of Communities (RDC of Region 8)***

The Local Government System is enshrined in the Constitution of Guyana. Chapter VII, Section 71(1) state that Local Government is a vital aspect of democracy and shall be organised so as to involve as many people as possible in the task of managing and developing the communities in which they live.

The Ministry of Communities has responsibility for overseeing Local Government, which comprises the RDCs, the municipalities and the neighbourhood democratic councils. The project location is within

the RDC of Region 8. This entity has an important role to play as a key stakeholder to be engaged in the planning and implementation of the project. The RDC is expected to be part of the Government owned company which will manage the operation of the facility. The RDC will also be a main beneficiary of the project, since it has sub-offices located at Kato Village.

#### **4.3.6 Public Utilities Commission**

The PUC is responsible for monitoring and enforcing operators' compliance with commitments to customers. These include commitments emanating from licenses and standard terms and conditions for operations, including operating standards and performance targets and development of expansion plans; the handling of consumers' complaints; and advising the MOPI on these issues. The PUC also is responsible for confirming and approving tariffs charged by public suppliers.

#### **4.3.7 Kato Village Council**

Indigenous communities are governed by a Village Council, comprising of a Toshao and Councilors. The Village Council is elected by members of the community and the process is outlined in the Amerindian Act.

The community of Kato has a Village Council in place which has already granted permission in 2017 for the construction of the hydropower project. It is expected that during the construction phase of the project the Village Council will have some oversight, including ensuring the contractor complies with the village rules, approving of staging areas and construction material sources, etc. During the operational phase it is expected that the Village Council will be a part of the Government owned company which will be set up to manage the facility. The provision of electricity to community residents, the location of transmission lines and determining of the rates to be charged for electricity will also require the involvement of the Village Council.

### **4.4 International and Regional Policy Framework**

Several International Agreements and CARICOM Regional Policy Framework that Guyana has aligned with provide a broad foundation and guiding principles for social, economic, environment, and energy related policies and sustainable development decision making in general. These are reviewed below.

#### **4.4.1 Agenda 21 and Rio +20**

The United Nations Conference on Environment and Development (UNCED) held in Rio De Janeiro in 1992 resulted in Agenda 21 consisting of several political actions, covering broad areas of social and economic development, conservation and management of resources for development, strengthening role of major groups, and the means of implementation. Areas of relevance to the project include:

- International cooperation to accelerate sustainable development in developing countries and related domestic policies.
- Changing consumption patterns.
- protection of the quality and supply of freshwater resources: application of integrated approaches to the development, management and use of water resources.
- Integrating environment and development in decision-making.
- Conservation of biological diversity.
- Recognizing and strengthening the role of indigenous people and their communities.
- Transfer of environmentally sound technology, cooperation and capacity-building.

Agenda 21 was underpinned by twenty-seven (27) principles for sustainable development. Some of the key principles include:

- Principle 3: The right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations.
- Principle 4: In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.
- Principle 10: Environmental issues are best handled with the participation of all concerned citizens, at the relevant level.
- Principle 11: States shall enact effective environmental legislation. Environmental standards, management objectives and priorities should reflect the environmental and developmental context to which they apply.
- Principle 17: Environmental impact assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority.
- Principle 22: Indigenous people and their communities and other local communities have a vital role in environmental management and development because of their knowledge and traditional practices.

Although there was no specific thematic area devoted to Energy in Agenda 21, there was substantial coverage. Agenda 21 addressed the full continuum from energy supply to demand and made a strong case for the transition from unsustainable to sustainable approaches to energy management. It placed greater emphasis on renewable energy sources, calling for the conservation of energy through energy efficient technologies and energy recovery in production and consumption processes.

Twenty years later, RIO+20 reviewed progress in meeting the Agenda 21 actions and resulted in several focused political outcomes providing clear and practical measures for achieving sustainable development. A process was launched to develop a set of Sustainable Development Goals (SDGs), which built on the MDGs<sup>54</sup> and converge with the post 2015 development agenda. The Rio+20 adopted guidelines on green economy policies and addressed a number of thematic areas, including energy.

Guyana's institutional framework for sustainable development, integrated planning and decision making and environmental and natural resources management has been strengthened since the Rio Summit (1992) and Rio+20. Several national policies, legislation, plans, strategies, and institutions have been developed and implemented towards ensuring sustainable development, the most recent being the GSDS.

#### ***4.4.2 United Nations Framework Convention on Climate Change (UNFCCC) and Paris Agreement***

The United Nations Framework Convention on Climate Change (UNFCCC) was entered into force in 1994 to achieve stabilization of greenhouse gas concentrations at a level that would prevent dangerous anthropogenic interference with the climate system.

In 2015, Parties to the UNFCCC produced the Paris Agreement to combat climate change and to accelerate and intensify the actions and investments needed for a sustainable low carbon future. The Paris Agreement builds upon the Convention. Importantly, countries committed to Nationally Determined Contributions (NDCs) to support reach the objectives of the Convention and the Paris

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<sup>54</sup> The Millennium Development Goals (MDGs) were at the forefront of the global development agenda and represented the international community's commitment to eradicate poverty by 2015. Goal 7 was dedicated to ensuring environmental sustainability. The MDGs was succeeded at the start of 2016 by an even more ambitious set of goals aimed at continuing the commitment and efforts of nations to eradicate social ills by 2030. These are referred to as the Sustainable Development Goals (SDGs).



Agreement. As part of the NDC, Guyana committed to develop a mix of wind, solar, biomass and hydropower and to improving access to energy in Guyana's hinterland. Guyana also committed to developing a 100% renewable power supply by 2025, provide that adequate and timely financial support is provided.<sup>55</sup> The Kato Hydroproject is expected to contribute to achieving the climate change mitigation targets Guyana has outline in its NDC.

Article 6 of the Paris Agreement allows countries to cooperate with each other to achieve the climate change mitigation targets outlined in their NDCs. The article facilitates direct bilateral cooperation between parties where emission reduction measures in one country may be transferred to another country to be counted in its NDC. Alternatively, Parties to the Paris Agreement may participate in a sustainable development mechanism which will be supervised by an independent body which will verify the results of emissions reductions measures. Non-market-based approaches for cooperating to achieve the NDC targets are also being developed under the Paris Agreement<sup>56</sup>. There may be an opportunity in the future to cooperate with other countries on the basis of the emissions reductions achieved by generating electricity from the Kato Hydroproject.

#### **4.4.3 Sustainable Development Goals (SDGs) - Agenda 2030**

The SDGs is a shared vision for Sustainable Development – Agenda 2030. It provides a global blueprint, through 17 specific goals and associated targets for civil society, private sector, and governments to translate into national development plans and strategies towards achieving this shared vision. Environment, sustainable use of natural resources, conservation of biodiversity, climate change, access to energy, energy efficiency and renewable energy are inherent across most if not all of the 17 SDGs. However, goals 6, 7, 12, 13 and 17 are directly relevant to the project.

Goal 6 focused on ensuring availability and sustainable management of water and sanitation for all. It highlights the fact that the natural environment e.g. forests and soils contribute to management and regulation of water availability and water quality, strengthening the resilience of watersheds and complementing investments in physical infrastructure and institutional and regulatory arrangements for water access, use and disaster preparedness. It emphasized that protecting and restoring water-related ecosystems and their biodiversity can ensure water purification and water quality standards.

Goal 7 is aimed at ensuring affordable and clean energy. It speaks to international cooperation in access to energy, increased energy efficiency and the increased investments in and use of renewable energy towards more sustainable and inclusive communities and resilience to environmental issues such as climate change.

Goal 12 addressed sustainable consumption and production and is focused on achieving sustainable use and management of natural resources, energy efficiency, sustainable infrastructure, environmentally sound waste management, and a better quality of life. Through sustainable consumption and production strategies and plans, countries aim to reduce future economic, environmental and social costs, strengthen economic competitiveness and reduction in poverty.

Goal 13 speaks to climate change and how affordable, scalable solutions can enable countries to leapfrog to cleaner, more resilient economies e.g. through renewable energy and a range of other measures to reduce emissions and increase adaptation efforts and move toward a low-carbon economy.

Goal 17 underpins a successful sustainable development agenda through partnerships between government, the private sector and civil society at all levels. It emphasized that strong international partnerships is required to ensure countries achieve the SDGs.

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<sup>55</sup> Government of Guyana, 2015. Nationally Determined Contribution. Pg. 10 -11.

<sup>56</sup> UNFCCC, 2016. The Paris Agreement, Article 6.

#### **4.4.4 The CARICOM Energy Policy (2013)<sup>57</sup>**

The CARICOM Energy Policy aims to see a fundamental transformation of the energy sectors of Member States through the provision of secure and sustainable supplies of energy, whilst minimizing energy waste in all sectors, and ensuring all citizens have access to affordable and stable, modern, clean and reliable energy supplies, and to facilitate the growth of internationally competitive Regional industries towards achieving sustainable development of the Community. The policy charts 15 broad policy actions that encourages a new climate-compatible development path that harnesses diverse domestic renewable energy resources, minimizes environmental damage, and spurs social opportunity, economic growth, and innovation. With respect to renewable energy, the policy is to diversify the energy sources through the increased use of renewable energy.

#### **4.4.5 The Caribbean Sustainable Energy Road Map and Strategy (2015)**

To translate the intended policy actions stated in the CARICOM Energy Policy, the CARICOM Secretariat commissioned the Caribbean Sustainable Energy Roadmap and Strategy (C-SERMS), designed to build on existing efforts in the region and to provide CARICOM member states with a coherent strategy for transitioning to sustainable energy. C-SERMS provides the basis for a more targeted approach to advancing sustainable energy development under the regional policy and in so doing acts as a framework for articulating, monitoring and adjusting regional level strategies, and for securing commitments from Member States towards achievement of the targets that are established. C-SERMS suggests a regional target of 48% of installed power capacity by the year 2027. Regional renewable energy capacity shared targets include 20% by 2017, 28% by 2022, and 47% by 2027. C-SERMS also recommended a 33% reduction in energy intensity to be applied evenly across all member states.

#### **4.4.6 Draft Caribbean Community Environment and Natural Resources Policy Framework<sup>58</sup>**

The Draft Caribbean Community Environment and Natural Resources Policy Framework outlines an umbrella regional approach to the sustainable management of the environment and natural resources of Member States. The draft policy has been formulated having recognized that unsustainable use of resources could undermine regional sustainable development options within the context of the CARICOM Single Market and Economy (CSME), and the 2030 SDGs. It therefore proposes a structure for environmental and natural resources management in CARICOM, balancing the need to exploit the land, air, water and oceans for economic development while maintaining healthy environments in member states. Guiding principles and long term goals for planning for the protection, conservation and sustainable use of the environmental and natural resources are outlined thereby creating the basis for effective environmental and natural resources governance in support of the CSME among Member States through the:

- Building and facilitation of regional consensus in the Caribbean Community on environmental and natural resources issues;
- Harmonization of national environmental regulatory regimes;
- Mobilization of financial and technical resources in support of the Policy Framework implementation; and
- Enhancement of trade competitiveness, efficiency and long-term Sustainability in the productive sectors

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<sup>57</sup>CARICOM, 2013. The CARICOM Energy Policy. Pg 28.

<sup>58</sup> CARICOM. Draft CARICOM Environment and Natural Resource Policy.

## 4.5 Other Policies and Guidelines

### 4.5.1 IDB Policies

The IDB has identified that environmental and social safeguards be applied during all project execution. Safeguards are applied to ensure that project funds are engaged in a manner consistent with the Bank's institutional policies with respect to social and environmental protection and management.

According to the Project Profile, the Kato Hydroproject has triggered the Environment and Safeguards Compliance Policy (OP 703) which requires that all bank financed operations shall be screened and classified according to their potential environmental impacts. This project is classified as *Category B: Operations that are likely to cause mostly local and short-term negative environmental and associated social impacts and for which effective mitigation measures are readily available.*

The following table outlines the project's compliance with IDB Policies.

**Table 4-3: The Project's Compliance with IDB Policies**

| Operational Policy                               | Aspect (if applicable)   | Overview of Project Compliance Status  |
|--|--|--|
| <b>I. OP-703</b>                                 |  |  |
| <b>B.1. Bank Policies</b>                        | OP-704: Disaster Risk Management                                   | <b>Compliance requirements expected to be met.</b> See Section II of this table.   |
|  | OP-761: Gender Equality in Development                             | The project will not cause negatively impact the gender balance in the communities.  |
|  | OP-710: Involuntary Resettlement                                   | <b>Not applicable.</b>   |
|  | OP-102: Access to Information                                      | <b>Compliance requirements met.</b> Environmental and Social Analysis (ESA) and Environmental and Social Management Plan (ESMP) to be disclosed.   |
|  | OP-765: Indigenous Peoples and Strategy for Indigenous Development | <b>Compliance requirements met.</b> The project is being implemented in and will benefit an indigenous community of Kato region 8.   |
| <b>B.2. Country laws and regulations</b>         | National legislation   | <b>Compliance requirements expected to be met.</b> The project must comply with national legislation on environment and occupational, safety and health as stated in the ESA and the ESMP.   |
| <b>B.3. Screening and Classification</b>         | Classification of the risk level                                   | <b>Compliance requirement met.</b> The project has been classified using the Bank toolkit as a Category B.   |
| <b>B.4. Other Risk Factors</b>                   | Executing agency   | <b>Compliance requirement expected to be met.</b> Risks on the environmental and social management of the operation for the executing agency- GEA. The risks will be addressed through the inclusion of clauses in the institutional arrangements. |
| <b>B5. Environmental Assessment Requirements</b> | Environmental and Social Assessment (ESA) and ESMP                 | <b>Compliance requirements met.</b> An Environmental and Social Assessment and the Environmental Social Management Plan have been prepared for the project.  |

| Operational Policy                              | Aspect<br>(if applicable)                        | Overview of Project Compliance Status  |
|---|--|--|
| <b>B.6 Consultation</b>                         | Stakeholder Engagement Plan                      | <b>Compliance requirements expected to be met.</b> A Public Participation and Communication Programme to be developed and implemented during project execution.  |
| <b>B.7. Supervision and Compliance</b>          | Supervision of Construction and Operation Phase  | <b>Compliance requirements expected to be met.</b> The Bank will supervise and monitor the adequate implementation of the ESMP through the executing agency.   |
| <b>B.11. Pollution Prevention and Abatement</b> | Water, air, noise and waste pollution management | <b>Compliance requirements expected to be met.</b> The project will conform to the EPA regulations and guidelines for water quality, air quality, noise management, hazardous waste, and litter prevention. The parameters to be measured will be those as set out in the GNBS water quality standards as followed by the EPA. |
| <b>B.12 Multiple Phase</b>                      | Previous interventions                           | <b>Not applicable.</b>   |
| <b>II. OP-704</b>                               |  |  |
| <b>Disaster Risk Management</b>                 | Operation classifies as Moderate.                | <b>Compliance requirements expected to be met.</b> The project is expected to have moderate vulnerability to disaster risks, and is not anticipated to exacerbate these. Mitigation measures are included in the ESA to address flooding and risk from fires.  |

#### **4.5.2 International Hydropower Association Sustainability Guidelines**

The Hydropower Sustainability Guidelines on Good International Industry Practice define expected sustainability performance for the hydropower sector across a range of environmental, social, technical and governance topics. There are 26 guidelines that present definitions of the processes and outcomes relating to good practice in hydropower project planning, operation and implementation. Developed for a range of stages in the lifecycle of a hydropower project, compliance with each guideline can be specified in commercial contracts between financiers and developers, and developers and contractors. These guidelines are a reference document for meeting the expectations of lenders, regulators, and consumers. The guidelines are governed by the Hydropower Sustainability Assessment Council, whose 100 members include social and environmental NGOs, intergovernmental organisations, development banks, governments, and hydropower companies and contractors.

#### **4.5.3 The Hydropower Sustainability Assessment Protocol**

The Hydropower Sustainability Assessment Protocol (HSAP) is a tool for assessing projects across a range of social, environmental, technical and economic criteria. The HSAP provides an international common language on how these criteria can be addressed at all stages of a hydropower project's lifecycle: planning, preparation, implementation and operation. Assessments use objective evidence to create a sustainability profile, which can be used to identify gaps and drive continuous improvement. These assessments are delivered by fully accredited assessors.

#### ***4.5.4 The Hydropower Sustainability ESG Gap Analysis Tool***

The Hydropower Sustainability ESG Gap Analysis Tool (HESG Tool) was developed by the IHA between February 2017 and June 2018 under the mandate of the Hydropower Sustainability Assessment Council, with the support of the Swiss State Secretariat for Economic Affairs (SECO). The tool was launched on 11 July 2018. HESG tool enables hydropower project proponents and investors to identify and address gaps against international good practice. The HESG Tool is based on the framework of the Hydropower Sustainability Assessment Protocol (HSAP). It assesses projects against the requirements of the HSAP's environmental, social and governance topics. The tool provides an action plan to help project teams address any gaps against good practice. It is divided into 12 sections which are compatible with the International Finance Corporation (IFC) Environmental and Social Performance Standards and the World Bank's new Environmental and Social Framework.

## 5.0 STAKEHOLDER FEEDBACK

The village of Kato serves as the location of the project and the main beneficiary. As such, consultation with the community is integral and has been ongoing since the early stages of project development. As discussed in Chapter 2 *Project Description*, developing the hydropower potential at the Chiung River, including the waterfall in Kato, has been under active consideration for the last decade. Accordingly, over that period, there have been several engagements with stakeholders on the development of a 300kW hydropower plant in Kato, including in 2012, 2014 and 2017. In 2018, the project was reduced to a 150kW hydropower plant to supply power to key activities in the Kato village.

For the purpose of the EAMP stakeholder engagements were undertaken with the Village Council and villagers of Kato. The objectives of these engagements were to:

- Update the Village Council and villagers on the progress and changes of the project and project scope;
- Provide the platform for stakeholders to receive clarifications on the project and share their views, concerns and expectations;
- Receive feedback from stakeholders on the main environmental and social concerns associated with the construction and operation of the hydropower facility; and
- Receive information from stakeholder on socio-economic indicators on the Kato village.

During the EAMP preparation two stakeholder engagements were conducted within the Kato village. These meetings were public fora at which members of the Village Council and villagers of Kato were present and participated. The first engagement was led by GEA/HECI while the second exercise was conducted by EMC. The schedule of consultations with these stakeholders is shown in Table 5-1.

**Table 5-1: Schedule of Stakeholder Engagements**

| Stakeholder Groups  | Venue                       | Date of Meeting |
|---|-----------------------------|-----------------|
| Public Meeting with representatives of the Village Council and villagers of Kato led by the GEA/HECI.             | Kato Multi-Purpose Building | July 13, 2019   |
| Public Meeting with representatives of the Village Council and villagers of Kato led by the consultants from EMC. | Kato Multi-Purpose Building | August 02, 2019 |

The consultation process was guided by the Ministry of Indigenous Peoples Affairs requirements of Free Prior Informed Consent. The consultations conducted by EMC are based on the principles of accountability, equality, non-discrimination, participation and transparency. The village of Kato was informed formally by EMC two weeks prior to the engagements and suitable dates were agreed with the Toshao. All community members were invited and the consultations were held in English, which is the language used by the villagers. The project concept was again presented to the villagers and time was given to answer questions or addressing any issue relating to the project. Interviews were held with selected villagers to provide additional information on the acceptability of the project and its possible impacts on the community.

During these engagements, several issues related to the construction and operation of the hydropower facility as well as potential environmental and social impacts were raised. These issues are presented in Table 5-2. The minutes of these engagements are attached as Appendix G.



**Table 5-2: Environmental and Social Issues Raised by Stakeholders**

| Issues  | Stakeholder Concerns and Questions  |
|---|---|
| <b>Public Meeting led by the GEA/HECI – July 13, 2019</b> |   |
| Dam Safety  | <ul style="list-style-type: none"> <li>Should the dam burst/fail will it affect persons living close to the waterway?</li> </ul>  |
| Land Ownership  | <ul style="list-style-type: none"> <li>Will the HECI own the land?</li> </ul>   |
| Generation Capacity and Access to Electricity             | <ul style="list-style-type: none"> <li>Why the reduction in the size of the system?</li> <li>Will everyone in the village get access to the electrical grid?</li> <li>Will the village of Kurukubaru be able to benefit from such a project given that a similar source as the Kato falls exist approximately 4 miles from the village?</li> </ul>  |
| Long-term Generation Capacity                             | <ul style="list-style-type: none"> <li>What is the timeline for expansion of the grid and hydro in keeping with the initial design (330kW)?</li> <li>Why talk about other sources of power if we are looking to install the hydro project?</li> </ul>   |
| Involvement of the Kato Village                           | <ul style="list-style-type: none"> <li>Continuous consultations should be conducted with the village</li> <li>The village will like to have a MOU signed regarding benefits to the village from the project.</li> </ul>   |
| Employment and Training                                   | <ul style="list-style-type: none"> <li>The village will like for persons in the village to be trained before and during construction.</li> <li>How early will the training take place?</li> <li>Will females be employed on the project?</li> </ul>   |
| Electricity Costs   | <ul style="list-style-type: none"> <li>What will the village have to pay for electricity?</li> </ul>  |
| Grid  | <ul style="list-style-type: none"> <li>Where will the grid be located?</li> </ul>   |
| Sourcing Raw Materials                                    | <ul style="list-style-type: none"> <li>Is there anything in the contract to convince the contractor to buy materials from Brazil, since it is viewed as more accessible?</li> </ul>   |
| Road Construction between Kato and Karasabi               | <ul style="list-style-type: none"> <li>Will the contractor fix the road between Karasabai and Kato?</li> </ul>  |
| <b>Public Meeting led by EMC – August 02, 2019</b>        |   |
| Expectations of the Project                               | <ul style="list-style-type: none"> <li>There are high expectations in the village for the hydropower plant to become operational including: <ul style="list-style-type: none"> <li>Electricity being available in homes across the village;</li> <li>Investment by individuals and village council in several ventures. Some of the main initiative being considered include brick manufacturing; agro-processing of black pepper, turmeric; and cassava processing plant. Processed agro-produce can then be sent to the coast since unprocessed produce is too expensive to transport.</li> </ul> </li> </ul> |

| Issues  | Stakeholder Concerns and Questions   |
|---|--|
|   | <ul style="list-style-type: none"> <li>○ Resuscitation of the Kato Sewing Group when electricity is available to allow for the use of electrical sewing machines.</li> <li>○ Employment for youths since there have been more interest in attending the Kuru Kuru Training Centre due to expectations of employment during the construction and operational phases of the hydropower plant.</li> </ul>   |
| Training and Employment                         | <ul style="list-style-type: none"> <li>▪ Few locals were employed during the construction of the Kato Secondary School as the village did not have skilled labour/ experts required. Those who were employed faced challenges with the contractor due to remuneration. However, a labour force now exists within the community and the contractor should employ locals.</li> <li>▪ The Village Council will be interested in receiving advice on the types of expertise that would be needed for the operation and maintenance of the hydropower plant.</li> </ul>   |
| Engagement with the Village Council             | <ul style="list-style-type: none"> <li>▪ The Council would like the opportunity to have a meeting with the contractor before construction commences.</li> <li>▪ The Contractor should be advised to follow the Village rules.</li> <li>▪ The Village Council recommends a formal agreement between the Village Council and the Government of Guyana on the project. This should be done through the agencies responsible for implementing the project.</li> <li>▪ If revenues or profits are earned in excess of the required operational and maintenance costs, some of these funds could go to the Village Council?</li> </ul>   |
| Elections                                       | <ul style="list-style-type: none"> <li>▪ Will the upcoming elections impact the implementation of the project?</li> </ul>  |
| Access to Electricity Generated from Hydropower | <ul style="list-style-type: none"> <li>▪ Villagers are concerned that not all residents will benefit from the project. During the GEA-led consultations on July 13, 2019, it was indicated that only Government buildings will be powered, not private homes because residences are scattered throughout the village and transmission will be costly. However, it should be noted that Government buildings are also scattered and that households are located in clusters across the village. Can power be transmitted to these clusters and then distributed within the clusters?</li> <li>▪ Will electricity generated from the hydropower plant will be sufficient to power the entire village?</li> </ul> |
| Ownership and Management                        | <ul style="list-style-type: none"> <li>▪ Who will own the project and how it will be managed? This is still not sorted.</li> <li>▪ In the future, the management and maintenance of the plant can be transitioned to the village as skills are built. The Village Council is interested in this option.</li> </ul>   |
| Electricity Costs                               | <ul style="list-style-type: none"> <li>▪ What the expected price of power as the villagers will need to know up-front so as to determine if the power will be affordable.</li> </ul>   |

| Issues  | Stakeholder Concerns and Questions  |
|---|---|
|   | <ul style="list-style-type: none"> <li>Will it be a flat fee or price per kilowatt hour?</li> <li>Will there be different costs for residents versus businesses?</li> </ul>   |
| Road from the Village Centre to the Proposed Site | <ul style="list-style-type: none"> <li>Who will be responsible for the maintenance of the road from the village to the project site? Currently, the road is in poor condition.</li> </ul>   |
| Dam Safety  | <ul style="list-style-type: none"> <li>What are some of the potential impacts of the dam bursting given that the weir will only be eight-feet tall?</li> </ul>  |
| Ecotourism  | <ul style="list-style-type: none"> <li>Will any ecotourism potential of the waterfall will be curtailed as a result of the installation of the hydropower plant?</li> </ul>   |
| Other concerns                                    | <ul style="list-style-type: none"> <li>Villagers indicated that they were previously concerned over possible restriction of access to the falls, availability of water supply downstream of the project, and potential for flooding upstream since persons live and farm in upstream areas. However, the engagement conducted on July 13, 2019 addressed these concerns.</li> </ul> |

## 6.0 ENVIRONMENTAL IMPACT ASSESSMENT

This section assesses and describes the potential impacts on the physical, biological and socio-economic environment of the project. The impact assessment identifies and describes project impacts during the two principal phases of the project that is, the construction and operation phases. Impact identification and assessment were conducted following a rigorous systematic approach in consideration of the following:

- Characterizing the baseline conditions of the project area (as discussed in Chapter 3);
- Identifying the impacts and their sources that potentially may be generated by the project. This was achieved through professional judgment, desk top analysis and review of relevant literature and the EMPs of similar projects, and consultations with project stakeholders;
- Rating impacts to determine impact significance; and
- Recommending appropriate mitigation measures to address significant negative impacts (as discussed in Chapter 7).

The impacts were assessed given the current status of the project and project environment. Impacts were assessed based on whether they are currently occurring, or if they are likely to occur in the future. For each impact the following were taken into consideration:

- Whether the impact is localised (Loc) or extensive (Ext);
- Whether it is short-term (ST) or long-term (LT);
- Whether it is avoidable (Av.) or unavoidable (Un.);
- Whether it is significant (Sig) or insignificant (Insig.); or
- Whether it is mitigable (M) or unmitigable (UM).

### 6.1 Physical Environment

#### 6.1.1 Geology and Soils

##### Impacts

During the construction phase, the following are considered potential impacts of the project:

- Accelerated erosion on the hillside where construction activities will require the clearing of natural vegetation and the excavation soils for establishment/installation of project components such as the penstock, possible burying of the headrace channel, and construction of access road leading to the hydropower plant.
- Instability of the hillside proximate to the river and waterfall head may have significant negative impacts on the headrace channel, penstock, and access road leading to the turbines and powerhouse.
- The use of heavy-duty construction machinery can result in soil compaction beyond the ability of permeable limits of the soil. Potential risks of compaction are likely to be particularly high at temporary work areas, stockpile areas and vehicle storage/maintenance areas. As a consequence, ponding of water can become an issue after heavy rainfall and continuous compaction thereby increasing risks of erosion of the surface.
- There are also risks of soils being contaminated by the accidental or intentional discharge of fuels, waste oils, lubricants or other hazardous wastes.

During the operational phase, the primary potential impact of erosion is expected at the hydropower plant including all areas located on slopes/inclines particularly during the wet seasons.

### Analysis

Erosion risk is considered to be significant given that the prevailing soil type at the project site is highly susceptible to erosion. Disturbance to this soil along the steep slopes for installation of project components, including construction of an access road for access to the powerhouse further increases the risks of erosion. However, if proper environmental and engineering management measures are utilised during the construction phase, erosion risk can be managed. Further disturbance is not expected to be significant since the area to be occupied by project components is expected to be in the vicinity of 700m<sup>2</sup>.

Geotechnical analysis should be conducted at Kato to determine whether any areas of the project site are at risk of a landslide. This is especially important given the susceptibility of the soils to erosion. Potential structural failure of the Kato hydropower plant may arise if the design is not informed by robust baseline data on key physical parameters. This is considered as a significant potential impact to the project.

Compaction is not considered a significant risk as this can be prevented or minimised during the construction phase of the project. Moreover, contamination of soils from the accidental discharges of fuels, waste oil lubricants or chemicals is not considered significant as this can be prevented if proper fuel and environmental management practices are followed. The measures outlined in the EMP outlined in Chapter 7 should be implemented during the construction and operation phases.

### **6.1.2 Surface Water**

#### Impacts

The following are considered as potential impacts to the surface water of the Chiung River during the construction phase of the project:

- Pollution of water courses from waste oils, fuel and lubricants and other hazardous or chemical wastes during the construction phase.
- Pollution of water courses due to leaching of contaminants from contaminated soils.
- Pollution of water courses by wastes generated by construction workers including solid waste.
- Sedimentation of the water bodies during the construction operational phases due to erosion and storm water runoff.

During the operational phase, water quality may be impacted as a result of runoff from disturbed areas containing high amount of sediments. Moreover, the discharge of sediments from the desander may impact sediment loads and nutrient concentrations particularly during the dry seasons.

### Analysis

Intentional or accidental discharge of waste oils, fuel, lubricants, sewage and other potential contaminants such as cleaning liquids or other chemicals can affect the quality of. During the construction phase, water quality can be affected if pollutants are discharged from construction activities. Further, the presence of construction workers may increase dumping of garbage into the Chiung River. However, these risks were not considered significant as they are all preventable if good

environmental management measures are implemented during the construction phase of the project. These measures are detailed in Chapter 7.

The removal of vegetation cover and the disturbance of soil may result in an increase of sediments being transported to the Chiung River downstream of the project site from eroded soil run-off during rain events resulting in the changes in water quality and increase in turbidity. During the operational phase of the project sediments collected by the desander will be released back into the Chiung River thus temporarily increasing the sediment load during this process. It should be noted that the Chiung River, during and after periods of heavy rainfall, contains a high sediment load resulting from runoff, as is shown in Section 3.1.6. Increased sediment loads may have potential negative impacts on flow rates of the river.

### **6.1.3 River Flow**

#### Impact

During construction and operational phases, approximately 20% of the annual flow of the Chiung River will be diverted from the riverbed to the headrace channel via the weir. This may result in localised changes and disruption of the existing flow patterns of the river.

In addition, deforestation upstream of the Kato waterfall head may change rainfall patterns resulting in a river flow lower than the level required for the generation of electricity.

#### Analysis

Significant impacts are not expected during the construction phase since the diversion of water is not likely to commence until the project becomes operational. However, during the operational phase, diversions to change the flow patterns and rates of the Chiung River at the location of the weir may have adverse impacts downstream including the flow rates at the waterfall head. This may have consequent impacts in riverine habitats and downstream water users. The significance of these impacts would have to be determined by a robust time-series of hydrological data for the Chiung River. However, based on the current project concept, during the dry season stream regulation residual flow will be maintained in the Chiung River via the weir. Based on the recorded flow measurements of the Chiung River, the minimal flow was determined to be in the magnitude of > 50 l/s. This flow was determined to be the minimal environmental flow<sup>59</sup> to be maintained within the River. Furthermore, the yearly major flow of over 80 % will remain over the riverbed and a 100% of the extracted flow will be returned to the River after passing through the powerhouse. Due to the stream regulation flows to be maintained, there should be no significant change anticipated in the natural water flow regime downstream of the intake structure and powerhouse during the dry and wet seasons.

The GEA has anticipated that significant levels of deforestation upstream of the Chiung River will reduce rainfall which supplies the headwaters of the River. This may ultimately reduce the flows of the River below the levels which are required for the generation of electricity.

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<sup>59</sup> The environmental flow describes the quantity, timing, and quality of water flows required to sustain the freshwater ecosystems and the human livelihoods and wellbeing that depend on these ecosystems.



#### **6.1.4 Groundwater**

##### Impact

There are unlikely to be any significant impacts on groundwater levels as a direct result of construction activities and the operation of the hydropower plant. Water supply wells may be impacted by leaching of waste oils, fuel and lubricants and other hazardous or chemical wastes from contaminated soils.

##### Analysis

Due to the remoteness of the site and the absence of any of the wells located in the village, it is unlikely that there are any existing water supply wells in the immediate vicinity of the construction site for the hydropower plant. In addition, any contamination of the water supply well that provides water to the Kato Secondary School by leaching of waste oil, or fuel and lubricants from contaminated soils is not considered a significant impact as these may be mitigated if good environmental management practices are followed by the contractor during the construction of the switch yard.

No project activity will occur below the water table.

#### **6.1.5 Noise**

##### Impact

Significant noise levels during the construction phase may have potential negative impacts on nearby receptors.

##### Analysis

Receptors located close to the project site include:

- Kato Secondary School including student dormitories;
- NAREI base; and
- Scattered residential homes including residences of teachers who work at the Kato Secondary School.

Of these receptors, the Kato Secondary School may be affected by noise nuisance during the construction phase of the project including the construction of the hydropower plant and especially during the construction of the switch yard which will be located within the school's environs. As such, the Kato Secondary School may be considered sensitive to the noise nuisance from the project. However, this impact is not expected to be significant, and will be short term and localised. Mitigation measures for managing these impacts are presented in Chapter 7. It should be noted that at the project site the background noise level is already high due to the River flow through the falls.

#### **6.1.6 Air Quality**

##### Impact

During the construction phase, dust levels may increase with potential negative impacts to nearby receptors by light and heavy vehicles traversing the road from Kato village to the proposed location and the road connected Kato to Karasabai. Adverse air quality impacts are not anticipated during the operational phase of the project.

### Analysis

Receptors to dust nuisance located close to the Chiung River include:

- Kato Secondary School including student dormitories;
- NAREI base; and
- Scattered residential homes including residences of teachers who work at the Kato Secondary School.

Increased emissions of dust during the construction phase may have adverse impacts on these stakeholders as significant levels of dust emissions may contribute to increased incidence of non-communicable respiratory diseases like asthma. However, this impact is not expected to be significant and will be short term and localised. Nevertheless, the contractor should closely monitor all dust emissions generated as a result of construction activities.

### ***6.1.7 Climate and Climate Change***

#### Impact

Potential impacts from the project that creates a micro-climate at the project site are not expected. However, changing weather patterns associated with global warming and climate change may result in variable precipitation which may have potential negative impacts on the project.

#### Analysis

As a run-of-the-river hydropower project, no reservoir or large-scale impounding of water will be done as part of the project. As a result, the risks that a micro-climate in the vicinity of the hydropower plant with changed temperature and humidity levels is negligible.

Adverse climate change impacts may have significant negative impacts on the project. According to climate change projections contained in Guyana's Second National Communication to the UNFCCC, average annual precipitation is expected to decline but rainfall occurring in heavy events will increase. It should be noted that a heavy rainfall event contributed to the landslide that led to structural failure of the Moco Moco Hydropower Plant and may increase risks of landslide at Kato, given that the soils are susceptible to erosion. Drought conditions are likely to impact flow rates of the Chiung River and thereby adversely impact routine generation of electricity from the hydropower plant. Both of these potential outcomes should be factored into the final design of the Kato Hydropower Plant.

As such, time-series hydrological data should be assessed to determine what constitutes heavier than normal and lighter than normal rainfall in this region. It is recognised that there are not sufficient rainfall records in Kato to establish this baseline and records of nearby communities, such as Kurukubaru and Paramakatoi, could also be used if available. These records could be used to assess: (i) return periods for heavy rainfall events that could be factored into the design of the hydropower plant; and (ii) enhance understanding of how drought conditions may impact electricity generation from the falls.

The project will also have positive impacts for climate change mitigation within the context of Guyana's Nationally Determined Contribution (NDC) to the UNFCCC. According to estimates from the GEA, the project will result in savings of approximately 900,000 kilograms of carbon dioxide annually<sup>60</sup>.

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<sup>60</sup> GEA 2018. Hydropower Feasibility Study 150 kW Kato Hydropower Station. Section 5.4.

## 6.2 Biological Resources

### 6.2.1 Vegetation

#### Impact

Lowland (and upland) savannahs – These savannahs are dominated by the grasses *Trachypogon*, and *Axonopus* and the shrubs *Curatella* and *Byrsonima* are found in the southern parts where the Pakaraima Mountains border the Rupununi and Rio Branco Savannahs. Most impact to the vegetation will occur during the construction phase when the vegetation cover will be directly impacted by land clearing of the project site. Though clearing will have some impact on the vegetation of the site, these plants are prevalent in the surrounding ecologically similar landscape of the project area and are widespread throughout the Pakaraima Mountains lowland savannahs. Moreover, the plant species that will be impacted by land clearing are not species of special conservation interest.

#### Analysis

Design activities will include geotechnical investigations, environmental field surveys, as well as topographic, hydrological and structural surveys of the project alignment. Personnel involved in these activities will access the project site by foot, four wheel drive vehicles and all-terrain vehicles (ATVs). Minor vegetation clearing would be required to establish the line of sight for surveying equipment. Design impacts will consequently be limited to potential impacts from the cutting of survey lines and ATV and pick-up vehicle access to the project site. The lines for the topographic and environmental surveys will be manually cleared and limited to the space desired for the surveys. These impacts are insignificant and will not require mitigation.

During the construction phase remnant vegetation cover will be directly impacted by land clearing of the project site. The area of the project site to be cleared should be limited to a linear area of approximately 700 m<sup>2</sup> of savannah grass vegetation within the hydropower plant site and along the right of way of approximately 4 km of the transmission and distribution network. Clearing at the area identified for the plant site and the transmission and distribution network should be conducted to maintain the aesthetics of the natural landscape and should be limited only to areas required for construction. Existing access roads of the project site should be maintained. No new road infrastructure is planned for project development. The transmission and distribution network should be established along existing roads of the village.

Small amounts of vegetation clearing, grubbing and topsoil removal will be conducted within the area of the weir and intake channel and power plant site, but is expected to be less intense along the area of the headrace and penstock. Gallery shrub and grass vegetation along the banks of the Chiung River within the project site should be maintained in place. The riparian gallery vegetation of the Chiung River provides stabilizing shelter for semi-aquatic fauna, and nutrient-rich food for their prey, such as fish, crabs and bivalves.

Additionally, most animal species follow established patterns in their daily and seasonal movements. The areas through which animals travel on their way to and from feeding, breeding and birthing grounds, and between their seasonal ranges, are known as corridors. The gallery vegetation along the Chiung River is considered an important wildlife corridor for the animal species particularly for small birds and small mammals, and semi-aquatic vertebrates. Consequently, the preservation of native vegetation will be necessitated in areas not earmarked for project development, particularly areas along the riparian gallery vegetation/riverbank vegetation including the aquatic habitats sheltered by the tree and shrub vegetation. The riparian gallery habitats along the Chiung River will be maintained in place to the extent practical as vegetative exclusive zones to protect the forest and aquatic habitats, which are important biodiversity corridors.

Though clearing will have some impact on the remnant vegetation of the site, these plants are prevalent in the surrounding ecologically similar landscape of the project area and are widespread throughout the Pakaraima Mountains lowland savannahs. Moreover, the plant species that will be impacted by land clearing are not species of special conservation interest.

The direct loss of cover vegetation may also result in the depletion of soil nutrients from enhanced leaching, occasioned by clearing, and the washing away by rain runoff. This can make plant regeneration difficult in the impacted area if not effectively managed. This impact is anticipated to be significant (localized, short term, and unavoidable), and can be mitigated by developing proper vegetation clearing procedures to ensure that vegetation removal is done during the dry weather conditions and staged to prevent soil erosion. Soil erosion control measures should be implemented, and vegetation clearing limited only to areas required for the project.

The removal of vegetation cover and excavation may result in an increase of sediment loads to the Chiung River from eroded soil run-off during rain events resulting in changes in water quality and increase in turbidity. Discharges from the sand trap could also add to the sediment load of the Chiung River. Changes in the water quality may result in temporarily reduced habitat quality for aquatic organisms, in turn resulting in the changes in the aquatic ecology and floristic composition of the Chiung River. Turbidity increases downstream of the affected area may impede light penetration of the Chiung River resulting in the growth retardation and/or the killing off of aquatic vegetation.

Loss of vegetation cover may also result in increases of nutrient loads downstream of the project site from rain run-off. Increases in nutrient loads could promote the proliferation of primary producers and lead to eutrophication and algal blooms. Algal blooms could disrupt normal ecosystem functioning of the Chiung River by causing oxygen depletion and the blocking of sunlight for submerged plants. This could eventually lead to the death of aquatic organisms including vegetation. These impacts are expected to be significant, (localized, short term, and avoidable) and mitigable.

Impacts from the loss of vegetation cover during the design and construction phases can be adequately mitigated. No impacts to vegetation is expected to occur during the operational phase.

### ***6.2.2 Terrestrial and Aquatic Fauna***

#### **Impact**

The ecological features and functions of the project area are replicated across the lowland savannas of the Pakaraimas Mountains region and by extension the larger Gran Sabana of Venezuela, the Rupununi Savannas and the Rio Branco Savannas of Brazil. The IUCN listed threatened species that are known to occur in the savanna eco-systems are widely distributed within lowland southwestern Guyana, and by extension the lowland forest and savanna habitats of Guyana, the Guiana Shield and lowland Amazonia. The project area has seen the presence of human and their activities for hundreds of years and may have altered the primary ecological functions and species composition of the area. The activities relating to the construction aspect of the Kato Hydro-power project may have some limited localised effect on the wildlife during the construction phase including limited displacement or mortality of some species, hunting of targeted species by workers, and changes in the water quality and flow impacting on fishes. During the operational phase aquatic fauna can also be impacted as a result of reduced water quality and flow within the river. However, the anticipated transformation of the habitats as a result of the project site is not expected to impact the long-term survivability of these species within the project area, in Guyana or globally.

## Analysis

Historic and current human activities within Kato Village and immediate areas have altered the primary ecological functions and species composition of the area, which has resulted in the fragmentation and loss of natural habitats. Vegetation clearing and habitat loss could lead to the displacement and some mortality of terrestrial vertebrate species, particularly species with reduced movement capabilities such as herpeto-faunal species, and invertebrates. Limited displacement of birds and small mammals, aquatic fauna and fish is however expected due to their high mobility and the availability of vast adjacent areas with similar habitat types. Resident fauna particularly small and medium sized mammals, and fish are likely to move to adjacent areas away from project impacted areas.

It is anticipated that some fauna, primarily birds, insects and small mammals and their predators may easily adapt to and thrive successfully in the project area owing to their ability to adapt well to human altered environments. Displacement impacts on terrestrial fauna are expected to be insignificant, (localized, short term and unavoidable). Vegetated corridors should be maintained, and construction activities timed to enable wildlife present in the area to relocate to adjacent areas. Animals with reduced movement capabilities should be allowed to escape if encountered by construction workers. Vegetation should be maintained in place to the extent practical within project impacted areas, for example, the gallery vegetation along the riverbanks.

The presence of workers and work camps during construction may promulgate the presence of domestic and synanthropic species during construction. An increase in these species may affect native species by acting as predators, competitors and disease vectors. Synanthropic species such as mice and rats tend to increase due to the availability of food from worker camps. Predator and scavenger species may also be attracted to the site for fleeing or dead animals. This impact is expected to be significant, (localized and short-term and avoidable). Worker camps and dwellings should be routinely sanitized and camp food ration and waste storage and disposal should be done in accordance with best practices.

As earlier indicated, the removal of vegetation cover may result in the increase of sediments being transported to Chiung River downstream of the project site from eroded soil run-off during rain events resulting in the changes in water quality and increase turbidity. Changes in the water quality may result in temporarily reduced habitat quality for aquatic organisms, in turn resulting in temporary changes in the aquatic ecology.

There may also be increases in the nutrient load from the deposition of eroded materials to the Chiung River. Increases in nutrient loads could promote the proliferation of primary producers and lead to eutrophication and algal blooms. Algal blooms can disrupt normal ecosystem functioning of the Chiung River and result in oxygen depletion and the blocking of sunlight for submerged plants. This could eventually lead to the death of aquatic fauna. It is expected that most aquatic fauna will be able to avoid these impacts by moving to areas with better conditions. These impacts are expected to be significant (localized, short term, and avoidable) and mitigable. These impacts can be mitigated through the implementation of the recommended measures. Water quality of the Chiung River downstream of the powerhouse should be continuously monitored during construction to ensure ecologically acceptable turbidity, nutrient and sediment levels.

During construction there could be the possibility of hydrocarbon contamination of the aquatic systems from accidental spills of lubricants and fuel and other contaminants. Hydrocarbons introduced into aquatic environments may change aquatic plant and animal growth, mortality and communities. Contaminants entering the Chiung River could be ingested by aquatic organisms causing reproductive impairment, stunted growth, and other physiological effects. Also, as contaminants naturally break down, they use dissolved oxygen, sometimes significantly reducing the dissolved oxygen content of the water and which could reduce the overall habitat suitability for many aquatic organisms. These are

significant impacts (short-term localized, and avoidable). These impacts can be mitigated by the implementation of a Spill Prevention and Clean-up Plan and by channeling hydro-carbon contaminated runoff to oil-water separators prior to discharge.

Hunting and gathering of wildlife by workers may occur if not strictly managed. Roadkill of wildlife may also be prevalent if drivers and vehicle users are not oriented on cautionary driving to prevent road accidents with wildlife. These impacts are expected to be significant (localized, short term avoidable, and mitigable). Hunting, fishing and gathering of wildlife in the project area by construction employees should be strictly prohibited. The workforce should be educated about the consequences of hunting. Drivers should be oriented on avoiding road kills of wildlife and reporting incidents of accidents with wildlife.

The Pakaraimas dry season stream regulation residual (environmental) flow will be maintained in the Chiung River via the intake structure. The environmental flow describes the quantity, timing, and quality of water flows required to sustain the freshwater ecosystems and the human livelihoods and wellbeing that depend on these ecosystems. Based on the recorded flow measurements of the Chiung River, the minimal flow was determined to be in the magnitude of > 50 l/s. This flow was determined to be the minimal environmental flow to be maintained within the Chiung River. Further, the yearly major flow of over 80 % will remain over the riverbed and a 100% of the extracted flow will be returned to the Chiung River after passing through the powerhouse. Due to the stream regulation flows to be maintained, there should be no significant change anticipated in the natural water flow regime downstream of the intake structure and powerhouse during the dry and wet seasons. Consequently, there are no significant changes anticipated in the flood plain moisture, nutrient or sediment input of the Chiung River, and as a result, no significant change is anticipated in the vegetative structure and habitats of the Chiung River.

The generation of dust, which settles on vegetation, from vehicle traffic on access roads of the project site during the construction and operation phases could impact early succession vegetation along these roads. Dust accumulation on plants has been found to impair biological functions including metabolism and photosynthesis, stunt growth, make them more susceptible to disease, and even cause mortality. However, due to the low vehicle traffic anticipated, dust generation from vehicle traffic and the resulting impact on roadside vegetation is expected to be insignificant, (localized, long-term, unavoidable).

The physical disturbance and noise produced from operational activities of the power plant facilities may impose additional stresses on wildlife and may lead to increased displacement. While disturbances may be stressful for some wildlife, other species may easily adapt to and thrive successfully in the area owing to the phenomenon of habituation. It is anticipated that terrestrial fauna will move to adjacent areas away from project impacted areas. Limited displacement of savannah birds is expected due to their high mobility and the availability of vast adjacent areas with similar habitat types. Wildlife displacement impacts from the physical disturbance and noise produced from operation activities of the power plant facilities are expected to be insignificant (localized, long-term and unavoidable).

During the operational phase there is the potential risk of environmental contamination that may affect biodiversity of the project area. This could be from eroded soil run-off during rain events resulting in the changes in water quality and increase turbidity; increases in the nutrient load from the deposition of eroded materials to the river; and hydrocarbon contamination of the aquatic systems from accidental spills of lubricants and fuel and other contaminants and which could persist during the operation phase. These impacts are anticipated to be significant (localized, short-term, avoidable, and mitigable).



## 6.3 Socioeconomic Environment

### 6.3.1 Land Take and Land Use

#### Impact

The community of Kato is a titled Amerindian Community and the project will utilize lands within the community. The project also has the potential to alter the land use within the community, both in a negative and positive manner. It could allow for diversification of the local economy and increase income while at the same time reduce traditional economic activities such as subsistence farming. The project could also result in migration of persons to areas served by the project.

#### Analysis

Project components such as the access road leading to the site and project structures such as the penstock, headrace channel, desander, powerhouse, switch yard and, in the longer term, the transmission and distribution network will utilize community lands. In addition, there will be temporary land take during the construction phase of the project which will include areas occupied by the contractor for work areas, material stockpiles and accommodations for workers. It is estimated that approximately 700m<sup>2</sup> may be utilized for project components. As a titled Amerindian Village, the Kato Village Council must approve the use of lands within its title. In 2017, the Kato Village Council provided approval for the construction of a 300-kW hydropower plant within the village. In light of these circumstances, the Kato Village Council should be kept informed of the construction plans prior to the commencement of construction including information on the anticipated temporary and permanent land take of the project.

The project could have both negative and positive impacts on the land use in Kato and its environs. Currently, the community is primarily dependent on subsistence agriculture. Electricity is currently available to some villagers but is mainly restricted to lighting. Through the provision of reliable and a steady supply of electricity, residents may tend to venture in other types of livelihood activities, including agro-processing, sewing, etc. In addition, persons, especially youths, may tend to seek employment with the project during the construction and operational phases, or in other emerging areas. These developments can lead to reduced involvement in traditional economic activities but at the same time contribute to improving the economic situation within the community since the increased domestic incomes will boost the local economy.

Given that the power supply will be concentrated within the village centre and at the Kato Secondary School this can encourage residents to relocate from other parts of the village to the village centre, or in close proximity to the school so that they can benefit from the power being supplied. There is the possibility of persons from nearby communities moving to Kato as well so as to benefit from the electricity supply that will be available.

The project is likely to necessitate the building of an all weather road to the project site from the village centre. This road can be used by the villagers especially to access the Secondary School area. Improved access will also be available to take tourists and villagers to the falls, thus aiding any future tourism plans.

### 6.3.2 Community Conflicts

#### Impact

Conflicts between the community and the contractor and implementing agency can arise if established procedures are not complied with and community expectations not fulfilled. Access to the falls area,

beneficiaries of the power to be supplied, influx of workers within the community and their behaviour, etc. can all result in conflicts during project planning, construction and operation.

### Analysis

It is expected that the contractor will hire many persons from Kato Village during the construction of the project especially for the low skilled positions. The increase in incomes during the construction period can have a positive impact on the local community by boosting the local economy through persons from the community being employed and spending by construction workers. Residents are also expected to be employed by the project during the operational phase and thereby securing longer term employment. However, the influx of non-local workers during the construction and operations phases could have a negative impact on the local community if not properly managed.

The abuse of alcohol and other drugs can be detrimental to the community when introduced and encouraged by non-local workers. There could be an increase in the risk of transmission of sexual diseases with the influx of workers who will have purchasing power and can use that power to influence persons to engage in unsafe sexual practices. In addition, the influx of the construction crew to the area can create security fears among local residents.

The influx of non-local workers could also lead to bad relations particularly between the male workers when the females are shown increased attention that is perhaps unwanted. Interpersonal relationships with married persons could lead to the breakup of families thereby disrupting the community dynamic. There could also be cases of unwanted pregnancies particularly affecting the younger women of the community.

Conflicts can also arise between the project and the community itself. The rate of power to be supplied, areas and persons to benefit, use of community resources, sharing of returns from the project, etc. could all present contentious issues. These should be resolved as early as possible and an agreement between the implementing agency and the community be established.

Restriction of access to the Chiung waterfalls, which is utilized by villagers and visitors of the community, and curtailing activities at the falls can also present an issue. However, based on the current project concept there will be no restriction to the falls area and villagers will continue to have full access. The possible restriction of water flow downstream of the project site along the Chiung River is also a concern of villages. However, based on current projections this is not likely to occur since there will be a continuous flow of water.

### **6.3.3 Cultural Change**

#### Impact

The increased and reliable power supply to be provided by the project once operational could result in long term change in the culture of the community.

#### Analysis

The Patamona People are native of the Pakaraima Mountains and the upper Siparuni River and have been engaged in subsistence agriculture for hundreds of years. The project will provide reliable and increased electricity supply to the community. As a result there could be further exposure to modernity within the community. The increasing dependence on modernity can cause long term, if not permanent cultural changes for the Patamona People. Dependence on modernity has the propensity for the eradication of historic cultural practices and following socioeconomic lines that are reinforced by technological and cultural shifts.

There is the possibility of shifting traditional livelihood activities to other opportunities that may arise as a result of the project, including employment in other areas.

The shift to electric lights that will be a permanent feature of the community can also change some aspects of the Patamona People such as the “dark night” storytelling and sleeping habits that were synchronized with their hunting and farming practices.

However, it should be noted that during the community engagements it was indicated that members of the village are eagerly awaiting the implementation of the project to capitalize on the benefits that can arise so as to improve their well-being and that of the community.

#### **6.3.4 Archaeological Resources**

##### **Impact**

The general project area has been occupied by the Patamona people for hundreds of years and there might be the possibility of artifacts being present at the project site which can be affected during the construction phase of the project.

##### **Analysis**

While there have been archaeological find in the wider project environment, as was discussed in Section 3.3.9, there has been none to date in proximity to the waterfall. Areas earmarked for the project have been utilized, grazed and farmed for a long period and as such, it is expected that the surface will be mostly absent of archaeological finds.

Nevertheless, excavations for construction of project components and installation of poles for the power transmission lines may have a possibility of encountering artifacts. As such a Chance Find Procedure will need to be prepared and implemented.

#### **6.4 Health and Safety**

##### **6.4.1 Workers Health and Safety**

##### **Impact**

Workers health and safety is always a major concern during the construction period since workers are usually exposed to conditions that can result in serious accidents to the extent where some can be fatal. Risks to workers' health and safety include accidents from the use of heavy equipment and machinery, excessive exposure to noisy equipment, inhalation of fumes, and improper use of equipment. Accidents can likely occur and may result in serious injuries or death if established guidelines and practices are not complied with. The following are therefore possible health and safety risks which are likely to occur:

- Sickness caused by the consumption of untreated water;
- Sickness caused by continuous exposure to excessive noise and vibrations from heavy duty equipment;
- Drowning due to accidental fall or being pinning in toppled equipment/vehicle;
- Injuries or death caused by the toppling of heavy duty equipment;
- Injuries or death from vehicular collisions;
- Injuries from slips, trips and falls;
- Ill health caused by insect bites/ stings or from hostile fauna;
- Injuries or death caused by snake bites;

- Injuries or ill health caused by working under extremely hot conditions;
- Injuries or death caused by tree felling activities;
- Injuries such as loss of limbs; and
- Illness caused by malaria or other diseases.

### Analysis

The construction of the Kato Hydroelectric facility will entail the use of several types of equipment, heavy duty machinery and vehicles. Works will be done in close proximity to the Chiung River and Falls and on the steep slopes which characterise most of the project area. There are expected to be multiple construction activities at each site with different risks. Particularly there is a high risk of vehicles/equipment slipping on the steep slopes while traversing on the loose materials.

While training and monitoring seeks to reduce the risk of any serious accidents, these can still occur. Risks may include accidents while using heavy duty equipment, improper use of equipment, etc. In such cases these exposures could result in physical injuries such as cuts, bruises, loss of limbs or could even be fatal. Exposure to high noise levels could result in increased stress levels.

Continuous training inclusive of weekly toolbox talks and monitoring could reduce the risk of any serious accidents. However, incidents can still occur if established guidelines and practices are not complied with. Proper safety procedures and guidelines will need to be followed and an emergency response system implemented to ensure adequate health care is accessed in a timely manner. Health and safety impacts could be exacerbated taking into consideration the access to immediate emergency and proper health care within the area and limited transportation to the site. The Kato Cottage Hospital capacity is limited, given the lack of expertise and resources.

### **6.4.2 Public Safety**

#### Impact

The safety of the community members could be compromised by the project's activities if guidelines and best practices are not complied with. There is the risk of accidents during both the construction and operation phases.

#### Analysis

The hydroelectric project site is located away from residences. However, some members of the community do visit the falls area from time to time. Members may also tend to visit the construction site to observe construction activities. As such, there may be the presence of personnel in proximity to the construction site. If the construction sites are not secured members of the public could get too close to the activities, creating a safety risk.

Construction materials, equipment and personnel will be transported through some areas of the community to and from the project site, resulting in an increase in traffic within the community. Currently, traffic within the community is minimal and villagers may not be aware of the risks associated with traffic. This can also present a risk of accidents occurring. During the operational phase it is expected that some form of transportation linked to the project will be maintained within the village.

During the installation of the transmission lines works will be done in close proximity to the Kato Secondary School, within the village centre, and other areas within the village. This will also expose members of the community, including the school children, to the safety risks.

The distribution network carrying approximately 110-120 volts and connecting to residents homes will be an additional risk. The community, which is not exposed to high voltage electricity, will need to be educated on the safe use of electrical networks and appliances.

There is the associated risk of persons swimming within the area behind the weir since the water level is expected to be approximately 2.5 meters.

## 6.5 Cumulative Impacts

### 6.5.1 National-Level Renewable Energy

As discussed in Chapter 4, Guyana's NDCs to the UNFCCC aims to achieve 100% renewable power supply by 2025. Accordingly, in recent years, the GoG has implemented several renewable energy initiatives including:

- Implementation of the Hinterland Electrification Programme, which provided 11,000 65-watt solar home systems to provide electricity for the first time to several hinterland communities including Kato;
- Implementation of a Green Public Sector Programme in 2017 and 2018 which saw the installation of a combined capacity of 3.02-megawatts of solar photovoltaic systems on the rooftops of 175 public or government buildings, and 64 solar powered LED street lights<sup>61</sup>;
- Installation of a 400-kilowatt solar farm in Mabaruma Region 1 with plans in place for similar solar farms in other areas in Region 1 including Port Kaituma and Matthew's Ridge<sup>62</sup>;
- Approval of an USD\$ 8 million low-cost loan by the Abu Dhabi Fund for Development and the International Renewable Energy Agency for the installation of a 5.2-megawatt grid-connected solar photovoltaic system in Guyana in January 2019<sup>63</sup>;
- Approval by Norway, in June 2019, under its Memorandum of Understanding with Guyana for the release of USD \$80 million to fund several 30-megawatt solar farms with storage in several hinterland communities<sup>64</sup>;
- Plans for the development of a 16-megawatt wind power facility at Hope, East Coast Demerara and other sites are being considered for development<sup>65</sup>; and
- Commissioning of a 20-kilowatt hydropower plant in the Amerindian village of Hosororo in Region 1 in 2019.

When completed, the Kato Hydropower plant will positively contribute to the achievement of Guyana's pledge for renewable energy by 2025. This positive impact may be further scaled-up in the longer term if the project electricity generation capacity is increased to 300-kilowatts over the longer-term.

### 6.5.2 Agricultural Development of Kato

Over the last ten-years, NAREI has been supporting Kato in the development of its agricultural sector including:

- Implementation of a trial process to produce four varieties of Irish potatoes (Picobello, Shepody, Spunta and Chieftan) building on the successes of large-scale potato production in Kato in the 1980s. This pilot was considered successful;
- Plans for the implementation of a trial for the farming of carrots in Kato<sup>66</sup>;

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<sup>61</sup> GEA\_undated. Solar.

<sup>62</sup> GEA\_undated. Solar

<sup>63</sup> Department of Public Information, 2019. US\$8M Solar Power Installation for Hinterland.

<sup>64</sup> Department of Public Information, 2019. Norway Approves \$16 Billion for Development of Solar Farms.

<sup>65</sup> GEA\_undated. Wind.

<sup>66</sup> NAREI, 2016. NAREI Aiding Crop Diversification in the North Pakaraimas.

- Implementation of a project in collaboration with the FAO, for the cultivation of rice in Kato; establishing a cassava seed bank; and rearing 'Black Giant' chickens for meat and egg production. This project was considered successful<sup>67</sup>.

In 2009, NAREI established a research station in Kato with the goal of trialing crops such black-eyed peas and black pepper, among others, and different farming techniques. However, a significant challenge facing the full-operationalization of the research station is power for pumps required for irrigation and possibly, drainage. As a result, electricity generated from hydropower at Kato will support this initiative from NAREI and in the longer term, farmers in the village of Kato. Moreover, during consultations with the community as part of the preparation of this EAMP, the Village Council expressed its interest in establishing an agro-processing facility which would use the electricity generated by the hydropower plant.<sup>68</sup>

### 6.5.3 Traffic

Currently there is very limited vehicular traffic within Kato. However, during the construction phase of the project traffic volumes traversing the road from Kato Village to the proposed hydropower plant; and the road from Karasabi (possibly for the transportation of construction equipment and materials) will increase, thereby contributing to an overall increase in traffic. This may potentially result in related indirect impacts of increasing noise and dust levels. Increased traffic may also have potential health and safety impacts for road users.

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<sup>67</sup> Department of Public Information, 2019. Kato Producing its own Rice.

<sup>68</sup> Appendix A. Minutes of Stakeholder Consultations on August 2, 2019.



**Table 6-1: Summary of Potential Impacts of the Kato Hydropower Plant**

| Environmental Component   | Impact                         | Phase                      | Source of Impact  | Impact Rating         |
|---------------------------|--------------------------------|----------------------------|---|-----------------------|
| <b>Physical Resources</b> |                                |                            |   |                       |
| Soils                     | Erosion along slopes           | Construction and Operation | <ul style="list-style-type: none"> <li>Prevailing soil types are susceptible to erosion</li> <li>Vegetation clearing and soil disturbance to facilitate construction activities</li> <li>Erosion of roads on inclines or slopes</li> <li>Risks of landslides</li> </ul> | Sig; Loc; LT; Av; M   |
|                           | Compaction of soil             | Construction               | <ul style="list-style-type: none"> <li>Movement of heavy equipment</li> </ul>   | Insig; Loc; ST; Av; M |
|                           | Soil Contamination             | Construction               | <ul style="list-style-type: none"> <li>Accidental release of fuels, waste oils and other oily wastes and lubricants into soils</li> </ul>   | Sig; Loc; ST; Av; M   |
| Surface Water             | Sedimentation of waterways     | Construction and Operation | <ul style="list-style-type: none"> <li>From runoff</li> <li>Discharge from the desander</li> </ul>  | Sig; ST; Loc; M       |
|                           | Contamination of surface water | Construction               | <ul style="list-style-type: none"> <li>Accidental or intentional discharge of waste oils, fuels, lubricants, chemical or hazardous wastes into the Chiung River</li> </ul>  | Sig; ST; Loc; Av; M   |
|                           |                                | Construction               | <ul style="list-style-type: none"> <li>Leaching of contaminants from contaminated soils into the Chiung River</li> </ul>  | Insig; Loc; M         |
|                           |                                | Construction and Operation | <ul style="list-style-type: none"> <li>Dumping of general solid wastes/ garbage into the Chiung River</li> </ul>  | Sig; LT; Loc; Av; M   |
| River Flow                | Reduced river flow             | Construction and Operation | <ul style="list-style-type: none"> <li>Diversion of approximately 20% of the river flow of the Chiung River</li> </ul>  | Sig; LT; Loc; Av; M   |
|                           |                                | Operation                  | <ul style="list-style-type: none"> <li>Deforestation upstream of the Chiung River reduces rainfall which supplies the River's headwaters</li> </ul>   | Sig; LT; UM           |
| Ground Water              | Contamination of ground water  | Construction               | <ul style="list-style-type: none"> <li>Leaching of contaminants from contaminated soils into freshwater wells</li> </ul>  | Insig; Loc; Av; M     |
| Air Quality               | Dust generation                | Construction and Operation | <ul style="list-style-type: none"> <li>Light and heavy vehicles traversing the roads during the construction phase</li> </ul>   | InSig; ST; Loc; Av; M |
| Noise and Vibration       | Noise and Vibration            | Construction               | <ul style="list-style-type: none"> <li>Noise nuisance from activities during the construction phase</li> </ul>  | Insig; ST; Loc; M     |
|                           |                                | Construction               | <ul style="list-style-type: none"> <li>Noise and vibrations affecting the Kato Secondary School during installation of</li> </ul>   | Sig; ST; Loc; Av.; M. |

| Environmental Component       | Impact  | Phase                      | Source of Impact   | Impact Rating       |
|-------------------------------|---|----------------------------|--|---------------------|
|                               |   |                            | transmission lines and construction of the switch yard.  |                     |
| Climate Change                | Climate Change Mitigation   | Operation                  | ▪ Contribution to Guyana’s climate change mitigation targets as outlined in the NDC.                         | Sig; LT             |
|                               | Climate Change Adaptation   | Construction and Operation | ▪ Heavy rainfall increases risks of landslides   | Sig; LT; Av.; M     |
|                               |   | Operation                  | ▪ Drought conditions reduces river flow below level required for operation of the hydropower plant           | Sig; UM             |
| Biological Resources          |   |                            |  |                     |
| Vegetation                    | Loss of vegetation cover and remnant vegetation                                       | Construction               | ▪ Land clearing, grubbing and topsoil removal  | InSig; ST; Un; Loc; |
|                               | Depletion of soil nutrients   | Construction and Operation | ▪ Loss of vegetation cover   | Sig; ST; Loc; Av; M |
|                               | Erosion and increase nutrient and sediment load to the Chiung River                   | Construction and Operation | ▪ Land clearing, grubbing and topsoil removal<br>▪ Vegetation clearing and erosion                           | Sig; ST; Loc; Av; M |
|                               | Dust impacts early succession vegetation  | Construction and Operation | ▪ Generation of dust from vehicle traffic  | InSig; Loc; LT; Un; |
| Terrestrial and Aquatic Fauna | Displacement and some mortality of terrestrial vertebrate species                     | Construction               | ▪ Vegetation clearing and habitat loss   | Sig; ST; Loc; Un; M |
|                               | Increase presence of domestic and synanthropic faunal species                         | Construction               | ▪ Increase presence of workers and work camps during construction.   | Sig; ST; Loc; Av; M |
|                               | Increases in the nutrient load and deposition of eroded materials to the Chiung River | Construction and Operation | ▪ Removal of vegetation cover  | Sig; ST; Loc; Av; M |
|                               | Hydrocarbon contamination of the aquatic systems                                      | Construction               | ▪ Accidental spills of lubricants and fuel and other contaminants  | Sig; ST; Loc; Av; M |
|                               | Hunting and gathering of wildlife by workers may occur if not strictly managed        | Construction               | ▪ Hunting and gathering of wildlife by workers not strictly managed  | Sig; ST; Loc; Av; M |
|                               | Prevalence of roadkill of wildlife by vehicle   | Construction               | ▪ Drivers and vehicle road users not educated on cautionary driving to prevent road accidents with wildlife. | Sig; ST; Loc; Av; M |
|                               | Stream regulation residual (environmental) flow not                                   | Construction and Operation | ▪ Installation of Wier and Intake Structure  | Sig; Loc; LT; Un; M |

| Environmental Component            | Impact  | Phase                      | Source of Impact  | Impact Rating       |
|------------------------------------|---|----------------------------|---|---------------------|
|                                    | maintained in the river via the intake structure.                   |                            |   |                     |
|                                    | Limited displacement of savannah wildlife.                          | Construction               | ▪ Physical disturbance and noise  | InSig; Loc; LT; Un; |
| <b>Socioeconomic Environmental</b> |   |                            |   |                     |
| Land Take/Land Use                 | Total permanent land-take   | Construction and Operation | ▪ Permanent land-take of all project components   | Insig; LT; Loc; Un  |
|                                    | Change in traditional livelihood activities                         | Operation                  | ▪ Availability of electricity to support other economic activities                            | Sig; LT; Loc; Un    |
|                                    | Migration of persons to areas where power distribution available    | Operation                  | ▪ Availability/distribution of power generated from the project                               | Sig; LT; Loc; M     |
| Conflicts                          | Possibility for community conflicts occurring                       | Construction and Operation | ▪ Foreign workers not abiding by village rules  | Sig; S; Loc; M      |
|                                    |   | Construction and Operation | ▪ Disagreement in arrangement between the community and implementing agency                   | Sig; LT; Ext; M; Av |
|                                    |   | Construction and Operation | ▪ Restriction of access to falls to community members and visitors                            | Sig; ST; Loc; Av    |
|                                    |   | Construction and Operation | ▪ Abuse of alcohol and drugs due to increase spending power from employment gained by project | Sig; LT; Loc; M     |
| Culture                            | Change in culture of the local population                           | Operation                  | ▪ Residents expose to modernity   | Sig; LT; Loc; Un    |
|                                    |   | Operation                  | ▪ Electricity supply contributing to change of traditional practices                          | Sig; LT; Loc; Un    |
| Health and Safety                  | Workers health and safety being compromised from project activities | Construction and Operation | ▪ Risk of injuries from accidents which can occur   | Sig; ST; Loc; M     |
|                                    |   | Construction               | ▪ Illness from exposure to unhealthy conditions   | Sig; ST; Loc; M     |
|                                    | Public safety being compromised by project activities               | Construction and Operation | ▪ Risk from accidents   | Sig; ST; Loc; M     |
| Archaeological Resources           | Damage of any archaeological discovery                              | Construction               | ▪ Vegetation clearing, landscaping and excavation   | Sig; ST; Loc; M     |

#### KEY – IMPACT RATING PARAMETERS

Loc – Localised  
Ex – Extensive

LT – Long Term  
ST – Short Term

Av. – Avoidable  
Un – Unavoidable

M. – Mitigable  
UM. – Unmitigable

Sig. – Significant  
Insig. – Insignificant

## 7.0 ENVIRONMENTAL MANAGEMENT PLAN

The activities to be conducted for the implementation of the project, in particular the construction phase, must be carried out in a manner which is in compliance with the legislation and guidelines outlined in Chapter 4, and in accordance with the conditions of the environmental authorisation to be granted by the EPA, and the requirements of the GEA and HECI. In this regard, this EMP has been prepared to guide the project's activities by setting out measures and strategies to address the environmental issues related to the implementation of the project. The EMP recommends activities to be undertaken in an effort to mitigate the principal adverse effects of the project and describes the way in which the main potential environmental and safety impacts of the project can be managed. The EMP also recommends appropriate mitigation measures that should be adopted by the contractor during the construction phase of the project as well as measures to be applied during the operation phase.

A framework to ensure that the EMP is effectively implemented is outlined in Chapter 8, including the roles and responsibilities of the various parties, plans to be developed by the contractor, monitoring to ensure compliance, etc. It is recommended that the contractor be required to prepare a Contractor's Environmental and Social Management Plan (CESMP) using the guidance provided in this EMP to outline how the contractor intends to manage the impacts identified and implement the mitigation measures recommended.

Mitigation measures identified to prevent, minimize and manage the adverse impacts discussed in Chapter 6 are outlined.

### 7.1 Physical Environment

#### 7.1.1 Erosion, Sedimentation and Compaction

During the construction phase of the project there will be some activities which will affect the soil, as was discussed in Chapter 6. These activities can contribute to soil erosion, compaction and sedimentation and which can be prevented or minimised. The following measures should be implemented to reduce these impacts:

##### Erosion

- Soil disturbance should be limited to areas only where it is absolutely necessary;
- The design for the hydropower plant should be informed by geotechnical assessments of the area and include appropriate slope stabilisation measures including measures for drainage of the area, and the provision of rock anchors in rocky areas;
- The gradient of the routes to be traversed by project equipment/vehicles should be reduced where possible;
- Adequate drainage should be provided at temporary work areas;
- Areas of exposed soil should be monitored during periods of heavy rainfall and proper control of stormwater flow over exposed soil surfaces should be practiced;
- Weather patterns should be considered before initiating major earthworks. Earthworks should be avoided during periods of heavy rainfall;
- Material stockpiles and waste debris should be located at least 10 m away from the drainage system;
- Material stockpiles should be kept to a minimum. Stockpiles may require berming to collect sediments from runoff during periods of heavy rainfall. Wooden or other material may be used to contain stockpiled material to prevent erosion;
- Excavated materials should be reused, where possible. In general, excavated materials should not remain onsite for more than two weeks and be disposed of at sites approved by the Village Council;

- Natural revegetation of cleared areas should be encouraged to the extent possible; and
- Regular maintenance of the access should be done.

#### Compaction

- Traffic and movement of heavy-duty equipment over open areas should be restricted and controlled and damage to these areas should be repaired as soon as possible;
- Soils that have been compacted by heavy-duty equipment during transport of materials and also during site works should be scarified;
- Appropriate heavy-duty equipment should be utilised for all works; and
- Designated routes for heavy-duty vehicles should be established and used to limit soil compaction.

#### Sedimentation

- Weather patterns should be considered during construction as heavy rainfall would increase sedimentation rates in areas where vegetation has been cleared; and
- Where possible, storm water runoff should not be directly discharged into Chiung River. This can be channelled through a vegetated area. Vegetated lands acts as a filter, trapping any large solid particles before the water enters the stream, thus can contribute to reducing the level of sedimentation.

### **7.1.2 Dust**

Potential dust pollution from construction of the hydropower plant can be considered negligible. Nevertheless, the following measures should be implemented to reduce the impacts of dust:

- Workers should be equipped with the necessary personal protective equipment (PPE) to combat dust nuisance. Personnel working within dusty environments should be required to use dust masks and respirators if needed;
- A speed limit should be imposed for vehicles traversing the roadway, especially in proximity to residences and the schools to reduce the generation of airborne particulate matter;
- During dry periods it may be necessary to soak some areas of the construction zone and routes where vehicles and equipment traverse;
- Dry materials for construction such as sand should not be stockpiled in close proximity to the Kato Secondary School or residences; and
- All vehicles transporting loose materials should be covered to minimize dust emissions.

### **7.1.3 Noise and Vibration**

Noise is not expected to be a significant environmental impact given the remoteness of the project site. However, there is still the need to implement measures to prevent and minimize noise, especially as it relates to impacts to workers, students and villagers. The limit prescribed in the GNBS Standard for construction projects are 90dB during the day and 75dB during the night. Compliance with these limits is necessary to ensure the impacts on the environment and human health, particularly for workers, are reduced. Therefore, the following measures should be implemented to reduce the impacts of noise:

- Workers should be equipped with the necessary PPE to mitigate noise pollution. Hearing protection for employees exposed to high noise levels: ear muffs and earplugs for employees who operate heavy-duty machines/equipment;
- The Village Council, administration of the Kato Secondary School, and residents living close to the location of the hydropower plant should be notified if any blasting is required as part of the construction activities;

- Noisy activities should not occur in close proximity to proximate receptors (as outlined above) during the night, on Sundays and on Holidays. It is not recommended to conduct any after 18:00hrs and prior to 6:00hrs. If this is required then the contractor should engage the Village Council and the administration of the Kato Secondary School. This should be done at least three days prior to the works;
- Noise levels should be controlled at the source through installation of mufflers on exhaust system;
- Noisy equipment such as generator should be sited away from workers accommodation and site office;
- The contractor should ensure that machinery and equipment are working efficiently; and
- Periodic monitoring of noise levels should be conducted.

#### **7.1.4 Waste Management**

Waste likely to be generated from this project includes domestic garbage and construction waste. Liquid waste will also be generated including sewage waste and waste water from sanitary facilities and work camp. Hazardous waste to be generated includes used batteries, waste oil, filters, oil containers and contaminated soils. If not managed properly, waste can result in soil and water contamination, contribute to ill health, and affect environmental aesthetics. The improper disposal of waste can result in mal-odours and attract vermin and other pests. Proper waste management is especially important as the proposed site for the hydropower facility is relatively undisturbed.

For each category of waste, the handling, storage and disposal measures varies. The disposal frequency or each waste type will also vary, depending on rates of generation. It is recommended that no significant amount of waste be allowed to accumulate onsite. Outlined below are various measures that should be implemented to properly dispose of waste associated with the project:

The contractors should include a plan to manage waste in the CESMP and take into consideration the guidance provided below:

##### Liquid Waste

- Sewage will be generated from work sites associated with the construction phase of the project. Given the remoteness of the location, and with the goal of leaving no un-necessary permanent structure behind, it is recommended that portable toilets be utilized. Pit latrines can also be utilized but should be of the ventilated improved type and be constructed in accordance with the draft GNBS Guidelines.
- If temporary camps are established at the proposed location for the hydropower plant, waste water from kitchen and bathing areas should be channeled to a soak away.
- For the facility operation, it is recommended that septic tanks should be installed, equipped with filter bed and soak-away.

##### Solid Waste

- Waste such as paper and cardboard, empty plastic bottles, cans, etc. should be collected via bins placed at strategic points around the construction zone and work areas. The bins should be emptied on a regular basis, or once filled. Garbage should not be allowed to accumulate onsite and should be collected and disposed of at an area and in a manner approved by the Village Council;
- All construction waste should be consolidated and reused as much as possible. If it cannot be reused then it should be properly disposed of. Consideration should be given to making the materials available to the community if requested. Waste should not be left in the open to litter the work areas and should be disposed of within 30 days;



- All workers are made aware of the proper waste handling and disposal requirements and practices. This ensures that all are aware of how to dispose of the different types of wastes generated, therefore minimizing the impacts that may occur from improper disposal;
- No burning of any type of waste should occur. If burial of waste is to be conducted these pits should be located at least 100 m from waterways and be covered regularly.

#### Hazardous Waste

- Waste oil from servicing of machinery and vehicles should be collected and reused/disposed in a safe and acceptable manner in accordance with the EPA guidance as outlined in the Environmental Permit. Waste oil drained from vehicles and machinery should be collected by pans and transferred to storage drums located in a designated area at least 100m away from the Chiung River and any other waterways;
- Used tyres should be stored in a covered area and not be allowed to accumulate water as they can become a breeding ground for mosquitoes;
- No machinery or machine parts should be washed in the Chiung River. This measure ensures that any oily wastes do not contaminate surface water;
- Used batteries should not be disposed in the environment. These batteries should be collected and returned to the suppliers or provided to used batteries dealers approved by the EPA.

The hazardous wastes listed above should not be stored at the construction site for extended periods. As such, timely removal is recommended.

#### ***7.1.5 Fuel, Lubricants and other Hazardous Materials***

During the construction phase of the project, special consideration for the transportation, handling and storage of fuel, lubricants and chemicals must be given as these are classified as hazardous substances. To reduce the risks on the environment and human health, and to avoid contamination of the Chiung River, preventative actions should be taken and/or mitigation measures implemented. It is necessary to implement the following measures to prevent and or reduce the impacts on the environment, in particular, contamination of soil and water from leaks and spills:

- Fuel storage onsite should be placed at a safe distance from the river, site office, accommodation and work areas. Long term storage areas and in particular for the operational phase should have secondary containment (bund wall) and impervious base and be covered to keep out rainfall;
- Fuel should be transported to the work areas as needed or in small quantities. Small quantities of fuel onsite will minimize the possibility of spillages to occur and also minimize the impacts if spillages do occur, especially since the construction activities would be temporary and it would not be feasible to construct a facility for the long-term storage of fuel. Any fuel storage at these areas should be placed higher than ground level to easily detect any leaks. Fuel should not be stored within 100 m of any waterway;
- Ensure the necessary preventative and response measures such as adequate signage, fire extinguishers and/or sand buckets are placed in and around the fuel storage areas. The type of fuel stored in tanks should be indicated and the signage should include 'No Smoking' and 'Highly Flammable';
- Fuel storage containers should be regularly monitored for leaks;
- When handling fuel, care should be taken to prevent spillage and leaks, especially during off-loading and refueling. All nozzles and hoses should be properly secured and stored away to avoid spills and/or accidents. Nozzles and hoses should be placed in a drip drum after use to prevent any spills from entering the environment and should be frequently inspected for leaks;
- During the filling/refilling process drip pans should be placed under the equipment/vehicle to prevent any possible contamination and subsequent run-off of fuel due to leaks;

- Regular maintenance should be conducted to ensure the proper functioning of machines, equipment and vehicles to avoid unnecessary leaks;
- Spill kits should be made available in the event of spillages. The kits should be placed in strategic locations that are accessible to key personnel who should be trained in the proper use of these kits through the executions of drills. Spill kits should contain sorbents with high absorbing capacity (up to 300 litres). The absorbent material should be in the form of booms, pillows and pads and the kits should include a pair of PVC gloves, a disposal bag and operating instructions; and
- Workers, mechanics and other staff should be trained on the proper use of spill kits, as well as in the safe handling of fuel and lubricants. Training in proper fuel handling practices including a mock spill clean-up exercise should be conducted prior to construction activities.

## 7.2 Biological Environment

### 7.2.1 Flora

No significant impact to the vegetation within the project area is anticipated during any of the phases of the project. Most of the anticipated impacts can be adequately mitigated. As such, the following measures should be implemented to avoid or minimise impacts to vegetation within the project areas:

- Clearing at the area identified for the plant site and the transmission and distribution network should be conducted in a manner to maintain the aesthetics of the natural landscape;
- Existing access roads of the project site should be upgraded and maintained thereby ensuring that vehicles utilize a designated route;
- The transmission and distribution network should be established along existing roads of the village;
- Vegetation clearing procedures should be developed to ensure that native vegetation removal is staged to minimize soil erosion, unwanted loss of vegetation cover and to ensure remnant vegetation is maintained in place, particularly the riparian gallery vegetation of the project site;
- Clearing of vegetation should be limited only to areas required for construction;
- Re-vegetation should be conducted where necessary, particularly in areas susceptible to erosion. Areas which were temporarily disturbed by construction activities, such as where the head race channel will be buried should be targeted, utilizing native vegetation;
- The gallery vegetation zones should be maintained in place to the extent practical as vegetative exclusive zones to protect the riparian habitats within the project site;
- The project should establish a vegetation monitoring plan which will delineate the vegetative exclusive zones, and clearing zones, and establish a monitoring regime to ensure vegetative zones are not inadvertently intruded or destroyed;
- Water quality downstream of the project site should be continuously monitored to ensure ecologically acceptable turbidity, nutrient and sediment levels are maintained; and
- Measures should be implemented to prevent forest fires such as no open or uncontrolled burning of waste and no disposal of lighted cigarettes by workers. Fire response equipment should be maintained at work areas.

### 7.2.2 Fauna

The impacts to wildlife resulting from project activities can be minimal once the recommended mitigation measures are implemented. Therefore, the following should be implemented to prevent and reduce any such impacts on wildlife:

- Vegetated corridors should be maintained and construction activities timed to enable wildlife present in the area to relocate to adjacent areas;
- Animals with reduced movement capabilities should be allowed to escape if encountered by

construction workers;

- Vegetation should be maintained in place to the extent practical within project impacted areas, for example, the gallery vegetation along the riverbanks;
- Worker camps and dwellings should be routinely sanitized and camp food ration and waste storage and disposal should be according to best practices;
- The project should implement erosion and sediment control measures and have in place a spill prevention and clean-up plan to mitigate potential erosion, sediment and hydro-carbon contamination impacts;
- Water quality of the Chiung River should be continuously monitored during construction to ensure ecologically acceptable turbidity, nutrient and sediment levels. This is further elaborated in the Monitoring Plan included in this EAMP;
- Drivers should be educated on avoiding road kills of wildlife and reporting incidents of accidents with wildlife;
- A minimal environmental flow of the magnitude of > 50 l/s should be maintained within the Chiung River at the project site. Further, the yearly major flow of over 80 % should remain over the riverbed and a 100% of the extracted flow should be returned to the Chiung River after passing through the powerhouse; and
- All workers should be prohibited from hunting, trapping, killing, harming or capturing of any wildlife. Workers should be educated on the importance of wildlife and the impacts they can cause, so as to ensure they are aware of the need to preserve wildlife and to reduce wildlife/roadway conflicts.

## 7.3 Socioeconomic Environment

### 7.3.1 Conflict Prevention

To prevent any conflicts during construction the following should be implemented:

- All potential affected parties should be informed of the details of the project and be engaged in discussions on possible measures to reduce the negative impacts;
- The relevant authorities should be notified of any emerging problems and the GEA/HECI should work with the Village Council to address any issues;
- As much as possible workers from Kato and surrounding communities should be employed during construction and selected residents should be trained to be employed for the operational phase;
- The contractor should engage the Village Council and share the construction work programme;
- Any use of community resources, including land to be used by the contractor during construction, raw materials, etc. should be approved by the Village Council;
- The village leadership should be invited to, prior to the commencement of works, share information with workers of the contractor on the village rules, norms, practices and expectations.
- The contractor should prepare and implement a Code of Conduct for workers which should state and guide the behavior of workers onsite and within the community. The Code of Conduct should address:
  - Respect of the village rules, customs and practices.
  - Respect for the Amerindian culture.
  - Clear understanding that it is illegal to bring alcohol into an Amerindian village for the purposed of offering it to a resident.
  - Hunting/trapping of wildlife is not allowed.
  - Compliance with applicable laws, rules, and regulations.

- Compliance with applicable health and safety requirements (including wearing prescribed personal protective equipment, preventing avoidable accidents and a duty to report conditions or practices that pose a safety hazard or threaten the environment).
- The use of illegal substances.
- Sexual harassment (for example to prohibit use of language or behavior, in particular towards women or children, that is inappropriate, harassing, abusive, sexually provocative, demeaning or culturally inappropriate).
- Violence or exploitation (for example the prohibition of the exchange of money, employment, goods, or services for sex, including sexual favors or other forms of humiliating, degrading or exploitative behavior).
- Protection of children (including prohibitions against abuse, defilement, or otherwise unacceptable behavior with children, limiting interactions with children, and ensuring their safety in the project area).
- Sanitation requirements (for example, to ensure workers use specified sanitary facilities provided by their employer and not open areas).
- Avoidance of conflicts of interest (such that benefits, contracts, or employment, or any sort of preferential treatment or favours, are not provided to any person with whom there is a financial, family, or personal connection).
- Respecting reasonable work instructions (including regarding environmental and social norms).
- Protection and proper use of property (for example, to prohibit theft, carelessness or waste).
- Duty to report violations of the Code.
- Non retaliation against workers who report violations of the Code, if that report is made in good faith.

To prevent any conflicts during the power generation and distribution phase of the project the following should be implemented:

- An agreement should be signed between the implementing agency and the Kato Village Council detailing arrangements regarding project ownership, cost of electricity for households and businesses and profit sharing;
- Residents having Free Prior Informed Consent on future plans for the hydroelectric project and other developmental projects linked to the facility;
- As much as is possible households from the community should be provided with power generated by the project;
- Community members should be employed in the operation aspect of the project. Expertise required should be shared with the community at an early stage so that the relevant training can be acquired;
- The determination of the rates for electricity provided to members of the community should be done in consultation with the community members; and
- The project should consider rehabilitating and maintaining the road from the community to the project site.

### **7.3.2 Stakeholder Engagement**

Stakeholder engagement is essential for projects occurring within indigenous communities and those utilizing local resources and will need to be fully integrated into the various stages of the process. It is expected that the leadership of the Kato village will be fully engaged during the project implementation. The following are recommended:

- GEA, HECI and the contractor should engage the community prior to the commencement of works to inform the residents of the proposed works, health and safety measures, responsibilities of the contractor, responsibility of the community, etc.;
- Messages from the project relating to possible employment and other opportunities should be posted or distributed in Kato thereby ensuring that all interested persons are aware, particularly women who are willing to work; and
- A representative of the Kato Village Council should be invited to the project progress meetings so that the community can be kept abreast on the progress of works and any other matter.

### **7.3.3 Conflict Resolution (Grievance Mechanism)**

A project-level grievance mechanism for affected community members is a process for receiving, evaluating, and addressing project-related grievances at the level of the company, or project.

A grievance mechanism should be implemented for the project outlining a clear set of opportunities for affected people or any other interested stakeholder to post a claim, request information and have a formal mechanism to communicate with the GEA/HECI and the contractor. The project must keep a grievance register normally lodged with the supervising entity for the project.

For the works to be conducted grievances may arise, since, given the nature of the project, it is expected that conflicts and other disagreements are possible. All stakeholders who believe aspects of the project will have a detrimental impact on the community, their day to day activities, the environment, or on their quality of life should be able to communicate their grievances. These grievances must be documented, analysed and responded to efficiently. Stakeholders may also submit comments and suggestions that they feel will increase the benefits of the project and decrease the impact they face. The outstanding grievances should be addressed at the monthly project meeting. It is expected that any grievances arising from the construction activities will be localized. As such, to ensure that the process is effective, a site level mechanism to address grievances is recommended.

The grievance mechanism should be coordinated by the GEA and HECI or suitable party who should act as a point of contact to receive complaints and work to address all grievances in a timely, effective and satisfactory manner, and to foster positive engagement when issues arise. Information on the grievance mechanism, including contact person and contact information should be shared with the communities via notices. These can be posted at the site and at public places within the community.

Grievances resulting from the project received should necessitate the following actions:

- The GEA and HECI should investigate reported grievances to determine the validity of a complaint and cause for the grievance;
- It should then be determined whether grievance can be resolved by the project team or whether outside authorities with regulatory or other responsibilities and relevant skills are to be consulted;
- Or it should be determined if corrective action are to be taken by the contractor and what those actions are;
- The nominated personnel should prepare the Grievance Report, including supporting materials such as photographs. If necessary, a clear list of tasks and outcomes expected shall be developed in order to have the grievance resolved in a timely manner;
- If grievance is the fault of the contractor, then the contractor is to implement corrective action immediately; and
- GEA and HECI should conduct follow-up inspection to monitor the situation and determine whether the problem is likely to recur and put measures in place to prevent recurrence.

A register of grievances received should be maintained and should include information such as date of complaint, by whom, nature of grievance, date investigated and by whom, validity and corrective action required, timeline for implementation of corrective action, and if the grievance was satisfactorily addressed or not. A monthly review on the status of grievances received/addressed should be conducted by the GEA and HECI.

Considering that the contractor will be responsible for addressing grievances including implementation of corrective actions, measures to be employed by the contractor in dealing with grievances should be outlined in the CESMP.

#### **7.3.4 Cultural Change**

The project should as far as possible try to ensure that the village of Kato is fully informed of the choices available to the community and likely actions or support to combat cultural changes. Given that the dependence on modernity has the propensity for the eradication of historic cultural practices the project should seek corrective measures to preserve the Patamona Culture, such as the recording of history for the future generations. Cultural programs and educational sessions should be promoted and supported by the project in order to ensure that the cultural heritage of the people are preserved. These initiatives should emerge from engagements with the Kato Village Council.

#### **7.3.5 Archaeological Finds**

There are no known archaeology sites in the vicinity of the project area. However, the wider area has been occupied by indigenous people for hundreds of years and there are sites where discoveries were made in the past. The following procedure should be followed in the event that archaeological materials or site are discovered during construction:

- All activities in the immediate vicinity of the remains should cease immediately;
- The find location should be recorded, and all remains left in place;
- The contractor should inform the GEA and HECI, who should then inform the Village Council and the National Trust of Guyana of the find;
- The National Trust of Guyana should coordinate with the relevant personnel to determine the significance of the findings and assess appropriate mitigative options;
- If the significance of the remains is judged to be sufficient enough to warrant further actions which cannot be avoided, the GEA and HECI, in collaboration with the National Trust of Guyana, will determine the appropriate course of such action;
- Relocation of the artefacts for preservation and security reasons may be determined as an appropriate action;
- In the case of human remains, the appropriate authority should be contacted. In addition, a coroner and/or physical anthropologist may be involved if the remains are classified as an artefact. Options for removal and burial should be considered if the location must be disturbed; and
- The National Trust of Guyana should inform the HECI and GEA of when work may recommence in the specific area.

### **7.4 Health and Safety**

#### **7.4.1 Workers Health and Safety**

The health and safety of workers involved in activities during the construction phase can be compromised. As such, it is necessary to implement measures to prevent these situations from occurring. The Contractor should, as part of the CESMP outline measures to ensure that the health



and safety of workers is preserved. The following measures should be implemented to reduce the risk to workers:

- The requirements of the Occupation Safety and Health Act should be complied with;
- The contractor should designate someone with the responsibility of ensuring occupational safety and health;
- Workers should be properly oriented to the safety and health rules and guidelines;
- Adequate training should be provided to workers in the execution of their tasks;
- Machinery/equipment should be operated by competent, licensed and authorized personnel only, and in a manner that does not endanger other employees or the Contractors equipment;
- An Emergency Response Plan should be prepared and made available to all relevant personnel and the necessary training and resources required should be provided;
- Well-equipped first aid kits should be provided at all work sites;
- At least one personnel trained in first aid should be present at the construction site;
- Arrangements should be in place to medivac personnel if required;
- Potable water for employees should be provided;
- Protective gear and clothes should be provided to employees and should be worn at all times during operation. Gear to be provided should include safety vests, hard hats, dust mask, ear plugs, gloves and safety boots where necessary. Rain coats should also be provided;
- Employees should be required to wear safety equipment and protective clothing provided by the contractor in all working areas. Monitoring should be done to ensure workers utilise the gears provided;
- Safety rules and guidelines should be posted at strategic locations; and
- Adequate signage should be erected, especially in hazardous areas.

#### 7.4.2 Public Safety

It is anticipated that during construction works the public can be exposed to certain activities which can present a risk to their safety. The contractor should, as part of the CESMP, outline measures to ensure that the safety of the public is not compromised. Specific areas that should be considered and incorporated in the Plan and implemented include:

- All hazardous areas should be secured to prevent access to unauthorized personnel.
- Warning signs should be installed in areas which present a risk for incidents to occur.
- Members of the community should be engaged prior to the commencement of works and made aware of the risks presented by the works and the precautionary measures that they should abide with.
- Vehicles passing through the village, especially near residential areas and the schools, should not exceed the stipulated speed limit and drivers should exercise extreme caution.

#### 7.5 Emergency Response

The contractor will be required to prepare an Emergency Response Plan (ERP) as part of the CESMP. The ERP should outline protocols for responding to environmental emergencies that may occur as a result of unforeseeable circumstances such as a spill of hazardous materials, accidents or medical emergencies. The ERP should describe the general types of emergency and actions to be followed should an emergency occur during the mobilization and operational phases of the project and should include:

- Emergency Contact Details;
- Emergency Procedures;
- Authority of Control;
- Emergency Response Equipment;

- Scenario Description and Response; and
- Incident Reporting.

All personnel should be aware of potential risks and take steps to cope with hazards in their work area. In addition, all personnel are expected to alert the correct personnel if they discover an accident, medical emergency, fire or spill. As such, the ERP should also outline the role of the various personnel in emergency response. The types of emergencies to be covered by the ERP should include fuel and other hazardous material spills, accidents to workers, traffic accidents, fire, etc.

The ERP should consider the remoteness of the project site and the limitations in terms of access and services available and should outline practical measures to respond to the various types of emergencies occurring at the project location.

## 8.0 EAMP IMPLEMENTATION FRAMEWORK

### *Introduction*

This chapter provides the management framework for the implementation of the EAMP. The activities to be conducted for the implementation of the project, especially during the construction phase, should be carried out in a manner which is in compliance with the legislation and guidelines outlined in Chapter 4, and in particular, with the requirements of the EPA as set out in the Environmental Permit.

### 8.1 Roles and Responsibilities

To ensure the environmental and social management measures are implemented HECI, GEA and the contractor will have major roles to play. The roles and responsibilities are outlined below:

#### HECI

The project is being executed by HECI on behalf of the Ministry of Public Infrastructure. HECI will have overall responsibility for ensuring that the environmental and social requirements of the project are met. Prior to the commencement of construction HECI will need to ensure that environmental authorization is obtained for the project, a process which has already commenced with the EPA.

During the construction phase, it is envisaged that HECI is likely to designate the responsibility of overseeing the project's implementation to the GEA. In the operational phase of the project, HECI is expected to take on the responsibility of ensuring that the social and environmental measures are complied with and to undertake monitoring and reporting activities in keeping with the requirements of the EPA Environmental Permit.

#### GEA

The GEA is expected to oversee the implementation of the project. As part of this role the GEA is expected to also have responsibility for overseeing the environmental and social management aspect of the project during the construction phase. As part of its team, the GEA is in the process of employing a Social and Environmental Officer who will assist with this responsibility. This person will have the responsibility of ensuring compliance with the environmental, social, health and safety requirements. Specific responsibility of the Environmental Officer should include:

- Review of the Contractor's CESMP to ensure it is compliant with the EPA's Environmental Permit for the project and the provisions of this EAMP;
- Approve the Contractor's CESMP;
- Conduct routine inspection of construction activities and site for compliance with the CESMP along with environmental monitoring of key parameters;
- Prepare Monthly Inspection Reports on environmental compliance by the contractor and which should include suggestions for corrective actions;
- Continuously engage with the contractor to ensure corrective actions are implemented;
- Participate in stakeholder engagements and outreach to stakeholders;
- Ensure the views of stakeholders are reported and any grievances received from stakeholders are addressed in a timely manner; and
- Participate in project progress meetings to discuss and report on environmental compliance.

#### Contractor

The Contractor will be responsible for ensuring environmental compliance and maintaining environmental quality at and around the construction site, workers accommodation and

equipment/materials storing areas. It is recommended that contractor be required to prepare a CESMP and employ an environmental personnel to assist with the implementation of environmental management measures. This personnel should be suitably qualified and experienced for such a portfolio. The responsibilities of the contractor environmental personnel are outlined below:

- Prepare the contractor's CESMP and oversee its implementation once approved. The CESMP should be guided by the EPA's Environmental Permit for the project and the provisions of this EAMP;
- Conduct training for all contractor staff on the health, safety, environmental and social requirements;
- Monitor all construction activities onsite and prepare and submit monthly environmental and social reports to the GEA;
- Supervise the contractor's workers to ensure full compliance with the requirements;
- Provide oversight of the implementation of all necessary mitigation measures to ensure compliance with the requirements;
- Identify any non-compliance and take corrective actions as appropriate;
- Liaise routinely with the GEA's Social and Environmental Officer;
- Assist in arranging and participate in meetings and engagements with stakeholders;
- Address grievances from stakeholders and maintain liaison;
- Attend meetings to report on environmental compliance; and
- Ensure all of the contractor's worksites are adequately decommissioned upon the completion of works.

The main responsibilities of the project's environmental management team are summarised in Table 8-1 below.

**Table 8-1: Summary of Environmental related Responsibilities**

| <b>Pre-Construction Phase</b> |   |
|-------------------------------|---|
| HECI                          | Securing environmental authorisation for the project from the EPA<br>Preparation of contractor bidding documents to include environmental requirements  |
| GEA                           | Employment of Social and Environmental Officer<br>Ensure that the contractor's CESMP is prepared and approved and training conducted by the contractor.   |
| Contractor                    | Employment of environmental personnel<br>Prepare the CESMP<br>Conduct site induction and training of employees  |
| <b>Construction Phase</b>     |   |
| HECI                          | General oversight of the contractor's environmental performance   |
| GEA                           | Monitoring of project activities to ensure health, safety, environmental and social compliance as well as environmental monitoring<br>Identify non-conformances and recommend corrective actions<br>Participating in stakeholder engagements and taking the lead in addressing/responding to stakeholder grievances<br>Convene monthly meetings and discuss status of contractor's compliance |
| Contractor                    | Implementation of the CESMP, mitigation and environmental management measures and corrective actions<br>Participating in the progress meetings<br>Preparation of the monthly environmental and social compliance reports  |

|                                |   |
|--------------------------------|---|
|                                | Monitor for non-compliances and effectiveness of mitigation measures                                    |
|                                | Engaging with stakeholder and address any grievances which might arise                                  |
|                                | Conduct regular refresher training for workers on health, safety, environmental and social requirements |
| <b>Post Construction Phase</b> |   |
| HECI                           | Post construction/operation monitoring and reporting in accordance with the EPA Environmental Permit.   |

## 8.2 Contractor's ESMP (CESMP)

The Contractor should be required to prepare a CESMP to mitigate issues pertinent to the construction phase of the project and relevant to their assigned tasks. This CESMP should be submitted to the GEA for approval prior to the commencement of works. Once approved, the CESMP is expected to be implemented during the construction period and be updated/revised periodically in a timely manner to ensure that it contains measures appropriate to the works being undertaken.

Preparation of the CESMP should be guided by this EAMP, the requirements outlined in the EPA's Environmental Permit, relevant national standards and guidelines including those of the GNBS, GEA and the Ministry of Public Infrastructure. The following should be addressed/included in the CESMP:

- Contractors' Work Programme – A brief overview of the contractor's proposed Work Programme should be provided, including information on expected duration of the works, number of workers to be onsite, type and quantity of heavy equipment to be onsite, details on workers accommodation, details on burrow pits and reclamation plans, medication facilities to be installed, etc. This information will be essential in the review process of the CESMP.
- HSSE Policy – If the contractor has a Health Safety, Social and Environmental Policy this should be included in the Plan. The policy should also address alcohol and drug use, hunting and the prevention of harm to wildlife, and interactions with local communities and stakeholders.
- Management Structure – The CESMP should describe the contractor's management structure for the project, clearly highlighting the responsibilities for health, safety, and the environment.
- Waste Management – Measures to manage the various waste types to be generated should be included, including solid waste, liquid waste/wastewater, hazardous waste and construction waste.
- Erosion and Sedimentation Control – The CESMP should describe measures to be implemented by the contractor to prevent erosion onsite, and sedimentation of the nearby river.
- Hazardous Materials Management – The Plan should outline how hazardous materials will be managed onsite, including fuel and lubricants.
- Dust Control - The contractor must include in the CESMP measures to prevent dust nuisance from occurring.
- Noise Prevention – measures to reduce noise levels and prevent noise nuisances should be detailed.

- Workers Health and Safety – A Health and Safety Plan for workers should form a component of the CESMP.
- Community Safety – Measures should be implemented to ensure that the safety of the community is not compromised and these measures should be documented in the CESMP.
- Contingency and Emergency Response Plan – A Contingency and Emergency Response Plan must be included in the CESMP to address emergencies relevant to the project. The possible emergencies are:
  - a. Accidents/Medical Emergencies
  - b. Fires
  - c. Fuel/Chemical Spills
  - d. Flooding

The Contingency and Emergency Response Plan should also address training of employees, assembly point in case of emergency, emergency contacts, communications, responsible personnel, response procedures and incident reporting.

- Chance Find Procedure – This should be included to cater for if during project activities archaeological pieces are found. The procedures to be followed should be outlined.
- Training - Training to be conducted should be described in the CESMP.
- Site Closure, Decommissioning and Restoration - At the conclusion of works the sites will need to be cleaned up, all waste removed and all temporary structures belonging to the Contractor dismantled and removed. The measures to be employed by the contractor during this process should be described in the CESMP.
- Grievances – A Grievance Mechanism is included in this EAMP (Section 7.3.3). However, since the contractor will be responsible for addressing grievances, including implementation of corrective actions, measures to be employed by the contractor in dealing with grievance should be outlined in the CESMP.
- Monitoring and Reporting – The CESMP should outline how monitoring will be done by the contractor's environmental personnel, including frequency, areas to be monitored, etc. A checklist to be utilized should be included.

### 8.3 Environmental Monitoring

Monitoring of project activities should be conducted to ensure that the recommended mitigation measures and management practices identified in this EAMP are implemented and effective. This should take place for both the construction and operation phases of the project.

The GEA's Social and Environmental Officer should conduct periodic monitoring of the construction site. The contractor's environmental personnel should conduct frequent visits to the construction site and prepare a monthly environmental compliance report to be submitted to the GEA. Table 8-2 below highlights the various parameters recommended to be monitored as well as the frequency and location of monitoring activities.



**Table 8-2: Environmental Monitoring**

| Parameters   | Frequency     | Locations   |
|--|---------------|---|
| <b>Air Quality</b> <ul style="list-style-type: none"> <li>Evidence of dust accumulation and suspended particles through visible observation</li> <li>Ease of visibility</li> </ul>   | Continuous    | Construction site and along access road                             |
| <b>Water Quality</b> <ul style="list-style-type: none"> <li>Temperature</li> <li>pH</li> <li>Turbidity</li> <li>Oils/Grease</li> <li>Dissolved Oxygen</li> <li>Coliform</li> </ul>   | Monthly       | The Chiung River both upstream and downstream of project activities |
| <b>Noise</b> <ul style="list-style-type: none"> <li>Decibel</li> </ul>   | Monthly       | Construction site   |
| <b>Waste Management</b> <ul style="list-style-type: none"> <li>Compliance with CESMP and waste management practices</li> <li>Littering and waste accumulation</li> </ul>   | Weekly        | Waste receptacles, disposal sites and active construction sites.    |
| <b>Wildlife</b> <ul style="list-style-type: none"> <li>Hunting and Trapping by workers</li> </ul>  | On Observance | Within the village  |
| <b>Health and Safety</b> <ul style="list-style-type: none"> <li>Use of protective gear by workers</li> <li>Adequate and appropriate signage</li> <li>Location of Emergency Procedures</li> <li>Tool box talks, Induction Training, etc.</li> <li>Health conditions of staff.</li> <li>Stocked First Aid Kit</li> <li>Demarcation of construction sites</li> <li>Speed limits by Construction vehicles</li> </ul> | Weekly        | Construction site   |
| <b>Community Wellbeing</b> <ul style="list-style-type: none"> <li>Employment</li> <li>Trained workforce</li> </ul>   | Monthly       | Kato Community  |
| <b>Community Conflict</b>  |               |   |

| Parameters  | Frequency | Locations      |
|---|-----------|----------------|
| <ul style="list-style-type: none"> <li>▪ Domestic disputes</li> <li>▪ Arrests</li> <li>▪ Physical altercations</li> </ul> | Monthly   | Kato Community |

It is expected that environmental monitoring would also be conducted by the EPA to determine compliance with the conditions of the Environmental Permit. Such monitoring would cover both the construction and operation phase of the project.

In the operational phase, it is recommended that HECI will develop and implement monitoring systems which will assist with the monitoring and reporting requirements of the EPA and as outlined in the Environmental Permit.

#### 8.4 Reporting

In order to ensure environmental compliance, it is essential that there be regular meetings of the project management team (Contractor, GEA, HECI and the RDC) and the preparation and submission of formal reports.

It is recommended that the GEA convene progress meetings at least monthly at which the contractor's environmental personnel will attend as well as the GEA's Social and Environmental Officer. Further, the agenda of each meeting should include environmental, health, safety and social compliance and where a report should be presented on the contractor's environmental and social performance. This report should then allow for discussion on areas for improvements, review the progress of implementation of corrective actions and to plan ahead to prevent non-compliances from occurring. These meetings should be convened on a statutory basis throughout the duration of the project and should be documented.

The contractor's environmental personnel should prepare a Monthly Environmental Compliance Report which should indicate areas of non-compliances, reasons for the non-compliances and corrective actions to be implemented. The report should also indicate environmental incidents occurring during the month, complaints or grievances received and follow-up actions. This report should be submitted to the GEA prior to the convening of the monthly meetings and should include but not limited to the following:

- Environmental incidents or non-compliances observed and corrective actions taken with regards to contract requirements, including waste management, contamination, noise and dust control, traffic management, etc.;
- Health and safety incidents, accidents, injuries and all fatalities that require treatment and actions taken to improve conditions. Information on number of workers, work hours, PPE provided and usage, and worker violations and follow-up actions taken (if any);
- CESMP implementation progress, including implementation of the management and mitigation measures outlined in the plan, effectiveness of the measures being implemented, any emerging environmental, social, health and safety issue and any adjustments required (if any); and
- Grievances by workers and community, including grievances received, how resolved, those unresolved and plan for resolving these.

Prior to construction, the contractor should prepare and submit a reporting format to the GEA for approval.

In addition to the monthly report, the contractor should also provide immediate notification to the GEA of incidents in the following categories:

- confirmed or likely violation of any Environmental Permit conditions or any relevant legislation;
- any fatality or serious (lost time) injury;
- significant adverse effects on the environment;
- damage to private or public properties; and
- any allegation of sexual harassment or sexual misbehaviour, child abuse, defilement, or other violations involving children.

Full details of such incidents should be provided within the timeframe agreed with the GEA.

### 8.5 Orientation and Training

During the construction phase of the project it is essential that the contractor conduct orientation and training of workers prior and during construction activities. Training should include both theory and practical exercises and to cover a range of topics on health, safety and the environment including an overview of the CESMP and the roles and responsibilities of Contractor personnel.

Training should be done as part of site induction and should include, but not be limited to the following:

- Environmental requirements and environmental management and health and safety measures as outlined in the CESMP;
- Workers' role and responsibilities in environmental management and health and safety;
- First aid, occupational safety and health measures and the use of PPE;
- Emergency response measures;
- Methods for waste and hazardous materials management and disposal; and
- Social responsibilities of all personnel working under the project and rules of engagement with stakeholders, in particular local communities.

Any new employee should undergo an orientation programme to ensure he/she fully understands the job requirements and employment conditions and is motivated to improve his/her skills.

The contractor should establish a schedule for training which should take place at least every 6 months and with the participation of the GEA Social and Environmental Officer. On a day-to-day basis, there should be Tool Kit Orientation by the contractor's manager to emphasise key issues on health, safety and the environment.

### 8.6 Mitigation and Monitoring Budget

An indicative annual budget is presented in Table 8-3 outlining estimated costs for mitigation and monitoring activities during the construction phase of the project.

Additionally, the costs identified are indicative since at this stage the final design for the project is not yet available, nor has the EPA issued an Environmental Permit which would outline monitoring and reporting details and requirements.

**Table 8-3: Budget for Mitigation and Monitoring**

| <b>Environmental Component/ Impacts</b> | <b>Action</b>  | <b>Equipment/ Personnel/ Activities</b>                                  | <b>Annual Cost US\$</b> |
|---|--|--|-------------------------|
|   | Hiring of contractor environmental personnel   |  | 20,000                  |
| Waste Management                        | Collection and disposal of garbage and construction waste  | Bins and garbage receptacles<br>Disposal of waste                        | 12,000                  |
|   | Managing of liquid waste   | Provision of Portable Toilets/Latrines/Toilets with Septic Tanks         | 12,000                  |
| Water Quality                           | Water quality tests such as pH, Turbidity, Oils/Grease, Dissolved Oxygen, Coliform, etc.                             | Samples collected and outsourced to Lab for analysis                     | 24,000                  |
| Noise                                   | Monitoring   | Noise level testing  | 500                     |
| Health and Safety                       | First Aid Kits   | Procure kits   | 1,000                   |
|   | Protective gear for workers e.g. safety vests, helmets, gloves, dust masks, safety boots and ear piece.              | Procure gears  | 6,000                   |
|   | Warning signs at work sites.   | Prepare and erect signs  | 2,000                   |
| Emergency Response                      | Fire Extinguishers and Spill Kits.   | Procure equipment  | 2,500                   |
|   | Communication Equipment  | Procure equipment and credit (satellite phone)                           | 5,000                   |
| Training                                | Training of personnel e.g. in Environmental Responsibilities, First Aid, Health and Safety, Emergency Response, etc. | Conduct training once per year   | 5,000                   |
| Incidentals and Emergencies             | Response needed in event of accidents and emergencies.   | Materials and personnel (depends on type/scale of incident or emergency) | 10,000                  |
| <b>TOTAL</b>                            |  |  | <b>100,000</b>          |

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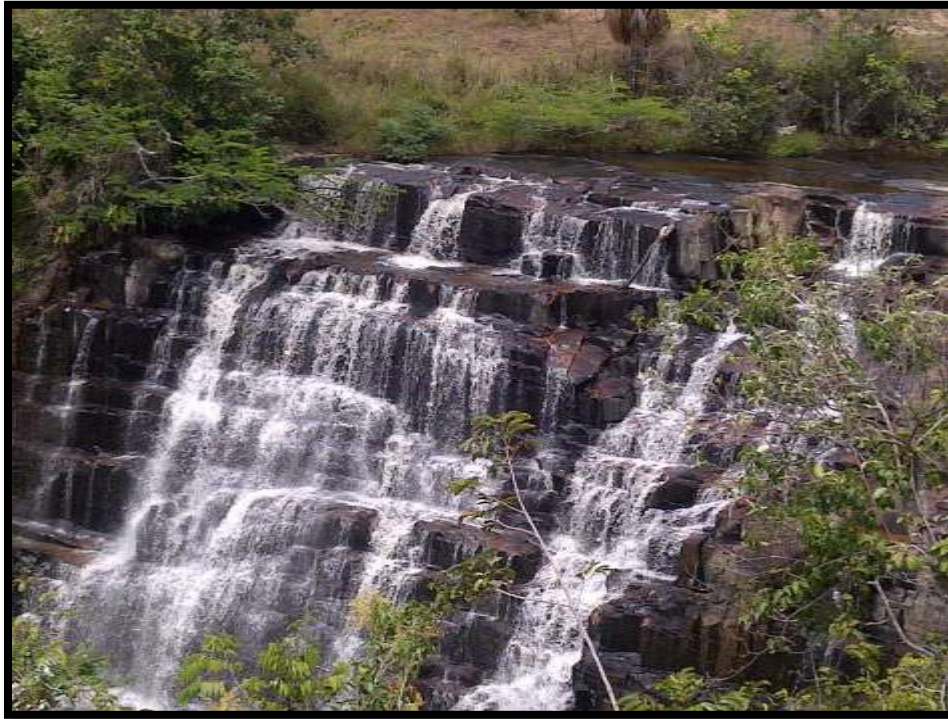
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## APPENDIX A: EAMP Team

| Name                         | Position   | Task   |
|------------------------------|--|--|
| Mr. Shyam Nokta              | Team Coordinator, Natural Resources and Environment Specialist | Responsible for overall planning and coordination of the EAMP preparation including review of submissions and the draft EAMP.  |
| Mr. Khalid Alladin           | Environmental Management Specialist                            | Responsible for assisting in the compiling the EAMP and taking the lead on impact analysis and mitigation.   |
| Ms. Kandila Ramotar          | Environment and Climate Specialist                             | Assisting in the preparation of the EAMP   |
| Mr. Maxwell Jackson          | Hydropower Specialist  | Responsible for review of project details and to identify key issues and providing technical (engineering) inputs into the EAMP preparation and supporting the impact analysis and mitigation. |
| Mr. Hance Thompson           | Biodiversity Specialist  | Responsible for developing an ecological profile of the project area (ecosystem, habitat, biodiversity) and inputs to the ecological assessment component of the EAMP preparation.             |
| Mr. Lakshman Richard Persaud | Social Specialist  | Responsible for local stakeholder engagements, preparation of a socio-economic profile and inputs to the social assessment component of the EAMP preparation.                                  |
| Mr. Enrique George Monize    | GIS Specialist   | Responsible for spatial layout of baseline information and maps preparations.  |

## **APPENDIX B: Terms of Reference for Preparation of the EAMP**

### **TERMS OF REFERENCE FOR THE PREPARATION OF AN ENVIRONMENTAL ASSESSMENT AND MANAGEMENT PLAN FOR THE KATO 150kW HYDROELECTRIC PROJECT**



October 2018

## 1. Introduction

The Terms of Reference sets out the framework for the preparation of the Environmental Assessment and Management Plan (EAMP) for the proposed 150kW hydroelectric project located at Kato, Region 8. The EAMP will focus on the assessment of the environmental consequences of the project and outline the appropriate environmental management practices to be applied during the phases of the project.

### 1.1 Background

Kato is a small village located in the West of the Potaro-Siparuni Region (Region 8), close to the Guyana/ Brazil border at approximately 310 km South West to the capital city of Georgetown. The proposed hydro power project will be situated on the Chiung River between the Amerindian villages of Kurukabaru and Kato. The facility will be designed to provide electricity to the population of Kato. Additionally, the community relies on subsistence farming and as such with the hydropower project, pumps can operate to provide irrigation services to farmlands which can contribute to local economic development, livelihood enhancement and security.

Guyana is mainly covered with dense rainforest, however, the proposed location for the project is dominated by savannah. The general area is located inside the Northern Savannah, which presents two wide flat parts bordered by the Chiung River, separated by the valley, excavated by the river stream and its tributaries. These areas are Kato Plateau (South) and the Chiung Plateau (Northwest). The Kato Village is in the North of Kato Plateau with a population of approximately 250 households. They are very isolated from each other, except for the airport area, where public administration buildings are located. The village is not connected to the national electricity grid which has resulted in the use of solar systems to meet some of the energy needs.



Figure 1: Location of Kato

## 2.0 Environmental Assessment Regulations

The proposed Kato hydroelectric project will be developed with the primary purpose of generating electricity using the water resource of the Chiung River. To conform to relevant environmental laws of Guyana, the following policy guidelines and legislation provide the framework within which the project must operate;

- 1) The National Environmental Action Plan, 1994
- 2) The Environmental Protection Act, 1996
- 3) The Wild Birds Protection Act, 1973
- 4) The Aquatic Wildlife Control Regulation, 1996
- 5) The Forestry Act, 1953 (and its proposed revision, 2009)
- 6) National Forest Policy and Plan
- 7) Public Health Ordinance, 1953
- 8) National Trust Act,
- 9) The Town and Country Planning Act,
- 10) The Drainage and Irrigation Act,
- 11) The Guyana Geology and Mines Commission Act, 1979
- 12) The National Development Strategy (draft), 2000
- 13) Environmental Protection Water Quality Regulations, 2000
- 14) Environmental Protection Air Quality Regulations 2000
- 15) Environmental Protection Noise Quality Regulations 2000
- 16) Environmental Protection Hazardous waste management regulations
- 17) Environmental Protection Authorisation Regulations 2000
- 18) Occupational Safety and Health Act, 1997
- 19) National Biodiversity Action Plan, 1999
- 20) Wildlife Conservation Regulation, 2013
- 21) National Energy Policy (1994)
- 22) Unserved Areas Electrification Programme (2004-2010)
- 23) Guyana Power Sector Policy and Implementation Strategy (2010)
- 24) Poverty Reduction Strategy Paper (2011-2015)
- 25) Low Carbon Development Strategy (2009, 2010 and 2013)
- 26) Regional Energy Policy (2013)
- 27) Draft Hinterland Energy Strategy (2013)
- 28) Guyana Energy Agency Draft Strategic Plan (2016-2020)
- 29) Guyana Green State Development Strategy

Guyana is a signatory to many international and regional conventions and protocols aimed at addressing environmental concerns. Some of these that are applicable to the Kato hydroelectric project are:

- 1) Convention on International Trade in Endangered Species of Fauna and Flora (CITES), 1973
- 2) Convention on Biological Diversity, UNCED, 1992
- 3) Treaty on Cooperation for the Development of the Amazon Basin, Brasilia, 1978
- 4) United Framework Convention on Climate Change, UNCED, 1992
- 5) Convention on the Protection of the World Cultural and National Heritage, 1972
- 6) Agenda 21
- 7) United Nations Convention Combating Desertification (UNCCD)

The above listed environmental laws, conventions and protocols provide legal authority for institutions in the country to implement mitigation measures, monitoring and technical supervision, thereby promoting the effective involvement of various concerned groups in development actions.

### 3.0 Objectives of the Environmental Assessment and Management Plan (EAMP)

1. Describe the phases of the proposed activity and identify the risks associated with each phase, and the receptors that will be potentially affected.
2. Identify the potential project failure modes.
3. Identify the potential environmental, economical and social impacts associated with project.
4. Identify cost effective measures to manage/reduce the impacts and risks associated with the project to an acceptable level.
5. Develop a monitoring plan for baseline, impact, and compliance monitoring.

## 4.0 Project Description

### 4.1 Objective of the Project

The goal of the project is to provide the remote hinterland communities of Kato with access to affordable energy services, generated from a sustainable and renewable source.

The specific objectives are:

To construct a 150kW run – of – the – River hydropower plant on the Chiung River to supply electricity to:

- ✓ irrigation systems to support commercial agriculture in Kato;
- ✓ existing government facilities/buildings in Kato and the new secondary and vocational school complex in Kato

### 4.2 Project Components

The project comprises the following components:

- 1) weir/ intake structure
- 2) Headrace canal
- 3) Forebay with sand trap,
- 4) Penstock
- 5) Powerhouse.
- 6) Switch Yard

### 4.3 Geographic Location of the Site

The project is located in Region 8 (Potaro-Siparuni) about 20 km from the Guyana/Brazil border at coordinates Latitude 04°39'43.28"N; Longitude 059°51'4.75"W.





Figure 2: shows the site location with the position of the main components (Length of Head Race ~ 550 m)

The village of Kato can be accessed by air and land transportation. The closest town (Lethem) is approximately 120km from Kato by road through mountainous terrain. However, the conditions of the roads vary and, in some cases, become impassable during the rainy season. It will take approximately 2 days from Lethem to Kato and back.

## 5.0 Requirements

The EAMP submitted to the procuring entity is required to be presented in a professional format. Additionally, all information must be accurate, clear, unambiguous and suitable for an understanding of the treatment, control and backup methods to be employed. The EAMP should provide a comprehensive description of the proposed/existing activity including its location (project address, block and section and certificate of ownership). Specific matters requiring attention are:

1. Justification and/or objectives for the proposed/existing activity;
2. The legal framework, including existing zoning and environmental approvals, decision making authorities and involved agencies; and
3. Consideration of alternative options.

### 5.1 Key characteristics of the proposed/existing activity

Include a description of the components of the proposed/existing activity, including the nature and extent of proposed and current works. This should include, but not be limited to, the following:

1. Life of project.
2. Total land area of site.
3. Identify any subsurface developments and include relevant details (e.g. Water table depth).
4. Area of disturbance (including access).
5. Operating hours (during construction and business operating hours).
6. Phases of the project:
  - i. Provide adequately dimensioned plans clearly showing the location and elements of the proposed/existing activity that are significant from the point of view of environmental protection.
  - ii. Locate and show dimensions (for progressive stages of development, if relevant) of plant, amenities buildings, access ways, stockpile areas, dredge areas, waste product disposal

and treatment areas, all dams and water storage areas, storage areas including fuel storage and waste oil and landscaped areas.

- iii. If appropriate, a process chart/mass balance diagram showing inputs, outputs and waste streams.
7. Waste management.
8. Water supply source (including maximum annual requirement).
9. Fuel storage capacity and quantity used (No. of fuel storage tanks above or underground).
10. A map showing the proposed/existing activity in the local context and in the regional context. The plan/s should include contours, north arrow, scale bar, legend, grid coordinates, the source of the data and a title.

## 5.2 Environmental Policy and Legal Framework

The EAMP should describe the Company's Environmental Policy and its alignment with national environmental policies and MEAs e.g. GSDS, LCDS etc. and its commitment to the protection of the Environment and the Legal Framework and explain how these will inform the design, development, and implementation of the EMP. Some aspects to consider are the following:

1. The project developer's/company's profile, environmental management policies and commitments: This section should include a summary of existing policies, guidelines and commitments in relation to health, safety and environment. It should also show the link of the company's policies and commitment to national policies and MEAs.
2. Institutional arrangements: This section should clearly define the responsibilities for management actions contained in the EAMP and clarify arrangements for coordination among the role players involved in implementation. Further, a flow diagram should be included showing responsibilities and communication channels.
3. Legal requirements for the project: The EAMP should identify the legislation, standards, guidelines and associated permits or licenses that apply to the project and are related to management activities specified in the EAMP. This section aids in identifying the legal framework for environmental protection and the legal basis for mitigation.
4. Definition of the environmental management objectives to be realized during the life of a project (i.e. pre-construction, construction, operation and/or decommissioning phases) in order to enhance benefits and minimize adverse environmental impacts.
5. Description of the detailed actions needed to achieve the environmental management objectives: The description of actions should include how they will be achieved, by whom, by when, with what resources, with what monitoring/verification, and to what target or performance level. Mechanisms must also be provided to address changes in the project implementation, emergencies or unexpected events, and the associated approval processes.

## 5.3 Environmental Factors

The EAMP should focus on the relevant environmental factors for the proposed/existing development, and these should be agreed in consultation with the procuring entity and other stakeholder agencies when necessary. The following points should be covered in the EAMP:

1. A description of the surrounding environment, including land uses and land features of the area. This also includes a description of the geology of the area and baseline information on the biodiversity in the area.
2. Summary of potential impacts associated with the proposed activity: Identify all impacts that could arise during each phase of the operation and distinguish, where applicable, between negative and positive impacts, direct and indirect impacts, immediate, short-term and long-term impacts, and cumulative impacts.

Describe impacts quantitatively, as far as possible, and consider those that can occur in unforeseen circumstances. The reliability of forecasts and predictions shall be indicated as appropriate. Impacts must be categorised and illustrated using an appropriate format e.g. matrices where applicable. Data from other existing activities using the same technology should be used to compare, or assist in the prediction of impacts for this proposed project, where applicable.

A determination of impact significance shall be provided for each key environmental or socio-economic and cultural component (by major phase or activity) after considering the application of proposed mitigation measures (i.e. rank the significance of residual effects following mitigation).

The potential impacts to be discussed include, but are not limited to, those related to:

- Human beings including, but not limited to, such aspects as:
- Community (health, safety, socio-cultural);
- Investigate possible effects to demographic and socio-economic and cultural profiles of the communities that would be potentially affected by the project e.g. consider neighbouring farmlands, local employment and training, local procurement, vulnerable groups (youth and elderly, handicapped, other users of the area etc.), transport, health services, security, lifestyle and culture.
- The introduction of increased dangers (e.g. fire, explosion, spills, chemical and other hazardous substances, if applicable) to the surrounding environment, including neighbouring communities;
- Flora and fauna including, but not limited to, such aspects as:
  - Impacts on terrestrial and aquatic habitat use and ecology;
  - Impacts to sensitive species such as endangered or subsistence/commercially exploited species;
  - Expected changes in the health of flora and fauna that will result from the introduction of the activity. This must include any expected changes to species count and diversity within the study area. The assumptions used for making such correlations must be explained;
  - Natural habitats - determine/estimate the degree of habitat fragmentation or degradation likely to occur both in qualitative and quantitative terms (i.e. acreage or extent of habitat fragmentation or reduction as well as the reduction in biodiversity and available ecological niches);
  - Wider impacts on terrestrial ecology of the study area, as effects are transferred along the food chain.
- Water (surface and groundwater) quality — including, but not limited to, such aspects as:
  - Impacts to the hydrology of the study area in terms of changes to groundwater recharge rates, drainage patterns, sediment loads and effects on water table (impacts should be quantified/qualified in relation to appropriate baseline parameters). Consider impacts to hydrological resources in terms of loss or impairment of resource (i.e. healthy ecological/aquatic habitat and source of potable water); The cumulative water quality effects that are likely to result from the project in combination with other existing, approved and other ancillary projects;
- Air quality, climate and climate change;
- Noise: estimate the potential for increased noise from the operations and vehicles, to the nearby communities (where applicable) and fauna;
- Geology, soils and terrain;
- Solid waste: identify the activities of all phases of the project that may produce both hazardous and non-hazardous solid waste, and assess the possible impacts associated with the type of waste produced;

- Impacts on archaeological and historical sites and cultural resources of interest, where applicable.
3. Description of mitigation measures:  
The EAMP should identify feasible and cost-effective mitigation measures to reduce significant negative environmental impacts to acceptable and legal levels. Mitigation measures should be described in detail and be accompanied by designs, equipment descriptions, and operating procedures. The technical aspects of implementing the mitigation measures should be described.
  4. Description of monitoring program:  
Environmental performance monitoring should be designed to ensure that mitigation measures are implemented. The monitoring program should clearly indicate the linkages between impacts, indicators to be measured, measurement methods and definition of thresholds that will signal the need for corrective action.  
  
A monitoring program could comprise three aspects:
    - i. Baseline measuring: This should occur prior to the start of the project or activity in order to determine the level and status of the environmental parameters prior to any impacts associated with the project or activity.
    - ii. Impact (or performance) monitoring: This type of monitoring should be ongoing throughout the project's life-cycle. Further, impact monitoring must be implemented to ensure that environmental impacts are within the predicted levels and that specified environmental performance targets are being achieved.
    - iii. Compliance monitoring: This type of monitoring is implemented to ensure that the prescribed mitigation measures are effective. Further, it ensures that the level of environmental parameters is compliant with the laws, regulations, and standards stipulated in the legal framework for environmental protection identified in the EAMP.
  5. Implementation schedule and reporting procedures:  
An implementation schedule must be prepared showing the sequence and timing (including frequency and duration) of the management actions and monitoring activities of the EAMP. The measures should be specified in an implementation schedule, showing links with the overall project.  
Procedures to provide information on the progress and results of mitigation and monitoring measures should also be clearly specified.
  6. Cost estimates:  
Section provides cost estimates for initial and recurring expenses for implementation of the EAMP, including provision for: mitigation and enhancement actions; training and environmental awareness requirements; monitoring; auditing; and corrective actions.
  7. Training and environmental awareness:  
This section of the document should specify the requirements with regards to training and environmental awareness for all site and other project personnel to ensure that actions specified within the EAMP are implemented effectively and efficiently.
  8. Documentation and record keeping:

The EAMP should indicate what systems will be put in place to ensure proper document handling and control, for all EAMP documentation.

9. Reporting procedures:  
This section should stipulate the reporting procedures and practices to be followed during EAMP implementation.
10. Auditing:  
This section should provide details on the schedule for environmental auditing, auditing team, reporting of results and corrective actions when needed.
11. Emergency response plan (ERP):  
This plan is developed with a goal to protect human health and the environment to the extent possible through minimization of impacts.

#### 5.4 EAMP Submission Checklist

This checklist is presented to help improve the information being provided and as such assist in reducing the timeframe for assessments. Information should be provided on all those items that are relevant to the proposal/existing development. It should also be noted that the list presented below is by no means limited and can be modified by the procuring entity at any given time.

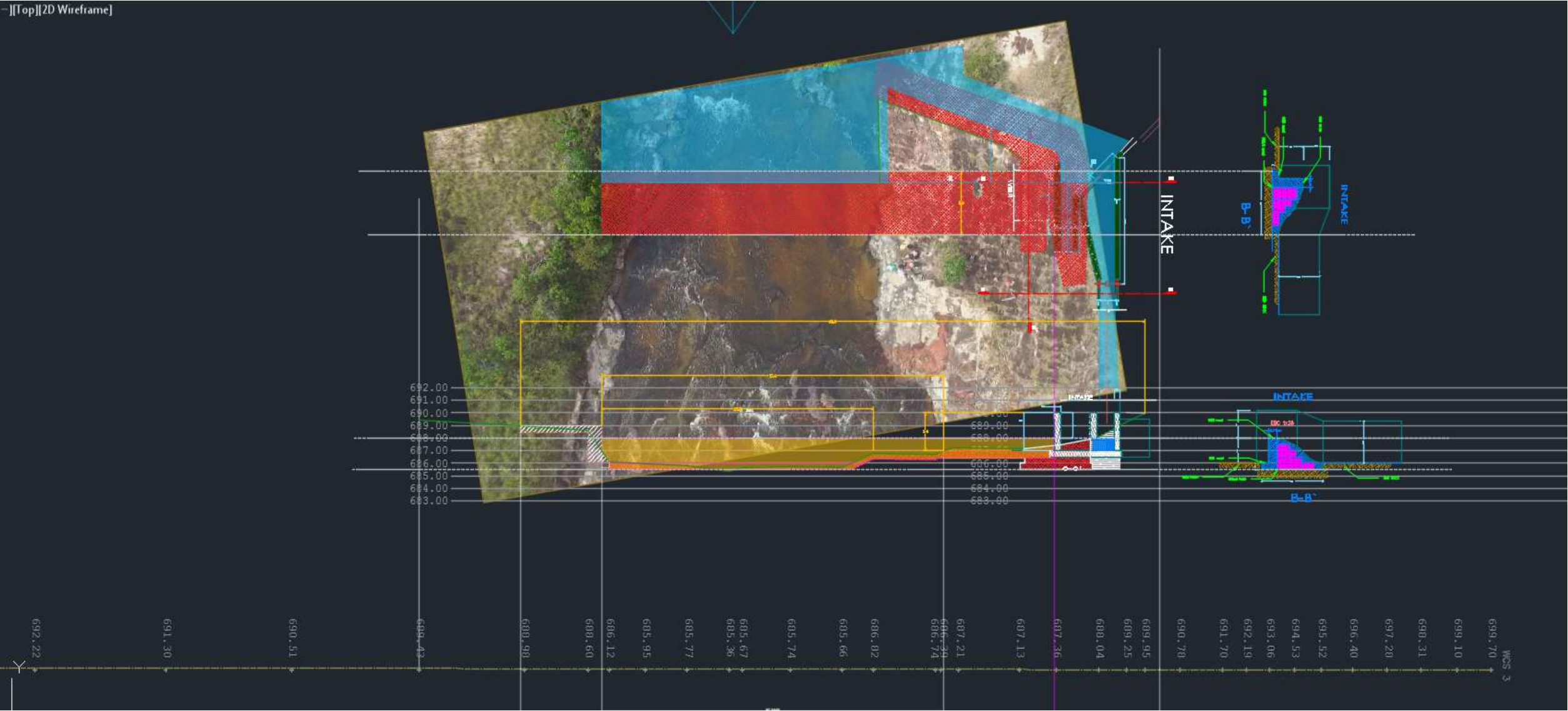
|    | ISSUES TO CONSIDER  | YES | NO | NA |
|----|---|-----|----|----|
| 1. | <b>Have you described the proposed/existing development in full and included plans showing the location of the proposed/existing development and surrounding environment (land uses/features)?</b>  |     |    |    |
|    | a. Description of proposed activities.<br>b. Ownership details of proposed land area<br>c. Bush land areas, other system areas and reserves.<br>d. Wetlands and waterways (e.g. declared waterways, etc.)<br>e. Priority surface and groundwater protection areas (e.g. public drinking water sources and other declared areas).<br>f. Any existing site contamination or details of previous land uses which may have contaminated the soil or water resources.<br>g. A layout of the proposed/existing development on a site plan with the current topography including contour lines and catchment boundaries, catchment areas, adjacent areas including creeks and buildings; the location of permanent storm water inlets, pipes, outlets, and other permanent drainage facilities; current vegetation on site and vegetation to be removed from the site, and detailed alterations to existing land structures. |     |    |    |
| 2  | <b>Have you addressed relevant issues from the following list and identified control measures to address environmental impacts? Details on control measures identified for each particular issue must be included.</b>  |     |    |    |

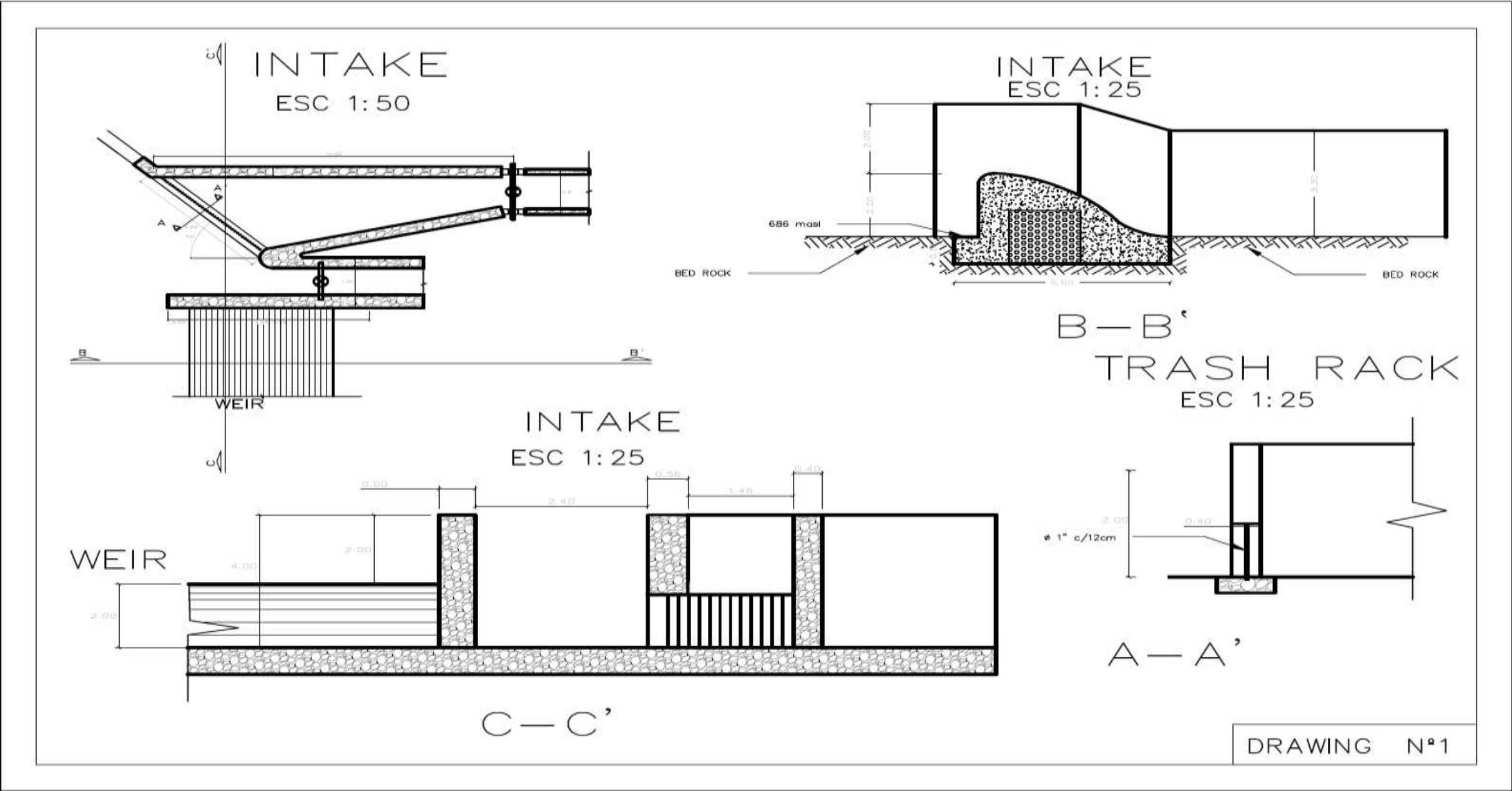
|           | ISSUES TO CONSIDER  | YES | NO | NA |
|-----------|---|-----|----|----|
|           | a. Air.<br>b. Particulates/dust.<br>c. Odour.<br>d. Noise/vibration.<br>e. Surface water.<br>f. Groundwater.<br>g. Wastewater reuse.<br>h. Solid waste.<br>i. Hazardous waste (medical, radioactive, chemical).<br>j. Hazardous materials.<br>k. Chemical substances, management and storage.<br>l. Compressed/liquid gas.<br>m. Underground/above ground fuel storage tanks.<br>n. Discharges to land.<br>o. Discharges to surface water.<br>p. Discharges to groundwater. |     |    |    |
| <b>3.</b> | <b>Have you addressed onsite water usage? for example:</b>  |     |    |    |
|           | a. Irrigation.<br>b. Cleaning.<br>c. Drinking.  |     |    |    |
| <b>4.</b> | <b>Have you provided the following information?</b>   |     |    |    |
|           | a. Operating hours.<br>b. Timescale for completion of construction works.<br>c. Planned timelines for construction and operation.<br>d. Risk assessment.<br>e. Environmental Protection measures required.<br>f. Detailed Monitoring Schedule<br>g. Company contact details including 24-hour emergency phone number.   |     |    |    |



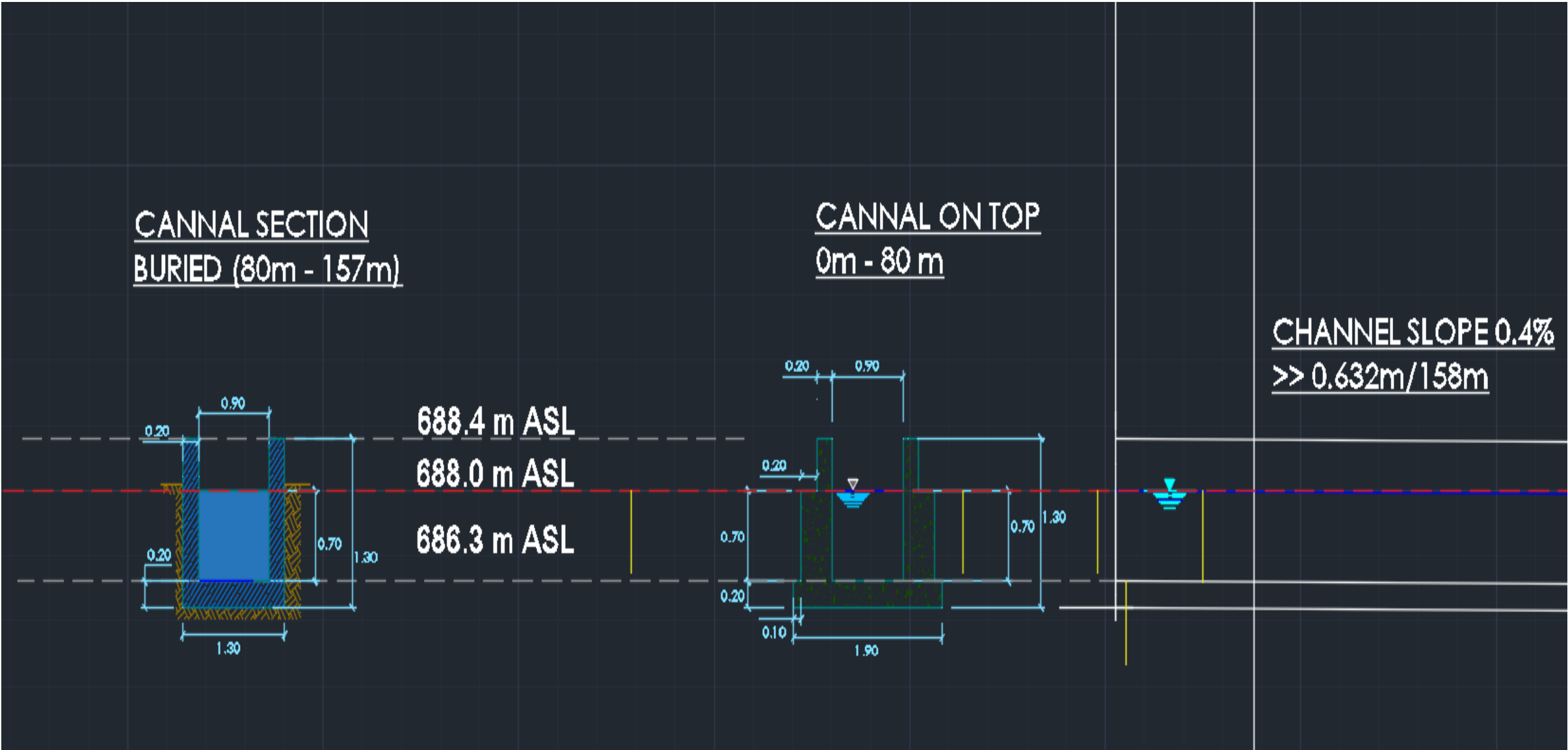
APPENDIX C: Concept Drawings for Project Components

I. Weir/Intake (Concept Design)

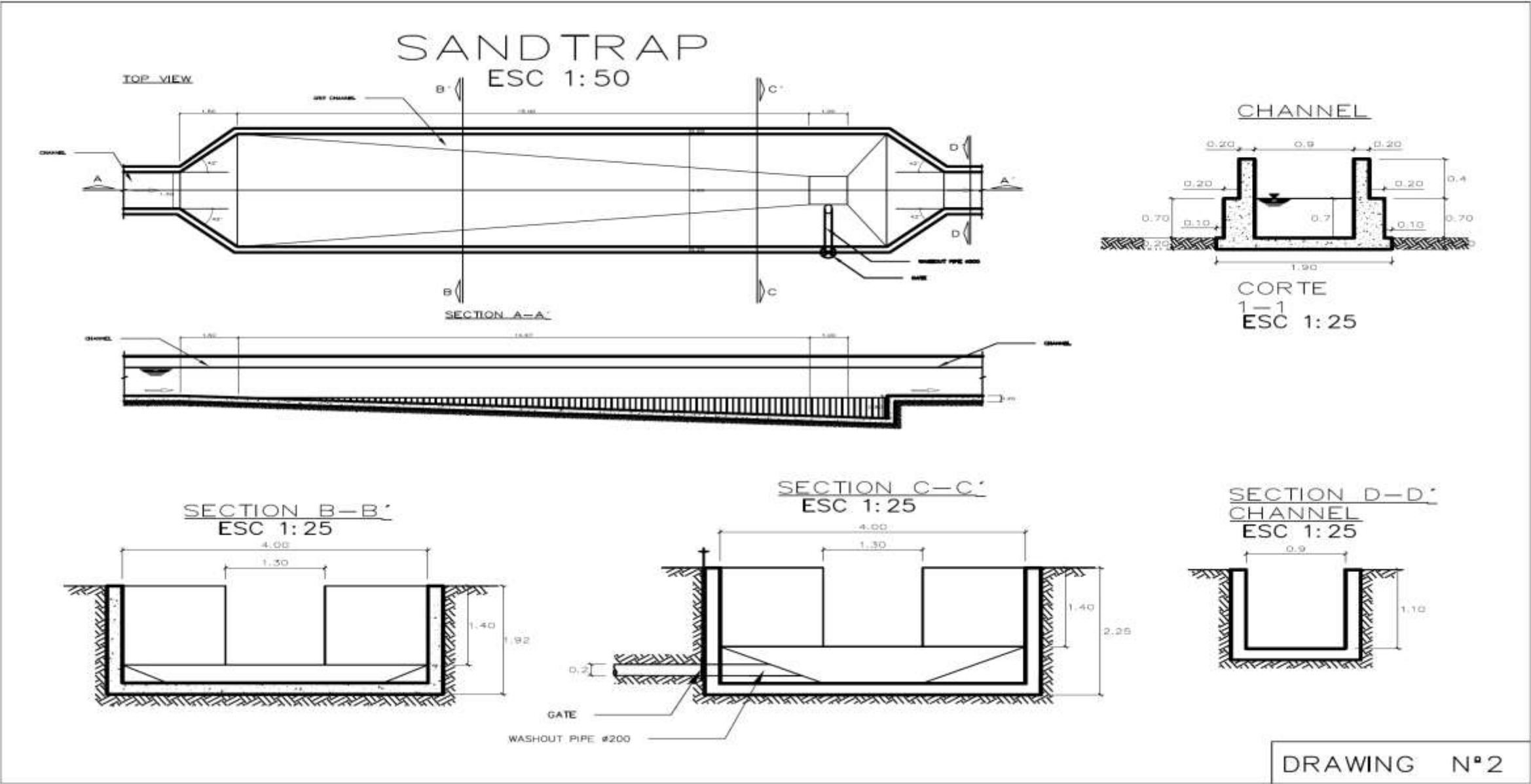




II. Head Race Channel (Concept Design)



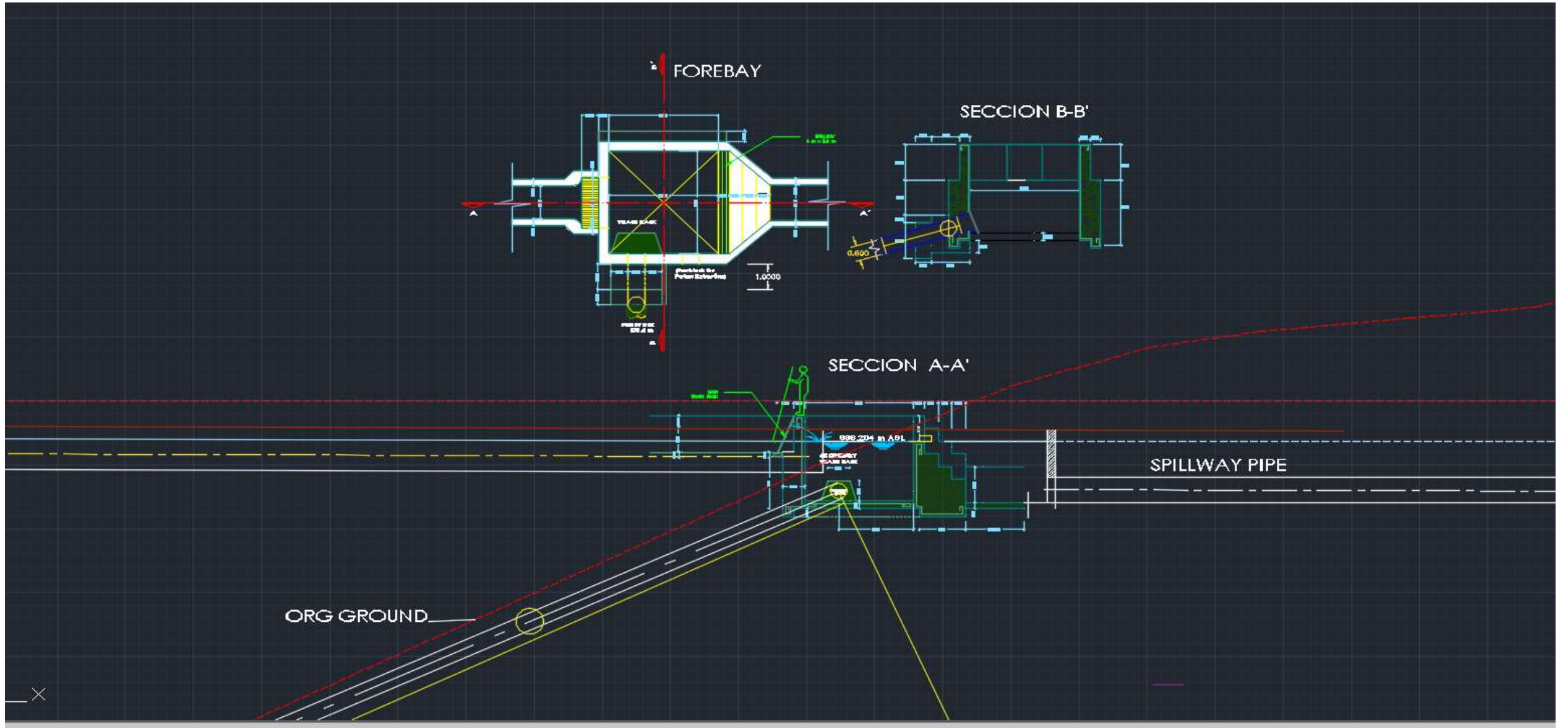
III. Desander (Sand-Trap) (Revision)







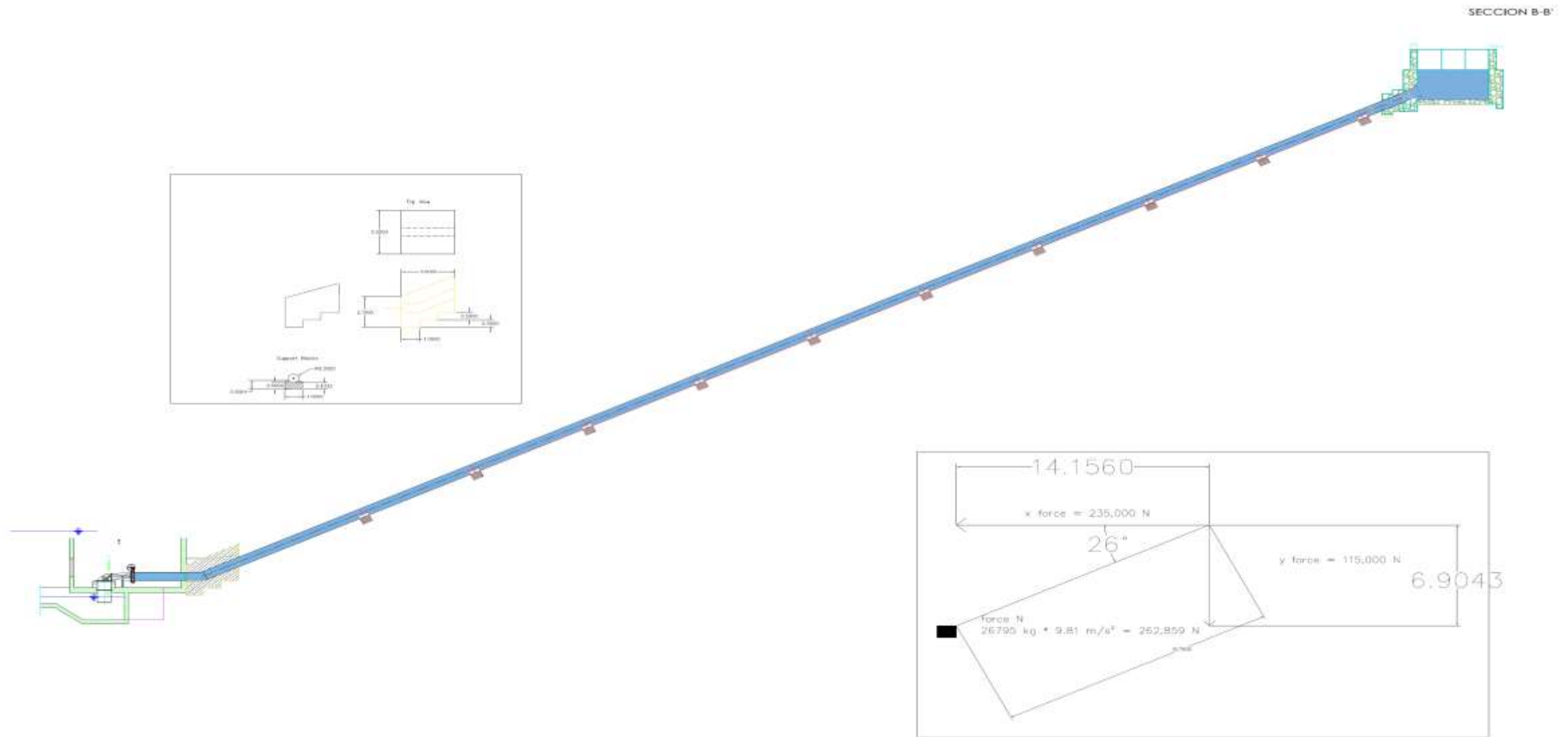
#### IV. Forebay (Revised Design)



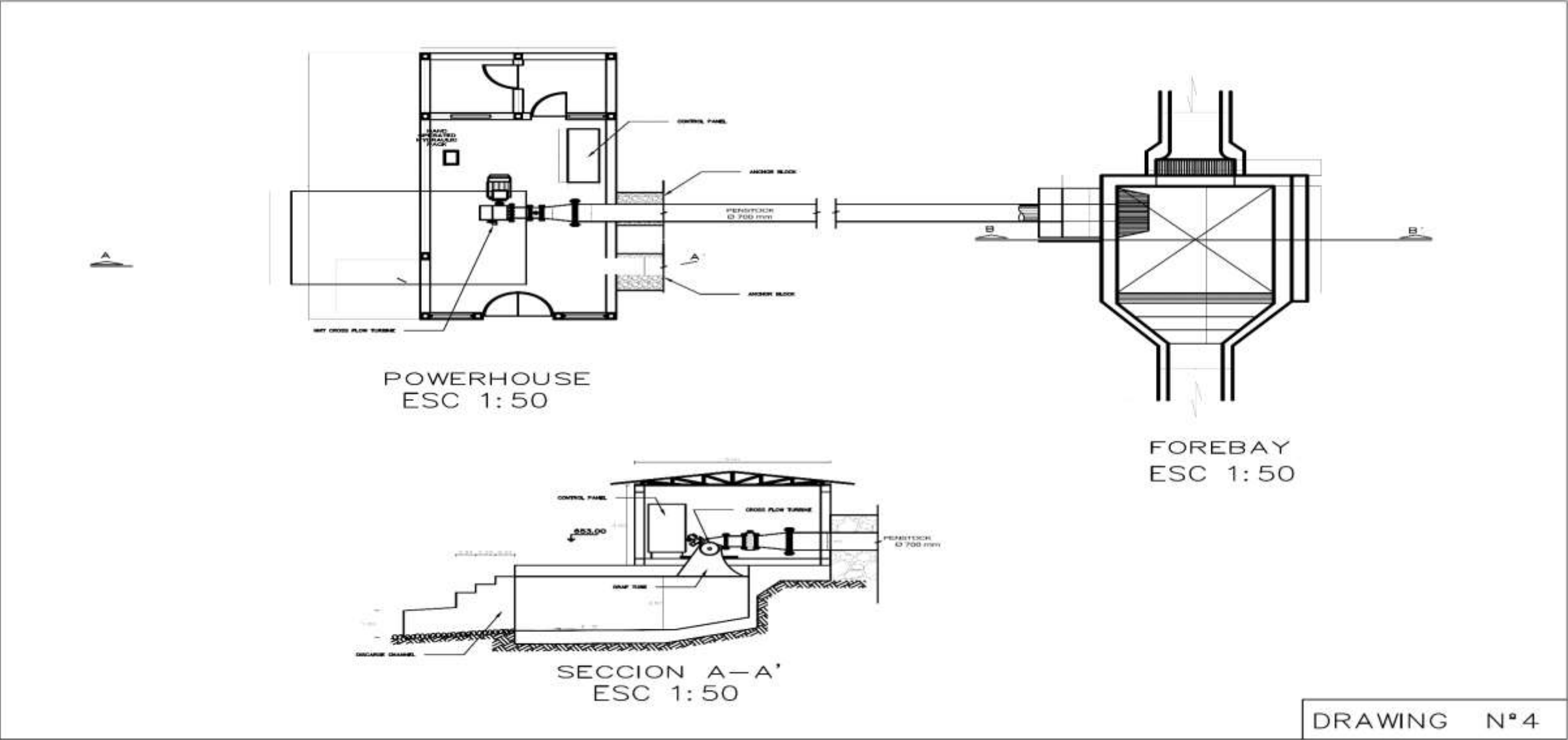


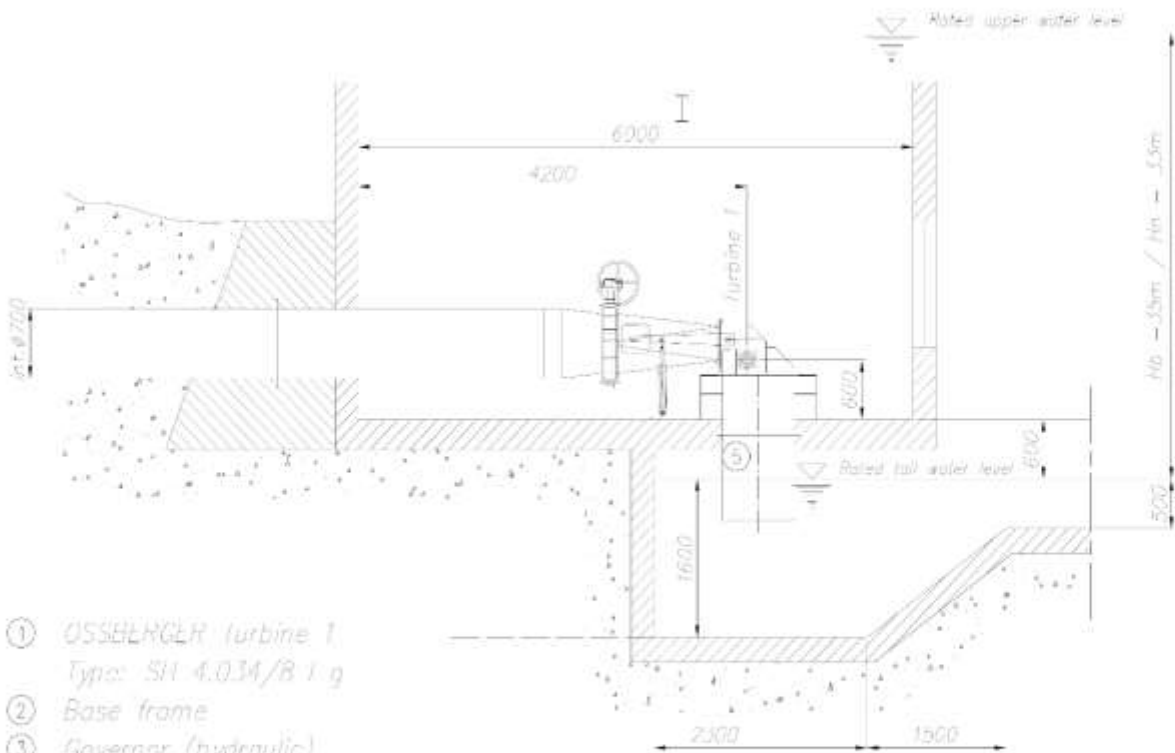


## V. Penstock (Revision)



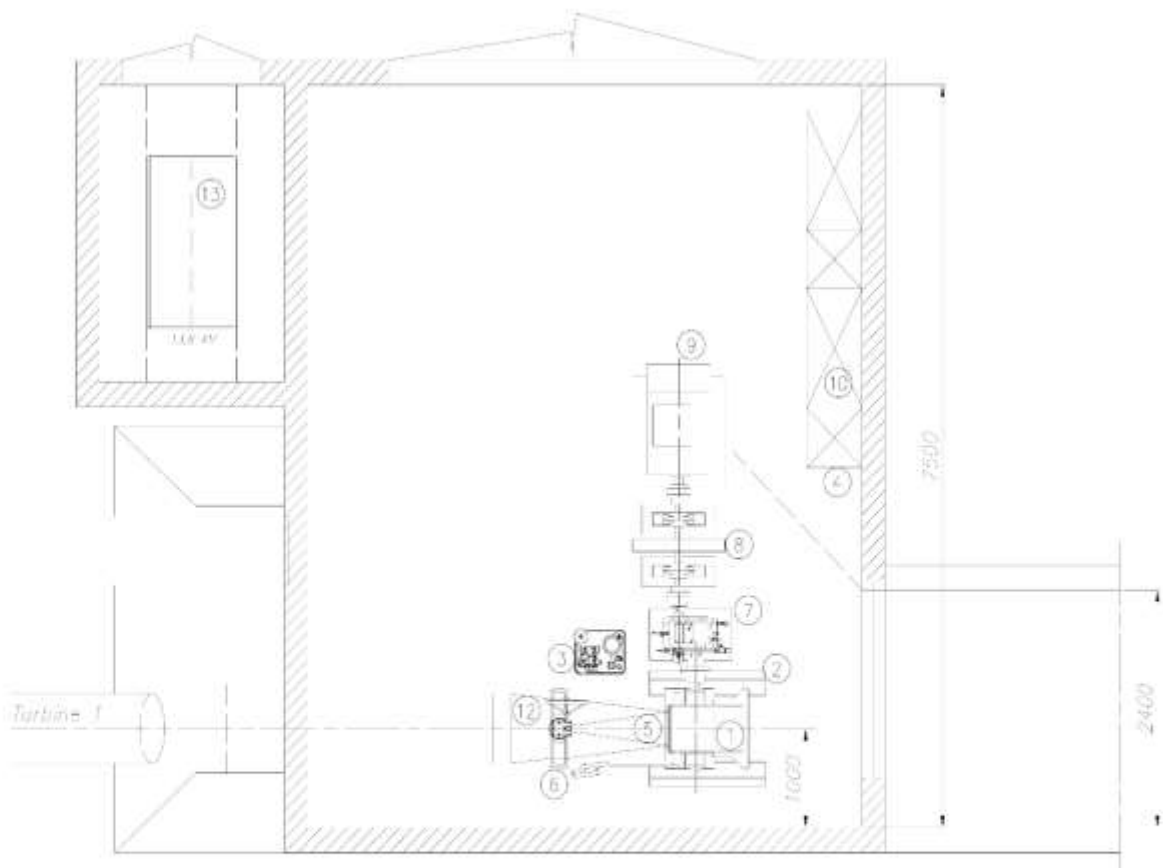
VI. Power House Turbine (Revision)





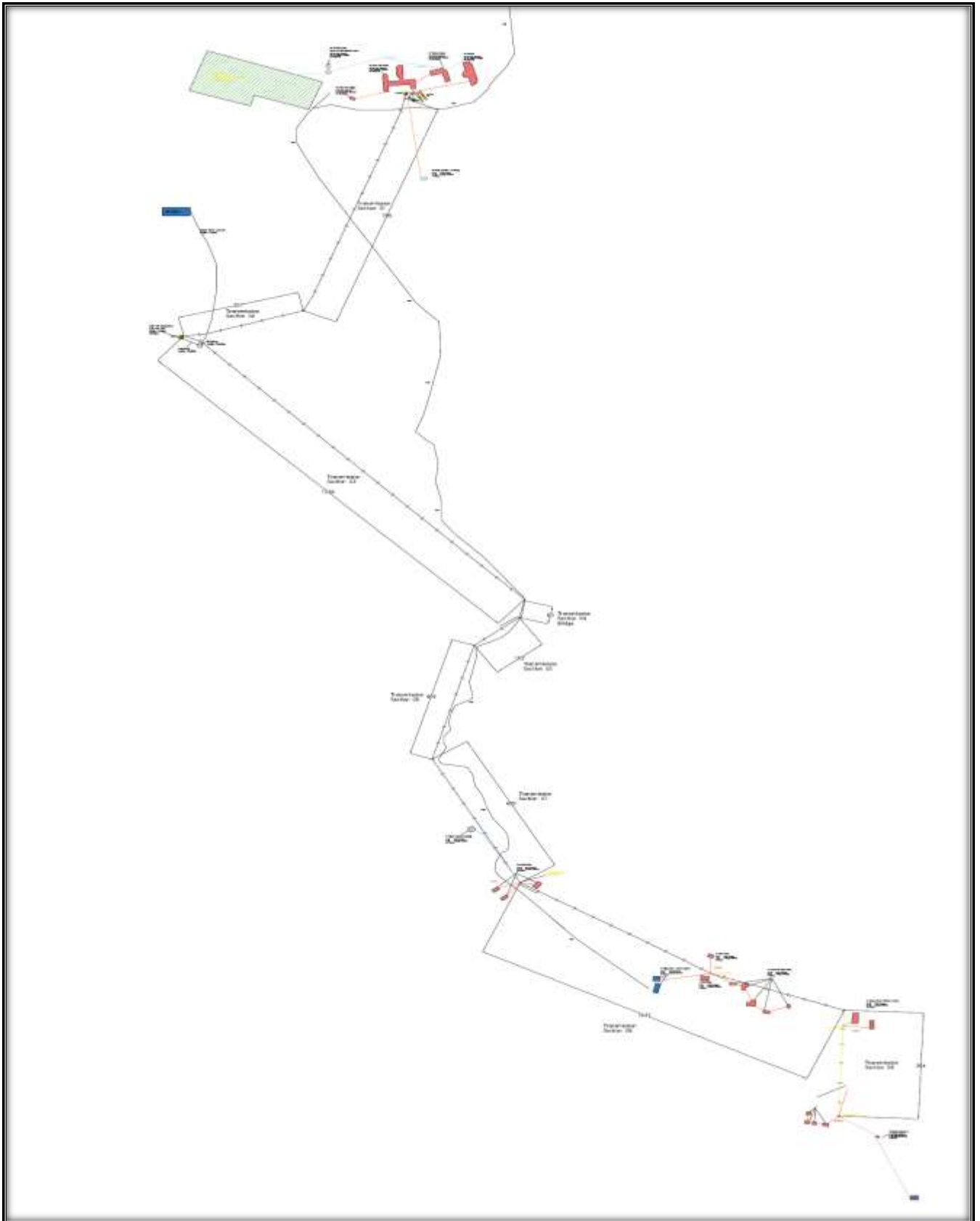
- ① OSSBERGER turbine 1  
Type: SH 4.034/B 1 g
- ② Base frame
- ③ Governor (hydraulic)  
Type: S 1 MK/R
- ④ Governor (electric)
- ⑤ Reducer/ Draft tube
- ⑥ Butterfly valve DN 600
- ⑦ Gear box with couplings  
n = 531 / 1200 r.p.m.

- ⑧ Flywheel
- ⑨ Generator  
n = 1200 r.p.m.
- ⑩ Power switchboard
- ⑪ Tapered pipe  $\varnothing 600 / \varnothing 700$
- ⑫ Transformer



Plant: KATO

## APPENDIX D: General Alignment of Transmission Network Route



## APPENDIX E: Approvals

### Kato Village Council Letter granting permission

Kato village council  
North Pakaraimas  
Region # 8  
16, August, 2017

Guyana Energy Agency  
295 Quamina Street  
South Commingsburg  
Georgetown

Dear Sir/ Madam,

#### **Permission for construction of 300 kW hydroelectric plant at Kato**

With reference to your letter dated August 11, 2017 seeking approval for construction of 300 kW hydroelectric plant at Kato. The village council hereby acknowledge same and wishes to inform you that during a meeting it was discussed and permission has been granted for its construction.

However, we request information as it relates to the date of its construction in advance so as to facilitate any adjustment regarding help etc. if necessary.

The village council also take this opportunity to remind you that the rules governing the village should be adhere to at all times.

Yours sincerely,



Clifton Pereira (Toshao)

cc: Hon. Ministry of Indigenous People's Affairs.  
Hon. Minister of Public Infrastructure.

KATO VILLAGE COUNCIL  
  
Toshao, Justice of Peace  
Date 16.8.2017

1. Trevor Bobbink J. Toshao
- 2.
3. Eric Felix councillor
4. Landrum Frederick Assistant Secretary
5. Ruby. Rodrigues councillor secretary
6. Jessica. Gouveia councillor
7. Winston. Robinson councillor



EPA Letter on Status of Environmental Authorization Application

**Environmental  
Protection  
Agency**



---

**September 27, 2017**

**Mr. Horace Williams**  
**Hinterland Electrification Company**  
Ministry of Public Infrastructure  
Wight's Lane  
Kingston  
Georgetown

Dear **Mr Williams**,

**Re: Status of Environmental Authorisation Application for Hydro Power Plant**

The Environmental Protection Agency (EPA) acknowledges receipt of your Application for Environmental Authorisation (Environmental Permit) submitted on June 12, 2017, to install and operate hydro power plant located at Chiung River, Kato, Region 8. Please note that the Agency has reviewed the information submitted and conducted a Site Visit of the proposed site.

Based on the Agency's screening of your proposed project, you will not be required to conduct an Environmental Impact Assessment (EIA) to facilitate the processing of your Environmental Authorisation. However, you are required to conduct and submit an Environmental Risk Assessment and Management Plan for the project at the intended location. This should identify any potential environmental and human risk and feasible of cost effective measures to manage/ reduce potential environmental impacts to biodiversity, water quality, air quality, and soil degradation to an acceptable level. It should also cover all phases of the development (construction and operation).

In keeping with the Environmental Protection Act, Cap.20:05, a Notice of this decision (EIA not required) was published in the *Starbrook and Chronicle Newspapers* on September 25, 2017.

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Page 1 of 2  
Ganges St., Sophia, Georgetown, GUYANA.  
Tel: (592) 225-5467/5471-5479/6044/6048 | Fax: 225-5481  
✉ [epa@epaguyana.org](mailto:epa@epaguyana.org) | 🌐 [www.epaguyana.org](http://www.epaguyana.org) | 🏢 Environmental Protection Agency - Guyana  
"The Environment is Everybody's Business"



## Environmental Protection Agency

Please be advised that within thirty (30) days of the publication of the Notice, any person who may be affected by the project may lodge an appeal against the Agency's decision with the Environmental Assessment Board (EAB). Once there are no objections from the public and all other permitting requirements are fulfilled, a Construction and Operation Permit with agreed conditions may be granted.

In addition, you are required to submit the following:

- No objection letter from the Regional Democratic Council, Region 8; and
- No objection letter from the Toshua in Kato, Region 8.

Should you have any questions or need clarification, please do not hesitate to make contact with our Office.

Yours sincerely,

Kemraj Parsram  
Executive Director (A.g)

**Attach:** EPA Guidelines for Preparing EMPs

C. Mr. Winston Setal – Engineer, Guyana Energy Agency.  
Mr. Trevlon Pyle– Electrical Engineer, Ministry of Public Infrastructure.

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Page 2 of 2


Ganges St., Sophia, Georgetown, GUYANA.


Tel: (592) 225-5467/5471-5472/6044/6048 | Fax: 225-5481

✉ [epa@epaguyana.org](mailto:epa@epaguyana.org) | 🌐 [www.epaguyana.org](http://www.epaguyana.org) | 🏢 Environmental Protection Agency - Guyana

*"The Environment is Everybody's Business"*

Office of the Regional Executive Officer (Region 8) Letter of Approval



  
**Office of the Regional Executive Officer**  
Regional Administration  
Mahdia, 111 Miles Potaro Road, Region No.8, Potaro Siparuni.  
Regional Executive Officer- Gavin Gounga Email-gavingounga at gmail.com Telephone 592-679-7907

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2017-11-20

Dr. Mahendra Sharma,  
Chief Executive Officer,  
Guyana Energy Agency.

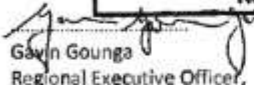
Dear Sir,

Approval to construct 300 KW Hydroelectric Plant at Kato North Pakaraimas.

---

I refer to the subject at Caption and hereby give the no objection on behalf of the Regional Administration for the proposed Hydro Power Project for Region No.; 8.

**REGIONAL EXECUTIVE OFFICER**  
Region #8

  
Gavin Gounga  
Regional Executive Officer,  
Region No. 8.


*Email to no*  
*Copy to*  
*1. Winston*  
*2. Gayle*  
*3. Seane.*

## APPENDIX F: Water Quality Analyses Laboratory Report

### Kaizen Analysis Data Report



58 High Street  
Kingston  
Georgetown, Guyana  
Tel: (592) 231-6346 / (592) 231-6348  
Email: inquiries@kaizen-guy.com

| ANALYSIS DATA REPORT  |  |  |                                 |
|---|--|--|---------------------------------|
| Customer:   | Environmental Management Consultants   | Lab File #: 000777-1-3   |                                 |
| Customer's Address:   | 60 Area H Ogle, ECD  |  |                                 |
| Customer Contact:   | Shammattie Ramnath   |  |                                 |
| Client Job #:   | 19-0154  |  |                                 |
| Item(s) Analyzed:   | Surface Water Samples  |  |                                 |
| Date of Sampling:   | 3-Aug-19   |  |                                 |
| Sampled By:   | Client   |  |                                 |
| Date of Receipt:  | 5-Aug-19   |  |                                 |
| Report Date:  | 13-Aug-19  |  |                                 |
| ANALYSIS RESULTS  |  |  |                                 |
| Parameter Name  | Units  | Results  |                                 |
|   |  | 000777-1<br>SW 1 - Upstream Weir   | 000777-2<br>SW 2 Waterfall Head |
| Biological Oxygen Demand  | mg.L <sup>-1</sup>   | < 3.00   | < 3.00                          |
| Parameter Name  | Units  | Results  |                                 |
|   |  | 000777-3<br>SW 3 Downstream Turbine  |                                 |
| Biological Oxygen Demand  | mg.L <sup>-1</sup>   | < 3.00   |                                 |
| * Detailed Test Methodologies and QA/QC data available upon request.  |  |  |                                 |
| Test Methodologies:   | Biological Oxygen Demand: SME/WW 6210 B  |  |                                 |
| Comments:   | Samples were analyzed out of the holding time because of the distance from sample point. |  |                                 |
| Report Authorized By:   |  | <br>Sheril Shah - Divisional Manager (Ag) |                                 |
| This test report relates only to the items tested and shall not be reproduced except in full, without written approval of the laboratory. |  |  |                                 |

GUYSUCO Analysis Report



**GUYANA SUGAR CORPORATION INC**

**CENTRAL LABORATORY**

Research Centre, Agriculture Department, LBI Compound, E.C.D, Guyana, S.A.

Telephone #: 592-220-1978 Email: ganpatj@guysuco.com

Fax #: 592-220-4027

| CAEMS SOP/RF No.: 013.1   | Version: 2 | Revision Status: 1  | Date of Issue: September 6, 1996   | Expiry Date: |  |  |
|---|------------|---------------------|--|--------------|--|--|
| <h1>Analysis Report</h1>  |            |                     |  |              |  |  |
| Report Number: W 223-225/2019—C   |            |                     | Date: 2019-08-20   |              |  |  |
| <b>To:</b><br>Mr. Shyam Nokta<br>Environmental Management Consultants<br>60 Area H<br>Ogle<br>East Coast Demerara<br><br>Tele: 222-4565 Fax #: 222-3172 |            |                     | <b>From:</b><br>Mr. Ganpat Jafer<br>Analyst<br><br>Central Laboratory<br>Agronomy and Analytical Services Department |              |  |  |
| Date Sample Received: 2019-08-06  |            |                     | Date Analysis Completed: 2019-08-09  |              |  |  |
| SAMPLE TYPE: Water  |            |                     |  |              |  |  |
| SAMPLE DESCRIPTION  | PARAMETER  |                     |  |              |  |  |
|   | COD (mg/L) | Oil & Grease (mg/L) |  |              |  |  |
| SW 1 Kato   | 136        | 0.07                |  |              |  |  |
| SW 11 Kato  | 128        | 0.08                |  |              |  |  |
| SW 111 Kato   | 20         | 0.12                |  |              |  |  |
|   |            |                     |  |              |  |  |
|   |            |                     |  |              |  |  |
|   |            |                     |  |              |  |  |

Checked by:

Nd- Not Detected

Mr. G. Jafer

C: Mr. Gavin Ramnarain-Head-Agric. Research  
Mr. Ashley Adams-Agronomy Research Manager

## **APPENDIX G: Records of Stakeholders Engagements**

### August 02, 2019 Meeting Lead by EMC

#### **Kato 150kW Hydro-Electric Project Public Meeting with Village Council and Villagers Kato**

**Date:** Friday, August 02, 2019  
**Venue:** Multi-Purpose Building  
**Time:** 14:55 hrs

#### **1. Welcome and Introductions**

- 1.1 The meeting was opened at 14.35 by Toshao Clifton Pereira who welcomed participants to the meeting and introduced the team from Environmental Management Consultants. Toshao Pereira invited Mr. Khalid Alladin to provide an overview of the purpose of the meeting.
- 1.2 Mr. Khalid Alladin, Projects Manager, EMC, welcomed participants to the meeting and thanked them for their attendance. Mr. Alladin indicated that an Environmental Assessment and Management Plan (EAMP) has to be prepared for the proposed Kato hydroelectric project. The EAMP will examine potential environmental and social impacts of the project and identify measures to manage or mitigate these impacts. He stated that an update on the project was provided during a consultation led by the Guyana Energy Agency (GEA) and Hinterland Electrification Company Inc. (HECI) with the Kato village on July 13, 2019. The objective of the meeting was to receive socio-economic information on the village and to receive feedback from the village on their concerns and expectations of the proposed hydropower project.

#### **2. Discussion**

- 2.1 Mr. Lakshman Persaud, EMC, led discussions to receive feedback from villagers on the socio-economic circumstances for the village.
- 2.2 The village has a population of 485 and there are more females than males. In addition, there are 105 households. The population is growing.
- 2.3 Most persons reside in the area referred to as the plateau, followed by the valley, and then the farms.
- 2.4 The main economic activity in the village is subsistence farming of vegetables, peas, various seasonal crops including kidney beans and black eye peas.

In the years previously, the National Agricultural Research and Extension Institute (NAREI) commenced activities to establish a research facility in Kato and a representative from NAREI is based in the village. The soil has been tilled on the identified land but there has been no further progress as there have been delays with the Ministry of Agriculture.

Livestock farming is also practiced at a subsistence level. There are approximately 60 heads of cattle in the village and some sheep are grazed in the valley. In addition, 'creole' chicken is reared for subsistence use and there is a project proximate to the school to rear the 'black giant' chickens.



Further, there are no mining, crafts or tourism initiatives in the village. Many young men travel to Brazil or to the mines for work resulting in migration out of the village. Currently, there is no influx of foreign nationals, such as Venezuelans, into the village.

- 2.5 There are three schools located within the village: a Nursery School with 16 students all of whom are from Kato; a Primary School with 94 students all of whom are from Kato; and a Secondary School with 304 students, 36 of whom are from Kato. Other students who attend the Secondary School come from villages within the sub-region.

The villagers noted that only a few students sit the National Grade 6 Examinations resulting in lower rates of enrollment in Secondary School. However, more students are taking the examinations and the largest batch of Grade 6 students sat the examinations in 2019.

Youths from Kato who have completed secondary school have also attended the Kuru Kuru Training Centre and have qualifications in electrical, masonry and carpentry skills.

- 2.6 There is a Kato Learning Resource Centre where one person is employed. In addition, two persons are employed at the Library in the Kato Secondary School.
- 2.7 There is a Health Centre in the Village with four staffers: Community Health Doctor, Medex, Field Assistant and Cleaner. A doctor was present in the Health Centre for two months in 2018. In addition, visiting doctors and dentists sometimes visit the community on outreaches. Immediate medical services are accessed in Brazil at Boa Vista.
- 2.8 Additional Government buildings located in Kato include: the District Office for the Regional Democratic Council with 17 workers all of whom are from Kato; the Regional Guesthouse; and a Police Station at which two Police Officers are stationed.
- 2.9 There are four return flights per week on the Ogle to Kato route on Sundays, Mondays, Wednesdays and Fridays. These flights may be cancelled before leaving Ogle if there are not enough persons booked to fly.
- 2.10 Other forms of transportation out of the area include by road to Lethem via Karasabi which currently takes 8 hours by all terrain bike, or 5 days by walking. Most persons prefer to travel to Brazil which is closer.
- 2.11 There is no phone signal in the village. However, internet and radio communication are available. There are four radios in the village at the Village Office, RDC Office, Health Centre and Police Station. Free wireless internet connection is available at the Kato Secondary School but there are also private service providers in the village. Some persons have satellite television.
- 2.12 There are no archaeological sites located in proximity to the waterfall. However, there is an old burial site located at one of the plateaus in the village. It was reported that a former Minister once led an investigation to the old burial site and took skulls for test/dating. However, no findings or updates were provided to the village.
- 2.13 Traditional religions are not practiced in the village. However, traditional remedies are still used for minor injuries such as sprains, cuts and bruises.
- 2.14 Construction in Kato is a challenge as materials like sand, gravel and cement have to be imported at significant costs. Only wood is locally available.

- 2.15 At present, all households received 65-watt solar panels from the Government and this is used for electricity. Most households have two light bulbs powered by these panels. Some persons have generators but these are costly to run as the cost of fuel is high at GYD 2500 per gallon.
- 2.16 There are four shops in the village one of which is run by the Village Council. There is a lot of trade with Brazil.
- 2.17 Residents collect water from a spring, wells behind the village and solar-powered points at various locations throughout the village. Water pressure drops during the dry seasons.

### **3. Other Issues Raised**

- 3.1 There are high expectations in the village for the hydropower plant to become operational including:
  - 3.1.1 Electricity being available in homes across the village;
  - 3.1.2 Investment by individuals and village council in several ventures. Some of the main initiative being considered include brick manufacture; agro-processing of black pepper, turmeric; and cassava processing plant. These can then be sold to the coast since currently transportation of produce is expensive.
  - 3.1.3 Resuscitation of the Kato Sewing Group when electricity is available to allow for the use of electrical sewing machines.
  - 3.1.4 Youths having more interest in attending the Kuru Kuru Training Centre due to expectations of employment during the construction and operational phases of the hydropower plant.

- 3.2 Few locals were employed during the construction of the Kato Secondary School as the village did not have skilled labour/ experts. Those who were employed faced challenges with the contractor due to remuneration. However, a labour force now exists within the community and the contractor should employ locals.

It was recommended that the contractor will have to follow the rules of the Village Council. The Council would like the opportunity to have a meeting with the contractor before construction commences.

- 3.3 The Village Council will be interested in receiving advice on the types of expertise that would be needed for the operation and maintenance of the hydropower plant so that youths can be encouraged to pursue studies in these fields.
- 3.4 The Village Council recommends a formal agreement between the Village Council and the Government of Guyana on the hydropower project.
- 3.5 There were concerns on whether the outcome of the elections will affect the implementation of the project.
- 3.6 During the GEA-led consultations on July 13, 2019:
  - 3.6.1 It was indicated that only Government buildings will be powered, not private homes. The reason given was that the residences are scattered throughout the village and transmission will be costly. However, it should be noted that Government buildings are also scattered and that households are located in clusters across the village. It was asked whether power can be transmitted to these clusters and then distributed from there.

- 3.6.2 It was enquired whether the electricity generated from the hydropower plant will be sufficient to power the entire village. The Toshao reference information provided by the GEA on the results of an energy demand survey which was conducted by a Trinidadian consultant and indicated that Kato uses 50kW of power. However, the Toshao recognized that another survey will be done by the GEA or the HECI.
- 3.6.3 There were concerns about who will own the project and how it will be managed. A few years down the line as skills are built, the management and maintenance of the plant can be transitioned to the village. The Village Council is interested in full ownership down the line.
- 3.6.4 It was noted that if revenues or profits are earned in excess of the required operational and maintenance costs, some of these funds could go to the Village Council.
- 3.6.5 It was asked what the expected price of power as the villagers will need to know up-front so as to determine if it is affordable. Will it be a flat fee or price per kilowatt hour? Will there be different costs for residents?
- 3.6.6 It was asked who will be responsible for the maintenance of the road from the village to the project site. Currently, the road is in poor condition.
- 3.6.7 There were concerns about potential impacts of the dam bursting given that the weir will only be eight-feet tall.
- 3.6.8 There are also concerns about whether any ecotourism potential of the waterfall will be curtailed as a result of the installation of the hydropower plant.
- 3.6.9 Residents of Kato use the falls for swimming and fishing. The main species of fish caught are sunfish, silverfish and hassar.
- 3.6.10 There is farming upstream of the waterfall head in Kato. The waterfalls in Kato is the largest on the line of the Chiung River.

The meeting closed at 16:25hrs.

## Images of the Meeting in Kato



**EMC Team at the Meeting**



**Toshao Pereira in Discussions**



**A Member of the Village in Discussions**



**Group Photo following the Public Meeting**

### List of Attendees

| Name                     | Address      | Gender | Address/ Email Address        | Telephone Number |
|--------------------------|--------------|--------|-------------------------------|------------------|
| Elizabeth Abraham        | Kato village | F      |                               |                  |
| Noel Fredericks          | Kato village | M      |                               |                  |
| Vidia Geronimo           | Kato village | F      |                               |                  |
| Quacy Robinson           | Kato village | M      |                               |                  |
| Bronson Gomes            | Kato village | M      |                               |                  |
| Bretlee Gomes            | Kato village | M      |                               |                  |
| Julita Gomes             | Kato village | F      |                               | 664-2480         |
| Alden Xavier             | Kato village | M      |                               |                  |
| Allan Xavier             | Kato village | M      |                               |                  |
| Gem Fredericks           | Kato village | F      |                               |                  |
| Merlyn Francis           | Kato village | F      |                               |                  |
| Sandreen Fredericks      | Kato village | F      |                               | 5735 USB         |
| Dominic Sehcha           | Kato village | M      |                               |                  |
| Mary Ignatius            | Kato village | F      |                               |                  |
| Mark Geronimo            | Kato village | M      |                               |                  |
| Ruby Rodrigues           | Kato village | F      |                               |                  |
| Diana Pereira – Richmond | Kato village | F      | diana.pereira201525@gmail.com | 688-7423         |
| Jeremiah Samuel          | Kato village | M      |                               |                  |
| Koreen Samuel            | Kato village | F      |                               |                  |
| Tim Sebastian            | Kato village | M      |                               |                  |
| Lensford Reuben          | Kato village | M      |                               |                  |
| Urlin Robinson           | Kato village | F      |                               |                  |
| Janessa Gomes            | Kato village | F      |                               |                  |

July 13, 2019 Meeting Lead by GEA/HECI

**Kato 150kW Hydro-Electric Project  
Notes on Public Meeting with Village Council and Villagers  
Kato**

**Date:** Saturday, July 13, 2019

**Venue:** Multi-Purpose Building

|   | Question/Concerns Raised   | Answer   | Remarks  |
|---|--|--|--|
| 1 | Should the dam burst/fail will it affect persons living close to the waterway?                       | There is currently no one living close to the location of the dam for which such an occasion will affect. Additionally, given the size of the dam and its location it is not possible. |  |
| 2 | Will the HECI own the land?  | No. The land belongs to Kato. However, they will be in possession of the plant to ensure operation. It is expected that persons from the village will be working at the plant.         |  |
| 3 | What is the timeline for expansion of the grid and hydro in keeping with the initial design (330kW)? | 5 years based on the payback and installation time. However, this can change given central government decision.  | Hydromet has a level logger but it is currently not functioning. GEA to install a new level logger to determine the potential for increasing the capacity of the installation.<br><br>MPI/HECI to advise on Grid expansion.<br>GEA will continue to monitor the energy demands and identify sustainable energy solutions to meet the growing energy demands. |
| 4 | Continuous consultations should be conducted with the village  | This will be a feature throughout the entire duration of the project.  |  |
| 5 | The village will like to have a MOU signed regarding benefits to the village from the project.       | Discussions will have to be held to determine what is required and come to an agreement suitable to both sides regarding the terms and conditions.                                     | MPI/HECI/GEA to discuss and advise on the approach of this.  |
| 6 | Will everyone in the village get access to the electrical grid?                                      | The aim is to have everyone connected. However, based on the final location of the grid persons living long distances away might not be connected. If such cases exist solar will be   | HECI to provide design and map with radius of supply.  |



|    | Question/Concerns Raised  | Answer   | Remarks  |
|----|---|--|--|
|    |   | looked at as an option/ having the person move closer to the grid.   |  |
| 7  | Why talk about other sources if we are looking to install the hydro project?  | The idea is to move away from depending on one source of electricity. The aim is to have a reliable supply and energy security. With more than one sources you can take advantage of their abundance when available and they can complement each other during the year |  |
| 8  | Will the village of Kurukubaru be able to benefit from such a project given that a similar source as the Kato falls exist approximately 4 miles from the village? | This is possible. However, an assessment will have to be carried out along with the different studies to determine the capacity and feasibility.   | In the interim, GEA will be designing a solar micro-grid for Kurukubaru. |
| 9  | The village will like for persons in the village to be trained before and during construction.  | We agree with training. A list of interested persons and their skill set to be provided by touthao.  | GEA to immediately commence training. HECI and GEI to be engaged         |
| 10 | What will the village have to pay for electricity?  | The cost will be determined by the utility, PUC and Government of Guyana. However, they will use the LCOE as a base line in formulating the cost.  | MPI/HECI to address.   |
| 11 | Why the reduction in the size of the system?  | Based on the tenders that were receive through multiple public tenders it was seen that the cost was higher than the budgeted amount. As such a decision was made to approach the project in phases to make it a reality.  |  |
| 12 | Where will the grid be located?   | The final location will be determined by HECI.   | HECI to provide design and map showing radius/limits of supply.          |
| 13 | Is there anything in the contract to convince the contractor to buy materials from Brazil, since it is viewed as more accessible?                                 | We cannot convince the contractor to do so. However, we have provided them with information about the options. The final decision will be left to them.  |  |
| 14 | Will the contractor do the road between Karasabai and Kato?   | No. However, as part of the contract they will have to construct a road to allow access to the powerhouse.   |  |
| 15 | Will females be employed on the project?  | Yes, once interested and available. We will be working   |  |

|    | Question/Concerns Raised                | Answer   | Remarks   |
|----|---|--|---|
|    |   | with the contractor to ensure that at least 40% of the workforce are females. Additionally, during the operation period, we will also be pushing for females to be employed. Regarding training please have their names submitted to the Toshao. |   |
| 16 | How early will the training take place? | We will work to have it started at the earliest practical date. The list of names will add to this process.  | GEA to commence training on week of Sept 1, 2019. |



**Kato Residents at the Consultation**

List of Attendees

KATO CONSULTATION JULY 13, 2019

| No. | NAME                | ADDRESS                          | ORGANISATION/DESIGNATION               | MALE | FEMALE |
|-----|---------------------|----------------------------------|--|------|--------|
| 1   | Gerald Rodrigues    | Kato Village                     | Vice Townsman                          | ✓    |        |
| 2   | Legnetta Rodrigues  | Kato Village                     | House Mother                           |      | ✓      |
| 3   | Verita Fredericks   | KATO VILLAGE                     | REGISTRATION CLERK / VILLAGE TREASURER |      | ✓      |
| 4   | Akeem CAMPBELL      | Brighton Village Co-ordinator/BC | Livestock extension Assistant          | ✓    |        |
| 5   | Callis Liverpool    | Kato Village                     | N.A.R.E.I                              | ✓    |        |
| 6   | Zico Williams       | Chiung Mouth Village             | Teacher                                | ✓    |        |
| 7   | Eustace Augustine   | Chiung Mouth Village             | Senior Councillor                      | ✓    |        |
| 8   | Junior George       | Chiung Mouth Village             | Resident                               | ✓    |        |
| 9   | Dominic Debra       | KATO Village                     | Farmer                                 | ✓    |        |
| 10  | Sandreen Fredericks | KATO Village                     | Typist Clerk R.D.C                     |      | ✓      |
| 11  | Bassian Fredericks  | Kato Village                     | Farmer                                 | ✓    |        |
| 12  | Ned Fredericks      | Kato Village                     | Village Councillor                     | ✓    |        |
| 13  | Nicodimus Francis   | Kurukabani                       | Village Councillor                     | ✓    |        |
| 14  | Berujani Williams   | Kato Village                     | Teacher                                |      | ✓      |
| 15  | Kamal Robinson      | Kato Village                     | Resident                               | ✓    |        |
| 16  | Bruce Martin        | Kurukabani Village               | Vice Townsman                          | ✓    |        |
| 17  | Mark Geronimo       | Kato                             | Village Councillor                     | ✓    |        |
| 18  | Adeline Fredericks  | Kato                             | Resident                               |      | ✓      |
| 19  | Jomo Fredericks     | Kato                             | Resident                               |      | ✓      |
| 20  | Eugene Rodrigues    | Kato                             | Resident                               | ✓    |        |

|    | NAMES                | ADDRESS | ORGANISATION/DESIGNATION | MALE | FEMALE |
|----|----------------------|---------|--------------------------|------|--------|
| 21 | Barlyn Robinson      | KATO    | Laundress                |      | ✓      |
| 22 | Kirton Pig           | KATO    |                          | ✓    |        |
| 23 | Thomas Fredericks    | KATO    |                          | ✓    |        |
| 24 | SEAVIO Fredericks    | KATO    | VILLAGER.                | ✓    |        |
| 25 | Idema Fredericks     | Kato    | councillor               | ✓    |        |
| 26 | Liselle Gomes        | Kato    | Teacher                  |      | ✓      |
| 27 | Mary Ignatius        | Kato    | Teacher                  |      | ✓      |
| 28 | Esopord Baldwinick   | Kato    | Kato Sportsclub chairman | ✓    |        |
| 29 | Marcelina Robinson   | Kato    | Seamstress               |      | ✓      |
| 30 | Francina Robinson    | Kato    | Farmer                   | ✓    |        |
| 31 | Duwall Fredericks    | Kato    | Farmer                   | ✓    |        |
| 32 | Vincent Rodrigues    | Kato    | Farmer                   | —    |        |
| 33 | Winston Robinson     | KATO    | Farmer                   |      |        |
| 34 | James E. Duval       | Kato    | Farmer                   |      |        |
| 35 | Lisa Geronimo        | Kato    | <del>P.R.E.</del>        | ✓    | ✓      |
| 36 | Louisa Williams      | Kato    | P.R.E.                   | ✓    |        |
| 37 | Christa Samuels      | Kato    | Recruit                  | ✓    | ✓      |
| 38 | Stephanie Baldwinick | Kato    | Gilbert                  | ✓    | ✓      |
| 39 | L. Pereira           | Kato    |                          | ✓    |        |
| 40 | F. Robinson          | Kato    | villager                 |      |        |
| 41 | Kunfud Gomes         | Kato    | Villager                 | ✓    |        |
| 42 | Nidia Geronimo       | Kato    | villager                 |      | ✓      |
| 43 | Nemuel Geronimo      | "       | "                        | ✓    |        |

|    |                     |              |                        |   |   |
|----|---------------------|--------------|------------------------|---|---|
| 44 | Ethel Fredericks    | Kato Village |                        |   | ✓ |
| 45 | Gem Fredericks      | Kato Village |                        |   | ✓ |
| 46 | Valencia Fredericks | Kato Village |                        |   | ✓ |
| 47 | Alden Xavier        | Kato Village |                        |   |   |
| 48 | Jeremiah Samuel     | Kato Village |                        |   |   |
| 49 | Headley Rio         | Kato Village | Regional Vice Chairman | ✓ |   |
| 50 | Apolonia Pereira    | Kato Village |                        |   |   |
| 51 | Valerie Fredericks  | Kato Village |                        |   |   |
| 52 | Doris Fredericks    | Kato Village |                        |   | ✓ |
| 53 | Annex Fredericks    | Kato Village | -                      | ✓ |   |
| 54 | Francis Gomes       | Kato Village |                        |   |   |
| 55 | Leifka Pereira      | Kato Village | Toshao                 | ✓ |   |
| 56 | Lensford Reuben     | Kato Village |                        | ✓ |   |
| 57 | Allan Xavier        | Kato Village |                        | ✓ |   |
| 58 | Genessa Gomes       | Kato Village | Community H. Worker    |   | ✓ |
| 59 | Ismael Fredericks   | Kato Village |                        |   |   |
| 60 |                     |              |                        |   |   |
| 61 |                     |              |                        |   |   |
| 62 |                     |              |                        |   |   |
| 63 |                     |              |                        |   |   |
| 64 |                     |              |                        |   |   |
| 65 |                     |              |                        |   |   |